22F2, 22M2

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with CONTRAST control set fully to the right, all other controls set for normal picture (in sync). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V406, V407 and pin 3 of V408. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage at pin 3 of V408 taken, using an oscilloscope with a capacitive voltage divider probe. Waveform at pin 3 of V408 can be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the cap lead. When taking the waveform this way, the shape of the waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

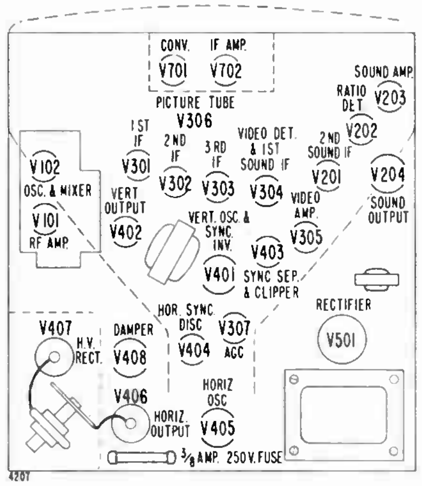
TV VOLTAGE DATA
(Voltages given on schematic)

- CONTRAST control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "0" position).
- Antenna disconnected from set with terminals shorted.
- Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (TV Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.
- Voltages at V306 measured from top of socket with tube removed.

CAUTION

Pulsed high voltages are present on the cap of V406, pin 3 of V408, and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 17.5 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliance as compared with that obtained with a 1.5 volt dry cell battery.



Top View of 22P2 Chassis. (V701 and V702 are accessible from underside of chassis).

22P2

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with CONTRAST control set fully to the right, all other controls set for normal picture (in sync). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V406, V407 and pin 3 of V408. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage at pin 3 of V408 taken, using an oscilloscope with a capacitive voltage divider probe. Waveform at pin 3 of V408 can be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the cap lead. When taking the waveform this way, the shape of the waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

VOLTAGE DATA
(Voltages given on schematic)

- TV voltage taken with function switch on "TV" position. CONTRAST control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "0" position). TV antenna disconnected from set with terminals shorted.
- Radio voltages V701 and V702 taken with function switch on "Rad" position; voltages measured from underside of tube sockets. When measured from top of tube sockets (with tube removed), B plus voltage at pins 5 and 6 of V701 and V702 will be approximately 275 volts.
- B plus voltages at V203 and V204, will be slightly higher when set is switched to "Rad" position. Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V306 measured from top of socket with tube removed.
- Voltages at V101 and V102 (TV Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.

CAUTION

Pulsed high voltages are present on the cap of V406, pin 3 of V408 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or VTVM with a high voltage probe. 2nd anode voltage is approximately 17.5 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliance as compared with that obtained with a 1.5 volt dry cell battery.

DIAL STRINGING

Dial stringing for the radio tuning control is shown below.

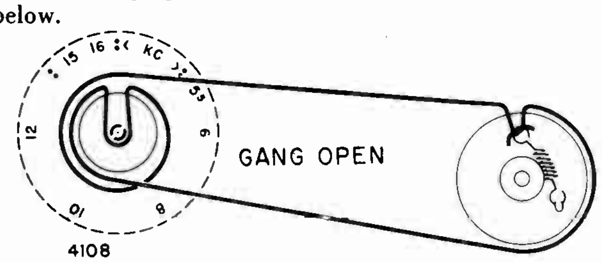


Figure 17. Dial Stringing for the 22P2 Chassis.

ALIGNMENT OF RADIO TUNER

The radio tuner in television and radio chassis should be aligned as instructed under "Radio Alignment Procedure" below.

The radio alignment trimmers are accessible without disassembly of the radio tuner from the TV chassis.

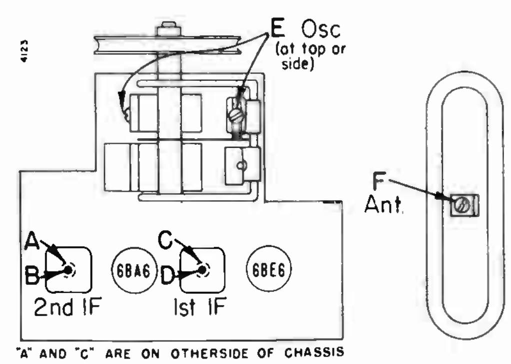


Figure 18. Trimmer Locations for AM Radio Tuner in 22P2 Chassis.

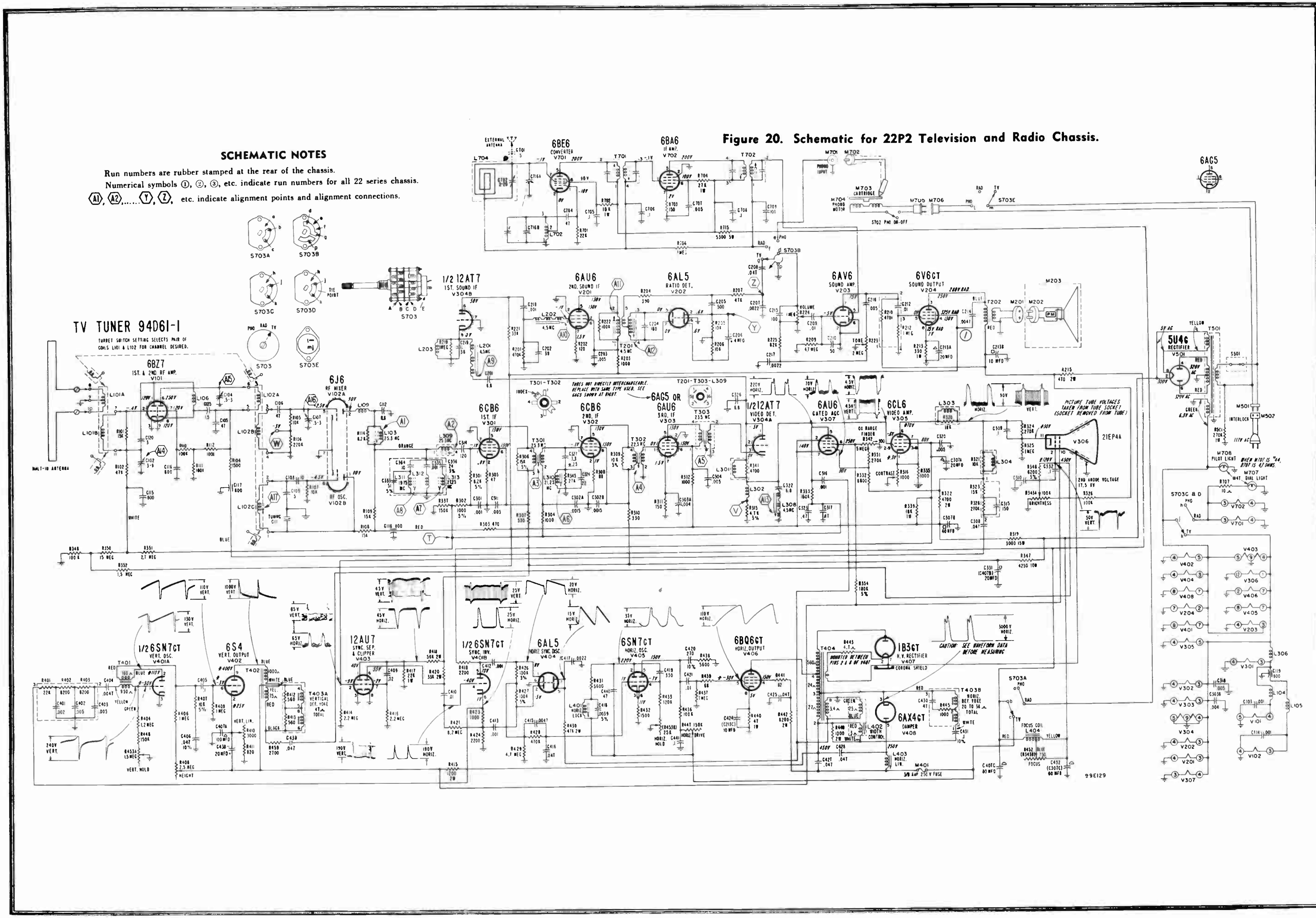


Figure 20. Schematic for 22P2 Television and Radio Chassis.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

Numerical symbols ①, ②, ③, etc. indicate run numbers for all 22 series chassis.

Ⓐ1, Ⓐ2,......Ⓨ, Ⓩ, etc. indicate alignment points and alignment connections.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

Numerical symbols ①, ②, ③, etc. indicate run numbers for all 22 series chassis.

(A1), (A2),.....(Y), (Z), etc. indicate alignment points and alignment connections.

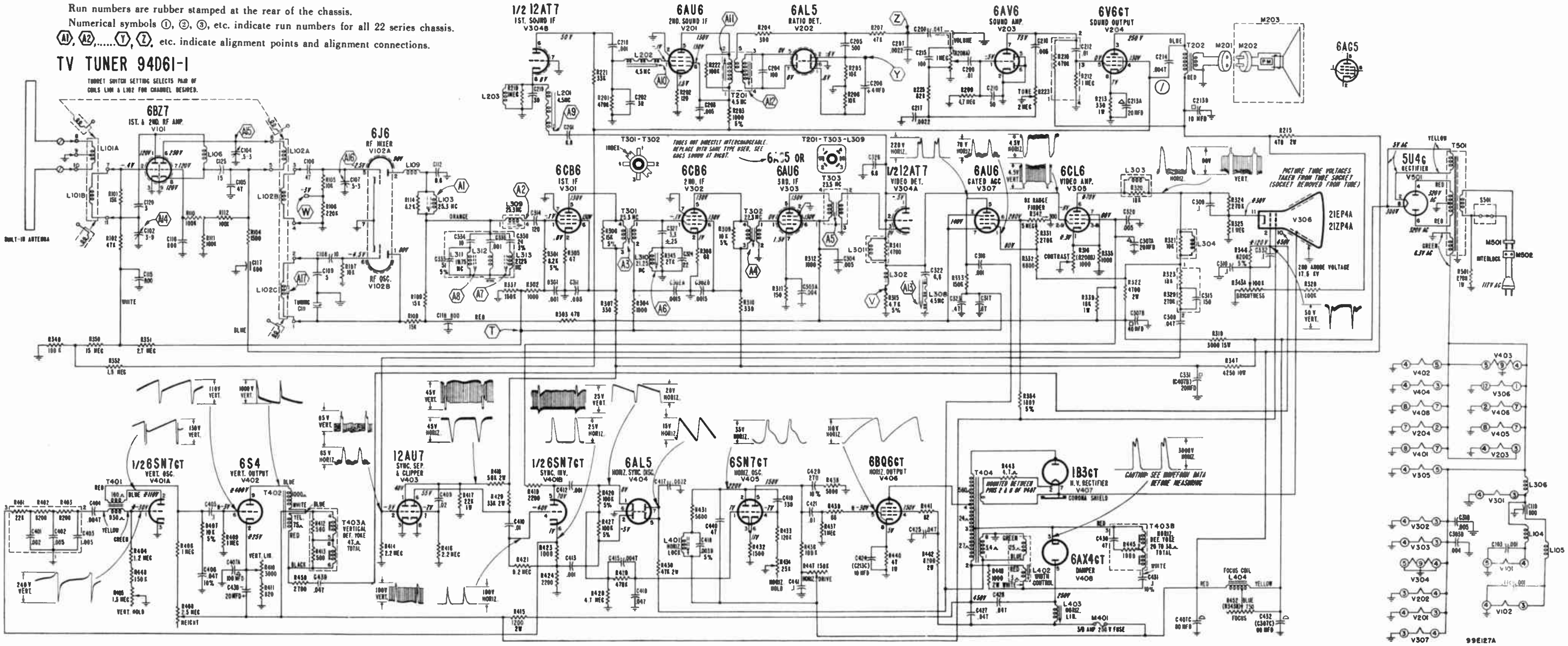


Figure 19. Schematic for 22F2 and 22M2 Television Chassis.

ADMIRAL TV PAGE 14-5

CHASSIS PARTS

RESISTORS

Sym.	Description	Part No.
R101	15,000 ohms, ½ watt	98A 45-67
R102	47,000 ohms, ½ watt	98A 45-17
R104	1,500 ohms, ½ watt	94D 47-58
R105	10,000 ohms, ½ watt	98A 45-18
R106	220,000 ohms, ½ watt	98A 45-21
R107	10,000 ohms, ½ watt	98A 45-18
R108	15,000 ohms, ½ watt	98A 45-67
R109	15,000 ohms, ½ watt	98A 45-67
R110	100,000 ohms, ½ watt	94C 37-87
R111	160,000 ohms, ½ watt	94D 47-59
R112	100,000 ohms, ½ watt	94C 37-87
R114	8,200 ohms, ½ watt	60B 8-822
R201	470,000 ohms, ½ watt	60B 8-474
R202	120 ohms, ½ watt	60B 8-121
R203	1,000 ohms, ½ watt	60B 8-102
R204	390 ohms, ½ watt	60B 8-391
R205	10,000 ohms, ½ watt	60B 8-103
R206	10,000 ohms, ½ watt	60B 8-103
R207	47,000 ohms, ½ watt	60B 8-473
R208A	1 megohm, **Volume** } 22F2, 22M2	75B 11-22
R208B	1,000 ohms, **Contrast** } chassis (R208 includes switch S501)	
R209	4.7 megohms, ½ watt	60B 8-475
•R210	470,000 ohms, ½ watt	60B 8-474
•R212	1 megohm, ½ watt	60B 8-105
R213	330 ohms, 1 watt	60B 14-331
R215	470 ohms, 2 watt	60B 20-471
R219	1 megohm, ½ watt	Part of L203
R221	33,000 ohms, ½ watt	60B 8-333
R222	100,000 ohms, ½ watt	60B 8-104
R223	2 megohms, **Tone** control	75B 13-22
R224	1 megohm, **Volume** control (22P2 chassis) (R224 includes switch S501)	75C 2-16
R225	82,000 ohms, ½ watt	60B 8-823
R301	8,200 ohms, ½ watt, 5%	60B 7-822
R302	1,000 ohms, ½ watt	60B 8-102
R303	470 ohms, ½ watt	60B 8-471
R304	1,000 ohms, ½ watt	60B 8-102
R305	47 ohms, ½ watt, carbon only	60B 28-45
R306	15,000 ohms, ½ watt	60B 8-153
R307	330 ohms, ½ watt	60B 8-331
R308	68 ohms, ½ watt, carbon only	60B 28-44
R309	10,000 ohms, ½ watt, 5%	60B 7-103
R310	330 ohms, ½ watt	60B 8-331
R311	150 ohms, ½ watt	60B 8-151
R312	1,000 ohms, ½ watt	60B 8-102
R315	4,700 ohms, ½ watt, 5%	60B 7-472
R316	**Contrast** control	
	22F2, 22M2 chassis	See R208B
	1000 ohms, 22P2 chassis	75B 13-21
R319	3,000 ohms, 15 watt, candohm	61A 3-14
R320	18,000 ohms, ½ watt	Part of L303
R321	10,000 ohms, ½ watt	Part of L304
R322	4,700 ohms, 2 watt	60B 20-472
‡R323	15,000 ohms, ½ watt	60B 8-153
R324	680,000 ohms, ½ watt (early sets)	60B 8-684
	270,000 ohms, ½ watt (later sets)	60B 8-274
R325	560,000 ohms, ½ watt (early sets)	60B 8-564
	1 megohm, ½ watt (later sets)	60B 8-105
R326	100,000 ohms, ½ watt	60B 8-104
‡R329	270,000 ohms, ½ watt	60B 8-274
R331	220,000 ohms, ½ watt	60B 8-224
R332	6,800 ohms, ½ watt	60B 8-682
R333	150,000 ohms, ½ watt	60B 8-154
R335	1,000 ohms, ½ watt	60B 8-102
R337	150,000 ohms, ½ watt	60B 8-154
R339	18,000 ohms, 1 watt	60B 14-183
R341	4,700 ohms, ½ watt	Part of L301
R342	5 megohms, **DX Range Finder**	75C 1-54
R343A	100,000 ohms, **Brightness** }	75B 17-1
R343B	750 ohms, **Focus** }	
R345	27,000 ohms, ½ watt	60B 8-273
R346	6,200 ohms, ½ watt, 5%	60B 7-622
R347	4250 ohms, 10 watt	61A 1-25
R349	100,000 ohms, ½ watt	60B 8-104
R350	15 megohms, ½ watt	60B 8-156
R351	2.7 megohms, ½ watt	60B 8-275
R352	1.5 megohms, ½ watt	60B 8-155
R354	180,000 ohms, ½ watt, 5%	60B 7-184
§R401	22,000 ohms, ½ watt	60B 8-223
§R402	8,200 ohms, ½ watt	60B 8-822
§R403	8,200 ohms, ½ watt	60B 8-822
R404	1.2 megohms, ½ watt	60B 8-125
R405	1.5 megohms, **Vertical Hold**, 22F2, 22M2 chassis	75B 13-26
R406	1 megohm, ½ watt	60B 8-105
R407	10,000 ohms, ½ watt, 5%	60B 7-103
R408	2.5 megohms, **Height**	75B 13-3
R409	1 megohm, ½ watt	60B 8-105
R410	3,000 ohms, **Vert. Lin.**	75B 13-7
R411	820 ohms, ½ watt	60B 8-821
R412	560 ohms, ½ watt	60B 8-561
R413	560 ohms, ½ watt	60B 8-561
R414	2.2 megohms, ½ watt	60B 8-225
R415	1,200 ohms, 2 watt	60B 20-122
R416	2.2 megohms, ½ watt	60B 8-225
R417	22,000 ohms, 1 watt	60B 14-223
R418	56,000 ohms, 2 watt	60B 20-563
R419	2,200 ohms, ½ watt	60B 8-222
R420	33,000 ohms, 2 watt	60B 20-333
R421	8.2 megohms, ½ watt	60B 8-825
R423	1,000 ohms, ½ watt	60B 8-102
R424	2,200 ohms, ½ watt	60B 8-222
R426	100,000 ohms, ½ watt, 5%	60B 7-104
R427	100,000 ohms, ½ watt 5%	60B 7-104
R428	470,000 ohms, ½ watt	60B 8-474
R429	4.7 megohms, ½ watt	60B 8-475
R430	47,000 ohms, 2 watt	60B 20-473
R431	5,600 ohms, ½ watt	60B 8-562
R432	1,500 ohms, ½ watt	60B 8-152
R433	120,000 ohms, ½ watt	60B 8-124
R434	25,000 ohms, **Horiz. Hold** 22F2, 22M2 chassis	75B 13-13
R436	150,000 ohms, ½ watt	60B 8-154
R437	1 megohm, ½ watt	60B 8-105
R438	5,600 ohms, ½ watt	60B 8-562
R439	68 ohms, ½ watt, carbon only	60B 28-44
R440	47 ohms, 1 watt	60B 14-470
R441	82 ohms, ½ watt, carbon only	60B 28-31
R442	8,200 ohms, 2 watt	60B 20-822
R443	4.7 ohms, ½ watt, carbon only	60B 28-11
R445	1,000 ohms, ½ watt	60B 8-102
R447	**Horiz. Drive** control	75B 13-29
R448	150,000 ohms, ½ watt	60B 8-154
R449	10,000 ohms, 2 watt, 10%	60B 20-102
R452	**Focus** control	See R343B
R453A	1.5 megohms, **Vert. Hold** } (22P2 chassis)	75B 17-2
R453B	25,000 ohms, **Horiz. Hold** }	
R501	270,000 ohms, 1 watt	60B 14-274
R701	22,000 ohms, ½ watt	60B 8-223
R702	10,000 ohms, 1 watt	60B 14-103
R703	150 ohms, ½ watt	60B 8-151
R704	27,000 ohms, 1 watt	60B 14-273
R706	1 megohm, ½ watt	60B 8-105
R707	10 ohms, ½ watt (used with #47 Bulb)	60B 8-100
	4.7 ohms, ½ watt (used with #44 Bulb)	60B 28-11
R715	5,300 ohms, 5 watt, candohm	61A 3-16

CAPACITORS

Sym.	Description	Part No.
C102	3 to 9 mmfd, Cer. Trim.	98A 45-96
C103	.001 mfd. min., ceramic	98A 45-24
C104	.5 to 3 mmfd, Cer. Trim.	98A 45-23
C105	47 mmfd, ceramic, N1400 temp. coeff.	94D 47-50
C106	47 mmfd, ceramic, N1400 temp. coeff.	94D 47-50
C107	.5 to 3 mmfd, Cer. Trim.	98A 45-23
C108	10 mmfd, 3%, Cer. N080 temp. coeff.	94D 47-51
C109	5 mmfd, 5%, Cer. N750 temp. coeff.	94D 47-52
C111	Tuning Rotor	98A 45-92
C112	6.8 mmfd, 3%, Cer, NPO temp. coeff.	94D 47-53
C114	.01 mfd, min. ceramic	98A 45-24
C115	800 mmfd, min. cer, feed-thru	94C 37-90
C116	800 mmfd, min, cer, disc	94C 37-91
C117	800 mmfd, min, cer, feed-thru	94C 37-90
C118	800 mmfd, min, cer, feed-thru	94C 37-90
C119	800 mmfd, min, cer, feed-thru	94C 37-90
C120	3 mmfd, 3%, ceramic	94D 47-54
C125	1.5 mmfd, ceramic	94D 46-84
C201	6.8 mmfd, N330 temp. coeff.	65C 6-71
C202	39 mmfd, ceramic, NPO temp. coeff.	65C 6-88
C203	.005 mfd, min, ceramic	65C 10-1
C204	180 mmfd, 5%, N030 temp. coeff.	65C 6-59
C205	500 mmfd, ceramic	65C 6-6
C206	4 mfd, 50 volts, electrolytic	67A 4-9
C207	.002 mfd, 400 volts, paper	64B 9-17
C208	.047 mfd, 200 volts, paper	64B 9-9
C209	.01 mfd, min, ceramic	65C 10-3
C210	50 mmfd, ceramic	65C 6-4
•C212	.01 mfd, 400 volts, paper	64B 5-10
C213A	20 mfd, 25 V. } electrolytic	67C 15-19
C213B	10 mfd, 450 V. }	
C213C	10 mfd, 25 V. }	
C214	.0047 mfd, 600 volts, paper	64B 9-15
C215	100 mmfd, ceramic	65C 6-3
C216	.005 mfd, min, ceramic	65C 10-1
C217	.0022 mfd, 600 volts, paper	64B 9-17
C219	39 mmfd, ceramic, NPO temp. coeff.	65C 6-88
C301	.001 mfd, min, ceramic	65C 6-41
C302A	.0015 mfd. } dual ceramic	65A 17-2
C302B	.0015 mfd. }	
C303A	.004 mfd. } dual ceramic	65A 17-1
C303B	.004 mfd. }	
C304	.005 mfd, min, ceramic	65C 10-1
C305	6.8 mmfd, ceramic, N330 temp. coeff.	65C 6-71
C307A	20 mfd, 450 V. } electrolytic	67C 15-27
C307B	40 mfd, 350 V. }	
C307C	60 mfd. 350 V. }	
C308	.047 mfd, 400 volts, paper	64B 9-9
C309	.1 mfd, 400 volts, paper	64B 5-5
C310	.1 mfd, 400 volts, paper	64B 5-5
C311	.005 mfd, min, ceramic	65C 10-1
C314	120 mmfd, 3%, mica	65B 1-10
‡C315	150 mmfd, mica	65B 21-151
C316	.001 mfd, 600 volts, paper	64B 9-19
C317	.47 mfd, 100 volts, paper	64A 10-51
C318	.005 mfd, min, ceramic	65C 10-1
C320	.005 mfd, min, ceramic	65C 10-1
C322	6.8 mmfd, N330 temp. coeff.	65C 6-71
C323	.47 mfd, 100 volts, paper	64A 10-51
C324	22 mmfd, 5%, cer, NPO temp. coeff.	65C 6-47
C325	120 mmfd, ceramic	65C 6-66
C326	6.8 mmfd, cer, N330 temp. coeff.	65C 6-71
C327	3.3 mmfd, cer. NPO temp. coeff.	65C 6-89
§C401	.002 mfd, 600 volts, paper	64B 5-14
§C402	.005 mfd, 600 volts, paper	64B 5-12
§C403	.0047 mfd, mica	65B 21-472
C404	.0047 mfd, mica	65B 21-472
C405	.1 mfd, 600 volts, paper	64B 5-5
C406	.047 mfd, 10%, 600 volts, paper	64A 2-14
C407A	100 mfd. 50 V. } electrolytic	67C 15-28
C407B	20 mfd, 400 V. }	
C407C	80 mfd, 350 V. }	
C409	.02 mfd. 400 volts, paper	64B 9-11
C410	.01 mfd, 400 volts, paper	64B 9-13
C412	.001 mfd, mica	65B 21-102
C413	.001 mfd, mica	65B 21-102
C415	.005 mfd, 600 volts, paper	64B 9-15
C416	.0022 mfd, 600 volts	64B 9-17
C417	.01 mfd, 400 volts, paper	64B 9-13
C418	.0039 mfd, 5%, silver mica	65B 1-63
C419	330 mmfd, mica	65B 21-331
C420	270 mmfd, mica	65B 21-271
C421	.01 mfd, 600 volts, paper	64B 9-13
C422	Electrolytic	See C213B
C424	Electrolytic	See C213C
C425	.047 mfd, 600 volts, paper	64B 9-9
C427	.047 mfd, 400 volts	64B 9-9
C428	.047 mfd, 400 volts	64B 9-9
C430	47 mmfd, 5%, 1,500 volts, mica	65B 1-64
C431	.1 mfd, 400 volts, paper	64A 2-6
C432	Electrolytic	See C307C
C434	.0068 mfd, 600 volts, paper	64A 2-15
C438	20 mfd, 475 volts, Electrolytic	67A 25-1
C439	.047 mfd, 400 volts	64B 9-9
C440	47 mmfd, mica	65B 21-470
C441	.1 mfd, 600 volts	64B 8-57
C701	5 mmfd, mica (C701 not supplied with set)	65B 1-62
C702	2 to 20 mmfd, trimmer	66B 8-5
C704	47 mmfd, ceramic	65C 6-79
C705	.1 mfd, 400 volts, paper	64A 3-15
C706	.1 mfd, 400 volts, paper	64A 3-15
C707	.005 mfd, min, ceramic	65C 10-1
C708	.1 mfd, 400 volts, paper	64A 3-15
C709	100 mmfd, min, ceramic	65C 6-3
C716A	420 mmfd, max. } gang (mounts horiz.)	68B 53-1
C716B	105 mmfd, max. }	

COILS, TRANSFORMERS

Sym.	Description	Part No.
L103	Mixer Plate Coil	98A 45-77
L104	Heater RF Choke	98A 45-13
L105	Heater RF Choke	98A 45-14
L106	Peaking Coil	94C 37-89
L109	Mixer Plate Choke	94D 46-86
L201	Sound Take-off Coil	72B 99-4
L202	Sound Coupling Coil	72B 99-4
L203	Peaking Coil (wound on R219)	73A 5-2
L301	Video Peaking Coil (wound on R341)	73A 5-15
L302	Video Peaking Coil	73A 5-7
L303	Video Peaking Coil (wound on R320)	73A 5-14
L304	Video Peaking Coil (wound on R321)	73A 11-1
L306	Heater RF Choke	73A 2-5
L308	Trap Coil (includes C322)	72B 99-3
L309	Coil, 1st IF Input	72B 109-1
L310	Coil, 21.25 MC Trap (includes C327, C324 and R345)	72C 96-30
L311	Coil 19.75 } Part of trap assembly	73C 12-1
L313	Coil 21.25 } (includes L312, C333, C334, C335 and C336)	
L401	Horizontal Lock Coil (includes C418, R431)	94B 17
L402	Width Control Coil	94A 49-2
L403	Horizontal Linearity Coil	94A 50-1
L404	Focus Coil	69D 117-11
L406	Choke Coil	73B 8-2
L702	Oscillator Coil	69A 52-4
L704	AM Antenna	69C 116-3
T201	Ratio Detector Transformer	72B 68-2
T202	Audio Output Transformer	
	for 22F2, 22M2 chassis	79C 33-7
	for 22P2 chassis	79C 33-6
T301	1st IF Transformer (includes C302, R304, and R306)	72C 96-29
T302	2nd IF Transformer (includes R309)	72D 111-1
T303	3rd IF Transformer (includes C305 and C325 (used with 6AG5)	72B 110-1
	3rd IF Transformer (used with 6AU6)	72B 113-1
T401	Blocking Oscil. Transformer	79A 18-4
T402	Vertical Output Transformer	79B 40-2
T403	Deflection Yoke (includes R412, R413, R445, C430)	94C 51-1
T404	Horizontal Output Transformer	79D 41-2
T501	Power Transformer	80C 35-3
T701	1st IF Transformer	72B 28-7
T702	2nd IF Transformer	72B 28-7
	Speaker, 5" PM	78B 59-3
	Speaker, 10" PM	78B 47-2
	Speaker 12" PM	78B 56-1

• Component may be part of couplate, part number 63B6-5. Order exact duplicate or individual components.
‡ Component may be part of couplate, part number 63B6-4. Order exact duplicate or individual components.
§ Component may be part of couplate, part number 63B6-2. Order exact duplicate or individual components.

For 94D 61-1 TV Tuner only

COILS, TRANSFORMERS

Sym.	Description	Part No.
L101	Antenna Coil (Stamped 2Q, 3Q, etc.)	
	for Channel #2	94D 46-52
	for Channel #3	94D 46-53
	for Channel #4	94D 46-54
	for Channel #5	94D 46-55
	for Channel #6	94D 46-56
	for Channel #7	94D 46-57
	for Channel #8	94D 46-58
	for Channel #9	94D 46-59
	for Channel #10	94D 46-60
	for Channel #11	94D 46-61
	for Channel #12	94D 46-62
	for Channel #13	94D 46-63
L102	Mixer—Osc. Coil (Stamped 2Q, 3Q, etc.)	
	for Channel #2	94D 46-72
	for Channel #3	94D 46-73
	for Channel #4	94D 46-74
	for Channel #5	94D 46-75
	for Channel #6	94D 46-76
	for Channel #7	94D 46-77
	for Channel #8	94D 46-78
	for Channel #9	94D 46-79
	for Channel #10	94D 46-80
	for Channel #11	94D 46-81
	for Channel #12	94D 46-82
	for Channel #13	94D 46-83

C2516Z, C2517Z, CU2516Z, CU2517Z

H2816Z, HU2816Z

H2516Z, HU2516Z

F2817Z, FU2817Z

TUBE COMPLEMENT

V1	6AM4	UHF Mixer
V2	6AF4	UHF Oscillator
V101	6BZ7	VHF RF Amplifier
V102	6J6	VHF Oscillator-Mixer
V201	6AU6	2nd Sound IF Amplifier
V202	6AL5	Ratio Detector
V203	6AV6	Sound Amplifier
V204	6V6GT	Sound Output
V301	6CB6	1st Intercarrier IF Amp.
V302	6CB6	2nd Intercarrier IF Amp.
V303	6AU6	3rd Intercarrier IF Amp.
V304A, V304B	12AT7	Video Detector; 1st Sound IF Amplifier
V305	6CL6* or 12BY7†	Video Amplifier
V306	(see page 2)	Picture Tube
V307	6AU6	Gated AGC
V401A, V401B	6SN7GT	Vertical Oscillator; Sync Inverter
V402	6AV5GT	Vertical Output
V403	12AU7* or 6C56†	Sync Separator and Clipper; Sync Sep. and Noise Lim.
V404	6AL5	Sync Discriminator
V405	6SN7GT	Horizontal Oscillator
V406	6CD6G	Horizontal Output
V407	1B3GT	2nd Anode Rectifier
V408	6V3	Damper
V501	5U4G	Rectifier
V502	5U4G	Rectifier

* 23E1Z, 23F1Z.
† 23B1AZ, 23C1AZ, 23E1AZ.

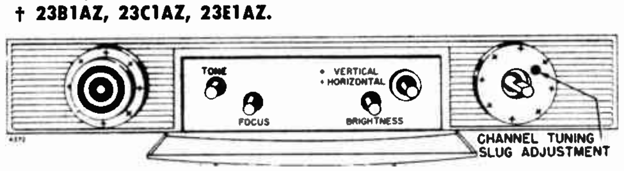


Figure 2. Control Panel for Models Using 23B1AZ, 23E1AZ and 23E1Z Chassis.

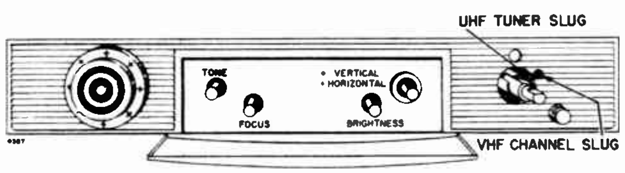


Figure 3. Control Panel for Models Using 23C1AZ and 23F1Z Chassis.

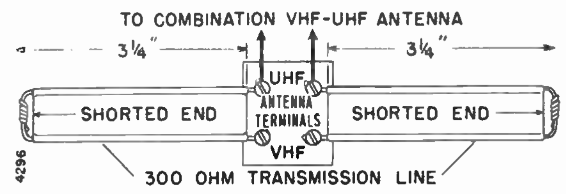


Figure 1. Antenna Connections When Combination VHF-UHF Antenna is Used.

Noise Gate Adjustment

The **Noise Gate** control, located at the rear of the set near the center, is used to improve sync stability in fringe areas and in noisy local areas.

Before making the **Noise Gate** adjustment, the **DX Range Finder**, located at the rear of the set, should be set at "0".

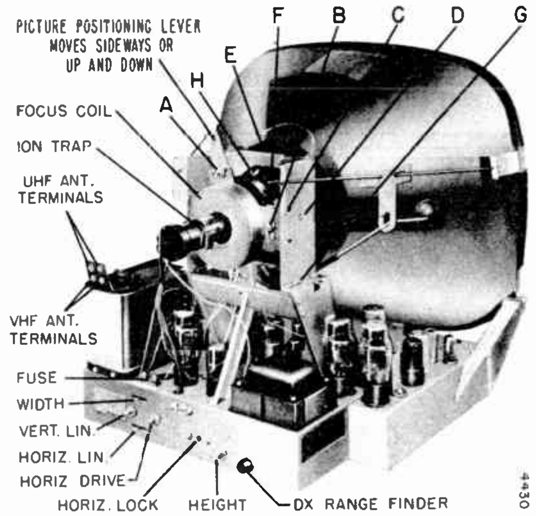


Figure 4. Rear View of 23E1Z and 23F1Z Chassis.

Set the **Noise Gate** fully to the left (counterclockwise). Set the **Channel Selector** for the strongest TV station and tune in a picture. Be sure that the **Vertical** and **Horizontal** controls on front panel are properly adjusted. If the picture is unstable (jitters or rolls), slowly turn the **Noise Gate** control to the right until picture just becomes stable. Check adjustment on other TV stations, and if necessary, readjust control.

Caution: If the **Noise Gate** control is turned too far to the right (clockwise) for a strong signal, the picture may become unstable (roll vertically or tear horizontally).

If the signal strength or noise level changes, it may be desirable to change the setting of the **Noise Gate**; however, it is generally possible to set it at a single compromise position which gives reasonable stability for the different signal conditions.

DX Range Finder Adjustment

The **DX Range Finder** control is at the extreme right when facing the rear of the chassis. This control is used to improve TV reception in fringe areas and in areas where there is interference.

The **DX Range Finder** should be set fully counterclockwise if good pictures can be obtained using the front panel controls of the receiver.

White flashes across the picture caused by extreme external noise can sometimes be minimized by careful adjustment of the **DX Range Finder**.

Where the TV signal strength is weak, the picture can often be improved by turning the **DX Range Finder** part

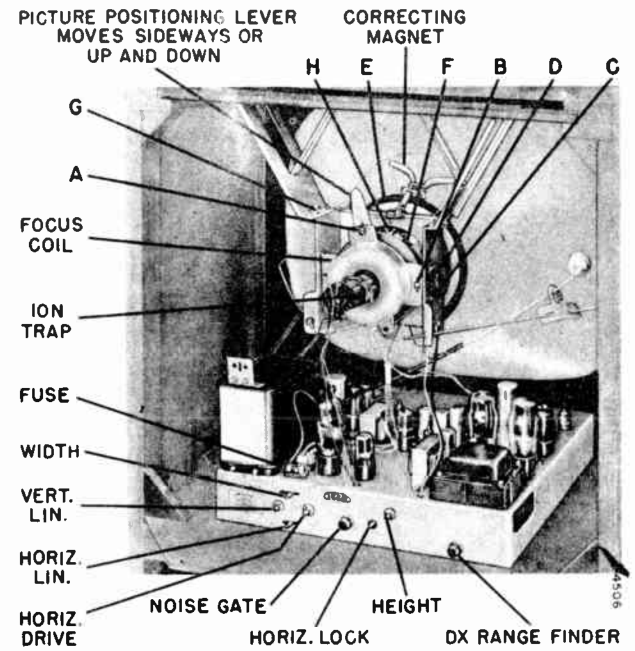


Figure 5. Rear View of 23B1AZ and 23C1AZ Chassis.

way to the right or, if necessary, fully clockwise. It may be necessary to make a slight readjustment of the **Noise Gate** control after adjusting the **DX Range Finder**.

If the signal strength changes, it may be desirable to change the setting of the **DX Range Finder**; however, it is generally possible to set it at a single compromise position which gives reasonable reception for the different signal strengths.

Caution: If the **DX Range Finder** is turned too far to the right for a strong signal, the picture may bend or disappear completely.

Horizontal Oscillator and Horizontal Drive Adjustment

When switching channels, the **Horizontal** control (on front panel) should keep the picture in horizontal sync through at least three fourths of its range. If the picture does not remain in horizontal sync, then adjust the rear panel controls as follows:

1. Allow the set to warm up. Tune in a station and adjust the **Brightness** and **Contrast** controls for average settings. Be sure that the **Noise Gate** and **DX Range Finder** controls are properly adjusted.
2. The **Horizontal Drive** control (at rear of set) is a potentiometer adjustment. Set the control to the approximate center of its rotation. If a white vertical line appears, turn the control to the left until the line just disappears.
3. Turn the **Horizontal** control (on front panel) fully to the left. While slowly rotating the **Horizontal** control to the right, switch the **Channel Selector** off and on a station several times. The picture should remain in horizontal sync for at least three fourths of the **Horizontal** control range. If not, set the **Horizontal** control to the position at which horizontal sync is lost.

Slowly turn the **Horizontal Lock** control to the right or left until the picture synchronizes. It may require one or more turns of the **Horizontal Lock** control to obtain the proper range for the **Horizontal** control on front panel.

THEORY OF OPERATION

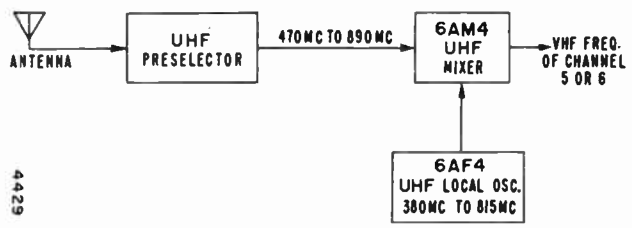


Figure 17. Block Diagram of UHF Tuner A4160.

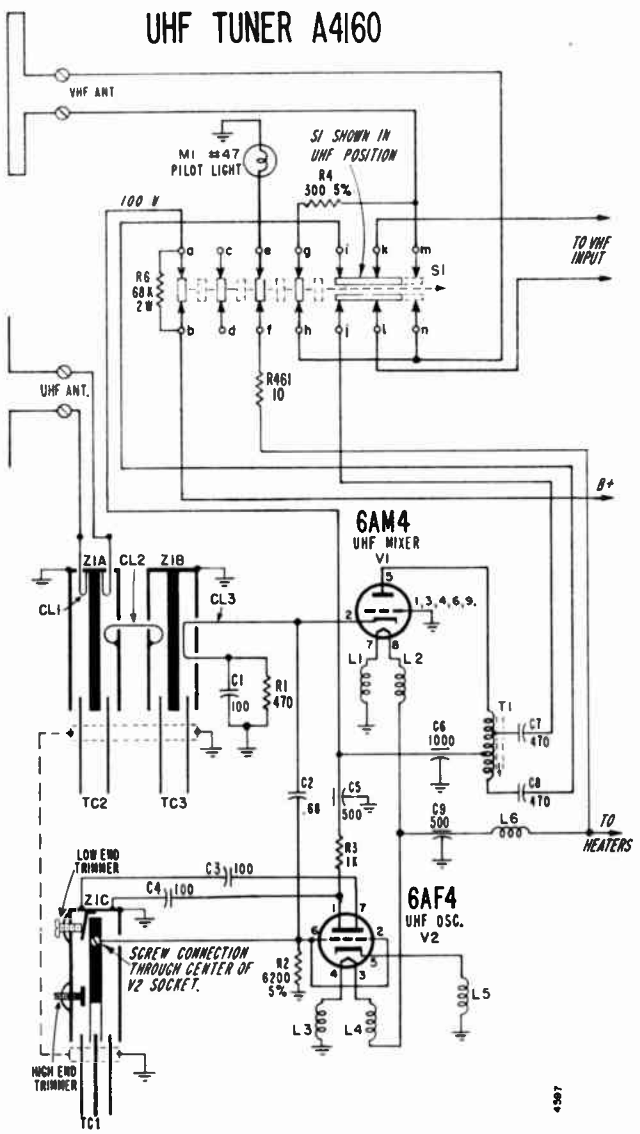


Figure 18. Schematic Diagram of UHF Tuner A4160.

TOUCH-UP OF RATIO DETECTOR SECONDARY USING A TELEVISION SIGNAL

This adjustment is accessible through the 1/4" hole (just below T201) in bottom of the cabinet or the chassis mounting shelf, located toward the right side facing the rear of the set. Removal of the chassis is therefore not required.

Adjustment need be made on one channel only. Proceed as follows:

1. Turn set on and allow about 15 minutes for warm up.
2. Tune set for normal picture and sound.
3. Carefully insert a non-metallic alignment tool through the top of T201. An alignment tool with a hexagonal end is required. When the alignment tool engages the bottom tuning slug A12, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about 1/4 to 1/2 turn.
4. If necessary, repeat individual channel slug adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will *not* be necessary to repeat the ratio detector secondary adjustment after *once* correctly adjusting it.

ALIGNMENT OF 4.5 MC TRAP USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting the slug A13 for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as instructed in step 3 under "4.5 MC Sound IF and Trap Alignment" procedure

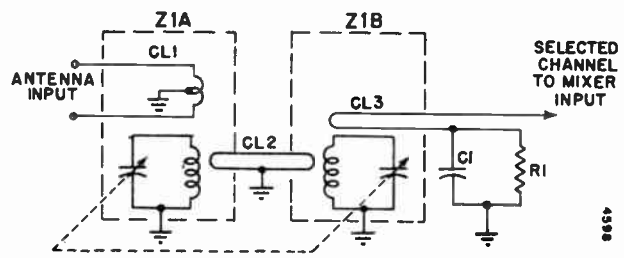


Figure 19. Equivalent Circuit of UHF Preselector.

SERVICE HINTS

UHF TUNER

The high frequencies at which the UHF tuner operates make it necessary that extreme care be exercised when servicing. The only field service recommended is minor repairs to the tuner such as replacement of tubes, switch S1 and resistors which are mounted on switch S1.

Alignment

The UHF tuner has been carefully aligned at the factory and generally should never require realignment in the field. Also, since alignment of the UHF tuner is quite involved, it is not recommended for field service. If it has been definitely determined that complete tuner alignment is required, it should be returned to your Admiral distributor for replacement.

Important: Do not under any circumstances attempt adjustment of the tracking screws or bend the capacitor tuning plates in any way.

The UHF tuner slug (mixer coupling network) may be adjusted to improve performance in weak signal areas or eliminate some forms of interference. This adjustment is located directly below the VHF channel slug adjustment. For information on "UHF Tuner Slug Adjustment"

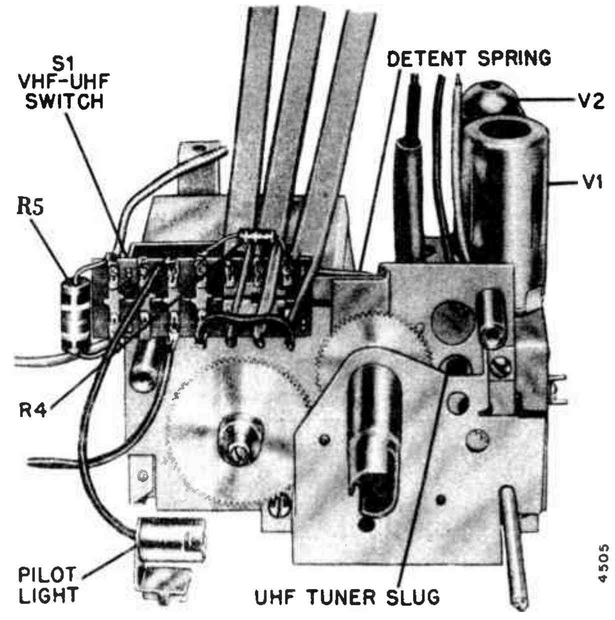


Figure 44. Front View of UHF Tuner.

Trouble Shooting

To isolate UHF trouble in a VHF-UHF receiver, it is suggested that VHF test equipment be used to check the VHF portion of the receiver in the same manner as checking for a defective VHF booster. If VHF operation is satisfactory, and it is known that a UHF signal of considerable strength exists, it can be assumed that the antenna or the UHF tuner is at fault. Carefully check the antenna and transmission line. If new tubes have been substituted in the UHF tuner and reception is still poor, the UHF tuner should be replaced. Be certain, however, that the VHF portion of the receiver is functioning normally. It is easy to be deceived where a strong VHF signal exists. Whenever possible, check VHF receiver sensitivity before replacing a UHF tuner. See "Fringe Area Television Reception" booklet, form number S346 Rev. 2, for instructions on checking sensitivity, expected sensitivity figures, and recommended equipment.

Faulty tubes will cause the majority of UHF tuner troubles. Listed below are some of the most common troubles generally due to faulty tubes.

1. Weak signal (excessive snow or no picture) can be caused by a faulty tube. Check V1 (6AM4) and V2 (6AF4).
2. Spurious responses. Spurious responses will show up as flashing on the screen while tuning in a picture. If flashing occurs at more than 6 points while tuning through the UHF band, check for a faulty oscillator tube V2 (6AF4).
3. Oscillator tube V2 (6AF4) gets excessively hot and B+ voltage at terminal "a" of VHF-UHF switch S1 is below 80 volts. Replace V2 (6AF4).

Note: Replacement of oscillator tube V2 (6AF4) may cause slight detuning of the oscillator circuit and thus affect tracking. If this occurs, a number of tubes should be tried, until the most satisfactory substitute for the original tube is found. Be sure that tubes and tube shields are pushed down and seated firmly.

Replacing Detent Spring on Switch S1

To replace the detent spring on switch S1, remove the mounting screw from the rear of the switch directly behind the spring. Lift the spring out with long nose pliers. Insert the replacement spring and mounting screw; do not tighten screw. Turn the High-Channel Selector shaft fully clockwise and position the detent spring until it engages the switch arm stud; then tighten screw. Check the operation of the switch to be sure that the switching action is positive.

Replacing Switch S1

To replace the VHF-UHF switch S1, carefully disconnect the leads and components from the switch. Remove switch mounting screws from the rear of the switch. Mount the replacement switch; do not tighten screws. Turn the High-Channel Selector shaft fully clockwise and position the detent spring until it engages the switch arm stud; then tighten screws. Check operation of the switch to be sure that the detent spring engages the switch and switching action is positive. Connect leads and components to the same terminals as on the original switch.

Servicing Tuning Drive

An all gear tuning drive assembly is used on UHF tuner A4160; see figure 45. The gear drive of these tuners should require very little attention. Rough tuning or play may be caused by insufficient clearance between gear M2 and idler pinion M3. The individual gears or the complete gear drive assembly are replaceable.

Lubrication: In general, the lubrication applied to the gears or bearing surfaces at time of manufacture should make lubrication seldom, if ever, necessary.

Lubricate gears or bearing surfaces with Admiral lubricant, part number 98A64-2, or light vaseline.

CAUTION: Use care so that lubricant does not come in contact with the UHF-VHF changeover switch. Do not use lubriplate or any similar lubricant containing zinc or cadmium.

Replacement of Gears: The complete gear train assembly or individual gears (M3, M4, M5, M6 and M7) are available for replacement (see figure 45). In general, it is recommended that the complete gear train and gear M2 be replaced, however, if difficulty is due to a specific gear or pinion, that particular part may be replaced individually.

When replacing the complete gear train, it will be necessary to remove the UHF tuner from the chassis

Gear M2 can be replaced without removing the UHF tuner from the chassis.

To replace gears M3, M4, M5, M6 and M7, proceed as follows:

1. Turn UHF fine tuning shaft (vernier) fully to the left (counterclockwise).
2. Remove the three screws which mount the gear cover plate to the tuner.
3. Remove and replace defective gear(s).
4. Set gears to original position. The UHF fine tuning shaft (vernier) must be rotated fully to the left (counterclockwise) and gear M2 must be about one tooth clockwise from full counterclockwise rotation.
5. Replace the three screws which mount the gear cover plate. **Important:** Before tightening screws, be sure gear M2 and idler pinion M3 have proper clearance to avoid binding or excessive backlash.

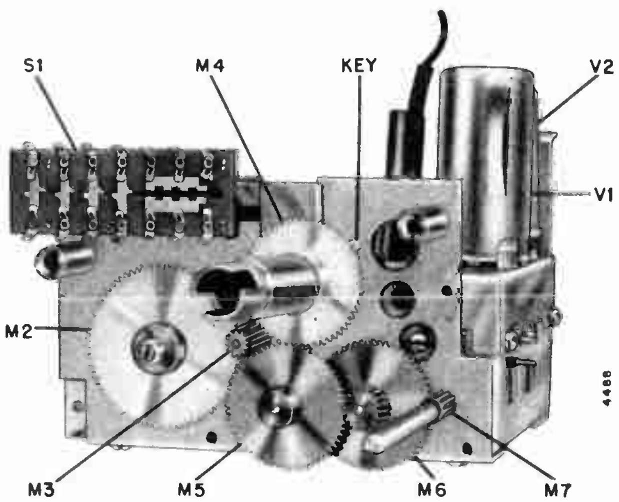


Figure 45. UHF Tuner Drive Assembly.

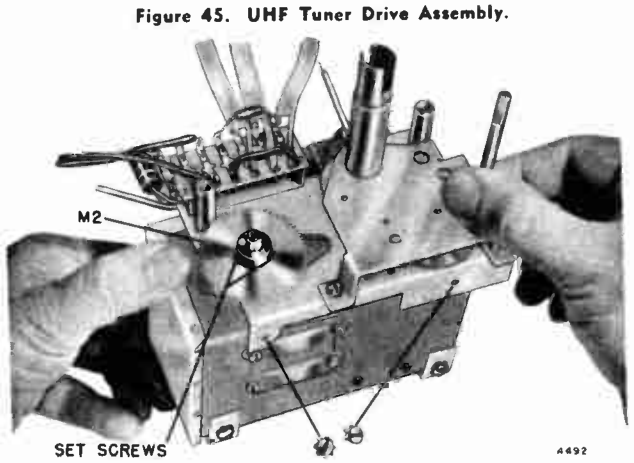


Figure 46. Front View of UHF Tuner A4160 Showing Removal of Gear Train.

To replace gear M2 without removing the UHF tuner from the chassis, it will be necessary to remove the screws which mount the VHF and UHF tuners to the chassis. Lower the tuners (without disconnecting wires) just far enough to allow access to gears. To replace gear M2, proceed as follows:

1. Turn UHF fine tuning shaft (vernier) fully to the left (counterclockwise).
2. Remove the two screws which mount the gear train assembly to the tuner; see figure 46.
3. Shift the gear train assembly to the right.
4. Using a #6 Allen wrench, loosen set screws on hub of gear M2; see figure 46.

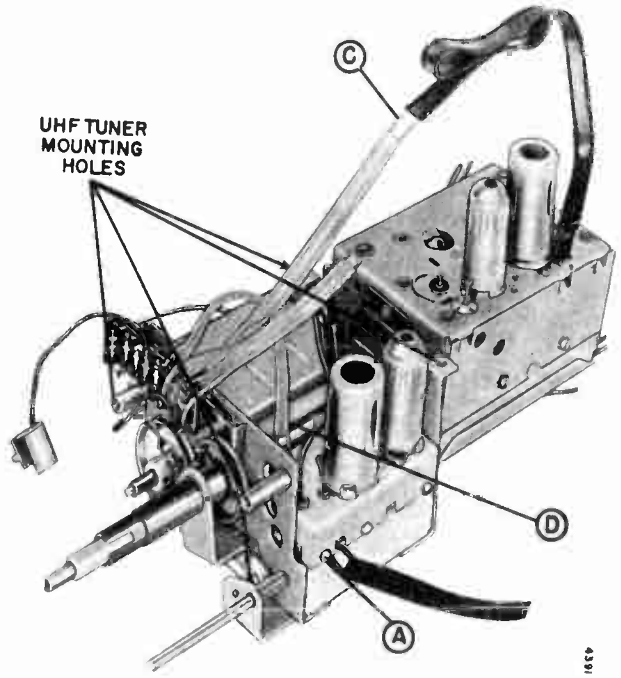


Figure 47. View of UHF and VHF Tuners With Connection Points for UHF Tuner Replacement.

5. Withdraw gear M2 from tuner shaft. **Caution:** Do not rotate M2 when removing, as tuner shaft may be marred.
6. Carefully insert the replacement gear. Space the gear 3/8 of an inch from the tuner and tighten each set screw equally.
7. Return the gear train assembly to its original position. The UHF fine tuning shaft must be rotated fully to the left (counterclockwise) and gear M2 must be about one tooth away from full counterclockwise rotation.
8. Replace the two screws which mount the gear train assembly to the tuner. **Important:** Before tightening screws, be sure that gears have proper clearance to avoid binding or excessive backlash.

Tuner Replacement

Replacement UHF tuners are supplied complete with connecting leads and components which are mounted to VHF-UHF switch S1. When soldering wires to switch S1, exercise care to prevent solder or rosin from running into the switch contacts. Switch contacts may also be damaged by application of excessive heat. Apply soldering iron to switch connection just long enough to melt solder.

A step-by-step procedure for removing the original UHF tuner and installing a replacement UHF tuner is given below. Carefully review the instructions and illustrations. Use figures 47, 48 and 49 for locations of connection points. See figure 22 for terminal location of VHF-UHF switch.

To remove the UHF tuner, proceed as follows:

1. Remove tube shields and tubes from the UHF tuner.

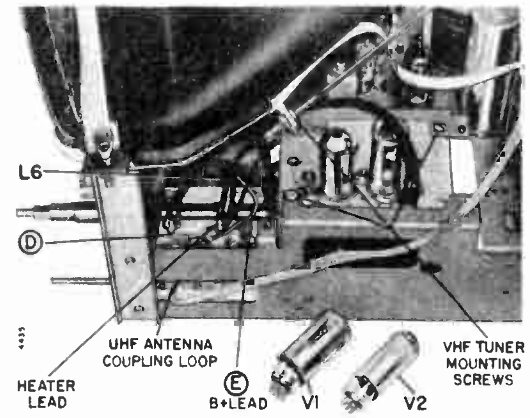


Figure 48. Side View of Chassis Showing UHF and VHF Tuners.

2. Unsolder the transmission line connected at point "A", terminals at the side of the UHF tuner.
3. Unsolder end of transmission line (23" length) connected to the lower terminals of the antenna terminal strip located at the top of the high voltage housing.
4. Unsolder the transmission line (7" length) at point "C", this runs from the VHF tuner to the VHF-UHF switch.
5. Unsolder the transmission line (6" length) at point "D", terminals of feed-thru insulators at top side of the UHF tuner. See figure 47.
6. Remove pilot light socket from mounting bracket.
7. Place the chassis on its side with the high voltage compartment away from the service bench.
8. Unsolder the lead connecting from terminal "b" of the VHF-UHF switch at point "F". Point "F" is the junction of C442 (20 mfd.) and R460 (12,000 ohms).

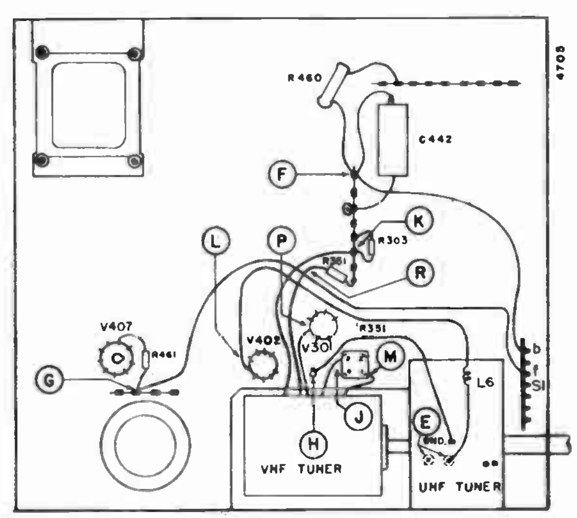


Figure 49. Bottom of TV Chassis With Connection Points for UHF and VHF Tuner Replacement.

V501 (tie-point), junction of capacitor C503. (.1 mfd.) and resistor R503 (9,000 ohms).

9. Unsolder the lead (usually brown) connecting from terminal "b" or "f" of VHF-UHF switch to point "G", terminal strip connection of resistor R461 (10 ohms).
10. Unsolder heater lead (wire with RF choke coil) at point "L", pin 5 of V402 (tie-point).
11. Unsolder the UHF tuner ground lead at point "H", ground lug in chassis.
12. Remove the tie bar at the front of the UHF tuner.
13. Remove the VHF tuner front mounting screws and only loosen the rear mounting screws. Use care so as not to break the short lead connecting from the VHF tuner to pin 1 of V301 (6CB6) tube.
14. Remove the UHF tuner front mounting screws and only loosen the rear mounting screws. Remove the rear mounting screws from the UHF tuner. Be careful so that the connections from the UHF tuner are not broken. To remove from chassis, lower the UHF tuner and slide it out while guiding the leads so that they do not catch on the chassis. See figure 50.

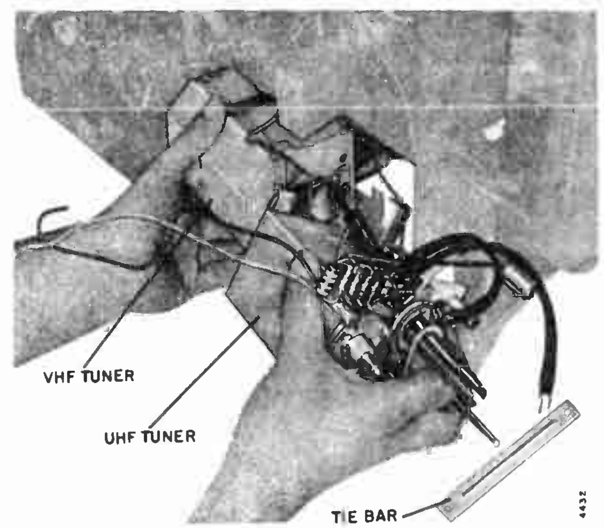


Figure 50. Bottom View of TV Chassis Showing Removal of UHF Tuner.

To install the replacement tuner, proceed as follows:

1. Remove the tube shields and tubes from the replacement UHF tuner. Insert the UHF tuner into the chassis so that the tuning shafts of the VHF tuner protrude through the center of the UHF tuning shaft. See figure 50.
2. Insert the pilot light socket through the rectangular cut-out and over the bar at the top front of the TV chassis. Insert the two lengths of transmission line through the rectangular cut-out in the chassis. Guide the heater lead (with choke coil), the ground lead (usually black) and leads from terminals "b" and "f" of VHF-UHF switch to the underside of the chassis through the rectangular cut-out in the chassis.

3. Replace the VHF and UHF tuner mounting screws. Before tightening screw, check tuner shafts to be sure that shafts operate freely, without binding. It may be necessary to shift tuners sideways or lower either tuner from the chassis, using washers as shims for proper clearance so that tuner shafts operate freely.
4. Solder transmission line from UHF antenna terminal to point "A", terminals at the side of the UHF tuner. **Important:** Do not twist wires. Lay wires parallel to each other, then solder.
5. Solder transmission line (23" length) connecting from terminals "m" and "n" of VHF-UHF switch to the lower terminals of the antenna terminal strip located at the top of the high voltage housing.
6. Solder transmission line (7" length) connecting from terminals "k" and "l" of VHF-UHF switch to point "C", junction of transmission line from VHF tuner.

   Important: Do not twist wires. Lay wires parallel to each other, then solder and tape.
7. Solder transmission line (6" length) connecting from terminals "i" and "j" of VHF-UHF switch to point "D", terminals of feed-thru insulators at top side of UHF tuner. See figures 47 and 48. **Important:** Do not twist wires. Lay wires parallel to each other, then solder.
8. Solder lead connecting from terminal "b" of VHF-UHF switch to point "F". Point "F" is the junction of C442 (20 mfd.) and R460 (12,000 ohms).
9. Solder pilot light lead (usually brown) connecting from terminal "f" of VHF-UHF switch to point "G", terminal strip connection of resistor R461 (10 ohms).
10. Solder heater lead (wire with RF choke coil) to point "L", pin 5 of V402 (tie-point).
11. Solder the UHF tuner ground lead to point "H", ground lug in chassis.
12. Replace tie bar at front of TV chassis.
13. Insert tubes and tube shields in tuner. **Important:** Be sure that tubes and tube shields are seated firmly.
14. Before operating set, check tuner to see that all mounting screws are tight and all soldered connections are secure. Refer to "Installation and Service Adjustments".

VHF TUNER

Servicing Channel Coils

The cabinets containing 23 series chassis have been provided with a rectangular cut-out in the chassis shelf just below the TV tuner. This access opening will permit servicing of the tuner channel coils or for installing UHF channel coils without removal of the chassis from the cabinet.

To gain access to the underside of the tuner, it is necessary to remove the screen covering from over the cut-out in the chassis shelf. Then remove the bottom shield from the bottom of the tuner. After servicing the channel coils, carefully replace the tuner shield. Replace the metal screen, using staples or thumb tacks to secure it to the cabinet.

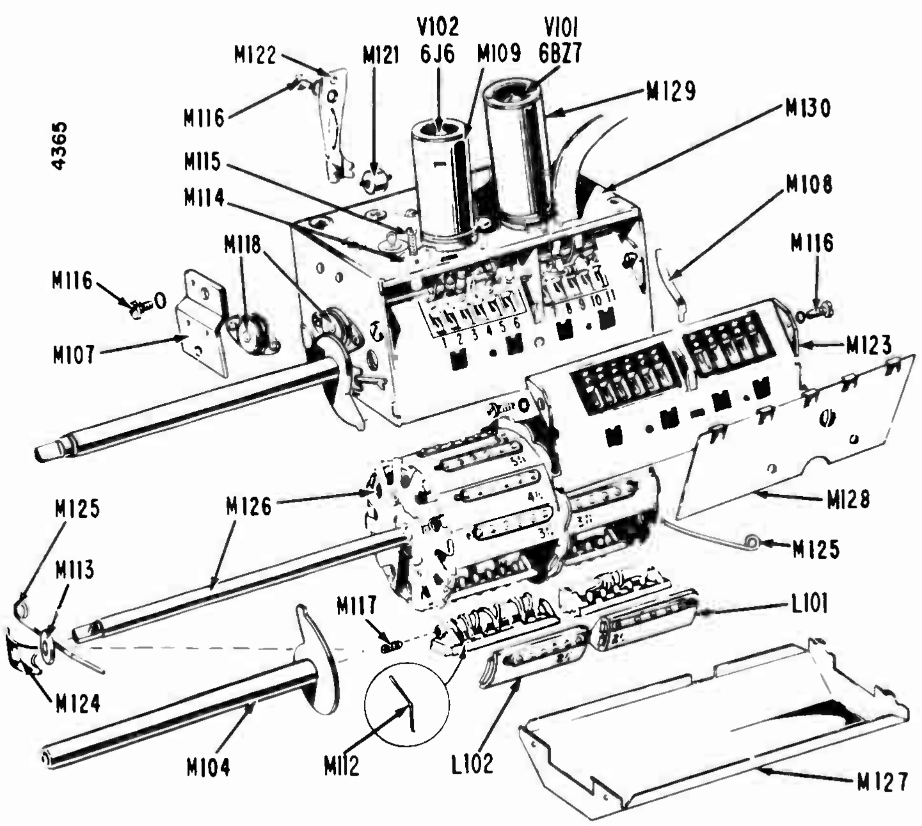


Figure 51. Exploded View of VHF Tuner.

Removing Channel Coils: Insert a screwdriver blade between the coil retainer spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward.

Replacing Oscillator Slugs: If VHF oscillator slugs fall into the coil form, remove the channel coil, move the slug retaining spring M112 aside, and tap the coil assembly until the slug slips forward. Set the slug retaining spring into position; it should rest firmly against the slug.

Servicing Contacts of VHF Tuner

A rectangular opening is provided at the side of the chassis for convenience in servicing the stationary contacts of the TV tuner or for making voltage or resistance measurements.

To gain access to the stationary contacts of the TV tuner, it is necessary to remove the mounting screws from the side cover plate on the tuner and unsolder the soldered joint grounding the cover plate to the tuner. Reassemble the cover plate in the same manner.

Adjusting Contact Springs: Should the stationary contacts make poor connections due to insufficient tension, remove several sets of coils from the turret. Rotate the turret to position making the bottom of the contact strip accessible for observation. With a narrow blade screwdriver, adjust the contact spring tension by carefully bending the spring inward until the highest point on the spring extends about 9/64 of an inch above the plastic surface of the contact plate. With correct tension of the contact spring, the spring should clear the flat surface of the turret coil by about 1/64 of an inch.

Cleaning Contacts: Remove several sets of coils from turret and rotate turret to position making contact points of contact plate accessible for cleaning.

Using a small, stiff brush and carbon tetrachloride, clean contact surfaces of stationary contacts.

Remove accumulated dust or grease from stationary contacts and contact plate with a soft canvas cloth dampened with carbon tetrachloride. Accumulated rosin may be removed with a soft cloth dampened with alcohol.

Clean contact surfaces of rotating coils in same manner.

Removing Tuner Turret Assembly

1. Remove retaining bracket M107 in front of the tuner.
2. Remove rotor shaft assembly M104, rotor contact spring M124 and fiber washer M113. For reassembly, note order of parts removal.
3. Remove front and rear turret retaining springs M125 by pressing straight end away from tab on chassis.
4. Using a screwdriver blade at the side of the tuner, press the detent spring M122 and roller M121 away from the turret detent plate.
5. Grasp tuner shaft and slip out of end plate bearings.

Removing Contact Plate Assembly M123

1. Remove turret.
2. Remove the mounting screws at the front and rear of Contact Plate and Bracket Assembly M123.
3. Unsolder both ends of contact plate assembly. Press outward the front and rear tuner chassis end plates.
4. To free contact plate assembly, release the contact plate tabs by pushing them away from the slots in the end plates.
5. Unsolder all connections to contact plate. Unsolder the solder joint holding contact plate to the center partition of the tuner chassis.
6. Reassemble in the same manner.

Replacement of the Ungrounded Stator Plate of Tuning Control

Stator plate M118 (part number 94A45-86) is replaced with wiring lead and trimmer capacitor C110 attached, because it is difficult to solder the wire lead to the silver plated surface on the ceramic stator plate disc.

To replace the stator plate, remove the turret assembly. Remove mounting rivets from stator plate by drilling out or clipping them out with diagonal wire cutters. Remove trimmer screw M115 and locking nut M114 from trimmer capacitor C110. Unsolder wiring lead connecting trimmer to terminal on contact plate.

Assemble the replacement stator plate (M118) by placing the ceramic button over the ⅝" hole in the chassis with the wiring lead extending into the chassis. Place the mounting bracket over the ceramic button and mount securely using #4x3/16" round head machine screws with #4-40x3/16" hex nuts and #4 shake proof lock washers. Mount trimmer capacitor C110 in chassis and solder wire lead to its original terminal on the contact plate making this lead as short as possible. Dress wiring lead from ceramic stator plate to trimmer capacitor C110 so it does not come in contact with the turret drum. After replacement of the stator plate, adjust trimmer capacitor C110 (overall oscillator adjustment).

Tuner Lubrication

In general the lubrication applied to points of wear or friction at time of manufacture should make lubrication seldom, if ever, necessary. However, should tuner lubrication become necessary, it is important that the correct amount and type of lubricant be used.

Using a clean brush, apply a film of switch contact oil (Admiral part number 98A64-1 or Viscosity Oil Co. #7069) to the surfaces of the coil contacts and stationary contact points.

Lubricate bearing surfaces of all other moving parts with Admiral lubricant, part #98A64-2, Viscosity Oil Co. #8857 lubricant, or light vaseline.

Caution: Do not use lubriplate or any similar lubricant containing zinc or cadmium.

VHF Tuner Replacement in Sets Using UHF Tuner

The removal or installation of a replacement VHF tuner in VHF-UHF sets using the All-Channel UHF tuner requires the lowering of the UHF tuner and unsoldering of leads as shown in figure 52.

A step-by-step procedure is given below for removing and installing a replacement VHF tuner in sets using All-Channel UHF tuner A4160. Use figure 49 for location of connection points J, K, M, P and R, and figure 52 for illustration of VHF tuner removal.

To remove the VHF tuner, proceed as follows:

1. Remove all screws mounting the UHF tuner to the chassis. UHF tuner leads need not be disconnected, however, use care so as not to break wire connections or connector lugs on VHF-UHF switch.
2. Place the TV chassis on its side with VHF-UHF tuners nearest the workbench. Place a block under the side of the chassis to avoid damage to the antenna coupling terminals extending through the side of the chassis from the UHF tuner.

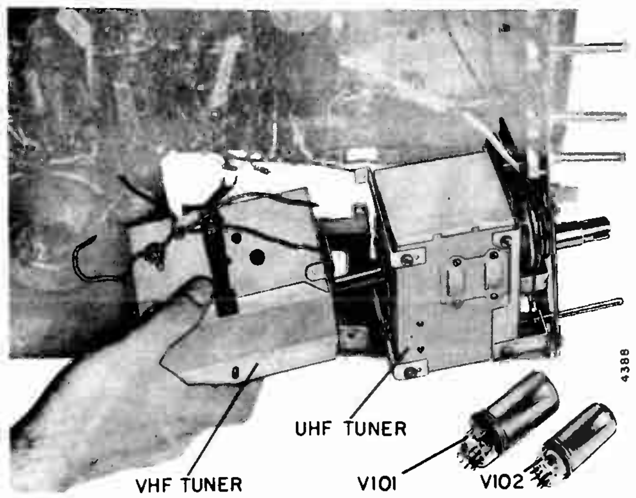


Figure 52. Bottom View of TV Chassis Showing Removal of VHF Tuner.

3. Unsolder VHF tuner leads at connection points J, K, M, P and R.
4. Remove tube shields and tubes from the VHF tuner.
5. Remove all screws mounting the VHF tuner to the chassis.
6. Remove the VHF tuner from the chassis by lowering the UHF tuner and sliding the VHF tuner to the rear of the chassis while lowering it at the same time.

To install a replacement VHF tuner, proceed as follows:

1. Remove tube shields and tubes from the replacement VHF tuner.
2. Apply a slight film of grease or vaseline to VHF tuner shaft.
3. Insert replacement VHF tuner in chassis by sliding the VHF tuner shaft through center of the UHF tuner shaft.
4. Replace VHF and UHF tuner mounting screws. Before tightening the mounting screws, check both tuner shafts to be sure that they operate freely, without binding. It may be necessary to shift tuners sideways or lower either tuner from the chassis by using washers as shims for proper clearance so that tuners operate freely.
5. Solder the VHF tuner leads to connection points J, K, M, P and R.
6. Insert the tubes and tube shields in the VHF tuner.
7. Before operating set, check VHF and UHF tuners to be sure that all mounting screws are tight and all soldered connections are secure. Refer to "Installation and Service Adjustments".

PRODUCTION CHANGES

Production changes coded RUN 2 and higher are given below. The run number is stamped on the rear of the chassis and indicates that the particular chassis has the change described under the run number, as well as all changes made prior to that time (i.e. all lower run numbers).

At the start of production the 23E1Z and 23B1AZ chassis were stamped RUN 1, however RUN 1 of the 23B1AZ chassis includes all the changes listed below through RUN 3. The 23C1AZ and 23F1Z were stamped RUN 4 at the start of production, and the 23E1AZ was stamped RUN 5.

RUN 2 (23E1Z Chassis)

Resistor Change to Improve Horizontal Linearity

See 23E1Z schematic for new circuit, see figure 53 below for original circuit.

R442 changed from 5,600 ohms, 2 watt to 18,000 ohms, 2 watt. R462, 5,600 ohms, 2 watt deleted. R462, 1,200 ohms, 2 watt added across horizontal linearity coil L403.

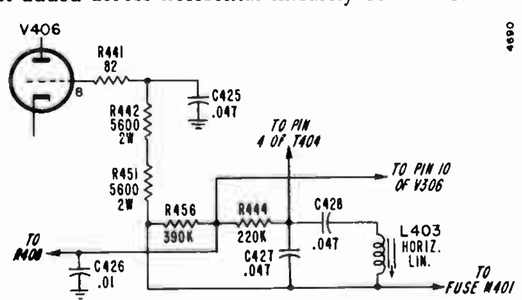


Figure 53. Original Screen Grid Circuit of V406 in 23E1Z Chassis.

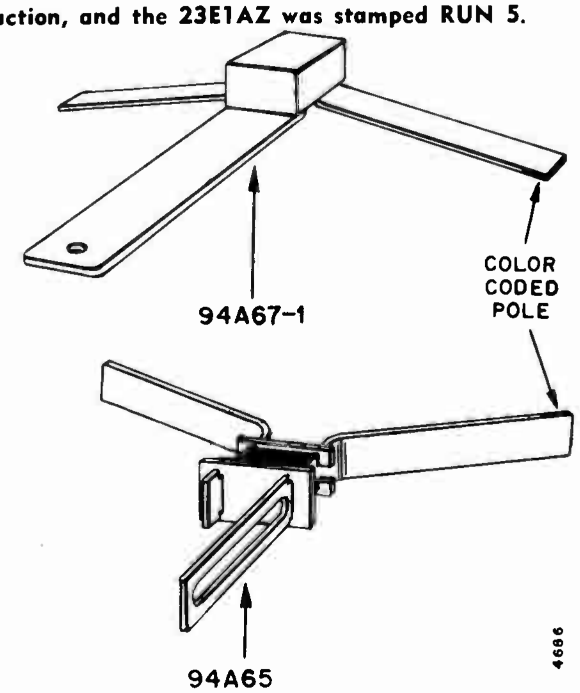


Figure 54. Different Types of Curvature Correcting Magnets.

RUN 3 (23E1Z Chassis, also RUN 1 23B1AZ Chassis)

Magnet Addition to Eliminate Pin-Cushion Effect

Curvature correcting magnets added to top and bottom of deflection yoke housing to eliminate pin-cushion effect at top and bottom of raster. Early production sets used part number 94A65 magnets while part number 94A67-1 magnets are currently being used. 94A67-1 magnets will be supplied as replacements (see figure 54 for illustration of different magnets).

RUN 4 (23B1AZ, 23C1AZ, 23E1Z and 23F1Z Chassis)

Capacitor Change to Improve Horizontal Oscillator Stability When Switching Channels

C419 changed from 470 mmfd. to 330 mmfd.

RUN 5 (23B1AZ, 23E1Z and 23E1AZ Chassis)

Resistor Change to Increase Width

R440 changed from 150 ohms, 2 watt to 120 ohms, 2 watt.

RUN 6 (23B1AZ and 23E1AZ Chassis)

Change to Increase Vertical Stability When Switching Channels

See 23B1AZ schematic on page 51 and 23E1AZ schematic on page 53 for new circuits. See figure 55 at right for original circuit.

R472 changed from 4,700 ohms to 3,300 ohms. R478 22,000 ohms, 2 watt and C445, 20 mfd, filter network added to plate circuit of V401B (½ 6SN7GT).

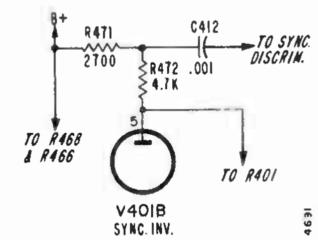


Figure 55. Original Plate Circuit of V401B in 23B1AZ and 23E1AZ Chassis.

RUN 7 (23B1AZ and 23E1AZ Chassis)

Resistor Change to Improve Horizontal Stability at Minimum Contrast

R335 changed from 1,000 ohms to 330 ohms, R331 changed from 180,000 ohms to 270,000 ohms.

ALIGNMENT

GENERAL

Complete alignment consists of the following individual procedures and should be performed in this sequence.

1. IF Amplifier and Trap Alignment.
2. IF Response Curve Check.
3. 4.5 MC Sound IF and Trap Alignment.
4. RF and Mixer Alignment.
5. Over-all RF and IF Response Curve Check.
6. VHF Oscillator Adjustment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available.

Important: Many service instruments do not meet the requirements given below. A list of recommended equipment is available from your Admiral distributor.

Oscilloscope

Standard oscilloscope, preferably one with wide band vertical deflection, vertical sensitivity at least .5 volt (RMS) per inch.

Signal (Marker) Generator

4.5 MC frequency.

18 to 30 MC frequency range.

50 to 90 MC frequency range.

170 to 225 MC frequency range.

Must have a calibration crystal for checking dial accuracy.

Sweep Generator

The sweep generator must provide sweep frequencies from 18 to 30 MC, 50 to 90 MC and 170 to 225 MC. The sweep width must be at least 10 MC. The output must be adjustable with at least one-tenth of a volt maximum. The output impedance should be 300 ohms balanced to ground.

A sweep generator not having constant output voltage over the swept range and linear sweep, will produce curves which are widely different from the ideal curves shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

Vacuum Tube Voltmeter

Preferably with low range (3 volt) DC zero center scale and a high voltage probe (30,000 volt range).

ALIGNMENT TOOLS

The following alignment tools are required. They are available from your Admiral distributor under the part numbers listed below:

Metal alignment screwdriver part number 98A30-9.

Non-metallic (fiber) alignment screwdriver (11½" long, ⅛" diameter) part number 98A30-10.

Non-metallic alignment wrench (9" long, for hexagon core IF slugs) part number 98A30-12.

ALIGNMENT HINTS

The following suggestions may be of assistance if difficulty is experienced during the alignment procedure.

Adjacent Channel Trap

If difficulty is experienced in aligning the 27.25 MC and 19.75 MC traps (A7 and A8), using the method outlined in the alignment procedure on page 38 make trap alignment as follows:

1. Connect an oscilloscope between plate of video amplifier V305 and chassis.
2. Make all connections and receiver control settings as instructed in steps 5 and 6 of the alignment procedure

3. Operate the signal generator with AM (audio) modulation turned on. Full generator output may be required. **Note:** If a termination resistor is used in the generator output cable, increased generator output can be obtained by disconnecting the terminating resistor. Connect a condenser (.002 mfd. or larger) in series with the generator high side.
4. Adjust A7 (27.25 MC trap) and A8 (19.75 MC trap) for minimum amplitude of the waveform on the oscilloscope.

IF Instability

When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF response curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning A5 (3rd IF transformer T303). To correct either of these conditions, the following alignment hints should be tried:

1. Check the generator output leads to be certain that the unshielded portion (especially the grounded lead) be as short as practicable.
2. Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible. (See figure 60).
3. Insulate a tube shield as shown in figure 56.
4. The use of a non-metallic alignment tool, approximately eight inches long, will permit adjustment without coming too near to the IF transformers.

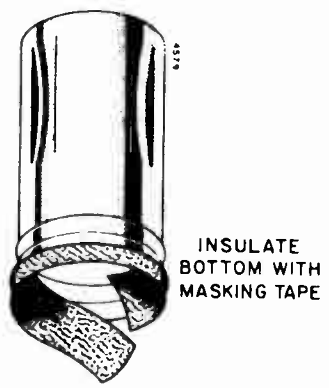


Figure 56. Special Tube Shield for IF Alignment and IF Response Curve Check.

Receiver Overloading When Checking Over-all Response Curve

Due to the inherent high sensitivity of these receivers, it is very easy to cause overloading in the third IF amplifier stage. In some cases, generator leakage alone is enough to produce a response curve on the oscilloscope. To prevent overloading do the following:

1. Be certain that the generator output attenuators are set at a minimum.
2. Some generators have a built-in pad in the output cable to be used when viewing the over-all response curve. Be sure that the pad in the cable is properly connected in the circuit. Refer to the generator instruction manual for details.
3. If a pad is not built in, the 12 db pad shown in figure 57 can be constructed and connected between the generator and the antenna terminals.

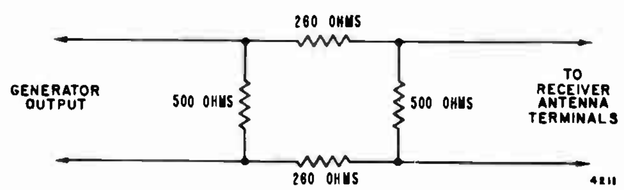


Figure 57. Illustration of 12 db Attenuation Pad for Viewing Over-all RF-IF Response Curve.

IF RESPONSE CURVE CHECK

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set Channel Selector on channel 12 or an unassigned high channel. Contrast control fully to the left. Connect negative of 4½ volt bias battery to test point "T"; positive to chassis.	Connect high side to top of 6J6 mixer-osc. special tube shield. Connect low side to chassis, see figure 56. Set sweep frequency to 23MC, and sweep width approximately 7MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on top of tube shield, low side to bottom of tube shield. Marker frequencies indicated an IF Response Curve.	Connect to test point "V" through a decoupling filter. See figures 60 and 61. Marker pips on scope will be more distinct if a condenser from 100 mmfd to 1000 mmfd is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 58. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touch-up with IF slugs as instructed below. If curve changes shape with hand capacity, see "Alignment Hints"

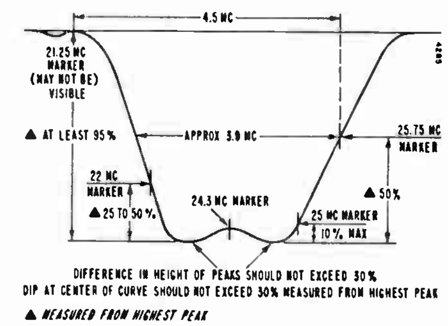


Figure 58. Ideal IF Response Curve.

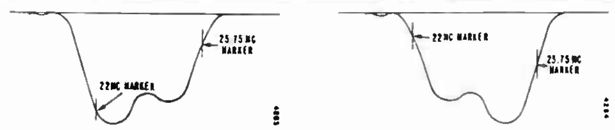


Figure 59. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks, carefully adjust slug A5 (23.5 MC). It should not be necessary to turn slug more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

* Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation. Also see "Adjacent Channel Trap"

IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point "T", see figure 61, positive to chassis. A 4½ volt battery is required for steps 1, 2, 3, 4, 7 and 8. A 1½ volt battery is required for steps 5 and 6.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel Selector to channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Contrast control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
1	25.3 MC	VTVM high side to test point "V" through a decoupling filter, common to chassis. See figures 60 and 61. Connect generator high side to top of special tube shield for 6J6 (V102); connect low side of generator to bottom part chassis. See figure 56.	Use 4½ volt bias battery. Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. Set channel switch to channel 12 or other unassigned high channel.	A1, A2 and A3 for maximum.
2	22.3 MC			A4 for maximum.
3	23.5 MC			A5 for maximum.
4	*21.25 MC			A6 for minimum.
5	*27.25 MC	Connect Generator and VTVM same as in step 1.	Use 1½ volt bias battery. Set channel switch between channels to break channel coil contact; VTVM reading will change when coil contact is broken.	A7 for minimum.
6	*19.75 MC			A8 for minimum.
7	25.3 MC	Connect Generator and VTVM same as in step 1.	Use 4½ volt bias battery. Set channel switch same as in step 1.	Readjust A1, A2 and A3 for maximum.
8	To insure correct IF alignment, make the "IF Response Curve Check" given below.			

4.5 MC SOUND IF AND TRAP ALIGNMENT

a. Connect signal generator high side to pin 1 or pin 2 of V304 (12AT7) through a .01 mfd. condenser, connect low side to chassis.

b. Allow about 15 minutes for receiver and test equipment to warm up.

c. Set Contrast control fully to the left (counterclockwise).

d. Use a ***non-metallic*** alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adjustment A11 can be made from top of chassis, if you use alignment tool #98A30-12 obtainable from Admiral distributor.

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
	When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle. IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station and follow steps 1, 2 and 3 below. If necessary use a higher scale on the VTVM.			
1	Set to exactly 4.5 MC.	High side to test point "Y"; common to chassis.	Use lowest DC scale on VTVM.	A9, A10 and A11 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
2		High side to test point "Z"; common to chassis.	Use zero center scale on VTVM, if available.	A12 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A12 was far off, repeat step 1.
3		High side to test point "Y"; common to chassis.	Connect a 10 mmfd. condenser from plate of V305 to pin 8 of V304 (12AT7). Use lowest DC scale on VTVM.	A13 for minimum.

SIMPLIFIED ALIGNMENT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures 61 and 63.

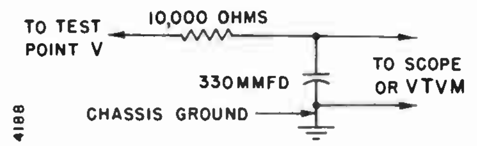


Figure 60. Decoupling Filter.

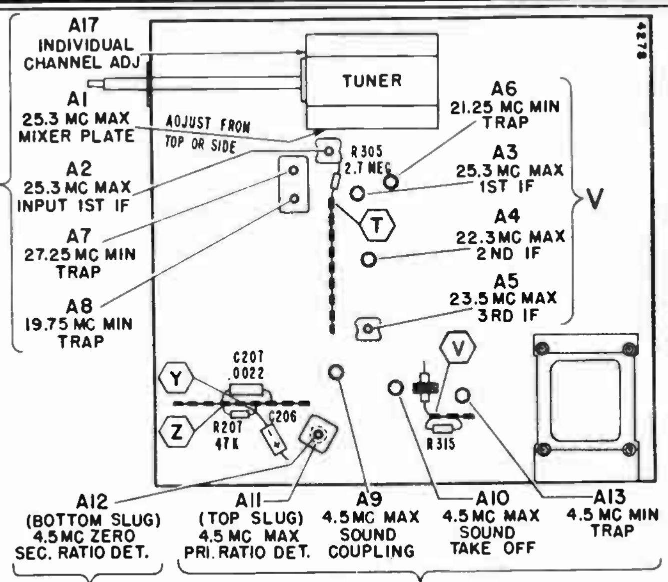


Figure 61. Bottom View of Chassis Showing Test Point Connections and IF Alignment Data.

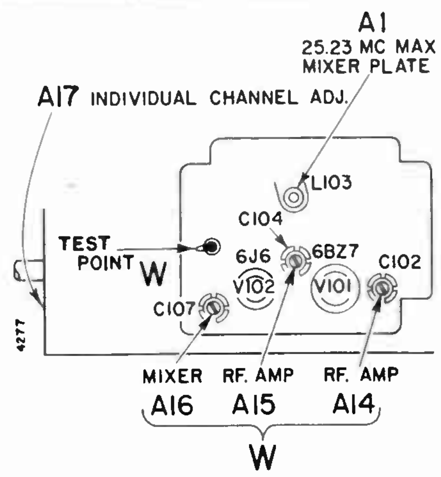


Figure 63. Top of TV Tuner, Showing Adjustment Locations.

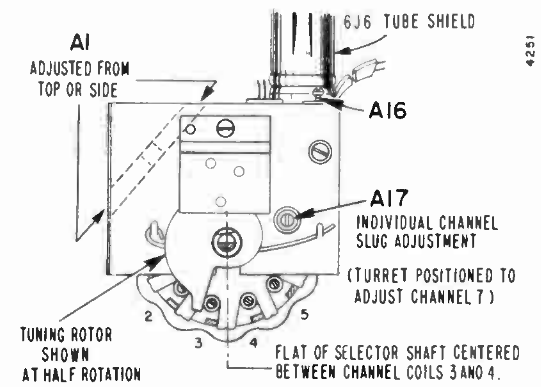


Figure 64. Front View of TV Tuner.

RF AND MIXER ALIGNMENT

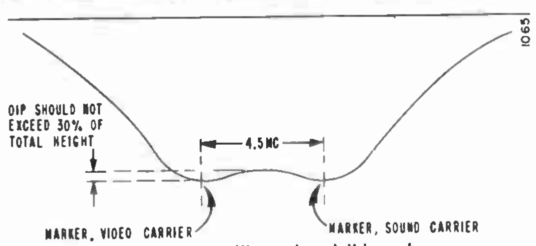
a. Connect negative of 4½ volt bias battery to AGC buss (test point "T"), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point "T" to chassis.

b. Connect sweep generator 300 ohm output to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

c. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (figure 63). Keep scope leads away from chassis.

d. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See frequency table below.	Check for RF response curve below. Alternately adjust A15 and A16 (figure 63) as required to obtain equal peak amplitudes and symmetry consistent with proper bandwidth and correct marker location.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping Channel 6. See frequency table below.	Check for RF response curve below. Adjust A14 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper bandwidth and correct marker location. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator to the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.



Full skirt of curve will not be visible unless generator sweep swidth extends beyond 10 MC.

Figure 62. RF Response Curve.

FREQUENCY TABLE

Channel Number	Channel Freq., MC	Video Carrier, MC	Sound Carrier, MC	VHF Osc., MC
2	54-60	55.25	59.75	81
3	60-66	61.25	65.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

OVER-ALL RF AND IF RESPONSE CURVE CHECK

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Contrast control fully to the left. Channel Selector on channel 12 or other unassigned high channel. Connect negative of 4½ volt bias battery to test point "T", positive to chassis.	Connect to antenna terminals. Set generator to sweep channel selected. Keep generator output as low as possible to prevent overloading. See frequency table on previous page.	If an external marker generator is used, loosely couple high side to sweep generator lead. Marker frequencies are shown in frequency table on previous page.	Connect to point "V" through a decoupling filter. See figures 60 and 61.	Compare the response curve obtained against the ideal curve shown in figure 65. If the curve is not within tolerance, touch up the IF slug as instructed below. It should never be necessary to turn slugs more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. IMPORTANT: When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change.

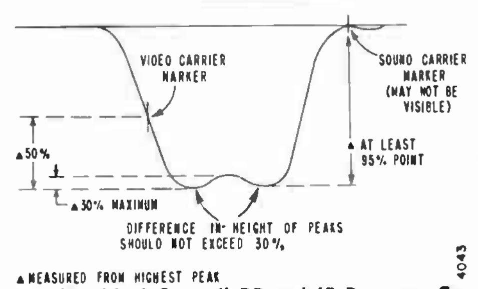
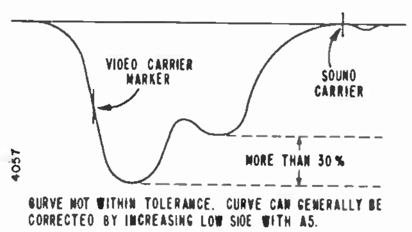


Figure 65. Ideal Over-all RF and IF Response Curve.

Note that video carrier (marker) on the "Over-all RF-IF Response Curve" will appear on the opposite side of the curve as compared to the "IF Response Curve" figure 8. This is due to action of the mixer tube.



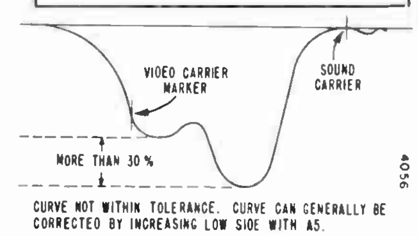


Figure 66. Over-all RF and IF Response Curves, Incorrect Shape.

VHF OSCILLATOR ADJUSTMENT USING SIGNAL GENERATOR

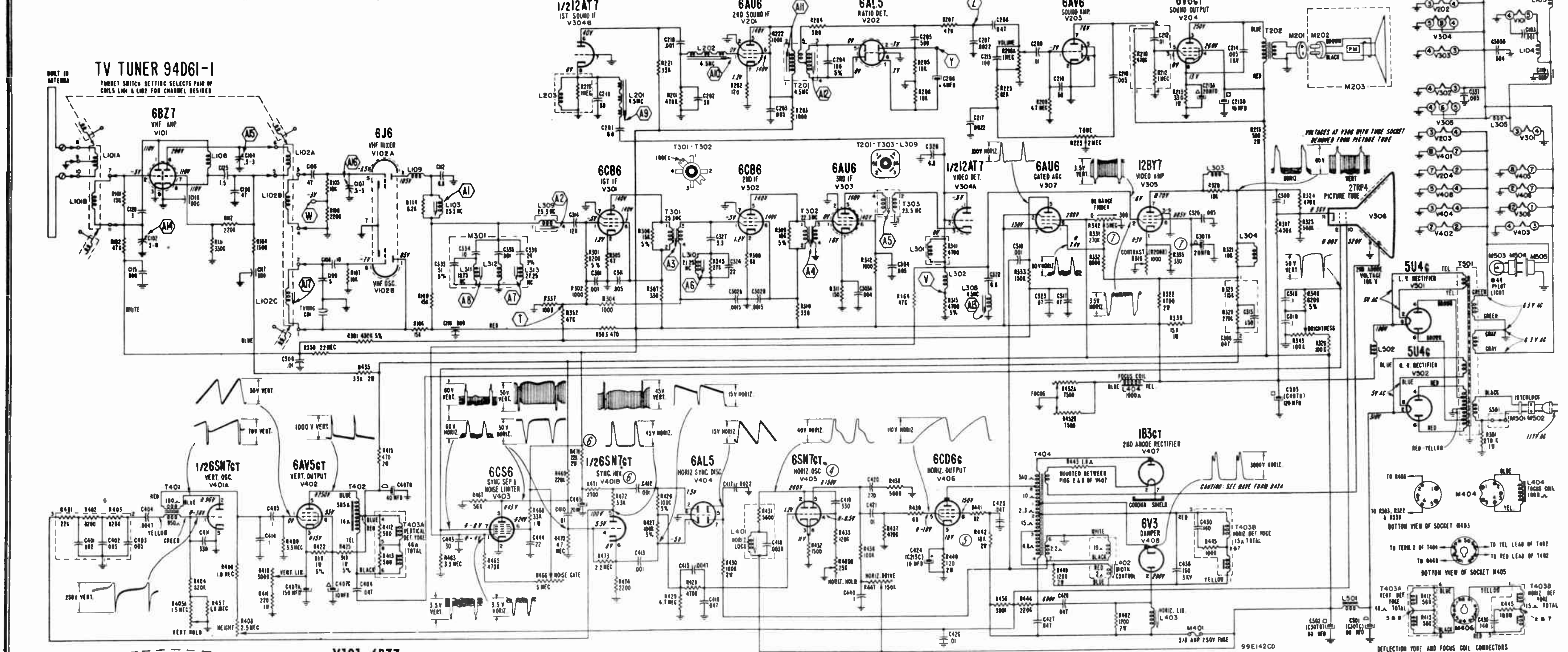
It is always advisable to make VHF oscillator adjustments using a Television Signal as instructed If a Television Signal is not available, VHF oscillator adjustment can be made using a crystal calibrated signal generator. Make adjustments as follows:

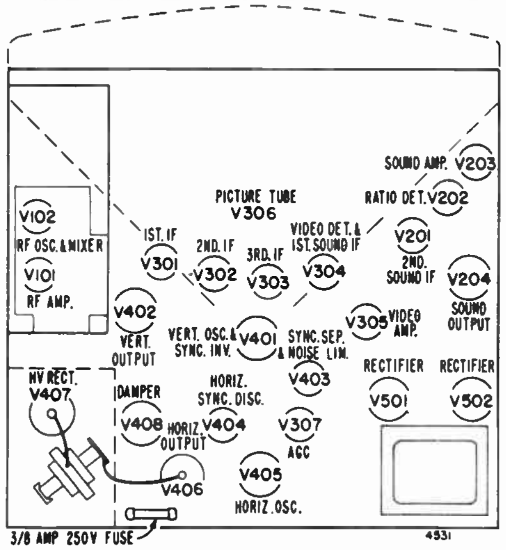
Receiver Control Settings	Signal Generator	Instructions
Set Channel Selector for each channel to be adjusted. Set "Tuning" control at half rotation. Turn volume control fully to the right (clockwise).	Connect to antenna terminals. Set generator to exact frequency of HF oscillator. See frequency table on previous page. **Set generator for maximum output.**	Connect a wire jumper from test point "W" on the tuner to test point "Z". See figure 61. Remove the ratio detector tube V202 (6AL5). Carefully adjust the individual oscillator slug A17 until a whistle (beat) is heard in the speaker of the receiver.

Schematic for 23B1AZ VHF Television Chassis.

SCHEMATIC NOTES

(A1), (A2),.....(Y), (Z), etc. indicate alignment points and alignment connections.
Numerical symbols ②, ③, ④, etc., on schematic indicate production changes covered by Run numbers. Run numbers are rubber stamped on the rear of the chassis.





Top View of Chassis.

V101—6BZ7
V102—6J6
V201—6AU6
V202—6AL5
V203—6AV6
V204—6V6GT
V301—6CB6
V302—6CB6
V303—6AU6
V304—12AT7
V305—12BY7
V306—27RP4
V307—6AU6
V401—6SN7GT
V402—6AV5GT
V403—6CS6
V404—6AL5
V405—6SN7GT
V406—6CD6G
V407—1B3GT
V408—6V3
V501—5U4G
V502—5U4G

TV VOLTAGE DATA
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Channel Selector** set on an unused channel. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position). **Noise Gate** control set fully to the left.
- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
  Voltages at V306 measured from top of socket with tube removed.
- Voltages at V101 and V102 (VHF tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.
  Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described or no voltage reading will be obtained.
- Voltages marked with an asterisk (*) will vary widely with control setting.

CAUTION

Pulsed high voltages are present on the caps of V406 and V408 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 19 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

WAVEFORM DATA
(Waveforms given on schematic)

Waveform taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). **Warning:** Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion. **Noise Gate** control set fully to the left.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency) or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

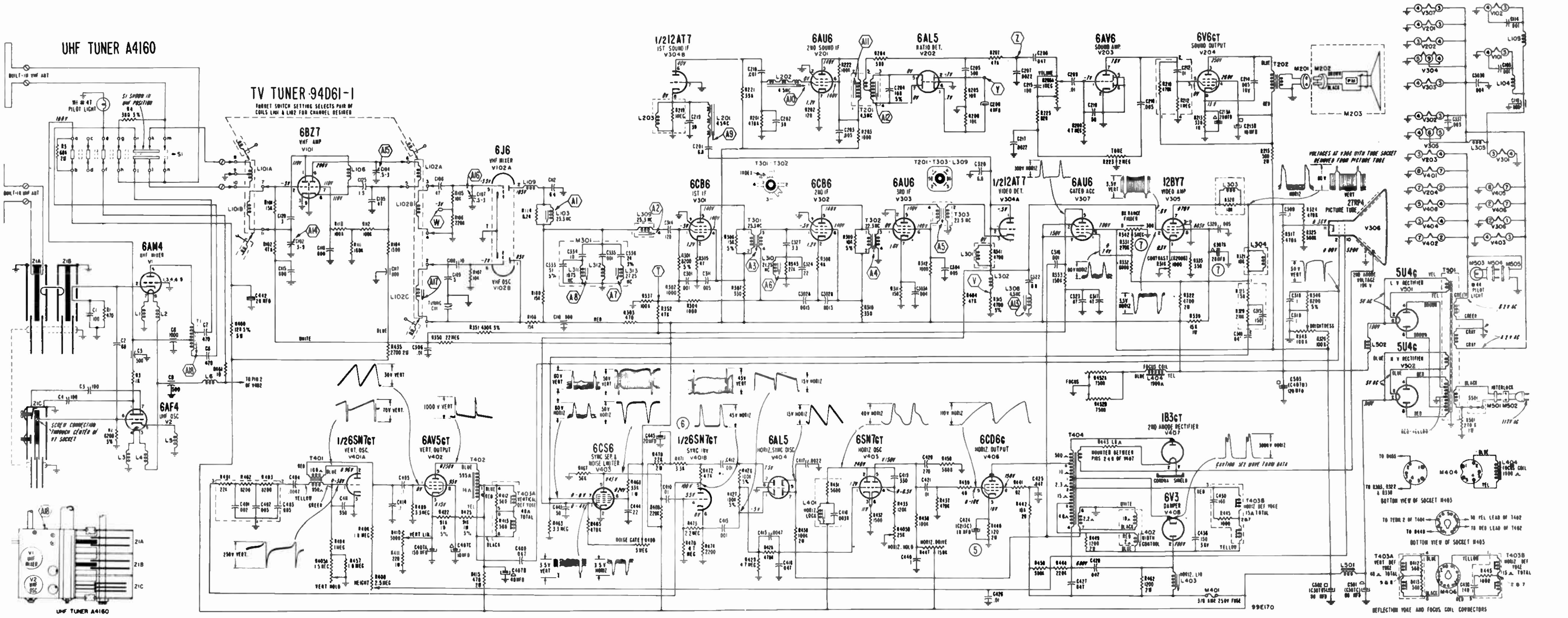
CAUTION

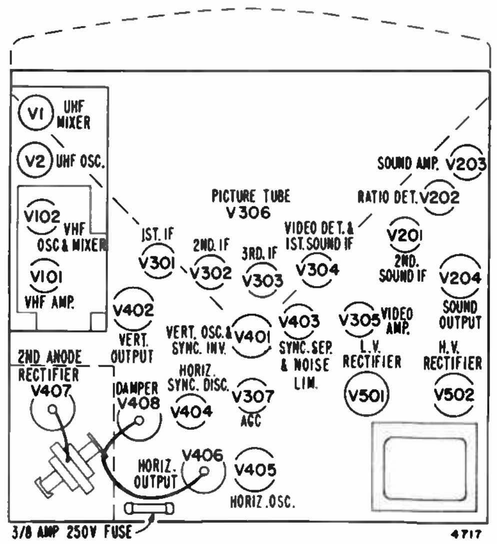
Pulsed high voltage is present on the caps of V406, V407 and V408. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at cap of V408 using an oscilloscope with a capacitive voltage divider probe. Waveform at the cap of V408 can be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the cap lead. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

Schematic for 23C1AZ VHF-UHF Television Chassis.

SCHEMATIC NOTES

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections. Numerical symbols (2), (3), (4), etc., on schematic indicate production changes covered by Run numbers. Run numbers are rubber stamped on the rear of the chassis.





Top View of Chassis.

V1 —6AM4
V2 —6AF4
V101—6BZ7
V102—6J6
V201—6AU6
V202—6AL5
V203—6AV6
V204—6V6GT
V301—6CB6
V302—6CB6
V303—6AU6
V304—12AT7
V305—12BY7
V306—27RP4
V307—6AU6
V401—6SN7GT
V402—6AV5GT
V403—6CS6
V404—6AL5
V405—6SN7GT
V406—6CD6G
V407—1B3GT
V408—6V3
V501—5U4G
V502—5U4G

WAVEFORM DATA
(Waveforms given on schematic)

Waveform taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). **Warning:** Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion. **Noise Gate** control set fully to the left.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltages reading shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltages are present on the caps of V406, V407 and V408. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at the cap of V408, using an oscilloscope with a capacitive voltage divider probe. Waveform at V408 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the cap lead. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

TV VOLTAGE DATA
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Low-Channel Selector** set on an unused VHF channel. **High-Channel Selector** in the "VHF" position. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position). **Noise Gate** control set fully to the left.
- VHF Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- B+ voltage at terminal "a" of VHF-UHF switch S1 taken with switch in UHF position.
- Voltages marked with an asterisk (*) will vary widely with control setting.

CAUTION

Pulsed high voltages are present on the cap of V406 and V408 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

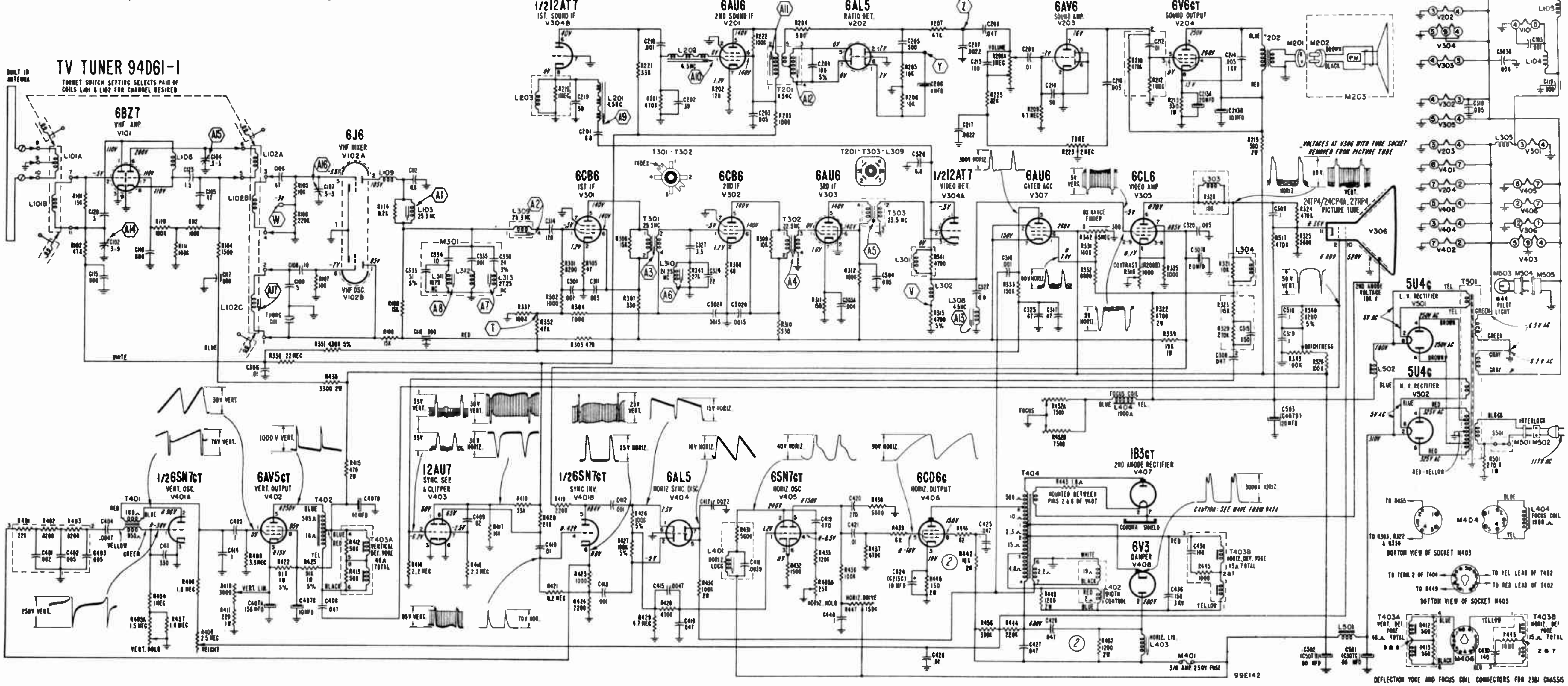
Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 19 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that ob ined with a 1.5 volt dry cell battery.

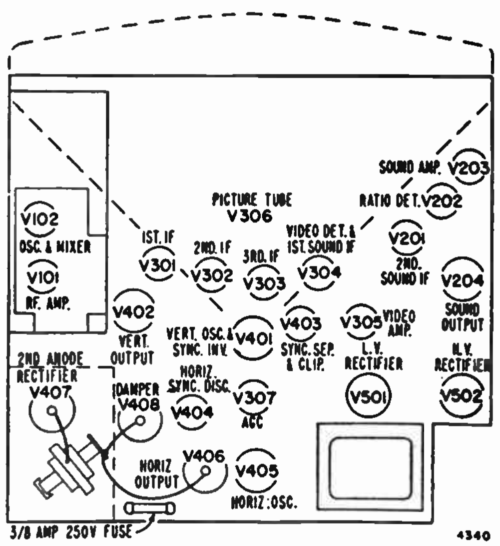
Schematic for 23E1Z VHF Television Chassis.

SCHEMATIC NOTES

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

Numerical symbols (2), (3), (4), etc., on schematic indicate production changes covered by Run numbers. Run numbers are rubber stamped on the rear of the chassis.





Top View of Chassis.

V101—6BZ7
V102—6J6
V201—6AU6
V202—6AL5
V203—6AV6
V204—6V6GT
V301—6CB6
V302—6CB6
V303—6AU6
V304—12AT7
V305—6CL6
V306—24TP4/24CP4A
V307—6AU6
V401—6SN7GT
V402—6AV5GT
V403—12AU7
V404—6AL5
V405—6SN7GT
V406—6CD6G
V407—1B3GT
V408—6V3
V501—5U4G
V502—5U4G

WAVEFORM DATA
(Waveforms given on schematic)

Waveform taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). **Warning:** incorrect adjustment of the **DX Range Finder** control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V406, V407 and V408. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at cap of V408 using an oscilloscope with a capacitive voltage divider probe. Waveform at the cap of V408 can be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the cap lead. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

TV VOLTAGE DATA
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Channel Selector** set on an unused channel. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position).
- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
  Voltages at V306 measured from top of socket with tube removed.
- Voltages at V101 and V102 (VHF tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.
  In tuners using a 6BZ7 tube, voltages taken at pins 1 and 8 must be taken as described or no voltage reading will be obtained.
- Voltages marked with an asterisk (*) will vary widely with control setting.

CAUTION

Pulsed high voltages are present on the caps of V406 and V408 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

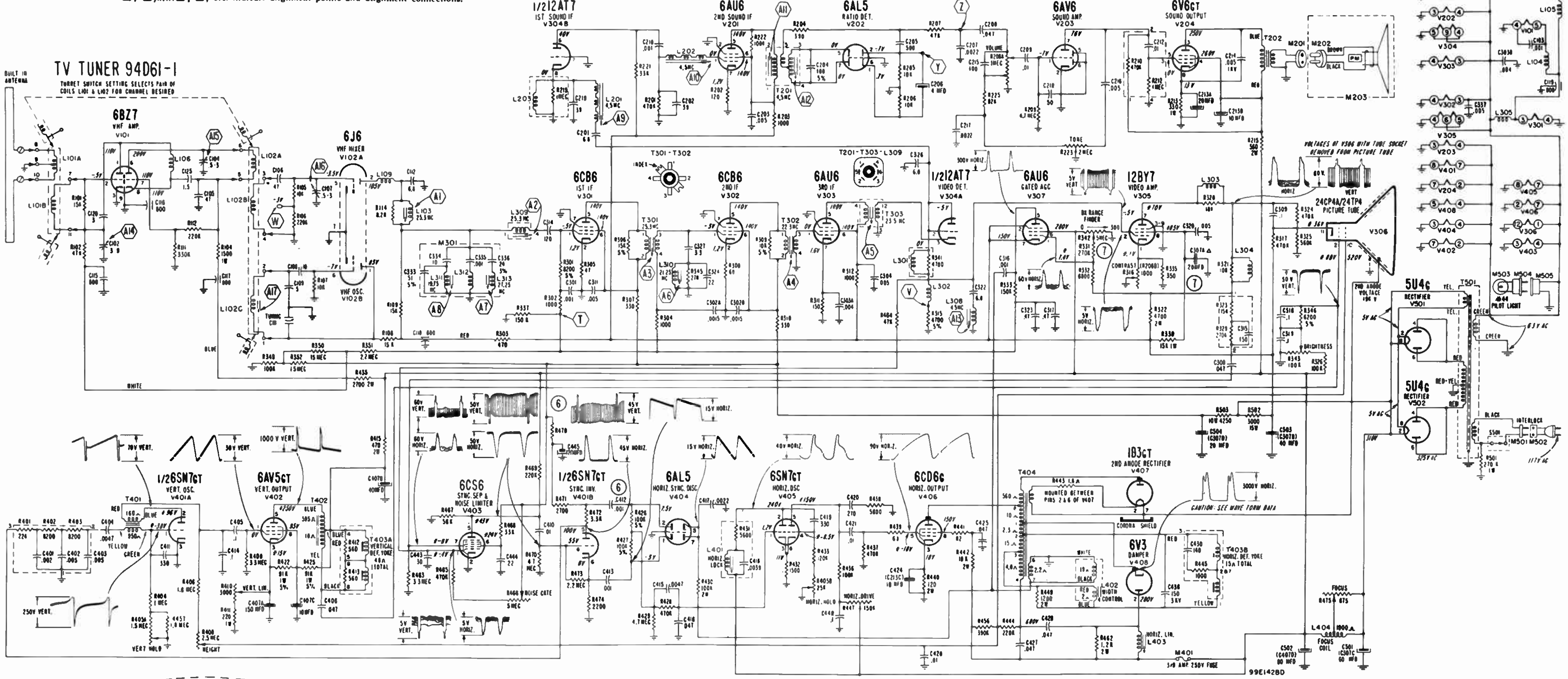
Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 19 KV. Proper filament voltage check of the 1B3GT tube may be made b, observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

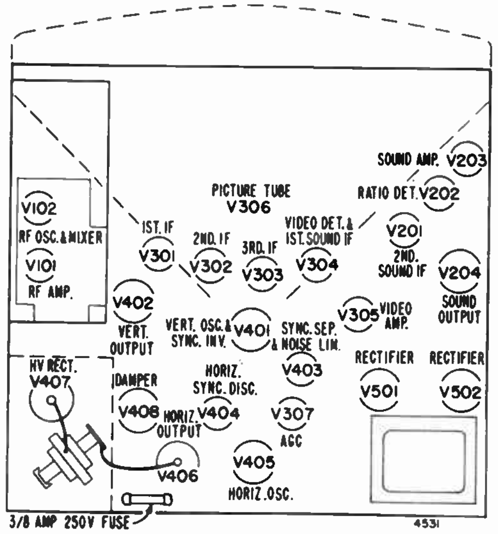
Schematic for 23E1AZ VHF Television Chassis.

SCHEMATIC NOTES

Numerical symbols ②, ③, ④, etc., on schematic indicate production changes covered by Run numbers. Run numbers are rubber stamped on the rear of the chassis.

A1, A2, ... Y, Z, etc. indicate alignment points and alignment connections.





Top View of Chassis.

V101—6BZ7
V102—6J6
V201—6AU6
V202—6AL5
V203—6AV6
V204—6V6GT
V301—6CB6
V302—6CB6
V303—6AU6
V304—12AT7
V305—12BY7
V306—24TP4/24CP4A
V307—6AU6
V401—6SN7GT
V402—6AV5GT
V403—6CS6
V404—6AL5
V405—6SN7GT
V406—6CD6G
V407—1B3GT
V408—6V3
V501—5U4G
V502—5U4G

WAVEFORM DATA
(Waveforms given on schematic)

Waveform taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). Warning: Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion. **Noise Gate** control set fully to the left.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V406, V407 and V408. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at cap of V408 using an oscilloscope with a capacitive voltage divider probe. Waveform at the cap of V408 can be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the cap lead. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

TV VOLTAGE DATA
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Channel Selector** set on an unused channel. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position). **Noise Gate** control set fully to the left.
- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
  Voltages at V306 measured from top of socket with tube removed.
- Voltages at V101 and V102 (VHF tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.
  Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described or no voltage reading will be obtained.
- Voltages marked with an asterisk (*) will vary widely with control setting.

CAUTION

Pulsed high voltages are present on the caps of V406 and V408 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

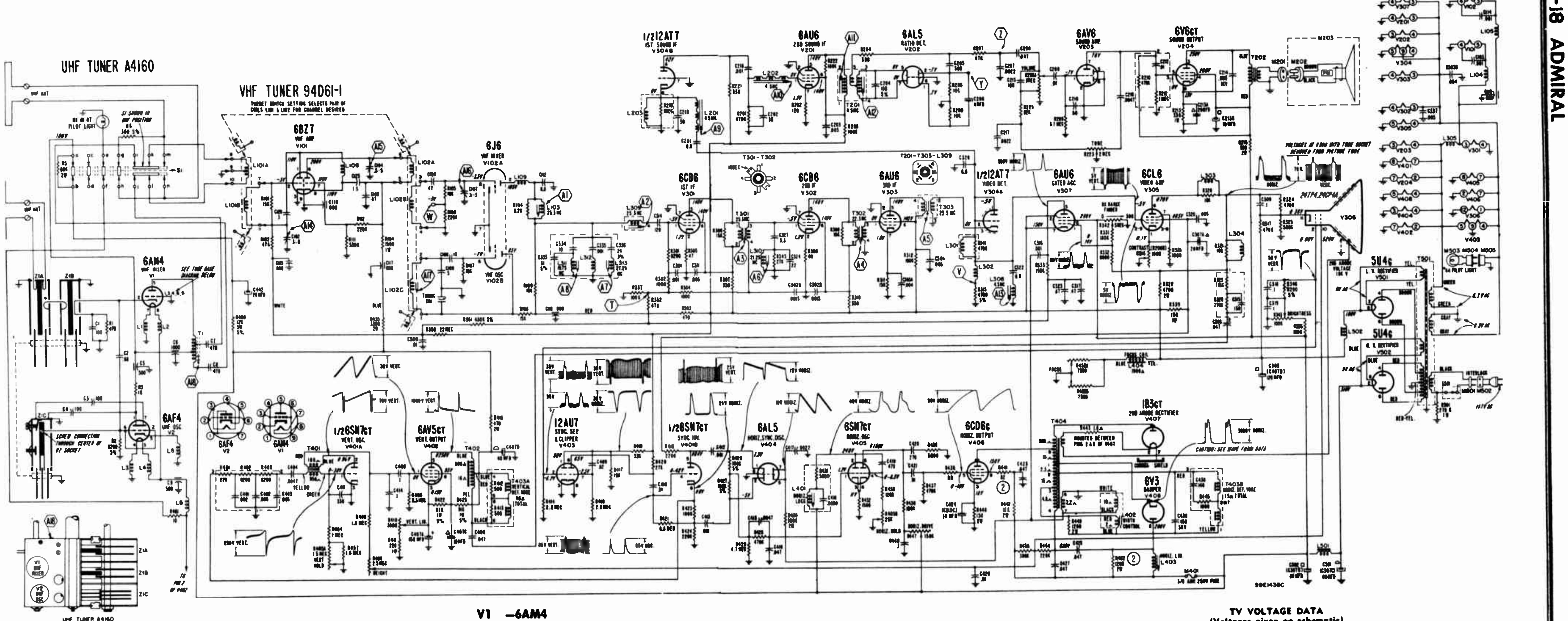
Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 19 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

SCHEMATIC NOTES

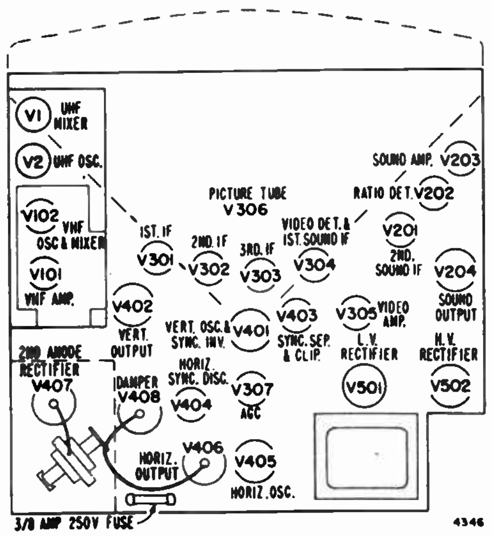
A1, A2, ... Y, Z, etc. indicate alignment points and alignment connections.

Numerical symbols 2, 3, 4, etc., on schematic indicate production changes covered by Run numbers. Run numbers are rubber stamped on the rear of the chassis.

Schematic for 23F1Z VHF-UHF Television Chassis.



V1 —6AM4
V2 —6AF4
V101—6BZ7
V102—6J6
V201—6AU6
V202—6AL5
V203—6AV6
V204—6V6GT
V301—6CB6
V302—6CB6
V303—6AU6
V304—12AT7
V305—6CL6
V306—24TP4/24CP4A
V307—6AU6
V401—6SN7GT
V402—6AV5GT
V403—12AU7
V404—6AL5
V405—6SN7GT
V406—6CD6G
V407—1B3GT
V408—6V3
V501—5U4G
V502—5U4G



Top View of Chassis.

WAVEFORM DATA
(Waveforms given on schematic)

Waveform taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). Warning: Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltages are present on the caps of V406, V407 and V408. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at the cap of V408 using an oscilloscope with a capacitive voltage divider probe. Waveform at V408 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the cap lead. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

TV VOLTAGE DATA
(Voltages given on schematic)

- Contrast control turned fully clockwise. **Low-Channel Selector** set on an unused VHF channel. **High-Channel Selector** in the "VHF" position. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position).
- VHF Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- B+ voltage at terminal "a" of VHF-UHF switch S1 taken with switch in UHF position.
- Voltages marked with an asterisk (*) will vary widely with control setting.

CAUTION

Pulsed high voltages are present on the cap of V406 and V408 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 19 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

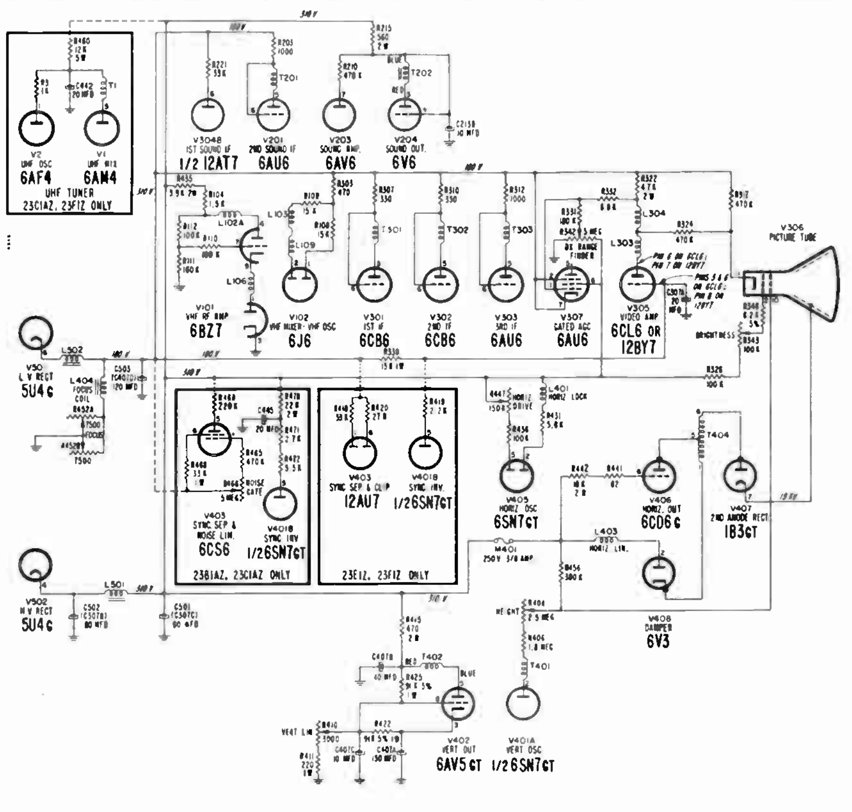


Figure 67. B+ Diagram of 23B1AZ, 23C1AZ, 23E1Z and 23F1Z Chassis.

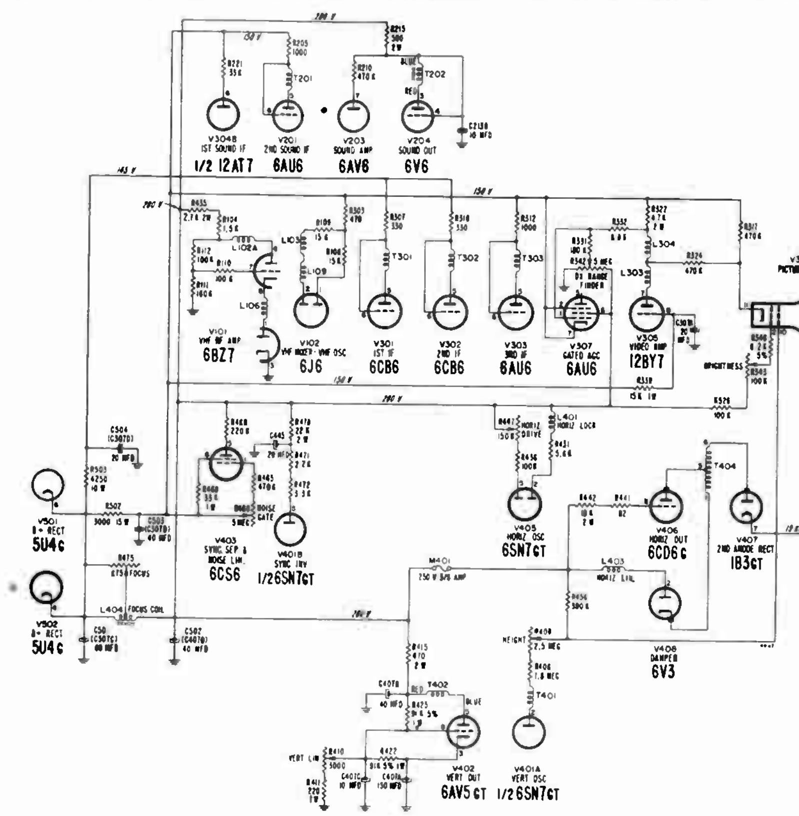


Figure 68. B+ Diagram of 23E1AZ Chassis.

PARTS LIST

Electrical components are numbered in different series according to their location on the schematic. Numbers 1-99 indicate components in the UHF tuner; 101-199, VHF tuner; 201-299, sound circuits; 301-399, intercarrier IF and video circuits; 401-499, sync and deflection circuits; 501-599, power supply circuits. Order replacements from your Admiral distributor by part number and description.

RESISTORS

Sym.	Description	Part No.
R1	470 ohms, ½ watt (23C1AZ, 23F1Z only)	60B 8-471
R2	6,200 ohms, ½ watt, 5% (23C1AZ, 23F1Z only)	60B 7-622
R3	1,000 ohms, ½ watt (23C1AZ, 23F1Z only)	60B 8-102
R4	300 ohms, ½ watt, 5% (23C1AZ, 23F1Z only)	60B 7-301
R5	68,000 ohms, 2 watt (23C1AZ, 23F1Z only)	60B 20-683
R101	15,000 ohms, ½ watt	98A 45-67
R102	47,000 ohms, ½ watt	98A 45-17
R103	Not Used	
R104	1,500 ohms, ½ watt	94D 47-58
R105	10,000 ohms, ½ watt	98A 45-18
R106	220,000 ohms, ½ watt	98A 45-21
R107	10,000 ohms, ½ watt	98A 45-18
R108	15,000 ohms, ½ watt	98A 45-67
R109	15,000 ohms, ½ watt	98A 45-67
R110	100,000 ohms, ½ watt	94C 37-87
R111	160,000 ohms, ½ watt	94D 47-59
R112	100,000 ohms, ½ watt	94C 37-87
R113	Not Used	
R114	8,200 ohms, ½ watt	60B 8-822
R201	470,000 ohms, ½ watt	60B 8-474
R202	120 ohms, ½ watt, carbon only	60B 8-121
R203	1,000 ohms, ½ watt	60B 8-102
R204	390 ohms, ½ watt	60B 8-391
R205	10,000 ohms, ½ watt	60B 8-103
R206	10,000 ohms, ½ watt	60B 8-103
R207	47,000 ohms, ½ watt	60B 8-473
R208A	1 megohm, **Volume** control	75B 11-22
R208B	1,000 ohms, **Contrast** control (R208 includes switch S501)	
R209	4.7 megohms, ½ watt	60B 8-475
†R210	470,000 ohms, ½ watt	60B 8-474
R211	Not Used	
†R212	1 megohm, ½ watt	60B 8-105
R213	330 ohms, 1 watt	60B 14-331
R214	Not Used	
R215	560 ohms, 2 watt	60B 20-561
R216 R217 R218	Not Used	
R219	1 megohm, ½ watt (part of L203)	60B 8-105
R220	Not Used	
R221	33,000 ohms, ½ watt	60B 8-333
R222	100,000 ohms, ½ watt	60B 8-104
R223	2 megohms, **Tone** control	75C 13-22
R224	Not Used	
R225	82,000 ohms, ½ watt	60B 8-823
R301	8,200 ohms, ½ watt, 5%	60B 7-822
R302	1,000 ohms, ½ watt	60B 8-102
R303	470 ohms, ½ watt	60B 8-471
R304	1,000 ohms, ½ watt	60B 8-102
R305	47 ohms, ½ watt, carbon only	60B 28-45
R306	15,000 ohms, ½ watt, 5%	60B 7-153
R307	330 ohms, ½ watt	60B 8-331
R308	68 ohms, ½ watt, carbon only	60B 28-44
R309	10,000 ohms, ½ watt, 5%	60B 7-103
R310	330 ohms, ½ watt	60B 8-331
R311	150 ohms, ½ watt	60B 8-151
R312	1,000 ohms, ½ watt	60B 8-102
R313 R314	Not Used	
R315	4,700 ohms, ½ watt, 5%	60B 7-472
R316	1,000 ohms, **Contrast** control	See R208B
R317	470,000 ohms, ½ watt	60B 8-474
R318 R319	Not Used	
R320	18,000 ohms, ½ watt (part of L303)	60B 8-183
R321	10,000 ohms, ½ watt (part of L304)	60B 8-103
R322	4,700 ohms, 2 watt	60B 20-472
*R323	15,000 ohms, ½ watt	60B 8-153
R324	470,000 ohms, ½ watt	60B 8-474
R325	560,000 ohms, ½ watt	60B 8-564
R326	100,000 ohms, ½ watt	60B 8-104
R327 R328	Not Used	
°R329	270,000 ohms, ½ watt	60B 8-274
R330	Not Used	
R331	180,000 ohms, ½ watt (Run 6 and lower)	60B 8-184
	270,000 ohms, ½ watt (Run 7 and higher)	60B 8-274
R332	6,800 ohms, ½ watt	60B 8-682
R333	150,000 ohms, ½ watt	60B 8-154
R334	Not Used	
R335	270 ohms, ½ watt (23E1Z only)	60B 8-271
	1,000 ohms, ½ watt (Run 6 and lower)	60B 8-102
	330 ohms, ½ watt (Run 7 and higher)	60B 8-331
R336	Not Used	
R337	150,000 ohms, ½ watt (23E1AZ only)	60B 8-154
	100,000 ohms, ½ watt	60B 8-104
R338	Not Used	
R339	18,000 ohms, 1 watt (23B1AZ only)	60B 14-183
	15,000 ohms, 1 watt	60B 14-153
R340	Not Used	
R341	4,700 ohms, ½ watt (part of L301)	60B 8-472
R342	5 megohms, **DX Range Finder** control	75C 1-54
R343	100,000 ohms, **Brightness** control	75C 13-25
R344	Not Used	
R345	27,000 ohms, ½ watt	60B 8-273
R346	6,200 ohms, ½ watt, 5%	60B 7-622
R347 R348	Not Used	
R349	100,000 ohms, ½ watt (23E1AZ only)	60B 8-104
R350	15 megohms, ½ watt (23E1AZ only)	60B 8-156
	22 megohms, ½ watt	60B 8-226
R351	2.7 megohms, ½ watt (23E1AZ only)	60B 8-275
	430,000 ohms, ½ watt, 5%	60B 7-434
R352	1.5 megohms, ½ watt (23E1AZ only)	60B 8-155
	47,000 ohms, ½ watt	60B 8-473
§R401	22,000 ohms, ½ watt	60B 8-223
§R402	8,200 ohms, ½ watt	60B 8-822
§R403	8,200 ohms, ½ watt	60B 8-822
R404	1 megohm, ½ watt (23E1Z, 23F1Z only)	60B 8-105
	820,000 ohms, ½ watt	60B 8-824
R405A	1.5 megohms, **Vert.** control	75B 17-2
R405B	25,000 ohms, **Horiz. Hold** control	
R406	1.8 megohms, ½ watt	60B 8-185
R407	Not Used	
R408	2.5 megohms, **Height** control	75C 20-1
R409	3.3 megohms, ½ watt	60B 8-335
R410	3,000 ohms, **Vert. Lin.** control	75C 13-18
R411	220 ohms, 1 watt	60B 14-221
R412	560 ohms, ½ watt (part of T403)	60B 8-561
R413	560 ohms, ½ watt (part of T403)	60B 8-561
R414	2.2 megohms, ½ watt (23E1Z, 23F1Z only)	60B 8-225
R415	470 ohms, 2 watt	60B 20-471
R416	2.2 megohms, ½ watt (23E1Z, 23F1Z only)	60B 8-225
R417	18,000 ohms, ½ watt (23E1Z, 23F1Z only)	60B 8-183
R418	33,000 ohms, ½ watt (23E1Z, 23F1Z only)	60B 8-333
R419	2,200 ohms, ½ watt (23E1Z, 23F1Z only)	60B 8-222
R420	27,000 ohms, ½ watt (23E1Z, 23F1Z only)	60B 8-273
R421	8.2 megohms, ½ watt (23E1Z, 23F1Z only)	60B 8-825
R422	91,000 ohms, 1 watt, 5%	60B 13-913
R423	1,000 ohms, ½ watt (23E1Z, 23F1Z only)	60B 8-102
R424	2,200 ohms, ½ watt (23E1Z, 23F1Z only)	60B 8-222
R425	91,000 ohms, 1 watt, 5%	60B 13-913
R426	100,000 ohms, ½ watt, 5%	60B 7-104
R427	100,000 ohms, ½ watt, 5%	60B 7-104
R428	470,000 ohms, ½ watt	60B 8-474
R429	4.7 megohms, ½ watt	60B 8-475
R430	100,000 ohms, 2 watt	60B 20-104
R431	5,600 ohms, ½ watt (part of L401)	60B 8-562
R432	1,500 ohms, ½ watt	60B 8-152
R433	120,000 ohms, ½ watt	60B 8-124
R434	Not Used	
R435	2,700 ohms, 2 watt (23E1AZ only)	60B 20-272
	3,300 ohms, 2 watt	60B 20-332
R436	100,000 ohms, ½ watt	60B 8-104
R437	470,000 ohms, ½ watt	60B 8-474
R438	5,600 ohms, ½ watt	60B 8-562
R439	68 ohms, ½ watt, carbon only	60B 28-44
R440	150 ohms, 2 watt (Run 4 and lower)	60B 20-151
	120 ohms, 2 watt (Run 5 and higher)	60B 20-121
R441	82 ohms, ½ watt, carbon only	60B 28-31
R442	18,000 ohms, 2 watt (Run 2 and higher)	60B 20-183
	5,600 ohms, 2 watt (Run 1 only)	60B 20-562
R443	1.8 ohms, ½ watt, carbon only	60B 28-46
R444	220,000 ohms, ½ watt	60B 8-224
R445	1,000 ohms, ½ watt (part of T403)	60B 8-102
R446	Not Used	
R447	150,000 ohms, **Horiz. Drive** control	75C 20-3
R448	Not Used	
R449	1,200 ohms, 2 watt	60B 20-122
R450	Not Used	
R451	5,600 ohms, 2 watt (Run 1 only) (Not used Run 2 and higher)	60B 20-562
R452A	7,500 ohms **Focus** (not used 23E1AZ)	75B 16-2
R452B	7,500 ohms	
R453 R454 R455	Not Used	
R456	390,000 ohms, ½ watt	60B 8-394
R457	1.8 megohms, ½ watt	60B 8-185
R458 R459	Not Used	
R460	12,000 ohms, 5 watt, 5% (23C1AZ, 23F1Z only)	61A 1-27
R461	10 ohms, ½ watt (23C1AZ, 23F1Z only)	60B 8-100
R462	1,200 ohms, 2 watt (Run 2 and higher) (Not used Run 1)	60B 20-122

Sym.	Description	Part No.
R463	3.3 megohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-335
R464	47,000 ohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-473
R465	470,000 ohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-474
R466	5 megohms, **Noise Gate** control (23B1AZ, 23C1AZ, 23E1AZ only)	75C 1-54
R467	56,000 ohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-563
R468	33,000 ohms, 1 watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 14-333
R469	220,000 ohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-224
R470	4.7 megohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-475
R471	2,700 ohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-272
R472	4,700 ohms, ½ watt (Run 5 and lower)	60B 8-472
	3,300 ohms, ½ watt (Run 6 and higher) (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-332
R473	2.2 megohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-225
R474	2,200 ohms, ½ watt (23B1AZ, 23C1AZ, 23E1AZ only)	60B 8-222
R475	675 ohms, **Focus** control (23E1AZ only)	75C 13-31
R476, R477	Not Used	
R478	22,000 ohms, 2 watt (Run 6 and higher) (Not used Run 5 and lower) (Not used in 23E1Z, 23F1Z)	60B 20-223
R501	270,000 ohms, 1 watt	60B 14-274
R502	3,000 ohms, 15 watt (23E1AZ only)	61A 3-14
R503	4,250 ohms, 10 watt (23E1AZ only)	61A 17-4

CAPACITORS

Sym.	Description	Part No.
C1	100 mmfd, 150 volts, mica (23C1AZ, 23F1Z only)	65A 25-2
C2	.68 mmfd, 600 volts, ceramic, NPO temp. coeff. (23C1AZ, 23F1Z only)	65A 19-1
C3	100 mmfd, 150 volts, mica (23C1AZ, 23F1Z only)	65A 25-2
C4	100 mmfd, 150 volts, mica (23C1AZ, 23F1Z only)	65A 25-2
C5	500 mmfd, 500 volts, silver mica button (23C1AZ, 23F1Z only)	65B 24-1
C6	.001 mfd, 500 volts, ceramic feed-thru (23C1AZ, 23F1Z only)	65A 26-1
C7	470 mmfd, 600 volts, ceramic disc (23C1AZ, 23F1Z only)	65C 10-12
C8	470 mmfd, 600 volts, ceramic disc (23C1AZ, 23F1Z only)	65C 10-12
C9	500 mmfd, 500 volts, silver mica button (23C1AZ, 23F1Z only)	65B 24-1
C101	Not Used	
C102	3 to 9 mmfd, ceramic trimmer	98A 45-96
C103	.001 mfd, min. ceramic	98A 45-24
C104	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C105	47 mmfd, ceramic N1400 temp. coeff.	94D 47-50
C106	47 mmfd, ceramic N1400 temp. coeff.	94D 47-50
C107	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C108	10 mmfd, 3%, ceramic NPO temp. coeff.	94D 47-51
C109	5 mmfd, 5%, ceramic N750 temp. coeff.	94D 47-52
C110	Not Used	
C111	Tuning Rotor	98A 45-92
C112	6.8 mmfd, 3%, ceramic NPO temp. coeff.	94D 47-53
C113	Not Used	
C114	.001 mfd, min. ceramic	98A 45-24
C115	800 mmfd, min. ceramic, feed-thru	94C 37-90
C116	800 mmfd, min. ceramic, disc	94C 37-91
C117	800 mmfd, min. ceramic, feed-thru	94C 37-90
C118	800 mmfd, min. ceramic, feed-thru	94C 37-90
C119	800 mmfd, min. ceramic, feed-thru	94C 37-90
C120	3 mmfd, 3%, ceramic	94D 47-54
C121, C122, C123, C124	Not Used	
C125	1.5 mmfd, ceramic	94D 46-84
C201	6.8 mmfd, ceramic, N330 temp. coeff.	65C 6-71
C202	39 mmfd, ceramic, NPO temp. coeff.	65C 6-88
C203	.005 mfd, 450 volts, ceramic	65C 10-1
C204	180 mmfd, 5%, ceramic, N030 temp. coeff.	65C 6-59
C205	500 mmfd, 500 volts, ceramic	65C 6-6
C206	4 mfd, 50 volts, electrolytic	67A 4-9
C207	.0022 mfd, 600 volts, paper	64B 9-17
C208	.047 mfd, 200 volts, paper	64B 9-41
C209	.01 mfd, 450 volts, ceramic	65C 10-3
C210	50 mmfd, 500 volts, ceramic	65C 6-4
C211	Not Used	
†C212	.01 mfd, 400 volts, paper	64B 5-25
C213A	20 mfd, 25 volts } electrolytic	67D 15-19
C213B	10 mfd, 450 volts } electrolytic	67D 15-19
C213C	10 mfd, 25 volts } electrolytic	67D 15-19
C214	.005 mfd, 1,000 volts, ceramic	65C 10-14
C215	100 mmfd, 500 volts, ceramic	65C 6-3
C216	.005 mfd, 450 volts, ceramic	65C 10-1
C217	.0022 mfd, 600 volts, paper	64B 9-17
C218	.001 mfd, 200 volts, paper	64B 9-9
C219	39 mmfd, ceramic NPO temp. coeff.	65C 6-88
C301	.001 mfd, 500 volts, ceramic	65C 6-41
C302A	.0015 mfd } 450 volts, dual ceramic	65A 17-2
C302B	.0015 mfd } 450 volts, dual ceramic	65A 17-2
C303A	.004 mfd } 450 volts, dual ceramic	65A 17-1
C303B	.004 mfd } 450 volts, dual ceramic	65A 17-1
C304	.005 mfd, 450 volts, ceramic	65C 10-1
C305	Not Used	
C306	.01 mfd, 400 volts, paper (not used in 23E1AZ)	64B 9-32
C307A	20 mfd, 250 volts } electrolytic (not used in 23E1AZ)	67D 15-26
C307B	80 mfd, 400 volts } electrolytic (not used in 23E1AZ)	67D 15-26
C307C	60 mfd, 450 volts } electrolytic (not used in 23E1AZ)	67D 15-26
C307A	20 mfd, 400 volts } electrolytic (23E1AZ only)	67D 15-35
C307B	40 mfd, 400 volts } electrolytic (23E1AZ only)	67D 15-35
C307C	60 mfd, 450 volts } electrolytic (23E1AZ only)	67D 15-35
C307D	20 mfd, 400 volts } electrolytic (23E1AZ only)	67D 15-35
C308	.047 mfd, 400 volts, paper	64B 9-28
C309	.1 mfd, 400 volts, paper	64B 9-26
C310	Not Used	
C311	.005 mfd, 450 volts, ceramic	65C 10-1
C312, C313	Not Used	
C314	120 mmfd, 500 volts, ceramic	65C 6-66
*C315	150 mmfd, mica	65B 21-151
C316	.001 mfd, 600 volts, paper	64B 9-19
C317	.47 mfd, 100 volts, paper	64A 10-51
C318	.1 mfd, 400 volts, paper	64B 9-26
C319	.1 mfd, 400 volts, paper	64B 9-26
C320	.005 mfd, 450 volts, ceramic	65C 10-1
C321	Not Used	
C322	6.8 mmfd, N330 temp. coeff.	65C 6-71
C323	.47 mfd, 100 volts, paper	64A 10-51
C324	22 mmfd, 500 volts, 5%, ceramic, NPO temp. coeff. (part of L310)	65C 6-47
C325	Not Used	
C326	6.8 mmfd, 500 volts, ceramic	65C 6-82
C327	3.3 mmfd, 500 volts, ±.25 mmfd, cer., NPO temp. coeff. (part of L310)	65C 6-89
C328, C329, C330, C331, C332	Not Used	
C333	51 mmfd, 5%, ceramic, N080 temp. coeff.	Part of M301
C334	10 mmfd, ceramic, NPO temp. coeff.	Part of M301
C335	.001 mfd, ceramic	Part of M301
C336	24 mmfd, 3%, ceramic, N080 temp. coeff.	Part of M301
C337	.005 mfd, 450 volts, ceramic	65C 10-1
§C401	.002 mfd, 600 volts, paper	64B 5-14
§C402	.005 mfd, 600 volts, paper	64B 5-12
§C403	.005 mfd, 600 volts, paper	64B 5-12
C404	.0047 mfd, 300 volts, mica	65B 21-472
C405	.1 mfd, 600 volts, paper	64B 9-57
C406	.047 mfd, 600 volts, paper	64B 9-9
C407A	150 mfd, 50 volts } electrolytic (not used in 23E1AZ)	67D 15-25
C407B	40 mfd, 400 volts } electrolytic (not used in 23E1AZ)	67D 15-25
C407C	10 mfd, 250 volts } electrolytic (not used in 23E1AZ)	67D 15-25
C407D	120 mfd, 250 volts } electrolytic (not used in 23E1AZ)	67D 15-25
C407A	150 mfd, 50 volts } electrolytic (23E1AZ only)	67D 15-34
C407B	40 mfd, 400 volts } electrolytic (23E1AZ only)	67D 15-34
C407C	10 mfd, 400 volts } electrolytic (23E1AZ only)	67D 15-34
C407D	80 mfd, 450 volts } electrolytic (23E1AZ only)	67D 15-34
C408	Not Used	
C409	.022 mfd, 400 volts, paper (23E1Z, 23F1Z only)	64B 9-30
C410	.01 mfd, 450 volts, ceramic	65C 10-3
C411	330 mmfd, 500 volts, mica	65B 21-331
C412	.001 mfd, 500 volts, mica	65B 21-102
C413	.001 mfd, 500 volts, mica	65B 21-102
C414	.1 mfd, 600 volts, paper	64B 9-57
C415	.0047 mfd, 600 volts, paper	64B 9-15
C416	.047 mfd, 400 volts, paper	64B 9-28
C417	.0022 mfd, 600 volts, paper	64B 9-17
C418	.0039 mfd, 5%, silver mica (part of L401)	65B 1-63
C419	470 mmfd, 500 volts, mica (Run 3 and lower)	65B 21-471
	330 mmfd, 500 volts, mica (Run 4 and higher)	65B 21-331
C420	270 mmfd, 500 volts, mica	65B 21-271
C421	.01 mfd, 600 volts, paper	64B 9-13
C422, C423	Not Used	
C424	Electrolytic	See C213C
C425	.047 mfd, 600 volts, paper	64B 9-9
C426	.01 mfd, 600 volts, paper	64B 9-13
C427	.047 mfd, 600 volts, paper	64A 2-14
C428	.047 mfd, 600 volts, paper	64A 2-14
C429	Not Used	
C430	140 mmfd, 5%, 1,500 volts, mica (part of T403)	65B 1-74
C431, C432, C433, C434, C435	Not Used	
C436	150 mmfd, 3,000 volts, ceramic	65C 10-10
C437, C438, C439	Not Used	
C440	.1 mfd, 600 volts, paper	64B 9-57
C441	Not Used	
C442	20 mfd, 475 volts, elect. (23C1AZ, 23F1Z only)	67A 25-1
C443	30 mmfd, 500 V., 5%, cer., NPO temp. coeff. (not used in 23E1Z, 23F1Z)	65C 6-52
C444	.22 mfd, 400 volts, paper (not used in 23E1Z, 23F1Z)	64B 9-24
C445	20 mfd, 475 volts, electrolytic (Run 6 and higher) (Not used Run 5 and lower) (Not used in 23E1Z, 23F1Z)	67A 25-1
C501	Electrolytic (all chassis)	See C307C
C502	Electrolytic (23E1AZ only)	See C407D
	Electrolytic (other chassis)	See C307B
C503	Electrolytic (23E1AZ only)	See C307B
	Electrolytic (other chassis)	See C407D
C504	Electrolytic (23E1AZ only)	See C307D
	Not used in 23B1AZ, 23C1AZ, 23E1Z, 23F1Z	

† May be part of couplate 63C6-5. Replace with new couplate or individual components.
* May be part of couplate 63C6-4. Replace with new couplate or individual components.
§ May be part of couplate 63C6-2. Replace with new couplate or individual components.

COILS, TRANSFORMERS

Sym.	Description	Part No.
L1	RF Choke (gray dot)	73A 6-4
L2	RF Choke (red dot)	73A 6-3
L3	RF Choke (gray dot)	73A 6-4
L4	RF Choke (red dot)	73A 6-3
L5	RF Choke (red dot)	73A 6-3
L6	RF Choke (mounted on top of tuner)	73A 2-5
L101	Antenna Coil (Stamped 2Q, 3Q, etc.) (For 94D 61-1 TV Tuner only)	
	for Channel #2	94D 46-52
	for Channel #3	94D 46-53
	for Channel #4	94D 46-54
	for Channel #5	94D 46-55
	for Channel #6	94D 46-56
	for Channel #7	94D 46-57
	for Channel #8	94D 46-58
	for Channel #9	94D 46-59
	for Channel #10	94D 46-60
	for Channel #11	94D 46-61
	for Channel #12	94D 46-62
	for Channel #13	94D 46-63
L102	Mixer-Osc. Coil (Stamped 2Q, 3Q, etc.) (For 94D 61-1 TV Tuner only)	
	for Channel #2	94D 46-72
	for Channel #3	94D 46-73
	for Channel #4	94D 46-74
	for Channel #5	94D 46-75
	for Channel #6	94D 46-76
	for Channel #7	94D 46-77
	for Channel #8	94D 46-78
	for Channel #9	94D 46-79
	for Channel #10	94D 46-80
	for Channel #11	94D 46-81
	for Channel #12	94D 46-82
	for Channel #13	94D 46-83
L103	Mixer Plate Coil	98A 45-77
L104	Heater RF Choke	98A 45-13
L105	Heater RF Choke	98A 45-14
L106	Peaking Coil	94C 37-89
L107, L108	Not Used	
L109	Mixer Plate Choke	94D 46-86
L201	Sound Take-off Coil	72B 99-10
L202	Sound Coupling Coil	72B 99-11
L203	Sound Peaking Coil	73A 5-2
L301	Video Peaking Coil (wound on R341)	73A 5-15
L302	Video Peaking Coil	73A 5-7
L303	Video Peaking Coil (wound on R320)	73A 5-14
L304	Video Peaking Coil (wound on R321)	73A 11-1
L305	Heater RF Choke	73A 2-5
L306, L307	Not Used	
L308	Coil, 4.5 MC Trap	72B 99-10
L309	Coil, 1st IF Input	72B 109-1
L310	Coil, 21.25 MC Trap (includes C327, C324 and R345)	72C 96-30
L311	Coil, 19.75 MC Trap	Part of M301
L312	Coil, Peaking	Part of M301
L313	Coil, 27.25 MC Trap	Part of M301
L401	Horizontal Lock Coil (includes C418, R431)	94B 17
L402	Width Coil	94A 49-3
L403	Horizontal Linearity Coil	94A 50-2
L404	Focus Coil	
	for 24TP4/24CP4A picture tube (23E1Z, 23F1Z)	69D 117-15
	for 24TP4/24CP4A picture tube (23E1AZ)	69D 117-14
	for 27RP4 picture tube	69D 117-13
L501	Filter Choke	74A 12
L502	Filter Choke	74B 18-8
T1	UHF Tuner Output Transformer	72A 112-2
T201	Ratio Detector Transformer	72B 68-2
T202	Audio Output Transformer	79B 49-2
T301	1st IF Transformer (includes R306)	72C 96-29
T302	2nd IF Transformer (includes R309)	72D 111-1
T303	3rd IF Transformer	72B 113-1
T401	Vert. Blocking Osc. Transformer	79A 18-5
T402	Vert. Output Transformer	79B 43-2
T403	Deflection Yoke (includes R412, R413, R445, C430)	
	for 24TP4/24CP4A picture tube	94D 74-2
	for 27RP4 pic. tube (includes plug)	94D 74-1
T404	Horizontal Output Transformer	79D 48-1
T501	Power Transformer (23E1AZ only)	80C 35-5
	Power Transformer (all other chassis)	80C 39-1
	Speaker, 10" PM	78B 88-21

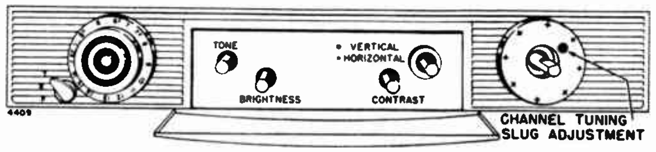


Figure 1. Control Panel in 20D2; CHANNEL Knob Removed.

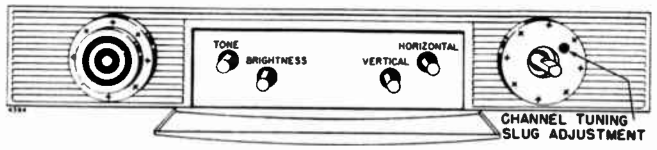


Figure 2. Control Panel in 20A2 and 20A2Z; CHANNEL Knob Removed.

SPECIFICATIONS

Picture Tube

Direct View Electromagnetic. See Model Identification Chart for different picture tubes used.

Operating Voltage

110-120 volts. 60 cycles, AC.

Wattage

195 watts for all models.

Input Impedance and Transmission Line

300-ohm balanced (between antenna terminals).

Note that 72 ohm coaxial cable may be used by connecting the outer conductor to the chassis and the inner conductor to either antenna terminal. In weak signal areas, the use of coaxial cable should be avoided.

Antenna

All models equipped with a built-in TV antenna. TV-Radio models equipped with a built-in radio antenna.

Intermediate Frequencies

Video 25.75 MC. Sound 21.25 MC.
Intercarrier Sound 4.5 MC.
Radio 455 KC. (TV-Radio models).

Fuse Location

The horizontal output circuit is fused with a 3/8 amp., 250 volt fuse, part number 84A4-3. The fuse is located at the rear of the high voltage compartment.

Record Changer

The model RC600 record changer is used in combination models. The changer model number is on the top rear of the changer pan and also on the changer model label on the underside of the changer.

For complete service data on the RC600 record changer, refer to Service Manual No. S454.

TUBE COMPLEMENT

V101	6BZ7	RF Amplifier
V102	6J6	Oscillator and Mixer
V201	6AU6	Sound IF Amplifier
V202	6AL5	Ratio Detector
V203	6AV6	AM Detector, AVC, Sound Amplifier in combination sets; Sound Amplifier in TV only sets
V204	†6Y6G or 6AS5	Sound Output
V301	6CB6	1st IF Amplifier
V302	6CB6	2nd IF Amplifier
V303	6U8	3rd IF Amplifier; Sync. Inv.
V304	6AL5	Video Detector, AGC
V305	12BY7	Video Amplifier
V306	§	Picture Tube
V401	12AU7	Sync Separator, Vertical Oscillator
V402	6S4	Vertical Output
V403	6AL5	Hor. Sync. Disc.
V404	6SN7GT	Horizontal Oscillator
V405	6BQ6GT	Horizontal Output
V406	1B3GT	H. V. Rectifier
V407	6AX4GT	Damper
V501	5U4G	Rectifier
*V701	6BE6	Converter (AM Radio)
*V702	6BA6	IF Amplifier (AM Radio)

† 6Y6G tube used in combination sets. 6AS5 tube used in TV only sets.

§ See "Model Identification Chart" on front page for different picture tubes used.

* V701 and V702 used in combination sets only.

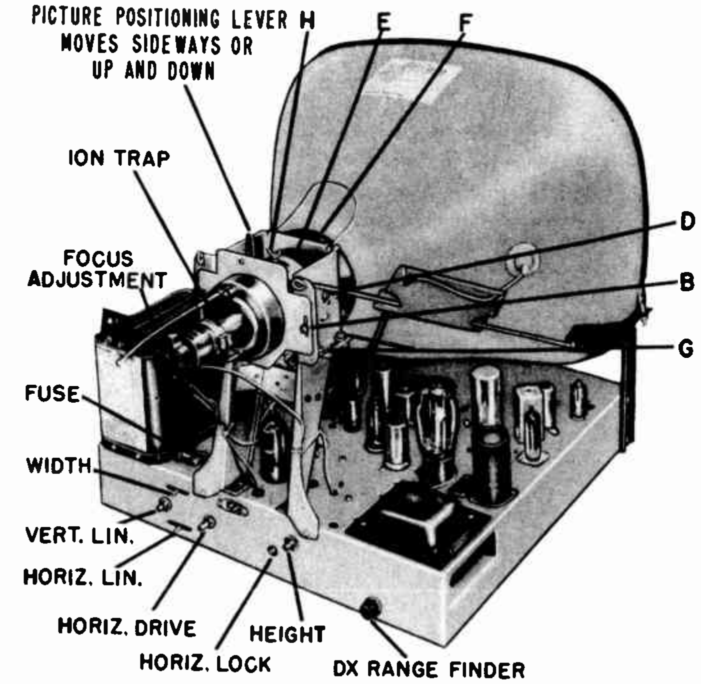


Figure 3. 20A2 and 20A2Z Chassis View Showing Rear Adjustment Locations.

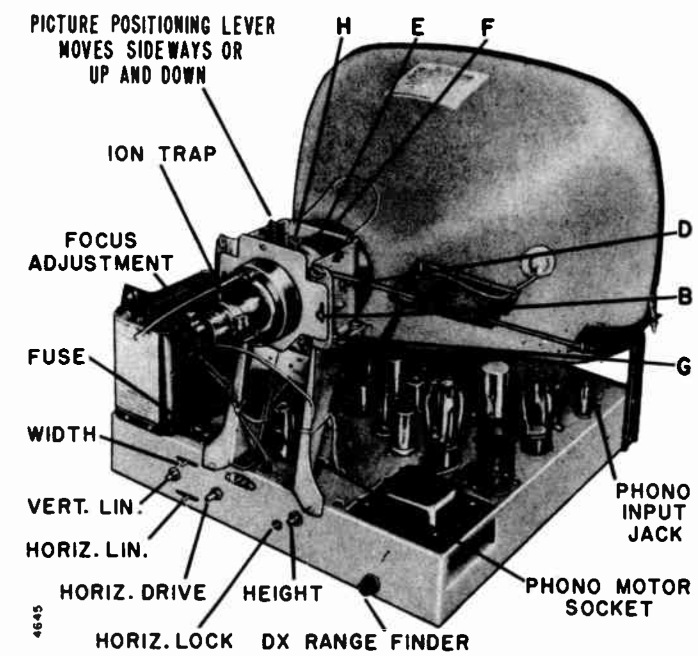


Figure 4. 20D2 Chassis View Showing Rear Adjustment Locations.

HORIZONTAL OSCILLATOR & DRIVE ADJ.

If the **Horizontal Drive** control (on rear of set) is not properly adjusted, it may be difficult to obtain sufficient picture width and brightness.

When switching channels, the **Horizontal** control (on front panel) should keep the picture in horizontal sync through at least three fourths of its range. If the picture does not remain in horizontal sync, then adjust the rear panel controls as follows:

a. Allow the receiver to warm up for a few minutes. Tune in a station, set the **Brightness** control at a lower than average setting. Turn **Contrast** control fully to the left. Important: Before proceeding, be sure that the **DX Range Finder** control (AGC) is adjusted according to the instructions given in this manual

b. Turn the **Horizontal** control (front panel) completely to the left. Turn the **Horiz. Drive** control fully to the right.

c. Turn the **Horiz. Lock** adjustment to the right until the picture falls out of sync. If the picture cannot be made to fall out of sync, momentarily interrupt the signal by switching the **Channel** control off channel and then back on.

d. With the picture out of sync, turn the **Horiz. Lock** adjustment slowly to the left until the picture just falls in sync.

e. Turn the **Channel** control to an unused channel. If a white vertical line(s) appears near the center of the screen, slowly turn the **Horiz. Drive** control to the left until the line(s) just disappears.

f. If, in step "e", the **Horiz. Drive** control required readjustment, tune in a station and repeat steps "c" and "d" to be sure of proper Horizontal Oscillator adjustment.

g. Adjustment should now be satisfactory. However, check adjustment by slowly rotating the **Horizontal** control in either direction while interrupting the television signal by switching the **Channel** control off channel and then back on. The picture should automatically fall in sync through at least half of the range of the **Horizontal** control. If necessary, repeat the above step.

h. Do not use the **Horiz. Drive** control to obtain correct width or linearity. If necessary, make Width and Horizontal Linearity adjustments.

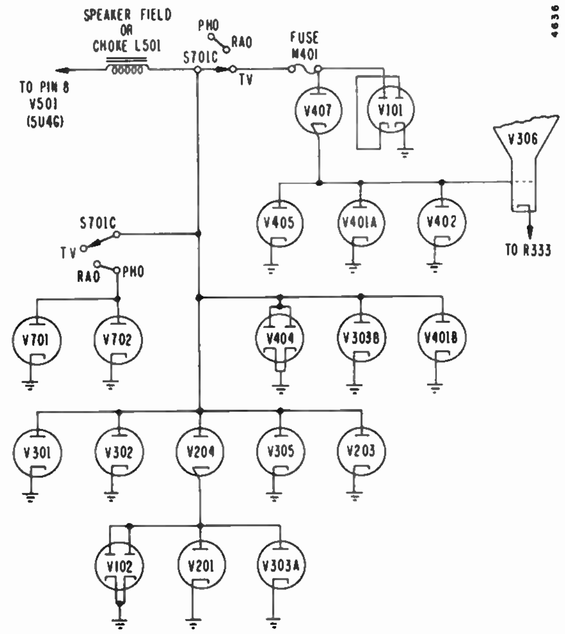


Figure 5. Simplified Diagram Showing B+ Distribution in 20D2 Chassis.

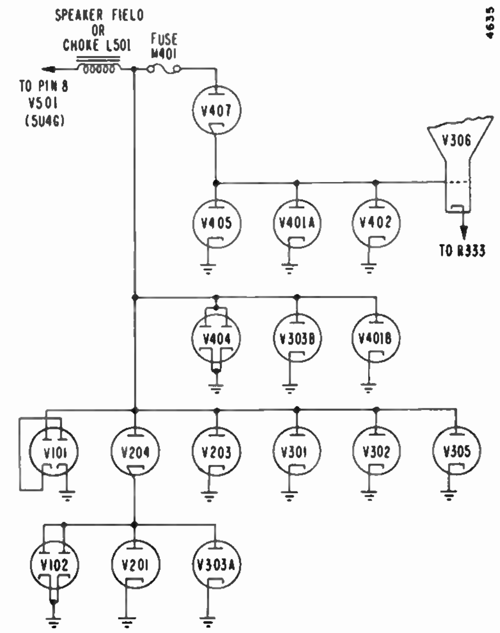


Figure 6. Simplified Diagram Showing B+ Distribution in 20A2 and 20A2Z Chassis.

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual procedures and should be performed in this sequence.

a. IF Amplifier and Trap Alignment.
b. IF Response Curve Check.
c. 4.5 MC Sound IF and Trap Alignment.
d. RF and Mixer Alignment.
e. Over-all RF and IF Response Curve Check.
f. HF Oscillator Adjustment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available.

IMPORTANT: Many service instruments do not meet the requirements given below. A list of recommended equipment is available from Admiral distributor.

Oscilloscope

Standard oscilloscope, preferably one with a wide band vertical deflection, vertical sensitivity at least .5 volt (RMS) per inch.

Signal (Marker) Generator

4.5 MC frequency.
18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.
Must have a built-in calibration crystal for checking dial accuracy.

Sweep Generator

Sweep generator must provide sweep frequencies from

18 to 30 MC range:	with at least 10 MC-sweep width.
50 to 90 MC range:	
170 to 225 MC range:	

Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground.

A sweep generator not having constant output voltage over the swept range and linear sweep, will produce curves which are widely different from the ideal curves shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

Vacuum-Tube Voltmeter

Preferably with low range (3 volt) DC zero center scale and a high voltage probe (30,000 volt range).

ALIGNMENT TOOLS

The following alignment tools are required. They can be obtained from the Admiral distributor under the part numbers listed below:

Metal alignment screwdriver, part number 98A30-9. ***Non-metallic*** (fiber) alignment screwdriver (11½" long, ⅛" diameter), part number 98A30-10.

Non-metallic alignment wrench (9" long, for hexagon core IF slugs), part number 98A30-12.

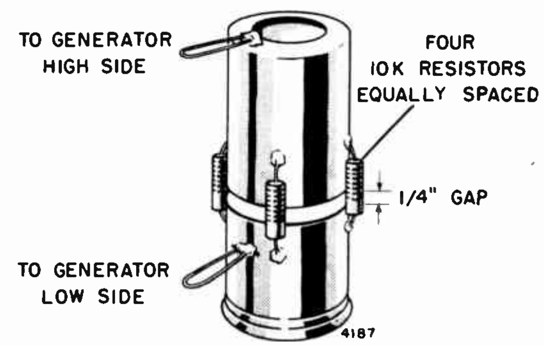


Figure 7. Special Tube Shield for IF Alignment and IF Response Curve Check.

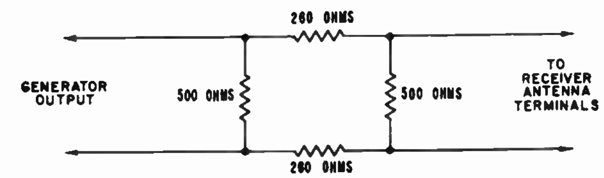
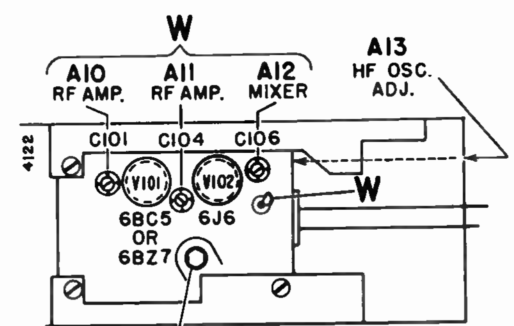


Figure 8. Illustration of 12 db Attenuation Pad for Viewing Over-all RF-IF Response Curve.



A5 23.1 MC MAX. MIXER PLATE

Figure 9. Top View of TV Tuner Showing Adjustment Locations.

IMPORTANT ALIGNMENT HINTS

The following suggestions should be performed if difficulty is experienced during the alignment procedure.

1. IF CIRCUIT INSTABILITY: When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF response curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning A2 (3rd IF transformer T303). To correct either of these conditions, the following alignment hints should be tried:

(a) Check the generator output leads to be certain that the unshielded portion (especially the grounded lead) be as short as practicable.

(b) Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible (see figure 10).

(c) Construct a special tube shield as shown in figure 7. This is made from an ordinary tube shield and four 10,000 ohm resistors. Keep the spacing between the two halves of the shield at a minimum (1/8 inch).

(d) The use of a *non-metallic* alignment tool, approximately eight inches long (part number 98A30-12), will permit adjustment without coming too near to the transformers.

2. RECEIVER OVERLOADING WHEN CHECKING THE OVER-ALL RESPONSE CURVE: Due to the inherent high sensitivity of these receivers, it is very easy to cause overloading in the third IF amplifier stage. In some cases, generator leakage alone is enough to produce a response curve on the oscilloscope. To prevent overloading, do the following:

(a) Be certain that the generator output attenuators are set at a minimum.

(b) Some generators have a built-in pad in the output table to be used when viewing the over-all response curve. Be sure that the pad in the cable is properly connected in the circuit. Refer to the generator instruction manual for details.

(c) If a pad is not built in, the 12 db pad shown below in figure 8 can be constructed and connected between the generator and the antenna terminals.

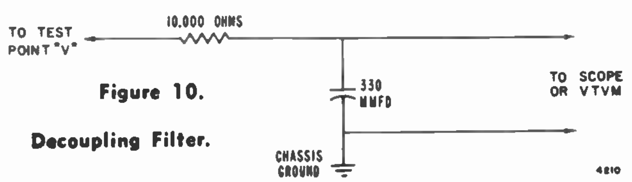


Figure 10.

Decoupling Filter.

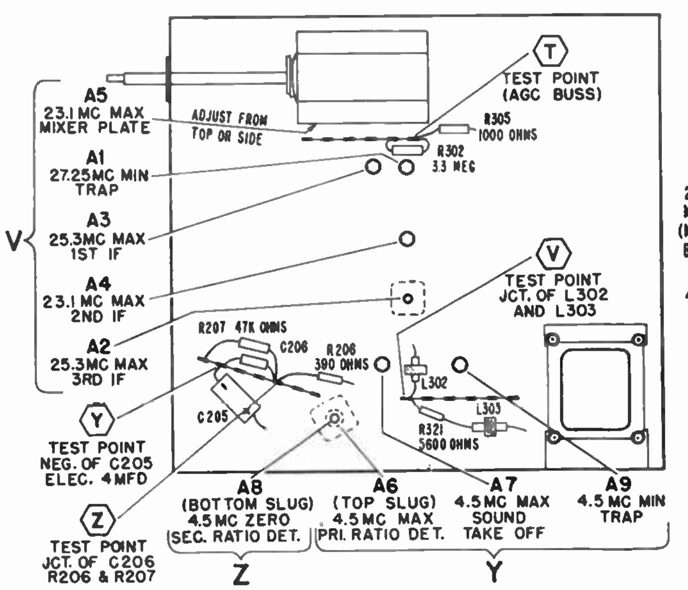


Figure 11. Bottom View of Chassis Showing Test Point Connections and IF Alignment Data.

IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point "T", see figure 11, positive to chassis. A 4½ volt battery is required for all steps below.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel Selector to channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Contrast control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
1	*27.25 MC	VTVM high side to test point "V" through a decoupling filter; see figs. 10 and 11, common to chassis. Generator high side to 6J6 (V102) special tube shield. Connect low side to bottom part of the tube shield, see figure 7.	Connect a 4½ volt bias battery to test point "T". Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. If unstable, refer to section 1 of the "Alignment Hints" on page 8.	A1 for minimum.
2	25.3 MC			A2 and A3 for maximum.
3	23.1 MC			A4 and A5 for maximum.
4	*27.25 MC			Repeat step 1 above.
5	To insure correct IF alignment, make the "IF Response Curve Check" given below.			

Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set Channel Selector on channel 12 or an unassigned high channel. Contrast control fully to the left. Connect negative of 4½ volt bias battery to test point "T"; positive to chassis.	Connect high side to 6J6 mixer-osc. special tube shield, see fig. 7. Connect low side to bottom part of tube shield. Set sweep frequency to 23MC, and sweep width approximately 7MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on tube shield, low side to chassis. Marker frequencies indicated on IF Response Curve.	Connect to test point "V" through a decoupling filter, see figs. 10 and 11. Marker pips on scope will be more distinct if a capacitor from 100 mmfd. to 1000 mmfd. is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 12. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touchup with IF slugs as instructed below. **Important:** If curve changes shape with hand capacity, see section 1 of "Alignment Hints" on page 8.

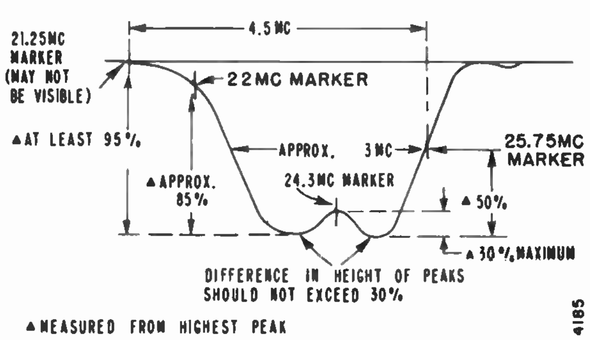


Figure 12. Ideal IF Response Curve.

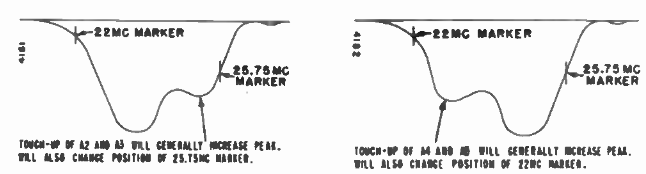
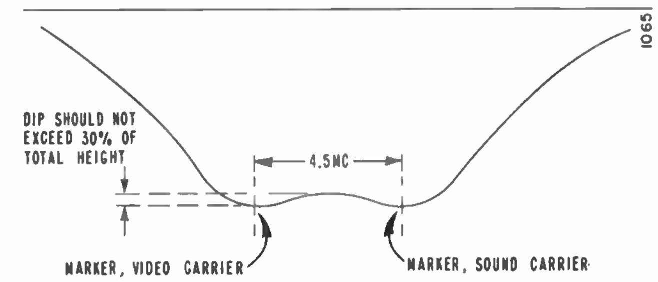


Figure 13. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks and marker location, carefully adjust alignment slugs as instructed under the above figures. It should not be necessary to turn the slugs more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.
Figure 14. RF Response Curve.

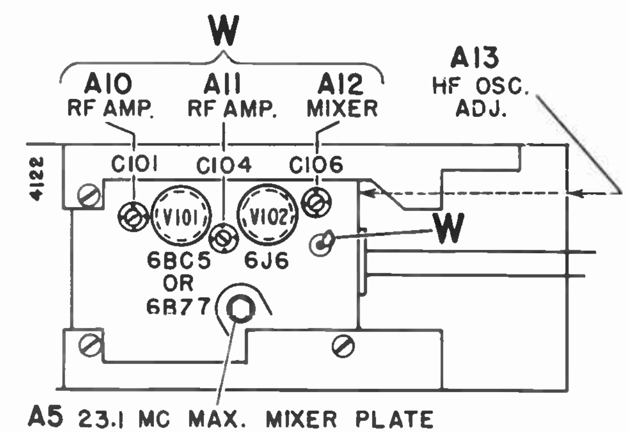


Figure 15. Top of TV Tuner, Showing Adjustment Location.

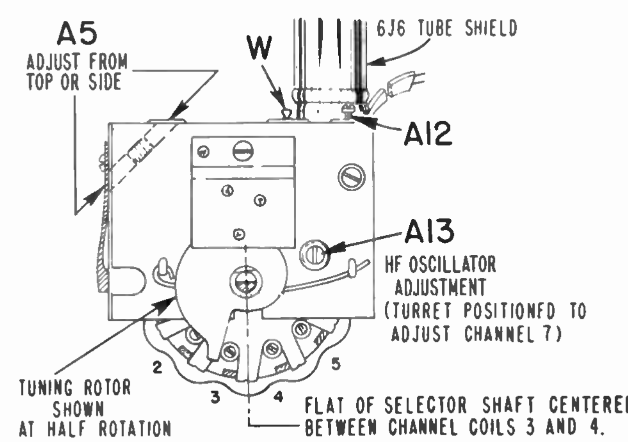


Figure 16. Front View of TV Tuner.

4.5 MC SOUND IF AND TRAP ALIGNMENT

See page 6 for touch-up of ratio detector using television signal without test equipment.

a. Connect signal generator high side to pin 2 of V304 (6AL5) through a .01 mfd. capacitor, connect low side to chassis.

b. Allow about 15 minutes for receiver and test equipment to warm up.

c. Set Contrast control fully to the left (counterclockwise).

d. Use a ***non-metallic*** alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adjustment A8 can be made from top of chassis, if you use alignment tool, part number 98A30-12 obtainable from Admiral distributor.

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
	When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle. IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station and follow steps 1, 2 and 3 below. If necessary use a higher scale on the VTVM.			
1	Set to exactly 4.5 MC	High side to test point "Y"; common to chassis.	Use lowest DC scale on VTVM.	A6 and A7 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
2		High side to test point "Z"; common to chassis.	Use zero center scale on VTVM, if available.	A8 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A6 was far off, repeat step 1.
3		High side to test point "Y"; common to chassis.	Connect a 10 mmfd. capacitor from pin 7 of V305 (12BY7) to pin 7 of V201 (6AU6). Use lowest DC scale on VTVM.	A9 for minimum.

RF AND MIXER ALIGNMENT

a. Connect negative of 4½ volt bias battery to AGC buss (test point "T"), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point "T" to chassis.

b. Connect sweep generator (with 300 ohm output) to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

c. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (figure 15). Keep scope leads away from chassis.

d. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping channel 10. See frequency table.	Alternately adjust A11 and A12 (figure 15) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location, see figure 14.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping channel 6. See frequency table.	Adjust A10 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper band width and correct marker location, see figure 14. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular low channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.

OVER-ALL RF AND IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Contrast control fully to the left. Channel Selector on channel 10 or other unassigned high channel. Connect negative of 4½ volt bias battery to test point "T", positive to chassis.	Connect to antenna terminals. Set generator to sweep channel selected. See frequency table on page 11. Keep generator output as low as possible, to prevent overloading. See section 2 of "Alignment Hints" on page 8.	If an external marker generator is used, loosely couple high side to sweep generator lead. Marker frequencies are shown in frequency table on page 11.	Connect to point "V" through a decoupling filter, see figs. 10 and 11.	Compare the response curve obtained against the ideal curve shown in figure 17. If the curve is not within tolerance, touch up the IF slug as instructed below. It should never be necessary to turn in slugs more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. IMPORTANT: When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change. See section 2 of "Alignment Hints", on page 8.

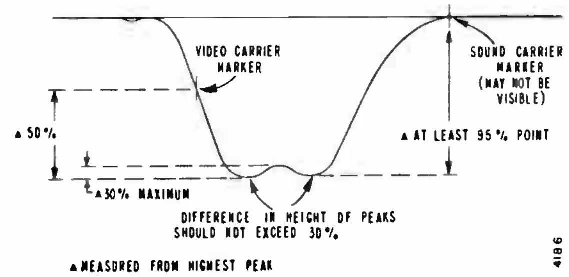
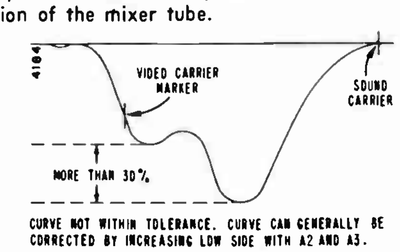


Figure 17. Ideal Over-all RF and IF Response Curve.

Note that video carrier (marker) on the "Over-all RF-IF Response Curve" will appear on the opposite side of the curve as compared to the "IF Response Curve" figure 12. This is due to action of the mixer tube.



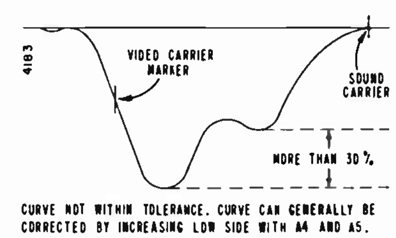


Figure 18. Over-all RF and IF Response Curves, Incorrect Shape.

HF OSCILLATOR ADJUSTMENT

(Using a signal generator)

It is always advisable to make HF oscillator adjustments using a Television Signal as instructed on page 3. If a Television Signal is not available, HF oscillator adjustment can be made using a crystal calibrated signal generator. Make adjustments as follows:

Receiver Control Settings	Signal Generator	Instructions
Set Channel selector for each channel to be adjusted. Set "Tuning" control at half rotation. Turn Volume control fully to the right (clockwise).	Connect to antenna terminals. Set generator to exact frequency of HF oscillator. See frequency table on page 11. **Set generator for maximum output.**	Connect a wire jumper from test point "W" on the tuner to test point "Z". See figure 11. Remove the ratio detector tube V202 (6AL5). Carefully adjust the oscillator slug A13 on each channel until a whistle (beat) is heard in the speaker of the receiver.

DIAL STRINGING

Dial stringing for the gang tuning control is shown below.

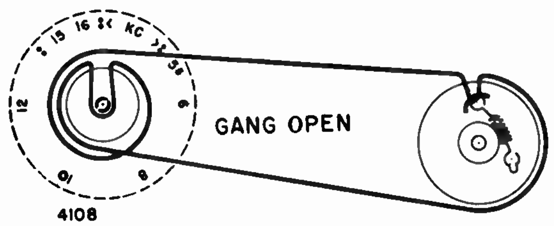


Figure 19. Dial Stringing for 20D2 Chassis.

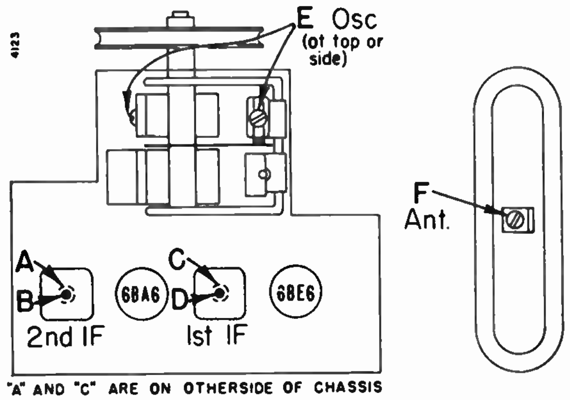


Figure 20. Radio Trimmer Locations.

WAVEFORM DATA

(Waveforms given on schematic)

Waveforms taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). Warning: Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

Waveform at V407 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions on this page.

NOTE: To read schematic for 20A2 and 20A2Z chassis, use sections in heavy solid lines; to read schematic for 20D2 chassis, use sections in heavy dotted lines and connect appropriate points indicated by dots coded

B1 B2 etc.

RADIO ALIGNMENT PROCEDURE

- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on.
- Function switch in "Radio" position.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.
- Use a ***non-metallic*** alignment tool for IF adjustments.
- Repeat adjustments to insure good results.

Step	Connect Signal Generator	Dummy Antenna Between Radio and Signal Generator	Signal Generator Frequency	Receiver Dial Setting	Adj. Trimmers in Following Order to Max.
1	Gang capacitor antenna stator	.1 MFD	455 KC	Tuning gang wide open	*A-B (2nd IF) *C-D (1st IF)
2	"	"	1620 KC	"	E (oscillator)
3	Place generator lead close to loop of set to obtain adequate signal. No actual connection (signal by radiation).		1400 KC	Tune in signal	§F (antenna)

* Adjustments A and C made from underside of chassis. See figure 20 for trimmer locations.
§ AM antenna trimmer may not peak if antenna leads are not properly routed or separated.

TV VOLTAGE DATA

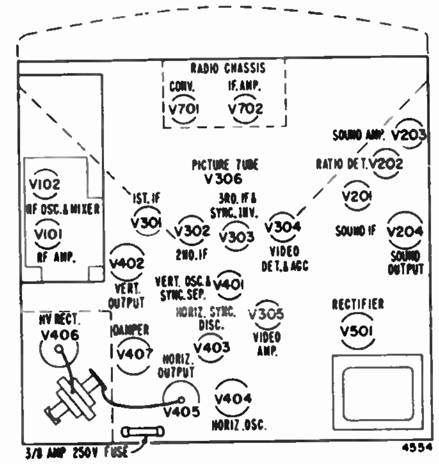
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Channel Selector** set on an unused channel. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position).
- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- Voltages marked with an asterisk (*) will vary widely with control setting. In combination models, B+ voltages in TV chassis will be slightly higher when set is switched to radio position. Alternate voltage readings for radio and TV are shown for sound output tube V204 (6Y6G) in 20D2 chassis.

CAUTION

Pulsed high voltages are present on the cap of V405, pin 3 of V407 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 16.5 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.



Top View of Chassis V701 & V702 Present in 20D2 Only.

V101—6BZ7
V102—6J6
V201—6AU6
V202—6AL5
V203—6AV6
V204—{6AS5 in 20A2 & 20A2Z; 6Y6G in 20D2}
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—12BY7
V306—{21ZP4A in 20A2 & 20D2; 21ZP4B in 20A2Z}
V401—12AU7
V402—6S4
V403—6AL5
V404—6SN7GT
V405—6BQ6GT
V406—1B3GT
V407—6AX4GT
V501—5U4G
V701—6BE6 } In 20D2 only
V702—6BA6 }

Figure 21. Schematic for 20D2 Chassis.

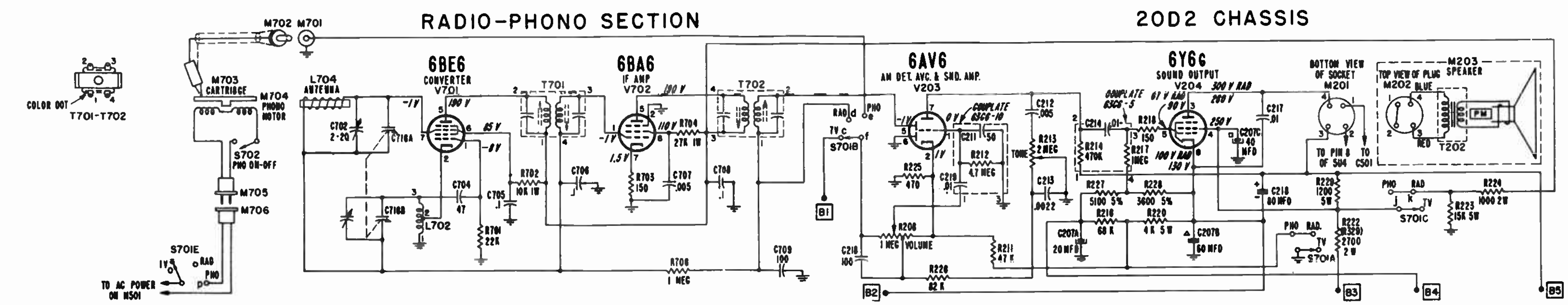
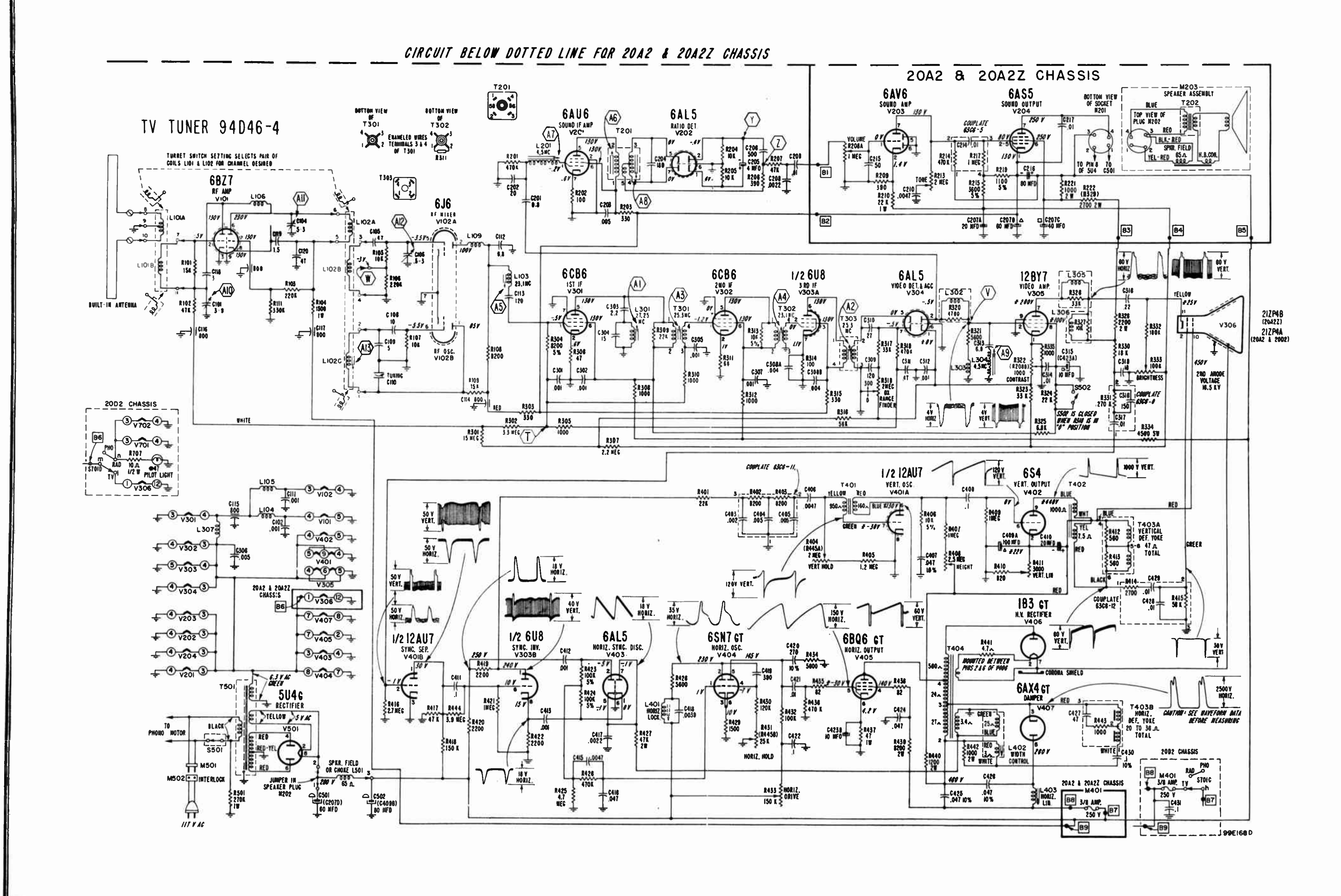


Figure 21. Schematic for 20A2, 20A2Z and 20D2 Chassis.



CHASSIS PARTS

RESISTORS

Sym.	Description	Part No.
R101	15,000 ohms, ½ watt	98A 45-67
R102	47,000 ohms, ½ watt	98A 45-17
R103	220,000 ohms, ½ watt	60B 8-224
R104	1,500 ohms, 1 watt	60B 14-152
R105	10,000 ohms, ½ watt	98A 45-18
R106	220,000 ohms, ½ watt	98A 45-21
R107	10,000 ohms, ½ watt	98A 45-18
R108	8,200 ohms, ½ watt	60B 8-822
R109	15,000 ohms, ½ watt	98A 45-67
R111	330,000 ohms, ½ watt	60B 8-334
R201	470,000 ohms, ½ watt	60B 8-474
R202	100 ohms, ½ watt, carbon only	60B 28-19
R203	330 ohms, ½ watt	60B 8-331
R204	10,000 ohms, ½ watt	60B 8-103
R205	10,000 ohms, ½ watt	60B 8-103
R206	390 ohms, ½ watt	60B 8-391
R207	47,000 ohms, ½ watt	60B 8-473
R208	1 megohm, **Volume** (20D2) (R208 includes switch S501)	75C 2-16
R208A	1 megohm, **Volume** } (20A2, 20A2Z)	75B 11-21
R208B	1,000 ohms, **Contrast** } (R208 includes switch S501)	
R209	390 ohms, ½ watt	60B 8-391
R210	22,000 ohms, 1 watt	60B 14-223
R211	47,000 ohms, ½ watt	60B 8-473
§R212	4.7 megohms	60B 8-475
R213	2 megohms, **Tone** control	75C 13-22
†R214	470,000 ohms, ½ watt	60B 8-474
R215	3,600 ohms, ½ watt, 5%	60B 7-362
R216	68,000 ohms, ½ watt	60B 8-683
†R217	1 megohm, ½ watt	60B 8-105
R218	150 ohms, ½ watt	60B 8-151
R219	1,100 ohms, ½ watt, 5%	60B 7-112
R220	4,000 ohms, 5 watt	61A 17-8
R221	1,000 ohms, 2 watt	60B 20-102
R222	2,700 ohms, 2 watt	60B 20-272
R223	15,000 ohms, 5 watt	61A 17-7
R224	1,000 ohms, 2 watt	60B 20-102
R225	470 ohms, ½ watt	60B 8-471
R226	82,000 ohms, ½ watt	60B 8-823
R227	5,100 ohms, ½ watt, 5%	60B 7-512
R228	3,600 ohms, ½ watt, 5%	60B 7-362
R229	1,200 ohms, 5 watt, 5%	61A 17-5
R301	15 megohms, ½ watt	60B 8-156
R302	3.3 megohms, ½ watt	60B 8-335
R303	330 ohms, ½ watt	60B 8-331
R304	8,200 ohms, ½ watt, 5%	60B 7-822
R305	1,000 ohms, ½ watt	60B 8-102
R306	47 ohms, ½ watt, carbon only	60B 28-45
R307	2.2 megohms, ½ watt	60B 8-225
R308	1,000 ohms, ½ watt	60B 8-102
R309	22,000 ohms, ½ watt	60B 8-223
R310	1,000 ohms, ½ watt	60B 8-102
R311	68 ohms, ½ watt, carbon only	60B 28-44
R312	1,000 ohms, ½ watt	60B 8-102
R313	10,000 ohms, ½ watt, 5%	60B 7-103
R314	100 ohms, ½ watt, carbon only	60B 28-19
R315	330 ohms, ½ watt	60B 8-331
R316	56,000 ohms, ½ watt	60B 8-563
R317	33,000 ohms, ½ watt	60B 8-333
R318	2 megohms, **DX Range Finder** control	75C 1-63
R319	470,000 ohms, ½ watt	60B 8-474
R320	4,700 ohms	Part of L302
R321	5,600 ohms, ½ watt	60B 8-562
R322	1,000 ohms, **Contrast** control (20D2)	75C 13-21
R323	33,000 ohms, ½ watt	60B 8-333
R324	22,000 ohms, ½ watt	60B 8-223
R325	6,800 ohms, ½ watt	60B 8-682
R326	33,000 ohms, ½ watt	Part of L305
R327	10,000 ohms, ½ watt	Part of L306
R328	2,200 ohms, 2 watt	60B 20-222
R329	See R222	

† May be part of couplate, part number 63C6-5. Replace with exact part or individual components.
§ May be part of couplate, part number 63C6-10. Replace with exact part or individual components.
: May be part of couplate, part number 63C6-11. Replace with exact part or individual components.
‡ May be part of couplate, part number 63C6-12. Replace with exact part or individual components.
* May be part of couplate, part number 63C6-8. Replace with exact part or individual components.

RESISTORS

Sym.	Description	Part No.
R330	18,000 ohms, ½ watt	60B 8-183
*R331	270,000 ohms, ½ watt	60B 8-273
R332	180,000 ohms, ½ watt	60B 8-184
R333	100,000 ohms, **Brightness**	75C 13-25
R334	4,500 ohms, 5 watt (vitreous enamel)	61A 17-1
R335	1,000 ohms, ½ watt	60B 8-102
R401	22,000 ohms ½ watt	60B 8-223
:R402	8,200 ohms, ½ watt	60B 8-822
:R403	8,200 ohms, ½ watt	60B 8-822
R404	2 megohms, **Vertical Hold** (20A2, 20A2Z)	75C 13-32
R405	1.2 megohms, ½ watt	60B 8-125
R406	10,000 ohms, ½ watt, 5%	60B 7-103
R407	1 megohm, ½ watt	60B 8-105
R408	2.5 megohms, **Height**	75C 13-3
R409	1 megohm, ½ watt	60B 8-105
R410	820 ohms, ½ watt	60B 8-821
R411	3,000 ohms, **Vert. Lin.**	75C 13-7
R412	560 ohms, ½ watt (Part of T403)	60B 8-561
R413	560 ohms, ½ watt (Part of T403)	60B 8-561
‡R414	2,700 ohms, ½ watt	60B 8-272
‡R415	56,000 ohms, ½ watt	60B 8-563
R416	2.7 megohms, ½ watt	60B 8-275
R417	47,000 ohms, ½ watt	60B 8-473
R418	150,000 ohms, ½ watt	60B 8-154
R419	2,200 ohms, ½ watt	60B 8-222
R420	2,200 ohms, ½ watt	60B 8-222
R421	1 megohm, ½ watt	60B 8-105
R422	2,200 ohms, ½ watt	60B 8-222
R423	100,000 ohms, ½ watt, 5%	60B 7-104
R424	100,000 ohms, ½ watt, 5%	60B 7-104
R425	4.7 megohms, ½ watt	60B 8-475
R426	470,000 ohms, ½ watt	60B 8-474
R427	47,000 ohms, 2 watt	60B 20-473
R428	5,600 ohms, ½ watt (Part of L401)	60B 8-562
R429	1,500 ohms, ½ watt	60B 8-152
R430	120,000 ohms, ½ watt	60B 8-124
R431	25,000 ohms, **Horiz. Hold** control (20A2, 20A2Z)	75C 13-28
R432	100,000 ohms, ½ watt	60B 8-104
R433	150,000 ohms, **Horiz. Drive**	75C 13-29
R434	5,600 ohms, ½ watt	60B 8-562
R435	82 ohms, ½ watt, carbon only	60B 28-31
R436	{1 megohm, ½ watt	60B 8-105
	{470,000 ohms, ½ watt (in later models)	60B 8-474
R437	47 ohms, 1 watt	60B 14-470
R438	82 ohms, ½ watt, carbon only	60B 28-31
R439	8,200 ohms, 2 watt	60B 20-822
R440	1,200 ohms, 2 watt	60B 20-122
R441	4.7 ohms, ½ watt, carbon only	60B 28-11
R442	1,000 ohms, 2 watt	60B 20-102
R443	1,000 ohms, ½ watt (Part of T403)	60B 8-102
R444	3.9 megohms, ½ watt	60B 8-395
R445A	2 megohms, **Vertical Hold** } (20D2)	75B 17-5
R445B	25,000 ohms, **Horiz. Hold** }	
R501	270,000 ohms, 1 watt	60B 14-274
R701	22,000 ohms, ½ watt	60B 8-223
R702	10,000 ohms, 1 watt	60B 14-103
R703	150 ohms, ½ watt	60B 8-151
R704	27,000 ohms, 1 watt	60B 14-273
R706	1 megohm, ½ watt	60B 8-105
R707	10 ohms, ½ watt	60B 8-100

CAPACITORS

Sym.	Description	Part No.
C101	3 to 9 mmfd, ceramic trimmer	98A 45-96
C102	.001 mfd, min, ceramic	98A 45-24
C103	800 mmfd, min, ceramic feed-thru	94C 37-90
C104	.5 to 3 mmfd, N470 ceramic trimmer	98A 45-23
C105	47 mmfd, ceramic, N1400 temp. coeff.	94D 47-50
C106	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C108	10 mmfd, 5%, cer, N750 temp. coeff.	98A 45-64
C109	5 mmfd, 5%, cer, N750 temp. coeff.	94D 47-52
C110	Tuning Rotor	94D 46-87
C111	.001 mfd, min, ceramic	98A 45-24
C112	6.8 mmfd, 3%, ceramic, NPO temp. coeff.	94D 47-53
C113	120 mmfd, silver mica	98A 45-78
C114	800 mmfd, min, ceramic feed-thru	94C 37-90

CAPACITORS

Sym.	Description	Part No.
C115	800 mmfd, min, ceramic feed-thru	94C 37-90
C116	800 mmfd, min, ceramic feed-thru	94C 37-90
C117	800 mmfd, min, ceramic feed-thru	94C 37-90
C118	3 mmfd, 3%, ceramic	94D 47-54
C119	1.5 mmfd, ceramic	94D 46-84
C120	47 mmfd, ceramic, N1400 temp. coeff.	94D 47-50
C201	6.8 mmfd, cer, N330 temp. coeff.	65C 6-71
C202	20 mmfd, 5%, ceramic	65C 6-51
C203	.005 mfd, min, ceramic	65C 10-1
C204	180 mmfd, 5%, N030 temp. coeff.	65C 6-59
C205	4 mfd, 50 volts, electrolytic	67A 4-9
C206	500 mmfd, ceramic	65C 6-6
C207A	20 mfd, 150 volts } electrolytic	67D 15-23
C207B	60 mfd, 200 volts }	
C207C	40 mfd, 350 volts }	
C207D	60 mfd, 350 volts }	
C208	.0022 mfd, 600 volts, paper	64B 9-17
C209	.01 mfd, 600 volts, paper	64B 8-13
C210	.0047 mfd, 600 volts, mica	64B 9-15
§C211	50 mmfd, ceramic	65C 6-4
C212	.0047 mfd, 600 volts, paper	64B 9-15
C213	.0022 mfd, 600 volts, paper	64B 9-17
†C214	.01 mfd, 600 volts, paper	64B 8-13
C215	50 mmfd, ceramic	65C 6-4
C216	80 mfd, 350 volts, electrolytic	67D 15-64
C217	.01 mfd, 600 volts, paper	64B 8-13
C218	100 mmfd, ceramic	65C 6-3
§C219	.01 mfd, 600 volts, paper	64B 8-13
C301	.001 mfd, min, ceramic	65C 6-41
C302	.001 mfd, min, ceramic	65C 6-41
C303	2.2 mmfd, ceramic (Part of L301)	65C 6-86
C304	15 mmfd, ceramic (Part of L301)	65C 6-50
C305	.001 mfd, min, ceramic	65C 6-41
C306	.005 mfd, ceramic	65C 10-1
C307	.001 mfd, min, ceramic	65C 6-41
C308A	.004 mfd. } dual ceramic	65A 17-1
C308B	.004 mfd. }	
C309	120 mmfd, ceramic	65C 6-66
C310	27 mmfd, ceramic	65C 6-87
C311	.47 mfd, 100 volts, paper	64A 10-1
C312	.001 mfd, min, ceramic	65C 6-41
C313	6.8 mmfd, cer, N330 temp. coeff.	65C 6-71
C314	.01 mfd, ceramic	65C 10-3
C315	Electrolytic	See C423B
*C316	150 mmfd, mica	65B 21-151
*C317	.01 mfd, 600 volts, paper	64B 8-13
C318	.22 mfd, 400 volts, paper	64B 9-24
C319	18 mmfd, mica	65B 5-4
:C403	.002 mfd, 600 volts, paper	64B 5-14
:C404	.005 mfd, 600 volts, paper	64B 5-12
:C405	.005 mfd, 600 volts, paper	64B 5-12
C406	.0047 mfd, 500 volts, mica	65B 21-472
C407	.047 mfd, 600 volts, paper	64A 2-14
C408	.1 mfd, 600 volts, paper	64B 9-7
C409A	100 mfd, 50 volts } electrolytic	67D 15-22
C409B	80 mfd, 350 volts }	
C410	20 mfd, 475 volts, electrolytic	67A 25-1
C411	.1 mfd, 200 volts, paper	64B 9-39
C412	.001 mfd, mica	65B 21-102
C413	.001 mfd, mica	65B 21-102
C415	.0047 mmfd, 500 volts, ceramic	65B 9-15
C416	.047 mfd, 400 volts, paper	64B 9-28
C417	.0022 mfd, 600 volts, paper	64B 8-17
C418	.0039 mfd.	Part of L401
C419	390 mmfd, mica	65B 21-391
C420	270 mmfd, mica	65B 21-271
C421	.01 mfd, 400 volts, paper	65C 10-3
C422	.1 mfd, 400 volts, paper	64B 9-76
C423A	10 mfd, 300 volts } electrolytic	67D 15-33
C423B	10 mfd, 25 volts }	
C424	.047 mfd, 400 volts, paper	64B 9-28
C425	.047 mfd, 600 volts, paper	64A 2-14
C426	.047 mfd, 600 volts, paper	64A 2-14
C427	47 mmfd, 5%, 1,500 volts, mica (Part of T403)	65B 1-64
‡C428	.01 mfd, 600 volts, paper	64B 8-13
‡C429	.01 mfd, 600 volts, paper	64B 8-13
C430	.1 mfd, 400 volts, paper	64B 9-26
C431	.1 mfd, 400 volts, paper	64B 9-26
C501	Electrolytic	See C207D

CAPACITORS

Sym.	Description	Part No.
C502	Electrolytic	See C409B
C702	3 to 30 mmfd, trimmer	Part of L704
C704	47 mmfd, ceramic	65C 6-79
C705	.1 mfd, 400 volts, paper	64A 3-15
C706	.1 mfd, 400 volts, paper	64A 3-15
C707	.005 mfd, min, ceramic	65C 10-1
C708	.1 mfd, 400 volts, paper	64A 3-15
C709	100 mmfd, ceramic	65C 6-3
C716A	420 mmfd, max. } gang	68B 53-1
C716B	104.7 mmfd, max. }	

COILS, TRANSFORMERS

Sym.	Description	Part No.	
L101	Antenna Coil (Stamped 2Q, 3Q, etc.)		For 94D 46-4 TV tuner
	for Channel #2	94D 46-52	
	for Channel #3	94D 46-53	
	for Channel #4	94D 46-54	
	for Channel #5	94D 46-55	
	for Channel #6	94D 46-56	
	for Channel #7	94D 46-57	
	for Channel #8	94D 46-58	
	for Channel #9	94D 46-59	
	for Channel #10	94D 46-60	
	for Channel #11	94D 46-61	
	for Channel #12	94D 46-62	
	for Channel #13	94D 46-63	
L102	Mixer—Osc. Coil (Stamped 2Q, 3Q, etc.)		For 94D 46-4 TV tuner
	for Channel #2	94D 46-72	
	for Channel #3	94D 46-73	
	for Channel #4	94D 46-74	
	for Channel #5	94D 46-75	
	for Channel #6	94D 46-76	
	for Channel #7	94D 46-77	
	for Channel #8	94D 46-78	
	for Channel #9	94D 46-79	
	for Channel #10	94D 46-80	
	for Channel #11	94D 46-81	
	for Channel #12	94D 46-82	
	for Channel #13	94D 46-83	
L103	Mixer Plate Coil	94D 46-85	
L104	Heater RF Choke	98A 45-13	
L105	Heater RF Choke	98A 45-14	
L106	RF Amplifier Plate Coil	94C 37-89	
L109	RF Mixer Plate Choke	94D 46-86	
L201	Sound Take-off Coil	72B 99-7	
L301	Trap Coil (includes C303, C304)	72C 96-23	
L302	Video Peaking Coil (wound on R320)	73A 5-15	
L303	Video Peaking Coil	73A 5-7	
L304	Trap Coil	72B 99-6	
L305	Video Peaking Coil (wound on R326)	73A 5-13	
L306	Video Peaking Coil (wound on R327)	73A 5-9	
L307	Heater RF Choke	73A 2-5	
L401	Horiz. Lock Control (includes R428, C418)	94B 17	
L402	Width Control Coil	94A 49-2	
L403	Horiz. Lin. Coil	94A 50-1	
L501	Filter Choke	74B 18-2	
L702	Oscillator Coil	69A 52-4	
L704	AM Antenna, Iron Core	69C 155-2	
T201	Ratio Detector Transformer	72B 68-2	
T202	Audio Output Transformer	79A 8	
T301	1st IF Transformer	72D 111-2	
T302	2nd IF Transformer	72C 96-22	
T303	3rd IF Transformer	72B 107-1	
T401	Vert. Blocking Oscillator Transformer	79A 18-5	
T402	Vert. Output Transformer	79B 40-2	
T403	Deflection Yoke (includes R412, R413, R443, C427)	94C 51-1	
T404	Horiz. Output Transformer	79D 41-2	
T501	Power Transformer	80C 35-1	
T701	1st IF Transformer	72B 28-7	
T702	2nd IF Transformer	72B 28-7	
Speaker			
	6" PM (includes output transformer)	78B 76-2	
	10" EM	78B 75-1	
	10" PM (includes choke)	78B 80-1	
	5" PM (includes choke and output transformer)	78B 79-1	

MODEL NUMBERS Model numbers may have suffix letter "N"	TV CHASSIS	PICTURE TUBE	VHF TUNER	UHF TUNER	RECORD CHANGER	RADIO	TONE CONTROL
TA2216, 17	For these models, see Service Manual No. 5536.						
TA2216A, 17A	20L2	21ZP4A	94D64-2	94D66-1	......	......	Yes
CA2236	For this model, see Service Manual No. 5536.						
CA2236A	20L2	21ZP4A	94D64-2	94D66-1	......	......	Yes
FA2226	20L2	21ZP4A	94D64-2	94D66-1	......	......	Yes

SPECIFICATIONS

Picture Tube

Direct View Electromagnetic. See Model Identification Chart for different picture tubes used.

Operating Voltage

110-120 volts, 60 cycles, AC.

Wattage

205 watts for all VHF-UHF models.

Input Impedance and Transmission Line

300 ohm balanced (between antenna terminals).

Antenna

All models are equipped with built-in VHF-UHF antennas.

Intermediate Frequencies

Video 45.75 MC. Sound 41.25 MC.
Intercarrier Sound 4.5 MC.

Fuse Location

The horizontal output circuit is fused with a 3/8 amp., 250 volt fuse, part number 84A4-3. The fuse is located on the top side of the chassis. See tube location illustration

UHF TUNER ALIGNMENT

The UHF tuner has been carefully aligned at the factory and generally should never require realignment in the field. Also, since alignment of the UHF tuner is quite involved, for the present, it is not recommended for field service. If it has been definitely determined that complete tuner alignment is required, it should be returned to the Admiral distributor for replacement.

Important: Do not under any circumstances attempt adjustment of the tracking screws or bend the capacitor tuning plates in any way.

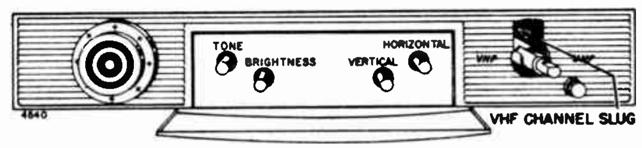
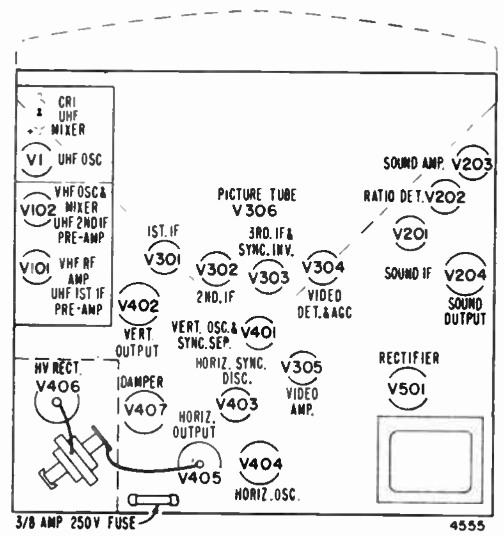


Figure 2. Control Panel in 20L2 Chassis; CHANNEL Knob Removed.



Top View of Chassis.

CR1 —94D66-50
1N82A or
1N124
V1 —6AF4
V101—6BZ7 or 6BQ7A
V102—6U8
V201—6AU6
V202—6AL5
V203—6AV6
V204—6AS5
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—12BY7
V306—21ZP4A
V401—12AU7
V402—6S4
V403—6AL5
V404—6SN7GT
V405—6BQ6GT
V406—1B3GT
V407—6AX4GT
V501—5U4G

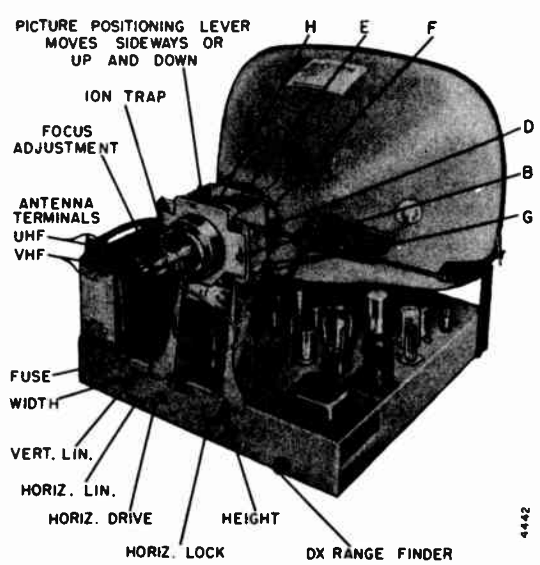


Figure 3. Rear View of 20L2 Chassis Showing Adjustment Locations.

HORIZONTAL OSCILLATOR AND DRIVE ADJUSTMENT

If the **Horizontal Drive** control (on rear of set) is not properly adjusted, it may be difficult to obtain sufficient picture width and brightness.

When switching channels, the **Horizontal** control (on front panel) should keep the picture in horizontal sync through at least three fourths of its range. If the picture does not remain in horizontal sync, then adjust the rear panel controls as follows:

a. Allow the set to warm up. Tune in a station and adjust the **Brightness** and **Contrast** controls for average settings. Be sure **DX Range Finder** control is adjusted as per instructions given previously.

b. The **Horizontal Drive** control (at rear of set) should be set to the approximate center of its rotation. If a white vertical line appears, turn the control to the left until the line disappears.

c. Turn the **Horizontal** control (on front panel) fully to the left. While slowly rotating the **Horizontal** control to the right, switch the **Channel Selector** off and on a station several times. The picture should remain in horizontal sync for at least three fourths of the **Horizontal** control range. If not, set the **Horizontal** control to the position at which horizonal sync is lost. As shown in the "Rear View of Chassis Showing Adjustment Location", slowly turn the **Horizontal Lock** control to the right or left until the picture synchronizes. It may require a few turns or more of the **Horizontal Lock** control to obtain the proper **Horizontal** control (on front panel) range.

SERVICE HINT

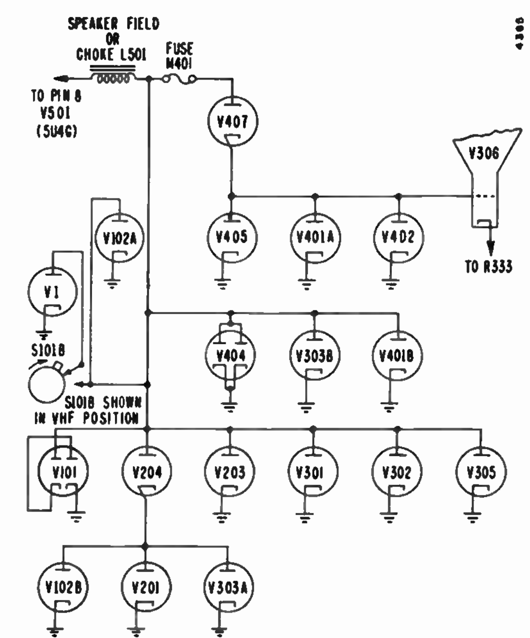


Figure 4. B+ Distribution 20L2 Chassis.

ALIGNMENT

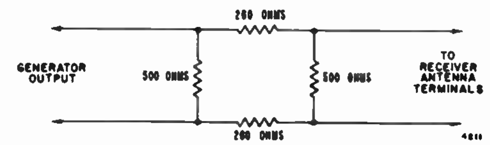


Figure 5. Illustration of 12 db Attenuation Pad for Viewing Over-all RF-IF Response Curve.

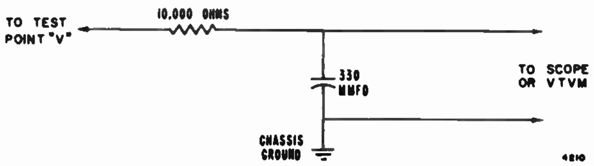


Figure 6. Decoupling Filter.

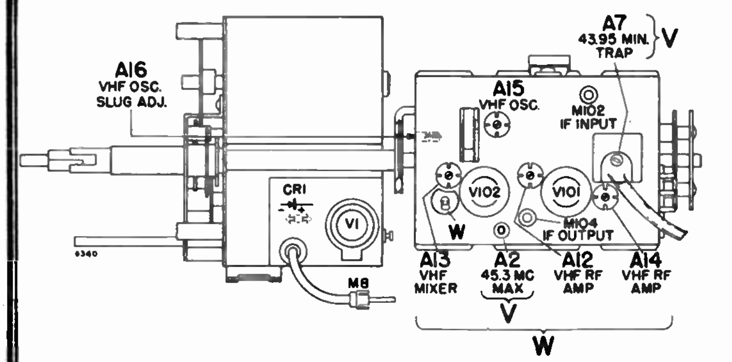


Figure 9. Top View of TV Tuner Showing Adjustment Locations.

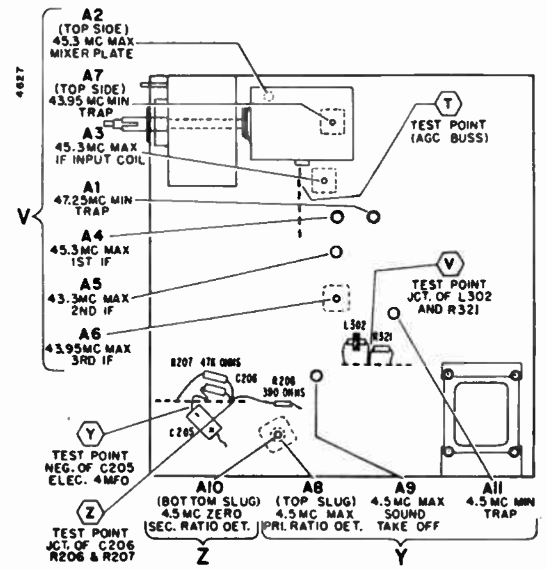


Figure 8. Bottom View of 20L2 Chassis Showing Test Point Connections and IF Alignment Data.

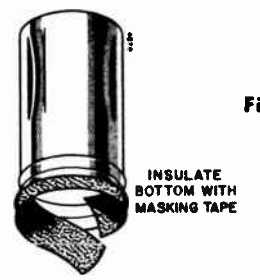


Figure 7. Tube Shield for IF Alignment and IF Response Curve Check.

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set Channel Selector on channel 12 or an unassigned high channel. Contrast control fully to the left. Connect negative of 4½ volt bias battery to test point "T"; positive to chassis.	Connect high side to 6U8 mixer-osc. insulated tube shield, see fig. 7. Connect low side to chassis near tube shield. Set sweep frequency to 44.5 MC, and sweep width approximately 7 MC.	If an external marker generator is used, loosely couple high side to tube shield, low side to chassis. Marker frequencies indicated on IF Response Curve.	Connect to test point "V" through a decoupling filter, see figs. 6 and 8. Marker pips on scope will be more distinct if a capacitor from 100 mmfd. to 1000 mmfd. is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 10. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touchup with IF slugs as instructed below. **Important:** If curve changes shape with hand capacity, see section 1 of "Alignment Hints."

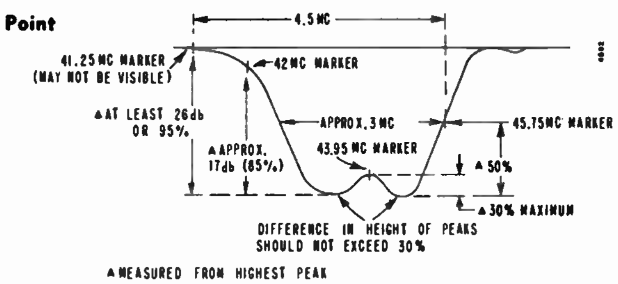


Figure 10. Ideal IF Response Curve.

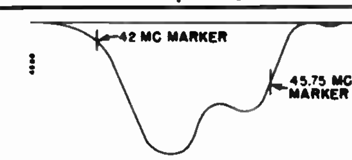


Figure 11. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks and correct marker location, carefully adjust slug A2 and if necessary, adjust slug A3. It should not be necessary to turn the slugs more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point "T", see figure 8, positive to chassis. A 4½ volt battery is required for all steps below.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel Selector to channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Contrast control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

  Note: Since A2 and A3 are adjustments of an overcoupled double tuned circuit, adjustment of A3 is first made at 43.3 MC (step 3) and then at 45.3 MC (step 5), to obtain proper peak.

Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
*1	*47.25 MC	VTVM high side to test point "V" through a decoupling filter; see figures 6 and 8, common to chassis.	Connect a 4½ volt bias battery to test point "T".	A1 for minimum.
2	45.3 MC		Use lowest DC scale on VTVM.	A2 for maximum.
3	45.3 MC	Generator high side to 6U8 (V102) special tube shield. Connect low side to chassis near the tube shield, see figure 7.	When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. If unstable, refer to section 1 of the "Alignment Hints" on page 7.	A3 for maximum.
4	45.3 MC			Repeat step 2.
5	45.3 MC			**Readjust** A3 for maximum.
6	45.3 MC			A4 for maximum.
7	43.3 MC			A5 for maximum.
8	43.95 MC			A6 for maximum.
9	43.95 MC	Connect VTVM as above. Generator high side to antenna terminals; full output may be required.	Follow above instructions. Set Channel Selector to 2 or other low channel.	A7 for minimum.
10	To insure correct alignment, repeat steps 1 and 6. Make the "IF Response Curve Check" given on page 9.			

* Before proceeding with alignment, turn slugs A2 and A3 out fully (counterclockwise). Check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

4.5 MC SOUND IF AND TRAP ALIGNMENT

See page 10 for touch-up of ratio detector using television signal without test equipment.

a. Connect signal generator high side to pin 2 of V304 (6AL5) through a .01 mfd. capacitor, connect low side to chassis.

b. Allow about 15 minutes for receiver and test equipment to warm up.

c. Set Contrast control fully to the left (counterclockwise).

d. Use a ***non-metallic*** alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adjustment A8 can be made from top of chassis, if you use alignment tool, part number 98A30-12 obtainable from Admiral distributor.

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
	When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle. IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station and follow steps 1, 2 and 3 below. If necessary use a higher scale on the VTVM.			
1	Set to exactly 4.5 MC.	High side to test point "Y"; common to chassis.	Use lowest DC scale on VTVM.	A8 and A9 for maximum (keep reducing generator output to keep VTVM at approximately 1 volt).
2		High side to test point "Z"; common to chassis.	Use zero center scale on VTVM if available.	A10 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A8 was far off, repeat step 1.
3		High side to test point "Y"; common to chassis.	Connect a 10 mmfd. capacitor from pin 7 of V305 (12BY7) to pin 7 of V201 (6AU6). Use lowest DC scale on VTVM.	A11 for minimum.

TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (A10, BOTTOM SLUG OF T201)

Adjustment need be made on one channel only.

Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.

b. Tune set for normal picture and sound.

c. Carefully insert a non-metallic alignment tool in the bottom slug of T201. An alignment tool with a screw-driver blade or hexagonal end is required depending on the transformer used, see * note below. When the alignment tool engages the bottom tuning slug A10, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.

ALIGNMENT OF 4.5 MC TRAP A11, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting slug A11 for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as instructed in step 3 of the "4.5 MC Sound IF and Trap Alignment."

* If ratio detector transformer (T201) has hollow hexagonal core slugs, bottom slug adjustment (A10) can be made from top of chassis, if you use alignment tool (part number 98A30-12; available at Admiral Distributor). Bottom slug (A10) can be reached through the hole in the core of the upper slug (A8).

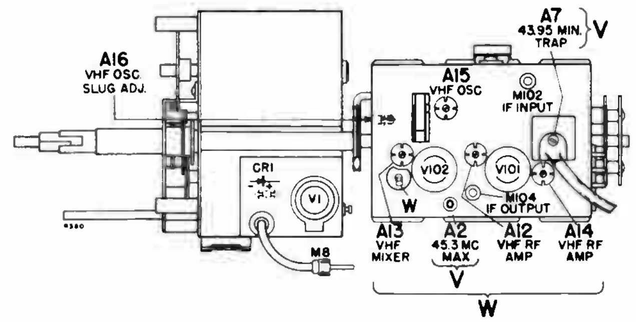


Figure 13. Top of Tuners, Showing VHF Adjustment Locations.

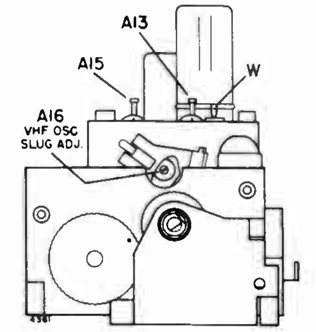


Figure 14. Front View of Tuners.

VHF OSCILLATOR ADJUSTMENT

(Using a signal generator)

It is always advisable to make VHF oscillator adjustments using a Television Signal as instructed on page 4. If a Television Signal is not available, HF oscillator adjustment can be made using a crystal calibrated signal generator. Note that adjustment "A15" (figure 10) is an overall oscillator adjustment and should only be made when the mixer-oscillator tube is replaced. Generally "A15" adjusts with about 3/16" of screw thread exposed. Make adjustments as follows:

Receiver Control Settings	Signal Generator	Instructions
Set Channel Selector for each channel to be adjusted. Set "Tuning" control at half rotation. Turn volume control fully to the right (clockwise).	Connect to antenna terminals. Set generator to exact frequency of VHF oscillator. See frequency table on page 10. **Set generator for maximum output.**	Connect a wire jumper from test point "W" on the tuner to test point "Z". See figure 8. Remove the ratio detector tube V202 (6AL5). Carefully adjust the oscillator slug A16 on each channel until a whistle (beat) is heard in the speaker of the receiver.

VHF TUNER RF AND MIXER ALIGNMENT

a. Connect negative of 4½ volt bias battery to AGC buss (test point "T"), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point "T" to chassis.

b. Connect sweep generator (with 300 ohm output) to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

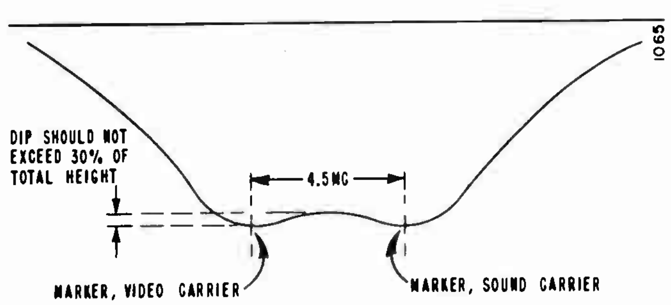
c. Connect oscilloscope through a 10,000 ohms resistor to test point "W" on tuner (figure 13). Keep scope leads away from chassis.

d. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See frequency table below.	Alternately adjust A12 and A13 (figure 13) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location, see figure 12.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping Channel 6. See frequency table below.	Adjust A14 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper bandwidth and correct marker location, see figure 12. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular low channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.

OVER-ALL VHF AND IF RESPONSE CURVE CHECK

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Contrast control fully to the left. Channel Selector on channel 10 or other unassigned high channel. Connect negative of 4½ volt bias battery to test point "T", positive to chassis.	Connect to antenna terminals. Set generator to sweep VHF channel selected. See frequency table on page 10. Keep generator output as low as possible, to prevent overloading. See section 2 of "Alignment Hints."	If an external marker generator is used, loosely couple high side to sweep generator lead. VHF marker frequencies are shown in frequency table on page 10.	Connect to point "V" through a decoupling filter; see figs. 6 and 8.	Compare the response curve obtained against the ideal curve shown in figure 15. If the curve is not within tolerance, touch up the IF slug as instructed below. It should never be necessary to turn slugs more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. IMPORTANT: When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change. See section 2 of "Alignment Hints."



Full skirt of curve will not be visible unless generator sweep width extends beyond 12 MC.

Figure 12. RF Response Curve.

VHF FREQUENCY TABLE

Channel Number	Channel Freq., MC	Video Carrier, MC	Sound Carrier, MC	HF Osc., MC
2	54-60	55.25	59.75	101
3	60-66	61.25	65.75	107
4	66-72	67.25	71.75	113
5	76-82	77.25	81.75	123
6	82-88	83.25	87.75	129
7	174-180	175.25	179.75	221
8	180-186	181.25	185.75	227
9	186-192	187.25	191.75	233
10	192-198	193.25	197.75	239
11	198-204	199.25	203.75	245
12	204-210	205.25	209.75	251
13	210-216	211.25	215.75	257

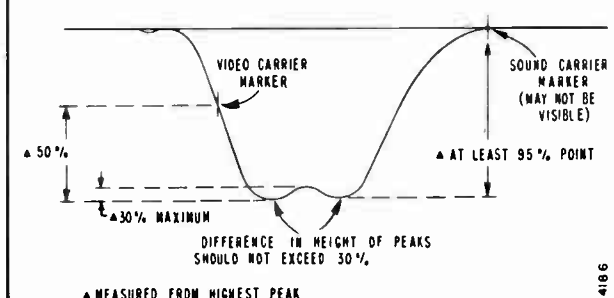


Figure 15. Ideal Over-all VHF and IF Response Curve.

Note that video carrier (marker) on the "Overall RF-IF Response Curve" will appear on the opposite side of the curve as compared to the "IF Response Curve" figure 10. This is due to action of the mixer tube.

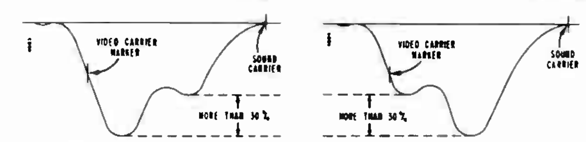


Figure 16. Over-all RF and IF Response Curves, Incorrect Shape.

Curves must have approximate equal peaks and correct marker location. If it is necessary to adjust for approximate equal peaks and marker location, carefully adjust slug A2 and if necessary slug A3. It should not be necessary to turn the slugs more than one turn in either direction.

IF PRE-AMPLIFIER RESPONSE CURVE CHECK AND ALIGNMENT

***Important:** This alignment is seldom required. It should be made only if UHF reception is poor and after usual causes of poor reception have been checked. This alignment should be made after completing preceding alignments.*

a. Set VHF Channel Selector at detent position midway between channels 5 and 6.

b. Connect negative of 4½ volt bias battery to AGC buss (test point "T"), positive to chassis.

c. Remove CR1 (mixer crystal) from holder. Connect sweep generator high side through 100 ohm resistor to negative clip of mixer crystal socket, see figure 13. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the high side of sweep generator. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

d. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (figure 18). Keep scope leads away from chassis.

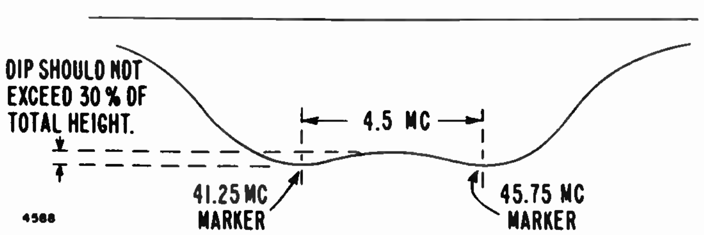
e. Allow about 15 minutes for receiver and test equipment to warm up.

f. Use a ***non-metallic*** alignment tool. If hollow core slugs are used, use alignment tool, part number 98A30-14.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
*1	45.75 MC (Video Carrier) 41.25 MC (Sound Carrier)	Set sweep at 43.5 MC, sweep width 12 MC.	Adjust A17 to obtain maximum amplitude at center of curve. Alternately adjust A18 and A19 (figure 18) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location; see figure 17.
2	If curve cannot be made to resemble response curve, figure 17, check to be sure all instructions have been followed. Check tubes V101 and V102 and repeat alignment. Important: After replacing tubes, it may be necessary to check "VHF Tuner RF And Mixer Alignment".		

* Before proceeding, detune slug A2 exactly 3 turns counter-clockwise. After completing this alignment, return slug A2 to its original setting by turning it exactly 3 turns clockwise.

Caution: Use extreme care to avoid damage to coils or slugs.



Full skirt of curve will not be visible unless generator sweep width extends beyond 12 MC.

Figure 17. IF Preamplifier Response Curve.

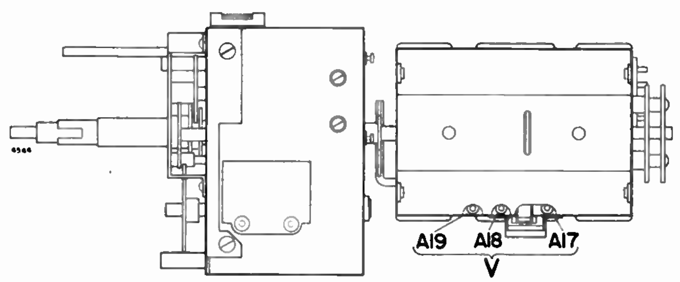


Figure 18. Bottom View of Tuners Showing IF Preamplifier Adjustments.

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). Warning: Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variation due to response of the oscilloscope and parts tolerances.

Waveform at V407 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower depending upon the degree of coupling.

TV VOLTAGE DATA
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Low-Channel Selector** set on an unused VHF channel. **High-Channel Selector** in the "VHF" position. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position).
- VHF Antenna disconnected from set with terminal shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 6 and 3 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- B+ voltage at terminal of VHF-UHF switch taken with tuner in UHF position.
- Voltages marked with an asterisk (*) will vary widely with control setting.

CAUTION

Pulsed high voltages are present on the cap of V405, pin 3 of V407 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 15 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

PRODUCTION CHANGES

Production changes are coded RUN 1, RUN 2, etc., as given in the headings below. Run number (stamped on chassis) indicates that this chassis has the change(s) incorporated which are explained under that particular run number heading below, as well as all changes (lower run numbers) made prior to that time. At the start of production chassis were stamped RUN 1; a few chassis were not stamped with a Run number.

CHANGE IN SYNC CIRCUITS

Run 2 and higher

In sets stamped Run 2 and higher, R330 was changed from 18,000 ohms to 27,000 ohms, R416 was changed from 2.7 megohms to 3.3 megohms, R417 was changed from 47,000 ohms to 27,000 ohms. The above changes were made to improve vertical sync and correct bending at top of picture.

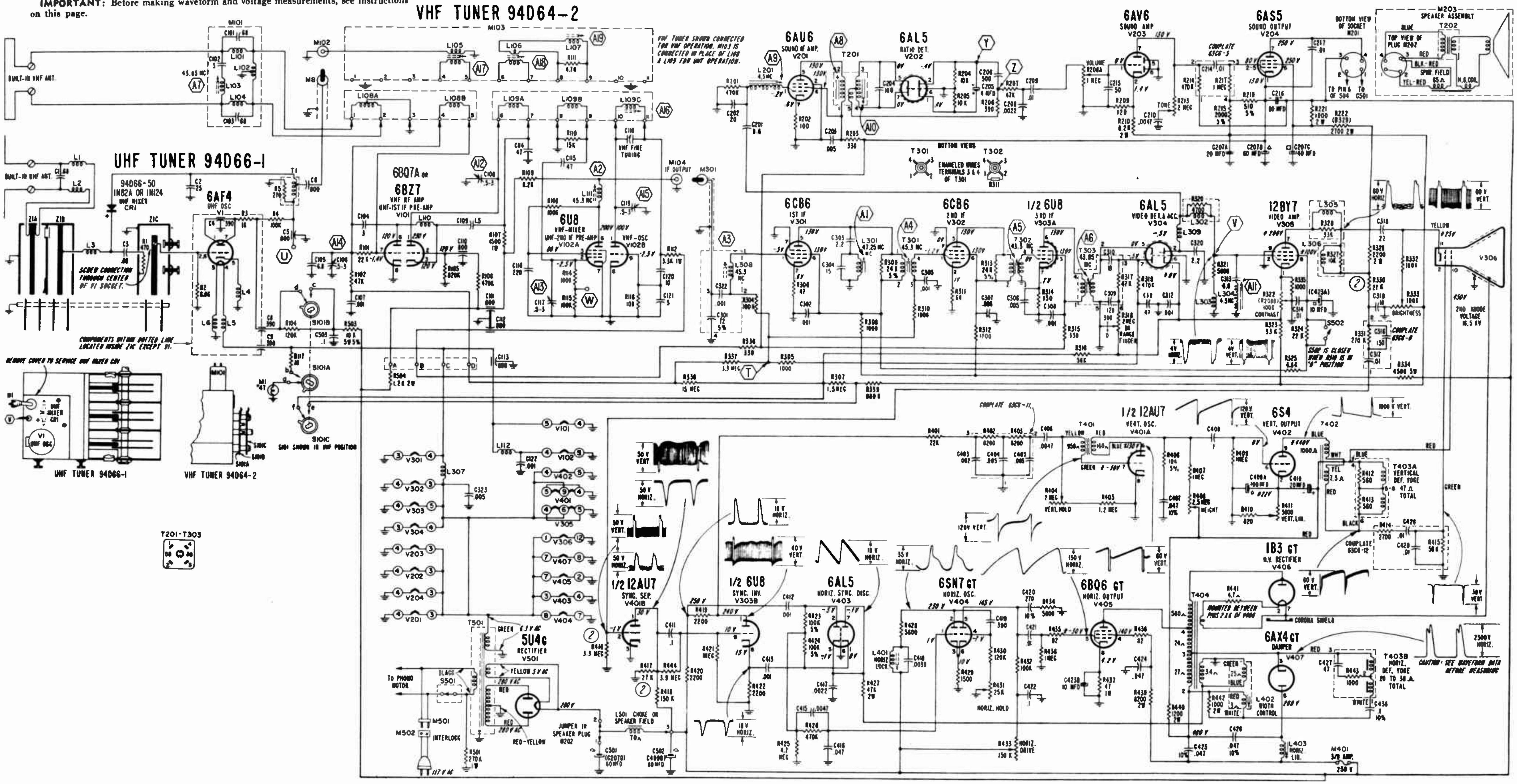
SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

A1, A2, ... Y, Z, etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions on this page.

Figure 20. Schematic for 20L2 Chassis.



CHASSIS PARTS

RESISTORS

Sym.	Description	Part No.
R1	470 ohms, ½ watt	60B 8-471
R2	6,800 ohms, ½ watt	60B 8-682
R3	1,000 ohms, ½ watt	60B 8-102
R4	100,000 ohms, ½ watt	60B 8-104
R5	270 ohms, ½ watt	60B 8-271
R101	22,000 ohms, ½ watt	60B 8-223
R102	47,000 ohms, ½ watt	60B 8-473
R104	120,000 ohms, ½ watt	60B 8-124
R105	820,000 ohms, ½ watt	60B 8-824
R106	470,000 ohms, ½ watt	60B 8-474
R107	1,500 ohms, 1 watt	60B 14-152
R108	100,000 ohms, ½ watt	60B 8-104
R109	8,200 ohms, ½ watt	60B 8-822
R110	15,000 ohms, ½ watt	60B 8-153
R111	4,700 ohms, ½ watt (Part of M103)	60B 8-472
R112	3,300 ohms, 1 watt	60B 14-332
R114	100,000 ohms, ½ watt	60B 8-104
R115	100,000 ohms, ½ watt	60B 8-104
R116	10,000 ohms, ½ watt	60B 8-103
R117	10 ohms, ½ watt	60B 8-100
R201	470,000 ohms, ½ watt	60B 8-474
R202	100 ohms, ½ watt, carbon only	60B 28-19
R203	330 ohms, ½ watt	60B 8-331
R204	10,000 ohms, ½ watt	60B 8-103
R205	10,000 ohms, ½ watt	60B 8-103
R206	390 ohms, ½ watt	60B 8-391
R207	47,000 ohms, ½ watt	60B 8-473
R208A	1 megohm, **Volume**	75B 11-21
R208B	1,000 ohms, **Contrast**	
	(R208 includes switch S501)	
R209	120 ohms, ½ watt	60B 8-121
R210	82,000 ohms, 2 watt	60B 20-822
R213	2 megohms, **Tone** control	75C 13-22
†R214	470,000 ohms, ½ watt	60B 8-474
R215	2,000 ohms, ½ watt, 5%	60B 7-202
†R217	1 megohm, ½ watt	60B 8-105
R219	510 ohms, ½ watt, 5%	60B 7-511
R221	1,000 ohms, 2 watt	60B 20-102
R222	2,700 ohms, 2 watt	60B 20-272
R304	100,000 ohms, ½ watt	60B 8-104
R305	1,000 ohms, ½ watt	60B 8-102
R306	47 ohms, ½ watt, carbon only	60B 28-45
R307	1.5 megohms, ½ watt	60B 8-155
R308	1,000 ohms, ½ watt	60B 8-102
R309	24,000 ohms, ½ watt, 5%	60B 7-243
R310	1,000 ohms, ½ watt	60B 8-102
R311	68 ohms, ½ watt, carbon only	60B 28-44
R312	1,000 ohms, ½ watt	60B 8-102
R313	24,000 ohms, ½ watt, 5%	60B 7-243
R314	150 ohms, ½ watt	60B 8-151
R315	330 ohms, ½ watt	60B 8-331
R316	56,000 ohms, ½ watt	60B 8-563
R317	47,000 ohms, ½ watt	Part of T303
R318	2 megohms, **DX Range Finder** control	75C 1-63
R319	470,000 ohms, ½ watt	60B 8-474
R320	4,700 ohms	Part of L302
R321	5,600 ohms, ½ watt	60B 8-562
R323	33,000 ohms, ½ watt	60B 8-333
R324	22,000 ohms, ½ watt	60B 8-223
R325	6,800 ohms, ½ watt	60B 8-682
R326	33,000 ohms	Part of L305
R327	10,000 ohms	Part of L306
R328	2,200 ohms, 2 watt	60B 20-222
R329	See R222	
R330	18,000 ohms, ½ watt (in chassis stamped RUN 1)	60B 8-183
	27,000 ohms, ½ watt (in chassis stamped RUN 2 and higher)	60B 8-273
•R331	270,000 ohms	60 8-274
R332	180,000 ohms	60B 8-184
R333	100,000 ohms, **Brightness**	75C 13-25
R334	4,500 ohms, 5 watt	61A 17-1
R335	1,000 ohms, ½ watt	60B 8-102
R336	330 ohms, ½ watt	60B 8-331
R337	3.3 megohms, ½ watt	60B 8-335
R338	15 megohms, ½ watt	60B 8-156
R339	680,000 ohms, ½ watt	60B 8-684
R401	22,000 ohms, ½ watt	60B 8-223
⁑R402	8,200 ohms, ½ watt	60B 8-822

RESISTORS

Sym.	Description	Part No.
⁑R403	8,200 ohms, ½ watt	60B 8-822
R404	2 megohms, **Vertical Hold**	75C 13-32
R405	1.2 megohms, ½ watt	60B 8-125
R406	10,000 ohms, ½ watt, 5%	60B 7-103
R407	1 megohm, ½ watt	60B 8-105
R408	2.5 megohms, **Height**	75C 13-3
R409	1 megohms, ½ watt	60B 8-105
R410	820 ohms, ½ watt	60B 8-821
R411	3,000 ohms, **Vert. Lin.**	75C 13-7
R412	560 ohms, ½ watt (part of T403)	60B 8-561
R413	560 ohms, ½ watt (part of T403)	60B 8-561
‡R414	2,700 ohms, ½ watt	60B 8-272
‡R415	56,000 ohms, ½ watt	60B 8-563
R416	2.7 megohms, ½ watt (in chassis stamped RUN 1)	60B 8-275
	3.3 megohms, ½ watt (in chassis stamped RUN 2 and higher)	60B 8-335
R417	47,000 ohms, ½ watt (in chassis stamped RUN 1)	60B 8-473
	27,000 ohms, ½ watt (in chassis stamped RUN 2 and higher)	60B 8-273
R418	150,000 ohms, ½ watt	60B 8-154
R419	2,200 ohms, ½ watt	60B 8-222
R420	2,200 ohms, ½ watt	60B 8-222
R421	1 megohm, ½ watt	60B 8-105
R422	2,200 ohms, ½ watt	60B 8-222
R423	100,000 ohms, ½ watt, 5%	60B 7-104
R424	100,000 ohms, ½ watt, 5%	60B 7-104
R425	4.7 megohms, ½ watt	60B 8-475
R426	470,000 ohms, ½ watt	60B 8-474
R427	47,000 ohms, 2 watt	60B 20-473
R428	5,600 ohms, ½ watt (part of L401)	60B 8-562
R429	1,500 ohms, ½ watt	60B 8-152
R430	120,000 ohms, ½ watt	60B 8-124
R431	25,000 ohms, **Horiz. Hold**	75C 13-28
R432	100,000 ohms, ½ watt	60B 8-104
R433	150,000 ohms, **Horiz. Drive**	75C 13-29
R434	5,600 ohms, ½ watt	60B 8-562
R435	82 ohms, ½ watt, carbon only	60B 28-31
R436	1 megohm, ½ watt	60B 8-105
	470,000 ohms, ½ watt (in later models)	60B 8-474
R437	47 ohms, 1 watt	60B 14-470
R438	82 ohms, ½ watt, carbon only	60B 28-31
R439	8,200 ohms, 2 watt	60B 20-822
R440	1,200 ohms, 2 watt	60B 20-122
R441	4.7 ohms, ½ watt, carbon only	60B 28-11
R442	1,000 ohms, 2 watt	60B 20-102
R443	1,000 ohms, ½ watt (part of T403)	60B 8-102
R444	3.9 megohms, ½ watt	60B 8-395
R501	270,000 ohms, 1 watt	60B 14-274
R503	10,000 ohms, 5 watt, 5%	61A 17-2
R504	1,200 ohms, 2 watt	60B 20-122

CAPACITORS

Sym.	Description	Part No.
C1	.68 mmfd 10%, ceramic	94D 66-51
C2	25 mmfd, 5%, cer, N750 temp. coeff.	94D 66-52
C3	.68 mmfd, 10%, ceramic	94D 66-51
C4	390 mmfd, silver mica	94D 66-53
C5	800 mmfd, min, ceramic feed-thru	94D 66-54
C6	800 mmfd, min, ceramic	94D 66-55
C8	390 mmfd, min, ceramic feed-thru	94D 66-56
C9	390 mmfd, min, ceramic feed-thru	94D 66-56
C101	68 mmfd, 3%, ceramic	Part of M10
C102	5 mmfd, 5%, ceramic	Part of M10
C103	68 mmfd, 3%, ceramic	Part of M10
C104	3 mmfd, 10%, ceramic	94D 64-86
C105	6.8 mmfd, 10%, ceramic	94D 64-85
C106	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C107	.001 mfd. min. ceramic	94D 64-101
C108	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C109	1.5 mmfd, 15%, cer, NPO temp. coeff.	94D 64-87
C110	800 mmfd, min, ceramic feed-thru	94C 37-90
C111	800 mmfd min, ceramic feed-thru	94C 37-90
C112	800 mmfd, min, ceramic feed-thru	94C 37-90
C113	800 mmfd, min, ceramic feed-thru	94C 37-90
C114	47 mmfd, 10%, ceramic	94D 64-88
C115	47 mmfd, 10%, ceramic	94D 64-88
C116	220 mmfd, 10%, ceramic	94D 64-89
C117	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C119	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C120	10 mmfd, 10%, cer, N750 temp. coeff.	94D 64-91

CAPACITORS

Sym.	Description	Part No.
C121	5 mmfd, 5%, N900 temp. coeff.	94D 64-100
C122	.001 mfd, min, ceramic	94D 64-101
C201	6.8 mmfd, ceramic N330 temp. coeff.	65C 6-71
C202	20 mmfd, 5%, ceramic	65C 6-51
C203	.005 mfd, 450 volts, min, ceramic	65C 10-1
C204	180 mmfd, 5%, N030 temp. coeff.	65C 6-59
C205	4 mfd, 50 volts, electrolytic	67A 4-9
C206	500 mmfd, ceramic	65C 6-6
C207A	20 mfd, 150 volts	
C207B	60 mfd, 200 volts	
C207C	40 mfd, 350 volts — electrolytic	67D 15-23
C207D	60 mfd, 350 volts	
C208	.0022 mfd, 600 volts, paper	64B 9-17
C209	.01 mfd, 600 volts, paper	64B 8-13
C210	.0047 mfd, 600 volts, paper	64B 9-15
†C214	.01 mfd, 600 volts, paper	64B 8-13
C215	50 mmfd, ceramic	65C 6-4
C216	80 mfd, 350 volts, electrolytic	67D 15-64
C217	.01 mfd, 600 volts, paper	64B 8-13
C301	72 mfd, 5%	Part of L308
C302	.001 mfd, min, ceramic	65C 6-41
C303	2.2 mmfd, ceramic (part of L301)	65C 6-86
C304	15 mmfd, ceramic (part of L301)	65C 6-50
C305	.001 mfd, min, ceramic	65C 6-41
C306	.005 mfd, 450 volts, min, ceramic	65C 10-1
C307	.005 mfd, 450 volts, min, ceramic	65C 10-1
C308	.001 mfd, min, ceramic	65C 6-41
C309	120 mmfd, ceramic (part of T303)	65C 6-66
C310	18 mmfd, ceramic (part of T303)	65C 6-91
C311	.47 mfd, 100 volts, paper	64A 10-1
C312	.001 mfd, min, ceramic	65C 6-41
C313	6.8 mmfd cer, N330 temp. coeff.	65C 6-71
C314	.01 mfd, ceramic	65C 10-3
C315	Electrolytic	See C423A
•C316	150 mmfd, mica	65B 21-151
•C317	.01 mfd, 600 volts, paper	64B 8-13
C318	.22 mfd, 400 volts, paper	64B 9-24
C319	18 mmfd, mica	65B 3-4
C320	2.2 mmfd, 10%, cer, NPO temp. coeff.	65C 6-86
C322	.001 mfd.	Part of L308
C323	.005 mfd, 450 volts, min, ceramic	65C 10-1
⁑C403	.002 mfd, 600 volts, paper	64B 5-14
⁑C404	.005 mfd, 600 volts, paper	64B 5-12
⁑C405	.005 mfd, 600 volts, paper	64B 5-12
C406	.0047 mfd, 500 volts, mica	65B 21-472
C407	.047 mfd, 600 volts, paper, 10%	64A 2-14
C408	.1 mfd, 600 volts, paper	64B 9-7
C409A	100 mfd, 50 volts — electrolytic	67D 15-22
C409B	80 mfd, 350 volts	
C410	20 mfd, 475 volts, electrolytic	67A 25-1
C411	.1 mfd, 200 volts, paper	64B 9-39
C412	.001 mfd, mica	65B 21-102
C413	.001 mfd, mica	65B 21-102
C415	.0047 mmfd, 300 volts, mica	65B 9-15
C416	.047 mfd, 400 volts	64B 9-28
C417	.0022 mfd, 600 volts	64B 8-17
C418	.0039 mfd.	Part of L401
C419	390 mmfd, mica	65B 21-391
C420	270 mmfd, mica	65B 21-271
C421	.01 mfd, 450 volts, ceramic	65C 10-3
C422	.1 mfd, 400 volts, paper	64B 9-76
C423A	10 mfd, 300 volts — electrolytic	67D 15-33
C423B	10 mfd, 25 volts	
C424	.047 mfd, 400 volts, paper	64B 9-28
C425	.047 mfd, 600 volts, paper, 10%	64A 2-14
C426	.047 mfd, 600 volts, paper, 10%	64A 2-14
C427	47 mmfd, 5%, 1,500 volts, mica (part of T403)	65B 1-64
‡C428	.01 mfd, 600 volts, paper	64B 8-13
‡C429	.01 mfd, 600 volts, paper	64B 8-13
C430	.1 mfd. 400 volts, paper	64B 9-26
C501	Electrolytic	See C207D
C502	Electrolytic	See C409B
C503	.1 mfd, 400 volts, paper	64B 9-26
C504	.1 mfd, 400 volts, paper	64B 9-26
	Speaker	
	10" PM (includes choke)	78B 80-2
	5" PM (includes choke and output transformer)	78B 79-2

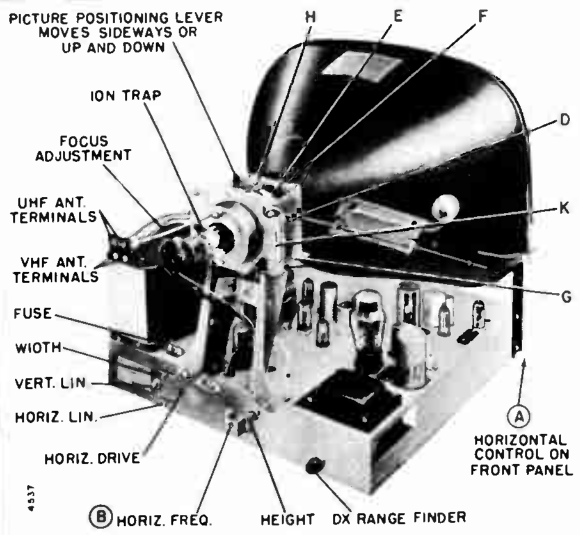
COILS, TRANSFORMERS

Sym.	Description	Part No.
L1	Trap Coil	94D 66-57
L2	Trap Coil	
L3	Coupling Coil	94D 66-58
L4	Cathode Choke	94D 66-59
L5	Heater Choke	94D 66-60
L6	Heater Choke	94D 66-60
L101	Trap Coil	Part of M101
L102	Trap Coil	Part of M101
L103	Trap Coil	Part of M101
L104	Antenna Matching Coil	Part of M101
L105	IF Preamplifier Coil	Part of M103
L106	IF Preamplifier Coil	Part of M103
L107	IF Preamplifier Coil	Part of M103
L108	Antenna Coil (Stamped 2U, 3U, etc.)	
	for Channel #2	94D 64-52
	for Channel #3	94D 64-53
	for Channel #4	94D 64-54
	for Channel #5	94D 64-55
	for Channel #6	94D 64-56
	for Channel #7	94D 64-57
	for Channel #8	94D 64-58
	for Channel #9	94D 64-59
	for Channel #10	94D 64-60
	for Channel #11	94D 64-61
	for Channel #12	94D 64-62
	for Channel #13	94D 64-63
	(Channels #2–#13:) For 94D 64-2 VHF tuner only	

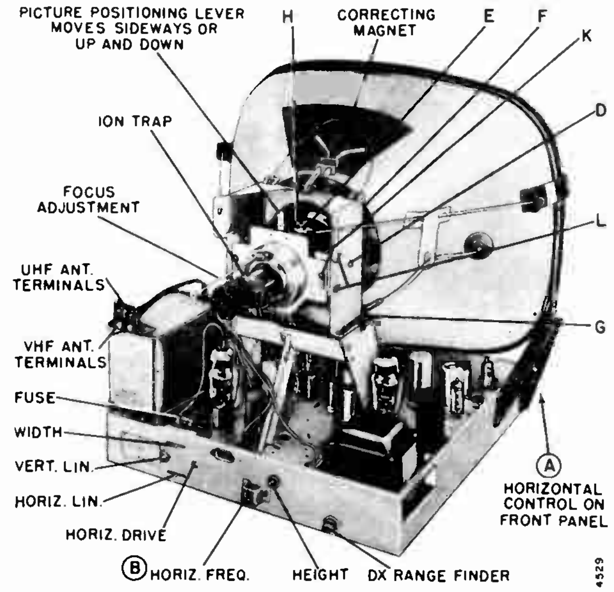
COILS, TRANSFORMERS

Sym.	Description	Port No.
L109	Mixer—Osc. Coil (Stamped 2, 3U, etc.)	
	for Channel #2	94D 64-72
	for Channel #3	94D 64-73
	for Channel #4	94D 64-74
	for Channel #5	94D 64-75
	for Channel #6	94D 64-76
	for Channel #7	94D 64-77
	for Channel #8	94D 64-78
	for Channel #9	94D 64-79
	for Channel #10	94D 64-80
	for Channel #11	94D 64-81
	for Channel #12	94D 64-82
	for Channel #13	94D 64-83
	(Channels #2–#13:) For 94D 64-2 VHF tuner only	
L110	VHF RF Amplifier Plate Coil	94D 64-104
L111	VHF Mixer Plate Coil	94D 64-103
L112	Heater Choke Coil	94D 64-105
L201	Sound Take-off Coil	72B 99-4
L301	Trap Coil (includes C303, C304)	72D 111-10
L302	Video Peaking Coil (wound on R320)	73A 5-15
L303	Video Peaking Coil	73A 5-7
L304	Trap Coil	72B 99-6
L305	Video Peaking Coil (wound on R326)	73A 5-13
L306	Video Peaking Coil (wound on R327)	73A 5-9
L307	Heater RF Choke	73A 2-5
L308	IF Input Coil (includes C301, C322)	72B 119-1
L309	RF Choke Coil	73A 6-9
L401	Horiz. Lock Control (includes R428, C418)	94B 17
L402	Width Control Coil	94A 49-2
L403	Horiz. Lin.	94A 50-1
L501	Filter Choke	74B 18-2
T1	Mixer Output Coil (includes R5)	94D 66-63
T201	Ratio Detector Transformer	72B 68-2
T202	Audio Output Transformer	79A 8
T301	1st IF Transformer	72D 111-6
T302	2nd IF Transformer	72D 111-7
T303	3rd IF Transformer	72B 118-1
T401	Vert. Blocking Oscillator Transformer	79A 18-5
T402	Vert. Output Transformer	79B 40-2
T403	Deflection Yoke (includes R412, R413, R443, C427)	94C 51-1
T404	Hor. Output Transformer	79D 41-2
T501	Power Transformer	80C 35-2

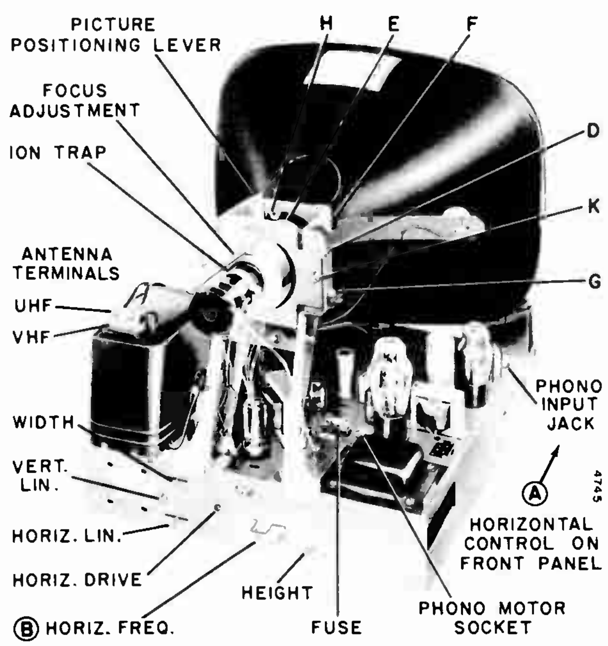
† May be part of couplate 63C6-5. Replace with exact part or individual components.
⁑ May be part of couplate 63C6-11. Replace with exact part or individual components.
‡ May be part of couplate 63C6-12. Replace with exact part or individual components.
• May be part of couplate 63C6-8. Replace with exact part or individual components.



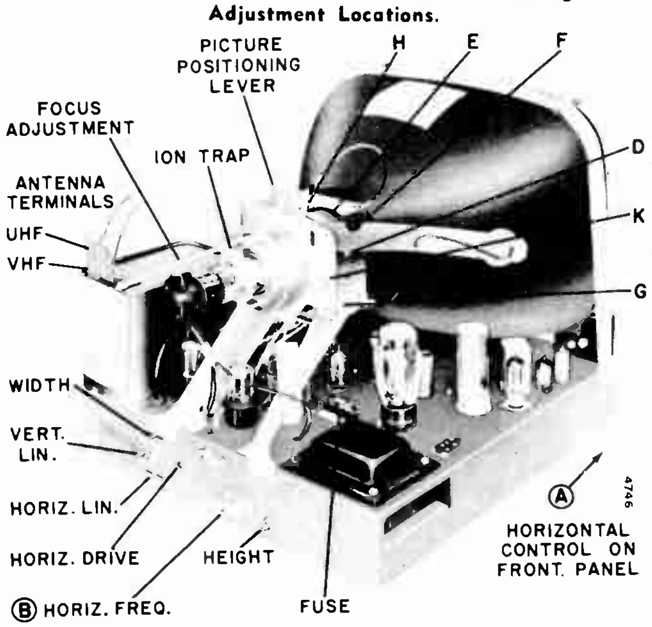
Rear View of 19L2 and 19L2Z Chassis Showing Rear Adjustment Locations.



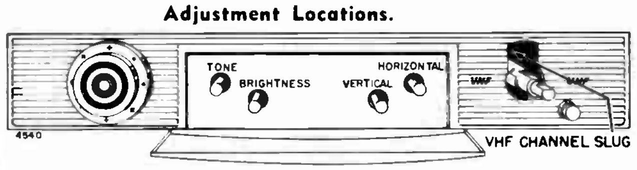
Rear View of 19R2 19S2 Chassis Showing Adjustment Locations.



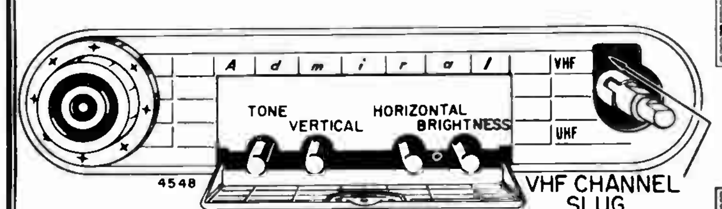
Rear View of 19Y1A Chassis Showing Adjustment Locations.



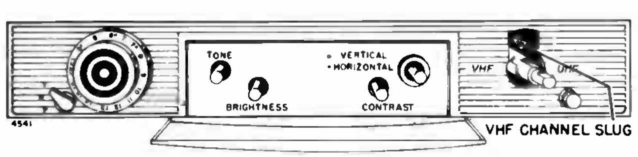
Rear View of 19T1C 19W1B and 19W1C Chassis Showing Adjustment Locations.



Control Panel on 19L2, 19L2Z, 19N2Z and 19R2 Sets; Knobs Removed.



Control Panel on 19T1, 19W1 and 19W1A Sets; Knobs Removed. Tone Control Not Used in 19T1 and 19W1A Sets.



Control Panel on 19M2 Sets; Knobs Removed.

UHF TUNER ALIGNMENT

- Connect UHF Sweep Generator to UHF antenna terminals, sweep width 12 MC. If sweep generator does not have a built-in marker generator, loosely couple a UHF marker generator to the transmission line between antenna terminals and UHF tuner.
- Connect oscilloscope through a 10,000 ohm resistor to test point "W" on VHF tuner (figure 58).
- Connect negative terminal of 1½ volt bias battery to test point "T", positive to chassis.
- DX Range Finder (if used) set at "0".
- Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Center Frequency	Instructions
1	503.50 MC	503 MC	Tune UHF tuner to channel 19, or until RF response curve is observed on oscilloscope. Adjust A20 (figure 59) until marker is located in the center of the response curve. *See note 1 below.
2	869.50 MC	869 MC	Tune UHF tuner to channel 80, or until RF response curve is observed on oscilloscope. Adjust A21 (figure 59) until marker is located in the center of the response curve. *See note 1 below.
3	Set the sweep generator to sweep the channel to be checked. Alternately set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check response curve for each channel operating in the service area. Marker locations should be as shown in figure 60. In general, the adjustments performed in steps 1 and 2 are sufficient to provide satisfactory curves and correct marker locations for all channels. However, if reasonable alignment is not obtained on a particular channel, see instructions given in steps 4 and 5 below.
4	885.25 (video carrier) 889.75 (sound carrier)	887 MC	Remove the snap fastened cover plate "B" from the bottom of the UHF tuner, see figure 59. Adjust both UHF preselector trimmer tabs (figure 61), by moving them up or down, to obtain maximum amplitude of response curve at test point "W". *See note 2 below.
5	Successively sweep channels 83 to 14, alternately inserting appropriate video and sound carrier marker.		Track both UHF preselector gangs to each other and to the oscillator gang from channel 83 to channel 14, by bending or knifing the preselector rotor blade segments (figure 61) adjacent to the stator line to obtain the desired response curve, see figure 60. Always knife the plates while tuning lower in frequency to avoid affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response curve, then proceed with the knifing of the proper section or of both sections, if required. Use caution when knifing the preselector blades so as not to disturb the position of the polystyrene damping blocks located beneath the stator line.

*NOTE 1: If UHF tuner is far out of alignment, the response curve may be too low in amplitude to be readily observed, or it may be very distorted in shape. In this case, it will be necessary to roughly align the preselector before completing final oscillator adjustment. This is done by knifing the preselector rotor blade segments (figure 61) adjacent to the stator line at dial setting for the affected channel.

*NOTE 2: Adjustment of the trimmer tabs is made from the bottom side of the UHF tuner by means of a small hook shaped tool Do not remove the top-side cover of the UHF tuner during alignment.

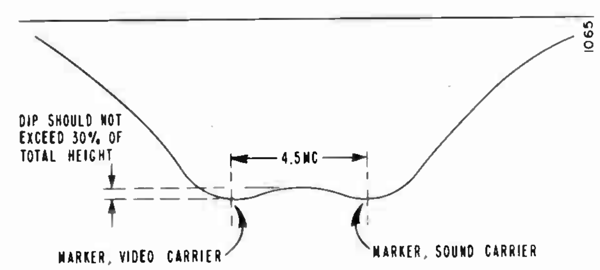


Figure 60. RF Response Curve Taken at Test Point "W".

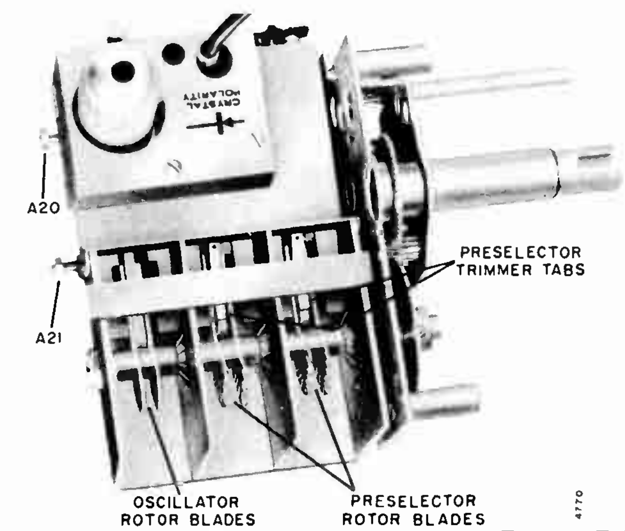


Figure 61. Top View of UHF Tuner Showing Trimmer Tab Locations (top-side cover removed for illustration only).

Make Horizontal Sync Adjustment as follows:

1. Set the **DX Range Finder** at "0" position (see chassis illustrations) and set the **Contrast** control (on front panel) for normal picture.
2. Important: Before making these adjustments, be sure that the picture can be made to sync vertically (remain stationary up and down) as lack of both vertical and horizontal sync is an indication of trouble in the sync circuits. If replacement of tubes V303, V401, V403 does not eliminate sync trouble, check for other trouble in the sync circuits.
3. With the picture in sync, rotate **Horizontal** control (A) on front panel from one end to the other. If picture does not hold sync as described in paragraphs "a" or "b" at left, set the **Horizontal** control (A) at the point where the picture just loses sync or becomes unstable, and slowly adjust the **Horizontal Frequency** (B) until the picture just falls back into sync. It may require several turns of adjustment (B). Repeat this procedure until the picture holds as described in paragraphs "a" or "b" at left. If the picture can be made to hold sync with adjustment of (B), adjustment is complete.

4. If horizontal sync is still unsatisfactory, carefully repeat entire procedure. Try replacing tube V403. It may be necessary to make Complete Horizontal Oscillator Alignment (using an oscilloscope)

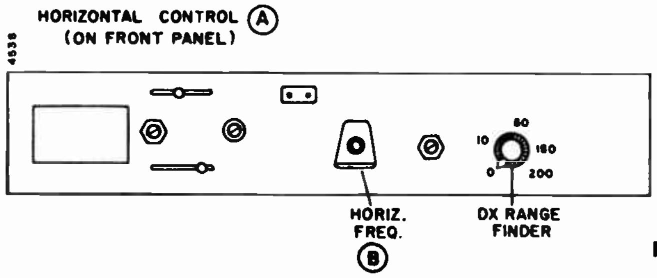


Figure 10. Rear View of Chassis Showing Horizontal Sync Adjustments.

COMPLETE HORIZONTAL OSCILLATOR ALIGNMENT

(Requires Oscilloscope)

1. IMPORTANT: Set the **DX Range Finder** at "0" position and set the **Contrast** control (on front panel) for normal picture.
2. Connect oscilloscope high side through a **10 mmfd. capacitor** to terminal marked "C" or "2" on the horizontal oscillator transformer T404 (see figure 11). It is important to use short leads and a very low capacity capacitor (at least 10 mmfd.) to avoid loading the circuit and thus distorting the waveform.

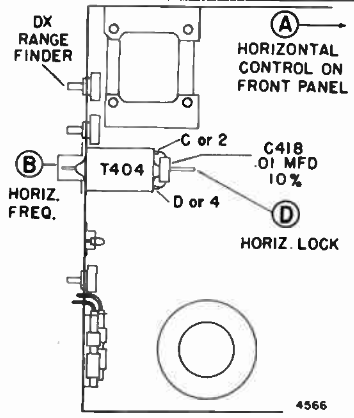


Figure 11. Bottom View of Chassis Showing Horizontal Sync Adjustments.

3. Set the oscilloscope sweep to 15.75 KC or a sub-multiple of it.
4. Adjust the **Horizontal Lock** slug (D) (see figure 11) until the oscilloscope waveform pattern appears as in figure 12. The rounded and pointed peaks of the waveform must have equal height. The picture must be kept in sync to obtain the proper oscilloscope waveform pattern. Keep the picture in sync by adjusting the **Hori-**

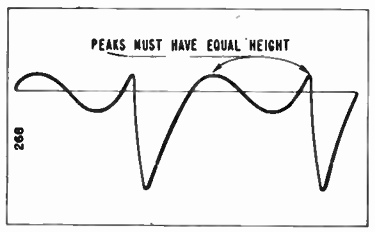


Figure 12. Horizontal Oscillator Waveform.

RADIO ALIGNMENT PROCEDURE

- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on.
- Function switch in "Radio" position.
- Connect ground wire from radio chassis to TV chassis.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.
- Use a ***non-metallic*** alignment tool for IF adjustments.
- Repeat adjustments to insure good results.

Step	Connect Signal Generator	Dummy Antenna Between Radio and Signal Generator	Signal Generator Frequency	Receiver Dial Setting	Adj. Trimmers in Following Order to Max.
1	Gang capacitor antenna stator	.1 MFD	455 KC	Tuning gang wide open	*A-B (2nd IF) *C-D (1st IF)
2	"	"	1620 KC	"	E (Oscillator)
3	Place generator lead close to loop of set to obtain adequate signal. No actual connection (signal by radiation).		1400 KC	Tune in signal	§F (antenna)

* Adjustments A and C made from underside of chassis. See figure 44 for alignment locations.
§ AM antenna trimmer may not peak if antenna leads are not properly routed or separated.

SERVICING RADIO TUNER IN 19M2 MODELS

SERVICING RADIO TUBES AND DIAL LIGHT

The radio tubes and radio dial light can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening cut in the underside of the chassis shelf.

The dial light can be serviced by removing the tuning knobs and plastic control panel. A number 47 dial light (part number 81A1-8) is used.

REMOVING RADIO TUNER

The radio tuner is mounted at the front apron of the chassis. Alignment, taking voltage readings or an inspection of the underside of the radio tuner can be performed without complete removal of the radio tuner from the TV chassis. To gain access to the underside of the radio tuner, remove the tuning drive drum and remove the four self-tappings screws at the front and rear of the radio tuner.

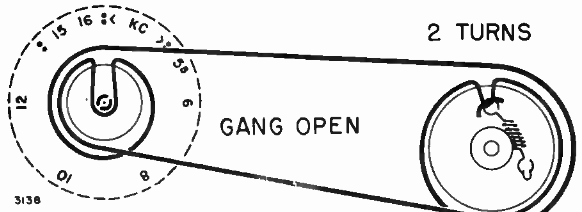


Figure 45. Drive Cord Stringing for Radio Tuner.

ALIGNMENT OF RADIO TUNER

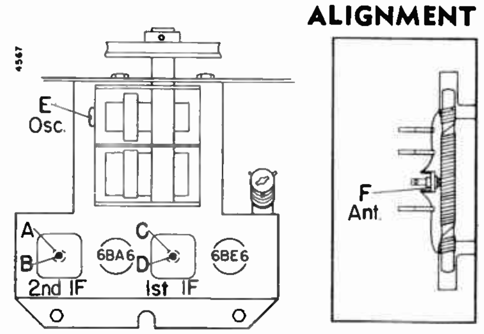


Figure 44. Location of Radio Alignment Adjustments.

The radio tuner in television and radio chassis should be aligned as instructed under "Radio Alignment Procedure" below.

Radio alignment adjustments B, C, D and F are accessible without disassembly of the radio tuner from the TV chassis. Adjustments A and C are made from underside of chassis, see paragraph above on "Removing Radio Tuner". The figure at left shows the locations of radio alignment adjustments.

SERVICING 3D1 RADIO CHASSIS

ALIGNMENT OF 3D1 RADIO CHASSIS

The 3D1 radio chassis should be aligned as instructed below.

Radio alignment adjustments are accessible without disassembly of the radio from the housing. Remove the radio escutcheon for aligning adjustments A and C. Adjustments A and C are accessible through holes in chassis housing. Location of alignment adjustments is shown in figure 47.

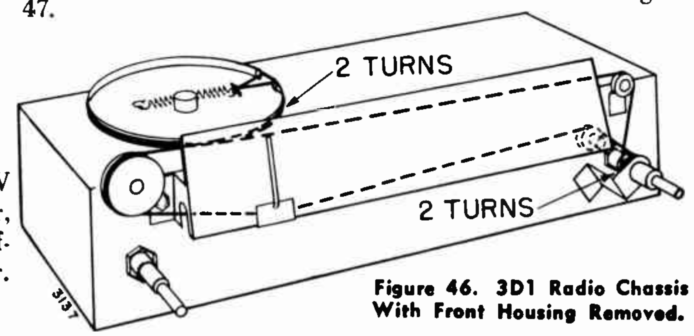


Figure 46. 3D1 Radio Chassis With Front Housing Removed.

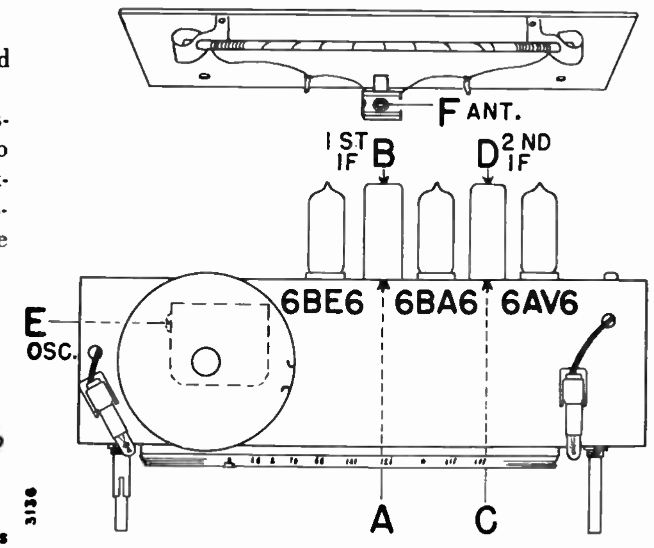


Figure 47. Trimmer Locations for 3D1 Radio.

3D1 RADIO ALIGNMENT PROCEDURE

- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on; Tone control fully clockwise.
- Band switch in AM position.
- AM antenna must be connected and placed in the same relative position to the chassis as when in the cabinet.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.
- Use a ***non-metallic*** alignment tool for IF adjustments.
- Repeat adjustments to insure good results.

Step	Connect Signal Generator	Dummy Antenna Between Radio and Signal Generator	Signal Generator Frequency	Receiver Dial Setting	Adj. Trimmers in Following Order to Max.
1	Gang capacitor antenna stator	.1 MFD	455 KC	Tuning Gang wide open	*A-B (2nd IF) *C-D (1st IF)
2	"	"	1620 KC	"	E (oscillator)
3	Place generator lead close to loop of set to obtain adequate signal. No actual connection (signal by radiation).		1400 KC	Tune in signal	§F (antenna)

* Adjustments A and C made from underside of chassis. See figure 47 above for alignment locations.
§ AM antenna trimmer adjustment "F" in step 3 should be repeated after set and antenna have been installed in cabinet. Important: AM antenna trimmer may not peak if antenna leads are not properly routed or separated.

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete VHF and UHF IF Pre-amplifier alignment consists of the following individual procedures and should be performed in this sequence.

a. IF Amplifier and Trap Alignment.
b. IF Response Curve Check.
c. 4.5 MC Sound IF and Trap Alignment.
d. RF and Mixer Alignment.
e. Over-all RF and IF Response Curve Check.
f. VHF Oscillator Adjustment.
g. IF Pre-amplifier Response Curve Check and Alignment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available.

IMPORTANT: Many service instruments do not meet the requirements given below. A list of recommended equipment is available from Admiral Distributor.

Oscilloscope

Standard oscilloscope, preferably one with a wide band vertical deflection, vertical sensitivity at least .05 volt (RMS) per inch.

Signal (Marker) Generator

4.5 MC frequency.
40 to 50 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.

Must have a built-in calibration crystal for checking dial accuracy.

Sweep Generator

Sweep generator must provide sweep frequencies from
40 to 50 MC range:
50 to 90 MC range:
170 to 225 MC range:
} with at least 10 MC sweep width.

Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground.

A sweep generator not having constant output voltage over the swept range and linear sweep, will produce curves which are widely different from the ideal curves shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

Vacuum-Tube Voltmeter

Preferably with low range (3 volt) DC zero center scale and a high voltage probe (30,000 volt range).

ALIGNMENT TOOLS

The following alignment tools are required. They can be obtained from the Admiral Distributor under the part numbers listed below:

Metal alignment screwdriver part number 98A30-9.
Non-metallic (fiber) alignment screwdriver (11½" long, ⅛" diameter) part number 98A30-10.

Non-metallic alignment wrench (9" long, for large hexagon core IF slugs) part number 98A30-12.

Non-metallic alignment wrench (9" long, for small hexagon core IF slugs) part number 98A30-13.

IMPORTANT ALIGNMENT HINTS

The following suggestions should be performed if difficulty is experienced during the alignment procedure.

1. IF CIRCUIT INSTABILITY: When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF response curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning A6 (3rd IF transformer T303). To correct either of these conditions, the following alignment hints should be tried:

(a) Check the generator output leads to be certain that the unshielded portion (especially the grounded lead) be as short as practicable.

(b) Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible (See figure 21).

(c) For injecting IF signal use an insulated tube shield over V102 (6U8) Oscillator-Mixer tube. Insulate bottom inside of tube shield with masking tape; see figure 16.

(d) The use of a non-metallic alignment tool, approximately eight inches long (part number 98A30-12), will permit adjustment without coming too near to the transformers.

2. RECEIVER OVERLOADING WHEN CHECKING THE OVER-ALL RESPONSE CURVE: Due to the inherent high sensitivity of these receivers, it is very easy to cause overloading in the third IF amplifier stage. In some cases, generator leakage alone is enough to produce a response curve on the oscilloscope. To prevent overloading, do the following:

(a) Be certain that the generator output attenuators are set at a minimum.

(b) Some generators have a built-in pad in the output table to be used when viewing the over-all response curve. Be sure that the pad in the cable is properly connected in the circuit. Refer to the generator instruction manual for details.

(c) If a pad is not built in, the 12 db pad shown below in figure 17 can be constructed and connected between the generator and the antenna terminals.

Figure 16. Tube Shield for IF Alignment and IF Response Curve Check.

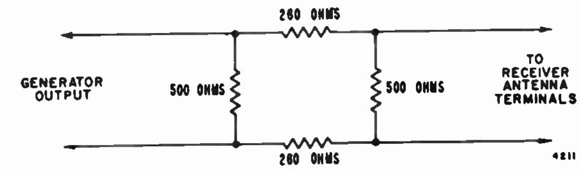


Figure 17. Illustration of 12 db Attenuation Pad for Viewing Over-all RF-IF Response Curve.

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures below.

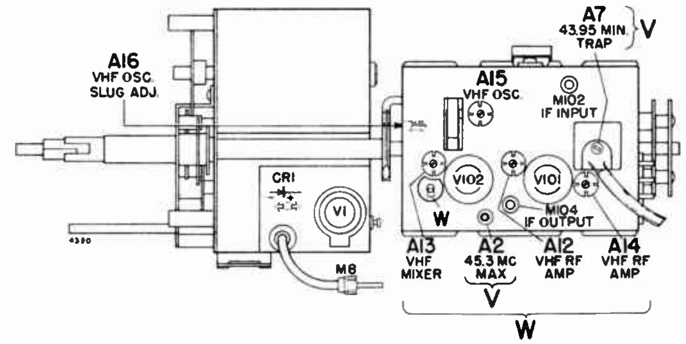


Figure 20. Top View of TV Tuner Showing Adjustment Locations.

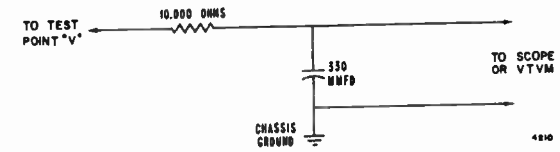


Figure 21. Decoupling Filter.

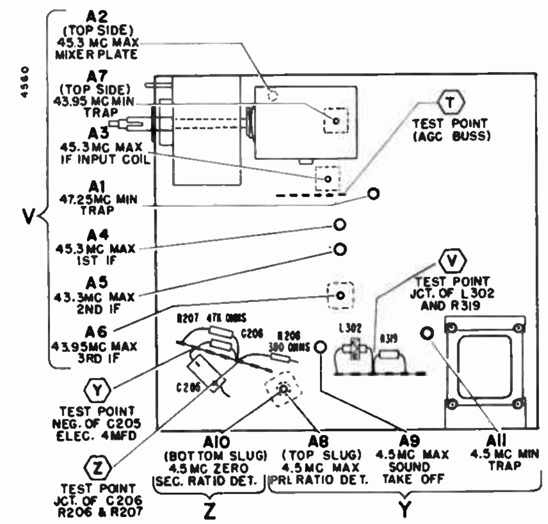


Figure 22. Bottom View of 19T1, 19W1 and 19W1A Chassis Showing Test Point Connections and IF Alignment Data.

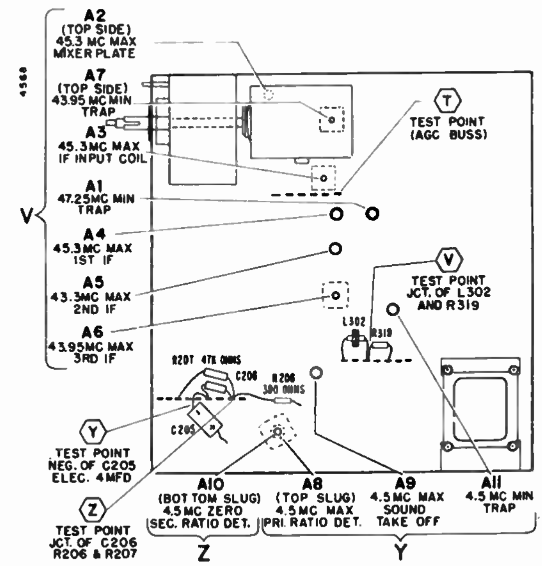


Figure 22A. Bottom View of 19L2, 19M2, 19N2Z and 19R2 Chassis Showing Test Point Connections and IF Alignment Data.

UHF TUNER ALIGNMENT

The UHF tuner has been carefully aligned at the factory and generally should never require realignment in the field. Also, since alignment of the UHF tuner is quite involved, for the present, it is not recommended for field service. If it has been definitely determined that complete tuner alignment is required, it should be returned to the Admiral distributor for replacement.

Important: Do not under any circumstances attempt adjustment of the tracking screws or bend the capacitor tuning plates in any way.

IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point "T", see figure 22, positive to chassis. A 4½ volt battery is required for all steps below.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel selector to Channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Contrast control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

*1	*47.25 MC	VTVM high side to test point "V" through a decoupling filter; see figs. 21 and 22, common to chassis. Generator high side to 6U8 (V102) special tube shield. Connect low side to chassis near the tube shield, see figure 16.	Connect a 4½ volt bias battery to test point "T". Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. If unstable, refer to section 1 of the "Alignment Hints" above.	A1 for minimum.
2	45.3 MC			A2 for maximum.
3	43.3 MC			A3 for maximum.
4	45.3 MC			Repeat step 2.
5	45.3 MC			Readjust A3 for maximum.
6	45.3 MC			A4 for maximum.
7	43.3 MC			A5 for maximum.
8	43.95 MC			A6 for maximum.
9	To insure correct alignment, repeat steps 1 and 4. Make the "IF Response Curve Check" given below.			

* Before proceeding with alignment, turn slugs A2 and A3 out fully (counter-clockwise). Check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set Channel selector on Channel 12 or an unassigned high channel. Picture control fully to the left. Connect negative of 4½ volt bias battery to test point "T"; positive to chassis.	Connect high side to 6U8 mixer-osc. insulated tube shield, see fig. 16. Connect low side to bottom part of tube shield. Set sweep frequency to 44.5 MC, and sweep width approximately 7 MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on tube shield, low side to chassis. Marker frequencies indicated on IF Response Curve.	Connect to test point "V" through a decoupling filter, see figs. 21 and 22. Marker pips on scope will be more distinct if a condenser from 100 mmfd. to 1000 mmfd. is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 18. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touchup with IF slugs as instructed below. *Important:* If curve changes shape with hand capacity, see section 1 of "Alignment Hints."

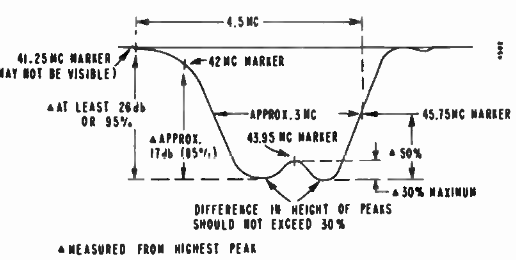


Figure 18. Ideal IF Response Curve.

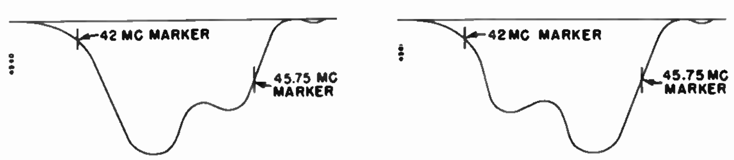


Figure 19. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks and correct marker location, carefully adjust slug A2 and if necessary, adjust slug A3. It should not be necessary to turn the slugs more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

4.5 MC SOUND IF AND TRAP ALIGNMENT

See below for touch-up of ratio detector using television signal without test equipment.

a. Connect signal generator high side to pin 2 of V304 (6AL5) through a .01 mfd. condenser, connect low side to chassis.

b. Allow about 15 minutes for receiver and test equipment to warm up.

c. Set Contrast control fully to the left (counterclockwise).

d. Use a NON-METALLIC alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adjustment A8 can be made from top of chassis, if you use alignment tool #98A30-12 obtainable from Admiral Distributor.

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
	When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle. IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station and follow steps 1, 2 and 3 below. If necessary use a higher scale on the VTVM.			
1	Set to exactly 4.5 MC	High side to test point "Y"; common to chassis.	Use lowest DC scale on VTVM.	A8 and A9 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
2		High side to test point "Z"; common to chassis.	Use zero center scale on VTVM, if available.	A10 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A8 was far off, repeat step 1.
3		High side to test point "Y"; common to chassis.	*Connect a 10 mmfd. capacitor from pin 5 of V305 (6CB6) to pin 7 of V201 (6AU6). Use lowest DC scale on VTVM.	A11 for minimum.

* In 19R2 chassis, connect 10 mmfd. capacitor from pin 7 of V305 (12BY7) to pin 7 of V201 (6AU6).

TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (A10, BOTTOM SLUG OF T201)

*Adjustment A10 is accessible through the ¼" hole (just below T201) in bottom of the cabinet or the chassis mounting shelf, located toward the left side facing the rear of the set. See figure 22. Removal of the chassis is therefore not required. ***Adjustment need be made on one channel only.*** Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.

b. Tune set for normal picture and sound.

c. Carefully insert a non-metallic alignment tool through the opening in cabinet bottom below T201. An alignment tool with a screwdriver blade or hexagonal end is required depending on the transformer used, see * note below. When the alignment tool engages the bottom tuning slug A10, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.

ALIGNMENT OF 4.5 MC TRAP A11, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting slug A11 for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as instructed in step 3 of the "4.5 MC Sound IF and Trap Alignment."

* If ratio detector transformer (T201) has hollow hexagonal core slugs, bottom slug adjustment A10 can be made from top of chassis, if you use alignment tool (part number 98A30-7; available at Admiral Distributor). Bottom slug (A10) can be reached through the hole in the core of the upper slug (A8)

VHF TUNER RF AND MIXER ALIGNMENT

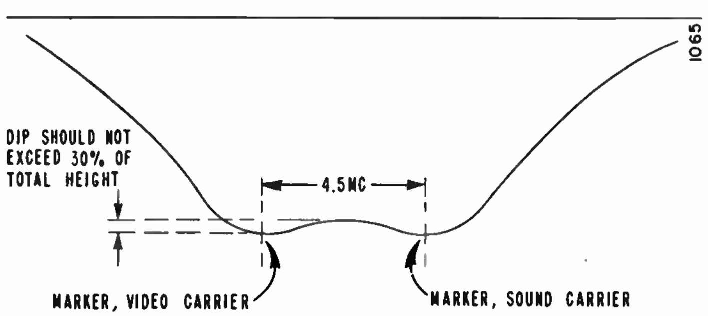
a. Connect negative of 4½ volt bias battery to AGC buss (test point "T"), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point "T" to chassis.

b. Connect sweep generator (with 300 ohm output) to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

c. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (figure 21). Keep scope leads away from chassis.

d. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See frequency table below.	Alternately adjust A12 and A13 (figure 24) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location; see figure 23.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping Channel 6. See frequency table below.	Adjust A14 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper band width and correct marker location; see figure 23. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular low channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.



Full skirt of curve will not be visible unless generator sweep width extends beyond 12 MC.
Figure 23. RF Response Curve.

VHF FREQUENCY TABLE

Channel Number	Channel Freq., MC	Video Carrier, MC	Sound Carrier, MC	HF Osc., MC
2	54- 60	55.25	59.75	101
3	60- 66	61.25	65.75	107
4	66- 72	67.25	71.75	113
5	76- 82	77.25	81.75	123
6	82- 88	83.25	87.75	129
7	174-180	175.25	179.75	221
8	180-186	181.25	185.75	227
9	186-192	187.25	191.75	233
10	192-198	193.25	197.75	239
11	198-204	199.25	203.75	245
12	204-210	205.25	209.75	251
13	210-216	211.25	215.75	257

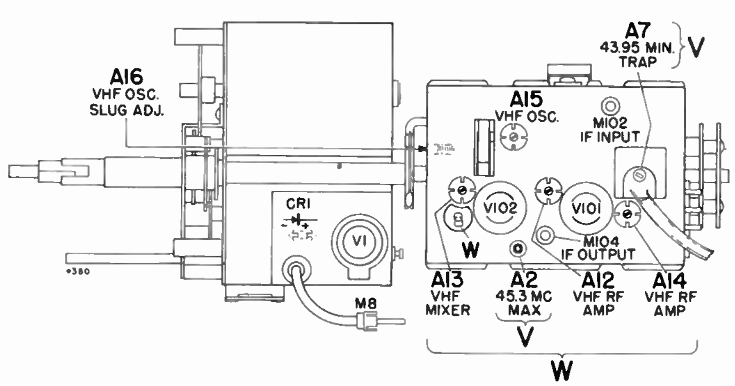


Figure 24. Top of Tuners, Showing VHF Adjustment Locations.

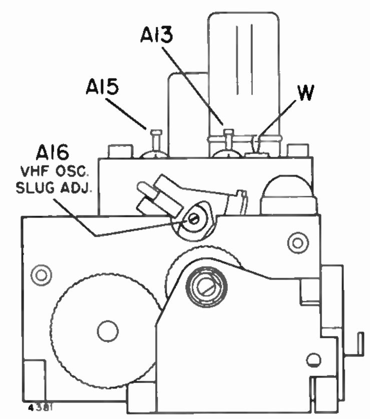


Figure 25. Front View of Tuners.

OVER-ALL VHF AND IF RESPONSE CURVE CHECK

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Contrast control fully to the left. Channel selector on nel selector on Channel 10 or other unassigned high channel. Connect negative of 4½ volt bias battery to test point "T", positive to chassis.	Connect to antenna terminals. Set generator to sweep VHF channel selected. See frequency table on page 23. Keep generator output as low as possible, to prevent overloading. See section 2 of "Alignment Hints."	If an external marker generator is used, loosely couple high side to sweep generator lead. VHF marker frequencies are shown in frequency table on page 23.	Connect to point "V" through a decoupling filter; see figs. 21 and 22.	Compare the response curve obtained against the ideal curve shown in figure 26. If the curve is not within tolerance, touch up the IF slug as instructed below. It should never be necessary to turn slugs more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. IMPORTANT: When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change. See section 2 of "Alignment Hints."

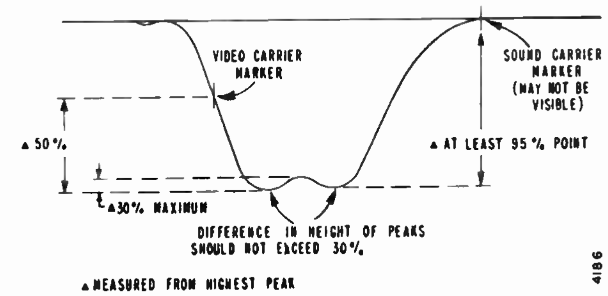
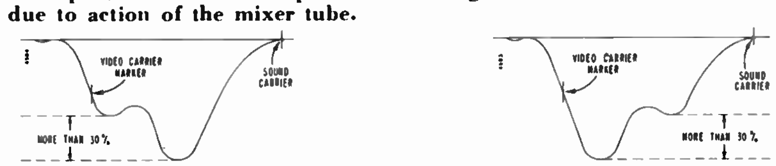


Figure 26. Ideal Over-all VHF and IF Response Curve.

Note that video carrier (marker) on the "Over-all RF-IF Response Curve" will appear on the opposite side of the curve as compared to the "IF Response Curve" figure 18. This is due to action of the mixer tube.



Curves must have approximate equal peaks and correct marker location. If it is necessary to adjust for approximate equal peaks and marker location, carefully adjust slug A2 and if necessary adjust slug A3. It should not be necessary to turn the slugs more than one turn in either direction.
Figure 27. Over-all RF and IF Response Curves, Incorrect Shape.

VHF OSCILLATOR ADJUSTMENT

(Using a signal generator)

It is always advisable to make VHF oscillator adjustments using a Television Signal as instructed on page 8. If a Television Signal is not available, HF oscillator adjustment can be made using a crystal calibrated signal generator. Note that adjustment "A15" (figure 18) is an overall oscillator adjustment and should only be made when the mixer-oscillator tube is replaced. Generally "A15" adjusts with about 3/16" of screw thread exposed. Make adjustments as follows:

Receiver Control Settings	Signal Generator	Instructions
Set Channel selector for each channel to be adjusted. Set "Tuning" control at half rotation. Turn volume control fully to the right (clockwise).	Connect to antenna terminals. Set generator to exact frequency of VHF oscillator. See frequency table on page 23. *Set generator for maximum output.*	Connect a wire jumper from test point "W" on the tuner to test point "Z". See figure 22. Remove the ratio detector tube V202 (6AL5). Carefully adjust the oscillator slug A16 on each channel until a whistle (beat) is heard in the speaker of the receiver.

Sym.	Description	Part No.
R405	47,000 ohms, 2 watt, in 19M2, 19M2Z, 19N2Z, 19R2	60B 20-473
	18,000 ohms, 1 watt, in 19L2, 19T1, 19W1, 19W1A	60B 14-183
R406	18,000 ohms, 1 watt, in 19L2, 19L2Z, 19T1, 19W1, 19W1A	60B 14-183
	15,000 ohms, ½ watt, in 19M2, 19M2Z, 19N2Z, 19R2	60B 8-153
R407	22,000 ohms, ½ watt	60B 8-222
†R408	8,200 ohms, ½ watt	60B 8-822
†R409	8,200 ohms, ½ watt	60B 8-822
R410	1.5 megohms, ½ watt, in early production sets	60B 8-155
	1.2 megohms, ½ watt, in later production sets	60B 8-125
	910,000 ohms, ½ watt, in 19R2	60B 8-914
R411	Vertical Hold control	
	2 megohms	75C 13-22
	1.5 megohms, in 19R2	75C 13-26
R412	10,000 ohms, ½ watt, 5%	60B 7-103
R413	1 megohm, ½ watt	60B 8-105
	1.8 megohms, ½ watt, in 19R2	60B 8-185
R414	2.5 megohms, Height control	75C 13-3
R415	1 megohm, ½ watt	60B 8-105
	470 ohms, ½ watt, in 19R2	60B 8-471
R416	3,000 ohms, Vert. Lin. control	75C 13-7
R417	820 ohms, ½ watt	60B 8-821
	220 ohms, ½ watt, in 19R2	60B 8-221
R418	560 ohms, ½ watt	60B 8-561
R419	560 ohms, ½ watt	60B 8-561
R420	330,000 ohms, ½ watt	60B 8-334
R421	820,000 ohms, ½ watt	60B 8-824
R422	330,000 ohms, ½ watt, 5%	60B 7-334
R423	82,000 ohms, ½ watt, 5%	60B 7-823
R424	3,900 ohms, ½ watt	60B 8-392
R425	68,000 ohms, ½ watt	60B 8-683
R426	50,000 ohms, Horiz. Hold control	75C 13-23
R427	22,000 ohms, ½ watt	60B 8-223
R428	150,000 ohms, ½ watt, 5%	60B 7-154
R429	8,200 ohms, ½ watt	60B 8-822
R430	150,000 ohms, ½ watt	60B 8-154
R431	820,000 ohms, ½ watt	60B 8-824
R432	82,000 ohms, ½ watt	60B 8-823
R433	1 megohm, ½ watt	60B 8-105
R434	82 ohms, ½ watt, carbon only	60B 28-31
R435	47 ohms, 1 watt	60B 14-470
	120 ohms, 2 watt, in 19R2	60B 20-121
R436	82 ohms, ½ watt, carbon only	60B 28-31
R437	8,200 ohms, 2 watt	60B 20-822
R438	1,200 ohms, 2 watt	60B 20-122
R439	1,000 ohms, 2 watt	60B 20-102
R440	1,000 ohms, ½ watt	60B 8-102
R441A	1.5 megohms, Vertical Hold control	75B 17-3
R441B	50,000 ohms, Horiz. Hold control	
R442	4.7 ohms, ½ watt, carbon only	60B 28-44
	1.8 ohms, ½ watt, carbon only, in 19R2	60B 28-46
⁑R444	56,000 ohms, ½ watt	60B 8-563
⁑R445	2,700 ohms, ½ watt	60B 8-272
R448	15,000 ohms, 2 watt	60B 20-153
R449	100,000 ohms, ½ watt	60B 8-104
R450	390,000 ohms, ½ watt	60B 8-394
R451	1,000 ohms, 2 watt	60B 20-102
R453	3.3 megohms, ½ watt	60B 8-335
R454	91,000 ohms, ½ watt, 5%	60B 7-913
R455	91,000 ohms, ½ watt, 5%	60B 7-913
R456	1,300 ohms, 2 watt, 5%	60B 19-132
R501	270,000 ohms, 1 watt	60B 14-274
R502	1,200 ohms, 2 watt	60B 20-122
R503	10,000 ohms, 5 watt, 5%	61A 1-30
R504	1,200 ohms, 2 watt	60B 20-122
R701	22,000 ohms, ½ watt	60B 8-223
R702	10,000 ohms, 1 watt	60B 14-103
R703	150 ohms, ½ watt	60B 8-151
R704	27,000 ohms, 1 watt	60B 14-273
R705	47,000 ohms, ½ watt	60B 8-473
R706	1 megohm, ½ watt	60B 8-105
R708	4.7 megohms, ½ watt	60B 8-475
R709	82,000 ohms, ½ watt	60B 8-823
R710A	2 megohms, Tone control } pot	75B 11-24
R710B	1 megohm, Volume control	
	(R710 includes switch S702.)	

CAPACITORS

Sym.	Description	Part No.
C1	.68 mmfd, 10%, ceramic	94D 66-51
C2	25 mmfd, 5%, cer, N750 temp. coeff	94D 66-52
C3	.68 mmfd, 10%, ceramic	94D 66-51
C4	390 mmfd, silver mica	94D 66-53
C5	800 mmfd, min, ceramic feed-thru	94D 66-54
C6	800 mmfd, min, ceramic	94D 66-55
C8	390 mmfd, min, ceramic feed-thru	94D 66-56
C9	390 mmfd, min, ceramic feed-thru	94D 66-56
C101	68 mmfd, 3%, ceramic	Part of M101
C102	5 mmfd, 5%, ceramic	Part of M101
C103	68 mmfd, 3%, ceramic	Part of M101
C104	3 mmfd, 10%, ceramic	94D 64-86
C105	6.8 mmfd, 10%, ceramic	94D 64-85
C106	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C107	.001 mfd, min, ceramic	94D 64-101
C108	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C109	1.5 mmfd, 15%, ceramic, NPO temp. coeff	94D 64-87
C110	800 mmfd, min, ceramic feed-thru	94C 37-90
C111	800 mmfd, min, ceramic feed-thru	94C 37-90
C112	800 mmfd, min, ceramic feed-thru	94C 37-90
C113	800 mmfd, min, ceramic feed-thru	94C 37-90
C114	47 mmfd, 10%, ceramic	94D 64-88
C115	47 mmfd, 10%, ceramic	94D 64-88
C116	220 mmfd, 10%, ceramic	94D 64-89
C117	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C119	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C120	10 mmfd, 10%, cer, N750 temp. coeff	94D 64-91
C121	5 mmfd, 5%, cer, N900 temp. coeff	94D 64-100
C122	.001 mfd, min, ceramic	94D 64-101
C201	6.8 mmfd, ceramic, N330 temp. coeff	65C 6-71
C202	20 mmfd, 5%, ceramic	65C 6-51
C203	.005 mfd, min, ceramic	65C 10-1
C204	180 mmfd, 5%, N030 temp. coeff	65C 6-59
C205	4 mfd, 50 volts, electrolytic	67A 4-9
C206	500 mmfd, ceramic	65C 6-6
C208	.0022 mfd, 600 volts, paper	64B 9-17
C209	.01 mfd, 400 volts, paper	64B 8-13
*C211	50 mmfd, ceramic	65C 6-4
‡C212	.01 mfd, 400 volts, paper	64B 8-13

* May be part of couplate, part number 63C6-10. Replace with exact part or individual components.
† May be part of couplate, part number 63C6-11. Replace with exact part or individual components.
⁑ May be part of couplate, part number 63C6-12. Replace with exact part or individual components.
‡ May be part of couplate, part number 63C6-5. Replace with exact part or individual components.

Sym.	Description	Part No.
C213A	20 mfd, 150 volts } electrolytic	67D 15-23
C213B	60 mfd, 200 volts	
C213C	40 mfd, 350 volts	
C213D	60 mfd, 350 volts	
C214	.01 mfd, 400 volts, paper	64B 8-13
C215	80 mfd, 350 volts, electrolytic	67D 15-64
C216	.01 mfd, 400 volts, paper	64B 8-13
*C217	.01 mfd, 400 volts, paper	64B 8-13
C218	.0047 mfd, 600 volts, paper	64B 9-15
C219	.0022 mfd, 600 volts, paper	64B 9-17
C220	100 mmfd, ceramic	65C 6-3
C301	72 mmfd, 5%, ceramic	65C 10-17
C302	.001 mfd, min, ceramic	65C 6-41
C303	2.2 mmfd, 10%, cer, NPO temp. coeff	65C 6-86
C304	15 mmfd, 5%, cer, NPO temp. coeff	65C 6-50
C305	.001 mfd, min, ceramic	65C 6-41
C307	.005 mfd, ceramic	65C 10-1
C308	.001 mfd, min, ceramic	65C 6-41
C309	120 mmfd, 10%, ceramic	65C 6-66
C310	18 mmfd, 5%, cer, NPO temp. coeff	65C 6-91
C311	.47 mfd, 100 volts, paper	64A 10-1
C312	.001 mfd, min, ceramic	65C 6-41
C313	.1 mfd, 400 volts, paper	64B 9-7
C314	6.8 mmfd, cer, N330 temp. coeff	65C 6-71
§C315	150 mmfd, mica	65B 21-151
C316	.22 mfd, 400 volts, paper	64B 8-24
§C317	.01 mfd, 400 volts, paper	64B 8-13
C318	.001 mfd, min, ceramic	65C 6-41
C319	.005 mfd, min, ceramic	65C 10-1
C321	.01 mfd, 400 volts, paper	64B 9-32
C322	Electrolytic	See C421B
C323	18 mmfd, 10%, mica	65B 5-4
C324	2.2 mmfd, 10%, cer, NPO temp. coeff	65C 6-86
C401	.1 mfd, 200 volts, paper	64B 9-39
C402	82 mmfd, 500 volts, mica	65B 21-820
†C403	.002 mfd, 600 volts, paper	64B 5-14
†C404	.005 mfd, 600 volts, paper	64B 5-12
†C405	.0047 mfd, 500 volts, mica	65B 21-472
C406	.0047 mfd, 500 volts, mica	65B 21-472
C407	.047 mfd, 600 volts, paper	64A 2-14
C408	.1 mfd, 600 volts, paper	64B 9-7
C409A	100 mfd, 50 volts } electrolytic	67D 15-22
C409B	80 mfd, 350 volts	
C410	20 mfd, 475 volts, electrolytic	67A 21-1
C412	68 mmfd, 500 volts, mica	65B 21-680
C413	.1 mfd, 200 volts, paper	64B 9-7
C414	.47 mfd, 100 volts, paper	64B 9-72
C415	.022 mfd, 400 volts, paper	64B 9-11
C416	.047 mfd, 400 volts, paper	64B 9-9
C417	270 mmfd, mica	65B 21-271
C418	.01 mfd, 400 volts, 10%, paper	64A 2-16
C419	820 mmfd, 500 volts, mica	65B 21-821
C420	680 mmfd, 500 volts, mica	65B 21-681
C421	.1 mfd, 200 volts, paper, in all chassis except 19R2	64B 9-7
C421A	10 mfd, 300 volts } electrolytic	67D 15-33
C421B	10 mfd, 25 volts	
	(C421A and C421B in 19R2)	
C422	.047 mfd, 400 volts, paper	64A 2-14
C423	.047 mfd, 400 volts, paper	64A 2-14
C424	.047 mfd, 400 volts, paper	64A 2-14
C425	47 mmfd, 5%, 1,500 volts, mica, in all chassis except 19R2	65B 1-64
	140 mmfd, 5%, 1,500 volts, mica, in 19R2 only	65B1-74
C426	.1 mfd, 400 volts, paper	64B 9-7
*C427	.01 mfd, 600 volts, paper	64B 8-13
*C428	.01 mfd, 600 volts, paper	64B 8-13
C429	82 mmfd, 500 volts, mica	65B 21-820
C430	10 to 160 mmfd, Horiz. Drive control	66A 30-2
C431	150 mmfd, 3,000 volts, ceramic, N750 temp. coeff	65C 10-10
C432	.01 mfd, 600 volts, paper	64B 8-13
C433A	200 mfd, 50 volts } electrolytic	67D 15-36
C433B	20 mfd, 350 volts	
C433C	20 mfd, 200 volts	
C433D	80 mfd, 350 volts	
	(C433 used in 19R2 only)	
C434	.47 mfd, 100 volts, paper	64A 10-1
C501	Electrolytic	See C213D
C502	Electrolytic, in 19R2 only	See C433D
C503	.1 mfd, 200 volts, paper	64B 9-7
C701	5 mmfd, mica	65B 1-62
C702	2 to 20 mmfd, trimmer	66B 8-5
C704	47 mmfd, ceramic	65C 6-79
C705	.01 mfd, min, ceramic (in 3D1 radio)	65C 10-8
	.1 mfd, 400 volts, paper (in built-in radio)	64A 3-15
C706	.1 mfd, 400 volts, paper	64A 3-15
C707	.005 mfd, min, ceramic	65C 10-1
C708	.1 mfd, 400 volts, paper	64B 9-7
C709	100 mmfd, ceramic } dual	63A 7-1
C710	100 mmfd, ceramic	
C711	.01 mfd, 400 volts, paper	64B 9-32
C712	100 mmfd, ceramic	65C 6-3
C713	.002 mfd, 400 volts, paper	64B 5-14
C714	.005 mfd, 600 volts, paper	64B 5-12
C716A	420 mmfd, max. } for built-in 2 tube radio	68B 53-1
C716B	104.7 mmfd, max.	
C716A	420 mmfd, max. } for 3 tube (3D1) radio	68B 32
C716B	108 mmfd, max.	
C717	.1 mfd, 400 volts, paper	64A 3-15

COILS, TRANSFORMERS

Sym.	Description	Part No.
L1	Antenna Peaking Coil	94D 66-57
L2	Antenna Peaking Coil	94D 66-57
L3	Mixer Peaking Coil	94D 66-58
L4	Choke Coil	94D 66-59
L5	Heater Choke Coil	94D 66-60
L6	Heater Choke Coil	94D 66-60
L101	Trap Coil	Part of M101
L102	Trap Coil	Part of M101
L103	Trap Coil	Part of M101
L104	Antenna Matching Coil	Part of M101
L105	IF Preamplifier Coil	Part of M103
L106	IF Preamplifier Coil	Part of M103
L107	IF Preamplifier Coil	Part of M103

* May be part of couplate, part number 63C6-10. Replace with exact part or individual components.
§ May be part of couplate, part number 63C6-8. Replace with exact part or individual components.
† May be part of couplate, part number 63C6-11. Replace with exact part or individual components.
⁑ May be part of couplate, part number 63C6-12. Replace with exact part or individual components.

Sym.	Description	Part No.
L108	Antenna Coil (Stamped 2U, 3U, etc.)	
	for Channel #2	94D 64-52
	for Channel #3	94D 64-53
	for Channel #4	94D 64-54
	for Channel #5	94D 64-55
	for Channel #6	94D 64-56
	for Channel #7	94D 64-57
	for Channel #8	94D 64-58
	for Channel #9	94D 64-59
	for Channel #10	94D 64-60
	for Channel #11	94D 64-61
	for Channel #12	94D 64-62
	for Channel #13	94D 64-63
	(For 94D 64-2 VHF tuner only)	
L109	Mixer - Osc. Coil (Stamped 2U, 3U, etc.)	
	for Channel #2	94D 64-72
	for Channel #3	94D 64-73
	for Channel #4	94D 64-74
	for Channel #5	94D 64-75
	for Channel #6	94D 64-76
	for Channel #7	94D 64-77
	for Channel #8	94D 64-78
	for Channel #9	94D 64-79
	for Channel #10	94D 64-80
	for Channel #11	94D 64-81
	for Channel #12	94D 64-82
	for Channel #13	94D 64-83
	(For 94D 64-2 VHF tuner only)	
L110	VHF RF Amplifier Plate Coil	94D 64-104
L111	VHF Mixer Plate Coil	94D 64-103
L112	Heater Choke Coil	94D 64-105
L201	Sound Take-off Coil	72B 99-4
L301	Trap Coil (includes C303 and C304)	72D 111-8
L302	Video Peaking Coil (wound on R318)	73A 5-15
L303	Video Peaking Coil	73A 5-7
L304	Trap Coil	72B 99-4
L305	Video Peaking Coil (wound on R323)	73A 5-13
L306	Video Peaking Coil (wound on R324)	73A 5-9
L307	Heater RF Choke	73A 2-5
L308	IF Input Coil (includes C301, C305)	72B 119-1
L309	RF Choke Coil	73A 6-9

Sym.	Description	Part No.
T403	Deflection Yoke	
	in all chassis except 19R2	94C 51-1
	in 19R2 only	94D 55-4
T404	Horiz. Blocking Osc. Transformer (includes L401)	69B 110
T405	Horizontal Output Transformer	
	in all chassis except 19R2	79D 41-1
	in 19R2 only	79D 52-1
T501	Power Transformer	
	in all chassis except 19R2	80C 35-2
	in 19R2 only	80C 35-4
T701	1st IF Transformer	72C 28-7
T702	2nd IF Transformer	72C 28-7
L401	Horiz. Lock Coil	Part of T404
L402	Width Control Coil	
	in all chassis except 19R2	94A 49-1
	in 19R2 only	94A 49-3
L403	Horizontal Linearity Coil	
	in all chassis except 19R2	94A 50-1
	in 19R2 only	94A 50-2
L501	Filter Choke	74B 18-2
L701	AM Antenna	69C 179-1
L702	Oscillator Coil	
	for built-in 2 tube radio	69A 52-4
	for 3 tube (3D1) radio	69A 52-9
L704	AM Antenna	69C 155-2
T1	Mixer Output Coil	94D 66-63
T201	Ratio Detector Transformer	72B 68-2
T301	1st IF Transformer (includes R306, R309, R335 and C318)	72D 111-6
T302	2nd IF Transformer (includes R311)	72D 111-7
T303	3rd IF Transformer (includes R316, C309 and C310)	72B 118-1
T401	Vert. Blocking Osc. Transformer	79A 18-4
T402	Vert. Output Transformer	
	in all chassis except 19R2	79B 40-2
	in 19R2 only	79B 43-3

Description	TA1811 Ebony	TA1812 Mahog.	TA1822 Mahog.	TA2212 Mahog.	TA2222 Mahog.	TA2226 Mahog.
Speaker, 5" PM (includes choke and output transformer)	78B 79-2	78B 79-2	78B 79-2	78B 79-2	78B 79-2	78B 79-2

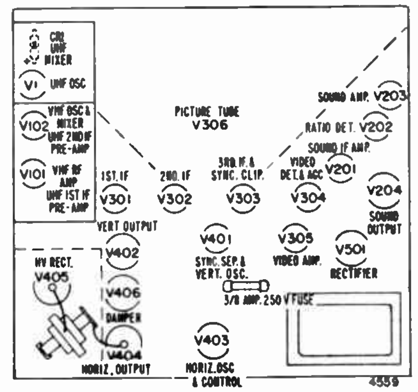
Description	CA2215Z Walnut	CA2216Z Mahog.	CA2217Z Blond	CA2236 Mahog.	CA2237 Blond
Speaker, 10" PM (includes choke and output transformer)	78B 80-2	78B 80-2	78B 80-2	78B 80-2	78B 80-2

Description	TA2215 Walnut	TA2216 Mahog.	TA2217 Blond	TA2218 Maple
Speaker, 5" PM (includes choke and output transformer)	78B 79-2	78B 79-2	78B 79-2	78B 79-2

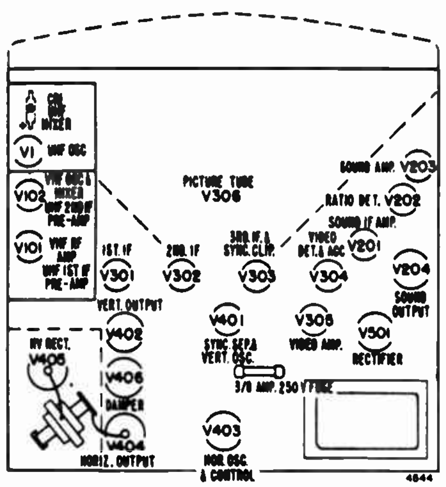
Description	HA2216Z Mahog.	HA2217Z Blond
Speaker, 10" PM (includes choke and output transformer)	78B 80-2	78B 80-2

Description	CA2526 Mahog.
Speaker, 10" PM (includes choke and output transformer)	78B 80-2

Description	KA2216 Mahog.	KA2217 Blond	LA2215Z Walnut	LA2216Z Mahog.	LA2217Z Blond
Speaker (includes transformer) 6" PM	78B 76-2	78B 76-2	....	....	....
12" PM	....	....	78B 77-1	78B 77-1	78B 77-1
Speaker Hood (Gold Hammerloid)	15B 998-1	15B 998-1	....	....	....



Top View of 19S2 Chassis.

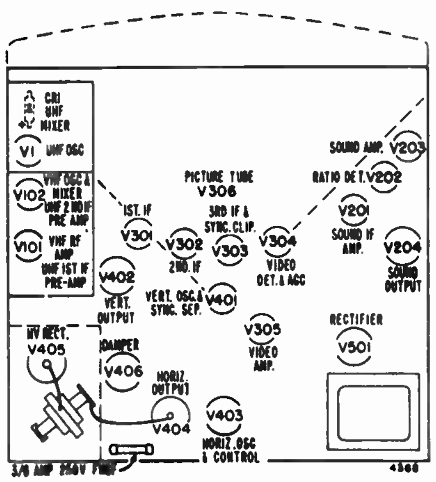


Top View of 19W1 and 19W1A Chassis.

TUBE COMPLEMENT

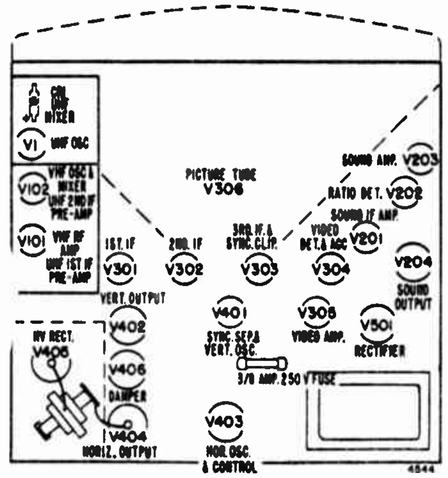
‡CR1 —94D66-50, 1N82A or 1N124
V1 —6AF4
V101—6BZ7
V102—6U8
V201—6AU6
V202—6AL5
V203—6AV6
V204—6AS5
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—6CB6
V306—21WP4
V401—12AU7
V402—6S4
V403—6SN7GT
V404—6BQ6GT
V405—1B3GT
V406—6AX4GT
V501—5U4G

‡ 94D66-50 recommended replacement.



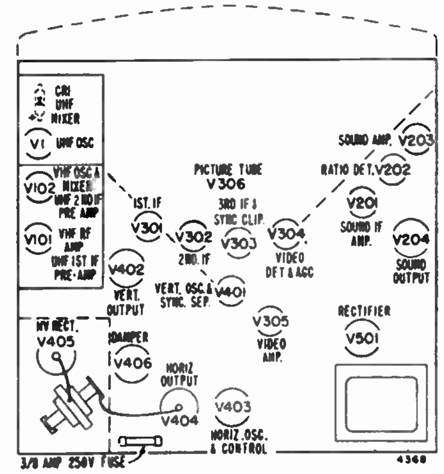
Top View of 19N2Z Chassis.

CR1 —1N82A or 1N124
V1 —6AF4
V101—6BZ7
V102—6U8
V201—6AU6
V202—6AL5
V203—6AV6
V204—6Y6G
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—6CB6
V306—21ZP4B
V401—12AU7
V402—6S4
V403—6SN7GT
V404—6BQ6GT
V405—1B3GT
V406—6AX4GT
V501—5U4G
V701—6BE6
V702—6BA6
V703—6AV6



Top View of 19T1 Chassis.

CR1 —1N82A or 1N124
V1 —6AF4
V101—6BZ7
V102—6U8
V201—6AU6
V202—6AL5
V203—6AV6
V204—6AS5
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—6CB6
V306—17BP4A
V401—12AU7
V402—6S4
V403—6SN7GT
V404—6BQ6GT
V405—1B3GT
V406—6AX4GT
V501—5U4G



Top View of 19R2 Chassis.

CR1 —1N82A, 1N124
V1 —6AF4
V101—6BZ7
V102—6U8
V201—6AU6
V202—6AL5
V203—6AV6
V204—6AS5
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—12BY7
V306—24CP4, 24QP4
V401—12AU7
V402—6AV5GT
V403—6SN7GT
V404—6CD6G
V405—1B3GT
V406—6AU4GT
V501—5U4G

PARTS LIST

Electrical components have symbols in 100 series, 200 series, etc., according to location on schematic. Order parts by part number and description from Admiral Distributor.

IF PRE-AMPLIFIER RESPONSE CURVE CHECK AND ALIGNMENT

Important: This alignment is seldom required. It should be made only if UHF reception is poor and after usual causes of poor reception have been checked. This alignment should be made after completing preceding alignments.

a. Set VHF Channel selector at detent position midway between channels 5 and 6.

b. Connect negative of 4½ volt bias battery to AGC buss (test point "T"), positive to chassis.

c. Remove CR1 (mixer crystal) from holder. Connect sweep generator high side through 100 ohm resistor to negative clip of mixer crystal socket, see figure 24. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the high side of sweep generator. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

d. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (figure 29). Keep scope leads away from chassis.

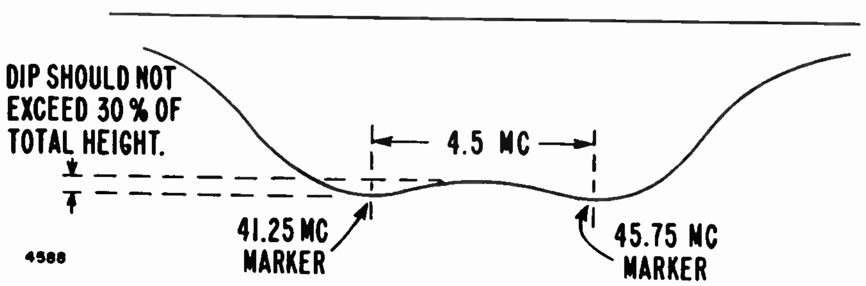
e. Allow about 15 minutes for receiver and test equipment to warm up.

f. Use a non-metallic alignment tool. If hollow core slugs are used, use alignment tool, part number 98A30-14.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
*1	45.75 MC (Video Carrier) 41.25 MC (Sound Carrier)	Set sweep at 43.5 MC, sweep width 12 MC.	Adjust A17 to obtain maximum amplitude at center of curve. Alternately adjust A18 and A19 (figure 29) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location; see figure 28.
2	If curve cannot be made to resemble response curve, figure 28, check to be sure all instructions have been followed. Check tubes V101 and V102 and repeat alignment. Important: After replacing tubes, it may be necessary to check "VHF Tuner RF And Mixer Alignment".		

* **Before proceeding, detune slug A2 exactly 3 turns counter-clockwise. After completing this alignment, return slug A2 to its original setting by turning it exactly 3 turns clockwise.**

Caution: Use extreme care to avoid damage to coils or slugs.



Full skirt of curve will not be visible unless generator sweep width extends beyond 12 MC.

Figure 28. IF Pre-amplifier Response Curve.

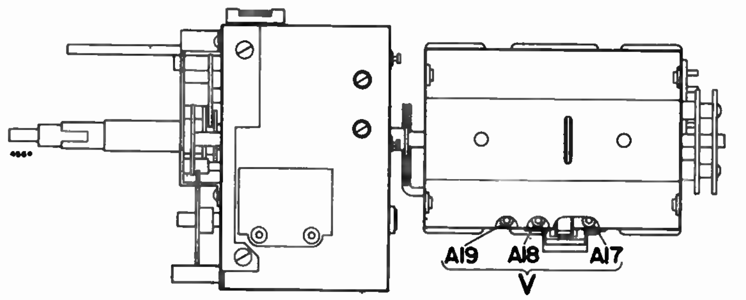


Figure 29. Bottom View of Tuners Showing IF Pre-amplifier Adjustments.

RESISTORS

Sym.	Description	Part No.
R1	470 ohms, ½ watt	60B 8-471
R2	6,800 ohms, ½ watt	60B 8-682
R3	1,000 ohms, ½ watt	60B 8-102
R4	100,000 ohms, ½ watt	60B 8-104
R5	270 ohms, ½ watt	60B 8-271
R101	22,000 ohms, ½ watt	60B 8-223
R102	47,000 ohms, ½ watt	60B 8-473
R104	120,000 ohms, ½ watt	60B 8-124
R105	820,000 ohms, ½ watt	60B 8-824
R106	470,000 ohms, ½ watt	60B 8-474
R107	1,500 ohms, 1 watt	60B 14-152
R108	100,000 ohms, ½ watt	60B 8-104
R109	8,200 ohms, ½ watt	60B 8-822
R110	15,000 ohms, ½ watt	60B 8-153
R111	4,700 ohms, ½ watt	60B 8-472
R112	3,300 ohms, 1 watt	60B 14-332
R114	100,000 ohms, ½ watt	60B 8-104
R115	100,000 ohms, ½ watt	60B 8-104
R116	10,000 ohms, ½ watt	60B 8-103
R117	10 ohms, ½ watt	60B 8-100
R201	470,000 ohms, ½ watt	60B 8-474
R202	100 ohms, ½ watt, carbon only (R202 was 68 ohms in early sets.)	60B 28-19
R203	330 ohms, ½ watt	60B 8-331
R204	10,000 ohms, ½ watt	60B 8-103
R205	10,000 ohms, ½ watt	60B 8-103
R206	390 ohms, ½ watt	60B 8-391
R207	47,000 ohms, ½ watt	60B 8-473
R208A	1 megohm, Volume control	75B 11-21
R208B	1,000 ohms, Contrast control	75B 11-21
*R209	4.7 megohms, ½ watt	60B 8-475
‡R210	470,000 ohms, ½ watt	60B 8-474
‡R211	1 megohm, ½ watt	60B 8-105
R212	2,000 ohms, ½ watt, in 19M2, 19M2Z, 19N2Z	60B 8-202
	1,500 ohms, ½ watt, 5%, in 19L2, 19T1, 19W1, 19W1A	60B 7-152
	3,600 ohms, ½ watt, in 19R2	60B 8-362
R213	820 ohms, ½ watt, 5%	60B 7-821
	1,100 ohms, ½ watt, 5%, in 19R2	60B 7-112
R214	1,200 ohms, 5 watt, in 19M2, 19M2Z	61A 1-10
	1,200 ohms, 1 watt	60B 14-122
	1,000 ohms, 2 watt, in 19R2	60B 20-102
	2,500 ohms, 7.5 watt, in 19N2Z	61A 1-23
R216	2 megohms, Tone control	75C 13-22
R217	82,000 ohms, ½ watt, in 19M2, 19M2Z	60B 8-823
	470 ohms, ½ watt, in 19N2Z	60B 8-471
R218	1,500 ohms, ½ watt, 5%	60B 7-152
R219	2,500 ohms, 7.5 watt	61A 1-23
R220	15,000 ohms, ½ watt	60B 8-153
R221	15,000 ohms, 5 watt	61A 1-7
R222	1,000 ohms, 2 watt	60B 20-102
R223	680 ohms, ½ watt, in 19L2, 19T1, 19W1, 19W1A	60B 8-681
	470 ohms, ½ watt, in 19M2, 19M2Z	60B 8-471
	390 ohms, ½ watt, in 19R2	60B 8-391
R224	68,000 ohms, ½ watt, in 19L2, 19T1, 19W1, 19W1A	60B 8-683
	47,000 ohms, ½ watt, in 19M2, 19M2Z, 19N2Z	60B 8-473
	22,000 ohms, 1 watt, in 19R2	60B 14-223
R225	1 megohm, Volume control (R225 includes switch S501.)	75C 2-16
R226	150 ohms, ½ watt	60B 8-151
R227	1,200 ohms, 1 watt	60B 14-122
R301	3.3 megohms, ½ watt	60B 8-335
R302	100,000 ohms, ½ watt	60B 8-104
R303	47 ohms, ½ watt, carbon only	60B 28-45
R304	330 ohms, ½ watt	60B 8-331
R306	24,000 ohms, ½ watt, 5%	60B 7-243
R309	1,000 ohms, ½ watt	60B 8-102
R311	24,000 ohms, ½ watt, 5%	60B 7-243
R312	1,000 ohms, ½ watt	60B 8-102
R313	150 ohms, ½ watt	60B 8-151
R314	330 ohms, ½ watt	60B 8-331
R315	2 megohms, DX Range Finder control	
	in all chassis except 19R2	75C 1-53
	in 19R2 (75C1-63 includes switch S502)	75C 1-63
R316	47,000 ohms, ½ watt	60B 8-473
R317	470,000 ohms, ½ watt	60B 8-474
R318	4,700 ohms	Part of L302
R319	5,600 ohms, ½ watt	60B 8-562
R320	1 megohm, ½ watt	60B 8-105
R321	1,000 ohms, Contrast control	See R208B
R322	33,000 ohms, ½ watt, in comb. sets	60B 8-333
	47,000 ohms, ½ watt, in TV only sets	60B 8-473
R323	33,000 ohms	Part of L305
R324	10,000 ohms	Part of L306
R326	5,600 ohms, 1 watt	60B 14-562
R327	27,000 ohms, ½ watt	60B 8-273
§R329	270,000 ohms, ½ watt	60B 8-274
R330	180,000 ohms, ½ watt	60B 8-184
R331	100,000 ohms, Brightness control	75C 13-25
R332	1,000 ohms, Contrast control	75C 13-21
R333	15 megohms, ½ watt	60B 8-156
R334	680,000 ohms, ½ watt	60B 8-684
R335	1,000 ohms, ½ watt	60B 8-102
R336	68 ohms, ½ watt, carbon only	60B 28-44
R337	4,500 ohms, 5 watt	61A 1-24
R338	56,000 ohms, ½ watt	60B 8-563
R339	39,000 ohms, ½ watt	60B 8-393
R343	1.5 megohms, ½ watt	60B 8-155
R344	2,200 ohms, 2 watt	60B 20-222
R345	1,000 ohms, ½ watt	60B 8-102
R401	2.7 megohms, ½ watt	60B 8-275
R402	12,000 ohms, ½ watt	60B 8-123
R403	1 megohm, ½ watt, in 19L2, 19L2Z, 19N2Z, 19T1, 19W1, 19W1A	60B 8-105
	680,000 ohms, ½ watt, in 19R2	60B 8-684
	47,000 ohms, ½ watt, in 19M2, 19M2Z	60B 8-473
R404	10,000 ohms, ½ watt	60B 8-103

* May be part of couplate, part number 63C6-10. Replace with exact part or individual components.
‡ May be part of couplate, part number 63C6-5. Replace with exact part or individual components.
§ May be part of couplate, part number 63C6-8. Replace with exact part or individual components.

Schematic for 19L2 and 19L2Z VHF-UHF Television Chassis.

TV VOLTAGE DATA
(Voltages given on schematic)

- CONTRAST control turned fully clockwise. LOW-CHANNEL selector set on an unused VHF channel. HIGH CHANNEL selector in the "VHF" position. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "0" position).
- VHF antenna disconnected from set with terminal shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.
  Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- B+ voltage at terminal of VHF-UHF switch taken with tuner in UHF position.
- Voltages marked with an asterisk (*) will vary widely with control setting.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions

WAVEFORM DATA
(Waveforms given on schematic)

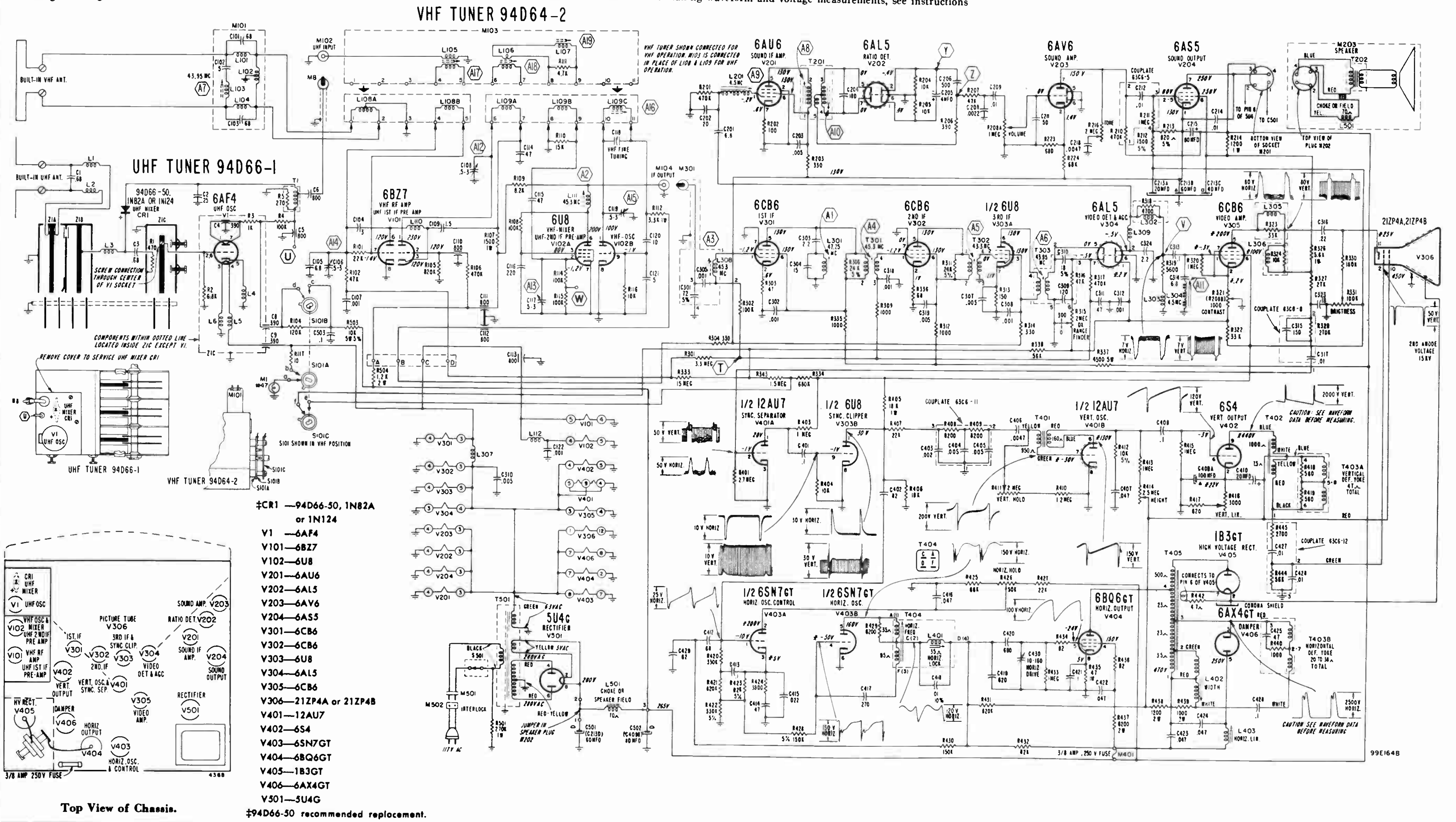
Waveforms taken with CONTRAST control set fully to the right, all other controls set for normal picture (in sync). DX Range Finder control set fully to the left (at "0" position). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. capacitor connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.



‡CR1 —94D66-50, 1N82A or 1N124
V1 —6AF4
V101—6BZ7
V102—6U8
V201—6AU6
V202—6AL5
V203—6AV6
V204—6AS5
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—6CB6
V306—21ZP4A or 21ZP4B
V401—12AU7
V402—6S4
V403—6SN7GT
V404—6BQ6GT
V405—1B3GT
V406—6AX4GT
V501—5U4G
‡94D66-50 recommended replacement.

Top View of Chassis.

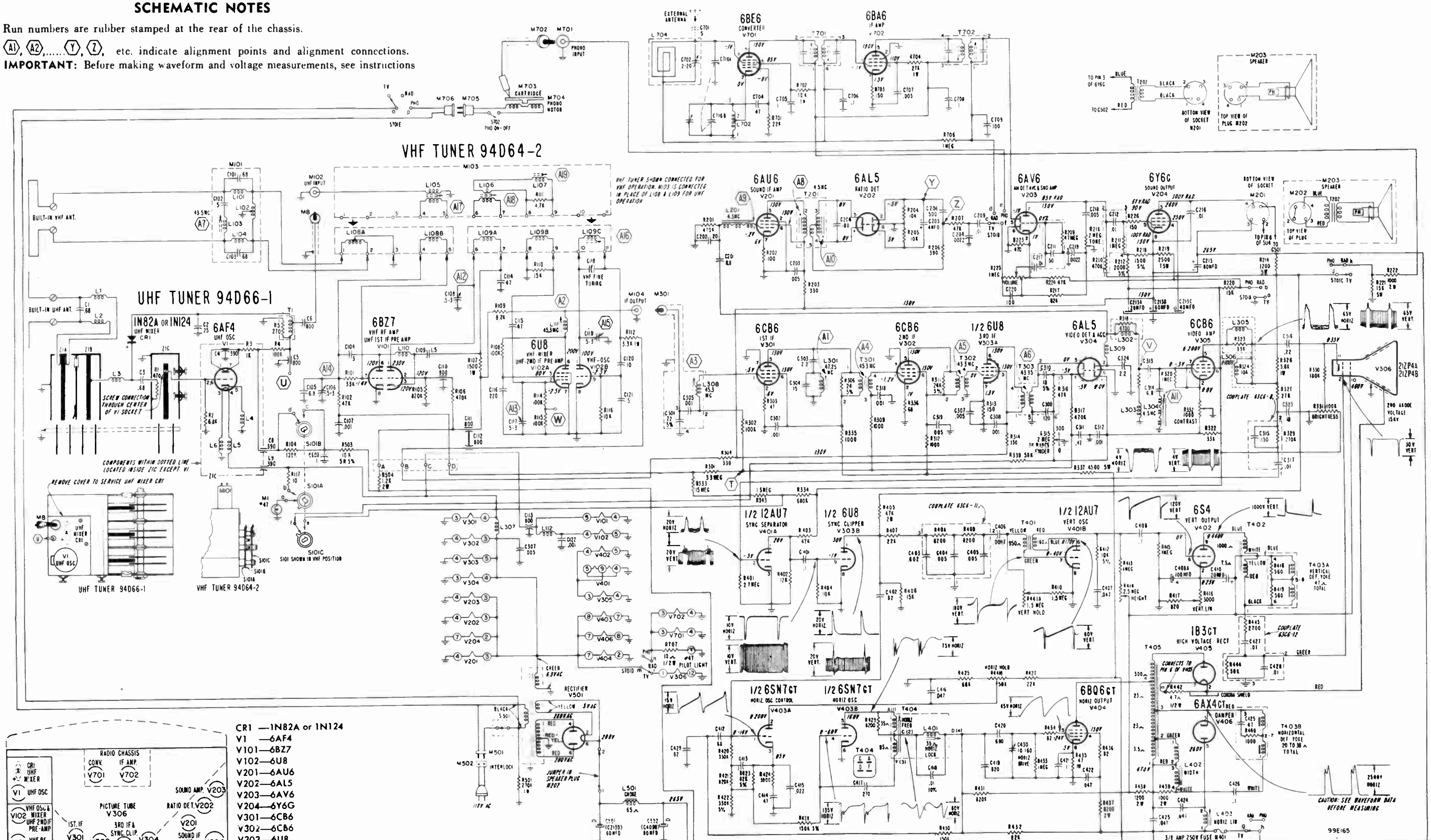
Schematic for 19M2 and 19M2Z VHF-UHF Television and Radio Chassis.

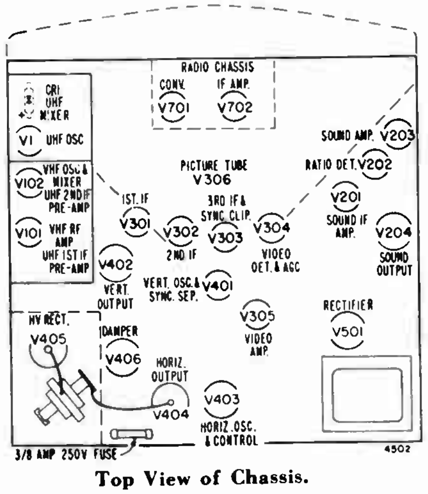
SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions





CR1 —1N82A or 1N124
V1 —6AF4
V101—6BZ7
V102—6U8
V201—6AU6
V202—6AL5
V203—6AV6
V204—6Y6G
V301—6CB6
V302—6CB6
V303—6U8
V304—6AL5
V305—6CB6
V306—21ZP4A, 21ZP4B
V401—12AU7
V402—6S4
V403—6SN7GT
V404—6BQ6GT
V405—1B3GT
V406—6AX4GT
V501—5U4G
V701—6BE6
V702—6BA6

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). Warning: Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. capacitor connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

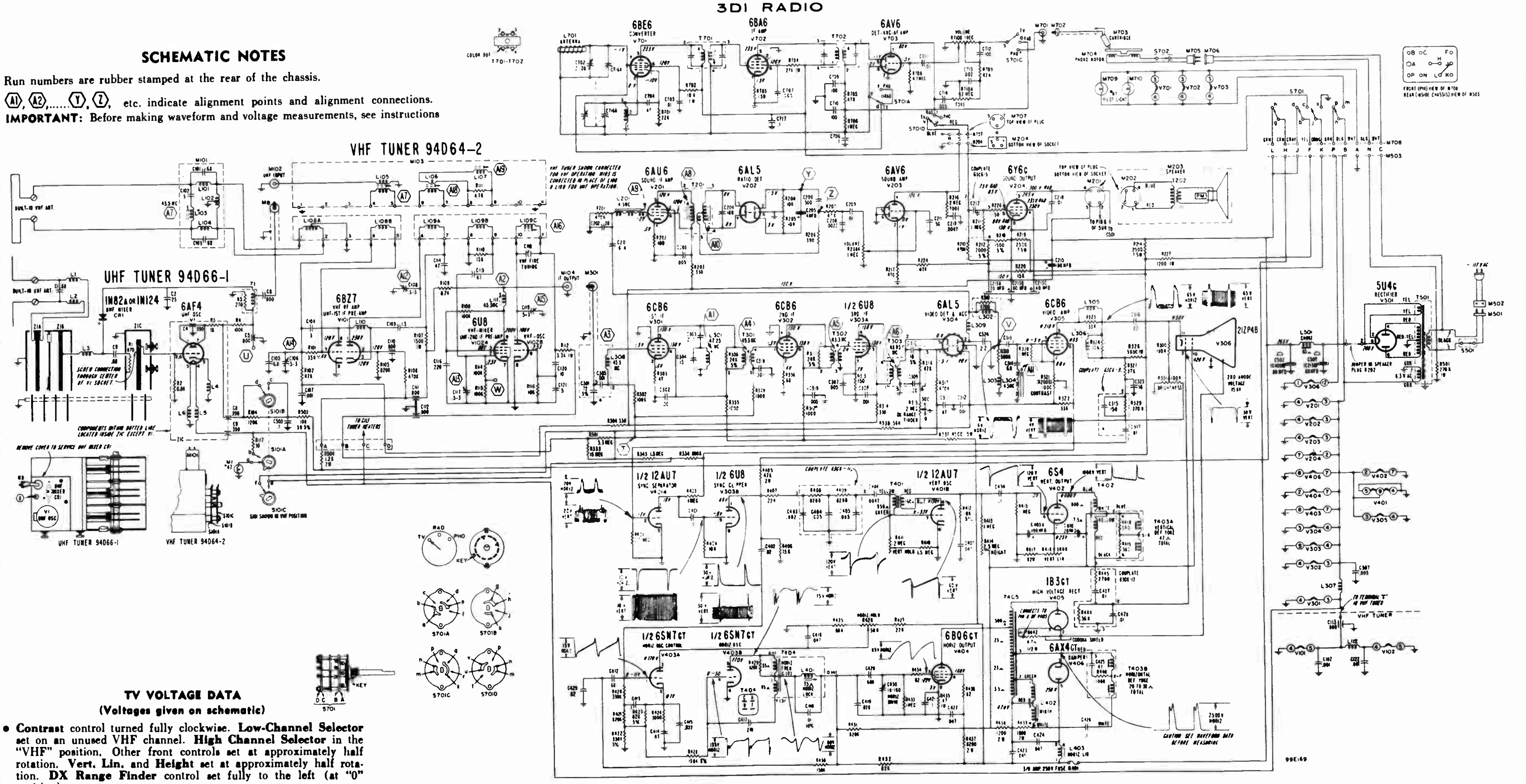
Schematic for 19N2Z VHF-UHF Television Chassis and 3D1 Radio.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions



TV VOLTAGE DATA

(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Low-Channel Selector** set on an unused VHF channel. **High Channel Selector** in the "VHF" position. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position).
- VHF Antenna disconnected from set with terminal shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- B+ voltage at terminal of VHF-UHF switch taken with tuner in UHF position.
- Voltages marked with an asterisk (*) will vary widely with control setting. In combination models, B+ voltages in TV chassis will be slightly higher when set is switched to radio position. Alternate voltage readings for radio and TV are shown for sound output tube V204 (6Y6G).

CAUTION

Pulsed high voltages are present on the cap of V404, pin 3 of V406 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 15 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

WAVEFORM DATA

(Waveforms given on schematic)

Waveforms taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). Warning: Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion.

Waveforms at video and sync stages obtained, with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. capacitor connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

Pulsed high voltages are present on the caps of V404, V405 and at pin 3 of V406. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at pin 3 of V406, using an oscilloscope with a capacitive voltage divider probe. Waveform at V406 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower depending upon the degree of coupling.

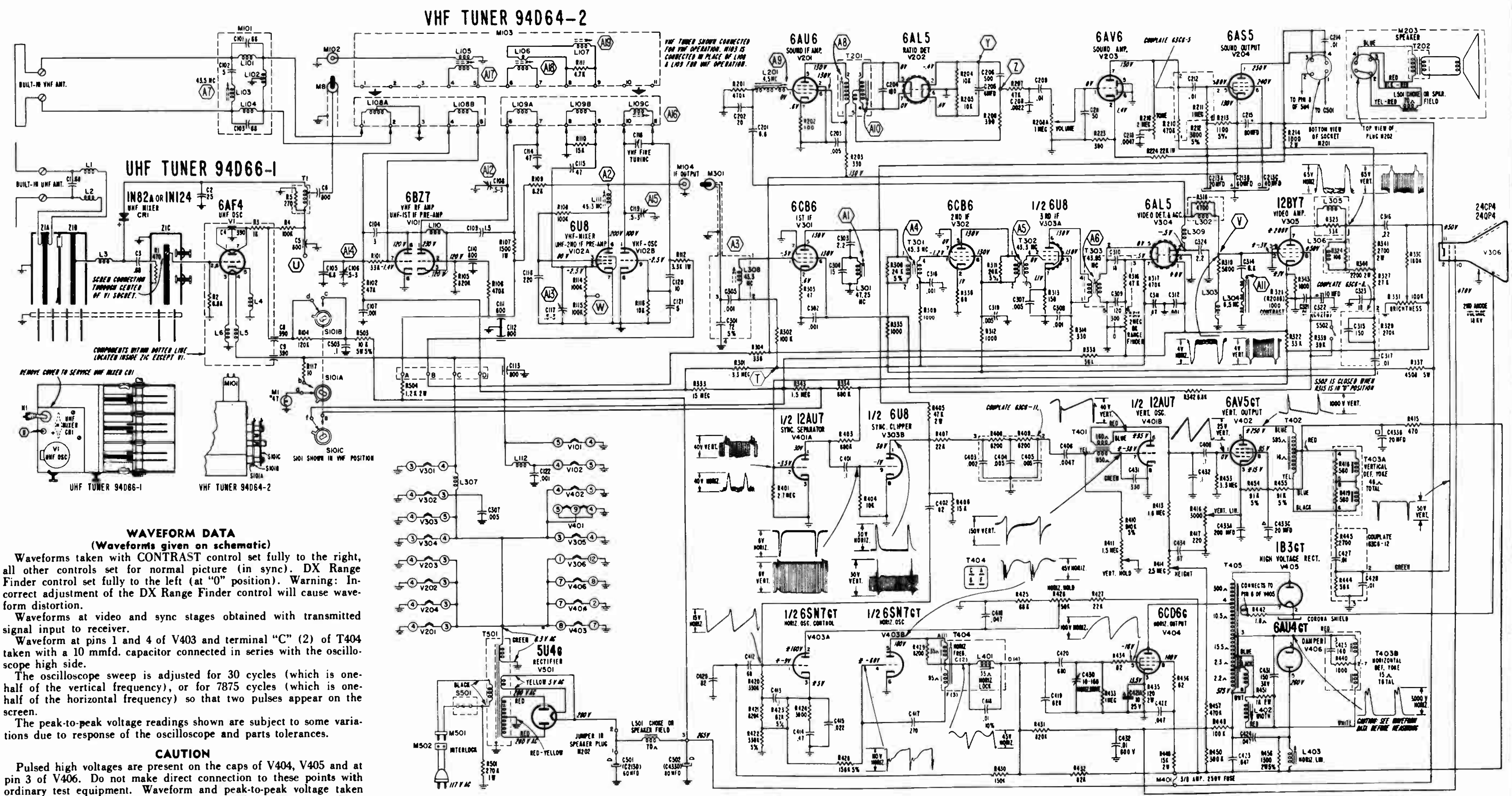
SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions

Schematic for 19R2 VHF-UHF Television Chassis.



WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with CONTRAST control set fully to the right, all other controls set for normal picture (in sync). DX Range Finder control set fully to the left (at "0" position). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. capacitor connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

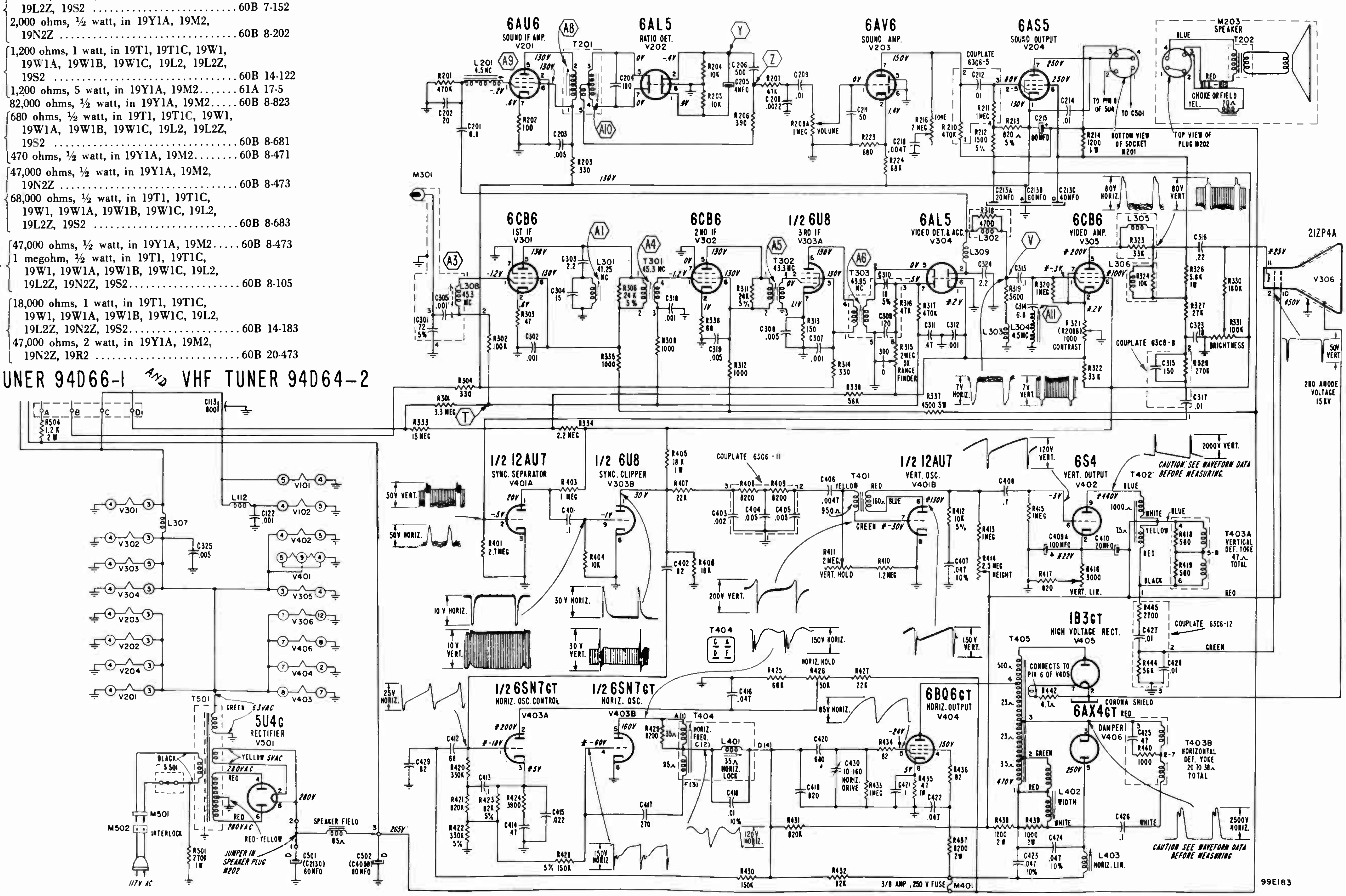
CAUTION

Pulsed high voltages are present on the caps of V404, V405 and at pin 3 of V406. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at pin 3 of V406, using an oscilloscope with a capacitive voltage divider probe. Waveform at V406 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower depending upon the degree of coupling.

Schematic for 19S2 VHF-UHF Television Chassis.

RESISTORS

Sym.	Description	Part No.
R4	100,000 ohms, ½ watt (R4 not used in later production tuners.)	60B 8-104
R212	1,500 ohms, ½ watt, 5%, in 19T1, 19T1C, 19W1, 19W1A, 19W1B, 19W1C, 19L2, 19L2Z, 19S2	60B 7-152
	2,000 ohms, ½ watt, in 19Y1A, 19M2, 19N2Z	60B 8-202
R214	1,200 ohms, 1 watt, in 19T1, 19T1C, 19W1, 19W1A, 19W1B, 19W1C, 19L2, 19L2Z, 19S2	60B 14-122
	1,200 ohms, 5 watt, in 19Y1A, 19M2	61A 17-5
R217	82,000 ohms, ½ watt, in 19Y1A, 19M2	60B 8-823
R223	680 ohms, ½ watt, in 19T1, 19T1C, 19W1, 19W1A, 19W1B, 19W1C, 19L2, 19L2Z, 19S2	60B 8-681
	470 ohms, ½ watt, in 19Y1A, 19M2	60B 8-471
R224	47,000 ohms, ½ watt, in 19Y1A, 19M2, 19N2Z	60B 8-473
	68,000 ohms, ½ watt, in 19T1, 19T1C, 19W1, 19W1A, 19W1B, 19W1C, 19L2, 19L2Z, 19S2	60B 8-683
R403	47,000 ohms, ½ watt, in 19Y1A, 19M2	60B 8-473
	1 megohm, ½ watt, in 19T1, 19T1C, 19W1, 19W1A, 19W1B, 19W1C, 19L2, 19L2Z, 19N2Z, 19S2	60B 8-105
R405	18,000 ohms, 1 watt, in 19T1, 19T1C, 19W1, 19W1A, 19W1B, 19W1C, 19L2, 19L2Z, 19N2Z, 19S2	60B 14-183
	47,000 ohms, 2 watt, in 19Y1A, 19M2, 19N2Z, 19R2	60B 20-473



Schematic for 19T1 VHF-UHF Television Chassis.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions

WAVEFORM DATA
(Waveforms given on schematic)

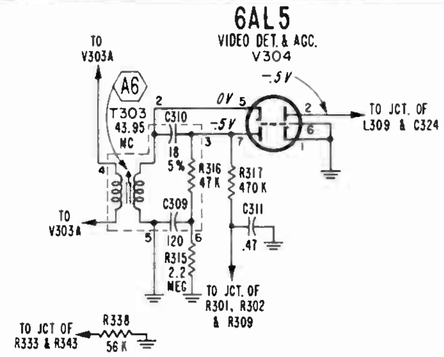
Waveforms taken with **Contrast** control set fully to the right, all other controls set for normal picture (in sync). **DX Range Finder** control set fully to the left (at "0" position). Warning: Incorrect adjustment of the **DX Range Finder** control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. capacitor connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.



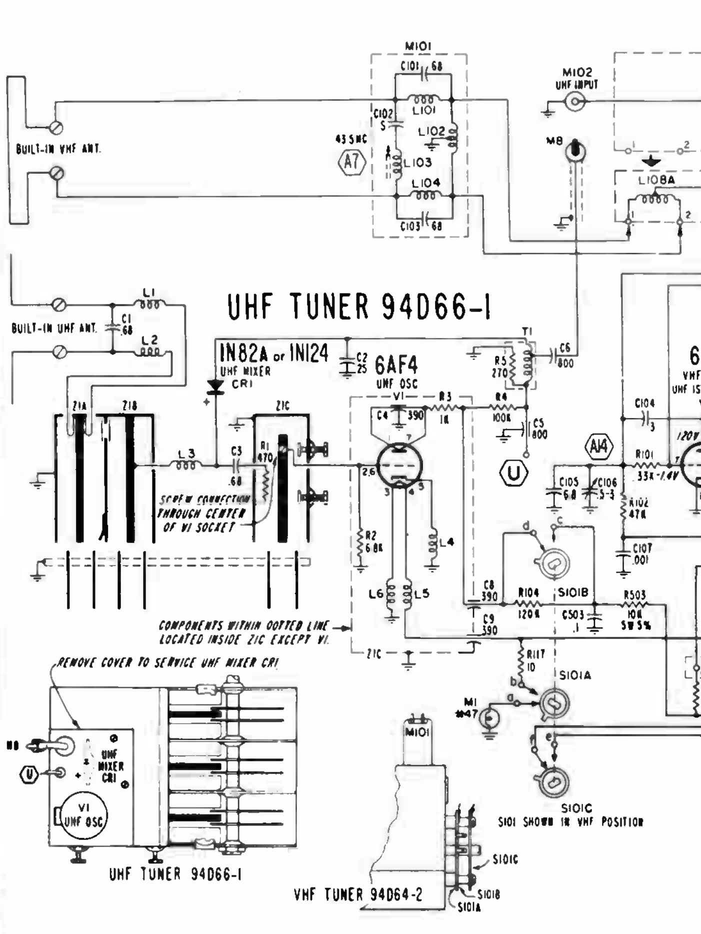
AGC DETECTOR CIRCUIT USED IN CHASSIS STAMPED RUN 4

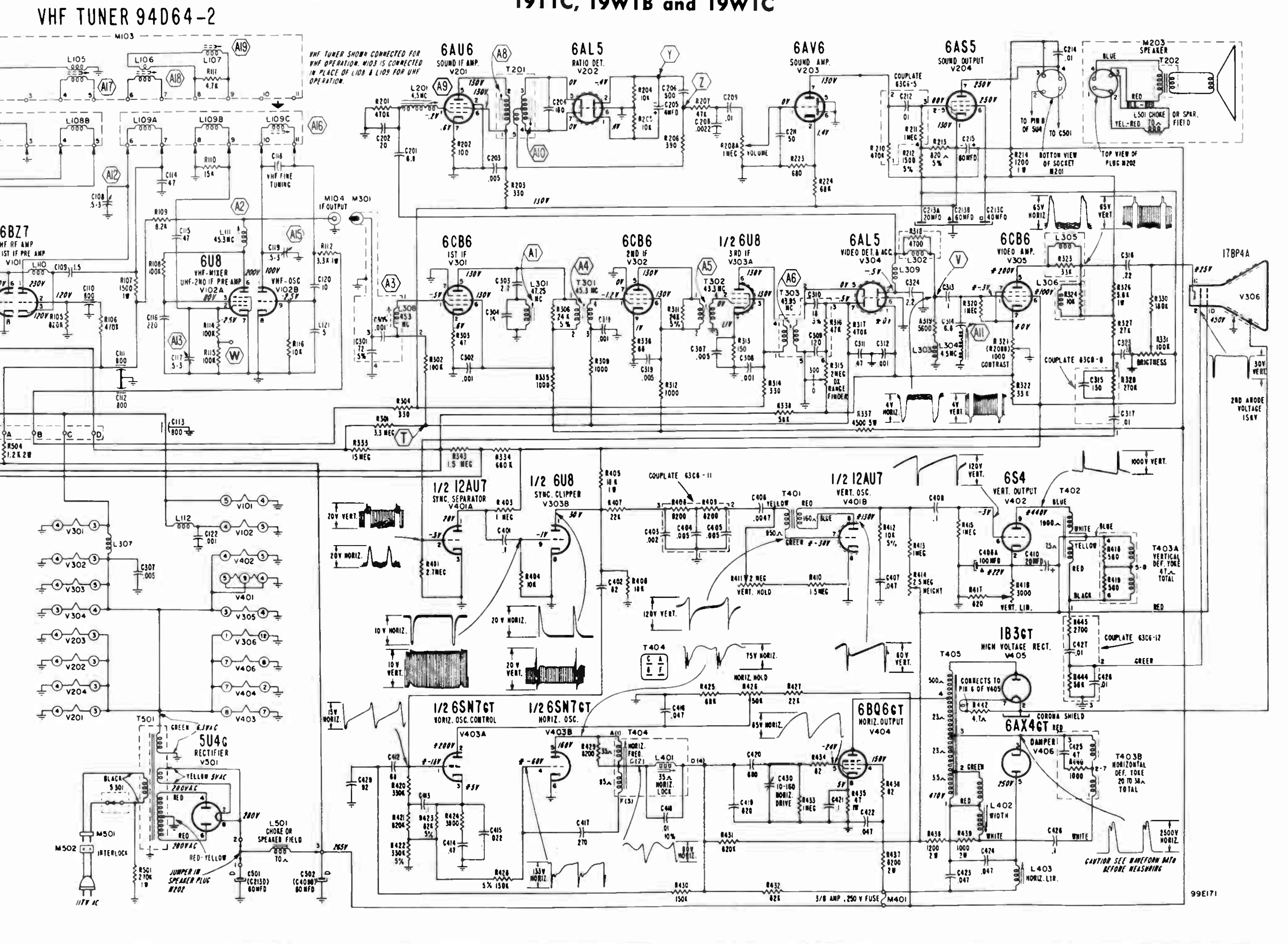
19T1C, 19W1B and 19W1C

CAUTION

Pulsed high voltages are present on the cap of V404, pin 3 of V406 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Pulsed high voltages are present on the caps of V404, V405 and at pin 3 of V406. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage taken at pin 3 of V406, using an oscilloscope with a capacitive voltage divider probe. Waveform at V406 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower depending upon the degree of coupling.





TV VOLTAGE DATA
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Low-Channel Selector** set on an unused VHF channel. **High Channel Selector** in the "VHF" position. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position).
- VHF Antenna disconnected from set with terminal shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- B+ voltage at terminal of VHF-UHF switch taken with tuner in UHF position.
- Voltages marked with an asterisk (*) will vary widely with control setting.

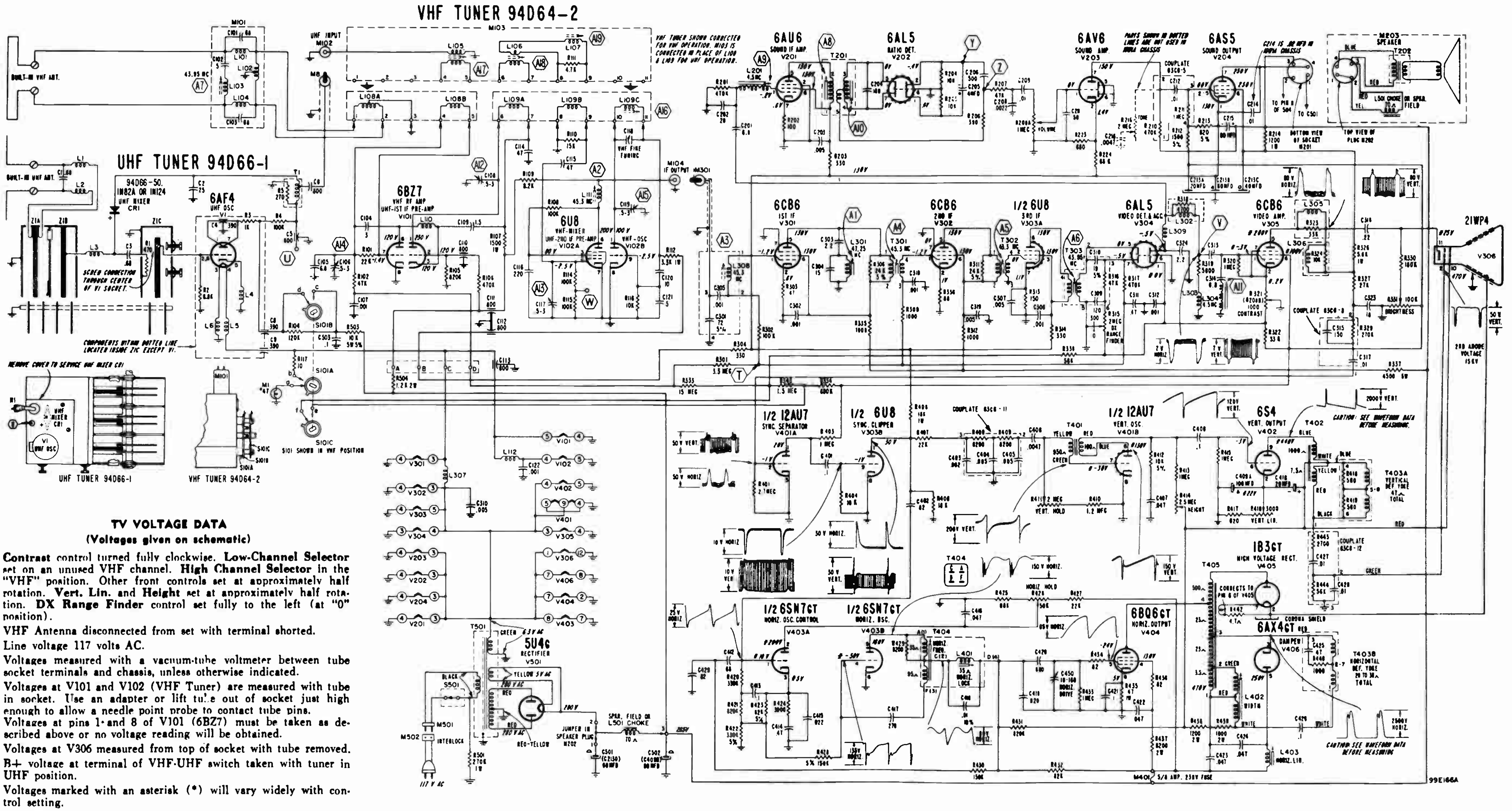
SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions

Schematic for 19W1 and 19W1A VHF-UHF Television Chassis. Applies to Chassis Stamped Run 3 and Higher.



TV VOLTAGE DATA
(Voltages given on schematic)

- **Contrast** control turned fully clockwise. **Low-Channel Selector** set on an unused VHF channel. **High Channel Selector** in the "VHF" position. Other front controls set at approximately half rotation. **Vert. Lin.** and **Height** set at approximately half rotation. **DX Range Finder** control set fully to the left (at "0" position).
- VHF Antenna disconnected from set with terminal shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (VHF Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins. Voltages at pins 1 and 8 of V101 (6BZ7) must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- B+ voltage at terminal of VHF-UHF switch taken with tuner in UHF position.
- Voltages marked with an asterisk (*) will vary widely with control setting.

SPECIFICATIONS

Power Supply Rating.................. 240 watts, 105-120 volts 60 cycle AC
Audio Power Rating.............. 3.5 watts maximum 2.3 watts undistorted
Antenna Input Impedance.................................... 300 ohms
Video Response...4 MC
Focus.. Magnetic
Deflection..90° Magnetic
Picture Carrier... 45.75 MC
Sound Carrier...41.25 MC
Adjacent Channel Picture Traps..........................39.75 MC
Adjacent Channel Sound Traps...........................47.25 MC

TUBE COMPLEMENT

V1	6AU6	Intercarrier Sound Amp.	V12A	6SN7GTA	Sync Splitter
V2	6BN6	Sound Limiter Det.	V12B		Horiz. Phase Comparer
V3	6BK5	Audio Output	V13	6W6GT	Vertical Output
V4	6CB6	First Picture I.F. Amp.	V14	6SN7GTA	Horizontal Oscillator
V5	6CB6	Second Picture I.F. Amp.	V15	6CD6G	Horizontal Output
V6	6CB6	Third Picture I.F. Amp.	V16	6AX4GT	Damper
V7	6AU6	First Video Amp.	V17	1B3GT	High Voltage Rectifier
V8	6AQ5	Second Video Amp.	V18	21AMP4	Picture Tube 21" 90°
V9A	6SN7GTA	R.F. AGC Clamp		21AMP4A	Picture Tube 21" 90° Alum.
V9B		Vertical Oscillator	V19	6BZ7	Tuner R.F. Amp.
V10	6AU6	AGC Amp.	V20	6X8	Tuner Mixer Oscillator
V11	6BY6	Sync Separator	V21	6AF4	UHF Oscillator

WARNING

One side of the a-c line is connected to the chassis through C5 and L405. The other side of the a-c line is connected to the chassis through R420, SR 1, and C1A in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment it is desirable that an a-c line isolation transformer capable of handling at least 300 watts be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment or receiver, or both.

BUZZ CONTROL

This control (R104) is provided to adjust the AM rejection characteristics of the sound system (sync buzz, noise, or hiss). Since this control has been adjusted for an optimum setting at the factory, do not attempt to alter this adjustment unless sync buzz, noise, or hiss is present. Caution: Turn this control slowly from the present preset position---usually not more than 30 degrees rotation in either direction will be necessary.

YOKE ADJUSTMENT

The picture tube cone should fit snugly into the large front hole rimmed in rubber in the Yoke Mount Frame.
The Yoke Radial Adjustment (top wingscrew) allows the yoke to be rotated right or left--rotating the picture right or left.

The Yoke Vertical Adjustment (2 hex head screws each side) allows centering of the yoke coaxially with the tube neck. Proper positioning of the yoke is important so that picture corner-cutting and side-shadows can be readily removed by the centering control.

WIDTH AND HORIZONTAL LINEARITY

These controls (L404 and L403) are adjusted by clips which slide in vertical slots located on the right of the rear flange of the chassis. They should be adjusted simultaneously to provide good width and linearity with the picture extending approximately 1/4" beyond the edges of the mask.

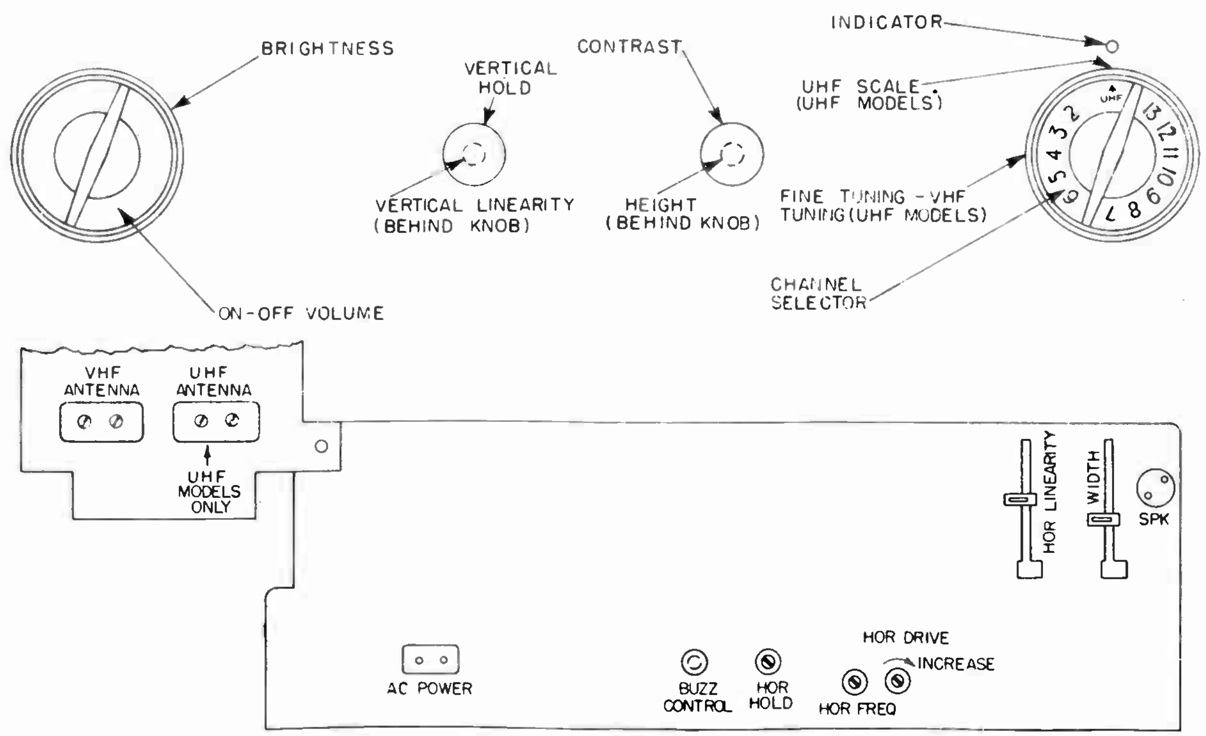
HORIZONTAL DRIVE

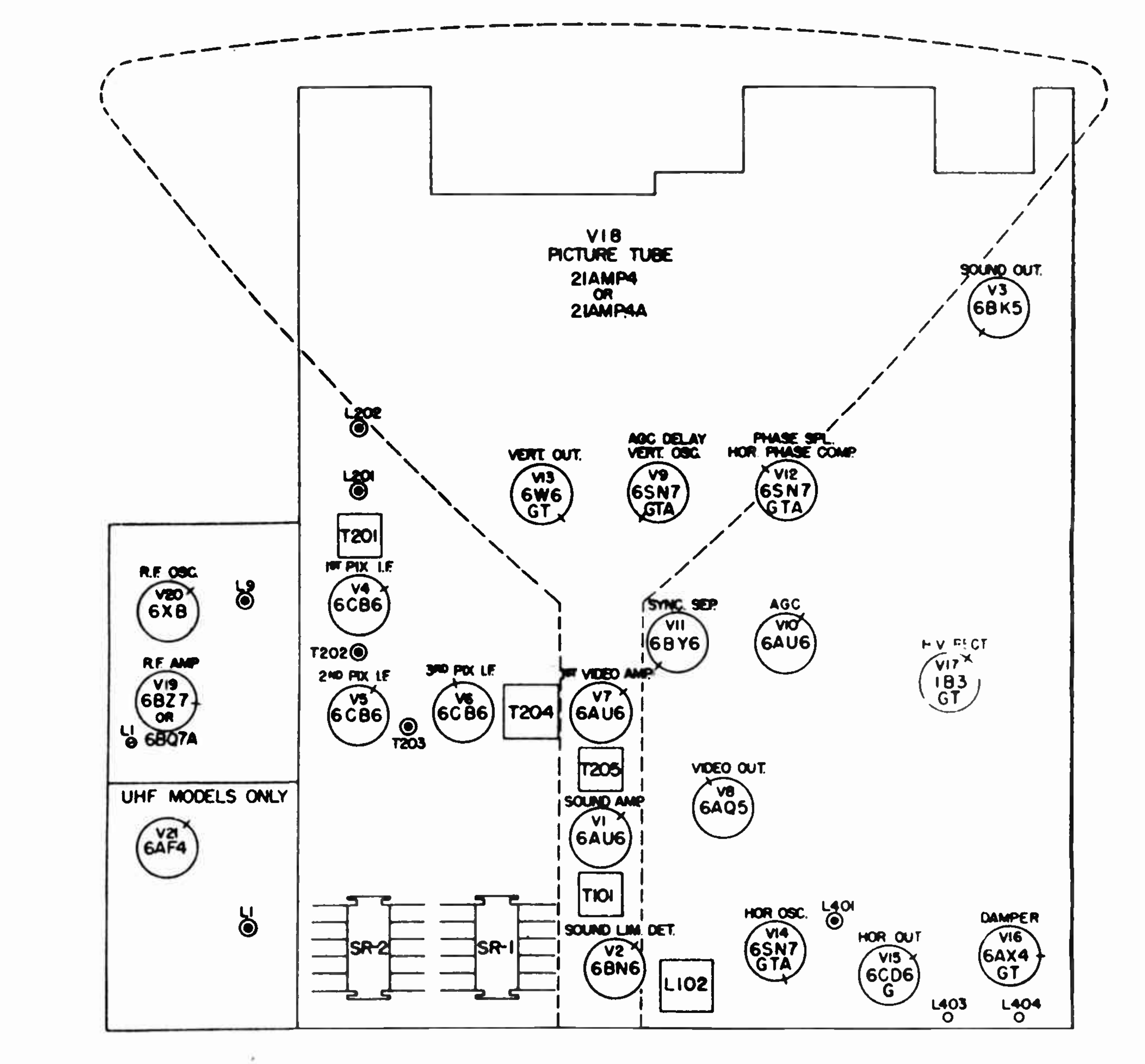
Adjust the Horizontal Drive Trimmer (C410B) to the point where "overdrive" lines (vertical white line near the center of the picture) just disappear. Turning this control to the right increases the Horizontal Drive.

HORIZONTAL FREQUENCY

Adjust the Horizontal Hold control to the center of its range. Adjust the Horizontal frequency trimmer (C410A) until picture will break sync at both ends of the Horizontal Hold range. When components are replaced the following procedure is to be used.

1. Short out horizontal lock lock coil (L401) and set the Horizontal hold control to the center of its range.
2. Adjust the horizontal frequency trimmer (C410A) for zero volts on the grid (pin 4 of V14) of the horizontal oscillator.
3. Remove the short from the Horizontal lock coil (L401) and adjust this coil for zero volts on the grid (pin 4 of V14) of the horizontal oscillator.





STAGGER-TUNED I.F. ALIGNMENT PROCEDURE

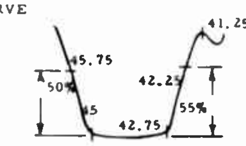
1. Set tuner to channel 9-10 or 11.
2. Pull AGC tube V10 out
3. Connect variable bias supply to junction R304 & R306. Adjust bias for -2 volts junction R202 & R205.
4. Connect VTVM across R212. Isolate VTVM with 18K resistor. Use -5V scale.
5. Connect RF signal generator to mixer tube shield (V20 6X8). Lift mixer tube shield until it is just ungrounded.
6. Good R.F. grounding between TV receiver on test and test equipment is necessary. A metal surface bench top should be used to insure proper RF grounding.

STEP	FREQUENCY	ADJUSTMENT	INSTRUCTIONS
1.	39.75 mc	Top L202 for min.	
2.	47.25 mc.	Top L201 for min.	Outer peak
3.	41.25mc.	Top T201 for min.	Outer peak
4.	42.9 mc.	Tuner coil for max.	
5.	45.2 mc.	Bottom T201 for max.	Outer peak--recheck steps 4 and 5.
6.	42.1 mc.	Top T202 for max.	Outer peak
7.	45.7 mc.	Top T203 for max.	Outer peak
8.	44.1 mc.	Bottom T204 for max.	Recheck steps 6, 7 and 8

OVERALL SWEEP CHECK

1. Connect RF signal generator to chassis near V4 for marker generator. Push shield down on mixer tube.
2. Connect oscilloscope across R212. Isolate oscilloscope lead with 300 μμf to ground and 18K resistor in series.
   To chassis ← 18K — To scope; 300 μμf to ground
3. Increase bias to -3.5 volts at junction R202 & R205.
4. Connect sweep generator to antenna terminals. Adjust sweep generator & tuner to channel 10.

CURVE



ADJUSTMENT	INSTRUCTIONS
T203	T203 positions 45.75 marker
T202	T202 positions 42.25
T204	T204 adjusts tilt of curve

Note: If desired curve cannot be obtained, slight adjustment of tu r coil and bottom T201 may be necessary.

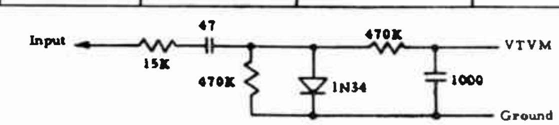
SOUND AND 4.5 MC TRAP ALIGNMENT

1. Tune in available TV station and reduce signal into set until hiss is heard with sound. This can be done by inserting an attenuator in the antenna lead-in or by removing antenna lead-in from the set and stray feeding in signal by placing lead-in in close proximity of the set.
2. Set buzz control in the middle of its range. Adjust take off coil (top T205), top and bottom T101, Quadrature coil (L102) and buzz control for cleanest sound and minimum buzz. If any adjustment cause hiss to disappear reduce signal into set until hiss reappears and continue with adjustments.

Note: If difficulty is encountered either in reducing signal sufficiently or adjustments being very broad. The following proceedu e may be used.

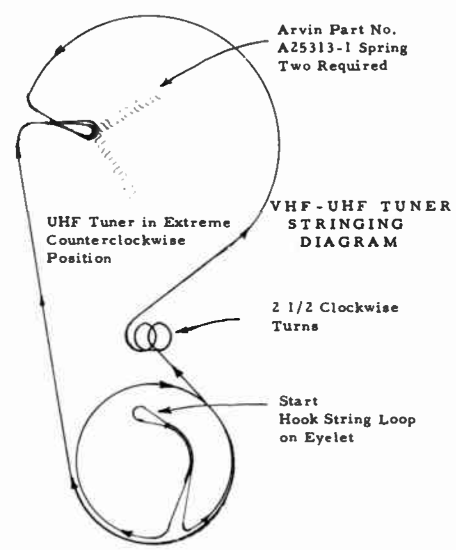
STEP	EQUIPMENT	CONNECTION	FREQUENCY	ADJUSTMENT	INSTRUCTIONS
1.	Det. jig *	Input of jig to pin 2 of V2			Keep lead between 15K resistor and pin 2 as short as possible
2.	VTVM	Output of jig	Tune in available channel	T205 Top (only), T101 (top and bottom) for max.	
3.		Remove jig	Same	Quadrature coil (L102) for max. sound	Set buzz control in middle of its range before adjusting L102
4.			Same	Buzz control for minimum buzz	Correct adjustment of buzz control is approx. middle of its range
5.	Det. jig *	Junction C321 and R333			Connect VTVM to output of jig
6.	RF signal generator	Pin 1 (V7)	4.5 mc	Tune 4.5 mc trap Bottom T205 for min.	

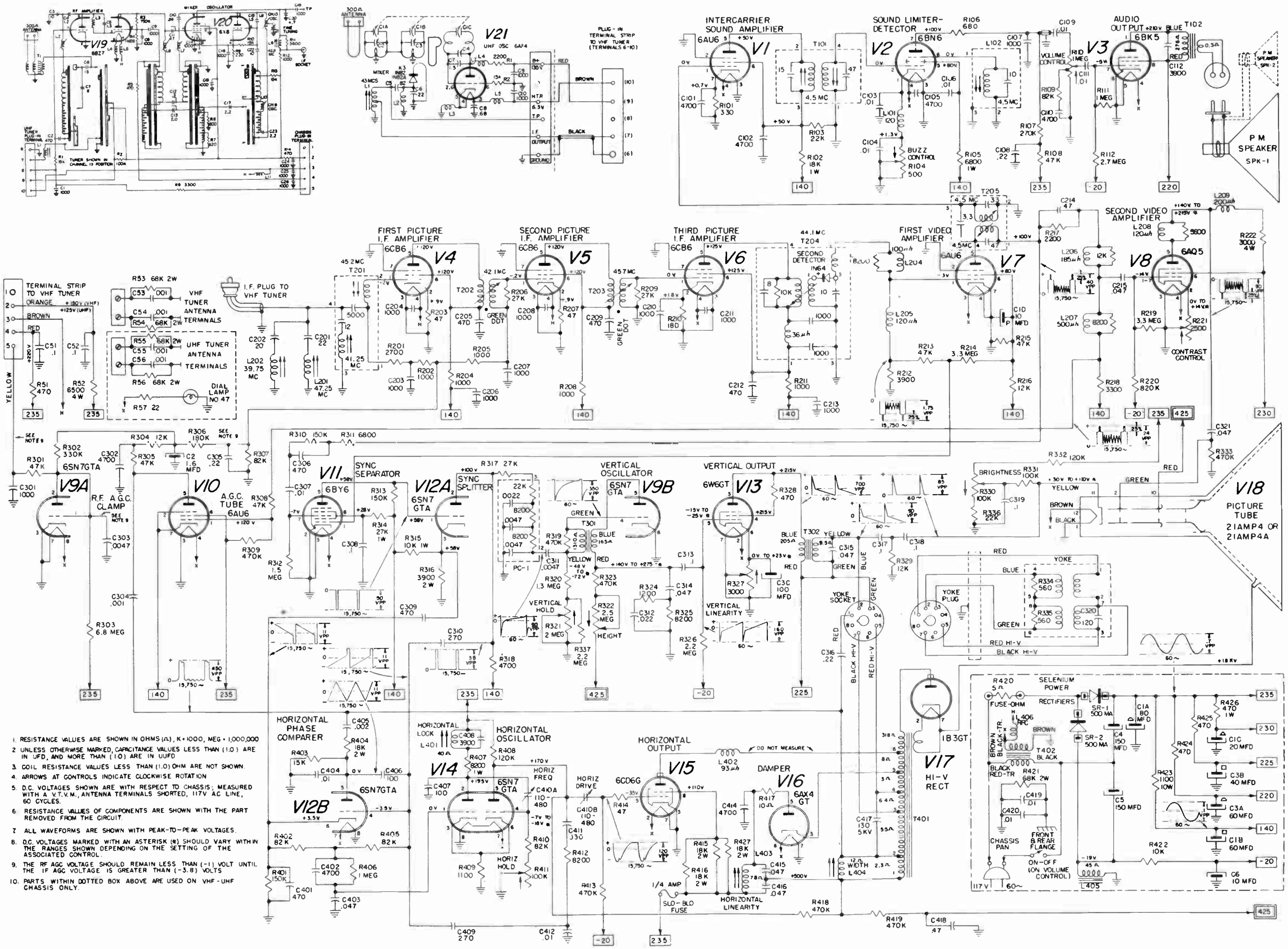
*Detector jig



TUBE FAILURE CHECK LIST

SYMPTOM	CHANGE TUBE
No picture--no sound--lighted screen	(UHF V21) V4, 5, 6, 7, 8, 19, 20
No sound--picture O.K.	V1, 2, 3
No picture--sound O.K. - no light on screen	V14, 15, 16, 17, 18
No picture--sound O.K.--one horizontal line on screen	V9, 13
No horizontal or vertical sychronization--sound O.K.	V11, 12
Picture weak, tears on strong signal	V10





1. RESISTANCE VALUES ARE SHOWN IN OHMS (Ω), K = 1000, MEG = 1,000,000
2. UNLESS OTHERWISE MARKED, CAPACITANCE VALUES LESS THAN (1.0) ARE IN UFD, AND MORE THAN (1.0) ARE IN UUFD
3. COIL RESISTANCE VALUES LESS THAN (1.0) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION
5. D.C. VOLTAGES SHOWN ARE WITH RESPECT TO CHASSIS; MEASURED WITH A V.T.V.M., ANTENNA TERMINALS SHORTED, 117V AC LINE, 60 CYCLES.
6. RESISTANCE VALUES OF COMPONENTS ARE SHOWN WITH THE PART REMOVED FROM THE CIRCUIT.
7. ALL WAVEFORMS ARE SHOWN WITH PEAK-TO-PEAK VOLTAGES.
8. D.C. VOLTAGES MARKED WITH AN ASTERISK (*) SHOULD VARY WITHIN THE RANGES SHOWN DEPENDING ON THE SETTING OF THE ASSOCIATED CONTROL.
9. THE RF AGC VOLTAGE SHOULD REMAIN LESS THAN (-1) VOLT UNTIL THE IF AGC VOLTAGE IS GREATER THAN (-3.8) VOLTS
10. PARTS WITHIN DOTTED BOX ABOVE ARE USED ON VHF-UHF CHASSIS ONLY.

HOW TO ORDER PARTS

Replacement parts should be ordered by Arvin part number, description and model number of receiver from your Arvin Distributor. The Distributor will order direct from the factory. All prices subject to change with out notice. Parts shipments are F.O.B. Columbus, Indiana.

CAPACITORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
C202	40355-13	20 μμf, 5%
C201	40355-15	22 μμf, 5%
C214	40355-4	47 μμf, 10%
C406, 407	40355-20	100 μμf, 10%
C417	40538	130 μμf, 5KV
C310, 409	40355-7	270 μμf, 10%
C411	40355-8	330 μμf, 10%
C205, 209 212, 306	41052-2	470 μμf, 20%
C309, 401	40355-9	470 μμf, 10%
C53, 54 55, 56	41135-102	.001 μf, 1500V.
C107	40054-102	.001 μf, 20%
C203, 204, 206, 207, 208, 211, 210, 301, 213	23078	.001 μf
C304	41837-2	.001 μf, 20%, 1000V.
C405	40054-202	.002 μf, 20%
C112	42227-1	.0039 μf, +20% -15%, 1000V.
C408	20433-392	.0039 μf, 5%
C101, 102, 105, 303, 414	40053-472	.0047 μf
C110, 302, 402	40054-472	.0047 μf, 20%
C311	24612-472	.0047 μf, 5%, 600V.
C103, 104, 106, 109, 111	40053-103	.01 μf
C307, 404, 412	25461-103	.01 μf, 20%, 600V.
C419, 420	41135-103	.01 μf, 1500V.
C312	25455-223	.022 μf, 20%, 200V.
C215, 321	25462-473	.047 μf, 20%, 400V.
C314	25461-473	.047 μf, 20%, 600V.
C315, 403	25455-473	.047 μf, 20%, 200V.
C415, 416	20457-473	.047 μf, 10%, 600V.
C51, 52, 308, 317, 318, 319	25462-104	.1 μf, 20%, 400V.
C313	25461-104	.1 μf, 20%, 600V.
C108, 316, 413	25462-224	.22 μf, 20%, 400V.
C305	25455-224	.22 μf, 20%, 200V.
C418	42196	.47 μf, 20%, 600V.
C410A, 410B	41842	110/480 μμf, Trimmer
C1	22422-24	80-60-20-10μf/300V., Elect.
C2	42612	1.6 μf, 150V., Elect.
C3	22422-25	60-40 μf/300V.; 100μf/50V., Elect.
C4, 5	22422-26	150 μf/150V., Elect.
C6	42008	10 μf/50V., Elect.

RESISTORS (ohms)

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
R420	41853	Fusible resistor (No Substitute)
R417	20308-100	10, 10%, 1/2W.
R57	22381-220	22, 10%, 1/2W.
R203, 207	22382-470	47, 5%, 1/2W.
R414	20061-470	47, 20%, 1/2W.
R210	22382-181	180, 5%, 1/2W.
R101	22381-331	330, 10%, 1/2W.
R51, 328	20061-471	470, 20%, 1/2 W.
R424, 425 426	20103-471	470, 20%, 1W.
R106	22381-681	680, 10%, 1/2W.
R202, 204, 205, 208, 211	20061-102	1000, 20%, 1/2W.
R409	22382-112	1100, 5%, 1/2W.
R423	42165-112	1100, 5%, 10W.
R324	22381-122	1200, 10%, 1/2W.
R217	22382-222	2200, 5%, 1/2W.
R201	22381-272	2700, 10%, 1/2W.
R222	41075-302	3000, 5%, 4W.
R218	22382-332	3300, 5%, 1/2W.
R212	22382-392	3900, 5%, 1/2W.
R316	20302-392	3900, 10%, 2W.
R318	22381-472	4700, 10%, 1/2W.
R52	41075-652	6500, 5%, 4W.
R311	22381-682	6800, 10%, 1/2W.
R105	20070-682	6800, 10%, 1W.
R407	20070-822	8200, 10%, 1W.
R325, 412	22382-822	8200, 5%, 1/2W.
R315	20070-103	10K, 10%, 1W.
R422	20061-103	10K, 20%, 1/2W.
R216, 304, 329	22381-123	12K, 10%, 1/2W.
R403	22381-153	15K, 10%, 1/2W.
R102	20070-183	18K, 10%, 1W.
R404, 415, 416	20302-183	18K, 20%, 2W.
R103, 336	22381-223	22K, 10%, 1/2W.
R206, 209	22382-273	27K, 5%, 1/2W.
R314	22383-273	27K, 5%, 1W.
R317	22381-273	27K, 10%, 1/2W.
R213, 215, 305, 308	22381-473	47K, 10%, 1/2W.
R108, 301	20061-473	47K, 20%, 1/2W.
R53, 54, 55, 56, 421	25228-683	68K, 20%, 2W.
R109, 410	22381-823	82K, 10%, 1/2W.
R307, 402, 405	22382-823	82K, 5%, 1/2W.
R331	20061-104	100K, 20%, 1/2W.
R332, 408	22381-124	120K, 10%, 1/2W.
R310	20061-154	150K, 20%, 1/2W.
R313	22382-154	150K, 5%, 1/2W.
R401	22381-154	150K, 10%, 1/2W.
R306	22382-184	180K, 5%, 1/2W.
R107	22381-274	270K, 10%, 1/2W.
R302	22382-334	330K, 5%, 1/2W.
R309	22382-474	470K, 5%, 1/2W.
R319, 323, 333, 413, 419	20061-474	470K, 20%, 1/2W.
R418	22381-474	470K, 10%, 1/2W.
R220	22382-824	820K, 5%, 1/2W.
R111	22382-105	1 meg., 5%, 1/2W.
R406	22381-105	1 meg., 10%, 1/2W.
R320	22382-135	1.3 meg., 5%, 1/2W.
R312	22381-155	1.5 meg., 10%, 1/2W.
R326, 337	20061-225	2.2 meg., 20%, 1/2W.
R112	22382-275	2.7 meg., 5%, 1/2W.
R219, 214	22382-335	3.3 meg., 5%, 1/2W.
R303	22382-685	6.8 meg., 5%, 1/2W.

COILS, CHOKES & TRANSFORMERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
	42504	Deflection Yoke
	22381-561	Resistor, 560 ohm, 10%, 1/2W. (R334, 335)
	40539-4	Capacitor, 120 μμf, 3KV., (C320)
L101, 205	25468-23	Coil, Peaking 120 μh on Dummy (black stripe)
L102	40937	Coil, Quadrature
L201	41849	Coil, Trap (47.25 Mc)
L202	41848	Coil, Trap (39.75 Mc)
L204	25468-22	Coil, Peaking 100 μh on 8200 ohm (green stripe)
L206	25468-29	Coil, Peaking 185 μh on 12K (blue stripe)
L207	25468-30	Coil, Peaking 500 μh on 8200 ohm (2 red stripes)
L208	25468-31	Coil, Peaking 120 μh on 5600 ohm (2 black stripes)
L209	25468-24	Coil, Peaking 200 μh on Dummy (white stripe)
L401	23449	Coil, Horizontal Oscillator
L402	25468-10	Coil, Peaking 93 μh on Dummy (black dot, orange dot)
L403	41887	Coil, Linearity Control (yellow dot, less core)
L404	41884	Coil, Width Control (white dot, less core)
	42157	Iron Core, Width & Linearity Coil
	42148	Spring Retainer, Width & Linearity Coil
L406	23095	Choke, Filament
L405	22561-6	Choke, Filter
T302	41984-1	Choke, Vertical Output
T101	41177	Transformer, Sound I.F.
T102	42144-1	Transformer, Audio Output
T201	42027	Transformer, Converter
T202, 203	42135	Transformer, 1st & 2nd I.F.
T204	42087	Transformer, 3rd I.F.
T205	41879	Transformer, Sound Take-off
T301	41745-1	Transformer, Vertical Oscillator
T401	41852	Transformer, Horizontal Output
T402	41844	Transformer, Filament

MISCELLANEOUS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
R110, 330	22464-64	Control, Volume & Brightness
R221, 322	22464-66	Control, Contrast & Height
R321, 327	22464-67	Control, Vert. Hold & Vert. Lin.
R104	41840-1	Control, Buzz
R411	41840-3	Control, Horizontal Hold
SPK1	42532	Speaker, 8" P.M. 21-550
SPK1	42529	Speaker, 6" P.M. 21-551, 21-553
SPK2	41876	Speaker, 5" P.M. 21-552
SPK1	42534	Speaker, 10" P.M. 21-552
SPK2	42531	Speaker, 4" P.M. 21-553
SR1, 2	42383	Selenium Rectifier (Model 500)
	41766-1	Tuner Assy. UHF
	42167	Tuner Assy. VHF
	42550-1	Focus Unit----PM Magnet
PC-1	24166	Printed Circuit (Vert. Int.)
	42158	Fuse .25 A Bussman MDV 1/4A, 250V.

SPECIFICATIONS

Power Supply	125 watts, 105-120 volts
Audio Power Rating	1.4 watts maximum 1.1 watts undistorted
Antenna Input Impedance	300 ohms
Video Response	3.3 MC
Focus	Electrostatic
Deflection	70 Magnetic
Picture Carrier	45.75 MC
Sound Carrier	41.25 MC

WARNING

One side of the AC line is connected directly to the metal chassis. During servicing and alignment an AC isolation transformer (150 watts or more) must be used to decrease the shock hazard and to prevent damage to the test equipment, receiver or both. The control mounting panel and the metal cabinet (Model 21-555) are isolated from the chassis by a 220K resistor and an .01 µf capacitor. A slight "shock" may be felt between earth ground an any of the screws at the rear of the cabinet. This "shock" is not dangerous as the current is limited by the isolation components. Care must be taken to prevent anything from shorting the control mounting panel or the cabinet to the chassis.

HEIGHT AND VERTICAL LINEARITY

These controls (R312 and R318) are a accessible only when the rear cover is removed. They should be adjusted simultaneously for proper height consistant with good vertical linearity. The picture should extend approximately 1/4" beyond the edges of the mask.

BUZZ CONTROL

This control (R103) is provided to adjust the AM rejection characteristics of the sound system (sync buzz, noise, or hiss). Since this control has been adjusted for an optimum setting at the factory, do not attempt to alter this adjustment unless sync buzz, noise, or hiss is present. Caution: Turn this control slowly from the present preset position---usually not more than 30 degrees rotation in either direction will be necessary.

YOKE ADJUSTMENT

The picture tube cone should fit snugly into the large front hole rimmed in rubber in the Yoke Mount Frame.

The Yoke Radial Adjustment (top wingscrew) allows the yoke to be rotated right or left--rotating the picture right or left.

The Yoke Vertical Adjustment (2 hex head screws each side) allows centering of the yoke coaxially with the tube neck. Proper positioning of the yoke is important so that picture corner-cutting and side -shadows can be readily removed by the centering control.

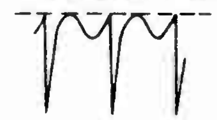
HORIZONTAL OSCILLATOR ADJUSTMENT

1. Adjust horizontal hold control (R404) maximum clockwise and connect a jumper from terminals C to D of Horizontal Oscillator transformer (T401).

2. Adjust top of T401 to get picture in Horizontal sync.

3. Remove jumper from terminals C to D and connect oscilloscope (lead isolated with 10K ohms) to terminal C of T401.

4. With picture in sync (it may be necessary to readjust top of T401) adjust bottom of T401 for curve with equal peaks as shown below.



(Make all adjustments at 117 volts AC line voltage)

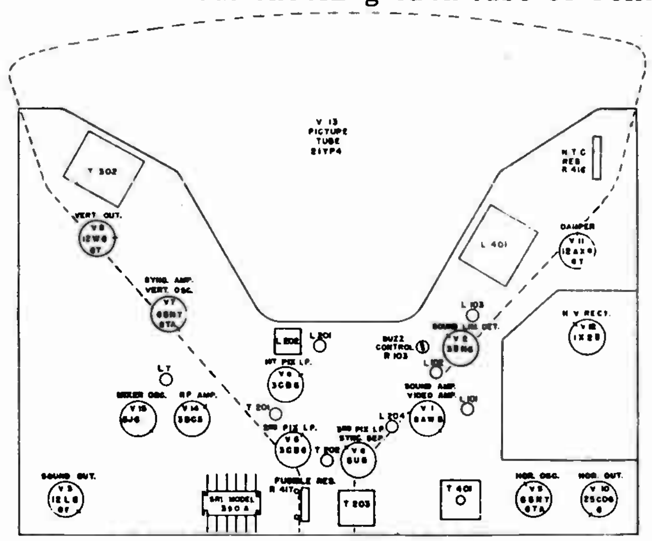
5. Remove oscilloscope. Readjust top of T401 so picture will break horizontal sync with 2 diagonal bars when hold control is turned to max. clockwise position.

TUBE FAULTS

It is possible to quickly locate a tube with a burned out filament by using a procedure such as this.

1. Remove the back and connect an ohm meter from one side of the fusing resistor to the chassis ground. An open circuit indicates a burned out filament.
2. Remove V1 (6AW8) and check continuity from pin 4 (counterclockwise from top of chassis) to fusing resistor. An open circuit here indicates an open filament V2, V7, V8, V9, V10, V11 or NTC resistor R418.
3. V3 can then be removed to find wheather the open filament is in the string consisting of V9, V10, V11 or NTC resistor R418 or in the string consisting of V3, V8, V7 or V2.

Thus the tube with an open filament can be singled out using a system such as this with out checking each tube or removing the complete chassis.



TUBE LAYOUT

DISASSEMBLY INSTRUCTIONS

1. Remove back which includes the AC line cord. Note: two screws must be removed from the bottom of each rear corner to release the back on model 21-555.
2. Unsolder red and green-white yoke leads from the terminal strip on the high voltage housing. Unsolder green and yellow vertical output transformer leads from the terminal strip on the left side of the yoke housing.

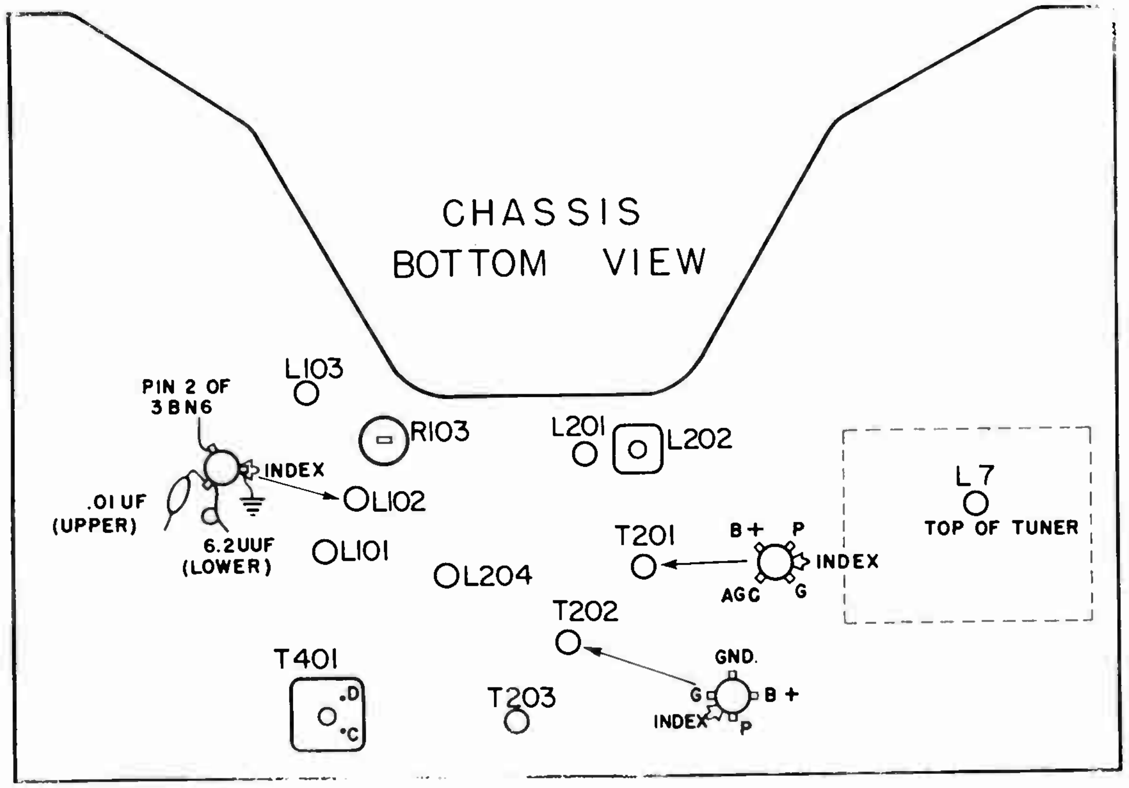
3. Remove screw holding ground strap from high voltage housing and unsolder speaker leads.

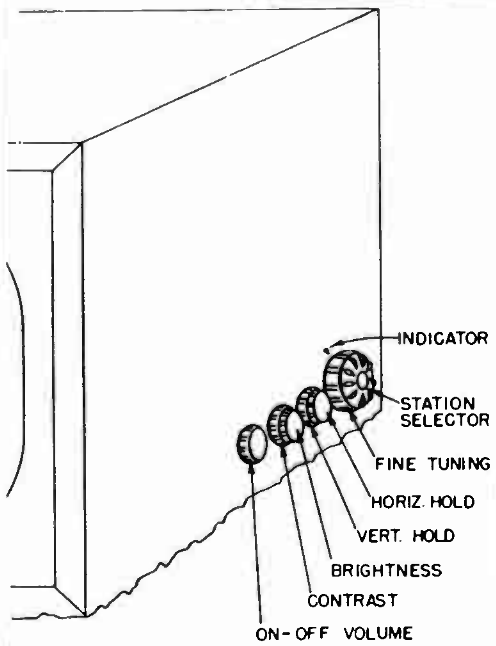
4. Pull off knobs. Loosen the three screws that hold the slotted tuner mounting bracket to the chassis and slide the tuner assembly to the right. This allows the shaft to clear the cabinet when the chassis is pulled to the rear.

5. Remove the five copper colored screws from the bottom. This allows the chassis to be removed.

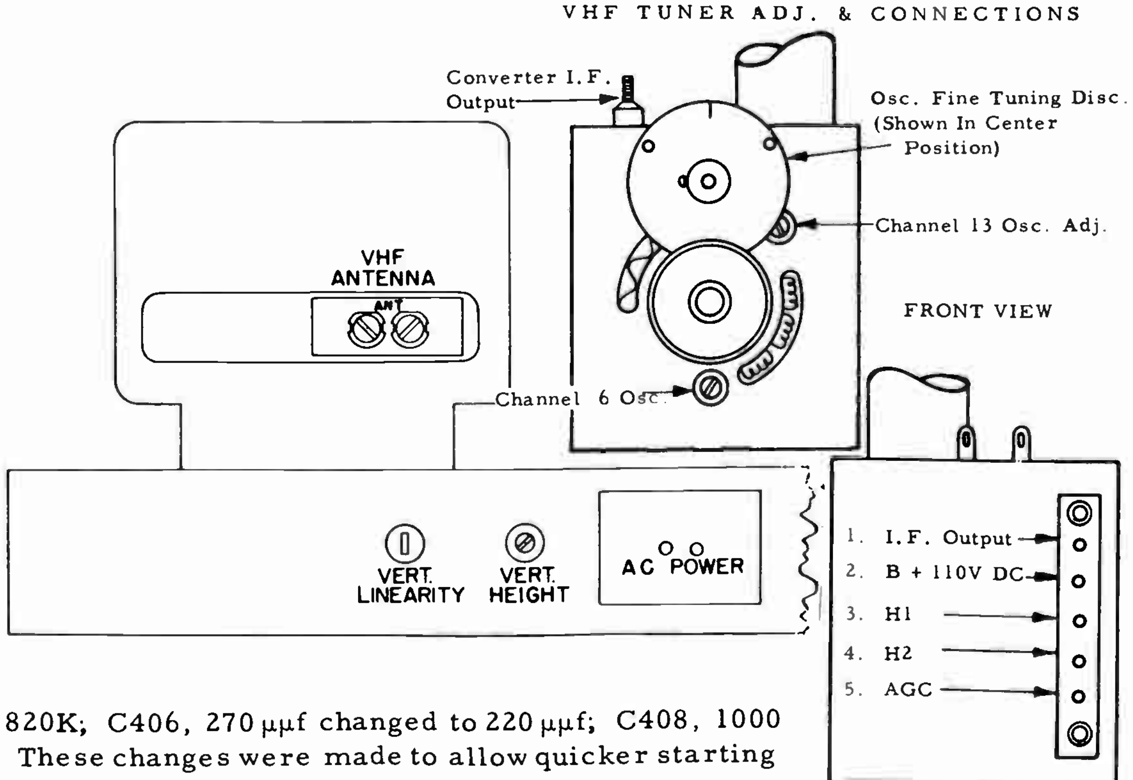
6. The cover on the high voltage housing may be removed by taking out two screws, sliding the cover to the rear and pulling the rear edge of the cover to the left. The high voltage housing may be removed by taking out four screws holding it to the chassis.

7. The second detector (1N64 part of T203) may be uncovered by removing two screws and lifting the transformer housing from the top of the chassis.





VHF TUNER ADJ. & CONNECTIONS



REAR VIEW

PRODUCTION CHANGES

1. R401, 1 meg changed to 820K; C406, 270 μμf changed to 220 μμf; C408, 1000 μμf changed to 1200 μμf. These changes were made to allow quicker starting of the horizontal oscillator.
2. C417, 4700 μμf; C418, 22 μμf, 3KV and L403, 10 μh added in damper circuit to improve the sync stability.
3. R330, 470K added above HEIGHT CONTROL.

NOTE: On early schematics horizontal deflection yoke connections were incorrectly numbered.

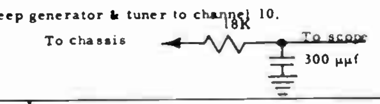
STAGGER-TUNED I.F. ALIGNMENT PROCEDURE

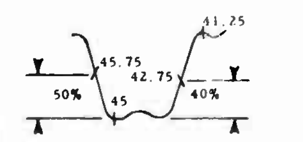
1. Set tuner to channel 9-10 or 11.
2. Connect variable bias supply to junction R211 & C207. Adjust bias for -2 volts.
3. Connect VTVM across R212. Isolate VTVM with 18K resistor. Use -5V scale.
4. Connect RF signal generator to mixer tube shield (V15 5J6). Lift mixer tube shield until it is just ungrounded.
5. Good R.F. grounding between TV receiver on test and test equipment is necessary. A metal surface bench top should be used to insure proper RF grounding. Use isolation transformer between chassis and AC line.

STEP	FREQUENCY	ADJUSTMENT	INSTRUCTIONS
1.	41.25 Mc	L201 for min.	
2.	42.9 Mc	Tuner coil for max.	L7 (top of tuner)
3.	45 Mc	L202 for max.	Recheck steps 2 and 3
4.	42.9 Mc	T201 for max.	
5.	45.3 Mc	T202 for max.	
6.	44 Mc	T203 for max.	
			Recheck steps 4, 5 and 6

OVERALL SWEEP CHECK

1. Connect RF signal generator to chassis near V4 for marker generator. Push shield down on mixer tube.
2. Connect oscilloscope across R212. Isolate oscilloscope lead with 300 μμf to ground and 18K resistor in series.
3. Increase bias to -2.5 volts
4. Connect sweep generator to antenna terminals. Adjust sweep generator & tuner to channel 10.





ADJUSTMENT	INSTRUCTIONS
T202	T202 positions 45.75 marker
T201	T201 positions 42.75
T203	T203 adjusts tilt of curve

Note: If desired curve cannot be obtained, slight adjustment of tuner coil and L202 may be necessary.

SOUND AND 4.5 MC TRAP ALIGNMENT

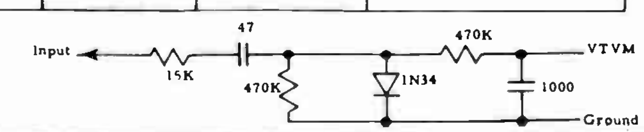
1. Tune in available TV station and reduce signal into set until hiss is heard with sound. This can be done by inserting an attenuator in the antenna lead-in or by removing antenna lead-in from the set and stray feeding in signal by placing lead-in in close proximity of the set.

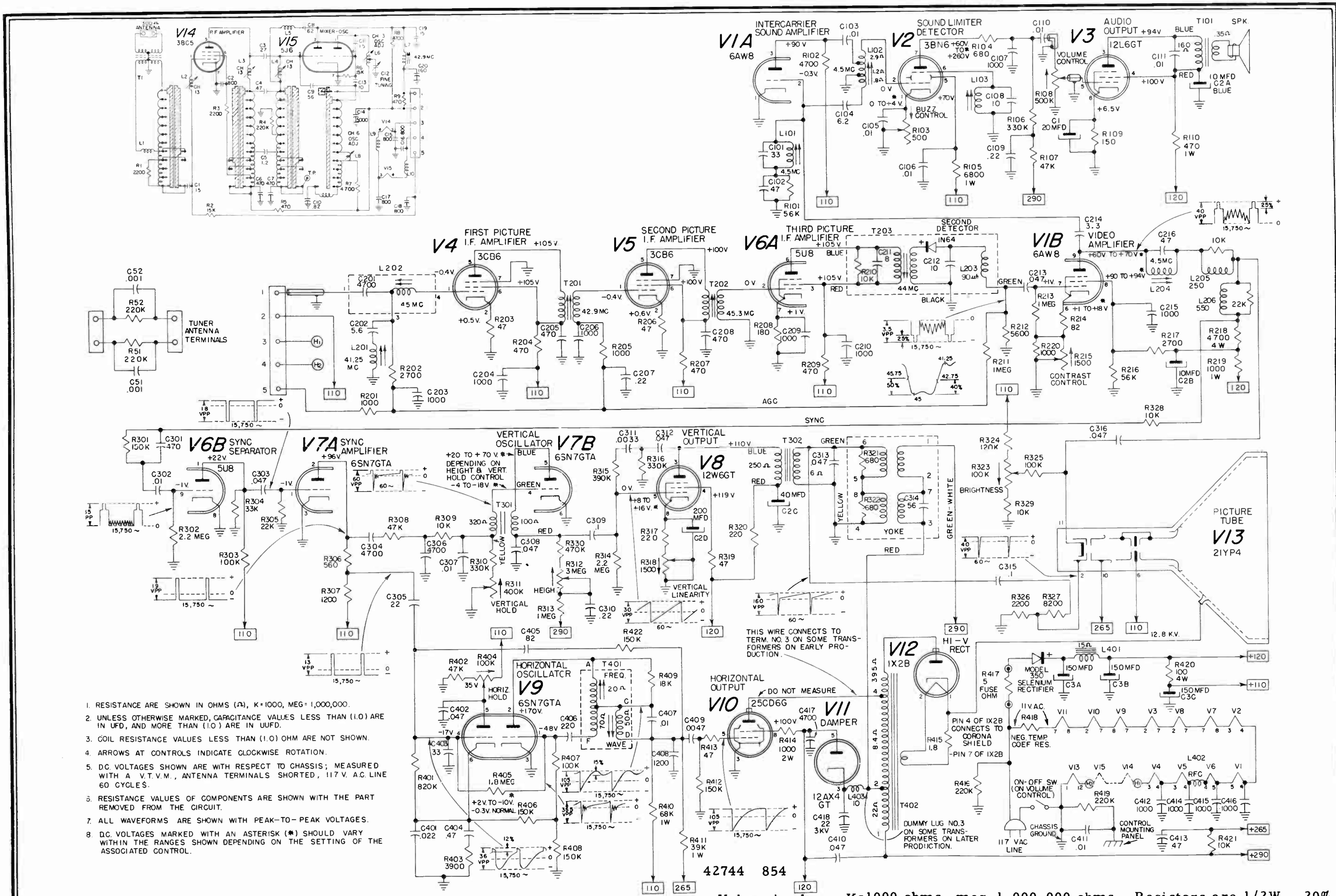
2. Set buzz control in the middle of its range. Adjust take off coil (top L101), L102, Quadrature coil (L103) and buzz control for cleanest sound and minimum buzz. If any adjustment cause hiss to disappear reduce signal into set until hiss reappears and continue with adjustments.

Note: If difficulty is encountered either in reducing signal sufficiently or adjustments being very broad. The following proceedure may be used.

STEP	EQUIPMENT	CONNECTION	FREQUENCY	ADJUSTMENT	INSTRUCTIONS
1.	Det. jig *	Input of jig to pin 2 of V2			Keep lead between 15K resistor and pin 2 as short as possible
2.	VTVM	Output of jig	Tune in available channel	L101 and L102 for max.	
3.		Remove jig	Same	Quadrature coil (L103) for max. sound	Set buzz control in middle of its range before adjusting L102
4.			Same	Buzz control for minimum buzz R103	Correct adjustment of buzz control is approx, middle of its range
5.	Det jig *	Junction C316 and R325			Connect VTVM to output of jig
6.	RF signal generator	Pin 7 (V1)	4.5 Mc	Tune 4.5 Mc trap L204 for min.	

* Detector jig





1. RESISTANCE ARE SHOWN IN OHMS (Ω), K=1000, MEG=1,000,000.
2. UNLESS OTHERWISE MARKED, CAPACITANCE VALUES LESS THAN (1.0) ARE IN UFD, AND MORE THAN (1.0) ARE IN UUFD.
3. COIL RESISTANCE VALUES LESS THAN (1.0) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5. D.C. VOLTAGES SHOWN ARE WITH RESPECT TO CHASSIS; MEASURED WITH A V.T.V.M., ANTENNA TERMINALS SHORTED, 117 V. A.C. LINE 60 CYCLES.
6. RESISTANCE VALUES OF COMPONENTS ARE SHOWN WITH THE PART REMOVED FROM THE CIRCUIT.
7. ALL WAVEFORMS ARE SHOWN WITH PEAK-TO-PEAK VOLTAGES.
8. D.C. VOLTAGES MARKED WITH AN ASTERISK (*) SHOULD VARY WITHIN THE RANGES SHOWN DEPENDING ON THE SETTING OF THE ASSOCIATED CONTROL.

Values of capacitors of 1 or less are in μf more than 1 in μμf unless otherwise indicated.

Values in ohms, K=1000 ohms, meg=1,000,000 ohms. Resistors are 1/2W., 20% unless otherwise indicated.

MODELS 21-554, -555, -557, Ch. "E" 383-VHF

PARTS LIST

CAPACITORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
C214	40355-25	3.3 Disc.
C202	40355-27	5.6 Disc.
C104	40355-29	6.2 Disc., (Part of L102)
C211	20205-29	8 Ceramic (Part of T203)
C108	40355-12	10 Disc.
C212	20205-30	10 Ceramic (Part of T203)
C305	40355-15	22 Disc., 5%
C101, 403	40355-22	33 Disc., 10%
C102, 216	40355-23	47 Disc., 10%
C314	24123-560	56 Disc., 10%, 2KV
C405		82 Disc., 20%
C406	42813-5	220 Silver Mica., 10%
C205, 208	41052-2	470 Disc., 20%
C301		470 Disc., 20%
C51, 52	41135-102	.001 Disc., 1500V.
C107		.001 Disc., 20%
C203, 204, 206, 209, 210, 215, 412, 414, 415, 416	23078	.001 Disc.
C408	42813-7	.0012 Silver Mica., 10%
C311		.0033 P.T., 600V., 20%
C304, 306, 409		.0047 Disc., 20%
C201, 417	40053-472	.0047 Disc., (Part of L202)
C103	40053-103	.01 Disc., (Part of L102)
C105, 106, 110	40053-103	.01 Disc.
C111	42227-2	.01 Disc., 1000V.
C302		.01 P.T., 600V., 20%
C307, 407		.01 P.T., 600V., 10%
C418	40539-5	22 µµf, 20%, 3KV
C411	41135-103	.01 Disc., 1500V.
C401		.022 P.T., 200V., 20%
C213, 303, 313, 316, 402		.047 P.T., 200V., 20%
C308, 312, 410		.047, 600V., 20%
C309		.1, 600V, 20%
C315		.1 P.T., 20%, 200V.
C109, 310		.22, 400V., 20%
C207		.22 P.T., 200V., 20%
C404		.47 P.T., 200V., 20%
C413		.47 P.T., 400V., 20%
C1	42724	20, 25V., Elect., (µf)
C2A, B, C, D,	42723	10-10-40/150V.; 200/35V., Elect. (µf)
C3A, B, C,	42722	150, 150V., Elect. (µt)

RESISTORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
R415	20308-18	1.8, 1/2W., 10%
R203, 206		47, 1/2W., 5%
R319, 413		47
R214		82, 1/2W., 10%
R420	41075-101	100, 4W., 10%
R109		150
R208		180, 1/2W., 5%
R317, 320		220
R110		470, 1W., 20%
R204, 207, 209		470
R306		560, 1/2W., 10%
R104		680, 1/2W., 10%
R321, 322		680
R201, 205, 220		1000
R219		1000, 1W., 20%
R414		1000, 2W., 10%
R307		1200, 1/2W., 10%
R326		2200, 1/2W., 10%
R202, 217		2700, 1/2W., 10%
R403		3900, 1/2W., 10%
R102		4700, 1/2W., 10%
R218	41075-472	4700, 4W., 5%
R212		5600, 1/2W., 5%
R105		6800, 1W., 10%
R327		8200, 1/2W., 10%
R210, 329, 328, 421		10K, 1/2W., 10%
R309		10K
R409		18K, 1/2W., 10%
R305		22K, 1/2W., 10%
R304		33K, 1/2W., 10%
R411		39K, 1W., 10%
R107, 308		47K
R402		47K, 1/2W., 10%
R101		56K, 1/2W., 10%
R216		56K, 1/2W., 10%
R410		68K, 1W., 10%
R303		100K, 1/2W., 10%
R325		100K
R407		100K, 1/2W., 5%
R324		120K, 1/2W., 10%
R301		150K, 1/2W, 10%
R406, 408, 422		150K, 1/2W., 5%
R412		150K
R51, 52, 416, 419		220K
R106, 310, 316		330K, 1/2W., 10%
R315		390K, 1/2W., 10%
R211, 313		1 meg.
R213		1 meg., 1/2W., 10%
R401		820K, 1/2W., 5%
R405		1.8 meg., 1/2W., 5%
R302, 314		2.2 meg.
R417	41853	Fusible Resistor (no substitute)
R418	42711	NTC Resistor (no substitute)
R330		470K

COILS, CHOKES & TRANSFORMERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
	42720	Deflection Yoke
		Resistor (R321, 322) 680 ohm, 1/2W., 20%
	24123-560	Capacitor (C313) Disc., 56 µµf, 10%, 2KV
L101	42754-1	Coil, Sound Take-Off (Includes C101, C102, R101)
L102	42750-1	Coil, Sound I.F. (Includes C103, C104)
L103	42758-1	Coil, Quadrature
L201	42757-1	Coil, Trap 41.25 Mc
L202	42753-1	Coil, Converter (Includes C201)
L203	42762-2	Coil, Peaking 90 µh on 1 meg. (part of T203) (red dot)
L204	42755-1	Coil, Trap 4.5 Mc (Includes C216 & L205)
L205	42762-1	Coil, Peaking 250 µh on 10K (brown dot)
L206	42762-3	Coil, Peaking 550 µh on 22K (orange dot)
L401	42760-1	Choke, Filter
L402	42761-1	Choke, Filament
L403	42762-4	Coil, Peaking 10 µh (yellow dot)
T101	42144-2	Transformer, Audio Output
T201, 202	42751-2	Transformer, 1st. I.F., 2nd I.F.
T203	42752-1	Transformer, 3rd I.F.(Includes R210, C212, C211, L203), 2nd Det.
T301	42766-1	Transformer, Vertical Oscillator
T302	42756-1	Transformer, Vertical Output
T401	42759-1	Transformer, Horizontal Oscillator
T402	42721	Transformer, Horizontal Output

MISCELLANEOUS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
	41851	Fusing resistor Clip
	42033	Chassis Mtg., Ins.
	24397-2	Plastic H. V., Cable Clamp
	42697	Interlock Plug
	42729	High Voltage Socket (1X2B)
	24911-11	Socket, Kinescope Assy.
	24116-12	Anode Connector & Lead
R108	22464-89	Control, Volume & Switch 500K
R215, 323	22464-90	Control, Contrast & Brightness 1500, 100K, ohm
R311, 402	22464-91	Control, Vertical & Horizontal Hold 400K, 100K
R103	42678	Control, Buzz 500 ohm
R318	42666	Control, Vert. Linearity 1500 ohm
R312	41840-4	Control, Height 3 meg.
	42677	Tuner Unit VHF

TM21E
TM21EU

KM21E
KM21EU

TB21E
TB21EU

KMT21E
KMT21EU

CHASSIS SPECIFICATIONS

POWER REQUIREMENTS
117 volts, 60 cycles AC

POWER CONSUMPTION
250 watts

ANTENNA INPUT IMPEDANCE
300 ohms—balanced

FINE TUNING
2-4 MC on all Channels

AUDIO POWER OUTPUT
2.8 watts

BAND WIDTH
Video Amplifier 3.8 MC, within 3 db
IF Amplifiers 4 MC, within 6 db
Antenna Input to Picture Tube 3.5 MC at 6 db
Ratio detector, peak-to-peak—200 KC

IF FREQUENCIES
Picture Carrier 45.75 MC
Sound Carrier 41.25 MC

DEFLECTION
Horizontal and Vertical Magnetic

FOCUS
Magnetic , PM

SCANNING

Interlaced	525 lines
Horizontal Frequency	15,750 cps
Vertical Frequency	60 cps
Frame Frequency	30 cps

TUBE COMPLEMENT T14-15, T14-16 BENDIX TELEVISION CHASSIS

Symbol No.	*Tube Type*	*Function*
V-1	6BZ7	RF Amplifier
V-2	6U8	Oscillator and Mixer
V-3	6BA6	First IF
V-4	6CB6	Second IF
V-5	6CB6	Third IF
V-6	6CB6	Fourth IF
V-7	6AU6	4.5 MC Amplifier
V-8	6AU6	Ratio Detector Driver
V-9	6AL5	Ratio Detector
V-10	6AU6	Audio Amplifier
V-11	6W6GT	Audio Output
V-12	6AU6	Keyed A.G.C. Amplifier
V-13	6AH6	Video Amplifier
V-15	6CS6	Sync Limiter and Noise Gate
V-16	21ZP4B	Picture Tube
V-17	5U4G	Rectifier
V-18	6SN7GT	Sync Clipper and Vertical Oscillator
V-19	6W6GT	Vertical Output
V-20	6AL5	Phase Detector
V-21	6SN7GT	Horizontal Oscillator
V-22	6CU6	Horizontal Output
V-23	6AX4GT	Horizontal Damper
V-24	1B3GT	High Voltage Rectifier
*V-25	6T4	UHF Oscillator

* Used on T14-16 only.

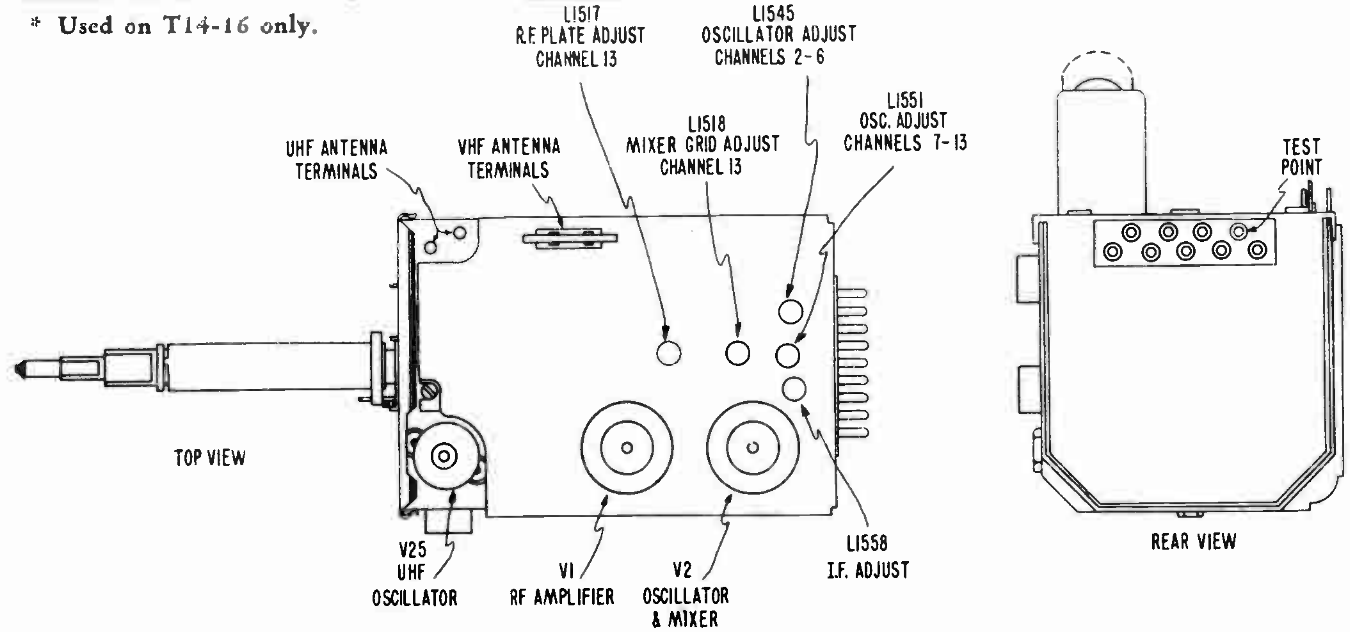


Figure 1—UHF-VHF Long Distance Tuner Sarkes Tarzian UV13.

ALIGNMENT PROCEDURE

CAUTION

Always determine by suitable tests, the causes of unsatisfactory operation before attempting to align portions of the receiver. Necessity for realignment will, in all cases, be rare.

Note

Before attempting any alignment or adjustment procedures, always allow at least a ten minute warm-up period.

ALIGNMENT OF THE RF AND MIXER STAGES

1. Connect an RF sweep generator with at least a 10 MC sweep width to the antenna terminals through the pad shown in figure 2.

2. Remove the keyed AGC Amplifier tube V12. (This is necessary in order to eliminate AGC action which would interfere with RF alignment.)

3. Connect the positive terminal of a 3-volt dry cell supply to chassis ground and connect the negative terminal of the dry cell to the junction of resistors R11 and R9.

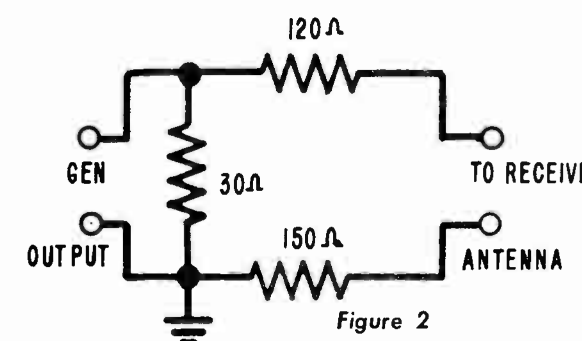


Figure 2

4. Attach the high side of the vertical input of an oscilloscope through a 10,000-ohm resistor to the test point located on the tuner. *(See figure 1, Tuner rear view.)* In order to synchronize the sweep of the oscilloscope with the RF sweep, connect the horizontal amplifier terminals of the oscilloscope to the terminals on the RF sweep generator labeled "oscillator sweep voltage".

5. Turn the station selector to channel 12 and adjust the sweep generator until it sweeps from 202 MC to 212 MC. (If the sweep generator does not supply marker signals at picture and sound carrier frequencies, an external source, such as a CW signal generator should be used to supply them. For method of marker injection, refer to instructions supplied by the manufacturer of the sweep generator being used.)

6. Adjust L1517 and L1518 located on tuner *(figure 1)* until the response curve is similar to that shown in figure 3. Check all other channels, readjusting L1517 and L1518 as required, to obtain optimum response on all twelve channels.

RF OSCILLATOR ALIGNMENT

1. Remove the Keyed AGC Amplifier Tube V12 from its socket and connect the negative terminal of a 3-volt dry cell bias supply to the RF and IF AGC test points. RF test point at junction of R11 and R9. IF test point at junction of R56 and R57. (This can best be accomplished by tying the two points together.)

2. Apply a CW signal to the antenna terminals through the pad shown in figure 2.

3. Connect the DC probe of a VTVM to V13, pin 1.

4. Turn the fine tuning control to approximately the center of its range and make the following adjustments:

a. LOW BAND ALIGNMENT

(1) Turn channel selector to channel No. 6.

(2) Tune signal generator to the sound carrier frequency of channel 6—87.75 MC.

(3) Adjust the low band oscillator slug L1545 *(figure 1)* until a sharp dip in the voltage on the VTVM is reached.

b. HIGH BAND ALIGNMENT

(1) Turn channel selector to channel No. 13.

(2) Tune signal generator to the sound carrier frequency of channel 13—215.75 MC.

(3) Adjust the high band oscillator slug L1551 *(figure 1)* until a sharp dip in the voltage reading on the VTVM is reached.

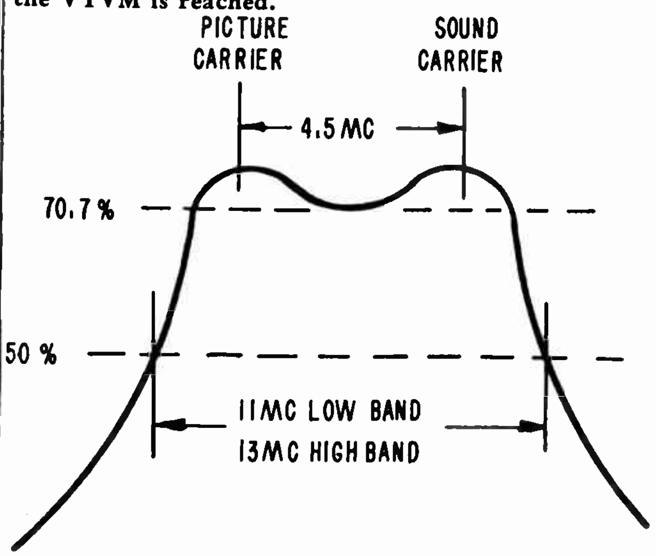


Figure 3

VISUAL CHECK OF IF ALIGNMENT

1. Lift the shield of the oscillator mixer tube V2 until it becomes ungrounded. Connect the high side of a sweep generator to the ungrounded tube shield and the ground lead to chassis ground. Connect a lead from the sweep synchronizing terminal on the sweep generator to the external sweep terminal on the oscilloscope.

2. Connect high side of oscilloscope to pin 7 of V13 video amplifier tube and ground lead to chassis ground. (Set contrast control at minimum.)

3. Remove the keyed AGC amplifier tube V12.

4. Connect the negative terminal of a 3-volt dry cell to the IF AGC test lead and the positive terminal to chassis ground.

5. Adjust sweep generator to sweep from 40 to 50 mc.

6. Connect a vacuum tube voltmeter between pin 1 of V13 and ground and adjust the sweep generator output until a reading of —2 volts is obtained.

7. Adjust the oscilloscope until the IF response curve is centered.

8. Place a lead from an AM signal generator near the IF strip and adjust it so that frequencies from 40 to 50 mc can be obtained.

9. Observe the response curve and the position of the markers *(see nominal response curve figure 4)*. A slight deviation from this response curve is permissible; however, complete realignment of the IF will be necessary if a great deviation is noted. Some improvement in the shape of the response curve may be accomplished by slightly readjusting L2 on the main chassis and L1558 on the tuner.

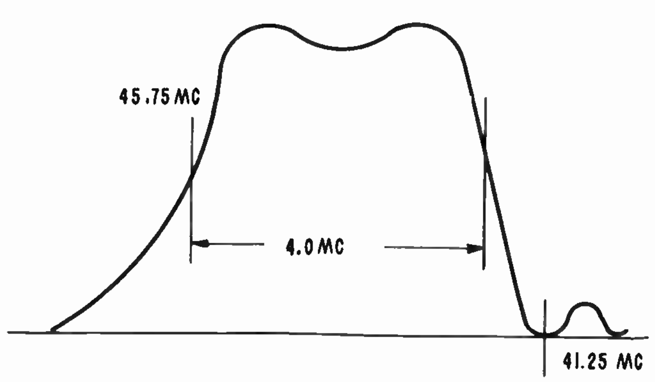


Figure 4

NOISE GATE ADJUSTMENT

NOTE: The noise gate control is adjusted at the factory to give optimum performance under varied conditions, therefore, only upon rare occasions would any adjustment be necessary.

If the receiver is to be operated in an extremely weak signal area where a high noise level is encountered, or this control becomes maladjusted by one means or another it can be satisfactorily SET by the following procedure:

Select and properly tune in the strongest station in the area.

Turn the contrast control to its maximum position (full clockwise).

With the noise gate control set at minimum, slowly turn it in the clockwise direction until a slight shifting of the picture in the horizontal plane is observed, then back off (counter-clockwise) ⅛ of a turn.

CAUTION: If this control is set too far in the clockwise direction poor sync operation may be obtained.

FOCALIZER ADJUSTMENT

Turn the plastic shaft, which extends through the back of the set near the picture tube base, for sharpest focus.

Move the arm which projects from the top of the focalizer assembly for proper picture centering. This arm can be adjusted in both the vertical and horizontal directions.

CAUTION: The ion trap magnet location should be re-checked upon completion of the above adjustments.

F. ALIGNMENT

Remove the AGC Amplifier (V12) from its socket. Connect the negative terminal of a 3 volt dry cell supply to the I.F. AGC test point and the positive terminal to chassis ground. Raise the tube shield of V2 so that it is not grounded and apply the signal to it.

Generator Freq.	VTVM Connections	Adjustment	Remarks
45 MC	To Test Point (C) and Ground	T3-T2-L1558*	Adjust for Max.
42 MC	To Test Point (C) and Ground	L5-T1-L2*	Adjust for Max.
41.25 MC	To Test Point (C) and Ground	L1-L3	Adjust for Min. with output of Signal Gen. at Max.
39.75 MC	To Test Point (C) and Ground	L4	Adjust for Min. with output of Signal Gen. at Max.

NOTE: It will be necessary to repeat the steps outlined above for optimum performance of the IF system.

* The designated frequencies for L1558 and L2 are to be used for preliminary alignment only. Since these two coils comprise a band pass circuit, final alignment should be made with a sweep generator.

SOUND ALIGNMENT

Connect the Negative Terminal of a 9 Volt dry cell supply to the I.F. AGC test point and the Positive Terminal to Chassis ground.

Signal Generator Coupling	Frequency	Connect	Adjust	Remarks
High side to Pin 1 of V13 (Video Amp)	4.5 MC	DC probe of VTVM to "Limiter grid test" Common lead to chassis.	L9 T10 (top & bottom)	Adjust for Max reading keeping output of Generator high enough to produce about 4V at "Lim. Grid Test."
SAME	4.5 MC	Parallel R38 with two 100K resistors which are within 1% of each other. DC probe of VTVM to "PT. A." Common lead to Chassis.	L11	Adjust for Max reading.
SAME	4.5 MC	DC probe of VTVM to "PT. B." Common lead to "PT. A."	L13	Adjust for Zero reading at cross over.

PRODUCTION CHANGE T14-15 & T14-16

Several reports from our factory field representatives indicates the vertical hold adjustment on the T14-15 and T14-16 chassis is rather critical in fringe operation. Improved "lock-in" may be had by slight reduction of the vertical height and linearity control settings.

The following production change has been incorporated at the factory and is suitable for field use where cases warrant:

1. The blue lead from R100, 2200 ohms, in the vertical plate return circuit, that formerly ran to the fuse, is now pulled down through the chassis and runs to the junction of R74A and R74B, the power supply filter resistors.

2. R73, the 47K plate resistor in the sync limiter and noise gate 6CS6 tube, V15, is disconnected from the + 150 volt supply and connected instead to Pin 6 of V12, the 6AU6 keyed A.G.C. amplifier.

SYMPTOM	CHASSIS TYPE	DEFECT	SUGGESTED REMEDY
Raster bouncing vertically at 60 cycle rate	T14	Open C42B	Replace electrolytic can C42A,B and C.
	T17	Open C31B	Replace electrolytic can C31A,B and C.
No vertical sync & critical horizontal sync.	T14	R85 burned open. Shorted 6SN7	Replace 6SN7 and R85
	T17	R69 burned open. Shorted 6SN7	Replace 6SN7 and R69

The charts attached have been compiled over the past year from information relayed to Bendix through our Field Service Engineers' Weekly Field Reports. The actual field defects, together with corrective measures taken, are listed.

These charts are not intended to imply that the defect associated with a particular symptom is necessarily the only possible defect causing an identical symptom. Rather, it should serve as a guide to indicate most probable cause, based on actuality.

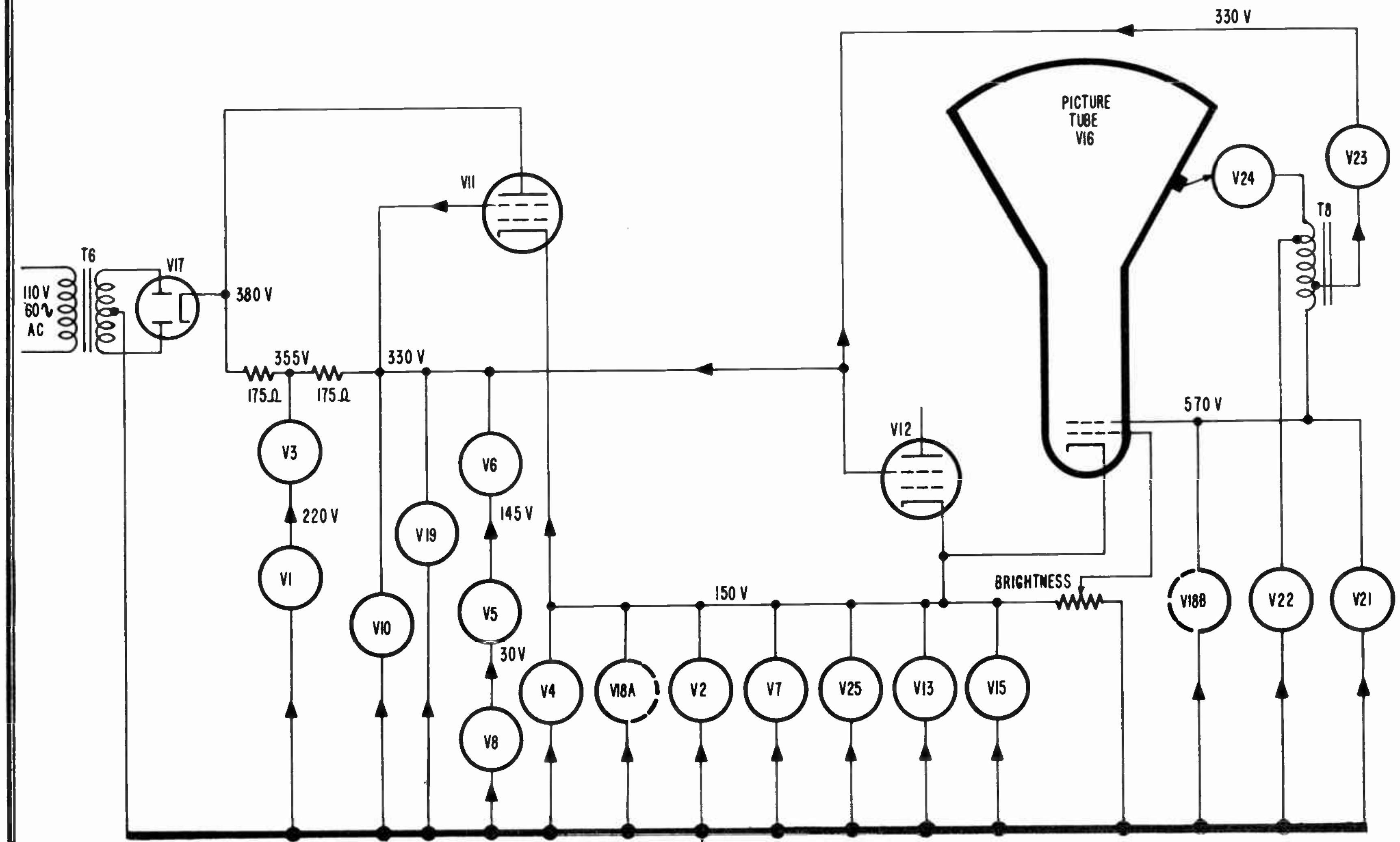
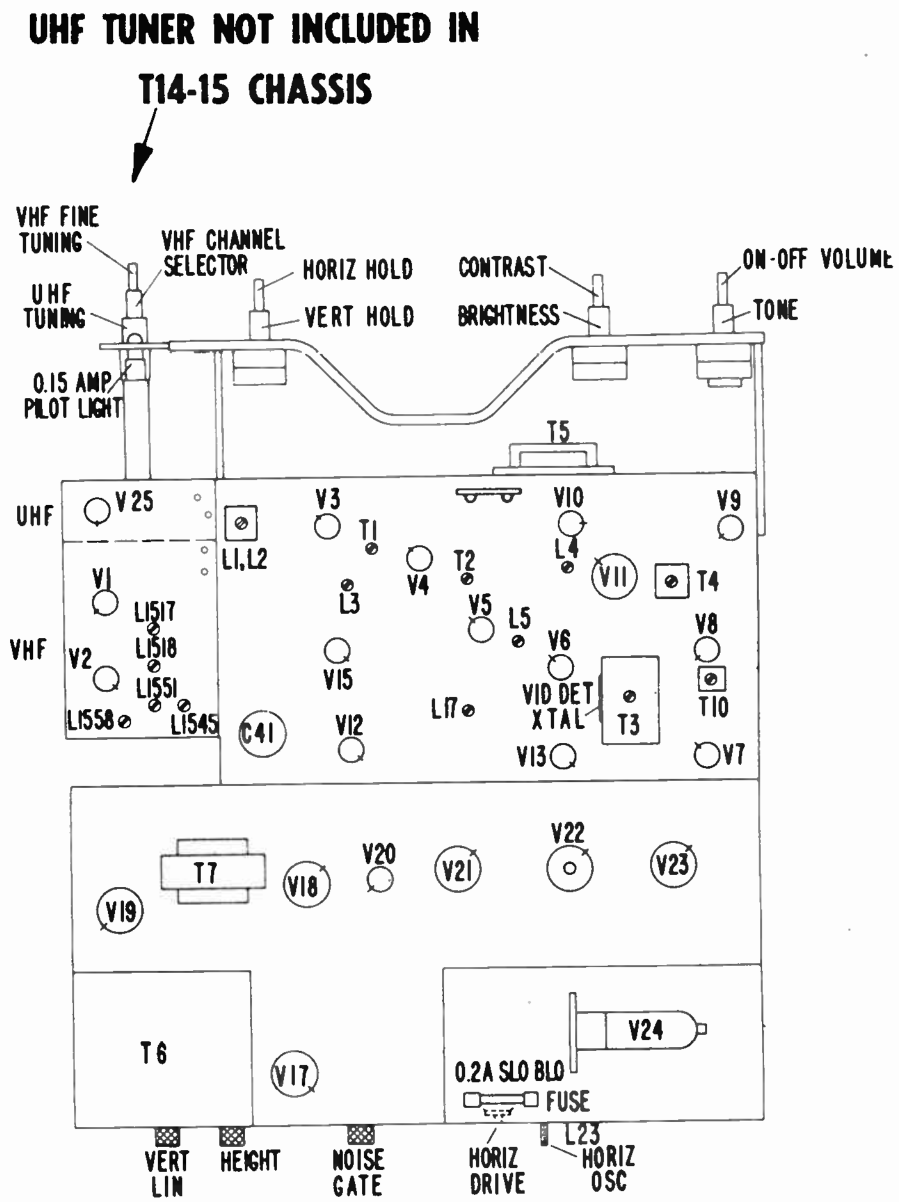


Figure 5—Voltage Distribution Chart T14-16



TOP VIEW

(Arrows Indicate Tube Keyways)

SYMPTOM	CHASSIS TYPE	DEFECT	SUGGESTED REMEDY
Intermittent and erratic horizontal oscillation.	T14	R117 changed value	Replace R117.
	T17	R105 changed value	Replace R105.
Low Sensitivity all channels, Standard Coil Tuner	T14	Check V2 for short & check value of R810	Replace V2 and/or R810 if necessary
	T17	Same	Same
Intermittent Audio	T14	Defective solder connection in ratio detector can.	Resolder all connections in can
	T17	Same	Same
Loss of picture and sound	T14	AGC line measures positive instead of negative due to shorted C86	Replace C86
	T17	Same trouble due to shorted C72	Replace C72
Loss of picture and sound.	T14	AGC line measures excessive negative voltage, R58 greatly increased in value.	Replace R58
	T17	Same trouble due to R42 greatly increased in value	Replace R42
Excessive vertical linearity	T14	Shorted C61 or R92 changed value	Replace C61 and/or R92
	T17	Shorted C47 or R80 changed value	Replace C47 and/or R80
Excessive loss of interlace. Scanning lines pairing.	T14	Leaky C57	Replace C57
	T17	Leaky C43	Replace C43
Audible sizzling or frying sound	T14 T17	Corona spray from 2nd anode of picture tube	Thoroughly clean surrounding area with lacquer thinner.
Picture shifted to left	T14	Faulty C93, .47 Mfd condenser	Replace C93
	T17	Faulty C-82 .47 Mfd	Replace C82
Insufficient height	T14	R99, 680K 1/2W increased in value	Replace R99 with 470K 1/2W
	T17	R87, 680K 1/2W increased in value	Replace R87 with 470K 1/2W
Set looses AGC when switching from weak to strong signal	T14 T17	IN60 crystal, video detector defective	Replace IN60 crystal
Short life 6BQ6 with possibly excess width	T14	C85, 10 Mfd 50V 6BQ6 cathode bypass shorted	Replace C85
	T17	C71, 10 Mfd 50V 6BQ6 cathode bypass shorted	Replace C71
Weak and erratic sync	T14	C50 2 Mfd 50V open	Replace C50
Weak and erratic horizontal sync	T14	Shorted turns in L23 horizontal oscillator coil or R83 changes value	Replace L23 or R83
	T17	Same trouble in L18 or R67 changes value	Replace L18 or R67
Erratic and distorted vertical sweep	T14	Leaky C59, .047 Mfd condenser	Replace C59
	T17	Leaky C45, .047 Mfd condenser	Replace C45
Vertical roll after warm up period	T14	R100, 2.2K, 2W resistor burnt or changed in value	Replace R100 with 2.2K, 4 watt.
	T17	Same trouble R88, 2.2K, 2W	Replace R88 with 2.2K, 4 watt
Set blows fuse when installed in cabinet	T14 T17	Chassis hold down bolt cutting B+ lead or leads	Tape lead & dress away from chassis basket lance
Poor brightness & blooming when brightness control is advanced.	T14	C67 shorted	Replace C67
	T17	C57 shorted	Replace C57
Raster pulls in considerably on both sides at max. brightness setting of brightness control	T14	C45 shorted	Replace C45
	T17	C35 shorted	Replace C35
Noise in sync, picture wanted to lock out the majority of the time. Noise inverter setting would not correct	T14 T17	Center tap on 300 ohm antenna winding of tuner not grounded	Connect center tap of tuner antenna coil to ground
No sound, no picture	T14	Shorted C4 & burnt R14, R74 or shorted C18 & burnt R25	Replace C4 and R14 & R74 or C18 and R25

TROUBLE SHOOTING THE BENDIX POWER MASTER CHASSIS (T-14 SERIES)*

I. RECEIVER DEAD - (No Sound or Raster)

1. Check AC power cord for good connection in AC outlet of known voltage source.
2. Check interlock on back of the chassis.
3. Check S1 on volume control R37R.
4. Check line cord for continuity to primary of power transformer T6.
5. Open primary on T6.
6. Check power transformer T6 secondary. For voltage and/or continuity each side of center tap.
7. Check for shorts in filament circuits and B+ shorts in low voltage filter circuits.
8. Gassy or open V17 (5U4G). Insure V17 is well seated in socket.

II. SOUND BUT NO RASTER

1. Check ion trap adjustment. (See Service Manual for procedure.) This check should be a "must" in initially setting up a new receiver.
2. Examine filament of V24 (1B3GT), high voltage rectifier; if lighted, this is good indication of second anode high voltage.
3. Examine connection to second anode, on picture tube.
4. Check to see if filament of picture tube (V14) is lighted. Possibility of bad socket connection.
5. Insure that plate cap for V22 (6BQ6GT or 6CU6) is making good connection.

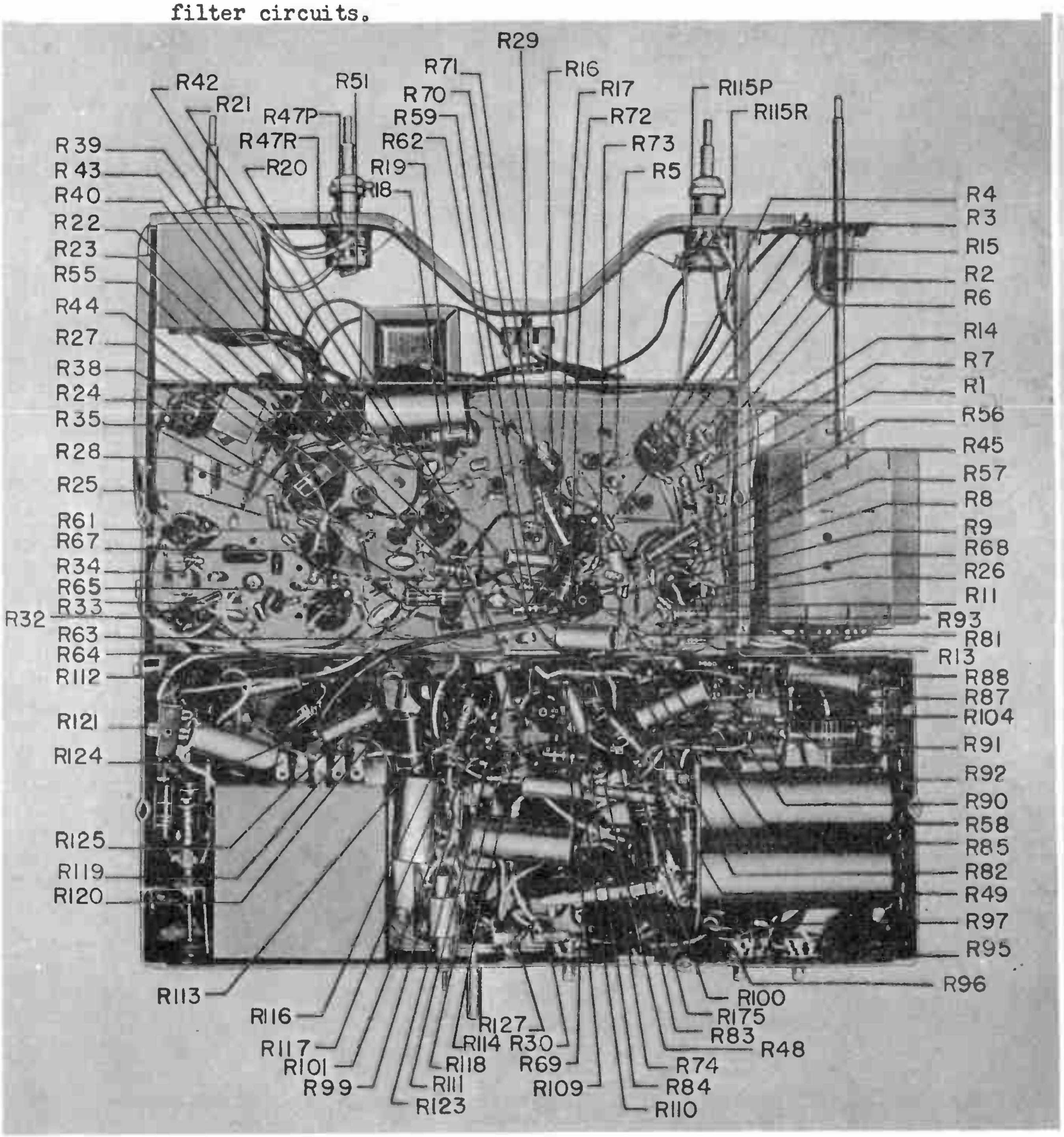


Figure 8a—Component Identification T14-15

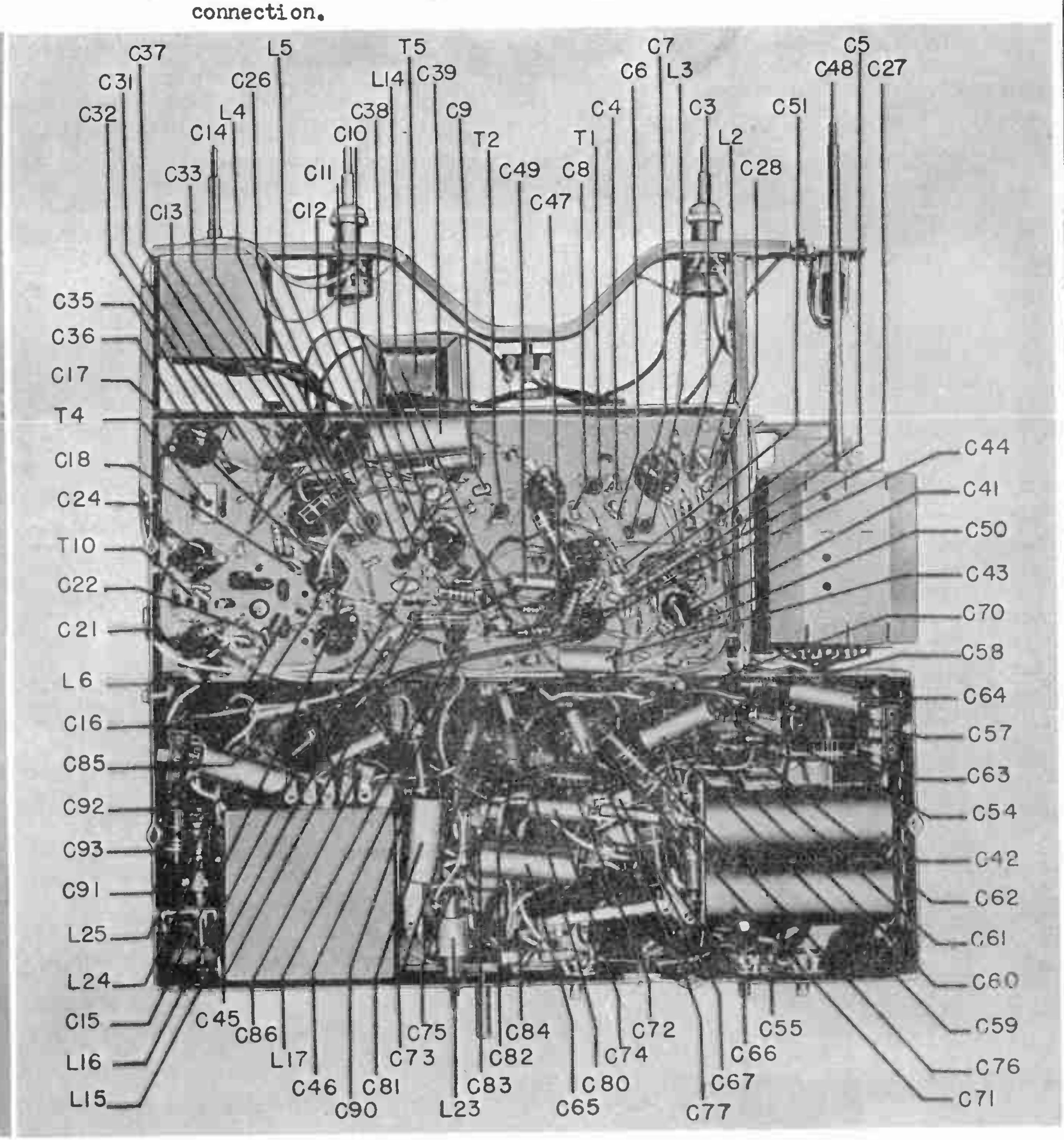


Figure 8b—Component Identification T14-15

6. Check for shorted or open V22 (6BQ6GT or 6CU6).
7. Check V23 (6W4GT or 6AX4) damper by replacement.
8. Check C94 (250 uuf) capacitor for leakage.
9. Check T8 horizontal output transformer for open primary and secondary. Do not overlook possibility of transformer breaking down under load.
10. Check V21 horizontal generator (6SN7GT) by replacement.
11. Check L23 horizontal oscillator coil.
12. Check C82, 330 uuf and C75, 3900 uuf for leakage.

III. PICTURE BUT NO SOUND

1. Check L9 for open.
2. Check connection to terminal #4 of T3.
3. Check V7, V8, V9 and V10.
4. Check for open voice coil or open secondary on T5.
5. Check connections to P2 and J2. (Speaker connections.)
6. Check for possible open connections or shorted turns in T4, ratio detector transformer.
7. Check R37R volume control for open circuit.
8. Insure correct voltages at tube socket connection in sound channel. If B/ voltage is low at any point, check for shorted by-pass condensers.

IV. WEAK SOUND, NORMAL PICTURE

1. Check V7, V8, V9 and V10.
2. Check for possible high resistance connections in T4 ratio detector transformer.
3. Check sound channel alignment. Do not overlook possibility of T4 secondary being misaligned at cross-over.

V. HUM IN SOUND

1. Check alignment of ratio detector transformer secondary (T4). Refer to Service Manual.
2. Check C35 for leakage.
3. Check V9, (6AL5), for cathode to filament leakage.
4. Insure that plate lead of vertical output transformer T7 is dressed as close to chassis as possible.
5. Keep AC switch lead dressed away from leads to volume control.

VI. HIGH VOLTAGE AND SOUND, BUT NO RASTER

1. Insure to see that picture tube V16 filament is lighted. Don't overlook possibility of a shorted picture tube.
2. Check to see that lead to second anode of picture tube is making good connection.

VII. NO HIGH VOLTAGE, BUT NORMAL SOUND

1. Check possibility of plate cap clip being disconnected from V22 (6BQ6GT or 6CU6) horizontal output tube.
2. Check V21, V22, V23 and V24.
3. Check L23 and C75.
4. Check C94, 250 uuf, capacitor.
5. Check T8 for open windings.

VIII. NO VERTICAL SWEEP APPEARING ON FACE OF PICTURE TUBE

1. Check for open primary of vertical output transformer T7.
2. Check V18 and V19.
3. Check C63 for short. (If shorted check value of R92.)

*Certain tubes are not found in the T14-15 & -16 chassis and should be disregarded.

IX. NO CONTROL OF VERTICAL SYNCHRONIZATION BY ADJUSTMENT OF THE VERTICAL HOLD

1. Check V18 and V19.
2. Check waveform with 'scope on both connections of C49, or its equivalent in T14-15 & -16 chassis.
3. Check for sync pulses on pin 1 and pin 3 of V18, (6SN7GT) sync clipper.
4. Check components in intergrating network C54, C57, R86, R87, R88, C58, C59.

X. EXCESSIVE VERTICAL SIZE

1. Check V18 and V19.
2. Check R97 for value change.
3. Check T7 vertical output transformer.

XI. INSUFFICIENT VERTICAL SIZE

1. Check V18 and V19.
2. Check T7 vertical output transformer.
3. Check C63 for leakage.

XII. NO CONTROL OF HORIZONTAL SYNC

1. Check V14, V15, V18, V20 and V21.
2. Check C70, C71, C73, C88 and C87.
3. Check C49 or its equivalent in T14-15, & -16 chassis.
4. Check L23 horizontal oscillator coil.

XIII. NO CONTROL OF HORIZONTAL OR VERTICAL SYNC

1. Check V13, V14, V15, and V18.

XIV. RECEIVER BLOWS FUSES

1. Check V21, V22 and V23.
2. Check for shorted winding in T8.
3. Check for short in yoke.
4. Check for short in vertical output transformer T7.
5. Shorted or gassy V19.
6. Check C63 for short or leakage.
7. Excessive leakage in C42B.

XV. SMEAR

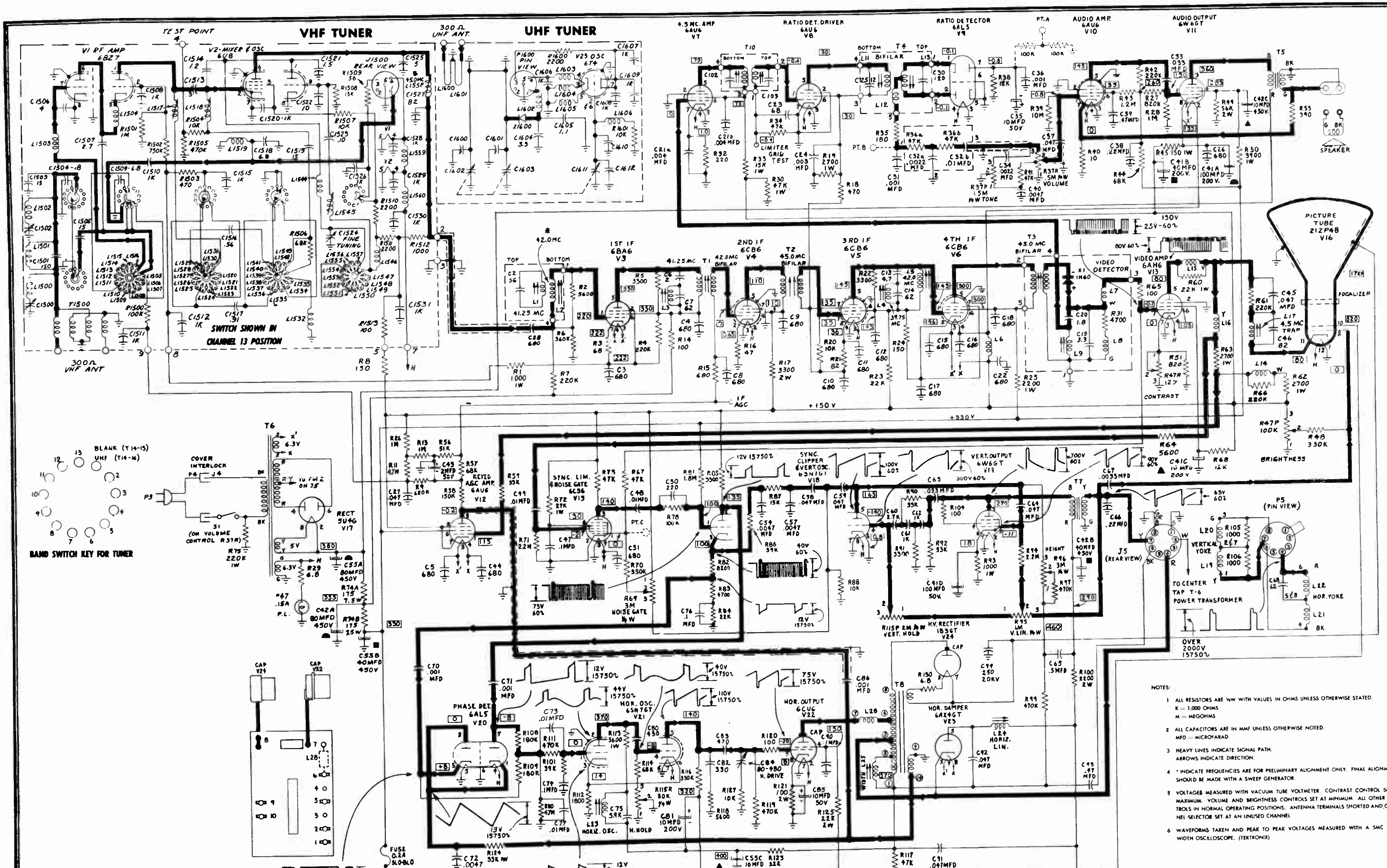
1. Check L2 for correct alignment at 42.0 mc.
2. Check C812 for leakage (Standard Coil) or its equivalent in the Sarkes Tarzian tuners.
3. Check L7, L8, L15 and L16 for open.
4. Check X1 video detector for poor front to back ratio.
5. Check by replacement V3, V4, V5, V6 and V13.

XVI. NOISE IN PICTURE

1. Arcing of high voltage or corona in the cage.
2. Intermittently open R131 (arcing). (Not present in T14-15 & -16 chassis)
3. Noisy contrast potentiometer R47R.

XVII. PICTURE BLOOMS

1. Possibility of picture tube being "gassy".
2. Gassy V19, V22 and V24.
3. Check value of R131. (Not present in T14-15 & -16 chassis)
4. Check horizontal damper tube V23, (6W4GT or 6AX4GT) by replacement.



NOTES.

1. ALL RESISTORS ARE ½W WITH VALUES IN OHMS UNLESS OTHERWISE STATED.
   K = 1,000 OHMS
   M = MEGOHMS
2. ALL CAPACITORS ARE IN MMF UNLESS OTHERWISE NOTED.
   MFD = MICROFARAD
3. HEAVY LINES INDICATE SIGNAL PATH.
   ARROWS INDICATE DIRECTION.
4. * INDICATE FREQUENCIES ARE FOR PRELIMINARY ALIGNMENT ONLY. FINAL ALIGNMENTS SHOULD BE MADE WITH A SWEEP GENERATOR.
5. VOLTAGES MEASURED WITH VACUUM TUBE VOLTMETER. CONTRAST CONTROL SET AT MAXIMUM. VOLUME AND BRIGHTNESS CONTROLS SET AT MINIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITIONS. ANTENNA TERMINALS SHORTED AND CHANNEL SELECTOR SET AT AN UNUSED CHANNEL
6. WAVEFORMS TAKEN AND PEAK TO PEAK VOLTAGES MEASURED WITH A 5MC BAND WIDTH OSCILLOSCOPE. (TEKTRONIX)

ELECTRICAL COMPONENTS

258061-2		V.H.F. TUNER	48.00
258061-3		U.H.F. TUNER	30.00
CC222Y5Y681M	C3, 4, 5, 8, 9, 10, 11, 12, 15, 16, 17, 18, 22, 26, 44, 51	CAPACITOR–Tub. Ceramic 680 mmf ±20% 500V	.20
267052-402	C21a, b	CAPACITOR–Dual Ceramic .004 mfd Min. 500V	.27
CC131S2L680K	C23	CAPACITOR–Tub. Ceramic 68 mmf ±10% 500V	.21
CC262Y5Y302M	C24	CAPACITOR–Disc Ceramic .003 mfd ±20% 500V	.26
267056-473	C27, 37, 45	CAPACITOR–Molded Tub. .047 mfd ±20% 200V	.25
CC222Y5Y681M	C28	CAPACITOR–Tub. Ceramic 680 mmf ±20% 500V	.20
267072-102	C31	CAPACITOR–Disc Ceramic .001 mfd ±10% 500V	.26
274291-1	C32a, b	COUPLATE–Molded	.68

PART NUMBER	SYMBOL NUMBER	DESCRIPTION	LIST PRICE
267036-333	C33	CAPACITOR—Molded Tub. .033 mfd ±20% 400V	.27
267073-222	C34	CAPACITOR—Disc Ceramic .0022 mfd ±20% 500V	.26
267024-26	C35	CAPACITOR—Elect. 10 mfd +250% —10% 50V 85°C	.80
CC222Z5Z102P	C36	CAPACITOR—Tub. Ceramic 1000 mmf Min. 500V	.24
267036-224	C38	CAPACITOR—Molded Tub. .22 mfd ±20% 400V	.39
267036-474	C39, 65	CAPACITOR—Molded Tub. .47 mfd ±20% 400V	.39
267073-472	C40	CAPACITOR—Disc Ceramic .0047 mfd ±20% 500V	.28
267005-14	C41a, b, c, d	CAPACITOR—Elect. (100-200, 40-200, 10-200, 100-50V) 85°C	3.24
267005-8	C42a, b, c, 55a, b, c	CAPACITOR—Elect. (80-450, 40-450, 10-450V)	3.28
267024-27	C43	CAPACITOR—Elect. 2 mfd +150% —10% 50V 85°C	.74
267056-104	C47, 76	CAPACITOR—Molded Tub. .1 mfd ±20% 200V	.25
267036-103	C48, 49	CAPACITOR—Molded Tub. .01 mfd ±20% 400V	.26
CC222Y5Y221M	C50	CAPACITOR—Tub. Ceramic 220 mmf ±20% 500V	.20
267060-472	C54, 57	CAPACITOR—Molded Tub. .0047 mfd ±10% 600V	.26
267036-473	C58, 91	CAPACITOR—Molded Tub. .047 mfd ±20% 400V	.30
267055-473	C59, 64	CAPACITOR—Molded Tub. .047 mfd ±20% 600V	.25
CM24B272K	C60	CAPACITOR—Mica 2700 mmf ±10% 500V	.45
CM24B102K	C61, 62	CAPACITOR—Mica 1000 mmf ±10% 500V	.36
267055-333	C63	CAPACITOR—Molded Tub. .033 mfd ±20% 600V	.27
267056-224	C66	CAPACITOR—Molded Tub. .22 mfd ±20% 200V	.43
267036-332	C67	CAPACITOR—Molded Tub. .0033 mfd ±20% 400V	.28
267036-102	C70, 71	CAPACITOR—Molded Tub. .001 mfd ±20% 400V	.25
267059-472	C72	CAPACITOR—Molded Tub. .0047 mfd ±10% 400V	.26
267059-103	C73, 77	CAPACITOR—Molded Tub. .01 mfd ±10% 400V	.26
267058-104	C74	CAPACITOR—Molded Tub. .1 mfd ±10% 200V	.25
CM24J392K	C75	CAPACITOR—Silvered Mica 3900 mmf ±10% 500V	.80
CM22B431K	C80	CAPACITOR—Mica 430 mmf ±10% 500V	.26
267024-14	C81	CAPACITOR—Elect. 10 mfd +100% —10% 200V	1.19
CM22B331K	C82	CAPACITOR—Mica 330 mmf ±10% 500V	.28
CC222Y5Y471M	C83	CAPACITOR—Tub. Ceramic 470 mmf ±20% 500V	.24
260009-11	C84	CAPACITOR—Trimmer Mica 80-480 mmf	.70
267024-16	C85	CAPACITOR—Elect. 10 mfd +250% —10% 50V	.80
CM24B102M	C86	CAPACITOR—Mica 1000 mmf ±20% 500V	.24
267055-104	C90	CAPACITOR—Molded Tub. .1 mfd ±20% 600V	.40
267059-473	C92	CAPACITOR—Molded Tub. .047 mfd ±10% 400V	.28
267056-474	C93	CAPACITOR—Molded Tub. .47 mfd ±20% 200V	.39
267065-2	C94	CAPACITOR—Ceramic 250 mmf 20 KV	1.20
RC24A102K	R1, 93	RESISTOR—Comp. 1000 ohms 1W ±10%	.22
RC23A562J	R2	RESISTOR—Comp. 5600 ohms 1/2W ±5%	.17
RC23A680J	R3	RESISTOR—Comp. 68 ohms 1/2W ±5%	.15
RC23A224K	R4, 7, 42, 61	RESISTOR—Comp. 220,000 ohms 1/2W ±10%	.13
RC23A332J	R5, 22	RESISTOR—Comp. 3300 ohms 1/2W ±5%	.15
RC23A364J	R6	RESISTOR—Comp. 360,000 ohms 1/2W ±5%	.15
RC23A151K	R8, 24	RESISTOR—Comp. 150 ohms 1/2W ±10%	.10
RC23A624J	R9	RESISTOR—Comp. 620,000 ohms 1/2W ±5%	.15
RC23A475J	R11	RESISTOR—Comp. 4.7 meg 1/2W ±5%	.17
RC23A105J	R13, 26, 28	RESISTOR—Comp. 1 meg 1/2W ±5%	.15
RC23A101K	R14, 65, 104, 120	RESISTOR—Comp. 100 ohms 1/2W ±10%	.13
RC23A681K	R15	RESISTOR—Comp. 680 ohms 1/2W ±10%	.10
RC23A470J	R16	RESISTOR—Comp. 47 ohms 1/2W ±5%	.15
RC25A332K	R17	RESISTOR—Comp. 3300 ohms 2W ±10%	.20
RC23A471K	R18	RESISTOR—Comp. 470 ohms 1/2W ±10%	.10
RC24A272K	R19, 62, 63	RESISTOR—Comp. 2700 ohms 1W ±10%	.15
RC23A103J	R20	RESISTOR—Comp. 10,000 ohms 1/2W ±5%	.17
RC23A820K	R21	RESISTOR—Comp. 82 ohms 1/2W ±10%	.13
RC23A223K	R23, 84	RESISTOR—Comp. 22,000 ohms 1/2W ±10%	.10
RC24A222K	R25	RESISTOR—Comp. 2200 ohms 1W ±10%	.18
RC23A824J	R27	RESISTOR—Comp. 820,000 ohms 1/2W ±5%	.17
268000-068	R29, 130	RESISTOR—Wire Wound 6.8 ohms 1/2W ±10%	.17
RC24A473K	R30	RESISTOR—Comp. 47,000 ohms 1W ±10%	.15
RC23A221K	R32	RESISTOR—Comp. 220 ohms 1/2W ±10%	.13
RC24A153K	R33	RESISTOR—Comp. 15,000 ohms 1W ±10%	.15
RC23A473K	R34, 41, 67, 73, 117	RESISTOR—Comp. 47,000 ohms 1/2W ±10%	.10
RC23A181K	R35	RESISTOR—Comp. 180 ohms 1/2W ±10%	.10
262037-3	R37 p, r, S1	POTENTIOMETER—Tandem 1.5 meg 1/4W ±30% (Tone) .5 meg 1/4W ±30% (vol. with switch)	1.80
RC23A123K	R38, 68	RESISTOR—Comp. 12,000 ohms 1/2W ±10%	.13
RC23A106K	R39	RESISTOR—Comp. 10 meg 1/2W ±10%	.10
RC23A100K	R40	RESISTOR—Comp. 10 ohms 1/2W ±10%	.10
RC23A125K	R43	RESISTOR—Comp. 1.2 meg 1/2W ±10%	.13
RC23A683K	R44, 114	RESISTOR—Comp. [illegible]000 ohms 1/2W ±10%	.13
RC24A151K	R45	RESISTOR—Comp. 150 ohms 1W ±10%	.15
262045-4	R47 p, r	POTENTIOMETER—Tandem 100,000 ohms 1/2W ±30% (Brightness)-1200 ohms 1/2W ±30% (contrast)	1.40
RC23A334K	R48, 116, 70	RESISTOR—Comp. 330,000 ohms 1/2W ±10%	.10
RC25A563K	R49	RESISTOR—Comp. 56,000 ohms 2W ±10%	.23
RC24A392K	R50	RESISTOR—Comp. 3900 ohms 1W ±10%	.15
RC23A821K	R51	RESISTOR—Comp. 820 ohms 1/2W ±10%	.10
RC23A391K	R55	RESISTOR—Comp. 390 ohms 1/2W ±10%	.10
RC23A513J	R56	RESISTOR—Comp. 51,000 ohms 1/2W ±5%	.15
RC23A683J	R57	RESISTOR—Comp. 68,000 ohms 1/2W ±5%	.15
RC23A154K	R58	RESISTOR—Comp. 150,000 ohms 1/2W ±10%	.10
RC23A333K	R59, 90	RESISTOR—Comp. 33,000 ohms 1/2W ±10%	.13
RC23A562K	R64, 118	RESISTOR—Comp. 5600 ohms 1/2W ±10%	.13
262025-27	R69, 96	POTENTIOMETER—3 meg 1/4W ±30% (Noise, Height)	.48
RC23A225K	R71, 94	RESISTOR—Comp. 2.2 meg 1/2W ±10%	.13
RC24A273K	R72	RESISTOR—Comp. 27,000 ohms 1W ±10%	.15
268018-1	R74a, b	RESISTOR—Wire Wound 350 ohms 15W ±10% (CTR. TAP)	.48
RC24A224K	R75	RESISTOR—Comp. 220,000 ohms 1W ±10%	.15
RC23A104K	R78	RESISTOR—Comp. 100,000 ohms 1/2W ±10%	.10
RC23A185K	R81	RESISTOR—Comp. 1.8 meg 1/2W ±10%	.13
RC23A822K	R82	RESISTOR—Comp. 8200 ohms 1/2W ±10%	.10
RC23A472K	R83	RESISTOR—Comp. 4700 ohms 1/2W ±10%	.10
RC23A332K	R85, 91	RESISTOR—Comp. 3300 ohms 1/2W ±10%	.10
RC23A393K	R86, 101	RESISTOR—Comp. 39,000 ohms 1/2W ±10%	.18
RC23A153K	R87	RESISTOR—Comp. 15,000 ohms 1/2W ±10%	.10
RC23A103K	R88, 127	RESISTOR—Comp. 10,000 ohms 1/2W ±10%	.10
RC23A333J	R92	RESISTOR—Comp. 33,000 ohms 1/2W ±5%	.15
262025-28	R95	POTENTIOMETER—1 meg 1/4W ±20% (V. Lin.)	.48
RC23A474K	R97, 99, 111, 119	RESISTOR—Comp. 47,000 ohms 1/2W ±10%	.10
RC25A222K	R100	RESISTOR—Comp. 2200 ohms 2W ±10%	.30
RC23A184K	R108, 109	RESISTOR—Comp. 180,000 ohms 1/2W ±10%	.10
RC23A475K	R110	RESISTOR—Comp. 4.7 meg 1/2W ±10%	.10
RC23A182K	R112	RESISTOR—Comp. 1800 ohms 1/2W ±10%	.10
RC24A562K	R113	RESISTOR—Comp. 5600 ohms 1W ±10%	.15
262049-1	R115 p, r	POTENTIOMETER—Tandem 2 meg 1/4W ±20% (V. Hold)-30,000 ohms 1/4W ±20% (H. Hold)	1.42
RC25A101K	R121	RESISTOR—Comp. 100 ohms 2W ±10%	.36
RC25A223K	R123, 125	RESISTOR—Comp. 22,000 ohms 2W ±10%	.20
RC24A333K	R124	RESISTOR—Comp. 33,000 ohms 1W ±10%	.15
259157-1	L1, 2, C2	COIL—1st I.F. Grid & Sound I.F. Trap	1.54
259146-1	L3, C6, 7	COIL ASSEMBLY—Sound I.F. Trap	1.11
259147-1	L4, C13, 14	COIL ASSEMBLY—Adj. Ch. Picture I.F. Trap	1.13
259148-1	L5	COIL ASSEMBLY—4th I.F. Grid	.70
259149-1	L6	CHOKE—Filament	.23
259120-4	L14, R66	COIL ASSEMBLY—Video Peaking	.38
259105-7	L15, R60	COIL ASSEMBLY—Video Peaking	.36
259105-4	L16	COIL ASSEMBLY—Video Peaking	.43
259108-2	L17, C46	COIL ASSEMBLY—4.5 MC Trap	.48
265077-2	L19, L20, L21, L22, C68, R105, 106, P5	YOKE—Deflection with Plug	9.96
259121-1	L23	COIL ASSEMBLY—Horiz. Oscillator	.83
259082-6	L24	COIL ASSEMBLY—Horiz. Linearity	1.23
259114-1	L25	COIL ASSEMBLY—Width Control	.99
259144-1	T1	TRANSFORMER ASSEMBLY—Second I.F. Grid	.64
259145-1	T2	TRANSFORMER ASSEMBLY—3rd I.F. Grid	.68
259158-1	T3, L7, 8, 9, C19, 20, R31, X1	TRANSFORMER ASSEMBLY—Output & 1st Sound I.F. & Video Detector	4.16
259156-1	T4, L11, 12, 13, C25, 30	TRANSFORMER—Ratio Detector	1.96
265071-17	T5	TRANSFORMER—Audio Output	1.98
265048-1	T6	TRANSFORMER—Power	15.97
265072-8	T7	TRANSFORMER—Vert. Output	3.12
265086-4	T8, L28	TRANSFORMER—Horiz. Output (High Voltage)	8.88
259154-1	T10, C102, 103	TRANSFORMER—2nd Sound I.F.	1.20
266164-5201		FUSE—"Slo-Blo" .2 amp Type 3AG	.31
274197-11		ION TRAP	.50
274282-3		FOCALIZER—PM	6.70
1N60	X1	DETECTOR—Crystal	1.17

CABINET REPLACEMENT PARTS LIST

PART NUMBER	TM21E	TM21EU	TB21E	TB21EU	KM21E	KM21EU	KMT21E	KMT21EU	DESCRIPTION	LIST PRICE
256012-4					X	X	X	X	SPEAKER—10" PM	7.83
256030-1	X	X	X	X					SPEAKER—4" x 6" PM	3.80

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picutre tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a– 4.5 megacycles

b– 22.8 megacycles

c– 25.4 megacycles

d– 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (± 1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel.

3 – Cathode Ray Oscilloscope with good low frequency response.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE HORIZONTAL OUTPUT TUBE FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L101 and L104 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.8 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L406, L103 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.

8 – Adjust L114 for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 ohms.)

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to 4.7 diode load resistor (R113); ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display having 5 volts vertical deflection as previously calibrated. (If you must touch scope verticel settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

5 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier is visible on bandpass and adjust sound trap (L114) to minimize effect of sound carrier marker.

6 – Check all channels as above.

SOUND ALIGNMENT

1 – Connect 4.5 megacycle signal generator to pin 2 of 12BH7 (V7) video amplifier.

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V9) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L113 and bottom of T100 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K(± 1%) resistors across R126 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to junction of C119 and C120 (Audio Take-Off of T100).

6 – Adjust top of T100 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER TRAP

When necessary, the video amplifier 4.5 mc trap (L110) should be adjusted as follows:

1 – Connect 4.5 mc signal generator "high" lead to picture tube grid; ground to chassis.

2 – Connect DC V.T.V.M. to pin 7 of 6AL5 (V9) ratio detector, 10 volt scale, negative polarity.

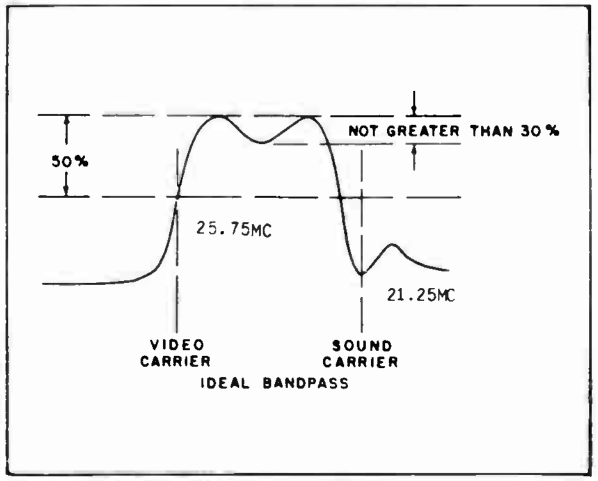
3 – Adjust L110 for minimum deflection on V.T.V.M.

R-F OSCILLATOR

If all channels are not within range of FINE TUNING control, adjust two screws located in <u>front</u> of r-f tuner unit for adjustment of either low or high band. <u>CAUTION:</u> Do not touch adjustments on <u>top</u> of r-f tuner unit, other than converter plate coil, <u>L404</u>, during IF Alignment.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.



IDEAL BANDPASS

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

The Width control (rear of H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

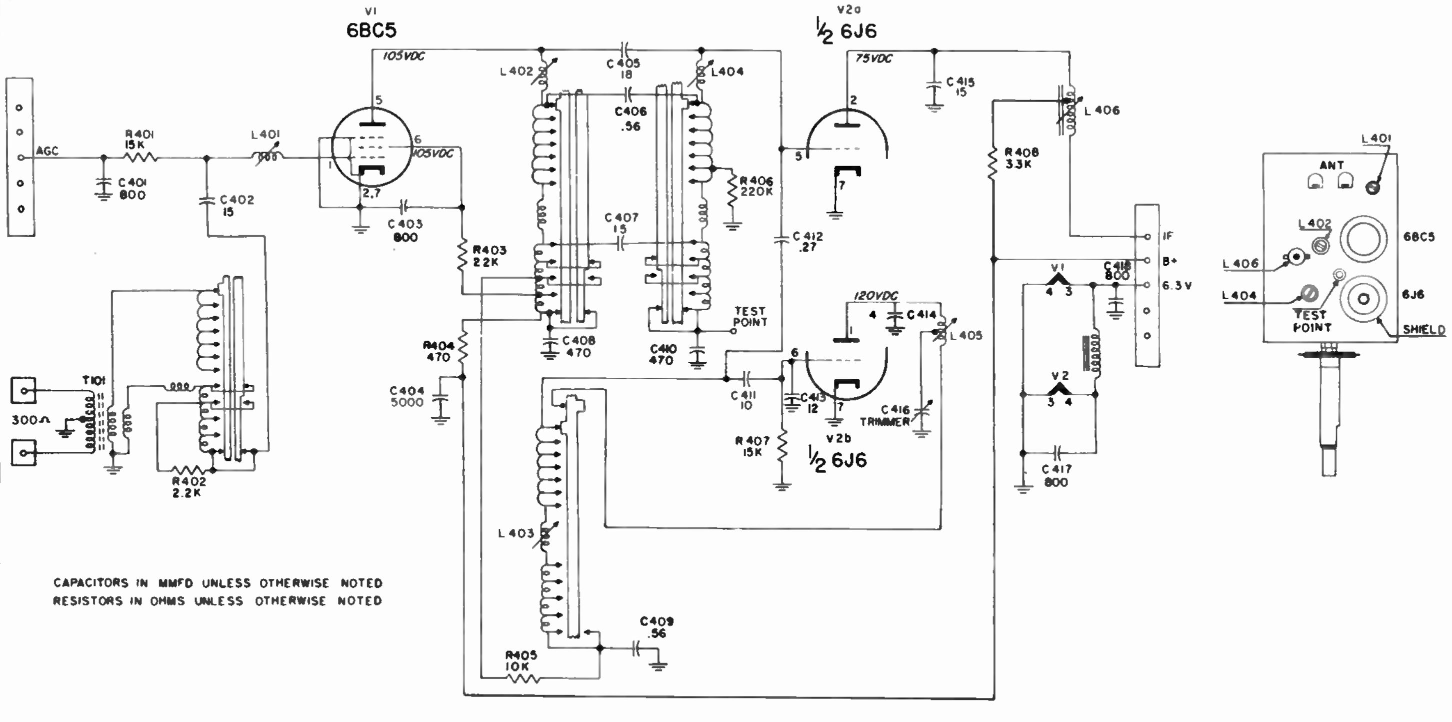
The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

PICTURE TUBE HANDLING PRECAUTIONS

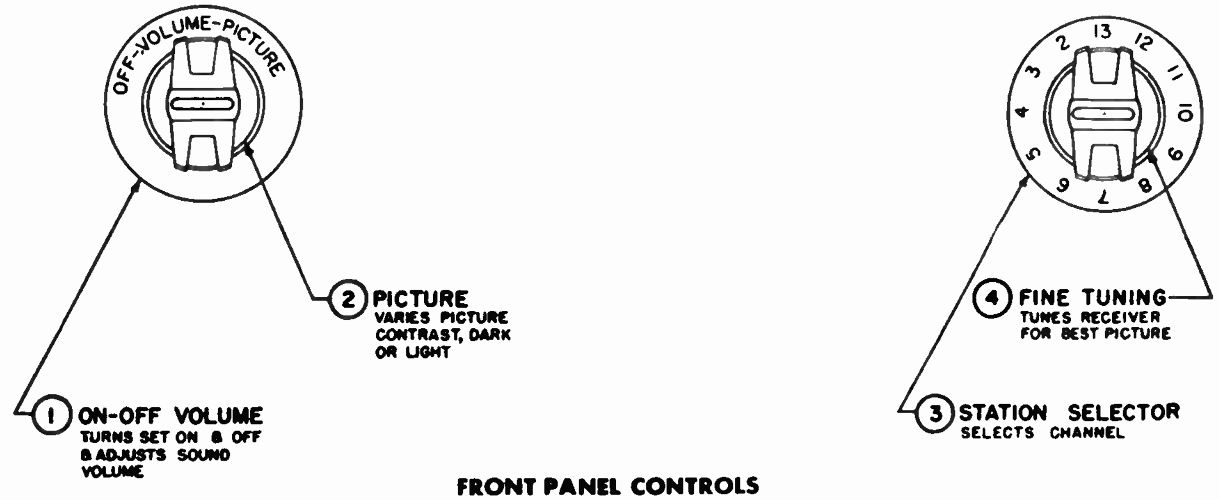
The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

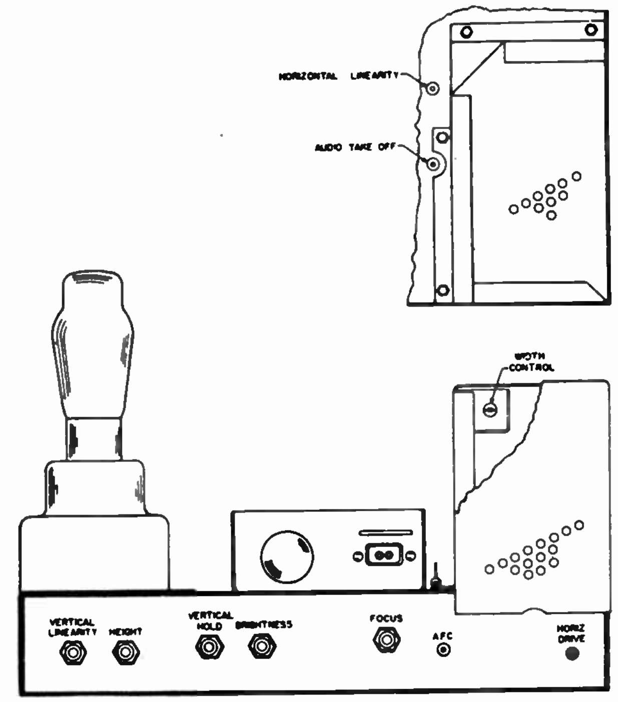
Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.



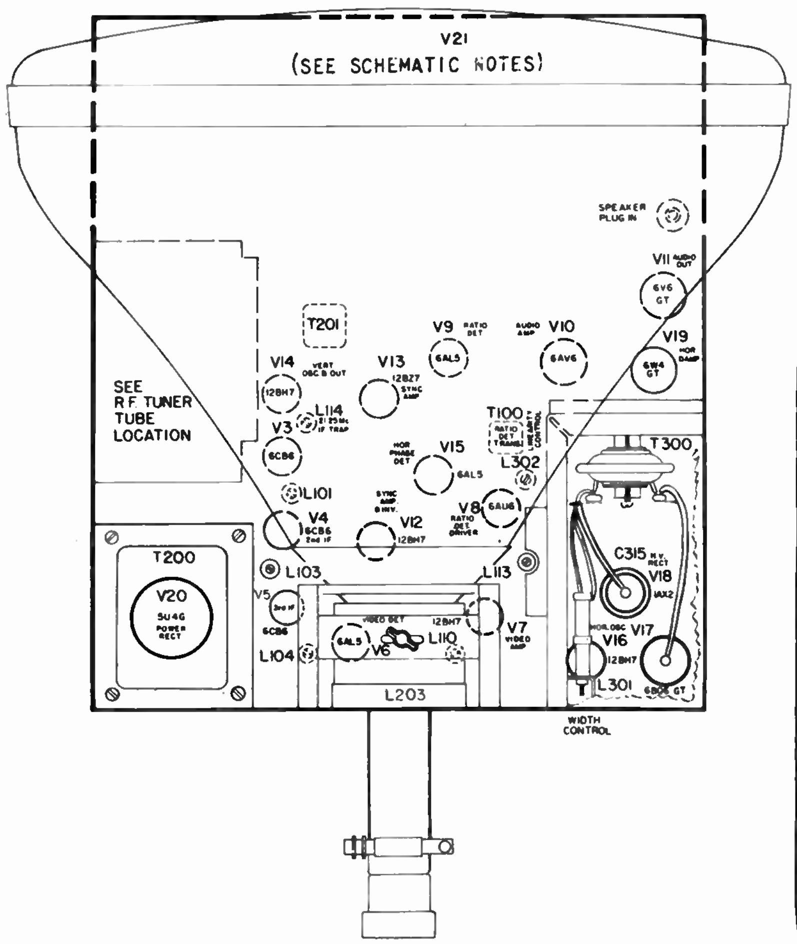
TUNER SCHEMATIC & TUBE LOCATION



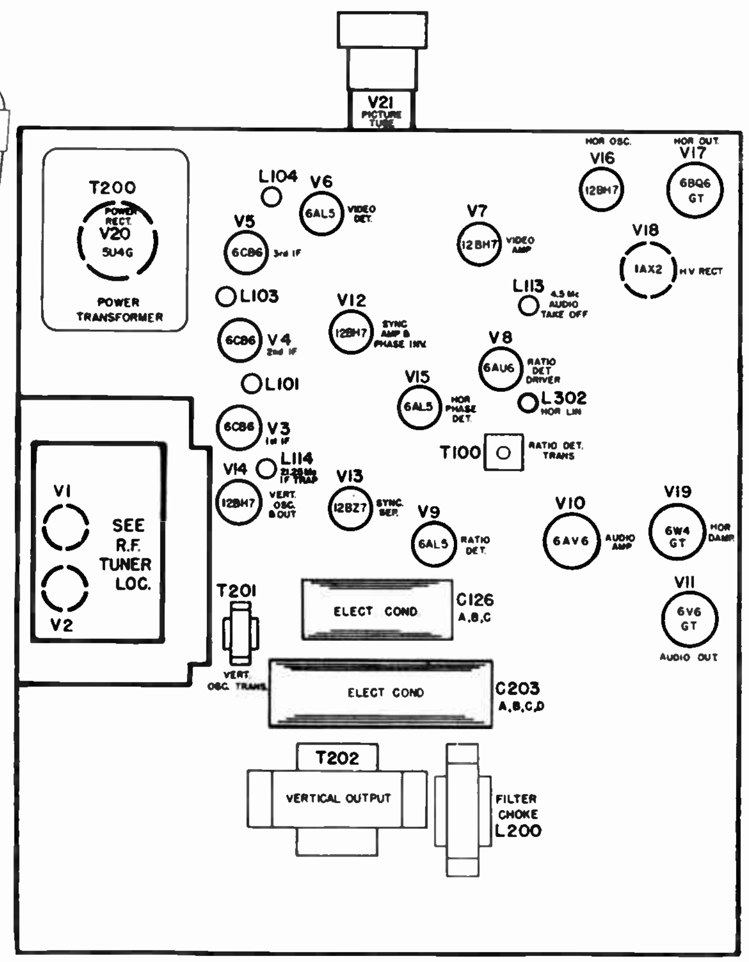
FRONT PANEL CONTROLS



REAR CONTROLS

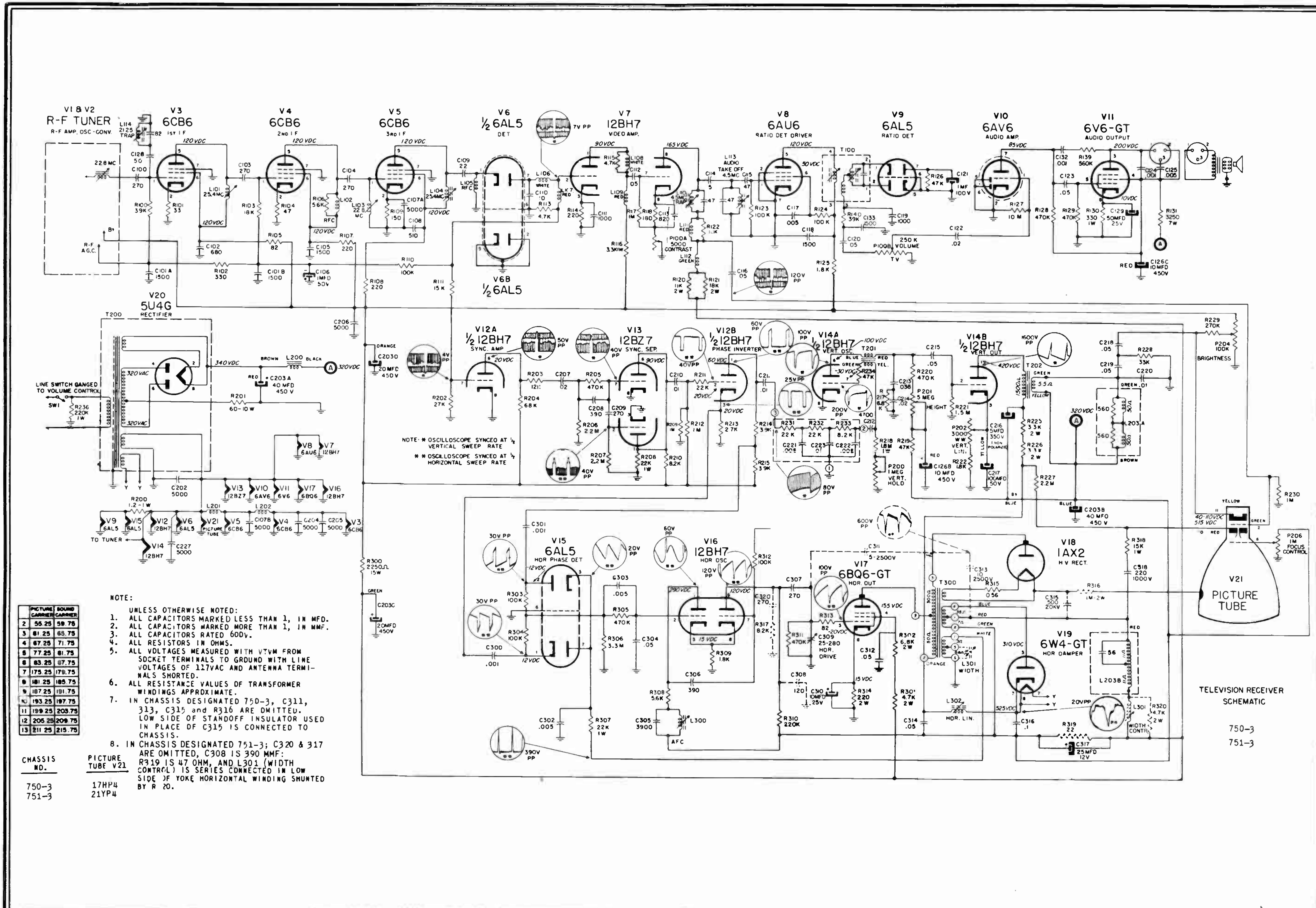


TUBE & TRIMMER LOCATION



BOTTOM VIEW

	MODEL 17M06	MODEL 22C06	MODEL 22C38
CABINET	A60215	A60201	A60201
SAFETY GLASS	A62457-23	A62457-25	A62457-25
GLASS RET. CLIP	A62466 or A6205	A —	—
RET. CLIP LOCKING SPRING	A541440 or w/ A62466	—	—
MASK	A62470	A62481	A62481
BACK COVER	A62329	A62483-2	A62495
SPEAKER	A5866 – 5" PM	A5124 – 8" PM	A58124 – 8" PM
KNOB, CHANNEL SELECTOR (VHF)	A39281-2	A39281-2	A39281-2
KNOB, CHANNEL SELECTOR (VHF & UHF)	A39277-2	A39277-2	A39277-2
KNOB, ON-OFF-VOLUME	A39280-2	A39280-2	A39280-2
KNOB, PIX CONTROL	A39279	A39279	A39279
KNOB VERNIER	A39278	A39278	A39278
INDICATOR DISC (UHF)	A40152	A40152	A40152



NOTE:

UNLESS OTHERWISE NOTED:
1. ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
2. ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
3. ALL CAPACITORS RATED 600V.
4. ALL RESISTORS IN OHMS.
5. ALL VOLTAGES MEASURED WITH VTVM FROM SOCKET TERMINALS TO GROUND WITH LINE VOLTAGES OF 117VAC AND ANTENNA TERMINALS SHORTED.
6. ALL RESISTANCE VALUES OF TRANSFORMER WINDINGS APPROXIMATE.
7. IN CHASSIS DESIGNATED 750-3, C311, 313, C315 and R316 ARE OMITTED. LOW SIDE OF STANDOFF INSULATOR USED IN PLACE OF C315 IS CONNECTED TO CHASSIS.
8. IN CHASSIS DESIGNATED 751-3; C320 & 317 ARE OMITTED, C308 IS 390 MMF: R319 IS 47 OHM, AND L301 (WIDTH CONTROL) IS SERIES CONNECTED IN LOW SIDE OF YOKE HORIZONTAL WINDING SHUNTED BY R 20.

	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

CHASSIS NO.	PICTURE TUBE V21
750-3	17HP4
751-3	21YP4

TELEVISION RECEIVER SCHEMATIC

750-3
751-3

RESISTORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
R100		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R101		PE231-1113	Carbon, 33 Ohm 1/2W ±10%
R102		PE231-1137	Carbon, 330 Ohm 1/2W ±10%
R103		PE231-1179	Carbon, 18K ohm 1/2w ±10%
R104		PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R105		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R106		PE231-1167	Carbon, 5600 ohm 1/2w ±10%
R107		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R108		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R109		PE231-1129	Carbon, 150 Ohm 1/2W ±10%
R110		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R111		PE231-1177	Carbon, 15k Ohm 1/2W ±10%
R112			
R113		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R114		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R115		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R116		PE232-1161	Carbon, 3300 Ohm 1W ±10%
R117		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R118		PE231-1131	Carbon, 180 Ohm 1/2W ±10%
R119			
R120		PE233-74	Carbon, 11k Ohm 2W ±5%
R121		PE233-1179	Carbon, 18k Ohm 2W ±10%
R122		PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R123		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R124		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R125		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R126		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R127		PE231-1245	Carbon, 10 Megohm 1/2W ±10%
R128		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R129		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R130		PE232-1137	Carbon, 330 Ohm 1W ±10%
R131		PC21134-4	Wirewound, 3250 Ohm 7W ±10%
R136		PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R139		PE231-1215	Carbon, 560K ohm 1/2w ±10%
R140		PE231-1187	Carbon, 39K ohm 1/2w ±10%
R200		PE23151	Wirewound, 1.2 Ohm 1W ±10%
R201		PC21134-2	Wirewound, 60 Ohm 10W ±10%
R202		PE231-1183	Carbon, 27k Ohm 1/2W ±10%
R203		PE231-1175	Carbon, 12k Ohm 1/2W ±10%
R204		PE231-1193	Carbon, 68k Ohm 1/2W ±10%
R205		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R206		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R207		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R208		PE232-1181	Carbon, 22k Ohm 1W ±10%
R209		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R210		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R211		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R212		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R213		PE231-1159	Carbon, 2700 Ohm 1/2W ±10%
R214		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R215		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R217		PE231-1169	Carbon, 6800 Ohm 1/2W ±10%
R218		PE232-127	Carbon, 1.8 Megohm 1W ±5%
R219		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R220		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R221		PE231-1225	Carbon, 1.5 Megohm 1/2W ±10%
R222		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R225		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R226		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R227		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R228		PE231-1185	Carbon, 33k Ohm 1/2W ±10%
R229		PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R230		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R231		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R232		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R233		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R234		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R236		PE232-1205	Carbon, 220K ohm 1w ±10%
R300		PC21134-16	Wirewound, 2250 Ohm 15W ±10%
R301		PE233-1165	Carbon, 4700 Ohm 2W ±10%
R302		PE233-1169	Carbon, 6800 Ohm 2W ±10%
R303		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R304		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R305		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R306		PE231-1233	Carbon, 3.3 Megohm 1/2W ±10%
R307		PE232-1181	Carbon, 22k Ohm 1W ±10%
R308		PE231-1167	Carbon, 5600 Ohm 1/2W ±10%
R309		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R310		PE231-1205	Carbon, 220k Ohm 1/2W ±10%
R311		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R312		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R313		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R314		PE233-1133	Carbon, 220 Ohm 2W ±10%
R315		PE23163	Carbon, 0.56 Ohm 1/2W ±10%
R316	751-3	PE233-2321	Carbon, 1.0 Megohm 2W ±20% (Allen Bradley)
R317	750-3	PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R318		PE232-1177	Carbon, 15k Ohm 1W ±10%
R319	750-3	PE231-1109	Carbon, 22 Ohm 1/2W ±10%
R319	751-3	PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R320	751-3	PE233-1165	Carbon, 4700 Ohm 2W ±10%

CAPACITORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
C100		PE190-133	Mica, 270mmf 500V ±10%
C101		PA19147	Ceramic, Shielded Dual Disc, 1500mmf GMV
C102		PE556-234	Ceramic Tubular, 680mmf 350V ±10% (Insul.)
C103		PE190-133	Mica, 270mmf 500V ±10%
C104		PE190-133	Mica, 270mmf 500V ±10%
C105		PA19148	Ceramic, Single Disc 1500mmf GMV
C106		PA20138	Electrolytic, 1mfd 50V
C107		PP19163	Ceramic, Shielded Dual Disc 5000mmf GMV
C108		PE190-140	Mica, 510mmf 500V ±10%
C109		PE190-107	Mica, 22mmf 500V ±10%
C110		PE555-101	Ceramic Tubular 10mmf. 500V ±20% (Unins.)
C111		PE555-136	Ceramic Tubular 1000mmf 350V ±20% (Unins.)
C112		PE194-160	Paper, .05mfd 600V ±20%
C113		PP19201	Ceramic Tubular, 820mmf 350V ±10% (Unins.)
C114		PE555-100	Ceramic Tubular, 5mmf 500V ±10% (Unins.)
C115		PE555-113-2	Ceramic Tubular, 47mmf 500V ±20% NPO
C116		PE197-160	Molded Tubular .05mfd 600V ±20%
C117		PE194-151	Paper, .005mfd 600V ±20%
C118		PA19148	Ceramic Single Disc 1500mmf GMV
C119		PE556-236	Ceramic Tubular, 1000mmf 350V ±10% (Insul.)
C120		PE194-160	Paper, .05mfd 600V ±20%
C121		PA620181	Electrolytic, 1mfd 100V
C122		PE194-156	Paper, .02mfd 600V ±20%
C123		PE194-160	Paper, .05mfd 600V ±20%
C124		PE194-145	Paper, .001mfd 600V ±20%
C125		PE194-151	Paper, .005mfd 600V ±20%
C126		PA20135	Electrolytic, 10-10-10 mfd 450V
C127		PE194-145	Paper, .001mfd 600V ±20%
C128		PE555-100	Ceramic, 5.0mmf 500V ±10% (Uninsul.)
C129		PA20182	Electrolytic, 50mfd 25V
C132		PE194-145	Paper, .001mfd 600V ±20%
C133		PE556-136	Ceramic Tubular, 1500mmf 350V ±20% (insul.)
C201			
C202		PA19109	Ceramic, Single Disc 5000mmf GMV
C203		PA20144	Electrolytic, 40-40-20-20-mfd 450V
C204		PA19109	Ceramic, Single Disc 5000mmf GMV
C205		PA19109	Ceramic, Single Disc 5000mmf GMV
C206		PA19109	Ceramic, Single Disc 5000mmf GMV
C207		PE194-156	Paper, .02mfd 600V ±20%
C208		PE190-137	Mica, 390mmf 500V ±10%
C209		PE190-133	Mica, 270mmf 500V ±10%
C210		PE194-155	Paper, .01mfd 600V ±20%
C211		PE194-155	Paper, .01mfd 600V ±20%
C212		PE192-163	Mica, 4700mmf 500V ±10%
C213		PE194-159	Paper, .035mfd 600V ±20%
C214		PE194-156	Paper, .02mfd 600V ±20%
C215		PE194-160	Paper. .05mfd 600V ±20%
C216		PA20174	Electrolytic, 5mfd 350V (Non-Polarized)
C218		PE194-160	Paper, .05mfd 600V ±20%
C219		PE194-160	Paper, .05mfd 600V ±20%
C220		PE194-155	Paper, .01mfd 600V ±20%
C221		PE194-151	Paper, .005mfd 600V ±20%
C222		PE194-151	Paper, .005mfd 600V ±20%
C223		PE194-155	Paper, .01mfd 600V ±20%
C227		PA19109	Ceramic, Single Disc 5000mmf GMV
C300		PE194-145	Paper, .001mfd 600V ±20%
C301		PE194-145	Paper, .001mfd 600V ±20%
C302		PE197-151	Molded Tubular .005mfd 600V ±20%
C303		PE197-151	Molded Tubular .005mfd 600V ±20%
C304		PE194-160	Paper, .05mfd 600V ±20%
C305		PE195-261	Mica, Silver, 3900mmf 500V ±5%

CAPACITORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
C306		PE190-137	Mica, 390mmf 500V ±10%
C307		PE190-133	Mica, 270mmf 500V ±10%
C308	750-3	PE190-125	Mica, 120mmf 500V ±10%
C308	751-3	PE190-137	Mica, 390mmf 500V ±10%
C309		PA1772	Trimmer, 25-280mmf
C310		PA20137	Electrolytic, 10mfd 25V
C311	751-3	PP19145	Mica, 5mmf 2500V GMV
C312		PE197-160	Molded Tubular .05mfd 600V ±20%
C313	751-3	PP19146	Mica, 10mmf 2500V GMV
C314		PE197-160	Molded Tubular .05mfd 600V ±20%
C315	751-3	PA1998-3	Ceramic, 500mmf 20kv
C316		PE197-162	Molded Tubular .1mfd 600V ±20%
C317		PA20147	Electrolytic 25mfd 12V
C318		PP19180	Mica, 220mmf 1000V ±10%
C320	750-3	PE190-133	Mica, 270mmf 500V ±10%

CHOKES & COILS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
L101		A3392	Coil, Pix IF
L102		A28253	Choke, RF
L103		A3392	Coil, Pix IF
L104		A3392	Coil, Pix IF
L105		A28253	Choke, RF
L106		A28255-2	Coil, Peaking (White)
L107		A28255-1	Coil, Peaking (Red)
L108		A28255-2	Coil, Peaking (White)
L109		A28255-1	Coil, Peaking (Red)
L110		A28286	Coil, 4.5 MC. Trap
L111		A28255-1	Coil, Peaking (Red)
L112		A28255-4	Coil, Peaking (Green)
L113		A28286	Coil, 4.5 MC Audio Takeoff
L114		A28314	Coil, 21.25 MC IF Trap
L200		A1406	Coil, Filter Choke
L201		A28276	Choke, Filament
L202		A28276	Choke, Filament
L203	750-3	A28328	Coil, Deflection Yoke
L203	751-3	A28330	Coil, Deflection Yoke
L300		A28263	Coil, Horiz. Freq. Control
L301	750-3	A28279-1	Coil, Width Control
L301	751-3	A28318-1	Coil, Width Control
L302		A28292	Coil, Horiz. Linearity
		A28331	Deflection Yoke Cover w/Centering Device

TRANSFORMERS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
T100		A1201 or 1202	Ratio Detector
T200		A10109	Power
T201		A10106	Vertical Oscillator
T202		A10152-1	Vertical Output
T300		A10136 or A10137	Horizontal Output

CONTROLS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
P100		A24142	Contrast-Volume, 5K-250K ohm
P200		A24112	Vertical Hold, 1.0 Megohm
P201		A24111	Vertical Size, 5.0 Megohm
P202		A24114	Vertical Linearity, 3K ohm Wirewound
P204		A24110	Brightness, 100K ohm
P206		A24112	Focus Control, 1.0 Megohm

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

MISC. CHASSIS ACCESS. & PARTS – ALL CHASSIS

PART NO.	DESCRIPTION
A65100K	Chassis
A5355	Shield, H.V. Supply
A5356	Cover, H.V. Supply Shield
A54609	Bracket, Horiz. Freq. Control Coil
A541059	Bracket, Interlock
A541242	Grounding Spring CRT Coating
A540-62	Terminal Strip, AAEAAAEAA
A540-67	Terminal Strip, AAAEAA
A540-44	Terminal Strip, AAEAA
A540-19	Terminal Strip, AEA
A540-34	Terminal Strip, AAEA
A18155	Socket, Octal Moulded
A18210	Socket, Octal Moulded Bakelite Saddle
A18173	Socket, 9 Pin Moulded
A18171	Socket, 9 Pin Moulded No Saddle
A18157	Socket, 9 Pin Wafer
A18147	Socket, 7 Pin Wafer
A18101	Socket, Speaker-Plug
A541131	Socket, H.V. Cond.
A562-6	Capacitor Clips; 1-3/8
A562-3	Capacitor Clips; 3/4
A54618-1	Tube Shield
A3206	Ion Trap
A541341	Anode Lead Holder

MISC. CHASSIS ACCESS. & PARTS – 17" TUBE

PART NO.	DESCRIPTION
A54851	Bracket, Yoke Hood & Support
A541084-1	Channel, CRT Front Support; Left
A541084-2	Channel, CRT Front Support; Right
A54827	Strap, CRT; Right
A54828	Strap, CRT; Left
A541086	Bracket, CRT Stop
A55141-1	Anode Connector Assembly
A541085	Cushion, Rubber; CRT Channel
A541110-2	Cushion, Sponge Rubber; CRT Strap, Right
A541110-1	Cushion, Sponge Rubber; CRT Strap, Left
A54971-18	Cushion, Cork; CRT Stop Bkt.
A18197-3	Socket, Kinescope

MISC. CHASSIS ACCESS. & PARTS – 21" CHASSIS

PART NO.	DESCRIPTION
A541251	Bracket, Interlock
A541248-1	Bracket, CRT Rear Support (Left)
A541248-2	Bracket, CRT Rear Support (Right)
A541000	CRT Rubber Grommet
A541246	Bracket, Yoke Hood and CRT Grommet
A541250-1	Bracket, Yoke Hood Support (Left)
A541250-2	Bracket, Yoke Hood Support (Right)
A541383	Bracket, CRT Front Support and Stop
A541249	Bracket, Tie Rod
A541254	CRT Strap Assembly
A541261-1	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541261-2	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541102-6	Rubber Cushion (CRT Strap)

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picture tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a. 4.5 megacycles

b. 22.25 megacycles

c. 25.4 megacycles

d. 23.6 megacycles

e. 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (±1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel, preferably 30% Amplitude-Modulated.

3 – Cathode Ray Oscilloscope with good low frequency response.

4 – 3 volt bias battery.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE COLOR PLUG FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on the inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to pin 1 of 6AU6 1st Video Amplifier (V12), ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L201 and L203 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.25 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L11, L202-top (see tube and trimmer location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set i-f signal generator to 23.6 mc. with sufficient output to read approximately 3 volts on the VTVM.

8 – Carefully adjust L205 (see tube and trimmer location) for maximum deflection on VTVM. Adjust signal generator out-put to keep meter reading approximately 3 volts.

9 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.

10 – Adjust L202-bottom for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 Ohms).

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. Filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to pin 1 of 6AU6 1st Vid. Amp. (V12) ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Connect 3 volt battery positive terminal to chassis negative terminal to AGC buss (see schematic diagram).

5 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display (see figure 1) having 5 volts vertical deflection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

6 – Adjust L205 slightly to even the height of peaks and to obtain an untilted bandpass.

7 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier visible on bandpass and adjust sound trap (L114) to minimize effect to sound carrier marker.

NOTE: If the fine tuning control is at end of range or out of range so that video carrier cannot be set at 50%, follow R-F OSCILLATOR ALIGNMENT procedure outlined below.

8 – Check all channels.

R-F OSCILLATOR ALIGNMENT

If all channels are not within range of FINE TUNING control (as evidenced by inability to eliminate "sound bars" from picture or by poor picture quality), the individual oscillator slugs may require readjustment.

1 – Repeat the set-up as for SWEEP ALIGNMENT CHECK, steps 1 through 7.

2 – Set FINE TUNING CONTROL to center of range, and with long fiber screwdriver alignment tool, adjust the individual oscillator slugs of each channel. (Accessible through the front of the tuner) so that video carrier markers fall 50% down on curve. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than the converter plate unit, L11, during I.F. alignment.

SOUND ALIGNMENT

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 4.5 mc. amplifier (V13).

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V15) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L206, L101, and bottom of T102 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K (± 1%) resistors across R106 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to centertap of 100K resistors, and connect ground wire of V.T.V.M. to top of C109 (Audio take-Off of T102).

6 – Adjust top of T102 for zero reading on V.T.V.M. between a plus and a minus peak.

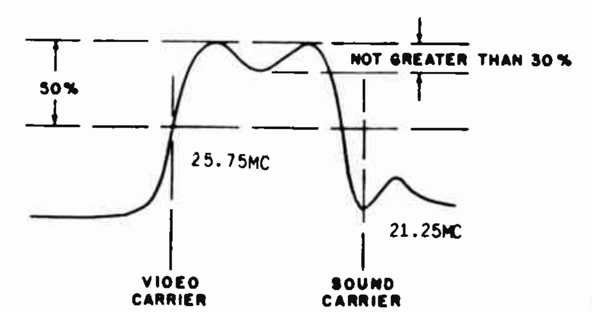
VIDEO AMPLIFIER 4.5 mc. TRAP

When necessary, the video amplifier 4.5 mc. trap (L104) should be adjusted as follows:

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 1st video amplifier (V12).

2 – Adjust signal generator output till 4.5 mc. dot pattern is clearly visible on screen of picture tube.

3 – Adjust L104 to minimize the dot pattern.



IDEAL BANDPASS

X59908

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

HEIGHT, WIDTH, LINEARITY, AND HORIZONTAL DRIVE

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

1 – Starting with the HORIZONTAL DRIVE control (rear of chassis) in extreme counterclockwise position, advance the control clockwise till the compression near the center of the picture (a vertical bright bar) is eliminated.

2 – The Width and Horizontal Linearity controls (rear of chassis) should be adjusted to give a picture that will fill the mask horizontally, with the minimum of stretching or compression.

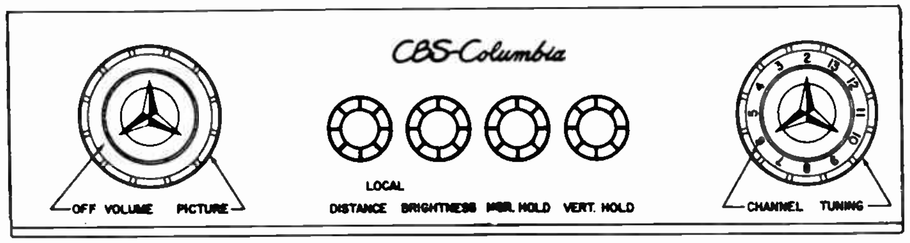
3 – The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

PICTURE TUBE HANDLING PRECAUTIONS

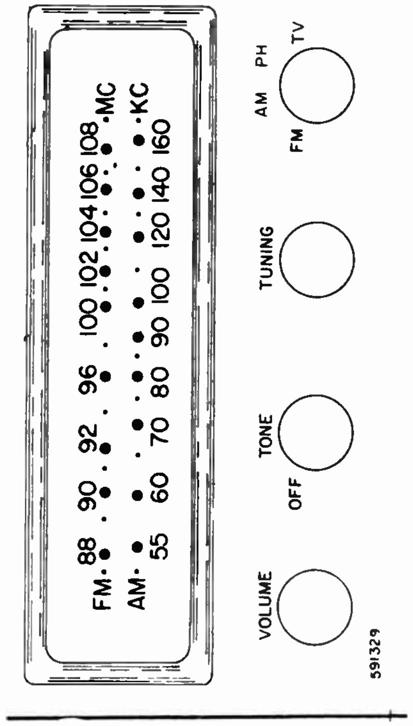
The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

RADIO ALIGNMENT CHART

Step No.	Band Switch in Position	Dummy Antenna	Signal Generator Freq.	Signal Generator Connection	Dial Position	Output Meter	Adjust C or L	Adjust For	Remarks
1	AM	0.1 Mfd.	455 kc.	Pin #2 12AT7	1620 kc.	Across Speaker	T5 & T3	Maximum Reading	
2	AM	....	1600 kc.	Radiating Loop	1600 kc.	Across Speaker	C10c Osc. Trimmer	Maximum Reading	
3	AM	....	600 kc.	Radiating Loop	600 kc.	Across Speaker	L7 Osc. Coil	Maximum Reading	Repeat Nos. 2 & 3 Until No Change Noticed
4	AM	....	1500	Radiating Loop	1500 kc.	Across Speaker	C10a Ant. Trimmer	Maximum Reading	Repeat Nos. 4 & 5 Until No Change Noticed
5	AM	....	600 kc.	Radiating Loop	600 kc.	Across Speaker	Loop Ant. 2 Taped Wires	Maximum Reading	
6	FM	0.1 Mfd.	10.7 mc. (0.1 volt)	V4 Pin #1 6AU6	....	VTVM at A.V.C.	Bottom of T6	Maximum Reading	See Note A
7	FM	0.1 Mfd.	10.7 mc.	V4 Pin #1 6AU6	....	VTVM at Audio	Top of T6	Zero Volts	See Note B
8	FM	300 ohms	10.7 mc.	Ant. Terminal	....	VTVM at A.V.C.	T4 & T2	Maximum Reading	See Note A
9	FM	300 ohms	108 mc.	Ant. Terminal	108	VTVM at A.V.C.	C10d Osc. Trimmer	Maximum Reading	
10	FM	300 ohms	90 mc.	Ant. Terminal	90	VTVM at A.V.C.	L6 F.M. Osc. Coil	Maximum Reading	See Note C
11	FM	300 ohms	90 mc.	Ant. Terminal	90	VTVM at A.V.C.	C10b FM. Ant.	Maximum Reading	See Note D



DIAL CALIBRATION AND KNOB LOCATION



ADJUSTMENT OF ANTI-PINCUSHION MAGNETS

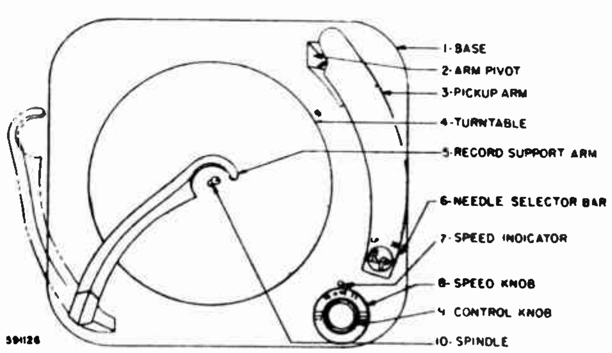
1-ADJUST THE HORIZONTAL CENTERING AND HORIZONTAL SIZE CONTROLS SO THAT ONE EDGE OF THE RASTER MAY BE SEEN.

2-IF EDGE OF RASTER IS BOWED, LOOSEN THE SCREW RETAINING THE ANTI-PINCUSHION MAGNET WHICH IS MOUNTED ON THE TIE-ROD BRACING THE PICTURE TUBE (ON THE SIDE WHICH SHOWS BOWING) SUFFICIENTLY TO ADJUST THE MAGNET BRACKET.

3-ADJUST THE MAGNET SPACING AND ROTATION, TO OBTAIN A STRAIGHT RASTER EDGE. TIGHTEN THE RETAINING SCREW.

4-REPEAT (1), (2), AND (3) FOR OPPOSITE EDGE OF RASTER.

OPERATION OF AUTOMATIC RECORD CHANGER



1. LOAD. Lift and turn Record Support Arm out of the way, place records on spindle, and place Record Support Arm back on top of records. (See figure 2).

2. SELECT SPEED. Set Speed Knob to proper speed for type of record to be played—33⅓—45, or 78 rpm.

3. SELECT NEEDLE. Observe carefully the red and white dots on the needle bar. Set this needle selector bar so that the red dot is showing when playing 33⅓—45 rpm records and the white dot showing when playing 78 rpm records.

4. START. Turn Control Knob on changer right hand front corner to "REJ" and release. The phonograph will then play the records on the spindle and automatically shut off the changer after the last record has been played.

5. MANUAL OPERATION

(a) With no records on the spindle shelf and record support over the spindle, turn "On-Off" Control Knob back to "REJ" and release. Changer will go through shut-off operation.

(b) Turn Control Knob to "On" position. (Do not turn past "On" position.)

(c) Lift pickup arm and place needle in the starting groove of the record.

6. VOLUME (first knob on left side of radio panel). The control marked "Volume" is actually a loudness control. The treble and bass are automatically balanced throughout the range of this control to give the best listening tone.

7. TONE (second knob on left side of radio panel). Turning to left on mid (Normal) position reduces the treble tone; turning clockwise emphasizes the treble tone.

8. REJECTING. To reject a record during playing, simply move the playing control knob (on the changer) forward and release as in starting.

IMPORTANT: Since the cabinet entirely closed is a fully engineered acoustic reproducer, the doors and drawer must be closed when playing. Playing this instrument with the drawer out will result in loss of the lower bass register.

The following equipment is necessary to properly align this receiver:

1. AM signal generator with frequency coverage from 455 kc. to 1700 kc.

2. FM or CW signal generator covering the FM band from 87 mc. to 109 mc. and 10.7 mc. for FM IF alignment.

3. Vacuum Tube Voltmeter (VTVM).

4. Output meter—to match 4 ohms, 5 watts maximum.

5. Insulated alignment screwdriver.

6. Dummy antenna—0.1 mfd. capacity, 300 ohm carbon resistor and inductive loop (fashioned from several turns of wire).

The safety glass of this receiver is removable so that the face of the picture tube may be cleaned. To accomplish this remove power cord from wall socket. Remove the upper strip that holds the safety glass in place by removing the five screws which secure the strip, supporting the safety glass so that it does not fall forward. Remove the safety glass by tilting it forward and lifting it out of the slot in the lower glass retaining strip. Be careful not to scratch or strike the surface of the picture tube with any object. Carefully clean face of picture tube and the inside surface of the safety glass with a soft, clean, dry cloth. DO NOT ATTEMPT TO REMOVE THE PICTURE TUBE MASK. Reassemble by inserting glass in slot of lower strip. Replace upper strip and tighten the screws securely.

Reference Notes to Alignment Chart

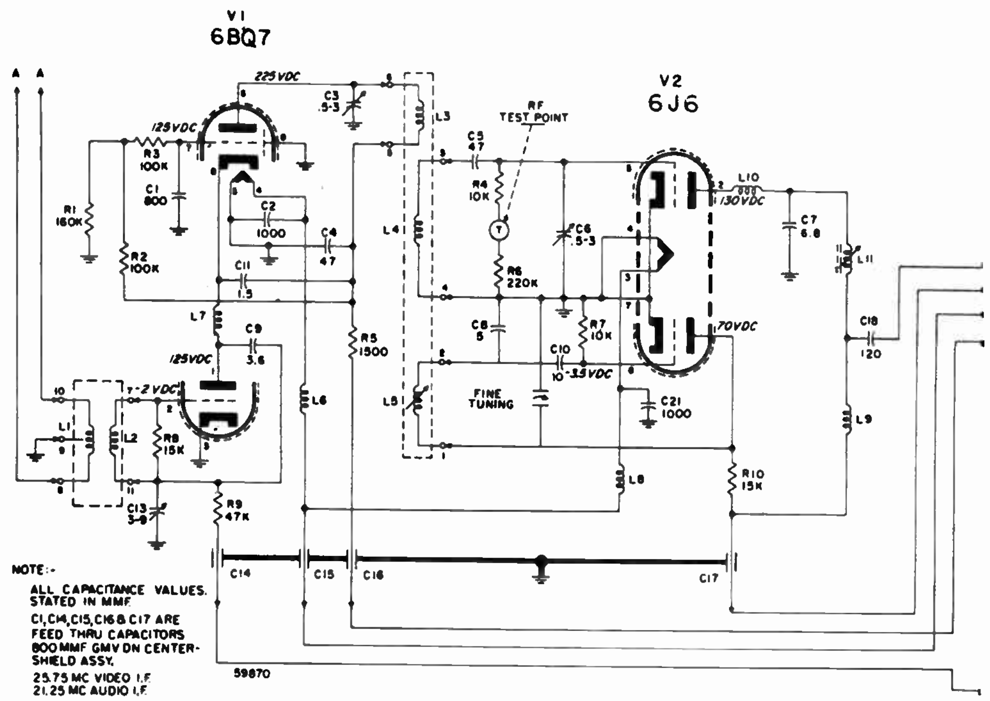
Before starting alignment, pointer must be set at 87.5 MC mark with gang fully closed.

Note A: Put two 100,000 ohm resistors in series across R–23 (30,000 ohms). Negative lead of V.T.V.M. is attached to the junction of these two resistors. Positive lead of V.T.V.M. is ground. V.T.V.M. on 3 volt scale.

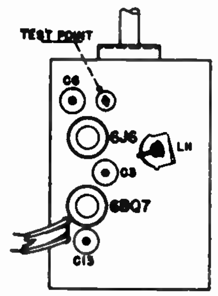
Note B: Negative lead of V.T.V.M. same as in Note A, positive lead of V.T.V.M. at junction of R–22 (27K ohm) and shielded lead, on terminal strip at ratio detector.

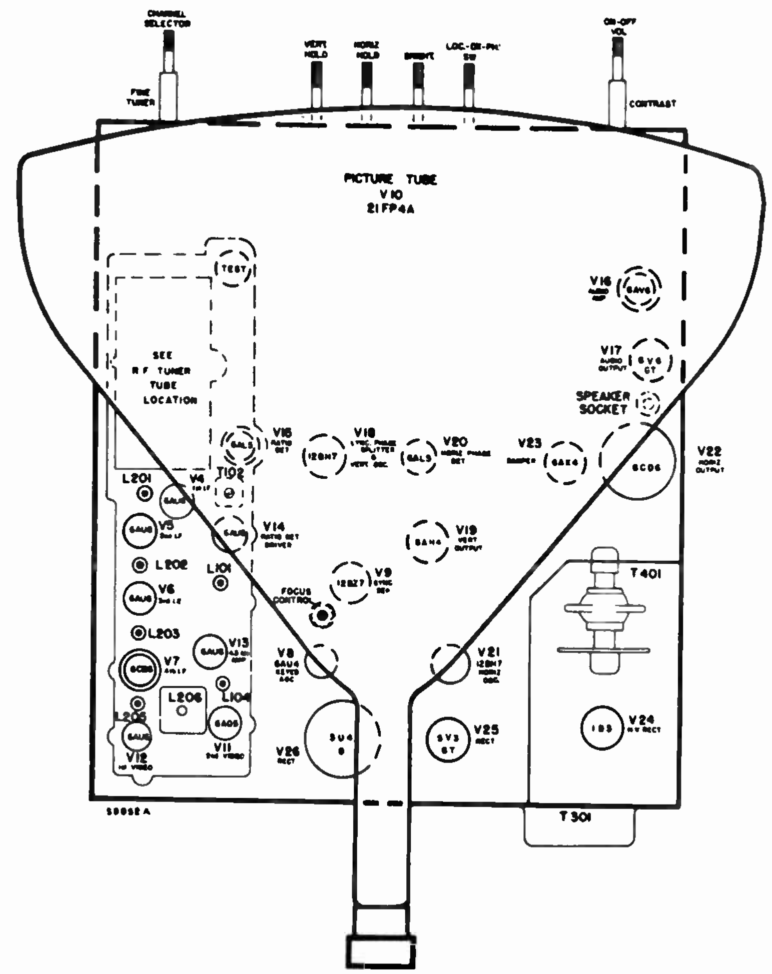
Note C: The FM R.F. and OSC. coils are made of stiff wire. To adjust these coils for band coverage and tracking squeeze coils together or spread apart as required.

Note D: Tune F.M. antenna trimmer (C10b) and at the same time rock the signal generator frequency back and forth for maximum deflection on the meter.

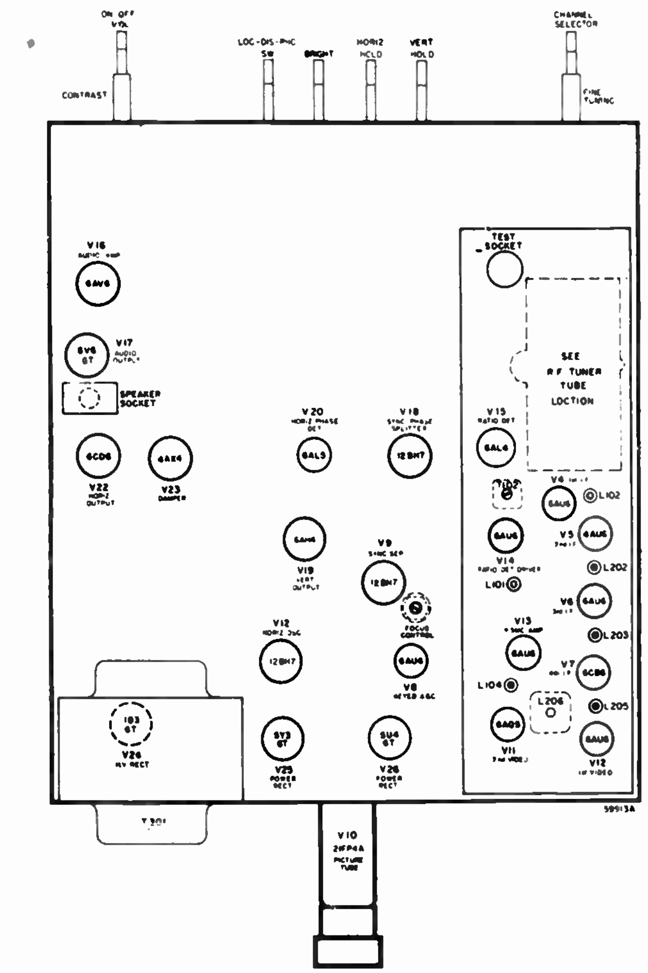


TUNER SCHEMATIC & TUBE LOCATION
12 POSITION 25MC VHF CASCODE TUNER PC-541215

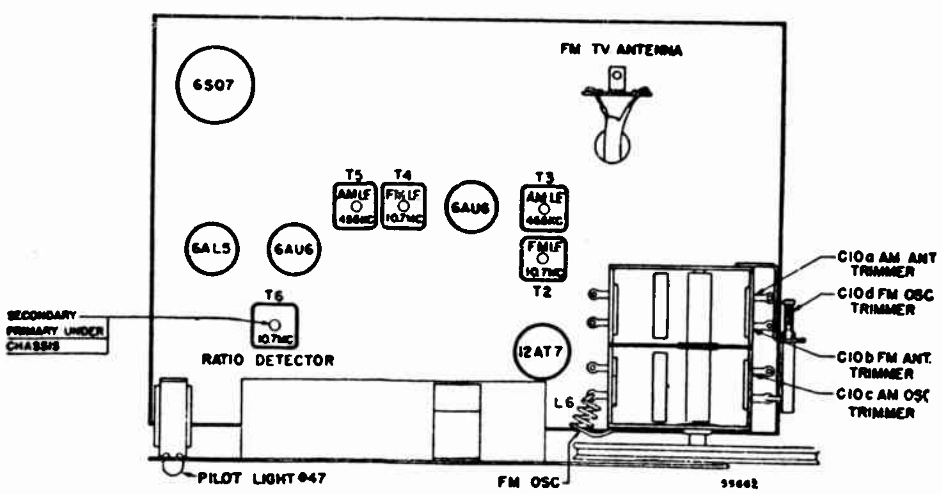




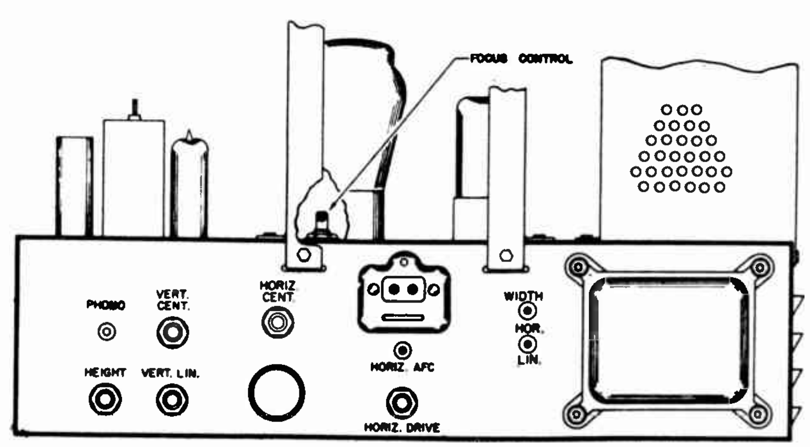
TUBE & TRIMMER LOCATION



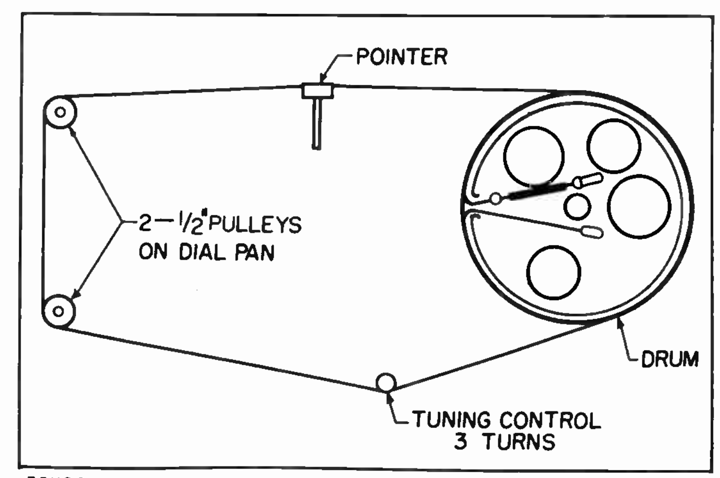
CHASSIS BOTTOM VIEW



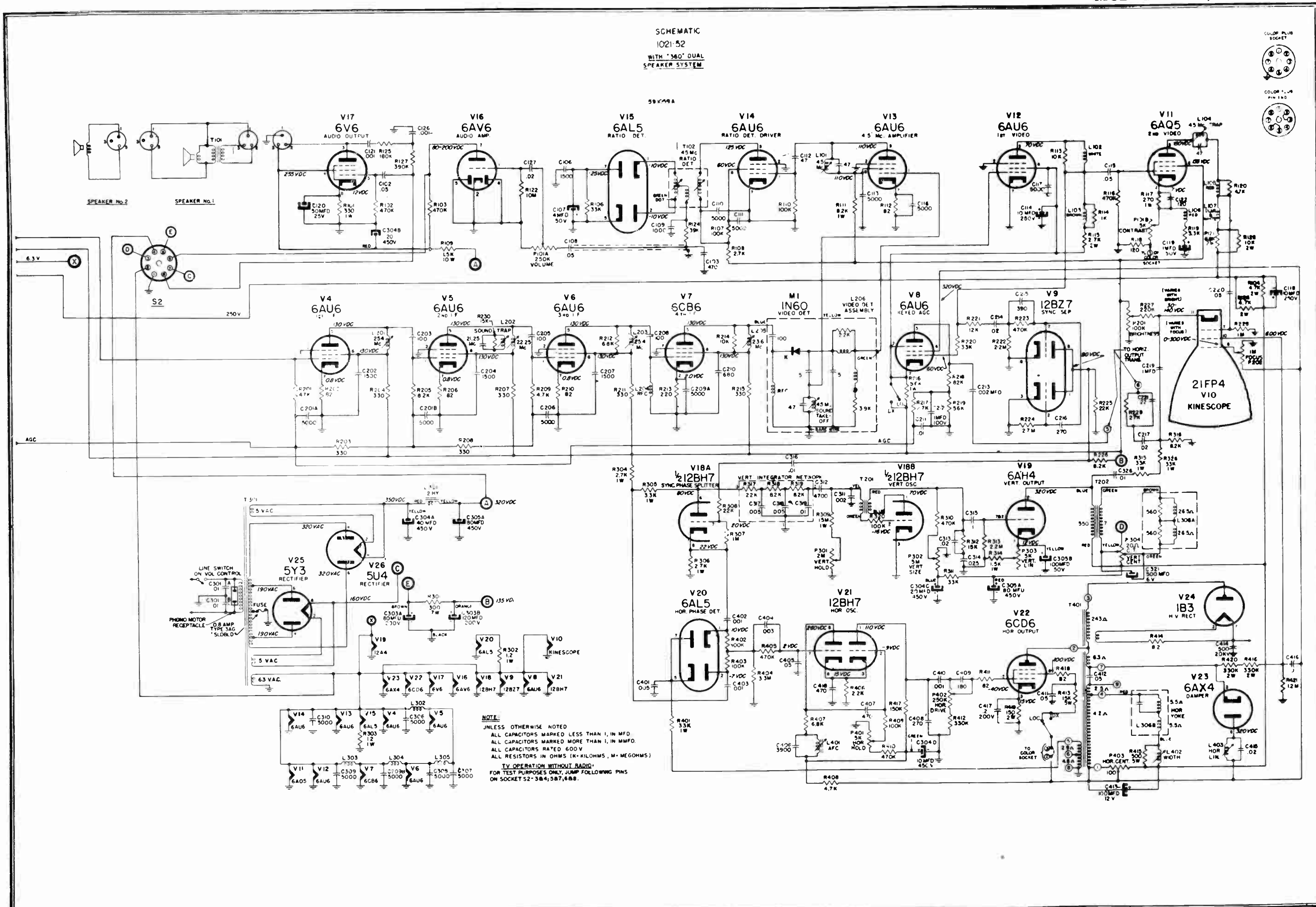
TUBE LOCATION



REAR CONTROLS



DIAL STRINGING



SCHEMATIC
1021-52
WITH "360" DUAL SPEAKER SYSTEM
V17 6V6 AUDIO OUTPUT
V16 6AV6 AUDIO AMP.
V15 6AL5 RATIO DET.
V14 6AU6 RATIO DET. DRIVER
V13 6AU6 4.5 MC. AMPLIFIER
V12 6AU6 1ST VIDEO
V11 6AQ5 2ND VIDEO
V4 6AU6
V5 6AU6
V6 6AU6
V7 6CB6
M1 1N60 VIDEO DET
V8 6AU6 KEYED AGC
V9 12BZ7 SYNC SEP
21FP4 V10 KINESCOPE
V18A 1/2 12BH7
V18B 1/2 12BH7 VERT OSC
V19 6AH4 VERT. OUTPUT
V25 5Y3 RECTIFIER
V26 5U4 RECTIFIER
V20 6AL5 HOR. PHASE DET.
V21 12BH7 HOR OSC.
V22 6CD6 HOR OUTPUT
V24 1B3 H V RECT
V23 6AX4 DAMPER
SPEAKER No. 2
SPEAKER No. 1
S2
NOTE:
UNLESS OTHERWISE NOTED
ALL CAPACITORS MARKED LESS THAN 1, IN MFD
ALL CAPACITORS MARKED MORE THAN 1, IN MMFD.
ALL CAPACITORS RATED 600 V
ALL RESISTORS IN OHMS (K=KILOHMS, M=MEGOHMS)
TV OPERATION WITHOUT RADIO:
FOR TEST PURPOSES ONLY, JUMP FOLLOWING PINS
ON SOCKET S2-3&4; 5&7; 6&8.

CAPACITORS

SYMB. NO.	PART NO.	DESCRIPTION
C102	A194-160	Paper, .05 mfd 600V ±20%
C103	A556-231	Ceramic Tubular 470mmf 350V ± 10%
C106	A19148	Ceramic Single Disc 1500 mmf GMV
C107	A20149	Electrolytic 4 mfd 50V
C108	A194-160	Paper, .05 mfd 600V ±20%
C109	A555-136-2	Ceramic Tubular, 1000 mmf 350V ±20% (Noninsul) NPO
C110	A19109	Ceramic Single Disc 5000 mmf GMV
C111	A19109	Ceramic Single Disc 5000 mmf GMV
C112	A555-113-2	Ceramic Tubular 47 mmf 500V ±20% (Noninsul) NPO
C113	A19109	Ceramic Single Disc 5000 mmf GMV
C114	A20145	Electrolytic 10 mfd 250V
C115	A194-160	Paper, .05 mfd 600V ±20%
C116	A19109	Ceramic Single Disc 5000 mmf GMV
C117	A19109	Ceramic Single Disc 5000 mmf GMV
C118	A20145	Electrolytic 10 mfd 250V
C119	A20138	Electrolytic 1 mfd 50V
C120	A20182	Electro, 50mfd 25V
C121	A194-A145	Paper, .001 mfd 600V ± 20%
C122	A190-125	Mica, 120mmf 500V ±10%
C123	A555-123	Ceramic Tubular,220mmf 500V ±20%
C126	A194-A145	Paper .001 mfd 600V ± 20%
C127	A194-A156	Paper .02mfd 600V ± 20%
C201	A19163	Ceramic Shielded Dual Disc 5000 mmf GMV
C202	A19148	Ceramic Single 1500 mmf GMV
C203	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C204	A19148	Ceramic Single Disc 1500 mmf GMV
C205	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C206	A19109	Ceramic Single Disc 5000 mmf GMV
C207	A19148	Ceramic Single Disc 1500 mmf GMV
C208	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C209	A19163	Ceramic Shielded Dual Disc 5000 mmf GMV
C210	A190-143	Mica 680 mmf 500V ±10%
C211	A194-155	Paper, .01 mfd 600V ±20%
C212	A194-21	Paper, 1.0 mfd 100V ±20%
C213	A194-146	Paper, .002 mfd 600V ±20%
C214	A194-156	Paper, .02 mfd 600V ±20%
C215	A190-137	Mica 390 mmf 500V ±10%
C216	A190-133	Mica 270 mmf 500V ±10%
C217	A194-156	Paper, .02 mfd 600V ±20%
C219	A194-162	Paper, .1 mfd 600V ±20%
C220	A197-160	Molded Tubular .05 mfd 600V ±20%
C221	A19220	Mica, 22mmf 600V ±10%
C301	A19198	Ceramic Shielded Dual Disc .01mfd 500V GMV
C303	A20170	Electrolytic 80 mfd 200V, 120 mfd 200V
C304	A20168	Electrolytic 40-20-20-10 mfd 450V
C305	A20169	Electrolytic 80 mfd 450V, 100 mfd 50V
C306	A19109	Ceramic Single Disc 5000 mmf GMV
C307	A19109	Ceramic Single Disc 5000 mmf GMV
C308	A19109	Ceramic Single Disc 5000 mmf GMV
C309	A19109	Ceramic Single Disc 5000 mmf GMV
C310	A19109	Ceramic Single Disc 5000 mmf GMV
C311	A197-146	Molded Tubular .002 mfd 600V ±20%
C312	A192-163	Mica 4700 mmf 500V ±10%
C313	A194-156	Paper, .02 mfd 600V ±20%
C314	A194-157	Paper, .025mfd 600V ±20%
C315	A194-162	Paper, .1 mfd 600V ±20%
C316	A194-155	Paper, .01 mfd 600V ±20%
C317	A194-151	Paper, .005 mfd 600V ±20%
C318	A194-151	Paper, .005 mfd 600V ±20%
C319	A194-155	Paper, .01 mfd 600V ±20%
C321	A20171	Electrolytic, 500mfd 6V (Non-Polarized)
C326	A194-203	Paper, .01 mfd 1000V ±20%
C401	A197-151	Molded Tubular .005 mfd 600V ±20%
C402	A194-145	Paper, .001 mfd 600V ±20%
C403	A194-145	Paper, .001 mfd 600V ±20%
C404	A197-148	Molded Tubular .003 mfd 600V ±20%
C405	A194-160	Paper, .05 mfd 600V ±20%
C406	A195-261	Silver Mica 3900 mmf 500V ±10%
C407	A190-139	Mica 470 mmf 500V ±10%
C408	A190-133	Mica 270 mmf 500V ±10%
C409	A190-129	Mica, 180mmf 500V ±10%
C410	A194-145	Paper, .001 mfd 600V ±20%
C411	A197-160	Molded Tubular .05 mfd 600V ±20%
C412	A197-160	Molded Tubular .05 mfd 600V ±20%
C413	A20141	Electrolytic 100 mfd 12V
C414	A19175-3	Ceramic 500 mmf 20kv
C415	A197-156	Molded Tubular .02 mfd 600V ±20%
C416	A194-162	Paper, .1 mfd 600V ±20%
C417	A19156	Paper, .2 mfd 200V ±20%
C418	A190-139	Mica 470 mmf 500V ±10%

RESISTORS

SYMB. NO.	PART NO.	DESCRIPTION
R101	A232-1137	Carbon 330 Ohm 1w ±10%
R102	A231-1213	Carbon 470K Ohm 1/2w ±10%
R103	A231-1205	Carbon, 220K ohm 1/2w ±10%
R104	A233-1165	Carbon, 4700 ohm 2w ±10%
R106	A231-1185	Carbon 33K Ohm 1/2w ±10%
R107	A231-1197	Carbon 100K Ohm 1/2w ±10%
R108	A231-1159	Carbon 2700 Ohm 1/2w ±10%
R109	A21134-12	Wirewound 1500 Ohm 10w ±10%
R110	A231-1197	Carbon 100K Ohm 1/2w ±10%
R111	A232-1171	Carbon 8200 Ohm 1w ±10%
R112	A231-1123	Carbon 82 Ohm 1/2w ±10%
R113	A231-1173	Carbon 10K Ohm 1/2w ±10%
R114	A231-1149	Carbon, 1000 ohm 1/2w ±10%
R115	A233-1159	Carbon 2700 Ohm 2w ±10%
R116	A231-1213	Carbon 470K Ohm 1/2w ±10%
R117	A232-1135	Carbon 270 Ohm 1w ±10%
R118	A231-1127	Carbon 120 Ohm 1/2w ±10%
R119	A231-1161	Carbon 3300 Ohm 1/2w ±10%
R120	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R121	A233-1163	Carbon 3900 Ohm 2w ±10%
R122	A231-1221	Carbon, 10 Megohm 1/2w ± 10%
R123	A231-1215	Carbon, 560K ohm, 1/2w ±10%
R124	A231-1187	Carbon 39K Ohm 1/2w ±10%
R125	A231-1203	Carbon, 180K ohm 1/2w ± 10%
R126	A233-1165	Carbon, 4700 ohm 2w ± 10%
R127	A231-1211	Carbon, 390K ohm 1/2w ± 10%
R201	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R202	A231-1123	Carbon 82 Ohm 1/2w ±10%
R203	A231-1137	Carbon 330 Ohm 1/2w ±10%
R204	A231-1137	Carbon 330 Ohm 1/2w ±10%
R205	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R206	A231-1123	Carbon 82 Ohm 1/2w ±10%
R207	A231-1137	Carbon 330 Ohm 1/2w ±10%
R208	A231-1137	Carbon 330 Ohm 1/2w ±10%
R209	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R210	A231-1123	Carbon 82 Ohm 1/2w ±10%
R211	A231-1137	Carbon 330 Ohm 1/2w ±10%
R212	A231-1169	Carbon 6800 Ohm 1/2w ±10%
R213	A231-1133	Carbon 220 Ohm 1/2w ±10%
R214	A231-1173	Carbon 10K Ohm 1/2w ±10%
R215	A231-1137	Carbon 330 Ohm 1/2w ±10%
R216	A232-1167	Carbon 5600 Ohm 1w ±10%
R217	A231-1159	Carbon 2700 Ohm 1/2w ±10%
R218	A231-1195	Carbon 82K Ohm 1/2w ±10%
R219	A231-1191	Carbon 56K Ohm 1/2w ±10%
R220	A231-1185	Carbon 33K Ohm 1/2w ±10%
R221	A231-1175	Carbon 12K Ohm 1/2w ±10%
R222	A231-1229	Carbon 2.2 Megohm 1/2w ±10%
R223	A231-1213	Carbon 470K Ohm 1/2w ±10%
R224	A231-1231	Carbon 2.7 Megohm 1/2w ±10%
R225	A231-1181	Carbon 22K Ohm 1/2w ±10%
R226	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R227	A231-1205	Carbon 220K Ohm 1/2w ±10%
R228	A231-1221	Carbon 1.0 Megohm 1/2w ±10%
R229	A231-1207	Carbon, 27K ohm 1/2w ±10%
R230	A231-1177	Carbon, 15K ohm 1/2w ±10%
R301	A21134-11	Wirewound 300 Ohm 7w ±10%
R302	A23151	Wirewound 1.2 Ohm 1w ±10%
R303	A23151	Wirewound 1.2 Ohm 1w ±10%
R304	A232-1159	Carbon 2700 Ohm 1w ±10%
R305	A232-1161	Carbon 330 Ohm 1w ±10%
R306	A232-1159	Carbon 2700 Ohm 1w ±10%
R307	A231-1221	Carbon 1.0 Megohm 1/2w ±10%
R308	A231-1181	Carbon 22K Ohm 1/2w ±10%
R309	A232-1225	Carbon 1.5 Megohm 1w ±10%
R310	A231-1213	Carbon 470K Ohm 1/2w ±10%
R311	A231-1185	Carbon 33K Ohm 1/2w ±10%
R312	A231-1177	Carbon, 15K ohm 1/2w ±10%
R313	A231-1229	Carbon 2.2 Megohm 1/2w ±10%
R314	A232-1153	Carbon, 1500 ohm 1w ±10%
R315	A232-1185	Carbon 33K Ohm 1w ±10%
R316	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R317	A231-1181	Carbon 22K Ohm 1/2w ±10%
R318	A231-1171	Carbon 8200 Ohm 1/2W ±10%
R319	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R320	A231-1190	Carbon 100K Ohm 1/2w ±10%
R326	A232-1185	Carbon 33K Ohm 1w ±10%

RESISTORS

SYMB. NO.	PART NO.	DESCRIPTION
R401	A232-1185	Carbon 33K Ohm 1w ±10%
R402	A231-1197	Carbon 100K Ohm 1/2w ±10%
R403	A231-1197	Carbon 100K Ohm 1/2w ±10%
R404	A231-1233	Carbon 3.3 Megohm 1/2w ±10%
R405	A231-1213	Carbon 470K Ohm 1/2w ±10%
R406	A231-1157	Carbon 2200 Ohm 1/2w ±10%
R407	A231-1169	Carbon 6800 Ohm 1/2w ±10%
R408	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R409	A231-1197	Carbon 100K Ohm 1/2w ±10%
R410	A231-1213	Carbon 470K Ohm 1/2w ±10%
R411	A231-1123	Carbon 82 Ohm 1/2w ±10%
R412	A231-1209	Carbon 330K Ohm 1/2w ±10%
R413	A21134-26	Wire Wound, 15K ohm 5w ±10%
R414	A23158	Carbon 8.2 Ohm 1/2w ±10%
R415	A21134-10	Wirewound 500 Ohm 5w ±10%
R416	A233-1209	Carbon 330 K Ohm 2w ±10%
R417	A231-1201	Carbon 150K Ohm 1/2w ±10%
R418	A231-1123	Carbon 82 Ohm 1/2w ±10%
R419	A233-1129	Carbon 150 Ohm 2w ±10%
R420	A233-1209	Carbon 330K Ohm 2w ±10%
R421	A231-1223	Carbon, 1.2 Megohm 1/2w ±10%

CHOKES & COILS

SYMB. NO.	PART NO.	DESCRIPTION
L101	PA28286	Coil Audio Takeoff
L102	PC28255-2	Coil, Peaking (white)
L103	PC28255-8	Coil Peaking (Brown)
L104	PA28286	Coil 4.5 mc Trap
L105	PC28255-1	Coil Peaking (Red)
L106	PC28255-1	Coil Peaking (Red)
L107	PC28255-11	Coil Peaking (Blue and White)
L201	PB3392	Coil Pix. I.F.
L202	PB28320	Coil Pix. I.F. w/Trap
L203	PB3392	Coil Pix. I.F.
L204	PA28253	Coil R.F. Choke
L205	PB3392	Coil Pix. I.F.
L206	PB28321	Coil, Video Detector Peaking Coil Assembly
L301	PB1414	Coil Filter Choke
L302	PA28276	Coil Filament Choke
L303	PA28276	Coil Filament Choke
L304	PA28276	Coil Filament Choke
L305	PA28276	Coil Filament Choke
L306	PC28317-1	Coil Deflection Yoke
L401	PA28263	Coil Horizontal Frequency Control
L402	PA28318	Coil Width Control
L403	PA28218	Coil Horizontal Linearity

TRANSFORMER

SYMB. NO.	PART NO.	DESCRIPTION
T102	PB1201 or PB1202	Transformer Ratio Detector
T201	PB10106-2	Transformer Vertical Block Osc.
T202	PC10154-2	Transformer, Vertical output
T301	PC10148	Transformer Power
T401	PC10161	Transformer, Horizontal output

CONTROLS

SYMB. NO.	PART NO.	DESCRIPTION
P101A,B	PA24136	Control Volume Contrast 250K-5K (Dual Front)
P201	PA24134	Control Brightness 100K (Front)
P202	PA24112	Control Focus 1 Megohm (Rear)
P301	PA24146	Control Vertical Hold 1 Megohm (Front)
P302	PA24111	Height 5 Megohm (Rear)
P303	PA24135	Control Vertical Linearity 5K 2w (Rear)
P304	PA24118	Control Vertical Centering 20 Ohm C.T. (Rear)
P401	PA24137	Control Horizontal Hold 5K (Front)
P402	PA24138	Control Horizontal Drive 250K (Rear)
P403	PA24116	Control Horizontal Centering 100 Ohm Wirewound (Rear)

REPAIR PARTS LIST 703 AM–FM RADIO

CAPACITORS

SCH. LOC.	PART NO.	DESCRIPTION
C1	A16109	AM FM Variable
C2	A20148	Electrolytic 10 mfd 450V
C3, C8, C19, C20	A190-115	Mica 47 mmf ± 10%
C4	A190-130	Mica 470 mmf ± 10%
C5, C34	A190-131	Mica 220 mmf ± 10%
C6, C15, C30, C32	A19109	Ceramic Disc 5000 mmf
C7	A19167	Ceramic Durez Coated 5000 mmf ± 10%
C9	A555-201	Ceramic 10 mmf ± 10%
C10	A1774	Trimmer
C11a, C11b, C16a, C16b, C22a, C22b, C31a, C31b	A19163	Ceramic Disc Dual 5000 mmf
C12, C24, C33	A194-112	Paper .05 mfd 400V ± 20%
C13	A19165	Ceramic 2.2 mmf
C17	A194-108	Paper .02 mfd 400V ± 20%
C18	A190-110	Mica 33 mmf 500V ± 10%
C21, C25	A194-107	Paper .01 mfd 400V ± 20%
C26	A194-98	Paper .002 mfd 400V ± 20%
C27. C28	A190-135	Mica 330 mmf ± 10%
C29	A20149	Electrolytic 4 mfd 50V
C30	A190-119	Mica 68 mmf 500V 10%

RESISTORS

SCH. LOC.	PART NO.	DESCRIPTION
R1	A21114	Resistor, Wirewound 2500 ohms 10w
R2	A2529	Control, Tone 250,000 ohm
R3	A24117	Control, Volume 500,000 ohm
R4, R24	A230-2321	Carbon 1 meg ohm ¼w ± 20%
R5	A230-2253	Carbon 1500 ohm ¼w ± 20%
R6	A231-2281	Carbon 22,000 ohm ½w ± 20%
R7	A231-1161	Carbon 3300 ohm ½w ± 10%
R8, R12	A231-2249	Carbon 1000 ohm ½w ± 20%
R9,	A230-2313	Carbon 470,000 ohm ¼w ± 20%
R10	A230-1123	Carbon 82 ohm ¼w ± 10%
R11	A232-2281	Carbon 22,000 ohm 1w ± 20%
R13	A230-2329	Carbon 2.2 meg ohm ¼w ± 20%
R14	A230-2309	Carbon 330K ohm ¼w 20%
R15	A231-2313	Carbon 470,000 ohm ½w ± 20%
R16	A231-2305	Carbon 220,000 ohm ½w ± 20%
R17	A230-1221	Carbon 68 ohm ¼w ± 10%
R18	A230-2345	Carbon 10 meg ohm ¼w ± 20%
R19	A232-1177	Carbon 15,000 ohm 1w ± 20%
R20	A232-2257	Carbon 2200 ohm 1w ± 20%
R21	A231-1217	Carbon 680K ohm ½w 20%
R22	A230-1183	Carbon 27,000 ohm ¼w ± 10%
R23	A230-84	Carbon 30,000 ohm ¼w ± 5%
R25	A230-89	Carbon 47,000 ohms ¼w 10%
R26	A230-1101	Carbon 10 ohm ¼w 10%
R27	A230-1203	Carbon 180K ¼w 10%

SOCKETS

SCH. LOC.	PART NO.	DESCRIPTION
	A18147	Socket, 7 Pin Miniature
	A18174	Socket, Phono Input
	A6528	Socket, Pilot Light
	A18155	Socket, Octal
S1	A37102	Switch, AM FM Phono, TV
T2	A3395	Transformer, FM IF 1st
T3	A3396	Transformer, AM IF 1st
T4	A3394	Transformer, FM IF 2nd
T5	A3399	Transformer, AM IF 2nd
T6	A3397	Transformer, Ratio Detector
L3, L8	A28283	Choke, FM Osc.
L6	A28287	Coil, FM Osc.
L7	A28285	Coil, AM Osc.
L5	A28288	Coil, FM Antenna
	A28293	Antenna, FM
L4	A62298	Antenna, AM Loop

I. F. ALIGNMENT PROCEDURE 40 mc IF

Before pulling a chassis for shop alignment, the serviceman should check these points:

1 – The antenna and installation:

2 – Front panel and rear chassis control settings, including picture tube adjustments.

3 – Reception on all available channels.

4 – Tubes: Substitute known good tubes for suspected defective ones.

5 – Wiring, connections and parts placement under the chassis, for loose joints, and accidental shorts.

TEST EQUIPMENT REQUIREMENTS

The equipment listed below is essential for the correct alignment of this receiver.

1 – Signal Generator with an output Variable between 10 and 100,000 microvolts, and crystal controlled or calibrated at the following frequencies:

a) 4.5 mc	d) 43.8 mc	g) 39.75 mc
b) 41.25 mc	e) 45.2 mc	h) 45.75 mc
c) 42.3 mc	f) 47.25 mc	i) 44.75 mc

2 – Signal Generator with an output Variable between from 30 to 230 mc, a sweep width of at least 10 mc and an output adjustable from 0 to .1 volt.

3 – Marker Generator, crystal controlled or calibrated for video and sound carrier frequencies of each channel. (Can be the same generator as in #1 if these frequencies are available.)

4 – Cathode Ray Oscilloscope with good low frequency response.

5 – D.C. Vacuum Tube Voltmeter with 5 volt and 10 volt ranges.

6 – Non metallic alignment tool, hexagonal bit, .095" across flats.

7 – One 3 volt battery.

8 – Two balanced (± 1%) 100K resistors.

I.F. ALIGNMENT

1 – Connect negative of 3V battery to AGC bus (Pin 7, test socket), positive to chassis.

2 – Remove mixer tube shield, connect Signal Generator, to it and replace over mixer tube so shield does not contact chassis.

3 – Connect VTVM negative lead to grid of first video amplifier (Pin 5, test socket) and positive lead to chassis.

4 – Plug line cord into receiver and electric outlet, turn receiver on and allow it to warm up a few minutes.

5 – Set VTVM on -5 volt range and signal generator to 44.75 mc unmodulated.

6 – Adjust 5th IF transformer L205 top slug for maximum output, setting signal generator attenuator to produce no more than a 3 volt reading on the VTVM.

7 – Set signal generator to 47.25 mc unmodulated and adjust L204 trap, bottom slug, for minimum reading on the VTVM.

8 – Set signal generator to 45.2 mc unmodulated and adjust top slug of 4th IF transformer L204 for maximum output as in (6).

9 – Set signal generator to 39.75 mc unmodulated and adjust trap L203, bottom slug for a minimum reading on VTVM.

10 – Set signal generator to 43.8 mc unmodulated and adjust top slug of L203 for a maximum VTVM reading as in (6).

11 – Set signal generator to 41.25 mc unmodulated and adjust trap L202, bottom slug, for a minimum VTVM reading.

12 – Set signal generator to 42.3 mc unmodulated and adjust the 2nd IF coil. L202, top slug, for a maximum VTVM reading as in (6).

13 – Set signal generator to 43.8 mc and adjust L201, 1st I.F. and and L14, tuner I.F. coil for an approximate maximum.

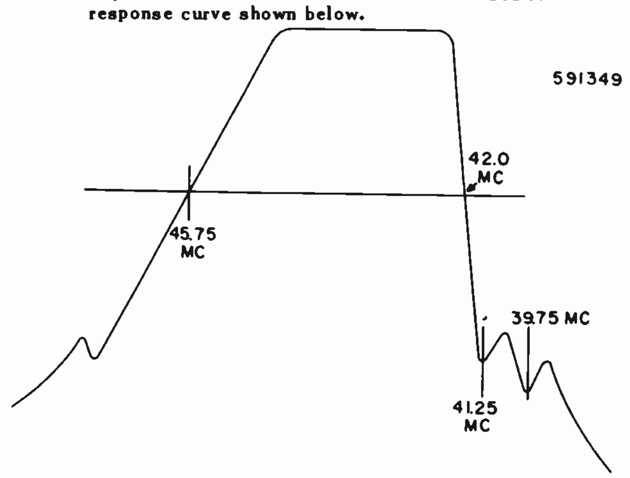
14 – Disconnect the signal generator from the tube shield.

15 – Connect Sweep Signal Generator to mixer tube shield and an oscilloscope, calibrated for 3 volts peak to peak as reference output level, in place of the VTVM.

16 – Loosely couple Marker Generator to input on the Sweep Signal Generator.

17 – Adjust Sweep Signal Generator dial and attenuator to show an IF response curve not over 3 volts peak to peak on the calibrated oscilloscope screen. (Exceeding this value will give a distorted response curve.)

18 – Adjust tuner IF coil and 1st IF coil L101 to obtain the response curve shown below.



RESPONSE CURVE 1100 SERIES

USUALLY: To set 45.75 marker at 50% point adjust tuner IF coil.

To compensate for tilt adjust 1st IF Coil L201. Bandwidth should be from 3.65 to 3.85 mc at the 50% point.

R-F OSCILLATOR (VHF TUNER PC541460)

If all channels are not within range of FINE TUNING control, adjust slug reached through front of r-f tuner unit for adjustment of each channel. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than converter plate coil, L14, during IF Alignment.

SOUND ALIGNMENT

1 – Connect 4.5 megacycle signal generator pin 1 of 6AU6 (V12) video amplifier. (Test Socket pin 5).

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V15) or to Test Socket pin 6, ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust sound take-off coil, L101 and bottom of T102 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K (±1%) resistors across R108 (Ratio Detector Load Resistor. (Test Socket pin 6 and Chassis). Connect DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to test socket pin 3. (Audio Take-Off of T102).

6 – Adjust top of T102 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER 4.5 mc. TRAP

When necessary, the video amplifier 4.5 mc. trap (L104) should be adjusted as follows:

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 1st video amplifier (V12).

2 – Adjust signal generator output till 4.5 mc. dot pattern is clearly visible on screen of picture tube.

3 – Adjust L104 to minimize the dot pattern.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be set halfway and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen. (Keep Brightness control low)

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

The Width control L402, should be adjusted to give a picture that will fill the mask horizontally.

The Height and Vertical Linearity controls should then be adjusted for a linear picture that will fill the mask vertically.

UHF TUNER ALIGNMENT

Tuner PC541459 41 mc. I.F. Coil Alignment.

Set the receiver channel selector for UHF.

1 – Connect the signal generator to the test point thru an isolating resistor of approximately 100K ohms.

2 – Connect VTVM to first video amplifier grid or to test socket pin 5.

3 – Set signal generator for 44.2 mc unmodulated. Turn receiver on and allow a short warm up period.

4 – Adjust T1 for maximum response as indicated on the VTVM.

ALIGNMENT PROCEDURE UHF TUNER PC541459

Alignment of the UHF Tuner is a simple procedure since its band-pass is essentially predetermined by the fixed characteristics of original component design, physical layout and associated circuitry. Except as stated otherwise in this procedure, band-pass is not subject to serious change during alignment, however, replacement of any component within the R-F or I-F circuits may disturb the band-pass characteristics. Accordingly, whenever parts within these circuits are replaced, electrical and physical specifications of the original components must be duplicated as closely as possible. Wires, parts and other accessories must be replaced in their former positions.

Complicated or specially designed test equipment is not required for practical alignment of the UHF Tuner. Instruments used for testing VHF sets are usually satisfactory. However, the following instruments are needed;

1 – VHF signal generator with AM output.

2 – Oscilloscope or vacuum tube volt-ohmmeter for measurement of the relative signal.

The oscilloscope or VTVM should be connected to the TV set first video amplifier grid or to test socket pin 5.

The procedure for alignment consists of the following steps.

1 – Positioning of the oscillator for proper band coverage.

2 – Alignment of R-F circuits for maximum effectiveness.

CABINET PARTS (1121-1)

MODEL	U22T22	U22T22B	U22C52	U22C52B
Cabinet	PE60263	PE60264	PE60208-1A	PE60208-2A
Safety Glass	PE62457-13	PE62457-13	PE62457-13	PE62457-13
Glass Retaining Strip (Upper)	PC62410-1	PC62410-2	PC62410-1	PC62410-2
Glass Retaining Strip (Lower)	PC62412-1	PC62412-2	PC62412-1	PC62412-2
Mask	PC62606	PC62606	PC62606	PC62606
Back Cover	PE62600A	PE62600A	PE62600A	PE62600A
Speaker 6" PM	PB58136	PB58136	PB58136	PB58136
6" PM	PB58133A	PB58133A	PB58133A	PB58133A
Knob, Channel Selector	PC39285	PC39286	PC39285	PC39286
Knob, On-Off Volume	PC39280-1C	PC39280-2C	PC39280-1C	PC39280-2C
Knob, Pix Control	PC39279A	PC39279A	PC39279A	PC39279A
Knob, Vernier	PB39278B	PB39278B	PB39278B	PB39278B
Knob, Auxiliary Control	PB39289	PB39290	PB39289	PB39290
Knob, Auxiliary Control - Ph/M/V Switch	PB39291	PB39292	PB39291	PB39292
UHF Indicator Disc	PB40157	PB40157	PB40157	PB40157

MODEL	U22C62	U22C62B
Cabinet	PE60210-1	PE60210-2
Safety Glass	PE62457-13	PE62457-13
Glass Retaining Strip (Upper)	PC62410-1	PC62410-2
Glass Retaining Strip (Lower)	PC62412-1	PC62412-2
Mask	PC62606	PC62606
Back Cover	PE62601A	PE62601A
Speaker 6" PM	PB58136	PB58136
6" PM	PB58133A	PB58133A
Knob, Channel Selector	PC39285	PC39286
Knob, On-Off Volume	PC39280-1C	PC39280-2C
Knob, Pix Control	PC39279A	PC39279A
Knob, Vernier	PB39278B	PB39278B
Knob, Auxiliary Control	PB39289	PB39290
Knob, Auxiliary Control - Ph/M/V Switch	PB39291	PB39292
UHF Indicator Disc	PB40157	PB40157

OSCILLATOR ADJUSTMENT

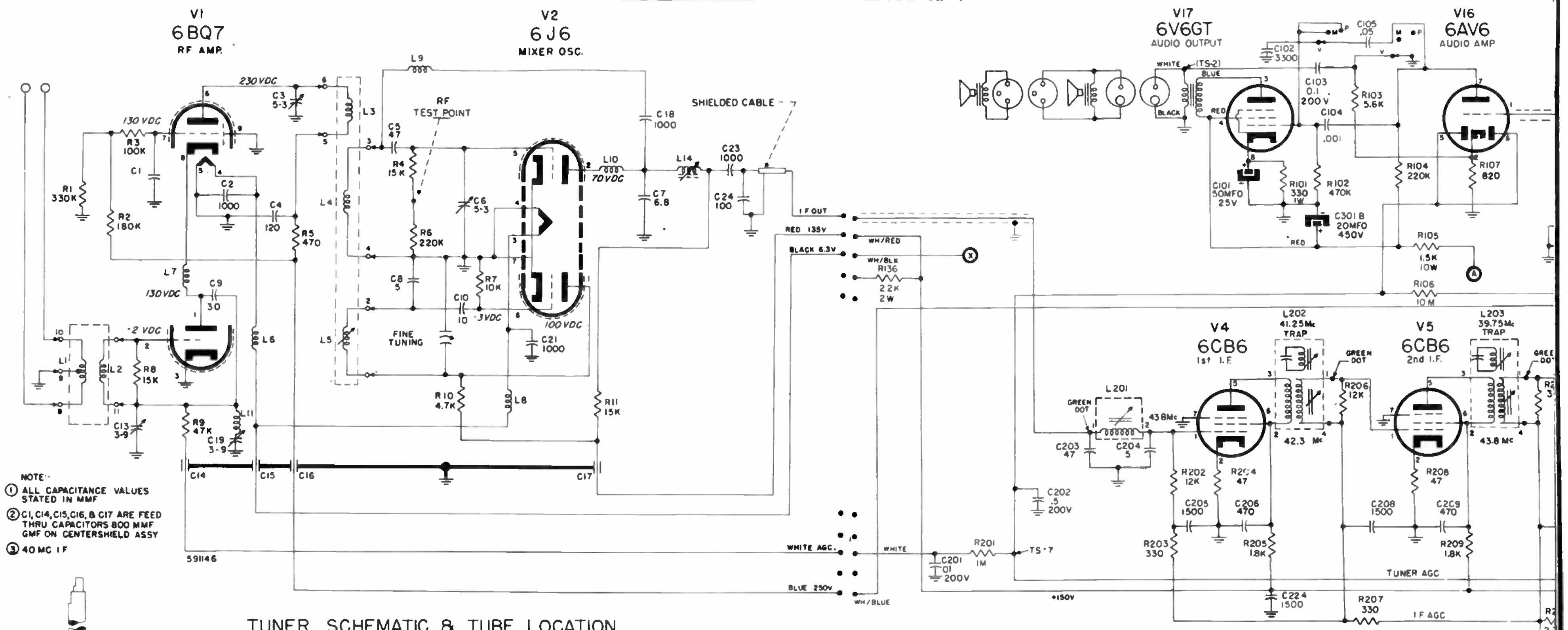
1 – Turn drum to extreme CCW position.

2 – Connect the signal generator to the UHF tuner antenna terminals and adjust generator for a signal between 459 and 466 megacycles. If no response is observed, carefully squeeze the short ends of the oscillator tuning condenser plates together or spread them apart until some frequency within the 459 to 466 mc range produces a response.

3 – Turn the tuning drum to extreme clockwise position.

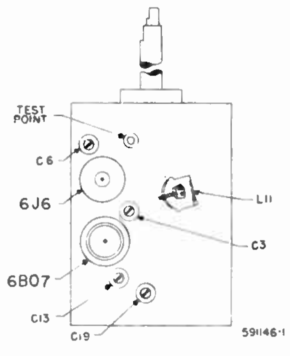
4 – Swing the signal generator thru the frequency range 894 to 903 megacycles. If a response within this range is obtained, no adjustment is necessary. If a response below 894 mc occurs, carefully squeeze the long ends of the oscillator plates slightly together until a signal between 894 and 903 mc producea a response. If the output occurs above 903 mc carefully spread the oscillator plates slightly at the long end.

Only a very slight amount of bending should be required in any case of incomplete band coverage, as this unit is assembled in a precision jig.



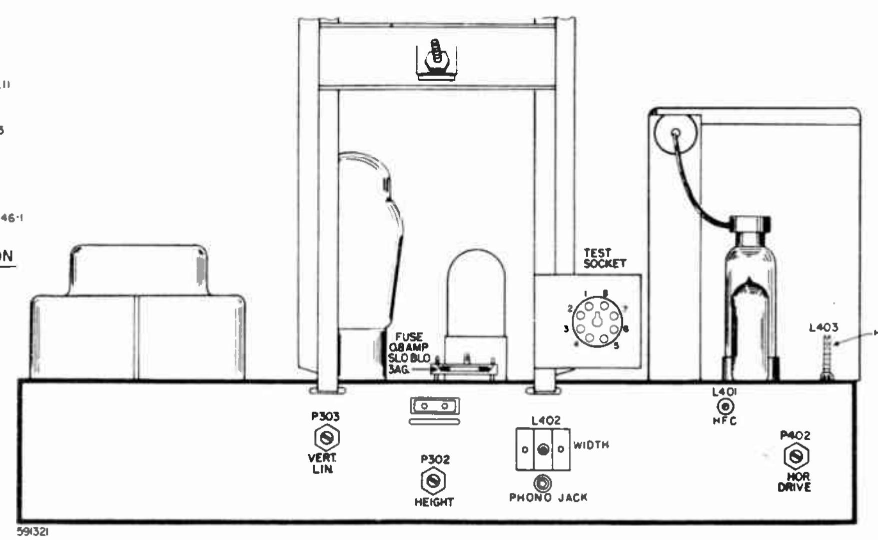
TUNER SCHEMATIC & TUBE LOCATION

40MC VHF TUNER PC-541497

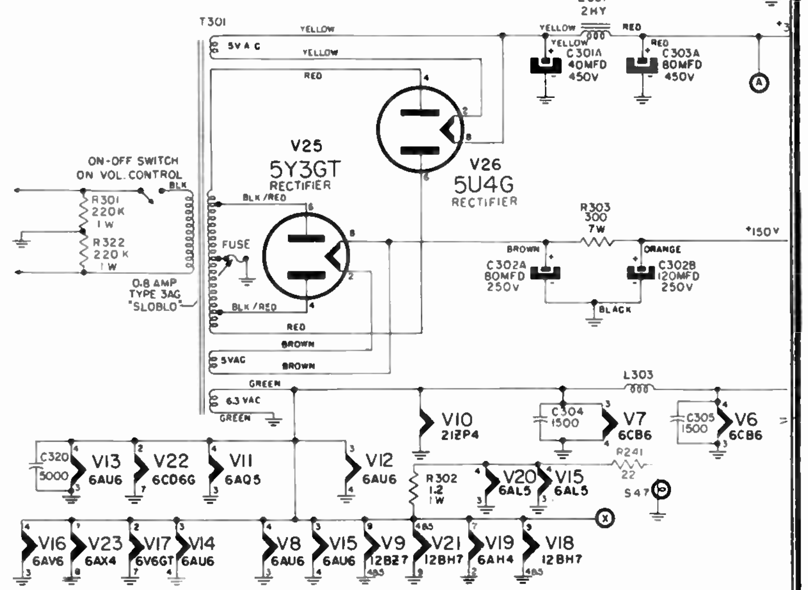


TUBE & TRIMMER LOCATION

40MC VHF TUNER PC-541497



REAR CONTROLS



R. F. ALIGNMENT

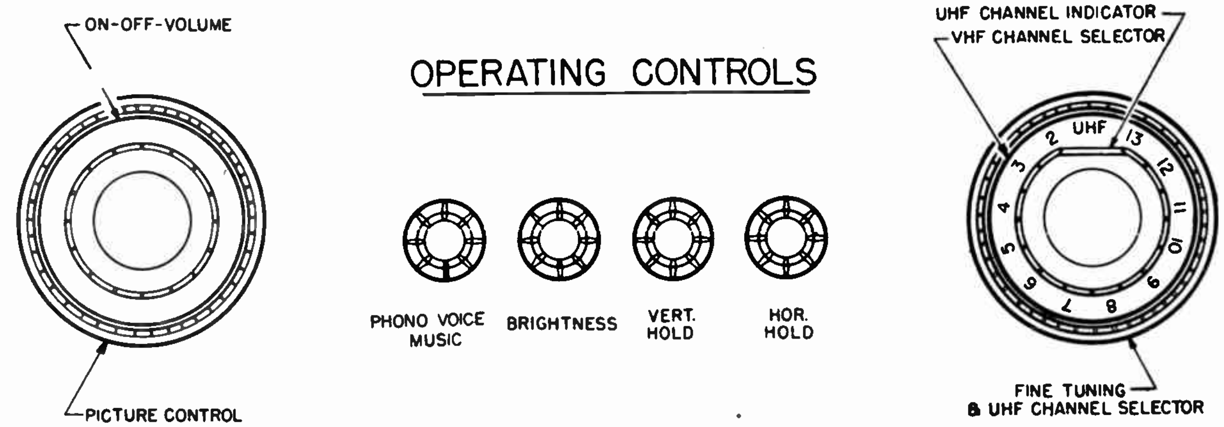
1 – With the signal generator and VTVM or oscilloscope connected as in the oscillator adjustment, adjust the signal generator to 470 mc and tune in this signal on the tuner. (near extreme counter clockwise position.)

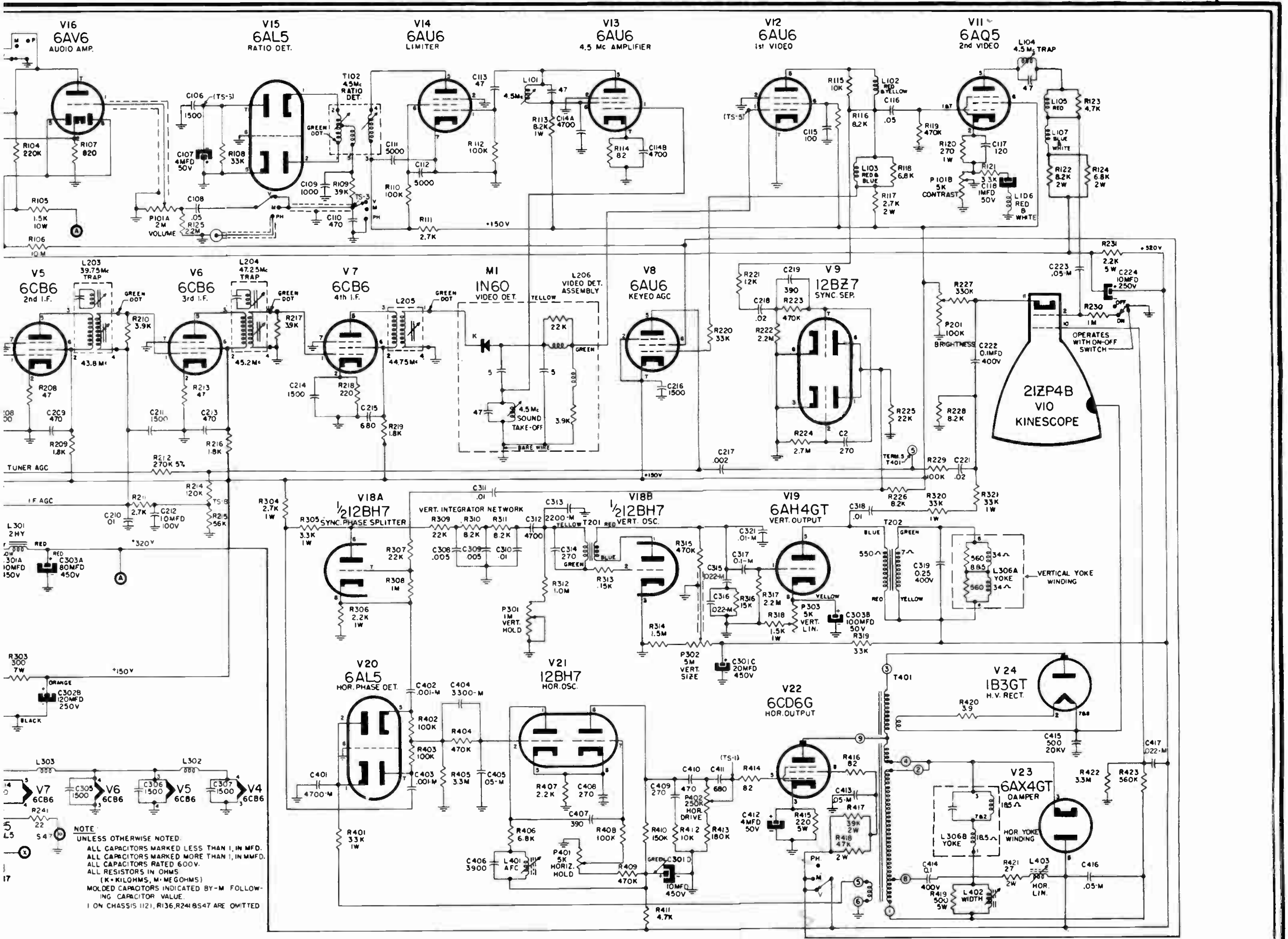
2 – Squeeze together or spread apart the short ends of the plates of the two R.F. tuning condenser sections until a maximum response is obtained.

3 – Set the signal generator to 890 mc and tune in this signal on the tuner (near extreme clockwise position).

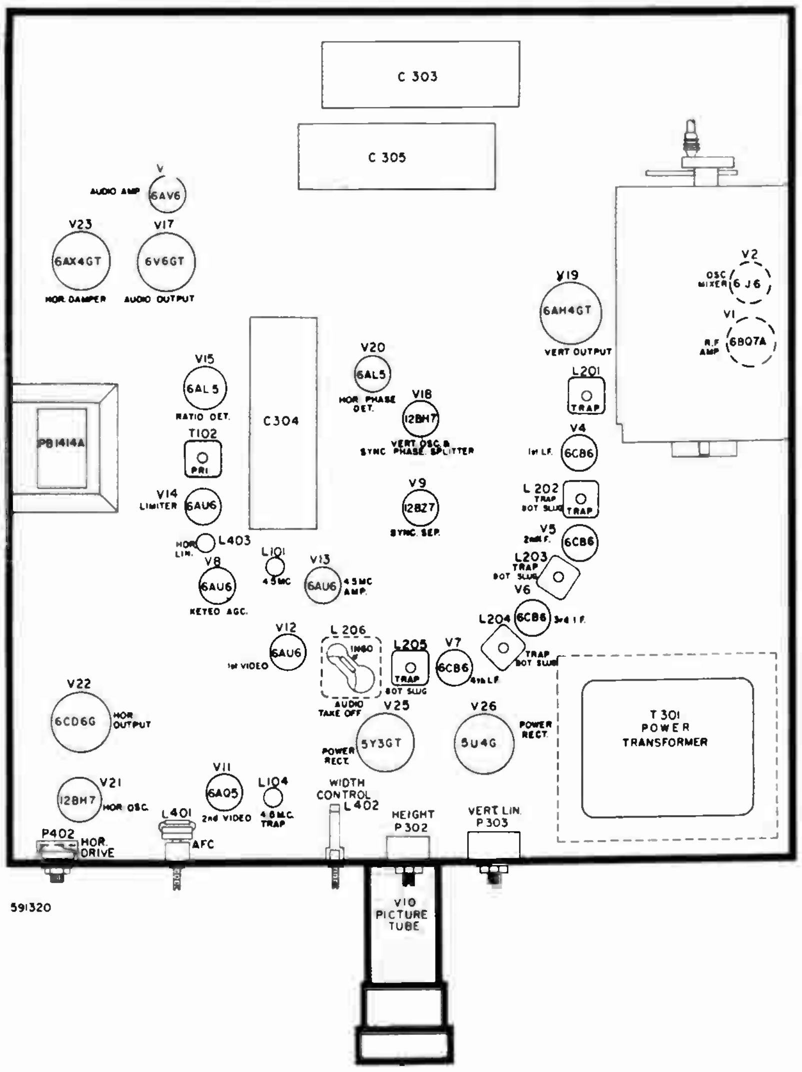
4 – Squeeze together or spread apart the long ends of the RF tuning condenser plates until a maximum response is obtained.

These steps complete the UHF tuner alignment.

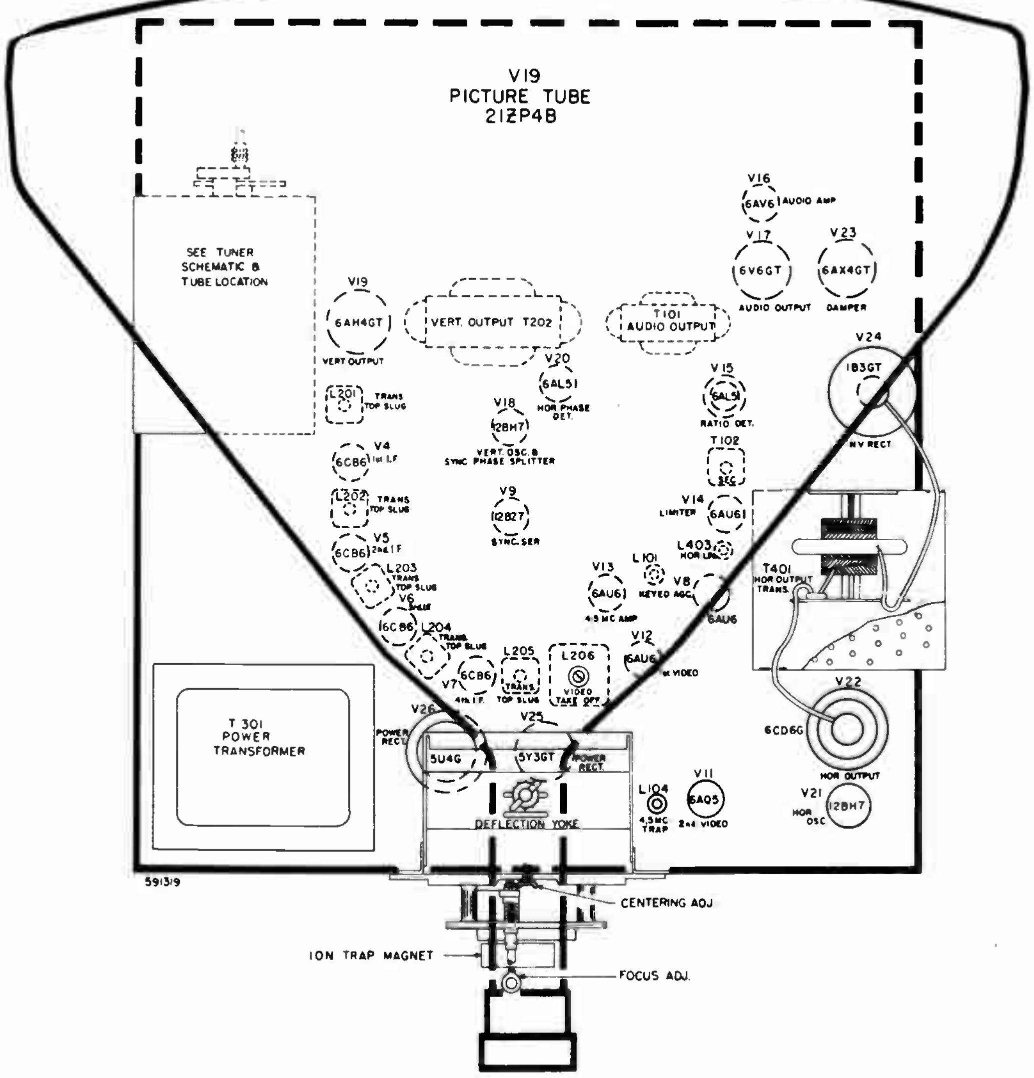




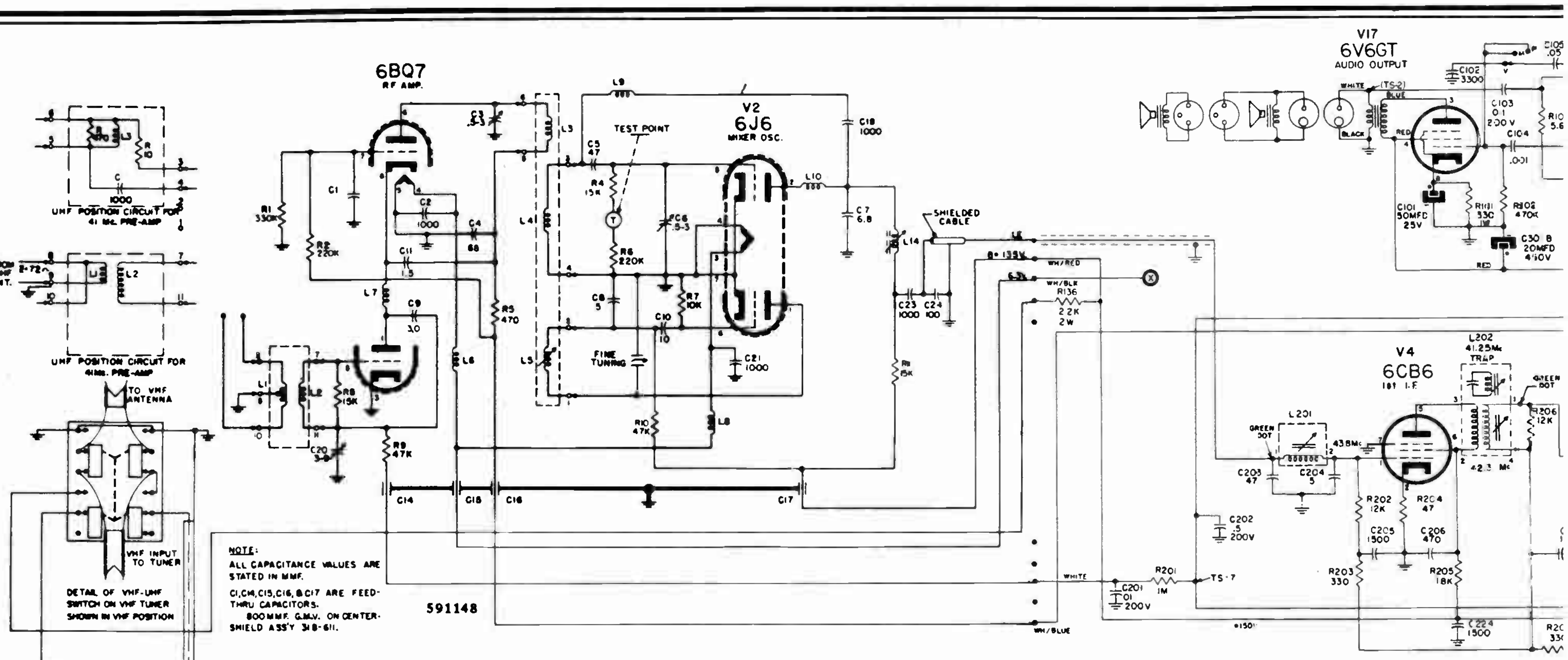
NOTE
UNLESS OTHERWISE NOTED:
ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
ALL CAPACITORS MARKED MORE THAN 1, IN MMFD.
ALL CAPACITORS RATED 600V.
ALL RESISTORS IN OHMS
(K=KILOHMS, M=MEGOHMS)
MOLDED CAPACITORS INDICATED BY -M FOLLOWING CAPACITOR VALUE.
1 ON CHASSIS 1121, R136, R241 & S47 ARE OMITTED



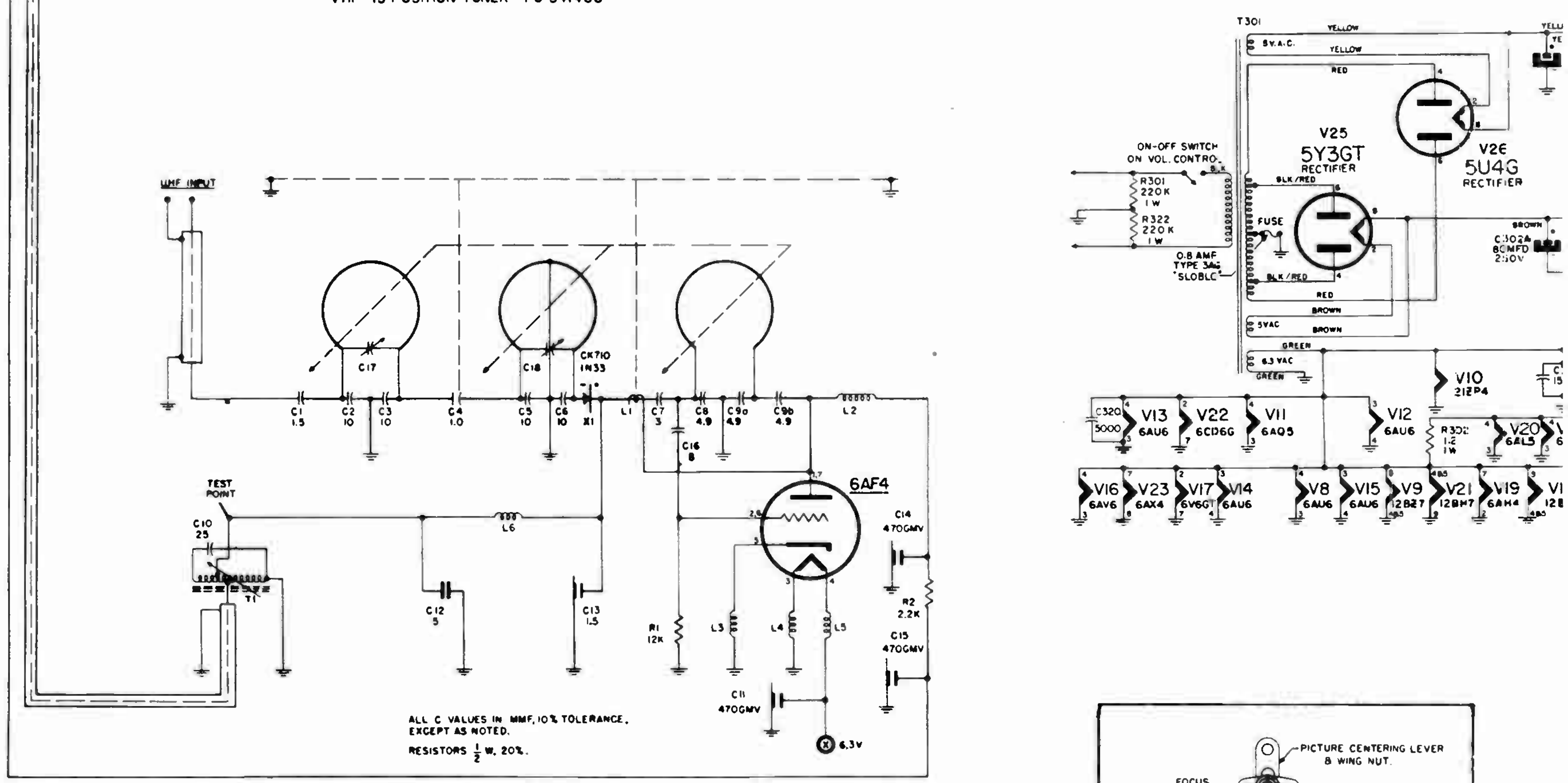
BOTTOM VIEW OF CHASSIS



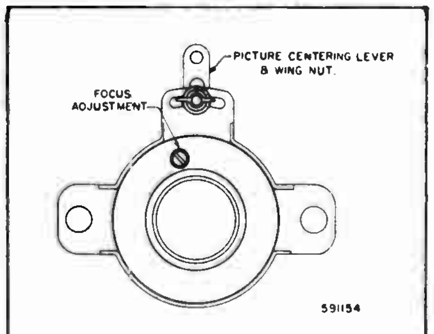
TUBE & TRIMMER LOCATION



VHF 13 POSITION TUNER PC-541460

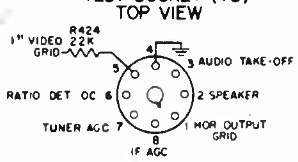


41 Mc. UHF TUNER PC.- 541459



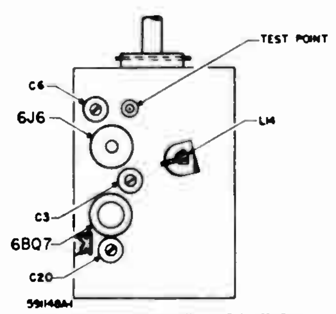
PM FOCUS & CENTERING UNIT

TEST SOCKET (TS) TOP VIEW

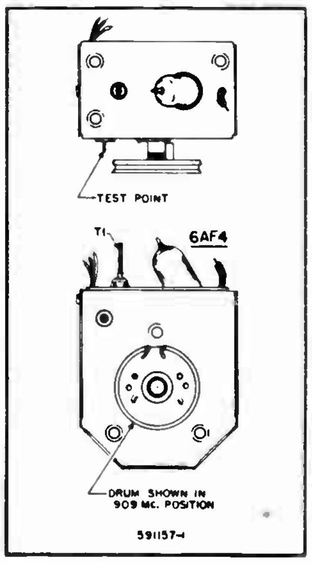


TELEVISION RECEIVER SCHEMATIC

1121
1121-1



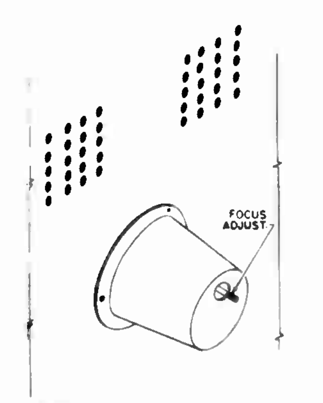
TUBE AND TRIMMER LOCATION
VHF TUNER PC-541460



TUBE AND TRIMMER LOCATION

FOCUS ADJUSTMENT

BACK VIEW



SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
C101	PA20182	Electrolytic 50mfd 25V
C102	PE197-148	Molded Tubular .003mfd 600V ±20%
C103	PE194A-66	Paper .1mfd 200V ±20%
C104	PE194A-145	Paper .001mfd 600V ±20%
C105	PE194A-160	Paper .05mfd 600V ±20%
C106	PA19148	Ceramic, Single Disc 1500mmf GMV
C107	PA20149	Electrolytic 4mfd 50V
C108	PE194A-160	Paper .05mfd 600V ±20%
C109	PE556-136-2	Ceramic Tubular, 1000mmf 350V ±20% (Insul)
C110	PE556-231	Ceramic Tubular, 470mmf 500V ±10% (Insul)
C111	PA19109	Ceramic Single Disc 5000mmf GMV
C112	PA19109	Ceramic Single Disc 5000mmf GMV
C113	PE555-113-2	Ceramic Tubular, 47mmf 500V ±20% (Unins)
C114A,B	PA19163	Ceramic Shielded Dual Disc 5000mmf GMV
C115	PE190-23	Mica, 100 mmf 500V
C116	PE194A-160	Paper .05mfd 600V ±20%
C117	PE190-125	Mica, 120mmf 500V ±10%
C118	PA20138	Electrolytic 1mfd 50V
C201	PE194A-59	Paper .01mfd 200V ±20%
C202	PE194A-68	Paper .5mfd 200V ±20%
C204	PE556-200	Ceramic Tubular, 5mmf 500V ±10% (Insul)
C205	PA 19148	Ceramic, Single Disc 1500mmf GMV
C206	PE556-231	Ceramic Tubular, 470mmf 500V ±10% (Insul)
C207	PA19148	Ceramic, Single Disc 1500mmf GMV
C208	PA19148	Ceramic, Single Disc 1500mmf GMV

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
R101	PE232-1137	Carbon, 330 ohm 1W ±10%
R102	PE231-1213	Carbon, 470K ohm 1/2W ±10%
R103	PE231-1167	Carbon, 5600 ohm 1/2W ±10%
R104	PE231-1205	Carbon, 220K ohm 1/2W ±10%
R105	PC21134-12	Wire-Wound 1500 ohm 10W ±10%
R106	PE231-1245	Carbon, 10 megohm 1/2W ±10%
R107	PE231-1147	Carbon, 820 ohm 1/2W ±10%
R108	PE231-1185	Carbon, 33K ohm 1/2W ±10%
R109	PE231-1187	Carbon, 39K ohm 1/2W ±10%
R110	PE231-1197	Carbon, 100K ohm 1/2W ±10%
R111	PE231-1159	Carbon, 2700 ohm 1/2W ±10%
R112	PE231-1197	Carbon, 100K ohm 1/2W ±10%
R113	PE232-1171	Carbon, 8200 ohm 1W ±10%
R114	PE231-1123	Carbon, 82 ohm 1/2W ±10%
R115	PE231-1173	Carbon, 10K ohm 1/2W ±10%
R116	PE231-1171	Carbon, 8200 ohm 1/2W ±10%
R117	PE233-1159	Carbon, 2700 ohm 2W ±10%
R118	PE231-1169	Carbon, 6800 ohm 1/2W ±10%
R119	PE231-1213	Carbon, 470K ohm 1/2W ±10%
R120	PE232-1135	Carbon, 270 ohm 1W ±10%
R121	PE231-1161	Carbon, 3300 ohm 1/2W ±10%
R122	PE233-1171	Carbon, 8200 ohm 2W ±10%
R123	PE231-1165	Carbon, 4700 ohm 1/2W ±10%
R124	PE233-1169	Carbon, 6800 ohm 2W ±10%
R125	PE231-1129	Carbon, 2.2 megohm 1/2W ±10%
R136 1121-1	PE233-1157	Carbon, 2200 ohm 2W ±10%
R201	PE231-1221	Carbon, 1.0 megohm 1/2W ±10%
R202	PE231-1175	Carbon, 12K ohm 1/2W ±10%
R203	PE231-1137	Carbon, 330 ohm 1/2W ±10%
R204	PE231-1117	Carbon, 47 ohm 1/2W ±10%
R205	PE231-1155	Carbon, 1800 ohm 1/2W ±10%
R206	PE231-1175	Carbon, 12K ohm 1/2W ±10%
R207	PE231-1137	Carbon, 330 ohm 1/2W ±10%
R208	PE231-1117	Carbon, 47 ohm 1/2W ±10%
R209	PE231-1155	Carbon, 1800 ohm 1/2W ±10%

TRANSFORMERS

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
T101	PC1205-1	Audio Output (Dual Spkrs.)
T102	PB1208	Ratio Detector
T201	PB10106-3E	Vert. Blocking Osc.
T202	PC10168	Vert. Output
T301	PC10172	Power
T401	PC10176	Horizontal Output

CHOKES & COILS

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
L101	PB28286	Coil, 4.5 mc Trap
L102	PC28255-16	Coil, Peaking (Red/Yellow)
L103	PC28255-17	Coil, Peaking (Red/Blue)
L104	PB28286	Coil, 4.5 mc Trap
L105	PC28255-1	Coil, Peaking (Red)
L106	PC28255-13	Coil, Peaking (Red/White)
L107	PC28255-11	Coil, Peaking (Blue/White)
L201	PB33111B	Trans., 1st IF 40md
L202	PC33107A	Trans., 2nd IF w/Trap
L203	PC33107A	Trans., 3rd IF w/Trap
L204	PC33109A	Trans., 4th IF w/Trap
L205	PB33112B	Trans., 5th IF 40mc Bifilar
L206	PB28346	Coil, Video Det. Peaking Coil Ass'y.
L301	PB1417	Coil, Filter Choke
L302	PA28276	Coil, Filament Choke .82 uh Insul.
L303	PA28276	Coil, Filament Choke .82 uh Insul.
L306A,B	PC28393	Coil Deflection Yoke
L401	PC28263	Coil, Horizontal Frequency Control
L402	PB28390A	Coil, Width Control
L403	PB28327	Coil, Horizontal Linearity

CONTROLS

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
P201	PA24160	Control, Brightness - 100K
P301	PA24161	Control, Vert. Hold 1 meg
P302	PA24148A	Control Height 5 meg
P303	PA24164B	Control, Vert. Lin. 5K/2W
P401	PA24162	Control, Horiz. Hold 5K
P402	PA24163	Control, Horiz. Drive 250K
	PA37123	Switch, 3 Pos. Phono,Music, Voice

CAPACITORS

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
C209	PE556-231	Ceramic Tubular, 470mmf 500V ±10% (Insul)
C210	PE194A-155	Paper .01mfd 600V ±20%
C211	PA19148	Ceramic, Single Disc 1500mmf GMV
C212	PE194A-21	Paper, 1.0mfd 100V ±20%
C213	PE556-231	Ceramic Tubular, 470mmf 500V ±10% (Insul)
C214	PA19148	Ceramic, Single Disc 1500mmf GMV
C215	PE 556-234	Ceramic Tubular, 680mmf 500V ±10%
C216	PA19148	Ceramic, Single Disc 1500mmf GMV
C217	PE194A-146	Paper .002mfd 600V ±20%
C218	PE194A-156	Paper .02mfd 600V ±20%
C219	PE190-137	Mica, 390mmf 500V ±10%
C220	PE190-133	Mica, 270mmf 500V ±10%
C221	PE194A-156	Paper .02mfd 600V ±20%
C222	194A-114	Paper .1mfd 400V ±20%
C223	PE197-160	Molded Tubular .05mfd 600V ±20%
C224	PA20145	Electrolytic 10mfd 250V
C301,A,B,C,D	PB20168	Electrolytic 40-20-20-10 mfd 450V
C302,A,B	PB20173A	Electrolytic 80mfd 250V; 120mfd 250V
C303,A,B	PB20169	Electrolytic, 80mfd 450V; 100mfd 50V
C304	PA19148	Ceramic, Single Disc 1500mmf GMV
C305	PA19148	Ceramic, Single Disc, 1500mmf GMV
C306	PA19148	Ceramic, Single Disc 1500mmf GMV

RESISTORS

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
R210	PE231-1163	Carbon, 3900 ohm 1/2W ±10%
R211	PE231-1159	Carbon, 3300 ohm 1/2W ±10%
R212	PE231-107	Carbon, 270 ohm 1/2W ±5%
R213	PE231-1117	Carbon, 47 ohm 1/2W ±10%
R214	PE231-1199	Carbon, 120K ohm 1/2W ±10%
R215	PE231-1191	Carbon, 56K ohm 1/2W ±10%
R216	PE231-1155	Carbon, 1800 ohm 1/2W ±10%
R217	PE231-1163	Carbon, 3900 ohm 1/2W ±10%
R218	PE231-1133	Carbon, 220 ohm 1/2W ±10%
R219	PE231-1155	Carbon, 1800 ohm 1/2W ±10%
R220	PE231-1185	Carbon, 33K ohm 1/2W ±10%
R221	PE231-1175	Carbon, 12K ohm 1/2W ±10%
R222	PE231-1229	Carbon, 2.2 megohm 1/2W ±10%
R223	PE231-1213	Carbon, 470K ohm 1/2W ±10%
R224	PE231-1231	Carbon, 2.7 megohm 1/2W ±10%
R225	PE231-1181	Carbon, 22K ohm 1/2W ±10%
R226	PE231-1171	Carbon, 8200 ohm 1/2W ±10%
R227	PE231-1209	Carbon, 330K ohm 1/2W ±10%
R228	PE231-1171	Carbon, 8200 ohm 1/2W ±10%
R229	PE231-1197	Carbon, 100K ohm 1/2W ±10%
R230	PE231-1221	Carbon, 1.0 megohm 1/2W ±10%
R231	PC21134-27	Wire-Wound 2200 ohm 5W ±10%
R241 1121-1	PE231-1109	Wire-Wound 22 ohm 5W ±10%
R301	PE232-1205	Carbon, 220K ohm 1W ±10%
R302	PE23151	Wire-Wound 1.2 ohm 1W ±10%
R303	PC21134-11	Wire-Wound 300 ohm 7W ±10%
R304	PE232-1159	Carbon, 2700 ohm 1W ±10%
R305	PE232-1161	Carbon, 3300 ohm 1W ±10%
R306	PE232-1157	Carbon, 2200 ohm 1W ±10%
R307	PE231-1181	Carbon, 22K ohm 1/2W ±10%
R308	PE231-1221	Carbon, 1.0 megohm 1/2W ±10%
R309	PE231-1181	Carbon, 22K ohm 1/2W ±10%
R310	PE231-1171	Carbon, 8200 ohm 1/2W ±10%
R311	PE231-1171	Carbon, 8200 ohm 1/2W ±10%
R312	PE231-1221	Carbon, 1.0 megohm 1/2W ±10%

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
C307	PA19148	Ceramic, Single Disc 1500mmf GMV
C308	PE194A-151	Paper .005mfd 600V ±20%
C309	PE194A-151	Paper .005mfd 600V ±20%
C310	PE194A-155	Paper .01mfd 600V ±20%
C311	PE194A-155	Paper .01mfd 600V ±20%
C312	PE192-163	Mica, 4700mmf 500V ±10%
C313	PE197-146	Molded Tubular .002mfd 600V ±20%
C314	PE190-133	Mica, 270mmf 500V ±10%
C315	PE197-156	Molded Tubular .02mfd 600V ±20%
C316	PE197-156	Molded Tubular .02mfd 600V ±20%
C317	PE197-162	Molded Tubular .1mfd 600V ±20%
C318	PE194A-155	Paper .01mfd 600V ±20%
C319	PE197-115	Molded Tubular .25mfd 400V ±20%
C320	PA19109	Ceramic, Single Disc 500mmf GMV
C321	PE197-155	Molded Tubular .01mfd 600V ±20%
C401	PE197-151	Molded Tubular .005mfd 600V ±20%
C402	PE197-145	Molded Tubular .001mfd 600V ±20%
C403	PE197-145	Molded Tubular .001mfd 600V ±20%
C404	PE197-148	Molded Tubular .003mfd 600V ±20%
C405	PE197-160	Molded Tubular .05mfd 600V ±20%
C406	PE195-261	Silver Mica 3900mmf 500V ±10%
C407	PE190-137	Mica, 390mmf 500V ±10%
C408	PE190-133	Mica, 270mmf 500V ±10%
C409	PE190-133	Mica, 270mmf 500V ±10%
C410	PE190-139	Mica, 470mmf 500V ±10%
C411	PE190-143	Mica, 680mmf 500V ±10%
C412	PA20149	Electrolytic 4mfd 50V
C413	PE197-160	Molded Tubular .05mfd 600V ±20%
C414	PE194A-114	Paper .1mfd 400V ±20%
C415	PB19175-3	Ceramic 500mmf 20KV
C416	PE197-160	Molded Tubular .05mfd 600V ±20%
C417	PE197-156	Molded Tubular, .02mfd 600V ±20%

SCHEM. LOC.	CHASSIS PART NO.	DESCRIPTION
R313	PE231-1177	Carbon, 15K ohm 1/2W ±10%
R314	PE231-1225	Carbon, 1.5 megohm 1/2W ±10%
R315	PE231-1213	Carbon, 470K ohm 1/2W ±10%
R316	PE231-1177	Carbon, 15K ohm 1/2W ±10%
R317	PE231-1229	Carbon, 2.2 megohm 1/2W ±10%
R318	PE232-1153	Carbon, 1500 ohm 1W ±10%
R319	PE231-1185	Carbon, 33K ohm 1/2W ±10%
R320	PE232-1185	Carbon, 33K ohm 1W ±10%
R321	PE232-1185	Carbon, 33K ohm 1W ±10%
R322	PE232-1205	Carbon, 220K ohm 1W ±10%
R401	PE232-1185	Carbon, 33K ohm 1W ±10%
R402	PE231-1197	Carbon, 100K ohm 1/2W ±10%
R403	PE231-1197	Carbon, 100K ohm 1/2W ±10%
R404	PE231-1213	Carbon, 470 ohm 1/2W ±10%
R405	PE231-1233	Carbon, 3.3 megohm 1/2W ±10%
R406	PE231-1169	Carbon, 6800 ohm 1/2W ±10%
R407	PE231-1157	Carbon, 2200 ohm 1/2W ±10%
R408	PE231-1197	Carbon, 100K ohm 1/2W ±10%
R409	PE231-1213	Carbon, 470K ohm 1/2W ±10%
R410	PE231-1201	Carbon, 150K ohm 1/2W ±10%
R411	PE231-1165	Carbon, 4700 ohm 1/2W ±10%
R412	PE231-1173	Carbon, 10K ohm 1/2W ±10%
R413	PE231-1203	Carbon, 180K ohm 1/2W ±10%
R414	PE231-1123	Carbon, 82 ohm 1/2W ±10%
R415	PC21134-31	Wire-Wound 220 ohm 5W ±10%
R416	PE231-1123	Carbon, 82 ohm 1/2W ±10%
R417	PE233-1187	Carbon, 39K ohm 2W ±10%
R418	PE233-1189	Carbon, 47K ohm 2W ±10%
R419	PC21134-10	Wire-Wound 500 ohm 5W ±10%
R420	PP23156	Carbon, 3.9 ohm 1/2W ±10%
R421	PE233-1111	Carbon, 27 ohm 2W ±10%
R422	PE231-1233	Carbon, 3.3 megohm 1/2W ±10%
R423	PE231-1215	Carbon, 560K ohm 1/2W ±10%
R424	PE231-1181	Carbon, 22K ohm 1/2W ±10%

TUNER PARTS

ALL CHASSIS	DESCRIPTION
PC541460B	VHF Tuner 40mc
PC541459A	UHF Tuner 40mc
PC541502	Tuner Mounting Bracket Assembly, Consisting of:
	1- PD541503 Tuner Mounting Bracket
	1- PB4697A Vernier Drive Shaft Bearing
	1- PA46108B Drive Pulley Stop Sleeve
PB37120	VHF/UHF Switch
PB541494A	Cam. (Actuates VHF/UHF Switch)
PB4599	Drive Shaft Assembly, Consisting of:
	1- PA45100 1" Drive Pulley, Rear
	1- PB4686 Drive Shaft
PB46102	Dial Scale Drive Tube Assembly
	1- PA46103 Dial Scale Drive Tube
	1- PB45105B 1-3/4" Drive Pulley
PA541266	Tuner Shaft Grounding Spring
PA46120A	Tuner Shaft Bearing Plate
PC541504	Tuner Mounting Bracket, Rear
PA46104	Drive Shaft Retainer Spring
PA46105	Vernier Drive Shaft Retainer Spring
PB46110	Mounting Hub, UHF Indicator Disc
PA46107	Dial Cord Tension Spring
PA45107	Dial Cord (Front)
PA45111	Dial Cord
PP54925	Dial Cord Clasp
PA45106	Spur Gear Assembly Consisting of:
	1- PB45117A Spur Gear
	1- PA541505 Rollpin
PB4699	Vernier Drive Shaft Assembly Consisting of:
	1- PB46100A Vernier Drive Shaft
	1- PA45103A Spur Gear
	1- PA45104A Spur Gear
	2- PA541470 Compression Spring (Anti-Backlash)
	1- PB46101 Vernier Drive Shaft Bushing
PB45101	Drive Pulley & Hub Assembly, Front Consisting of:
	1- PA45102 1" Drive Pulley, Front
	1- PB4698 Drive Pulley Hub, Front
PA4966	Pilot Light Socket Assembly
PA4967	Pilot Light Shield
PP4947	Pilot Light, Type S47 (Brown Bead-Bayonet Base)
PA46120A	Tuner Shaft Bearing Plate
PA541266	Tuner Shaft Grounding Spring
PA4584 or PA4588	Dial Cord Pulley
PP591116	Stringing Diagram

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picture tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a. 4.5 megacycles

b. 22.25 megacycles

c. 25.4 megacycles

d. 23.6 megacycles

e. 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (∠1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel, preferably 30% Amplitude-Modulated.

3 – Cathode Ray Oscilloscope with good low frequency response.

4 – 3 volt bias battery.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE COLOR PLUG FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on the inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to pin 1 of 6AU6 1 st Video Amplifier (V12), ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L201 and L203 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.25 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L11, L202-top (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set i-f signal generator to 23.6 mc. with sufficient output to read approximately 3 volts on the VTVM.

8 – Carefully adjust L205 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator out-put to keep meter reading approximately 3 volts.

9 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.

10 – Adjust L202-bottom for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 Ohms).

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. Filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to pin 1 of 6AU6 1st Vid. Amp. (V12) ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Connect 3 volt battery positive terminal to chassis negative terminal to AGC buss (see schematic diagram).

5 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display (see figure 1) having 5 volts vertical deflection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

6 – Adjust L205 slightly to even the height of peaks and to obtain an untilted bandpass.

7 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier visible on bandpass and adjust sound trap (L114) to minimize effect to sound carrier marker.

NOTE: If the fine tuning control is at end of range or out of range so that video carrier cannot be set at 50%, follow R-F OSCILLATOR ALIGNMENT procedure outlined below.

8 – Check all channels.

R-F OSCILLATOR ALIGNMENT

If all channels are not within range of FINE TUNING control (as evidenced by inability to eliminate "sound bars" from picture or by poor picture quality), the individual oscillator slugs may require readjustment.

1 – Repeat the set-up as for SWEEP ALIGNMENT CHECK, steps 1 through 7.

2 – Set FINE TUNING CONTROL to center of range, and with long fiber screwdriver alignment tool, adjust the individual oscillator slugs of each channel. (Accessible through the front of the tuner) so that video carrier markers fall 50% down on curve. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than the converter plate unit, L11, during I.F. alignment.

SOUND ALIGNMENT

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 4.5 mc. amplifier (V13).

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V15) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L206, L101, and bottom of T102 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K (∠1%) resistors across R106 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to centertap of 100K resistors, and connect ground wire of V.T.V.M. to top of C109 (Audio take-Off of T102).

6 – Adjust top of T102 for zero reading on V.T.V.M. between a plus and a minus peak.

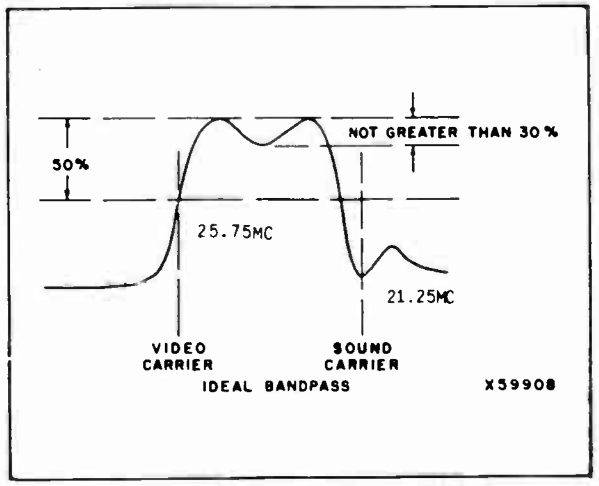
VIDEO AMPLIFIER 4.5 mc. TRAP

When necessary, the video amplifier 4.5 mc. trap (L104) should be adjusted as follows:

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 1st video amplifier (V12).

2 – Adjust signal generator output till 4.5 mc. dot pattern is clearly visible on screen of picture tube.

3 – Adjust L104 to minimize the dot pattern.



HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and after the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

HEIGHT, WIDTH, LINEARITY, AND HORIZONTAL DRIVE

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

1 – Starting with the HORIZONTAL DRIVE control (rear of chassis) in extreme counterclockwise position, advance the control clockwise till the compression near the center of the picture (a vertical bright bar) is eliminated.

2 – The Width and Horizontal Linearity controls (rear of chassis) should be adjusted to give a picture that will fill the mask horizontally, with the minimum of stretching or compression.

3 – The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

PICTURE TUBE HANDLING PRECAUTIONS

The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow or a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.

CAPACITORS

SYMB. NO.	PART NO.	DESCRIPTION
C102	A194-160	Paper, .05 mfd 600V ±20%
C103	A556-238	Ceramic, Tubular 1500 mmf 350V ±10%
C106	A19148	Ceramic Single Disc 1500 mmf GMV
C107	A20149	Electrolytic 4 mfd 50V
C108	A194-160	Paper, .05 mfd 600V ±20%
C109	A555-136-2	Ceramic Tubular, 1000 mmf 350V ±20% (Noninsul) NPO
C110	A19109	Ceramic Single Disc 5000 mmf GMV
C111	A19109	Ceramic Single Disc 5000 mmf GMV
C112	A555-113-2	Ceramic Tubular 47 mmf 500V ±20% (Noninsul.) NPO
C113	A19163	Ceramic Shielded Dual Disc 5000 mmf GMV
C114	A20145	Electrolytic 10 mfd 250V
C115	A194-160	Paper, .05 mfd 600V ±20%
C117	A19109	Ceramic Single Disc 5000 mmf GMV
C118	A20145	Electrolytic 10 mfd 250V
C119	A20138	Electrolytic 1 mfd 50V
C121	A19216	Paper, .04 mfd 600V ±20%
C122	A190-125	Mica, 120 mmf 500V ±10%
C123	A555-123	Ceramic Tubular, 220 mmf 500V ±20%

SYMB. NO.	PART NO.	DESCRIPTION
C201	A19163	Ceramic Shielded Dual Disc 5000 mmf GMV
C202	A19148	Ceramic Single 1500 mmf GMV
C203	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C204	A19148	Ceramic Single Disc 1500 mmf GMV
C205	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C206	A19109	Ceramic Single Disc 5000 mmf GMV
C207	A19148	Ceramic Single Disc 1500 mmf GMV
C208	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C209	A19163	Ceramic Shielded Dual Disc 5000 mmf GMV
C210	A190-143	Mica 680 mmf 500V ±10%
C211	A194-155	Paper, .01 mfd 600V ±20%
C212	A194-21	Paper, 1.0 mfd 100V ±20%
C213	A194-146	Paper, .002 mfd 600V ±20%
C214	A194-156	Paper, .02 mfd 600V ±20%
C215	A190-137	Mica 390 mmf 500V ±10%
C216	A190-133	Mica 270 mmf 50V ±10%
C217	A194-156	Paper, .02 mfd 600V ±20%
C218	A194-162	Paper, .1 mfd 600V ±20%
C219	A194-162	Paper, .1 mfd 600V ±20%
C220	A197-160	Molded Tubular .05 mfd 600V ±20%

SYMB. NO.	PART NO.	DESCRIPTION
C301	A19198	Ceramic Shielded Dual Disc .01 mfd 500V GMV
C303	A20173	Electrolytic 80 mfd 200V, 120 mfd 250V
C304	A20172	Electrolytic 20-20-20-10 mfd 450V
C305	A20169	Electrolytic 80 mfd 450V, 100 mfd 50V
C306	A19109	Ceramic Single Disc 5000 mmf GMV
C307	A19109	Ceramic Single Disc 5000 mmf GMV
C308	A19109	Ceramic Single Disc 5000 mmf GMV
C309	A19109	Ceramic Single Disc 5000 mmf GMV
C310	A19109	Ceramic Single Disc 5000 mmf GMV
C311	A197-145	Molded Tubular .001 mfd 600V ±20%
C312	A192-163	Mica 4700 mmf 500V ±10%
C314	A194-162	Paper, .1 mfd 600V ±20%
C315	A194-162	Paper, .1 mfd 600V ±20%
C316	A194-155	Paper, .01 mfd 600V ±20%
C317	A194-151	Paper, .005 mfd 600V ±20%
C318	A194-151	Paper, .005 mfd 600V ±20%
C319	A194-155	Paper, .01 mfd 600V ±20%
C322	A20149	Electrolytic, 4 mfd 50V
C323	A20145	Electrolytic 10 mfd 250V
C326	A190-140	Mica 510 mmf 500V ±10%
C327	A19109	Ceramic Single Disc 5000 mmf GMV

SYMB. NO.	PART NO.	DESCRIPTION
C401	A197-146	Molded Tubular .002 mfd 600V ±20%
C402	A194-145	Paper, .001 mfd 600V ±20%
C403	A194-145	Paper, .001 mfd 600V ±20%
C404	A197-151	Molded Tubular, .005 mfd 600V ±20%
C405	A194-160	Paper, .05 mfd 600V ±20%
C406	A195-261	Silver Mica 3900 mmf 500V ±10%
C407	A190-139	Mica 470 mmf 500V ±10%
C408	A190-133	Mica 270 mmf 500V ±10%
C409	A190-143	Mica, 680 mmf 500V ±10%
C410	A190-139	Mica 470 mmf 500V ±10%
C411	A197-115	Molded Tubular, .25 mfd 400V ±20%
C412	A197-160	Molded Tubular .05 mfd 600V ±20%
C414	A19175-4	Ceramic 500 mmf 30kv
C415	A197-160	Molded Tubular .05 mfd 600V ±20%
C416	A194-162	Paper, .1 mfd 600V ±20%
C417	A20149	Electrolytic 4 mfd 50V
C418	A190-139	Mica 470 mmf 500V ±10%
C419	A197-194	Molded Tubular .002 mfd 1000V ±20%
C420	A19136	Mica, 220 mmf 2500V ±10%
C421	A194-146	Paper, .002 mfd 600V ±20%
C422	A190-121	Mica 82 mmf 500V ±10%

PART NO.	DESCRIPTION
PA18155	Socket, Octal Molded
PA18210	Socket, Octal Molded w/Molded Saddle, Mica Filled Bakelite
PA18157	Socket, 9 Pin Wafer
PA18170	Socket, 9 Pin Wafer
PA18147	Socket, 7 Pin Wafer
PA18101	Socket, Speaker Plug
PB18205	Socket, H.V. Rectifier Assembly
PE540–7	Terminal Strip AE
PE540–19	Terminal Strip AEA
PE540–34	Terminal Strip AAEA
PE540–35	Terminal Strip AEAA
PE540–44	Terminal Strip AAEAA
PE540–67	Terminal Strip AAAEAA
PA18207	Socket, 9 Pin Molded w/Adapter Plate
PA54661	Interlock Connector, Male
PA18177 or PA18179	Dummy Plug Assembly, Male Octal (Color Socket)
PA37111	Switch; 4P3T Rotary Wafer (Local–Dx–Phono) (Front)
PA18174	Socket, Phono Jack
PB55141–7	Anode Lead Assembly
PC18160–10	Socket Kinescope
PD5372	Shield H. V. Supply
PB5373	Cover, H.V. Supply Shield
PA5377	Shield, H. V. Socket
PC541300	Front Tube Support (Upper)
PB541301–1	Front Tube Support (Lower, Right)
PB541301–2	Front Tube Support (Lower, Left)
PC541303	Tube Strap Assembly
PA541304	Tube Stop
PA541328	Anode Lead Holder
PA541310	Yoke Support Hold Down Bracket
PA541309	Rubber Spacer
PA541327	Phenolic Barrier
PA541363	Tension Spring (CRT Front to Rear Support).

CABINET REPAIR PARTS LIST

	MODEL 27C31 CHASSIS 1021-1
CABINET	A60213
SAFETY GLASS	A62457-18
MASK	A62449
BACK COVER	A62450
SPEAKER #1	A58133 - 6" PM
SPEAKER #2	A58132 - 6" PM
KNOB–PHONO/DX–LOC.SW.	A39247-1
KNOB–CHANNEL SELECTOR	A39242-1
KNOB–VERNIER	A39240-3
KNOB–ON–OFF–VOLUME	A39241-1
KNOB–PICTURE CONTROL	A39239-3
KNOB–AUXILIARY CONTROL	A39246-1

RESISTORS

SYMB. NO.	PART NO.	DESCRIPTION
R101	A232-1137	Carbon 330 Ohm 1w ±10%
R102	A231-1213	Carbon 470K Ohm 1/2w ±10%
R103	A231-1205	Carbon, 220K ohm 1/2w ±10%
R104	A233-1165	Carbon, 4700 ohm 2w ±10%
R105	A231-2345	Carbon 10 Megohm 1/2w ±20%
R106	A231-1185	Carbon 33K Ohm 1/2w ±10%
R107	A231-1197	Carbon 100K Ohm 1/2w ±10%
R108	A231-1159	Carbon 2700 Ohm 1/2w ±10%
R109	A21134-12	Wirewound 1500 Ohm 10w ±10%
R110	A231-1197	Carbon 100K Ohm 1/2w ±10%
R111	A232-1171	Carbon 8200 Ohm 1w ±10%
R112	A231-1123	Carbon 82 Ohm 1/2w ±10%
R113	A231-1173	Carbon 10K Ohm 1/2w ±10%
R114	A231-1149	Carbon, 1000 ohm 1/2w ±10%
R115	A233-1159	Carbon 2700 Ohm 2w ±10%
R116	A231-1213	Carbon 470K Ohm 1/2w ±10%
R117	A232-1135	Carbon 270 Ohm 1w ±10%
R118	A231-1127	Carbon 120 Ohm 1/2w ±10%
R119	A231-1161	Carbon 3300 Ohm 1/2w ±10%
R120	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R121	A233-1163	Carbon 3900 Ohm 2w ±10%
R122	A231-1161	Carbon, 3300 ohm 1/2w ±10%
R123	A231-1215	Carbon, 560K ohm 1/2w ±10%
R124	A231-1187	Carbon 39K Ohm 1/2w ±10%
R125	A231-1179	Carbon, 18K ohm 1/2w ±10%
R126	A233-1165	Carbon, 4700 ohm 2w ±10%
R127	A231-1117	Carbon, 47 ohm 1/2w ±10%

SYMB. NO.	PART NO.	DESCRIPTION
R201	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R202	A231-1123	Carbon 82 Ohm 1/2w ±10%
R203	A231-1137	Carbon 330 Ohm 1/2w ±10%
R204	A231-1137	Carbon 330 Ohm 1/2w ±10%
R205	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R206	A231-1123	Carbon 82 Ohm 1/2w ±10%
R207	A231-1137	Carbon 330 Ohm 1/2w ±10%
R208	A231-1137	Carbon 330 Ohm 1/2w ±10%
R209	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R210	A231-1123	Carbon 82 Ohm 1/2w ±10%
R211	A231-1137	Carbon 330 Ohm 1/2w ±10%
R212	A231-1169	Carbon 6800 Ohm 1/2w ±10%
R213	A231-1133	Carbon 220 Ohm 1/2w ±10%
R214	A231-1173	Carbon 10K Ohm 1/2w ±10%
R215	A231-1137	Carbon 330 Ohm 1/2w ±10%
R216	A232-1167	Carbon 5600 Ohm 1w ±10%
R217	A231-1159	Carbon 2700 Ohm 1/2w ±10%
R218	A231-1195	Carbon 82K Ohm 1/2w ±10%
R219	A231-1191	Carbon 56K Ohm 1/2w ±10%
R220	A231-1185	Carbon 33K Ohm 1/2w ±10%
R221	A231-1175	Carbon 12K Ohm 1/2w ±10%
R222	A231-1229	Carbon 2.2 Megohm 1/2w ±10%
R223	A231-1213	Carbon 470K Ohm 1/2w ±10%
R224	A231-1231	Carbon 2.7 Megohm 1/2w ±10%
R225	A231-1181	Carbon 22K Ohm 1/2w ±10%
R226	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R227	A231-1205	Carbon 220K Ohm 1/2w ±10%
R228	A231-1221	Carbon 1.0 Megohm 1/2w ±10%
R230	A231-1177	Carbon, 15K ohm 1/2w ±10%

SYMB. NO.	PART NO.	DESCRIPTION
R301	A21134-11	Wirewound 300 Ohm 7w ±10%
R302	A23151	Wirewound 1.2 Ohm 1w ±10%
R303	A23151	Wirewound 1.2 Ohm 1w ±10%
R304	A232-1159	Carbon 2700 Ohm 1w ±10%
R305	A232-1161	Carbon 3300 Ohm 1w ±10%
R306	A232-1159	Carbon 2700 Ohm 1w ±10%
R307	A231-1221	Carbon 1.0 Megohm 1/2w ±10%
R308	A231-1181	Carbon 22K Ohm 1/2w ±10%
R309	A232-1219	Carbon, 820K ohm 1/2w ±10%
R310	A231-1213	Carbon 470K Ohm 1/2w ±10%
R311	A231-1185	Carbon 33K Ohm 1/2w ±10%
R315	A231-1175	Carbon 12K Ohm 1/2w ±10%
R316	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R317	A231-1181	Carbon 22K Ohm 1/2w ±10%
R318	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R319	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R320	A231-1191	Carbon 56K Ohm 1/2w ±10%
R321	A231-1213	Carbon 470K Ohm 1/2w ±10%
R322	A21134-17	Wirewound 60 Ohm 15w ±10%
R323	A231-1201	Carbon 150K Ohm 1/2w ±10%
R324	A232-1201	Carbon 150K Ohm 1w ±10%
R325	A231-1177	Carbon 15K Ohm 1/2w ±10%
R327	A231-1213	Carbon, 470K ohm 1/2w ±10%
R328	A231-1213	Carbon, 470K ohm 1/2w ±10%

SYMB. NO.	PART NO.	DESCRIPTION
R401	A231-1183	Carbon 27K Ohm 1/2w ±10%
R402	A231-1197	Carbon 100K Ohm 1/2w ±10%
R403	A231-1197	Carbon 100K Ohm 1/2w ±10%
R404	A231-1233	Carbon 3.3 Megohm 1/2w ±10%
R405	A231-1213	Carbon 470K Ohm 1/2w ±10%
R406	A231-1155	Carbon, 1800 ohm 1/2w ±10%
R407	A231-1169	Carbon 6800 Ohm 1/2w ±10%
R408	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R409	A231-1197	Carbon 100K Ohm 1/2w ±10%
R410	A231-1213	Carbon 470K Ohm 1/2w ±10%
R411	A231-1123	Carbon 82 Ohm 1/2w ±10%
R412	A231-1205	Carbon, 220K ohm 1/2w ±10%
R413	A233-1179	Carbon 18K Ohm 2w ±10%
R415	A233-1165	Carbon 4700 Ohm 2w ±10%
R416	A231-1235	Carbon 3.9 Megohm 1/2w ±10%
R417	A231-1201	Carbon 150K Ohm 1/2w ±10%
R418	A231-1123	Carbon 82 Ohm 1/2w ±10%
R419	A21134-19	Wirewound 180 Ohm 5w ±10%
R420	A231-1221	Carbon 1.0 Megohm 1/2w ±10%
R421	A233-1181	Carbon 22K Ohm 2w ±10%
R423	A232-1201	Carbon 150K Ohm 1w ±10%
R424	A232-1201	Carbon 150K Ohm 1w ±10%
R425	A232-1173	Carbon 10K Ohm 1w ±10%
R426	A23162	Carbon 2.4 Ohm 1/2w ±10%
R428	A233-1165	Carbon 4700 Ohm 2w ±10%
R429	A231-1171	Carbon 8200 Ohm 1/2w ±10%

SYMB. NO.	PART NO.	DESCRIPTION
L101	PA28286	Coil Audio IF
L102	PC28255-2	Coil, Peaking (white)
L103	PC28255-8	Coil Peaking (Brown)
L104	PA28286	Coil (4.5 mc. Trap)
L105	PC28255-1	Coil Peaking (Red)
L106	PC28255-1	Coil Peaking (Red)
L107	PC28255-11	Coil Peaking (Blue and White)
L201	PB3392	Coil Pix IF
L201	PB28339	Coil IF w/Trap
L202	PB28320	Coil Pix IF w/Trap
L203	PB3392	Coil Pix IF
L204	PA28253	Coil RF Choke
L205	PB3392	Coil Pix IF
L206	PB28321	Coil, Video Detector Peaking Coil Assembly
L301	PB1406	Coil Filter Choke
L302	PA28276	Coil Filament Choke
L303	PA28276	Coil Filament Choke
L304	PA28276	Coil Filament Choke
L305	PA28276	Coil Filament Choke
L306	PC28326	Deflection Yoke (Cosine Wound–Ferrite Core)
L401	PA28263	Coil Horizontal Frequency Control
L402	PA28318	Coil Width Control
L403	PB28327	Coil Horizontal Linearity

SYMB. NO.	PART NO.	DESCRIPTION
T102	PB1201 or PB1202	Transformer Ratio Detector
T201	PB10106–2	Transformer Vertical Blocking Oscillator
T202	PC10115–6	Transformer Vertical Output
T202	PC10154–1	Transformer Vertical Output
T301	PC10151	Transformer Power
T401	PC10155	Transformer Horizontal Output

SYMB. NO.	PART NO.	DESCRIPTION
P101A,B	PA24136	Control Volume Contrast 250K–5K (Dual Front)
P201	PA24134	Control Brightness 100K (Front)
P301	PA24146	Control Vertical Hold 2 Megohm (Front)
P302	PA24111	Height 5 Megohm (Rear)
P303	PA24112	Control Vertical Linearity 1 Meg. (Rear)
P401	PA24137	Control Horizontal Hold 5K (Front)
P402	PA24138	Control Horizontal Drive 250K (Rear)

R-F OSCILLATOR

If all channels are not within range of FINE TUNING control, adjust two screws located in front of r-f tuner unit for adjustment of either low or high band. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than converter plate coil, L405, during IF Alignment.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The Receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

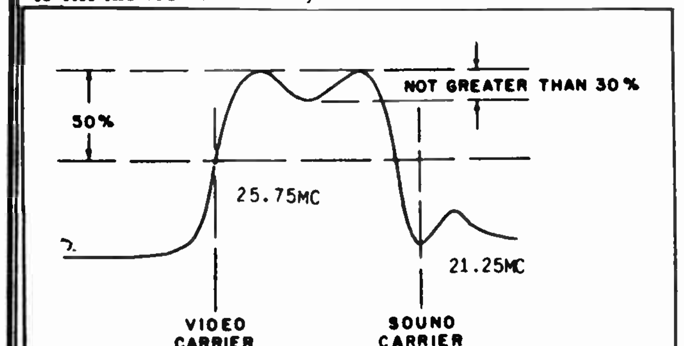
4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.



IDEAL BANDPASS

The Width control (rear of H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

TELEVISION ALIGNMENT PROCEDURE, UHF

Alignment of the UHF Tuner is a simple procedure since its bandpass is essentially predetermined by the fixed characteristics of original component design, physical layout and associated circuitry. Except as stated otherwise in this procedure, band-pass is not subject to serious change during alignment, however, replacement of any component within the R-F or I-F circuits may disturb the band-pass characteristics. Accordingly, whenever parts within these circuits are replaced, electrical and physical specifications of the original components must be duplicated as closely as possible. Wires, parts and other accessories must be replaced in their former positions.

Complicated or specially designed test equipment is not required for practical alignment of the UHF Tuner. Instruments used for testing VHF sets are usually satisfactory. However, the following instruments are needed;

1 – VHF signal generator with AM output and a sweep modulation of at least 12 megacycles.
2 – Oscilloscope or vacuum tube volt-ohmmeter for measurement of the relative signal.
3 – An operating VHF television set. (The latter is suggested as a practical amplifier for raising the output signal of the converter to a level which permits convenient observation.)

The UHF Tuner to be tested should be connected to the VHF television set in the usual manner. The oscilloscope or VTVM should then be connected to the TV set at a point which permits satisfactory observation of the relative intensity and character of the AM (or sweep-modulated) signal introduced into the tuner.

The procedure for alignment consists of the following steps in the suggested sequence given:

1 – Positioning of the oscillator for proper band coverage.
2 – Alignment of R-F-circuits for maximum effectiveness.

OSCILLATOR ADJUSTMENT

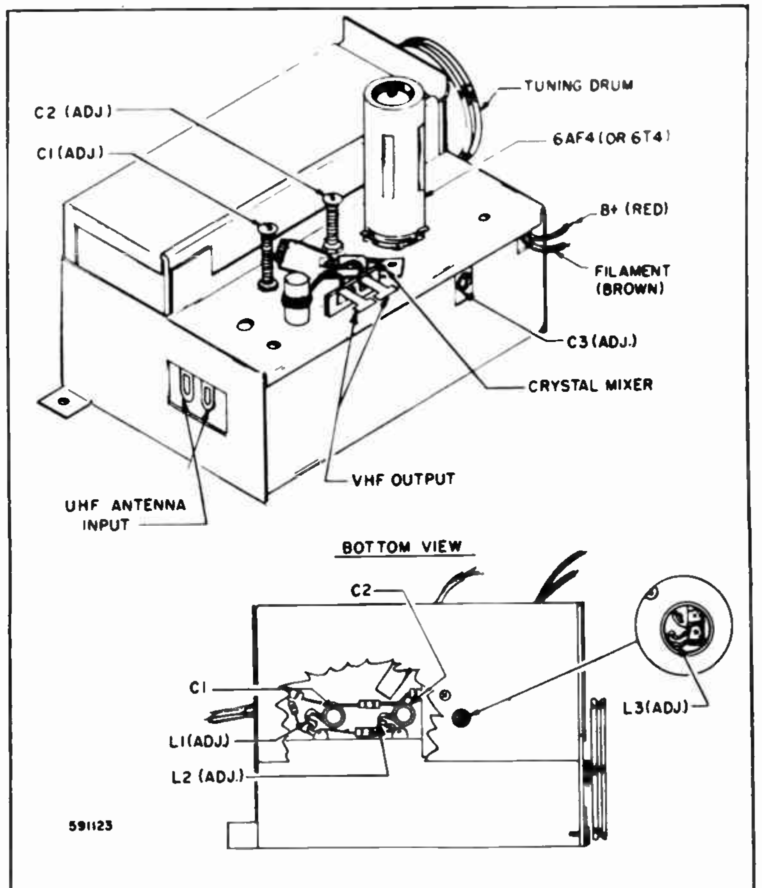
1 – Adjust UHF channel tuning control to extreme counter-clockwise position.
2 – Feed a 465-megacycle AM signal UHF Tuner antenna terminals through a resistive matching network. The input impedance of the tuner is 300 ohms balanced. Adjust oscillator trimmer (C3) for maximum signal. (Use non-metallic alignment tool.) (When using a VHF signal generator, a fundamental of 93 megacycles may be employed to produce the 5th harmonic energy of 465 megacycles.)
3 – Adjust VHF channel to extreme clockwise position.
4 – Set signal generator for a 900-megacycle output (5th harmonic of 180 megacycles). Carefully spread or pinch together the legs of the oscillator end-inductor (L3) for a maximum signal.
5 – Repeat above steps until no further improvement in signal is apparent. (The oscillator alignment figures of 465 and 900 megacycles are only approximate, and may not fall precisely at the maximum dial settings; however, in every case the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the dial.)

R.F. ALIGNMENT

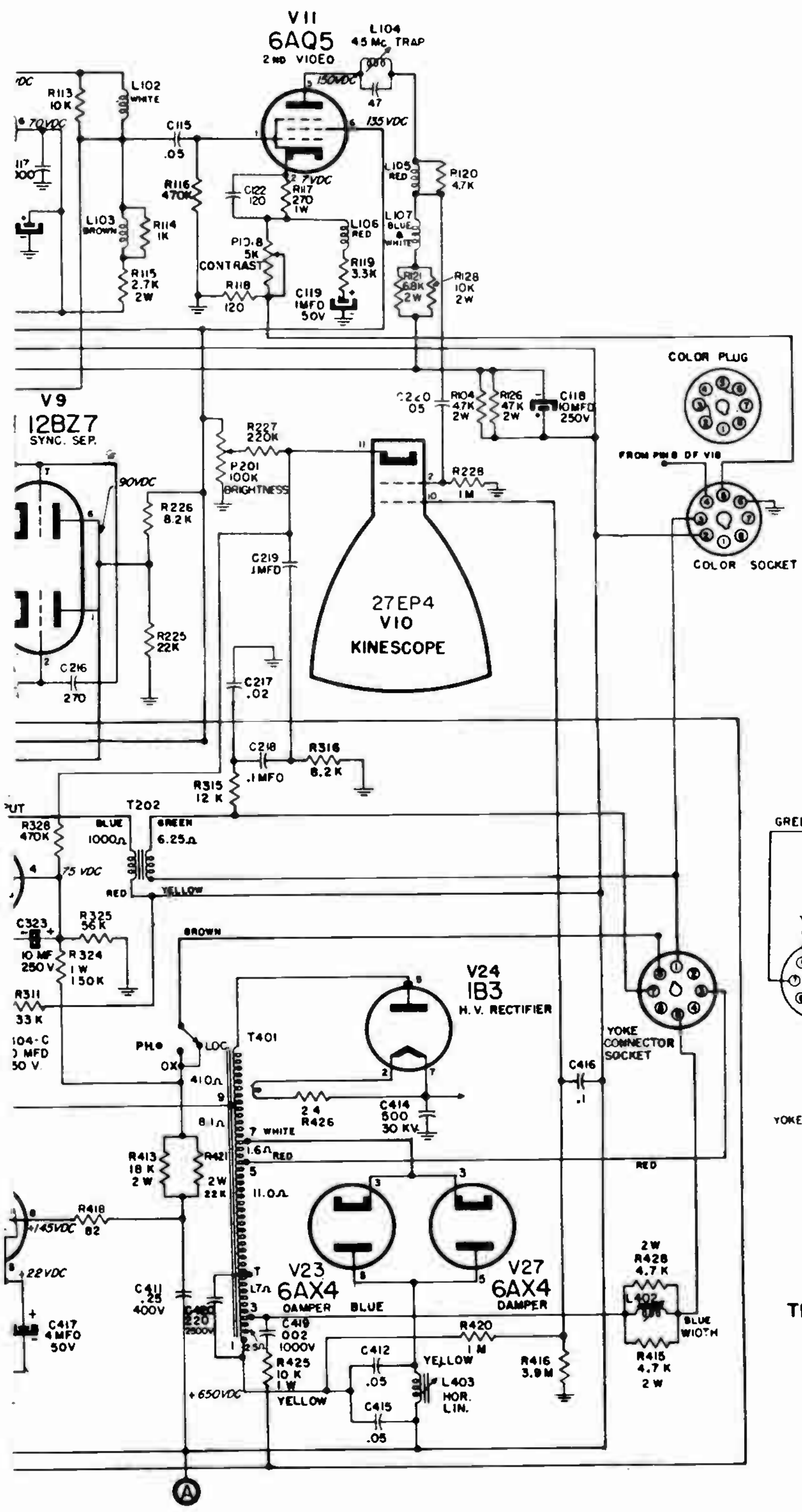
1 – Adjust UHF channel tune control to extreme counter-clockwise position.
2 – Feed at 465-megacycle signal into the converter antenna terminals (as indicated above for oscillator alignment).
3 – Adjust R-F trimmers (C1 & C2) for maximum signal.
4 – Readjust tuning control to extreme clockwise position.
5 – Set signal generator for 900-megacycle output.
6 – Adjust end-inductors (L1 & L2) for maximum signal.
7 – Repeat above steps until no further improvement in signal is apparent.

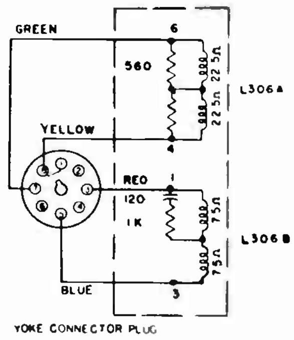
PICTURE TUBE HANDLING PRECAUTIONS

The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.



UHF TUNER PC-541335

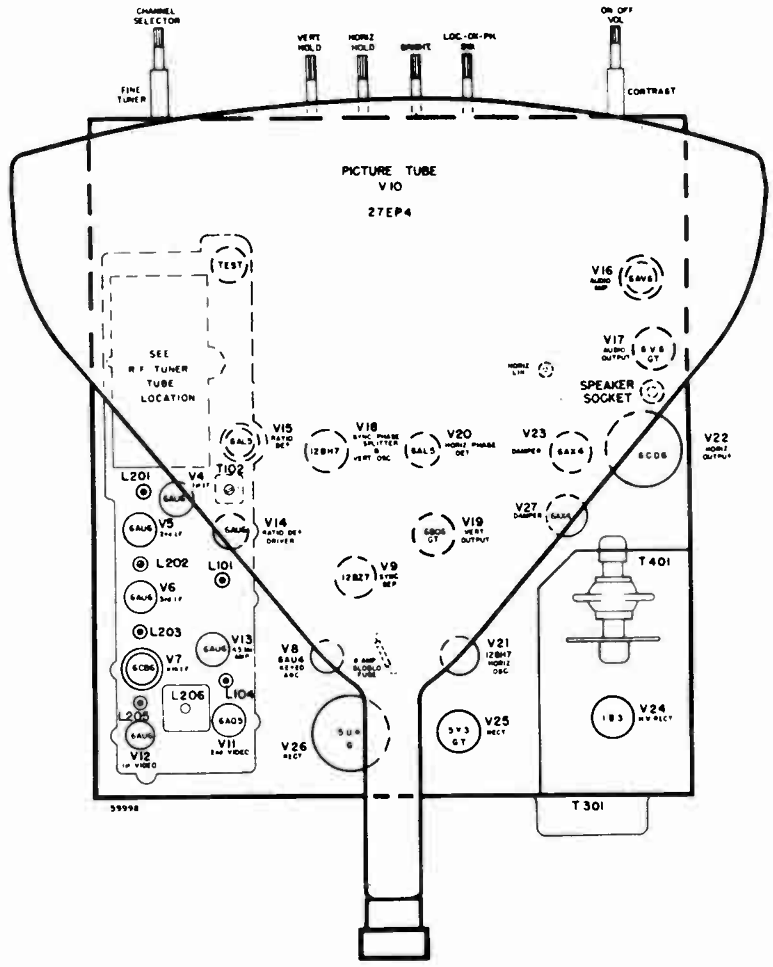




TELEVISION RECEIVER SCHEMATIC

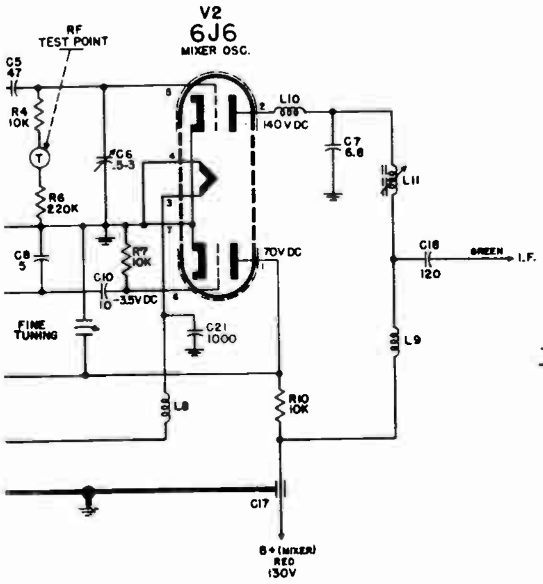
1027-1

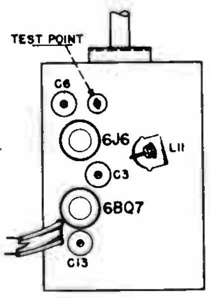
591050



TUBE & TRIMMER LOCATION

1027 CHASSIS





CODE TUNER PC-541215

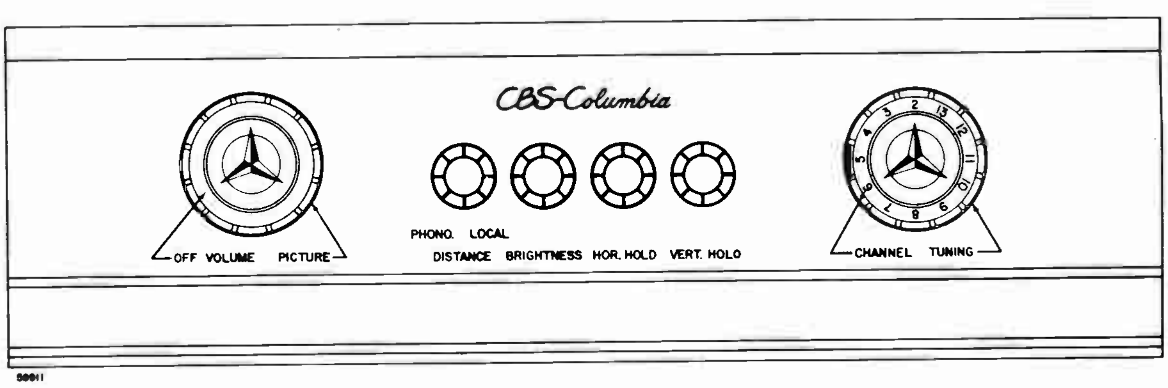
ADJUSTMENT OF ANTI-PINCUSHION MAGNETS

1-ADJUST THE HORIZONTAL CENTERING AND HORIZONTAL SIZE CONTROLS SO THAT THE ONE EDGE OF RASTER MAY BE SEEN.

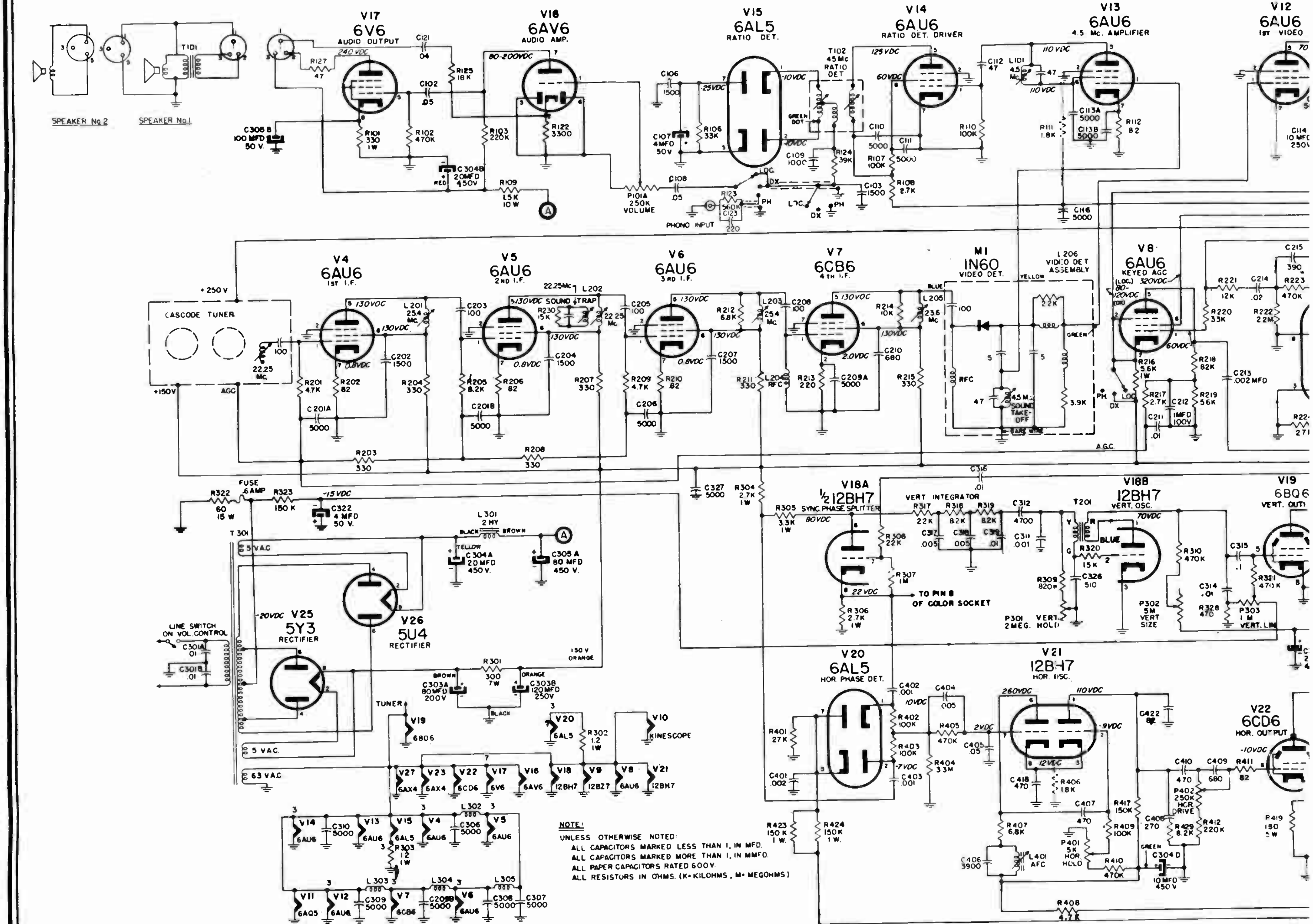
2-IF EDGE OF RASTER IS BOWED, LOOSEN THE SCREW RETAINING THE ANTI-PINCUSHION MAGNET WHICH IS MOUNTED ON THE TIE-ROD BRACING THE PICTURE TUBE (ON THE SIDE WHICH SHOWS BOWING) SUFFICIENTLY TO ADJUST THE MAGNET BRACKET.

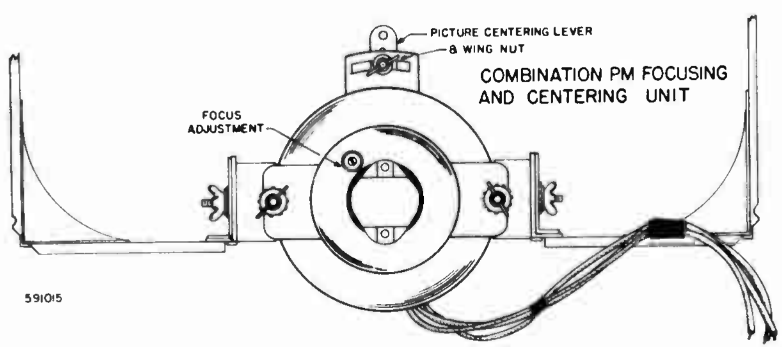
3-ADJUST THE MAGNET SPACING AND ROTATION, TO OBTAIN A STRAIGHT RASTER EDGE. TIGHTEN THE RETAINING SCREW.

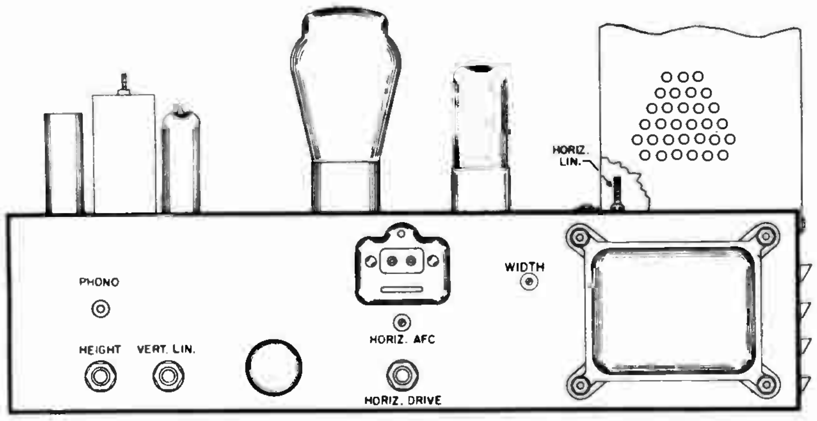
4-REPEAT (1), (2), AND (3) FOR OPPOSITE EDGE OF RASTER.



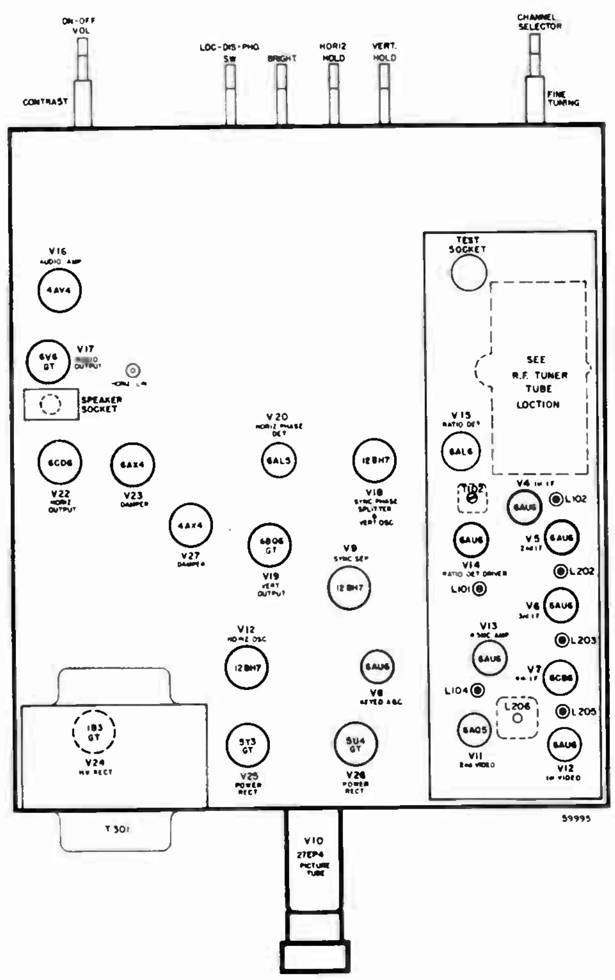
The safety glass of this receiver is removable so that the face of the picture tube may be cleaned. To accomplish this remove power cord from wall socket. Remove the upper and side strips that hold the safety glass in place by removing the three screws which secure each of the strips, supporting the safety glass so that it does not fall forward. Remove the safety glass by tilting it forward and lifting it out of the slot found in the top edge of the control panel. Be careful not to scratch or strike the surface of the picture tube with any object. Carefully clean face of picture tube and the inside surface of the safety glass with a soft, clean, dry cloth. DO NOT ATTEMPT TO REMOVE THE PICTURE TUBE MASK. Reassemble by inserting lower edge of glass in slot. Replace upper and side strips and tighten the screws securely.



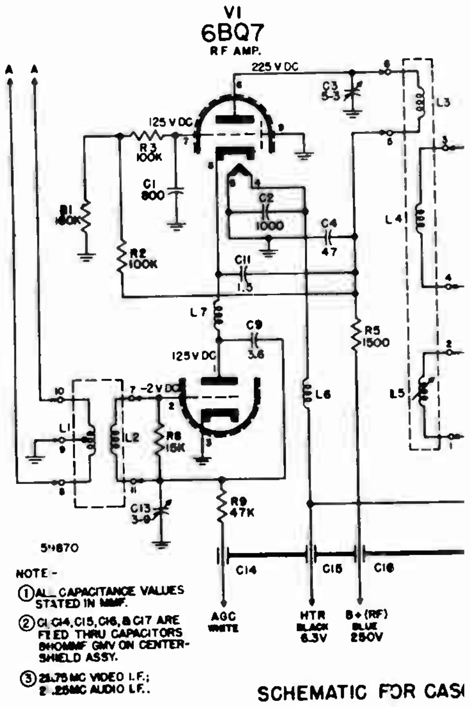




REAR CONTROLS
1027 CHASSIS



CHASSIS BOTTOM VIEW
1027 CHASSIS



SCHEMATIC FOR CAS

SERVICE DATA ON CBS - COLUMBIA TELEVISION RECEIVERS

800 SERIES CAPACITORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
C100		PE190-133	Mica, 270mmf 500V ±10%
C101		PA19147	Ceramic, Shielded Dual Disc, 1500mmf GMV
C102		PE556-234	Ceramic Tubular, 680mmf 350V ±10% (Insul.)
C103		PE190-133	Mica, 270mmf 500V ±10%
C104		PE190-133	Mica, 270mmf 500V ±10%
C105		PA19148	Ceramic, Single Disc 1500mmf GMV
C106		PA20138	Electrolytic, 1mfd 50V
C107		PP19163	Ceramic, Shielded Dual Disc 5000mmf GMV
C108		PE190-140	Mica, 510mmf 500V ±10%
C109		PE190-107	Mica, 22mmf 500V ±10%
C110		PE555-101	Ceramic Tubular 10mmf. 500V ±20% (Unins.)
C111		PE555-136	Ceramic Tubular 1000mmf 350V ±20% (Unins.)
C112		PE194-A160	Paper, .05mfd 600V ±20%
C113		PP19201	Ceramic Tubular, 820mmf 350V ±10% (Unins.)
C114		PE555-100	Ceramic Tubular, 5mmf 500V ±20% (Unins.)
C115		PE555-113-2	Ceramic Tubular, 47mmf 500V ±20% NPO (Unins.)
C116		PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C117		PE194-A151	Paper, .005mfd 600V ±20%
C118		PA19148	Ceramic Single Disc 1500mmf GMV
C119		PE556-236	Ceramic Tubular, 1000mmf 350V ±10% (Insul.)
C120		PE194-A160	Paper, .05mfd 600V ±20%
C121		PA20181	Electrolytic, 1mfd 100V
C122		PE194-156	Paper, .02mfd 600V ±20%
C123		PE194-A160	Paper, .05mfd 600V ±20%
C124		PE194-A145	Paper, .001mfd 600V ±20%
C125		PE194-A151	Paper, .005mfd 600V ±20%
C126		PA20175	Electrolytic, 10-10mfd 450V 100mfd 50V
C128		PE555-100	Ceramic, 5.0mmf 500V ±20% (Uninsul.)
C129		PA20182	Electrolytic, 50mfd, 25V
C131		PE194-A64	Paper, .05mfd 200V ±20%
C132		PE194-A145	Paper, .001mfd 600V ±20%
C133		PE556-238	Ceramic Tubular, 1500mmf, 350V, ±10% (Insul.)
C201			
C202		PA19109	Ceramic, Single Disc 5000mmf GMV
C203		PA20144	Electrolytic, 40-40-20-20-mfd 450V
C204		PA19109	Ceramic, Single Disc 5000mmf GMV
C205		PA19109	Ceramic, Single Disc 5000mmf GMV
C206		PA19109	Ceramic, Single Disc 5000mmf GMV
C207		PE194-A156	Paper, .02mfd 600V ±20%
C208		PE190-137	Mica, 390mmf 500V ±10%
C209		PE190-133	Mica, 270mmf 500V ±10%
C210		PE194-A155	Paper, .01 mfd 600V ±20%
C211		PE194-A155	Paper, .01mfd 600V ±20%
C212		PE192-163	Mica, 4700mmf 500V ±10%
C213		PE194-A159	Paper, .035mfd 600V ±20%
C214		PE194-A156	Paper, .02mfd 600V ±20%
C215		PE194-A160	Paper, .05mfd 600V ±20%
C216		PA20174	Electrolytic, 5mfd 350V (Non-Polarized)
C217		PA20130	Electrolytic, 100mfd 25V
C218		PE194-A160	Paper, .05mfd 600V ±20%
C219		PE194-A160	Paper, .05mfd 600V ±20%
C220		PE194-A160	Paper, .05mfd 600V ±20%
C221		PE194-A151	Paper, .005 mfd 600V ±20%
C222		PE194-A151	Paper, .005mfd 600V ±20%
C223		PE194-A155	Paper, .01mfd 600V ±20%
C227		PA19109	Ceramic Single Disc, 5000mmf, GMV
C300		PE194-A145	Paper, .001mfd 600V ±20%
C301		PE194-A145	Paper, .001mfd 600V ±20%
C302		PE197-151	Paper, Molded Tubular .005mfd 600V ±20%
C303		PE197-151	Paper, Molded Tubular .005mfd 600V ±20%
C304		PE194-A160	Paper, .05mfd 600V ±20%
C305		PE195-261	Mica, Silver, 3900mmf 500V ±5%
C306		PE190-137	Mica, 390mmf 500V ±10%
C307		PE190-133	Mica, 270mmf 500V ±10%
C308		PE190-137	Mica, 390mmf 500V ±10%
C309		PA1772	Trimmer, 25-280mmf
C310		PA20137	Electrolytic, 10mfd 25V
C311		PP19145	Mica, 5mmf 2500V ±20%
C312		PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C313		PP19146	Mica, 10mmf 2500V ±20%
C314		PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C315		PA1998-3	Ceramic, 500mmf 20kv
C316		PE197-162	Paper, Molded Tubular .1mfd 600V ±20%
C317		PA20147	Electrolytic 25mfd 12V
C318		PP19180	Mica, 220mmf 1000V ±10%
C320		PE190-133	Mica, 270mmf 500V ±10%
C324		PP19217	Mica, 10mmf 1500V ±10%
C325		PP19218	Mica, 22mmf 1000V ±10%

800 SERIES RESISTORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
R100		PE231-1159	Carbon, 2700 Ohm 1/2W ±10%
R101		PE213-1117	Carbon, 47 Ohm 1/2W ±10%
R102		PE231-1137	Carbon, 330 Ohm 1/2W ±10%
R103		PE231-1179	Carbon, 18k Ohm 1/2W ±10%
R104		PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R105		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R106		PE231-1167	Carbon, 5600 Ohm 1/2W ±10%
R107		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R108		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R109		PE231-1129	Carbon, 150 Ohm 1/2W ±10%
R110		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R111		PE231-1177	Carbon, 15k Ohm 1/2W ±10%
R112			
R113		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R114		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R115		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R116		PE232-1161	Carbon, 3300 Ohm 1W ±10%
R117		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R118		PE231-1131	Carbon, 180 Ohm 1/2W ±10%
R119			
R120		PE233-74	Carbon, 11k Ohm 2W ±5%
R121		PE233-1179	Carbon, 18k Ohm 2W ±10%
R122		PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R123		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R124		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R125		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R126		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R127		PE231-1245	Carbon, 10 Megohm 1/2W ±10%
R128		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R129		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R130		PE232-1137	Carbon, 330 Ohm 1W ±10%
R131		PC21134-4	Wirewound, 3250 Ohm 7W ±10%
R133		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R134		PE231-1195	Carbon, 82k Ohm 1/2W ±10%
R135		PE231-1239	Carbon, 5.6 Megohm 1/2W ±10%
R139		PE231-1215	Carbon, 560k Ohm 1/2W ±10%
R140		PE231-1187	Carbon, 39k Ohm, 1/2W ±10%
R200		PE23151	Wirewound, 1.2 Ohm 1W ±10%
R201		PC21134-22	Wirewound, 80 Ohm 15W ±10%
R202		PE231-1183	Carbon, 27k Ohm 1/2W ±10%
R203		PE231-1175	Carbon, 12k Ohm 1/2W ±10%
R204		PE231-1193	Carbon, 68k Ohm 1/2W ±10%
R205		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R206		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R207		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R208		PE232-1181	Carbon, 22k Ohm 1W ±10%
R209		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R210		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R211		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R212		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R213		PE231-1159	Carbon, 2700 Ohm 1/2W ±10%
R214		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R215		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R216		PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R217		PE231-1169	Carbon, 6800 Ohm 1/2W ±10%
R218		PE232-127	Carbon, 1.8 Megohm 1W ±5%
R219		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R220		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R221		PE231-1225	Carbon, 1.5 Megohm 1/2W ±10%
R222		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R225		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R226		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R227		PE232-1209	Carbon, 330k Ohm 1W ±10%
R228		PE231-1185	Carbon, 33k Ohm 1/2W ±10%
R229		PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R230		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R231		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R232		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R233		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R234		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R236		PE232-1205	Carbon, 220k Ohm, 1W ±10%
R238		PE233-1169	Carbon, 6800 Ohm 2W ±10%
R300		PC21134-16	Wirewound, 2250 Ohm 15W ±10%
R301		PE233-1165	Carbon, 4700 Ohm 2W ±10%
R302		PE233-1169	Carbon, 6800 Ohm 2W ±10%
R303		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R304		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R305		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R306		PE231-1233	Carbon, 3.3 Megohm 1/2W ±10%
R307		PE232-1181	Carbon, 22k Ohm 1W ±10%
R308		PE231-1167	Carbon, 5600 Ohm 1/2W ±10%
R309		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R310		PE231-1205	Carbon, 220k Ohm 1/2W ±10%
R311		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R312		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R313		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R314		PE233-1133	Carbon, 220 Ohm 2W ±10%
R315		PE23163	Carbon, 0.51 Ohm 1/2W ±10%
R316		PE233-2321	Carbon, 1.0 Megohm 2W ±10% (Allen Bradley)
R318		PE232-1217	Carbon, 680 Ohm 1W ±10%
R319		PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R320		PE233-1165	Carbon, 4700 Ohm 2W ±10%
R321		PE233-1163	Carbon, 3900 Ohm 2W ±10%
R322		PE233-1169	Carbon, 6800 Ohm 2W ±10%
R323		PE233-1169	Carbon, 6800 Ohm 2W ±10%
R325		PE232-1217	Carbon, 680k Ohm 1W ±10%

CHOKES & COILS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
L101		A3392	Coil, Pix IF
L102		A28253	Choke, RF
L103		A3392	Coil, Pix IF
L104		A3392	Coil, Pix IF
L105		A28253	Choke, RF
L106		A28255-2	Coil, Peaking (White)
L107		A28255-1	Coil, Peaking (Red)
L108		A28255-2	Coil, Peaking (White)
L109		A28255-1	Coil, Peaking (Red)
L110		A28286	Coil, 4.5 MC Trap
L111		A28255-1	Coil, Peaking (Red)
L112		A28255-4	Coil, Peaking (Green)
L113		A28286	Coil, 4.5 MC Audio Takeoff
L114		A28314	Coil, 21.25 MC IF Trap
L200		A1406	Coil, Filter Choke
L201		A28276	Choke, Filament
L202		A28276	Choke, Filament
L203		A28330	Coil, Deflection Yoke
L300		A28263	Coil, Horiz. Freq. Control
L301		A28318-1	Coil, Width Control
L302		A28292	Coil, Horiz. Linearity
		A28331	Deflection Yoke Cover w/Centering Device

TRANSFORMERS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
T100		A1201 or 1202	Ratio Detector
T200		A10109	Power
T201		A10106	Vertical Oscillator
T202		A10152	Vertical Output
		A10136 or	
T300		A10137	Horizontal Output

CONTROLS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
P100		A24142	Contrast-Volume, 5K-250K ohm
P200		A24112	Vertical Hold, 1.0 Megohm
P201		A24111	Vertical Size, 5.0 Megohm
P202		A24114	Vertical Linearity, 3K ohm Wirewound
P204		A24110	Brightness, 100K ohm
P205		A24141	Horizontal Hold, 5K ohm
P206		A24112	Focus Control, 1.0 Megohm

*Used on all chassis unless otherwise specified in this column If specified, the part is used only on the chassis indicated.

MISC. CHASSIS ACCESS. & PARTS — ALL CHASSIS

PART NO.	DESCRIPTION
A65100K	Chassis
A5355	Shield, H.V. Supply
A5356	Cover, H.V. Supply Shield
A54609	Bracket, Horiz. Freq. Control Coil
A541059	Bracket, Interlock
A541242	Grounding Spring CRT Coating
A540-62	Terminal Strip, AAEAAAEAA
A540-67	Terminal Strip, AAAEAA
A540-44	Terminal Strip, AAEAA
A540-19	Terminal Strip, AEA
A540-34	Terminal Strip, AAEA
A18155	Socket, Octal Moulded
A18210	Socket, Octal Moulded Bakelite Saddle
A18173	Socket, 9 Pin Moulded
A18171	Socket, 9 Pin Moulded No Saddle
A18157	Socket, 9 Pin Wafer
A18147	Socket, 7 Pin Wafer
A18101	Socket, Speaker-Plug
A541131	Socket, H.V. Cond.
A562-6	Capacitor Clips; 1-3/8
A562-3	Capacitor Clips; 3/4
A54618-1	Tube Shield
A3206	Ion Trap
A541341	Anode Lead Holder
A541336	Tuner, Less Tubes (VHF)
A541335	Tuner,(Less Tubes (UHF)
A541251	Bracket, Interlock
A541248-1	Bracket, CRT Rear Support (Left)
A541248-2	Bracket, CRT Rear Support (Right)
A541000	CRT Rubber Grommet
A541246	Bracket, Yoke Hood and CRT Grommet
A541250-1	Bracket, Yoke Hood Support (Left)
A541250-2	Bracket, Yoke Hood Support (Right)
A541243	Bracket, CRT Front Support and Stop
A541249	Bracket, Tie Rod
A541254	CRT Strap Assembly
A541261-1	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541261-2	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541102-6	Rubber Cushion (CRT Strap)

Note: FOCUS CONTROL located in place of TV AM PHONO knob on straight Television Receivers.

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picutre tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a– 4.5 megacycles

b– 22.8 megacycles

c– 25.4 megacycles

d– 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (± 1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel.

3 – Cathode Ray Oscilloscope with good low frequency response.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE HORIZONTAL OUTPUT TUBE FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L101 and L104 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.8 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L404, L103 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.

8 – Adjust L114 for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 ohms.)

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to 4.7 diode load resistor (R113); ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display having 5 volts vertical deflection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

5 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier is visible on bandpass and adjust sound trap (L114) to minimize effect of sound carrier marker.

6 – Check all channels as above.

SOUND ALIGNMENT

1 – Connect 4.5 megacycle signal generator to pin 2 of 12BH7 (V7) video amplifier.

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V9) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L113 and bottom of T100 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K(± 1%) resistors across R126 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to junction of C119 and C120 (Audio Take-Off of T100).

6 – Adjust top of T100 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER TRAP

When necessary, the video amplifier 4.5 mc trap (L110) should be adjusted as follows:

1 – Connect 4.5 mc signal generator "high" lead to picture tube grid; ground to chassis.

2 – Connect DC V.T.V.M. to pin 7 of 6AL5 (V9) ratio detector, 10 volt scale, negative polarity.

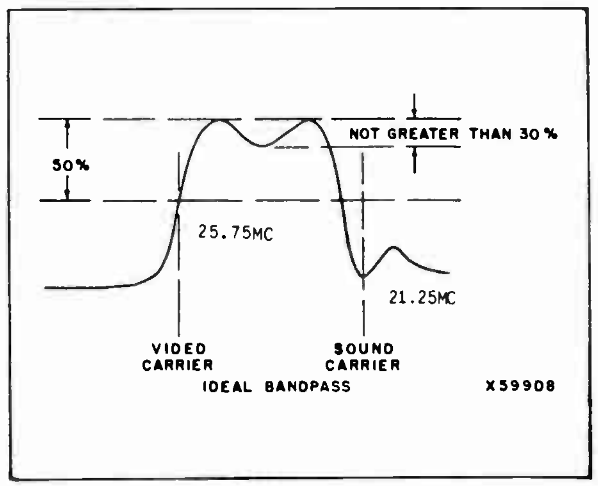
3 – Adjust L110 for minimum deflection on V.T.V.M.

R-F OSCILLATOR

If all channels are not within range of FINE TUNING control, adjust two screws located in front of r-f tuner unit for adjustment of either low or high band. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than converter plate coil, L404, during IF Alignment.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.



DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

The Width control (rear of H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

AM RADIO ALIGNMENT PROCEDURE

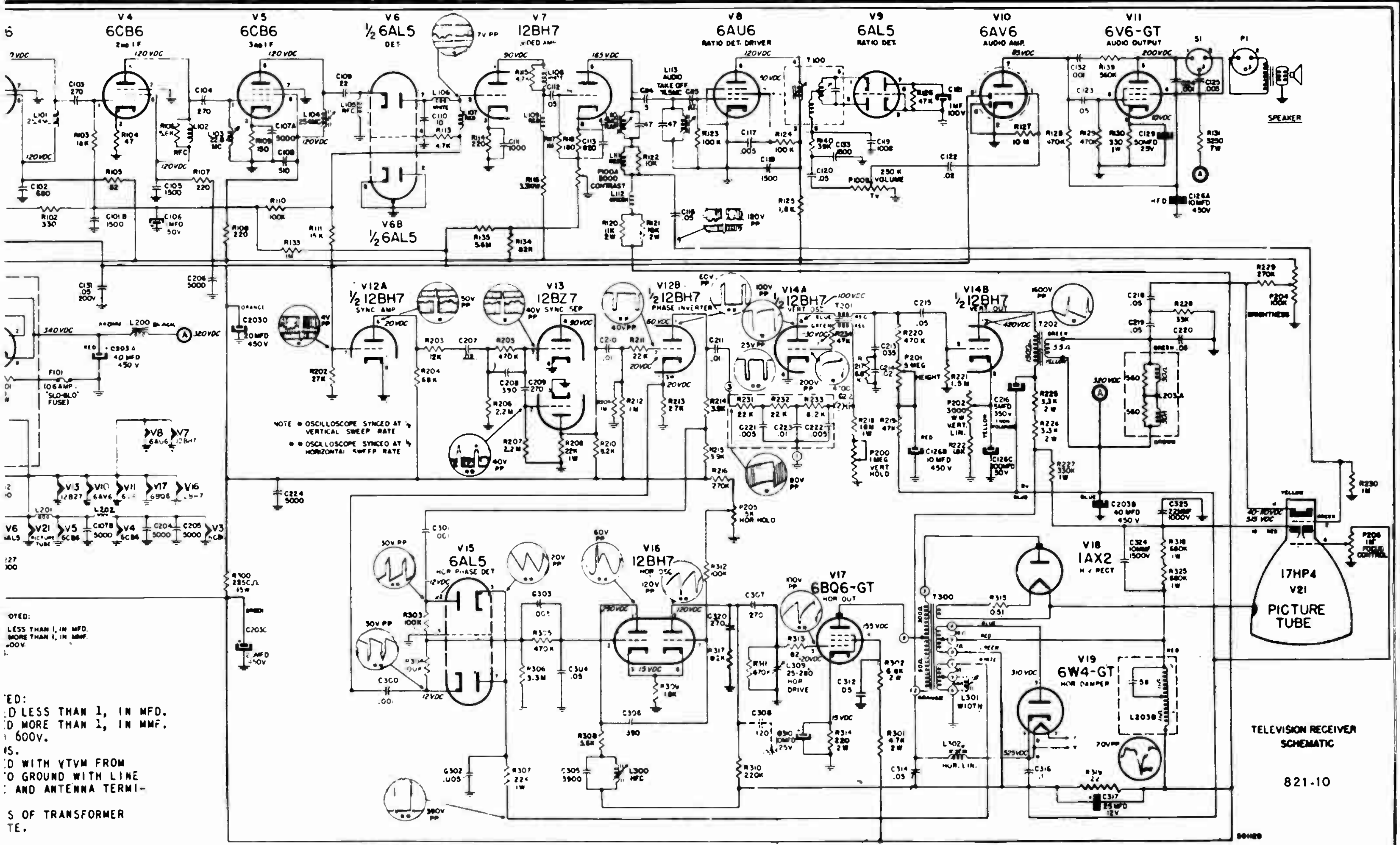
Signal Generator	Alignment Frequency	Adjust	Read Max. Output Across Voice Coil
Connected to Antenna Section of Gang and Gnd. thru 0.1 mfd Capacitor.	455 KC	Top & Bottom T502 & T501	Gang Open
	1620 KC	Trimmer C501B	
Connected to Radiating Loop.	1400 KC	Trimmer C501A	Gang Tuned To 1400 KC

PICTURE TUBE HANDLING PRECAUTIONS

The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.



TELEVISION RECEIVER SCHEMATIC

821-10

SWEEP ALIGNMENT CHECK

though not essential, a sweep alignment check is a desirable verification of l-F and I.F. response. Proceed as follows:

– Connect R-F sweep generator to antenna terminals (antenna impedance 300 ohms.)
– Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. filament).
– Connect vertical input of oscilloscope (through 10K isolating resistor) to 4.7 diode load resistor (R113); ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.
– Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display having 5 volts vertical deflection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).
– Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier is visible on bandpass and adjust sound trap (L114) to minimize effect of sound carrier marker.
– Check all channels as above.

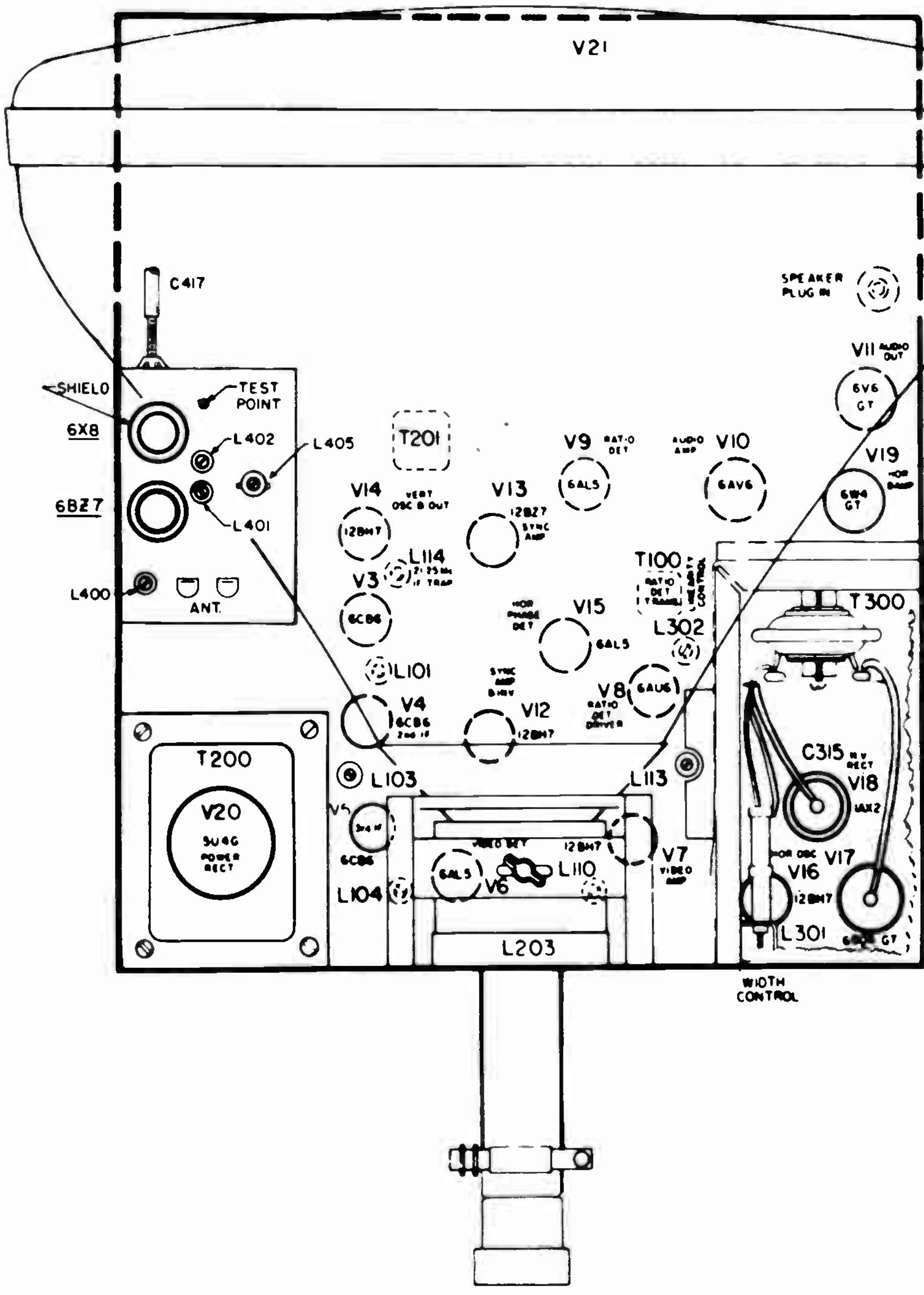
SOUND ALIGNMENT

- Connect 4.5 megacycle signal generator to pin 2 of 12BH6 (V7) video amplifier.
- Connect DC V.T.V.M. lead to pin 7 of 6AL6 (V9) ratio detector, negative polarity.
- Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.
- Adjust L113 and bottom of T100 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.
- Attach two series-connected 100K (± 1%) resistors across R126 (Ratio Detector Load Resistor). Connected DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to junction of C119 and C120 (Audio Take-Off of T100).
- Adjust top of T100 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER TRAP

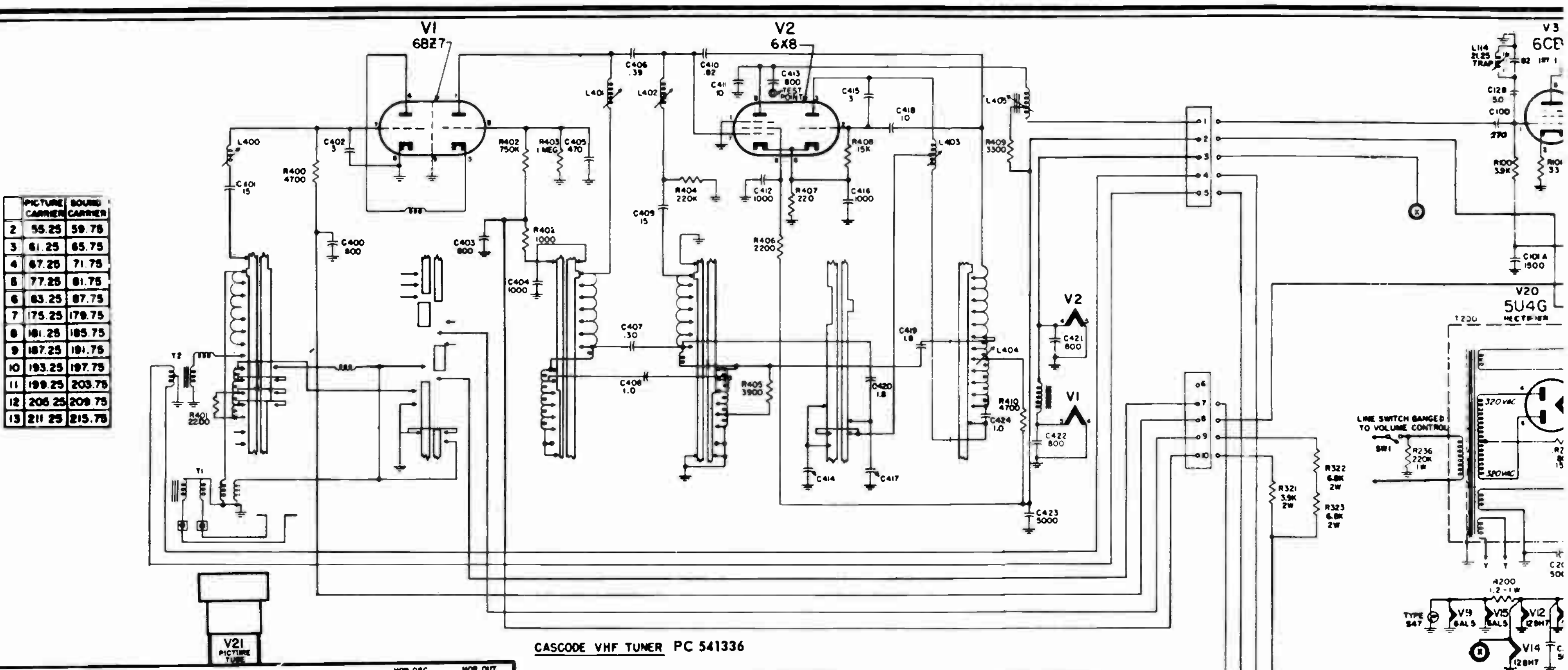
ıen necessary, the video amplifier 4.5 mc trap (L110) should be adjusted as ı:

- Connect 4.5 mc signal generator "high" lead to picture tube grid; ground to chassis.
- Connect DC V.T.V.M. to pin 7 to 6AL5 (V9) ratio detector, 10 volt scale, negative polarity.
- Adjust L110 for minimum deflection on V.T.V.M.

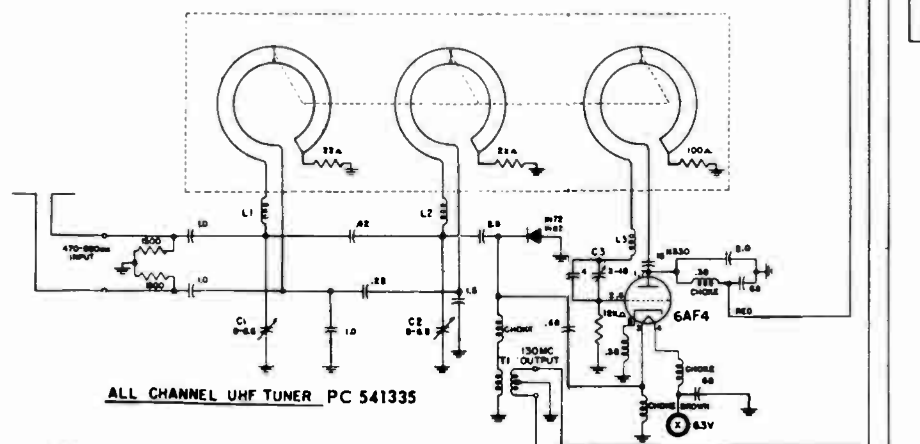


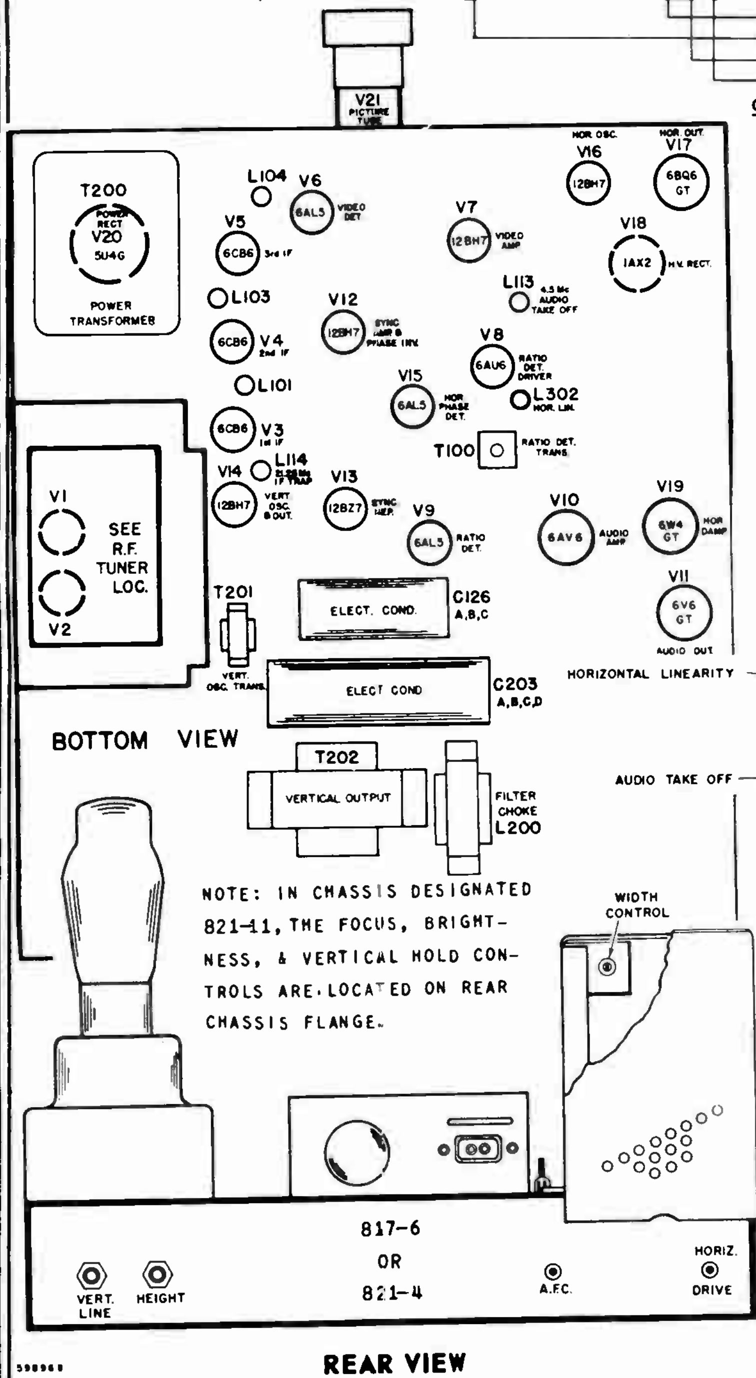
TUBE & TRIMMER LOCATION

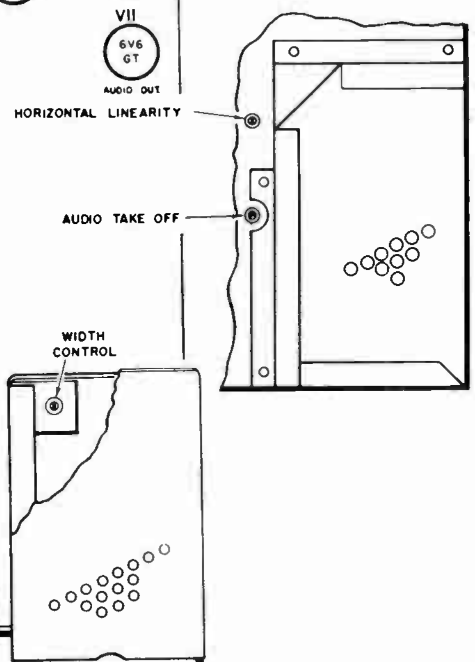
TOP VIEW



	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75







REAR VIEW

TELEVISION ALIGNMENT PROCEDURE VHF

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.
2 – Front panel and rear chassis controls, including picture tube adjustments.
3 – Reception on all available channels.
4 – Tube failures. Substitnte from your kit of known good replacements.
5 – Visnal inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:
  a– 4.5 megacycles
  b– 22.8 megacycles
  c– 25.4 megacycles
  d– 21.25 megacycles
2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.
3 – A pair of balanced (± 1%) 100K carbon resistors.

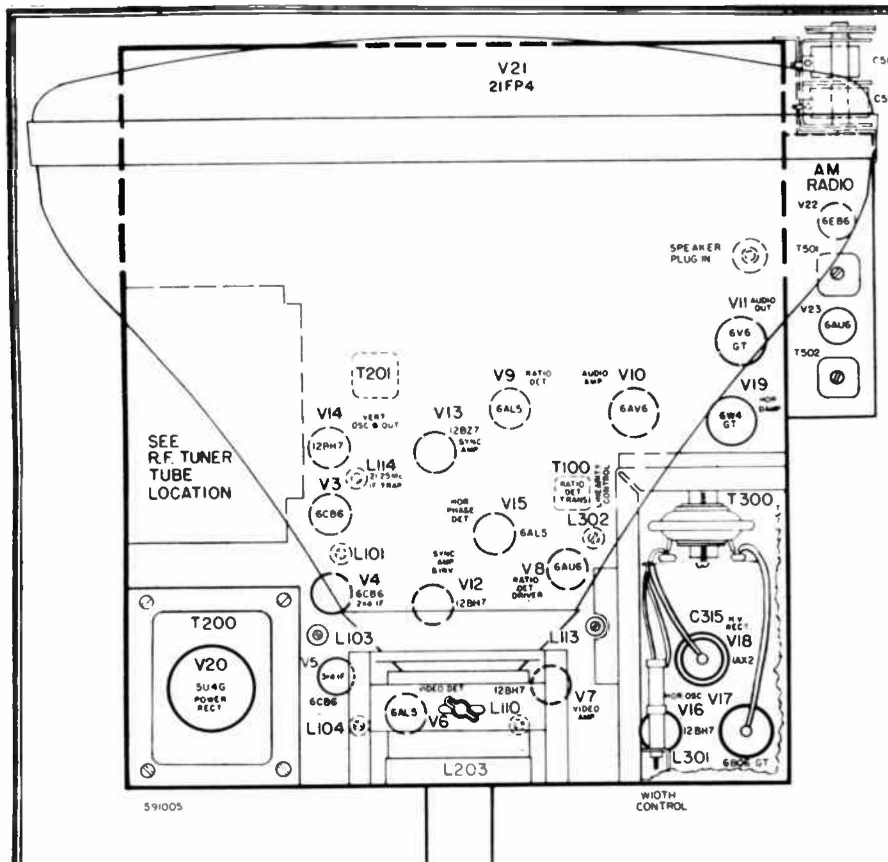
TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.
2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel.
3 – Cathode Ray Oscilloscope with good low frequency response.

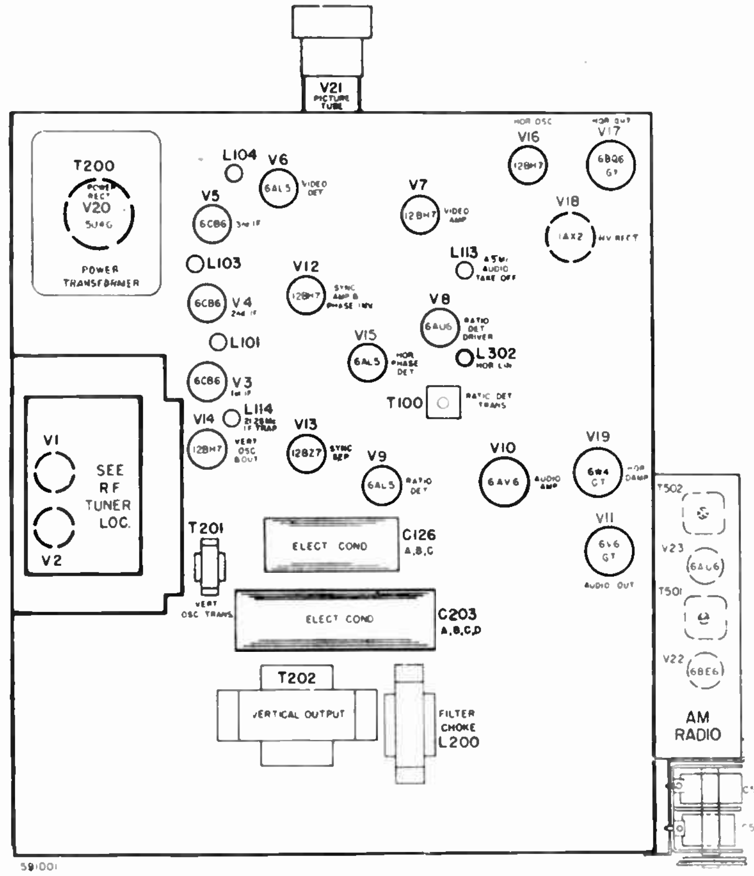
CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE HORIZONTAL OUTPUT SOCKET FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

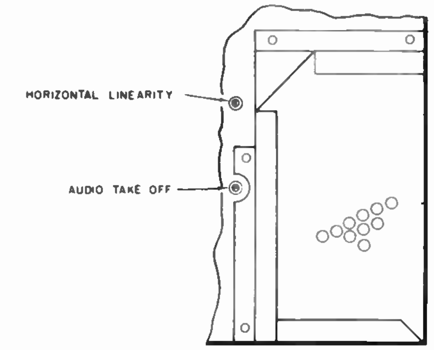
1 – Connect "high" lead of signal Generator to the VHF antenna. (Test point cannot be used for IF alignment because low generator impedance detunes IF circuits in plate circuits of 6x8 mixer oscillator.)
2 – Connect DC VTVM lead (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Set VTVM to 5 volt scale, negative polarity.
3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.
4 – Carefully adjust L101 and L104 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.
5 – Set I.F. signal generator to 22.8 megacycles with sufficient output to read approximately 3 volts on the VTVM.
6 – Carefully adjust L405, L103 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.
7 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.
8 – Adjust L114 for minimum deflection on VTVM.

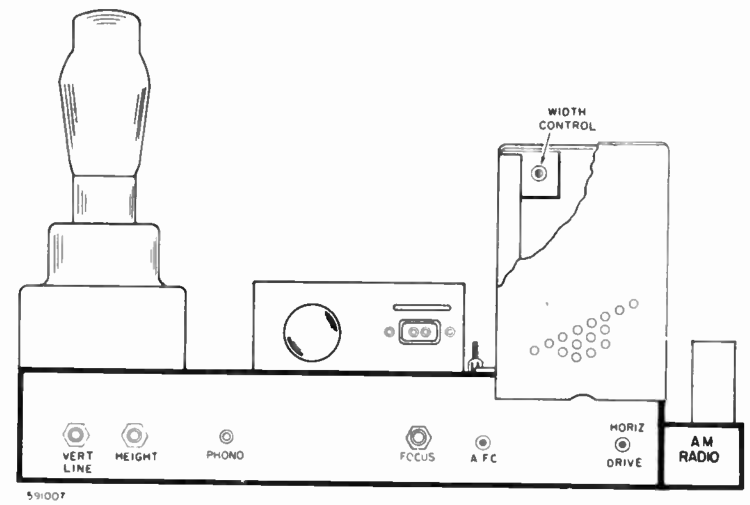


TUBE & TRIMMER LOCATION
821-20

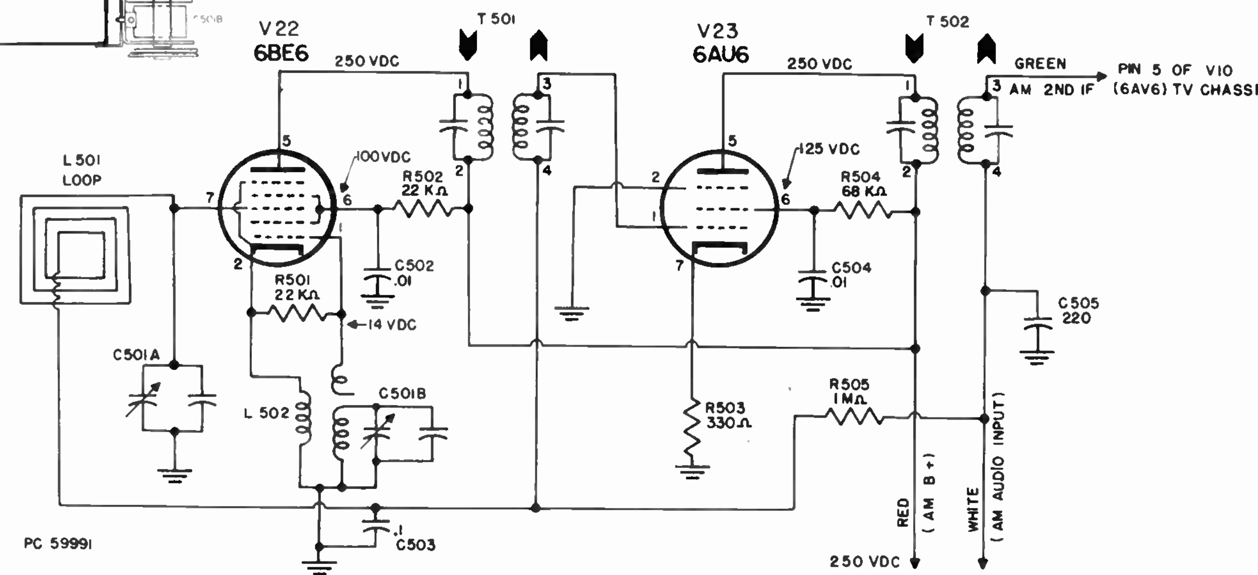


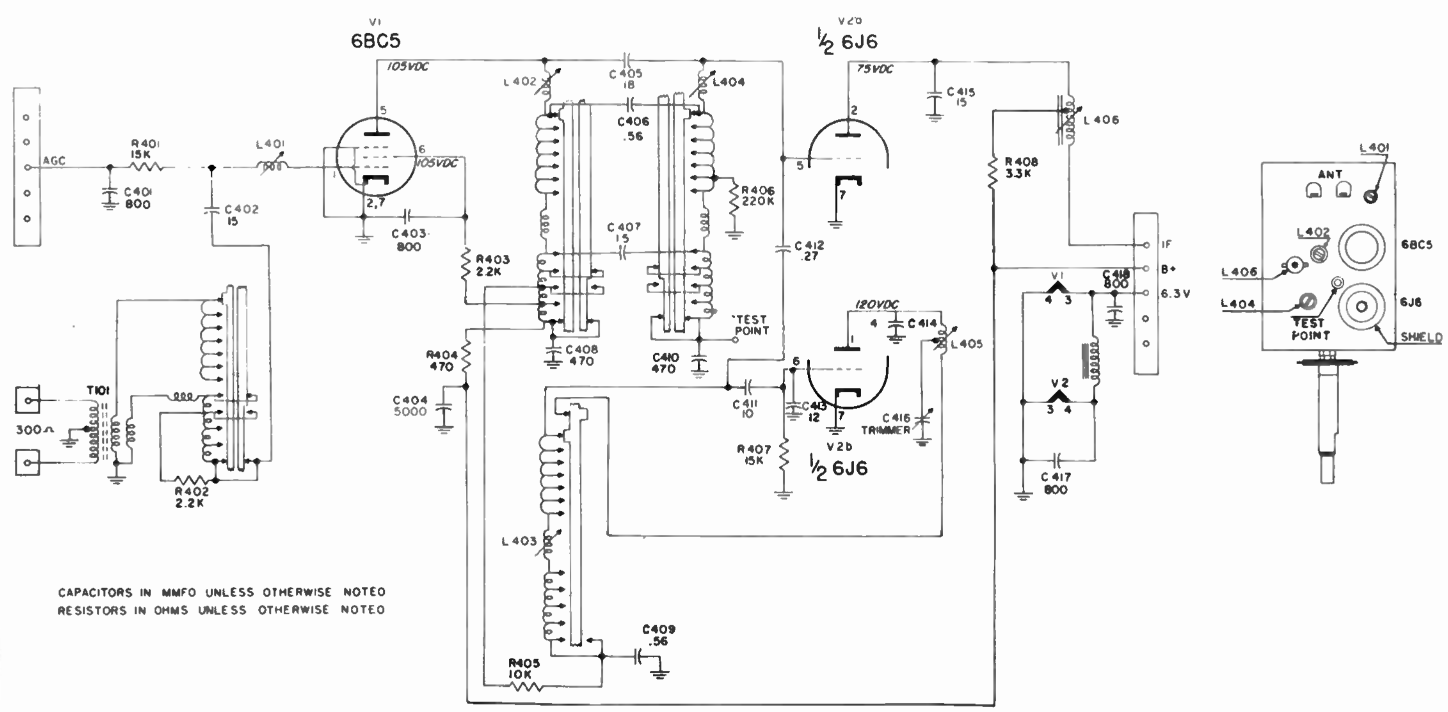
BOTTOM VIEW
821-20





REAR CHASSIS CONTROLS
821-20

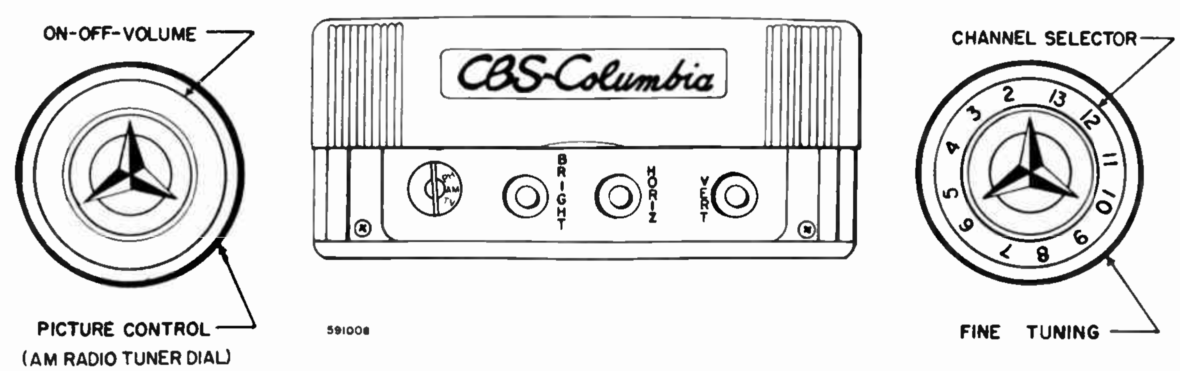




CAPACITORS IN MMFD UNLESS OTHERWISE NOTED
RESISTORS IN OHMS UNLESS OTHERWISE NOTED

TUNER SCHEMATIC & TUBE LOCATION

RADIO TUNER CHASSIS MODEL 2A1



800 SERIES RESISTORS

SCHEM. LOC.	PART NO.	DESCRIPTION
R100	PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R101	PE231-1113	Carbon, 33 Ohm 1/2W ±10%
R102	PE231-1137	Carbon, 330 Ohm 1/2W ±10%
R103	PE231-1177	Carbon, 15k Ohm 1/2W ±10%
R104	PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R105	PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R106	PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R107	PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R108	PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R109	PE231-1129	Carbon, 150 Ohm 1/2W ±10%
R110	PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R111	PE231-1177	Carbon, 15k Ohm 1/2W ±10%
R113	PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R114	PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R115	PE231-1165	Carbon, 4700 Ohm 1/2W±10%
R116	PE232-1161	Carbon, 3300 Ohm 1W ±10%
R117	PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R118	PE231-1131	Carbon, 180 Ohm 1/2W ±10%
R120	PE233-74	Carbon, 11k Ohm 2W ±5%
R121	PE233-1179	Carbon, 18k Ohm 2W ±10%
R122	PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R123	PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R124	PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R125	PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R126	PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R127	PE231-1245	Carbon, 10 Megohm 1/2W ±10%
R128	PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R129	PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R130	PE232-1137	Carbon, 330 Ohm 1W ±10%
R131	PC21134-4	Wirewound, 3250 Ohm 7W ±10%
R136	PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R137	PE231-1165	Carbon, 4.7k Ohm 1/2W ±10%
R138	PE231-1219	Carbon, 820k Ohm 1/2W ±10%
R139	PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R140	PE231-1187	Carbon, 39k Ohm 1/2W ±10%
R200	PE23151	Wirewound, 1.2 Ohm 1W ±10%
R201	PC21134-2	Wirewound, 60 Ohm 10W ±10%
R202	PE231-1183	Carbon, 27k Ohm 1/2W ±10%
R203	PE231-1175	Carbon, 12k Ohm 1/2W ±10%
R204	PE231-1193	Carbon, 68k Ohm 1/2W ±10%
R205	PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R206	PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R207	PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R208	PE232-1181	Carbon, 22k Ohm 1W ±10%
R209	PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R210	PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R211	PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R212	PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R213	PE231-1159	Carbon, 2700 Ohm 1/2W ±10%
R214	PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R215	PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R216	PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R217	PE231-1169	Carbon, 6800 Ohm 1/2W ±10%
R218	PE232-127	Carbon, 1.8 Megohm 1W ±5%
R219	PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R220	PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R221	PE231-1225	Carbon, 1.5 Megohm 1/2W ±10%
R222	PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R223	PE232-1189	Carbon, 47k Ohm 1W ±10%
R224	PE232-1201	Carbon, 150k Ohm 1W ±10%
R225	PE233-1161	Carbon, 3300 Ohm 2W ±10%
R226	PE233-1161	Carbon, 3300 Ohm 2W ±10%
R227	PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R228	PE231-1185	Carbon, 33k Ohm 1/2W ±10%
R229	PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R230	PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R231	PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R232	PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R233	PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R234	PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R237	PP23151	Carbon, 4.7 Ohm 1/2W ±10%
R238	PE233-1169	Carbon, 6800 Ohm 2W ±10%
R300	PC21134-16	Wirewound, 2250 Ohm 15W ±10%
R301	PE233-1165	Carbon, 4700 Ohm 2W ±10%
R302	PE233-1169	Carbon, 6800 Ohm 2W ±10%
R303	PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R304	PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R305	PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R306	PE231-1233	Carbon, 3.3 Megohm 1/2W ±10%
R307	PE232-1181	Carbon, 22k Ohm 1W ±10%
R308	PE231-1167	Carbon, 5600 Ohm 1/2W ±10%
R309	PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R310	PE231-1205	Carbon, 220k Ohm 1/2W ±10%
R311	PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R312	PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R313	PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R314	PE233-1133	Carbon, 220 Ohm 2W ±10%
R315	PE23163	Carbon, 0.56 Ohm 1/2W ±10%
R316	PE233-2321	Carbon, 1.0 Megohm 2W ±20% (Allen Bradley)
R318	PE232-1177	Carbon, 15k Ohm 1W ±10%
R319	PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R320	PE233-1165	Carbon, 4700 Ohm 2W ±10%

800 SERIES CAPACITORS

SCHEM. LOC.	PART NO.	DESCRIPTION
C100	PE190-133	Mica, 270mmf 500V ±10%
C101	PA19147	Ceramic, Shielded Dual Disc, 1500mmf GMV
C102	PE556-234	Ceramic Tubular, 680mmf 350V ±10% (Insul.)
C103	PE190-133	Mica, 270mmf 500V ±10%
C104	PE190-133	Mica, 270mmf 500V ±10%
C105	PA19148	Ceramic, Single Disc 1500mmf GMV
C106	PA20138	Electrolytic, 1mfd 50V
C107	PP19163	Ceramic, Shielded Dual Disc 5000mmf GMV
C108	PE190-140	Mica, 510mmf 500V ±10%
C109	PE190-107	Mica, 22mmf 500V ±10%
C110	PE555-101	Ceramic Tubular, 10mmf 500V ±20% (Unins.)
C111	PE555-136	Ceramic Tubular 1000mmf 350V ±20% (Unins.)
C112	PE194-160	Paper, .05mfd 600V ±20%
C113	PP19201	Ceramic Tubular, 820mmf 350V ±10% (Unins.)
C114	PE555-100	Ceramic Tubular, 5mmf 500V ±10% (Unins.)
C115	PE555-113-2	Ceramic Tubular, 47mmf 500V ±20% NPO
C116	PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C117	PE194-151	Paper, .005mfd 600V ±20%
C118	PA19148	Ceramic Single Disc 1500mmf GMV
C119	PE556-236	Ceramic Tubular, 1000mmf 350V ±10% (Insul.)
C120	PE194-160	Paper, .05mfd 600V ±20%
C121	PA20138	Electrolytic, 1mfd 50V
C122	PE194-156	Paper, .02mfd 600V ±20%
C123	PE194-160	Paper, .05mfd 600V ±20%
C124	PE194-155	Paper, .01mfd 600V ±20%
C125	PE194-151	Paper, .005mfd 600V ±20%
C126	PA20135	Electrolytic, 10-10-10mfd 450V
C128	PE555-100	Ceramic, 5.0mmf 500V ±10% (Uninsul.)
C129	PA20137	Electrolytic, 10mfd 25V
C132	PE194-146	Paper, .002 mfd 600V ±20%
C133	PE556-238	Ceramic Tubular, 1500mmf 350V ±10% (Insul)
C201		
C202	PA19109	Ceramic, Single Disc 5000mmf GMV
C203	PA20144	Electrolytic, 40-40-20-20mfd 450V
C204	PA19109	Ceramic, Single Disc 5000mmf GMV
C205	PA19109	Ceramic, Single Disc 5000mmf GMV
C206	PA19109	Ceramic, Single Disc 5000mmf GMV
C207	PE194-156	Paper, .02mfd 600V ±20%
C208	PE190-137	Mica, 390mmf 500V ±10%
C209	PE190-133	Mica, 270mmf 500V ±10%
C210	PE194-155	Paper, .01mfd 600V ±20%
C211	PE194-155	Paper, .01mfd 600V ±20%
C212	PE192-163	Mica, 4700mmf 500V ±10%
C213	PE194-159	Paper, .035mfd 600V ±20%
C214	PE194-156	Paper, .02mfd 600V ±20%
C215	PE194-160	Paper, .05mfd 600V ±20%
C216	PA20145	Electrolytic, 10mfd 250V
C217	PA20130	Electrolytic, 100mfd 25V
C218	PE194-160	Paper, .05mfd 600V ±20%
C219	PE194-160	Paper, .05mfd 600V ±20%
C220	PE194-155	Paper, .01mfd 600V ±20%
C221	PE194-151	Paper, .005mfd 600V ±20%
C222	PE194-151	Paper, .005mfd 600V ±20%
C223	PE194-155	Paper, .01mfd 600V ±20%
C226	PE194-114	Paper, 0.1mfd 400V ±20%
C227	PA19109	Ceramic, Single Disc 5000mmf GMV
C300	PE194-145	Paper, .001mfd 600V ±20%
C301	PE194-145	Paper, .001mfd 600V ±20%
C302	PE197-151	Paper, Molded Tubular .005mfd 600V ±20%
C303	PE197-151	Paper, Molded Tubular .005mfd 600V ±20%
C304	PE194-160	Paper, .05mfd 600V ±20%
C305	PE195-261	Mica, Silver, 3900mmf 500V ±5%
C306	PE190-137	Mica, 390mmf 500V ±10%
C307	PE190-133	Mica, 270mmf 500V ±10%
C308	PE190-137	Mica, 390mmf 500V ±10%
C309	PA1772	Trimmer, 25-280mmf
C310	PA20137	Electrolytic, 10mfd 25V
C311	PP19145	Mica, 5mmf 2500V GMV
C312	PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C313	PP19146	Mica, 10mmf 2500V GMV
C314	PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C315	PA1998-3	Ceramic, 500mmf 20kv
C316	PE197-162	Paper, Molded Tubular .1mfd 600V ±20%
C317	PA20147	Electrolytic 25mfd 12V
C318	PP19180	Mica, 220mmf 1000V ±10%

CHOKES & COILS

SCHEM. LOC.	PART NO.	DESCRIPTION
L101	A3392	Coil, Pix IF
L102	A28253	Choke, RF
L103	A3392	Coil, Pix IF
L104	A3392	Coil, Pix IF
L105	A28253	Choke, RF
L106	A28255-2	Coil, Peaking (White)
L107	A28255-1	Coil, Peaking (Red)
L108	A28255-2	Coil, Peaking (White)
L109	A28255-1	Coil, Peaking (Red)
L110	A28286	Coil, 4.5 MC. Trap
L111	A28255-1	Coil, Peaking (Red)
L112	A28255-4	Coil, Peaking (Green)
L113	A28286	Coil, 4.5 MC Audio Takeoff
L114	A28314	Coil, 21.25 MC IF Trap
L200	A1406	Coil, Filter Choke
L201	A28276	Choke, Filament
L202	A28276	Choke, Filament
L203	A28330	Coil, Deflection Yoke
L300	A28263	Coil, Horiz. Freq. Control
L301	A28318-1	Coil, Width Control
L302	A28292	Coil, Horiz. Linearity
	A28331	Deflection Yoke Cover w/Centering Device

TRANSFORMERS

SCHEM. LOC.	PART NO.	DESCRIPTION
T100	A1201 or 1202	Ratio Detector
T200	A10109	Power
T201	A10106	Vertical Oscillator
T202	A10152-1	Vertical Output
T300	A10136 or A10137	Horizontal Output

CONTROLS

SCHEM. LOC.	PART NO.	DESCRIPTION
P100	A24142	Contrast-Volume, 5K-250K ohm
P200	A24112	Vertical Hold, 1.0 Megohm
P201	A24111	Vertical Size, 5.0 Megohm
P202	A24114	Vertical Linearity, 3K ohm Wirewound
P204	A24110	Brightness, 100K ohm
P205	A24141	Horizontal Hold, 5K ohm
P206	A24112	Focus Control, 1.0 Megohm
SW2	A37115	TV/AM/Phono Switch

AM TUNER CHASSIS
MODEL 2A1
CHASSIS 821-20

SYMB. NO.	PART NO.	DESCRIPTION
C501A,B	PB16114	Ganged Capacitor
C502	PB19210-6	Capacitor Ceramic Single Disc .01 Min.GMV
C503	PE196-66	Capacitor Paper .1 200V ±20%
C504	PB19210-6	Capacitor Ceramic Single Disc .01 Min.GMV
C505	PE556-123	Capacitor Ceramic 220 mmf 20%
R501	PE231-1181	Carbon Resistor 22K 1/2w ±10%
R502	PE232-1181	Carbon Resistor 22K 1w ±10%
R503	PE231-1137	Carbon Resistor 330 Ohm 1/2w ±10%
R504	PE231-1193	Carbon Resistor 68K ±10%
R505	PE231-1221	Carbon Resistor 1 Megohm 1/2w ±10%
L501	PB28345	Antenna Coil
L502	PB28344-1	Oscillator Coil
T501	PB33102A	IF Transformer
T502	PB33102A	IF Transformer

SAFETY GLASS REMOVAL INSTRUCTION

The safety glass of this receiver is removable so that the face of the Picture Tube may be cleaned. Before proceeding, carefully observe the following precautions:

1 – REMOVE THE POWER CORD FROM THE WALL SOCKET.

2 – DO NOT ATTEMPT TO REMOVE THE PIX TUBE MASK UNDER ANY CIRCUMSTANCES.

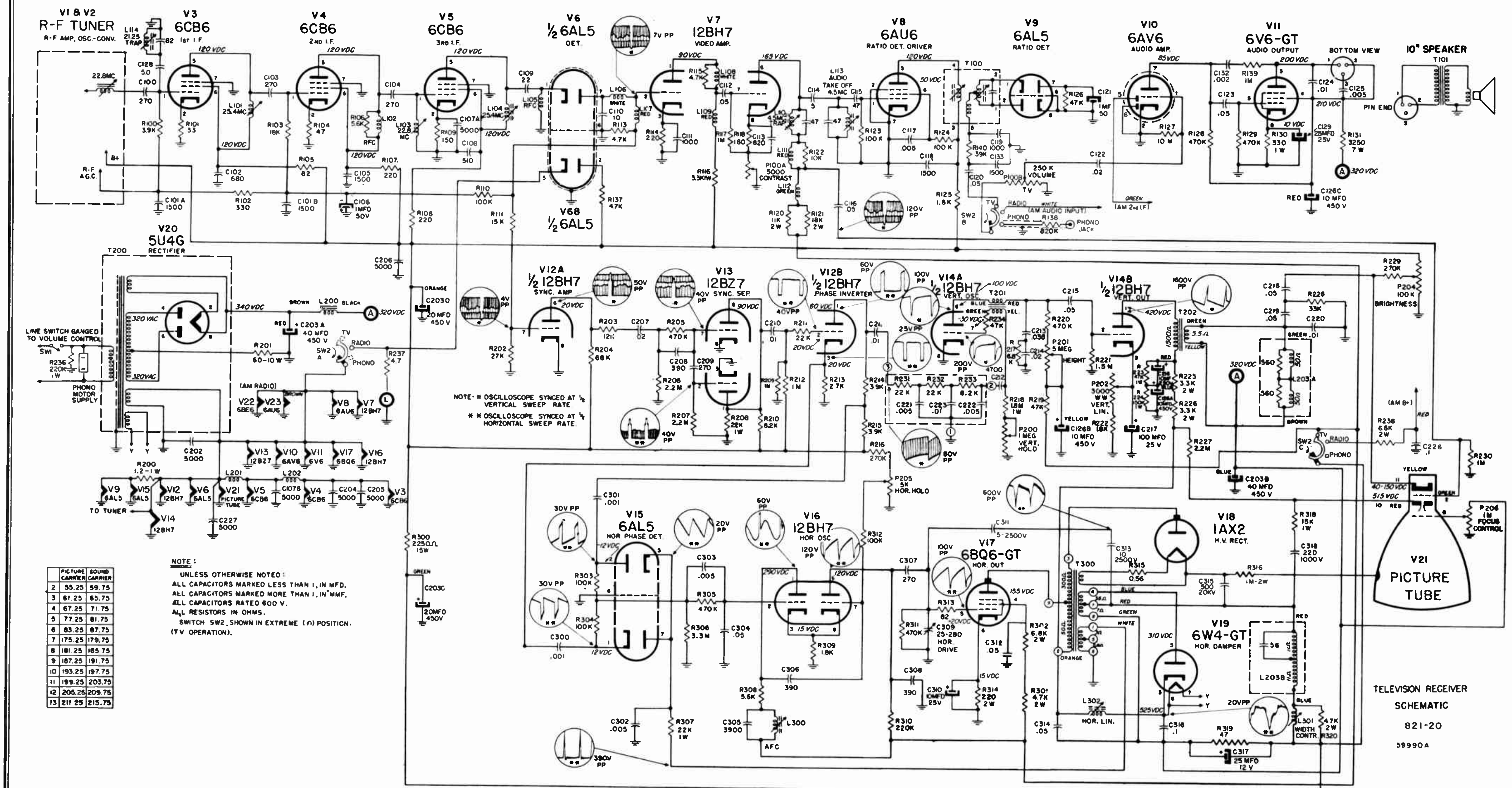
3 – BE CAREFUL NOT TO SCRATCH OR STRIKE THE SURFACE OF THE PICTURE TUBE WITH ANY OBJECT.

4 – CLEAN THE FACE OF THE PICTURE TUBE AND THE INSIDE SURFACE OF THE SAFETY GLASS WITH A SOFT, CLEAN, DRY CLOTH.

Remove upper strip secured by (5) screws. Tilt glass forward and lift out of slot of lower glass retaining strip. Observing the above precautions, carefully clean Pix Tube and Safety Glass. Reassemble by inserting glass in slot of lower strip, replacing upper strip and tightening screws securely.

CABINET REPAIR PARTS LIST

PART NAME	MODEL 22K38	PART NAME	MODEL 22K38
Cabinet	PE60194	Speaker	PC58121 10" PM
Trapdoor	PD4497	Knob, TV/AM/Phono Switch	PA39266
Trapdoor, Base	PD4498	Knob, On-Off-Volume	PC39241-1
Safety Glass	PC62457-13	Knob, Channel Selector	PC39242-1
Retainer Strip, Upper	PC62410-1	Knob, Pix Control and AM Dial Scale Assembly	PC39246-1
Retainer Strip, Lower	PC62427-1	Knob, Vernier and Dial Assembly	PC39265
Mask	PC62424	Record Changer	PC6426-6
Back Cover	PC62431		



NOTE:

UNLESS OTHERWISE NOTEO:
ALL CAPACITORS MARKEO LESS THAN 1, IN MFD.
ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
ALL CAPACITORS RATEO 600 V.
ALL RESISTORS IN OHMS.
SWITCH SW2, SHOWN IN EXTREME (∩) POSITICN. (TV OPERATION).

	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

TELEVISION RECEIVER SCHEMATIC 821-20

59990A

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picture tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a. 4.5 megacycles

b. 22.25 megacycles

c. 25.4 megacycles

d. 23.6 megacycles

e. 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (⁄1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel, preferably 30% Amplitude-Modulated.

3 – Cathode Ray Oscilloscope with good low frequency response.

4 – 3 volt bias battery.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE COLOR PLUG FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on the inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to pin 1 of 6AU6 1 st Video Amplifier (V12), ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L201 and L203 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.25 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L11, L202-top (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set i-f signal generator to 23.6 mc. with sufficient output to read approximately 3 volts on the VTVM.

8 – Carefully adjust L205 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator out-put to keep meter reading approximately 3 volts.

9 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient defection on VTVM.

10 – Adjust L202-bottom for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 Ohms).

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. Filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to pin 1 of 6AU6 1st Vid. Amp. (V12) ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Connect 3 volt battery positive terminal to chassis negative terminal to AGC buss (see schematic diagram).

5 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display (see figure 1) having 5 volts vertical defection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

6 – Adjust L205 slightly to even the height of peaks and to obtain an untilted bandpass.

7 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier visible on bandpass and adjust sound trap (L114) to minimize effect to sound carrier marker.

NOTE: If the fine tuning control is at end of range or out of range so that video carrier cannot be set at 50%, follow R-F OSCILLATOR ALIGNMENT procedure outlined below.

8 – Check all channels.

R-F OSCILLATOR ALIGNMENT

If all channels are not within range of FINE TUNING control (as evidenced by inability to eliminate "sound bars" from picture or by poor picture quality), the individual oscillator slugs may require readjustment.

1 – Repeat the set-up as for SWEEP ALIGNMENT CHECK, steps 1 through 7.

2 – Set FINE TUNING CONTROL to center of range, and with long fiber screwdriver alignment tool, adjust the individual oscillator slugs of each channel. (Accessible through the front of the tuner) so that video carrier markers fall 50% down on curve. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than the converter plate unit, L11, during I.F. alignment.

SOUND ALIGNMENT

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 4.5 mc. amplifier (V13).

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V15) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L206, L101, and bottom of T102 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K (⁄1%) resistors across R106 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to centertap of 100K resistors, and connect ground wire of V.T.V.M. to top of C109 (Audio take-Off of T102).

6 – Adjust top of T102 for zero reading on V.T.V.M. between a plus and a minus peak.

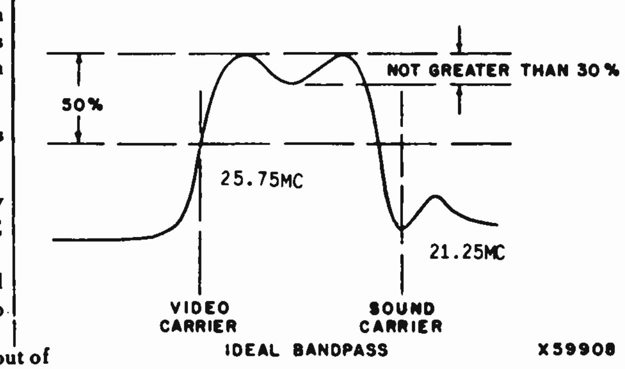
VIDEO AMPLIFIER 4.5 mc. TRAP

When necessary, the video amplifier 4.5 mc. trap (L104) should be adjusted as follows:

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 1st video amplifier (V12).

2 – Adjust signal generator output till 4.5 mc. dot pattern is clearly visible on screen of picture tube.

3 – Adjust L104 to minimize the dot pattern.



HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

HEIGHT, WIDTH, LINEARITY, AND HORIZONTAL DRIVE

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

1 – Starting with the HORIZONTAL DRIVE control (rear of chassis) in extreme counterclockwise position, advance the control clockwise till the compression near the center of the picture (a vertical bright bar) is eliminated.

2 – The Width and Horizontal Linearity controls (rear of chassis) should be adjusted to give a picture that will fill the mask horizontally, with the minimum of stretching or compression.

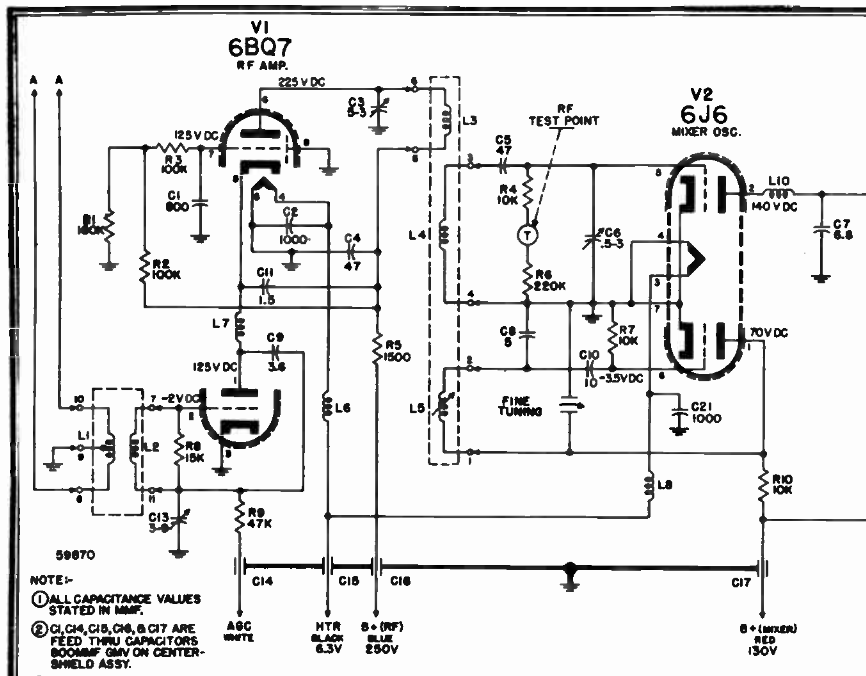
3 – The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

PICTURE TUBE HANDLING PRECAUTIONS

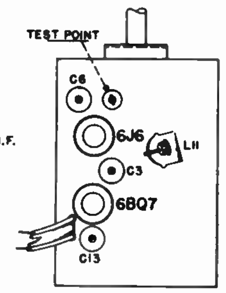
The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

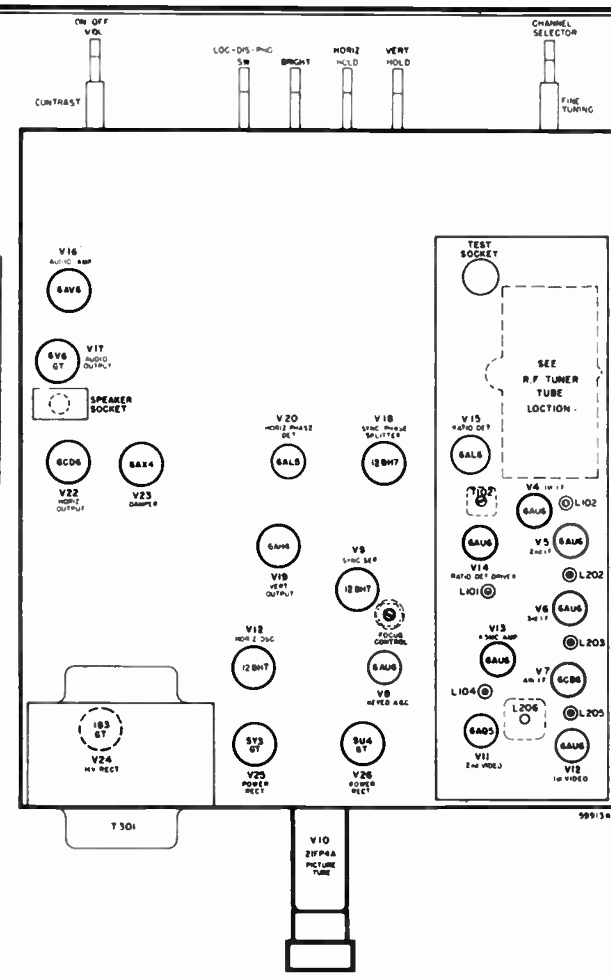
HIGH VOLTAGE WARNING

Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone not thoroughly familiar with the precautions necessary when working on high voltage equipment.

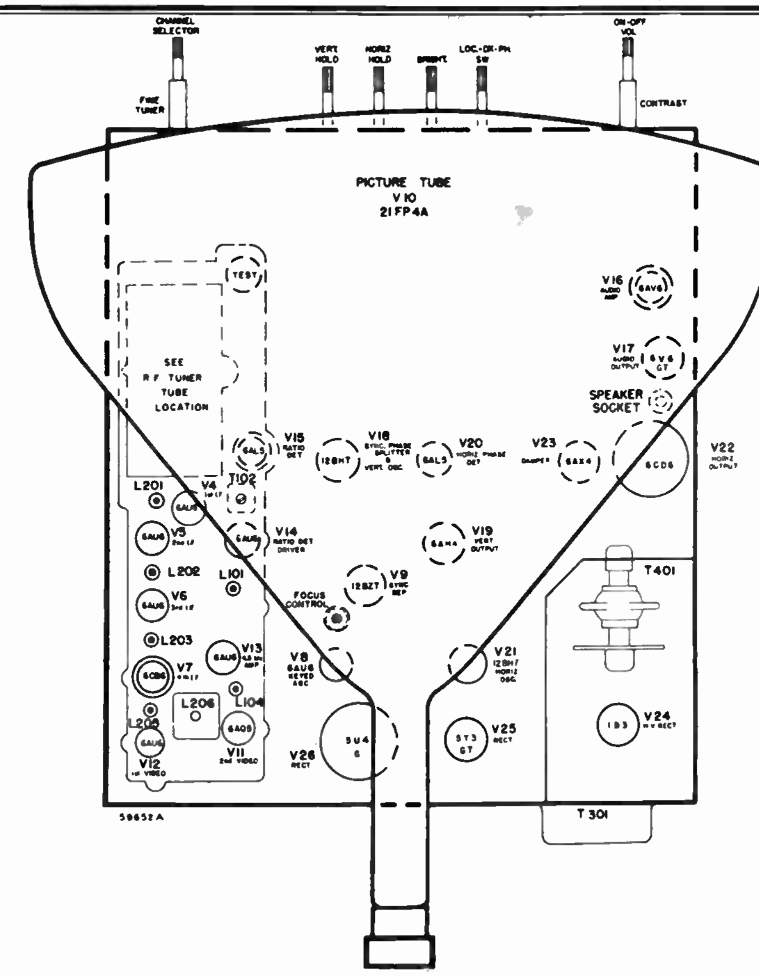


SCHEMATIC FOR CASCODE TUNER PC-541215





CHASSIS BOTTOM VIEW
1021 CHASSIS



TUBE & TRIMMER LOCATION
1021 CHASSIS

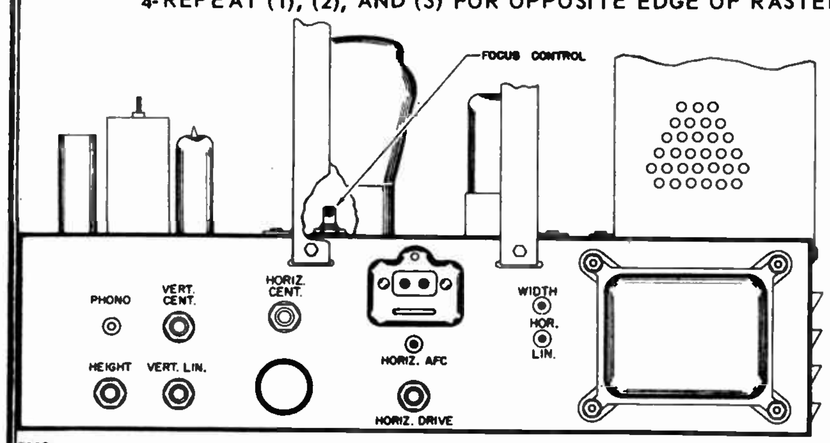
ADJUSTMENT OF ANTI-PINCUSHION MAGNETS

1-ADJUST THE HORIZONTAL CENTERING AND HORIZONTAL SIZE CONTROLS SO THAT THE ONE EDGE OF RASTER MAY BE SEEN.

2-IF EDGE OF RASTER IS BOWED, LOOSEN THE SCREW RETAINING THE ANTI-PINCUSHION MAGNET WHICH IS MOUNTED ON THE TIE-ROD BRACING THE PICTURE TUBE (ON THE SIDE WHICH SHOWS BOWING) SUFFICIENTLY TO ADJUST THE MAGNET BRACKET.

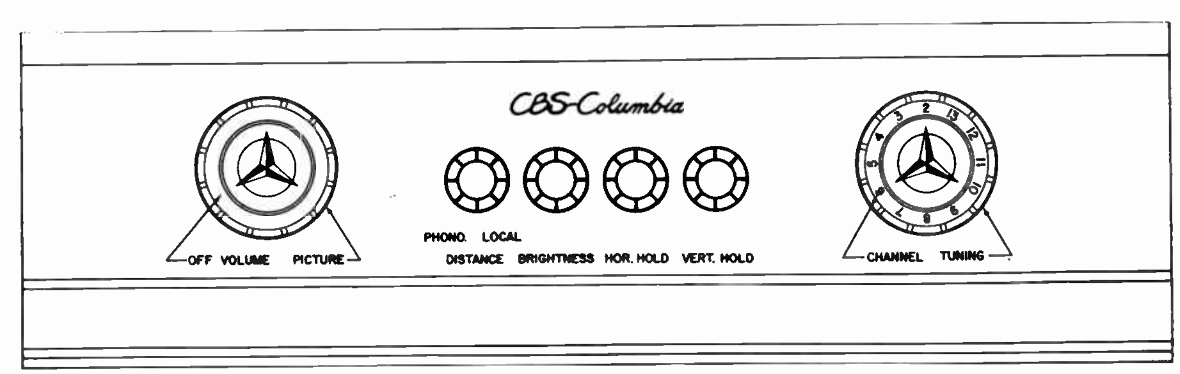
3-ADJUST THE MAGNET SPACING AND ROTATION, TO OBTAIN A STRAIGHT RASTER EDGE. TIGHTEN THE RETAINING SCREW.

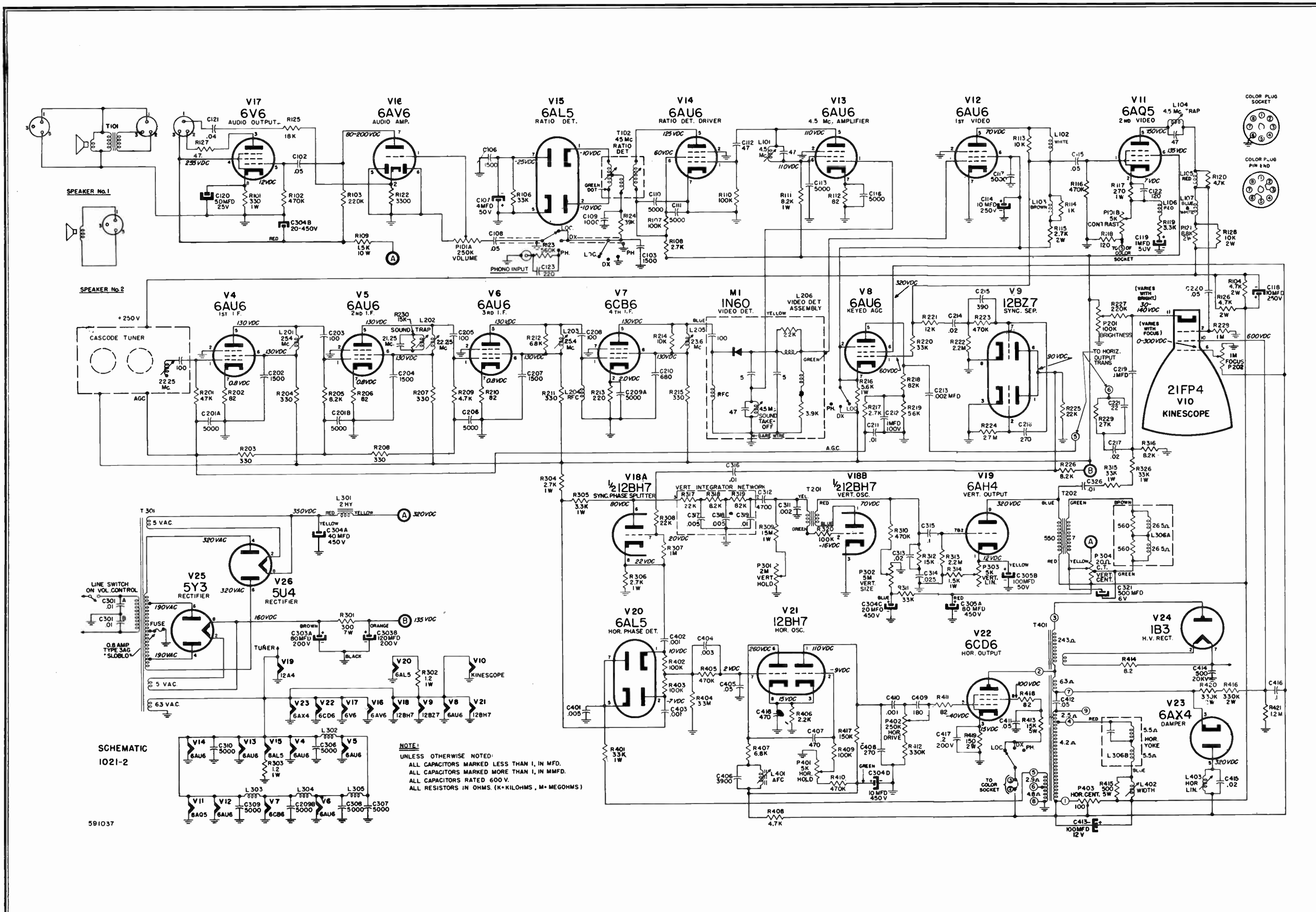
4-REPEAT (1), (2), AND (3) FOR OPPOSITE EDGE OF RASTER.



REAR CONTROLS
1021 CHASSIS

The safety glass of this receiver is removable so that the face of the picture tube may be cleaned. To accomplish this remove power cord from wall socket. Remove the upper strip that holds the safety glass in place by removing the five screws which secure the strip, supporting the safety glass so that it does not fall forward. Remove the safety glass by tilting it forward and lifting it out of the slot in the lower glass retaining strip. Be careful not to scratch or strike the surface of the picture tube with any object. Carefully clean face of picture tube and the inside surface of the safety glass with a soft, clean, dry cloth. DO NOT ATTEMPT TO REMOVE THE PICTURE TUBE MASK. Reassemble by inserting glass in slot of lower strip. Replace upper strip and tighten the screws securely.





V17 6V6 AUDIO OUTPUT
V16 6AV6 AUDIO AMP.
V15 6AL5 RATIO DET.
V14 6AU6 RATIO DET. DRIVER
V13 6AU6 4.5 Mc. AMPLIFIER
V12 6AU6 1ST VIDEO
V11 6AQ5 2ND VIDEO
L104 4.5 Mc. TRAP
COLOR PLUG SOCKET
COLOR PLUG PIN END
SPEAKER No.1
SPEAKER No.2
T101
T102 4.5 Mc RATIO DET
P101A 250K VOLUME
PHONO INPUT
CONTRAST
V4 6AU6 1ST I.F.
V5 6AU6 2ND I.F.
V6 6AU6 3RD I.F.
V7 6CB6 4TH I.F.
M1 1N60 VIDEO DET.
L206 VIDEO DET ASSEMBLY
4.5 Mc SOUND TAKE-OFF
V8 6AU6 KEYED AGC
V9 12BZ7 SYNC. SEP.
CASCODE TUNER
+250V
AGC
TO HORIZ. OUTPUT TRANS
P201 100K BRIGHTNESS
FOCUS P202
21FP4 V10 KINESCOPE
V18A 1/2 12BH7 SYNC. PHASE SPLITTER
VERT. INTEGRATOR NETWORK
V18B 1/2 12BH7 VERT. OSC.
V19 6AH4 VERT. OUTPUT
T202
P301 2M VERT. HOLD
P302 5M VERT. SIZE
P303 5K VERT. LIN.
P304 20Ω C.T. VERT. CENT.
L301 2 HY
T301
LINE SWITCH ON VOL. CONTROL
FUSE 0.8 AMP TYPE 3AG "SLOBLO"
V25 5Y3 RECTIFIER
V26 5U4 RECTIFIER
V20 6AL5 HOR. PHASE DET.
V21 12BH7 HOR. OSC.
V22 6CD6 HOR. OUTPUT
V24 1B3 H.V. RECT.
V23 6AX4 DAMPER
T401
P401 5K HOR. HOLD
L401 AFC
P402 250K HOR. DRIVE
P403 HOR. CENT.
L306B HOR. YOKE
L402 WIDTH
L403 HOR. LIN.
TO COLOR SOCKET
SCHEMATIC 1021-2
591037
NOTE:
UNLESS OTHERWISE NOTED:
ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
ALL CAPACITORS MARKED MORE THAN 1, IN MMFD.
ALL CAPACITORS RATED 600 V.
ALL RESISTORS IN OHMS. (K=KILOHMS, M=MEGOHMS)

SERVICE DATA ON CBS - COLUMBIA TELEVISION RECEIVERS MASTERLINE SERIES

CAPACITORS

SYMB. NO.	PART NO.	DESCRIPTION
C102	A194-160	Paper, .05 mfd 600V ±20%
C103	A556-238	Ceramic, Tubular 1500 mmf 350V ±10%
C106	A19148	Ceramic Single Disc 1500 mmf GMV
C107	A20149	Electrolytic 4 mfd 50V
C108	A194-160	Paper, .05 mfd 600V ±20%
C109	A555-136-2	Ceramic Tubular, 1000 mmf 350V ±20% (Noninsul) NPO
C110	A19109	Ceramic Single Disc 5000 mmf GMV
C111	A19109	Ceramic Single Disc 5000 mmf GMV
C112	A555-113-2	Ceramic Tubular 47 mmf 500V ±20% (Noninsul) NPO
C113	A19109	Ceramic Single Disc 5000 mmf GMV
C114	A20145	Electrolytic 10 mfd 250V
C115	A194-160	Paper, .05 mfd 600V ±20%
C116	A19109	Ceramic Single Disc 5000 mmf GMV
C117	A19109	Ceramic Single Disc 5000 mmf GMV
C118	A20145	Electrolytic 10 mfd 250V
C119	A20138	Electrolytic 1 mfd 50V
C120	A20182	Electro, 50mfd 25V
C121	A19216	Paper, .04 mfd 600V ±20%
C122	A190-125	Mica, 120mmf 500V ±10%
C123	A555-123	Ceramic Tubular, 220mmf 500V ±20%
C201	A19163	Ceramic Shielded Dual Disc 5000 mmf GMV
C202	A19148	Ceramic Single 1500 mmf GMV
C203	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C204	A19148	Ceramic Single Disc 1500 mmf GMV
C205	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C206	A19109	Ceramic Single Disc 5000 mmf GMV
C207	A19148	Ceramic Single Disc 1500 mmf GMV
C208	A556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insul.) NPO
C209	A19163	Ceramic Shielded Dual Disc 5000 mmf GMV
C210	A190-143	Mica 680 mmf 500V ±10%
C211	A194-155	Paper, .01 mfd 600V ±20%
C212	A194-21	Paper, 1.0 mfd 100V ±20%
C213	A194-146	Paper, .002 mfd 600V ±20%
C214	A194-156	Paper, .02 mfd 600V ±20%
C215	A190-137	Mica 390 mmf 500V ±10%
C216	A190-133	Mica 270 mmf 500V ±10%
C217	A194-156	Paper, .02 mfd 600V ±20%
C219	A194-162	Paper, .1 mfd 600V ±20%
C220	A197-160	Molded Tubular .05 mfd 600V ±20%
C221	A19220	Mica, 22mmf 600V ±10%
C301	A19198	Ceramic Shielded Dual Disc .01 mfd 500V GMV
C303	A20170	Electrolytic 80 mfd 200V, 120 mfd 200V
C304	A20168	Electrolytic 40-20-20-10 mfd 450V
C305	A20169	Electrolytic 80 mfd 450V, 100 mfd 50V
C306	A19109	Ceramic Single Disc 5000 mmf GMV
C307	A19109	Ceramic Single Disc 5000 mmf GMV
C308	A19109	Ceramic Single Disc 5000 mmf GMV
C309	A19109	Ceramic Single Disc 5000 mmf GMV
C310	A19109	Ceramic Single Disc 5000 mmf GMV
C311	A197-146	Molded Tubular .002 mfd 600V ±20%
C312	A192-163	Mica 4700 mmf 500V ±10%
C313	A194-156	Paper, .02 mfd 600V ±20%
C314	A194-157	Paper, .025mfd 600V ±20%
C315	A194-162	Paper, .1 mfd 600V ±20%
C316	A194-155	Paper, .01 mfd 600V ±20%
C317	A194-151	Paper, .005 mfd 600V ±20%
C318	A194-151	Paper, .005 mfd 600V ±20%
C319	A194-155	Paper, .01 mfd 600V ±20%
C321	A20171	Electrolytic, 500mfd 6V (Non-Polarized)
C326	A194-203	Paper, .01 mfd 1000V ±20%
C401	A197-151	Molded Tubular .005 mfd 600V ±20%
C402	A194-145	Paper, .001 mfd 600V ±20%
C403	A194-145	Paper, .001 mfd 600V ±20%
C404	A197-148	Molded Tubular .003 mfd 600V ±20%
C405	A194-160	Paper, .05 mfd 600V ±20%
C406	A195-261	Silver Mica 3900 mmf 500V ±10%
C407	A190-139	Mica 470 mmf 500V ±10%
C408	A190-133	Mica 270 mmf 500V ±10%
C409	A190-129	Mica, 180mmf 500V ±10%
C410	A194-145	Paper, .001 mfd 600V ±20%
C411	A197-160	Molded Tubular .05 mfd 600V ±20%
C412	A197-160	Molded Tubular .05 mfd 600V ±20%
C413	A20141	Electrolytic 100 mfd 12V
C414	A19175-3	Ceramic 500 mmf 20kv
C415	A197-156	Molded Tubular .02 mfd 600V ±20%
C416	A194-162	Paper, .1 mfd 600V ±20%
C417	A19156	Paper, .2 mfd 200V ±20%
C418	A190-139	Mica 470 mmf 500V ±10%

RESISTORS

SYMB. NO.	PART NO.	DESCRIPTION
R101	A232-1137	Carbon 330 Ohm 1w ±10%
R102	A231-1213	Carbon 470K Ohm 1/2w ±10%
R103	A231-1205	Carbon, 220K ohm 1/2w ±10%
R104	A233-1165	Carbon, 4700 ohm 2w ±10%
R106	A231-1185	Carbon 33K Ohm 1/2w ±10%
R107	A231-1197	Carbon 100K Ohm 1/2w ±10%
R108	A231-1159	Carbon 2700 Ohm 1/2w ±10%
R109	A21134-12	Wirewound 1500 Ohm 10w ±10%
R110	A231-1197	Carbon 100K Ohm 1/2w ±10%
R111	A232-1171	Carbon 8200 Ohm 1w ±10%
R112	A231-1123	Carbon 82 Ohm 1/2w ±10%
R113	A231-1173	Carbon 10K Ohm 1/2w ±10%
R114	A231-1149	Carbon, 1000 ohm 1/2w ±10%
R115	A233-1159	Carbon 2700 Ohm 2w ±10%
R116	A231-1213	Carbon 470K Ohm 1/2w ±10%
R117	A232-1135	Carbon 270 Ohm 1w ±10%
R118	A231-1127	Carbon 120 Ohm 1/2w ±10%
R119	A231-1161	Carbon 3300 Ohm 1/2w ±10%
R120	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R121	A233-1163	Carbon 3900 Ohm 2w ±10%
R122	A231-1161	Carbon, 3300 ohm 1/2w ±10%
R123	A231-1215	Carbon, 560K ohm, 1/2w ±10%
R124	A231-1187	Carbon 39K Ohm 1/2w ±10%
R125	A231-1179	Carbon, 18K ohm 1/2w ±10%
R126	A233-1165	Carbon, 4700 ohm 2w ±10%
R127	A231-1117	Carbon, 47 ohm 1/2w ±10%
R201	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R202	A231-1123	Carbon 82 Ohm 1/2w ±10%
R203	A231-1137	Carbon 330 Ohm 1/2w ±10%
R204	A231-1137	Carbon 330 Ohm 1/2w ±10%
R205	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R206	A231-1123	Carbon 82 Ohm 1/2w ±10%
R207	A231-1137	Carbon 330 Ohm 1/2w ±10%
R208	A231-1137	Carbon 330 Ohm 1/2w ±10%
R209	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R210	A231-1123	Carbon 82 Ohm 1/2w ±10%
R211	A231-1137	Carbon 330 Ohm 1/2w ±10%
R212	A231-1169	Carbon 6800 Ohm 1/2w ±10%
R213	A231-1133	Carbon 220 Ohm 1/2w ±10%
R214	A231-1173	Carbon 10K Ohm 1/2w ±10%
R215	A231-1137	Carbon 330 Ohm 1/2w ±10%
R216	A232-1167	Carbon 5600 Ohm 1w ±10%
R217	A231-1159	Carbon 2700 Ohm 1/2w ±10%
R218	A231-1195	Carbon 82K Ohm 1/2w ±10%
R219	A231-1191	Carbon 56K Ohm 1/2w ±10%
R220	A231-1185	Carbon 33K Ohm 1/2w ±10%
R221	A231-1175	Carbon 12K Ohm 1/2w ±10%
R222	A231-1229	Carbon 2.2 Megohm 1/2w ±10%
R223	A231-1213	Carbon 470K Ohm 1/2w ±10%
R224	A231-1231	Carbon 2.7 Megohm 1/2w ±10%
R225	A231-1181	Carbon 22K Ohm 1/2w ±10%
R226	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R227	A231-1205	Carbon 220K Ohm 1/2w ±10%
R228	A231-1221	Carbon 1.0 Megohm 1/2w ±10%
R229	A231-1207	Carbon, 27K ohm 1/2w ±10%
R230	A231-1177	Carbon, 15K ohm 1/2w ±10%
R301	A21134-11	Wirewound 300 Ohm 7w ±10%
R302	A23151	Wirewound 1.2 Ohm 1w ±10%
R303	A23151	Wirewound 1.2 Ohm 1w ±10%
R304	A232-1159	Carbon 2700 Ohm 1w ±10%
R305	A232-1161	Carbon 330 Ohm 1w ±10%
R306	A232-1159	Carbon 2700 Ohm 1w ±10%
R307	A231-1221	Carbon 1.0 Megohm 1/2w ±10%
R308	A231-1181	Carbon 22K Ohm 1/2w ±10%
R309	A232-1225	Carbon 1.5 Megohm 1w ±10%
R310	A231-1213	Carbon 470K Ohm 1/2w ±10%
R311	A231-1185	Carbon 33K Ohm 1/2w ±10%
R312	A231-1177	Carbon, 15K ohm 1/2w ±10%
R313	A231-1229	Carbon 2.2 Megohm 1/2w ±10%
R314	A232-1153	Carbon, 1500 ohm 1w ±10%
R315	A231-1185	Carbon 33K Ohm 1w ±10%
R316	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R317	A231-1181	Carbon 22K Ohm 1/2w ±10%
R318	A231-1171	Carbon 8200 Ohm 1/2W ±10%
R319	A231-1171	Carbon 8200 Ohm 1/2w ±10%
R320	A231-1190	Carbon 100K Ohm 1/2w ±10%
R326	A232-1185	Carbon 33K Ohm 1w ±10%
R401	A232-1185	Carbon 33K Ohm 1w ±10%
R402	A231-1197	Carbon 100K Ohm 1/2w ±10%
R403	A231-1197	Carbon 100K Ohm 1/2w ±10%
R404	A231-1233	Carbon 3.3 Megohm 1/2w ±10%
R405	A231-1213	Carbon 470K Ohm 1/2w ±10%
R406	A231-1157	Carbon 2200 Ohm 1/2w ±10%
R407	A231-1169	Carbon 6800 Ohm 1/2w ±10%
R408	A231-1165	Carbon 4700 Ohm 1/2w ±10%
R409	A231-1197	Carbon 100K Ohm 1/2w ±10%
R410	A231-1213	Carbon 470K Ohm 1/2w ±10%
R411	A231-1123	Carbon 82 Ohm 1/2w ±10%
R412	A231-1209	Carbon 330K Ohm 1/2w ±10%
R413	A21134-26	Wire Wound, 15K ohm 5w ±10%
R414	A23158	Carbon 8.2 Ohm 1/2w ±10%
R415	A21134-10	Wirewound 500 Ohm 5w ±10%
R416	A233-1209	Carbon 330 K Ohm 2w ±10%
R417	A231-1201	Carbon 150K Ohm 1/2w ±10%
R418	A231-1123	Carbon 82 Ohm 1/2w ±10%
R419	A233-1129	Carbon 150 Ohm 2w ±10%
R420	A233-1209	Carbon 330K Ohm 2w ±10%
R421	A231-1223	Carbon, 1.2 Megohm 1/2w ±10%

CHOKES & COILS

SYMB. NO.	PART NO.	DESCRIPTION
L101	PA28286	Coil Audio Takeoff
L102	PC28255-2	Coil, Peaking (white)
L103	PC28255-8	Coil Peaking (Brown)
L104	PA28286	Coil 4.5 mc Trap
L105	PC28255-1	Coil Peaking (Red)
L106	PC28255-1	Coil Peaking (Red)
L107	PC28255-11	Coil Peaking (Blue and White)
L201	PB3392	Coil Pix. I.F.
L202	PB28320	Coil Pix. I.F. w/Trap
L203	PB3392	Coil Pix. I.F.
L204	PA28253	Coil R.F. Choke
L205	PB3392	Coil Pix. I.F.
L206	PB28321	Coil, Video Detector Peaking Coil Assembly
L301	PB1414	Coil Filter Choke
L302	PA28276	Coil Filament Choke
L303	PA28276	Coil Filament Choke
L304	PA28276	Coil Filament Choke
L305	PA28276	Coil Filament Choke
L306	PC28317-1	Coil Deflection Yoke
L401	PA28263	Coil Horizontal Frequency Control
L402	PA28318	Coil Width Control
L403	PA28218	Coil Horizontal Linearity

TRANSFORMER

SYMB. NO.	PART NO.	DESCRIPTION
T102	PB1201 or PB1202	Transformer Ratio Detector
T201	PB10106-2	Transformer Vertical Block Osc.
T202	PC10154-2	Transformer, Vertical output
T301	PC10148	Transformer Power
T401	PC10161	Transformer, Horizontal output

CONTROLS

SYMB. NO.	PART NO.	DESCRIPTION
P101A,B	PA24136	Control Volume Contrast 250K-5K (Dual Front)
P201	PA24134	Control Brightness 100K (Front)
P202	PA24112	Control Focus 1 Megohm (Rear)
P301	PA24146	Control Vertical Hold 1 Megohm (Front)
P302	PA24111	Height 5 Megohm (Rear)
P303	PA24135	Control Vertical Linearity 5K 2w (Rear)
P304	PA24118	Control Vertical Centering 20 Ohm C.T. (Rear)
P401	PA24137	Control Horizontal Hold 5K (Front)
P402	PA24138	Control Horizontal Drive 250K (Rear)
P403	PA24116	Control Horizontal Centering 100 Ohm Wirewound (Rear)

MISC. CHASSIS ACCESS. & PARTS

PART NO.	DESCRIPTION
PA18155	Socket; Octal Molded
PA18210	Socket; Octal Molded w/Molded Saddle, Mica Filled Bakelite.
PA18157	Socket; 9 Pin Wafer
PA18170	Socket; 9 Pin Wafer, 1-5/16" Mtg. Centers
PA18147	Socket; 7 Pin Wafer
PA18101	Socket Speaker Plug
PB18205	Socket; H.V. Rectifier Assembly
PE540-67	Terminal Strip AAAEAA
PE540-35	Terminal Strip AEAA
PE540-19	Terminal Strip AEA
PE540-18	Terminal Strip AAE
PE540-34	Terminal Strip AAEA
PE540-44	Terminal Strip AAEAA
PE540-7	Terminal Strip AE
PA18207	Socket, 9 Pin Molded w/Adapter Plate
PD5366	Shield, H.V. Supply
PB5367	Cover, H.V. Supply Shield
PA54661	Interlock Connector, Male
PC18197-5	Socket, Kinescope (6 Pin)
PC55141-6	Anode Lead Assembly
PA37111	Switch; 4P3T Rotary Wafer (Local-Dx-Phono) (Front)
PC541201	Bracket, CRT Front Support
PB541191	Bracket, CRT Stop
PB541202	Bracket, CRT Stop (Left and Right Sides)
PB541219	Bracket, Anode Lead Holder Assembly
PA18174	Socket; Phono Jack
PB541259	CRT Strap Assembly
PC541198	Bracket Yoke Hood and CRT Grommet Support
PA541203	CRT Rubber Grommet (Yoke Hood)
PD541197-1	Bracket CRT Rear Support — Left
PD541197-2	Bracket CRT Rear Support — Right
PA541280	Grounding Spring, CRT Coating
PA541127	Grounding Spring Positioner
PB541102-5	Cushion, Rubber, CRT Strap
PB541110-4	Cushion, Sponge Rubber, CRT Stop Bracket and Lower Front Support
PB541110-6	Cushion, Sponge Rubber, CRT Front Support
PB541110-7	Cushion, Sponge Rubber CRT Stop (Side) Brackets

CABINET REPAIR PARTS LIST

	MODEL 22C61B CHASSIS 1021-2
CABINET	A60209
SAFETY GLASS	A62457-13
GLASS RETAINER STRIP (UPPER)	A62410-2
GLASS RETAINER STRIP (LOWER)	A62412-2
MASK	A62418
BACK COVER	A62420
SPEAKER #1	A58133-6" PM
SPEAKER #2	A58132-6" PM
KNOB—PHONO/DX—LOC.SW.	A39247-2
KNOB—CHANNEL SELECTOR	A39242-2
KNOB—VERNIER	A39240-3
KNOB—ON—OFF—VOLUME	A39241-2
KNOB—PICTURE CONTROL	A39239-3
KNOB—AUXILIARY CONTROL	A39246-1

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

TELEVISION ALIGNMENT PROCEDURE VHF

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.
2 – Front panel and rear chassis controls, including picture tube adjustments.
3 – Reception on all available channels.
4 – Tube failures. Substitute from your kit of known good replacements.
5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 micro-volts, and crystal controlled or crystal-calibrated at the following frequencies:
a–4.5 megacycles c–25.4 megacycles
b–22.8 megacycles d–21.25 megacycles
2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.
3 – A pair of balanced (± 1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.
2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel.
3 – Cathode Ray Oscilloscope with good low frequency response.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE HORIZONTAL OUTPUT TUBE FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal Generator to the VHF antenna. (Test point cannot be used for IF alignment because low generator impedance detunes IF circuits in plate circuits of 6x8 mixer oscillator.)
2 – Connect DC VTVM lead (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Set VTVM to 5 volt scale, negative polarity.
3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.
4 – Carefully adjust L101 and L104 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.
5 – Set I.F. signal generator to 22.8 megacycles with sufficient output to read approximately 3 volts on the VTVM.
6 – Carefully adjust L2, L103 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.
7 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.
8 – Adjust L114 for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 ohms.)
2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. filament).
3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.
4 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display having 5 volts vertical deflection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).
5 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier is visible on bandpass and adjust sound trap (L114) to minimize effect of sound carrier marker.
6 – Check all channels as above.

SOUND ALIGNMENT

1 – Connect 4.5 megacycle signal generator to pin 2 of 12BH6 (V7) video amplifier.
2 – Connect DC V.T.V.M. lead to pin 7 of 6AL6 (V9) ratio detector, negative polarity.
3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.
4 – Adjust L113 and bottom of T100 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.
5 – Attach two series-connected 100K (± 1%) resistors across R126 (Ratio Detector Load Resistor). Connected DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to junction of C119 and C120 (Audio Take-Off of T100).
6 – Adjust top of T100 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER TRAP

When necessary, the video amplifier 4.5 mc trap (110) should be adjusted as follows:

1 – Connect 4.5 mc signal generator "high" lead to picture tube grid; ground to chassis.
2 – Connect DC V.T.V.M. to pin 7 to 6AL5 (V9) ratio detector, 10 volt scale, negative polarity.
3 – Adjust L110 for minimum deflection on V.T.V.M.

R-F OSCILLATOR

If all channels are not within range of FINE TUNING control, adjust two screws located in front of r-f tuner unit for adjustment of either low or high band. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than converter plate coil, L2. during IF Alignment.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The Receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

* L406 in chassis 105-3-81706, 105-3-82104 & 105-3-82106

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.
2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).
3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.
4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.
5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.
6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

The Width control (rear of H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

TELEVISION ALIGNMENT PROCEDURE, UHF

Alignment of the UHF Tuner is a simple procedure since its bandpass is essentially predetermined by the fixed characteristics of original component design, physical layout and associated circuitry. Except as stated otherwise in this procedure, band-pass is not subject to serious change during alignment, however, replacement of any component within the R-F or I-F circuits may disturb the band-pass characteristics. Accordingly, whenever parts within these circuits are replaced, electrical and physical specifications of the original components must be duplicated as closely as possible. Wires, parts and other accessories must be replaced in their former positions.

Complicated or specially designed test equipment is not required for practical alignment of the UHF Tuner. Instruments used for testing VHF sets are usually satisfactory. However, the following instruments are needed;

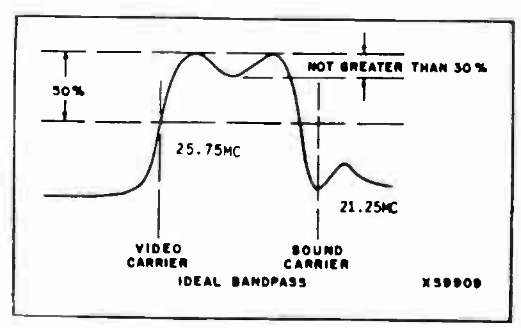
1 – VHF signal generator with AM output and a sweep modulation of at least 12 megacycles.
2 – Oscilloscope or vacuum tube volt-ohmmeter for measurement of the relative signal.
3 – An operating VHF television set. (The latter is suggested as a practical amplifier for raising the output signal of the converter to a level which permits convenient observation.)

PICTURE TUBE HANDLING PRECAUTIONS

The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow or a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.



ALIGNMENT PROCEDURE UHF TUNER PC541452

Alignment of the UHF Tuner is a simple procedure since its bandpass is essentially predetermined by the fixed characteristics of original component design, physical layout and associated circuitry. Except as stated otherwise in this procedure, band-pass is not subject to serious change during alignment, however, replacement of any component within the R-F or I-F circuits may disturb the band-pass characteristics. Accordingly, whenever parts within these circuits are replaced, electrical and physical specifications of the original components must be duplicated as closely as possible. Wires, parts and other accessories must be replaced in their former positions.

Complicated or specially designed test equipment is not required for practicsl alignment of the UHF Tuner. Instruments used for testing VHF sets are usually satisfactory. However, the following instruments are needed;

1 – VHF signal generator with AM output.
2 – Oscilloscope or vacuum tube volt-ohmmeter for measurement of the relative signal.

The oscilloscope or VTVM should be connected across the TV set video detector load resistor, R113.

The procedure for alignment consists of the following steps in the suggested sequence given;

1 – Positioning of the oscillator for proper band coverage.
2 – Alignment of R-F circuits for maximum effectiveness.

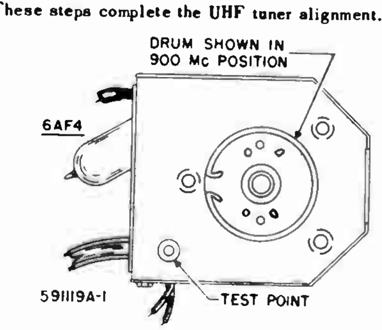
OSCILLATOR ADJUSTMENT

1 – Turn drum to extreme CCW position.
2 – Correct the signal generator to the UHF tuner antenna terminals and adjust generator for a signal between 459 and 466 megacycles. If no response is observed, carefully squeeze the short ends of the oscillator tuning condenser plates together or spread them apart until some frequency within the 459 to 466 mc range produces a response.
3 – Turn the tuning drum to extreme clockwise position.
4 – Swing the signal generator thru the frequency range 894 to 903 megacycles. If a response within this range is obtained, no adjustment is necessary. If a response below 894 mc occurs, carefully squeeze the long ends of the oscillator plates slightly together until a signal between 894 and 903 mc produces a response. If the output occurs above 903 mc carefully spread the oscillator plates slightly at the long end.

NOTE: Only a very slight amount of bending should be required in any case of incomplete band coverage, as this unit is assembled in a precision jig.

1 – With the signal generator and VTVM or oscilloscope connected as in the oscillator adjustment, adjust the signal generator to 470 mc and tune in this signal on the tuner. (near extreme counter clockwise position.)
2 – Squeeze together or spread apart the short ends of the plates of the two R.F. tuning condenser sections until a maximum response is obtained.
3 – Set the signal generator to 890 mc and tune in this signal on the tuner (near extreme clockwise position).
4 – Squeeze together or spread apart the long ends of the RF tuning condenser plates until a maximum response is obtained.

These steps complete the UHF tuner alignment.



125.25 Mc UHF TUNER PC 541452

800 SERIES CAPACITORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
C100		PE190-133	Mica, 270mmf 500V ±10%
C101		PA19147	Ceramic, Shielded Dual Disc, 1500mmf GMV
C102		PE556-234	Ceramic Tubular, 680mmf 350V ±10% (Insul.)
C103		PE190-133	Mica, 270mmf 500V ±10%
C104		PE190-133	Mica, 270mmf 500V ±10%
C105		PA19148	Ceramic, Single Disc 1500mmf GMV
C106		PE194-A21	Paper, 1.0mfd 100V ±20%
C107		PP19163	Ceramic, Shielded Dual Disc 5000mmf GMV
C108		PE190-140	Mica, 510mmf 500V ±10%
C109		PE190-107	Mica, 22mmf 500V ±10%
C110		PE555-101	Ceramic Tubular 10mmf. 500V ±20% (Unins.)
C111		PE555-136	Ceramic Tubular 1000mmf 350V ±20% (Unins.)
C112		PE194-A160	Paper, .05mfd 600V ±20%
C113		PP19201	Ceramic Tubular, 820mmf 350V ±10% (Unins.)
C114		PE555-100	Ceramic Tubular, 5mmf 500V ± 20% (Unins.)
C115		PE555-113-2	Ceramic Tubular, 47mmf 500V ± 20% NPO (Unins.)
C116		PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C117		PE194-A151	Paper, .005mfd 600V ±20%
C118		PA19148	Ceramic Single Disc 1500mmf GMV
C119		PE556-236	Ceramic Tubular, 1000mmf 350V ±10% (Insul.)
C120		PE194-A160	Paper, .05mfd 600V ±20%
C121		PA20181	Electrolytic, 1mfd 100V
C122		PE194-A156	Paper, .02mfd 600V ±20%
C123		PE194-A160	Paper, .05mfd 600V ±20%
C124		PE194-A145	Paper, .001mfd 600V ±20%
C125		PE194-A151	Paper, .005mfd 600V ±20%
C126		PA20175	Electrolytic, 10-10mfd 450V 100mfd 50V
C128		PE555-100	Ceramic, 5.0mmf 500V ±20% (Uninsul.)
C129		PA20182	Electrolytic, 50mfd, 25V
C132		PE194-A145	Paper, .001mfd 600V ±20%
C133		PE556-231	Ceramic tubular, 470mmf 500V ±20% (Insul.)
C135		PE194-A146	Paper, .002 mfd 600V ±20%
C202		PA19109	Ceramic, Single Disc 5000mmf GMV
C203		PA20144	Electrolytic, 40-40-20-20-mfd 450V
C204		PA19109	Ceramic, Single Disc 5000mmf GMV
C205		PA19109	Ceramic, Single Disc 5000mmf GMV
C206		PA19109	Ceramic, Single Disc 5000mmf GMV
C207		PE194-A156	Paper, .02mfd 600V ±20%
C208		PE190-137	Mica, 390mmf 500V ±10%
C209		PE190-133	Mica, 270mmf 500V ±10%
C210		PE194-A155	Paper, .01mfd 600V ±20%
C211		PE194-A155	Paper, .01mfd 600V ±20%
C212		PE192-163	Mica, 4700mmf 500V ±10%
C213		PE194-A159	Paper, .035mfd 600V ±20%
C214		PE194-A156	Paper, .02mfd 600V ±20%
C215		PE194-A160	Paper, .05mfd 600V ±20%
C216		PA20174	Electrolytic, 5mfd 350V (Non-Polarized)
C218		PE194-A160	Paper, .05mfd 600V ±20%
C219		PE194-A160	Paper, .05mfd 600V ±20%
C220		PE194-A162	Paper, 0.1mfd 600V ±20%
C221		PE194-A151	Paper, .005mfd 600V ±20%
C222		PE194-A151	Paper, .005mfd 600V ±20%
C223		PE194-A155	Paper, .01mfd 600V ±20%
C227		PA19109	Ceramic Single Disc, 5000 mmf, GMV
C300		PE194-A145	Paper, .001mfd 600V ±20%
C301		PE194-A145	Paper, .001mfd 600V ±20%
C302		PE197-151	Paper, Molded Tubular .005mfd 600V ±20%
C303		PE197-151	Paper, Molded Tubular .005mfd 600V ±20%
C304		PE194-A160	Paper, .05mfd 600V ±20%
C305		PE195-261	Mica, Silver, 3900mmf 500V ±5%
C306		PE190-137	Mica, 390mmf 500V ±10%
C307		PE190-137	Mica, 390mmf 500V ±10%
C308	817-81,-86	PE190-125	Mica, 120mmf 500V ±10%
C308	822-2,-4	PE190-137	Mica, 390mmf 500V ±10%
C309		PA1772	Trimmer, 25-280mmf
C310		PA20137	Electrolytic, 10mfd 25V
C311	822-2,-4	PP19145	Mica, 5mmf 2500V ±20%
C312		PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C313	822-2,-4	PP19146	Mica, 10mmf 2500V ±20%
C314		PE197-160	Paper, Molded Tubular .05mfd 600V ±20%
C315	822-2,-4	PA1998-3	Ceramic, 500mmf 20kv
C316		PE197-162	Paper, Molded Tubular .1mfd 600V ±20%
C317		PA20147	Electrolytic 25mfd 12V
C318		PE19146	Mica, 220mmf 1000V ±10%
C320	817-81,-86	PE190-133	Mica, 270mmf 500V ±10%
C324		PP19217	Mica, 10mmf 1500V ±10%
C325		PE19232	Mica, 22mmf 1500V ±10%
C326		PE194-A146	Paper, .002mfd 600V ±20%

800 SERIES RESISTORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
R100		PE231-1159	Carbon, 2700 Ohm 1/2W ±10%
R101		PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R102		PE231-1137	Carbon, 330 Ohm 1/2W ±10%
R103		PE231-1179	Carbon, 18k Ohm 1/2W ±10%
R104		PE231-1119	Carbon, 56 Ohm 1/2W ±10%
R105		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R106		PE231-1167	Carbon, 5600 Ohm 1/2W ±10%
R107		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R108		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R109		PE231-1129	Carbon, 150 Ohm 1/2W ±10%
R110		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R111		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R113		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R114		PE231-1133	Carbon, 220 Ohm 1/2W ±10%
R115		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%
R116		PE232-1161	Carbon, 3300 Ohm 1W ±10%
R117		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R118		PE231-1131	Carbon, 180 Ohm 1/2W ±10%
R120		PE233-74	Carbon, 11k Ohm 2W ±5%
R121		PE233-1179	Carbon, 18k Ohm 2W ±10%
R122		PE231-1173	Carbon, 10k Ohm 1/2W ±10%
R123		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R124		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R125		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R126		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R127		PE231-1245	Carbon, 10 Megohm 1/2W ±10%
R128		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R129		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R130		PE232-1137	Carbon, 330 Ohm 1W ±10%
R131		PC21134-4	Wirewound, 3250 Ohm 7W ±10%
R133		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R134		PE231-1195	Carbon, 82k Ohm 1/2W ±10%
R135		PE231-1239	Carbon, 5.6 Megohm 1/2W ±10%
R139		PE231-1215	Carbon, 560k Ohm 1/2W ±10%
R140		PE231-1187	Carbon, 39K ohm, 1/2W, ±10%
R141		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R200		PE23151	Wirewound, 1.2 Ohm 1W ±10%
R201		PC21134-22	Wirewound, 80 Ohm 15W ±10%
R203		PE231-1175	Carbon, 12k Ohm 1/2W ±10%
R204		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R205		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R206		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R207		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%
R208		PE232-1181	Carbon, 22k Ohm 1W ±10%
R209		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R210		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R211		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R212		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R213		PE231-1159	Carbon, 2700 Ohm 1/2W ±10%
R214		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R215		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%
R216	817-86,822-4	PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R217		PE231-1169	Carbon, 6800 Ohm 1/2W ±10%
R218		PE232-127	Carbon, 1.8 Megohm 1W ±5%
R219		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R220		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R221		PE231-1225	Carbon, 1.5 Megohm 1/2W ±10%
R222		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R225		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R226		PE233-1161	Carbon, 3300 Ohm 2W ±10%
R227		PE232-1209	Carbon, 330k Ohm 1W ±10%
R228		PE231-1185	Carbon, 33k Ohm 1/2W ±10%
R229		PE231-1207	Carbon, 270k Ohm 1/2W ±10%
R230		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%
R231		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R232		PE231-1181	Carbon, 22k Ohm 1/2W ±10%
R233		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R234		PE231-1189	Carbon, 47k Ohm 1/2W ±10%
R236		PE232-1205	Carbon, 220K ohm, 1W, ±10%
R242		PE231-1185	Carbon, 33k Ohm 1/2W ±10%
R300		PC21134-16	Wirewound, 2250 Ohm 15W ±10%
R301		PE233-1165	Carbon, 4700 Ohm 2W ±10%
R302		PE233-1169	Carbon, 6800 Ohm 2W ±10%
R303		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R304		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R305		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R306		PE231-1233	Carbon, 3.3 Megohm 1/2W ±10%
R307		PE232-1181	Carbon, 22k Ohm 1W ±10%
R308		PE231-1167	Carbon, 5600 Ohm 1/2W ±10%
R309		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%
R310		PE231-1205	Carbon, 220k Ohm 1/2W ±10%
R311		PE231-1213	Carbon, 470k Ohm 1/2W ±10%
R312		PE231-1197	Carbon, 100k Ohm 1/2W ±10%
R313		PE231-1123	Carbon, 82 Ohm 1/2W ±10%
R314		PE233-1133	Carbon, 220 Ohm 2W ±10%
R315		PE23163	Carbon, 0.51 Ohm 1/2W ±10%
R316	822-2,-4	PE233-2321	Carbon, 1.0 Megohm 2W ±20% (Allen Bradley)
R317	817-81,-86	PE231-1171	Carbon, 8200 Ohm 1/2W ±10%
R318		PE232-1217	Carbon, 680k Ohm 1W ±10%
R319	817-81,-86	PE231-1109	Carbon, 22 Ohm 1/2W ±10%
R319	822-2,-4	PE231-1117	Carbon, 47 Ohm 1/2W ±10%
R320	822-2,-4	PE233-1165	Carbon, 4700 Ohm 2W ±10%
R321		PE233-1163	Carbon, 3900 Ohm 2W ±10%
R322		PE233-1169	Carbon, 3900 Ohm 2W ±10%
R323		PE233-1169	Carbon, 3900 Ohm 2W ±10%
R325		PE232-1217	Carbon, 680k Ohm 1W ±10%
R326		PE233-1169	Carbon, 3900 Ohm 2W ±10%

CHOKES & COILS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
L101		A3392	Coil, Pix IF
L102		A28253	Choke, RF
L103		A3392	Coil, Pix IF
L104		A3392	Coil, Pix IF
L105		A28253	Choke, RF
L106		A28255-2	Coil; Peaking (White)
L107		A28255-1	Coil, Peaking (Red)
L108		A28255-2	Coil, Peaking (White)
L109		A28255-1	Coil, Peaking (Red)
L110		A28286	Coil, 4.5 MC. Trap
L111		A28255-1	Coil, Peaking (Red)
L112		A28255-4	Coil, Peaking (Green)
L113		A28286	Coil, 4.5 MC Audio Takeoff
L114		A28314	Coil, 21.25 MC IF Trap
L200		A1406	Coil, Filter Choke
L201		A28276	Choke, Filament
L202		A28276	Choke, Filament
L203	817-81,-86	A28328	Coil, Deflection Yoke
L203	822-2,-4	A28330	Coil, Deflection Yoke
L300		A28263	Coil, Horiz. Freq. Control
L301	817-81,-86	A28279-1	Coil, Width Control
L301	822-2,-4	A28318-1	Coil, Width Control
L302		A28292	Coil, Horiz. Linearity
	817-81,-86 822-3	PC28331	Def. Yoke Cov. w/Cent. Rings
	822-4	PC28332	Def. Yoke Cover

TRANSFORMERS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
T100		A1201 or 1202	Ratio Detector
T200		A10109	Power
T201		A10106	Vertical Oscillator
T202		A10152	Vertical Output
T300		A10136 or A10137	Horizontal Output

CONTROLS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
P100		A24142	Contrast-Volume, 5K-250K ohm
P200		A24112	Vertical Hold, 1.0 Megohm
P201		A24111	Vertical Size, 5.0 Megohm
P202		A24114	Vertical Linearity, 3K ohm Wirewound
P204		A24110	Brightness, 100K ohm
P205	817-86,822-4	A24141	Horizontal Hold, 5K ohm
P206	817-81,-86	A24112	Focus Control, 1.0 Megohm

SAFETY GLASS REMOVAL INSTRUCTIONS

The safety glass of some receivers is removable so that the face of the Picture Tube may be cleaned. Before proceeding, carefully observe the following precautions:

1. REMOVE THE POWER CORD FROM THE WALL SOCKET.
2. DO NOT ATTEMPT TO REMOVE THE PIX TUBE MASK UNDER ANY CIRCUMSTANCES.
3. BE CAREFUL NOT TO SCRATCH OR STRIKE THE SURFACE OF THE PICTURE TUBE WITH ANY OBJECT.
4. CLEAN THE FACE OF THE PICTURE TUBE AND THE INSIDE SURFACE OF THE SAFETY GLASS WITH A SOFT, CLEAN, DRY CLOTH.

WOOD TABLE MODELS WITH 17 INCH PICTURE TUBE

Remove wood strip along upper edge of glass, secured by (4) screws. Tilt glass forward and lift out of slot over control panel. Observing the above precautions, carefully clean Pix Tube and Safety Glass. Reassemble by inserting glass in slot, replace upper strip and tightening screws securely.

METAL TABLE MODELS WITH 17 INCH PICTURE TUBE

Remove (2) ornamental clips which retain safety glass at corners of lower edge of glass. Raise glass slightly and bring forward, observing the above precautions. Carefully clean Pix Tube and Safety Glass.

Reassemble by inserting glass in slot, replacing clips, and tightening screws securely.

METAL TABLE MODELS WITH 21 INCH PICTURE TUBE

Proceed as for 17" Metal Table Models, except that lower edge of glass is retained by metal strip, secured by (4) screws.

MODELS WITH 21 INCH PICTURE TUBE

Remove upper strip secured by (5) screws. Tilt glass forward and lift out of slot of lower glass retaining strip. Observing the above precautions, carefully clean Pix Tube and Safety Glass. Reassemble by inserting glass in slot of lower strip, replacing upper strip and tightening screws securely.

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

DESCRIPTION OF CHASSIS

CHASSIS NO.	DESCRIPTION
700	19 Tube Television Receiver chassis (including rectifiers), for 12½" round picture tube.
700-1	19 Tube Television Receiver chassis, including rectifiers, for 16" rectangular picture tube.
700-10	20 Tube Television Receiver chassis, including rectifiers, for 16" rectangular picture tube.
700-2	19 Tube Television Receiver chassis, including rectifiers, for 16" rectangular tube with provision for connecting 507 AM/FM chassis and record changer.
700-20	20 Tube Television Receiver chassis including rectifiers, for 16" rectangular tube with provision for connecting 507 AM/FM chassis and record changer.
700-30	20 Tube Television Receiver chassis, including rectifiers, for 14" rectangular picture tube.
700-40	20 Tube Television Receiver chassis, including rectifiers, for 19" round tube.
700-50	20 Tube Television Receiver chassis, including rectifiers, for 16" Rectangular tube with provision for connecting 703 AM/FM chassis and record changer.
700-90	20 Tube Television Receiver chassis, including rectifiers, for 16" rectangular tube, with socket for color adapter connection.
700-91	20 Tube Television Receiver chassis, including rectifiers, for 19" round tube, with socket for color adapter connection.
700-92	20 Tube Television Receiver chassis, including rectifiers, for 16" rectangular tube, with provision for connecting 703 AM/FM chassis and record changer, and socket for color adapter.
700-93	20 Tube Television Receiver chassis, including rectifiers, for 20" rectangular tube, with socket for color picture connection.
700-95	20 Tube Television Receiver chassis, including rectifiers, for 20" rectangular tube, with provision for connecting 703 AM/FM record changer and socket for color adapter.
700-96	20 Tube Television Receiver chassis, including rectifiers, for 17" rectangular tube, with socket for color adapter connection.

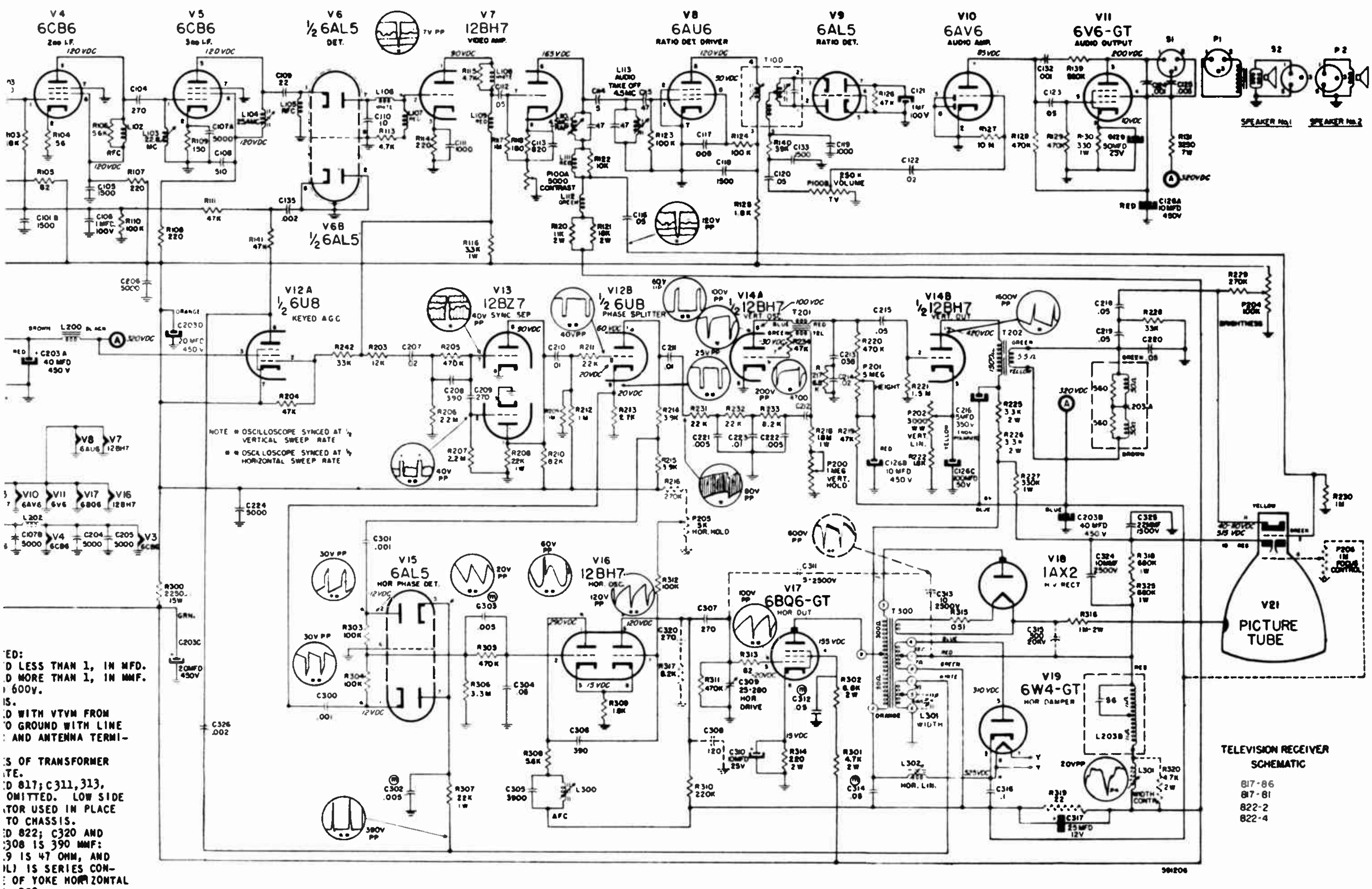
MODEL	17M1	17T1	17C2	17C7	17C5	17C5-B	17K1	19C1	20C1	20C2	20K1	20M1
CHASSIS	700-96	700-96	700-96	700-96	700-96	700-96	700-96	700-40 700-91	700-93	700-93	700-95	700-90
TYPE	Table	Table	full door Console	Open-face Consolette	Open-face Consolette	Open-face Consolette	Console Comb. 2/3 doors	Open-face Consolette	Open-face Consolette	Console 2/3 door	Console Comb. 2/3 doors	Table
PICTURE TUBE	17" Rect.	17" Rect.	17" Rect.	17" Rect.	17" Rect.	17" Rect.	17" Rect.	19" Round	20" Rect.	20" Rect.	20" Rect.	20" Rect.
CABINET	Metal	Mahog.	Mahog.	Mahog.	Mahog.	Blond Wood	Mahog. Wood	Mahog.	Mahog.	Mahog.	Mahog.	Metal
AM/FM CHASSIS	none	none	none	none	none	none	703	none	none	none	703	none
3 SPEED REC. CHANGER	none	none	none	none	none	none	VM 950	none	none	none	VM 950	none
BUILT-IN ANTENNA	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
ANTENNA INPUT IMPEDANCE	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm
SPEAKER	5"	5"	10"	5"	8"	8"	8"	10"	8"	8"	10"	5"
TOTAL POWER CONSUMPTION (117V-60 CYC.)	210	210	210	210	210	210	220	210	215	215	225	215
AUDIO OUTPUT MAX. WATTS	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
PACKED WEIGHT	82	70	125	91	97	97	140	147	110	132	160	97
CAB. WIDTH	18-15/16	18	26-5/16	20½	22	22	27	27½	23¼	27¾	27½	21⅞
CAB. DEPTH	20	19-1/16	28⅛	19	20½	20½	21-5/16	22	19	23-5/16	23¾	21
CAB. HEIGHT	17½	16-15/16	36½	35¼	36¼	36¼	36¾	39	38¾	39½	39½	20⅝
COLOR SOCKET	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

GENERAL SPECIFICATIONS OF MODELS

MODEL	12T1	12T2	12C1	14T1	16T1 & 16T1B	16C1	16C2	16C5	16K1	16M1
CHASSIS	700	700	700	700-1,-30 700-10	700-1,- -10,-90	700-1,-10 -90	700-10, 700-90	700-10, 700-90	700-50, 700-92	700-10, 700-90
TYPE	Table	Table	Open-face Consolette	Table	Table	Open-face Consolette	Full-door Console	Open-face Consolette	Console Comb. 2/3 door	Table
PICTURE TUBE	12½" Round	12½" Round	12½" Round	14" Rect.	16" Rect.	16" Rect.	16" Rect.	16" Rect.	16" Rect.	16" Rect.
CABINET	Mahog.	Mahog.	Mahog.	Mahog. with Escutch.	Mahog.	Mahog.	Mahog.	Mahog. with Escutch.	Mahog.	Metal
AM/FM CHASSIS	none	none	none	none	none	none	none	none	703	none
3 SPEED REC. CHANGER	none	none	none	none	none	none	none	none	VM 950	none
BUILT-IN ANTENNA	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
ANTENNA INPUT IMPEDANCE	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm	75 or 300 ohm
TOTAL POWER CONSUMPTION (117V-60 CYC.)	200	200	200	210	210	210	210	210	220	210
SPEAKER	5"	5"	5"	5"	5"	10"	10"	8"	8"	5"
AUDIO OUTPUT MAX. WATTS	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
PACKED WEIGHT	62	62	94	64	72	88	112	96	139	80
CAB. WIDTH	17	17	18⅞	18	18	22	26	21½	27	19
CAB. DEPTH	18⅝	18⅝	20¾	19⅛	19⅛	20½	22	20-9/16	21-5/16	20
CAB. HEIGHT	15¾	15¾	32¾	17⅜	17⅜	36¼	36½	34¼	36¼	17¾
COLOR SOCKET	no	no	no	no	yes	yes	yes	yes	yes	yes

TUBE COMPLEMENT FOR CHASSIS

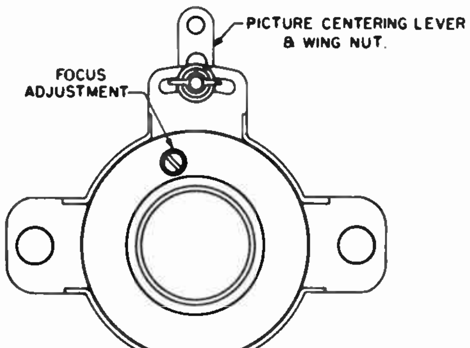
CHASSIS	700	700-1-2-5	700-10-20-90-91-92-93 700-40-50-95-96
R.F. AMPLIFIER	V1 — 6AG5 or 6CB6	V1 — 6AG5 or 6CB6	V1 — 6AG5 or 6CB6
R.F. CONVERTER	V2 — 6J6	V2 — 6J6	V2 — 6J6
1st I.F. AMPLIFIER	V4 — 6AU6	V4 — 6AU6	V4 — 6AU6 or 6BC5
2nd I.F. AMPLIFIER	V5 — 6AU6	V5 — 6AU6	V5 — 6AU6
3rd I.F. AMPLIFIER	V6 — 6AU6	V6 — 6AU6	V6 — 6AU6
VIDEO DETECTOR	V7A — ½ 6AL5	V7A — ½ 6AL5	V7A — ½ 6AL5
A.G.C. DIODE	V7B — ½ 6AL5	V7B — ½ 6AL5	V7B — ½ 6AL5
1st VIDEO AMPLIFIER	V8 — 6CB6	V8A — ½ 12BH7	V8A — ½ 12BH7
2nd VIDEO AMPLIFIER	——	V8B — ½ 12BH7	V8B — ½ 12BH7
RATIO DETECTOR DRIVER	V9 — 6AU6	V9 — 6AU6	V9 — 6AU6
RATIO DETECTOR	V10A — ½ 6T8	V10A — ½ 6T8	V10A — 6AL5
AUDIO AMPLIFIER	V10B — ½ 6T8	V10B — ½ 6T8	V21 — 6SQ7
AUDIO OUTPUT	V11 — 6V6	V11 — 6V6	V11 — 6V6
PICTURE TUBE	V12 — 12LP4	V12 — 16RP4	V12 — 16RP4, 17BP4A, 20CP4
D.C. RESTORER & SYNC CLIPPER	V13A — ½ 12BH7	V13A — ½ 12BH7	V13A — ½ 12BH7
SYNC AMPLIFIER & PHASE SPLITTER	V13B — ½ 12BH7	V13B — ½ 12BH7	V13B — ½ 12BH7
VERT. SWEEP OSC.	V14A — ½ 12BH7	V14A — ½ 12BH7	V14A — ½ 12BH7
VERT. SWEEP OUTPUT	V14B — ½ 12BH7	V14B — ½ 12BH7	V14B — ½ 12BH7
HOR. PHASE DETECTOR	V15 — 6AL5	V15 — 6AL5	V15 — 6AL5
HOR. SWEEP OSC.	V16 — 12BH7	V16 — 12BH7	V16 — 12BH7
HOR. SWEEP OUTPUT	V17 — 6BQ6	V17 — 6BQ6	V17 — 6BQ6
HI VOLTAGE RECTIFIER	V18 — 1X2	V18 — 1X2	V18 — 1X2
HORIZONTAL DAMPER	V19 — 6W4	V19 — 6W4	V19 — 6W4
POWER SUPPLY RECTIFIER	V20 — 5U4G	V20 — 5U4G	V20 — 5U4G



:ED:
D LESS THAN 1, IN MFD.
D MORE THAN 1, IN MMF.
600v.
S.
D WITH VTVM FROM
O GROUND WITH LINE
AND ANTENNA TERMI-

S OF TRANSFORMER
TE.
D 817; C311,313,
OMITTED. LOW SIDE
TOR USED IN PLACE
TO CHASSIS.
D 822; C320 AND
308 IS 390 MMF:
9 IS 47 OHM, AND
L) IS SERIES CON-
OF YOKE HORIZONTAL
R320.
D 822-2 & 817-81; ALL
ARE LOCATED ON REAR
05 (HORIZ. HOLD
E OMITTED AND R312
OUND.
822-4, P206 IS
S AND CENTERING

PM FOCUS
ENTERING UNIT



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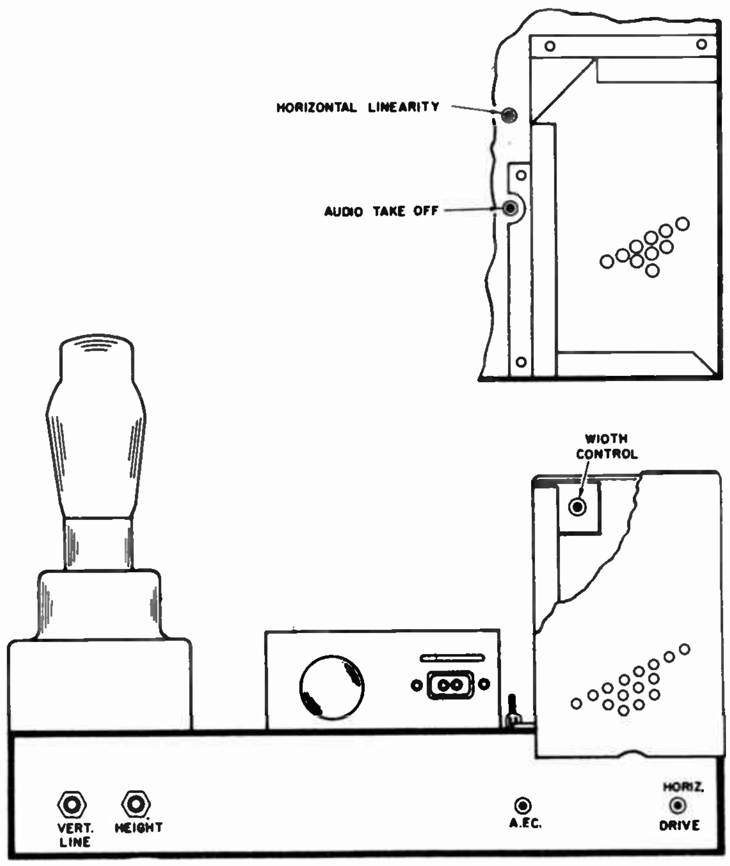
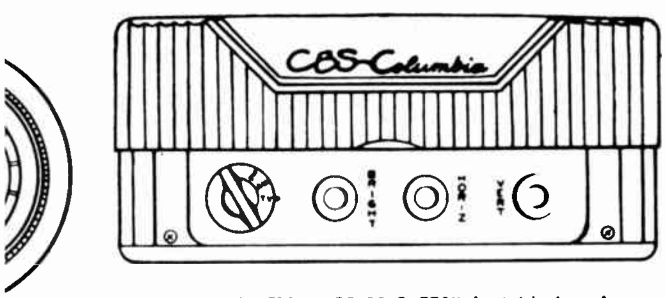
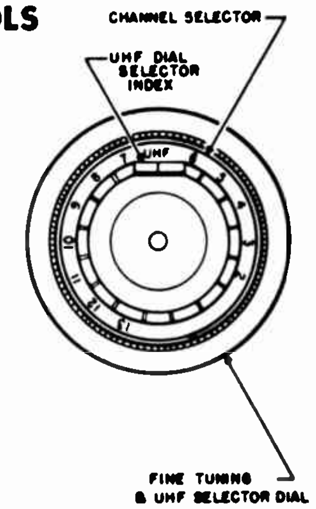


REAR OF CHASSIS

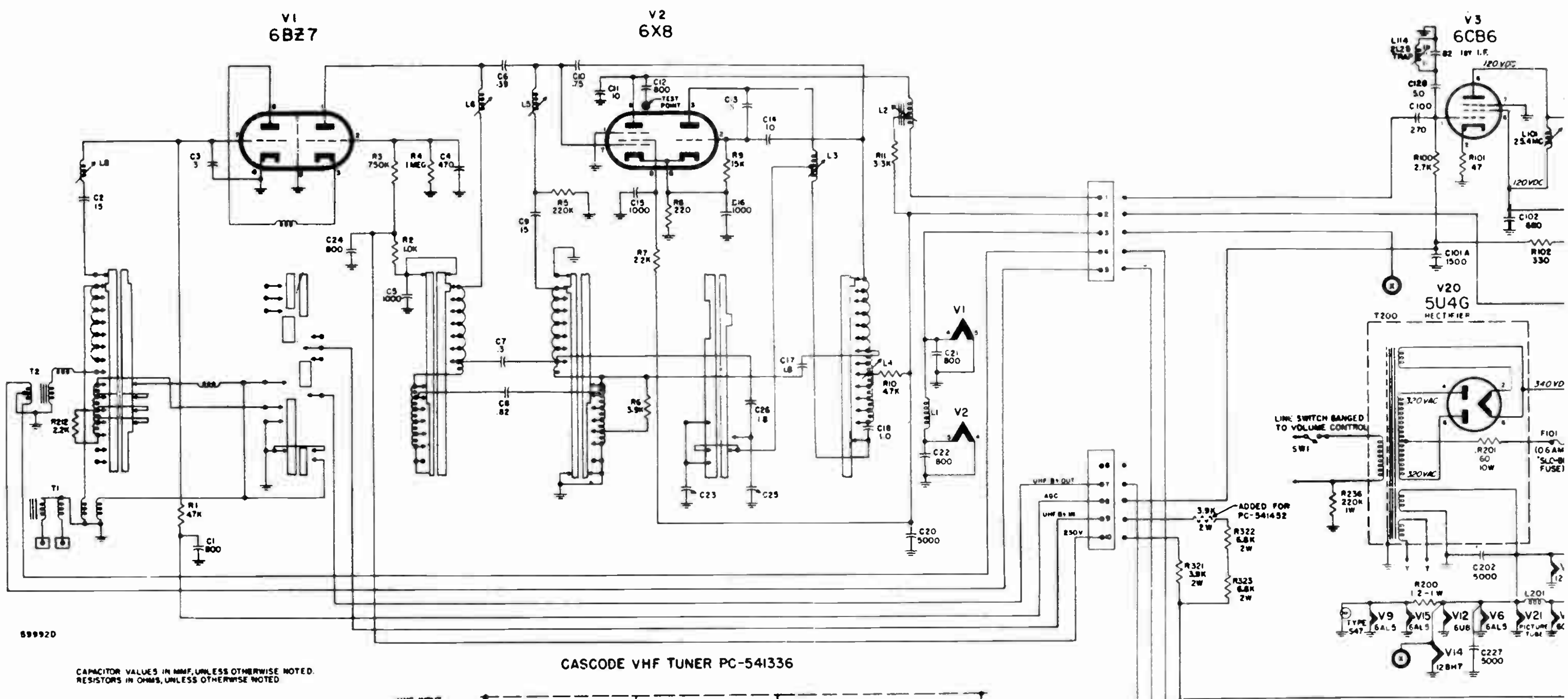
LOCATION OF OPERATING CONTROLS





Note FOCUS CONTROL or BRASS BUTTON located in place of TV/AM/PHONO knob on straight Television Receivers.

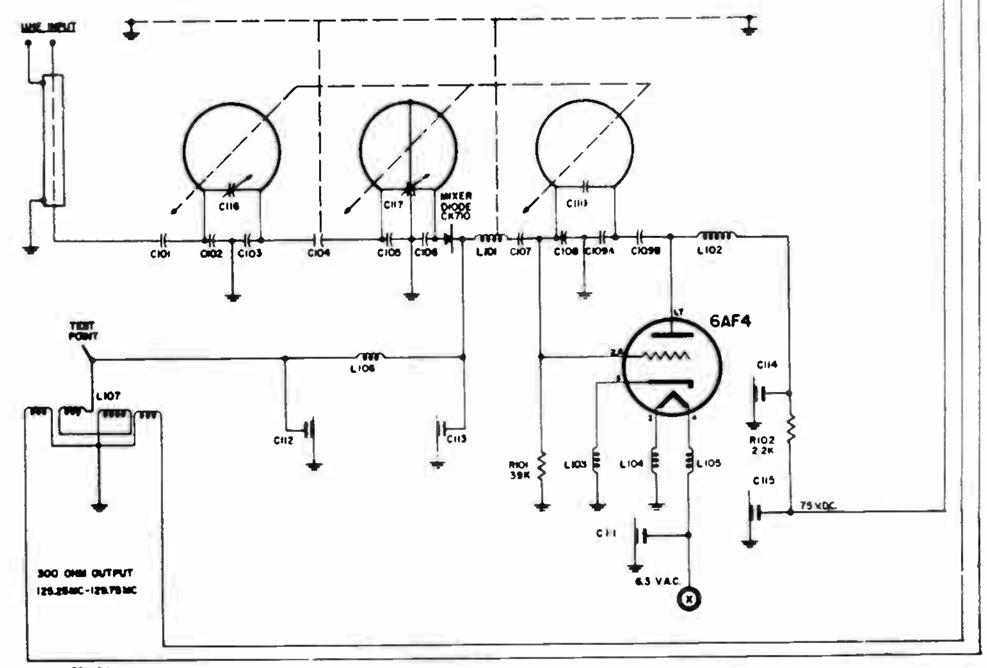
591159



CAPACITOR VALUES IN MMF, UNLESS OTHERWISE NOTED.
RESISTORS IN OHMS, UNLESS OTHERWISE NOTED

CASCODE VHF TUNER PC-541336

	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

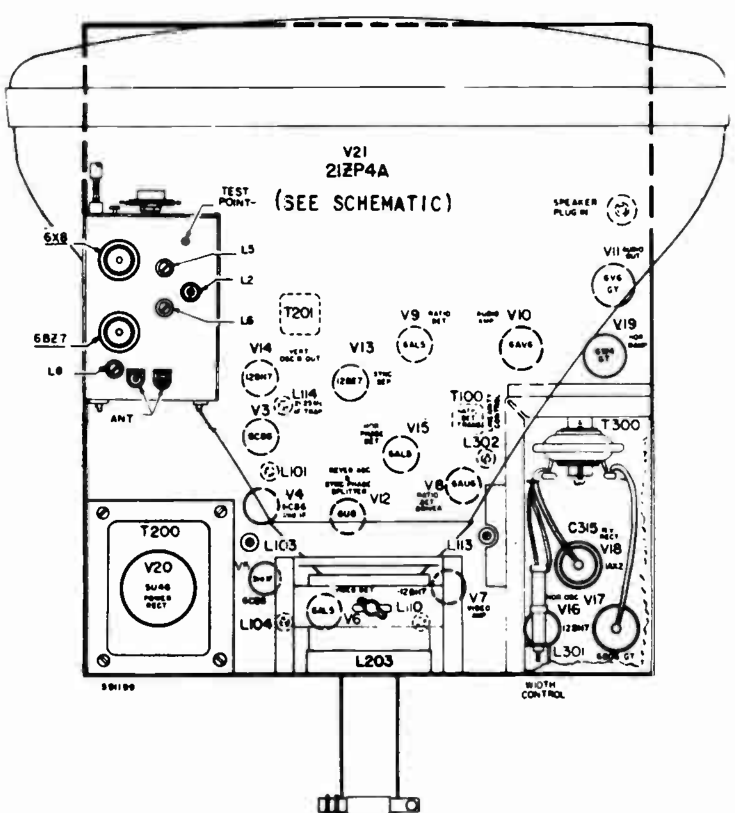


125.25-125.75 Mc. UHF TUNER PC-541452

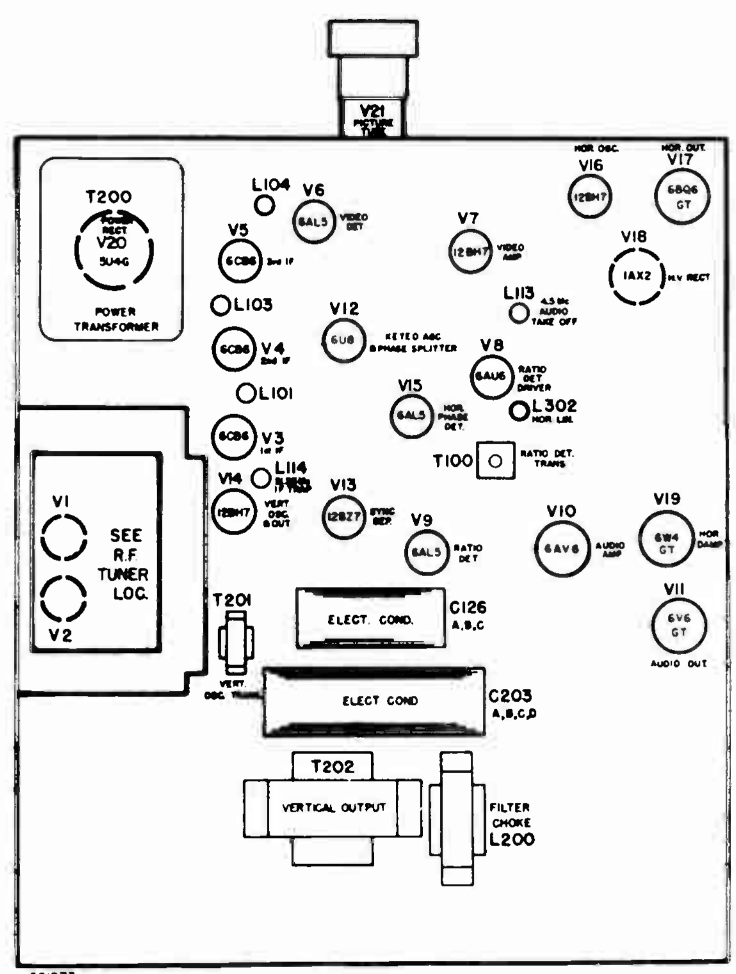
CHASSIS NO.	PICTURE TUBE (V21)
817-86	17HP4
817-81	17HP4
822-2	21ZP4A
822-4	21ZP4A

NOTE:

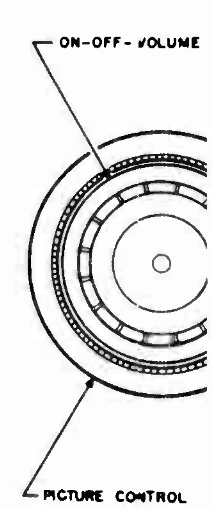
UNLESS OTHERWISE N(
1. ALL CAPACITORS MAR
2. ALL CAPACITORS MAR
3. ALL CAPACITORS RAT
4. ALL RESISTORS IN O
5. ALL VOLTAGES MEASU SOCKET TERMINALS VOLTAGES OF 117V NALS SHORTED.
6. ALL RESISTANCE VAL WINDINGS APPROXI
7. IN CHASSIS DESIGNA C315 AND R316 AR OF STANDOFF INSU C315 IS CONNECTE
8. IN CHASSIS DESIGNA 317 ARE OMITTED, C311 IS 5 MMF, R L301 (WIDTH CONT NECTED IN LOW SI WINDING SHUNTED
9. IN CHASSIS DESIGNA AUXILIARY CONTRO CHASSIS FLANGE; CONTROL) & R216 IS CONNECTED TO
10. IN CHASSIS 822-2 A OMITTED AS PM FO DEVICE IS USED.



TUBE & TRIMMER LOCATION
821
WITH KEYED AGC



BOTTOM VIEW
800 SERIES
(WITH KEYED AGC)



PARTS REMOVAL

TO REMOVE THE CHASSIS FROM THE CABINET:

1 — Remove the screws holding the back to the cabinet.
2 — Remove the screws holding the antenna terminal strip to the cabinet.
3 — Remove the screws holding the interlock bracket to the cabinet.
4 — Reach into the cabinet from the rear and remove the speaker plug from the speaker socket.
5 — Remove all the knobs from the front of the cabinet by pulling them straight out.
6 — Remove the mounting screws from the base of the chassis. These screws will be found under the cabinet in the table models and under the chassis mounting board in the console models.
7 — Slide the chassis straight out being careful not to hit the picture tube.
8 — To replace the chassis reverse the operations listed above.

CAUTION:

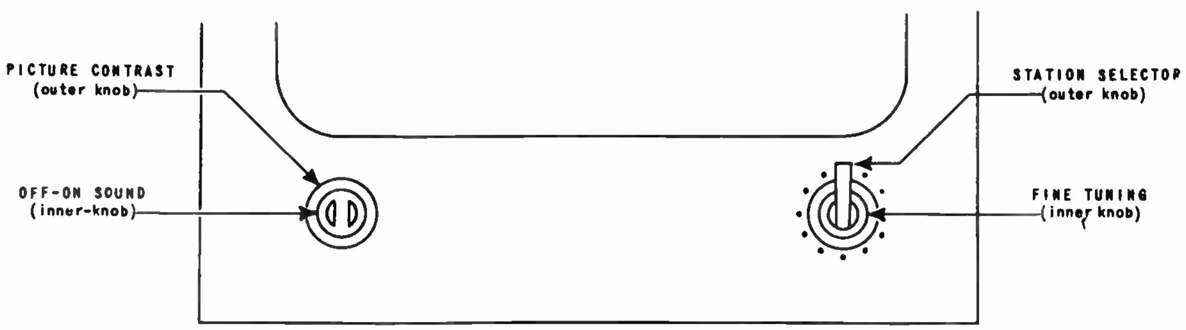
THE PICTURE TUBE ENCLOSES A HIGH VACUUM AND, DUE TO ITS LARGE AREA, IS SUBJECTED TO CONSIDERABLE AIR PRESSURE. THEREFORE, PICTURE TUBES MUST BE HANDLED WITH EXTREME CARE.

DO NOT OPEN THE PICTURE TUBE SHIPPING CARTON, INSTALL, REMOVE OR HANDLE THE PICTURE TUBE IN ANY MANNER UNLESS SHATTERPROOF GOGGLES AND HEAVY GLOVES ARE WORN. PEOPLE NOT SO EQUIPPED SHOULD BE KEPT AT A DISTANCE WHILE PICTURE TUBES ARE BEING HANDLED.

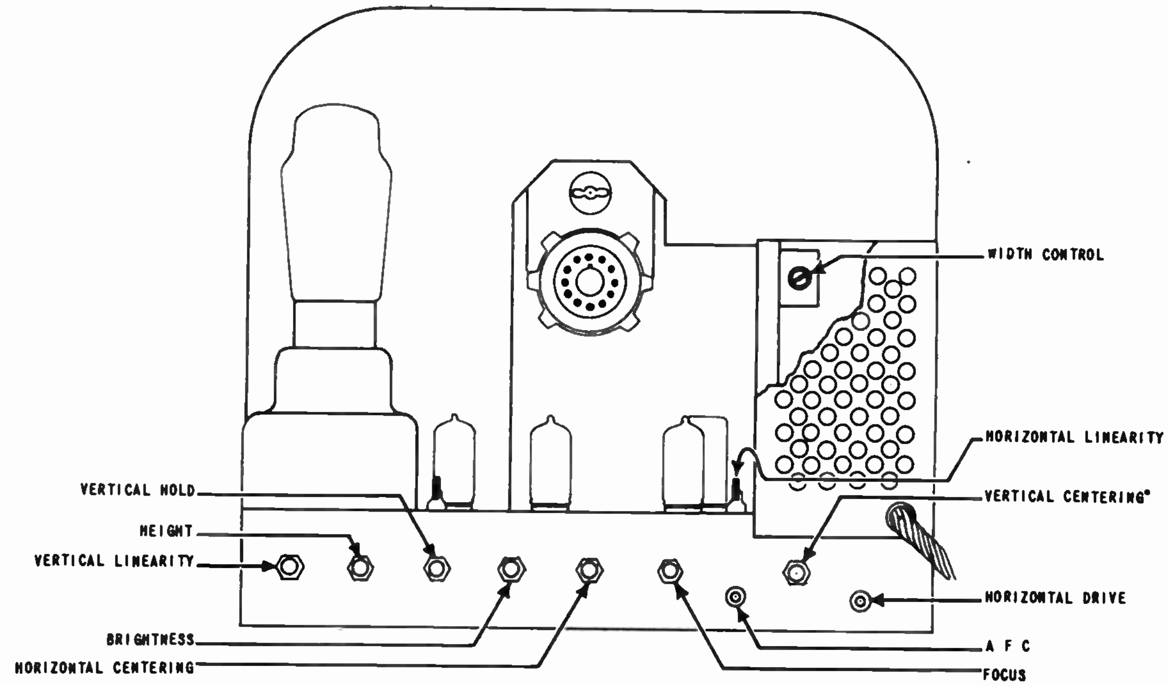
THE LARGE END OF THE PICTURE TUBE, PARTICULARLY THAT PART AT THE RIM OF THE VIEWING SURFACE, MUST NOT BE SUBJECTED TO ANY IMPACT, SCRATCH, OR MORE THAN MODERATE PRESSURE AT ANY TIME.

IN INSTALLATION OR REMOVING, IF THE TUBE STICKS OR FAILS TO SLIP SMOOTHLY INTO ITS SOCKET OR DEFLECTION YOKE, INVESTIGATE AND REMOVE THE CAUSE OF THE TROUBLE. DO NOT FORCE THE TUBE.

FRONT PANEL OPERATING CONTROLS



REAR CHASSIS CONTROLS

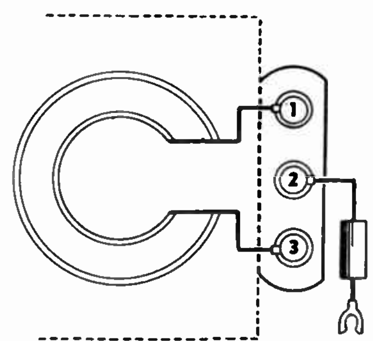


ANTENNA SYSTEM

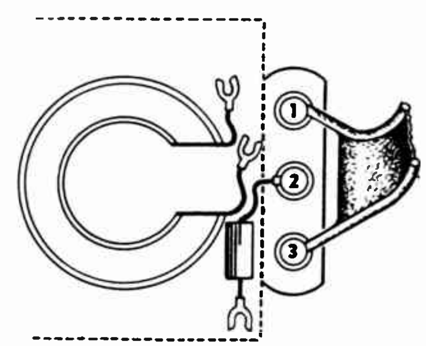
All models covered in this manual, with the exception of the 16M1, 17M1 and 20M1 feature a built-in antenna which is shipped connected to the receiver input. In those installations where an external antenna is desired, it will be necessary to disconnect the built-in antenna from terminals 1 and 3, (shown below) and hook up the external antenna lead-in as follows:—

1 — Where the external antenna lead-in is 300 ohm ribbon, make connection to Terminals 1 and 3 on the antenna terminal strip, leaving the resistor and lug assembly from terminal 2 hanging free.

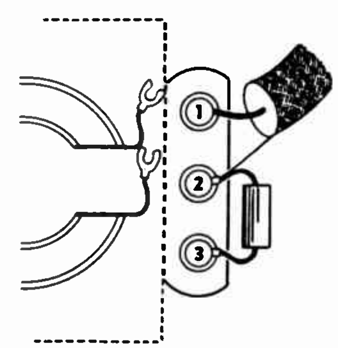
2 — Where the external antenna lead-in is 75 ohm coaxial line, connect the center conductor to terminal 1, the shield to terminal 2, and strap the Resistor supplied with terminal 2 between terminal 2 and 3.



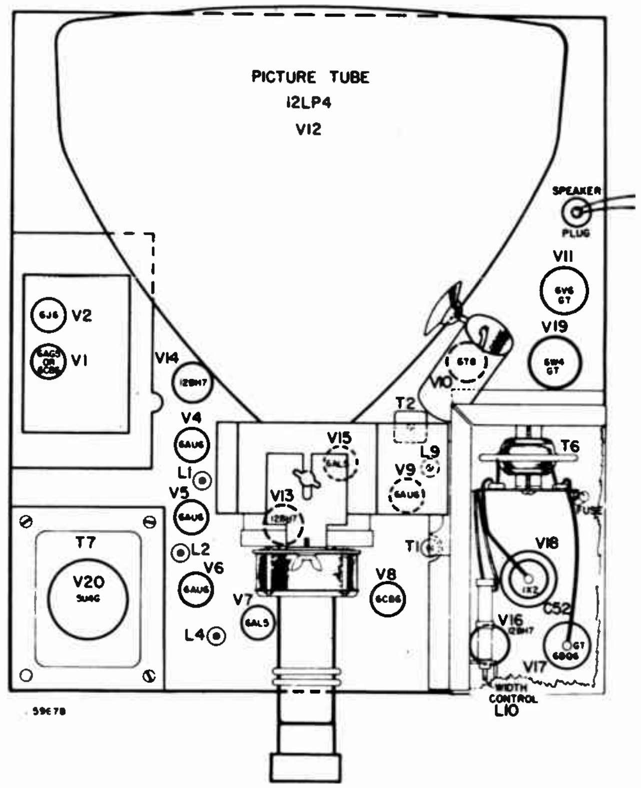
CONNECTION FOR BUILT- IN ANTENNA



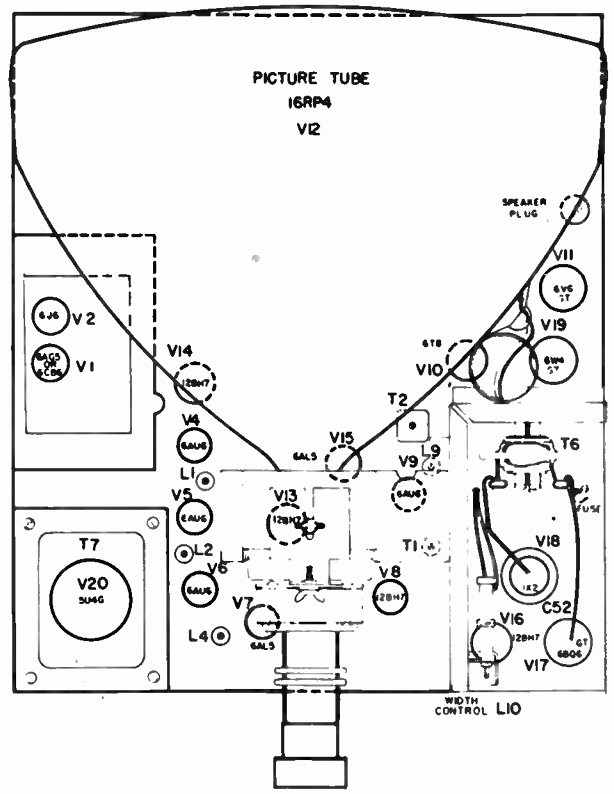
CONNECTION FOR 300 OHM ANTENNA LEAD-IN WIRE



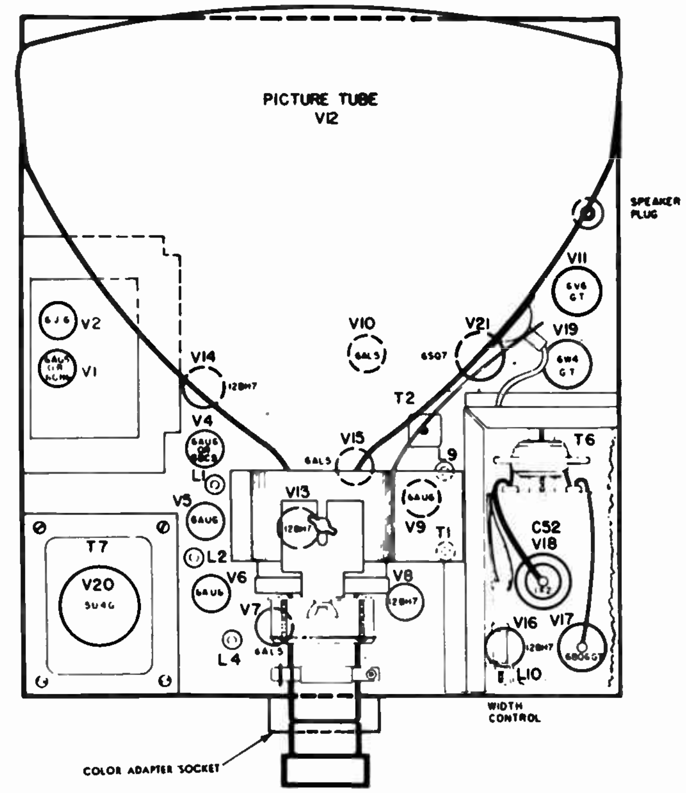
CONNECTION FOR 75 OHM ANTENNA LEAD-IN LINE



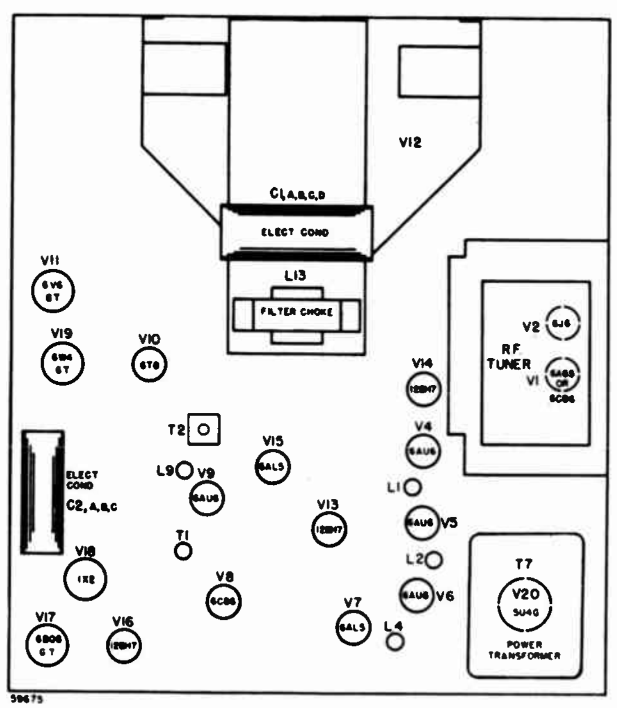
TOP VIEW — 700 CHASSIS (12½")



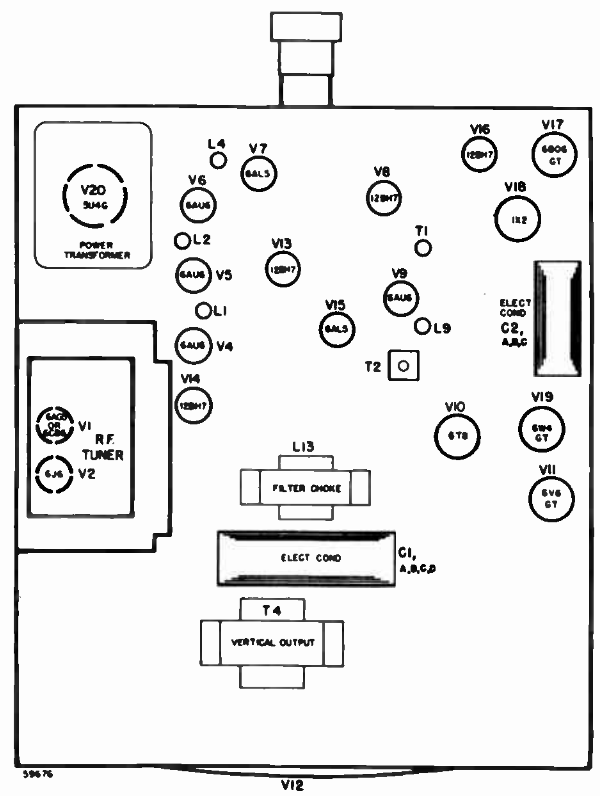
TOP VIEW — 700-1 CHASSIS



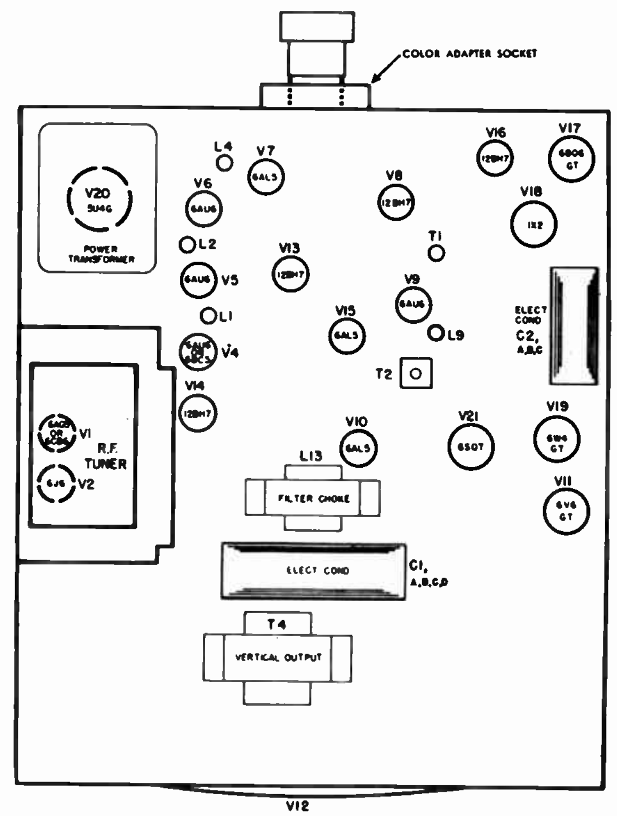
TOP VIEW OF 700-10, 20, 40, 50, 90, 91, 92, 93, 30, 95, 96 CHASSIS



BOTTOM VIEW — 700 CHASSIS (12½")



BOTTOM VIEW — 700-1 CHASSIS (16")



BOTTOM VIEW
700-10, 20, 40, 50, 90, 91, 92, 93, 30, 95, 96 CHASSIS

TUBE SOCKET VOLTAGES AS INDICATED ON V.T.V.M. FOR 12½" AND 14" SETS

Tube Location	Tube Type	PIN NUMBERS 1	2	3	4	5	6	7	8	9
*V1	6CB6	—0.7	0.4	5.4	0	95	100	0	—	—
V1	6AG5	—0.7	0	5.4	0	95	100	0	—	—
V2	6J6	80	75	0	5	—2.4	—4.4	0	—	—
● V4	6AU6	0 TO —1.5 ▲	0	5	0	120	121	0.2	—	—
V5	6AU6	0 TO —1.5 ▲	0	5	0	120	121	0.2	—	—
V6	6AU6	0 TO —1.5 ▲	0	5.2	0	120	121	0.2	—	—
V7	6AL5	0	—1.0 TO —4.0 ▲	0	5.4	0 TO 22.0 ▲	0	—1.0 TO —4.0 ▲	—	—
V8	12BH7	110	0.2 TO 0.3 ▲	2.3	5.4	0	250	5.8	13	0
**V8	6CB6	—0.2	7	0	5.4	110	120	7	—	—
V9	6AU6	0.2 TO —0.2 ▲	0	0	5.4	220	210	0	—	—
V10	6T8	—4.0 TO —9.0 ▲	—10 TO —20 ▲	—3.5 TO —8.0 ▲	0	4.4	0	0	—10	60 TO 70 ▲
***V10A	6AL5	—10 TO —20 ▲	—10 TO —20 ▲	4	0	0	0	—10 TO —40 ▲	—	—
***V10B	6SQ7	0	—1	0	0	0	50	0	5.4	—
V11	6V6	0	5.4	220	220	0	0	0	10	—
V13	12BH7	90	20	24	0	0	24	0	10 TO 50 ▲	5.2
V14	12BH7	400	—0.4 TO +0.4 ▲	16 TO 29 ▲	5.2	5.2	95	—21	0	0
V15	6AL5	+15	—15	4.4	0	—0.2	0	—0.2	—	—
V16	12BH7	150	3.5	15	5	5	100	—6.0	15	0
V17	6BQ6	0	0	0	150	—8 TO —25 ▲	11.5	5.5	12	—
V19	6W4	—	—	450	—	275	—	—1	—	—

NOTES: ▲ NORMAL VOLTAGE RANGE INDICATED — VALUE DEPENDS UPON SETTING OF CONTROLS.
* 6CB6 USED AS R.F. AMPLIFIER INSTEAD OF 6AG5 ON SOME SETS.
** 6CB6 USED AS FIRST VIDEO AMPLIFIER ON 12½" CHASSIS 700 ONLY.
*** 6AL5 AND 6SQ7 SUBSTITUTED FOR 6T8 ON SOME 16" CHASSIS AND ALL 19" CHASSIS.
● 6BC5 USED AS 2ND I.F. AMPLIFIER ON SOME 16" AND 20" CHASSIS.

FIG. 16A — VOLTAGE CHART

TUBE SOCKET VOLTAGES AS INDICATED ON V.T.V.M. FOR 16",17",19" AND 20" SETS
(NO SIGNAL)

Tube Location	Tube Type	PIN NUMBERS 1	2	3	4	5	6	7	8	9
*V1	6BC5	—0.7	0.4	5.4 AC	0	95	100	0	—	—
V1	6AG5	—0.7	0	5.4 AC	0	95	100	0	—	—
V2	6J6	80	75	0	5 AC	—2.4	—4.4	0	—	—
V4	6BC5	0 TO —1.5 ▲	0.2	5 AC	0	120	121	0.2	—	—
V5	6AU6	0 TO —1.5 ▲	0	5 AC	0	120	121	0.2	—	—
V6	6AU6	0 TO —1.5 ▲	0	5.2 AC	0	120	121	0.2	—	—
V7	6AL5	0	0	0	5.4 AC	0	0	—0.2	—	—
V8	12BH7	90	0.2 TO 0.3 ▲	0 TO 5.5 ▲	5.4 AC	0	250	0	9	0
V9	6AU6	0.2 TO —0.2 ▲	0	0	5.4 AC	130	60	0	—	—
V10	6AL5	—0.4	—0.4	4 AC	0	0	0	—0.7	—	—
V11	6V6	0	5.4	220	220	0	0	0	10	—
V13	12BH7	45	20	20	0	0	20	0	6 TO 25 ▲	5.2
V14	12BH7	400	—0.4 TO +0.4 ▲	16 TO 29 ▲	5.2 AC	0	95	—21	0	5.2 AC
V15	6AL5	+5.0	—7.0	0	4.4 AC	0	0	0	—	—
V16	12BH7	280	+1.2	15	5	5	100	—2.0	15	0
V17	6BQ6	0	0	0	150	—8 TO —25 ▲	—	5.5	12	—
V19	6W4	—	—	500	—	300	—	500	500	—
V21	6SQ7	0	—1	0	0	0	80	0	5.4	—

NOTES: ▲ NORMAL VOLTAGE RANGE INDICATED — VALUE DEPENDS UPON SETTING OF CONTROLS.
* 6CB6 USED AS R.F. AMPLIFIER INSTEAD OF 6AG5 ON SOME SETS.

FIG. 16 VOLTAGE CHARTS

RESISTANCE TABLE FOR CHASSIS COVERED IN THIS MANUAL

Tube Location	Tube Type	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V1	6BC5	RESISTANCE CHECK ON TUNER NOT RECOMMENDED DUE TO INACCESSIBILITY								
V1	6AG5	RESISTANCE CHECK ON TUNER NOT RECOMMENDED DUE TO INACCESSIBILITY								
V2	6J6	RESISTANCE CHECK ON TUNER NOT RECOMMENDED DUE TO INACCESSIBILITY								
V4	6BC5	1 Meg.	40	0	0	60k	60k	40	X	X
V5	6AU6	1 Meg.	0	0	0	60k	60k	80	X	X
V6	6AU6	0	0	0	0	60k	60k	80	X	X
V7	6AL5	3	0	0	0	0	0	5k	X	X
V8	12BH7	60k	5k	15	0	0	60k	1 Meg.	500	0
V9	6AU6	100k	0	0	0	60k	200k	0	X	X
V10	6AL5	I N F.	I N F.	0	0	0	0	40k	X	X
V11	6V6	X	0	60k	60k	500k	X	0	300	X
V13	12BH7	100k	1.5 Meg.	2500	0	0	1.5 Meg.	0	7.70k	0
V14	12BH7	200k	1.5 Meg.	0	0	0	700k	1.2 Meg.	0	0
V15	6AL5	3.5M	3.5 Meg.	0	0	2.8k	0	2.8k	X	X
V16	12BH7	60k	4 Meg.	2.8k	0	0	350k	100k	2.8k	0
V17	6BQ6	X	0	X	60k	480k	X	0	150	X
V19	6W4	X	X	200k	X	60k	X	200k	200k	X

NOTE: X INDICATES THAT EITHER PIN IS NOT USED OR IS USED AS TERMINAL POST FOR ANOTHER PART OF THE CIRCUIT

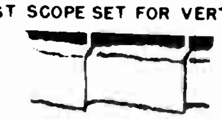
WAVE FORMS

1. INPUT TO FIRST VIDEO AMPLIFIER. PIN 2 OF V8A (12BH7) TO GROUND

2. OUTPUT OF SECOND VIDEO AMPLIFIER. PIN 6 OF V8B (12BH7) TO GROUND.

3. OUTPUT OF SYNC. CLIPPER & AMPLIFIER PIN 6 OF V13 (12BH7) TO GROUND.

TEST SCOPE SET FOR VERT. PULSE RATE



4. OUTPUT OF SYNC. CLIPPER & AMPLIFIER. PIN 6 OF V13 (12BH7) TO GROUND.

TEST SCOPE SET FOR HORIZ. PULSE RATE

5. INPUT TO VERTICAL SWEEP OSCILLATOR. JCT. OF R43, C33, TO GROUND.

6. OUTPUT OF VERTICAL OSCILLATOR. R42, C36, TO GROUND.

7. OUTPUT OF VERTICAL SWEEP AMPLIFIER. PIN 1 OF V14B (12BH7) TO GROUND.

8. OUTPUT OF VERTICAL SWEEP TRANSFORMER. GREEN LEAD TO GROUND.

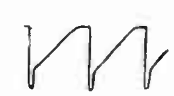
9. INPUT TO HORIZONTAL PHASE DETECTOR V15 (6AL5)

BETWEEN PIN 1 AND GROUND

BETWEEN PIN 2 AND GROUND

10. OUTPUT OF HORIZONTAL PHASE DECTECTOR. PIN 5 OR 7 OF V15 (6AL5) TO GROUND.

11. INPUT TO HORIZONTAL SWEEP AMPLIFIER. JCT. OF C46, R63, R62, TO GROUND.



12. OUTPUT OF FLYBACK TRANSFORMER PIN 5 OF V19 (6W4) TO GROUND.

13. CORRECTION WAVESHAPE FED BACK FROM HORIZONTAL DAMPER TUBE. PIN 3 OF V19 (6W4) TO GROUND.

14. WAVESHAPE ACROSS A.F.C. HORIZONTAL LOCK CIRCUIT. JCT. OF L7, C42, R57, TO GROUND. SCOPE FREQUENCY 15750 C.P.S.

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves tying up bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the user's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble;

1 — The antenna and installation.

2 — Front panel and rear chassis controls, including Picture Tube adjustments.

3 — Reception on all available channels.

4 — Tube failures. Substitute from your kit of known good replacements.

5 — Visual inspection of under side of chassis for obvious faults, such as loose connections, etc.

TEST INSTRUMENTS REQUIRED FOR ALIGNMENT:

The equipment specified below is desirable but in cases where the service shop does not have it, it is possible to align the receiver by use of a 30mc. generator, using the picture and speaker as indication of alignment.

1 — Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal-controlled or crystal-calibrated at the following frequencies;
(a) 4.5 megacycles
(b) 23.0 megacycles — See note below
(c) 25.4 megacycles — See note below

NOTE: On some of the models covered in this manual, the I.F. frequencies were 22.8 and 25.2 megacycles. In order to eliminate interference at certain locations, these frequencies were changed to 23.0 and 25.4 megacycles. Except for areas where interference prevents use of 22.8 and 25.2 megacycles, either set of frequencies can be used.

2 — R.F. Sweep Generator having a frequency range from 40 to 220 megacycles with a sweep width of 10 megacycles, and an adjustable output of at least 0.1 volt, maximum.

3 — Crystal-controlled or crystal-calibrated markers for the sound carrier cf each television channel 2 through 13. Picture carrier markers are desirable but not necessary.

4 — Cathode Ray Oscilloscope.

5 — Vacuum Tube Voltmeter-VTVM.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A POTENTIAL OF APPROXIMATELY 12,000 VOLTS. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE 6BQ6 TUBE FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

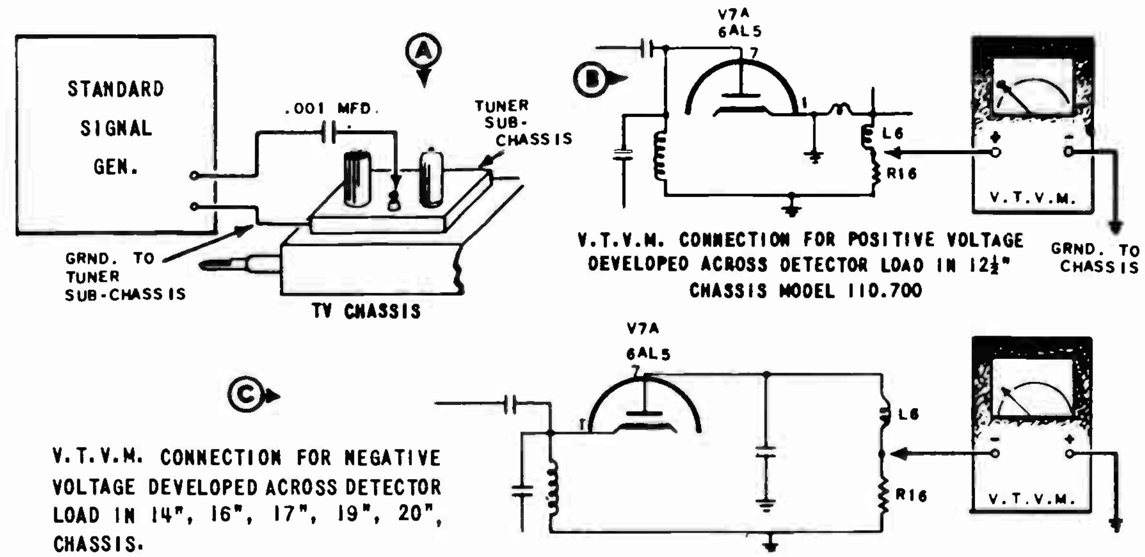
SEQUENCE OF ALIGNMENT:

It is recommended that the ratio detector driver be aligned first, followed by the ratio detector, I.F., and tuner alignments in that order unless the location of the misalignment is known.

AIDS IN SERVICING:

In addition to step-by-step alignment procedures following, see the instrument connection figures, and voltages and waveshapes charts.

TEST INSTRUMENT CONNECTIONS FOR I.F. ALIGNMENT

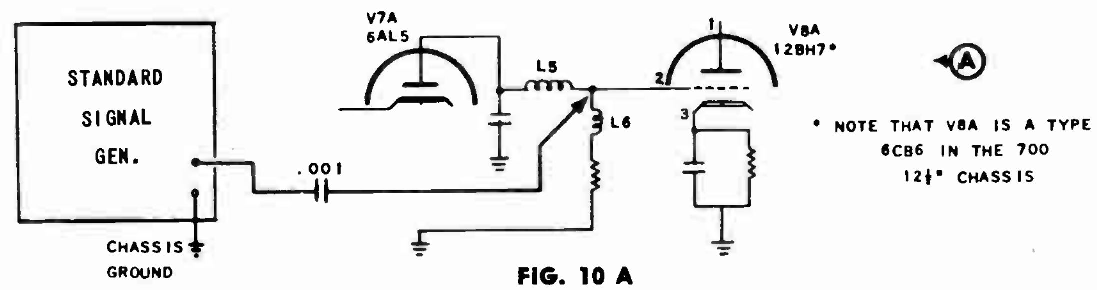


V.T.V.M. CONNECTION FOR POSITIVE VOLTAGE DEVELOPED ACROSS DETECTOR LOAD IN 12½" CHASSIS MODEL 110.700

V.T.V.M. CONNECTION FOR NEGATIVE VOLTAGE DEVELOPED ACROSS DETECTOR LOAD IN 14", 16", 17", 19", 20", CHASSIS.

FIG. 9 A, B & C

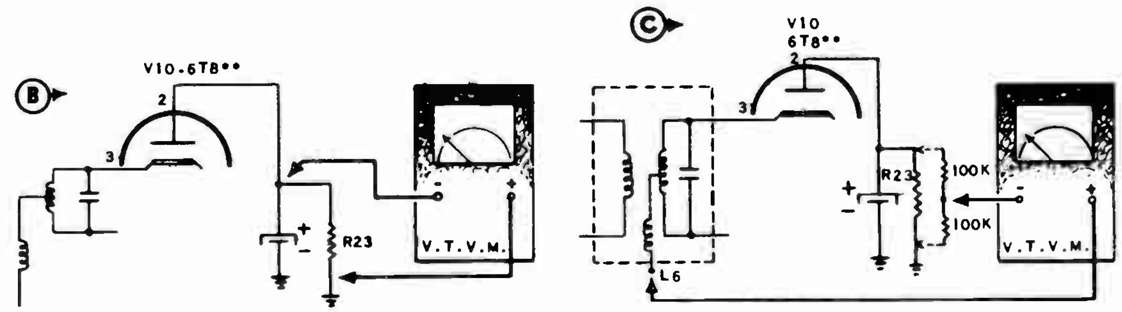
TEST INSTRUMENT CONNECTIONS FOR RATIO DETECTOR ALIGNMENT



* NOTE THAT V8A IS A TYPE 6CB6 IN THE 700 12½" CHASSIS

FIG. 10 A

SIGNAL GENERATOR CONNECTION FOR RATIO DETECTOR ALIGNMENT



V.T.V.M. CONNECTION FOR DETECTOR DRIVER ALIGNMENT.

**NOTE THAT V10 IS 6AL5 IN CHASSIS .700-10. 20. -30. -40. -50. -90. -91. -92. -93. -95. -96.

V.T.V.M. CONNECTION FOR RATIO DETECTOR ALIGNMENT

RATIO DETECTOR DRIVER AND RATIO DETECTOR ALIGNMENT

In aligning this section of the television receiver, the sound trap must be resonated at 4.5 mc. to separate the sound from the picture information, and the ratio detector transformer must be adjusted to complete balance in the secondary winding for maximum AM rejection. The sound trap is T1, located between the video amplifier (V8B) and the detector driver (V9). The discriminator transformer is T2, located between the detector driver (V9) and the ratio detector (V10A). A 4.5 mc. signal is fed into the final video amplifier, and the sound trap and ratio detector are adjusted in proper sequence to obtain VTVM readings across the detector plate load resistor R23, as specified in the step-by-step procedure below;

1 — Connect the VTVM across R23, with the positive lead from the meter to the chassis and the negative lead to the other side of R23. On those chassis utilizing a 6T8 tube as the detector V10, this latter connection will be at pin 2 of the 6T8. On those chassis utilizing a 6AL5 as the detector, this connection will be at pin 7 of the 6AL5. See figure 10B showing these connections.

2 — Connect the signal generator output through a .001 mfd mica capacitor to the junction of L5 and L6 in the input to the first video amplifier, V8A. Ground the other side of the generator to the chassis. See figure 10A for this connection.

3 — Set the signal generator to 4.5 mc. and adjust its output to provide about 10 volts reading on the VTVM.

4 — Adjust sound trap T1 for maximum reading on the VTVM. Two types of sound traps were used in the production of the models covered herein, i.e., a single-ended coil, and a double-ended coil. The single-ended coil is adjusted from the top, and the double-ended coil, from the bottom, since the top half of this coil is not used. Both of these coils can be peaked at two points, and the peak point selected should be the one closest to the full counter-clockwise position of the slug. This setting minimizes the possibility of intercarrier buzz.

5 — Adjust the top slug on the discriminator transformer T2 for maximum reading on the VTVM.

6 — Connect two 100k resistors across R23 as shown in figure 10C.

7 — Reconnect the VTVM, running one lead to the junction point of these two 100k resistors, and the other lead to the tertiary winding lug (pin 6) of the discriminator transformer T2. See figure 10C for these connections. Adjust VTVM for zero center at 5 volts.

8 — Adjust bottom slug on T2. Note that during this adjustment, a point will be found where the VTVM will swing rather sharply from positive to negative, or vice versa. The correct setting of this adjustment is obtained when the VTVM pointer reads zero, setting as per (7) above, as the slug is passed through this point.

9 — Repeat steps 4, 5, 6, 7, and 8. This completes the ratio detector alignment.

I.F. ALIGNMENT:

The I.F. alignment of the models covered in this manual is based on peaking one set of I.F. coils at 23.0 mc. and the other set of I.F. coils at 25.4 mc. A signal generator feeds these frequencies to the I.F. strip, and a VTVM connected across the video detector load resistor R16 in proper polarity, serves as a measuring device for this peaking operation. The pair of 23.0 mc. coils are L401 on the tuner sub-chassis, and L2, located between the second and third I.F. stages. The 25.4 mc. coils are L1, located between the first and second I.F. stages, and L4, located between the third I.F. and the video detector. A recommended step-by-step procedure is given below;

1 — Set front panel "CONTRAST" control 1/4 turn clockwise.

2 — Connect the VTVM in proper polarity across the video detector (V7A) load resistor R16. One connection should be to the chassis, and the other to the junction of shunt peaking coil L6 and R16. See Figure 9B.

3 — Connect the signal generator through a .001 mfd capacitor to the test loop located between the two tubes on top of the tuner sub-chassis. See Figure 9A.

4 — Inject minus 3 volt bias to A.G.C. terminal on tuner, Figure 13C.

5 — Set the signal generator to 23.0 mc. and adjust its output so that the VTVM shows a reading of 2.5 volts maximum.

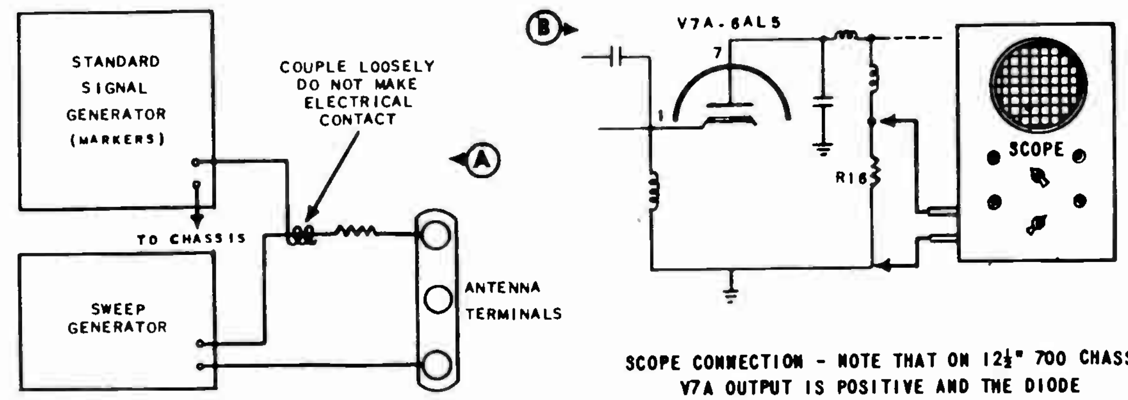
6 — Adjust L2 and L401 for maximum reading on the VTVM.

7 — Reset the signal generator to 25.4 mc. and adjust its output so that the VTVM shows a reading of 2.5 volts maximum.

8 — Adjust L1 and L4 for maximum VTVM reading.

9 — Repeat steps 4, 5, 6 and 7 in sequence to achieve further peak readings on the VTVM. If the VTVM pointer goes off scale, lower the signal generator output accordingly.

TEST INSTRUMENT CONNECTIONS FOR TUNER ALIGNMENT



SWEEP AND MARKER CONNECTIONS

SCOPE CONNECTION - NOTE THAT ON 12½" 700 CHASSIS V7A OUTPUT IS POSITIVE AND THE DIODE OUTPUT IS TAKEN FROM THE CATHODE

FIG. 11

OVERALL RESPONSE — ANTENNA TO PICTURE DETECTOR

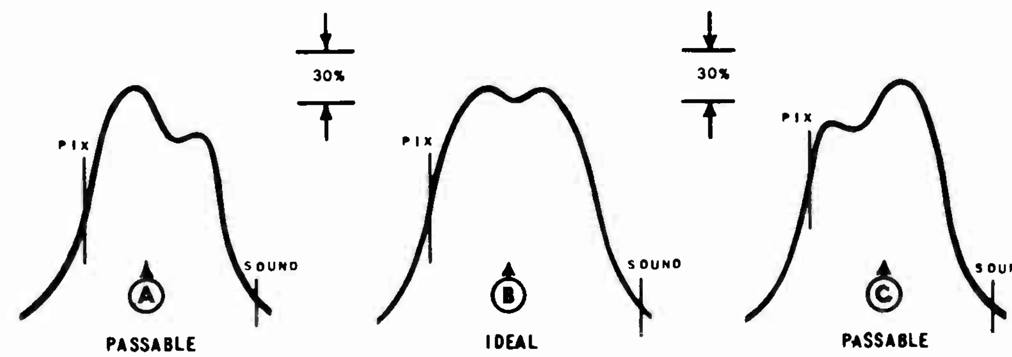
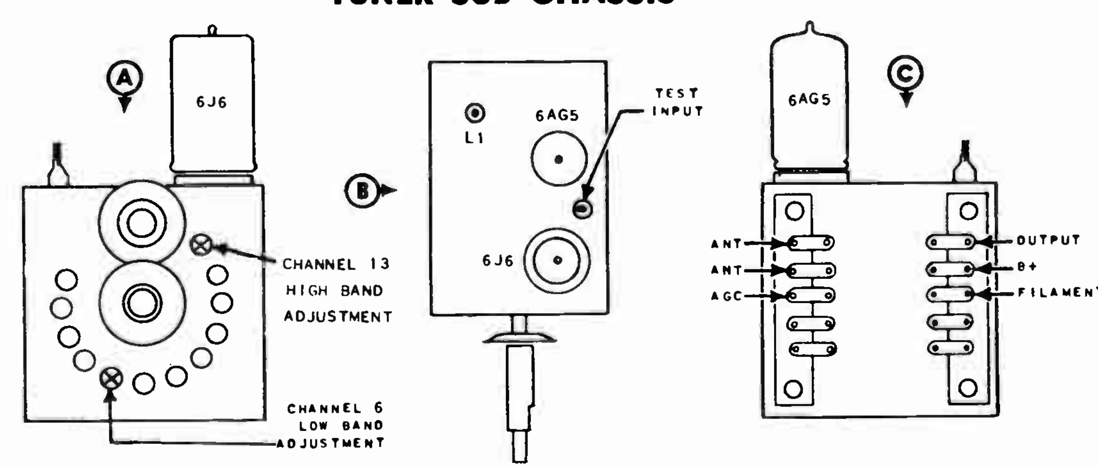


FIG. 12

TUNER SUB CHASSIS



TRIMMER LOCATION TUNER FRONT VIEW

TUBE LOCATION TUNER TOP VIEW

REAR TERMINAL LOCATION TUNER REAR VIEW

R.F. TUNER ALIGNMENT

The alignment of the R.F. bandpass was made at the factory and it is not desirable to readjust it in the field inasmuch as all adjustments must be made by moving and spreading coils. It any adjustment of the tuner must be made, it is recommended that the entire sub-chassis be replaced, and the defective unit returned to the source for repair.

NOTE: BEFORE ATTEMPTING TO ALIGN THE TUNER, IT IS NECESSARY THAT THE I.F. AMPLIFIER BE CORRECTLY ALIGNED. Sweep I.F. to make sure that it is the tuner and not the I.F. that needs alignment.

PROCEDURE — LOCAL OSCILLATOR ALIGNMENT:

1 — Connect the R.F. sweep generator to the antenna terminals. See Figure 11A. Put 3 volt bias between ground and an AGC terminal.

2 — If the sweep generator is not provided with internal crystal-controlled or crystal-calibrated markers, connect a marker generator to the antenna terminals also. See Figure 11A.

3 — Connect the cathode ray oscilloscope across the video detector load resistor R16. See Figure 11B.

4 — Adjust the R.F. sweep generator for 10 mc. sweep width, with center frequency at approximately 213 mc.

5 — Adjust the marker generator for the picture carrier of channel 13 (211.25 mc.).

6 — Set the Channel Selector switch to channel 13, with the fine tuning control at the middle of its rotation range.

7 — Turn on the receiver and allow about 15 minutes for it to warm up and stabilize.

8 — Set the oscilloscope gain control for a convenient size picture on the oscilloscope.

9 — Adjust the slug in channel 13 oscillator coil until the oscillator pip is at the middle of the picture side of the response curve on the oscilloscope, per Figure 12B.

10 — Set the Channel Selector switch to channel 12 and using the frequencies shown in Figure 14 below, adjust by displacing the channel 12 increment loop until the oscillator pip is at the middle of the picture side of the response curve on the oscilloscope, per Figure 12B.

11 — Repeat operation 10 above using the appropriate frequencies and increment loops for Channel Selector switch settings of 11, 10, 9, 8 and 7 in that order. This completes the high band oscillator alignment.

12 — Set Channel Selector switch to 6, and proceed as in 9 above, using the proper slug and frequencies. See Figures 13 and 14.

Channel Switch Setting	2	3	4	5	6	7	8	9	10	11	12	13
Sweep Gen.	57	63	69	79	85	177	183	189	195	201	207	213
Marker Gen. Settings (Pix carrier)	55.25	61.25	67.25	77.25	83.25	175.25	181.25	187.25	193.25	199.25	205.25	211.25

PROCEDURE — R.F. TUNER BANDPASS ALIGNMENT

Do not attempt to align the RF bandpass unless you find it necessary. The procedure is as follows;

1 — Connect the R.F. Sweep Generator, Marker Generator, and Oscilloscope as in 1, 2, and 3, under R.F. Tuner Alignment. Refer to table below for instrument settings for each channel alignment. Put 3 volt bias between ground and AGC.

2 — Set the R.F. sweep generator for 10 mc. sweep width, and its center frequency at 213 mc.

3 — Set the CHANNEL SELECTOR switch to channel 13, and the fine tuning control at the middle of its rotation range.

4 — Turn on the television receiver and allow about 15 minutes for the set to warm up and stabilize.

5 — Set the oscilloscope gain control for a convenient size picture on the oscilloscope.

6 — See permissable response curves, Figure 12. If the response curve on the oscilloscope does not fall within these limits, the picture on the oscilloscope can be made to approach the desirable form by either spreading or compressing the particular coils in the tuner circuit at channel 13 setting. Referring to the 5 decks on the master switch in the tuner, note that the deck nearest the front (shaft) end of the tuner contains those coils regulating the local oscillator, and these should NOT be touched during any bandpass adjustments. On the second, third and fourth decks of the master switch are the coils for the mixer grid, the R.F. amplifier plate, and the antenna coupling transformer, respectively, and the particular coils connected in the circuit for channel 13, on these three rear decks are the ones that should be compressed or expanded to achieve the desired bandpass characteristic. Note that too broad a curve results in loss of sensitivity, and rejection.

7 — Proceed with Channel Selector switch at 12, and with Sweep and marker generators set per Figure 15 below, repeat 6 above to achieve proper curve. Repeat for channel 11, then 10, 9, etc. When completion of channel 2 is reached, the bandpass alignment is finished.

Channel Selector Switch	2	3	4	5	6	7	8	9	10	11	12	13
R.F. Sweep Generator Setting	57	63	69	79	85	177	183	189	195	201	207	213
Marker Generator Setting (Sound)	59.75	65.75	71.75	81.75	87.75	179.75	185.75	191.75	197.75	203.75	209.75	215.75
Marker Generator Setting (Picture)	55.25	61.25	67.25	77.25	83.25	175.25	181.25	187.25	193.25	199.25	205.25	211.25

MODEL 703 AM—FM TUNER

Used with Model 16K1, 17K1 AND 20K1 Television Receiver

ELECTRICAL AND MECHANICAL DATA

Frequency Range........(AM) 535 KC to 1620 KC
(FM) 87 MC to 109 MC
Intermediate Frequency..............(AM) 455 KC (FM) 10.7 MC

Power Supply.........117 volts AC, 60 cycles
Speaker ....PM

TUBE COMPLEMENT

1	12AT7	Oscillator-Converter
1	6AU6	1st IF Amplifier
1	6AU6	2nd IF Amplifier*
1	6SQ7	AM Detector—1st Audio (AM-FM)
1	6AL5	FM Detector

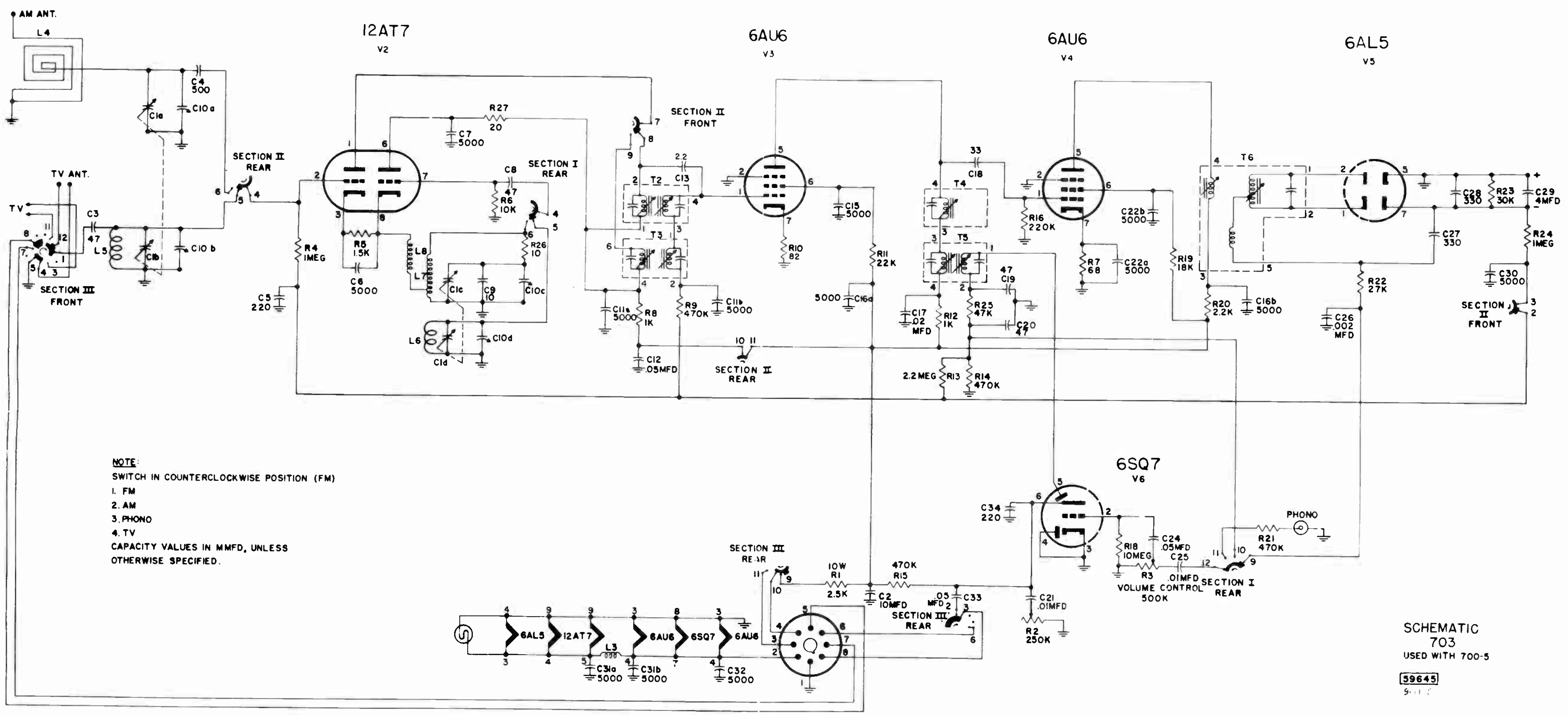
* Not in Circuit in AM Position

SOCKET VOLTAGES

TUBE	POSITION	1	2	3	4	5	6	7	8
12AT7	Oscillator-Converter	245	0	4.2 AC	6.3 AC	6.3 AC	245	−4.5	0
6AU6	1st IF. Amplifier	−0.5	0	0	6.3 AC	250	155	1.1	....
6AU6	2nd IF. Amplifier	0	0	0	6.3 AC	225	160	1.2	....
6SQ7	AM Detector 1st Audio (AM-FM)	0	0.8	0	0	−0.5	92	6.3 AC	0
6AL5	FM Detector	−1.6	−1.4	6.3 AC	0	0	0	−2.5	....

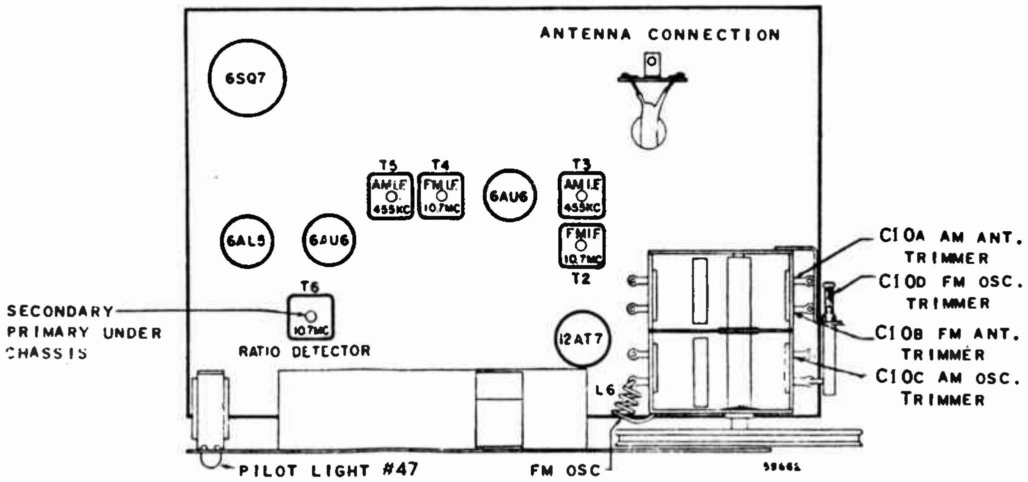
NOTE: All DC voltages measured with V.T.V.M. from Chassis to socket contact indicated. All voltages are positive DC unless otherwise marked.
Volume control full on. Zero signal input.

Tone control in counter-clockwise position.
Band switch in "AM" position.
Variable condenser set at minimum.
Line voltage 117 volts, 60 cycle AC.



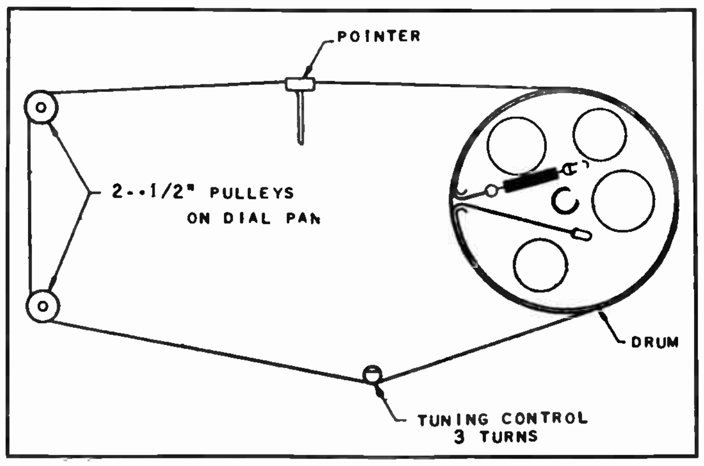
SCHEMATIC 703
USED WITH 700-5
59645

ALIGNMENT PROCEDURE



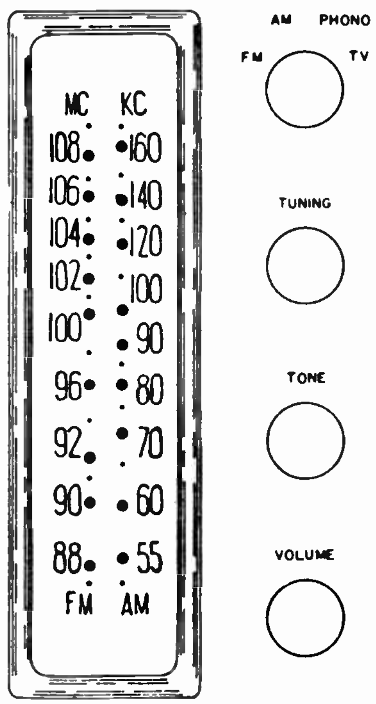
The following equipment is necessary to properly align this receiver:

1. AM signal generator with frequency coverage from 455 kc. to 1700 kc.
2. FM or CW signal generator covering the FM band from 87 mc. to 109 mc. and the 10.7 mc. for FM IF alignment.
3. Vacuum Tube Voltmeter (VTVM).
4. Output meter—to match 4 ohms, 5 watts maximum.
5. Insulated alignment screwdriver.
6. Dummy antenna—0.1 mfd. capacitor, 300 ohm carbon resistor and inductive loop (fashioned from several turns of wire).



DIAL STRINGING

DIAL CALIBRATION AND KNOB LOCATION



Reference Notes to Alignment Chart Below.

Before starting alignment, pointer must be set 87.5 MC. mark with gang fully closed

Note A: Put two 100,000 ohm resistors in series across R-23 (30,000 ohms). Negative lead of V.T.V.M. is attached to the junction of these two resistors. Positive lead of V.T.V.M. is ground. V.T.V.M. on 3 volt scale.

Note B: Negative lead of V.T.V.M. same as in Note A, positive lead of V.T.V.M. at junction of R-22 (27K ohm) and shielded lead, on terminal strip at ratio detector.

Note C: The FM R.F. and OSC. coils are made of stiff wire. To adjust these coils for bandwidth and tracking move coils together or apart as required.

Note D: Tune F.M. antenna trimmer (ClOb) and at the same time rock the signal generator frequency back and forth for maximum deflection on the meter.

ALIGNMENT CHART

See circuit diagram for 703 chassis at rear of book

Step No.	Band Switch in Position	Dummy Antenna	Signal Generator		Dial Position	Output Meter	See Fig. 34 Adjust		Remarks
			Freq.	Connection			C or L	For	
1	AM	0.1 Mfd.	455 kc.	Pin #2 12AT7	1620 kc.	Across Speaker	T5 & T3	Maximum Reading	
2	AM	....	1600 kc.	Radiating Loop	1600 kc.	Across Speaker	C10c Osc. Trimmer	Maximum Reading	
3	AM	....	600 kc.	Radiating Loop	600 kc.	Across Speaker	L7 Osc. Coil	Maximum Reading	Repeat Nos. 2 & 3 Until No Change Noticed
4	AM	....	1500	Radiating Loop	1500 kc.	Across Speaker	C10a Ant. Trimmer	Maximum Reading	Repeat Nos. 4 & 5 Until No Change Noticed
5	AM	....	600 kc.	Radiating Loop	600 kc.	Across Speaker	Loop Ant. 2 Taped Wires	Maximum Reading	
6	FM	0.1 Mfd.	10.7 mc. (0.1 volt)	V4 Pin #1 6AU6	....	VTVM at A.V.C.	Bottom of T6	Maximum Reading	See Note A
7	FM	0.1 Mfd.	10.7 mc.	V4 Pin #1 6AU6	....	VTVM at Audio	Top of T6	Zero Volts	See Note B
8	FM	300 ohms	10.7 mc.	Ant. Terminal	....	VTVM at A.V.C.	T4 & T2	Maximum Reading	See Note A
9	FM	300 ohms	108 mc.	Ant. Terminal	108	VTVM at A.V.C.	C10d Osc. Trimmer	Maximum Reading	
10	FM	300 ohms	90 mc.	Ant. Terminal	90	VTVM at A.V.C.	L6 F.M. Osc. Coil	Maximum Reading	See Note C
11	FM	300 ohms	90 mc.	Ant. Terminal	90	VTVM at A.V.C.	C10b FM. Ant.	Maximum Reading	See Note D

CIRCUIT CHANGES IN PRODUCTION ON CHASSIS 700-10, 20, 30, 40, 50

The following changes were made on the above chassis as production progressed, in order to make certain improvements. They are not retroactive. If you have an early production chassis which does not incorporate the changes below, do not make the change except to correct an actual complaint.

1—TO REDUCE RESISTOR FAILURE ON ALL 110.700 SERIES CHASSIS:—
R48 was changed from a 1W to a 2W Resistor, 3.3K ±10%.

2—TO IMPROVE AGC STABILITY:—
C6 was changed from .1 mfd 200v Capacitor to .25 mfd. 200v.
C9 was changed from .005 mfd. 600v to a Ceramic 22 mmf, 600v. ±20%.
R77 — a Resistor (270K, 1/2W ±10%) was added between the Cathode of the Picture Tube and the arm of the brightness control.

3—TO IMPROVE VERTICAL SWEEP LINEARITY AND OPERATING POINT OF THE VERTICAL SWEEP OUTPUT TUBE:—
R49 was changed from 330 ohms to 1,000 ohms.
R43 was changed from 3.3 meg ohms to 1.5 meg ohms.
R86 was added (3300 ohms 2W.) in series with the low end of the vertical output transformer primary.
C35 was changed from .01 mfd to .02 mfd. 600v.

4—TO INCREASE AUDIO SENSITIVITY:—
R20 was removed.
C16 connection to junction of R69 and L11 was changed to Pin 1 of 12BH7 video amplifier.

5—TO IMPROVE IMMUNITY OF VERTICAL TRIGGERING TO NOISE:—
C16 was changed from .01 mfd to .05 mfd, 600v on all 16" and 19" chassis.
R26 was added (3900 ohms 1/2W ±10%) between ground and junction of R38 — R39.

6—TO INCREASE RANGE OF CONTRAST CONTROL ON ALL 16" CHASSIS:—
R10 was changed from 2.2 meg ohms to 1 meg.
R76 was changed from 1 meg ohm to 3.3 meg ohms.

7—TO IMPROVE HORIZONTAL LINEARITY ON ALL CHASSIS:—
C62 was changed from .1 mfd 600v to .05 mfd, 600v.
C50 was changed from .25 mfd. to 25 mfd 12v., Electrolytic.

8—TO IMPROVE SYNC STABILITY:—
On all 16" Chassis:
R32 was changed from 3.9k to 1.8k.
R34 was changed from 3.3 megs to 1 meg.
R52 was changed from 6.8k to 2.7k.
R83 was added (1,000 ohms 1/2W ±20%) between side of C14 and ground.
R17 was changed from 560 ohm to 330 ohm.

CIRCUIT CHANGES IN PRODUCTION ON CHASSIS 700-90, 91, 92, 93, 95, 96

The following changes were made on the above 16", 17" and 20" Chassis as production progressed, in order to make certain improvements. They are not retroactive. If you have a previous production chassis which does not incorporate the changes below do not make the change except to correct an actual complaint.

1—R66—was removed in Picture Tube high voltage lead: This resistor was removed in accordance with revision of Underwriters' specifications.

2—R81—was removed in the Filament Supply of V-14: Design changes in the 12BH7 Tube eliminated the need for a dropping resistor in the Filament Supply.

3—Correction of Schematic:
The filament supply for the Tuner Tubes comes directly from the 6.3 winding of the Power Transformer, and no dropping resistor (shown on the print as R81) is in series filament supply of the Tuner Tubes.

4—Additional Capacitor required because of change in Vertical Blocking Osc. Transformer T5:
In some sets T5 Blocking Osc. Transformer A10125 was used instead of A10106. The use of Blocking Osc. Transformer A10125 required an additional capacitor C72-.001 mfd) between the red lead of this transformer and ground.

5—Changes required to improve Sync. Stability:
(a) R33 — changed from 270K to 180K.
(b) R36 — changed from 2700 Ohm to 3300 Ohm.
(c) R82 — An additional Resistor (27K) connected between pins 1 and 3 of V13.
(d) C69 — An additional Capacitor (.002 mfd) inserted betwen R38 and pin 1 of V13.

6—Changes in Contrast Control:
Some sets were manufactured with the Contrast Control (PL-a) as a 10K potentiometer, requiring a 1.8K fixed resistor R14 in parallel between the center arm and ungrounded terminal of PL-a. If a 1.5K potentiometer was used as PL-a in the chassis, this shunting resistor (R14) was omitted.

7—To Eliminate Horizontal Fold Over:
C 61 was changed from .005 mfd 600 Volts to .01 mfd 600 Volts.

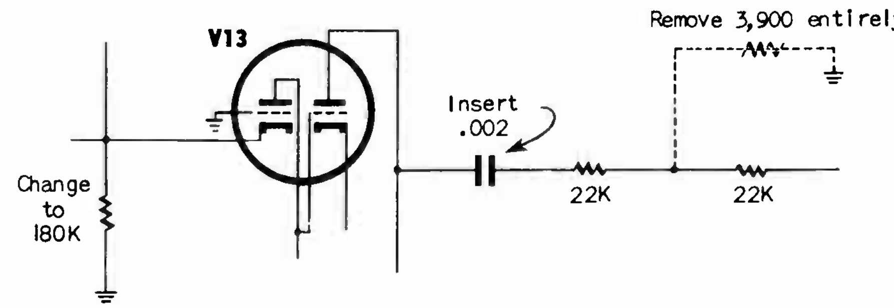
8—To minimize feed-back from Antenna on AM/FM TV Combination sets:
C12 (.1 mfd 600v) A Capacitor, was added to the Circuit, connected between ground and the junction of R5 and C4-a.

SERVICE NOTES

1—We are now substituting the contrast and volume control, old part number A24109 (10,000 ohms), with a similar control part number A24124 (1500 ohms). When using the new control A24124 the 1800 ohm resistor from the center arm to the high side of the old control should be removed.
The substitution of the control A24124 in place of A24109 (10,000 ohms) is only applicable to our models #700-90-91-92-93 and 95. These models can easily be identified in the fied by the fact that the contrast control is in the cathode of the 1st video amplifier (V8A). This change is not applicable in the other 700 series chassis due to the fact that the contrast control #24109 is used in an entirely different manner.

2—To increase vertical sync stability a .002 capacitor should be inserted between the 22,000 ohm resistor and plate (pin #1) of the sync amplifier and phase splitting tube (V-13) as shown in the drawing below. In conjunction with this change the 3,900 ohm resistor from the junction of the 22,000 ohm resistor to ground should be removed.

3—To further improve vertical sync stability in strong signal areas, change the 270,000 ohm cathode resistor of V-13 to 180,000 ohms. These changes are now being incorporated in our current production.



4—Field complaints have been received of an audio buzz or hum in some chassis of the 700 series due to poor contact of the aquadag coating of the Hytron 16RP4 tubes with the grounding strap. It has been found that under certain conditions of humidity, the binder used in the aquadag will form a chalky coating which prevents proper contact between the aquadag and the grounding strap.
This can be corrected by carefully washing the area around and under the contact spring, using a cloth moistened with water. After the area around the grounding spring has been washed and dried, it should be blackened by the application of graphite from a very soft pencil.
CAUTION: The set must be shut off and the high voltage supply discharged when this is done. NO OTHER TYPE PICTURE TUBE SHOULD BE WASHED IN THIS MANNER BECAUSE MOST STANDARD AQUADAG COATINGS ARE WATER SOLUBLE AND WOULD BE REMOVED IF WASHED.

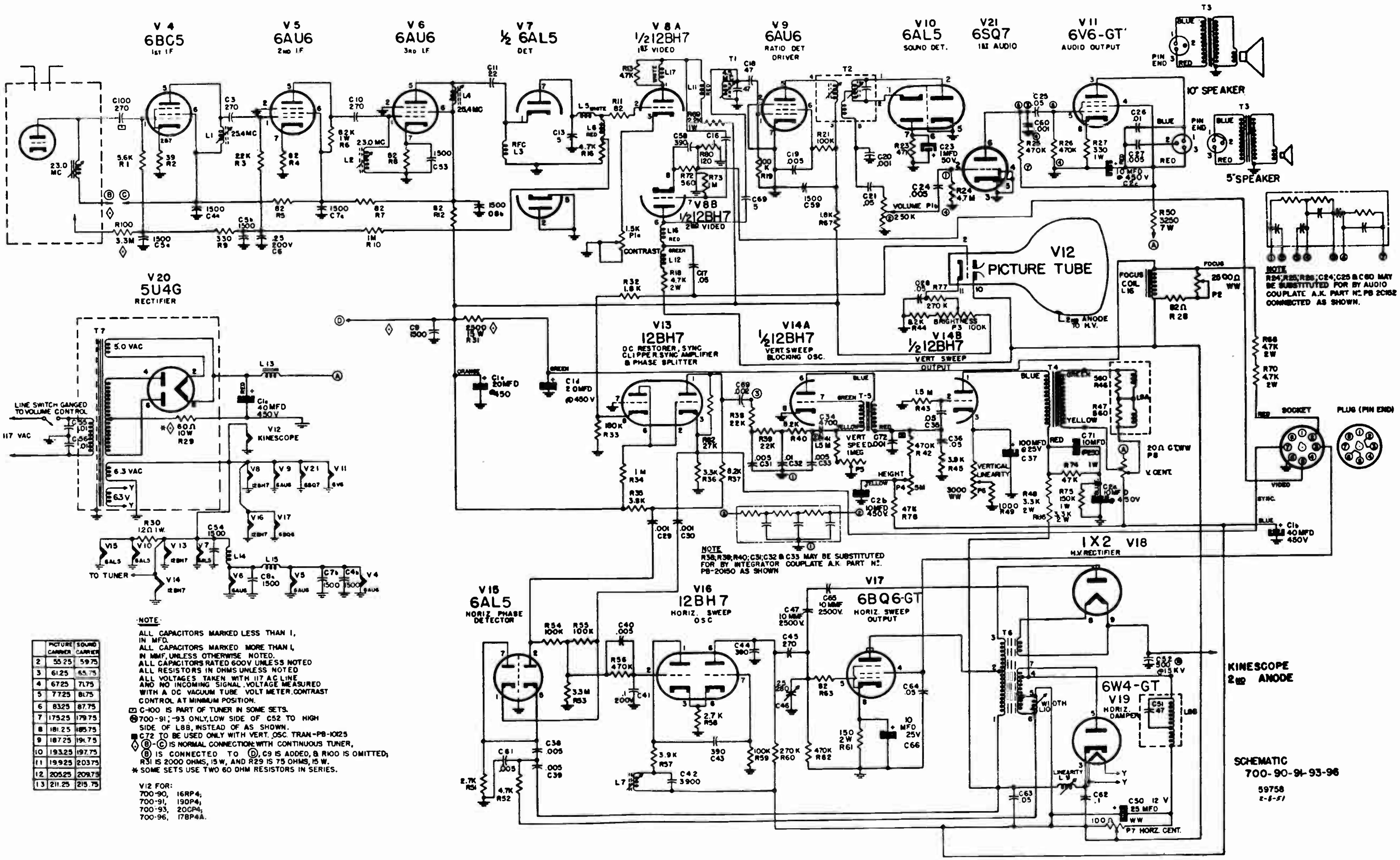
5—Hum in the model 16K1 (6 way combination) can be corrected by shielding the following 2 leads:
a. There is an orange colored wire running from the switch on chassis #703 to pin #7 on the plug. Change this to a shielded wire and ground the shield close to the switch.
b. There is a wire, usually yellow, running from pin #7 of the socket on the side of the chassis to the junction of the 60 ohm and 220 ohm resistors (R29 and R82) in the upper right hand corner of the chassis. This lead must be shielded and the shield grounded at the end closest to the junction of the two resistors.
Shielding of these two leads will eliminate or reduce the hum to an extremely low level.

6—Referring to the 700-90 schematic in our service manual, the following changes will further improve the vertical sync stability:
a. Add a 27 K ohm resistor from pin #1 to pin #3 of V13.
b. Change R36 from 2.7 K to 3.3 K ohms.
c. Change R37 from 3.9 K to 8.2 K ohms.

Horizontal Foldover

7—When the AFC control is correctly adjusted in the Air King chassis 700-10 or later series, the picture will fall into horizontal sync instantly when changing from station to station and it should be stable. Sometimes this cannot be done without causing a foldover on either the right or the left side of the picture. When this condition is present, it is an indication of unstable horizontal hold due to incorrect phasing from the transmitter. At certain adjustments of the AFC control the picture will jitter violently. To correct this condition, the 2.7K phasing resistor (R52) will have to be increased to approximately 5K if the foldover is on the left side of the picture or decreased to about 1K if the foldover is on the right side of the picture.

8—Buzzing — A small number of 700-93 chassis have been shipped which were found to have a considerable amount of hum or buzz. This can be corrected by putting a shield over the glass 6SQ7 tube, providing the 6SQ7 is of the metal ring base type. (substitution of a metal 6SQ7 will have the same effect).



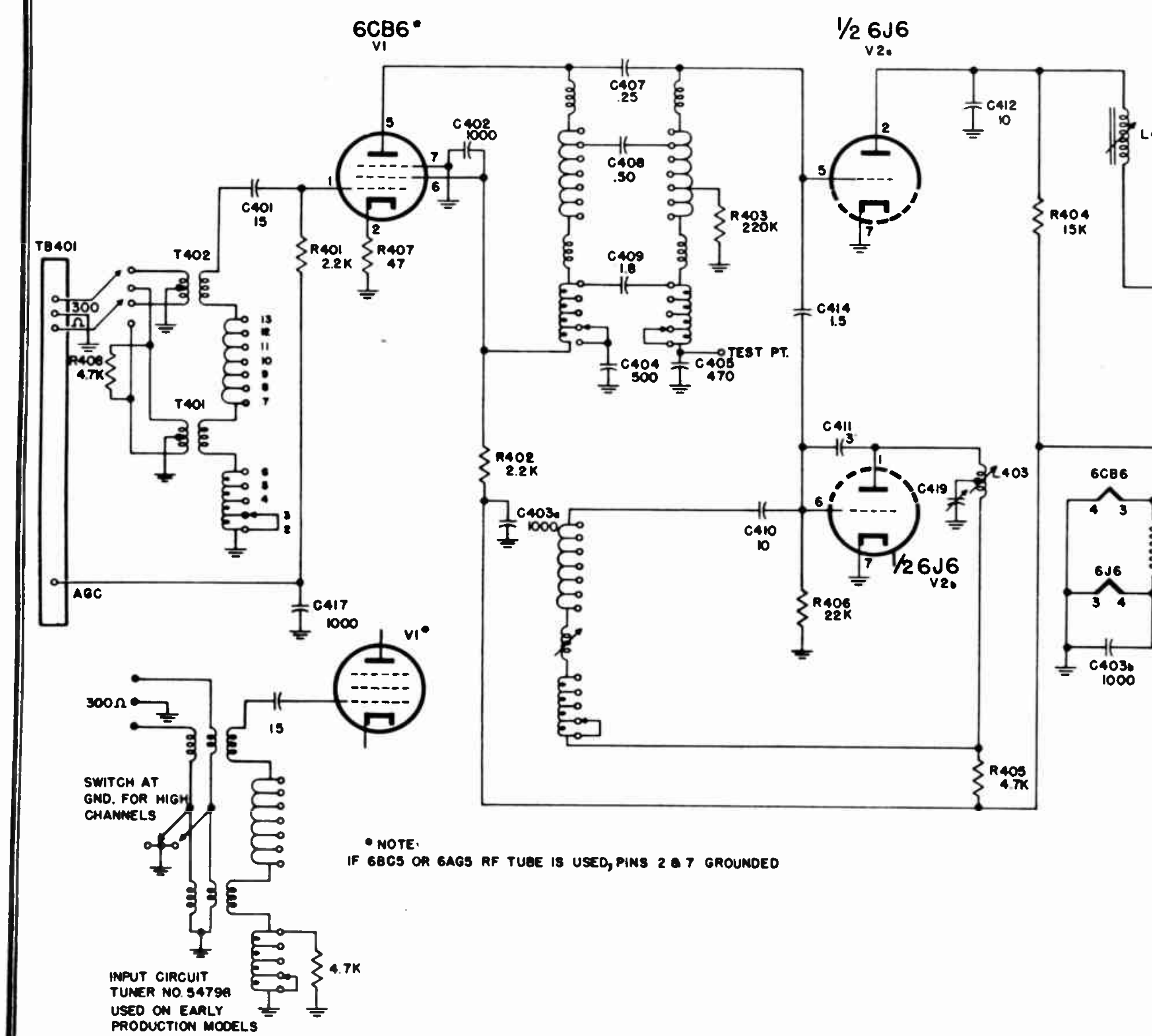
	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

NOTE

ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
ALL CAPACITORS MARKED MORE THAN 1, IN MMF, UNLESS OTHERWISE NOTED.
ALL CAPACITORS RATED 600V UNLESS NOTED
ALL RESISTORS IN OHMS UNLESS NOTED
ALL VOLTAGES TAKEN WITH 117 AC LINE AND NO INCOMING SIGNAL. VOLTAGE MEASURED WITH A DC VACUUM TUBE VOLT METER. CONTRAST CONTROL AT MINIMUM POSITION.
C-100 IS PART OF TUNER IN SOME SETS.
700-91; -93 ONLY, LOW SIDE OF C52 TO HIGH SIDE OF L88, INSTEAD OF AS SHOWN.
■ C72 TO BE USED ONLY WITH VERT. OSC. TRAN-PB-10125
◊ Ⓑ-Ⓒ IS NORMAL CONNECTION; WITH CONTINUOUS TUNER, Ⓑ IS CONNECTED TO Ⓓ, C9 IS ADDED, & R100 IS OMITTED; R31 IS 2000 OHMS, 15 W, AND R29 IS 75 OHMS, 15 W.
* SOME SETS USE TWO 60 OHM RESISTORS IN SERIES.

V12 FOR:
700-90, 16RP4;
700-91, 19DP4;
700-93, 20CP4;
700-96, 17BP4A.

SCHEMATIC FOR RF TUNER NO. 54946, Model TT3-X



REPAIR PARTS LIST

RESISTORS FOR 12½", 14", 16" & 19" SETS

SCHEM. LOCATION	CHASSIS*	PART NO.	DESCRIPTION
R 1		A231-1171	Carbon 8,200 ohm 1/2 W ± 10%
R 2		A231-1123	Carbon 82 ohm 1/2 W ± 10%
R 3		A231-1181	Carbon 22,000 ohms 1/2 W ± 10%
R 4		A231-1123	Carbon 82 ohms 1/2 W ± 10%
R 5		A231-1123	Carbon 82 ohms 1/2 W ± 10%
R 6		A232-1171	Carbon 8,200 ohms 1 W ± 10%
R 7		A231-1123	Carbon 82 ohms 1/2 W ± 10%
R 8		A231-1123	Carbon 82 ohms 1/2 W ± 10%
R 9		A231-1137	Carbon 330 ohms 1/2W ± 10%
R 10		A231-1221	Carbon 1 meg ohm 1/2 W ± 10%
R 10	700-1	A231-1229	Carbon 2.2 meg ohm 1/2 W ± 10%
R 11		A231-1229	Carbon 2.2 meg ohm 1/2 W ± 10%
R 11	700	A231-1221	Carbon 1 meg ohm 1/2 W ± 10%
R 12		A231-1123	Carbon 82 ohms 1/2 W ± 10%
R 13		A231-1189	Carbon 47,000 ohm 1/2 W ± 10%
R 14		A231-1197	Carbon 100,000 ohm 1/2 W ± 10%
R 15		A231-1173	Carbon 10,000 ohm 1/2 W ± 10%
R 15	700	A231-1189	Carbon 47,000 ohm 1/2 W ± 10%
R 16		A231-1165	Carbon 4,700 ohm 1/2 W ± 10%
R 17		A231-1137	Carbon 330 ohms 1/2 W ± 10%
R 17	700-1 700-2	A231-1143	Carbon 560 ohm 1/2 W ± 10%
R 18		A233-1165	Carbon 4,700 ohm 2 W ± 10%
R 18	700	A232-1167	Carbon 5,600 ohms 1 W ± 10%
R 19		A231-1197	Carbon 100,000 ohms 1/2 W ± 10%
R 20		A231-1181	Carbon 22,000 ohm 1/2 W ± 10%
R 21		A231-1197	Carbon 100,000 ohm 1/2 W ± 10%
R 22		A231-1189	Carbon 47,000 ohm 1/2 W ± 10%
R 23		A231-1189	Carbon 47,000 ohm 1/2 W ± 10%
R 24		A231-1233	Carbon 3.3 meg ohm 1/2 W ± 10%
R 25		A231-1213	Carbon 470,000 ohm 1/2 W ± 10%
R 26		A231-1213	Carbon 470,000 ohm 1/2 W ± 10%
R 27		A232-1137	Carbon 330 ohms 1/2 W ± 10%
R 27	700	A232-1133	Carbon 220 ohm 1 W ± 10%
R 28		A231-1123	Carbon 82 ohm 1/2 W ± 10%
R 29		A21107	Wire Wound 60 ohm 10 W
R 30		A23151	Wire Wound 1.2 ohm 1 W
R 31		A21110	Wire Wound 2,500 ohm 15 W
R 31	700	A21106	Wire Wound 1.500 ohm 7 W
R 32		A231-1155	Carbon 1,800 ohm 1/2 W ± 10%
R 32	700 700-1	A231-1163	Carbon 3,900 ohm 1/2 W ± 10%
R 33		A231-1207	Carbon 270,000 ohm 1/2 W ± 10%
R 34		A231-1221	Carbon 1 meg ohm 1/2 W ± 10%
R 34	700 700-1	A231-1233	Carbon 3.3 meg ohm 1/2 W ± 10%
R 35		A231-1163	Carbon 3,900 ohm 1/2 W ± 10%
R 36		A231-1159	Carbon 2,700 ohm 1/2 W ± 10%
R 36	700	A231-1163	Carbon 3,900 ohm 1/2 W ± 10%
R 37		A231-1163	Carbon 3,900 ohm 1/2 W ± 10%
R 38		A231-1189	Carbon 22,000 ohm 1/2 W ± 10%
R 39		A231-1189	Carbon 22,000 ohm 1/2 W ± 10%
R 40		A231-1171	Carbon 8,200 ohm 1/2 W ± 10%
R 41		A231-1225	Carbon 1.5 meg ohm 1/2 W ± 10%
R 41	700-50	A231-1223	Carbon 1.2 meg ohm 1/2 W ± 10%
R 41	700	A231-1227	Carbon 1.8 meg ohm 1/2 W ± 10%
R 42		A231-1213	Carbon 470,000 ohm 1/2 W ± 10%
R 42	700	A231-1227	Carbon 1.8 meg ohm 1/2 W ± 10%

* Used on all chassis (700,-1,-2,-20,-40,-50,-30,-90,-91,-92,-93,-95) unless specified in this column. If specified, the part is used only on chassis shown.

SCHEM. LOCATION	CHASSIS*	PART NO.	DESCRIPTION
R 43		A231-1233	Carbon 3.3 meg ohm 1/2 W ± 10%
R 44		A231-1171	Carbon 8,200 ohm 1/2 W ± 10%
R 45		A231-1163	Carbon 3,900 ohm 1/2 W ± 10%
R 45	700	A231-1171	Carbon 8,200 ohm 1/2 W ± 10%
R 46		A231-1143	Carbon 560 ohm 1/2 W ± 10%
R 47		A231-1143	Carbon 560 ohm 1/2 W ± 10%
R 48		A232-1161	Carbon 3,300 ohm 1 W ± 10%
R 48	700-2/700-50	A233-1161	Carbon 3,300 ohm 2 W ± 10%
R 48	700	A231-1155	Carbon 1,800 ohm 1/2 W ± 10%
R 49		A231-1137	Carbon 330 ohm 1/2 W ± 10%
R 50		A21111	Wire Wound 3,250 ohm 7 W
R 50	700	A231-1189	Carbon 47,000 ohm 1/2 W ± 10%
R 51		A231-1159	Carbon 2,700 ohm 1/2 W ± 10%
R 51	700	A231-1189	Carbon 47,000 ohm 1/2 W ± 10%
R 52		A231-1159	Carbon 2,700 ohm 1/2 W ± 10%
R 52	700-1	A231-1169	Carbon 6,800 ohm 1/2 W ± 10%
R 52	700	A231-1155	Carbon 1,800 ohm 1/2 W ± 10%
R 53		A231-1233	Carbon 3.3 meg ohm 1/2 W ± 10%
R 54		A231-1197	Carbon 100,000 ohm 1/2 W ± 10%
R 55		A231-1197	Carbon 100,000 ohm 1/2 W ± 10%
R 56		A231-1213	Carbon 470,000 ohm 1/2 W ± 10%
R 57		A231-1163	Carbon 3,900 ohm 1/2 W ± 10%
R 58		A231-1159	Carbon 2,700 ohm 1/2 W ± 10%
R 59		A231-1197	Carbon 100,000 ohm 1/2 W ± 10%
R 60		A231-1207	Carbon 270,000 ohm 1/2 W ± 10%
R 61		A233-1129	Carbon 150 ohm 2 W ± 10%
R 61	700	A232-1171	Carbon 8,200 ohm 1 W ± 10%
R 62		A231-1213	Carbon 470,000 ohm 1/2 W ± 10%
R 63		A231-1123	Carbon 83 ohms 1/2 W ± 10%
R 64		A231-1207	Carbon 270,000 ohm 1/2 W ± 10%
R 64	700	A231-1165	Carbon 4,700 ohms 2 W ± 10%
R 66		A233-1221	Carbon 1 meg ohm 2 W ± 10%
R 67		A231-1155	Carbon 1,800 ohm 1/2 W ± 10%
R 68		A233-1165	Carbon 4,700 ohms 2 W ± 10%
R 69		A232-1157	Carbon 2,700 ohms 1 W ± 10%
R 70		A233-1165	Carbon 4,700 ohms 2 W ± 10%
R 70	700	A231-1207	Carbon 270,000 ohm 1/2 W ± 10%
R 71		A231-1137	Carbon 330 ohms 1/2 W ± 10%
R 71	700-1	A231-1143	Carbon 560 ohm 1/2 W ± 10%
R 71	700	A21112	Wire Wound 22,000 ohm 1/2 W
R 72		A231-1137	Carbon 330 ohms 1/2 W ± 10%
R 72	700	A233-1171	Carbon 8,200 ohm 2 W ± 10%
R 73		A231-1221	Carbon 1 meg ohm 1/2 W ± 10%
R 73	700	A233-1171	Carbon 8,200 ohm 2 W ± 10%
R 74		A232-1189	Carbon 47,000 ohm 1 W ± 10%
R 75		A232-1201	Carbon 150,000 ohm 1 W ± 10%
R 75	700	231-1207	Carbon 270,000 ohm 1/2 W ± 10%
R 76		A231-1233	Carbon 3.3 meg ohm 1/2 W ± 10%
R 76	700-1	A231-1221	Carbon 1 meg ohm 1/2 W ± 10%
R 77		A231-1207	Carbon 270,000 ohm 1/2 W ± 10%
R 78		A231-1189	Carbon 47,000 ohm 1/2 W ± 10%
R 79		A231-1233	Carbon 3.3 meg ohm 1/2 W ± 10%
R 79	700-50	A231-2249	Carbon 1,000 ohms 1/2 W ± 10%
R 80		A231-1163	Carbon 3,900 ohms 1/2 W ± 10%
R 81		A21115	Wire Wound 220 ohms 7 W
R 83		A231-1149	Carbon 1,000 ohm 1/2 W ± 10%

* Used on all chassis (700,-2,-20,-40,-50,-30,-90,-91,-92,-93,-95) unless specified in this column. If specified, the part is used only on chassis shown.

RESISTORS FOR 17" & 20" CHASSIS

SCHEM. LOCATION	PART NO.	DESCRIPTION
R 1	PE 231-1167	Resistor 5.6K 1/2 W ± 10%
R 2	PE 231-1115	Resistor 39 Ohm 1/2 W ± 10%
R 3	PE 231-1181	Resistor 22,000 Ohm 1/2 W ± 10%
R 4-5	PE 231-1123	Resistor 82 Ohm 1/2 W ± 10%
R 6	PE 232-1171	Resistor 8,200 Ohm 1 W ± 10%
R 7-8	PE 231-1123	Resistor 82 Ohm 1/2 W ± 10%
R 9	PE 231-1137	Resistor 330 Ohm 1/2 W ± 10%
R 10	PE 231-1221	Resistor 1 Megohm 1/2 W ± 10%
R 11-12	PE 231-1123	Resistor 82 Ohm 1/2 W ± 10%
R 13-16	PE 231-1165	Resistor 4.7K 1/2 W ± 10%
R 16	PE 233-1165	Resistor 4.7K 2 W ± 10%
R 19	PE 231-1197	Resistor 100,000 Ohm 1/2 W ± 10%
R 20	PE 231-1127	Resistor 120 Ohm 1/2 W ± 10%
R 21	PE 231-1197	Resistor 100,000 Ohm 1/2 W ± 10%
R 23	PE 231-1189	Resistor 47,000 Ohm 1/2 W ± 10%
R 24	PE 231-1237	Resistor 4.7 Megohm 1/2 W
R 25-26	PE 231-1213	Resistor 470,000 Ohm 1/2 W ± 10%
R 27	PE 232-1137	Resistor 330 Ohm 1 W ± 10%
R 28	PE 231-1123	Resistor 82 Ohm 1/2 W ± 10%
R 29	PP 21107	Resistor 60 Ohm 10 W wirewound
R 30	PE 23151	Resistor 1.2 Ohm 1 W ± 10%
R 31	PA 21110	Resistor Wirewound 2,500 Ohm 15 W
R 32	PE 231-1155	Resistor 1,800 Ohm 1/2 W ± 10%
R 33	PE 231-1203	Resistor 180K Ohm 1/2 W ± 10%
R 34	PE 231-1221	Resistor 1 Megohm 1/2 W ± 10%
R 35	PE 231-1163	Resistor 3,900 Ohm 1/2 W ± 10%
R 36	PA 231-1161	Resistor 3.3K Ohm 1/2 W ± 10%
R 37	PE 231-1171	Resistor 8.2K Ohm 1/2 W ± 10%
R 38-39	PE 231-1181	Resistor 22,000 Ohm 1/2 W
R 40	PE 231-1171	Resistor 8,200 Ohm 1/2 W ± 10%
R 41	PE 231-1225	Resistor 1.5 Meg 1/2 W ± 10%
R 42	PE 231-1213	Resistor 470,000 Ohm 1/2 W ± 10%
R 43	PE 231-1225	Resistor 1.5 Meg 1/2 W ± 10%

SCHEM. LOCATION	PART NO.	DESCRIPTION
R 44	PE 231-1171	Resistor 8,200 Ohm 1/2 W ± 10%
R 45	PE 231-1163	Resistor 3,900 Ohm 1/2 W ± 10%
R 48	PE 233-1161	Resistor 3.3K 2W ± 10%
R 49	PE 231-2249	Resistor 1,000 Ohm 1/2 W ± 20%
R 50	PA 21111	Resistor Wirewound 3,250 Ohm 7W ± 10%
R 51	PE 231-1159	Resistor 2.7K 1/2 W ± 10%
R 52	PE 231-1165	Resistor 4.7K 1/2 W ± 10%
R 53	PE 231-1233	Resistor 3.3 Megohm 1/2 W ± 10%
R 54-55	PE 231-1197	Resistor 100,000 Ohm 1/2 W ± 10%
R 56	PE 231-1213	Resistor 470,000 Ohm 1/2 W ± 10%
R 57	PE 231-1163	Resistor 3,900 Ohm 1/2 W ± 10%
R 58	PE 231-1159	Resistor 2,700 Ohm 1/2 W ± 10%
R 59	PE 231-1197	Resistor 100,000 Ohm 1/2 W ± 10%
R 60	PE 231-1207	Resistor 270,000 Ohm 1/2 W ± 10%
R 61	PE 233-1129	Resistor 150 Ohm 2W ± 10%
R 62	PE 231-1213	Resistor 470,000 Ohm 1/2 W ± 10%
R 63	PE 231-1123	Resistor 82 Ohm 1/2 W
R 67	PE 231-1155	Resistor 1,800 Ohm 1/2 W ± 10%
R 68	PE 233-1165	Resistor 4,700 Ohm 2 W ± 10%
R 69	PE 232-1157	Resistor 2.2K 1 W ± 10%
R 70	PE 233-1165	Resistor 4,700 Ohm 2 W ± 10%
R 71	PE 231-1137	Resistor 330 Ohm 1/2 W ± 10%
R 72	PE 231-1143	Resistor 560 Ohm 1/2 W ± 10%
R 73	PE 231-1221	Resistor 1 Megohm 1/2 W ± 10%
R 74	PE 232-1189	Resistor 47,000 1 W ± 10%
R 75	PE 232-1201	Resistor 150,000 1 W ± 10%
R 77	PE ?31-1207	Resistor 270,000 Ohm 1/2 W ± 10%
R 78	PE 231-1189	Resistor 47,000 Ohm 1/2 W ± 10%
R 81	PE 23151	Resistor 1.2 Ohm 1 W ± 10%
R 82	PE 231-1183	Resistor 27K Ohm 1/2 W ± 10%
R 86	PE ?33-1161	Resistor 3.3K Ohm 2 W ± 10%
R 100	PE 231-1233	Resistor 3.3 Megohm 1/2 W ± 10%

*Some sets use ?-60 Ohm resistors in series; others use a 75 Ohm 15 W resistor

REPAIR PARTS LIST

CAPACITORS FOR 17" & 20" CHASSIS

C 1	PA 20144	Capacitor Electr. 40-40-20-20 @ 450
C 2	PA 20135	Capacitor Electr. 10-10-10-10 @ 450
C 3	PE 190-133	Capacitor Mica 270 mmf ± 10%
C 4-5	PA 19147	Capacitor Ceramic Dual 1,500 mmf Disc.
C 6	PE 194-67	Capacitor Paper .25 mfd 200 V ± 20%
C 7-8	PE 19147	Capacitor Ceramic Dual 1,500 mmf Disc.
C 9	PA 19418	Capacitor Ceramic Single Disc. 1500 (some sets only)
C 10	PE 190-133	Capacitor Mica 270 mmf ± 10%
C 11	PE 190-107	Capacitor Mica 22 mmf ± 10%
C 13	PE 555-100	Capacitor Tubular 5 mmf ± 20%
C 16	PE 194-162	Capacitor Paper .1 600 V
C 17	PE 194-160	Capacitor Paper .05 600 V
C 18	PE 555-113	Capacitor Ceramic 47 mmf ± 20%
C 19	PE 194-151	Capacitor Paper .005 mfd 600 V ± 20%
C 20	PE 194-145	Capacitor Paper .001 mfd 600 V
C 21	PE 194-160	Capacitor Paper .05 600 V
C 23	PA 20138	Capacitor Electr. 1 mfd 50 V
C 24	PE 194-151	Capacitor Paper .005 mfd 600 V
C 25	PE 194-160	Capacitor Paper .05 600 V
C 26	PE 194-155	Capacitor Paper .01 600 V
C 27	PE 194-151	Capacitor Paper .005 mfd 600 V
C 28	PE 194-160	Capacitor Paper .05 600 V
C 29-30	PE 194-145	Capacitor Paper .001 mfd 600 V
C 31	PE 194-151	Capacitor Paper .005 mfd 600 V
C 32	PE 194-155	Capacitor Paper .01 600 V
C 33	PE 194-151	Capacitor Paper .005 mfd 600 V
C 34	PE 192-163	Capacitor Mica 4,700 mmf 500 V ± 10%
C 35-36	PE 194-160	Capacitor Paper .05 600 V
C 37	PP 20130	Capacitor Electr. 100 mfd 25 V
C 38-39-40	PE 194-151	Capacitor Paper .005 mfd 600 V
C 41	PE 194-66	Capacitor Paper .1 mfd 200 V
C 42	PE 195-261	Capacitor Silver Mica 3,900 mmf ±5% 500V
C 43-44	PE 190-137	Capacitor Mica 390 mmf 500 V
C 45	PE 190-133	Capacitor Mica 270 mmf
C 46	PA 1772	Capacitor Trimmer 25 to 280 mmf
C 47	PP 19146	Capacitor Mica 10 mmf 2,500 V
C 52	PA 1998-2	Capacitor Ceramic 500 mmf 15K V
C 53-54	PA 19148	Capacitor Ceramic single disc 1500
C 55-56	PP 19106	Capacitor Moulded .01 mfd 600 V
C 58	PE 190-137	Capacitor Mica 390 mmf 500 V
C 59	PA 19148	Capacitor Ceramic single disc 1500 mmf
C 60	PE 194-145	Capacitor Paper .001 mfd 600 V ± 20%
C 61	PE 194-151	Capacitor Paper .005 mfd 600 V ± 20%
C 62	PE 194-162	Capacitor Paper .1 mfd 600 V ± 20%
C 63-64	PE 194-160	Capacitor Paper .05 600 V ± 20%
C 65	PP 19146	Capacitor Mica 10 mmf 2500 V
C 66	PP 20137	Capacitor Electr. 10 mfd 25 V
C 69	PE 555-100	Capacitor Ceramic 5 mmf ± 20%
C 71	PA 20145	Capacitor Electr. 10 mfd 250 V
C 72	PE 194-145	Capacitor Paper .001 mfd 600 V

CONTROLS, COILS, CHOKES & TRANSFORMERS FOR 17"&20" CHASSIS

L 1-2-4	PB 3392	Coil, Pix I.F.
L 3	PA 28253	Coil, I.F. Choke
L 5	PA 28255-2	Coil, Peaking white
L 6	PA 28255-1	Coil, Peaking red
L 7	PA 28263	Horizontal Freq. Control Coil
L 8	PC 28302-1	Deflection Yoke (20" chassis only)
L 9	PA 28292	Linearity Coil
L 10	PA 28279	Width Coil
L 11	PA 28255-1	Coil, Peaking red
L 12	PA 28255-4	Coil, Peaking green
L 13	PB 1406	Filter Choke
L 14-15	PA 28276	Filament Choke
L 16	PA 28255-1	Coil, Peaking red
L 17	PA 28255-2	Coil, Peaking white
L 18	PB 28295-2	Focus Coil (20" chassis only)
P 1	PA 24124	Control, Contrast & Volume
P 2	PA 24113	Control, Focus 2,500 Ohm
P 3	PA 24110	Control, Brightness 100K Ohm
P 4	PA 24111	Control, Height 5 Megohm
P 5	PA 24112	Control, Vert. Speed 1 Megohm
P 6	PA 24114	Control, Vert. Linearity 3,000 Ohm
P 7	PA 24116	Control, Horizontal Centering
P 8	PA 24118	Control, Vertical Centering
T 1	PA 28286	Transformer, Audio Take-off
T 2	PB 1201/1202	Ratio Detector
T 4	PB 10115-4	Vertical Output Transformer
T 5	PB 10125	Vertical Oscillator Transformer
T 6	PC 10104/10108	Horizontal Output Transformer
T 7	PC 10109	Power Transformer
L 8	PB 28278-3	Deflection Yoke (17" chassis only)
L 18	PB 28282	Focus Coil (17" chassis only)

CAPACITORS FOR 12½", 14", 16" & 19" SETS

SCHEM. LOCATION	CHASSIS	PART NO.	DESCRIPTION
C 1	700	A20134	Electr. 40-40-20-20 @ 350
C 1		A20144	Electr. 40-40-20-20 @ 450
C 2		A20135	Electr. 10-10-10- @450
C 3		A190-133	Mica 270 mmf ± 10%
C 4-5		A19147	Ceramic Dual 1,500 mmf Disc.
C 6		A194-67	Paper .25 mfd 200 V ± 20%
C 7-8		A19147	Ceramic Dual 1,500 mmf Disc.
C 9		A555-106	Ceramic 22 mmf 500 V ± 20%
C 10-11		A190-133	Mica 270 mmf ± 10%
C 12		A555-113-2	Ceramic 47 mmf ± 20% N.P.O.
C 13		A555-100	Ceramic 5 mmf ± 20%
C 14		A20141	Electr. 100 mfd 12 V
C 14	700	A20130	Electr. 100 mfd 25 V
C 15		A190-143	Mica 680 mmf 500 V ± 10%
C 16			Paper .01 mfd 600 V ± 20%
C 16	700	A194-151	Paper .005 mfd 600 V ± 20%
C 17			Paper .1 mfd 600 V ± 20%
C 18	700,700-1	A555-113-2	Ceramic 47 mmf ± 20% N.P.O.
C 19		A194-151	Paper .005 mfd 600 V ± 20%
C 19	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 37		A30130	Electr. 100 mfd 25 V
C 38-39-40		A194-151	Paper .005 mfd 600 V ± 20%
C 38-39	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 41		A194-66	Paper .1 mfd 200 V ± 20%
C 42		A195-261	Mica Silver 3900 mmf 5% 500 V
C 42	700-50	A193-261	Mica Silver 3900 mmf ± 5% 500 V
C 43-44		A190-137	Mica 390 mmf ± 10% 500 V
C 45		A190-133	Mica 270 mmf ± 10%
C 46		A1772	Trimmer 25 to 280 mmf
C 47		A19146	Mica 10 mmf 2500 V
C 47	700	A19150	Mica 24 mmf 300 V
C 50		A20147	Electr. 25 mfd 12 V
C 51	700	A190-115	Mica 47 mmf ± 10%
C 52		A1998-2	Ceramic 500 mmf 15K V
C 53-54		A19148	Disc. 1500 mmf
C 55-56		A19106	Moulded .01 mfd ± 20% 600 V
C 57		A20141	Electr. 100 mfd 12 V
C 57	700	A20143	Electr. 1 mfd 12 V
C 58		A190-137	Mica 390 mmf ± 10% 500V

SCHEM. LOCATION	CHASSIS	PART NO.	DESCRIPTION
C 20		A194-145	Paper .001 mfd 600 V ± 20%
C 21		A194-160	Paper .005 mfd 600 V ± 20%
C 22		A194-145	Paper .001 mfd 600 V ± 20%
C 23		A20138	Electr. 1 mfd 50 V
C 24		A194-151	Paper .005 mfd 600 V ± 20%
C 24	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 25		A194-160	Paper .005 mfd 600 V ± 20%
C 26-27		A194-151	Paper .005 mfd 600 V ± 20%
C 26	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 27	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 28		A194-160	Paper .005 mfd 600 V ± 20%
C 29-30		A194-145	Paper .001 mfd 600 V ± 20%
C 31		A194-151	Paper .005 mfd 600 V ± 20%
C 31	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 32		A194-155	Paper .01 mfd 600 V ± 20%
C 33		A194-151	Paper .005 mfd 600 V ± 20%
C 33	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 34		A192-163	Mica 4700 mmf 500 V ± 10%
C 35		A194-155	Paper .01 mfd 600 V ± 20%
C 36		A194-160	Paper .005 mfd 600 V ± 20%
C 58	700	A19148	Ceramic Disc. 1500 mmf
C 59		A19148	Ceramic Disc. 1500 mmf
C 60		A194-145	Paper .001 mfd 600 V ± 20%
C 61		A194-151	Paper .005 mfd 600 V ± 20%
C 61	700-50	A194-160	Paper .005 mfd 600 V ± 20%
C 62		A 194-162	Paper .1 mfd 600 V ± 20%
C 62	700	A194-160	Paper .005 mfd 600 V ± 20%
C 63		A194-160	Paper .005 mfd 600 V ± 20%
C 64		A194-160	Paper .005 mfd 600 V ± 20%
C 65		A19146	Mica 10 mmf 2500 V
C 65	700	A19150	Mica 24 mmf 3000 V
C 66		A20137	Mica 220 mmf 2500 V
C 66	700	A555-100	Ceramic 5 mmf ± 20%
C 67	700	A191-147	Mica 1000 mmf ± 10% 500 V
C 68	700	A194-66	Paper .1 mfd 200 V ± 20%
C 68	700-50	A19136	Mica 220 mmf 2500 V
C 69		A555-100	Ceramic 5 mmf ± 20%
C 70	700-1	A194-66	Paper .1 mfd 200 V ± 20%
C 71		A20145	Electr. 10 mfd 250 V
C 72	700-1	A191-147	Mica 1000 mmf ± 10% 500 V

RESISTORS FOR AM-FM TUNER USED IN MODELS 16KI, 17KI & 20KI

R 1	A230-2321	Carbon 1 Meg ohm 1/4 W. ± 20%
R 2	A230-2225	Carbon 100 Ohm 1/4 W. ± 20%
R 3	A230-2265	Carbon 4.7K Ohm 1/4 W. ± 20%
R 4	A230-1101	Carbon 10 Ohm 1/4 W. ± 20%
R 5	A230-2313	Carbon 470,000 Ohm 1/4 W. ± 20%
R 6	A230-2281	Carbon 22,000 Ohm 1/4 W. ± 20%
R 7	A230-1183	Carbon 27,000 Ohm 1/4 W. ± 20%
R 8	A230-2265	Carbon 4.7K Ohm 1/4 W. ± 20%
R 9	A230-2261	Carbon 3,300 Ohm 1/4 W. ± 20%
R 10	A230-2329	Carbon 2.2 Meg ohm 1/4 W. ± 20%
R 11	A230-2221	Carbon 68 Ohm 1/4 W. ± 20%
R 12	A231-1171	Carbon 8,200 Ohm 1/2 W. ± 10%
R 13	A230-2281	Carbon 22,000 Ohm 1/4 W. ± 20%
R 14	A230-2329	Carbon 2.2 Meg ohm 1/4 W. ± 20%
R 15	A230-2221	Carbon 68 Ohm 1/4 W. ± 20%
R 16	A232-68	Carbon 6,200 Ohm 1 W. ± 5%
R 17	A230-2305	Carbon 220,000 Ohm 1/4 W. ± 20%
R 18	A230-1177	Carbon 15,000 Ohm 1/4 W. ± 10%
R 20	A230-2313	Carbon 470,000 Ohm 1/4 W. ± 20%
R 21	A230-2281	Carbon 22,000 Ohm 1/4 W. ± 20%
R 24	A232-2277	Carbon 15,000 Ohm 1 W. ± 20%
R 26	A230-2305	Carbon 220,000 Ohm 1/4 W. ± 20%
R 28	A230-2345	Carbon 10 Meg ohm 1/4 W. ± 20%
R 30	A230-2313	Carbon 470,000 Ohm 1/4 W. ± 20%

CAPACITORS FOR AM-FM TUNER USED IN MODELS 16KI, 17KI & 20KI

C 1	A16108	Capacitor, variable, AM FM w/drum
C 2	A555-236	Ceramic 1000 mmf, ± 10% Uninsulated
C 3	A555-218	Ceramic 100 mmf, ± 10% Uninsulated
C 4	A19109	Ceramic Disc. 5000 mmf
C 5	A555-204	Ceramic 18 mmf, ± 10% Uninsulated
C 6	A555-214	Ceramic 50 mmf, ± 10% Uninsulated
C 7	A555-214	Ceramic 50 mmf, ± 10% Uninsulated
C 8	A19109	Ceramic Disc. 5000 mmf
C 9	A19109	Ceramic Disc. 5000 mmf
C 10	A555-208	Ceramic 25 mmf, ± 10% Insulated
C 11	A1985	Mica 500 mmf
C 12	A555-232	Ceramic 500 mmf, ± 10%
C 13	A19109	Ceramic Disc. 5000 mmf
C 14	A19109	Ceramic Disc. 5000 mmf
C 15	A19109	Ceramic Disc. 5000 mmf
C 16	A191-23	Mica 100 mmf
C 17	A191-23	Mica 100 mmf
C 18	A19109	Ceramic Disc. 5000 mmf
C 19	A19109	Ceramic Disc. 5000 mmf
C 20	A196-97	Paper .001 mfd 400 V. ± 20%
C 22	A20132	Electrolytic 10 mfd, 25 V.
C 23	A19109	Ceramic Disc. 5000 mmf
C 24	A196-97	Paper .001 mfd 400 V. ± 20%
C 25	A196-112	Paper .05 mfd 400 V. ± 20%
C 26	A20131	Electrolytic 20-10 @ 350 V.
C 29	A196-112	Paper .05 mfd 400 V. ± 20%
C 30	A196-107	Paper .01 mfd 400 V. ± 20%
C 32	A196-112	Paper .05 mfd 400 V. ± 20%
C 34	A196-107	Paper .01 mfd 400 V. ± 20%
C 31	A191-23	Mica 100 mmf
C 38	A20131	Electrolytic 20-10 @ 350 V.
C 40	A196-107	Paper .01 mfd 400 V. ± 20%
C 41	A1773	Trimmer, A.S.P.
C 42	A5556-200-9	Ceramic 500 mmf, ± 5% mmf N750 Ins
C 43	A19109	Ceramic Disc. 5000 mmf
C 47	A19109	Ceramic Disc. 5000 mmf
C 48	A191-102	Mica 10 mmf, ± 10%

MISC. PARTS FOR AM-FM TUNER USED IN MODELS 16KI, 17KI & 20KI

L 3	28283	Choke FM Osc.
L 4	A62298	Choke AM Loop
L 5	A28288	Coil FM Antenna
L 6	A28287	Coil FM Osc.
L 7	A28285	Coil AM Osc.
L 8	A28283	Choke FM Osc.
S 1	A37102	Switch AM/FM Phono TV
T 2	A3395	Transformer FM IF 1st
T 3	A3396	Transformer AM IF 1st
T 4	A3394	Transformer AM IF 2nd
T 5	A3399	Transformer AM IF 2nd
T 6	A3397	Transformer Ratio Detector
	A4114	Pointer Dial Scale

CONTROLS, COILS & CHOKES (ALL CHASSIS)

SCHEM. LOCATION	CHASSIS	PART NO.	DESCRIPTION
L 3		A28253	Choke, I.F.
L 4	700-50	A28276	Choke, Filament
L 5		A28255-1	Coil, Peaking, Red
L 6		A28255-5	Coil, Peaking, Yellow
L 6	700-50	A28256-6	Coil, Peaking, Yellow
L 7		A28263	Coil, Horizontal Freq. Control
L 9	700,700-2,-50	A28292	Coil, Linearty
L 9		A28259	Coil, Linearty
L 10		A28279	Coil, Width Control
L 10	700	A28258-2	Coil, Width Control
L 11		A28255-2	Coil, Peaking, White
L 11	700	A28255-3	Coil, Peaking, Blue
L 12		A28255-4	Coil, Peaking, Green
L 13		A1406	Choke, Filter
L 14		A28276	Choke, Filament
L 15		A28276	Choke, Filament
L 16		A28255	Coil, Peaking, White
L 16	700	A28274	Coil, Focus
P1	16" & 20"	A24124	Control Contrast & Vol.
P 1		A24109	Control, Contrast & Vol.
P 2		A24113	Control, Focus 2500 Ohm
P 3		A24110	Control, Brightness 100K Ohm
P 4		A24111	Control, Height 5 Meg ohm
P 5		A24112	Control, Vert. Speed 1 Meg ohm
P 6		A24114	Control, Vert. Linearty 3000 Ohm
P 7		A24116	Control, Horiz. Centering
R 74	700	A24116	Control, Horiz. Centering
P 8		A24118	Control, Vert. Centering

TRANSFORMERS FOR 12½", 14", 16" & 19" SETS

SCHEM. LOCATION	CHASSIS	PART NO.	DESCRIPTION
T 1		A28286	Audio take-off
L 1-2		A3392	I.F.
T 2		A3393,A1201	Ratio Detector
T 2	700-50	A1201,A1202	Ratio Detector
T 4		A10115,A1350-2	Vertical Output
T 4	700	A1354	Vertical Output
L 4		A3392	I.F.
T 5		A10106	Vertical Osc.
T 6		A10104,A10108	Horizontal Output
T 7		A10109	Power
T 7	700	A10105	Power
L 8		A28278-2	Yoke Deflection
L 8	700	A28261	Yoke Deflection

PART NO.	DESCRIPTION
	MODEL 12C1
PC 5866	Speaker 5"
	MODEL 12T1
PC 5866	Speaker 5"
	MODEL 12T2
PC 5866	Speaker 5"
	MODEL 14T1
PC 5866	Speaker 5"
	MODEL 16C2
PD 58121	Speaker 10"
	MODEL 16C1
PD 58121	Speaker 10"
	MODEL 16C5
PE 58124	Speaker 8"
	MODEL 20C2
PC 58124	Speaker 8"
	MODEL 20K1
PD 58121	Speaker 10"
	MODEL 20M1
PC 5866	Speaker 5"
	TABLE MODEL 16T1-16TIB
PC 5866	Speaker 5"

PART NO.	DESCRIPTION
	MODEL 16K1
PC 58127	Speaker 8"
	MODEL 17T1
PC 5866	Speaker 5"
	MODEL 16M1
PC 5866	Speaker 5"
	MODEL 17C2
PD 58121	Speaker 10"
	MODEL 17MI
PC 5866	Speaker 5"
	MODEL 17C7
PC 5866	Speaker 5"
	MODEL 17C5
PC 58124	Speaker 8"

PART NO.	DESCRIPTION
	MODEL 17K1
PC 58124	Speaker 8"
	MODEL 19C1
PD 58121	Speaker 10"
	MODEL 20C1
PC 58124	Speaker 8"

Specifications

Picture Tube
Type	CBS Hytron 19VP22
Dimensions	19-inch round, all glass. Viewing area 205 square inches

Operating Controls
Station Selector, Fine and UHF Tuning, Vertical and Horizontal Hold, Contrast, Volume, Tone, Chroma and Hue

Power Rating
Source	105—120 volts 60-cycle AC
Consumption	500 Watts

Number of Tubes
41 tubes plus 3 rectifiers, 2 selenium rectifiers and 3 crystal diodes

Ant. Input Impedance
VHF	300 ohms balanced
UHF	300 ohms balanced

Frequency Range
Channels 2 through 82

Intermediate Frequencies
Video IF	45.75 mc
Sound IF	41.25 mc
Sound Intercarrier Freq.	4.5 mc
Color Subcarrier Freq.	42.17 mc
Adjacent Channel Sound Trap Freq.	39.75 mc
Adjacent Channel Video Trap Freq.	47.25 mc
Accompanying Channel Sound for less than 10% distortion	41.25 mc

Crt High Voltage
26 kv adjusted

Loudspeakers
Size	Two, 6½ in x 9¼ in. speakers
Voice Coil	3.2 ohms at 400 cycles

Focus
Electrostatic

Deflection
Electromagnetic

Convergence
Static	PM Magnetic
Dynamic	Electromagnetic

Cabinet Dimensions
Model	Width	Height	Depth
205C1 Console	34¼	42-11/16	26-1/16
205C2 Console w/Doors	34¼	42-11/16	26-15/16

Tube Complement
Symbol	Type	Function
V1	6BZ7	RF Amplifier
V2	6N8	Mixer and Oscillator
V3	6AF4	UHF Oscillator
V4	6CB6	1st IF
V5	6BC6	2nd IF
V6	6BC6	3rd IF
V7	6CB6	4th IF
V8	6CL6	5th IF
V9	6AU6	Sound IF Amplifier
V10	6AU6	Driver
V11	6AL5	Ratio Detector
V12	6AU6	Audio Amplifier
V13	6AQ5	Audio Output
V14	6CL5	1st Video Amplifier
V15	6AN8	2nd Video Amplifier—Q Phase Splitter
V16	6AN8	Band Pass Amp.—Color Killer
V17	6CB6	Burst Amplifier
V18	6AL5	Phase Det.
V19	6AN8	Reactance Tube—3.58 mc Oscillator
V20	12AT7	Horizontal Phase Splitter
V21	6AN8	I Amplifier—AGC Clamp
V22	6BY6	Q Demodulator
V23	6BY6	I Demodulator
V24	6AN8	I Amplifier—I Phase Splitter
V25	12BH7	Green Adder—Green Output
V26	12BH7	Blue Adder—Blue Output
V27	12BH7	Red Adder—Red Output
V28	6BC7	Green Red Blue DC Restorers
V29	6AN8	AGC Amp—Horiz. Sync Separator
V31	12AT7	Vert. Sync Separator—Sync Clipper
V32	6BL7	Vert. Oscillator—Vert. Output
V33	6AL5	Horizontal Phase Det.
V34	12AU7	Horizontal Oscillator
V35	6CU6	Horizontal Output
V36	6AU4	Damper
V37	3A3	HV Rectifier
V38	3A3	HV Rectifier
V39	3A3	HV Rectifier
V40	6BD4	HV Regulator
V41	6BL7	Convergence sawtooth Gen-Blue conv. Output
V42	6BL7	Green conv. Output—Conv. Cathode Follower
V43	6BL7	Pulse Shaper—Red. Conv. Output
V44	19VP22	Colorton CRT
V46	6CU6	Horizontal Output

Warning – High Voltage
POTENTIALS AS HIGH AS 26,000 VOLTS ARE PRESENT WHEN THIS RECEIVER IS OPERATING. OPERATION OF THE RECEIVER OUTSIDE THE CABINET OR WITH COVERS REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH-VOLTAGE EQUIPMENT.

General

The CBS-Columbia Model 205 is an 82 channel VHF-UHF color television receiver employing a CBS-Hytron 19-inch round, direct-viewing Colortron. The receiver utilizes 44 tubes, 2 selenium rectifiers and 3 crystal diodes.

Features of the receiver include: 205 square-inch picture, CBS-Columbia "360" Full-Fidelity sound system, wide-band color reproduction, regulated high-voltage supply, five-stage picture i-f amplification, stabilized horizontal and vertical sweep circuits, 3.58-mc crystal oscillator with afc, slide-out color tube mount, dual-chassis construction, and conveniently located service controls.

Installation

Antenna
The antenna requirements for color reception are somewhat more critical than for black-and-white reception. In general, outdoor antennas are preferred. The antenna used must have a flat response over the frequency range of the color channel being received, and tbe transmission line must be properly matched to the antenna and the receiver input (300 ohms).

Antenna orientation is more critical. Some antenna positions may provide black-and-white reception but no color reception. The antenna should be oriented for best color reception while receiving a color program. Where several stations are received from different directions an antenna rotator may be required.

Multiple antenna installations, particularly those employing distribution amplifier systems, may not provide satisfactory color reception. If such an installation is to be used, modification of the system may be required.

Many TV boosters do not have sufficient bandwidth for color reception. If a booster is to be used it should be checked to insure adequate results.

An antenna specially designed for color reception is available from your CBS-Columbia Distributor.

Unpacking
The receiver and the color picture tube assembly are shipped in separate cartons. All controls are adjusted and the components on the neck of the picture tube are properly positioned at the factory. To avoid the need for complete adjustment of the receiver, the controls and the CRT components should not be disturbed during the unpacking and installation of the receiver.

The following procedure should be used to prepare the receiver for operation:

1. Remove the receiver and picture tube assembly from their cartons.
2. Remove the cabinet back cover.
3. Remove the staples fastening the CRT cup to the cabinet shelf.
4. Insert the rear end of the cup into the large hole in the back cover, from the front side of the cover. Tap the front edge of the cup with a mallet until it snaps into place.
5. Remove the four bolts fastening the picture-tube assembly to its shipping pallet and discard the pallet.
6. Slide the picture tube assembly carefully into place on the cabinet shelf and position it so that the picture-tube screen is properly centered and flush against the mask.
7. Insert the four bolts removed in step 5 through the slots in the picture-tube mounting board into the holes in the cabinet shelf, and tighten.
8. Insert the Field Neutralizing, Yoke, and Convergence Assembly plugs into their sockets on the deflection chassis. Connect the CRT high-voltage Connector to the deflection chassis high-voltage lead, insert the Video Output plug into its socket on the signal chassis, and fasten the CRT socket to the base of the picture tube.

Initial Adjustment
After the receiver has been unpacked and installed, an initial check of performance should be made to determine whether or not the receiver requires adjustment. The room lighting should be subdued during the performance check.

The following procedure should be used:

1. Connect an antenna to the receiver and apply power.

2. Turn the set on and tune to the channel which provides the strongest signal available.

3. If overload occurs, adjust the AGC control. The customer control panel must be removed to provide access to the AGC control. Removal of the panel is described in steps 4 and 5 of the paragraph on Service Controls.

4. Check the action of the HORIZONTAL HOLD control and adjust the AFC (front of deflection chassis, Fig. 2) if required.

5. Check the size, linearity, and centering, and adjust if necessary.

6. If a drive line (bright vertical line near center of picture) is observed, turn the HORIZONTAL DRIVE control fully clockwise, then counterclockwise until the line just disappears.

7. Adjust the BRIGHTNESS and CONTRAST controls for a normal picture, then rotate the BRIGHTNESS control throughout its range. If variation in picture size is noted at *normal* brightness settings, perform the High-Voltage Adjustment procedure.

Note: The picture size should remain constant over most of the BRIGHTNESS control range. Loss of regulation, (indicated by a sudden increase in picture size) near maximum brightness setting, is normal. The BRIGHTNESS should always be operated within the range of regulation.

8. Adjust the BRIGHTNESS and CONTRAST controls for a normal picture. If two or three severely misregistered color images are observed, adjust the Static Convergence Magnets as described in steps 1 and 2 of the Convergence procedure.

9. Turn the CONTRAST control fully counterclockwise and the BRIGHTNESS control fully clockwise. The raster should be a a uniform dim neutral gray without signs of color contamination.

10. If the entire screen shows a uniform coloring, other than neutral gray, adjust the SCREEN controls (Fig. 2) as described in steps 2, 3 and 4 of the paragraph on White Adjustment.

11. If only portions of the screen show coloring in step 9, turn the CONTRAST, BLUE SCREEN and GREEN SCREEN controls fully counterclockwise and the BRIGHTNESS control fully clockwise. Set the RED SCREEN control for a barely visible red raster and adjust the FIELD NEUTRALIZING control for a pure red raster without signs of color impurity. If a pure red raster cannot be obtained, perform the Purity Adjustment Procedure.

12. Perform the White Adjustment procedure.

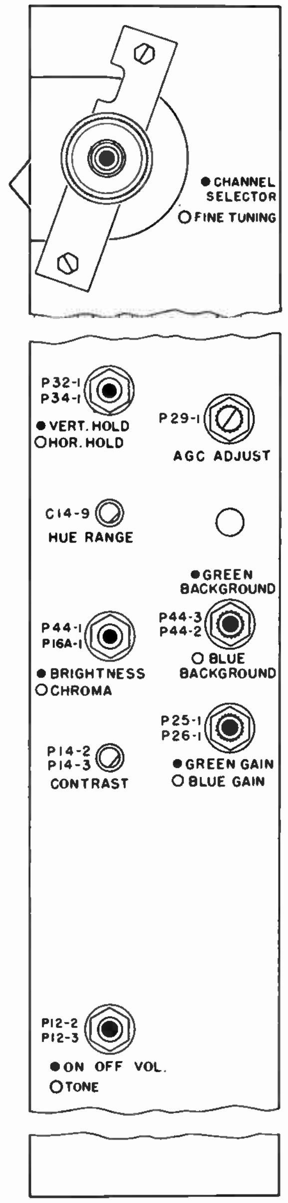


Fig. 1—Signal chassis front controls.

13. Adjust the BRIGHTNESS and CONTRAST controls for a normal picture. If severe misregistration is observed near the edges of the picture, perform the complete Convergence procedure.

14. Tune to a station transmitting a color signal, or a black-and-white signal with a color stripe. The color stripe is a narrow vertical bar (yellowish-green in color) appearing at the left and right edges of the picture. To synchronize the color circuits when receiving the stripe adjust the AFC control (Fig. 2) so that the picture moves to the left, placing the left-hand stripe in the horizontal blanking internal.

15. Adjust the HUE and CHROMA controls for proper hue and saturation.

Service Controls

Access to the service controls and adjustments may be obtained as follows:

1. Remove the cabinet rear cover.

2. Remove the two large bolts located at the upper right and left hand corners of the cabinet back.

3. Pull the cabinet top back about two inches, toward the rear of the cabinet, and lift it off the cabinet.

Note: The receiver is provided with a Top Interlock, located directly above the customer controls. To operate the receiver with the top off, remove the a-c plug from the deflection chassis and apply power directly to the chassis using a space line cord.

4. Remove all front panel knobs.

5. Using a thin screwdriver, unfasten the two clips holding the customer control panel in place and pull the panel away from the cabinet. The clips are located at the bottoms of the holes through which the Channel Selector and Off-On Volume control shafts project.

6. Locate the recessed finger grips on the bottom of the board running across the lower edge of the cabinet front. If the board is held in place by a screw, remove the screw.

7. Grasp the board with both hands and pull it firmly away from the cabinet.

Color Tube Adjustment Procedure

Equipment Required

1. High-Voltage Meter with a full-scale range of at least 50 KV.

2. White Dot Generator. The generator should supply round dots approximately 1/8" in diameter on a 19-inch coolr CRT. The Hickock 650C is a suitable instrument.

3. Off-the-air test pattern, or a linearity bar or cross hatch generator. Most dot generators supply a suitable crosshatch pattern.

4. T-Connector for insertion in the high-voltage lead when making measurements.

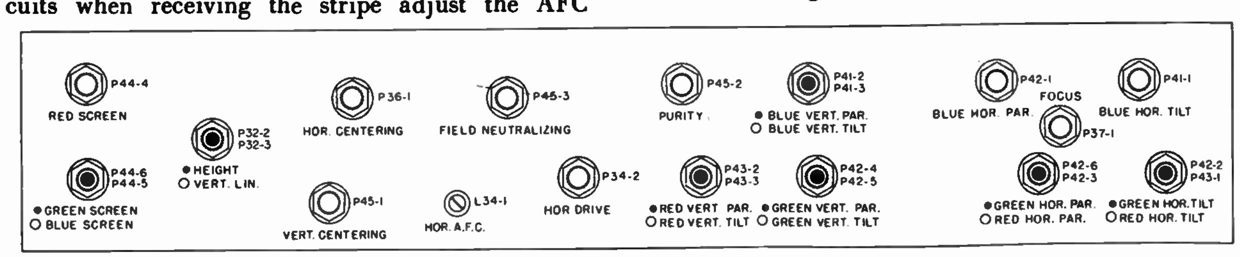


Fig. 2—Deflection chassis front controls.

High-Voltage Adjustment

1. Turn the set off, open the CRT High-Voltage Connector, ("L" in Fig. 3) and insert a T-Connector in the lead.

Caution: To avoid an electrical shock ground the high voltage before touching the lead.

2. Connect a High-Voltage Meter (50 kv range) to the T-Connector.

3. Turn the BRIGHTNESS and CONTRAST controls fully counterclockwise and turn the set on.

4. After allowing sufficient time for the set to warm-up, adjust the HIGH-VOLTAGE REGULATOR control (rear of deflection chassis) for a meter reading of 26 kv.

5. Turn the BRIGHTNESS control up to a high level and note the variation in high-voltage. The voltage should not drop more than 500 volts up to the point where loss of regulation occurs. If the BRIGHTNESS is advanced excessively loss of regulation, indicated by marked picture blooming, will occur. The brightness should always be operated within the range of regulation.

6. Turn the set off and disconnect the High-Voltage Meter.

Color Purity Adjustment

1. Connect a Dot Generator to the receiver antenna terminals.

2. Turn the set on and adjust the FINE TUNING, BRIGHTNESS, CONTRAST and FOCUS controls for a clearly visible dot display.

Note: The room lighting should be subdued during the balance of the procedure. Set the BRIGHTNESS and CONTRAST controls at the lowest levels that give a clearly visible dot pattern.

3. Adjust the RED, GREEN and BLUE SCREEN controls to make the red, green and blue dots on the CRT screen approximately the same size.

4. Check the physical positioning of the Yoke, Convergence Coil Assembly, Purity Magnet (or coil) and the Blue Beam Corrector. The correct positioning of these components is shown in Fig. 3.

Note: If the above components are not properly positioned it may be impossible to set up the CRT correctly.

5. Adjust the Red, Green and Blue Static Convergence Magnets (Fig. 3) and the Blue Beam Corrector ("S" in Fig. 3) to converge (superimpose) the group of dots, (a red, a green and a blue dot) located nearest the center of the screen. See Fig. 4B for adjustment procedure.

6. Turn the CONTRAST control and the GREEN and BLUE SCREEN controls fully counterclockwise,

and turn the BRIGHTNESS and RED SCREEN controls fully clockwise.

7. Set the FIELD NEUTRALIZING control at mid-position.

8. Loosen the Yoke Positioning Screws ("N" in Fig. 3) and slide the Deflection Yoke back toward the base of the CRT as far as possible without touching the Convergence Coil Assembly.

9. Rotate the Purity Magnet (or coil) around the neck of the tube, increasing the field strength in steps, until a large pure red area is obtained in the center of the screen. Disregard the size of the area —adjust for the purest possible red in the *center* of the screen.

Note: If the receiver uses a Purity *Magnet*, the field strength is increased by separating the tabs (H in Fig. 3) on the magnet. If a Purity *Coil* is used the field strength is increased by turning the Purity control clockwise. Use the weakest field that provides satisfactory results.

10. Slide the Deflection Yoke slowly forward on the neck of the tube until the largest uniform red field is obtained on the CRT screen. Lock the Yoke in position.

Note: The rear surface of the Yoke should be perpendicular to the neck of the CRT, and the space between the inner surface of the Yoke and the tube neck should be uniform at all points.

11. If a completely uniform red field is not obtained in the previous step, readjust the Purity Magnet (or coil) slightly. If color contamination still exists at the edges of the screen, adjust the FIELD NEUTRALIZING control to minimize it.

Note: If satisfactory purity cannot be obtained the yoke may be moved slightly out of alignment with the CRT neck to minimize contamination. This should be done only when good purity cannot be obtained as previously described.

12. Turn the RED SCREEN control fully counterclockwise and the GREEN SCREEN control fully clockwise. A uniform green field should be obtained over the entire face of the CRT.

13. Turn the GREEN SCREEN control fully counterclockwise and the BLUE SCREEN control fully clockwise. A uniform blue field should be obtained over the entire face of the CRT.

Note: If neck shadow, due to improper Yoke positioning, or serious color contamination is noted in steps, 13, 14 or 15, repeat the purity adjustment from step 9.

14. Turn the BLUE SCREEN control fully counterclockwise and the RED SCREEN control clockwise until a barely visible red raster is obtained.

15. Turn up the GREEN SCREEN control until the raster turns yellow.

16. Turn up the BLUE SCREEN control until the raster turns a neutral gray (low-brightness white).

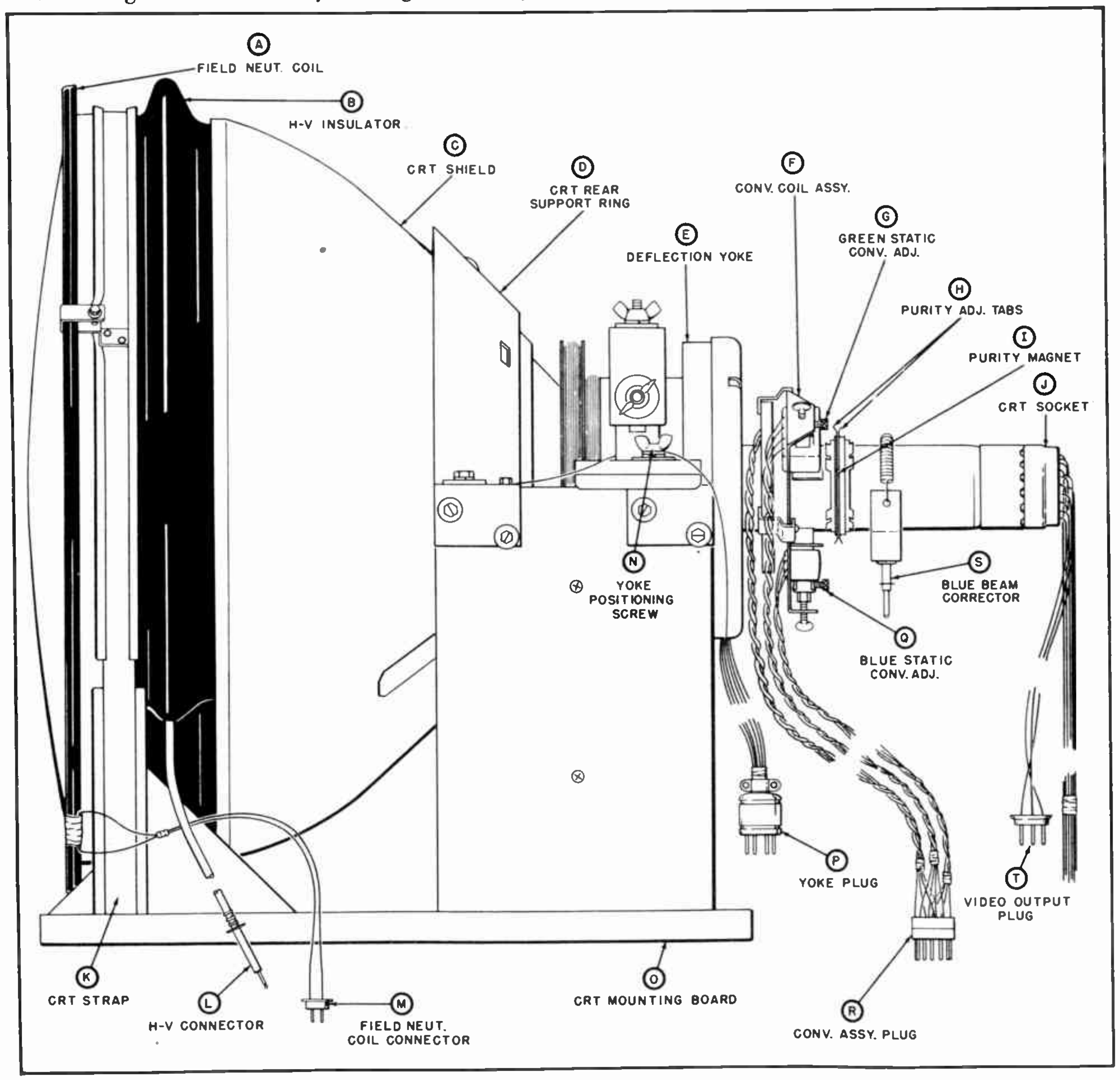


Fig. 3—Picture tube assembly.

Size and Linearity

1. Connect an antenna to the receiver and tune in a station transmitting a test pattern. If a test pattern is not available a suitable bar or crosshatch generator is required for the steps that follow.

2. Adjust the CONTRAST and BRIGHTNESS controls in the normal manner for a black-and-white picture. Disregard any color fringing or contamination in the picture.

3. Adjust the HEIGHT, VERTICAL LINEARITY, and VERTICAL CENTERING controls to provide a linear picture that extends no more than 1/4 inch above and below the mask opening.

4. Adjust the WIDTH, HORIZONTAL CENTERING and HORIZONTAL LINEARITY controls to provide a linear picture that extends no more than 1/4 inch beyond the left and right hand edges of the mask opening.

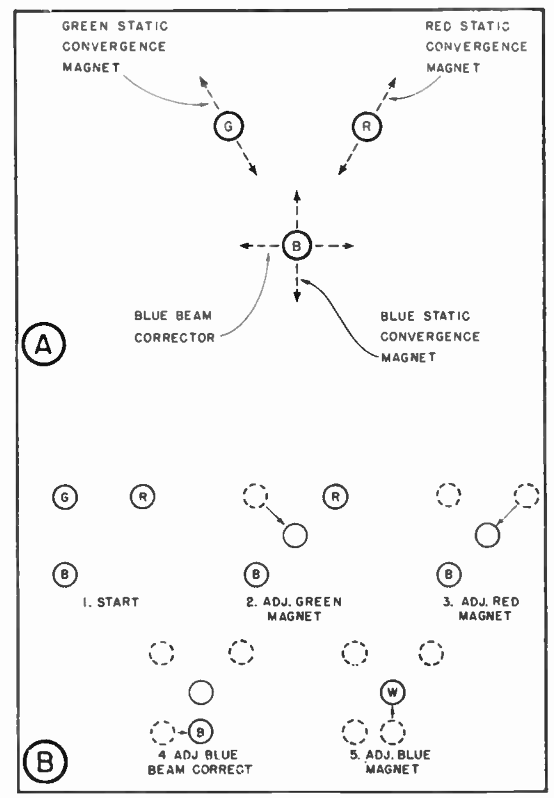


Fig. 4—(A) Motions of the color dots produced by adjustment of the Red, Green, and Blue Static Convergence Magnets. (B) Procedure for converging group of dots using the Static Convergence Magnets and Blue Beam Corrector.

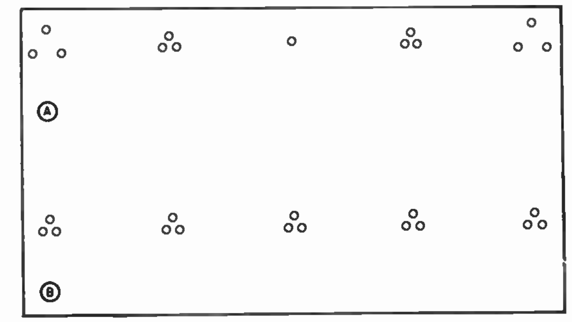


Fig. 5—Dots along horizontal through center of screen, (A) before adjustment of HORIZONTAL PARABOLA and TILT controls and, (B) after proper adjustment of HORIZONTAL PARABOLA and TILT controls.

Convergence Adjustments

1. Connect a Dot Generator to the receiver and adjust the BRIGHTNESS and CONTRAST CONTROLS for a low brightness dot display.

2. Adjust the Red, Green, and Blue Static Convergence Magnets and the Blue Beam Corrector (neck of CRT, Fig. 3) until the group of dots nearest the center of the screen is converged (see Fig. 4B) and forms a single white dot.

Note: The objective in this step and those that follow is to position all of the dots on the screen in the form of small equilateral triangles of uniform size, each consisting of a red, a green and a blue dot, as shown in Figs. 5 and 6.

3. Adjust the RED, GREEN and BLUE HORIZONTAL PARABOLA controls until all of the triangles along a horizontal line through the center of the screen are as uniform in size and shape as possible (see Fig. 5). Adjustment of the HORIZONTAL PARABOLA controls causes the triangles at the left and right edges of the screen to decrease in size and those in the center to increase in size.

Note: The movement of the dots produced by adjustment of each of the PARABOLA and TILT controls is shown in Fig. 7.

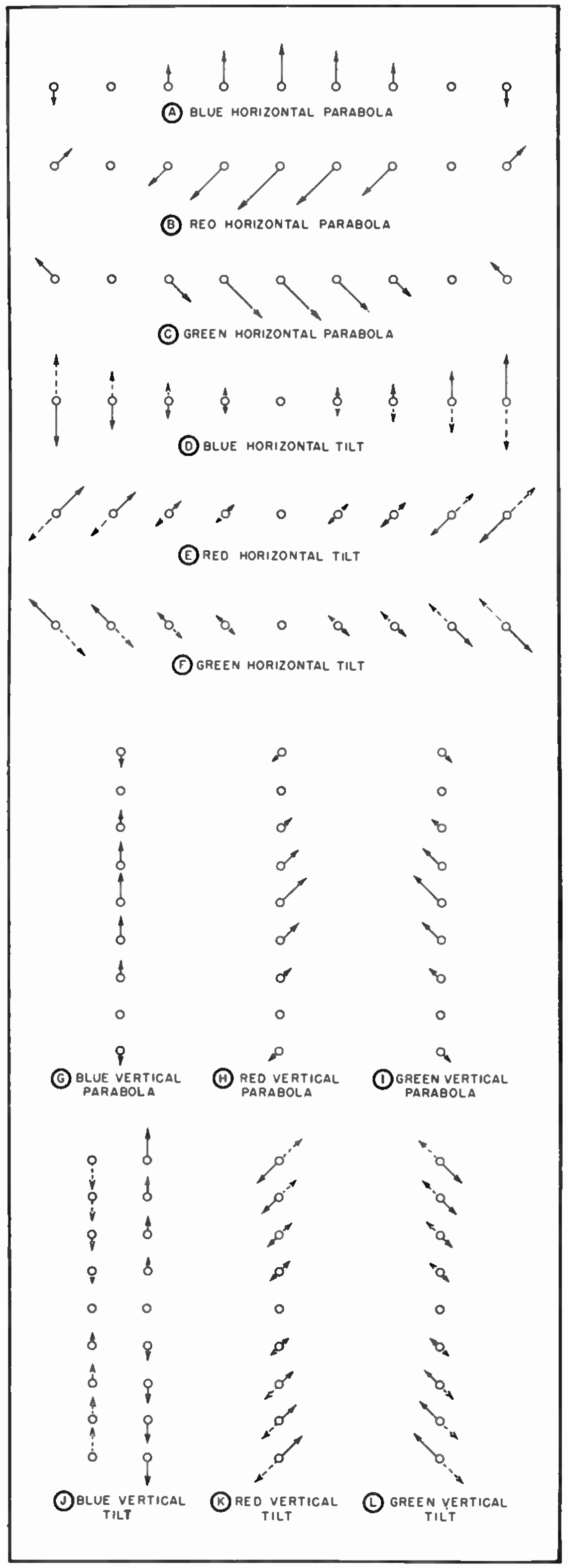


Fig. 7—Motions of colored dots caused by adjustment of PARABOLA and TILT controls. Dotted lines indicate effect of counterclockwise rotation, solid lines indicate effect of clockwise rotation. Effects of PARABOLA controls are shown for rotation from full counterclockwise to full clockwise positions.

4. Adjust the RED, GREEN and BLUE HORIZONTAL TILT controls to eliminate any nonuniformity in the triangles along the horizontal line through the center of the screen. Adjustment of the HORIZONTAL TILT controls increases or decreases the sizes of the triangles at either side of the raster. They have little effect at the center of the screen. After completion of this step, adjust the Red, Green and Blue Static Convergence Magnets to provide approximately 1/16 inch spacing between the dots in each triangular group along the horizontal line.

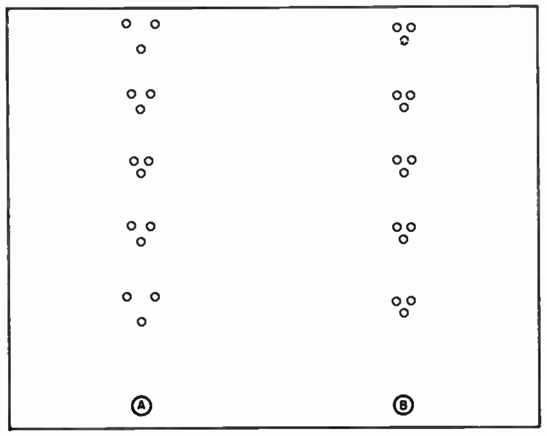


Fig. 6—Dots along vertical line through center of screen, (A) before adjustment of VERTICAL PARABOLA and TILT controls and, (B) after proper adjustment of VERTICAL PARABOLA and TILT controls.

5. Adjust the RED, GREEN and BLUE VERTICAL PARABOLA controls until all of the triangles along a vertical line through the center of the picture are as uniform as possible (see Fig. 6). Adjustment of the VERTICAL PARABOLA controls causes the triangles at the top and bottom of the screen to decrease in size and those in the center to increase in size.

6. Adjust the RED, GREEN and BLUE VERTICAL TILT controls to eliminate any nonuniformity in the triangles along the vertical line through the center of the screen. Adjustment of the VERTICAL TILT controls causes the triangles at the top and bottom of the screen to increase or decrease in size. They have little effect at the center of the screen.

7. The PARABOLA and TILT controls may interact to some extent. As a result, minor readjustment of these controls may be necessary to obtain small, uniform equilateral triangles over as large an area of the screen as possible.

8. Adjust the Red, Green and Blue Static Convergence Magnets, and the Blue Beam Corrector to converge (superimpose) the three dots in the group nearest the center of the screen. Refer to Fig. 4B for adjustment procedure. With this final adjustment all of the groups of three colored dots should converge simultaneously to form white dots.

White Adjustment

1. Connect an antenna to the receiver and tune in a station transmitting a black-and-white program.
2. Turn the CONTRAST, BLUE SCREEN and GREEN SCREEN controls fully counterclockwise.

3. Turn the BRIGHTNESS control fully clockwise and adjust the RED SCREEN control for a barely visible red raster.

4. Turn the GREEN SCREEN control clockwise until the raster turns a greenish-yellow.

5. Turn the BLUE SCREEN control clockwise until the raster turns a neutral gray (low-brightness white).

6. Advance the CONTRAST control to obtain a normal picture.

7. Adjust the BLUE and GREEN GAIN controls until the picture is black-and-white.

8. Turn the BRIGHTNESS control counterclockwise until the picture is just visible and adjust the BLUE and GREEN BACKGROUND controls for neutral gray picture.

9. Run the BRIGHTNESS and CONTRAST controls through their range. If tinting is observed in the picture repeat steps 7 and 8 until it is eliminated.

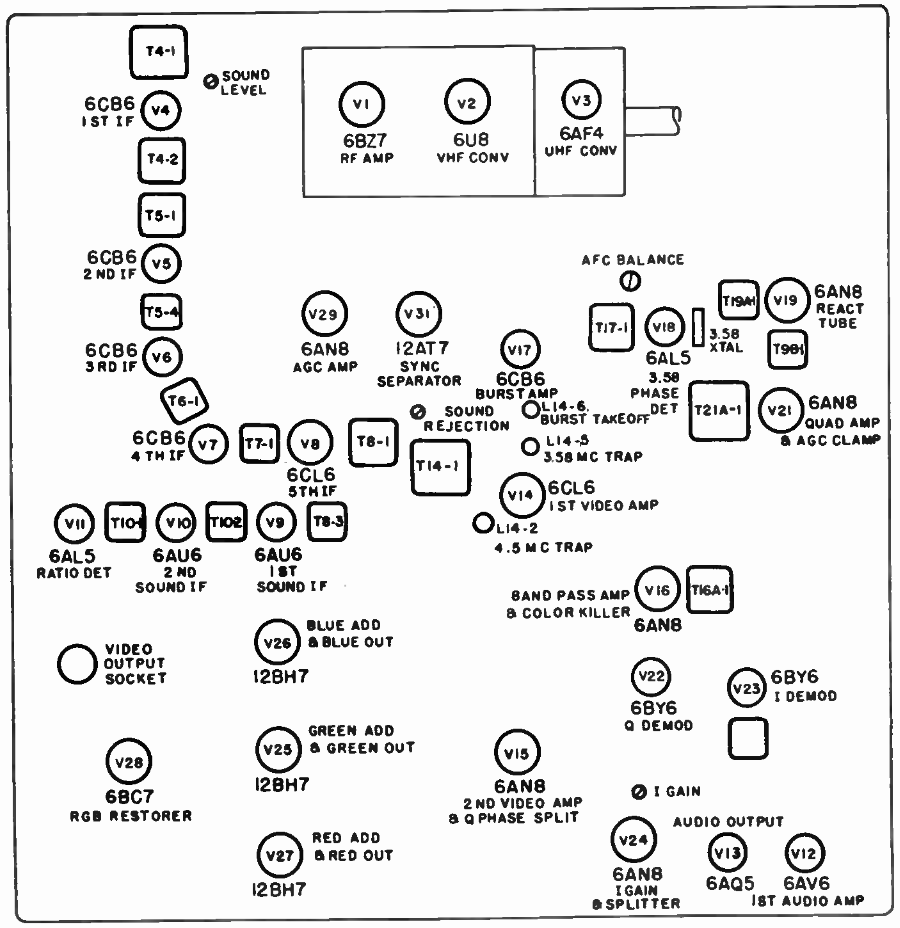


Fig. 8—Top view of signal chassis

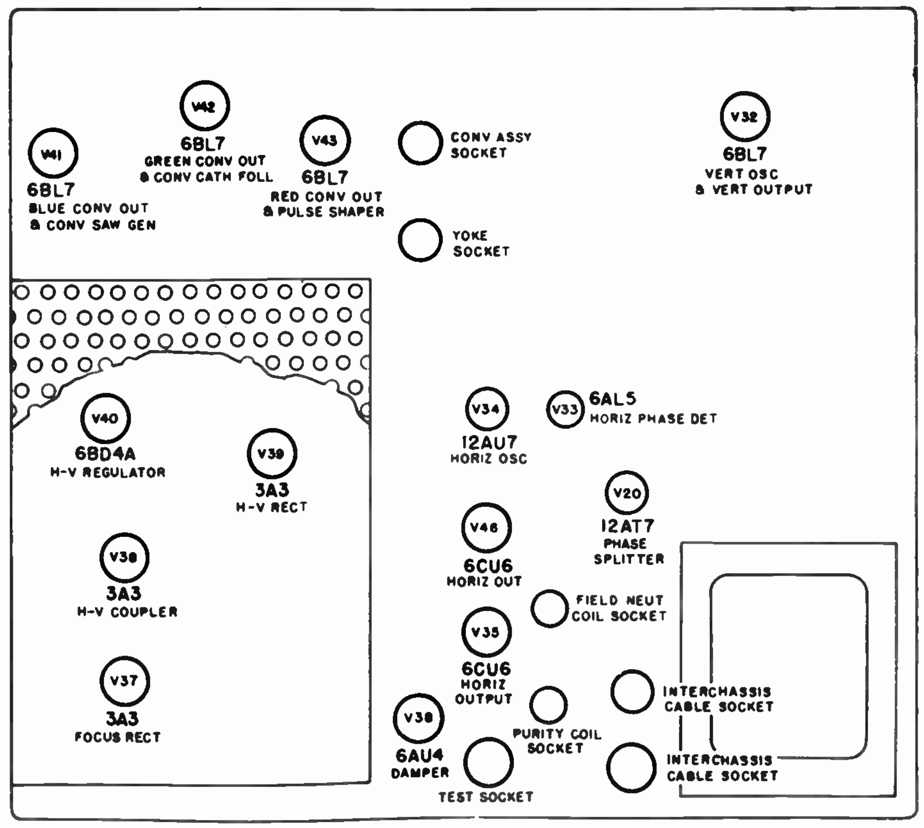
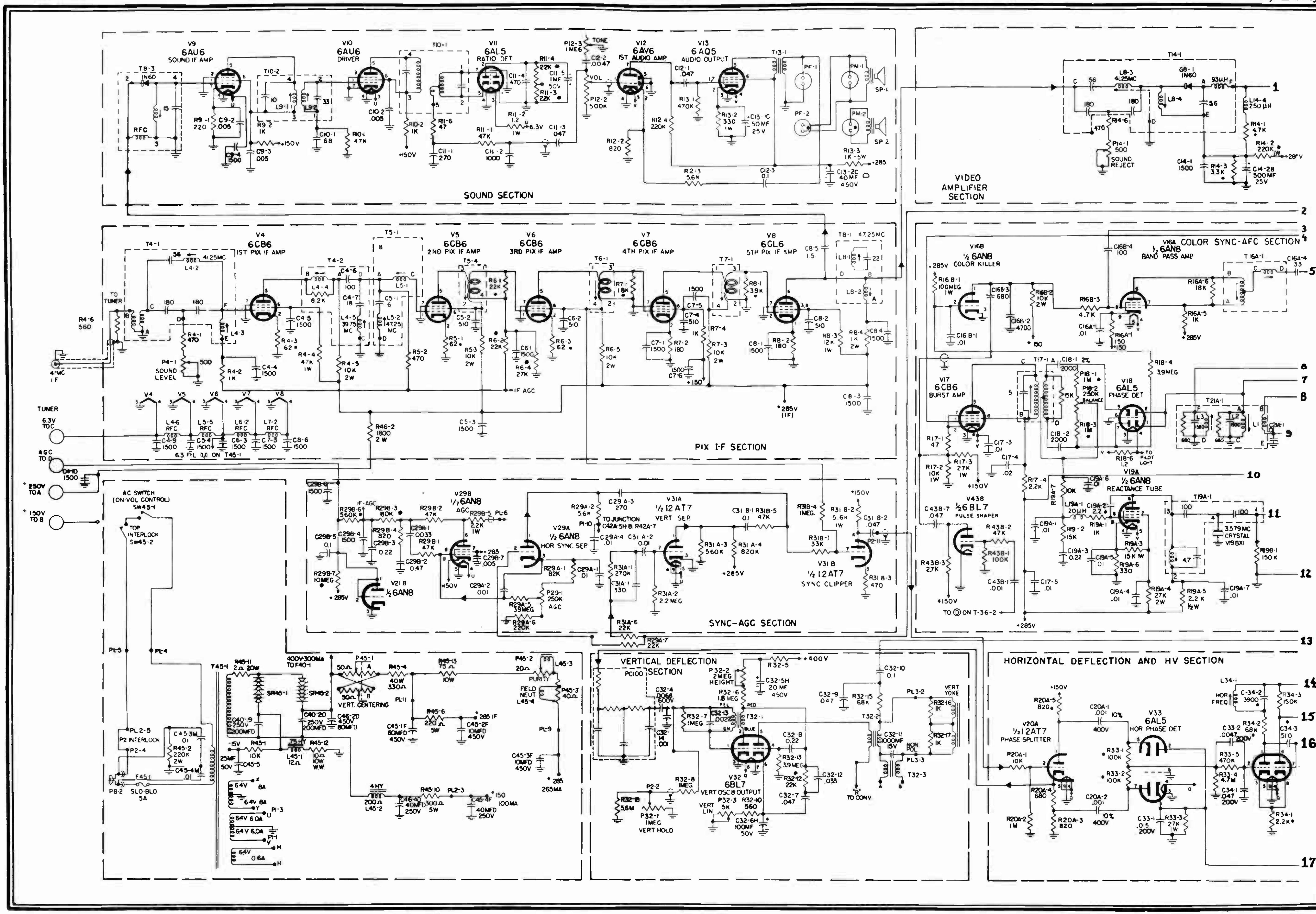
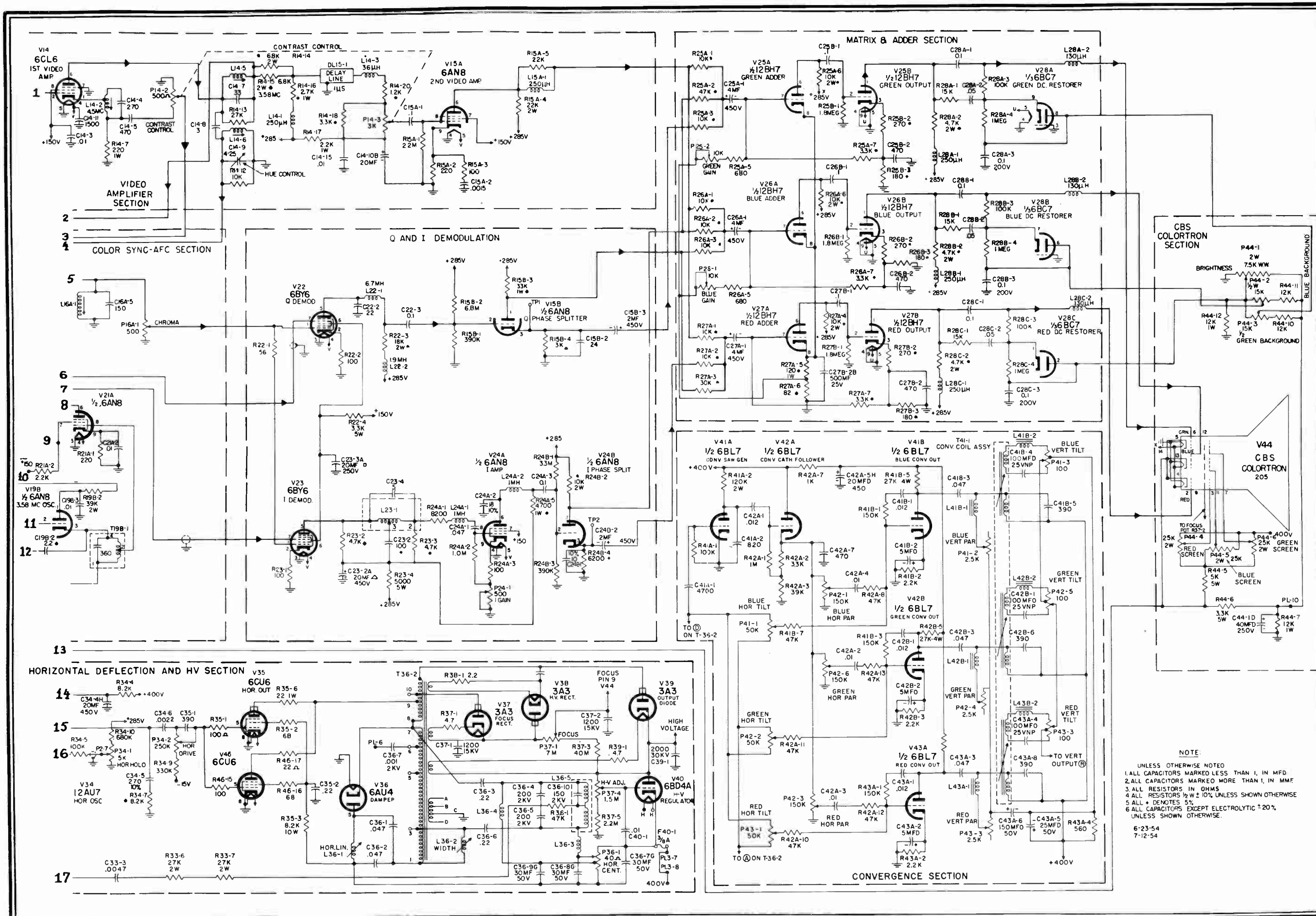
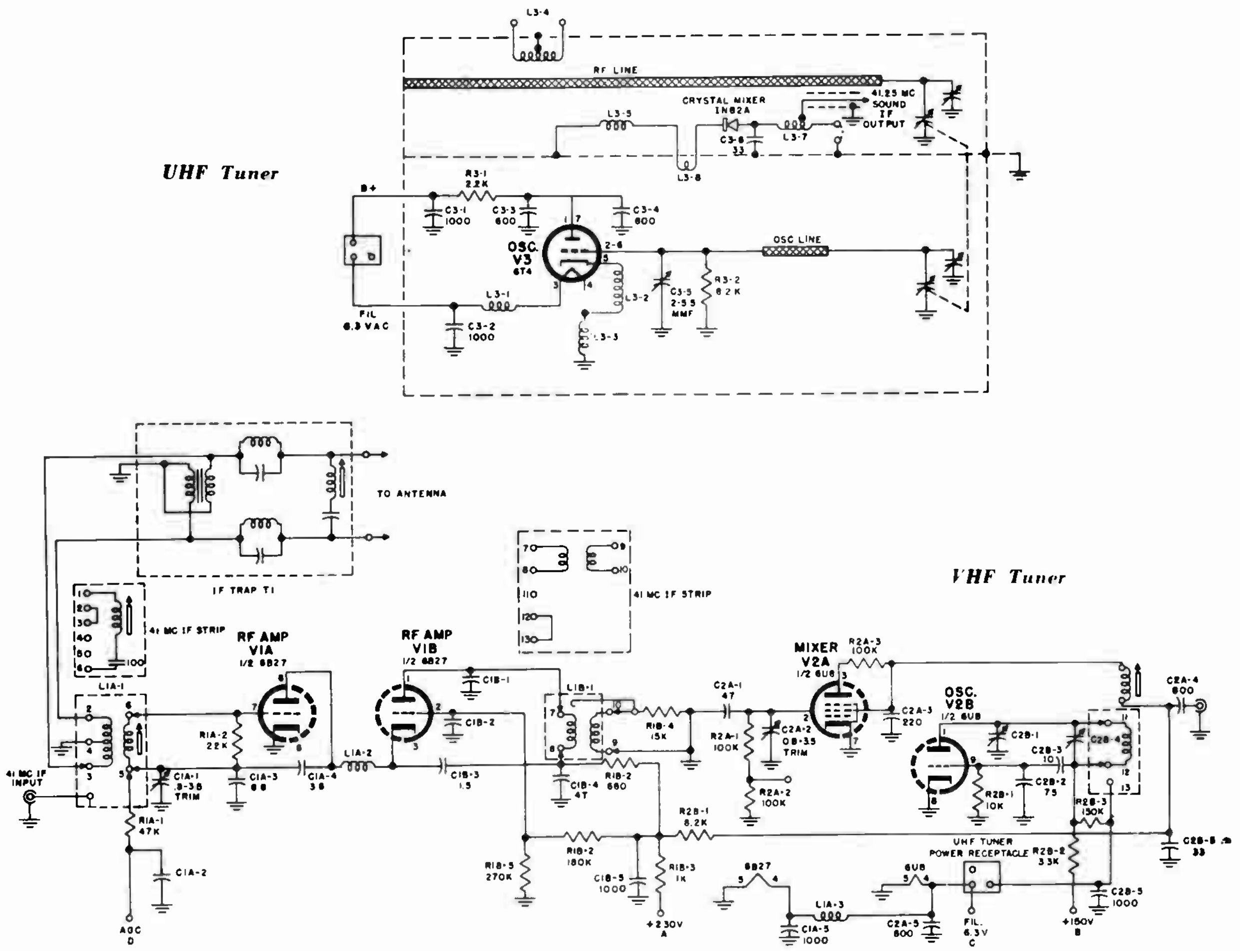


Fig. 9—Top view of deflection chassis


SOUND SECTION
V9 6AU6 SOUND IF AMP
V10 6AU6 DRIVER
V11 6AL5 RATIO DET
V12 6AV6 1ST AUDIO AMP
V13 6AQ5 AUDIO OUTPUT
VIDEO AMPLIFIER SECTION
PIX I-F SECTION
V4 6CB6 1ST PIX IF AMP
V5 6CB6 2ND PIX IF AMP
V6 6CB6 3RD PIX IF AMP
V7 6CB6 4TH PIX IF AMP
V8 6CL6 5TH PIX IF AMP
COLOR SYNC-AFC SECTION
V16B 1/2 6AN8 COLOR KILLER
V16A 1/2 6AN8 BAND PASS AMP
V17 6CB6 BURST AMP
V18 6AL5 PHASE DET
V19A 1/2 6AN8 REACTANCE TUBE
V43B 1/2 6BL7 PULSE SHAPER
SYNC-AGC SECTION
V29B 1/2 6AN8 AGC
V29A 1/2 6AN8 HOR SYNC SEP
V21B 1/2 6AN8
V31A 1/2 12AT7 VERT SEP
V31B 1/2 12AT7 SYNC CLIPPER
VERTICAL DEFLECTION SECTION
V32 6BL7 VERT OSC & OUTPUT
HORIZONTAL DEFLECTION AND HV SECTION
V20A 1/2 12AT7 PHASE SPLITTER
V33 6AL5 HOR PHASE DET
AC SWITCH (ON-VOL CONTROL) SW45-1
TOP INTERLOCK SW45-2
SLO-BLO 5A
VERT. CENTERING
FIELD NEUT L45-4
PURITY
VERT HOLD
3.579 MC CRYSTAL



MODEL 205, Early



PARTS LIST

SYM.	PART NO.	DESCRIPTION
		CAPACITORS
C4-4	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C4-5	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C4-9	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C4-10	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C5-2	23 065 510	Ceramic Disc., 510 mfd 1000V 10% GP
C5-3	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C5-4	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C6-1	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C6-2	23 065 510	Ceramic Disc., 510 mfd 1000V 10% GP
C6-3	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C7-1	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C7-3	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C7-4	23 065 510	Ceramic Disc., 510 mfd 1000V 10% GP
C7-5	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C7-6	23 064 640	Ceramic Disc.. 1500 mfd 1000V GMV
C8-1	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C8-2	23 065 510	Ceramic Disc., 510 mfd 1000V 10% GP
C8-3	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C8-4	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C8-5	23 000 421	Ceramic, 1.5 mmfd
C8-6	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C9-2	23 065 910	Ceramic Disc., .005 mfd 600V GMV
C9-3	23 065 910	Ceramic Disc., .005 mfd 600V GMV
C9-4	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C10-1	23 000 110	Ceramic Tubular, 68 mmfd 500V 10%
C10-2	23 065 910	Ceramic Disc., .005 mfd 600V GMV
C11-1	23 001 670	Ceramic Tubular, 270 mmfd 500V 20%
C11-2	23 000 740	Ceramic Tubular, 1000 mmfd 500V 20%
C11-3	22 016 740	Molded Tubular, .047 mfd 200V 20%
C11-4	23 064 600	Ceramic Disc., 470 mfd 1000V GMV
C11-5	21 000 671	Electrolytic, 1 mfd 50V
C12-1	22 017 240	Molded Tubular, .047 mfd 400V 20%
C12-2	22 017 120	Molded Tubular, .0047 mfd 400V 20%
C12-3	22 016 740	Molded Tubular, .047 mfd 200V 20%
C13-1C	21 000 881	Electrolytic, 50/20/40/20 mfd 25/450/450/250V
C13-2C	21 000 881	Electrolytic, 40/20/50/20 mfd 450/250/25/450V
C14-1	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C14-2B	21 000 881	Electrolytic, 500/500/20 mfd 25/25/450V
C14-3	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C14-4	20 001 370	Mica, 270 mmfd 500V 5%
C14-5	20 004 000	Mica, 470 mmfd 500V 10%
C14-7	23 061 170	Ceramic Disc., 33 mmfd 1000V 5% NPO
C14-8	23 060 760	Ceramic Disc., 3 mmfd 1000V 10% NPO
C14-9	26 000 141	Air Variable, 4-25 mmfd
C14-10B	21 000 881	Electrolytic, 20/500/500 mfd 450/25/25V
C14-11	23 064 640	Ceramic Disc., 1500 mmfd 1000V GMV
C14-15	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C15A-1	22 017 280	Molded Tubular, .1 mfd 400V 20%
C15A-2	22 017 060	Molded Tubular, .0015 mfd 400V 20%
C15B-2	23 060 840	Ceramic Disc., 24 mmfd 1000V 10% NPO
C15B-3	21 000 672	Electrolytic, 2 mfd 450V
C16A-1	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C16A-4	23 061 170	Ceramic Disc., 33 mmfd 1000V 5% NPO
C16A-5	20 003 370	Mica, 150 mmfd 500V 10%
C16B-1	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C16B-2	22 017 160	Molded Tubular, .01 mfd 400V 20%
C16B-3	22 017 580	Molded Tubular, .0022 mfd 600V 20%
C16B-4	20 003 830	Mica, 100 mmfd 500V 10%
C17-2	21 000 672	Electrolytic, 2 mfd 450V
C17-3	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C17-4	23 065 930	Ceramic Disc., .02 mfd 600V GMV
C17-5	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C18-1	20 013 640	Silver Mica, 2000 mmfd 500V 2%
C18-2	20 013 640	Silver Mica, 2000 mmfd 500V 2%
C19A-1	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C19A-2	23 061 050	Ceramic Disc., 2 mmfd 1000V 5% NPO
C19A-3	22 016 820	Molded Tubular, .22 mfd 200V 20%
C19A-4	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C19A-5	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C19A-6	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C19A-7	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C19B-2	23 061 050	Ceramic Disc., 2 mmfd 1000V 5% NPO
C19B-3	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C20A-1	22 008 040	Molded Tubular, .001 mfd 400V 10%
C20A-2	22 008 040	Molded Tubular, .001 mfd 400V 10%
C21A-1	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C21A-2	23 065 920	Ceramic Disc., .01 mfd 600V GMV
C22-2	23 061 130	Ceramic Disc., 22 mmfd 1000V 5% NPO
C22-3	22 017 280	Molded Tubular, 1 mfd 400V 20%
C23-2A	21 000 881	Electrolytic, 20/40/20/50 mfd 450/450/250/25V
C23-2	23 005 120	Ceramic Tubular, 100 mmfd 500V 5%
C23-3A	21 000 881	Electrolytic, 20/50/20/40 mfd 250/25/450/450V
C23-4	23 061 070	Ceramic Disc., 5 mmfd 1000V 5% NPO
C24A-1	22 017 240	Molded Tubular, .047 mfd 200V 20%
C24A-2	23 060 810	Ceramic Disc., 18 mmfd 1000V 10% NPO
C24A-3	22 017 280	Molded Tubular, 1 mfd 400V 20%
C24B-1	23 060 780	Ceramic Disc., 10 mmfd 1000V 10% NPO
C24B-2	21 000 672	Electrolytic, 2 mfd 450V
C25A-1	21 000 673	Electrolytic, 4 mfd 450V
C25B-1	22 017 280	Molded Tubular, 1 mfd 400V 20%
C25B-2	20 004 000	Mica, 470 mfd 500V 10%
C26A-1	21 000 673	Electrolytic, 4 mfd 450V
C26B-1	22 017 280	Molded Tubular, .1 mfd 400V 20%
C26B-2	20 004 000	Mica, 470 mmfd 500V 10%
C27A-1	21 000 673	Electrolytic, 4 mfd 450V
C27B-1	22 017 280	Molded Tubular, .1 mfd 400V 20%
C27B-2	20 004 000	Mica, 470 mmfd 500V 10%
C27B-2B	21 000 871	Electrolytic, 500/20/500 mmfd 25/450/25V
C28A-1	22 017 280	Molded Tubular, .1 mfd 400V 20%
C28A-2	22 017 240	Molded Tubular, .047 mfd 400V 20%
C28A-3	22 016 780	Molded Tubular, .1 mfd 200V 20%
C28B-1	22 017 280	Molded Tubular, .1 mfd 400V 20%
C28B-2	22 017 240	Molded Tubular, .047 mfd 400V 20%
C28B-3	22 016 780	Molded Tubular, .1 mfd 200V 20%
C28C-1	22 017 280	Molded Tubular, .1 mfd 400V 20%
C28C-2	22 017 240	Molded Tubular, .047 mfd 200V 20%
C28C-3	22 016 780	Molded Tubular, .1 mfd 200V 20%
C29A-1	23 065 920	Molded Tubular, .01 mfd 600V GMV
C29A-2	22 017 040	Molded Tubular, .001 mfd 400V 20%
C29A-3	23 001 670	Ceramic Tubular, 270 mmfd 500V 20%
C29A-4	23 065 920	Ceramic Disc., .01 mmf 600V GMV
C29B-1	22 017 100	Molded Tubular, .0033 mfd 400V 20%
C29B-2	22 016 840	Molded Tubular, .47 mfd 200V 20%
C29B-3	22 016 820	Molded Tubular, .22 mfd 200V 20%
C29B-4	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C29B-5	22 017 280	Molded Tubular, .1 mfd 400V 20%
C29B-6	23 064 640	Ceramic Disc., 1500 mfd 1000V GMV
C29B-7	23 065 910	Ceramic Disc., .005 mfd 600V GMV
C31A-1	20 003 960	Mica, 330 mmfd 500V 10%
C31A-2	22 017 160	Molded Tubular, .01 mfd 400V 20%
C31A-3	23 065 920	Ceramic Disc., .01 mfd 1000V GMV
C31B-1	22 017 280	Molded Tubular, .1 mfd 400V 20%
C31B-2	22 017 240	Molded Tubular, .047 mfd 400V 20%
C32-4	22 008 640	Molded Tubular, .0068 mfd 600V 10%
C32-5H	21 000 931	Electrolytic, 20/20/20/100 mfd 450/450/450/50V
C32-6H	21 000 931	Electrolytic, 100/20/20/20 mfd 50/450/450/450V
C32-7	22 017 740	Molded Tubular, .047 mfd 600V 20%
C32-8	22 017 820	Molded Tubular, .22 mfd 600V 20%
C32-9	22 017 240	Molded Tubular, .047 mfd 400V 20%
C32-10	22 017 780	Molded Tubular, .1 mfd 600V 20%
C32-11	21 000 961	Electrolytic, 1000 mfd 15V NP
C32-12	22 011 720	Molded Tubular, .033 mfd 400V 20%
C32-13	22 017 580	Molded Tubular, .0022 mfd 600V 20%
C32-14	22 017 540	Molded Tubular, .001 mfd 600V 20%
C33-1	22 016 680	Molded Tubular, .015 mfd 200V 20%
C33-2	22 016 620	Molded Tubular, .0047 mfd 200V 20%
C33-3	23 000 631	Ceramic Disc., .0047 mfd 1.5 KV 20%
C34-1	22 016 740	Molded Tubular, .047 mfd 200V 20%
C34-2	20 012 520	Mica, 3900 mmfd 500V 5%
C34-3	20 005 120	Mica, 510 mmfd 500V 5%
C34-4H	21 000 931	Electrolytic, 20/100/20/20 mfd 450/50/450/450V
C34-5	20 003 440	Mica, 270 mfd 500V 10%
C34-6	22 017 580	Molded Tubular, .0022 mfd 600V 20%
C35-1	20 003 480	Mica, 390 mmfd 500V 10%
C35-2	22 017 820	Molded Tubular, .22 mfd 600V 20%
C36-1	22 017 740	Molded Tubular, .047 mfd 600V 20%
C36-2	22 017 740	Molded Tubular, .047 mfd 600V 20%
C36-3	22 017 820	Molded Tubular, .22 mfd 600V 20%
C36-4	20 030 800	Mica, 200 mmfd 2 KV 10%
C36-5	20 030 800	Mica, 200 mmfd 2 KV 10%
C36-6	22 017 820	Molded Tubular, .22 mfd 600V 20%
C36-7	23 000 521	Ceramic Disc., .001 mfd 2 KV 10%
C36-7G	21 000 921	Electrolytic, 30/30/30 mfd 50/50/50V
C36-8G	21 000 921	Electrolytic, 30/30/30 mfd 50/50/50V
C36-9G	21 000 921	Electrolytic, 30/30/30 mfd 50/50/50V
C37-1	23 000 151	Ceramic, 1200 mmfd 15 KV
C37-2	23 000 151	Ceramic, 1200 mmfd 15 KV
C38-1	23 000 181	Ceramic, 1200 mmfd 15 KV
C39-1	23 000 161	Ceramic, 2000 mmfd 30 KV
C40-1	22 017 660	Molded Tubular, .01 mfd 600V 20%
C40-19	21 000 901	Electrolytic, 200 mfd 250V
C40-20	21 000 901	Electrolytic, 200 mfd 250V
C41A-1	22 017 620	Molded Tubular, .0047 mfd 600V 20%
C41A-2	20 005 170	Mica, 820 mmfd 500V 5%
C41B-1	22 015 170	Molded Tubular, .012 mfd 600V 10%
C41B-2	21 000 941	Electrolytic, 5 mfd 25V
C41B-3	22 017 740	Molded Tubular, .047 mfd 600V 20%
C41B-4	21 000 971	Electrolytic, 100 mfd 25V NP
C41B-5	20 003 480	Mica, 390 mmfd 500V 10%
C42A-1	22 015 170	Molded Tubular, .012 mfd 600V 10%
C42A-2	22 017 660	Molded Tubular, .01 mfd 600V 20%
C42A-3	22 017 660	Molded Tubular, .01 mfd 600V 20%
C42A-4	22 017 660	Molded Tubular, .01 mfd 600V 20%
C42A-5H	21 000 931	Electrolytic, 20/20/100/20 mfd 450/450/50/450V
C42A-7	20 001 900	Mica, 470 mfd 500V 20%
C42B-1	22 015 170	Molded Tubular, .012 mfd 600V 10%
C42B-2	21 000 941	Electrolytic, 5 mfd 25V
C42B-3	22 017 740	Molded Tubular, .047 mfd 600V 20%
C42B-5	20 003 480	Mica, 390 mmfd 500V 10%
C42B-6	21 000 971	Electrolytic, 100 mfd 25V NP
C43A-1	22 015 170	Molded Tubular, .012 mfd 600V 10%
C43A-2	21 000 941	Electrolytic, 5 mfd 25V
C43A-3	22 017 740	Molded Tubular, .047 mfd 600V 20%
C43A-4	21 000 971	Electrolytic, 100 mfd 25V NP
C43A-5	21 000 677	Electrolytic, 25 mfd 50V
C43A-6	21 000 951	Electrolytic, 150 mfd 50V
C43A-8	20 003 480	Mica, 390 mmfd 500V 10%
C43B-1	22 014 540	Molded Paper, .001 mfd 400V 10%
C43B-2	22 014 740	Molded Paper, .047 mfd 400V 10%
C44-1D	21 000 911	Electrolytic, 40/80/40 mfd 250/450/250V
C45-1F	21 000 891	Electrolytic, 60/40/10/ mfd 450/250/450/450V
C45-2F	21 000 891	Electrolytic, 10/10/60/40 mfd 450/450/450/250V
C45-3M	23 000 511	Ceramic, .01 mfd 1400V
C45-3F	21 000 891	Electrolytic, 10/60/40/10 mfd 450/450/250/450V
C45-4F	21 000 891	Electrolytic, 40/10/10/60 mfd 250/450/450/450V
C45-4M	23 000 511	Ceramic, .01 mfd 1400V
C45-5	21 000 677	Electrolytic, 25 mfd 50V
C46-2D	21 000 911	Electrolytic, 40/40/80 mfd 250/250/450V
C46-4D	21 000 911	Electrolytic, 40/40/80 mfd 250/250/450V
		RESISTORS
R4-1	30 331 230	Carbon, 330 ohm ½W 10%
R4-2	30 102 230	Carbon, 1K ohm ½W 10%
R4-3	30 620 130	Carbon, 62 ohm ½W 5%
R4-4	30 473 240	Carbon, 47K ohm 1W 10%
R4-5	30 103 250	Carbon, 10K ohm 2W 10%
R4-6	30 561 230	Carbon, 560 ohm ½W 10%
R5-1	30 620 130	Carbon, 62 ohm ½W 5%
R5-2	30 471 230	Carbon, 470 ohm ½W 10%
R5-3	30 103 250	Carbon, 10K ohm 2W 10%
R6-1	30 223 130	Carbon, 22K ohm ½W 5%
R6-2	30 223 130	Carbon, 22K ohm ½W 5%
R6-3	30 620 130	Carbon, 62 ohm ½W 5%
R6-4	30 273 130	Carbon, 27K ohm ½W 5%
R6-5	30 103 250	Carbon, 10K ohm 2W 10%
R7-1	30 183 130	Carbon, 18K ohm ½W 5%
R7-2	30 181 230	Carbon, 180 ohm ½W 10%
R7-3	30 103 250	Carbon, 10K ohm 2W 10%
R7-4	30 102 230	Carbon, 1K ohm ½W 10%
R8-1	30 392 130	Carbon, 3.9K ohm ½W 5%
R8-2	30 181 230	Carbon, 180 ohm ½W 10%
R8-3	30 123 240	Carbon, 12K ohm 1W 10%
R8-4	30 102 250	Carbon, 1K ohm 2W 10%
R9-1	30 221 230	Carbon, 220 ohm ½W 10%
R9-2	30 102 230	Carbon, 1K ohm ½W 10%
R10-1	30 473 230	Carbon, 47K ohm ½W 10%
R10-2	30 102 230	Carbon, 1K ohm ½W 10%
R11-1	30 473 230	Carbon, 47K ohm ½W 10%
R11-2	30 000 061	Carbon, 1.2 ohm 1W 10%
R11-3	30 223 130	Carbon, 22K ohm ½W 5%
R11-4	30 223 130	Carbon, 22K ohm ½W 5%
R11-6	30 470 230	Carbon, 47 ohm ½W 10%
R12-2	30 821 230	Carbon, 820 ohm ½W 10%
R12-3	30 562 230	Carbon, 5.6K ohm ½W 10%
R12-4	30 224 230	Carbon, 220 ohm ½W 10%
R13-1	30 474 230	Carbon, 470K ohm ½W 10%
R13-2	30 331 240	Carbon, 330 ohm 1W 10%
R13-3	31 000 074	Wirewound, 1K ohm 5W 10%
R14-1	30 472 130	Carbon, 4.7K ohm ½W 5%

SYM.	PART NO.	DESCRIPTION
R14-2	30 224 140	Carbon, 220K ohm 1W 5%
R14-3	30 332 130	Carbon, 3.3K ohm ½W 5%
R14-6	30 331 230	Carbon, 470 ohm ½W 10%
R14-7	30 221 240	Carbon, 220 ohm 1W 10%
R14-12	30 103 230	Carbon, 10K ohm ½W 10%
R14-13	30 273 230	Carbon, 27K ohm ½W 10%
R14-14	30 682 150	Carbon, 6.8K ohm 2W 5%
R14-15	30 682 150	Carbon, 6.8K ohm 2W 5%
R14-16	30 272 140	Carbon, 2.7K ohm 1W 5%
R14-17	30 222 240	Carbon, 2.2K ohm 1W 10%
R14-18	30 332 130	Carbon, 3.3K ohm ½W 5%
R14-20	30 122 130	Carbon, 1.2K ohm ½W 5%
R15A-1	30 225 230	Carbon, 2.2 megohm ½W 10%
R15A-2	30 221 230	Carbon, 220 ohm ½W 10%
R15A-3	30 101 230	Carbon, 100 ohm ½W 10%
R15A-4	30 223 250	Carbon, 22K ohm 2W 10%
R15A-5	30 223 230	Carbon, 22K ohm ½W 10%
R15B-1	30 394 230	Carbon, 390K ohm ½W 10%
R15B-2	30 685 230	Carbon, 6.8 megohm ½W 10%
R15B-3	30 333 140	Carbon, 33K ohm 1W 5%
R15B-4	30 302 130	Carbon, 3K ohm ½W 5%
R16A-1	30 151 230	Carbon, 150 ohm ½W 10%
R16A-5	30 102 230	Carbon, 1K ohm ½W 10%
R16A-6	30 183 230	Carbon, 18K ohm ½W 10%
R16B-1	30 000 751	Carbon, 100 megohm 1W 10%
R16B-2	30 273 240	Carbon, 27K ohm 1W 10%
R16B-3	30 822 230	Carbon, 8.2K ohm ½W 10%
R17-1	30 221 230	Carbon, 220 ohm ½W 10%
R17-2	30 123 230	Carbon, 12K ohm ½W 10%
R17-3	30 224 230	Carbon, 22K ohm ½W 10%
R17-4	30 222 230	Carbon, 2.2K ohm ½W 10%
R18-1	30 105 130	Carbon, 1 megohm ½W 5%
R18-3	30 105 130	Carbon, 1 megohm ½W 5%
R18-4	30 395 230	Carbon, 3.9 megohm ½W 10%
R18-6	30 000 061	Carbon, 1.2 ohm 1W 10%
R18-7	30 153 230	Carbon, 15K ohm ½W 10%
R19A-1	30 102 230	Carbon, 1K ohm ½W 10%
R19A-2	30 153 230	Carbon, 15K ohm ½W 10%
R19A-3	30 153 240	Carbon, 15K ohm 1W 10%
R19A-4	30 273 250	Carbon, 27K ohm 2W 10%
R19A-5	30 222 230	Carbon, 2.2K ohm ½W 10%
R19A-6	30 331 230	Carbon, 330 ohm ½W 10%
R19A-7	30 103 230	Carbon, 10K ohm ½W 10%
R19B-1	30 154 230	Carbon, 150K ohm ½W 10%
R19B-2	30 393 250	Carbon, 39K ohm 2W 10%
R20A-1	30 103 230	Carbon, 10K ohm ½W 10%
R20A-2	30 105 230	Carbon, 1 megohm ½W 10%
R20A-3	30 821 130	Carbon, 820 ohm ½W 5%
R20A-4	30 681 230	Carbon, 680 ohm ½W 10%
R20A-5	30 821 130	Carbon, 820 ohm ½W 5%
R21A-1	30 221 230	Carbon, 220 ohm ½W 10%
R21A-2	30 222 230	Carbon, 2.2K ohm ½W 10%
R22-1	30 560 230	Carbon, 56 ohm ½W 10%
R22-2	30 101 230	Carbon, 100 ohm ½W 10%
R22-3	30 183 150	Carbon, 18K ohm 2W 5%
R22-4	31 000 493	Wirewound, 3.3K ohm 5W 10%
R23-1	30 101 230	Carbon, 100 ohm ½W 10%
R23-2	30 472 130	Carbon, 4.7K ohm ½W 5%
R23-3	30 472 130	Carbon, 4.7K ohm ½W 5%
R23-4	31 000 492	Wirewound, 5K ohm 5W 10%
R24A-1	30 822 230	Carbon, 8.2K ohm ½W 10%
R24A-2	30 105 230	Carbon, 1 megohm ½W 10%
R24A-3	30 101 230	Carbon, 100 ohm ½W 10%
R24A-5	30 472 140	Carbon, 4.7K ohm 1W 5%
R24B-1	30 335 230	Carbon, 3.3 megohm ½W 10%
R24B-2	30 103 150	Carbon, 10K ohm 2W 5%
R24B-3	30 394 230	Carbon, 390K ohm ½W 10%
R24B-4	30 622 130	Carbon, 6.2K ohm ½W 5%
R24A-1	30 103 130	Carbon, 10K ohm ½W 5%
R25A-2	30 473 130	Carbon, 47K ohm ½W 5%
R25A-3	30 103 130	Carbon, 10K ohm ½W 5%
R25A-5	30 681 230	Carbon, 680 ohm ½W 10%
R25A-6	30 103 150	Carbon, 10K ohm 2W 5%
R25A-7	30 332 130	Carbon, 3.3K ohm ½W 5%
R25B-1	30 185 230	Carbon, 1.8 megohm ½W 10%
R25B-2	30 271 130	Carbon, 270 ohm ½W 5%
R25B-3	30 181 130	Carbon, 180 ohm ½W 5%
R26A-1	30 103 130	Carbon, 10K ohm ½W 5%
R26A-2	30 103 130	Carbon, 10K ohm ½W 5%
R26A-3	30 103 130	Carbon, 10K ohm ½W 5%
R26A-5	30 681 230	Carbon, 680 ohm ½W 10%
R26A-6	30 103 150	Carbon, 10K ohm 2W 5%
R26A-7	30 332 130	Carbon, 3.3K ohm ½W 5%
R26B-1	30 185 230	Carbon, 1.8 megohm ½W 10%
R26B-2	30 271 130	Carbon, 270 ohm ½W 5%
R26B-3	30 181 130	Carbon, 180 ohm ½W 5%
R27A-1	30 103 130	Carbon, 10K ohm ½W 5%
R27A-2	30 103 130	Carbon, 10K ohm ½W 5%
R27A-3	30 303 130	Carbon, 30K ohm ½W 5%
R27A-4	30 103 150	Carbon, 10K ohm 2W 5%
R27A-5	30 121 140	Carbon, 120 ohm 1W 5%
R27A-6	30 820 130	Carbon, 82 ohm ½W 5%
R27A-7	30 332 130	Carbon, 3.3K ohm ½W 5%
R27B-1	30 185 230	Carbon, 1.8 megohm ½W 10%

SYM.	PART NO.	DESCRIPTION
R27B-2	30 271 130	Carbon, 270 ohm ½W 5%
R27B-3	30 181 130	Carbon, 180 ohm ½W 5%
R28A-1	30 153 230	Carbon, 15K ohm ½W 10%
R28A-2	30 472 150	Carbon, 4.7K ohm 2W 5%
R28A-3	30 104 230	Carbon, 100K ohm ½W 10%
R28A-4	30 105 230	Carbon, 1 megohm ½W 10%
R28B-1	30 153 230	Carbon, 15K ohm ½W 10%
R28B-2	30 472 150	Carbon, 4.7K ohm 2W 5%
R28B-3	30 104 230	Carbon, 100K ohm ½W 10%
R28B-4	30 105 230	Carbon, 1 megohm ½W 10%
R28C-1	30 153 230	Carbon, 15K ohm ½W 10%
R28C-2	30 472 150	Carbon, 4.7K ohm 2W 5%
R28C-3	30 104 230	Carbon, 100K ohm ½W 10%
R28C-4	30 105 230	Carbon, 1 megohm ½W 10%
R29A-1	30 823 230	Carbon, 82K ohm ½W 10%
R29A-2	30 562 230	Carbon, 5.6K ohm ½W 10%
R29A-5	30 395 230	Carbon, 3.9 megohm ½W 10%
R29A-6	30 224 230	Carbon, 220K ohm ½W 10%
R29A-7	30 223 230	Carbon, 22K ohm ½W 10%
R29B-1	30 473 230	Carbon, 47K ohm ½W 10%
R29B-2	30 473 230	Carbon, 47K ohm ½W 10%
R29B-3	30 184 130	Carbon, 180K ohm ½W 5%
R29B-4	30 821 230	Carbon, 820 ohm ½W 10%
R29B-5	30 222 240	Carbon, 2.2K ohm 1W 10%
R29B-6	30 564 130	Carbon, 560K ohm ½W 5%
R29B-7	30 475 130	Carbon, 4.7 megohm ½W 5%
R31A-1	30 274 230	Carbon, 270K ohm ½W 10%
R31A-2	30 225 230	Carbon, 2.2 megohm ½W 10%
R31A-3	30 564 230	Carbon, 560K ohm ½W 10%
R31A-4	30 824 230	Carbon, 820K ohm ½W 10%
R31A-6	30 223 230	Carbon, 22K ohm ½W 10%
R31B-1	30 333 230	Carbon, 33K ohm ½W 10%
R31B-2	30 562 240	Carbon, 5.6K ohm 1W 10%
R31B-3	30 471 240	Carbon, 470 ohm ½W 10%
R31B-4	30 105 230	Carbon, 1 megohm ½W 10%
R31B-5	30 473 230	Carbon, 47K ohm ½W 10%
R32-5	30 472 230	Carbon, 4.7K ohm ½W 10%
R32-6	30 185 230	Carbon, 1.8 megohm ½W 10%
R32-7	30 105 230	Carbon, 1 megohm ½W 10%
R32-8	30 105 230	Carbon, 1 megohm ½W 10%
R32-10	30 561 230	Carbon, 560 ohm ½W 10%
R32-12	30 223 130	Carbon, 22K ohm ½W 5%
R32-13	30 395 230	Carbon, 3.9 megohm ½W 10%
R32-15	30 682 250	Carbon, 6.8K ohm 2W 10%
R32-16	30 102 230	Carbon, 1K ohm ½W 10%
R32-17	30 102 230	Carbon, 1K ohm ½W 10%
R32-18	30 565 230	Carbon, 5.6 megohm ½W 10%
R33-1	30 104 130	Carbon, 100K ohm ½W 5%
R33-2	30 104 130	Carbon, 100K ohm ½W 5%
R33-3	30 273 240	Carbon, 27K ohm 1W 10%
R33-4	30 475 230	Carbon, 4.7 megohm ½W 10%
R33-5	30 474 230	Carbon, 470K ohm ½W 10%
R33-6	30 273 250	Carbon, 27K ohm 2W 10%
R33-7	30 273 250	Carbon, 27K ohm 2W 10%
R34-1	30 222 130	Carbon, 2.2K ohm ½W 5%
R34-2	30 682 130	Carbon, 6.8K ohm ½W 5%
R34-3	30 154 230	Carbon, 150K ohm ½W 10%
R34-4	30 822 230	Carbon, 8.2K ohm ½W 10%
R34-5	30 104 130	Carbon, 100K ohm ½W 5%
R34-7	30 822 130	Carbon, 8.2K ohm ½W 5%
R34-9	30 334 230	Carbon, 330K ohm ½W 10%
R34-10	30 684 230	Carbon, 680K ohm ½W 10%
R35-1	30 101 230	Carbon, 100 ohm ½W 10%
R35-2	30 680 230	Carbon, 68 ohm ½W 10%
R35-3	30 220 240	Carbon, 22 ohm 1W 10%
R35-6	31 000 503	Wirewound, 8.2K 15W
R36-1	30 472 230	Carbon, 4.7K ohm ½W 10%
R37-1	30 000 071	Carbon, 4.7 ohm ½W 10%
R37-3	33 000 071	40 megohms, High Voltage Type 10%
R37-5	30 225 230	Carbon, 2.2 megohm ½W 10%
R38-1	30 000 071	Carbon, 2.2 ohm ½W 10%
R39-1	30 000 071	Carbon, 4.7 ohm ½W 10%
R41A-1	30 104 230	Carbon, 100K ohm ½W 10%
R41A-2	30 124 250	Carbon, 120K ohm 2W 10%
R41B-1	30 154 230	Carbon, 150K ohm ½W 10%
R41B-2	30 222 230	Carbon, 2.2K ohm ½W 10%
R41B-3	30 154 230	Carbon, 150K ohm ½W 10%
R41B-5	31 000 494	Wirewound, 27K ohm 4W
R41B-7	30 473 230	Carbon, 47K ohm ½W 10%
R42A-1	30 105 230	Carbon, 1 megohm ½W 10%
R42A-2	30 332 230	Carbon, 3.3K ohm ½W 10%
R42A-3	30 393 230	Carbon, 39K ohm ½W 10%
R42A-7	30 102 230	Carbon, 1K ohm ½W 10%
R42A-8	30 473 230	Carbon, 47K ohm ½W 10%
R42A-10	30 473 230	Carbon, 47K ohm ½W 10%
R42A-11	30 473 230	Carbon, 47K ohm ½W 10%
R42A-12	30 473 230	Carbon, 47K ohm ½W 10%
R42A-13	30 473 230	Carbon, 47K ohm ½W 10%
R42B-3	30 222 230	Carbon, 2.2K ohm ½W 10%
R42B-4	31 000 494	Wirewound, 27K ohm 4W
R42B-5	31 000 494	Wirewound, 27K ohm 4W
R43A-1	30 154 230	Carbon, 150K ohm ½W 10%
R43A-2	30 222 230	Carbon, 2.2K ohm ½W 10%
R43A-4	30 561 230	Carbon, 560 ohm ½W 10%

SYM.	PART NO.	DESCRIPTION
R43B-1	30 104 230	Carbon, 100K ohm ½W 10%
R43B-2	30 473 230	Carbon, 47K ohm ½W 10%
R43B-3	30 273 230	Carbon, 2.7K ohm ½W 10%
R44-5	31 000 492	Wirewound, 5K ohm 5W
R44-6	31 000 493	Wirewound, 3.3K ohm 5W
R44-7	30 123 240	Carbon, 12K ohm 1W 10%
R44-10	30 123 230	Carbon, 12K ohm ½W 10%
R44-11	30 123 230	Carbon, 12K ohm ½W 10%
R44-12	30 123 240	Carbon, 12K ohm 1W 10%
R45-1	30 103 230	Carbon, 10K ohm ½W 10%
R45-2	30 224 250	Carbon, 220K ohm 2W 10%
R45-4	31 000 451	Wirewound, 330 ohm 40W
R45-6	31 000 497	Wirewound, 220 ohm 5W 10%
R45-10	31 000 495	Wirewound, 330 ohm 5W
R45-11	31 000 431	Wirewound, 2 ohm 20W
R45-12	31 000 498	Wirewound, 10 ohm 10W
R45-13	31 000 499	Wirewound, 75 ohm 10W 10%
R46-2	30 182 250	Carbon, 1.8K ohm 2W 10%
R46-15	30 101 230	Carbon, 100 ohm ½W 10%
R46-16	30 680 230	Carbon, 68 ohm ½W 10%
R46-17	30 220 240	Carbon, 22 ohm 1W 10%

TRANSFORMERS

T4-1	12 000 851	Pix IF Trans.
T4-2	12 000 861	Pix IF Trans.
T5-1	12 000 871	Pix IF Trans.
T5-4	12 000 901	Pix IF Trans.
T6-1	12 000 901	Pix IF Trans.
T7-1	12 000 911	Pix IF Trans.
T8-1	12 000 891	Pix IF Trans.
T8-3	12 000 941	Sound IF Trans.
T10-1	12 000 201	Ratio Detector Trans.
T10-2	12 000 931	Sound IF Trans.
T13-1	10 000 231	Audio Output Trans.
T14-1	12 000 881	Pix IF Trans.
T16A-1	12 000 921	Band Pass Amp. Trans.
T17-1	12 000 951	Burst Amp. Plate Trans.
T19A-1	16 001 221	Reactance Tube Plate Coil
T19B-1	16 001 231	Crystal Osc Output Coil
T21A-1	12 000 961	Quad. Amp. Trans.
T32-1	12 000 971	Vertical Oscillator Trans.
T32-2	12 000 981	Vertical Output Trans.
T32-3	12 000 991	Vertical Isolation Trans.
T36-2	12 001 001	Horiz. Output Trans.
T41-1	16 001 311	Convergence Coil Ass'y.
T45-1	10 000 581	Power Transformer

CONTROLS

P4-1	36 001 111	Sound Level, 500 ohm ¼W
P12-2	36 001 071	Volume Cont. w/S., 500K ohm ¼W Dual w/P12-3
P12-3	36 001 071	Tone Control, 1 megohm ¼W Dual w/P12-2
P14-1	36 001 111	Sound Rej., 500 ohm ¼W
P14-2	36 001 141	Contrast, 500 ohm ¼W Dual w/P14-3
P14-3	36 001 141	Contrast, 3K ohm 1W Dual w/P14-2
P16A-1	36 001 131	Chroma, 500 ohm ¼W Dual w/P44-1
P18-1	36 001 091	Color Bal., 250K ohm ¼W
P24-1	36 001 111	I Gain, 500 ohm ¼W
P25-2	36 001 243	Green Gain, 10K ohm ½W Dual w/P26-1
P26-1	36 001 243	Blue Gain, 10K ohm ½W Dual w/P25-1
P29-1	36 001 091	AGC, 250K ohm ¼W
P32-1	36 001 151	Vert. Hold, 1 megohm ¼W Dual w/P34-1
P32-2	36 001 245	Height, 2 megohm ¼W Dual w/P32-3
P32-3	36 001 246	Vert. Lin., 5K ohm 2W Dual w/P32-2
P34-1	36 001 151	Horiz. Hold, 5K ohm ¼W Dual w/P32-1
P34-2	36 001 091	Horiz. Drive, 250K ohm ¼W
P36-1	36 000 931	Horiz. Cent., 40 ohm 4W
P37-1	36 001 171	Focus, 7 megohm
P37-2	36 001 262	H. V. Adj., 1.5 meg ½W
P41-1	36 001 201	Blue Horiz Tilt, 50K ohm 1W
P41-2	36 001 241	Blue Vert Para, 2.5K ohm ½W Dual w/P41-3
P41-3	36 001 241	Blue Vert. Tilt, 100 ohm ½W Dual w/P41-2
P42-1	36 001 261	Blue Horiz. Para, 150 Kohm ½W
P42-2	36 001 245	Green Horiz. Tilt, 50K ohm ½W Dual w/P43-1
P42-3	36 001 244	Red Horiz. Para, 150K ohm ½W Dual w/P42-6
P42-4	36 001 241	Green Vert. Para, 2.5K ohm ½W Dual w/P42-5
P42-5	36 001 241	Green Vert. Tilt, 100 ohm ½W Dual w/P42-4
P42-6	36 001 244	Green Horiz. Para, 150K ohm ½W Dual w/P42-3
P43-1	36 001 245	Red Horiz. Tilt, 50K ohm 1W Dual w/P42-2
P43-2	36 001 241	Red Vert. Para, 2.5K ½W Dual w/P43-3
P43-3	36 001 241	Red Vert. Tilt, 100 ohm ½W Dual w/P43-2
P44-1	36 001 131	Brightness, 7.5K ohm 2W Dual w/P16-1
P44-2	36 001 242	Blue Backgrd., 15K ohm ½W Dual w/P44-3

SYM.	PART NO.	DESCRIPTION
P44-3	36 001 242	Green Backgrd., 15K ohm ½W Dual w/P44-2
P44-4	36 001 212	Red Screen, 25K 2W WW
P44-5	36 001 247	Blue Screen, 25K ohm, 2W WW Dual w/P44-6
P44-6	36 001 247	Green Screen, 25K ohm, 2W WW Dual w/P44-5
P45-1	36 001 248	Vert. Cent. Tandem, 20 ohm 2W CT.
P45-2	36 001 211	Purity, 20 ohm 2W WW
P45-3	36 001 241	Field Neutralizing 40 ohm 4W

MISCELLANEOUS

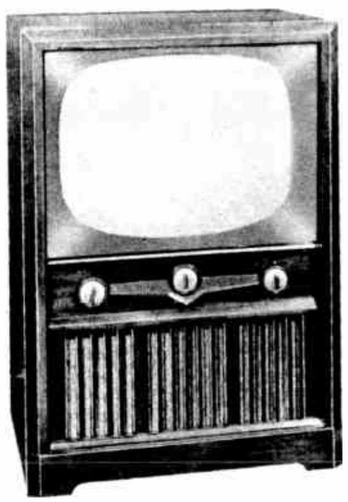
DL15-1	16 000 801	Delay Line
F40-1	43 000 090	Fuse, ⅜ Amp. "Slo-Blo"
F45-1	43 000 080	Fuse, 5 Amp. "Slo-Blo"
L4-6	15 000 511	Filament Choke
L5-5	15 000 511	Filament Choke
L6-2	15 000 511	Filament Choke
L7-2	15 000 511	Filament Choke
L14-1	16 000 051	Peaking Coil—250 mh—Black
L14-2	15 000 631	Coil, 4.5 MC Trap
L14-3	16 000 524	Peaking Coil—36 mh—Green/Blue
L14-4	16 000 051	Peaking Coil—250 mh—Black
L14-5	15 000 621	Burst Amp Take Off #1
L14-6	15 000 621	Burst Amp Take Off #2
L15A-1	16 000 051	Peaking Coil—250 mh—Black
L16A-1	16 000 211	Band Pass Amp. Outlet Coil
L19A-1	16 000 521	Peaking Coil, 20 mh
L22-1	15 000 611	Peaking Coil
L22-2	15 000 531	Peaking Coil
L23-1	15 000 601	Coil
L24A-1	15 000 541	Peaking Coil, 1 mh ±15%
L24A-2	15 000 541	Peaking Coil, 1 mh ±15%
L28A-1	16 000 051	Peaking Coil—250 mh—Black
L28A-2	16 000 522	Peaking Coil—130 mh
L28B-1	16 000 051	Peaking Coil—250 mh—Black
L28B-2	16 000 522	Peaking Coil—130 mh
L28C-1	16 000 051	Peaking Coil—250 mh—Black
L28C-2	16 000 522	Peaking Coil—130 mh
L34-1	16 000 111	Horizontal Frequency Coil
L36-1	16 001 251	Linearity Coil
L36-2	16 000 271	Width Coil
L36-3	16 001 321	Horizontal Isolation Inductor
L36-4	16 001 331	Horizontal Isolation Inductor
L36-5	16 001 241	Deflection Yoke
L45-1	16 001 291	Filter Choke, .75 HY 750 MA
L41B-1	16 001 341	Dynamic Convergence Inductor
L41B-2	16 001 341	Dynamic Convergence Inductor
L42B-1	16 001 341	Dynamic Convergence Inductor
L42B-2	16 001 341	Dynamic Convergence Inductor
L43A-1	16 001 341	Dynamic Convergence Inductor
L43B-2	16 001 341	Dynamic Convergence Inductor
L45-2	16 001 301	Filter Choke 4 HY 100 MA
L45-3	16 001 281	Purifying Coil
L45-4	16 001 261	Field Neutralizing Coil
PC100	82 000 121	Vertical Integrator Couplate
SW45-2	40 000 281	Top Interlock Switch
SR45-1	62 000 051	Selenium Rectifier
SR45-2	62 000 051	Selenium Rectifier
X19B-1	63 000 061	3.579 MC Quartz Crystal
	44 001 081	H. V. Anode Connector
	04 004 351	CRT Socket & Cable Assembly
	47 000 081	Extension Shaft (Focus Cont. H. V.)
	69 000 621	G.I. Tuner, VHF-UHF
	64 000 111	Pilot Light Bulb
	46 003 411	Pilot Light Shield
	76 002 851	Mounting Hub—UHF Indicator Disc.
	80 000 321	Line Cord w/Connector
	80 000 691	Interlock Line Cord
	41 000 111	Antenna Terminal 1-UHF 1-VHF
	19 000 221	Blue Beam Positioning Magnet
	46 003 321	CRT—Magnetic Shield
	76 003 151	Knob—Fine Tuning
	76 002 991	Knob—Channel Selector (Yellow)
	76 003 161	Knob—Channel Selector (Beige)
	76 003 001	Knob—On-Off Volume (Yellow)
	76 003 171	Knob—On-Off Volume (Beige)
	81 000 431	CRT Weld Insulated
	76 003 141	Knob-Tone
	72 000 731	Removable Front Control Panel
	71 001 381	CRT Mask (Chartreuse)
	71 001 382	CRT Mask (Beige)
	72 000 201	Nameplate CBS-Columbia Logotype —360
	71 001 351	Cabinet Back Cover
	73 000 261	#1 Speaker 6 x 9
	73 000 271	#2 Speaker 6 x 9
	77 000 421	Safety Glass
	76 003 231	Knob—Rear—Chroma, Horiz. Hold
	76 003 241	Knob—Rear—Hue, Contrast
	76 003 251	Knob—Front—Contrast, Vert. Hold, Hue, Brightness
	76 002 961	Dial Scale—UHF

INTERMEDIATE FREQUENCY:

Video Carrier — 26.4 mc.
Sound Carrier — 21.9 mc.
Intercarrier Sound — 4.5 mc.
U.H.F. Output — Channels 5 or 6.

DEFLECTION: Electromagnetic.
FOCUS: Magnetic (P. M.)
ION TRAP: Single Permanent Magnet.
HORIZONTAL SCANNING FREQ.: 15,750 c.p.s.
VERTICAL SCANNING FREQ.: 60 c.p.s.
FRAME FREQUENCY: 30 c.p.s
SCANNING: Interlaced, 525 lines.
SPEAKER: 12" Permanent Magnet.
VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

F-24CDMU (Mahogany)
F-24CDBU (Blond)



F-27COMU (Mahogany)
F-27COBU (Blond)

SOUND ALIGNMENT

1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, between grid of video amplifier and chassis.

2. Connect high side of scope through detector probe to the junction of R132 and C121 (picture tube cathode, pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L111, for minimum 400 cycle deflection on scope.

3. Connect electronic voltmeter to lug 2 of ratio detector, V105, and adjust 4.5 mc. sound take-off (L115) and bottom of ratio detector transformer (T102) for peak reading on voltmeter. Adjust the input to make this peak reading 4 volts.

4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R135 and R136 (refer to Schematic Wiring Diagram). Adjust top of T102 for zero balance on electronic voltmeter.

5. Recheck steps 2, 3 and 4 above.

6. Remove input signal, scope and electronic voltmeter.

I. F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

To Check I.F. Alignment (on Oscilloscope)

Equipment: Sweep Generator, Marker Frequency Generator, Oscilloscope, VTVM (electronic voltmeter), Variable Bias Control Assembly with 4 1/2 volt battery.

a. Set up vertical gain control on scope to read approximately 8.8 volts peak to peak between arbitrary reference lines. This can readily be done as follows:

   1. Draw two horizontal lines spaced approximately 3" apart (depending on size of tube).

   2. Connect low side of scope lead to chassis and the high side of lead to the 6.3 volt filament circuit. This will provide a signal with a peak to peak voltage of 17.6 volts.

   3. Adjust scope vertical gain control until the distance between the two horizontal lines equals one-half the peak to peak amplitude of the 60 cycle sine wave. Leave the vertical gain in this position until the sweep generator attenuator has been set in step "h."

b. Set channel selector knob to unused channel. Set fine tuning control and contrast control to maximum counter-clockwise position. Set noise gate to maximum counter-clockwise position. Set Local-Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.

d. Lift the shield of the Oscillator-Mixer tube V2 sufficiently to clear the socket ground clips. Connect the high side of lead from sweep signal generator to the ungrounded tube shield and the ground side of generator lead to the tuner chassis. Keep leads as short as possible (about 1 inch).

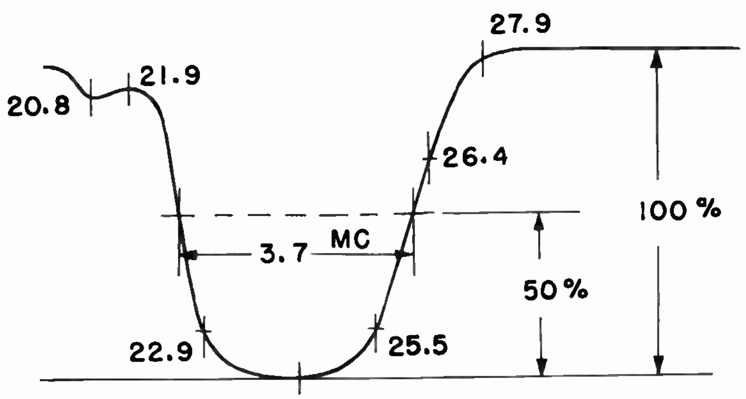
e. Connect center tap of -4.5 volt variable bias supply to pin #1 of AGC amplifier (refer to sketch of "Variable Bias Control Assembly"). Connect high side lead of VTVM to the junction of C115, R107 and R110. Connect the common lead to the chassis. Adjust bias control to obtain -3v. DC reading on the meter.

f. Set generator to sweep from 20 mc. to 32 mc.

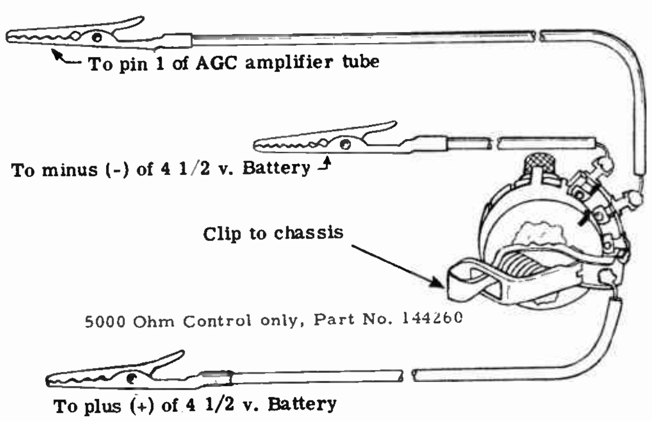
g. Transfer high side of scope lead to top of R116. Adjust the output of the sweep generator to obtain curve on scope of approximately 10 volts peak to peak. (Excessive input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form. Be sure to keep the input level below the overload point, indicated by a flattening of the peak).

h. Set the marker generator to the various frequencies given (20.8 mc, 21.9 mc, etc.) and compare their relative position with those shown on the Nominal Response Curve. (Be sure to keep the marker at the minimum usable amplitude. Excessive signal will distort wave shape.) Slight deviation in shape from the nominal response curve is permissable, but if any great deviation is noted, it will be necessary to re-align the IF amplifier as in section 2. (NOTE: The response curve may vary with the type of sweep equipment used. Such variations due to equipment can be checked by comparing the resultant curve with that observed on a known good chassis.)

I. F. ALIGNMENT (Cont'd)



NOMINAL OVERALL I.F. RESPONSE CURVE
NOTE: Response as Seen by Means of Sweep Generator



VARIABLE BIAS CONTROL ASSEMBLY

I.F. Alignment Procedure (Using Signal Generator and VTVM)

Equipment: Signal (Marker) Generator, VTVM (electronic voltmeter, 1000 mmf. capacitor, Swamping Network (see step "o"), Variable Bias Control Assembly with 4 1/2 volt battery.

a. Set channel selector switch to an unoccupied channel and the fine tuning control to the maximum counter-clockwise position. A channel in the upper band (channels 7 to 13) will allow easier adjustment of L10 in step "o".

b. Set contrast control to the maximum counter-clockwise position. Set noise gate to the maximum counter-clockwise position. Set Local Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.

d. Connect center tap of -4.5 volt Variable Bias Supply to pin #1 of AGC amplifier (see sketch of "Variable Bias Control Assembly"). Connect high side lead of VTVM to the junction of C115, R107 and R110; connect the common lead to the chassis. Adjust the bias control for meter reading of -3.5 volt DC.

e. Connect high side of lead from signal (marker) generator through a 1000 mmf. capacitor to TP-2 (wire protruding from top of tuner through the insulating grommet next to L10). Connect the ground lead to the RF tuner case.

f. Transfer high side lead of VTVM to top of detector load resistor, R116.

g. Set signal (Marker) generator to 24.4 mc and set attenuator of signal generator to produce a meter deflection of approximately -2 volts DC. Adjust top of T101 for maximum DC meter reading. (Be sure sweep generator is off.) Readjust output from signal generator if necessary to keep meter deflection at -2 volts DC maximum.

h. Set signal generator to 22.9 mc and adjust top of L103 for maximum DC meter indication. Limit meter deflection to approximately -2 volts DC maximum by adjusting output attenuator on generator.

i. Set signal generator to 21.9 mc and adjust bottom of L103 for minimum DC meter deflection. Input should be high enough to permit a definite null to be observed on meter. (If necessary, IF bias may be reduced for this step.)

j. Repeat steps "h" and "i". Reset bias to -3.5 volts if necessary.

k. Reset IF bias at -3.5v. Set generator to 25.5 mc and adjust top of L102 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

l. Reset signal generator to 24.4 mc. Adjust top of L101 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

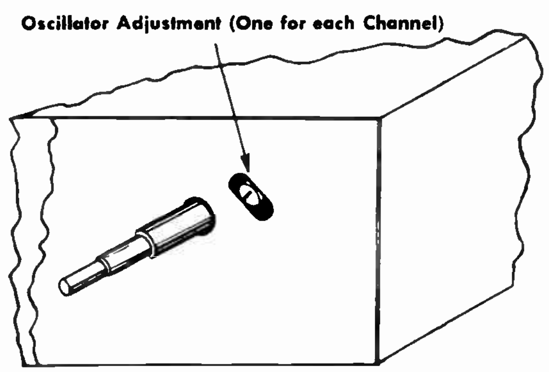
m. Reset signal generator to 27.9 mc and adjust the bottom of L101 for minimum DC meter deflection. Signal generator output must be sufficient to produce a definite null. (If necessary IF bias may be reduced for this step).

n. Repeat steps "l" and "m". If bias has been reduced below -3.5 volts, reset to -3.5 volts for step "l".

o. Transfer high side of signal generator lead to TP-1. Set signal generator to 25.5 mc. Set IF bias to -3.5 volts. Connect the Swamping Network (a 1000 ohm resistor in series with a 1000 mmf capacitor) across L101 making connections to the two lugs on the coil form closest to the chassis. Adjust L10 for a maximum meter reading. I-F bias may be reduced if necessary to obtain a usable deflection. Remove Swamping Network.

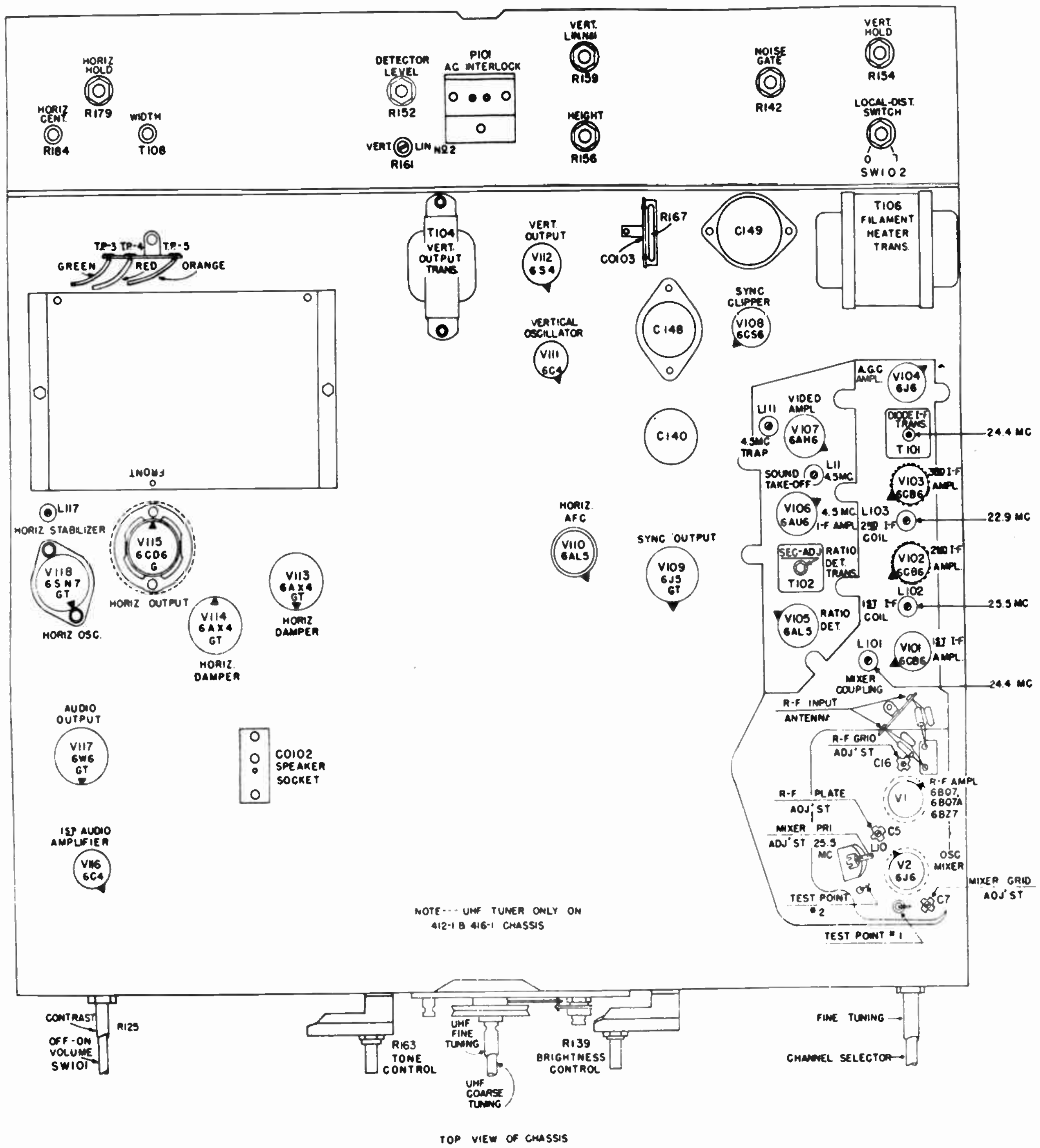
p. Disconnect alignment equipment.

VHF TUNER OSCILLATOR ADJUSTMENT

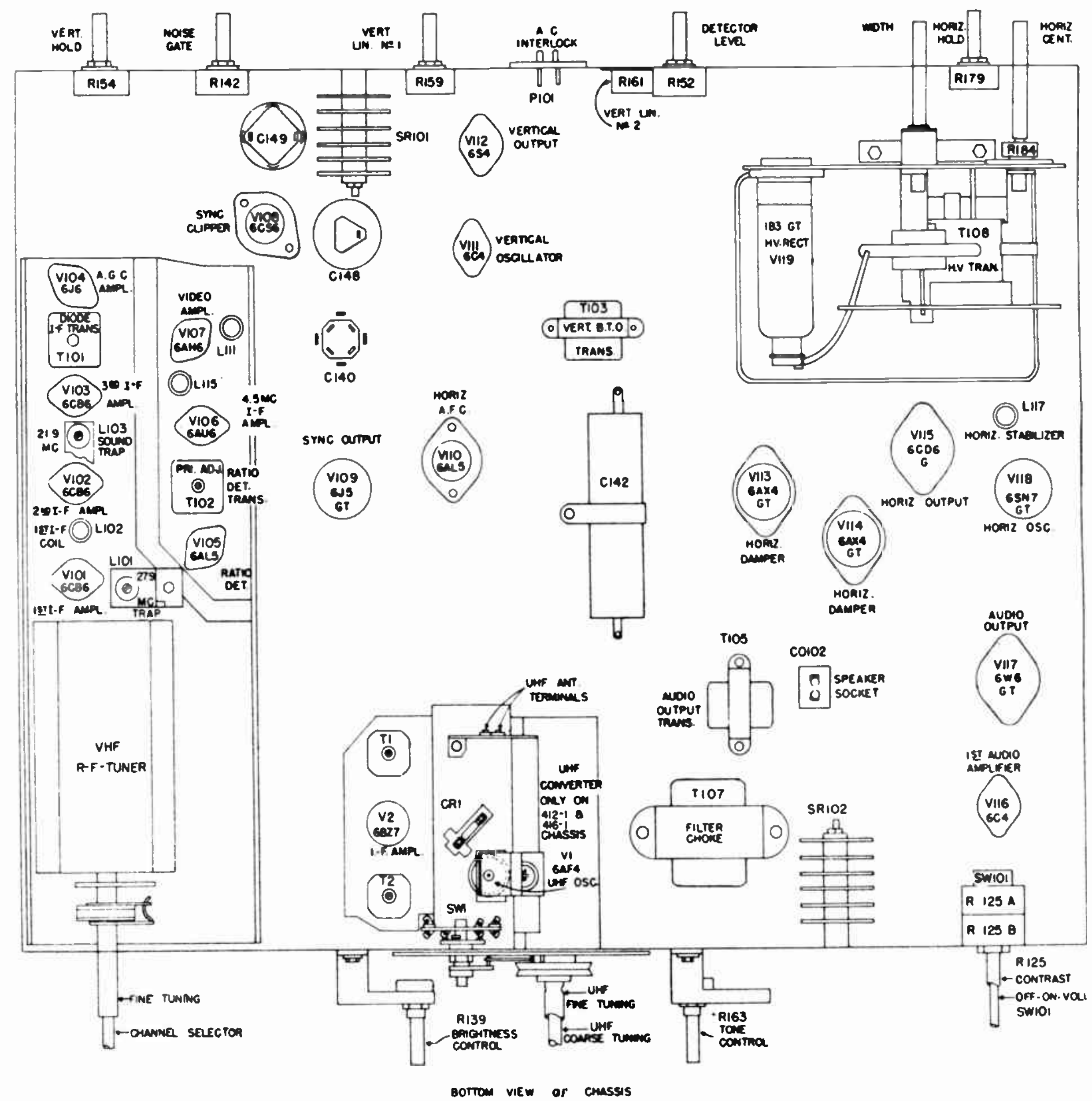


CHASSIS FRONT VIEW

A turret type VHF tuner is used on this receiver, and there is an oscillator adjustment for each channel. When the receiver is installed, the oscillator should be adjusted for each channel on which a station is operating in the area. Set the Channel Switch to the channel that is to be adjusted. Turn the Fine Tuning control to the center of its range. The oscillator trimmer screw is directly to the right of the tuner shaft, and is accessible through a hole in the front of the chassis after the two VHF tuning knobs have been removed. Use a non-metallic screw driver and adjust the oscillator trimmer screw until the proper tuning point is in the center of the Fine Tuning range.



VHF CHASSIS 412-1 416-1 TOP VIEW
(Tube and Alignment Locations)



VHF CHASSIS 412-1 416-1 BOTTOM VIEW
(Tube Socket and Alignment Locations)

UHF ALIGNMENT

ALIGNMENT NOTES:

CAUTION: This UHF converter unit is used with a VHF receiver that has one side of the chassis connected to the power line. DO NOT CONNECT TEST EQUIPMENT TO ANY PART OF THE RECEIVER OR GROUND THE CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED BETWEEN THE POWER LINE AND RECEIVER.

1. Remove the UHF Converter from the VHF receiver chassis.

2. In order that the converter will operate with the tuning shaft in maximum CCW* position, it will be necessary to disengage the function switch shaft from the linkage which operates it and manually set the switch to the UHF position. To accomplish this, loosen the two set-screws which secure the arm and hub assembly to the shaft. Turn the switch clockwise to the UHF position and leave it in this position while aligning.

3. Connect the output leads of the UHF converter to the R.F. input terminals of the VHF Tuner.

4. Reconnect the B+ and filament leads of the tuner to the same points on the VHF receiver from which they were disconnected. Connect UHF Converter chassis to B- (VHF receiver chassis).

5. Keep all leads as short as possible. One suggested way of doing this is to mount the UHF converter at right angles to the TV chassis with one mounting screw. Most of the leads on the UHF converter will then be of sufficient length that no additional length will need to be added.

6. Set VHF Tuner to Channel 6.

7. Alignment should be followed in the order shown.

IF ALIGNMENT

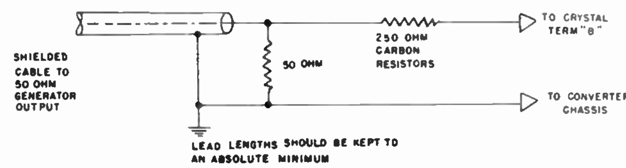
1. Connect an electronic voltmeter or an oscilloscope across the second detector load resistor.

2. Turn on the power.

3. Apply an 82 mc. signal (amplitude modulated if a scope is used) to the crystal terminal (B) at the junction of C13 and L9 through the resistor network shown in Sketch A.

* CW = Clockwise
CCW = Counter-clockwise

Resistor Matching Network for I.F. Alignment



SKETCH A-12

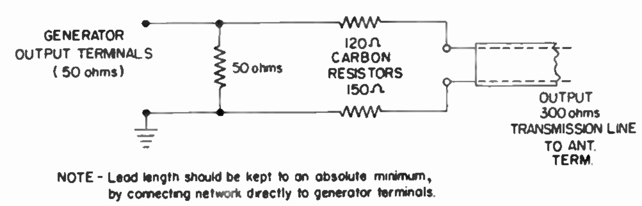
4. Adjust plate coil (T1) and grid coil (T2) for maximum indication on the electronic voltmeter or scope.

5. Disconnect the resistor network from the crystal terminal.

OSCILLATOR ALIGNMENT:

1. With the electronic voltmeter or scope connected across the second detector load resistor, apply a 460 mc. signal (amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.

Resistor Matching Network for Osc. & R.F. Alignment



SKETCH B-12

2. With the tuner shaft at maximum CCW* position, adjust the oscillator trimmer C6 for peak reading on the electronic voltmeter or maximum indication on the scope (oscillator frequency is set to 84 mc. below the carrier frequency).

3. Set the signal generator to 904 mc.

4. Rotate the tuner shaft to the maximum CW position and adjust the oscillator end inductor L4 up or down for maximum reading on the voltmeter.

5. Open the ground connection on L10 and connect an 0-10 ma. D.C. meter between the open end of the crystal return choke L10 and ground.

UHF ALIGNMENT (Cont'd)

6. Adjust the oscillator coupling coil L11 for maximum crystal current when the tuner shaft is rotated to the maximum CW position. When operating at normal line voltage (117 volts, 60 cycles), the maximum current should not exceed 5 ma. at any setting of the tuner shaft. When operating at low line voltage (105 volts, 60 cycles), the minimum crystal current must not be less than 0.3 ma. at any setting of the tuner shaft.

7. Repeat steps 1 through 4 until maximum reading is obtained.

R-F CIRCUIT ALIGNMENT

1. With the electronic voltmeter or scope connected across the second detector load resistor of the VHF receiver, apply a 460 mc. signal (amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.

2. With the tuner shaft at the maximum CCW position, adjust the antenna trimmer C4 for maximum meter reading or for maximum scope indication.

3. Reset signal generator to 904 mc.

4. Rotate the tuner shaft to maximum CW position. Adjust the antenna end inductor L3 by forming larger or smaller loop until maximum reading on the meter (or scope) is obtained.

5. Repeat steps 1 through 4 until maximum reading is obtained.

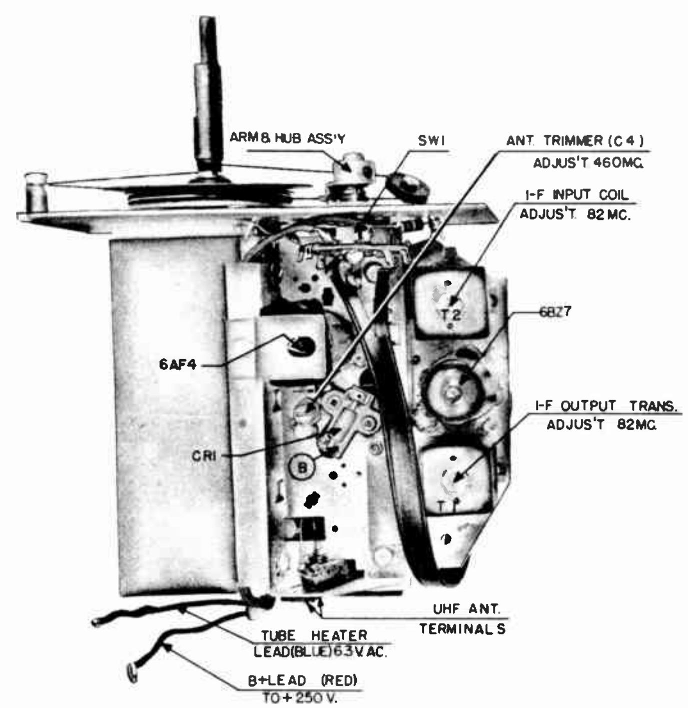
6. Turn the power switch to the "OFF" position.

7. Disconnect the generator, the electronic voltmeter or scope, and the resistor network. Disconnect the 0-10 ma. meter, and solder the open lead of L10 to the chassis.

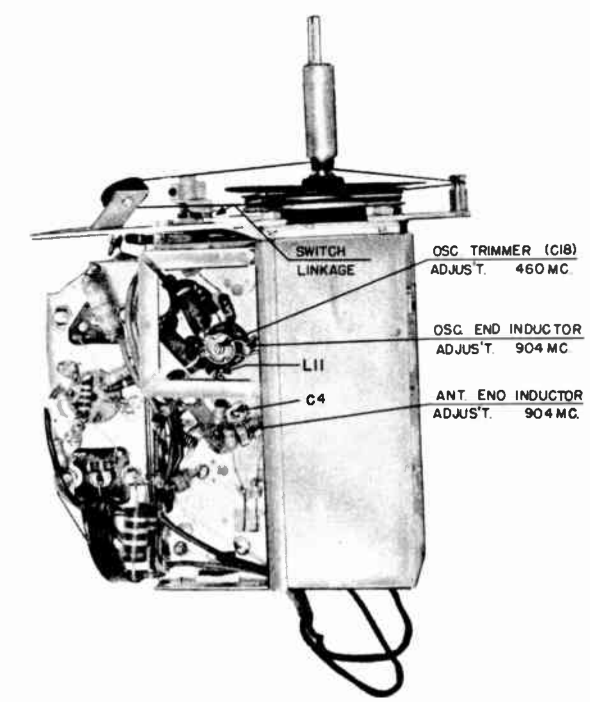
8. Re-engage the toggle coupling in the pin on the arm and hub assembly and tighten the set-screws that secure the collar to the switch shaft.

9. The Function Switch should be checked for proper operation under conditions of customer use. At full CCW rotation of the tuner shaft, all VHF position contacts must be fully and firmly made and all UHF position contacts must be fully broken. All UHF position contacts must be fully and firmly made and all VHF position contacts must be fully broken, when the tuner shaft is 7 1/2° or more from full CCW, as tuner shaft is rotated in a clockwise direction.

10. Replace the UHF Converter on the VHF receiver chassis.



TOP VIEW-UHF Converter



BOTTOM VIEW-UHF Converter

SCHEMATIC REPLACEMENT PARTS LIST

CHASSIS 412, 412-1, 416 & 416-1

Symbol No.	Part No.	Description
C101	156201-1	Capacitor, 470 mmf., 2 kv., disc ceramic
C102	156201-1	Capacitor, 470 mmf., 2 kv., disc ceramic
C103	137499-37	Capacitor, 110 mmf., 10%, 500 v., mica (Part of L101)
C104	156201-3	Capacitor, 470 mmf., 500 v., disc ceramic
C105	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C106	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C107	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C108	137499-33	Capacitor, 68 mmf., 10%, 500 v., mica (Part of L104)
C109	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C110	39001-19	Capacitor, .1 mfd., 600 v., paper
C111	156201-4	Capacitor, .0012 mfd., 600 v., disc ceramic
C112	137727-135	Capacitor, 10 mmf., 500 v., ceramic
C113	137727-103	Capacitor, 5 mmf., 500 v., ceramic
C114	39001-19	Capacitor, .1 mfd., 600 v., paper
C115	154157-1	Capacitor, .5 mfd.; -10% + 40%, 25 v., paper
C116	39001-19	Capacitor, .1 mfd., 600 v., paper
C117	156201-2	Capacitor, .001 mfd., 2 kv., disc ceramic
C118	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic
C119	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C120	137727-126	Capacitor, 33 mmf., 500 v., ceramic
C121	39001-19	Capacitor, .1 mfd., 600 v., paper
C122	137727-133	Capacitor, 68 mmf., 10%, 500 v., ceramic
C123	144675-6	Capacitor, .004 mfd., 500 v. / Capacitor, .004 mfd., 500 v. } Two Section Disc Ceramic
C124	Part of T102	Capacitor, 10 mmf.
C125	Part of T102	Capacitor, 100 mmf.
C126	154103-1	Capacitor, 5 mfd., 50 v., electrolytic
C127	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C128	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C129	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C130	39001-19	Capacitor, .1 mfd., 600 v., paper
C131	39477-7	Capacitor, .01 mfd., 600 v., molded paper
C132	39001-17	Capacitor, .05 mfd., 600 v., paper
C133	39477-5	Capacitor, .0047 mfd., 600 v., molded paper
C134	39477-5	Capacitor, .0047 mfd., 600 v., molded paper
C135	39478-7	Capacitor, .01 mfd., 10%, 600 v., molded paper
C136	39001-78	Capacitor, .006 mfd., 600 v., paper
C137	39477-11	Capacitor, .047 mfd., 600 v., molded paper
C138	39477-11	Capacitor, .047 mfd., 600 v., molded paper
C139	39001-5	Capacitor, .0005 mfd., 600 v., paper
C140A	155910-1	Capacitor, 10 mfd., 10%, 300 v. } Electrolytic
C140B		Capacitor, 200 mfd., 10%, 150 v. } Electrolytic
C140C		Capacitor, 30 mfd., 10%, 150 v. } Electrolytic
C140D		Capacitor, 200 mfd., 10%, 150 v. } Electrolytic
C141	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C142	156021-1	Capacitor, 20 mfd., 10%, 600 v., electrolytic
C143	154104-1	Capacitor, 10 mfd., 50 v., electrolytic
C144	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C145	39001-13	Capacitor, .01 mfd., 600 v., paper
C146	39001-82	Capacitor, .03 mfd., 600 v., paper
C147	39001-14	Capacitor, .015 mfd., 600 v., paper
C148	155911-1	Capacitor, 200 mfd., 10%, 150 v., electrolytic
C149A	155426-1	Capacitor, 200 mfd., 150 v. } Electrolytic
C149B		Capacitor, 5 mfd., 150 v. } Electrolytic
C150	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C151	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C152	39478-114	Capacitor, .0033 mfd., 10%, 1000 v., molded paper
C153	146434-16	Capacitor, .006 mfd., 10%, 600 v., paper
C154	39001-82	Capacitor, .03 mfd., 600 v., paper
C155	39001-76	Capacitor, .003 mfd., 600 v., paper
C156	137727-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C157	39001-14	Capacitor, .015 mfd., 600 v., paper
C158	137499-30	Capacitor, 3900 mmf., 10%, 500 v., mica
C159	137499-34	Capacitor, 560 mmf., 10%, 500 v., mica
C160	137499-32	Capacitor, 680 mmf., 10%, 500 v., mica
C161	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C162	39001-19	Capacitor, 0.1 mfd., 600 v., paper
C163	156569-1	Capacitor, 120 mmf., 10%, 5 kv., disc ceramic
C164	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C166	Part of L118	Capacitor, .1 mfd., 5%, 200 v., paper
C167	Part of L116	Capacitor, 120 mmf., 10%, 3 kv., disc ceramic
C168	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C169	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C170	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic

Symbol No.	Part No.	Description
C171	39001-17	Capacitor, .05 mfd., 600 v., paper
C172	39001-19	Capacitor, 0.1 mfd., 600 v., paper
C173	156054	Capacitor, 10 mfd., 10 v., electrolytic
C174	39001-19	Capacitor, 0.1 mfd., 600 v., paper
C175	39001-13	Capacitor, .01 mfd., 600 v., paper
C176	137727-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C177	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C178	137727-126	Capacitor, 33 mmf., 500 v., ceramic
C179	151109-1	Capacitor, 500 mmf., 20 kv., ceramic (Used on 416, 416-1 Chassis only)
R101	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R102	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R103	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
R104	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R105	Part of L104	Resistor, 3900 ohm, 5%, 1/2 w.
R106	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R107	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R108	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R109	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R110	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R111	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R112	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R113	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
R114	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R115	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R116	39375-67	Resistor, 5600 ohm, 5%, 1/2 w.
R117	39374-33	Resistor, 47,000 ohm, 10%, 1/2 w.
R118	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R119	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R120	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R121	39374-48	Resistor, 82,000 ohm, 10%, 1/2 w.
R122	39374-48	Resistor, 82,000 ohm, 10%, 1/2 w.
R123	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R124	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R125A	156331-1	Control, Volume (1 megohm) } Assembly
R125B		Control, Contrast (1000 ohm) } Assembly
R126	Part of L110	Resistor, 8200 ohm, 10%, 1/2 w.
R127	Part of L113	Resistor, 6800 ohm, 10%, 1/2 w.
R128	39375-365	Resistor, 6800 ohm, 5%, 2 w.
R129	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R130	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
R131	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R132	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R133	38374-15	Resistor, 150 ohm, 10%, 1/2 w.
R134	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R135	39374-18	Resistor, 270,000 ohm, 10%, 1/2 w.
R136	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R137	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R138	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R139	155352-1	Control, Brightness (5 megohm)
R140	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R141	39374-35	Resistor, 560 ohm, 10%, 1/2 w.
R142	156332-1	Control, Noise Gate (10 megohm)
R143	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R144	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R145	39374-67	Resistor, 1.8 megohm, 10%, 1/2 w.
R146	39374-63	Resistor, 1.2 megohm, 10%, 1/2 w.
R147	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R148	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R149	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R150	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R151	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R152	156334-1	Control, Detector Level (5 megohm)
R153	39374-37	Resistor, 10,000, 10%, 1/2 w.
R154	155610-1	Control, Vertical Hold (1 megohm)
R155	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R156	154086-1	Control, Height (5 megohm)
R157	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R158	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R159	155519-1	Control, Vertical Linearity (750 ohm)
R160	39374-117	Resistor, 2200 ohm, 10%, 1 w.
R161	156447	Control, Vertical Linearity (1000 ohm)
R162	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R163	155389-1	Control, Tone (250,000 ohm)
R164	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R165	39303-9	Resistor, 1.2 ohm, 10%, 1/2 w. (On 412-1 & 416-1 Chassis)
R166	39303-9	Resistor, 1.2 ohm, 10%, 1/2 w. (On 412 & 416 Chassis)
R167	156540	Resistor, 7.5 ohm, 10%, 7.5 w., wire wound

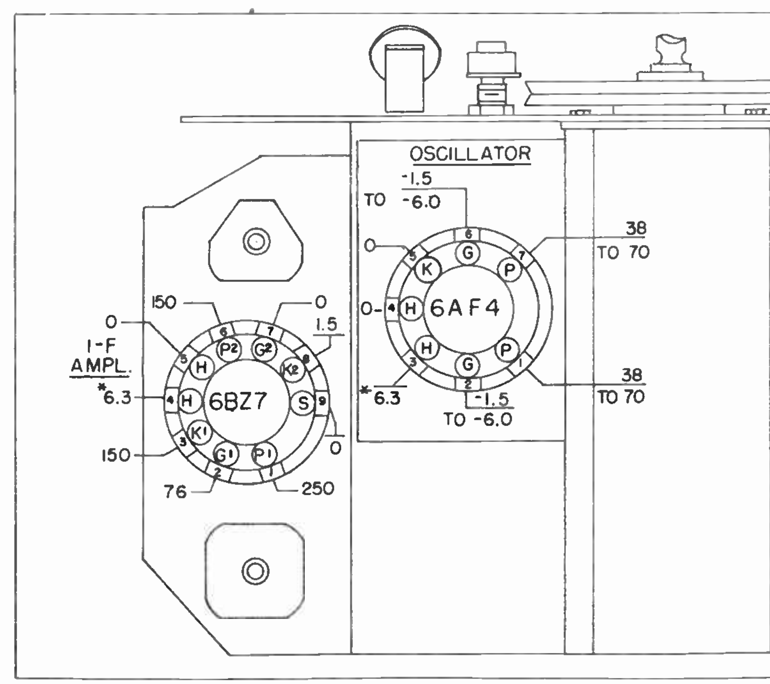
SCHEMATIC REPLACEMENT PARTS LIST

CHASSIS 412, 412-1, 416 & 416-1

Symbol No.	Part No.	Description
R168	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R169	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R170	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R171	39374-135	Resistor, 68,000 ohm, 10%, 1 w.
R172	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R173	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R174	39374-135	Resistor, 68,000 ohm, 10%, 1 w.
R175	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.
R176	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R177	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R178	39374-46	Resistor, 56,000 ohm, 10%, 1/2 w.
R179	155511-1	Control, Horizontal Hold (170,000 ohm)
R180	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
R181	39374-47	Resistor, 68,000 ohm, 10%, 1/2 w.
R182	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R183	39374-215	Resistor, 15,000 ohm, 10%, 2 w.
R184	155844	Control, Horizontal Centering (75 ohm)
R185	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R186	39374-50	Resistor, 120,000 ohm, 10%, 1/2 w.
R187	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R188	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R189	39374-51	Resistor, 150,000 ohm, 10%, 1/2 w.
R190	93974-23	Resistor, 680 ohm, 10%, 1/2 w. (Part ofL116)
R191	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L116)
R192	39374-42	Resistor, 27,000 ohm, 10%, 1/2 w.
R193	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R194	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R195	39374-215	Resistor, 15,000 ohm, 10%, 2 w.
R196	Part of L119	Resistor, 180 ohm, 10%, 1/2 w.
R197	39374-25	Resistor, 1000 ohm, 10%, 1/2 w. (Part of L116)
R198	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R199	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R200	Part of L112	Resistor, 8200 ohm, 10%, 1/2 w.
R201	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R202	39374-202	Resistor, 1800 ohm, 10%, 2 w. (On 412, 412-1)
R203	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R204	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R205	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
L101	155304	Coil, Converter I.F. (1.98-4.5 microhenries)
L102	155319	Coil, 1st I.F. (1.95-4 microhenries)

Symbol No.	Part No.	Description
L103	155348	Coil, 2nd. I.F. (2.4-4.5 microhenries)
L104	156361	Coil, R.F. Choke (70 microhenries)
L105	156362	Coil, R.F. Choke (5 microhenries)
L106	154376	Coil, Diode Choke (15.5 microhenries)
L107	156714	Coil, Video Peaking (90 microhenries)
L108	154184	Coil, Video Peaking (335 microhenries)
L109	155256	Coil, Choke R.F. Filament(.576 microhenries)
L110	154194	Coil, Video Peaking (414 microhenries)
L111	155446	Coil, 4.5 MC Trap (27-57 microhenries)
L112	156618	Coil, Video Peaking (117 microhenries)
L113	154206	Coil, Video Peaking (106 microhenries)
L114	156619	Coil, Video Peaking (240 microhenries)
L115	155442	Coil, Sound Take-Off (12-23 microhenries)
L116A	156839-1	Deflection Yoke } Assembly
L116B		Deflection Yoke } Assembly
L117	154220	Coil, Horizontal Oscillator (18-37 microhenries)
L118	155944	Network, Yoke Coupling (10 millihenries)
L119	156575	Coil, R.F. Choke (16 microhenries)
T101	155594-1	Transformer, Diode I.F.
T102	154108-1	Transformer, Ratio Detector
T103	155255-1	Transformer, Vertical Oscillator
T104	155966-1	Transformer, Vertical Output
T105	154109-3	Transformer, Audio Output
T106	155532	Transformer, Filament
T107	156005-1	Choke, Filter
T108	155445-2	Transformer, Horizontal Deflection
CO102	138352	Socket, 2 Prong Female
CO103	154114	Socket, Terminal Strip
SW101	Part of R125	Switch, On-Off
SW102	156329-1	Switch, Rotary (AGC Control)
CR101	154111	Crystal, 1N64 (Part of T101)
SR101	155575-1	Rectifier, Selenium
SR102	155575-1	Rectifier, Selenium
SP101	138762-6	Speaker, 12" PM
CA101	132300-6	Cable & Plug, AC Power
P101	154125	Receptacle, Interlock
P102	131983	Plug, 2 Prong Male
I101	138437-8	Lamp, Dial (On 412-1, 416-1)
I102	138437-8	Lamp, Dial (On 412-1, 416-1)
I103	138437-8	Lamp, Dial (On 412-1, 416-1)
I104	138437-8	Lamp, Dial (On 412, 416)

UHF SOCKET VOLTAGE CHART

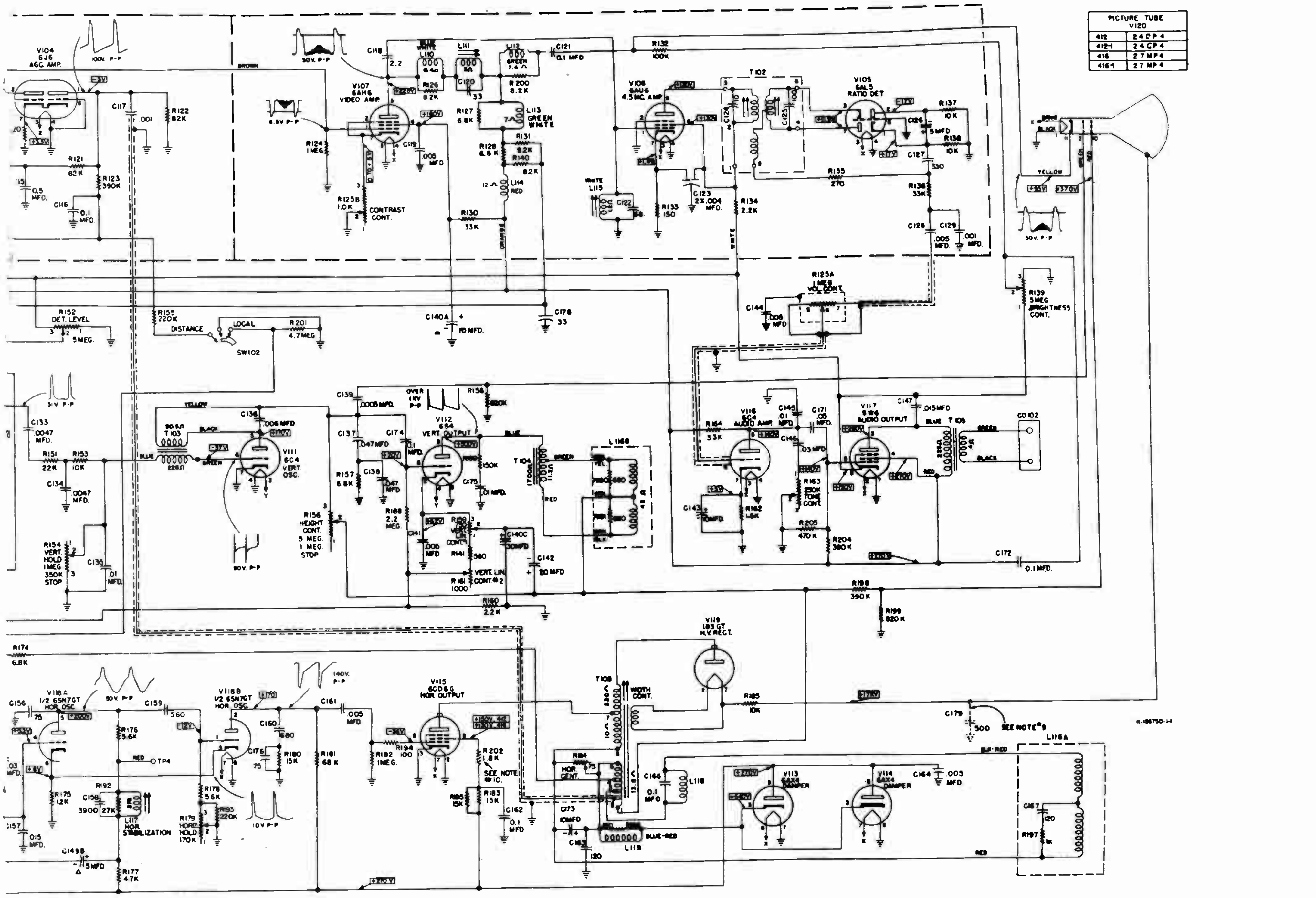


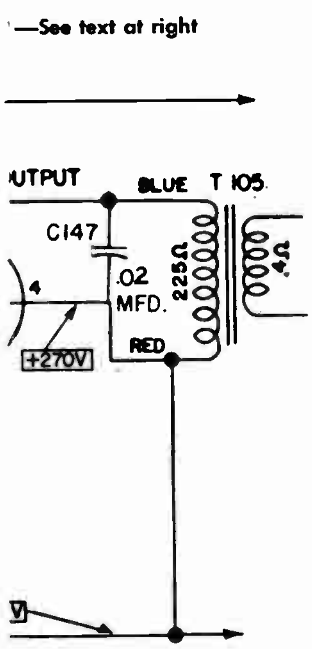
NOTES:

1. BOTTOM VIEW OF TUBE SOCKETS.
2. VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS WITH THE FUNCTION SWITCH IN "UHF" POSITION.
3. * = AC. VOLTAGES.
   NC = NO CONNECTION.
4. OSCILLATOR SOCKET VOLTAGE VARIES WITH FREQUENCY, OTHER VOLTAGES ± 10%.
5. LINE VOLTAGES, 117V, 60 ∿ AC.
6. MINIMUM CRYSTAL CURRENT FOR PROPER OPERATION OF THE OSCILLATOR, 300 μa.

412, 412-1, 416 & 416-1 (See note*)

PICTURE TUBE V120	
412	24CP4
412-1	24CP4
416	27MP4
416-1	27MP4



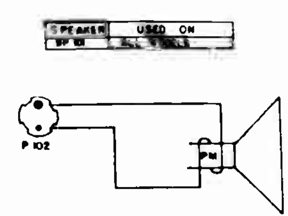


A), capacitor C146 is connected as shown in Figure 2. The ...hematic is made in later production sets to eliminate the possibility of oscillation in the Audio Amplifier. Figures 3 and 4 also show circuits used on chassis 412 (Code A & B), 412-1 (Code A), and 416 (Code A). In later production sets the .01 mfd. capacitor (see Fig. 3) is omitted to reduce horizontal distortion at high brightness levels. At the same time a 4.7 megohm resistor (see full chassis schematic) was added to improve sync stability with action of the AGC switch.

On chassis 412 (Codes A, B, & C), 412-1 (Code A), and 416 (Code A & B), the coupling between the Audio Amplifier and Audio Output stages is direct coupling, as shown in Fig. 2. The circuit which appears in later production sets (shown on the complete schematic) is a production change only, not a design improvement.

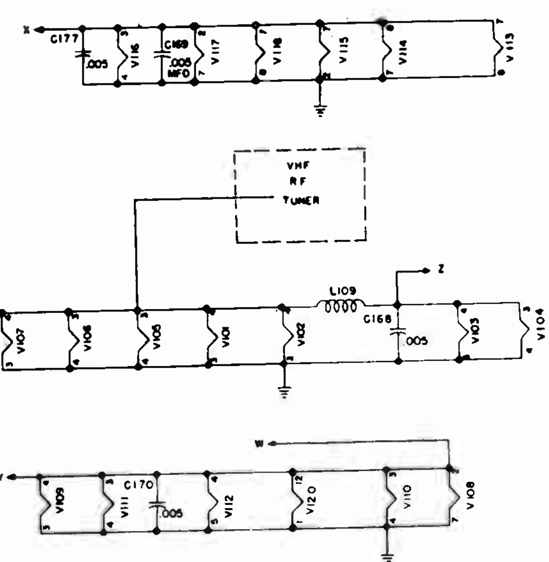
*Note: Chassis schematic printed here is for chassis coded as follows: 412 (Code D)
412-1 (Code B)
416 (Code C)
416-1 (Code A)

For circuit variations found in chassis with earlier code letters, see page 20.



NOTES:

1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2. SUPPLY VOLTAGE 117 VOLTS 60 CYCLE AC.
3. K=1000
4. ALL CAPACITANCE VALUES IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. I-104 IS USED ON 412 & 416 CHASSIS.
6. I-101, I-102, I-103, USED ON 412-1 & 416-1 CHASSIS.
7. R165 USED ON 412-1 & 416-1 CHASSIS.
8. R166 USED ON 412 & 416 CHASSIS.
9. C179 USED ON 416 & 416-1 CHASSIS.
10. R202 USED ON 412 & 412-1 CHASSIS.



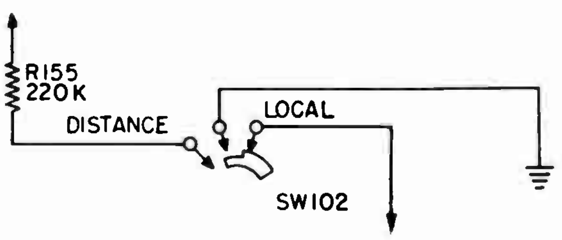
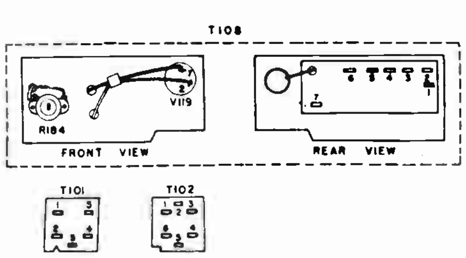
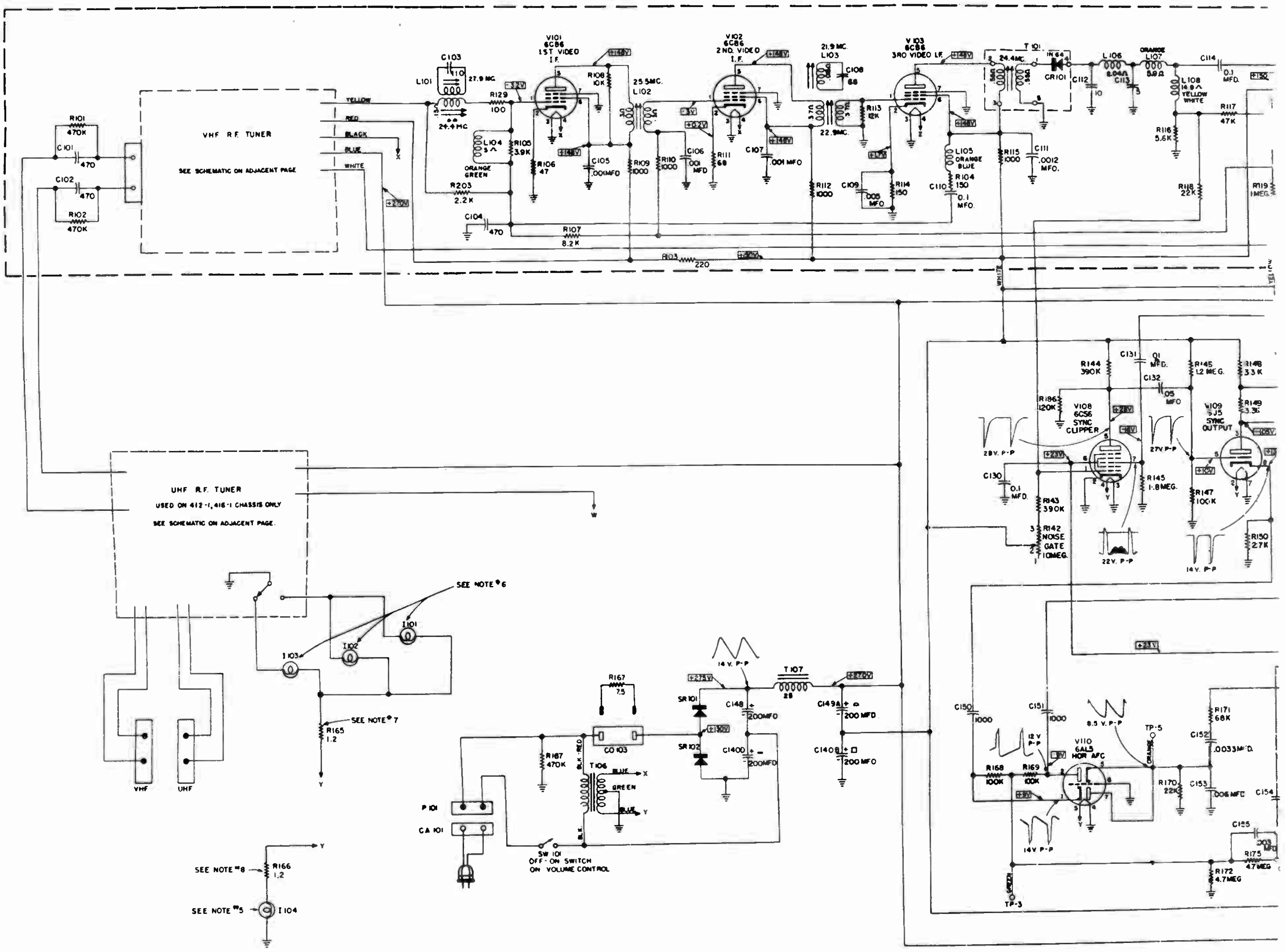


Fig. 4



SCHEMATIC WIRING DIAGRAM—CHASSI.



On chassis 412 (Code A & B), 412-1 (Code A), and 416 (Code
change from this circuit to that shown in the full chassis sc'

Chassis 412 (Codes A, B & C), 412-1 (Code A) 416 (Codes A & B)

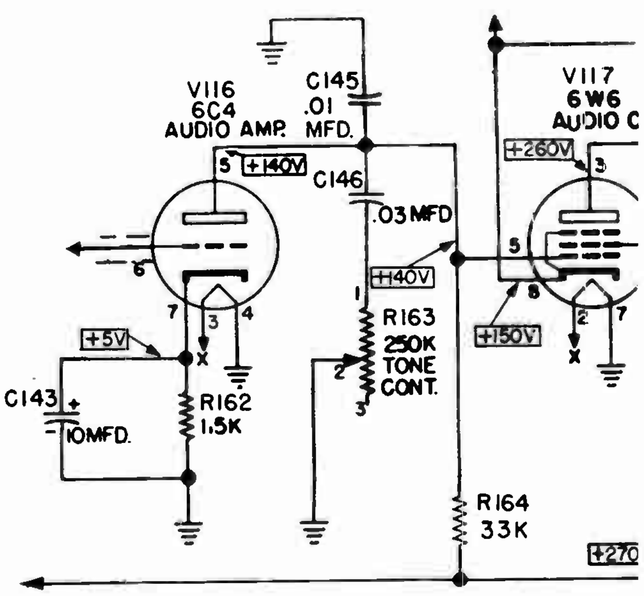


Fig. 2

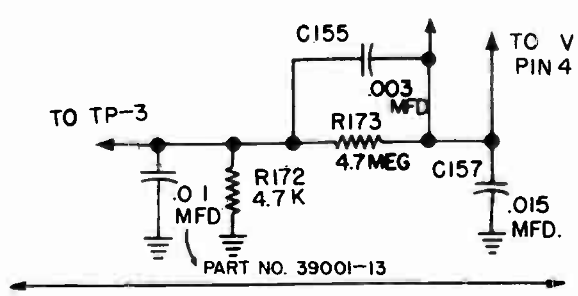


Fig. 3

CODE LETTER CHANGES

CHASSIS 412, 412-1, 416 & 416-1

IMPORTANT

Chassis 412 (Code A) and 412-1 (Code A) are furnished with a double cathode 6CD6G tube. In all later models a single cathode type 6CD6G is used. It has since been found that some manufacturers' single cathode types will not perform as satisfactorily as those tubes used in factory production. Therefore, when replacing the 6CD6G in these chassis, use only the double cathode type. Crosley Service Parts Department will stock only 6CD6G's with double cathodes.

Chassis 412 (Codes A & B), 412-1 (Code A)

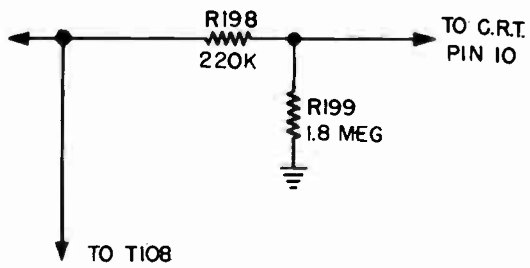


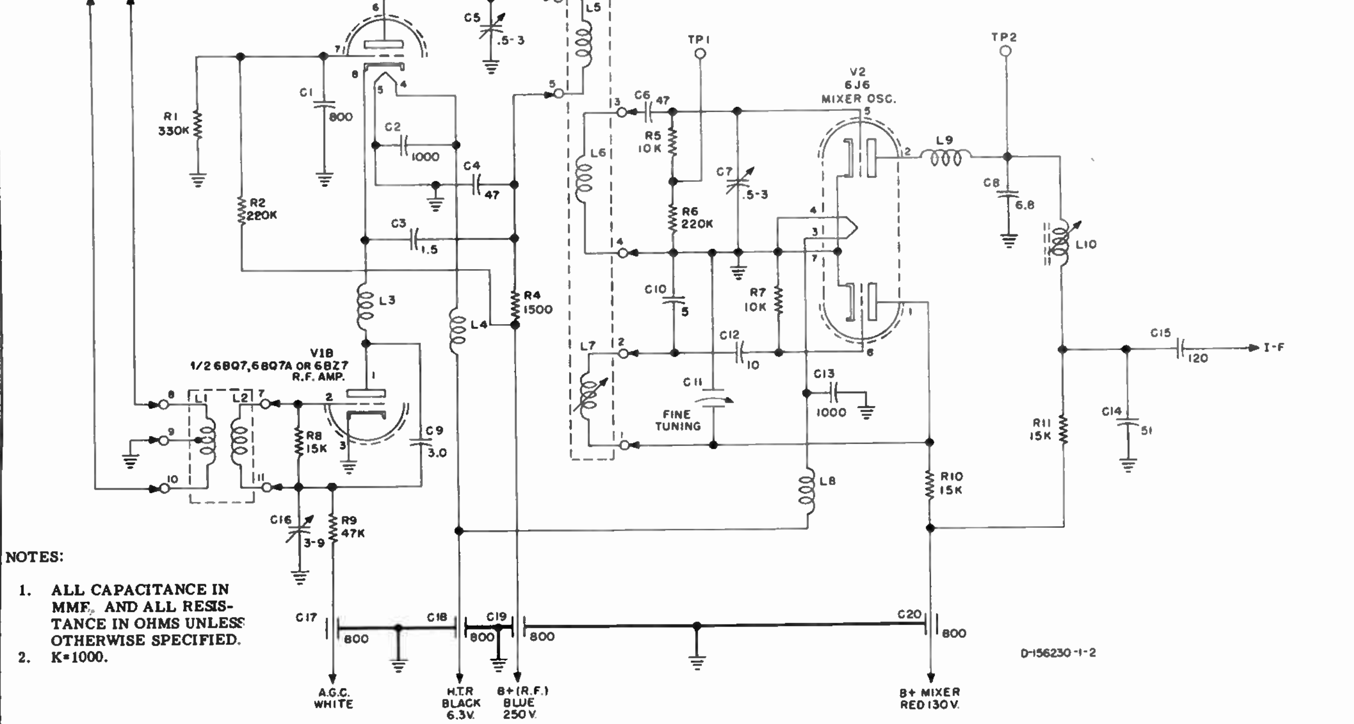
Fig. 1

The circuit shown in Fig. 1 appears in the chassis listed above the figure. To improve the contrast ratio, all later production chassis use the resistor values shown in the full chassis schematic.

Chassis 412 (Codes A & B), 412-1 (Code A)

In these chassis, R202 is omitted in the screen circuit of the 6CD6G. It is added in later production chassis to reduce excessive high voltage.

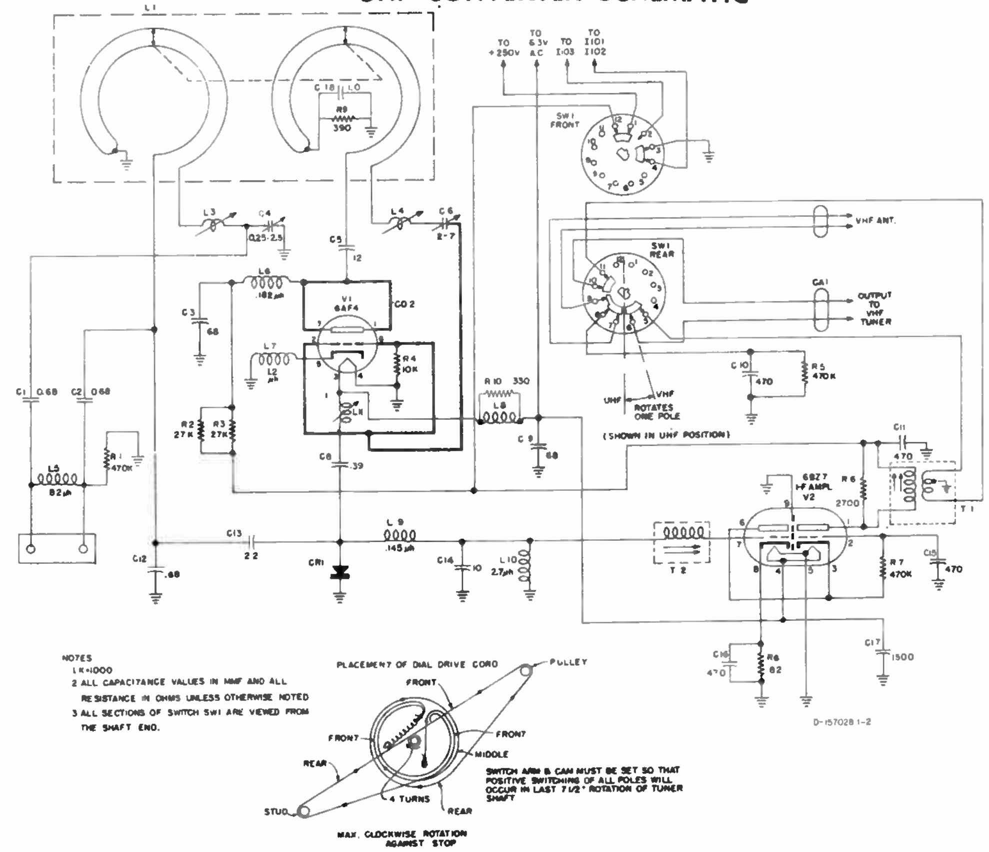
VHF TUNER SCHEMATIC



NOTES:

1. ALL CAPACITANCE IN MMF. AND ALL RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. K=1000.

UHF CONVERTER SCHEMATIC



REPLACEMENT PARTS LIST
VHF TUNER

Symbol No.	Part No.	Description
C1	156906-1	Capacitor, 800 mmf., Feed Thru
C2	156906-2	Capacitor, 1000 mmf., disc ceramic
C3	156906-3	Capacitor, 1.5 mmf., disc ceramic
C4	156906-4	Capacitor, 47 mmf., 10%, disc ceramic
C5	156906-5	Capacitor, .5-3 mmf., Trimmer ceramic
C6	156906-4	Capacitor, 47 mmf., disc ceramic
C7	156906-5	Capacitor, .5-3 mmf., Trimmer ceramic
C8	156906-8	Capacitor, 6.8 mmf., ± .25 mmf. disc ceramic
C9	156906-9	Capacitor, 3 mmf., ± .25 mmf., disc ceramic
C10	156906-10	Capacitor, 5 mmf., ± .25 mmf., disc ceramic
C11	See Ref. 15	Capacitor, Fine Tuning
C12	156906-12	Capacitor, 10 mmf., 10%, disc ceramic
C13	156906-2	Capacitor, 1000 mmf., disc ceramic
C14	156906-14	Capacitor, 51 mmf., 5%, disc ceramic
C15	156906-15	Capacitor, 120 mmf., 10%, disc ceramic
C16	156906-16	Capacitor, 3-9 mmf., Trimmer ceramic
C17	156906-17	Capacitor, 800 mmf., Feed Thru
C18	156906-17	Capacitor, 800 mmf., Feed Thru
C19	156906-17	Capacitor, 800 mmf., Feed Thru
C20	156906-17	Capacitor, 800 mmf., Feed Thru
R1	39374-55	Resistor, 330,000 ohm, 10%, 1/2 w.
R2	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R4	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R5	156906-47	Resistor, 10,000 ohm, 10%, 1/2 w.
R6	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R7	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R8	156906-48	Resistor, 15,000 ohm, 10%, 1/2 w.
R9	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R10	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
R11	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
L1, L2	156907*	Antenna Coil Assembly
L3	156906-49	Choke, Cathode
L4	156906-50	Choke, Filament, R.F. Amplifier

Symbol No.	Part No.	Description
L5, L6, L7	156908*	R.F. & Oscillator Coil Assembly
L8	156906-51	Choke, Filament, Mixer
L9	156906-52	Choke, Plate, Mixer
L10	156906-53	I.F. Assembly
1		R.F. Amplifier (V1)
2		Mixer Oscillator (V2)
3	156906-23	Tube Shield (V1)
4	156906-24	Tube Shield (V2)
5	156906-25	Shield (Side)
6	156906-26	Shield (Bottom)
7	156906-27	Roller Detent
8	156906-28	Spring Detent
9	156906-29	Spring, Shaft Retaining
10	156906-29	Spring, Shaft Retaining
12	156906-32	Plate, Fine Tuning Grounding
13	156906-33	Mounting Strap, Ceramic Bushing
15	156906-35	Ceramic Bushing & Lead Assembly (Fine Tuning)
16, 17, 18	See C5, C7, & C16	Capacitor, Ceramic
19	156906-39	Nut (Spring), Trimmer
20	156906-40	Screw, Trimmer
21	156906-41	Contact Bracket Assembly
26	156906-44	Spring, Slug Retaining
40	See L10	R.F. Assembly
41 thru 52	See L1, L2	Antenna Coil Assembly
53 thru 64	See L5, L6, & L7	R.F. & Oscillator Coil Assembly
	156189	VHF Tuner Complete

* One Antenna Coil Assembly and one R.F. & Oscillator Coil Assembly is necessary for each channel to be received. The dash number following the basic part number indicates the channel for which the assembly is designed.
Example: 156907-2, Antenna Coil Assembly for Channel 2.
156908-13, R.F. & Oscillator Coil Assembly for Channel 13.

NOTE: Reference numbers (1, 2, 3, etc.) that follow Symbol No. L10 refer to corresponding numbers on Exploded View of the VHF Tuner.

REPLACEMENT PARTS LIST
UHF CONVERTER

Symbol No.	Part No.	Description
C1	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C2	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C3	152997-8	Capacitor, 68 mmf., 500 v.
C4	151880-3	Capacitor, .25 - 2.5 mmf.
C5	155439-1	Capacitor, 12 mmf.
C6	156078-1	Capacitor, 2-7 mmf., Oscillator Trimmer Assembly
C8	152997-15	Capacitor, .39 mmf., 10%, 500 v.
C9	152997-8	Capacitor, 68 mmf., 500 v.
C10	156201-1	Capacitor, 470 mmf., 2 k.v., disc ceramic
C11	137727-104	Capacitor, 470 mmf., ceramic
C12	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C13	152997-1	Capacitor, 2.2 mmf., 10%, 500 v.
C14	152997-11	Capacitor, 10 mmf., 10%, 500 v.
C15	137727-104	Capacitor, 470 mmf., ceramic
C16	137727-104	Capacitor, 470 mmf., ceramic
C17	137727-113	Capacitor, 1500 mmf., 500 v.
C18	152997-2	Capacitor, 1.0 mmf., 10%, 500 v.
R1	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R2	39374-218	Resistor, 27,000 ohm, 10%, 2 w.
R3	39374-218	Resistor, 27,000 ohm, 10%, 2 w.
R4	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R5	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R6	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R7	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R8	39374-12	Resistor, 82 ohm, 10%, 1/2 w.
R9	Part of L1	Resistor, 390 ohm, 10%, 1/2 w.
R10	Part of L8	Resistor, 330 ohm, 10%, 1/2 w.
L1	155158-1	Inductuner, UHF
L3	Part of C4	Inductance
L4	Part of C6	Inductance
L5	148936-2	Choke, R.F. (.82 microhenries)
L6	156167-1	Choke, R.F. (.182 microhenries)
L7	148936-4	Choke, R.F. (1.2 microhenries)
L8	157134-1	Choke, Oscillator Filament
L9	155510	Choke, R.F. (145 microhenries)
L10	148936-5	Choke, R.F. (2.7 microhenries)

Symbol No.	Part No.	Description
L11	157135-1	Inductance (Variable), Choke, Oscillator Coupling
CA1		Transmission Line, Antenna (300 ohm)
CO1	155604	Terminal Board, UHF Antenna
CO2	155431-1	Strap, Oscillator Plate
CR1	151871	Crystal, Germanium (1N72)
SW1	156170-1	Switch, Function
	155495	Arm & Hub Assembly, Function Switch
	155561	Arm, Toggle
	155441	Bracket, Antenna
	154736	Bracket, Idler Pulley
	155488	Bracket, Tube Lock
	155427	Clip & Board Assembly, Crystal
	154803	Cotter Pin (External)
	155893	Eyelet (3 used to hold Rotors to Shaft)
	156788	Fibre Hub, Small Knob Shaft, Groove Pin & Outer Shaft Assembly
	155466-1	Guard, Fishpaper
	137939-1	Idler Pulley
	155491	Pin, Drive Cord Guide
	156672	Pulley, Drive Cord
	137940-1	Rivet, Idler Pulley
	137940-8	Rivet, Toggle Arm
	155481-1	Screw, Nylon (used to mount C6)
	39311-2	Set Screw, Arm & Hub Assembly
	155898	Shaft & Stop Assembly, Inductuner
	153804	Shield (Lid), Oscillator
	153806	Shield, Oscillator
	154677	Shield, Tube (V1)
	154743	Shield (Fish Paper Disc), Drive Cord
	152053-1	Socket, Tube (V1)
	152078-1	Socket, Tube (V2)
	51752	Spring, Drive Cord Tension
	156930	UHF Converter Complete
	155895	Washer (1 used), Shaft & Stop Assembly
	148206-1	Washer (Spring Tension), Toggle Arm

Model F-24PDMU
(Mahogany)
Model F-24PDBU
(Blond)

POWER SUPPLY: . . . . .117 volts, 60 cycle, a.c.

POWER CONSUMPTION:
VHF Television Position . . . . 175 watts
UHF Television Position . . . . 180 watts
AM-FM Radio Position . . . . 65 watts
Phonograph Position . . . . 85 watts

AUDIO POWER OUTPUT:
Television . . . . 1.4 watts maximum
Radio or Phonograph . . . . .2 watts undistorted

ANTENNA INPUT IMPEDANCE:
Television . . . . 300 ohms balanced
FM Radio . . . . 75 ohms balanced

INTERMEDIATE FREQUENCY (AM-FM CHASSIS):
AM - 455 kc.
FM - 10.7 mc.

INTERMEDIATE FREQUENCY (TV CHASSIS):

Video Carrier—26.4 mc.
Sound Carrier—21.9 mc.
Intercarrier Sound—4.5 mc.
U.H.F. Output—Channels 5 or 6.

DEFLECTION: Electromagnetic.

FOCUS: Magnetic (P.M.)

ION TRAP: Single Permanent Magnet.

HORIZONTAL SCANNING FREQ: 15,750 c.p.s.

VERTICAL SCANNING FREQ: 60 c.p.s.

FRAME FREQUENCY: 30 c.p.s.

SCANNING: Interlaced, 525 lines.

SPEAKER: 12" Permanent Magnet.

VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

I. F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

To Check I. F. Alignment (on Oscilloscope):

Equipment: Sweep Generator, Marker Frequency Generator, Oscilloscope, VTVM (electronic voltmeter), Variable Bias Control Assembly with 4 1/2 volt battery.

a. Set up vertical gain control on scope to read approximately 8.8 volts peak to peak between arbitrary reference lines. This can readily be done as follows:

1. Draw two horizontal lines spaced approximately 3" apart (depending on size of tube).

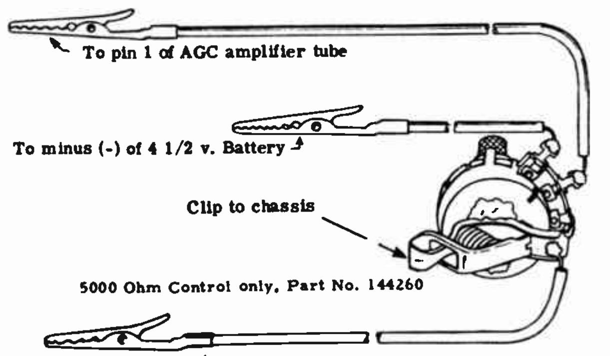
2. Connect low side of scope lead to chassis and the high side of lead to the 6.3 volt filament circuit. This will provide a signal with a peak to peak voltage of 17.6 volts.

3. Adjust scope vertical gain control until the distance between the two horizontal lines equals one-half the peak to peak amplitude of the 60 cycle sine wave. Leave the vertical gain in this position until the sweep generator attenuator has been set in step "h".

b. Set channel selector knob to unused channel. Set fine tuning control and contrast control to maximum counter-clockwise position. Set noise gate to maximum counter-clockwise position. Set Local-Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.

d. Lift the shield of the Oscillator-Mixer tube V2 sufficiently to clear the socket ground clips. Connect the high side of lead from sweep signal generator to the ungrounded tube shield and the ground side of generator lead to the tuner chassis. Keep leads as short as possible (about 1 inch).



VARIABLE BIAS CONTROL ASSEMBLY

e. Connect center tap of -4.5 volt variable bias supply to pin #1 of AGC amplifier (refer to sketch of "Variable Bias Control Assembly"). Connect high side lead of VTVM to the junction of C115, R107 and R110. Connect the common lead to the chassis. Adjust bias control to obtain -3v. DC reading on the meter.

f. Set generator to sweep from 20 mc. to 32 mc.

g. Transfer high side of scope lead to top of R116. Adjust the output of the sweep generator to obtain curve on scope of approximately 10 volts peak to peak. (Excessive input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form. Be sure to keep the input level below the overload point, indicated by a flattening of the peak).

h. Set the marker generator to the various frequencies given (20.8 mc, 21.9 mc, etc.) and compare their relative position with those shown on the Nominal Response Curve. (Be sure to keep the marker at the minimum usable amplitude. Excessive signal will distort wave shape.) Slight deviation in shape from the nominal response curve is permissible, but if any great deviation is noted, it will be necessary to re-align the IF amplifier as in section 2. (NOTE: The response curve may vary with the type of sweep equipment used. Such variations due to equipment can be checked by comparing the resultant curve with that observed on a known good chassis.)

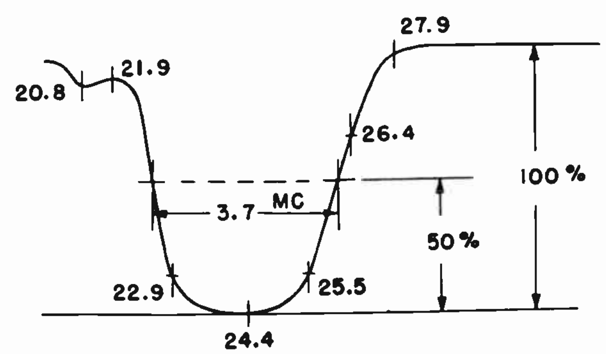
I. F. Alignment Procedure
(Using Signol Generator and VTVM):

Equipment: Signal (Marker) Generator, VTVM (electronic voltmeter), 1000 mmf. capacitor, Swamping Network (see step "o"), Variable Bias Control Assembly with 4 1/2 volt battery.

a. Set channel selector switch to an unoccupied channel and the fine tuning control to the maximum counter-clockwise position. A channel in the upper band (channels 7 to 13) will allow easier adjustment of L10 in step "o".

b. Set contrast control to the maximum counter-clockwise position. Set noise gate to the maximum counter-clockwise position. Set Local Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.



NOMINAL OVERALL I. F. RESPONSE CURVE
NOTE: Response as Seen by Means of Sweep Generator

d. Connect center tap of -4.5 volt Variable Bias Supply to pin #1 of AGC amplifier (see sketch of "Variable Bias Control Assembly"). Connect high side lead of VTVM to the junction of C115, R107 and R110; connect the common lead to the chassis. Adjust the bias control for meter reading of -3.5 volt DC.

e. Connect high side of lead from signal (marker) generator through a 1000 mmf. capacitor to TP-2 (wire protruding from top of tuner through the insulating grommet next to L10). Connect the ground lead to the RF tuner case.

f. Transfer high side lead of VTVM to top of detector load resistor, R116.

g. Set signal (marker) generator to 24.4 mc. and set attenuator of signal generator to produce a meter deflection of approximately -2 volts DC. Adjust top of T101 for maximum DC meter reading. (Be sure sweep generator is off.) Readjust output from signal generator if necessary to keep meter deflection at -2 volts DC maximum.

h. Set signal generator to 22.9 mc. and adjust top of L103 for maximum DC meter indication. Limit meter deflection to approximately -2 volts DC maximum by adjusting output attenuator on generator.

i. Set signal generator to 21.9 mc. and adjust bottom of L103 for minimum DC meter deflection. Input should be high enough to permit a definite null to be observed on meter. (If necessary, IF bias may be reduced for this step.)

j. Repeat steps "h" and "i". Reset bias to -3.5 volts if necessary.

k. Reset IF bias at -3.5v. Set generator to 25.5 mc. and adjust top of L102 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

l. Reset signal generator to 24.4 mc. Adjust top of L101 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

I. F. ALIGNMENT (continued)

m. Reset signal generator to 27.9 mc. and adjust the bottom of L101 for minimum DC meter deflection. Signal generator output must be sufficient to produce a definite null. (If necessary IF bias may be reduced for this step).

n. Repeat steps "l" and "m". If bias has been reduced below -3.5 volts, reset to -3.5 volts for step "l".

o. Transfer high side of signal generator lead to TP-1. Set signal generator to 25.5 mc. Set IF bias to -3.5 volts. Connect the Swamping Network (a 1000 ohm resistor in series with a 1000 mmf. capacitor) across L101 making connections to the two lugs on the coil form closest to the chassis. Adjust L10 for a maximum meter reading. IF bias may be reduced if necessary to obtain a usable deflection. Remove Swamping Network.

p. Disconnect alignment equipment.

SOUND ALIGNMENT

1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, between grid of video amplifier (pin 1, V109) and chassis.

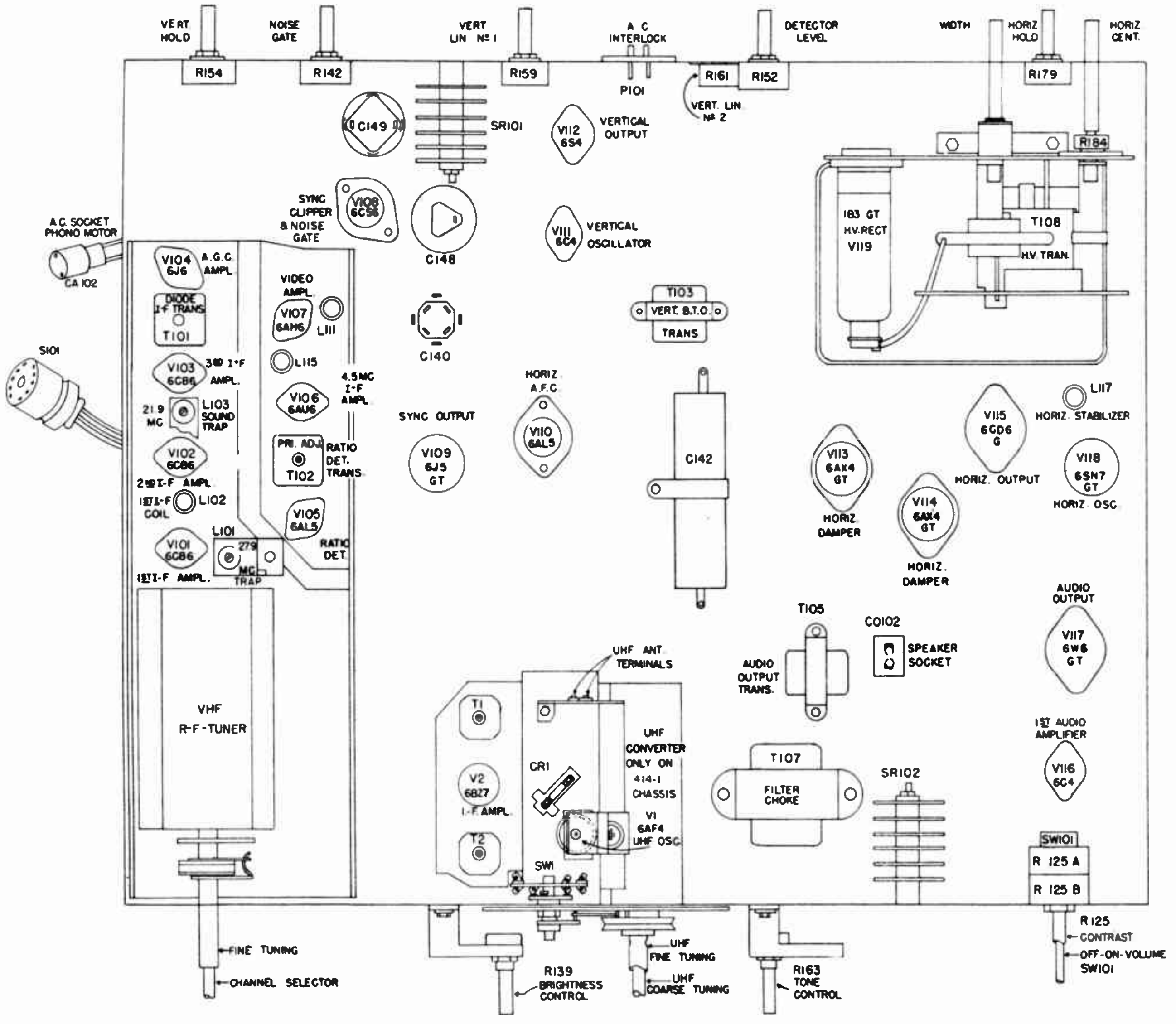
2. Connect high side of scope through detector probe to the junction of R132 & C121 (picture tube cathode). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L111, for minimum 400 cycle deflection on scope.

3. Connect electronic voltmeter to pin 2 of ratio detector tube, V107, and adjust 4.5 mc. sound take-off (L115) and bottom of ratio transformer (T102) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.

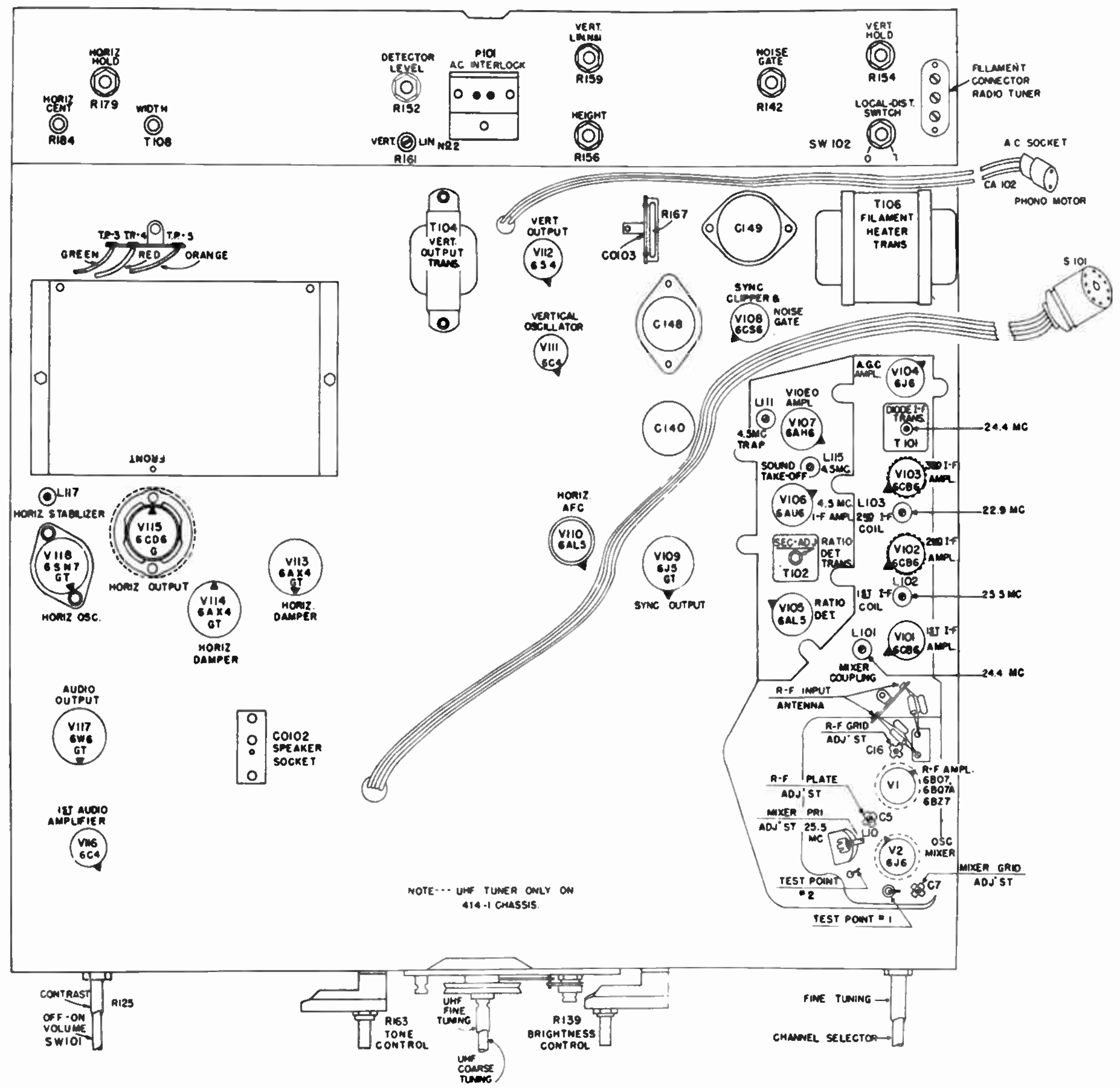
4. Adjust input to obtain 12 volts output. Transfer high side of voltmeter to junction of R135 and R136 (refer to Schematic Wiring Diagram). Adjust top of T102 for zero balance on electronic voltmeter.

5. Recheck steps 2, 3 and 4 above.

6. Remove input signal, scope and electronic voltmeter.



BOTTOM VIEW, CHASSIS 414-1
(Tube and Alignment Location)



TOP VIEW, CHASSIS 414-1
(Tube and Alignment Location)

UHF ALIGNMENT

ALIGNMENT NOTES:

CAUTION: This UHF converter unit is used with a VHF receiver that has one side of the chassis connected to the power line. DO NOT CONNECT TEST EQUIPMENT TO ANY PART OF THE RECEIVER OR GROUND THE CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED BETWEEN THE POWER LINE AND RECEIVER.

1. Remove the UHF Converter from the VHF receiver chassis.

2. In order that the converter will operate with the tuning shaft in maximum CCW* position, it will be necessary to disengage the function switch shaft from the linkage which operates it and manually set the switch to the UHF position. To accomplish this, loosen the two set-screws which secure the arm and hub assembly to the shaft. Turn the switch clockwise to the UHF position and leave it in this position while aligning.

3. Connect the output leads of the UHF converter to the R. F. input terminals of the VHF Tuner.

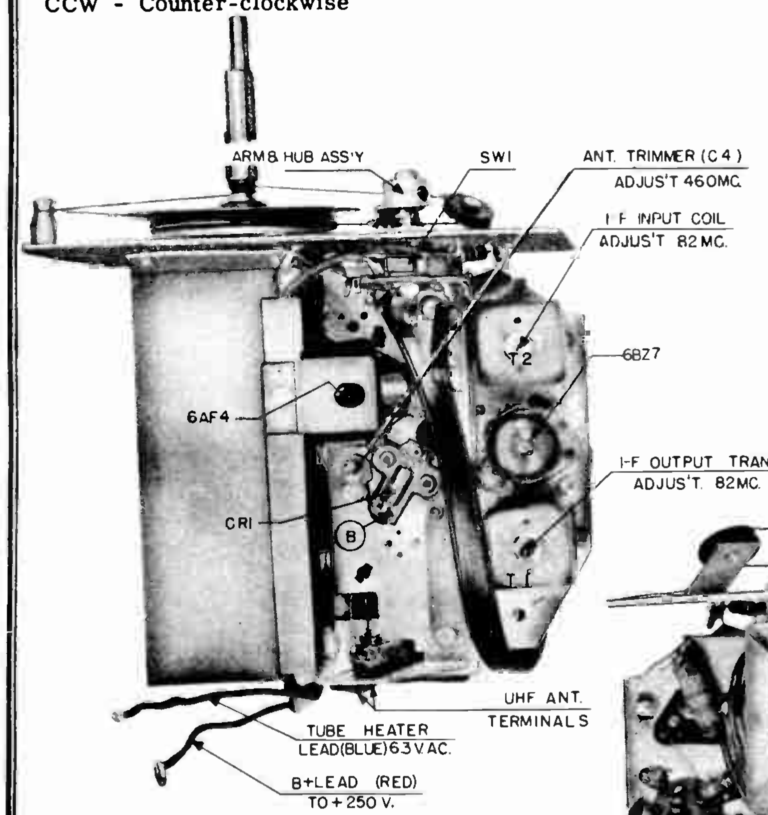
4. Reconnect the B+ and filament leads of the tuner to the same points on the VHF receiver from which they were disconnected. Connect UHF Converter chassis to B- (VHF receiver chassis).

5. Keep all leads as short as possible. One suggested way of doing this is to mound the UHF converter at right angles to the TV chassis with one mounting screw. Most of the leads on the UHF converter will then be of sufficient length that no additional length will need to be added.

6. Set VHF Tuner to Channel 6.

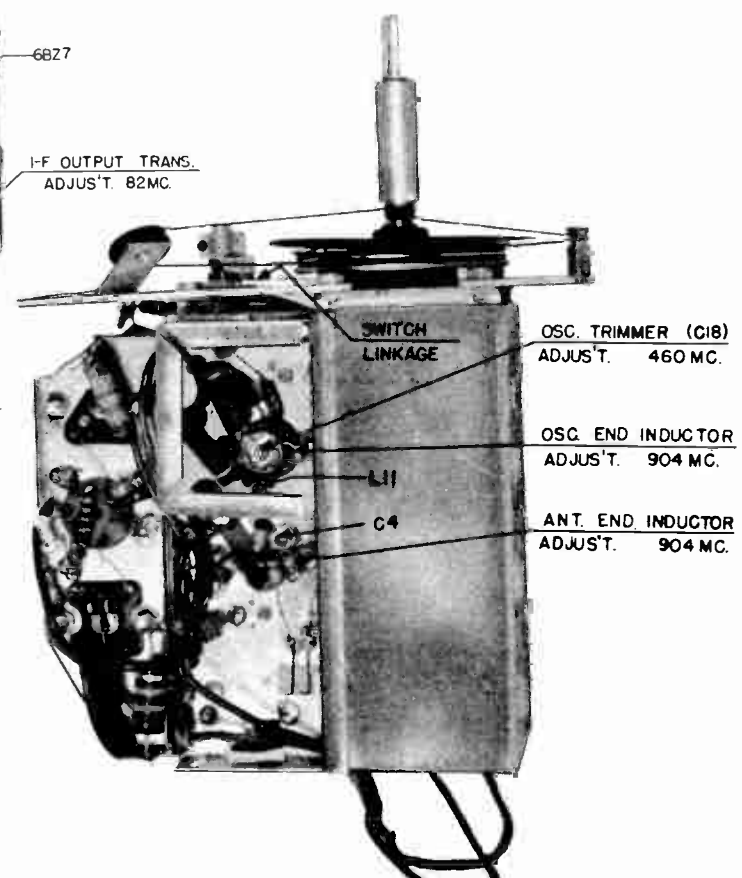
7. Alignment should be followed in the order shown.

*CW - Clockwise
CCW - Counter-clockwise



TOP VIEW - UHF Converter

BOTTOM VIEW - UHF Converter



UHF ALIGNMENT (continued)

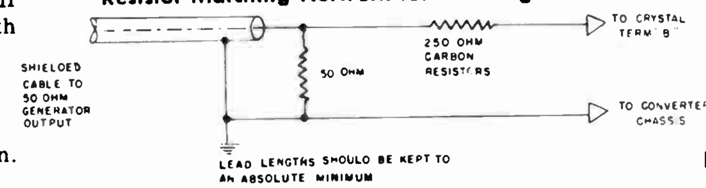
I. F. ALIGNMENT

1. Connect an electronic voltmeter or an oscilloscope across the second detector load resistor.

2. Turn on the power.

3. Apply an 82 mc. signal (amplitude modulated if a scope is used) to the crystal terminal (B) at the junction of C13 and L9 through the resistor network shown in Sketch A.

Resistor Matching Network for I. F. Alignment



SKETCH A

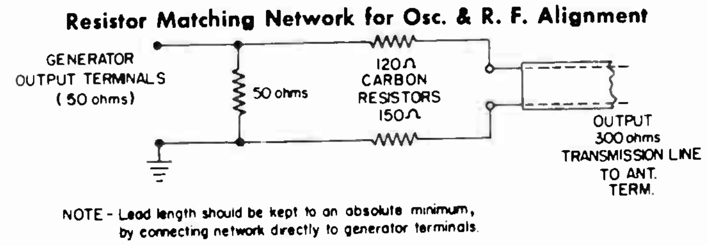
4. Adjust plate coil (T1) and grid coil (T2) for maximum indication on the electronic voltmeter or scope.

5. Disconnect the resistor network from the crystal terminal.

OSCILLATOR ALIGNMENT:

1. With the electronic voltmeter or scope connected across the second detector load resistor, apply a 460 mc. signal (amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.

Resistor Matching Network for Osc. & R. F. Alignment



SKETCH B

2. With the tuner shaft at maximum CCW* position, adjust the oscillator trimmer C6 for peak reading on the electronic voltmeter or maximum indication on the scope (oscillator frequency is set to 84 mc. below the carrier frequency).

3. Set the signal generator to 904 mc.

4. Rotate the tuner shaft to the maximum CW position and adjust the oscillator end inductor L4 up or down for maximum reading on the voltmeter.

*CW - Clockwise
CCW - Counter-clockwise

5. Open the ground connection on L10 and connect an 0-10 ma. D.C. meter between the open end of the crystal return choke L10 and ground.

6. Adjust the oscillator coupling coil L11 for maximum crystal current when the tuner shaft is rotated to the maximum CW position. When operating at normal line voltage (117 volts, 60 cycles), the maximum current should not exceed 5 ma. at any setting of the tuner shaft. When operating at low line voltage (105 volts, 60 cycles), the minimum crystal current must not be less than 0.3 ma. at any setting of the tuner shaft.

7. Repeat steps 1 through 4 until maximum reading is obtained.

R. F. CIRCUIT ALIGNMENT

1. With the electronic voltmeter or scope connected across the second detector load resistor of the VHF receiver, apply a 460 mc. signal (amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.

2. With the tuner shaft at the maximum CCW position, adjust the antenna trimmer C4 for maximum meter reading or for maximum scope indication.

3. Reset signal generator to 904 mc.

4. Rotate the tuner shaft to maximum CW position. Adjust the antenna end inductor L3 by forming larger or smaller loop until maximum reading on the meter (or scope) is obtained.

5. Repeat steps 1 through 4 until maximum reading is obtained.

6. Turn the power switch to the "OFF" position.

7. Disconnect the generator, the electronic voltmeter or scope, and the resistor network. Disconnect the 0-10 ma. meter, and solder the open lead of L10 to the chassis.

8. Re-engage the toggle coupling in the pin on the arm and hub assembly and tighten the set-screws that secure the collar to the switch shaft.

9. The Function Switch should be checked for proper operation under conditions of customer use. At full CCW rotation of the tuner shaft, all VHF position contacts must be fully and firmly made and all UHF position contacts must be fully broken. All UHF position contacts must be fully and firmly made and all VHF position contacts must be fully broken, when the tuner shaft is 7 1/2° or more from full CCW, as tuner shaft is rotated in a clockwise direction.

10. Replace the UHF Converter on the VHF receiver chassis.

ALIGNMENT CHART

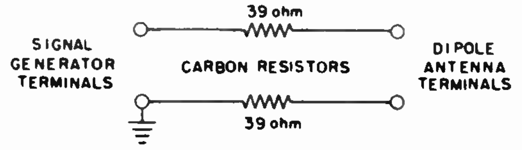
For alignment locations see photograph on page 14 and chart on page 19.

ALIGNMENT SEQUENCE	SIGNAL GENERATOR OUTPUT			POSITION OF		ADJUST	TYPE OF SELECTIVITY CURVE	REMARKS
	FREQUENCY	IN SERIES WITH	TO	FUNCTION SWITCH	TUNING DIAL OR TUN. CAP.			
1	455 KC	.05 mfd	V301 grid pin 7	AM	Open	A & B	Single peak	
2	455 KC	.05 mfd	V301 grid pin 7	AM	Open	C & D	Single peak	Retouch A & B
3	10.7 MC	.05 mfd	V304 grid pin 1	FM	Closed	E	Single peak	See notes 1 & 2
4	10.7 MC	.05 mfd	V304 grid pin 1	FM	Closed	F	----------	Balance to zero volts Notes 1 & 3
5	10.7 MC	.05 mfd	V303 plate pin 5	FM	Closed	E & G	Single peak	See note 4 repeat adj. of E & G for max. align.
6	10.7 MC	.05 mfd	V303 grid pin 1	FM	Closed	H	Single peak	Note 4
7	10.7 MC	.05 mfd	stator center gang section	FM	Closed	J, K & H	Single peak	Notes 4 & 5
8	98 MC	FM Dummy Antenna	FM Ant. Term.	FM	98 MC Mark	L	----------	Note 6
9	104 MC	FM Dummy Antenna	FM Ant. Term.	FM	104 MC	M	----------	Note 7
10	92 MC	FM Dummy Antenna	FM Ant. Term.	FM	92 MC	P	----------	Note 8
11	Repeat steps 9 and 10 until no further improvement is noted.							
12	1400 KC	200 mmf.	Ext. Ant. Term.	AM	1400 KC mark	R	----------	Adjust to peak
13	1400 KC	200 mmf.	Ext. Ant. Term.	AM	1400 KC	S	----------	Note 9

ALIGNMENT CHART NOTES

1. Use an unmodulated signal with generator output of approximately 100,000 microvolts output.
2. Connect an electronic voltmeter across the 27,000 ohm diode load resistor, R309.
3. Connect two 100,000 ohm carbon resistors, matched within 2%, in series. Connect resistors across the 4 mfd. stabilizing capacitor, C320 in the diode circuit. Connect the electronic voltmeter between the output of the I. F. bypass network, C316 and the midpoint of the two 100,000 ohm resistors. Align secondary core (F) of T303 for zero volts, first using a high scale on the voltmeter and then switching to the lowest scale for balance.
4. Use an unmodulated signal. Connect electronic voltmeter across the 27,000 ohm load resistor R309. Limit output of signal generator so that the DC. reading on the voltmeter does not exceed 5 volts. Reduce signal generator output when necessary to hold the 5 volt alignment level. Shift gang capacity slightly to remove interfering spurious FM oscillator signal during FM I. F. alignment.
5. Remove the two 100,000 ohm resistors and the electronic voltmeter after alignment.
6. Adjust turn spacing on FM oscillator coil by spreading or squeezing slightly so that the 98 megacycle signal falls on the 98 megacycle mark on the dial background.
7. Rock gang while adjusting the FM R. F. trimmer until maximum output meter reading is obtained or align for maximum noise level at zero signal.
8. Adjust turn spacing on FM R. F. coil until maximum output meter reading is obtained, using tuning wand to determine "off frequency" setting.
9. Receiver and loop antenna should be in place in the cabinet when aligning the antenna trimmer "S" on the loop support. Align for maximum output.

F. M. DUMMY ANTENNA



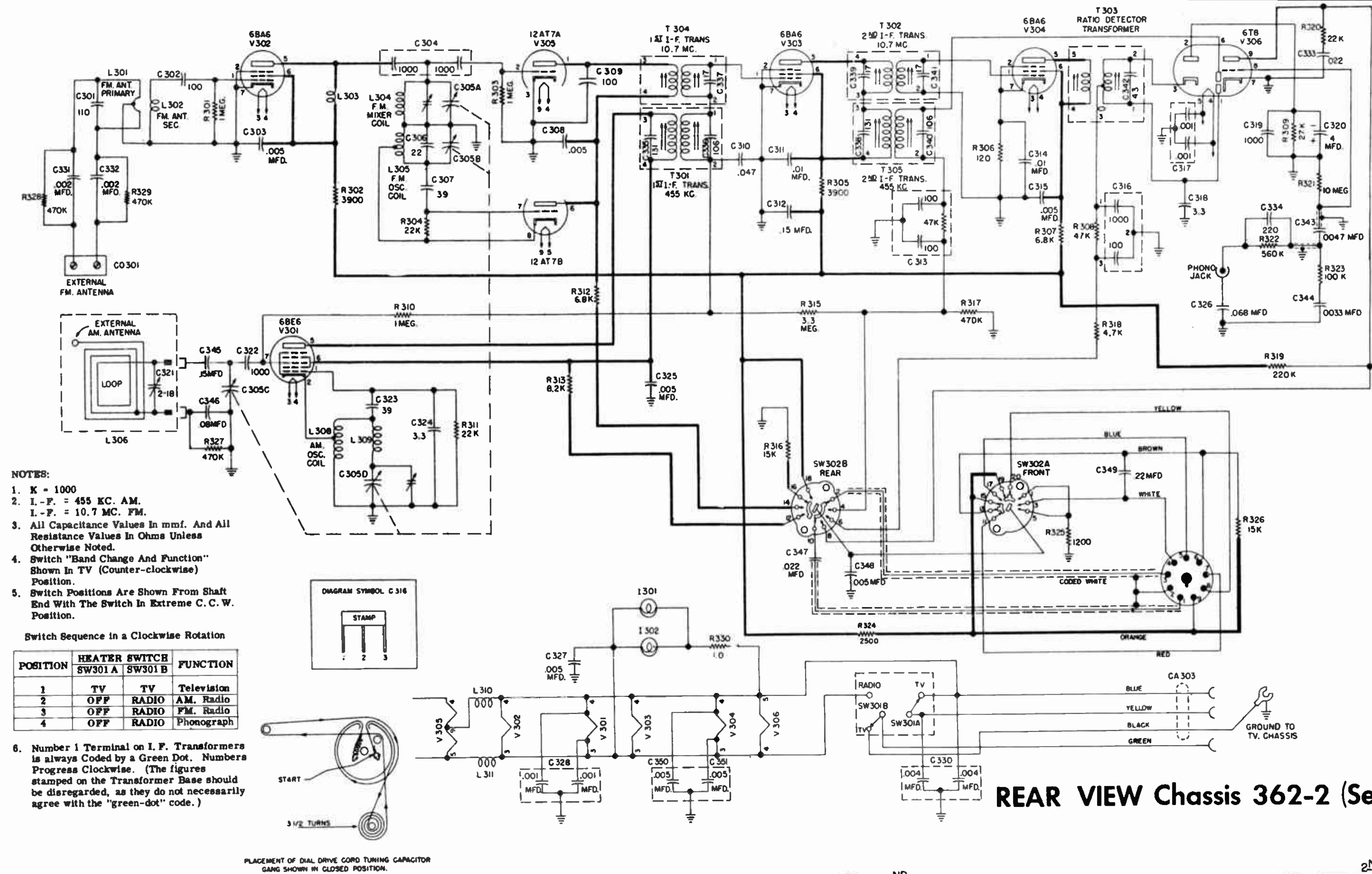
AM-FM TUNER ALIGNMENT PROCEDURE

NOTE: As the radio dial is mounted in the cabinet, it will be necessary to mark oscillator alignment points on the dial background when the chassis is removed from the cabinet, before proceeding with alignment. It will be noted that the dial background has an indentation near the left-hand end. With the tuning gang in full mesh, set the dial pointed to center over this indentation. Using the indentation as a reference point, measure off 2 29/32" to the right and make a pencil mark on the dial background close to the bottom. This mark will correspond to the "98" (98 MC.) calibration on the upper portion of the radio dial. Make another mark 5 1/16" from the indentation to locate the "140" (1400 KC) position on the dial background.

1. Connect an isolation transformer between the power line and the power cord of the television receiver.
2. With the radio tuner power and heater cables and the speaker connected to the television receiver, set the function switch to the position indicated on the ALIGNMENT CHART.
3. Connect output meter across the secondary of the output transformer or voice coil leads to speaker (3.2 ohms).
4. All Amplitude Modulated Input signals are modulated 30% at 400 c.p.s. with the high side of signal generator connected to the receiver as indicated in the ALIGNMENT CHART and the low side of the generator connected to the receiver chassis.
5. All Frequency Modulated signals are modulated 30% at 400 c.p.s.; 30% modulation being equivalent to a deviation of 22.5 kilocycles.
6. Turn the volume control knob to maximum clockwise position and adjust signal generator output to produce a noticeable output meter reading. Keep signal generator output as low as possible to prevent AVC action in the receiver.
7. Alignment sequence must be followed.

VHF OSCILLATOR ADJUSTMENT - A turret type VHF tuner is used on this receiver, and there is an oscillator adjustment for each channel. When the receiver is installed, the oscillator should be adjusted for each channel on which a station is operating in the area. Set the Channel Switch to the channel that is to be adjusted. Turn the Fine Tuning control to the center of its range. The oscillator trimmer screw is directly to the right of the tuner shaft, and is accessible through a hole in the front of the chassis after the two VHF tuning knobs have been removed. Use a non-metallic screwdriver and adjust the oscillator trimmer screw until the proper tuning point is in the center of the Fine Tuning range.

AM-FM TUNER SCHEMATIC
CHASSIS 362-3



NOTES:

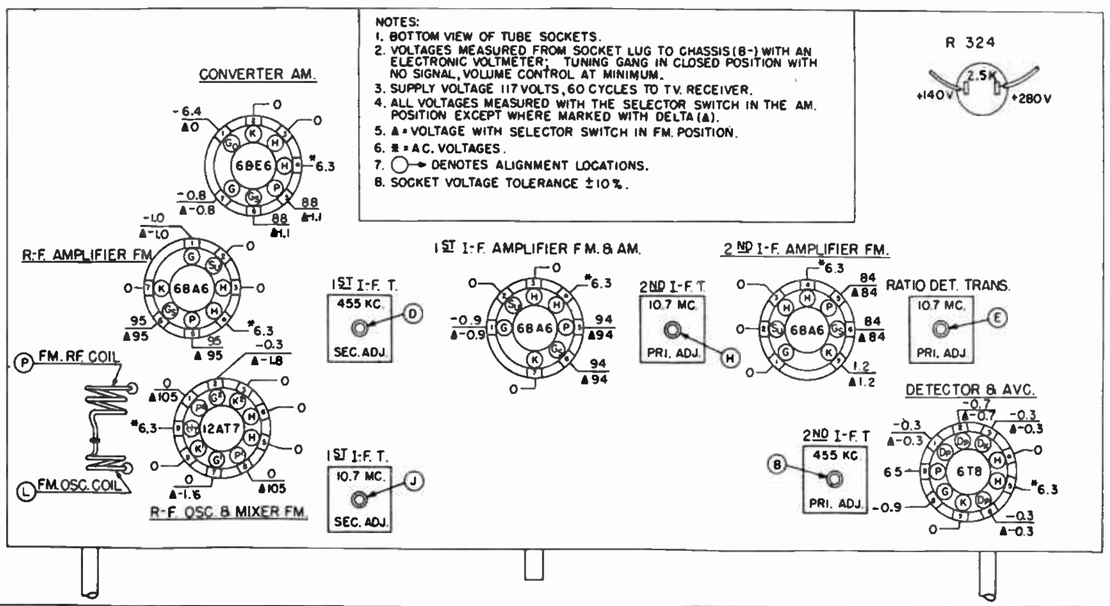
1. K = 1000
2. I.-F. = 455 KC. AM.
   I.-F. = 10.7 MC. FM.
3. All Capacitance Values In mmf. And All Resistance Values In Ohms Unless Otherwise Noted.
4. Switch "Band Change And Function" Shown In TV (Counter-clockwise) Position.
5. Switch Positions Are Shown From Shaft End With The Switch In Extreme C. C. W. Position.

Switch Sequence in a Clockwise Rotation

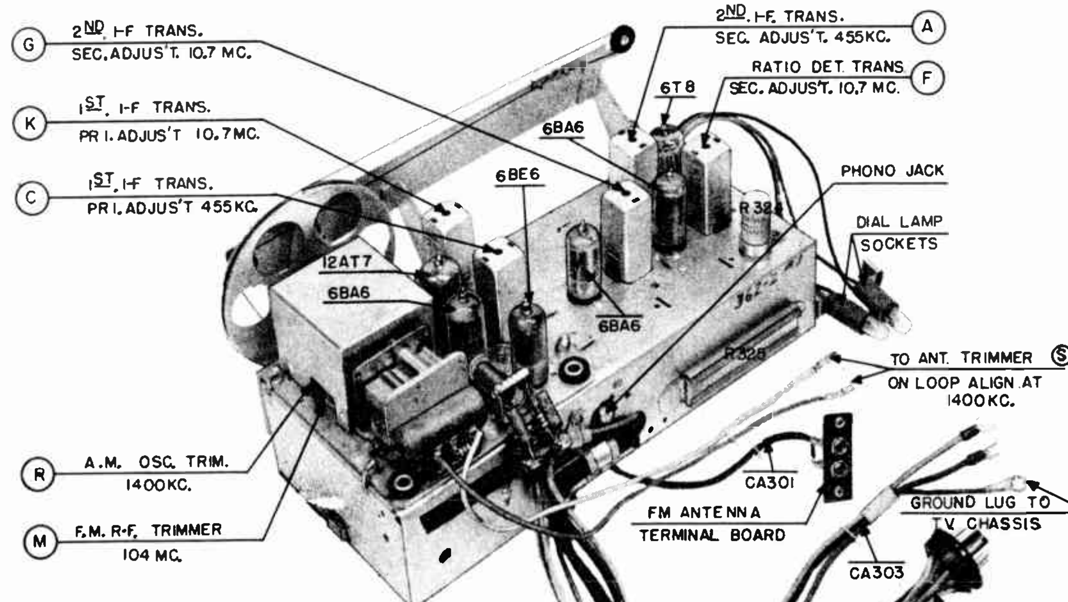
POSITION	HEATER SWITCH SW301 A	HEATER SWITCH SW301 B	FUNCTION
1	TV	TV	Television
2	OFF	RADIO	AM. Radio
3	OFF	RADIO	FM. Radio
4	OFF	RADIO	Phonograph

6. Number 1 Terminal on I. F. Transformers is always Coded by a Green Dot. Numbers Progress Clockwise. (The figures stamped on the Transformer Base should be disregarded, as they do not necessarily agree with the "green-dot" code.)

AM-FM SOCKET VOLTAGE CHART

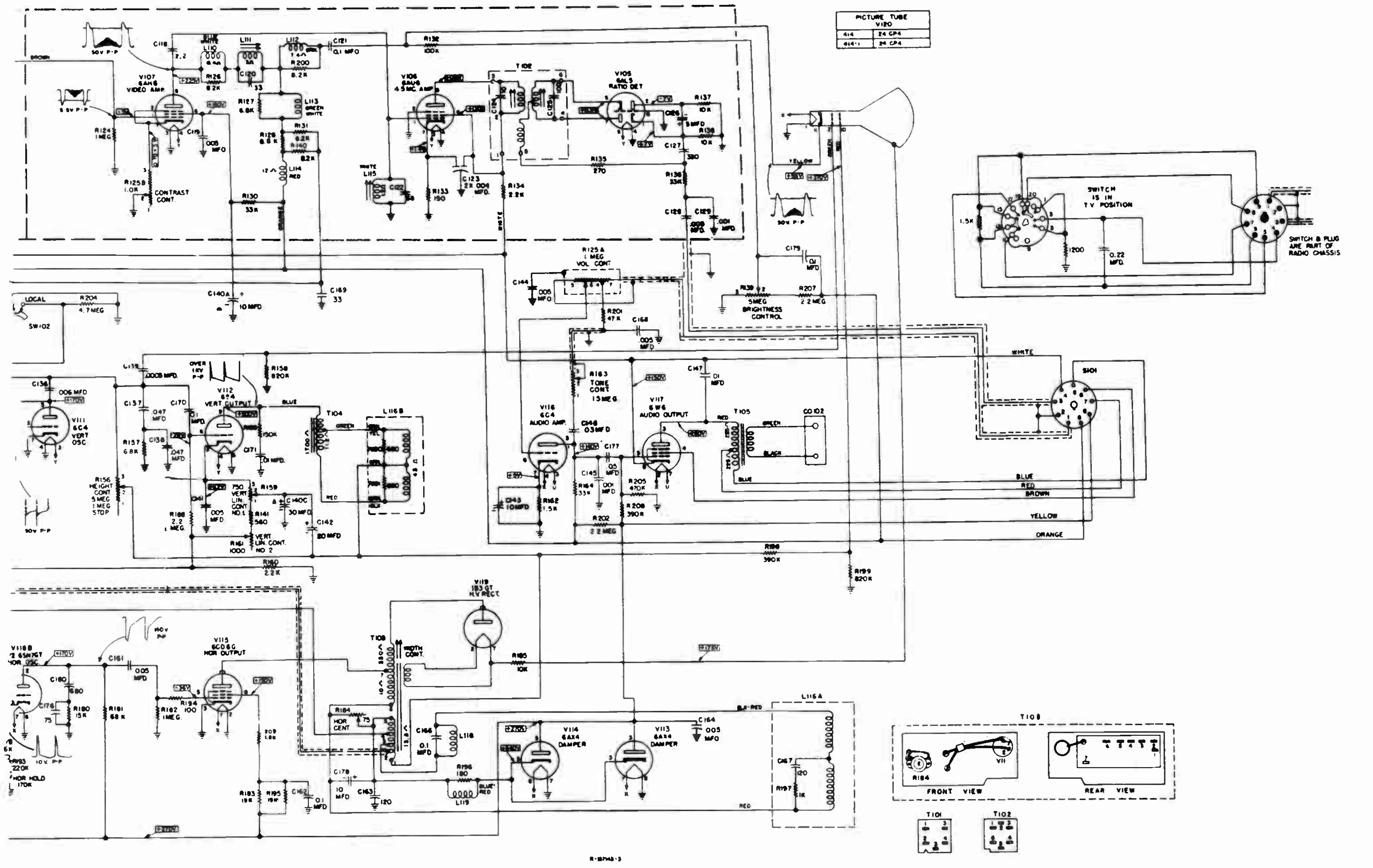


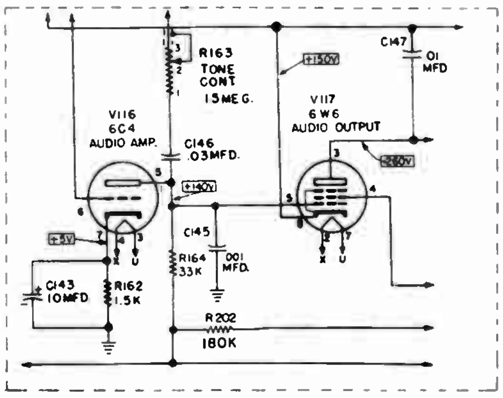
REAR VIEW Chassis 362-2 (See Note)



NOTES: 1. TUBE & ALIGNMENT LOCATIONS FOR 362-3.
2. THE PHOTOGRAPH SHOWS THE REAR VIEW OF CHASSIS 362-2. THE ONLY DIFFERENCE IN CHASSIS 362-3 IS THAT THE FILAMENT CABLE HAS THREE CONDUCTORS WITH A FOURTH CONNECTION TO THE TV CHASSIS.

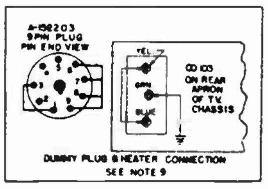
'HASSIS 414 & 414-1 (Code B)

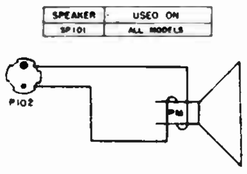


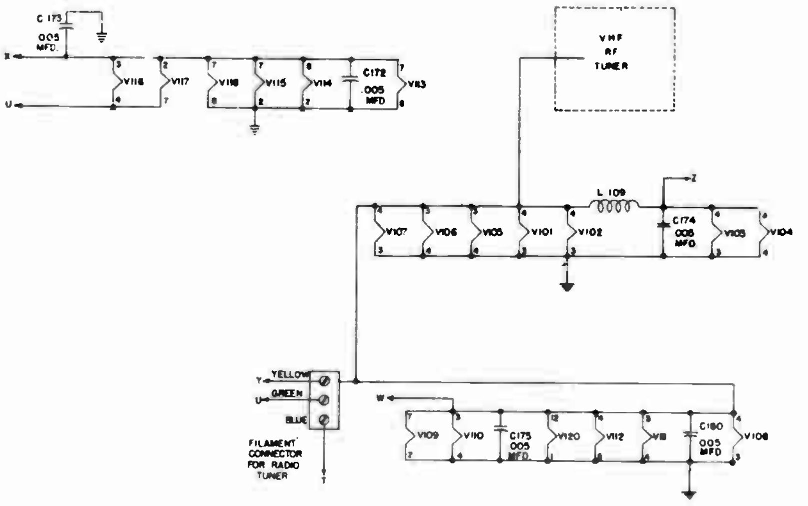


:HASSIS: 414 (Code A)
414-1 (Code A)

:oupling circuit between the
tput tubes as it is found in
(Code A). Later production
is shown in the full Chassis







EPLACEMENT PARTS LIST

VHF Tuner (see note)

ription	Symbol No.	Part No.	Description
, Feed Thru	L5		
f., disc ceramic	L6	156908-*	R. F. & Oscillator Coil Assembly
, disc ceramic	L7		
10%, disc ceramic	L8	156906-51	Choke, Filament, Mixer
., Trimmer, ceramic	L9	156906-52	Choke, Plate, Mixer
disc ceramic	L10	156906-53	I. F. Assembly
., Trimmer, ceramic	1		R. F. Amplifier (V1)
, ± .25 mmf.,	2		Mixer Oscillator (V2)
	3	156906-23	Tube Shield (V1)
± .25 mmf.,	4	156906-24	Tube Shield (V2)
	5	156906-25	Shield (Side)
± .25 mmf.,	6	156906-26	Shield (Bottom)
	7	156906-27	Roller, Detent
ing	8	156906-28	Spring, Detent
10%, disc ceramic	9	156906-29	Spring, Shaft Retaining
f., disc ceramic	10	156906-29	Spring, Shaft Retaining
5%, disc ceramic	12	156906-32	Plate, Fine Tuning Grounding
, 10%, disc ceramic	13	156906-33	Mounting Strap, Ceramic Bushing
, Trimmer, ceramic	14	156906-54	Fine Tuning Shaft Assembly
, Feed Thru	15	156906-35	Ceramic Bushing & Lead Assembly (Fine Tuning)
, Feed Thru			
, Feed Thru	16		
, Feed Thru	17	See C5, C7, & C16	Capacitor, Ceramic Tube
m, 10%, 1/2 w.	18		
m, 10%, 1/2 w.	19	156906-39	Nut (Spring), Trimmer
10%, 1/2 w.	20	156906-40	Screw, Trimmer
n, 10%, 1/2 w.	21	156906-41	Contact Bracket Assembly
m, 10%, 1/2 w.	22	156906-45	Coil Support Assembly & Insulated Shaft
n, 10%, 1/2 w.	26	156906-44	Spring, Slug Retaining
n, 10%, 1/2 w.	40	See L10	I. F. Assembly
), 10%, 1/2 w.	41		
n, 10%, 1/2 w.	thru	See L1, L2	Antenna Coil Assembly
o, 10%, 1/2 w.	52		
	53		
ly	thru	See L5, L6, & L7	R. F. & Oscillator Coil Assembly
	64		
F. Amplifier		156189	VHF Tuner Complete

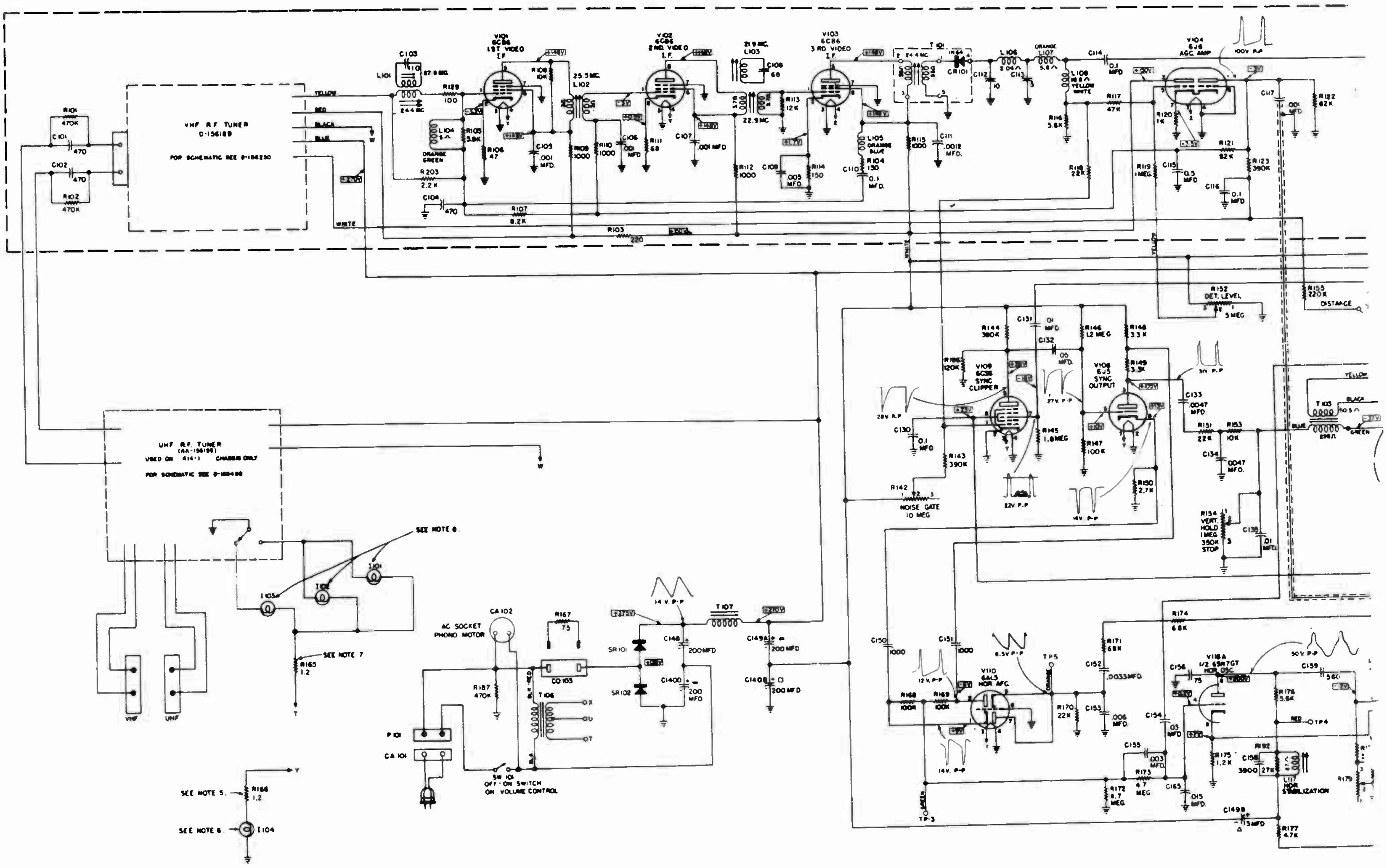
Coil Assembly are necessary for each channel to be received. The dash number following the basic
ly is designed. Example: 156907-2, Antenna Coil Assembly for Channel 2; 156908-13, R. F. &

bol No. L10 refer to corresponding numbers on Exploded View of the VHF Tuner

NOTES:

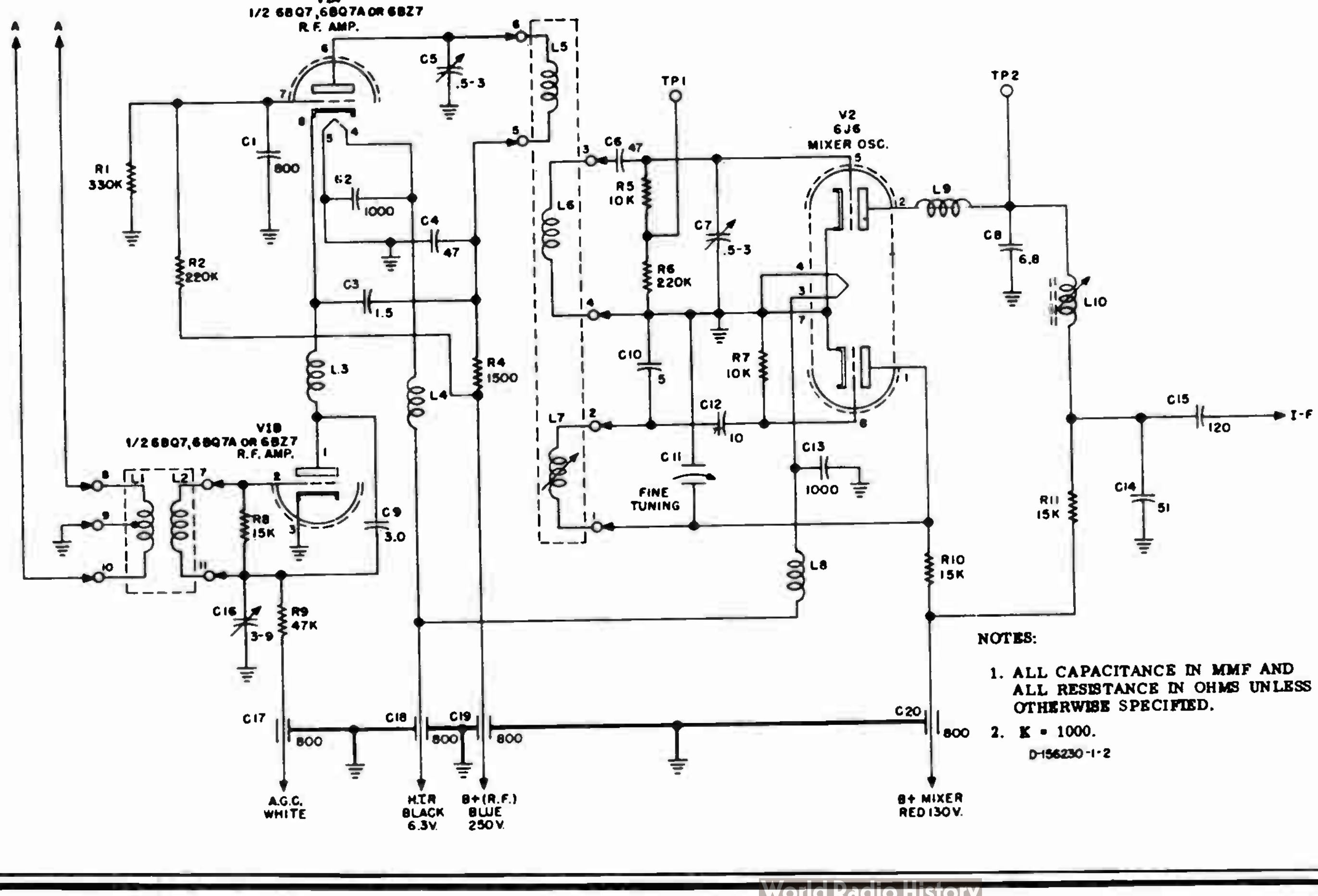
1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2. SUPPLY VOLTAGE 117 VOLTS 60 CYCLE AC.
3. K = 1000
4. ALL CAPACITANCE VALUES IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. R166 IS USED ON 414 CHASSIS.
6. I104 IS USED ON 414 CHASSIS.
7. R165 IS USED ON 414-1 CHASSIS.
8. I101, I102, I103 IS USED ON 414-1 CHASSIS.
9. WHEN SERVICING THE TELEVISION CHASSIS WITH THE RADIO TUNER DISCONNECTED, A DUMMY PLUG MUST BE INSERTED IN THE 9 PIN SOCKET ON THE REAR APRON OF THE TV. CHASSIS, AND A WIRE STRAP MUST BE CONNECTED ACROSS THE OUTSIDE TERMINALS OF CO103 AND A GROUND STRAP FROM CENTER TERMINAL TO CHASSIS TO COMPLETE THE TUBE HEATER CIRCUIT.
10. EARLY PRODUCTION CHASSIS USED A CONTRAST CONTROL WITH A RESISTANCE ELEMENT OF 1500 OHMS. A 3300 OHM, 10%, 1/2 WATT FIXED RESISTOR (PART NUMBER 39374-31) WAS CONNECTED BETWEEN TERMINAL LUG 1 AND LUG 3 OF THE CONTROL. THE 1500 OHM CONTROL HAS THE SAME PART NUMBER (155580-1) AS THE 1000 OHM CONTROL. THE SERVICE DEPT. WILL FURNISH ONLY THE 1000 OHM CONTROL. WHEN USING THIS CONTROL, DO NOT USE THE 3300 OHM RESISTOR SHUNT. (NO CODE LETTER IS USED TO DESIGNATE THIS CHANGE).
11. SEE PAGE 20 (CODE CHANGES FOR CIRCUITS THAT WERE CHANGES DURING PRODUCTION).

SCHEMATIC WIRING DIAGRAM C



The figure at the right shows the audio amplifier and the audio ou
Chassis 414 (Code A) and 414-1
Chassis (Code B) have the circuit
Schematic.

VHF TUNER SCHEMATIC



NOTES:

1. ALL CAPACITANCE IN MMF AND ALL RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. K = 1000.

D-156230-1-2

R

Symbol No.	Part No.	Desc.
C1	156906-1	Capacitor, 800 mmf.
C2	156906-2	Capacitor, 1000 mm
C3	156906-3	Capacitor, 1.5 mmf.
C4	156906-4	Capacitor, 47 mmf.,
C5	156906-5	Capacitor, .5-3 mmf
C6	156906-4	Capacitor, 47 mmf.,
C7	156906-5	Capacitor, .5-3 mmf
C8	156906-8	Capacitor, 6.8 mmf. disc ceramic
C9	156906-9	Capacitor, 3 mmf., disc ceramic
C10	156906-10	Capacitor, 5 mmf., disc ceramic
C11	See Ref. 15	Capacitor, Fine Tuni
C12	156906-12	Capacitor, 10 mmf.,
C13	156906-2	Capacitor, 1000 mm
C14	156906-14	Capacitor, 51 mmf.,
C15	156906-15	Capacitor, 120 mmf.
C16	156906-16	Capacitor, 3-9 mmf.
C17	156906-17	Capacitor, 800 mmf.
C18	156906-17	Capacitor, 800 mmf.
C19	156906-17	Capacitor, 800 mmf.
C20	156906-17	Capacitor, 800 mmf.
R1	39374-55	Resistor, 330,000 oh
R2	39374-53	Resistor, 220,000 oh
R4	39374-27	Resistor, 1500 ohm,
R5	156906-47	Resistor, 10,000 ohm
R6	39374-53	Resistor, 220,000 oh
R7	39374-37	Resistor, 10,000 ohm
R8	156906-48	Resistor, 15,000 ohm
R9	39374-45	Resistor, 47,000 ohm
R10	39374-39	Resistor, 15,000 ohm
R11	39374-39	Resistor, 15,000 ohm
L1 L2	156907-*	Antenna Coil Assemb
L3	156906-49	Choke, Cathode
L4	156906-50	Choke, Filament, R.

* One Antenna Coil Assembly and one R. F. & Oscillato
part number indicates the channel for which the assem
Oscillator Coil Assembly for Channel 13.

NOTE: Reference numbers (1, 2, 3, etc.) that follow Sy

REPLACEMENT PARTS LIST

AM-FM Tuner Chassis 362-3

Symbol No.	Part No.	Description
C301	145913-2	Capacitor, 110 mmf., 5%, 500 v., ceramic
C302	137727-1	Capacitor, 100 mmf., 300 v., ceramic
C303	137727-121	Capacitor, .005 mfd., 500 v., ceramic
C304A	144675-7	Capacitor, 1000 mmf., 500 v. Disc
C304B		Capacitor, 1000 mmf., 500 v. Ceramic
C305A	152158-1	Capacitor, Tuning
C305B		Capacitor, Tuning Four
C305C		Capacitor, Tuning Section
C305D		Capacitor, Tuning
C306	137727-98	Capacitor, 22 mmf., 2%, 500 v., ceramic
C307	137727-109	Capacitor, 39 mmf., 10%, 200 v., ceramic
C308	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C309	137727-90	Capacitor, 100 mmf., 500 v., ceramic
C310	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C311	144675-13	Capacitor, .01 mfd., 500 v., disc ceramic
C312	39477-31	Capacitor, .15 mfd., 400 v., molded paper
C313	142951-2	Capacitor-Resistor Unit, Two 100 mmf. capacitors & one 47,000 ohm resistor
C314	144675-13	Capacitor, .01 mfd., 500 v., disc ceramic
C315	137727-121	Capacitor, .005 mfd., 500 v., ceramic
C316	144675-12	Capacitor, 1000 mfd., 500 v. Disc
		Capacitor, 100 mfd., 500 v. Ceramic
C317	144675-7	Capacitor, .001 mfd., 500 v. Disc
		Capacitor, .001 mfd., 500 v. Ceramic
C318	137398-5	Capacitor, 3.3 mmf., 500 v., ceramic
C319	137727-8	Capacitor, 1000 mmf., 300 v., ceramic
C320	142958-1	Capacitor, 4 mfd., 50 v., Electrolytic
C321	Part of L306	Capacitor, Trimmer
C322	137727-8	Capacitor, 1000 mmf., 300 v., ceramic
C323	137727-109	Capacitor, 39 mmf., 10%, 200 v., ceramic
C324	137398-5	Capacitor, 3.3 mmf., 500 v., ceramic
C325	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C326	39478-46	Capacitor, .068 mfd., 10%, 600 v., molded paper
C327	137727-121	Capacitor, .005 mfd., 500 v., ceramic
C328	144675-7	Capacitor, .001 mfd., 500 v., Two Section
		Capacitor, .001 mfd., 500 v. disc ceramic
C330	144675-6	Capacitor, .004 mfd., 500 v. Two Section
		Capacitor, .004 mfd., 500 v. disc ceramic
C331	156258-1	Capacitor, .002 mfd., 400 v., paper
C332	156258-1	Capacitor, .002 mfd., 400 v., paper
C333	39477-43	Capacitor, .022 mfd., 600 v., molded paper
C334	137727-131	Capacitor, 220 mmf., 500 v., ceramic
C335	Part of T301	Capacitor, 131 mmf.
C336	Part of T301	Capacitor, 106 mmf.
C337	Part of T304	Capacitor, 17 mmf.
C338	Part of T305	Capacitor, 131 mmf.
C339	Part of T302	Capacitor, 17 mmf.
C340	Part of T305	Capacitor, 106 mmf.
C341	Part of T302	Capacitor, 17 mmf.
C342	Part of T303	Capacitor, 43 mmf.
C343	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C344	39477-38	Capacitor, .0033 mfd., 600 v., molded paper
C345	39001-20	Capacitor, .15 mfd., 600 v., paper
C346	39001-85	Capacitor, .08 mfd., 600 v., paper
C347	39477-43	Capacitor, .022 mfd., 600 v., molded paper
C348	137727-121	Capacitor, .005 mfd., 500 v., ceramic
C349	39477-32	Capacitor, .22 mfd., 400 v., molded paper
*C350	39433-11	Capacitor, .005 mfd., 150 v., paper
*C351	39433-11	Capacitor, .005 mfd., 150 v., paper
R301	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R302	39374-120	Resistor, 3900 ohm, 10%, 1 w.
R303	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R304	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R305	39374-120	Resistor, 3900 ohm, 10%, 1 w.
R306	39374-14	Resistor, 120 ohm, 10%, 1/2 w.
R307	39374-123	Resistor, 6800 ohm, 10%, 1 w.
R308	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R309	39374-42	Resistor, 27,000 ohm, 10%, 1/2 w.
R310	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R311	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R312	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.

Symbol No.	Part No.	Description
R313	39374-124	Resistor, 8200 ohm, 10%, 1 w.
R315	39374-73	Resistor, 3.3 megohm, 10%, 1/2 w.
R316	39374-215	Resistor, 15,000 ohm, 10%, 2 w.
R317	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R318	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R319	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R320	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R321	39374-85	Resistor, 10 megohm, 10%, 1/2 w.
R322	39374-58	Resistor, 560,000, 10%, 1/2 w.
R323	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R324	152338-4	Resistor, 2500 ohm, 5%, 10 w.
R325	155936-1	Resistor, 1200 ohm, 5%, 7 w.
R326	39374-215	Resistor, 15,000 ohm, 10%, 2 w.
R327	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R328	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R329	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R330	39303-8	Resistor, 1 ohm, 10%, 1/2 w.
CA301		Cable, 75 ohm Transmission Line
CA302	156640-1	Cable & Switch Assy. (R312, R318, CA302, C330, C347, C349, SW301, SW302, CA303)
CA303	Part of CA302	Cable, Heater Cable & Lugs
CO301	150208-1	Assembly, Terminal Board
I301	138437-1	Dial Bulb, Type 47, 6.3 v., .15 amp.
I302	138437-1	Dial Bulb, Type 47, 6.3 v., .15 amp.
J301	155717-1	Connector, Phonograph
L301	143322-1	Coil, F. M. Antenna Primary
L302	145724-1	Coil, F. M. Antenna Secondary
L303	143837-1	Coil, Choke
L304	151747-1	Coil, R. F. (F. M.)
L305	151746-1	Coil, Oscillator (F. M.)
L306	152345-1	Loop Antenna (A. M.)
L308	152448-1	Coil, Oscillator (A. M.)
L309	143837-1	Choke
L310	149187-1	Choke
L311	149187-1	Choke
P301	152203	Connector, Cable
SW301A	156120	Switch, Range & Power (Assembly)
SW301B		
SW302A		
SW302B		
T301	139919-3	Transformer, 1st I. F. (455 Kc.)
T302	145025-1	Transformer, 2nd I. F. (10.7 Mc.)
T303	145193-1	Transformer, Ratio Detector
T304	145025-3	Transformer, 1st I. F. (10.7 Mc.)
T305	139919-3	Transformer, 2nd I. F. (455 Kc.)
	152125-3	Background Assembly, Dial
	131154-1	Cotter (External), Drive Shaft
	145697	Insulation & Bushing Assembly
	138853	Insulator, Control Mtg.
	155952	Insulator, Dial Background (2 used)
	155517	Link
	155721	Link and Connecting Arms
	139040	Mounting (Shock), Sub Chassis
	152195	Pointer, Dial
	137939-1	Pulley, Drive Cord Idler
	132028	Rivet, Drive Cord
	137940-1	Rivet, Idler Pulley
	39311-60	Set Screw
	155518	Shaft, Dial Drive
	152651	Shield Assembly
	145205	Socket, Contact (AM Antenna Leads)
	136565-25	Socket, Dial Light
	139727-10	Socket and Cable, Phono Motor
	142761	Socket, Tube (V301, V302)
	39462-2	Socket, Tube (V303, V304)
	144732	Socket, Tube (V305)
	145607	Socket, Tube (V306)
	145757	Spring, Drive Cord
	138568	Strip (Paper), Dial Pointer
	139121	Stud, Insulating
	134916	Washer (Spring), Drive Shaft
	138976	Washer (Extruded), Control Mtg.

* These Two Capacitors Replace a Two Section .004 Capacitor Used in Early Production.

SCHEMATIC REPLACEMENT PARTS LIST

Symbol No.	Part No.	Description
C101	156201-1	Capacitor, 470 mmf., 2 kv., disc ceramic
C102	156201-1	Capacitor, 470 mmf., 2 kv., disc ceramic
C103	137499-37	Capacitor, 110 mmf., 10%, 500 v., mica (Part of L101)
C104	156201-3	Capacitor, 470 mmf., 500 v., disc ceramic
C105	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C106	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C107	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C108	137499-33	Capacitor, 68 mmf., 10%, 500 v., mica (Part of L104)
C109	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C110	39001-19	Capacitor, .1 mfd., 600 v., paper
C111	156201-4	Capacitor, .0012 mfd., 600 v., disc ceramic
C112	137727-135	Capacitor, 10 mmf., 500 v., ceramic
C113	137727-103	Capacitor, 5 mmf., 500 v., ceramic
C114	39001-19	Capacitor, .1 mfd., 600 v., paper
C115	154157-1	Capacitor, .5 mfd., -10% + 40%, 25 v., paper
C116	39001-19	Capacitor, .1 mfd., 600 v., paper
C117	156201-2	Capacitor, .001 mfd., 2 kv., disc ceramic
C118	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic
C119	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C120	137727-126	Capacitor, 33 mmf., 500 v., ceramic
C121	39001-19	Capacitor, .1 mfd., 600 v., paper
C122	137737-133	Capacitor, 68 mmf., 10%, 500 v., ceramic
C123	144675-6	Capacitor, .004 mfd., 500 v. Two Section
		Capacitor, .004 mfd., 500 v. Disc Ceramic
C124	Part of T102	Capacitor, 10 mmf.
C125	Part of T102	Capacitor, 100 mmf.
C126	154103-1	Capacitor, 5 mfd., 50 v., electrolytic
C127	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C128	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C129	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C130	39001-19	Capacitor, .1 mfd., 600 v., paper
C131	39477-7	Capacitor, .01 mfd., 600 v., molded paper
C132	39001-17	Capacitor, .05 mfd., 600 v., paper
C133	39477-5	Capacitor, .0047 mfd., 600 v., molded paper
C134	39477-5	Capacitor, .0047 mfd., 600 v., molded paper
C135	39478-7	Capacitor, .01 mfd., 10%, 600 v., molded paper
C136	39001-78	Capacitor, .006 mfd., 600 v., paper
C137	39477-11	Capacitor, .047 mfd., 600 v., molded paper
C138	39477-11	Capacitor, .047 mfd., 600 v., molded paper
C139	39001-5	Capacitor, ,0005 mfd., 600 v., paper
C140A	155910-1	Capacitor, 10 mfd., 10%, 300 v.
C140B		Capacitor, 200 mfd., 10%, 150 v. Electrolytic
C140C		Capacitor, 30 mfd., 10%, 150 v.
C140D		Capacitor, 200 mfd., 10% 150 v.
C141	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C142	156021-1	Capacitor, 20 mfd., 10%, 600 v., electrolytic
C143	154104-1	Capacitor, 10 mfd., 50 v., electrolytic
C144	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C145	39001-7	Capacitor, .001 mfd., 600 v., paper
C146	39001-82	Capacitor, .03 mfd., 600 v., paper
C147	39001-13	Capacitor, .01 mfd., 600 v., paper
C148	155911-1	Capacitor, 200 mfd., 10%, 150 v., electrolytic
C149A	155436-1	Capacitor, 200 mfd., 300 v. Electrolytic
C149B		Capacitor, 5 mfd., 300 v.
C150	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C151	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C152	39478-114	Capacitor, .0033 mfd., 10%, 1000v., molded paper
C153	146434-16	Capacitor, .006 mfd., 10%, 600 v., paper
C154	39001-82	Capacitor, .03 mfd., 600 v., paper
C155	39001-76	Capacitor, .003 mfd., 600 v., paper
C156	137737-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C158	137499-30	Capacitor, 3900 mmf., 10%, 500 v., mica
C159	137499-34	Capacitor, 560 mmf., 10%, 500 v., mica
C160	137499-32	Capacitor, 680 mmf., 10%, 500 v., mica
C161	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C162	39001-19	Capacitor, .1 mfd., 600 v., paper
C163	156569-1	Capacitor, 120 mmf., 10%, 5 kv., disc ceramic
C164	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C165	39001-14	Capacitor, .015 mfd., 600 v., paper
C166	Part of L118	Capacitor, .1 mfd., 5%, 200 v., paper
C167	154988	Capacitor, 120 mmf., 10%, 3 kv., disc ceramic
C168	39001-11	Capacitor, .005 mfd., 600 v., paper
C169	137727-126	Capacitor, 33 mmf., 500 v., ceramic
C170	39001-19	Capacitor, .1 mfd., 600 v., paper
C171	39001-13	Capacitor, .01 mfd., 600 v., paper

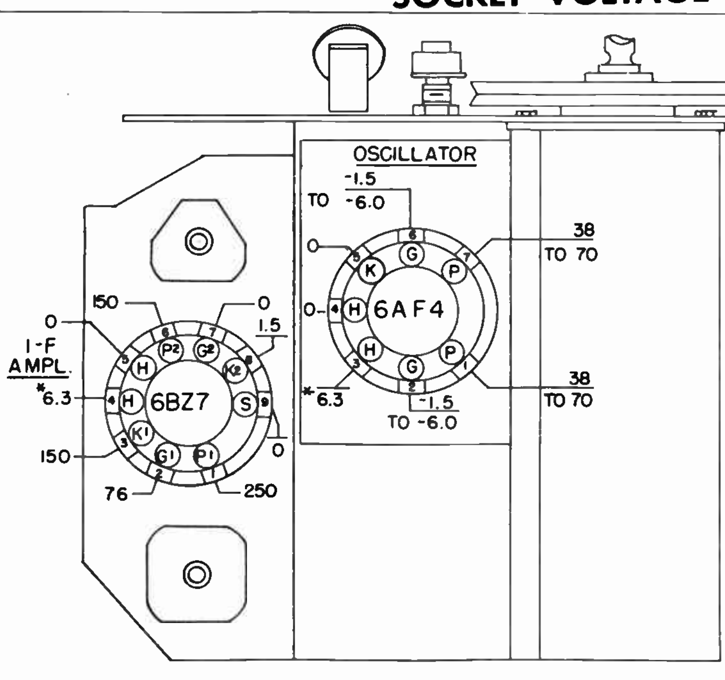
Symbol No.	Part No.	Description
C172	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C173	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C174	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C175	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C176	137727-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C177	39001-17	Capacitor, .05 mfd., 600 v., paper
C178	156054-1	Capacitor, 10 mfd., 10 v., electrolytic
C179	39001-19	Capacitor, .1 mfd., 600 v., paper
C180	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
R101	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R102	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R103	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
R104	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R105	Part of L104	Resistor, 3900 ohm, 5%, 1/2 w.
R106	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R107	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R108	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R109	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R110	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R111	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R112	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R113	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
R114	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R115	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R116	39375-67	Resistor, 5600 ohm, 5%, 1/2 w.
R117	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R118	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R119	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R120	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R121	39374-48	Resistor, 82,000 ohm, 10%, 1/2 w.
R122	39374-48	Resistor, 82,000 ohm, 10%, 1/2 w.
R123	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R124	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R125A	155580-1	Control, Volume (1 megohm) Assembly
R125B		Control, Contrast (1000 ohm)
R126	Part of L110	Resistor, 8200 ohm, 10%, 1/2 w.
R127	Part of L113	Resistor, 6800 ohm, 10%, 1/2 w.
R128	39375-365	Resistor, 6800 ohm, 5%, 2 w.
R129	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R130	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
R131	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R132	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R133	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R134	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R135	39374-18	Resistor, 270,000 ohm, 10%, 1/2 w.
R136	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R137	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R138	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R139	155352-1	Control, Brightness (5 megohm)
R140	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R141	39374-22	Resistor, 560 ohm, 10%, 1/2 w.
R142	156332-1	Control, Noise Gate (10 megohm)
R143	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R144	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R145	39374-67	Resistor, 1.8 megohm, 10%, 1/2 w.
R146	39374-63	Resistor, 1.2 megohm, 10%, 1/2 w.
R147	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R148	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R149	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R150	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R151	39374-41	Resistor, 22,000 ohm, 10% 1/2 w.
R152	156334-1	Control, Dectector Level (5 megohm)
R153	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R154	155610-1	Control, Vertical Hold (1 megohm)
R155	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R156	154086-1	Control, Height (5 megohm)
R157	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R158	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R159	155519-1	Control, Vertical Linearity (750 ohm)
R160	39374-117	Resistor, 2200 ohm, 10%, 1 w.
R161	148861-1	Control, Vertical Linearity (1000 ohm)
R162	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R163	155956-1	Control, Tone (1.5 megohm)
R164	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R165	39303-9	Resistor, 1.2 ohm, 10%, 1/2 w. (On 414-1 Chassis)
R166	39303-9	Resistor, 1.2 ohm, 10%, 1/2 w. (On 414 Chassis)
R167	156540	Resistor, 7.5 ohm, 10%, 7.5 w., wire wound
R168	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R169	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.

SCHEMATIC REPLACEMENT PARTS LIST

Chassis 414 & 414-1

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
R170	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.	L105	156362	Coil, R. F. Choke (5 microhenries)
R171	39374-135	Resistor, 68,000 ohm, 10%, 1w.	L106	154376	Coil, Diode Choke (15.5 microhenries)
R172	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.	L107	156714	Coil, Video Peaking (90 microhenries)
R173	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.	L108	154184	Coil, Video Peaking (335 microhenries)
R174	39374-135	Resistor, 68,000 ohm, 10%, 1 w.	L109	155256	Coil, Choke R.F. Filament (.576 microhenries)
R175	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.			
R176	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.	L110	154194	Coil, Video Peaking (414 microhenries)
R177	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.	L111	155446	Coil, 4.5 Mc. Trap (27-57 microhenries)
R178	39374-46	Resistor, 56,000 ohm, 10%, 1/2 w.	L112	156618	Coil, Video Peaking (117 microhenries)
R179	155511-1	Control, Horizontal Hold (170,000 ohm)	L113	154206	Coil, Video Peaking (106 microhenries)
R180	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.	L114	156619	Coil, Video Peaking (240 microhenries)
R181	39374-47	Resistor, 68,000 ohm, 10%, 1/2 w.	L115	155442	Coil, Sound Take-Off (12-23 microhenries)
R182	39374-61	Resistor, 1 megohm, 10%, 1/2 w.	L116A	156839-1	Deflection Yoke Assembly
R183	39374-215	Resistor, 15,000 ohm, 10%, 2 w.	L116B		Deflection Yoke Assembly
R184	155844	Control, Horizontal Centering (75 ohm)	L117	154220	Coil, Horizontal Oscillator (18-37 microhenries)
R185	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.			
R186	39374-50	Resistor, 120,000 ohm, 10%, 1/2 w.	L118	155944	Network, Yoke Coupling (10 millihenries)
R187	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.	L119	156575	Coil, R.F. Choke (16 microhenries)
R188	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.	T101	155594-1	Transformer, Diode I. F.
R189	39374-139	Resistor, 150,000 ohm, 10%, 1 w.	T102	154108-1	Transformer, Ratio Detector
R190	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L116)	T103	155255-1	Transformer, Vertical Oscillator
R191	39374-23	Resistor, 680 ohm, 10%, 1/2 w.(Part of L116)	T104	155966-1	Transformer, Vertical Output
R192	39374-42	Resistor, 27,000 ohm, 10%, 1/2 w.	T105	155587-1	Transformer, Audio Output
R193	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.	T106	155532	Transformer, Filament
R194	39374-13	Resistor, 100 ohm, 10%, 1/2 w.	T107	156005-1	Choke, Filter
R195	39374-215	Resistor, 15,000 ohm, 10%, 2 w.	T108	155445-2	Transformer, Horizontal Deflection
R196	Part of L119	Resistor, 180 ohm, 10%, 1/2 w.	CO102	138352	Socket, 2 Prong Female
R197	39374-25	Resistor, 1000 ohm, 10%, ½ w. (Part of L116)	CO103	154114	Socket, Terminal Strip
R198	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.	SW101	Part of R125	Switch, On-Off
R199	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.	SW102	156329-1	Switch, Rotary (AGC Control)
R200	Part of L112	Resistor, 8200 ohm, 10%, 1/2 w.	S101	156563-1	Power Cable & Socket Assembly
R201	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.	CR101	154111	Crystal, IN64 (Part of T101)
R202	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.	SR101	155575-1	Rectifier, Selenium
R203	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.	SR102	155575-1	Rectifier, Selenium
R204	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.	SP101	138762-6	Speaker, 12" PM
R205	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.	CA101	132300-14	Cable & Plug, AC Power
R207	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.	CA102	139727-7	AC Socket, Phono Motor
R208	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.	P101	154125	Receptacle, Interlock
R209	39374-202	Resistor, 1800 ohm, 10%, 2 w.	P102	131983	Plug, 2 Prong Male
L101	155304	Coil, Converter I.F. (1.98-4.5 microhenries)	I101	138437-8	Lamp, Dial (On 414-1)
L102	155319	Coil, 1st I.F. (1.95-4 microhenries)	I102	138437-8	Lamp, Dial (On 414-1)
L103	155348	Coil, 2nd. I.F. (2.4-4.5 microhenries)	I103	138437-8	Lamp, Dial (On 414-1)
L104	156361	Coil, R.F. Choke (70 microhenries)	I104	138437-8	Lamp, Dial (On 414)

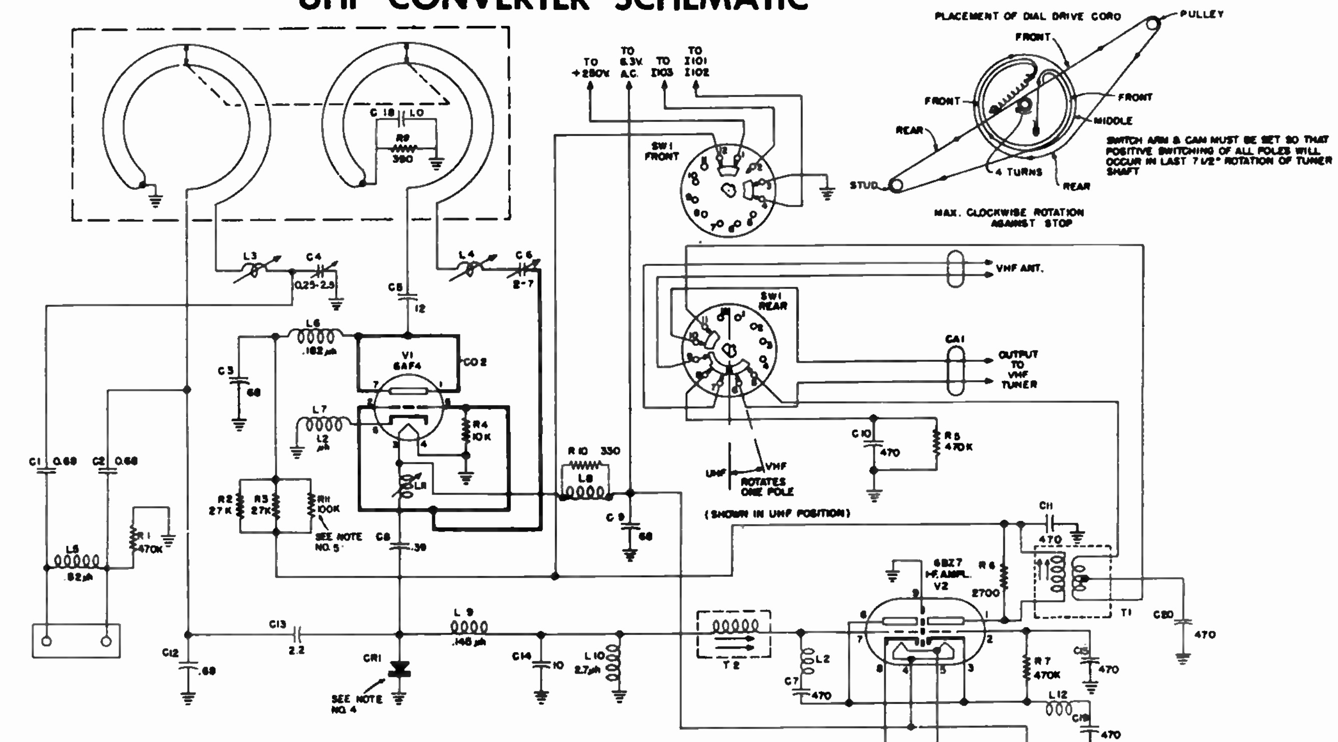
UHF CONVERTER SOCKET VOLTAGE CHART



NOTES:

1. BOTTOM VIEW OF TUBE SOCKETS.
2. VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS WITH THE FUNCTION SWITCH IN "UHF" POSITION.
3. * = AC. VOLTAGES.
   NC = NO CONNECTION.
4. OSCILLATOR SOCKET VOLTAGE VARIES WITH FREQUENCY, OTHER VOLTAGES ± 10%.
5. LINE VOLTAGES, 117V, 60∿AC.
6. MINIMUM CRYSTAL CURRENT FOR PROPER OPERATION OF THE OSCILLATOR, 300 μa.

UHF CONVERTER SCHEMATIC



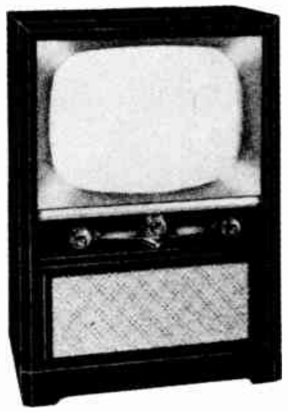
NOTES:

1. K = 1000
2. All Capacitance Values In MMF. And All Resistance In Ohms Unless Otherwise Noted.
3. All Sections Of Switch SW1 Are Viewed From The Shaft End.
4. When Possible, Replace The Crystal Mixer With One Of The Same Type. When The Same Type Is Not Available One Of The Other Types Can Ordinarily Be Used As A Substitute. However, Because Of Individual Crystal Characteristics The Substitution Of The 1N72 (Part No. 151871) For The 1N82 (Part No. 155459) Or K3D May Be Less Satisfactory.
5. In Some Early Production UHF Tuners, R11 Was Not Used. In Some Later UHF Tuners, R11 Is 87,000 Ohm, 10%, 1/2 Watt.

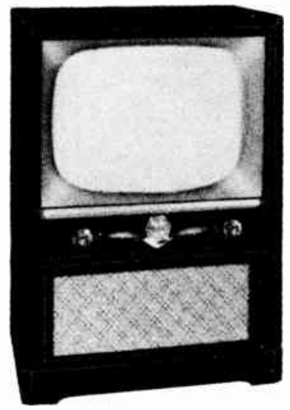
REPLACEMENT PARTS LIST

UHF Converter

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
C1	152997-6	Capacitor, .68 mmf., 10%, 500 v.	L9	155510	Choke, R. F. (145 microhenries)
C2	152997-6	Capacitor, .68 mmf., 10%, 500 v.	L10	148936-5	Choke, R. F. (2.7 microhenries)
C3	152997-8	Capacitor, 68 mmf., 500 v.	L11	157135-1	Inductance (Variable), Choke, Oscillator Coupling
C4	151880-3	Capacitor, .25 - 2.5 mmf.			
C5	155439-1	Capacitor, 12 mmf.	L12	157473-1	Coil, Cathode Neutralizing
C6	156078-1	Capacitor, 2-7 mmf., Oscillator Trimmer Assembly	CA1		Transmission Line, Antenna (300 ohm)
			CO1	155604	Terminal Board, UHF Antenna
C7	137727-104	Capacitor, 470 mmf., ceramic	CO2	155431-1	Strap, Oscillator Plate
C8	152997-15	Capacitor, .39 mmf., 10%, 500 v.	CR1	157690-1	Crystal, Mixer (K3D)
C9	152997-8	Capacitor, 68 mmf., 500 v.	SW1	156170-1	Switch, Function
C10	156201-1	Capacitor, 470 mmf., 2 k.v., disc ceramic		155495	Arm & Hub Assembly, Function Switch
C11	137727-104	Capacitor, 470 mmf., ceramic		155561	Arm, Toggle
C12	152997-6	Capacitor, .68 mmf., 10%, 500 v.		155441	Bracket, Antenna
C13	152997-1	Capacitor, 2.2 mmf., 10%, 500 v.		154736	Bracket, Idler Pulley
C14	152997-11	Capacitor, 10 mmf., 10%, 500 v.		155488	Bracket, Tube Lock
C15	137727-104	Capacitor, 470 mmf., ceramic		155427	Clip & Board Assembly, Crystal
C16	137727-104	Capacitor, 470 mmf., ceramic		154803	Cotter Pin (External)
C17	137727-113	Capacitor, 1500 mmf., 500 v.		155893	Eyelet (3 used to hold Rotors to Shaft)
C18	152997-2	Capacitor, 1.0 mmf., 10%, 500 v.		156788	Fibre Hub, Small Knob Shaft, Groove Pin & Outer Shaft Assembly
C19	137727-104	Capacitor, 470 mmf., ceramic			
C20	156201-1	Capacitor, 470 mmf., 2 k.v., disc ceramic		155466-1	Guard, Fishpaper
R1	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.		137939-1	Idler Pulley
R2	39374-218	Resistor, 27,000 ohm, 10%, 2 w.		155491	Pin, Drive Cord Guide
R3	39374-218	Resistor, 27,000 ohm, 10%, 2 w.		156672	Pulley, Drive Cord
R4	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.		137940-1	Rivet, Idler Pulley
R5	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.		137940-8	Rivet, Toggle Arm
R6	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.		155481-1	Screw, Nylon (used to mount C6)
R7	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.		39311-2	Set Screw, Arm & Hub Assembly
R8	39374-12	Resistor, 82 ohm, 10%, 1/2 w.		155898	Shaft & Stop Assembly, Inductuner
R9	Part of L1	Resistor, 390 ohm, 10%, 1/2 w.		153804	Shield (Lid), Oscillator
R10	Part of L8	Resistor, 330 ohm, 10%, 1/2 w.		153806	Shield, Oscillator
R11	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.		154677	Shield, Tube (V1)
L1	155158-1	Inductuner, UHF		154743	Shield (Fish Paper Disc), Drive Cord
L2	157472-1	Coil, Grid Neutralizing		152053-1	Socket, Tube (V1)
L3	Part of C4	Inductance		152078-1	Socket, Tube (V2)
L4	Part of C6	Inductance		51752	Spring, Drive Cord Tension
L5	148936-2	Choke, R. F. (.82 microhenries)		156930	UHF Converter Complete
L6	156167-1	Choke, R. F. (.182 microhenries)		155895	Washer (1 used), Shaft & Stop Assembly
L7	148936-4	Choke, R. F. (1.2 microhenries)		148206-1	Washer (Spring Tension), Toggle Arm
L8	157134-1	Choke, Oscillator Filament			



F-24COLU-1
(Mahogany)
F-24COLBU-1
(Blond)



F-24COLH
(Mahogany)
F-24COLBH
(Blond)

I. F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

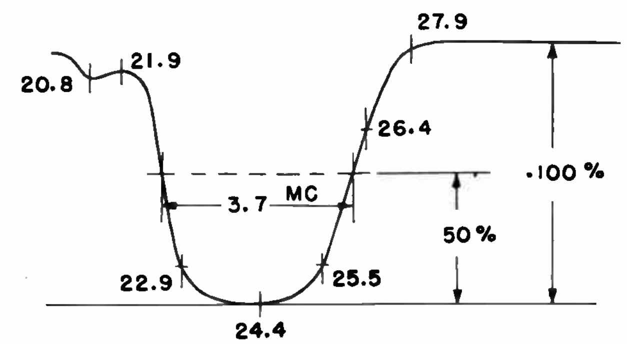
CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

To Check I. F. Alignment (on Oscilloscope):

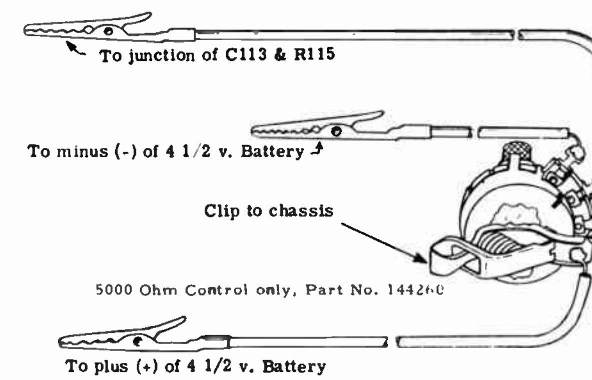
Equipment: Sweep Generator, Marker Frequency Generator, Oscilloscope, VTVM (electronic voltmeter), Variable Bias Control Assembly with 4 1/2 volt battery.

a. Set up vertical gain control on scope to read approximately 8.8 volts peak to peak between arbitrary reference lines. This can readily be done as follows:

1. Draw two horizontal lines spaced approximately 3" apart (depending on size of tube).
2. Connect low side of scope lead to chassis and the high side of lead to the 6.3 volt filament circuit. This will provide a signal with a peak to peak voltage of 17.6 volts.
3. Adjust scope vertical gain control until the distance between the two horizontal lines equals one-half the peak to peak amplitude of the 60 cycle sine wave. Leave the vertical gain in this position until the sweep generator attenuator has been set in step "h".



VARIABLE BIAS CONTROL ASSEMBLY



NORMAL OVERALL I. F. RESPONSE CURVE
NOTE: Response as Seen by Means of Sweep Generator

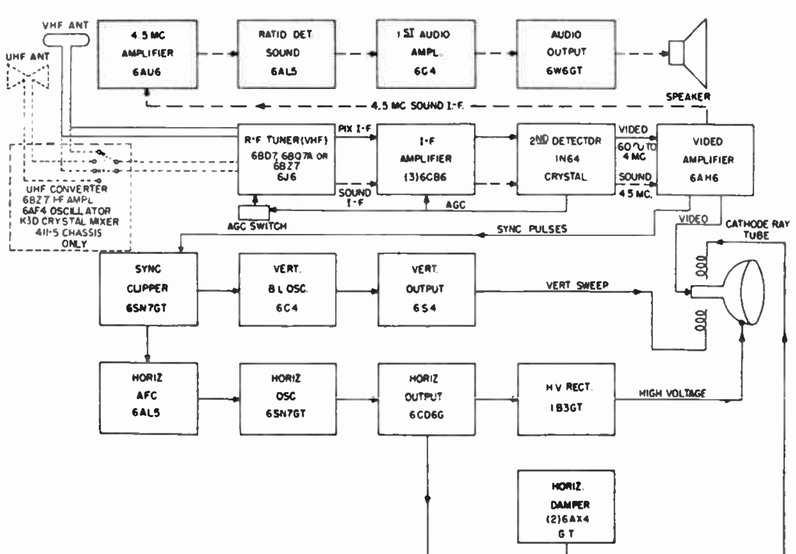
POWER SUPPLY: 117 volts, 60 cycle, a.c.

POWER CONSUMPTION: 160 watts VHF.
165 watts UHF.

AUDIO POWER OUTPUT: 1.4 watts maximum.

ANTENNA INPUT IMPEDANCE: 300 ohms balanced.

BLOCK DIAGRAM:



INTERMEDIATE FREQUENCY:

Video Carrier—26.4 mc.
Sound Carrier—21.9 mc.
Intercarrier Sound—4.5 mc.
U.H.F. Output—Channels 5 or 6.

DEFLECTION: Electromagnetic.

FOCUS: Magnetic (P.M.)

ION TRAP: Single Permanent Magnet.

HORIZONTAL SCANNING FREQ: 15,750 c.p.s.

VERTICAL SCANNING FREQ: 60 c.p.s.

FRAME FREQUENCY: 30 c.p.s.

SCANNING: Interlaced, 525 lines.

SPEAKER: 12" Permanent Magnet.

VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

b. Set channel selector knob to unused channel. Set fine tuning control and contrast control to maximum counter-clockwise position. Set noise gate to maximum counter-clockwise position. Set Local-Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.

d. Lift the shield of the Oscillator-Mixer tube V2 sufficiently to clear the socket ground clips. Connect the high side of lead from sweep signal generator to the ungrounded tube shield and the ground side of generator lead to the tuner chassis. Keep leads as short as possible (about 1 inch).

e. Apply -3.0 volts D.C. bias to I-F Bias line, junction of C113 and R115 (see "Variable Bias Control Assembly").

f. Set generator to sweep from 20 mc. to 32 mc.

g. Transfer high side of scope lead to top of R116. Adjust the output of the sweep generator to obtain curve on scope of approximately 10 volts peak to peak. (Excessive input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form. Be sure to keep the input level below the overload point, indicated by a flattening of the peak).

I. F. ALIGNMENT (continued)

h. Set the marker generator to the various frequencies given (20.8 mc., 21.9 mc., etc.) and compare their relative position with those shown on the Nominal Response Curve. (Be sure to keep the marker at the minimum usable amplitude. Excessive signal will distort wave shape.) Slight deviation in shape from the nominal response curve is permissible, but if any great deviation is noted, it will be necessary to re-align the IF amplifier as in section 2. (NOTE: The response curve may vary with the type of sweep equipment used. Such variations due to equipment can be checked by comparing the resultant curve with that observed on a known good chassis.)

I. F. Alignment Procedure
(Using Signal Generator and VTVM):

Equipment: Signal (Marker) Generator, VTVM (electronic voltmeter), 1000 mmf. capacitor, Swamping Network (See step "o"), Variable Bias Control Assembly with 4 1/2 volt battery.

a. Set channel selector switch to an unoccupied channel and the fine tuning control to the maximum counter-clockwise position. A channel in the upper band (channels 7 to 13) will allow easier adjustment of L10 in step "o".

b. Set contrast control to the maximum counter-clockwise position. Set noise gate to the maximum counter-clockwise position. Set Local Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.

d. Apply -3.0 volts D.C. bias to I-F Bias line, junction of C113 and R115 (see "Variable Bias Control Assembly").

e. Connect high side of lead from signal (marker) generator through a 1000 mmf. capacitor to TP-2 (wire protruding from top of tuner through the insulating grommet next to L10). Connect the ground lead to the RF tuner case.

f. Transfer high side lead of VTVM to top of detector load resistor, R116.

g. Set signal (Marker) generator to 24.4 mc. and set attenuator of signal generator to produce a meter deflection of approximately -2 volts DC. Adjust top of T101 for maximum DC meter reading. (Be sure sweep generator is off.) Readjust output from signal generator if necessary to keep meter deflection at -2 volts DC maximum.

h. Set signal generator to 22.9 mc. and adjust top of L103 for maximum DC meter indication. Limit meter deflection to approximately -2 volts DC maximum by adjusting output attenuator on generator.

i. Set signal generator to 21.9 mc. and adjust bottom of L103 for minimum DC meter deflection. Input should be high enough to permit a definite null to be observed on meter. (If necessary, IF bias may be reduced for this step.)

j. Repeat steps "h" and "i". Reset bias to -3.5 volts if necessary.

k. Reset IF bias at -3.5 v. Set generator to 25.5 mc. and adjust top of L102 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

l. Reset signal generator to 24.4 mc. Adjust top of L101 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

m. Reset signal generator to 27.9 mc. and adjust the bottom of L101 for minimum DC meter deflection. Signal generator output must be sufficient to produce a definite null. (If necessary IF bias may be reduced for this step).

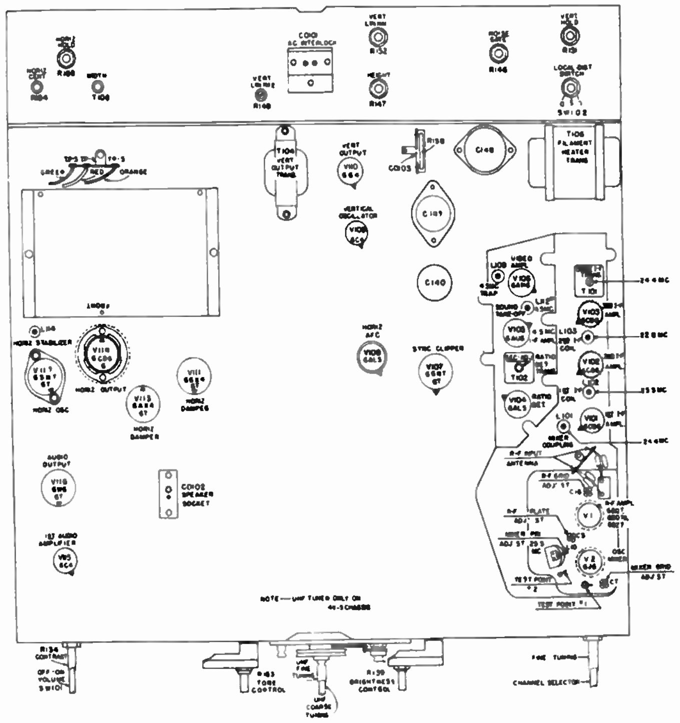
n. Repeat steps "l" and "m". If bias has been reduced below -3.5 volts, reset to -3.5 volts for step "l".

o. Transfer high side of signal generator lead to TP-1. Set signal generator to 25.5 mc. Set IF bias to -3.5 volts. Connect the Swamping Network (a 1000 ohm resistor in series with a 1000 mmf. capacitor) across L101 making connections to the two lugs on the coil form closest to the chassis. Adjust L10 for a maximum meter reading. I-F bias may be reduced if necessary to obtain a usable deflection. Remove Swamping Network.

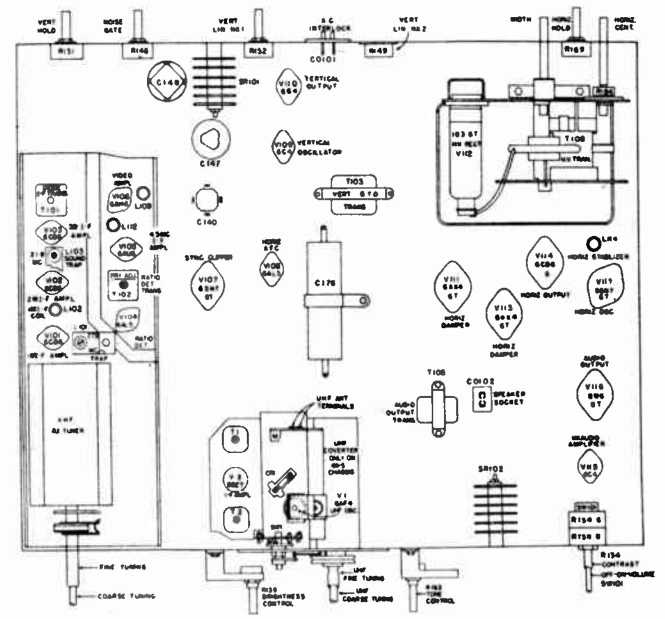
p. Disconnect alignment equipment.

SOUND ALIGNMENT

1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, between grid of video amplifier and chassis.
2. Connect high side of scope through detector probe to the picture tube cathode (pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L109, for minimum 400 cycle deflection on scope.
3. Connect electronic voltmeter to pin 2 of ratio detector tube, V104, and adjust 4.5 mc. sound take-off (L112) and bottom of ratio transformer (T102) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.
4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R129 and C128 (refer to Schematic Wiring Diagram). Adjust top of T102 for zero balance on electronic voltmeter.
5. Recheck steps 2, 3 and 4 above.
6. Remove input signal, scope and electronic voltmeter.



VHF CHASSIS (411-4) TOP VIEW
(Tube and Alignment Locations)



VHF CHASSIS (411-4) BOTTOM VIEW
(Tube Socket and Alignment Locations)

UHF ALIGNMENT

ALIGNMENT NOTES:

CAUTION: This UHF converter unit is used with a VHF receiver that has one side of the chassis connected to the power line. DO NOT CONNECT TEST EQUIPMENT TO ANY PART OF THE RECEIVER OR GROUND THE CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED BETWEEN THE POWER LINE AND RECEIVER.

1. Remove the UHF Converter from the VHF receiver chassis.
2. In order that the converter will operate with the tuning shaft in maximum CCW* position, it will be necessary to disengage the function switch shaft from the linkage which operates it and manually set the switch to the UHF position. To accomplish this, loosen the two set-screws which secure the arm and hub assembly to the shaft. Turn the switch clockwise to the UHF position and leave it in this position while aligning.
3. Connect the output leads of the UHF converter to the R. F. input terminals of the VHF Tuner.
4. Reconnect the B+ and filament leads of the tuner to the same points on the VHF receiver from which they were disconnected. Connect UHF Converter chassis to B- (VHF receiver chassis).

* CW - Clockwise
CCW - Counter-clockwise

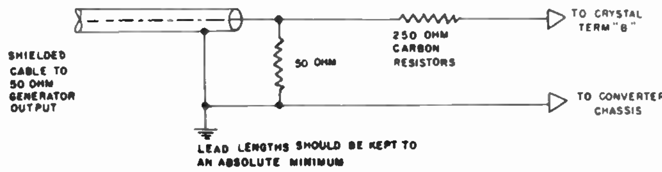
5. Keep all leads as short as possible. One suggested way of doing this is to mount the UHF converter at right angles to the TV chassis with one mounting screw. Most of the leads on the UHF converter will then be of sufficient length that no additional length will need to be added.
6. Set VHF Tuner to Channel 6.
7. Alignment should be followed in the order shown.

I. F. ALIGNMENT

1. Connect an electronic voltmeter or an oscilloscope across the second detector load resistor.
2. Turn on the power.
3. Apply an 82 mc. signal (amplitude modulated if a scope is used) to the crystal terminal (B) at the junction of C13 and L9 through the resistor network shown in Sketch A.

UHF ALIGNMENT (continued)

Resistor Matching Network for I. F. Alignment



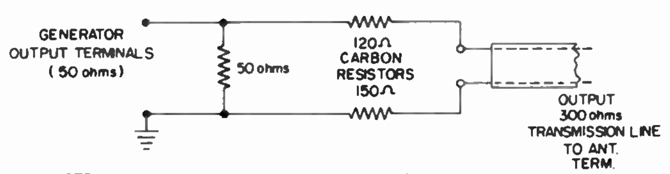
SKETCH A

4. Adjust plate coil (T1) and grid coil (T2) for maximum indication on the electronic voltmeter or scope.
5. Disconnect the resistor network from the crystal terminal.

OSCILLATOR ALIGNMENT:

1. With the electronic voltmeter or scope connected across the second detector load resistor, apply a 460 mc. signal (amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.

Resistor Matching Network for Osc. & R. F. Alignment



NOTE - Lead length should be kept to an absolute minimum, by connecting network directly to generator terminals.

SKETCH B

2. With the tuner shaft at maximum CCW* position, adjust the oscillator trimmer C6 for peak reading on the electronic voltmeter or maximum indication on the scope (oscillator frequency is set to 84 mc. below the carrier frequency).
3. Set the signal generator to 904 mc.
4. Rotate the tuner shaft to the maximum CW position and adjust the oscillator end inductor L4 up or down for maximum reading on the voltmeter.
5. Open the ground connection on L10 and connect an 0-10 ma. D.C. meter between the open end of the crystal return choke L10 and ground.

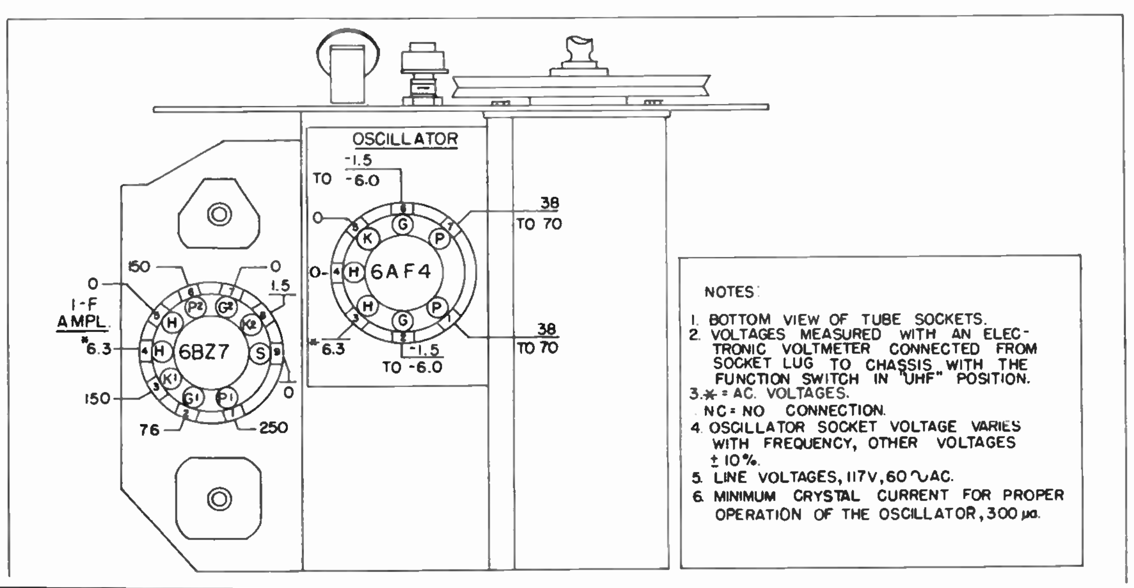
*CW - Clockwise
CCW - Counter-clockwise

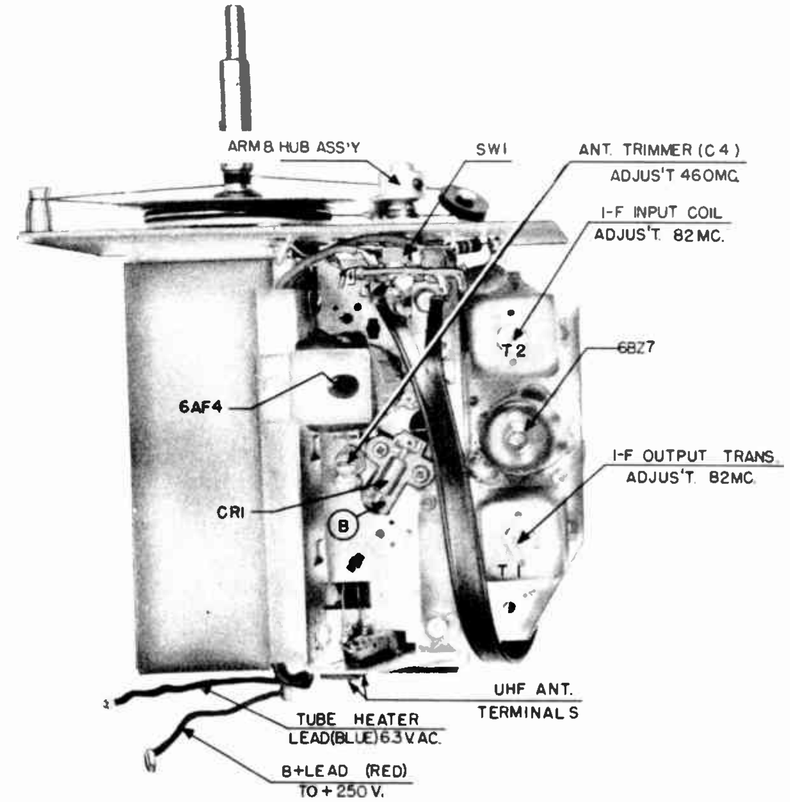
6. Adjust the oscillator coupling coil L11 for maximum crystal current when the tuner shaft is rotated to the maximum CW position. When operating at normal line voltage (117 volts, 60 cycles), the maximum current should not exceed 5 ma. at any setting of the tuner shaft. When operating at low line voltage (105 volts, 60 cycles), the minimum crystal current must not be less than 0.3 ma. at any setting of the tuner shaft.
7. Repeat steps 1 through 4 until maximum reading is obtained.

R. F. CIRCUIT ALIGNMENT

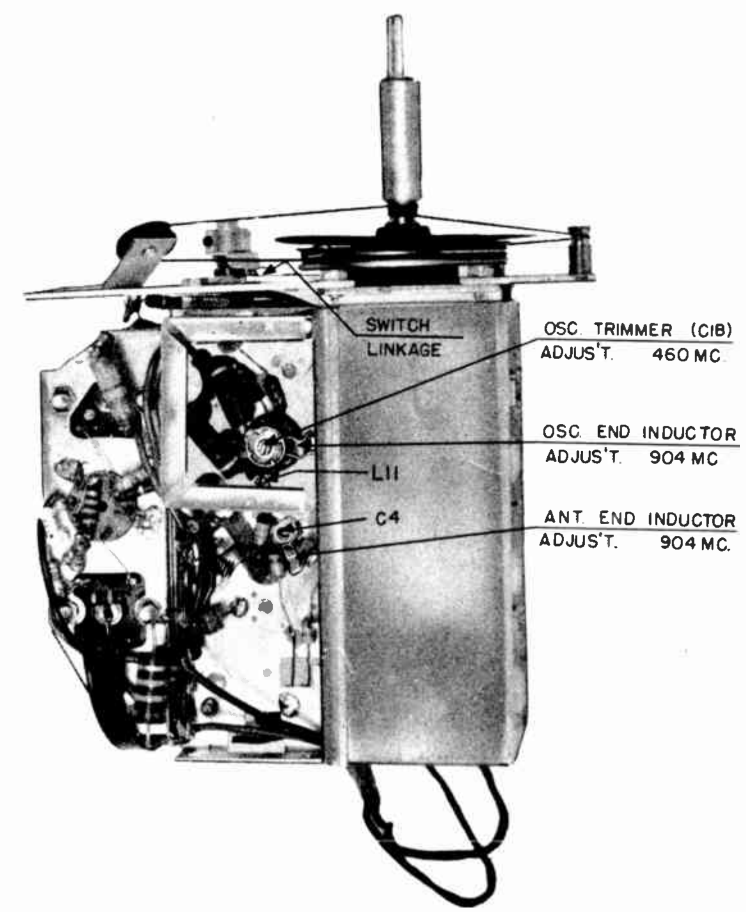
1. With the electronic voltmeter or scope connected across the second detector load resistor of the VHF receiver, apply a 460 mc. signal (Amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.
2. With the tuner shaft at the maximum CCW position, adjust the antenna trimmer C4 for maximum meter reading or for maximum scope indication.
3. Reset signal generator to 904 mc.
4. Rotate the tuner shaft to maximum CW position. Adjust the antenna end inductor L3 by forming larger or smaller loop until maximum reading on the meter (or scope) is obtained.
5. Repeat steps 1 through 4 until maximum reading is obtained.
6. Turn the power switch to the "OFF" position.
7. Disconnect the generator, the electronic voltmeter or scope, and the resistor network. Disconnect the 0-10 ma. meter, and solder the open lead of L10 to the chassis.
8. Re-engage the toggle coupling in the pin on the arm and hub assembly and tighten the set-screws that secure the collar to the switch shaft.
9. The Function Switch should be checked for proper operation under conditions of customer use. At full CCW rotation of the tuner shaft, all VHF position contacts must be fully and firmly made and all UHF position contacts must be fully broken. All UHF position contacts must be fully and firmly made and all VHF position contacts must be fully broken, when the tuner shaft is 7 1/2° or more from full CCW, as tuner shaft is rotated in a clockwise direction.
10. Replace the UHF Converter on the VHF receiver chassis.

SOCKET VOLTAGE CHART





TOP VIEW - UHF Converter



BOTTOM VIEW - UHF Converter

SCHEMATIC REPLACEMENT PARTS LIST

Chassis: 411-4 & 411-5

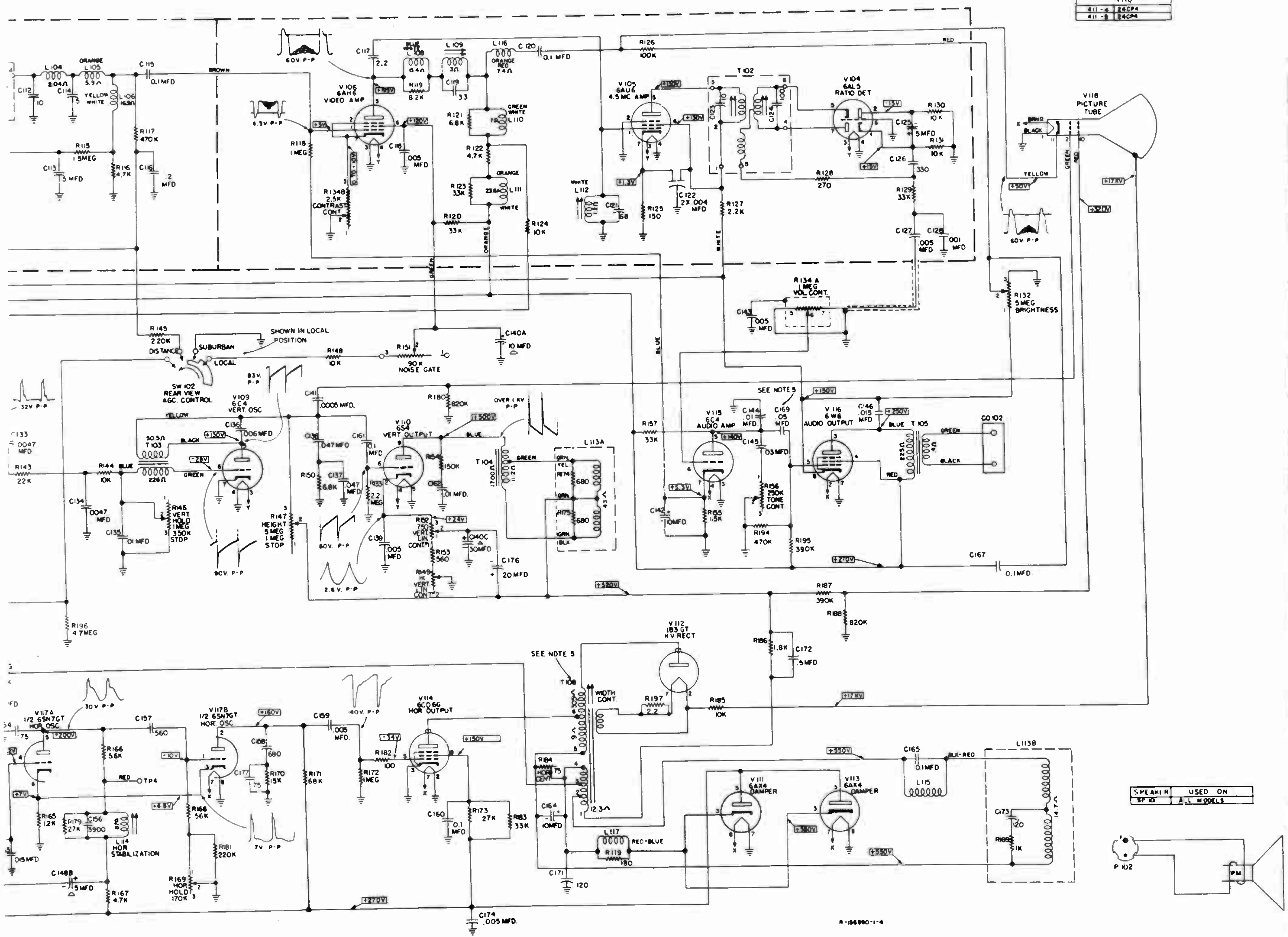
Symbol No.	Part No.	Description
C101	156201-1	Capacitor, 470 mmf., 2 kv., disc ceramic
C102	156201-1	Capacitor, 470 mmf., 2 kv., disc ceramic
C104	137499-37	Capacitor, 110 mmf., 10%, 500 v., mica
C105	144675-28	Capacitor, .001 mfd., 10%, 500 v., disc ceramic
C106	144675-28	Capacitor, .001 mfd., 10%, 500 v., disc ceramic
C107	144675-28	Capacitor, .001 mfd., 10%, 500 v., disc ceramic
C108	144675-28	Capacitor, .001 mfd., 10%, 500 v., disc ceramic
C109	137499-33	Capacitor, 68 mmf., 10%, 500 v., mica
C110	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C111	144675-28	Capacitor, .001 mfd., 10%, 500 v., disc ceramic
C112	137727-135	Capacitor, 10 mmf., 10%, 500 v., ceramic
C113	154157	Capacitor, .5 mfd., 10%, 25 v., paper
C114	137727-103	Capacitor, 5 mmf., 10%, 500 v., ceramic
C115	39001-19	Capacitor, .1 mfd., 600 v., paper
C116	39001-86	Capacitor, .2 mfd., 600 v., paper
C117	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic
C118	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C119	137727-126	Capacitor, 33 mmf., 500 v., 10%, ceramic
C120	39001-19	Capacitor, .1 mfd., 600 v., paper
C121	137727-133	Capacitor, 68 mmf., 500 v., 10%, disc ceramic
C122	144675-6	Capacitor, .004 mfd., 10%, 500 v. } Two Section disc ceramic
C122		Capacitor, .004 mfd., 10%, 500 v.
C123	Part of T102	Capacitor, 10 mmf.
C124	Part of T102	Capacitor, 100 mmf.
C125	154103	Capacitor, 5 mfd., 50 v., Electrolytic
C126	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C127	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C128	144675-28	Capacitor, .001 mfd., 10%, 500 v., disc ceramic
C129	137727-131	Capacitor, 220 mmf., 10%, 500 v., ceramic
C130	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C131	137727-26	Capacitor, 22 mmf., 500 v., ceramic
C132	39001-17	Capacitor, .05 mfd., 600 v., paper
C133	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C134	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C135	39478-41	Capacitor, .01 mfd., 10%, 600 v., molded paper
C136	39001-78	Capacitor, .006 mfd., 600 v., paper
C137	39478-45	Capacitor, .047 mfd., 10%, 600 v., molded paper
C138	39478-45	Capacitor, .047 mfd., 10%, 600 v., molded paper
C139	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C140A	155910	Capacitor, 10 mfd., 300 v. } Electrolytic
C140B		Capacitor, 200 mfd., 150 v.
C140C	155910	Capacitor, 30 mfd., 150 v. } Electrolytic
C140D		Capacitor, 200 mfd., 150 v.
C141	39001-5	Capacitor, .0005 mfd., 600 v., paper
C142	154104	Capacitor, 10 mfd., 50 v., Electrolytic
C143	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C144	39001-13	Capacitor, .01 mfd., 600 v., paper
C145	39001-82	Capacitor, .03 mfd., 600 v., paper
C146	39001-14	Capacitor, .015 mfd., 600 v., paper
C147	155911	Capacitor, 200 mfd., 150 v., Electrolytic
C148A	155426	Capacitor, 200 mfd., 150 v. } Electrolytic
C148B		Capacitor, 5 mfd., 150 v.
C149	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C150	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C151	39478-114	Capacitor, .0033 mfd., 10%, 1000 v., molded paper
C152	146434-16	Capacitor, .006 mfd., 10%, 600 v., paper
C153	39001-76	Capacitor, .003 mfd., 600 v., paper
C154	137727-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C155	39001-14	Capacitor, .015 mfd., 600 v., paper
C156	137499-30	Capacitor, 3900 mmf., 10%, 500 v., mica
C157	137499-34	Capacitor, 560 mmf., 10%, 500 v., mica
C158	137499-32	Capacitor, 680 mmf., 10%, 500 v., mica
C159	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C160	39001-19	Capacitor, .1 mfd., 600 v., paper
C161	39001-19	Capacitor, .1 mfd., 600 v., paper
C162	39001-13	Capacitor, .01 mfd., 600 v., paper
C164	156054	Capacitor, 10 mfd., 10 v., Electrolytic
C165	155939	Capacitor, .1 mfd., 5%, 200 v., paper
C167	39001-19	Capacitor, .1 mfd., 600 v., paper
C168	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C169	39001-17	Capacitor, .05 mfd., 600 v., paper
C170	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C171	156569	Capacitor, 120 mmf., 10%, 5 kv., disc ceramic
C172	39001-23	Capacitor, .5 mfd., 600 v., paper
C173	154988	Capacitor, 120 mmf., 10%, 3 kv., ceramic
C174	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C176	156021	Capacitor, 20 mfd., 600 v., Electrolytic
C177	137727-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C178	39001-82	Capacitor, .03 mfd., 600 v., paper
R101	39374-57	Resistor, 470,000 ohm., 10%, 1/2 w.
R102	39374-57	Resistor, 470,000 ohm., 10%, 1/2 w.
R103	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
R104	39375-63	Resistor, 3900 ohm, 5%, 1/2 w.
R105	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R106	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R107	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R108	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R109	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R110	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R111	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R112	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
R113	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R114	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R115	39374-65	Resistor, 1.5 megohm, 10%, 1/2 w.

SCHEMATIC REPLACEMENT PARTS LIST

Chassis: 411-4 & 411-5

Symbol No.	Part No.	Description
R116	39375-65	Resistor, 4700 ohm, 5%, 1/2 w.
R117	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R118	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R119	Part of L108	Resistor, 8200 ohm, 10%, 1/2 w.
R120	39374-219	Resistor, 33,000 ohm, 10%, 2 w.
R121	Part of L110	Resistor, 6800 ohm, 10%, 1/2 w.
R122	39375-361	Resistor, 4700 ohm, 5%, 2 w.
R123	Part of L111	Resistor, 3300 ohm, 10%, 1/2 w.
R124	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R125	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R126	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R127	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R128	39374-18	Resistor, 270 ohm, 10%, 1/2 w.
R129	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R130	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R131	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R132	155352	Control, Brightness (5 megohm)
R133	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R134A	154085	Control, Volume (1 megohm) } Assembly
R134B		Control, Contrast (2500 ohm)
R135	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R136	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R137	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R138	39374-146	Resistor, 560,000 ohm, 10%, 1 w.
R139	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R140	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R141	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R142	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R143	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R144	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R145	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R146	155610	Control, Vertical Hold (1 megohm)
R147	154086	Control, Height (5 megohm)
R148	39374-125	Resistor, 10,000 ohm, 10%, 1 w.
R149	148861	Control, Vertical Linearity (1000 ohm)
R150	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R151	155576	Control, Noise Gate (90,000 ohm)
R152	155519	Control, Vertical Linearity (750 ohm)
R153	39374-22	Resistor, 560 ohm, 10%, 1/2 w.
R154	39374-139	Resistor, 150,000 ohm, 10%, 1 w.
R155	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R156	155389	Control, Tone (250,000 ohm)
R157	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R158	156540	Resistor, 7.5 ohm, 10%, 5 w. wire wound
R159	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R160	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R161	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R162	39374-135	Resistor, 68,000 ohm, 10%, 1 w.
R163	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R164	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R165	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.
R166	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R167	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R168	39374-46	Resistor, 56,000 ohm, 10%, 1/2 w.
R169	155511	Control, Horizontal Hold
R170	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
R171	39374-47	Resistor, 68,000 ohm, 10%, 1/2 w.
R172	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R173	39374-218	Resistor, 27,000 ohm, 10%, 2 w.
R174	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L113)
R175	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L113)
R176	39374-135	Resistor, 68,000 ohm, 10%, 1 w.
R177	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R179	39374-42	Resistor, 27,000 ohm, 10%, 1/2 w.
R180	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R181	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R182	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R183	39374-219	Resistor, 33,000 ohm, 10%, 2 w.
R184	155844	Control, Horizontal Centering (75 ohm)
R185	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w. (Part of T108)
R186	39374-204	Resistor, 1800 ohm, 10%, 2 w.
R187	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R188	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R189	39374-25	Resistor, 100 ohm, 10%, 1/2 w.
R190	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R191	Part of L117	Resistor, 180 ohm, 10%, 1/2 w.
R193	39374-13	Resistor, 1000 ohm, 10%, 1/2 w.
R194	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R195	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R196	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
L101	155304	Coil, Converter IF (1.98-4.5 microhenries)
L102	155319	Coil, 1st IF (1.95-4 microhenries)
L103	155348	Coil, 2nd IF (2.4-4.5 microhenries)
L104	154376	Coil, Choke Diode (15.5 microhenries)
L105	156714	Coil, Video Peaking (90 microhenries)
L106	154184	Coil, Video Peaking (335 microhenries)
L107	155256	Choke, RF Filament (.576 microhenries)
L108	154194	Coil, Video Peaking (412 microhenries)
L109	155446	Coil, 4.5 MC. Trap (27-57 microhenries)
L110	154206	Coil, Video Peaking (106 microhenries)
L111	154176	Coil, Video Peaking (840 microhenries)
L112	155442	Coil, Sound Take Off (12-35 microhenries)
L113A	156839-1	Deflection Yoke } Assembly
L113B		Deflection Yoke
L114	154220	Coil, Horizontal Oscillator (18-37 microhenries)
L115	155944	Network, Yoke Coupling (10 millihenries)
L116	156035	Coil, Video Peaking (117 microhenries)
L117	156575	Coil, RF Choke (16 microhenries)
T101	155594	Transformer, Diode IF
T102	154108	Transformer, Ratio Detector
T103	155255-1	Transformer, Vertical Oscillator
T104	155966	Transformer, Vertical Output
T105	154109-3	Transformer, Audio Output
T106	155532	Transformer, Filament
T107	156005-1	Choke, Filter
T108	155445-5	Transformer, Horizontal Deflection
CO102	138352	Socket, Speaker
CO103	154114	Socket, Terminal Strip
SW101	Part of R134	Switch, ON-OFF
SW102	155554	Switch, Rotary
CR101	154111	Crystal, 1N64 (Part of T101)
SR101	155575-1	Selenium Rectifier
SR102	155575-1	Selenium Rectifier
SP101	138762-6	Speaker, P.M. (12")
CA101	132300-6	Cable & Plug, AC Power
P101	154125	Receptacle, Interlock
P102	131983	Plug, 2 Prong Male

VIRING DIAGRAM CHASSIS 411-4 & 411-5



CODE LETTER CHANGES

CHASSIS 411-4 & 411-5

(Important)

-4 (Code A) the coupling between the Audio Amplifier and Audio Output stages is direct coupling, as shown in circuit which appears in the complete schematic applys to chassis 411-4 (Code B and later) and to all 411-5 is a production change only.

Chassis 411-4 (Code A)

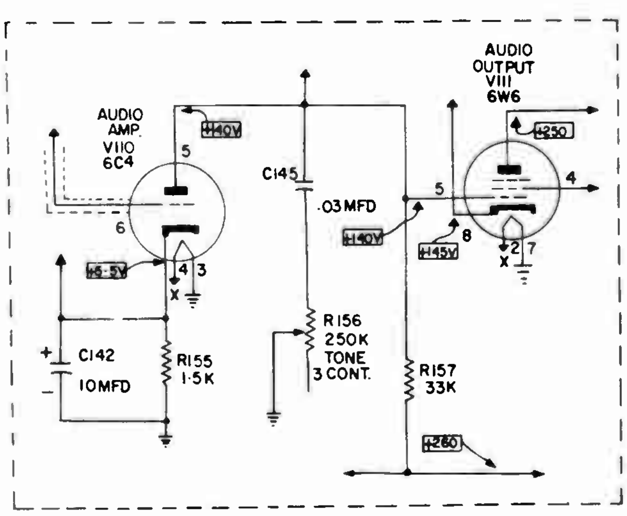
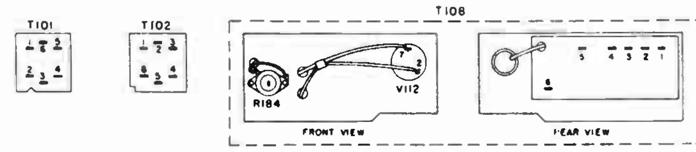
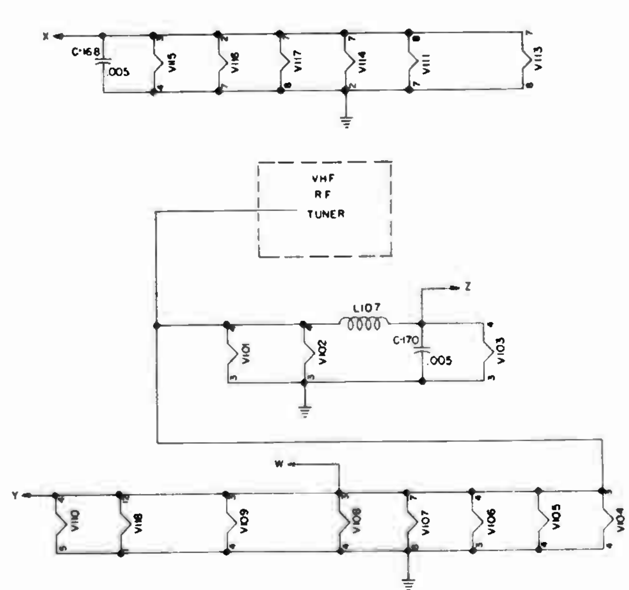


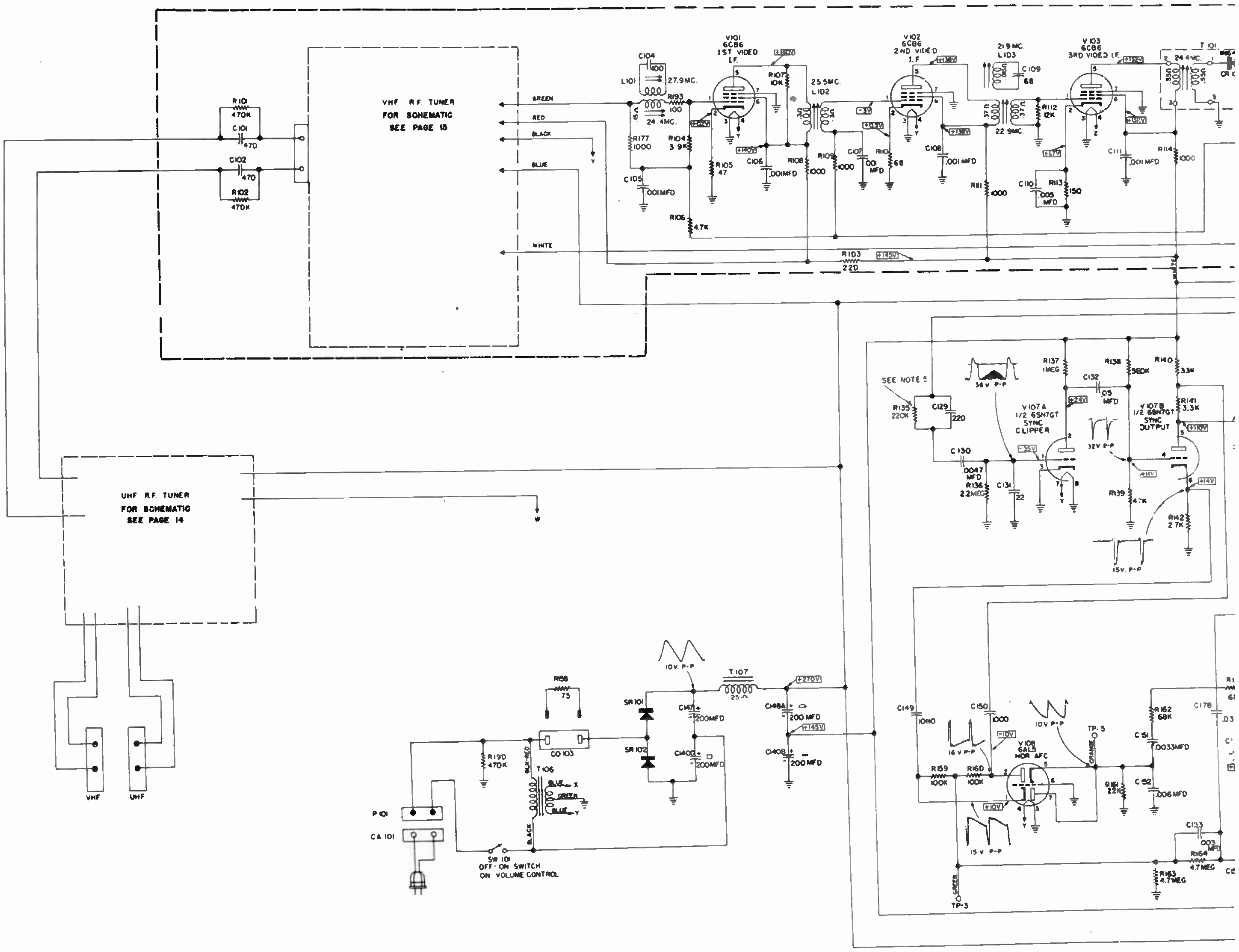
Figure 1

Chassis 411-4 (Code A or B) 411-5 (Code A)

NOTES:
1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2. SUPPLY VOLTAGE 117 VOLTS 60 CYCLE AC.
3. K=1000
4. ALL CAPACITANCE VALUES IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. IMPORTANT - SEE CODE CHANGES







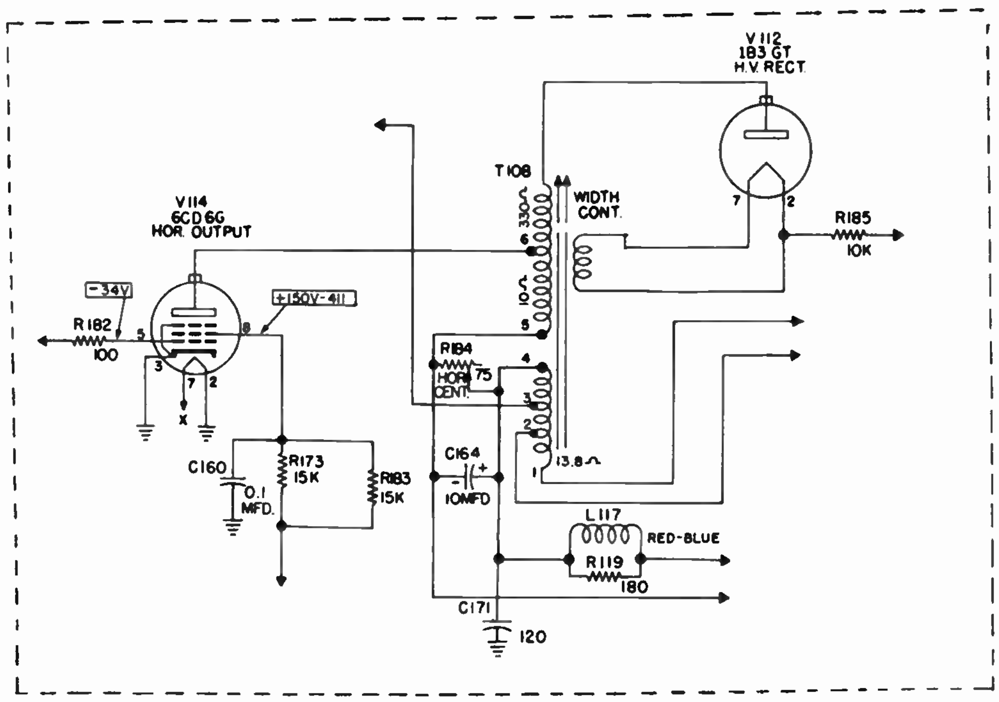


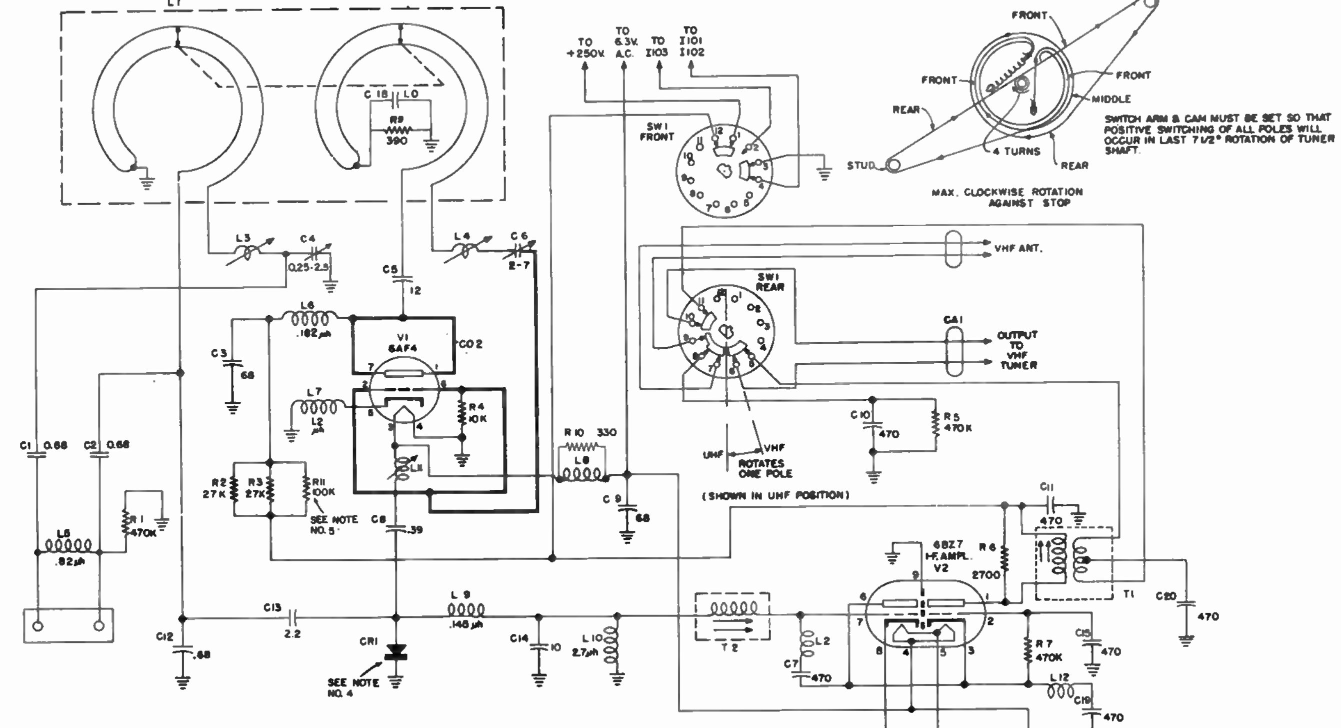
Figure 2

On chassis 411
Figure 1. The
chassis. This

On chassis 411-4 (Code A or B), 411-5 (Code A), T108 Horizontal Deflection Transformer, Part No. 155455-1 is used. Resistors R173 and R183 are 15,000 ohm, 2 w., 10%, as shown in Figure 2. The Transformer T108 and Resistors R173 and R183 which appear in the complete schematic apply to chassis 411-4 (Code C or later) and to chassis 411-5 (Code B or later).

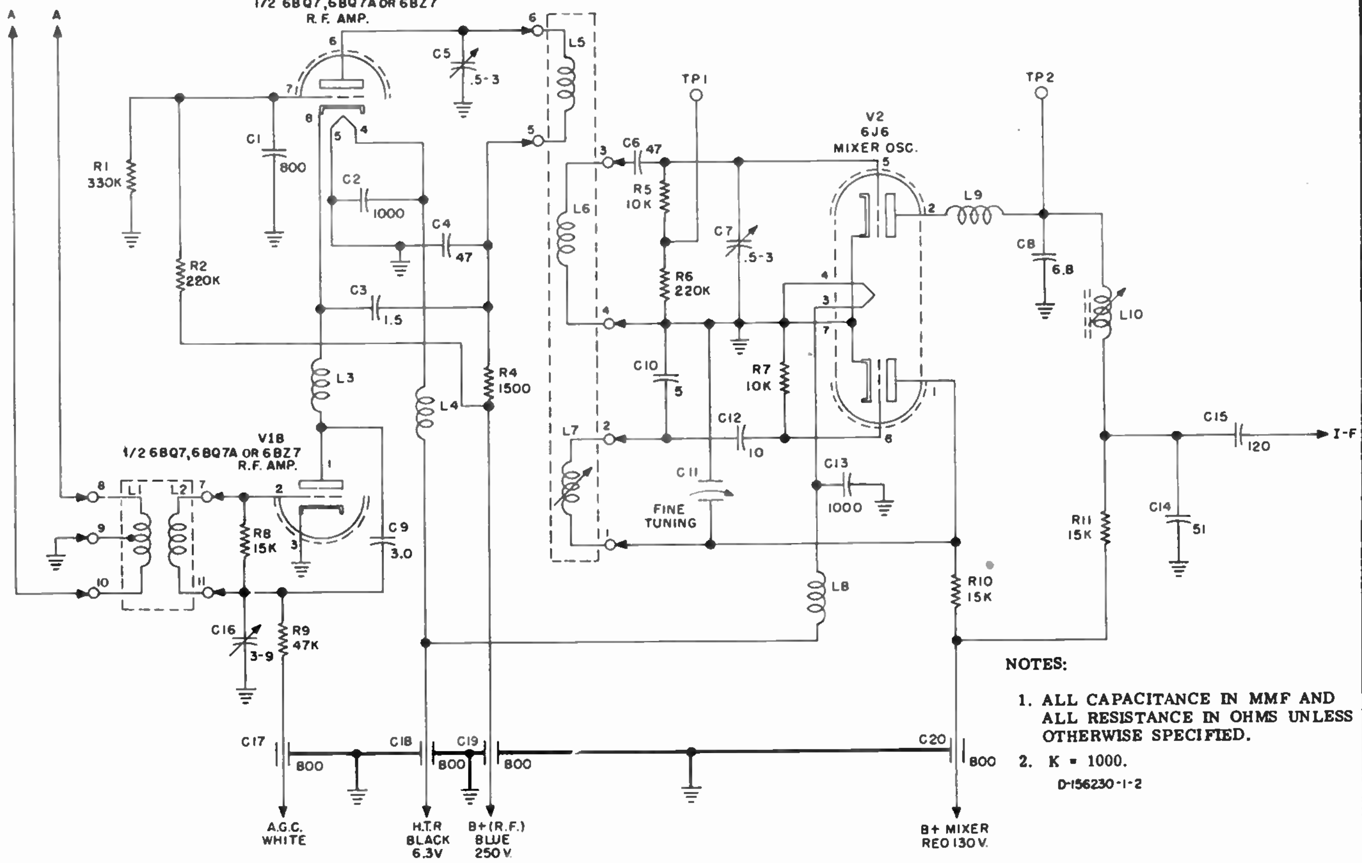
On chassis 411-4 (Code A or B), 411-5 (Code A) Resistor, R135 is 470,000 ohm. On chassis 411-4 (Code C or later), 411-5 (Code B or later) Resistor, R135 is 220,000 ohm. This resistor was changed to improve the Vertical Sync stability.

UHF CONVERTER SCHEMATIC



NOTES:
1. K = 1000
2. All Capacitance Values In MMF. And All Resistance In Ohms Unless Otherwise Noted.
3. All Sections Of Switch SW1 Are Viewed From The Shaft End.
4. When Possible, Replace The Crystal Mixer With One Of The Same Type. When The Same Type Is Not Available One Of The Other Types Can Ordinarily Be Used As A Substitute. However, Because Of Individual Crystal Characteristics The Substitution Of The 1N72 (Part No. 151871) For The 1N82 (Part No. 155459) Or K3D May Be Less Satisfactory.
5. In Some Early Production UHF Tuners, R11 Was Not Used. In Some Later UHF Tuners, R11 Is 87,000 Ohm, 10%, 1/2 Watt.

VHF TUNER SCHEMATIC



NOTES:
1. ALL CAPACITANCE IN MMF AND ALL RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. K = 1000.

REPLACEMENT PARTS LIST

UHF Converter

Symbol No.	Part No.	Description
C1	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C2	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C3	152997-8	Capacitor, 68 mmf., 500 v.
C4	151880-3	Capacitor, .25 - 2.5 mmf.
C5	155439-1	Capacitor, 12 mmf.
C6	156078-1	Capacitor, 2-7 mmf., Oscillator Trimmer Assembly
C7	137727-104	Capacitor, 470 mmf., ceramic
C8	152997-15	Capacitor, .39 mmf., 10%, 500 v.
C9	152997-8	Capacitor, 68 mmf., 500 v.
C10	156201-1	Capacitor, 470 mmf., 2 k.v., disc ceramic
C11	137727-104	Capacitor, 470 mmf., ceramic
C12	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C13	152997-1	Capacitor, 2.2 mmf., 10%, 500 v.
C14	152997-11	Capacitor, 10 mmf., 10%, 500 v.
C15	137727-104	Capacitor, 470 mmf., ceramic
C16	137727-104	Capacitor, 470 mmf., ceramic
C17	137727-113	Capacitor, 1500 mmf., 500 v.
C18	152997-2	Capacitor, 1.0 mmf., 10%, 500 v.
C19	137727-104	Capacitor, 470 mmf., ceramic
C20	156201-1	Capacitor, 470 mmf., 2 k.v., disc ceramic
R1	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R2	39374-218	Resistor, 27,000 ohm, 10%, 2 w.
R3	39374-218	Resistor, 27,000 ohm, 10%, 2 w.
R4	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R5	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R6	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R7	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R8	39374-12	Resistor, 82 ohm, 10%, 1/2 w.
R9	Part of L1	Resistor, 390 ohm, 10%, 1/2 w.
R10	Part of L8	Resistor, 330 ohm, 10%, 1/2 w.
R11	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
L1	155158-1	Inductuner, UHF
L2	157472-1	Coil, Grid Neutralizing
L3	Part of C4	Inductance
L4	Part of C6	Inductance
L5	148936-2	Choke, R. F. (.82 microhenries)
L6	156167-1	Choke, R. F. (.182 microhenries)
L7	148936-4	Choke, R. F. (1.2 microhenries)
L8	157134-1	Choke, Oscillator Filament

Symbol No.	Part No.	Description
L9	155510	Choke, R. F. (145 microhenries)
L10	148936-5	Choke, R. F. (2.7 microhenries)
L11	157135-1	Inductance (Variable), Choke, Oscillator Coupling
L12	157473-1	Coil, Cathode Neutralizing
CA1		Transmission Line, Antenna (300 ohm)
CO1	155604	Terminal Board, UHF Antenna
CO2	155431-1	Strap, Oscillator Plate
CR1	157690-1	Crystal, Mixer (K3D)
SW1	156170-1	Switch, Function
	155495	Arm & Hub Assembly, Function Switch
	155561	Arm, Toggle
	155441	Bracket, Antenna
	154736	Bracket, Idler Pulley
	155488	Bracket, Tube Lock
	155427	Clip & Board Assembly, Crystal
	154803	Cotter Pin (External)
	155893	Eyelet (3 used to hold Rotors to Shaft)
	156788	Fibre Hub, Small Knob Shaft, Groove Pin & Outer Shaft Assembly
	155466-1	Guard, Fishpaper
	137939-1	Idler Pulley
	155491	Pin, Drive Cord Guide
	156672	Pulley, Drive Cord
	137940-1	Rivet, Idler Pulley
	137940-8	Rivet, Toggle Arm
	155481-1	Screw, Nylon (used to mount C6)
	39311-2	Set Screw, Arm & Hub Assembly
	155898	Shaft & Stop Assembly, Inductuner
	153804	Shield (Lid), Oscillator
	153806	Shield, Oscillator
	154677	Shield, Tube (V1)
	154743	Shield (Fish Paper Disc), Drive Cord
	152053-1	Socket, Tube (V1)
	152078-1	Socket, Tube (V2)
	51752	Spring, Drive Cord Tension
	156930	UHF Converter Complete
	155895	Washer (1 used), Shaft & Stop Assembly
	148206-1	Washer (Spring Tension), Toggle Arm

REPLACEMENT PARTS LIST

VHF Tuner (see note)

Symbol No.	Part No.	Description
C1	156906-1	Capacitor, 800 mmf., Feed Thru
C2	156906-2	Capacitor, 1000 mmf., disc ceramic
C3	156906-3	Capacitor, 1.5 mmf., disc ceramic
C4	156906-4	Capacitor, 47 mmf., 10%, disc ceramic
C5	156906-5	Capacitor, .5-3 mmf., Trimmer, ceramic
C6	156906-4	Capacitor, 47 mmf., disc ceramic
C7	156906-5	Capacitor, .5-3 mmf., Trimmer, ceramic
C8	156906-8	Capacitor, 6.8 mmf., ± .25 mmf., disc ceramic
C9	156906-9	Capacitor, 3 mmf., ± .25 mmf., disc ceramic
C10	156906-10	Capacitor, 5 mmf., ± .25 mmf., disc ceramic
C11	See Ref. 15	Capacitor, Fine Tuning
C12	156906-12	Capacitor, 10 mmf., 10%, disc ceramic
C13	156906-2	Capacitor, 1000 mmf., disc ceramic
C14	156906-14	Capacitor, 51 mmf., 5%, disc ceramic
C15	156906-15	Capacitor, 120 mmf., 10%, disc ceramic
C16	156906-16	Capacitor, 3-9 mmf., Trimmer, ceramic
C17	156906-17	Capacitor, 800 mmf., Feed Thru
C18	156906-17	Capacitor, 800 mmf., Feed Thru
C19	156906-17	Capacitor, 800 mmf., Feed Thru
C20	156906-17	Capacitor, 800 mmf., Feed Thru
R1	39374-55	Resistor, 330,000 ohm, 10%, 1/2 w.
R2	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R4	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R5	156906-47	Resistor, 10,000 ohm, 10%, 1/2 w.
R6	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R7	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R8	156906-48	Resistor, 15,000 ohm, 10%, 1/2 w.
R9	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R10	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
R11	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
L1, L2	156907-*	Antenna Coil Assembly
L3	156906-49	Choke, Cathode
L4	156906-50	Choke, Filament, R. F. Amplifier

Symbol No.	Part No.	Description
L5, L6, L7	156908-*	R. F. & Oscillator Coil Assembly
L8	156906-51	Choke, Filament, Mixer
L9	156906-52	Choke, Plate, Mixer
L10	156906-53	I. F. Assembly
1		R. F. Amplifier (V1)
2		Mixer Oscillator (V2)
3	156906-23	Tube Shield (V1)
4	156906-24	Tube Shield (V2)
5	156906-25	Shield (Side)
6	156906-26	Shield (Bottom)
7	156906-27	Roller, Detent
8	156906-28	Spring, Detent
9	156906-29	Spring, Shaft Retaining
10	156906-29	Spring, Shaft Retaining
12	156906-32	Plate, Fine Tuning Grounding
13	156906-33	Mounting Strap, Ceramic Bushing
14	156906-54	Fine Tuning Shaft Assembly
15	156906-35	Ceramic Bushing & Lead Assembly (Fine Tuning)
16, 17, 18	See C5, C7, & C16	Capacitor, Ceramic Tube
19	156906-39	Nut (Spring), Trimmer
20	156906-40	Screw, Trimmer
21	156906-41	Contact Bracket Assembly
22	156906-45	Coil Support Assembly & Insulated Shaft
26	156906-44	Spring, Slug Retaining
40	See L10	I. F. Assembly
41 thru 52	See L1, L2	Antenna Coil Assembly
53 thru 64	See L5, L6, & L7	R. F. & Oscillator Coil Assembly
	156189	VHF Tuner Complete

*One Antenna Coil Assembly and one R. F. & Oscillator Coil Assembly are necessary for each channel to be received. The dash number following the basic part number indicates the channel for which the assembly is designed. Example: 156907-2, Antenna Coil Assembly for Channel 2; 156908-13, R. F. & Oscillator Coil Assembly for Channel 13.

NOTE: Reference numbers (1, 2, 3, etc.) that follow Symbol No. L10 refer to corresponding numbers on Exploded View of the VHF Tuner

POWER SUPPLY: . . . . . . 117 volts, 60 cycle, a.c.

POWER CONSUMPTION:

VHF Position . . . . 150 watts
UHF Position . . . . 155 watts

AUDIO POWER OUTPUT: . . . . 1.4 watts maximum

ANTENNA INPUT IMPEDANCE: . 300 ohms balanced

INTERMEDIATE FREQUENCY:

Video Carrier—26.4 mc.
Sound Carrier—21.9 mc.
Intercarrier Sound—4.5 mc.
U. H. F. Output—Channels 5 or 6.

DEFLECTION: Electromagnetic.

FOCUS: Magnetic (P.M.) on 404-4 & 404-5 chassis
Electrostatic on 402-4 & 404-5 chassis

ION TRAP: Single Permanent Magnet.

HORIZONTAL SCANNING FREQ: 15,750 c.p.s.

VERTICAL SCANNING FREQ: 60 c.p.s.

FRAME FREQUENCY: 30 c.p.s.

SCANNING: Interlaced, 525 lines.

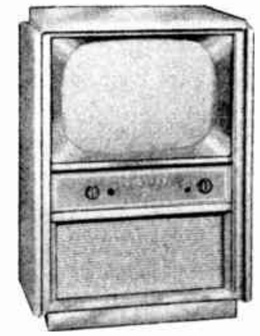
SPEAKER: 10" Permanent Magnet console models.
5 1/4" Permanent Magnet table models.

VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

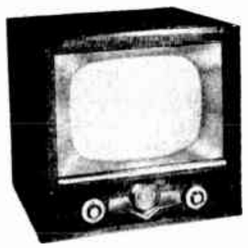
GF-21COMH
(Mahogany)
GF-21COBH
(Blond)

GF-21CDMH
(Mahogany)

F-21CDLH
(Mahogany)
F-21CDLBH
(Blond)



GF-21CDLH
(Mahogany)
GF-21CDLBH
(Blond)

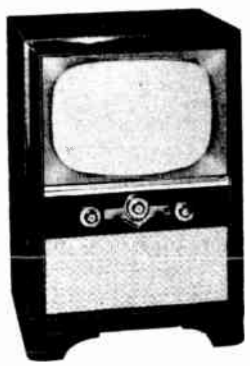


F-17TOSH
(Mahogany)
F-17TOSBH
(Blond)

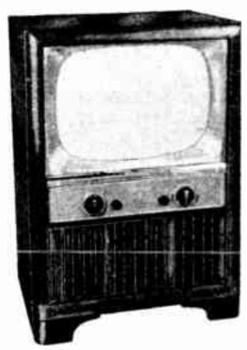
F-21TOSH
(Mahogany)
F-21TOSBH
(Blond)

GF-21TOMH
(Mahogany)

F-21CDLH
(Mahogany)
F-21CDLBH
(Blond)



F-21COLH
(Mahogany)
F-21COLBH
(Blond)



GF-21COMH
(Mahogany)
GF-21COBH
(Blond)

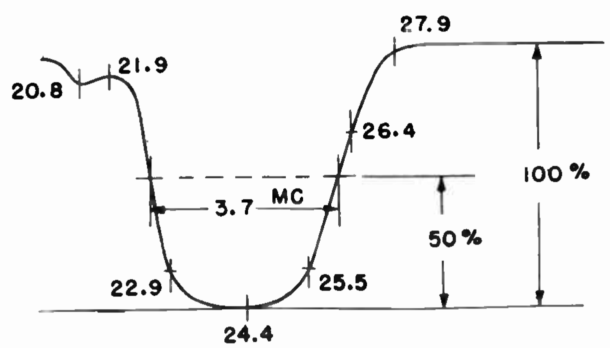
I. F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

To Check I. F. Alignment (on Oscilloscope):

Equipment: Sweep Generator, Marker Frequency Generator, Oscilloscope, VTVM (electronic voltmeter), Variable Bias Control Assembly with 4 1/2 volt battery.



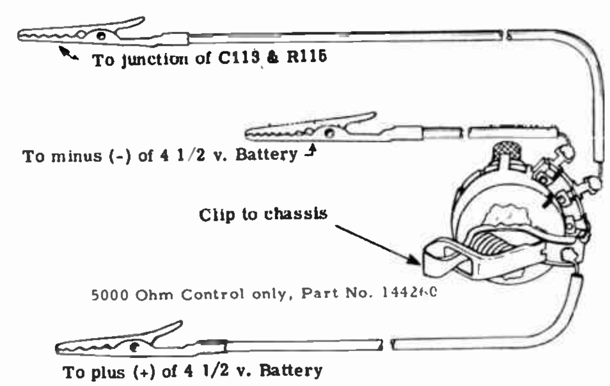
NORMAL OVERALL I. F. RESPONSE CURVE
NOTE: Response as Seen by Means of Sweep Generator

a. Set up vertical gain control on scope to read approximately 8.8 volts peak to peak between arbitrary reference lines. This can readily be done as follows:

1. Draw two horizontal lines spaced approximately 3" apart (depending on size of tube).

2. Connect low side of scope lead to chassis and the high side of lead to the 6.3 volt filament circuit. This will provide a signal with a peak to peak voltage of 17.6 volts.

3. Adjust scope vertical gain control until the distance between the two horizontal lines equals one-half the peak to peak amplitude of the 60 cycle sine wave. Leave the vertical gain in this position until the sweep generator attenuator has been set in step "h".



VARIABLE BIAS CONTROL ASSEMBLY

I. F. ALIGNMENT (continued)

b. Set channel selector knob to unused channel. Set fine tuning control and contrast control to maximum counter-clockwise position. Set noise gate to maximum counter-clockwise position. Set Local-Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.

d. Lift the shield of the Oscillator-Mixer tube V2 sufficiently to clear the socket ground clips. Connect the high side of lead from sweep signal generator to the ungrounded tube shield and the ground side of generator lead to the tuner chassis. Keep leads as short as possible (about 1 inch).

e. Apply -3.0 volts D.C. bias to I-F Bias line, junction of C113 and R115 (see "Variable Bias Control Assembly").

f. Set generator to sweep from 20 mc. to 32 mc.

g. Transfer high side of scope lead to top of R116. Adjust the output of the sweep generator to obtain curve on scope of approximately 10 volts peak to peak. (Excessive input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form. Be sure to keep the input level below the overload point, indicated by a flattening of the peak).

h. Set the marker generator to the various frequencies given (20.8 mc., 21.9 mc., etc.) and compare their relative position with those shown on the Nominal Response Curve. (Be sure to keep the marker at the minimum usable amplitude. Excessive signal will distort wave shape.) Slight deviation in shape from the nominal response curve is permissible, but if any great deviation is noted, it will be necessary to realign the IF amplifier as in section 2. (NOTE: The response curve may vary with the type of sweep equipment used. Such variations due to equipment can be checked by comparing the resultant curve with that observed on a known good chassis.)

I. F. Alignment Procedure
(Using Signal Generator and VTVM):

Equipment: Signal (Marker) Generator, VTVM (electronic voltmeter), 1000 mmf. capacitor, Swamping Network (See step "o"), Variable Bias Control Assembly with 4 1/2 volt battery.

a. Set channel selector switch to an unoccupied channel and the fine tuning control to the maximum counter-clockwise position. A channel in the upper band (channels 7 to 13) will allow easier adjustment of L10 in step "o".

b. Set contrast control to the maximum counter-clockwise position. Set noise gate to the maximum counter-clockwise position. Set Local Distance switch to "Local" position.

c. Remove RF amplifier tube (V1) from socket on VHF tuner.

d. Apply -3.0 volts D.C. bias to I-F Bias line, junction of C113 and R115 (see "Variable Bias Control Assembly").

e. Connect high side of lead from signal (marker) generator through a 1000 mmf. capacitor to TP-2 (wire protruding from top of tuner through the insulating grommet next to L10). Connect the ground lead to the RF tuner case.

f. Transfer high side lead of VTVM to top of detector load resistor, R116.

g. Set signal (Marker) generator to 24.4 mc. and set attenuator of signal generator to produce a meter deflection of approximately -2 volts DC. Adjust top of T101 for maximum DC meter reading. (Be sure sweep generator is off.) Readjust output from signal generator if necessary to keep meter deflection at -2 volts DC maximum.

h. Set signal generator to 22.9 mc. and adjust top of L103 for maximum DC meter indication. Limit meter deflection to approximately -2 volts DC maximum by adjusting output attenuator on generator.

i. Set signal generator to 21.9 mc. and adjust bottom of L103 for minimum DC meter deflection. Input should be high enough to permit a definite null to be observed on meter. (If necessary, IF bias may be reduced for this step.)

j. Repeat steps "h" and "i". Reset bias to -3.5 volts if necessary.

k. Reset IF bias at -3.5 v. Set generator to 25.5 mc. and adjust top of L102 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

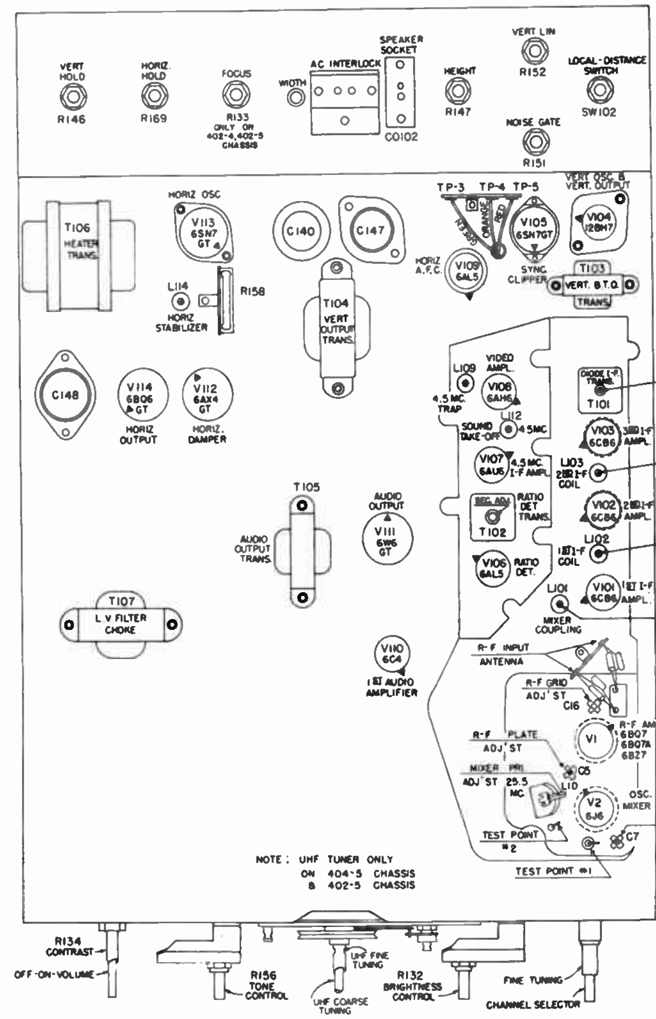
l. Reset signal generator to 24.4 mc. Adjust top of L101 for maximum meter deflection. Limit meter reading to approximately -2 volts DC maximum by adjusting output attenuator on generator.

m. Reset signal generator to 27.9 mc. and adjust the bottom of L101 for minimum DC meter deflection. Signal generator output must be sufficient to produce a definite null. (If necessary IF bias may be reduced for this step).

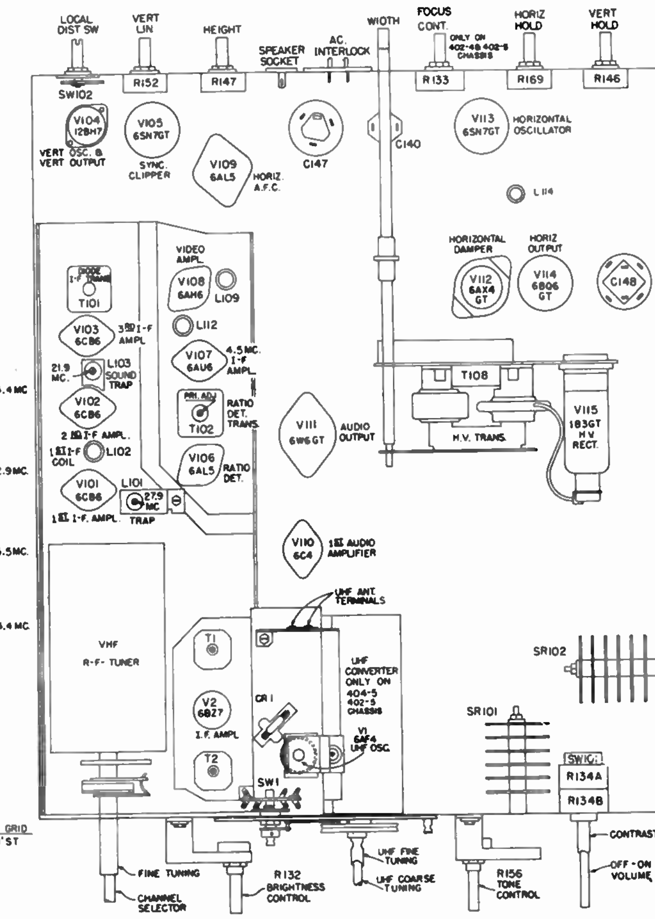
n. Repeat steps "l" and "m". If bias has been reduced below -3.5 volts, reset to -3.5 volts for step "l".

o. Transfer high side of signal generator lead to TP-1. Set signal generator to 25.5 mc. Set IF bias to -3.5 volts. Connect the Swamping Network (a 1000 ohm resistor in series with a 1000 mmf. capacitor) across L101 making connections to the two lugs on the coil form closest to the chassis. Adjust L10 for a maximum meter reading. I-F bias may be reduced if necessary to obtain a usable deflection. Remove Swamping Network.

p. Disconnect alignment equipment.



VHF CHASSIS (404-5 & 402-5) TOP VIEW
(Tube and Alignment Locations)



VHF CHASSIS (404-5 & 402-5) BOTTOM VIEW
(Tube Socket and Alignment Locations)

SOUND ALIGNMENT

1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, between grid of video amplifier and chassis.

2. Connect high side of scope through detector probe to the picture tube cathode (pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L109, for minimum 400 cycle deflection on scope.

3. Connect electronic voltmeter to pin 2 of ratio detector tube, V104, and adjust 4.5 mc. sound take-off (L112) and bottom of ratio transformer (T102) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.

4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R129 and C128 (refer to Schematic Wiring Diagram). Adjust top of T102 for zero balance on electronic voltmeter.

5. Recheck steps 2, 3 and 4 above.

6. Remove input signal, scope and electronic voltmeter.

UHF ALIGNMENT (continued)

ALIGNMENT NOTES:

CAUTION: This UHF converter unit is used with a VHF receiver that has one side of the chassis connected to the power line. DO NOT CONNECT TEST EQUIPMENT TO ANY PART OF THE RECEIVER OR GROUND THE CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED BETWEEN THE POWER LINE AND RECEIVER.

1. Remove the UHF Converter from the VHF receiver chassis.
2. In order that the converter will operate with the tuning shaft in maximum CCW* position, it will be necessary to disengage the function switch shaft from the linkage which operates it and manually set the switch to the UHF position. To accomplish this, loosen the two set-screws which secure the arm and hub assembly to the shaft. Turn the switch clockwise to the UHF position and leave it in this position while aligning.
3. Connect the output leads of the UHF converter to the R. F. input terminals of the VHF Tuner.
4. Reconnect the B+ and filament leads of the tuner to the same points on the VHF receiver from which they were disconnected. Connect UHF Converter chassis to B- (VHF receiver chassis).

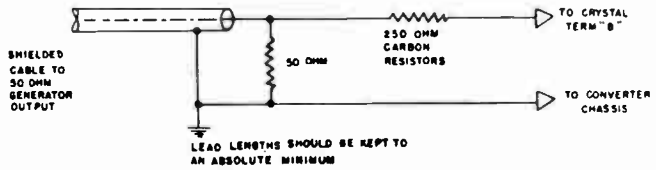
* CW - Clockwise
CCW - Counter-clockwise

5. Keep all leads as short as possible. One suggested way of doing this is to mount the UHF converter at right angles to the TV chassis with one mounting screw. Most of the leads on the UHF converter will then be of sufficient length that no additional length will need to be added.
6. Set VHF Tuner to Channel 6.
7. Alignment should be followed in the order shown.

I. F. ALIGNMENT

1. Connect an electronic voltmeter or an oscilloscope across the second detector load resistor.
2. Turn on the power.
3. Apply an 82 mc. signal (amplitude modulated if a scope is used) to the crystal terminal (B) at the junction of C13 and L9 through the resistor network shown in Sketch A.

Resistor Matching Network for I. F. Alignment



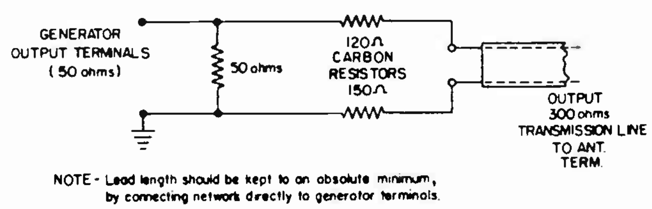
SKETCH A

4. Adjust plate coil (T1) and grid coil (T2) for maximum indication on the electronic voltmeter or scope.
5. Disconnect the resistor network from the crystal terminal.

OSCILLATOR ALIGNMENT:

1. With the electronic voltmeter or scope connected across the second detector load resistor, apply a 460 mc. signal (amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.

Resistor Matching Network for Osc. & R. F. Alignment



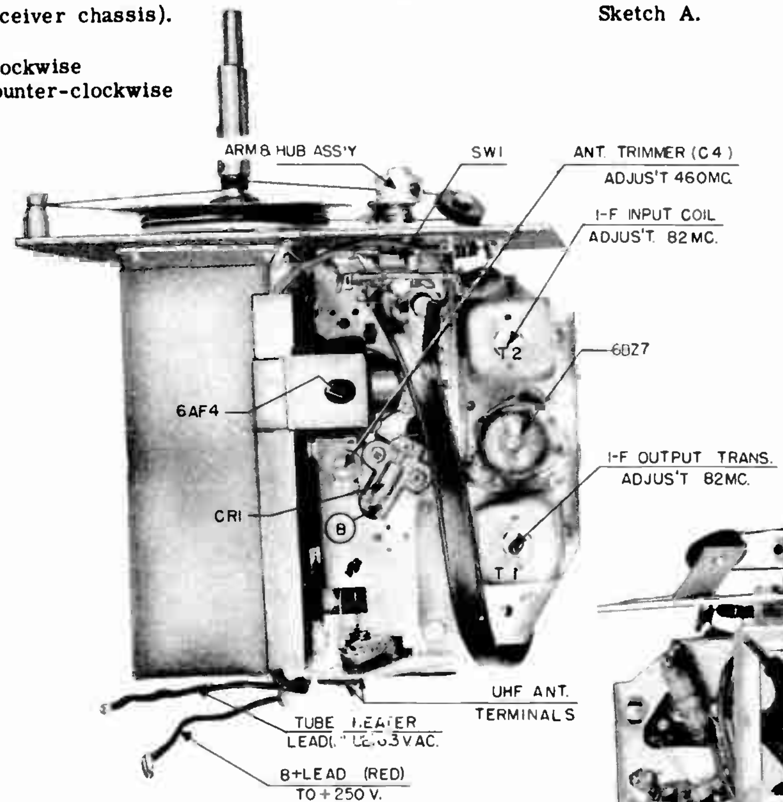
SKETCH B

2. With the tuner shaft at maximum CCW* position, adjust the oscillator trimmer C6 for peak reading on the electronic voltmeter or maximum indication on the scope (oscillator frequency is set to 84 mc. below the carrier frequency).
3. Set the signal generator to 904 mc.
4. Rotate the tuner shaft to the maximum CW position and adjust the oscillator end inductor L4 up or down for maximum reading on the voltmeter.
5. Open the ground connection on L10 and connect an 0-10 ma. D.C. meter between the open end of the crystal return choke L10 and ground.
6. Adjust the oscillator coupling coil L11 for maximum crystal current when the tuner shaft is rotated to the maximum CW position. When operating at normal line voltage (117 volts, 60 cycles), the maximum current should not exceed 5 ma. at any setting of the tuner shaft. When operating at low line voltage (105 volts, 60 cycles), the minimum crystal current must not be less than 0.3 ma. at any setting of the tuner shaft.
7. Repeat steps 1 through 4 until maximum reading is obtained.

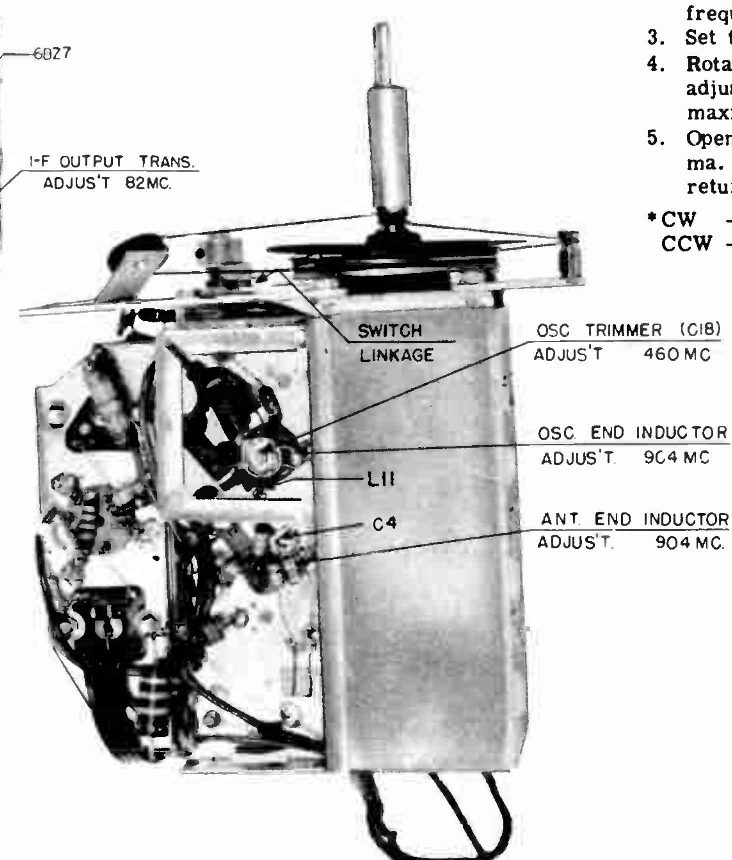
*CW - Clockwise
CCW - Counter-clockwise

R. F. CIRCUIT ALIGNMENT

1. With the electronic voltmeter or scope connected across the second detector load resistor of the VHF receiver, apply a 460 mc. signal (Amplitude modulated if a scope is used) to the UHF antenna terminals through the resistor network shown in Sketch B.
2. With the tuner shaft at the maximum CCW position, adjust the antenna trimmer C4 for maximum meter reading or for maximum scope indication.
3. Reset signal generator to 904 mc.
4. Rotate the tuner shaft to maximum CW position. Adjust the antenna end inductor L3 by forming larger or smaller loop until maximum reading on the meter (or scope) is obtained.
5. Repeat steps 1 through 4 until maximum reading is obtained.
6. Turn the power switch to the "OFF" position.
7. Disconnect the generator, the electronic voltmeter or scope, and the resistor network. Disconnect the 0-10 ma. meter, and solder the open lead of L10 to the chassis.
8. Re-engage the toggle coupling in the pin on the arm and hub assembly and tighten the set-screws that secure the collar to the switch shaft.
9. The Function Switch should be checked for proper operation under conditions of customer use. At full CCW rotation of the tuner shaft, all VHF position contacts must be fully and firmly made and all UHF position contacts must be fully broken. All UHF position contacts must be fully and firmly made and all VHF position contacts must be fully broken, when the tuner shaft is 7 1/2° or more from full CCW, as tuner shaft is rotated in a clockwise direction.
10. Replace the UHF Converter on the VHF receiver chassis.

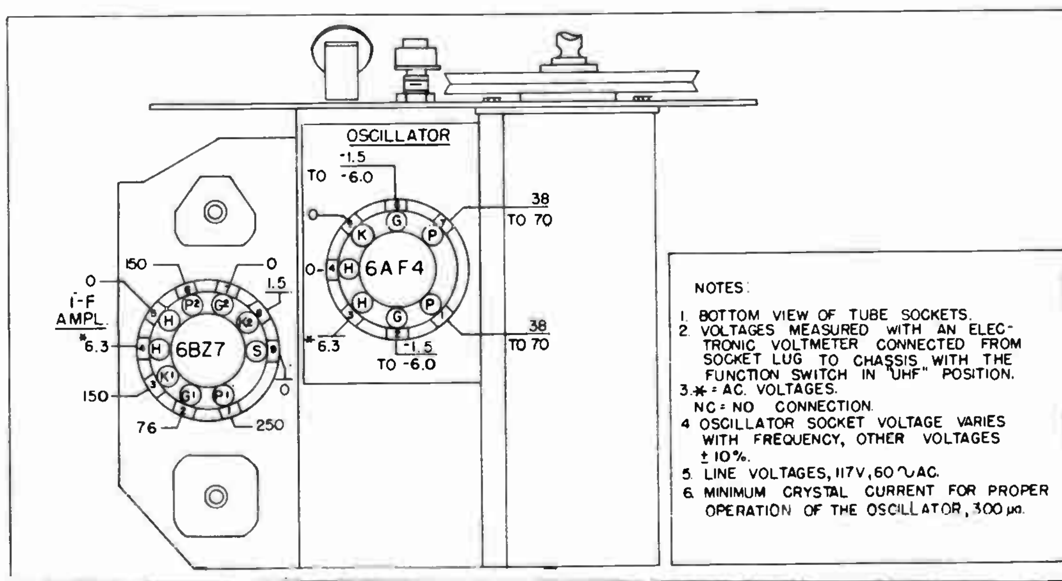


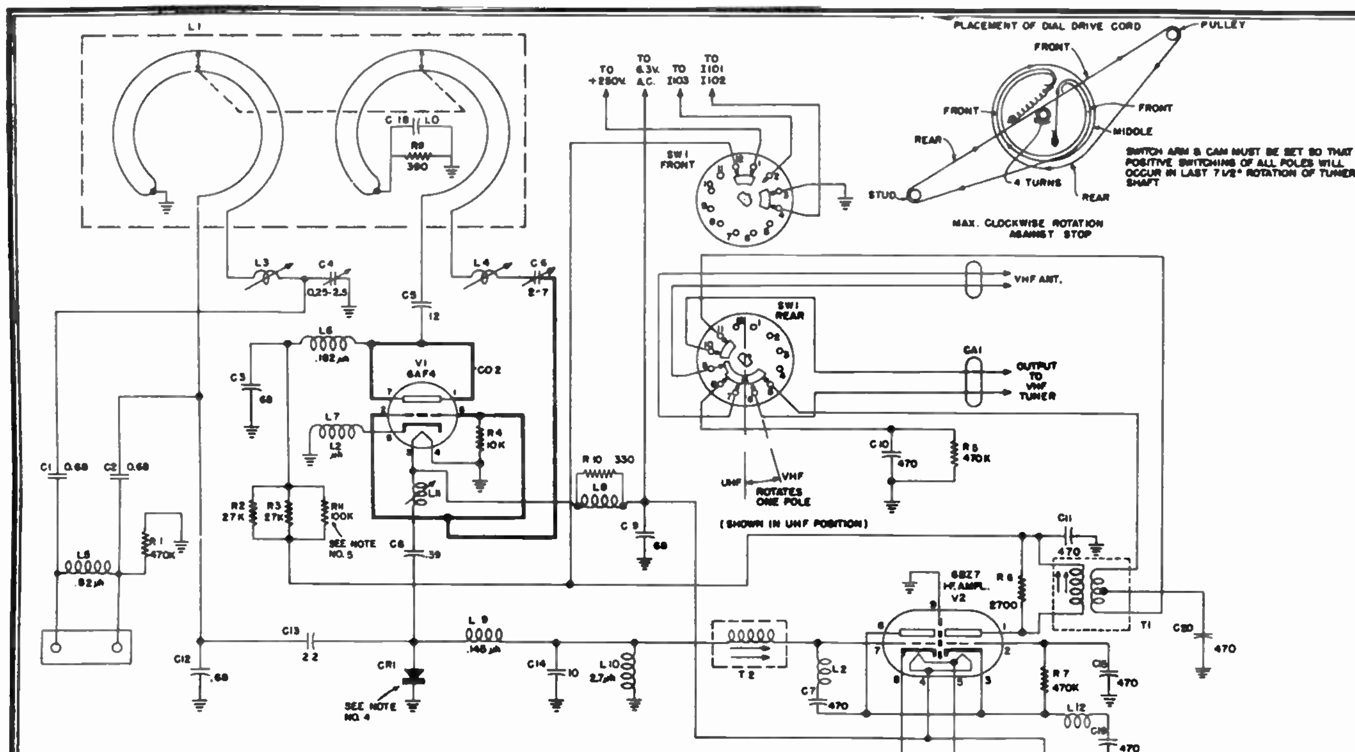
TOP VIEW - UHF Converter



BOTTOM VIEW - UHF Converter

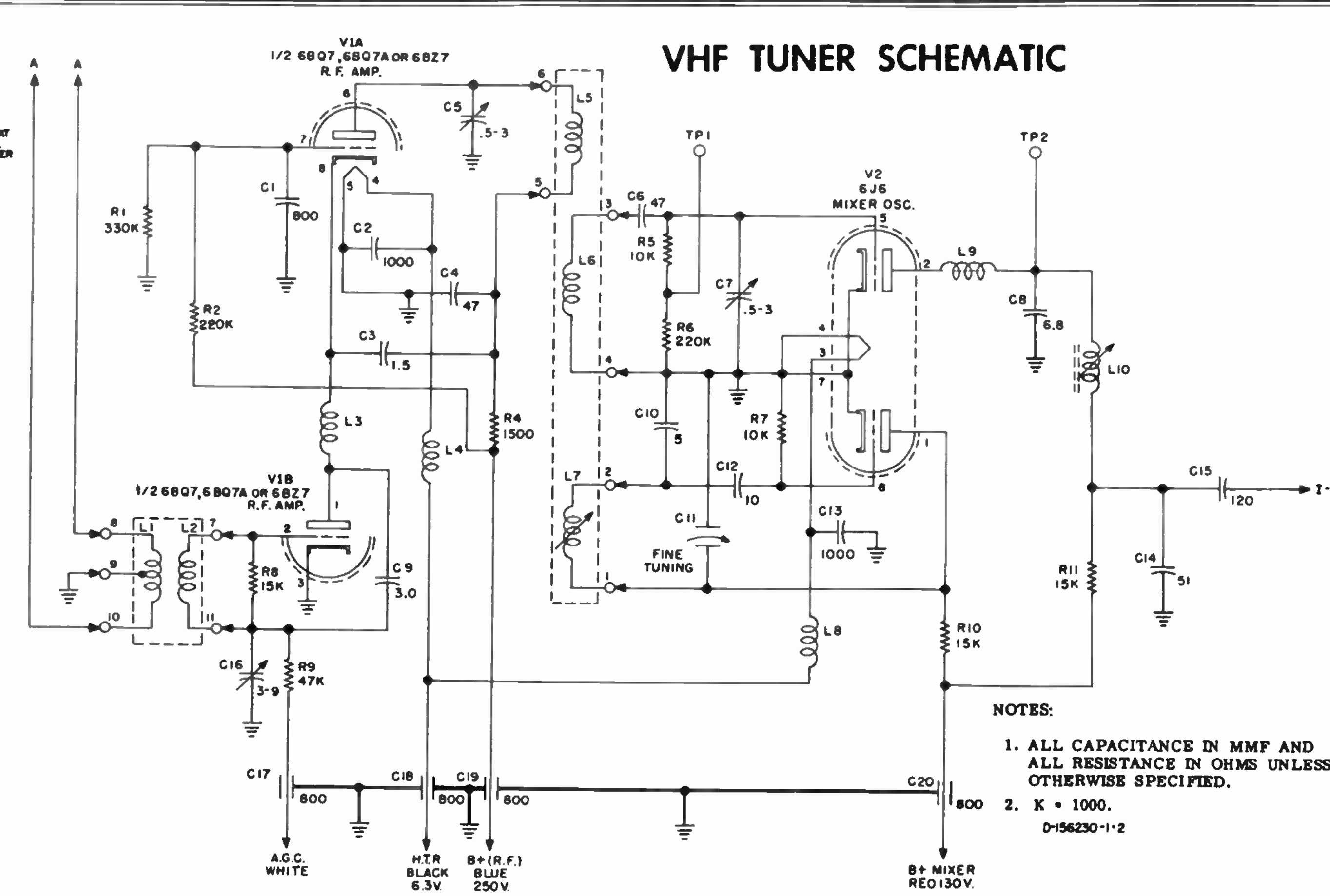
SOCKET VOLTAGE CHART





NOTES:
1. K = 1000
2. All Capacitance Values In MMF. And All Resistance In Ohms Unless Otherwise Noted.
3. All Sections Of Switch SW1 Are Viewed From The Shaft End.
4. When Possible, Replace The Crystal Mixer With One Of The Same Type. When The Same Type Is Not Available One Of The Other Types Can Ordinarily Be Used As A Substitute. However, Because Of Individual Crystal Characteristics The Substitution Of The 1N72 (Part No. 151871) For The 1N82 (Part No. 155459) Or K3D May Be Less Satisfactory.
5. In Some Early Production UHF Tuners, R11 Was Not Used. In Some Later UHF Tuners, R11 Is 87,000 Ohm, 10%, 1/2 Watt.

UHF CONVERTER SCHEMATIC



NOTES:
1. ALL CAPACITANCE IN MMF AND ALL RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. K = 1000.

D-156230-1-2

REPLACEMENT PARTS LIST
UHF Converter

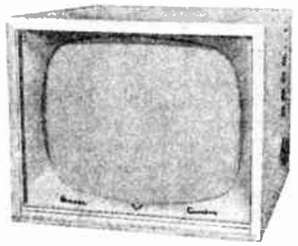
Symbol No.	Part No.	Description
C1	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C2	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C3	152997-8	Capacitor, 68 mmf., 500 v.
C4	151880-3	Capacitor, .25 - 2.5 mmf.
C5	155439-1	Capacitor, 12 mmf.
C6	156078-1	Capacitor, 2-7 mmf., Oscillator Trimmer Assembly
C7	137727-104	Capacitor, 470 mmf., ceramic
C8	152997-15	Capacitor, .39 mmf., 10%, 500 v.
C9	152997-8	Capacitor, 68 mmf., 500 v.
C10	156201-1	Capacitor, 470 mmf., 2 k.v., disc ceramic
C11	137727-104	Capacitor, 470 mmf., ceramic
C12	152997-6	Capacitor, .68 mmf., 10%, 500 v.
C13	152997-1	Capacitor, 2.2 mmf., 10%, 500 v.
C14	152997-11	Capacitor, 10 mmf., 10%, 500 v.
C15	137727-104	Capacitor, 470 mmf., ceramic
C16	137727-104	Capacitor, 470 mmf., ceramic
C17	137727-113	Capacitor, 1500 mmf., 500 v.
C18	152997-2	Capacitor, 1.0 mmf., 10%, 500 v.
C19	137727-104	Capacitor, 470 mmf., ceramic
C20	156201-1	Capacitor, 470 mmf., 2 k.v., disc ceramic
R1	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R2	39374-218	Resistor, 27,000 ohm, 10%, 2 w.
R3	39374-218	Resistor, 27,000 ohm, 10%, 2 w.
R4	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R5	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R6	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R7	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R8	39374-12	Resistor, 82 ohm, 10%, 1/2 w.
R9	Part of L1	Resistor, 390 ohm, 10%, 1/2 w.
R10	Part of L8	Resistor, 330 ohm, 10%, 1/2 w.
R11	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
L1	155158-1	Inductuner, UHF
L2	157472-1	Coil, Grid Neutralizing
L3	Part of C4	Inductance
L4	Part of C6	Inductance
L5	148936-2	Choke, R. F. (.82 microhenries)
L6	156167-1	Choke, R. F. (.182 microhenries)
L7	148936-4	Choke, R. F. (1.2 microhenries)
L8	157134-1	Choke, Oscillator Filament
L9	155510	Choke, R. F. (145 microhenries)
L10	148936-5	Choke, R. F. (2.7 microhenries)
L11	157135-1	Inductance (Variable), Choke, Oscillator Coupling
T1	156934-1	Transformer, I. F. Output
T2	156933-1	Transformer, I. F. Input
L12	157473-1	Coil, Cathode Neutralizing
CA1		Transmission Line, Antenna (300 ohm)
CO1	155604	Terminal Board, UHF Antenna
CO2	155431-1	Strap, Oscillator Plate
CR1	157690-1	Crystal, Mixer (K3D)
SW1	156170-1	Switch, Function
	155495	Arm & Hub Assembly, Function Switch
	155561	Arm, Toggle
	155441	Bracket, Antenna
	154736	Bracket, Idler Pulley
	155488	Bracket, Tube Lock
	155427	Clip & Board Assembly, Crystal
	154803	Cotter Pin (External)
	155893	Eyelet (3 used to hold Rotors to Shaft)
	156788	Fibre Hub, Small Knob Shaft, Groove Pin & Outer Shaft Assembly
	155466-1	Guard, Fishpaper
	137939-1	Idler Pulley
	155491	Pin, Drive Cord Guide
	156672	Pulley, Drive Cord
	137940-1	Rivet, Idler Pulley
	137940-8	Rivet, Toggle Arm
	155481-1	Screw, Nylon (used to mount C6)
	39311-2	Set Screw, Arm & Hub Assembly
	155898	Shaft & Stop Assembly, Inductuner
	153804	Shield (Lid), Oscillator
	153806	Shield, Oscillator
	154677	Shield, Tube (V1)
	154743	Shield (Fish Paper Disc), Drive Cord
	152053-1	Socket, Tube (V1)
	152078-1	Socket, Tube (V2)
	51752	Spring, Drive Cord Tension
	156930	UHF Converter Complete
	155895	Washer (1 used), Shaft & Stop Assembly
	148206-1	Washer (Spring Tension), Toggle Arm

REPLACEMENT PARTS LIST
VHF Tuner (see note)

Symbol No.	Part No.	Description
C1	156906-1	Capacitor, 800 mmf., Feed Thru
C2	156906-2	Capacitor, 1000 mmf., disc ceramic
C3	156906-3	Capacitor, 1.5 mmf., disc ceramic
C4	156906-4	Capacitor, 47 mmf., 10%, disc ceramic
C5	156906-5	Capacitor, .5-3 mmf., Trimmer, ceramic
C6	156906-4	Capacitor, 47 mmf., disc ceramic
C7	156906-5	Capacitor, .5-3 mmf., Trimmer, ceramic
C8	156906-8	Capacitor, 6.8 mmf., ± .25 mmf., disc ceramic
C9	156906-9	Capacitor, 3 mmf., ± .25 mmf., disc ceramic
C10	156906-10	Capacitor, 5 mmf., ± .25 mmf., disc ceramic
C11	See Ref. 15	Capacitor, Fine Tuning
C12	156906-12	Capacitor, 10 mmf., 10%, disc ceramic
C13	156906-2	Capacitor, 1000 mmf., disc ceramic
C14	156906-14	Capacitor, 51 mmf., 5%, disc ceramic
C15	156906-15	Capacitor, 120 mmf., 10%, disc ceramic
C16	156906-16	Capacitor, 3-9 mmf., Trimmer, ceramic
C17	156906-17	Capacitor, 800 mmf., Feed Thru
C18	156906-17	Capacitor, 800 mmf., Feed Thru
C19	156906-17	Capacitor, 800 mmf., Feed Thru
C20	156906-17	Capacitor, 800 mmf., Feed Thru
R1	39374-55	Resistor, 330,000 ohm, 10%, 1/2 w.
R2	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R4	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R5	156906-47	Resistor, 10,000 ohm, 10%, 1/2 w.
R6	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R7	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R8	156906-48	Resistor, 15,000 ohm, 10%, 1/2 w.
R9	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R10	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
R11	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
L1, L2	156907-*	Antenna Coil Assembly
L3	156906-49	Choke, Cathode
L4	156906-50	Choke, Filament, R. F. Amplifier
L5, L6, L7	156908-*	R. F. & Oscillator Coil Assembly
L8	156906-51	Choke, Filament, Mixer
L9	156906-52	Choke, Plate, Mixer
L10	156906-53	I. F. Assembly
1		R. F. Amplifier (V1)
2		Mixer Oscillator (V2)
3	156906-23	Tube Shield (V1)
4	156906-24	Tube Shield (V2)
5	156906-25	Shield (Side)
6	156906-26	Shield (Bottom)
7	156906-27	Roller, Detent
8	156906-28	Spring, Detent
9	156906-29	Spring, Shaft Retaining
10	156906-29	Spring, Shaft Retaining
12	156906-32	Plate, Fine Tuning Grounding
13	156906-33	Mounting Strap, Ceramic Bushing
14	156906-54	Fine Tuning Shaft Assembly
15	156906-35	Ceramic Bushing & Lead Assembly (Fine Tuning)
16, 17, 18	See C5, C7, & C16	Capacitor, Ceramic Tube
19	156906-39	Nut (Spring), Trimmer
20	156906-40	Screw, Trimmer
21	156906-41	Contact Bracket Assembly
22	156906-45	Coil Support Assembly & Insulated Shaft
26	156906-44	Spring, Slug Retaining
40	See L10	I. F. Assembly
41 thru 52	See L1, L2	Antenna Coil Assembly
53 thru 64	See L5, L6, & L7	R. F. & Oscillator Coil Assembly
	156189	VHF Tuner Complete

* One Antenna Coil Assembly and one R. F. & Oscillator Coil Assembly are necessary for each channel to be received. The dash number following the basic part number indicates the channel for which the assembly is designed. Example: 156907-2, Antenna Coil Assembly for Channel 2; 156908-13, R. F. & Oscillator Coil Assembly for Channel 13.

NOTE: Reference numbers (1, 2, 3, etc.) that follow Symbol No. L10 refer to corresponding numbers on Exploded View of the VHF Tuner



MODEL G-21TOBH
(Blond)

SPECIFICATIONS

POWER SUPPLY: 117 volts, 60 cycle, a.c.
POWER CONSUMPTION 130 watts.
AUDIO POWER OUTPUT: 1.0 watts maximum.
ANTENNA INPUT IMPEDANCE: 300 ohms balanced
FREQUENCY RANGE: 54 to 88 mc. & 174 to 216 mc. (Channels 2 thru 13)

INTERMEDIATE FREQUENCY:
Video Carrier—26.4 mc.
Sound Carrier—21.9 mc.
Intercarrier Sound—4.5 mc.

DEFLECTION: Electromagnetic.
FOCUS: Electrostatic.
ION TRAP: Single Permanent Magnet.
HORIZONTAL SCANNING FREQ: 15,750 c.p.s.
VERTICAL SCANNING FREQ: 60 c.p.s.
FRAME FREQUENCY: 30 c.p.s.
SCANNING: Interlaced, 525 lines.
SPEAKER: 4" Permanent Magnet.
VOICE COIL IMPEDANCE: 3.2 ohms @ 400 cycles.

ION TRAP MAGNET ADJUSTMENT

The proper adjustment of the Ion Trap Magnet cannot be overemphasized, for it is not only important to obtain maximum brightness and a good quality picture, but also to the life expectancy of the picture tube. (See Service Instruction No. 4-03).

Place the Ion Trap on the neck of the picture tube close to the tube base and over the internal pole pieces that are mounted on the gun structure. If there is a code dot or arrow on the magnet, this side should be toward the tube face. There are two possible positions on the tube neck where the Ion Trap will produce maximum brightness. ALWAYS SET THE ION TRAP IN THE POSITION CLOSEST TO THE BASE OF THE TUBE.

If the picture tube has been installed or if the receiver has been moved, it is imperative that the Brightness control be kept at a low setting until after the initial adjustment of the Ion Trap and also that the adjustment be made immediately after the receiver is turned on. It is important that the intensity of the beam be low when the receiver starts operating, if the magnet has not yet been adjusted. By keeping the intensity low, the beam current is low enough that the electron beam is not likely to damage the anode top disc before the magnet is adjusted.

TO ADJUST THE ION TRAP MAGNET- Set the Brightness control completely counter-clockwise, then advance slightly clockwise (less than 1/4 turn). Slide the trap forward or backward on the neck of the tube and at the same time rotate trap clockwise or counter-clockwise until a raster appears, then adjust for maximum brightness. If no raster is obtained with this setting of the Brightness control, advance the control slightly clockwise and repeat adjustment of the trap until a raster appears. The final setting of the trap should be made with the Brightness control set to the maximum position with which good line focus can be obtained. If neck shadow is encountered, or if the picture is off center, correction should be made with the centering magnet on the back cover of the deflection yoke. Never use the Ion Trap to correct neck shadow. Always set the trap to the position where maximum brightness is obtained. After any adjustment of the deflection yoke or centering magnet the Ion Trap should always be checked and readjusted for maximum brightness.

DISASSEMBLY

IMPORTANT: When it is necessary to remove the cabinet from the cabinet base, or to remove the picture tube or chassis from the cabinet base, care should be exercised to be sure that the correct screws are being loosened. It is advisable, when loosening the screws on the underneath side of the base, to keep the base in its normal position but extended slightly over the edge of the work-bench.

Removing The Cabinet From The Cabinet Base

1. Remove the control knobs, the cabinet back, the antenna terminal plate, and the wires from the speaker (or the speaker from the cabinet).
2. Remove the two wood screws on the inside rear corners that hold the cabinet base to the wood supports on the bottom of each side and the two screws that hold the chassis to the wood strip on the inside of the cabinet above the chassis.
3. Remove the six hex head screws and the lockwashers on the underside of the base (along the sides of the cabinet) and also one wood screw that is through the base at the center front on the bottom.
4. Lift the cabinet up and off the base.
5. To replace the cabinet, reverse the removal procedure.

Removing The Chassis From The Cabinet Base

Should it be necessary to trouble shoot or to replace parts in the IF strip, the following procedures may be useful in servicing the chassis.

1. Remove the cabinet back and cabinet as outlined above.
2. Remove the CRT socket and Ion Trap.
3. Disconnect the CRT high voltage lead.
4. Remove the two hex head screws holding the interlock receptacle tothe base.
5. Remove the two nuts below the vertical controls (On the screws holding the chassis to the CRT rear support).
6. Remove the bolts that hold the chassis to the base and carefully slide the chassis from around the CRT neck. DO NOT ALLOW PRESSURE TO BE EXERTED ON THE NECK OF THE PICTURE TUBE.

Should it be necessary to use the CRT during service, proceed as follows:

1. Remove the yoke wing nut and turn the yoke around.
2. Turn the chassis around and carefully slide the yoke and chassis over the neck of the tube.
3. Use a short piece of tape and tape the yoke to the bell of the CRT.
4. Use a short jumper between the high voltage lead and the CRT.
5. Replace Ion Trap and CRT socket.

Removing The Picture Tube

HANDLING PRECAUTIONS - Do not remove or handle the picture tube in any manner unless heavy gloves and protective goggles are worn. KEEP TUBE AWAY FROM THE BODY WHILE HANDLING.

1. Remove cabinet from the chassis and cabinet base as outlined above.
2. Disconnect the tube socket and remove the ion trap magnet from the neck of the tube. Loosen the wing screw on the deflection yoke bracket.
3. Disconnect the second anode lead from the bell of the tube.
4. Remove the nuts on both tie rods that extend from the tube support bracket to the tube rests. Unhook the tie rods.
5. Remove the two nuts that are on the screws that hold the top of the tube support bracket to the chassis.
6. Remove both hex head machine screws that hold the tube strap to the base on either side of the two tube rests, and lift off the strap.
7. Raise tube slightly at the front so that it will clear the stops on the tube rests, and pull the tube forward to remove.

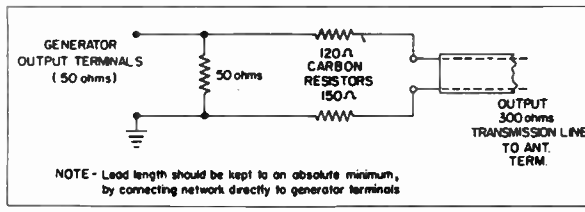
DO NOT ALLOW PRESSURE TO BE EXERTED ON THE NECK OF THE TUBE.

Replacing The Picture Tube

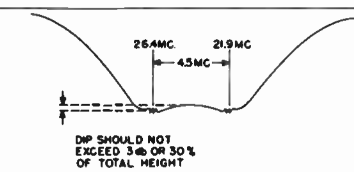
1. Guide neck of tube through opening in the tube support bracket and deflection yoke, and place bottom of face plate against stops on tube rests. Be sure the pads are in position between the tube and tube rests.
2. Place pad and strap over tube and insert the two hex head screws through the base and screw into the strap brackets but do not tighten.
3. Replace and tighten the two nuts on the screws that hold the tube support to the chassis.
4. Replace the tie rods, apply the nuts and tighten. Bell of tube should rest against insulating ring on the tube support bracket.
5. Tighten the two screws that hold the strap to the base.
6. Connect second anode to the tube.
7. Push deflection yoke forward against flare of tube, and tighten wing screw.
8. Replace ion trap on neck of tube and connect tube socket.
9. Make necessary adjustments on the ion trap and deflection yoke. See "ADJUSTMENTS" on page 5.
10. Replace the cabinet over the chassis and base, then follow instructions for "Removing The Chassis From The Cabinet", steps 1 to 3 in reverse order.

R.F. AND MIXER ALIGNMENT

Step No.	Station Selector	Oscilloscope	Bias	Signal Generator To	Adjust
1.	Chan. #10	High side through a 10,000 ohm resistor to TP1 on Tuner. Ground lead to Tuner Case.	-1.5 volts to white lead on tuner.	Signal Generator set to 195.5 MC., 400 cycle 30% AM modulated. Through Dummy Antenna to the Antenna lead-in.	C-3 for maximum 400 cycle response on scope. Remove signal Generator.
2.	"	"	"	Sweep Generator to Antenna lead-in through dummy antenna. Set Generator to sweep Channel 10 freq. Loosely couple Marker Generator to sweep output cable. Set marker to either 21.9 or 26.4 mc.	Adjust C5 & C9, to produce a response curve similar to R.F. and Mixer Response Curve.



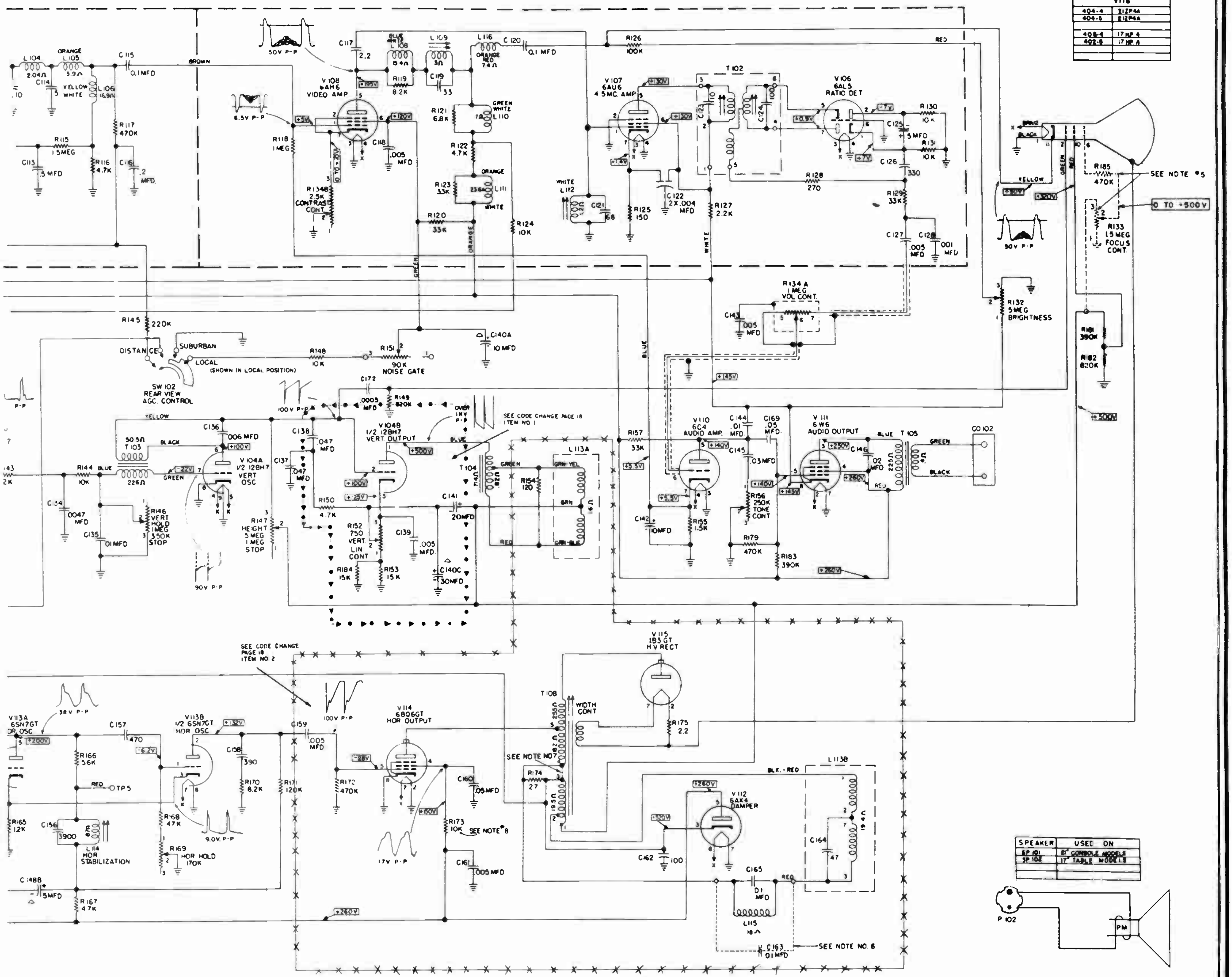
DUMMY ANTENNA



R. F. & MIXER RESPONSE CURVE

Without disturbing the R.F. grid, R.F. plate, and mixer-grid trimmer, check the response on the other VHF TV channels by setting the station selector to the desired channel and changing the frequency of the sweep generator to correspond to the channel being checked. The response curve should be essentially the same on all channels and the markers should fall in similar positions on the response curve. A slight amount of tilt can be tolerated. The amount of tilt indicated by the relative amplitudes of the response curves where the picture and sound I.F. Markers rest should not exceed 30% of the over-all response curve amplitude.

402-4, 402-5, 404-4 & 404-5



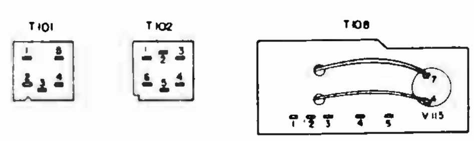
	R178	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
nic	R179	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
	R180	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
nic	R181	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
ceramic	R182	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
	R183	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
of L113)	R184	39374-215	Resistor, 15,000 ohm, 10%, 2 w.
	R185	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w. (used on 402-4 & 402-5 Chassis only)
nic	L101	155304	Coil, Convertor I. F. (1.98 to 4.5 microhenries)
	L102	155319	Coil, 1st I. F. (1.95 to 4.5 microhenries)
	L103	155348	Coil, 2nd I. F. (2.4 to 4.5 microhenries)
	L104	154376	Coil, Diode Choke (15.5 microhenries)
	L105	156714	Coil, Video Peaking (90 microhenries)
	L106	154184	Coil, Video Peaking (335 microhenries)
	L107	155256	Choke, Filament RF (.576 microhenries)
	L108	154194	Coil, Video Peaking (414 microhenries)
	L109	155446	Coil, 4.5 MC. Trap (27 to 57 microhenries)
	L110	154206	Coil, Video Peaking (106 microhenries)
	L111	154176	Coil, Video Peaking (840 microhenries)
	L112	155442	Coil, Sound Take-Off (12 to 23 microhenries)
	L113A	157044-1	Yoke, Deflection } Assembly, (Used on
	L113B		Yoke, Deflection } 402-4 & 402-5 only)
	L113A	157044-2	Yoke, Deflection } Assembly, (Used on
	L113B		Yoke, Deflection } 404-4 & 404-5 Chassis)
	L114	154220	Coil, Horizontal Oscillator (18 to 37 microhenries)
	L115	154156	Network, Yoke Coupling (3 microhenries, used on 404-4 & 404-5 Chassis only)
	L116	156035	Coil, Video Peaking (117 microhenries)
	T101	155594	Transformer, Diode IF

IENT PARTS LIST

Schematic)

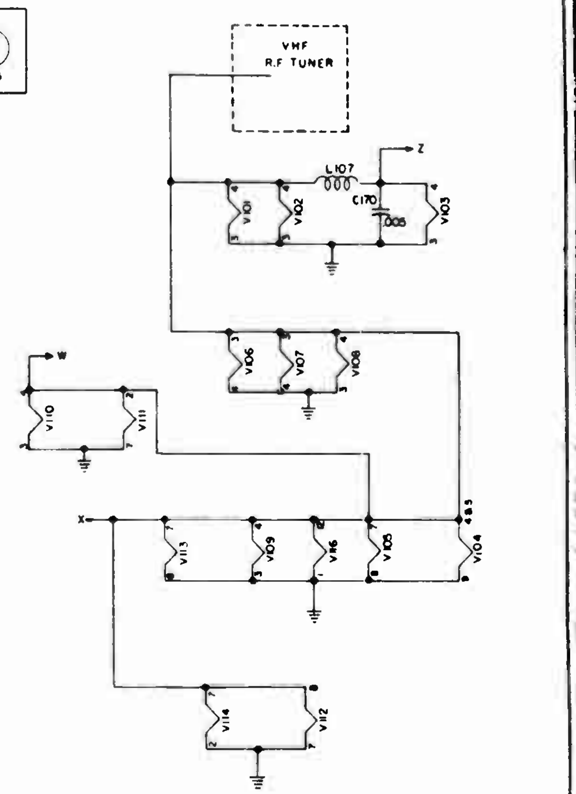
402-5, 404-4 & 404-5

	Symbol No.	Part No.	Description
	SW102	155554	Switch, Rotary (AGC Control)
	CR101	154111	Crystal, 1N64 (Part of T101)
	SR101	155575-2	Rectifier, Selenium
	SR102	155575-2	Rectifier, Selenium
	SP101	138762-5	Speaker, PM (10")
	SP102	138762-7	Speaker, PM (5 1/4")
	CA101	132300-6	Cable & Plug Assembly, AC Power
	P101	154125	Receptacle, AC Power
	P102	131983	Plug (Male), 2 Prong

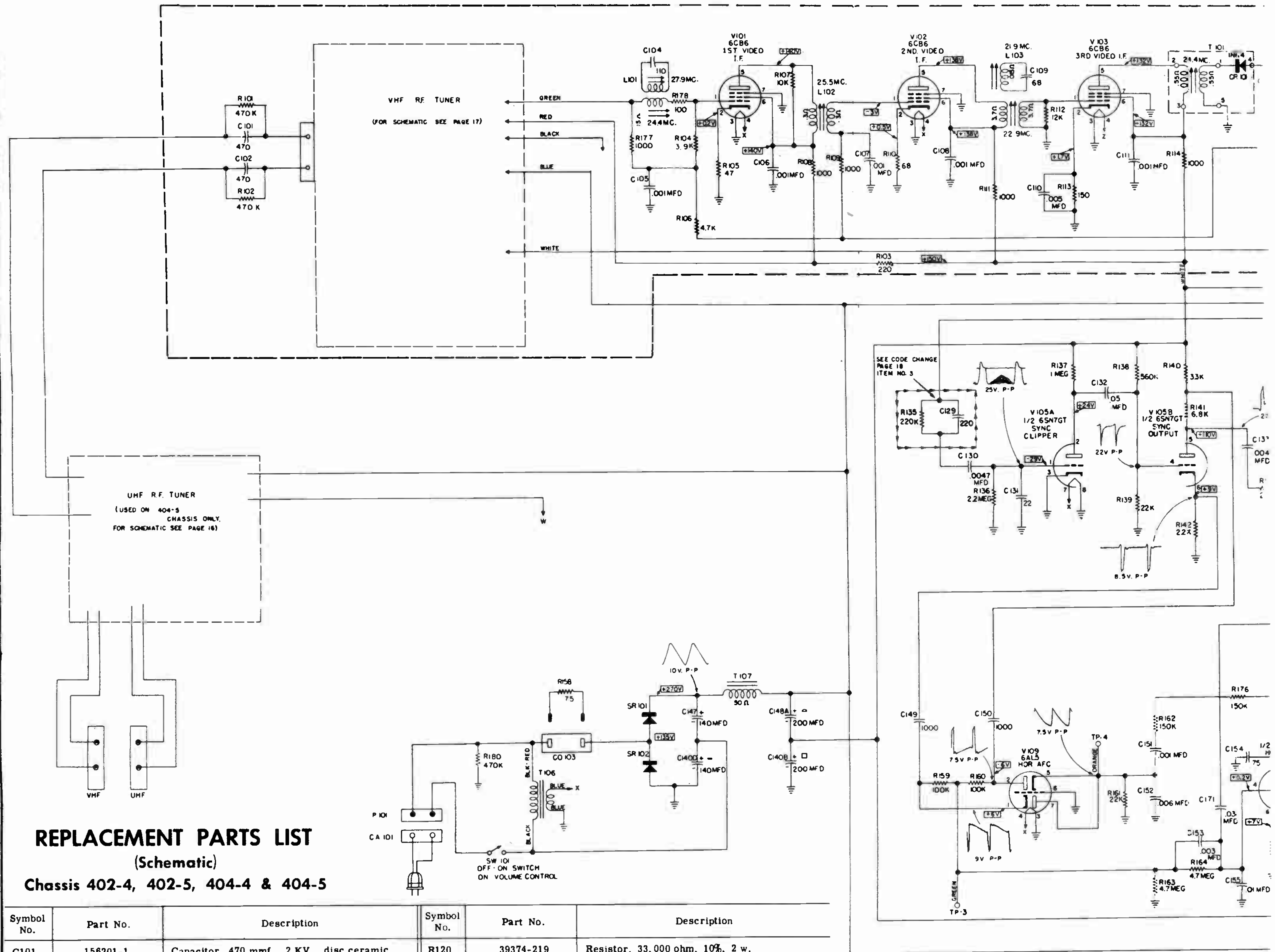


NOTES:

1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2. SUPPLY VOLTAGE 117 VOLTS 60 CYCLE AC.
3. K = 1000
4. ALL CAPACITANCE VALUES IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. R133 AND R185 USED ONLY ON 402-4 AND 402-5 CHASSIS.
6. C165 AND L115 ARE REPLACED BY C163 ON 402-4 & 402-5 CHASSIS.
7. R174 IS REMOVED AND A JUMPER IS CONNECTED BETWEEN TERMINALS 2 & 3 OF T108 ON 402-4 & 402-5 CHASSIS.
8. R173 IS A SPECIAL RESISTOR WHICH WILL WITHSTAND OVERLOAD FOR LIMITED PERIODS OF TIME.



SCHEMATIC WIRING DIAGRAM CHASSI



REPLACEMENT PARTS LIST

(Schematic)

Chassis 402-4, 402-5, 404-4 & 404-5

Symbol No.	Part No.	Description
C101	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C102	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C104	Part of L101	Capacitor, 110 mmf., 10%, 500 v., ceramic
C105	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C106	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C107	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C108	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C109	Part of L103	Capacitor, 68 mmf., 10%, 500 v., mica
C110	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C111	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C112	137727-135	Capacitor, 10 mmf., 500 v., ceramic
C113	154157	Capacitor, .5 mfd., 25 v., paper
C114	137727-103	Capacitor, 5 mmf., 500 v., ceramic
C115	39001-19	Capacitor, .1 mfd., 600 v., paper
C116	39001-86	Capacitor, .2 mfd., 600 v., paper
C117	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic
C118	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C119	137727-126	Capacitor, 33 mmf., 500 v., ceramic
C120	39001-19	Capacitor, .1 mfd., 600 v., paper
C121	137727-133	Capacitor, 68 mmf., 10%, 500 v., ceramic
C122	144675-6	Capacitor, .004 mfd., 400 v. } Assembly
C122		Capacitor, .004 mfd., 400 v. } Assembly
C123	Part of T102	Capacitor, 10 mmf.
C124	Part of T102	Capacitor, 100 mmf.
C125	154103	Capacitor, 5 mfd., 50 v., Electrolytic
C126	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C127	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C128	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C129	137727-131	Capacitor, 220 mmf., 500 v., ceramic
C130	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C131	137727-26	Capacitor, 22 mmf., 500 v., ceramic
C132	39001-17	Capacitor, .05 mfd., 600 v., paper
C133	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C134	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C135	39478-41	Capacitor, .01 mfd., 600 v., 10%, molded paper
C136	39001-78	Capacitor, .006 mfd., 600 v., paper
C137	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C138	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C139	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C140A	155438	Capacitor, 10 mfd., 300 v. } Electrolytic
C140B		Capacitor, 200 mfd., 150 v. } Electrolytic
C140C		Capacitor, 30 mfd., 150 v. } Electrolytic
C140D		Capacitor, 140 mfd., 150 v. } Electrolytic
C141	154097	Capacitor, 20 mfd., 450 v., Electrolytic
C142	154104	Capacitor, 10 mfd., 50 v., Electrolytic
C143	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C144	39001-13	Capacitor, .01 mfd., 600 v., paper
C145	39001-82	Capacitor, .03 mfd., 600 v., paper
C146	39001-80	Capacitor, .02 mfd., 600 v., paper
C147	155684	Capacitor, 140 mfd., 150 v., Electrolytic
C148A	155426	Capacitor, 200 mfd., 150 v. } Electrolytic
C148B		Capacitor, 5 mfd., 150 v. } Electrolytic
C149	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C150	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C151	39478-108	Capacitor, .001 mfd., 10%, 1000 v., molded paper
C152	146434-16	Capacitor, .006 mfd., 10%, 600 v., paper
C153	39001-76	Capacitor, .003 mfd., 600 v., paper
C154	137727-134	Capacitor, 75 mmf., 500 v., ceramic
C155	39001-13	Capacitor, .01 mfd., 600 v., paper
C156	137499-30	Capacitor, 3900 mmf., 500 v., mica
C157	137499-36	Capacitor, 470 mmf.. 500 v., mica

Symbol No.	Part No.	Description
R120	39374-219	Resistor, 33,000 ohm, 10%, 2 w.
R121	Part of L110	Resistor, 6800 ohm, 10%, 1/2 w.
R122	39375-361	Resistor, 4700 ohm, 5%, 2 w.
R123	Part of L111	Resistor, 3300 ohm, 10%, 1/2 w.
R124	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R125	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R126	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R127	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R128	39374-18	Resistor, 270 ohm, 10%, 1/2 w.
R129	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R130	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R131	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R132	155352	Control, Brightness (5 megohm)
R133	154094	Control, Focus (1.5 megohm, used on 402-4 and 402-5 chassis only)
R134A	154085	Control, Volume (1 megohm) } Assembly
R134B		Control, Contrast (2500 ohm) } Assembly
R135	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R136	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R137	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R138	39374-146	Resistor, 560,000 ohm, 10%, 1 w.
R139	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R140	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R141	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R142	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R143	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R144	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R145	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R146	155610	Control, Vertical Hold
R147	154086	Control, Height
R148	39374-125	Resistor, 10,000 ohm, 10%, 1 w.
R149	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R150	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R151	155576	Control, Noise Gate (90,000 ohm)
R152	155519	Control, Vertical Linearity
R153	39374-215	Resistor, 15,000 ohm, 10%, 2 w.
R154	39374-14	Resistor, 120 ohm, 10%, 1/2 w.
R155	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R156	155389	Control, Tone (250,000 ohm)
R157	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R158	154089	Resistor, 7.5 ohm, 10%, 5 w. Wire Wound
R159	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R160	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R161	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R162	39374-139	Resistor, 150,000 ohm, 10%, 1 w.
R163	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R164	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R165	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.
R166	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R167	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R168	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R169	155511	Control, Horizontal Hold
R170	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R171	39374-50	Resistor, 120 ohm, 10%, 1/2 w.
R172	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R173	156911-1	Resistor, 10,000 ohm, 10%, 2 w.
R174	39374-6	Resistor, 27 ohm, 10%, 1/2 w. (Used on 404-4 & 404-5 Chassis only)
R175	39303-12	Resistor, 2.2 ohm, (Part of T108)
R176	39374-139	Resistor, 150,000 ohm, 10%, 1 w.
R177	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.

C158	137499-31	Capacitor, 390 mmf., 500 v., mica
C159	144675-2	Capacitor, .005 mfd., 500 v., disc cera
C160	39001-17	Capacitor, .05 mfd., 600 v., paper
C161	144675-2	Capacitor, .005 mfd., 500 v., disc cera
C162	157046-1	Capacitor, 100 mmf., 10%, 3 KV., disc
C163	39001-19	Capacitor, .1 mfd., 600 v., paper
C164	154211	Capacitor, 47 mmf., 2 KV., mica (Part
C165	Part of L115	Capacitor, .1 mfd., 200 v., paper
C169	39001-17	Capacitor, .05 mfd., 600 v., paper
C170	144675-2	Capacitor, .005 mfd., 500 v., disc cera
C171	39001-82	Capacitor, .03 mfd., 600 v., paper
C172	39001-5	Capacitor, .0005 mfd., 600 v., paper
R101	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R102	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R103	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
R104	39375-63	Resistor, 3900 ohm, 5%, 1/2 w.
R105	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R106	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R107	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R108	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R109	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R110	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R111	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R112	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
R113	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R114	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R115	39374-65	Resistor, 1.5 megohm, 10%, 1/2 w.
R116	39375-65	Resistor, 4700 ohm, 5% 1/2 w.
R117	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R118	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R119	Part of L108	Resistor, 8200 ohm, 10%, 1/2 w.

REPLACEM

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Chassis 402-4,

Symbol No.	Part No.	Description
T102	154108	Transformer, Ratio Detector
T103	155255-1	Transformer, Vertical Oscillator
T104	155572	Transformer, Vertical Output
T105	154109-2	Transformer, Audio Output
T106	155390	Transformer, Filament
T107	155529-1	Choke, Filter
T108	157045-1	Transformer, Horizontal Deflection
CO102	138352	Socket, Speaker
CO103	154114	Socket, Terminal Strip
SW101	Part of R134 A & B	Switch, ON-OFF Power

I.F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes.
The rear side of the chassis means the side on which the tubes are mounted.

VIDEO I. F. ALIGNMENT (with VTVM)

In the I.F. Alignment, limit input of signal generator so that reading on VTVM does not exceed -2 volts.

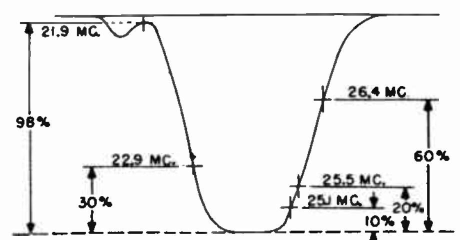
Step No.	Connect Signal Generator Through a .01 Capacitor	Signal Gen. Freq. MC.	Connect VTVM	Miscellaneous Connections and Instructions	Adjust
1.	Test Point No. 2 on Tuner (closest to L9 slug adjustment).	24.4 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis	T101 for maximum indication on meter, limit input to make peak less than -2 volts D.C. on VTVM.
2.	"	22.9 mc.	"	"	L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.
3.	"	21.9 mc.	"	"	L103 (front slug) for minimum. Input level should be high enough to produce at least .5 volts at null on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
4.	Repeat steps 2 and 3.				
5.	"	25.5 mc.	"	"	L102 for maximum.
6.	"	25.1 mc.	"	"	L101 (front slug) for maximum. Use first peak from tinnerman clip end of coil.
7.	"	27.9 mc.	"	"	See Note 1. L101 (rear slug) for minimum deflection on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
8.	Repeat step 6 (and 7, if adjacent channel trap is used).				
9.	Test Point No. 1 on Tuner (closest to C21 trimmer screw).	25.1 mc.	"	Connect a 100 ohm resistor in series with a 1000 mmf. cap. across L101.	L9 (brass screw) on the Tuner for maximum.

Note 1. This adjustment can be made only on receivers where the Adjacent Channel Trap has been added. For installation of this trap in areas where adjacent channel interference is prevalent

TO CHECK I. F. ALIGNMENT (with scope)

Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form.

Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

Sweep Gen. Connected to	Scope Connected to	Bias	Sweep Gen. Set to	Remarks
Ungrounded shield of V2 and chassis.	High side of contrast control R120 and chassis. Contrast control at minimum contrast.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	Sweep from 20 to 30 megacycles.	Provide markers as shown on curve.  Nominal Overall I.F. Response Curve A slight deviation in response curve is tolerable, but if any great deviation is noted, the I. F. stages will have to be realigned.

SOUND ALIGNMENT

The 4.5 mc. trap (front of L109) must be aligned first, regardless of which procedure is used for the remainder of the alignment (Procedure A or B).

Step No.	Channel Set To	Adjust	Remarks
1.	Any unused channel	Connect a crystal controlled 4.5 mc., 400 cycle amplitude modulated signal (30% or greater) between pin 8 of V104 and chassis. Connect high side of scope through a detector probe to cathode of picture tube, low side to chassis. Adjust L109 (rear slug) for minimum 400 cycle indication on scope.	Remove signal generator and scope from the receiver.

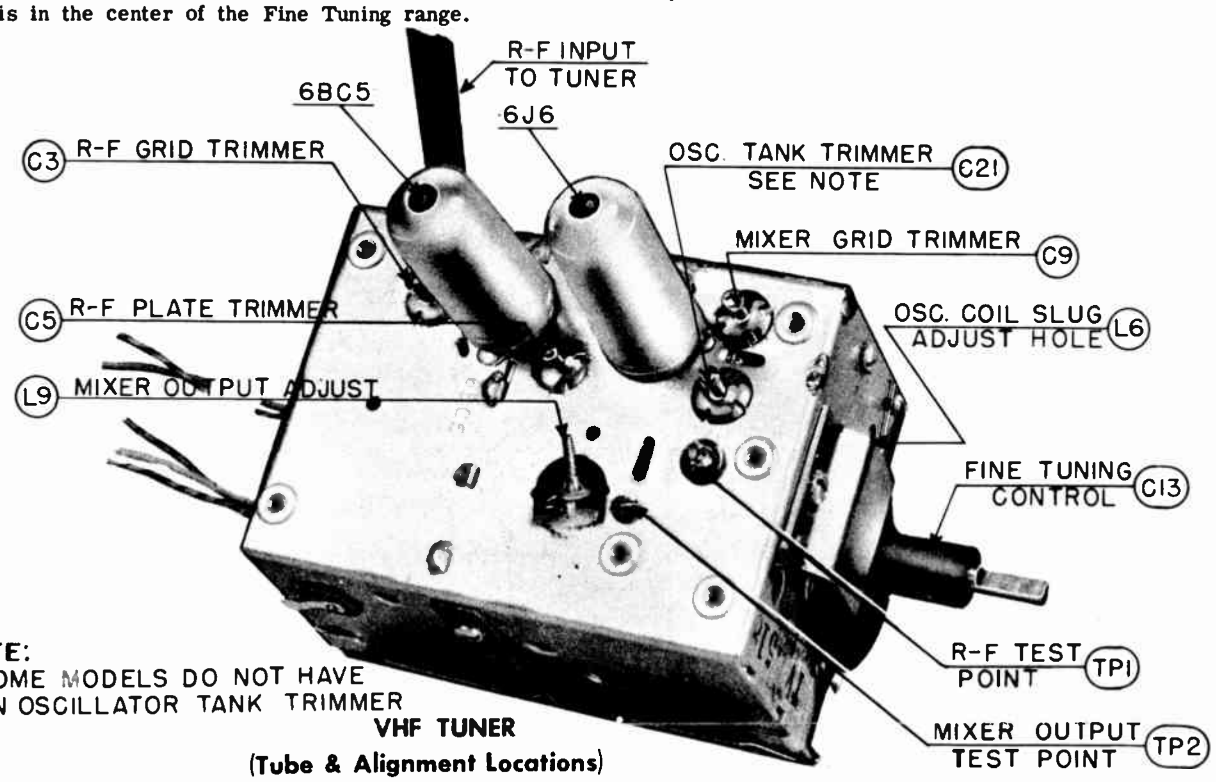
Proceed with the remainder of the Sound Alignment, using either a signal from a TV station as in Procedure A, or alignment equipment as in Procedure B.

PROCEDURE A (with signal from station)

Step No.	Channel Set To	Adjust	Remarks
1.	Strong signal	L106 for maximum sound output.	Set Buzz Control (R132) approximately 90° from clockwise stop.
2.	Weak signal	L111 and L109 (front slug) for maximum sound output.	If the signal in the area is too strong to obtain these peaks, remove the antenna from the receiver.
3.	Weak signal	Buzz Control (R132) for minimum noise (hash).	This signal should be weak enough to allow noise (hash) to come through along with the sound.
4.	Strong signal	L106 again for maximum sound output.	Limit the volume control setting so that this peak can be heard.

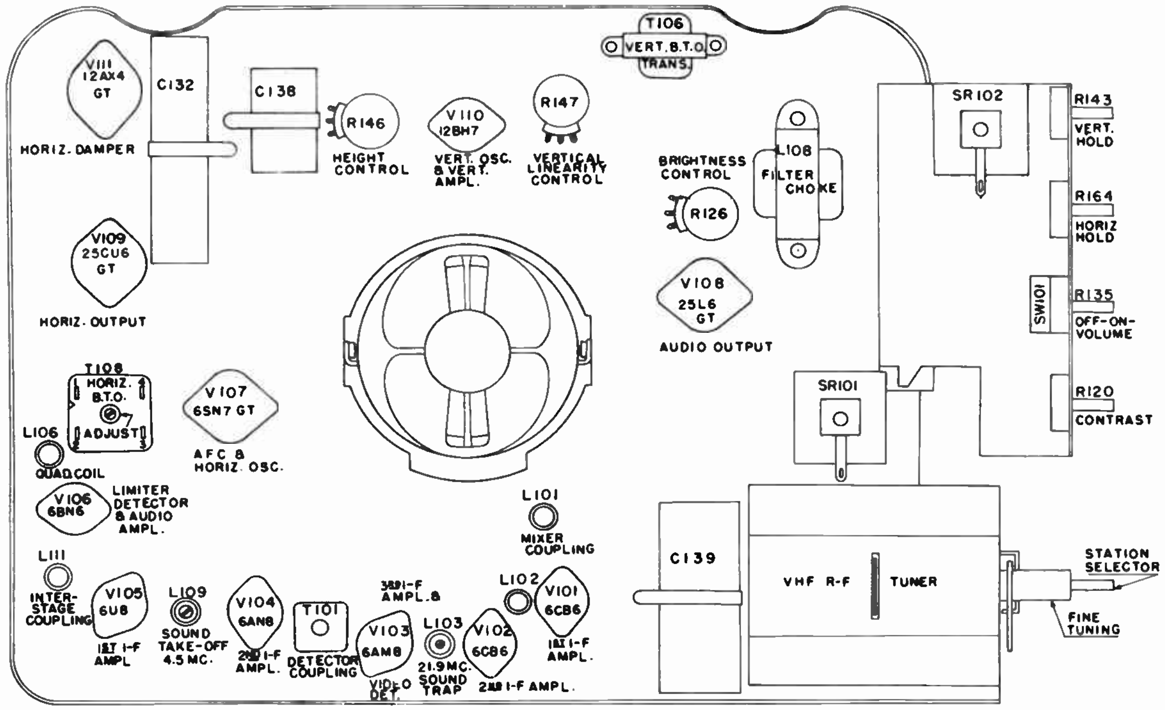
ALTERNATE OSCILLATOR ALIGNMENT

A turret type VHF tuner is used on this receiver, and there is an oscillator adjustment for each channel. When the receiver is installed, the oscillator should be adjusted for each channel on which a station is operating in the area. Set the Channel Switch to the channel that is to be adjusted. Turn the Fine Tuning control to the center of its range. The oscillator trimmer screw is directly below the tuner shaft, and is accessible through a hole in the front of the chassis after the two VHF tuning knobs have been removed. Use a non-metallic screw driver and adjust the oscillator trimmer screw until the proper tuning point is in the center of the Fine Tuning range.



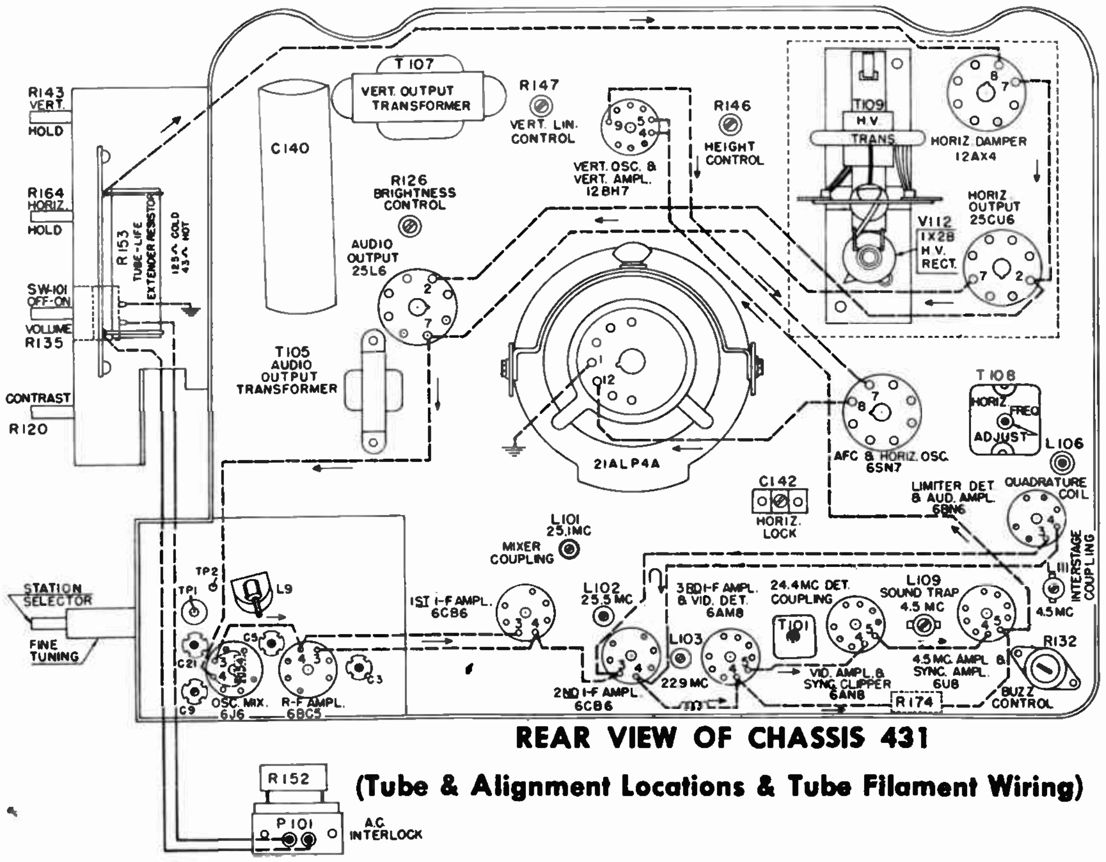
NOTE:
SOME MODELS DO NOT HAVE
AN OSCILLATOR TANK TRIMMER

VHF TUNER
(Tube & Alignment Locations)



FRONT VIEW OF CHASSIS 431

(Tube & Alignment Locations)



REAR VIEW OF CHASSIS 431

(Tube & Alignment Locations & Tube Filament Wiring)

VHF OSCILLATOR ALIGNMENT

OSCILLATOR ALIGNMENT (using scope)

Step No.	Oscilloscope	Channel Selector	Sweep Generator	Marker Generator	Adjust
1.	High side of scope to high side of R120 contrast control. Low side to chassis. See Note.	Chan. #2	To sweep Channel 2 frequencies. Connect Gen. output in series with dummy antenna to antenna lead-in. (See sketch of dummy antenna, page 6.)	59.75 Sound I. F. Carrier.	Channel 2 oscillator slug so that marker falls into bottom of valley on curve (the point corresponding to the 21.9 mc. marker as shown on Nominal Overall I. F. Response Curve sketch.) Be sure that the Fine Tuning Control is set to the center of its range.
2.	Repeat the above procedure for each of the remaining channels, by resetting the sweep generator and the marker generator to the correct frequencies for each channel that is to be adjusted.				

Note: Apply a -3.0 volts negative bias to Junction of C111 and R117 or to white lead from VHF R. F. Tuner. Use whichever is the most convenient point.

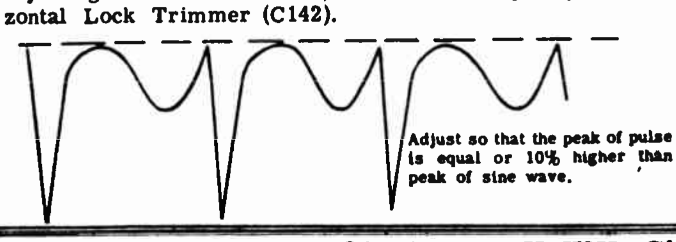
PROCEDURE B (with alignment equipment)

Step No.	Connect Signal Gen.	Signal Gen. Freq. MC.	Connect Scope	Miscellaneous Instructions	Adjust
1.	Pin 8 of V104.	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation.	Across secondary of output trans. T105.	Set Buzz Control (R132) to approximately 90° from clockwise. stop. Set the Volume Control (R135) at a low level.	L106 for maximum 400 cycle indication on scope.
2.	"	"	"	"	L111 for maximum response keeping input signal at a low level (below limiting).
3.	"	"	"	"	L109 (front slug) for maximum response keeping input signal at a low level.
4.	"	4.5 MC. AM modulated 400 c.p.s.	"	Use a high input level on signal generator.	Buzz Control (R132) for null (minimum 400 c.p.s. amplitude on scope).
5.	"	4.5 MC. FM modulated 400 c.p.s., 25KC. deviation.	" "	Set the Volume Control (R135) at a low level.	Re-peak L106 for maximum 400 cycle indication on scope.

HORIZONTAL BLOCKING OSCILLATOR ALIGNMENT

Tune Receiver to TV signal, adjust contrast control for normal picture below limiting in the Video Amplifier, and proceed as follows:

Step No.	Contrast Control Set For	Miscellaneous	Adjust
1.	Normal Picture	----------------------	Horizontal Hold Control (R164) and Horizontal Frequency Adjustment (rear slug of T108) until picture is in sync.
2.	"	Connect scope in series with 10 mmf. to lug 4 of T108.	Adjust Horizontal BTO Trap (front slug of T108) to obtain the waveform shown below. Keep the picture in sync at all times by re-adjusting the Horizontal Hold, Horizontal Frequency and/or Horizontal Lock Trimmer (C142).



3.	"	Horizontal Hold set fully clockwise.	Adjust Horizontal Frequency (rear slug of T108) by turning out until the picture is just out of sync. Then turn the control slowly in until the picture is just ready to fall into sync (indicated by a wide black vertical or diagonal horizontal blanking bar).
4.	"	Horizontal Hold set fully counter-clockwise.	Picture should normally be in sync. Remove the signal by tuning off and then re-tuning to the station. If more than seven bars are present, adjust the Horizontal Lock Trimmer slightly counter-clockwise until three or four bars appear when the receiver is tuned off and then re-tuned to the station (Horizontal Hold Control still set fully counter-clockwise). If less than three bars are present, adjust the Horizontal Lock Trimmer clockwise to obtain the three or four bars as described above. Since the Horizontal Lock Trimmer adjustment affects the horizontal frequency, the adjustments of both the Horizontal Frequency Adjustment and the Horizontal Lock Trimmer must be repeated until the conditions outlined in steps 3 and 4 exist simultaneously at the extreme positions of the Horizontal Hold control. Check pull-in range, which should be normally 60^{o} to 120^{o}.
5.	Weak Picture	----------------------	Set the Horizontal Hold Control so that when the receiver is tuned off and then re-tuned to the station, the picture returns completely in sync.

TABLE OF SOCKET VOLTAGES

The following voltages were measured with an electronic voltmeter while the set was operating on 117 volts, 60 cycle a.c. with no signal input, antenna terminals shorted, Station Selector set to channel 3, and the Brightness and Contrast Controls at minimum setting. Electronic voltmeter connected between socket lug and chassis. * = AC. voltages. Voltages may vary depending upon the setting of other controls.
D. C. current at junction of L108 and C132B, with contrast control in the maximum counter-clockwise position, 190 ma. With contrast set at maximum clockwise position, D. C. current at this point is 200 ma.

SYMBOL	TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V101	6CB6	-0.8	+0.6	*50.4	*44.1	+135	+131	0	---	---
V102	6CB6	-0.6	+0.7	*44.1	*37.8	+137	+143	0	---	---
V103	6AM8	+1.0	----	+137	*37.8	*31.5	+145	0	-1.1	0
V104	6AN8	+10.5	-0.9	0	*31.5	*25.2	+250	+230	+1.7	+7.3
V105	6U8	+53.5	----	+59	*25.2	*18.9	+59	+0.8	0	-0.5
V106	6BN6	+2.5	----	*44.1	*37.8	+100	---	+100	---	---
V107	6SN7GT	+16	+74 to +150	+2.1	-90	+210	0	*12.6	*6.3	---
V108	25L6GT	----	*81.7	+250	+270	+145	---	*56.7	+150	---
V109	25CU6	----	*81.7	----	+130	-30	---	*56.7	0	Cap – High Voltage
V110	12BH7	+72	-19	0	*18.9	*18.9	●+490	+72	+95	*12.6
V111	12AX4	----	----	●+515	-----	+265	---	*81.7	*94	---
V112	1X2B	----	----	----	-----	----	---	---	H. V. 13KV	---
V113	21ATP4	*0	----	----	-----	----	Gnd or +150	(Pin 10) +300	(Pin 11) +150	(Pin 12) *6.3
V1	6BC5	----	0	*44.1	*50.4	+125	+125	0	----	---
V2	6J6	+80	+78	*50.4	*56.7	----	-7.4	0	----	---

● Do not measure. High voltage pulse over 2 kv. on cathode of Damper Tube and over 1 kv. on pin 6 of V110.

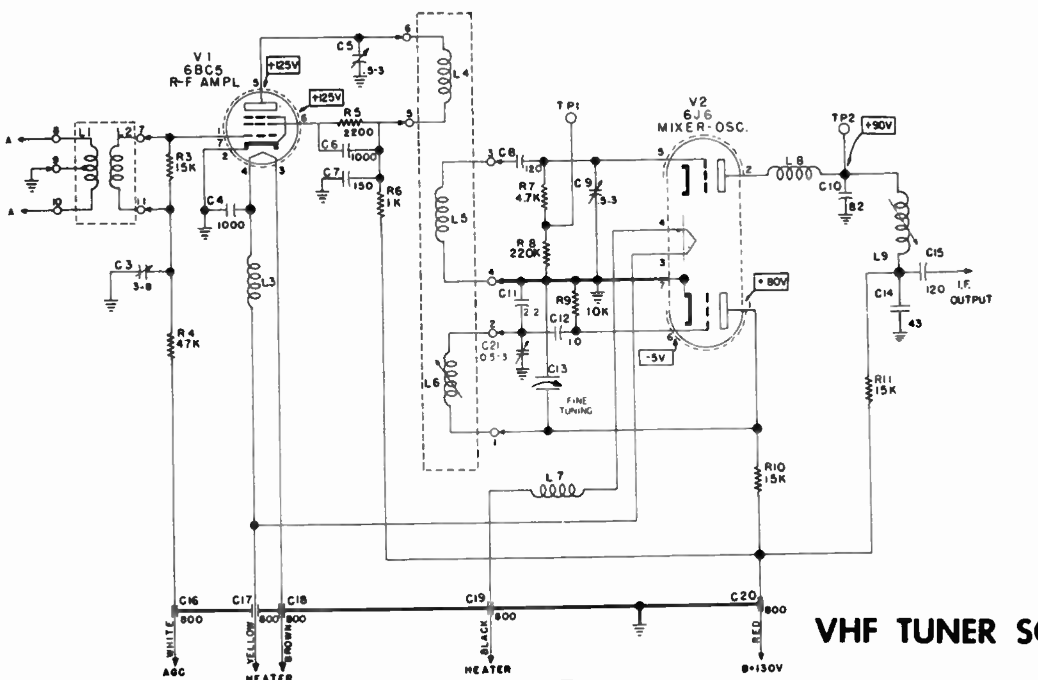
SCHEMATIC PARTS LIST

Symbol No.	Part No.	Description
C101	156201-1	Capacitor, 470 mmf., 2KV, Disc Ceramic
C102	156201-1	Capacitor, 470 mmf., 2KV, Disc Ceramic
C103	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C104	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C105	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C106	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C107	137499-33	Capacitor, 68 mmf., 500 v., 10%, Silver Mica (Part of L103)
C108	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C109	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C110	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C111	157810-1	Capacitor, .25 mfd., -15% + 40%, 25 v., Paper
C112	137727-135	Capacitor, 10 mmf., 10%, N080, 500 v., Ceramic
C113	157906-1	Capacitor, .1 mfd., 150 v., Paper
C114	137727-103	Capacitor, 5 mmf., 10%, N030, Ceramic
C115	137727-126	Capacitor, 33 mmf., 10%, N080, 500 v., Ceramic (Part of L109)
C116	137727-133	Capacitor, 68 mmf., 10%, N080, 500 v., Ceramic (Part of L109)
C117	39478-47	Capacitor, .1 mfd., 10%, 600 v., Molded Paper
C119	39478-41	Capacitor, .01 mfd., 10%, 600 v., Molded Paper
C120	39478-41	Capacitor, .01 mfd., 10%, 600 v., Molded Paper
C121	137727-126	Capacitor, 33 mmf., 10%, N080, 500 v., Ceramic
C122	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C123	39478-41	Capacitor, .01 mfd., 10%, 600 v., Molded Paper
C124	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C125	137727-43	Capacitor, 15 mmf., 10%, N080, 500 v., Ceramic
C126	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C127	39001-80	Capacitor, .02 mfd., 600 v., Paper
C128	39001-80	Capacitor, .02 mfd., 600 v., Paper
C129	157813-1	Network, Sync Take-Off
C130	39001-17	Capacitor, .05 mfd., 600 v., Paper
C131	157812-1	Network, Vertical Integrator
C132A	157836-1	Capacitor, 5 mfd., 150 v. } Electro-lytic
C132B		Capacitor, 200 mfd., 150 v. } Electro-lytic
C133	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C134	39477-45	Capacitor, .047 mfd., 600 v., Molded Paper
C136	158215-25	Capacitor, .005 mfd., 500 v., Disc Ceramic
C137	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C138	157903-1	Capacitor, 20 mfd., 450 v., Electrolytic
C139	157837-1	Capacitor, 140 mfd., 300 v., Electrolytic
C140A	157838-2*	Capacitor, 140 mfd., 300 v. } Electro-lytic
C140B		Capacitor, 30 mfd., 150 v. } Electro-lytic
C140C	157838-2*	Capacitor, 200 mfd., 150 v. } Electro-lytic
C140D		Capacitor, 5 mfd., 300 v. } Electro-lytic
C141	137727-61	Capacitor, 20 mmf., 10%, N220, 300 v., Ceramic
C142	157870-1	Capacitor, 10-160 mmf., Horizontal Lock, Trimmer
C143	39001-17	Capacitor, .05 mfd., 600 v., Paper
C144	157810-1	Capacitor, .25 mfd., -15%, +40%, 25 v., Paper
C145	39001-80	Capacitor, .02 mfd., 600 v., Paper
C146	137737-126	Capacitor, 33 mmf., 10%, N080, 500 v., Ceramic
C147	137498-22	Capacitor, 220 mmf., 10%, 500 v., Mica
C148	148813-2	Capacitor, .01 mfd., 10%, 400 v., Paper (Special)
C149	144675-33	Capacitor, 1300 mmf., 10%, 500 v., Disc Ceramic
C150	144675-33	Capacitor, 1300 mmf., 10%, 500 v., Disc Ceramic
C151	39001-17	Capacitor, .05 mfd., 600 v., Paper
C152	158215-3	Capacitor, 68 mmf., 10%, 3KV., Disc Ceramic
C153	39001-85	Capacitor, .08 mfd., 600 v., Paper
C154	158215-3	Capacitor, 68 mmf., 10%, 3KV., Disc Ceramic (Part of L107)
C155	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C156	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
R101	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R102	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R103	39374-53	Resistor, 220 ohm, 10%, 1/2 w.
R104	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R105	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R106	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R107	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R108	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R109	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R110	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R111	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R112	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R113	39374-38	Resistor, 12,000 ohm, 10%, 1/2 w.
R114	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R115	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R116	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R117	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R118	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R119	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R120	157804-1	Control, Contrast (1500 ohm)
R121	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R122	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
R123	Part of L105	Resistor, 4700 ohm, 10%, 1/2 w.
R124	39374-210	Resistor, 5600 ohm, 10%, 2 w.
R125	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R126	157801-1	Control, Brightness (5 megohm)
R127	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R130	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R131	39374-40	Resistor, 18,000 ohm, 10%, 1/2 w.
R132	157955-2	Control, Buzz (500 ohm)
R133	39374-122	Resistor, 5600 ohm, 10%, 1 w.
R134	39374-57	Resistor, 470 ohm, 10%, 1/2 w.
R135	157803-1	Control, Volume (330,000 ohm)
R136	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R137	39374-58	Resistor, 560,000 ohm, 10%, 1/2 w.
R138	39374-65	Resistor, 2.2 megohm, 10%, 1/2 w.
R139	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R140	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R141	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R142	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R143	157805-1	Control, Vertical Hold (1 megohm, 350,000 ohm stop)
R145	39374-59	Resistor, 680,000 ohm, 10%, 1/2 w.
R146	157806-1	Control, Height (5 megohm, 1 megohm stop)
R147	157800-1	Control, Vertical Linearity (750 ohm)
R148	156911-4	Resistor, 7500 ohm, 10%, 3 w.
R150	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R151	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R152	154089-1	Resistor, 7.5 ohm, 10%, 5 w. Wire Wound (Fuse Type)
R153	157949-1	Resistor, Heater Current Limiting Resistor (125 ohm cold - 43 ohm hot)
R154	158230-2	Resistor, 43 ohm, 10%, 5 w.
R155	39374-47	Resistor, 68,000 ohm, 10%, 1/2 w.
R156	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L107)
R157	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L107)
R159	39374-58	Resistor, 560,000 ohm, 10%, 1/2 w.
R160	39374-51	Resistor, 150,000 ohm, 10%, 1/2 w.
R161	39374-51	Resistor, 150,000 ohm, 10%, 1/2 w.
R162	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R163	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R164	157802-1	Control, Horizontal Hold (145,000 ohm 70,000 ohm stop) See Note 6
R165	39374-42	Resistor, 27,000 ohm, 10%, 1/2 w.
R166	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R167	39374-51	Resistor, 150,000 ohm, 10%, 1/2 w.
R168	39375-131	Resistor, 2.7 megohm, 5%, 1/2 w.
R169	39374-40	Resistor, 18,000 ohm, 10%, 1/2 w.
R170	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R171	156911-5	Resistor, 12,000 ohm, 10%, 3 w.
R172	Part of L112	Resistor, 27,000 ohm, 10%, 1/2 w.
R173	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R174	158230-2	Resistor, 126 ohm, 10%, 10 w.
R175	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.

*C140 is one 4-Section electrolytic capacitor, Part No. 157838-2.

L101	157787-1	Coil, Converter I.F. (3.7-7.5 microhenries)	L111	157856-1	Coil, Sound Coupling (Primary, 7.5-13.5 microhenries; Secondary, 21-39 microhenries)
L102	157789-1	Coil, 1st I. F. (1.95-4 microhenries	L112	158007-1	Coil, Video Peaking (220 microhenries)
L103	157936-1	Coil, 2nd I. F. & Trap (2.4-4.5 microhenries)	T101	157844-1	Transformer, I. F. Output
L104	154376-1	Coil, Choke Diode (15.5 microhenries)	T105	157919-1	Transformer, Audio Output
L105	157833-1	Coil, Video Peaking (710 microhenries)	T106	155255-3	Transformer, Vertical Block Oscillator
L106	157842-1	Coil, Quadrature Grid (37-75 microhenries)	T107	158477-1	Transformer, Vertical Output
L107A	158426-1	Deflection Yoke } Assy., less rear	T108	157791-1	Transformer, Horizontal Oscillator & Trap
L107B		Deflection Yoke } cover & centering Mag.	T109	158481-2	Transformer, Horizontal Deflection (Assembly)
L108	155529-1	Choke, Filter (1.0 henry, 240 ma.)	SR101	155575-2	Rectifier Selenium
L109	157841-1	Coil, Sound Take-Off (Primary, 26-54 microhenries; Secondary, 11.5-19.5 microhenries)	SR102	155575-2	Rectifier Selenium
			P101	154125	Receptacle, Interlock
L110	155256-1	Choke (R. F.) Filament (.576 microhenries)	CA101	132300-6	Cable & Plug, Power
			SP101	138762-8	Speaker, 4" P. M.

R10	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.	L7	156906-51	Choke, Oscillator Filament
R11	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.	L8	156906-52	Choke, Mixer Plate
L1 } L2 }	158021-* See Note 3, opposite page	Antenna Coil Assembly (VHF channels)	L9	158106-11	I.F. Coil Assembly
			3	156906-24	Shield (V1, V2)
			4	156906-40	Screw, Trimmer
L3	156906-50	Choke, RF Filament	5	156906-39	Nut (Spring), Trimmer
L4 } L5 } L6 }	158022-* See Note 3, opposite page	RF and Oscillator Coil Assembly (VHF channels)	6 } 7 } 8 } 9 }	C3, C5, C9, C21	Capacitor, Ceramic Tube



VHF TUNER SCHEMATIC

PARTS LIST

VHF Tuner

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
C3	156906-16	Capacitor, 3-8 mmf., Antenna Trimmer and Lead Assembly	C16	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C4	158106-1	Capacitor, 1000 mmf., disc Ceramic	C17	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C5	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly	C18	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C6	158106-1	Capacitor, 1000 mmf., Disc Ceramic	C19	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C7	158106-2	Capacitor, 150 mmf., 10% Disc Ceramic			
C8	158106-3	Capacitor, 120 mmf., 10%, N750, Disc Ceramic	C20	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C9	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly	C21	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly
C10	158106-15	Capacitor, 8.2 mmf.	R3	158106-9	Resistor, 15,000 ohm, 20%, 1/2 w. (IRC Type BTS)
C11	158106-5	Capacitor, 2.2 mmf., ± .25 mmf., N750, Ceramic			
C12	158106-6	Capacitor, 10 mmf., 10%, N1400, Disc Ceramic	R4	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
			R5	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
C13	See Ref. 13, 15 & 20	Fine Tuning	R6	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
			R7	158106-10	Resistor, 4700 ohm, 10%, 1/2 w., (IRC Type BTS)
C14	158106-16	Capacitor, 43 mmf.	R8	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w
C15	158106-3	Capacitor, 120 mmf., 10%, N750, Disc Ceramic	R9	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.

NOTES

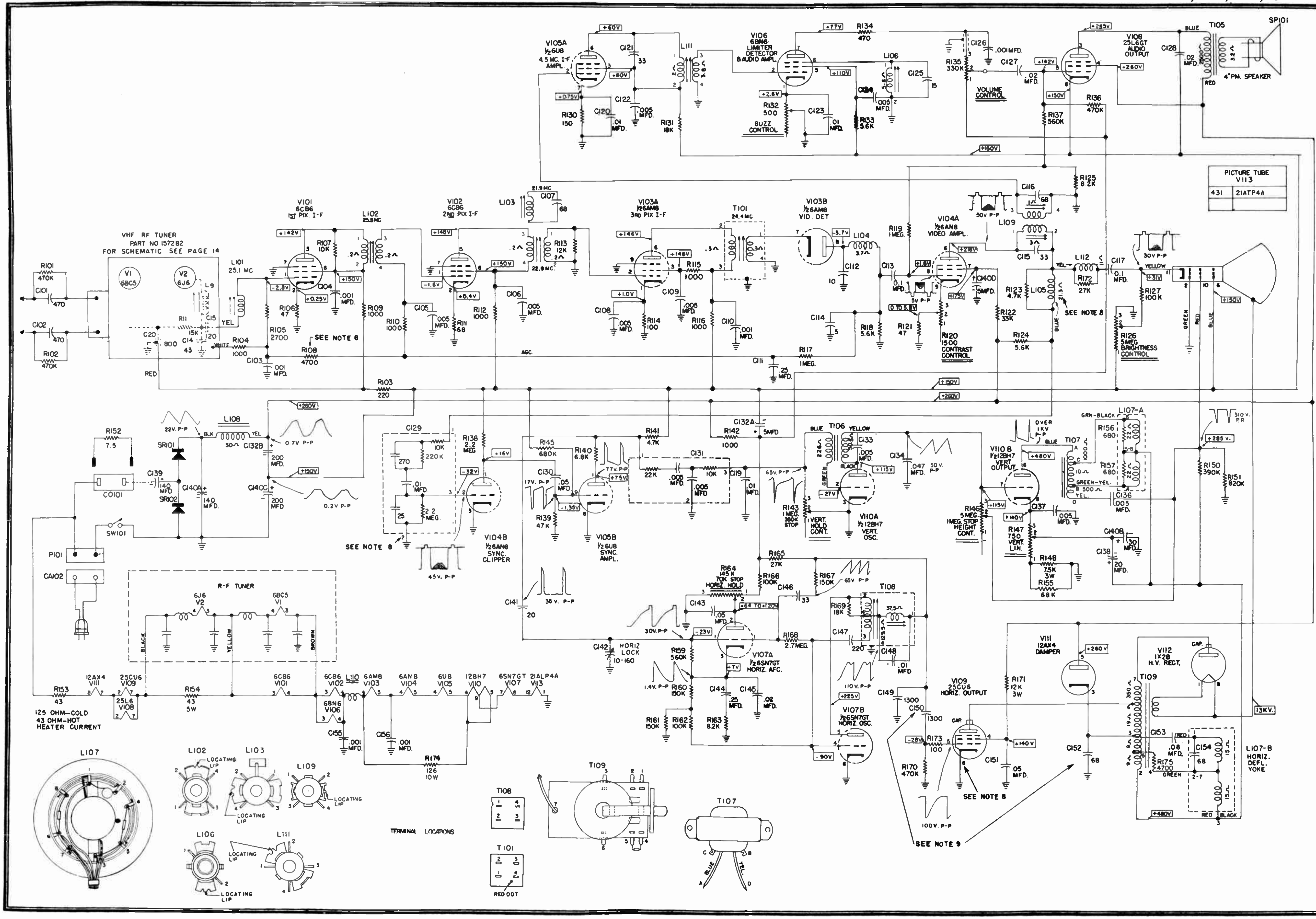
VHF TUNER

1. All capacitance in mmf. and all resistance in ohms unless otherwise specified.
2. K = 1000.
3. TUNER STRIPS. One Antenna Coil Assembly and one R.F. and Oscillator Coil Assembly are necessary for each channel to be received (VHF or UHF). The dash number following the part number indicates the channel for which the assembly is designed.

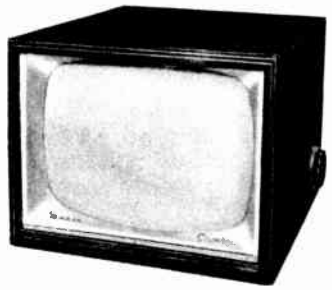
   Examples for VHF: 158021-2 is the Antenna Coil Assembly for Channel 2.
   158022-13 is the R.F. and Oscillator Coil Assembly for Channel 13.

   UHF coils are not furnished as part of the tuner. The two coil assemblies required for and UHF channel may be ordered as one part under part numbers 158023-14 (for channel 14) through 158023-83 (for channel 83). The coil assemblies listed above are stamped with the channel number and the letter "H". The letter "H" indicates that the coils are designed for use with the tuner in this chassis.

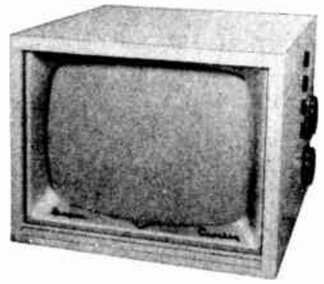
1. All D.C. voltages measured with an electronic voltmeter connected from socket lug to chassis. Some voltages are variable depending upon signal input. Voltages shown were measured with a signal voltage of 850,000 microvolts and with a normal picture on the picture tube and the contrast and brightness controls set for 50 volts peak to peak on the cathode (pin 11) of the picture tube. Socket voltage tolerance 10%. For table of socket voltages under no-signal conditions
2. Supply voltage, 117 volts, 60 cycle AC.
3. K = 1000.
4. On all capacitance values in mmf. and all resistance values in ohms unless otherwise noted.
5. Better focus may be obtained with replacement picture tubes if the electronic focus anode is connected to a point other than +150 volts. Suggested points to try are: chassis ground, +260 volts, +285 (picture tube, pin 10) and +480 volts.
6. The Horizontal Hold control R164 used in chassis 431 has an overall resistance of 145,000 ohms, with a 70,000 ohm stop. This control is marked with Part No. B-157802-1-2 or B-157802-1-3. It is directly interchangeable with an earlier control marked B-157802-1-1, which has an overall resistance of 170,000 ohms, with a 70,000 ohm stop. It will be noticed, however, that the control with the lower overall resistance gives a somewhat wider hold range.
7. On the Vertical Integrating Network C131, leads 2 and 3 are closely spaced, and lead 2 is the middle lead. On the Sync Take-Off Network C129, leads 1 and 2 are closely spaced, and lead 2 is the middle one. When replacing either of these units, the leads must be connected as shown in the schematic in order to obtain satisfactory operation.
8. In some early production chassis 431, certain circuits may be found to differ from those shown on the schematic.
   a. In some chassis, R108 is a 3900 ohm, 10%, 1/2 watt resistor (Part No. 39374-32) in place of the 4700 ohm, 10%, 1/2 watt resistor (Part No. 39374-33) shown in the schematic and parts list.
   b. In some chassis, a 47,000 ohm, 10%, 1/2 watt resistor (Part No. 39374-45) is added between lead #2 of Sync Take-Off Network (Part No. 157813-1) and ground. Where this resistor is added, there is also a 3900 ohm, 10%, 1/2 watt resistor (Part No. 39374-32) added in parallel with L105 and R123. When a replacement Network is installed, these two resistors are not required and should be removed. The network should then be connected as shown in the schematic.
   c. To reduce horizontal overdrive, a 22 mmf., 10%, 1/2 watt resistor (Part No. 39374-5) was added in some chassis between the cathode of V109 (25CU6) and chassis ground. This resistor was no longer used in production when the Code B change went into effect, as described below.
9. Code Change B: On chassis 431, Code B, the values of two capacitors were changed to reduce horizontal overdrive. C150 was changed to a 560 mmf., 10%, 500 v., disc ceramic capacitor (Part No. 144675-32). C152 was changed to an 82 mmf., 10%, N750, 3000 v., disc ceramic capacitor (Part No. 158215-32).



VHF RF TUNER
PART NO 157282
FOR SCHEMATIC SEE PAGE 14
V101 6CB6 1ST PIX I-F
V102 6CB6 2ND PIX I-F
V103A 1/2 6AM8 3RD PIX I-F
V103B 1/2 6AM8 VID. DET
V104A 1/2 6AN8 VIDEO AMPL.
V105A 1/2 6U8 4.5 MC. I-F AMPL.
V106 6BN6 LIMITER DETECTOR & AUDIO AMPL.
V108 25L6GT AUDIO OUTPUT
4" PM. SPEAKER
VOLUME CONTROL
BUZZ CONTROL
CONTRAST CONTROL
BRIGHTNESS CONTROL
PICTURE TUBE V113
431 21ATP4A
V104B 1/2 6AN8 SYNC. CLIPPER
V105B 1/2 6U8 SYNC. AMPL.
V110A 1/2 12BH7 VERT. OSC.
V110 B 1/2 12BH7 VERT. OUTPUT
VERT. HOLD CONT.
HEIGHT CONT.
VERT. LIN.
V107A 1/2 6SN7GT HORIZ. AFC.
V107B 1/2 6SN7GT HORIZ. OSC.
HORIZ. HOLD
HORIZ LOCK
V109 25CU6 HORIZ. OUTPUT
V111 12AX4 DAMPER
V112 1X2B H.V. RECT.
L107-B HORIZ. DEFL. YOKE
13KV.
R-F TUNER
125 OHM-COLD
43 OHM-HOT
HEATER CURRENT
SEE NOTE 8
SEE NOTE 9
TERMINAL LOCATIONS
LOCATING LIP
RED DOT



Model H-17TOMH (Mahogany)



Model H-17TOBU (Blond)

TUBE COMPLEMENT

Symbol	Tube	Function	Symbol	Tube	Function
V1	6BC5	R. F. Amplifier	V107	6SN7GT	Horizontal AFC & Horizontal Oscillator
V2	6J6	VHF Oscillator & Mixer	V108	25L6GT	Audio Output
V101	6CB6	1st I. F. Amplifier	V109	25CU6	Horizontal Output
V102	6CB6	2nd I. F. Amplifier	V110	12BH7	Vertical Oscillator & Vertical Output
V103	6AM8	3rd I. F. Amplifier & Video Detector	V111	12AX4GT	Horizontal Damper
V104	6AN8	Video Amplifier & Sync Clipper	V112	1X2B	High Voltage Rectifier
V105	6U8	4.5 mc. I. F. Amplifier & Sync Amplifier	V113	17AVP4	Picture Tube
V106	6BN6	Limiter-Discriminator & Audio Amplifier			

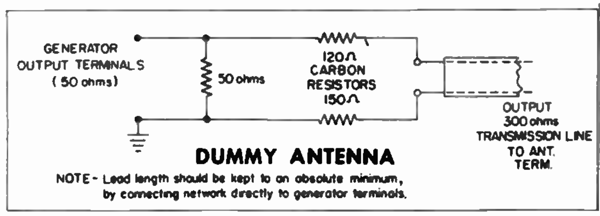
UHF CONVERTER

(Used on "U" Models Only)

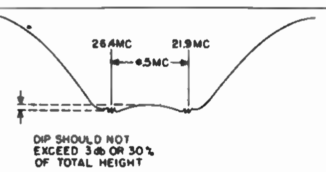
Symbol	Tube	Function
V1	6T4	Oscillator
V2	6BK7A	I. F. Amplifier
CR1	1N82 1N82A or 4JB2C-9	Crystal Mixer

R.F. AND MIXER ALIGNMENT

Step No.	Station Selector	Oscilloscope	Bias	Signal Generator To	Adjust
1.	Chan. #10	High side through a 10,000 ohm resistor to TP1 on Tuner. Ground lead to Tuner Case.	-1.5 volts to white lead on tuner.	Signal Generator set to 195.5 MC., 400 cycle 30% AM modulated. Through Dummy Antenna to the Antenna lead-in.	C-3 for maximum 400 cycle response on scope. Remove signal Generator.
2.	"	"	"	Sweep Generator to Antenna lead-in through dummy antenna. Set Generator to sweep Channel 10 freq. Loosely couple Marker Generator to sweep output cable. Set marker to either 21.9 or 26.4 mc.	Adjust C5 & C9, to produce a response curve similar to R.F. and Mixer Response Curve.



R. F. & MIXER RESPONSE CURVE



Without disturbing the R.F. grid, R.F. plate, and mixer-grid trimmer, check the response on the other VHF TV channels by setting the station selector to the desired channel and changing the frequency of the sweep generator to correspond to the channel being checked. The response curve should be essentially the same on all channels and the markers should fall in similar positions on the response curve. A slight amount of tilt can be tolerated. The amount of tilt indicated by the relative amplitudes of the response curves where the picture and sound I.F. Markers rest should not exceed 30% of the over-all response curve amplitude.

I.F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes.
The rear side of the chassis means the side on which the tubes are mounted.

VIDEO I. F. ALIGNMENT (with VTVM)

In the I.F. Alignment, limit input of signal generator so that reading on VTVM does not exceed -2 volts.

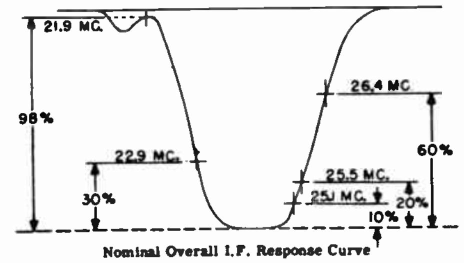
Step No.	Connect Signal Generator Through a .01 Capacitor	Signal Gen. Freq. MC.	Connect VTVM	Miscellaneous Connections and Instructions	Adjust
1.	Test Point No. 2 on Tuner (closest to L9 slug adjust-ment).	24.4 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis	T101 for maximum indication on meter, limit input to make peak less than -2 volts D.C. on VTVM.
2.	"	22.9 mc.	"	"	L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.
3.	"	21.9 mc.	"	"	L103 (front slug) for minimum. Input level should be high enough to produce at least .5 volts at null on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
4.	Repeat steps 2 and 3.				
5.	"	25.5 mc.	"	"	L102 for maximum.
6.	"	25.1 mc.	"	"	L101 (front slug) for maximum. Use first peak from tinnerman clip end of coil.
7.	"	27.9 mc.	"	"	See Note 1. L101 (rear slug) for minimum deflection on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
8.	Repeat step 6 (and 7, if adjacent channel trap is used).				
9.	Test Point No. 1 on Tuner (closest to C21 trimmer screw).	25.1 mc.	"	Connect a 100 ohm resistor in series with a 1000 mmf. cap. across L101.	L9 (brass screw) on the Tuner for maximum.

Note 1. This adjustment can be made only on receivers where the Adjacent Channel Trap has been added. For installation of this trap in areas where adjacent channel interference is prevalent, see page 4.

TO CHECK I. F. ALIGNMENT (with scope)

Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form.

Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

Sweep Gen. Connected to	Scope Connected to	Bias	Sweep Gen. Set to	Remarks
Ungrounded shield of V2 and chassis.	High side of contrast control R120 and chassis. Contrast control at minimum contrast.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	Sweep from 20 to 30 megacycles.	Provide markers as shown on curve.  Nominal Overall I.F. Response Curve. A slight deviation in response curve is tolerable, but if any great deviation is noted, the I. F. stages will have to be realigned.

VHF OSCILLATOR ALIGNMENT

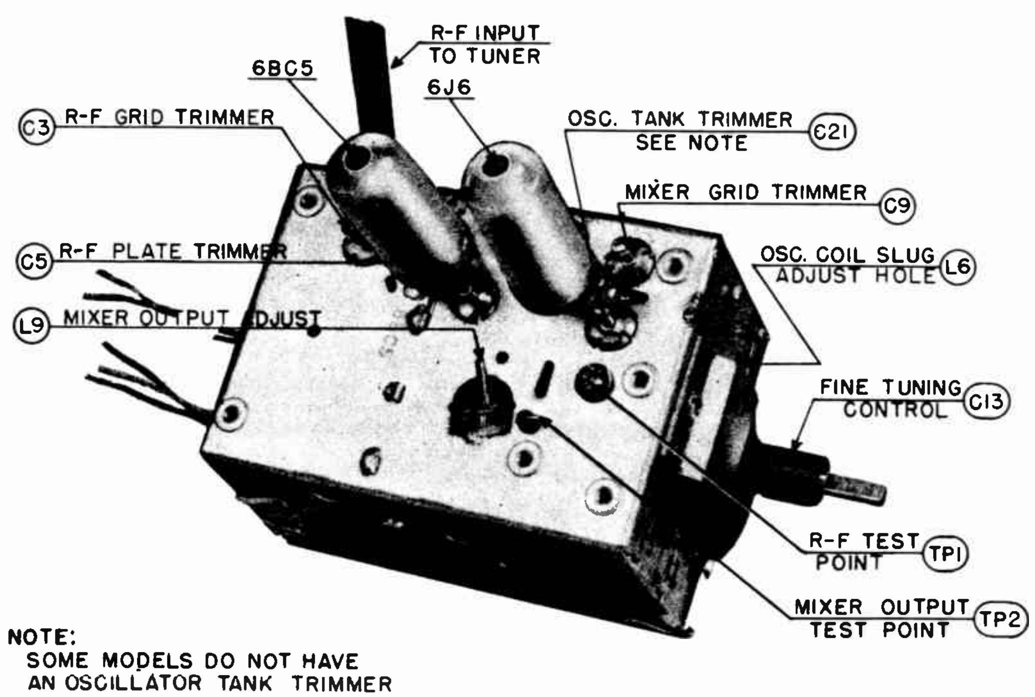
OSCILLATOR ALIGNMENT (using scope)

Step No.	Oscilloscope	Channel Selector	Sweep Generator	Marker Generator	Adjust
1.	High side of scope to high side of R120 contrast control. Low side to chassis. See Note:	Chan. #2	To sweep Channel 2 Freq. Connect Gen. output in series with dummy antenna to antenna lead-in.	59.75 Sound I.F. Carrier.	Channel 2 oscillator slug so that marker falls into bottom of valley on curve (the point corresponding to the 21.9 mc. marker as shown on Nominal Overall I.F. Response Curve sketch.) Be sure that the Fine Tuning Control is set to the center of its range.
2.	Repeat the above procedure for each of the remaining channels, by resetting the sweep generator and the marker generator to the correct frequencies for each channel that is to be adjusted.				

Note: Apply a -3.0 volts negative bias to Junction of C111 and R117 or to white lead from VHF R.F. Tuner. Use whichever is the most convenient point.

ALTERNATE OSCILLATOR ALIGNMENT

A turret type VHF tuner is used on this receiver, and there is an oscillator adjustment for each channel. When the receiver is installed, the oscillator should be adjusted for each channel on which a station is operating in the area. Set the Channel Switch to the channel that is to be adjusted. Turn the Fine Tuning control to the center of its range. The oscillator trimmer screw is directly to the right of the tuner shaft, and is accessible through a hole in the front of the chassis after the two VHF tuning knobs have been removed. Use a non-metallic screw driver and adjust the oscillator trimmer screw until the proper tuning point is in the center of the Fine Tuning range.



NOTE:
SOME MODELS DO NOT HAVE
AN OSCILLATOR TANK TRIMMER

VHF TUNER
(Tube & Alignment Locations)

HORIZONTAL BLOCKING OSCILLATOR ALIGNMENT

Tune Receiver to TV signal, adjust contrast control for normal picture below limiting in the Video Amplifier, and proceed as follows:

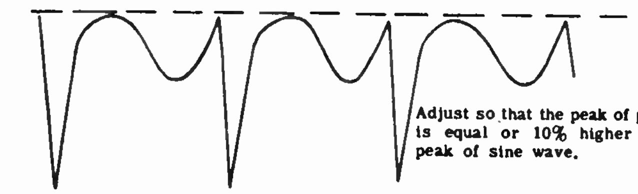
Step No.	Contrast Control Set For	Miscellaneous	Adjust
1.	Normal Picture	---------------------	Horizontal Hold Control (R164) and Horizontal Frequency Adjustment (rear slug of T108) until picture is in sync.
2.	"	Connect scope in series with 10 mmf. to lug 4 of T108.	Adjust Horizontal BTO Trap (front slug of T108) to obtain the waveform shown below. Keep the picture in sync at all times by re-adjusting the Horizontal Hold, Horizontal Frequency and/or Horizontal Lock Trimmer (C142). 
3.	"	Horizontal Hold set fully clock-wise.	Adjust Horizontal Frequency (rear slug of T108) by turning out until the picture is just out of sync. Then turn the control slowly in until the picture is just ready to fall into sync (indicated by a wide black vertical or diagonal horizontal blanking bar).
4.	"	Horizontal Hold set fully counter-clockwise.	Picture should normally be in sync. Remove the signal by tuning off and then re-tuning to the station. If more than seven bars are present, adjust the Horizontal Lock Trimmer slightly counter-clockwise until three or four bars appear when the receiver is tuned off and then re-tuned to the station (Horizontal Hold Control still set fully counter-clockwise). If less than three bars are present, adjust the Horizontal Lock Trimmer clockwise to obtain the three or four bars as described above. Since the Horizontal Lock Trimmer adjustment affects the horizontal frequency, the adjustments of both the Horizontal Frequency Adjustment and the Horizontal Lock Trimmer must be repeated until the conditions outlined in steps 3 and 4 exist simultaneously at the extreme positions of the Horizontal Hold control. Check pull-in range, which should be normally 60° to 120°.
5.	Weak Picture	---------------------	Set the Horizontal Hold Control so that when the receiver is tuned off and then re-tuned to the station, the picture returns completely in sync.

TABLE OF SOCKET VOLTAGES

The following voltages were measured with an electronic voltmeter while the set was operating on 117 volts, 60 cycle a.c. with no signal input, antenna terminals shorted, Station Selector set to channel 3, and the Brightness and Contrast Controls at minimum setting. Electronic voltmeter connected between socket lug and chassis. * = AC. voltages. Voltages may vary depending upon the setting of other controls.

D. C. current at junction of L108 and C132B, with contrast control in the minimum counter-clockwise position, 190 ma. With contrast set at maximum clockwise position, D. C. current at this point is 200 ma.

SYMBOL	TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V101	6CB6	-.6	+.6	*50.4	*44.1	+128	+125	0	---	---
V102	6CB6	-1.0	+.8	*44.1	*37.8	+139	+139	0	---	---
V103	6AM8	+1.1	---	+139	*37.8	*31.5	+142	0	-0.8	0
V104	6AN8	+88	0	0	*31.5	*25.2	+250	+237	+1.8	+6.2
V105	6U8	+54	---	+62	*25.2	*18.9	+62	+.8	0	+0.1
V106	6BN6	+2.8	---	*44.1	*37.8	+104	---	+100	---	---
V107	6SN76T 6SN7GT	-5.2	+79 to +141	+6.6	-60	+214	0	*12.6	*6.3	---
V108	25L6GT	---	*81.7	+255	+260	+139	---	*56.7	+150	---
V109	25CU6	---	*81.7	---	+130	-23.5	---	*56.7	0	Cap - High Voltage
V110	12BH7	+63	-19	0	*18.9	*18.9	●+480	+64	+85	*12.6
V111	12AX4	---	---	●+520	---	+265	----	*81.7	*94	---
V112	1X2B	---	---	---	---	---	---	---	H. V. 13KV	---
V113	17AVP4	*0	---	---	---	---	Gnd or +150	(Pin 10) +300	(Pin 11) +150	(Pin 12) *6.3
V1	6BC5	---	---	*44.1	*50.4	+135	+128	0	---	---
V2	6J6	+82	+87	*50.4	*56.7	---	-6.0	0	---	---

● Do not measure. High voltage pulse over 2 kv. on cathode of Damper Tube and over 1 kv. on pin 6 of V110.

SOUND ALIGNMENT

The 4.5 mc. trap (front of L109) must be aligned first, regardless of which procedure is used for the remainder of the alignment (Procedure A or B).

Step No.	Channel Set To	Adjust	Remarks
1.	Any unused channel	Connect a crystal controlled 4.5 mc., 400 cycle amplitude modulated signal (30% or greater) between pin 8 of V104 and chassis. Connect high side of scope through a detector probe to cathode of picture tube, low side to chassis. Adjust L109 (rear slug) for minimum 400 cycle indication on scope.	Remove signal generator and scope from the receiver.

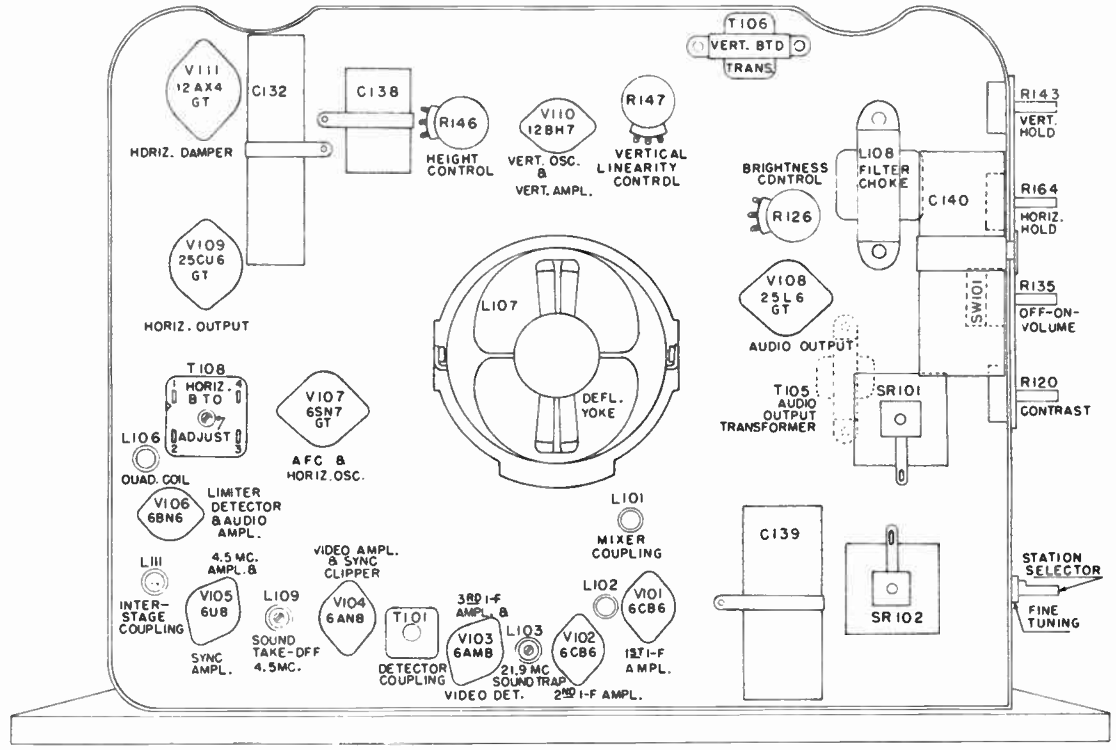
Proceed with the remainder of the Sound Alignment, using either a signal from a TV station as in Procedure A, or alignment equipment as in Procedure B.

PROCEDURE A (with signal from station)

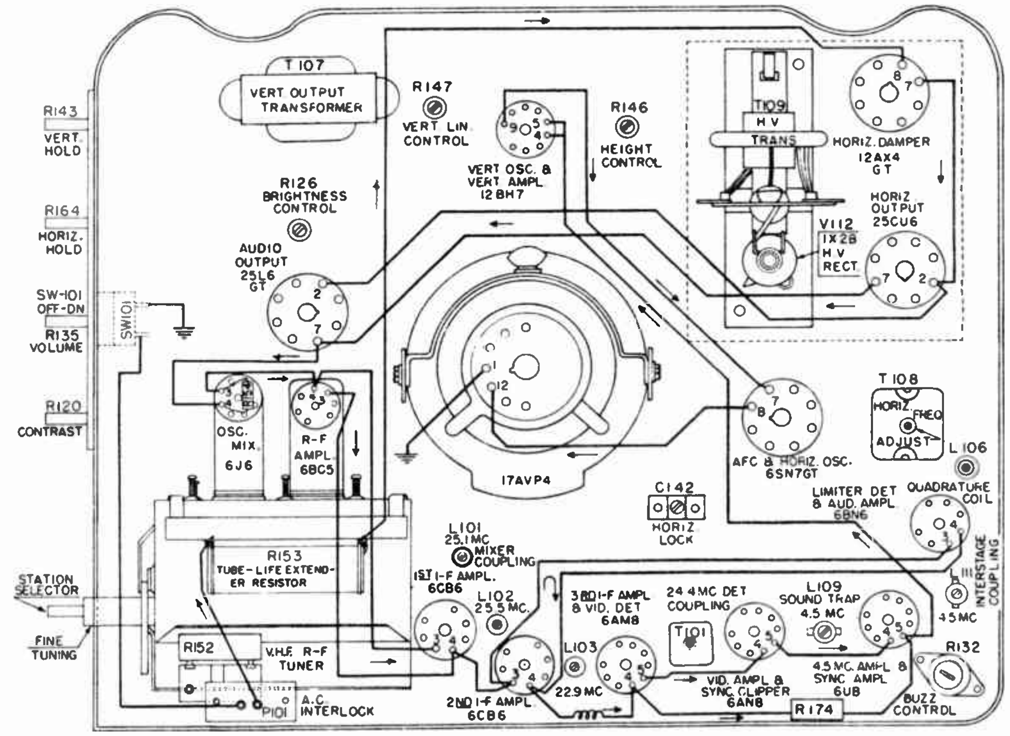
Step No.	Channel Set To	Adjust	Remarks
1.	Strong signal	L106 for maximum sound output.	Set Buzz Control (R132) approximately 90° from clockwise stop.
2.	Weak signal	L111 and L109 (front slug) for maximum sound output.	If the signal in the area is too strong to obtain these peaks, remove the antenna from the receiver.
3.	Weak signal	Buzz Control (R132) for minimum noise (hash).	This signal should be weak enough to allow noise (hash) to come through along with the sound.
4.	Strong signal	L106 again for maximum sound output.	Limit the volume control setting so that this peak can be heard.

PROCEDURE B (with alignment equipment)

Step No.	Connect Signal Gen.	Signal Gen. Freq. MC.	Connect Scope	Miscellaneous Instructions	Adjust
1.	Pin 8 of V104.	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation.	Across secondary of output trans. T105.	Set Buzz Control (R132) to approximately 90° from clockwise. stop. Set the Volume Control (R135) at a low level.	L106 for maximum 400 cycle indication on scope.
2.	"	"	"	"	L111 for maximum response keeping input signal at a low level (below limiting).
3.	"	"	"	"	L109 (front slug) for maximum response keeping input signal at a low level.
4.	"	4.5 MC. AM modulated 400 c.p.s.	"	Use a high input level on signal generator.	Buzz Control (R132) for null (minimum 400 c.p.s. amplitude on scope).
5.	"	4.5 MC. FM modulated 400 c.p.s., 25KC. deviation.	" "	Set the Volume Control (R135) at a low level.	Re-peak L106 for maximum 400 cycle indication on scope.



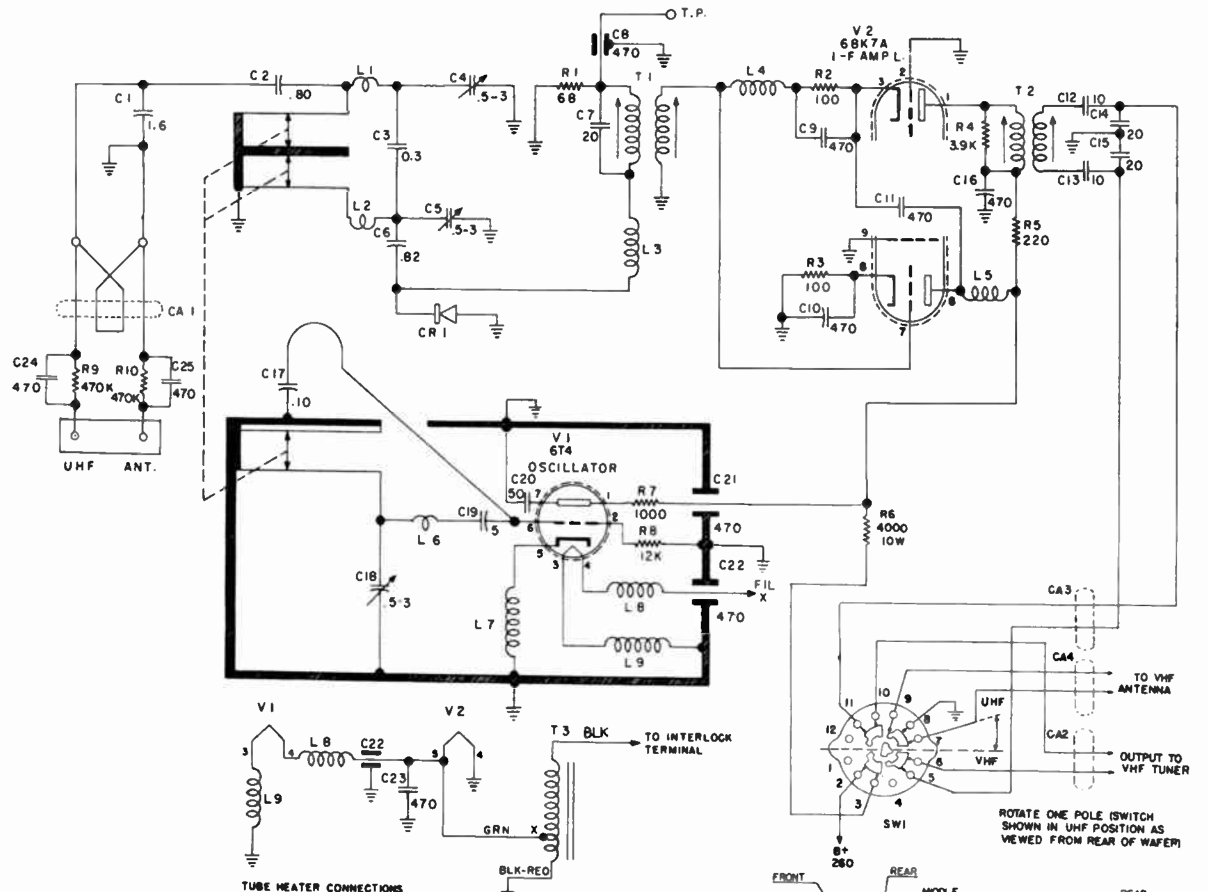
FRONT VIEW OF CHASSIS 432
(Tube & Alignment Locations)



REAR VIEW OF CHASSIS 432
(Tube & Alignment Locations & Tube Filament Wiring)

SCHEMATIC UHF CONVERTER

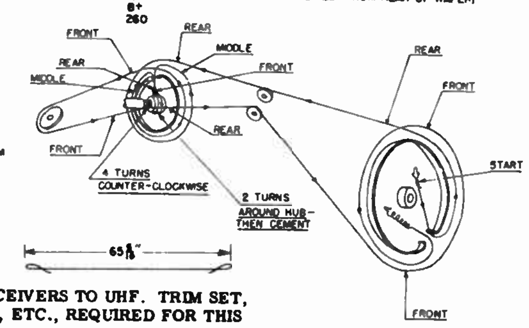
(Part No. 158116)



NOTES:

ALL CAPACITANCE VALUES IN MMF. & ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
ALL RESISTORS 1/2 WATT, EXCEPT AS NOTED.
K = 1000.

PLACEMENT OF DIAL DRIVE CORD SHOWN WITH PULLEYS IN MAXIMUM COUNTER-CLOCKWISE ROTATION AGAINST STOP.

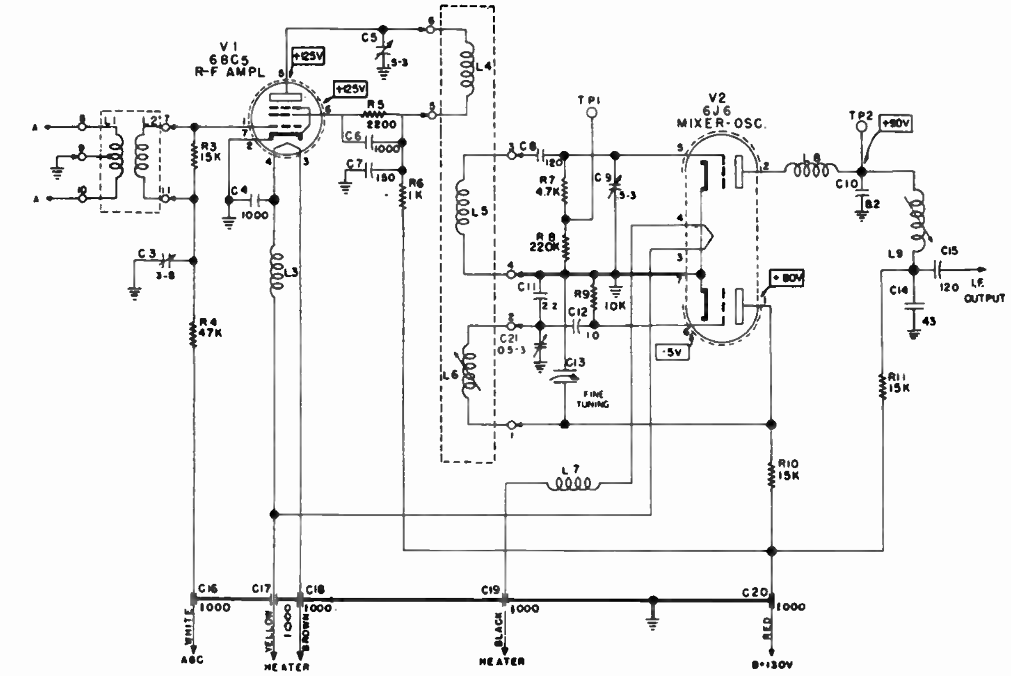


THIS CONVERTER, PART NO. 158116, MAY ALSO BE USED TO CONVERT NON-UHF RECEIVERS TO UHF. TRIM SET, PART NO. 158156-1, CONTAINS THE NECESSARY KNOBS, HARDWARE & INSTRUCTIONS, ETC., REQUIRED FOR THIS CONVERSION.

Symbol No.	Part No.	Description
R6	158186-12	Resistor, 4000 ohm, 10 w., Wirewound
SW1	157867-1	Switch, VHF-UHF
T3	157915-1	Transformer, Filament
CA1	157982	Transmission Line, (125 ohm) order in feet only
*CR1	158186-21	Crystal Mixer, 1N82A
	158186-22	Crystal Mixer, 1N82
	158186-23	Crystal Mixer, 4JB2C-9
	157884-1	Bracket, Tuner and Resistor Mounting
	157896-1	Bracket, Tuner and Transformer Mounting
	157783-1	Grommet (Nylon), 3 used
	158038-1	Insulator (Plastic sleeve), Pulley Hub
	157940-1	Standoff (Fibre), Antenna

*When replacing the crystal, it is best to make the replacement with the same type crystal as the one originally used in the converter. Because of slight variations between crystals of the same part number, it is generally considered good practice to try several different crystals of a particular type to select the one that gives the best performance in that particular converter.

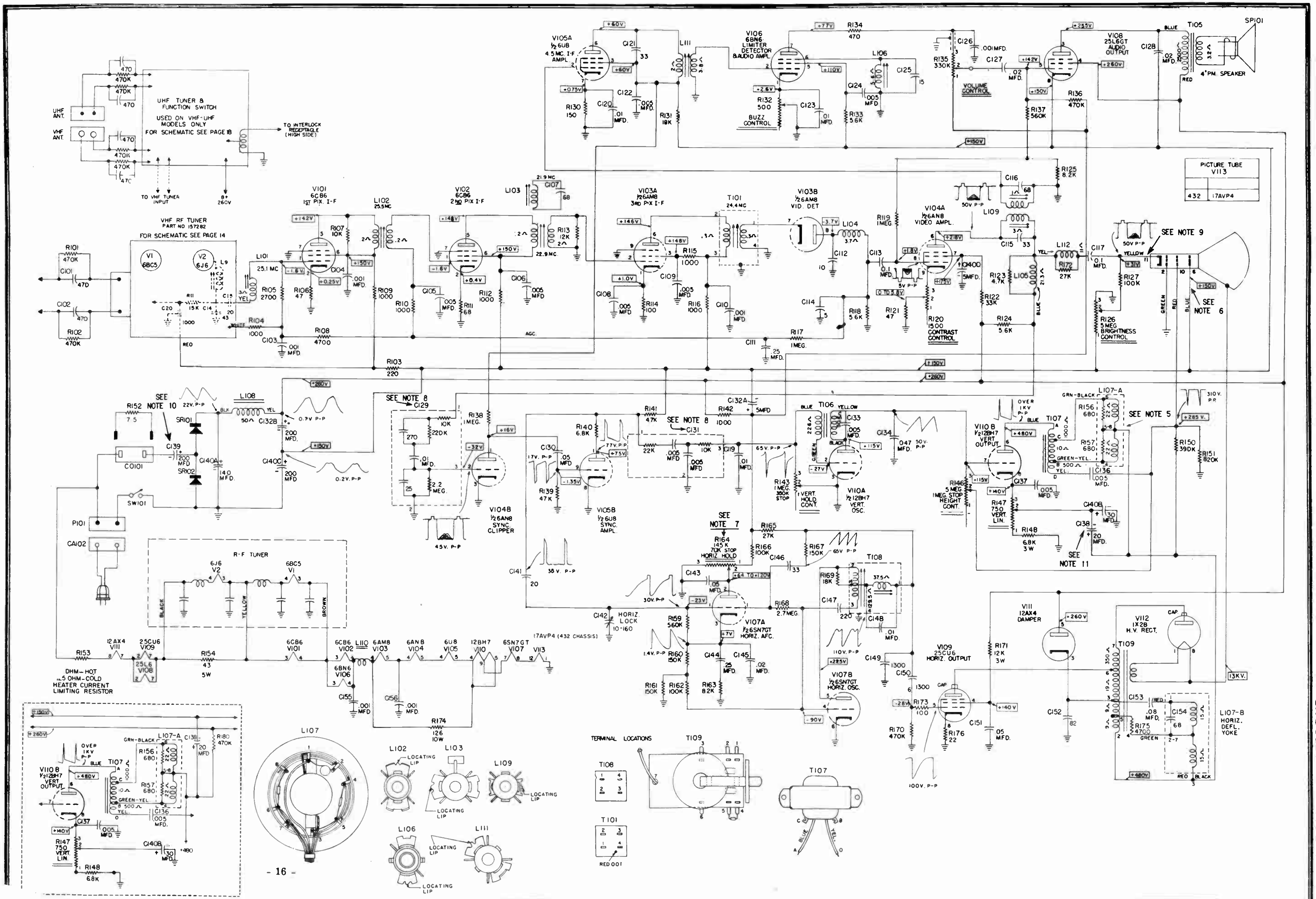
VHF TUNER SCHEMATIC



REPLACEMENT PARTS LIST

VHF Tuner

Symbol No.	Part No.	Description
C3	156906-16	Capacitor, 3-8 mmf., Antenna Trimmer and Lead Assembly
C4	158106-1	Capacitor, 1000 mmf., disc Ceramic
C5	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly
C6	158106-1	Capacitor, 1000 mmf., Disc Ceramic
C7	158106-2	Capacitor, 150 mmf., 10% Disc Ceramic
C8	158106-3	Capacitor, 120 mmf., 10%, N750, Disc Ceramic
C9	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly
C10	158106-15	Capacitor, 8.2 mmf.
C11	158106-5	Capacitor, 2.2 mmf., ± .25 mmf., N750, Ceramic
C12	158106-6	Capacitor, 10 mmf., 10%, N1400, Disc Ceramic
C13	See Ref. 13, 15 & 20	Fine Tuning
C14	158106-16	Capacitor, 43 mmf.
C15	158106-3	Capacitor, 120 mmf., 10%, N750, Disc Ceramic
C16	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C17	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C18	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C19	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C20	158106-8	Capacitor, 1000 mmf. minimum, Feed Thru
C21	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly
R3	158106-9	Resistor, 15,000 ohm, 20%, 1/2 w. (IRC Type BTS)
R4	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R5	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R6	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R7	158106-10	Resistor, 4700 ohm, 10%, 1/2 w., (IRC Type BTS)
R8	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R9	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R10	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
R11	39374-39	Resistor, 15,000 ohm, 10%, 1/2 w.
L1, L2	158021-* See Note 3, opposite page	Antenna Coil Assembly (VHF channels)
L3	156906-50	Choke, RF Filament
L4, L5, L6	158022-* See Note 3, opposite page	RF and Oscillator Coil Assembly (VHF channels)
L7	156906-51	Choke, Oscillator Filament
L8	156906-52	Choke, Mixer Plate
L9	158106-11	I.F. Coil Assembly
3	156906-24	Shield (V1, V2)
4	156906-40	Screw, Trimmer
5	156906-39	Nut (Spring), Trimmer
6, 7, 8, 9	C3, C5, C9, C21	Capacitor, Ceramic Tube
10	158106-11	I.F. Assembly
11	156906-27	Roller, Detent
12	156906-28	Spring, Detent
13	156906-35	Ceramic Bushing and Lead Assembly (Fine Tuning)
14	156906-33	Mounting Strip, Ceramic Bushing
15	158106-12	Plate, Fine Tuning Ground
16	158106-13	Drum and Insulated Shaft Assembly, without Coils
17	156906-29	Spring, Shaft Retaining
18	156906-34	Washer, Fiber
19	156906-31	Spring, Fine Tuning
20	158106-14	Fine Tuning Cam
21	156906-44	Spring, Slug Retaining
22	156906-26	Shield (Bottom Cover)
23	156906-25	Shield (Side)
24	156906-41	Contact Bracket Assembly
25 thru 36	See L1,L2	Antenna Coil Assembly (VHF channels)
37 thru 48	See L4,L5,L6	R.F. & Oscillator Coil Assembly (VHF channels)
	157282	VHF Tuner Complete



F. Rider

MODELS H-17TOBH, BHU, MH, MHU, WH, WHU, Ch. 432

SCHEMATIC REPLACEMENT PARTS LIST

CHASSIS 432

Symbol No.	Part No.	Description
C101	156201-1	Capacitor, 470 mmf., 2KV, Disc Ceramic
C102	156201-1	Capacitor, 470 mmf., 2KV, Disc Ceramic
C103	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C104	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C105	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C106	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C107	137499-33	Capacitor, 68 mmf., 500 v., 10%, Silver Mica (Part of L103)
C108	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C109	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C110	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C111	157810-1	Capacitor, .25 mfd., -15% + 40%, 25 v., Paper
C112	137727-135	Capacitor, 10 mmf., 10%, N080, 500 v., Ceramic
C113	157906-1	Capacitor, .1 mfd., 150 v., Paper
C114	137727-103	Capacitor, 5 mmf., 10%, N030, Ceramic
C115	137727-126	Capacitor, 33 mmf., 10%, N080, 500 v., Ceramic (Part of L109)
C116	137727-133	Capacitor, 68 mmf., 10%, N080, 500 v., Ceramic (Part of L109)
C117	39478-47	Capacitor, .1 mfd., 10%, 600 v., Molded Paper
C119	39478-41	Capacitor, .01 mfd., 10%, 600 v., Molded Paper
C120	39478-41	Capacitor, .01 mfd., 10%, 600 v., Molded Paper
C121	137727-126	Capacitor, 33 mmf., 10%, N080, 500 v., Ceramic
C122	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C123	39478-41	Capacitor, .01 mfd., 10%, 600 v., Molded Paper
C124	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C125	137727-43	Capacitor, 15 mmf., 10%, N080, 500 v., Ceramic
C126	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C127	39001-80	Capacitor, .02 mfd., 600 v., Paper
C128	39001-80	Capacitor, .02 mfd., 600 v., Paper
C129	157813-1	Network, Sync Take-Off
C130	39001-17	Capacitor, .05 mfd., 600 v., Paper
C131	157812-1	Network, Vertical Integrator
C132A	157836-1	Capacitor, 5 mfd., 150 v. } Electrolytic
C132B		Capacitor, 200 mfd., 150 v. }
C133	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C134	39477-45	Capacitor, .047 mfd., 600 v., Molded Paper
C136	158215-25	Capacitor, .005 mfd., 500 v., Disc Ceramic
C137	144675-2	Capacitor, .005 mfd., 500 v., Disc Ceramic
C138	157903-1	Capacitor, 20 mfd., 450 v., Electrolytic
C139	158557*	Capacitor, 200 mfd., 200 v., Electrolytic
C140A	157838-3	Capacitor, 140 mfd., 300 v. }
C140B		Capacitor, 30 mfd., 150 v. } Electrolytic
C140C		Capacitor, 200 mfd., 150 v. }
C140D		Capacitor, 5 mfd., 300 v. }
C141	137727-61	Capacitor, 20 mmf., 10%, N220, 300 v., Ceramic
C142	157870-1	Capacitor, 10-160 mmf., Horizontal Lock, Trimmer
C143	39001-17	Capacitor, .05 mfd., 600 v., Paper
C144	157810-1	Capacitor, .25 mfd., -15%, +40%, 25 v., Paper
C145	39001-80	Capacitor, .02 mfd., 600 v., Paper
C146	137727-126	Capacitor, 33 mmf., 10%, N080, 500 v., Ceramic
C147	137498-22	Capacitor, 220 mmf., 10%, 500 v., Mica
C148	148813-2	Capacitor, .01 mfd., 10%, 400 v., Paper (Special)
C149	144675-33	Capacitor, 1300 mmf., 10%, 500 v., Disc Ceramic
C150	144675-33	Capacitor, 1300 mmf., 10%, 500 v., Disc Ceramic
C151	39001-17	Capacitor, .05 mfd., 600 v., Paper
C152	158215-32	Capacitor, 82 mmf., 10%, 3KV., Disc Ceramic
C153	39001-85	Capacitor, .08 mfd., 600 v., Paper
C154	158215-3	Capacitor, 68 mmf., 10%, 3KV., Disc Ceramic (Part of L107)
C155	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
C156	144675-28	Capacitor, .001 mfd., 500 v., Disc Ceramic
R101	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R102	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R103	39374-53	Resistor, 220 ohm, 10%, 1/2 w.
R104	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R105	39374-30	Resistor, 2700 ohm, 10%, 1/2 w.
R106	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R107	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R108	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R109	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R110	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R111	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R112	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R113	39374-38	Resistor, 12,000 ohm, 10%, 1/2 w.
R114	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R115	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R116	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R117	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R118	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R119	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R120	157804-1	Control, Contrast (1500 ohm)
R121	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R122	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
R123	Part of L105	Resistor, 4700 ohm, 10%, 1/2 w.
R124	39374-210	Resistor, 5600 ohm, 10%, 2 w.
R125	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R126	157801-1	Control, Brightness (5 megohm)
R127	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R130	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R131	39374-40	Resistor, 18,000 ohm, 10%, 1/2 w.
R132	157955-2	Control, Buzz (500 ohm)
R133	39374-122	Resistor, 5600 ohm, 10%, 1 w.
R134	39374-57	Resistor, 470 ohm, 10%, 1/2 w.
R135	157803-1	Control, Volume (330,000 ohm)
R136	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R137	39374-58	Resistor, 560,000 ohm, 10%, 1/2 w.
R138	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R139	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R140	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R141	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R142	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R143	157805-1	Control, Vertical Hold (1 megohm, 350,000 ohm stop)
R146	157806-1	Control, Height (5 megohm, 1 megohm stop)
R147	157800-1	Control, Vertical Linearity (750 ohm)
R148	156911-6	Resistor, 6800 ohm, 10%, 3 w.
R150	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R151	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R152	154089-1	Resistor, 7.5 ohm, 10%, 5 w. Wire Wound (Fuse Type)
R153	157949-1	Resistor, Heater Current Limiting Resistor (125 ohm cold - 43 ohm hot)
R154	158230-2	Resistor, 43 ohm, 10%, 5 w.
R156	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L107)
R157	39374-23	Resistor, 680 ohm, 10%, 1/2 w. (Part of L107)
R159	39374-58	Resistor, 560,000 ohm, 10%, 1/2 w.
R160	39374-51	Resistor, 150,000 ohm, 10%, 1/2 w.
R161	39374-51	Resistor, 150,000 ohm, 10%, 1/2 w.
R162	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R163	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R164	157802-1	Control, Horizontal Hold (145,000 ohm 70,000 ohm stop) See Note 7
R165	39374-42	Resistor, 27,000 ohm, 10%, 1/2 w.
R166	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R167	39374-51	Resistor, 150,000 ohm, 10%, 1/2 w.
R168	39375-131	Resistor, 2.7 megohm, 5%, 1/2 w.
R169	39374-40	Resistor, 18,000 ohm, 10%, 1/2 w.
R170	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R171	156911-5	Resistor, 12,000 ohm, 10%, 3 w.
R172	Part of L112	Resistor, 27,000 ohm, 10%, 1/2 w.
R173	39374-13	Resistor, 100 ohm, 10%, 1/2 w.
R174	158230-1	Resistor, 126 ohm, 10%, 10 w.
R175	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R176	39374-5	Resistor, 22 ohm, 10%, 1/2 w.
R180	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w. See Note 11
L101	157787-1	Coil, Converter I.F. (3.7 - 7.5 microhenries)
L102	157789-1	Coil, 1st I.F. (1.95 - 4 microhenries)
L103	157936-1	Coil, 2nd I.F. & Trap (2.4 - 4.5 microhenries)
L104	154376-1	Coil, Choke Diode (15.5 microhenries)
L105	157833-1	Coil, Video Peaking (710 microhenries)
L106	157842-1	Coil, Quadrature Grid (37 - 75 microhenries)
L107A	158426-1	Deflection Yoke } Assy., less rear
L107B		Deflection Yoke } cover & centering Mag.
L108	155529-1	Choke, Filter (1.0 henry, 240 ma.)
L109	157841-1	Coil, Sound Take-Off (Primary, 26-54 microhenries; Secondary, 11.5 - 19.5 microhenries)
L110	155256-1	Choke (R.F.) Filament (.576 microhenries)
L111	157856-1	Coil, Sound Coupling (Primary, 7.5 - 13.5 microhenries; Secondary, 21 - 39 microhenries)
L112	158007-1	Coil, Video Peaking (220 microhenries)
T101	157844-1	Transformer, I.F. Output
T105	157919-1	Transformer, Audio Output
T106	155255-3	Transformer, Vertical Block Oscillator
T107	158477-1	Transformer, Vertical Output
T108	157791-1	Transformer, Horizontal Oscillator & Trap
T109	158481-5	Transformer, Horizontal Deflection (Assembly)
SR101	155575-2	Rectifier Selenium
SR102	155575-2	Rectifier Selenium
P101	154125	Receptacle, Interlock
CA101	132300-6	Cable & Plug, Power
SP101	138762-8	Speaker, 4" P.M.
CO101	154114	Socket, Terminal Strip
SW101	Part of R135	Switch, On-Off

*See Note #10

NOTES

VHF TUNER

1. All capacitance in mmf. and all resistance in ohms unless otherwise specified.
2. K = 1000.
3. TUNER STRIPS. One Antenna Coil Assembly and one R.F. and Oscillator Coil Assembly are necessary for each channel to be received (VHF or UHF). The dash number following the part number indicates the channel for which the assembly is designed.

   Examples for VHF: 158021-2 is the Antenna Coil Assembly for Channel 2.
   158022-13 is the R.F. and Oscillator Coil Assembly for Channel 13.

   UHF coils are not furnished as part of the tuner. The two coil assemblies required for any UHF channel may be ordered as one part under part numbers 158023-14 (for channel 14) through 158023-83 (for channel 83). The coil assemblies listed above are stamped with the channel number and the letter "H". The letter "H" indicates that the coils are designed for use with the tuner in this chassis.

NOTES

CHASSIS 432

1. All D.C. voltages measured with an electronic voltmeter connected from socket lug to chassis. Some voltages are variable depending upon signal input. Voltages shown were measured with a signal voltage of 850,000 microvolts and with a normal picture on the picture tube and the contrast and brightness controls set for 50 volts peak to peak on the cathode (pin 11) of the picture tube. Socket voltage tolerance 10%. For table of socket voltages under no-signal conditions, see page 11.
2. Supply voltage, 117 volts, 60 cycle AC.
3. K = 1000.
4. All capacitance values in mmf. and all resistance values in ohms unless otherwise noted.
5. Lug 3 connected to boost voltage and Lug 3, 8 and 5 connected internally.
6. Better focus may be obtained with replacement picture tubes if the electronic focus anode is connected to a point other than +150 volts. Suggested points to try are: chassis ground, +260 volts, +285 (picture tube, pin 10) and +480 volts.
7. The Horizontal Hold control R164 used in chassis 432 has an overall resistance of 145,000 ohms, with a 70,000 ohm stop. This control is marked with Part No. B-157802-1-2 or B-157802-1-3. It is directly interchangeable with an earlier control marked B-157802-1-1, which has an overall resistance of 170,000 ohms, with a 70,000 ohm stop. It will be noticed, however, that the control with the lower overall resistance gives a somewhat wider hold range.
8. On the Vertical Integrating Network C131, leads 2 and 3 are closely spaced, and lead 2 is the middle lead. On the Sync Take-Off Network C129, leads 1 and 2 are closely spaced, and lead 2 is the middle one. When replacing either of these units, the leads must be connected as shown in the schematic in order to obtain satisfactory operation.
9. The yellow lead wire from pin 11 CRT is taped to the rest of CRT lead wires in late models. This was done to reduce the possibilities of regeneration due to the yellow wire getting too close to the I.F. input coil.

   If regeneration occurs in early model sets, the taping of the yellow lead wire will help to reduce it.
10. In some early production chassis 432 (not designated by a code letter), C139 is a 140 mfd., 300 v., electrolytic capacitor, Part No. 157837-1. For replacement purposes, use either Part No. 157837-1 or 158557-1, whichever may be available.
11. The inset at the lower left of the complete schematic wiring diagram shows a slight variation in circuitry which was used on some early production chassis 432. The code letter following the chassis number was not changed to designate this change in circuitry, because of the relatively small number of chassis on which it was used.

VIDEO IF ALIGNMENT RA-312/313

Place STATION SELECTOR between channels to disable oscillator. Remove fuse, F201. Connect a short length of wire to grid of mixer tube (see figure 1). Use the lowest VTVM range for all steps.

Step	Signal Generator Frequency	Signal Generator Connect To	Output Indicator	Connect to	Adjust
1	43.5 MC Center Freq. 10 MC deviation.	Grid of Mixer 1	Oscillograph through XTAL	Pin 5, V201 1XTAL	L201 (top) for 41.25 MC trap. L201 (bottom) for 47.25 MC trap. Z201 (bottom) for 42.25 MC marker. Mixer plate coil (T101) and Z201 (top) for 45.75 MC marker. Note: Repeat adjustments until markers are positioned as specified. (42.25 MC, 45.75 MC, 55%, 70%, 41.25 MC, 47.25 MC)
2	44.0 MC (Marker) No Sweep	As Above 2	VTVM	Pin 7, V205 2VTVM	Z204 for maximum negative reading. Set signal generator output to maintain reading on lowest range of VTVM.
3	42.35 MC (Marker) No Sweep	As Above 3	VTVM	As Above 3VTVM	Z203 for maximum negative reading.
4	44.85 MC (Marker) No Sweep	As Above 4	VTVM	As Above 4VTVM	Z202 for maximum negative reading.
5	4.5 MC 400 CPS AM	Pin 7, V205 5	Oscillograph through XTAL	Junction of C220 and R226 5XTAL	L207 for minimum reading.

SOUND IF ALIGNMENT

Step	Signal Generator Frequency	Signal Generator Connect To	Output Indicator	Connect to	Adjust
6	4.5 MC 1 MC Sweep	Pin 7, V205 6	Oscillograph through XTAL	Pin 7, V207 6XTAL	L211 and Z206 (bottom) for waveform (4.5MC)
7	As Above	As Above 7	Oscillograph DIRECT	Junction of C236 & R242 7DIR	Z206 (top) for waveform. (4.5MC)

ALTERNATE SOUND IF ALIGNMENT — USING TV SIGNAL

Step	Signal	Output Indicator	Connect to	Adjust
6	TV Signal. Teleset must be tuned for best picture	VTVM	Pin 7, V207 6VTVM	L211 and Z206 (bottom) for maximum reading.
7	As Above	VTVM	Junction of C236 & R242 7VTVM	Z206 (top) for null point.

ALIGNMENT TEST POINTS

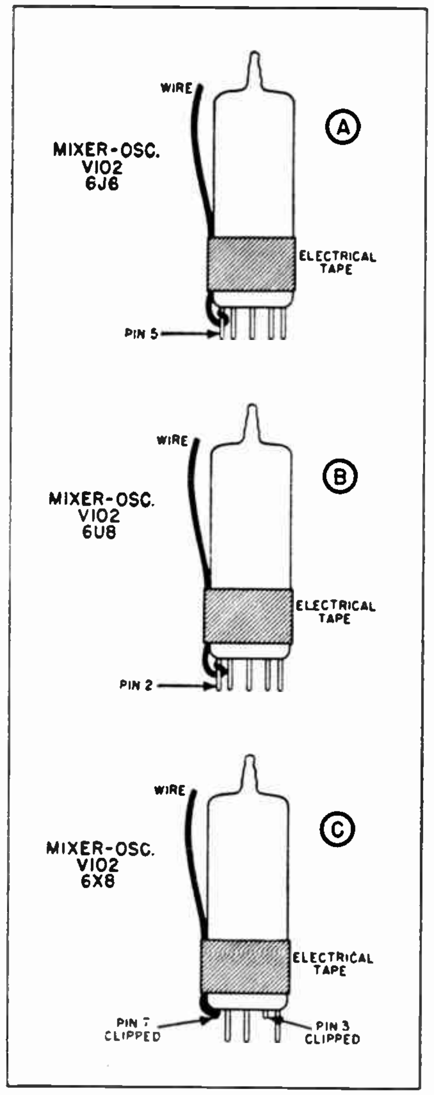
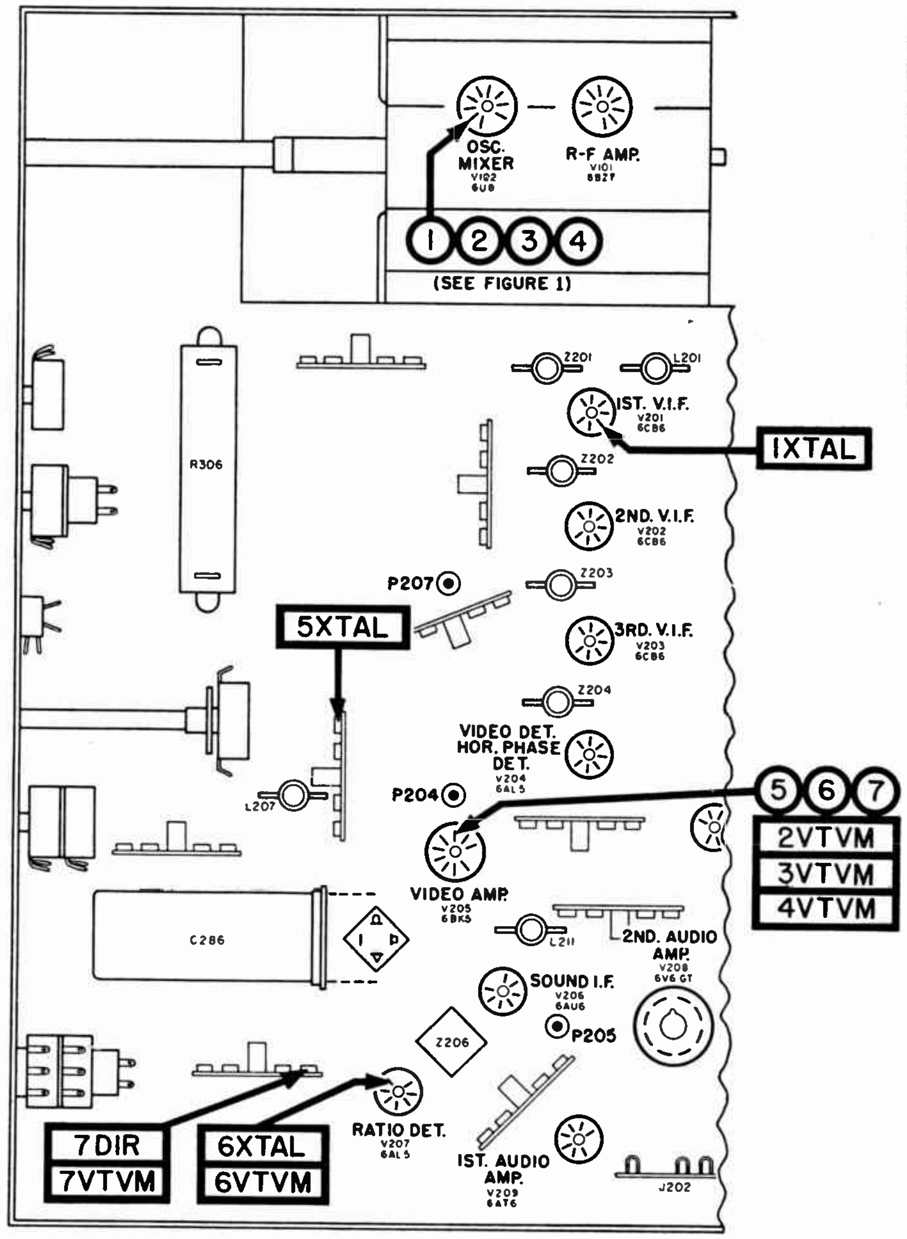


Figure 1. Adapter tubes for use in connecting alignment equipment to the grid of the mixer stage. A—6J6 adapter for chassis with tuner 89 012 912. B—6U8 adapter for chassis with tuner 89 013 461. C—6X8 adapter for chassis with tuner 89 013 561.



NOTES

When the alignment procedure has been completed the setting of the tuner oscillator slugs should be checked on each available channel and corrected if necessary.

For tuners 89 012 912 and 89 013 461 proceed as follows:

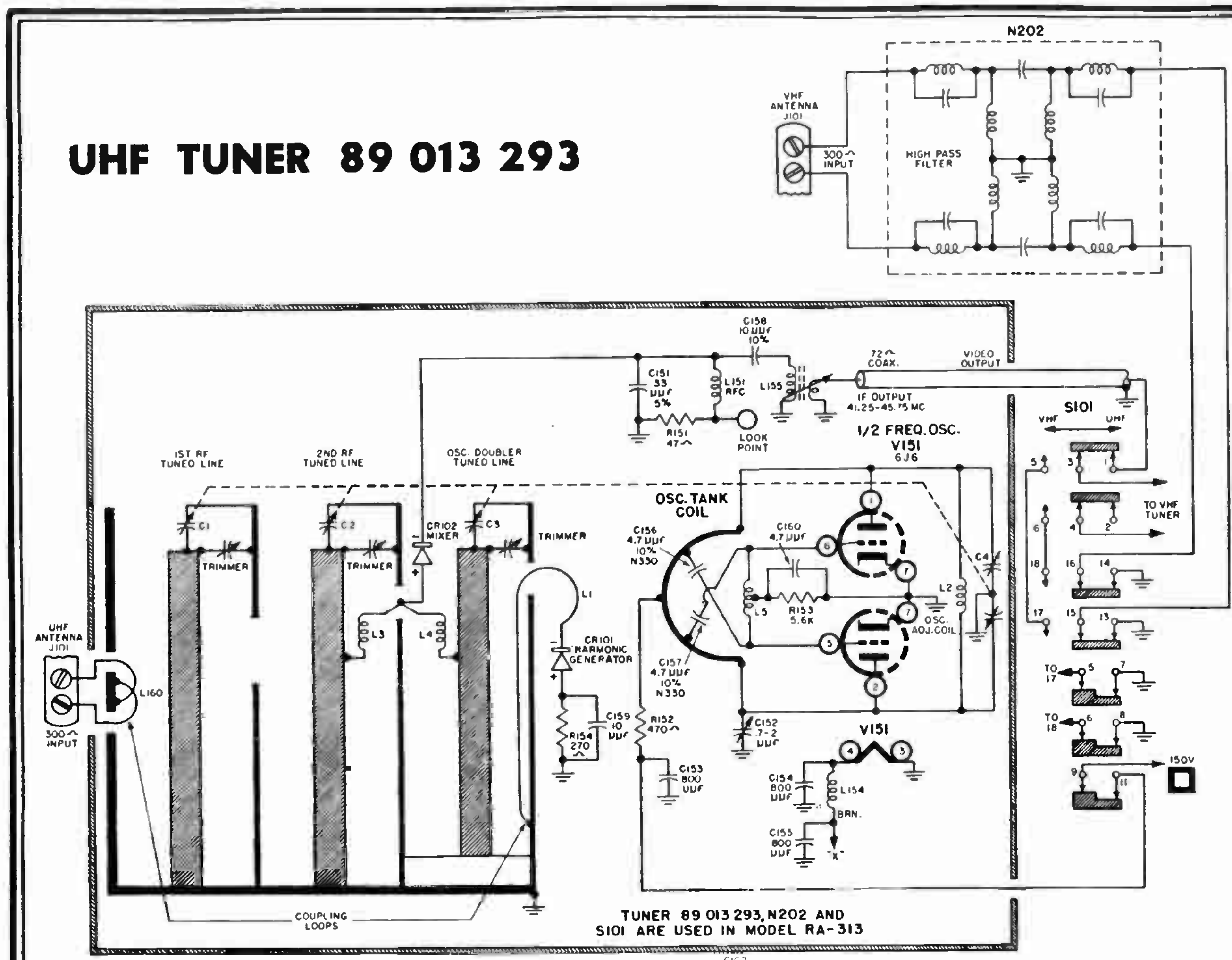
1. Tune the receiver to each available channel.
2. Place the flat of the Fine Tuning control face downward and adjust the oscillator slug for best picture and sound.

For Tuner 89 013 561 use the following procedure:

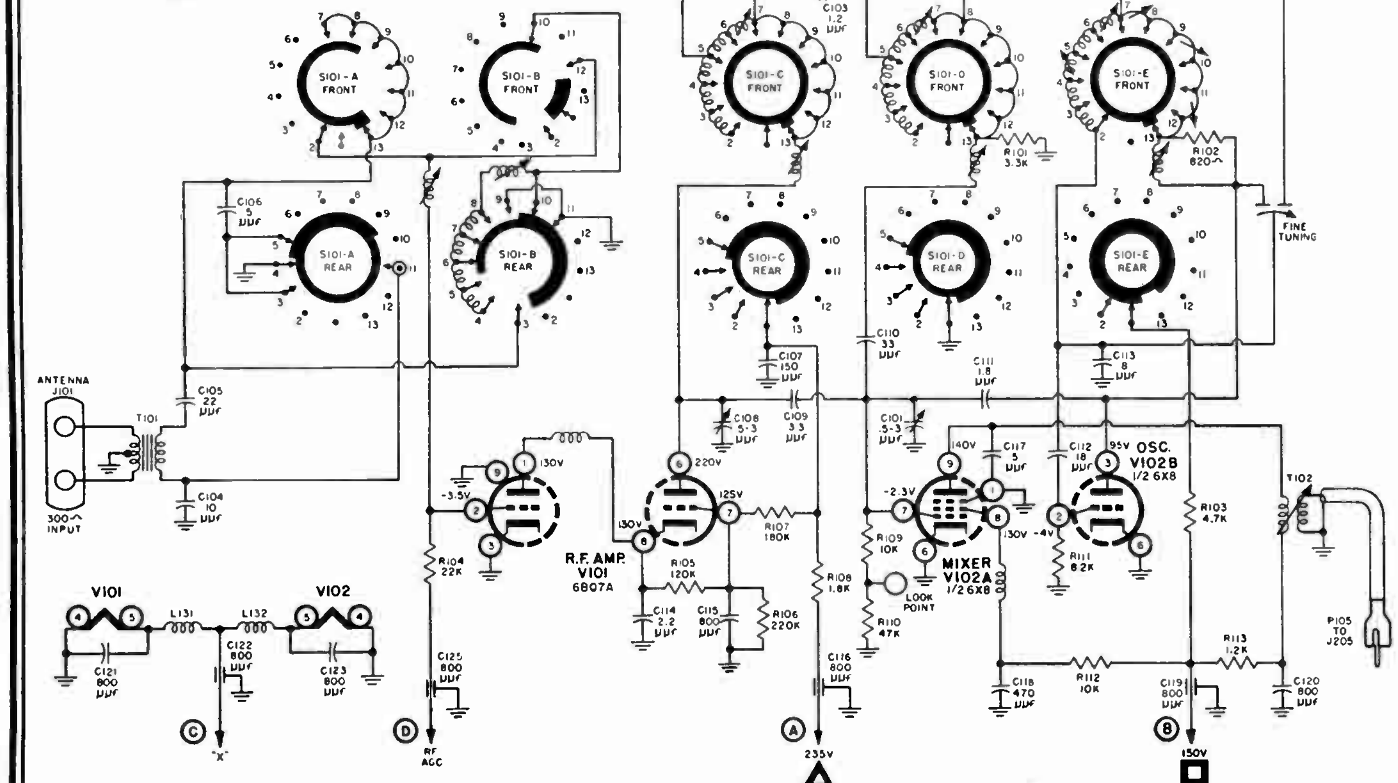
1. Turn the station selector to the highest frequency channel that does not tune in properly.
2. Place the flat of the Fine Tuning Control face upward.
3. On Channels 7 through 13 adjust the oscillator slug over the tuner shafts for best picture and sound. On channels 2 through 6 adjust the oscillator slug below the tuner shafts for best picture and sound.

Note: The oscillator slug above the tuner shafts affects the tuning of all channels from 7 through 13 while the lower oscillator slug affects the tuning of all channels from 2 through 6.

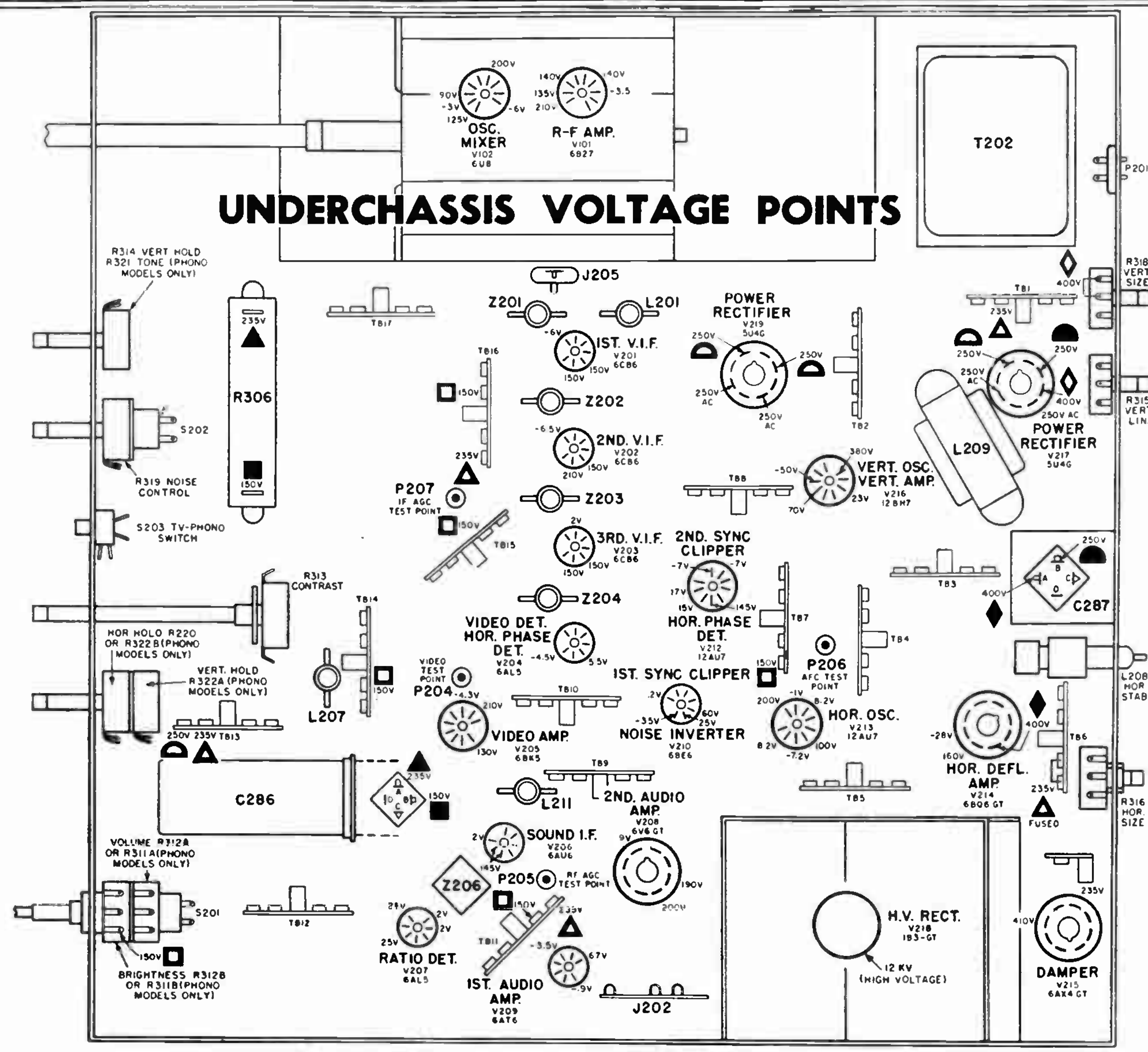
UHF TUNER 89 013 293



TUNER 89 013 561



UNDERCHASSIS VOLTAGE POINTS



RESISTANCE MEASUREMENTS
All Readings to Ground

		1	2	3	4	5	6	7	8	9
V201	6CB6	1.2 M	47	.05	0	70K	70K	0		
V202	6CB6	1.2 M	68	.05	0	70K	70K	0		
V203	6CB6	.1	180	.05	0	70K	70K	0		
V204	6AL5	.1	10K	.1	0	4.8 M	0	3.3K		
V205	6BK5	70K	NC	3.3K	.05	0	27	3.3K	70K	NC
V206	6AU6	1.5	0	0	.05	70K	70K	220		
V207	6AL5	INF	INF	.05	0	15K	0	15K		
V208	6V6-GT	NC	0	70K	70K	470K	NC	.05	220	
V209	6AT6	10 M	0	0	.05	1.3 M	NC	500K		
V210	6BE6	35K	0	0	.05	40K	70K	2.2 M		
V212	12AU7	4.8 M	4.8 M	10K	.05	.05	70K	530K	1.2K	0
V213	12AU7	70K	5.5 M	1.8K	0	0	250K	120K-170K	1.8K	.05
V214	6BQ6-GT	NC	.05	INF	70K-80K	470K	NC	0	0	Cap INF
V215	6AX4-GT	NC	NC	INF		70K		.05	0	
V216	12BH7	INF	2.2 M	820-5K	.05	.05	INF	1 M-2.5 M	0	0
V217	5U4-G	NC	70K	INF	13	NC	13	NC	70K	
V218	1B3-GT	NC	INF	INF	NC	NC	INF	INF	NC	Cap INF
V219	5U4-G	NC	70K	NC	13	NC	13	NC	70K	
V101	6BZ7	70K	350K	INF	0	.1	INF	1.2 M	0	0
V102	6U8	70K	200K	180K	.1	0	70K	0	0	12K
V401*	CRT	0	1 M				0			

*10	11	12
INF	100K-350K	.05

The above resistance readings were taken with an RCA Model WV97A VTVM. All readings are in ohms, K=1000, M=million. When the reading is affected by a control two readings are given. These readings indicate the variation produced by the control.

PARTS LIST

Symbol	Part No.
CHASSIS	
C201	03 151 900
C202	03 153 710
C203	03 152 470
C204	03 151 960
C205	03 152 470
C206	03 151 520
C207	03 151 520
C208	03 151 960
C209	03 151 900
C210	03 151 960
C211	03 153 740
C212	03 153 700
C213	03 153 180
C214	03 153 700
C215	03 146 750
C216	03 140 320
C217	03 151 550
C218	03 153 710
C220	03 141 140
C221	03 151 550
C222	03 133 010
C223	03 141 100
C229	03 152 490
C230	03 151 550
C231	03 015 920
C232	03 015 920
C233	03 151 960
C235	03 153 730
C236	03 015 920
C239	03 153 740
C242	03 015 920
C243	03 153 740
C244	03 153 730
C249	03 140 170
C250	03 140 320
C251	03 140 370
C252	03 141 030
C253	03 151 930
C254	03 141 120
C255	03 140 320
C256	03 146 790
C257	03 020 500
C258	03 153 800
C259	03 153 800
C260	03 141 030
C261	03 140 330
C262	03 153 700
C263	03 133 020
C264	03 139 683
C265	03 021 130
C266	03 020 500
C267	03 141 040
C268	03 141 100
C269	03 151 940
C270	03 141 500
C271	03 254 013
C272	03 254 012
C273	03 121 560
C274	03 140 580
C275	03 139 682
C276	03 140 300
C277	03 141 500
C278	03 141 820
C279	03 140 540
C280	03 140 330
C281	03 153 820
C282	03 141 760
C283	03 140 360
C284	03 140 360
C286	03 151 425
C287	03 151 426
C288	03 138 362
F201	11 000 730
J201	12 001 310
J101 (312)	40 018 001
J101 (313)	40 018 011
J202	40 016 721
J203	34 003 466
J204	09 002 760
J205	09 031 070
L201	21 012 421
L202	21 012 451
L203	21 006 622
L204	21 006 628
L205	21 006 628
L206	21 006 629
L207	21 010 964
L208	21 010 991
L209	21 012 431
L211	21 012 212
L212	21 006 520
L213	21 011 762
L214	21 011 762
L215	21 011 762
L216	21 006 550
L217	89 013 571
N201	88 000 631
N202	88 000 731
P201	09 036 920
P202	50 041 047
P203	09 018 810
P208	09 018 810
P402	09 033 001
R201	02 041 930
R202	02 031 610
R203	02 032 490
R204	02 031 700
R205	02 032 400
R206	02 034 970
R207	02 041 980
R208	02 031 630
R210	02 032 400
R211	02 031 980
R214	02 031 680
R215	02 032 400
R218	02 031 830
R219	02 031 850
R220	02 031 580
R221	02 031 880
R222	02 037 860
R224	02 113 070
R225	02 031 800
R226	02 032 540
R235	02 031 690
R237	02 031 720
R238	02 032 420
R240	02 031 910
R241	02 031 910
R242	02 041 930
R247	02 032 660
R249	02 032 580
R250	02 032 580
R251	02 034 690
R252	02 038 410
R256	02 032 010
R257	02 032 230
R258	02 032 090
R259	02 032 270
R260	02 032 130
R261	02 032 600
R262	02 031 020
R263	02 031 920
R264	02 032 020
R266	02 031 260
R267	02 037 930
R268	02 031 950
R269	02 032 070
R270	02 031 990
R271	02 031 750
R272	02 031 980
R273	02 031 730
R274	02 032 090
R275	02 032 010
R276	02 032 210
R278	02 031 730
R279	02 032 400
R280	02 032 010
R281	02 032 110
R282	02 030 680
R283	02 030 540
R284	02 032 110
R285	02 032 020
R286	02 031 020
R287	02 030 640
R288	02 032 580
R289	02 032 350
R290	02 032 160
R291	02 223 020
R292	02 037 790
R294	02 035 000
R295	02 031 890
R296	02 032 010
R297	02 032 620
R298	02 034 760
R299	02 034 980
R300	02 030 760
R301	02 041 740
R302	02 041 740
R303	02 045 010
R304	02 034 960
R305	02 042 600
R306	02 235 201
R307	02 031 900
R311	01 058 341
R312	01 058 321
R313	01 054 571
R314	01 056 031
R315	01 056 021
R316	01 058 602
R317	01 056 035
R318	01 056 041
R319	01 054 591
R320	01 056 033
R321	01 056 034
R322	01 058 331
S201	01 058 341
S201	01 058 321
S202	01 054 591
S203	05 005 120
T201	20 009 021
T202 (17")	20 009 013
T202 (21")	20 009 014
T204	20 009 081
V201	6CB6
V202	6CB6
V203	6CB6
V204	6AL5
V205	6BK5
V206	6AU6
V207	6AL5
V208	6V6-GT
V209	6AT6
V210	6BE6
V212	12AU7
V213	12AU7
V214	6BQ6-GT
V215	6AX4-GT
V216	12BH7
V217	5U4-G
V218	1B3-GT
V219	5U4-G
V401	17HP4
V401	21YP4
Z201 (312)	20 009 745
Z201 (313)	20 008 744
Z202	20 008 991
Z203	20 008 991
Z204	20 008 991
Z206	20 009 041
TUNER 89 013 461	
C101	03 125 500
C103	03 119 150
C104	03 119 170
C105	03 123 020
C106	03 119 160
C110	03 160 041
C111	03 119 150
C112	03 119 150
C113	03 123 010
C114	03 126 010
C116	03 154 580
C117	03 123 030
C119	03 100 490
C120	03 100 490
C121	03 125 500
C122	03 125 500
C123	03 125 500
C124	03 100 490
L101	21 012 041
L113	21 010 470
N101	88 000 861
R102	02 032 120
R103	02 032 110
R104	02 034 790
R105	02 031 870
R106	02 031 970
R108	02 032 010
R109	02 031 890
R110	02 031 880
R111	02 034 830
R112	02 032 010
R115	02 031 930
R116	02 032 010
T101	20 009 311
V101	6BZ7
V102	6U8

TUNER STRIPS ANTENNA 89 013 461

Channel	Part No.
2	40 018 091
3	40 018 092
4	40 018 093
5	40 018 094
6	40 018 095
7	40 018 096
8	40 018 097
9	40 018 098
10	40 018 099
11	40 018 101
12	40 018 102
13	40 018 103

MIXER 89 013 461

Channel	Part No.
2	40 018 104
3	40 018 105
4	40 018 106
5	40 018 107
6	40 018 108
7	40 018 109
8	40 018 111
9	40 018 112
10	40 018 113
11	40 018 114
12	40 018 115
13	40 018 116

TUNER 89 012 912

Symbol	Part No.
C101	03 125 500
C102	03 125 010
C103	03 019 840
C104	03 124 780
C105	03 124 770
C106	03 124 790
C107	03 125 500
C108	03 119 170
C109	03 119 170
C110	03 019 840
C111	03 125 110
C112	03 124 790
C113	03 125 110
C114	03 125 500
C115	03 126 010
C116	03 126 010
C117	03 019 840
C118	03 126 191
C119	03 124 790
C120	03 125 500
C121	03 124 790
C123	03 125 000
L106	21 011 811
L107	21 011 571
L108	21 011 581
L109	21 011 801
L110	21 011 561
P104	09 018 810
R101	02 031 840
R104	02 041 180
R105	02 030 430
R106	02 041 730
R107	02 031 890
R108	02 032 040
R109	02 031 890
R110	02 031 850
R111	02 031 890
S101	05 007 371
V101	6BK7
V102	6J6

TUNER STRIPS 89 012 912

Channel	Part No.
2	40 014 881
3	40 014 882
4	40 014 883
5	40 014 884
6	40 014 885
7	40 014 886
8	40 014 887
9	40 014 888
10	40 014 889
11	40 014 891
12	40 014 892
13	40 014 893
40 mc IF	40 018 151

UHF TUNER 89 013 293

Symbol	Part No.
C151	03 126 130
C152	03 125 180
C153	03 125 500
C154	03 125 500
C155	03 125 500
C156	03 126 140
C157	03 126 140
C158	03 125 460
C159	03 125 110
C160	03 014 560
CR101	26 001 082
CR102	26 001 082
L151	21 011 821
L154	21 011 831
L155	21 011 841
R151	02 031 610
R152	02 031 730
R153	02 031 890
R154	02 031 700
V151	6J6

TUNER 89 013 561

Symbol	Part No.
C101	03 137 300
C102	03 133 900
C103	03 133 840
C104	03 146 790
C105	03 152 940
C106	03 133 920
C107	03 154 560
C108	03 137 300
C109	03 133 900
C110	03 152 960
C111	03 133 570
C112	03 152 930
C113	03 146 780
C114	03 133 590
C115	03 124 790
C116	03 131 900
C117	03 146 750
C118	03 131 800
C119	03 131 900
C120	03 124 790
C121	03 124 790
C122	03 131 900
C123	03 124 790
C125	03 131 900
L131	21 013 211
L132	21 013 211
R101	02 031 830
R102	02 041 760
R103	02 031 850
R104	02 032 500
R105	02 032 020
R106	02 032 050
R107	02 032 040
R108	02 034 800
R109	02 032 480
R110	02 032 520
R111	02 031 880
R112	02 032 480
R113	02 031 780
T101	20 009 291
T102	20 009 301
V101	6BQ7A
V102	6 x 8

MECHANICAL PARTS

CHASSIS

Part No.	Description
12 007 151	Lampholder
12 006 700	Lens, Green, Pilot Light
29 000 662	Magnet Ion Trap
29 000 731	Magnet Centering
30 027 964	Spring Deflection Coil
30 042 981	Spring Shock Mount, V213
30 043 101	Spring Contact CRT
34 001 100	Socket Tube Octal, V208, V214
34 001 670	Socket Tube 9 Prong, V216
34 002 380	Socket Tube Octal, V217, V219
34 002 740	Socket Tube 9 Prong, V213
34 003 370	Socket Tube Octal, V215
34 004 121	Socket Standoff, V218
34 004 130	Socket Tube 7 Prong Min.
34 004 140	Socket Tube 9 Prong, V205, V212
35 029 401	Strap, CRT Support, 21"
35 029 402	Strap, CRT Support, 17"
36 005 200	Plate Contact (6BQ6)
38 014 956	Cushion Bottom, 17" CRT
38 014 957	Cushion Bottom, 21" CRT
38 014 958	Cushion Top, 17" CRT
38 014 959	Cushion Top 21" CRT
38 015 501	Cushion CRT Rear
42 002 860	Shield, Min. Tube
42 007 110	Base, Min. Tube Shield
42 010 241	Corona Shield, V218
42 010 300	Shield Tube, V213
43 005 152	Bushing RA-313
60 408 170	Screw (CRT Strap)
61 010 000	U Lock Nut (CRT Strap)
61 030 050	U Lock Nut (CRT Mtg. Bracket)

TUNER 89 013 461

Part No.	Description
30 003 491	Shaft, Fine Tuning
30 029 470	Detent Roller Spring
30 029 480	Detent Roller
30 043 441	Spring, Drum Support (1" 7/16)
30 043 451	Spring, Fine Tuning Cam
30 043 461	Tension Spring
30 043 471	Snap Ring, Drum Shaft
30 043 481	Cam, Fine Tuning
31 022 301	Cover, Side & Bottom
40 016 781	Rear Terminal Mtg. Board
42 010 581	Shield Tube V102
42 010 591	Shield Tube V101

89 013 912

Part No.	Description
30 008 310	Dial Cord
30 013 000	Ring Retainer ¼"
30 033 611	UHF Dial Sleeve
30 033 621	Backlash Gear and Pulley
30 033 641	Shaft, Backlash Gear
30 033 651	Ring Bearing
30 033 661	Bearing Bracket
30 035 011	Extension Shaft
30 035 020	Detent Roller and Spring
30 035 030	Spring Shaft Support
30 035 040	Snap Ring
30 035 100	Pulley Dial Cord
30 035 461	Spring Dial Cord
30 036 621	Cam
30 036 631	Gear Tuning Shaft
30 042 551	Coupling, Shaft
35 025 600	Bearing Plate
42 002 900	Tube Shield V101
42 003 400	Tube Shield V102
42 007 930	Bottom Shield
42 007 940	Side Shield
43 005 011	Spacer, Shaft
60 057 501	Screw Bearing Plate
60 408 200	Screw Bottom, Side Shield
60 409 600	Screw Bearing Plate
60 806 101	Set Screw
61 025 200	Lock Nut Flat
62 000 020	Washer, Flat Fiber
62 403 221	"C" Washer, Shaft

89 013 293

Part No.	Description
42 002 900	Tube Shield V151
45 005 011	Dial UHF

89 013 561

Part No.	Description
03 160 011	Plate, Fine Tuning
03 160 021	Rotor, Fine Tuning
03 160 031	Dielectric, Fine Tuning
30 043 911	Spring, Detent
30 043 921	Ball, Spring Detent
42 009 030	Shield, Tube

CABINET PARTS

Part No.	Description
18 003 601	Speaker Assy 5"
18 003 611	Speaker Assy 10"
22 001 941	Antenna Loop VHF-UHF
22 002 041	Antenna Loop VHF
30 031 282	Cup Back Panel, 21"
30 043 151	Cup Back Panel, 17"
31 021 732	Cover Dust, 21"
32 004 441	Panel Front 17"
32 004 371	Panel Back 17"
32 004 381	Panel Back 21"
35 029 971	Bracket, Glass Mtg. 17"
35 029 973	Bracket, Glass Mtg. 21"
35 030 001	Rail, Glass Mtg. 17"
35 030 003	Rail, Glass Mtg. 21"
38 015 511	Cushion, Glass Top 17"
38 015 571	Mask and GI Bot. Support 17"
38 016 001	Cushion Safety Glass 17"
38 016 002	Cushion Safety Glass 21"
42 010 561	Shield Panel 17"
42 010 562	Shield Panel 21"
45 004 005	Safety Glass 17"
45 004 006	Safety Glass 21"
45 005 963	Knob Fine Tuning RA-313
45 005 973	Knob Brightness RA-313
45 005 983	Dial UHF, RA-313
45 006 031	Knob Control Door
50 002 900	Cable Assy-Power
64 010 472	Hinge Cover Control
64 010 803	Mask Gold 17"
64 010 821	Mask Gold 21"

Baylor, Clifford Dellwood, Richfield Hamilton & Belvidere

Part No.	Description
31 021 961	Door Control
32 004 443	Front Panel, Clifford
32 004 444	Front Panel, Dellwood, Richfield
38 015 513	Cushion Glass Top
38 015 541	Mask and GI Side Support
45 005 963	Knob Fine Tuning RA-312
45 005 973	Knob Brightness RA-312
45 006 001	Knob Selector 12 Pos.
45 006 021	Knob Volume
45 006 041	Knob Control Door

Barton, Winsted Bradley

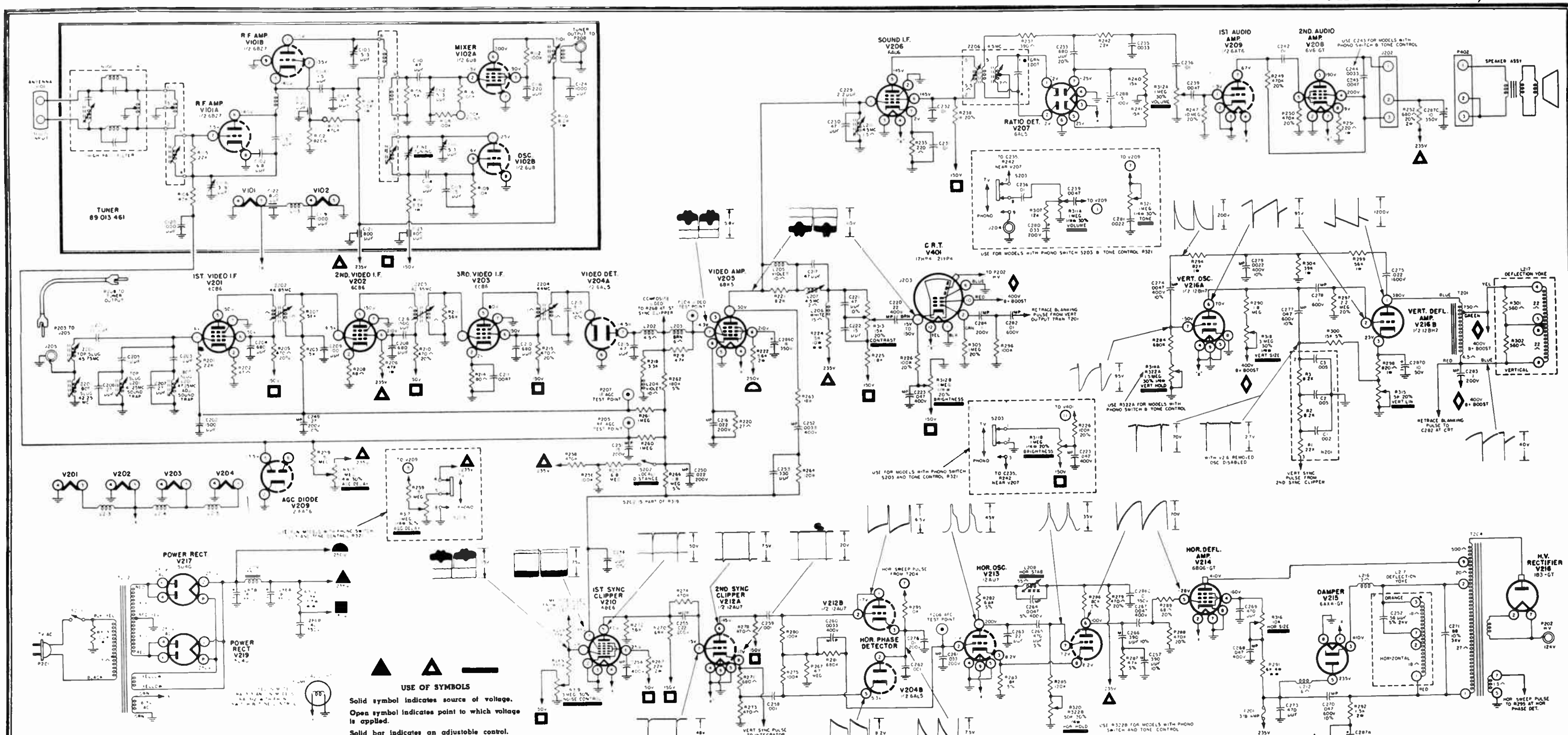
Part No.	Description
31 021 962	Door Control
45 005 964	Knob Fine Tuning RA-312
45 005 974	Knob Brightness RA-312
45 006 013	Knob Selector 13 Pos. Bld. RA-313
45 006 013	Knob Selector 13 Pos. Wal. RA-313
45 006 014	Knob Selector 13 Pos. Mahog. RA-312
45 006 015	Knob Selector 13 Pos. Bld. RA-312
45 006 015	Knob Selector 13 Pos. Wal. RA-312
45 006 022	Knob Volume Mahog.
45 006 023	Knob Volume Blonde
45 006 023	Knob Volume Walnut

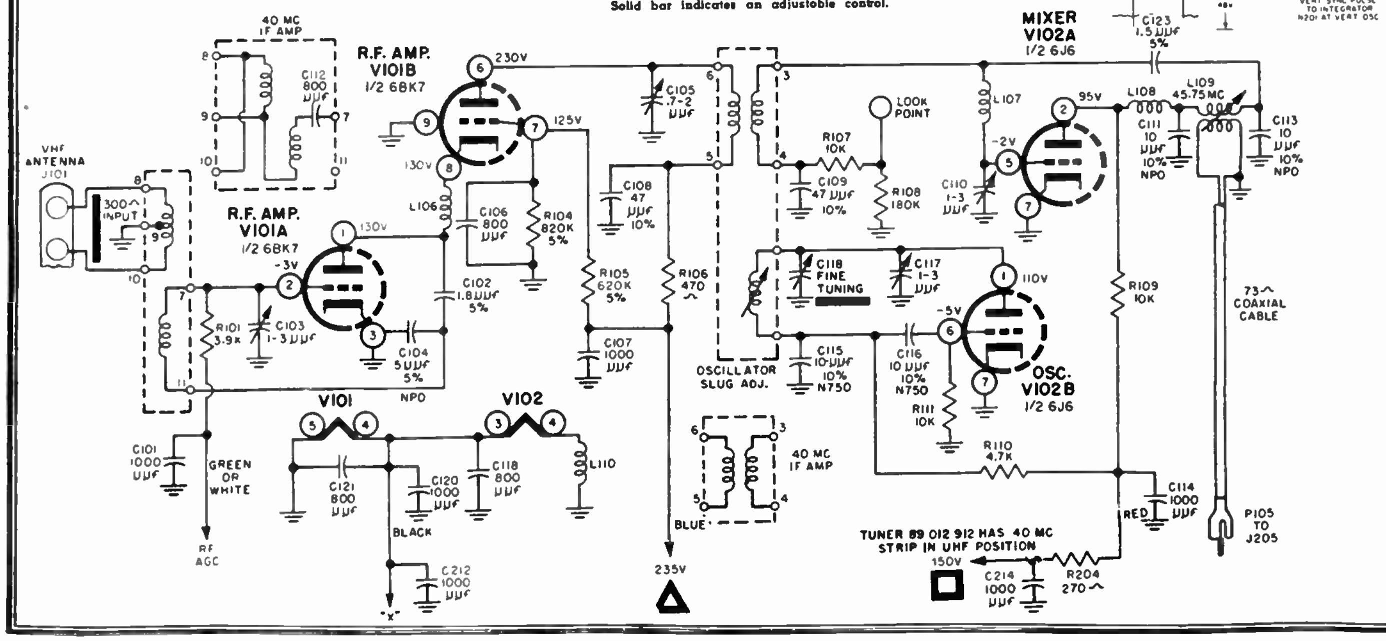
Winsted, Bradley

Part No.	Description
32 004 442	Front Panel, Winsted
38 015 512	Cushion Glass Top
38 015 542	Mask and GI Side Support

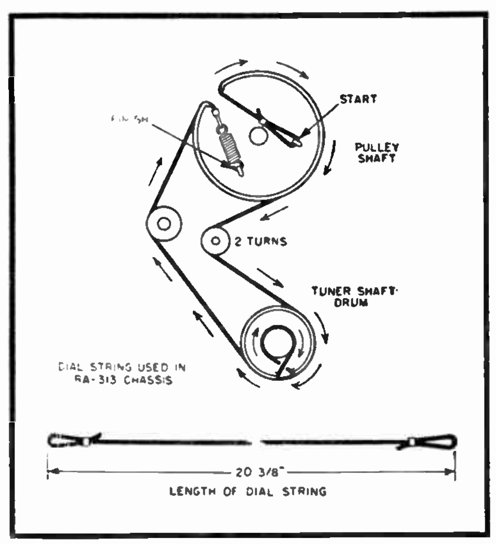
Bradley

Part No.	Description
32 004 431	Panel Front, Mahog.
32 004 432	Panel Front, Blonde
32 004 433	Panel Front, Walnut





DIAL STRINGING



NOTES

1. All waveforms and voltages were taken under operating conditions. The receiver was tuned to an average strength TV signal, the Contrast control rotated fully clockwise and the Noise control was rotated fully counter-clockwise.
2. The Noise control and Local-Distance switch consists of a potentiometer, R319, and a snap switch, S202. When R319 is rotated fully counter-clockwise S202 opens (Local position as shown in the schematic).
3. Voltages ± 20% of those shown are normal.
4. All resistors are 10%, one-half watt, unless otherwise indicated. W. W. indicates wire wound resistor.
5. All capacitors are 20%, 500V, unless otherwise indicated. All capacitors are ceramic, unless indicated as follows: M-mica, P-paper, ± -electrolytic, MP-Molded Paper.
6. Tuner 89 013 461 is used in RA-312 chassis with Phono switch and Tone control. Tuner 89 013 561 is used in RA-312 chassis without Phono switch and Tone control. Tuner 89 012 912 and filter N202 are used with UHF tuner 89 013 293 in RA-313 chassis.
7. In some of the earlier chassis the circuit is as follows: Pin 6 of the 6CB6 2nd video i-f is connected to the junction of R210 and Z203. C218, R206 are not used. R222 is a 4.7K 10% 2W resistor connecting to the + 235 volt line. R262 is a 120K 10% 1/2W resistor, R258 is a 220K 10% 1/2W resistor and R266 is a 1.8 Meg. 10% 1/2W resistor. A 180K 10% 1/2W resistor is connected between the junction of R261, R262 and the junction of R260 and R266. R300 is connected to pin 3 of the 12BH7 Vertical Deflection Amplifier.

MODELS 748B, 748C,
798B

MODELS 777B
796B

MODELS 787A, 787B,
797B, 797C

RECEIVER CHARACTERISTICS

ITEM	DESCRIPTION
Voltage Rating	115 V. - 60 Cycles A. C.
Power Consumption	205 Watts
Frequency Range VHF	54 - 88 mc.; 174 - 216 mc.
Frequency Range UHF	470 - 890 mc.
Intermediate Frequencies	Video - 45.75 mc. Audio - (intercarrier) 4.5 mc.
Antenna Input Impedance	300 ohms, Balanced
Channel Selection VHF	Twelve Position Rotary Turret
Channel Selection UHF	Continuous Tuning Channels 14 to 83

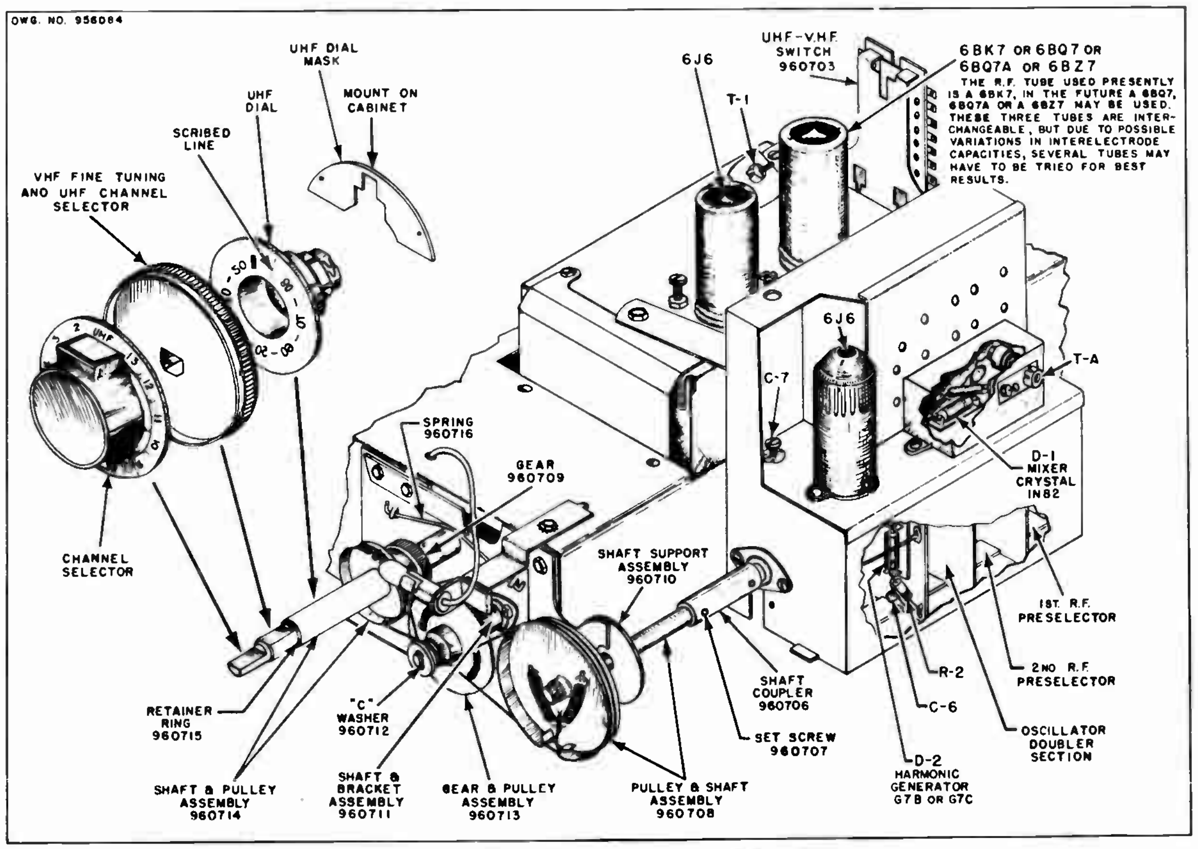


FIGURE 3 - UHF-VHF TUNER ASSEMBLY DRAWING
CHASSIS 120179-B & 120203-B

CHASSIS DIFFERENCES

UHF-VHF Chassis 120179-B and 120203-B are electrically similar. Different chassis numbers have been assigned due to the slightly different placement of the 5U4GT rectifier tubes.

VHF Chassis 120204-B and 120205-B are also electrically similar, but have been assigned different chassis numbers for the same reason as above.

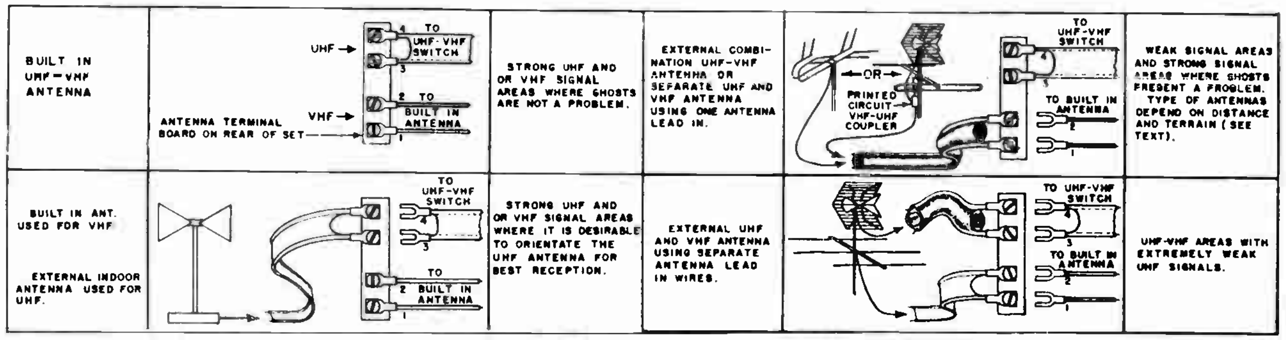


Figure 4. ANTENNA CONNECTIONS

ALIGNMENT V.H.F.

ALIGNMENT

a. Equipment Required - A sweep generator, (10 MC. sweep with center frequency of 44 MC. plus all necessary R.F. sweep frequencies as listed in R.F. Table), accurate marker generator, oscilloscope and V.T.V.M. are required for alignment. The marker generator must supply frequencies of 4.5 MC., 40 to 48 MC. and 50 to 216 MC.

b. Alignment Points - The location of all I.F. transformers, Tuned Circuits, and trimmers shown in Figure 9.

TV R.F. & MIXER ALIGNMENT (V.H.F.)

Connect 3 volt bias battery to both I.F. and R.F. AGC. circuits, positive terminal to chassis, negative terminal to junction of R-19, C-19, C-18. Add a jumper wire from this junction to junction of R-10, R-16, C-8 so that the bias battery is also applied to I.F. AGC.

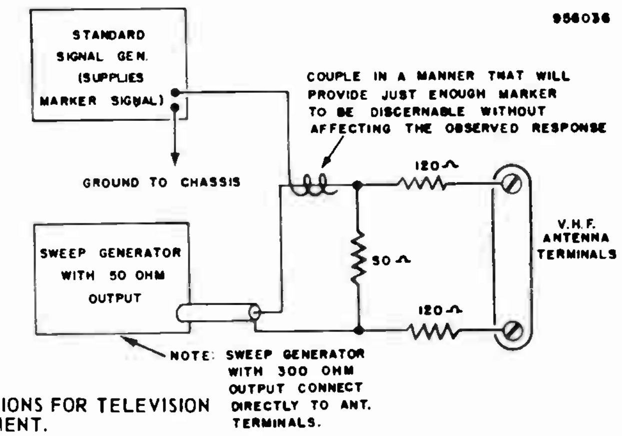


Figure 5. GENERATOR CONNECTIONS FOR TELEVISION R.F. CHANNEL ALIGNMENT.

ALIGNMENT OF MIRACLE PICTURE LOCK (Horizontal A.F.C. & Osc.)

Before proceeding be sure the Fringe Compensator Switch has been turned "OFF" (fully counter clockwise past click).

1. Tune set to a good channel.
2. Short phase coil (L-13) with a jumper wire, leads have been brought to top of chassis on terminal strip near V-13 horizontal oscillator (see tube location diagram Figure 11).
3. Short horizontal control grid to chassis. This point has also been brought to top of chassis on same strip as mentioned in Step 2.
4. Rotate horizontal hold control (R-73) to center of its mechanical range.
5. Adjust horizontal balance control (R-71) (rear of chassis) until picture pulls into synchronism (in most cases picture will sway from side to side).
6. Remove short from horizontal phase coil (L-13) and adjust L-13 for same synchronous condition as Step 5 above.
7. Remove short from horizontal control grid. Horizontal frequency circuits are now properly aligned.
8. When properly adjusted (Steps 1 to 7) the horizontal hold control can be moved slowly over most of its range without throwing the picture out of sync.
9. Readjust horizontal hold control (R-73) so that the picture remains in sync when switching channels (near center of range).

ADJUSTMENT OF NOISE INVERTER (Fringe Compensator)

1) Be sure the miracle picture lock has been properly adjusted (horizontal hold circuits). See above.

2) Tune in a weak station. Turn fringe compensator switch to the "ON" position and adjust the fringe compensator control for best picture stability.

3) Try all channels and readjust fringe compensator if necessary for best overall picture stability.

NOTE: In most locations this added protection will not be necessary and the fringe compensator should remain in the "OFF" position. If this is not done, picture wiggle and or vertical roll might result in strong signal areas.

SWEEP & MARKER GENERATOR CONNECTIONS	SWEEP & MARKER GENERATOR FREQ. RANGE	MARKER GEN. FREQ.	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 5 and adjust sweep controls for width so that complete channel response may be observed as shown in Fig. 6	Channel #12 207 MC. Center Freq.	209.75 MC. Sound Carrier 205.25 MC. Pix Carrier	Vert. input of scope through 10K resistor to test point on tuner Fig. 9 Low side to chassis	Set Channel Selector to #12 NOTE Keep output of R.F. Marker Generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	C-2 R.F. Amp. Input Trimmer C-5 R.F. Plate Trimmer C-6 Mixer Grid Trimmer	Adjust Trimmers C-2, C-5 and C-6 to obtain response shown in Fig. 6 IMPORTANT: When adjusting trimmers C-2, C-5 and C-6 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as Above	#13 213 MC.	*215.75 MC. **211.25 MC.	Same as Above	Set Channel Selector to #13 (See Note Above)		The r-f band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers C-2, C-5 and C-6. Adjust the r-f sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers.
	#11 201 MC.	*203.75 MC. **199.25 MC.		Set Channel Selector to #11 (See Note Above)		
	#10 195 MC.	*197.75 MC. **193.25 MC.		Set Channel Selector to #10 (See Note Above)		
	#9 189 MC.	*191.75 MC. **187.25 MC.		Set Channel Selector to #9 (See Note Above)		
	#8 183 MC.	*185.75 MC. **181.25 MC.		Set Channel Selector to #8 (See Note Above)		
	#7 177 MC.	*179.75 MC. **175.25 MC.		Set Channel Selector to #7 (See Note Above)		
	#6 85 MC.	* 87.75 MC. ** 83.25 MC.		Set Channel Selector to #6 (See Note Above)		
	#5 79 MC.	* 81.75 MC. ** 77.25 MC.		Set Channel Selector to #5 (See Note Above)		
	#4 69 MC.	* 71.75 MC. ** 67.25 MC.		Set Channel Selector to #4 (See Note Above)		
	#3 63 MC.	* 65.75 MC. ** 61.25 MC.		Set Channel Selector to #3 (See Note Above)		
	#2 57 MC.	* 59.75 MC. ** 55.25 MC.		Set Channel Selector to #2 (See Note Above)		

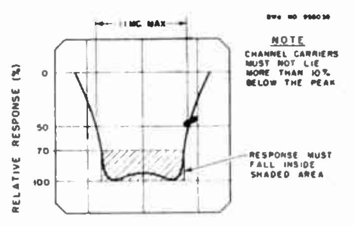


Figure 6 -- TUNER RESPONSE CURVE SHOWING BAND-PASS LIMITS.

The response for all channels should meet with the requirements of Fig. 6. To do so it may be necessary to compromise by slightly changing the initial channel #12 adjustments of C-2, C-5 and C-6 while switched to channel which does not conform.

I.F. ALIGNMENT

1) Tune receiver to unused Channel 10 or 12.

2) Connect 3 volt bias battery with negative terminal to I.F. AGC. (Junction R-10, C-8, R-16) positive terminal to chassis.

3) Connect D.C. V.T.V.M. to video test point, low side to chassis.

4) Connect terminated marker generator to floating shield of converted tube V-23 6J6. (Shield raised slightly so that it does not make contact with chassis). Use unmodulated marker. See Fig. 8.

NOTE: WE HAVE RECENTLY STANDARDIZED ON THE USE OF HEX. HEAD SLUGS. THESE CAN BE ADJUSTED FROM TOP OR BOTTOM. BEFORE ADJUSTING SLUGS MAKE CERTAIN THE CORRECT TYPE OF FIBRE ALIGNMENT TOOL IS USED (SEE FIG. 8A) ALTERNATE PART NUMBERS SHOWN ON PARTS LIST HAVE SLOTTED SLUGS.

MARKER GENERATOR	ADJUST	PROCEDURE
45.75 MC. Unmodulated	T-4	Peak for maximum response. Adjust output of signal generator so that maximum response does not produce more than -2V. D.C. on V.T.V.M.
43.2 MC. Unmodulated	T-3	
42.0 MC. Unmodulated	T-2	
45.0 MC. Unmodulated	L-3 T-1	
41.25 MC. Unmodulated	L-2	Adjust trap for minimum response. Increase output from signal generator so that a true minimum position can be found.

5) Connect vertical input of an oscilloscope instead of V.T.V.M. to video test point with vertical scope gain set at, or near, maximum. (Horizontal scope sweep set at 400 cycles).

MARKER GENERATOR	ADJUST	PROCEDURE
47.25 MC. 400 Cycles Amp. Mod.	L-1	With signal generator set at maximum output, adjust L-1 for minimum vertical response on scope.

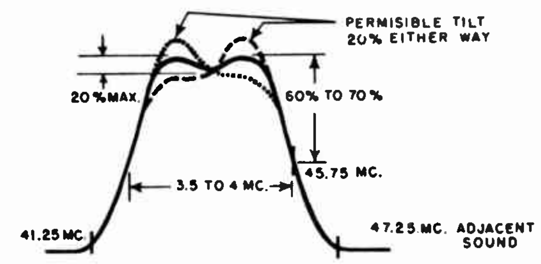
*Sound Carrier Marker
**Picture Carrier Marker

6) Now that all the I.F. coils and transformers have been set, the overall response can be observed and adjusted if necessary.

SIGNAL GENERATOR INPUT CONNECTION	FREQUENCY SWEEP	FREQUENCY MARKER	MEASURING INSTRUMENT	ADJUST	PROCEDURE
Connect terminated sweep and marker as shown in Fig. 8	Center frequency 44 MC. 10 MC. Sweep	45.75 MC.	Scope connected to Video Test Point low side to chassis	T-4	If 45.75 MC. doesn't lie from 60 to 70% down adjust T-4 (see fig. 7) for tolerances. *

Providing overall curve is within tolerances as shown below, no further adjustments are needed. If band width or tilt is not as specified, repeat entire alignment procedure. If still out then a slight retouching is permissible. TRAPS L-1 and L-2 MUST BE ADJUSTED AS INDICATED ABOVE. DO NOT RE-ADJUST WHILE OBSERVING OVERALL I.F. RESPONSE CURVE.

*KEEP OUTPUT OF SIGNAL GENERATOR AS LOW AS POSSIBLE WHEN OBSERVING THE OVERALL I.F. SHAPE SINCE TUBE OVERLOAD MIGHT RESULT AND THE RESPONSE WILL APPEAR INCORRECTLY FLAT AND WIDE.



NOTE: It may be impossible to observe the 47.25 MC. marker with the average service equipment due to the high attenuation of trap L-1 (adjacent sound).

Figure 7. OVERALL I.F. RESPONSE CURVE

All instrument leads should be dressed as shown and kept as short as possible to prevent interaction between input and output leads. Failure to do this may result in an unstable response indication.

NOTE: It is important that the output cable of the sweep and marker generator be properly terminated in their characteristic impedance which is usually from 50 to 75 ohms. If this termination has not been built into the end of the cable by the instrument manufacturer * then a resistor of the proper value (characteristic impedance) should be connected across the output of each generator cable as shown above.

*If in doubt check your instruction book which is issued by the test equipment manufacturer.

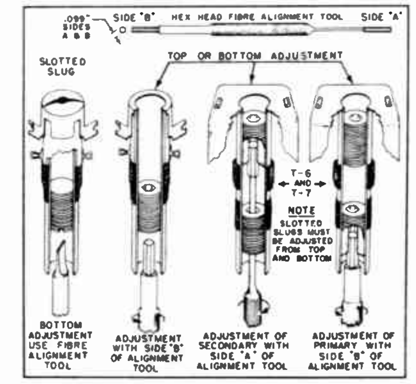


FIGURE 8A

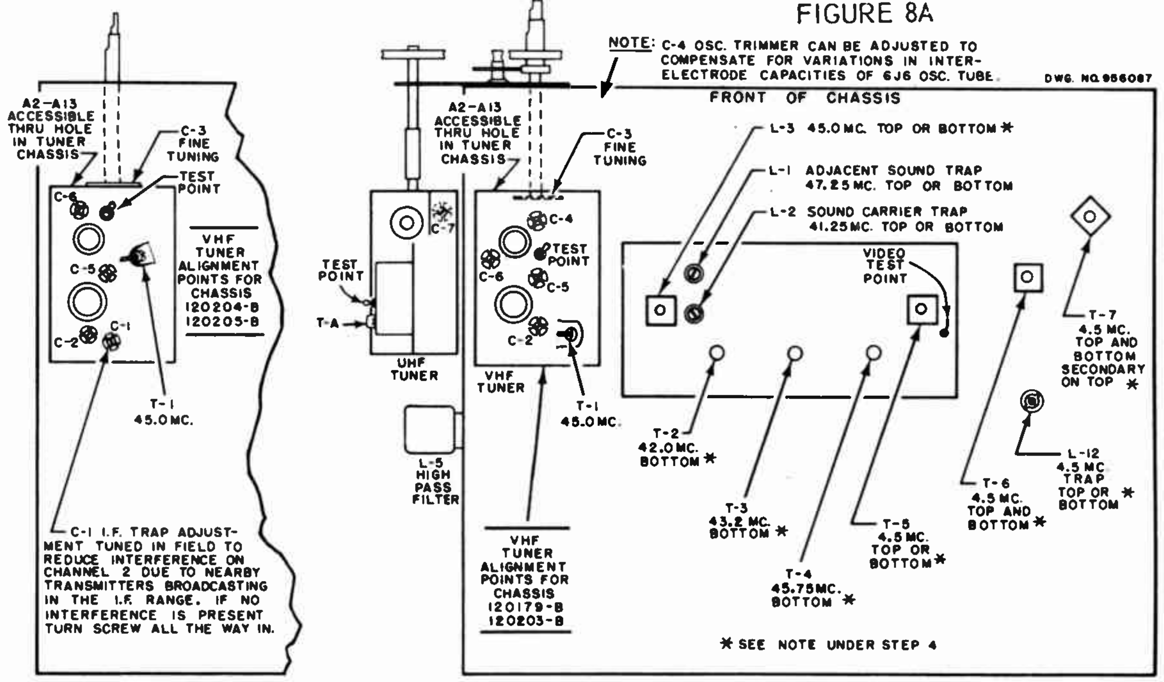
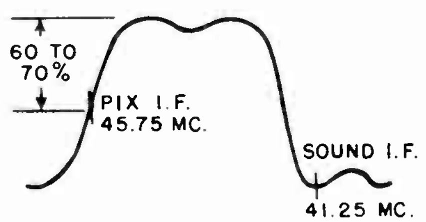


Figure 9. LOCATION OF ALIGNMENT POINTS (TOP VIEW)

R.F. OSCILLATOR ALIGNMENT (V.H.F.)

1. Connect maker and sweep generator as shown in Figure 5, low side to chassis.
2. Connect scope to junction L-8, R-22, low side to chassis or video test point.
3. Connect 3 volt bias battery as described under R.F. alignment
4. Before undertaking oscillator alignment be sure I.F. circuits are correctly aligned for band pass characteristic and trap settings.
5. During oscillator alignment, it is necessary to set the fine tuning control so that the tooth on the fine tuning cam points downward. On the 470712 tuner the flat of the fine tuning shaft should point downward with respect to the bottom of the chassis.

MARKER SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR FREQUENCY	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
*209.75 MC. **205.25 MC.	Channel #12 Center Frequency 207 MC. 10 MC. Sweep	Be sure that fine tuning control has been properly positioned (tooth on the cam pointing down) NOTE During this step and thru-out all succeeding steps it is necessary to: 1. Keep output of sweep generator at a level that does not allow the reading on a VTVM to exceed minus 1 volt when connected across video detector load at minimum sweep width. 2. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	Adjust Slug A-12	NOTE: Before making the following adjustment, advance the vertical gain control on the scope in order to magnify the sound trap portion of the response curve. Then, use a non-metallic screwdriver to adjust channel #12 oscillator slug (accessible thru hole on front of r-f tuner unit) and shift response curve so that sound carrier marker is located at the position indicated below. Now reduce gain control setting of scope to restore pattern to normal amplitude and observe position of picture carrier marker. This marker should appear on the high frequency side of the characteristic curve. The amplitude of the picture carrier should be between 60 and 70% down from peak response.
*215.75 MC. **211.25 MC.	Channel #13 213 MC.	Set Channel Selector to #13 (See note above)	Adjust the r-f sweep generator and marker generator for operation on other television channels; set marker generator to sound carrier frequency. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of r-f tuner unit. (A-2 to A-13) This permits response curve to be shifted so that sound carrier marker will appear at the position indicated below.	
*203.75 MC. **199.25 MC.	Channel #11 201 MC.	Set Channel Selector to #11 (See note above)		
*197.75 MC. **193.25 MC.	Channel #10 195 MC.	Set Channel Selector to #10 (See note above)		
*191.75 MC. **187.25 MC.	Channel #9 189 MC.	Set Channel Selector to #9 (See note above)		
*185.75 MC. **181.25 MC.	Channel #8 183 MC.	Set Channel Selector to #8 (See note above)	 TYPICAL OVERALL RESPONSE CURVE	
*179.75 MC. **175.25 MC.	Channel #7 177 MC.	Set Channel Selector to #7 (See note above)		
* 87.75 MC. ** 83.25 MC.	Channel #6 85 MC.	Set Channel Selector to #6 (See note above)		
* 81.75 MC. ** 77.25 MC.	Channel #5 79 MC.	Set Channel Selector to #5 (See note above)		
* 71.75 MC. ** 67.25 MC.	Channel #4 69 MC.	Set Channel Selector to #4 (See note above)		
* 65.75 MC. ** 61.25 MC.	Channel #3 63 MC.	Set Channel Selector to #3 (See note above)		
* 59.75 MC. ** 55.25 MC.	Channel #2 57 MC.	Set Channel Selector to #2 (See note above)	NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward).	

NOTE: If an unsatisfactory overall response is obtained for a particular channel, observe R-F amp. and Mixer response curve for that channel (as described in R-F Amp. and Mixer Alignment Table). If characteristic curve does not conform reasonably well within the typical curve shown in Figure 6, then do the following things:

1. Check method of connecting scope, voltmeter and generator leads to eliminate possible distortion of observed response, or:
2. Attempt to obtain a better compromise for R.F. response on all channels by realigning R-F Amp. and Mixer circuits, or:
3. Try replacing Antenna, R-F and Oscillator coils for the particular channel.

*Sound Carrier Marker
**Picture Carrier Marker

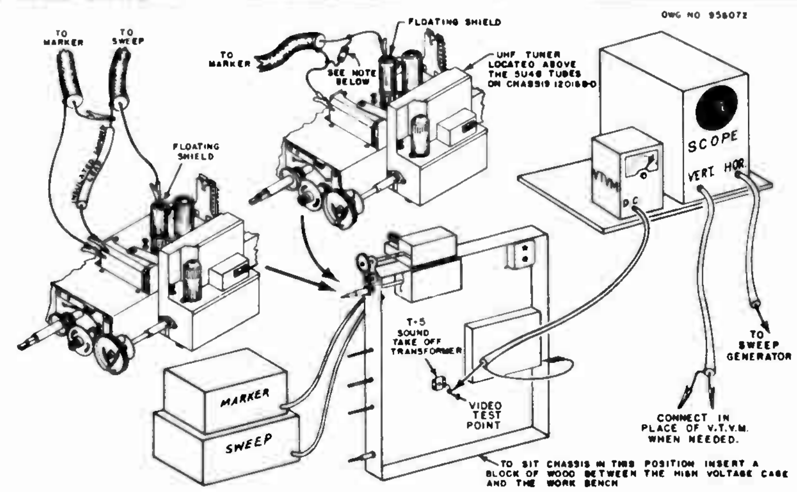


Figure 8. CONNECTIONS FOR I.F. ALIGNMENT

SOUND ALIGNMENT

(A) USING 4.5 mc UNMODULATED SIGNAL GENERATOR

1) Short pin #1 of V-3 Chassis with short jumper wire.
2) Keep output of signal generator low so as to provide a sharp meter indication with adjustment of transformers.

(B) USING TRANSMITTED TV AIR SIGNAL

1) Connect antenna and tune to a good on the air TV station.
2) Adjust fine tuning control for best picture.
3) Adjust antenna coupling for moderate signal so as to provide a sharp meter indication with adjustment of transformers.
4) Meter reading may pulsate due to changes in signal strength; do not confuse with a peak adjustment.

STEP	SIGNAL GENERATOR INPUT		MEASURING INSTRUMENT	ADJUST	PROCEDURE
	CONNECTION	FREQUENCY			
1	Marker Gen. through .01 MF to Pin 7 of V-4 low side to chassis. - or - Connect antenna and tune in a good transmitted TV. signal (any channel)	4.5 MC (Unmodulated) - or - A good on the air TV. channel	Conntec D.C. V.T.V.M. (negative scale) through 10K Resistor to Junction of C-30, R-35, R-36 – low side to chassis.	T-5 Top or Bottom T-6 Top and Bottom	Peak for maximum voltage. Adjust output of signal generator to produce about a one volt D.C. rise on meter (1 volt above noise* voltage) If T.V. signal is used adjust ant. coupling to receiver to produce about the same voltage rise.
2	Same as above.	Same as above.	Connect V.T.V.M. through 10K Resistor to Junction of R-44, C-34 – low side to chassis.	T-7 Top and Bottom (Discriminator on top)	A) Detune Discriminator secondary T-7 for maximum negative meter reading. B) Adjust primary T-7 for maximum negative meter reading. C) Readjust Discriminator secondary (towards original setting) for zero D.C. reading on V.T.V.M. D) Check Audio, if distorted repeat steps A – C.

* The noise voltage is measured under no signal conditions (antenna terminals shorted directly at tuner by means of a short jumper wire; or disconnect 4.5 MC. generator if procedure (A) above is followed.)

4.5 MC VIDEO TRAP ALIGNMENT (L-12)

1. Connect crystal controlled 4.5 mc. signal generator through a .01 mf. condenser to the grid of the video amplifier tube (Pin 1 of V-5, 6CB6) low side to chassis.
2. Set contrast control for maximum contrast (fully clockwise).
3. Connect a V.T.V.M. (D.C. scale) through an R.F. probe to the cathode of the picture tube (Pin 11, yellow lead) low side to chassis.
4. Adjust the 4.5 mc. trap L-12 for minimum reading on the V.T.V.M.

If a crystal controlled generator is not available the video trap can be adjusted in the field by setting the fine tuning control for maximum 4.5 mc. in picture and adjusting the 4.5 mc. trap (L-12) until this 4.5 mc. beat note is reduced. Be sure that video ringing is not introduced from this adjustment since this indicates the trap was aligned at too low a frequency.

ALIGNMENT (UHF TUNER)

The alignment of the tuner is factory set and will actually not require any additional adjustments other than to compensate for differences in 6J6 oscillator tubes. Because of this fact, the only adjustment to be made in the field is trimmer C-7 which is located next to the 6J6 oscillator tube.

This trimmer is normally set at the factory to track the highest U.H.F. channel (83). This must be done with a U.H.F. sweep and marker generator. In the field however, this equipment is not readily available and C-7 should therefore be used to track the highest U.H.F. channel received in the area. It is usually best to try a few 6J6 tubes until one is found which more nearly resembles the original, thus requiring only a slight adjustment of C-7.

In the event T-A has been tampered with or replaced, it should be adjusted for best results on all U.H.F. channels received in the area. This I.F. sometimes normally has only a slight effect on the picture or sound.

Before doing any work on this U.H.F. tuner, whether in the field or shop, be sure that the V.H.F. I.F. and R.F. circuits have been properly set up, (this can be checked by viewing an on the air V.H.F. channel or by instruments).

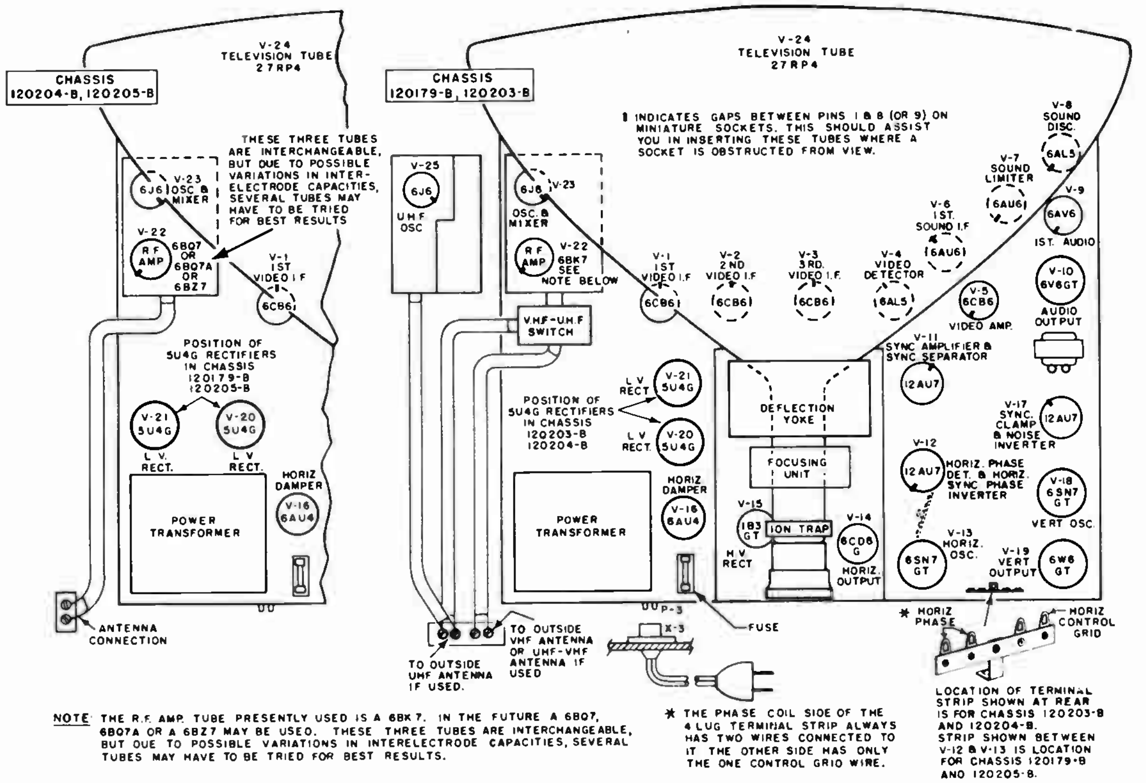


Figure 11. TUBE LOCATIONS DIAGRAM FOR CHASSIS 120179-B, 120203-B, 120204-B, 120205-B

TUBE TROUBLE ANALYSIS CHART FOR CHASSIS 120179-B 120203-B, 120204-B, 120205-B

SYMPTOM	CHECK
Weak or no sound nor video (picture), raster normal - UHF only	V-25, D-1, D-2 *
Weak or no sound nor video (picture), raster normal - UHF and or VHF	V-22, V-23, V-1, V-2, V-3, V-4 *
Weak or no sound - Video and raster normal - - - - - UHF and or VHF	V-6, V-7, V-8, V-9, V-10
Weak or no video - Sound and raster normal - - - - - UHF and or VHF	V-5, V-24
Poor or no horizontal nor vertical sync - sound and video normal (contrast control makes video darker or lighter) - UHF and or VHF	V-11, V-17
Poor or no horizontal nor vertical sync - Video weak or distorted, raster normal - sound may or may not be normal - UHF and or VHF	V-22, V-23, V-1, V-2, V-3, V-4
Poor or no horizontal sync - raster normal and sound normal (picture locks in vertically) - - - - - - - - - UHF and or VHF	V-11, V-12, V-13, V-17
Poor or no vertical sync - raster normal and sound normal (picture locks in horizontally) - - - - - - - - UHF and or VHF	V-11, V-17, V-18
Horizontal line (no vertical sweep) - sound normal - UHF and or VHF	V-18, V-19
Insufficient horizontal size, sound & video normal - UHF and or VHF	V-14, V-16, V-20, V-21 V-26**
Insufficient vertical size, or white horizontal bar in picture, horizontal size OK - - - - - - - - - - UHF and or VHF	V-19
No sound, no raster - tubes lit - - - - - - - - - - - - UHF and or VHF	Fuse, V-20, V-21
No sound, no raster - tubes not lit - - - - - - - - - - UHF and or VHF	Plug connection in wall socket, ON-OFF switch, line cord.

By raster we mean the illuminated scanning lines.

* Another very common fault is a shorted or open circuit antenna connection to set.

** Some 120179-B chassis used two 6AX4GT tubes (V-16, V-26) instead of one 6AU4G (V-16).

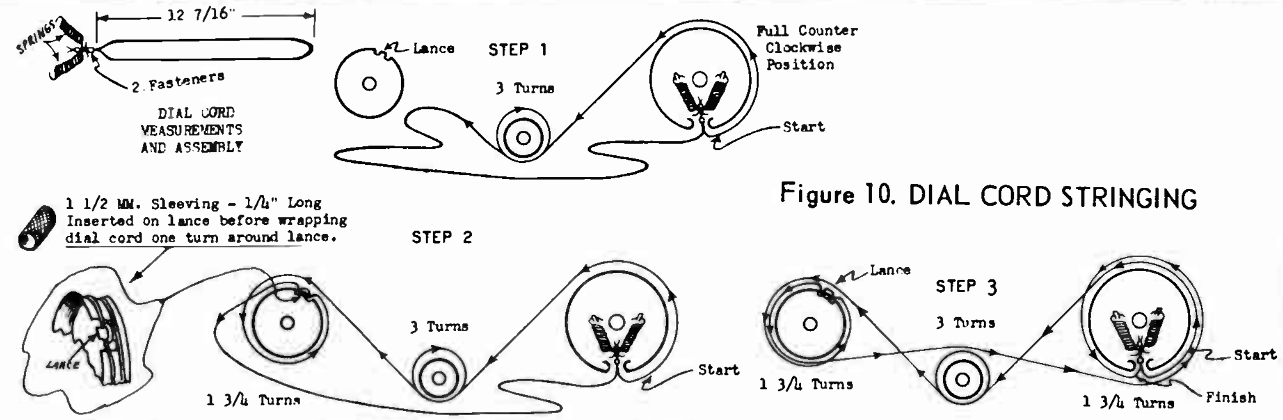
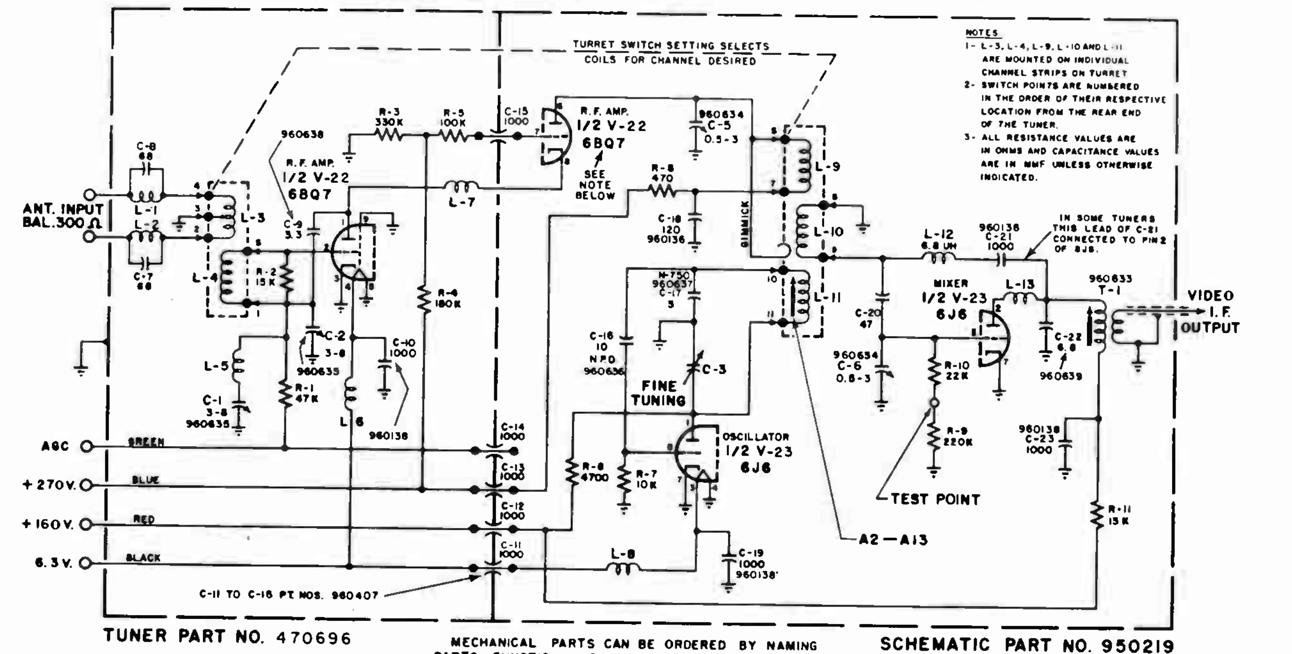


Figure 10. DIAL CORD STRINGING



NOTE: THE R.F. AMP. TUBE PRESENTLY USED IS A 6BQ7. IN THE FUTURE A 6BQ7, 6BQ7A OR A 6BZ7 MAY BE USED. THESE THREE TUBES ARE INTERCHANGEABLE, BUT DUE TO POSSIBLE VARIATIONS IN INTERELECTRODE CAPACITIES, SEVERAL TUBES MAY HAVE TO BE TRIED FOR BEST RESULTS.

Figure 12. SCHEMATIC DIAGRAM OF TURRET TYPE TUNER USED ON VHF CHASSIS 120204-B, 120205-B

REPAIR OF VHF TUNER

The majority of tuner troubles which are not due to defective tubes can usually be detected by a physical examination of the tuner (turret removed), such as burnt resistors, broken parts, bent or dirty contact fingers, cold solder joints, broken socket pins, etc.

If the tuner checks out physically it should then be checked according to the following trouble shooting chart.

It should always be borne in mind that a burnt resistor is usually the result of a shorted condenser or tube.

The part numbers of items which are not generally commercially available are given on the tuner schematic. When replacing parts, leads should be kept as short as possible and components replaced in the same position as the original parts.

More detailed general information on turret tuner repairs can be found in Service Note titled "Emerson Turret Type Tuner #470651" released April 1, 1951.

TUNER TROUBLE SHOOTING CHART

Measurements taken under same conditions as listed   To take measurements from 6BQ7 socket, remove 6BQ7 tube but leave 6J6 tube in its socket, likewise when taking measurements from the 6J6 socket leave 6BQ7 tube in its socket.

V-22	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6BQ7 or 6BQ7A or 6BZ7	Pin 1	OV.	INF.	(C-9, 3.3 mmf) shorted
	Pin 2	-.27V	1.4 meg	(R-2, 15K) or (R-1, 47K) open or shorted
	Pin 3	OV.	0 ^	Cold solder joint
	Pin 6	+270V.	20K	(C-5) trimmer shorted, (C-18, C-13) shorted, (L-9) open, (R-8, 470 ohm) open or shorted
	Pin 7	+158V.	260 K	(R-3, 330 K), (R-4, 180 K) or (R-5, 100 K) open or shorted, (C-15, 1000 mmf) shorted
	Pin 8	OV.	INF.	(C-9, 3.3 mmf) shorted
	Pin 9	OV.	0 ^	Cold solder joint

V-23	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6J6	Pin 1	+160V.	17K	(R-6, 4700 ohm) open or shorted, (C-12, 1000 mmf), (C-16, 10 mmf) or (C-17, 5 mmf) shorted
	Pin 2	+160V.	30K	(L-13) open, (C-21, 1000 mmf), (C-22, 6.8 mmf) or (C-23, 1000 mmf) shorted, (R-11, 15 K) open or shorted
	Pin 5	OV.	230K	
	Pin 6	OV.	10 K	(C-16, 10 MMF) shorted
	Pin 7	OV.	0 ^	Cold solder joint
	Test Point	−1 V. to −4 V.	210K	Oscillator injection voltage varies between channels (low frequency channels have higher injection voltage about −4 v.)

GENERAL TROUBLE SHOOTING INFORMATION (UHF TUNER)

Since the operation of this tuner is dependent almost entirely on its mechanical configuration, all component parts whether lumped constants or transmission line sections, have been manufactured and mounted as rigid as possible. If it is necessary to replace a component, the exact replacement part should be used. Be sure it is mounted in the same position using the same lead lengths as the original. This is very important since at UHF frequencies a small piece of wire has an appreciable inductance. Stray capacitances between components and chassis also tend to effect the circuit's operation to a marked degree.

Due to the simplicity of design and manufacture of this tuner, little trouble is to be expected. In the event that this tuner becomes defective in any way, the trouble shooting chart in this note can be used to good advantage.

If the crystal D-2 is open or shorted, or the oscillator is inoperative, there will be no bias developed across R-2. If replacing D-2 does not rectify this condition, then it can be assumed that the oscillator is not functioning.

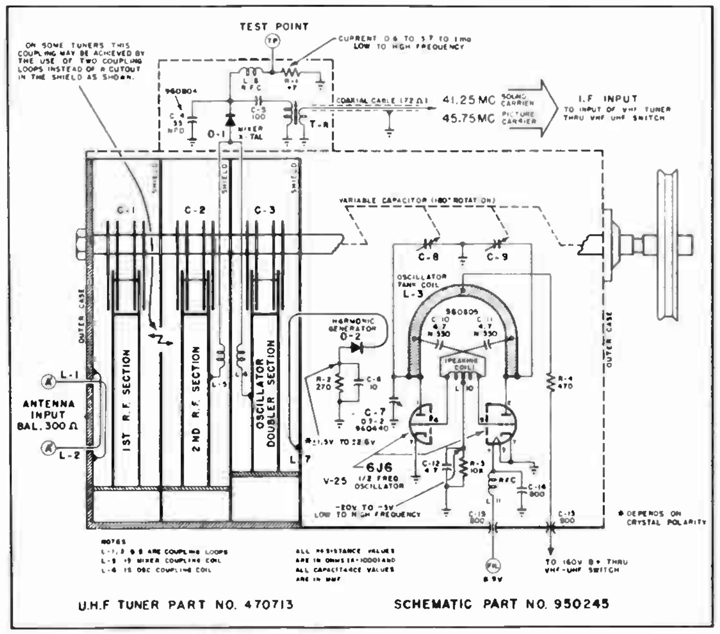


Figure 13 – SCHEMATIC DIAGRAM UHF TUNER 470713

Be sure that the harmonic generator coupling loop (L-7) is not touching the shield. A voltage and resistance check of the 6J6 oscillator circuit should soon locate the trouble.

If the correct bias is measured across the resistor R-2 and the set still operates poorly on UHF, then it can be assumed that the mixer crystal D-1 is defective in some way. This can easily be determined by lifting R-1 off chassis and inserting a D.C. milliameter between it and chassis. In the event that the current readings are abnormally low or high, a new crystal known to be good should be inserted (see trouble shooting chart). If it is desired to localize the difficulty further, C-4 and, or C-5 can be disconnected. When soldering near crystals, be sure to use a small tipped, low wattage iron, placing the pliers between the crystal and the connection so as to absorb the heat thus protecting the crystal. This is important, since excessive heat can easily damage it.

Do not attempt to repair or adjust this tuner by adjusting any of the coupling loops or by moving various components. The only adjustment that can be made in the field is C-7 to compensate for a change in interelectrode capacities when a new 6J6 is used. The proper procedure for this is shown under alignment

Components which are not a part of the R.F. or oscillator tuned circuits such as feed thru condensers, B plus resistors, T-A, etc., can usually be replaced with little difficulty providing the above precautions are observed.

NOTE: In the event that this tuner needs an overall alignment or service of parts, the defective tuner should be returned for repairs through your Emerson distributor.

REPLACEMENT OF TUNERS (UHF - VHF CHASSIS)

If it becomes necessary to return a UHF tuner to your distributor for repair or replacement, remove and retain the extension shaft and pulley. When returning the VHF tuner, remove and retain the VHF-UHF switch and the front plate which consists of a pulley and gear combination. This is important since replacement tuners will not come equipped with the above devices.

Under no conditions are both the VHF and UHF tuners to be returned as a unit. Before returning for replacement or repair, an honest effort should be made to repair the unit since all special and major parts will be available through your Emerson distributor.

TROUBLE SHOOTING CHART (UHF TUNER)

Component		Variations Low to High Frequency	POSSIBLE TROUBLE (If voltage readings not normal)
6J6	B+ Filament R-3	+160V. 6.3V. A.C -20V. to -3V.	C-10, C-15, C-11 shorted, the V.H.F.-U.H.F. switch L-11 open, C-14, C-13 shorted R-3 open, C-12 shorted, L-10 open or shorted
D-2 Harmonic Gen. Crystal	R-2	-1.5V. to -2.6V.	Crystal defective, C-6 shorted Voltage polarity depends upon crystal polarity
D-1 Mixer Crystal	Current thru R-1 Insert Milliameter	0.6 thru 3.7 to 1.00 ma. (current)	D-1 defective, C-4 shorted, L-8 open

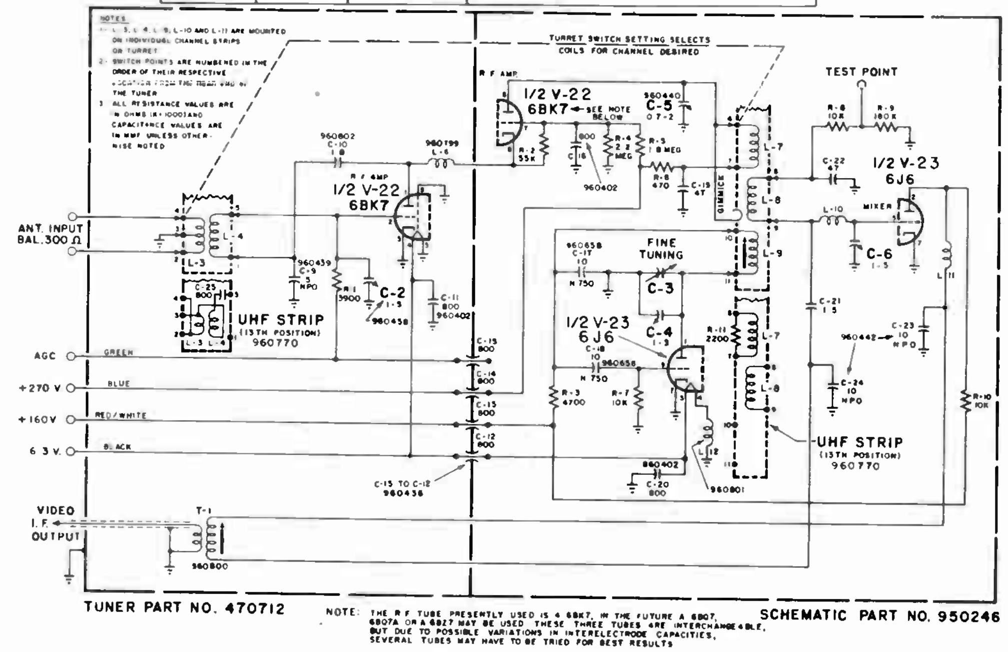


Figure 14. SCHEMATIC DIAGRAM OF VHF TUNER 470712 USED ON UHF-VHF CHASSIS 120179-B, 120203-B

REPAIR OF TUNER

The majority of tuner troubles which are not due to defective tubes can usually be detected by a physical examination of the tuner (turret removed), such as burnt resistors, broken parts, bent or dirty contact fingers, cold solder joints, broken socket pins, etc.

If the tuner checks out physically it should then be checked according to the following trouble shooting chart.

It should always be borne in mind that a burnt tuner resistor is usually the result of a shorted condenser or tube.

The part numbers of items which are not generally commercially available are given on the tuner schematic. When replacing parts, leads should be kept as short as possible and components replaced in the same position as the original parts.

TUNER TROUBLE SHOOTING CHART

Measurements taken under same conditions as listed To take measurements from 6BK7 socket, remove 6BK7 tube but leave 6J6 tube in its socket. likewise when taking measurements from the 6J6 socket leave 6BK7 tube in its socket. VHF tuner switched to any channel except UHF position.

V-22	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6BK7 or 6BQ7 or 6BQ7A or 6BZ7	Pin 1	105V	2 meg.	(C-9, 3.3 mmf) shorted
	Pin 2	−.4V.	1.6 meg.	(R-2, 15K) or (R-1, 47K) open or shorted
	Pin 3	OV.	0 ^	Cold solder joint
	Pin 6	+270V.	24K	(C-5) trimmer shorted, (C-18, C-13) shorted, (L-9)open, (R-8, 470 ohm) open or shorted
	Pin 7	+142V.	1.6 meg.	(R-3, 330 K),(R-4, 180 K) or (R-5, 100 K) open or shorted, (C-15, 1000 mmf) shorted
	Pin 8	+142V..	1.6 meg.	(C-9, 3.3 mmf) shorted
	Pin 9	OV.	0 ^	Cold solder joint

V-23	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6J6	Pin 1	+160V.	17K	(R-6, 4700 ohm) open or shorted, (C-12, 1000 mmf), (C-16, 10 mmf) or (C-17, 5 mmf) shorted
	Pin 2	+160V.	25K	(L-13) open, (C-21, 1000 mmf), (C-22, 6.8 mmf) or (C-23, 1000 mmf) shorted, (R-11, 15 K) open or shorted
	Pin 5	OV.	200 K	
	Pin 6	OV.	10 K	(C-16, 10 MMF) shorted
	Pin 7	OV.	0 ^	Cold solder joint
	Test Point	−.5V. to −3.5V.	180 K	Oscillator injection voltage varies between channels (low frequency channels have higher injection voltage about −4 v.)

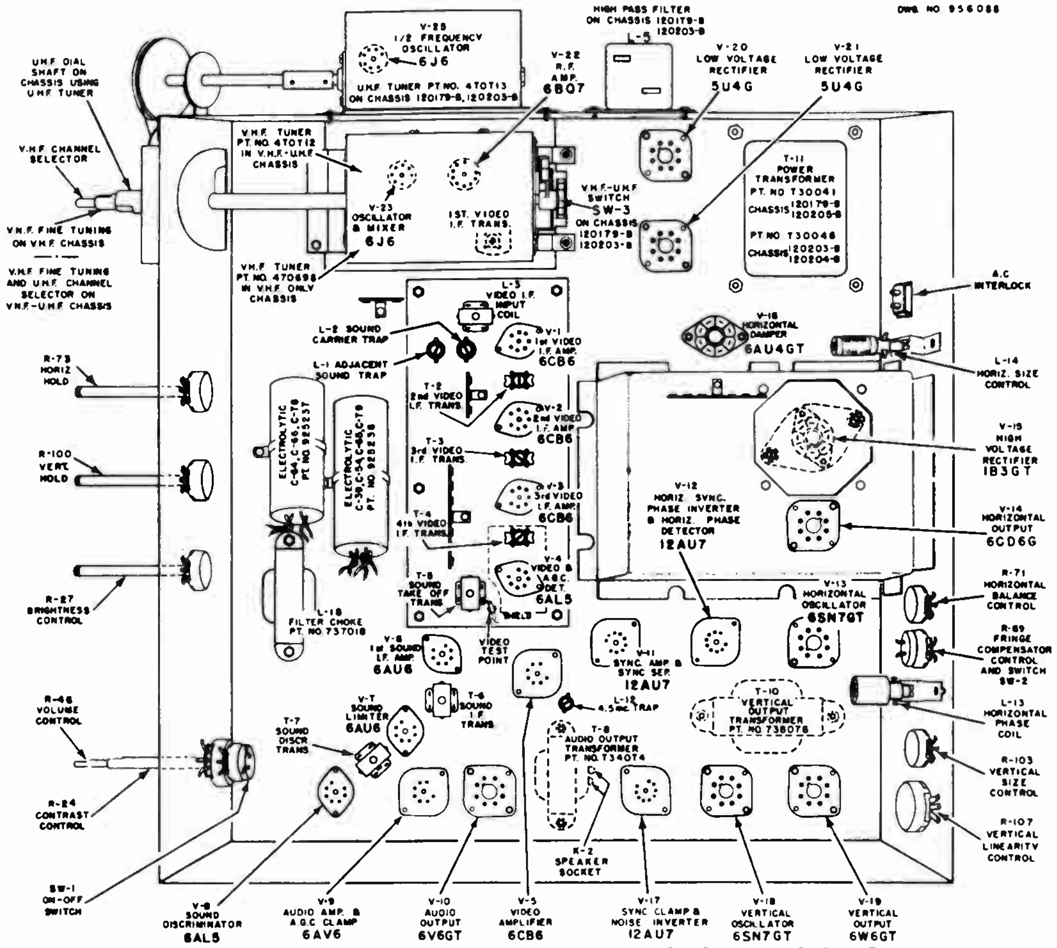


Figure 16. UNDERSIDE VIEW OF CHASSIS. 120179-B & 120205-B

NOTE: UNDERSIDE VIEW OF CHASSIS 120203-B & 120204-B THE SAME AS ABOVE EXCEPT FOR LOCATIONS OF 5U4G RECTIFIER TUBES

PRODUCTION CHANGES

In the course of production various changes were incorporated in the order shown below. Changes as listed under a particular letter also include changes as listed under all previous letters unless otherwise noted. All changes released after this note is printed will be sent out to our distributors in the form of field service bulletins. These should be kept together with the service note for future reference. By utilizing this information the schematic can be easily modified to correspond to a chassis of any triangle code.

1. The wattage of resistors R-108 (470 ohms) and R-110 (33,000 ohm) have increased from 1/2 watt to 1 watt to prevent these resistors from overloading at extreme settings of the vertical size and linearity controls. Chassis incorporating this change are coded as follows.
   120179-B △A 120203-B, 120204-B, 120205-B – Initial Production

2. For standardization purposes the two 6AX4GT damper tubes (V-16, V-26) have been replaced with a single 6AU4GT damper tube (V-16). Chassis incorporating this change are coded as follows.
   120179-B △B 120203-B, 120204-B, 120205-B – Initial Production

3. Due to component variations it was found necessary to change R-74 from 330K to 390K 1/2 watt in order to eliminate an overdrive bar that has developed (white vertical line in raster).
   At the same time a 100mmf 4kv. condenser (pt. No. 928114) was added between terminals 4 and 8 of the horizontal output transformer to increase width for low line voltage operation. Chassis incorporating these changes are coded as follows.
   120179-B △C 120203-B, 120204-B – Initial Production 120205-B △B

NOTE: Triangle △A on the 120205-B chassis signifies the use of a 27RP4 picture tube instead of a 27EP4. Since the 27RP4 has an acquadag coating it forms it's own Hi-voltage filter condenser and as a result C-61 (500 mmf, 30kv.) and R-84 (100K, 1 watt) are omitted. The 27RP4 is used on the 120203-B and 120204-B chassis.

4. C-38 .0047 mf condenser has been increased from 400 to 600 volts to reduce the possibility of failure in the event the set is operated with the speaker disconnected. Chassis incorporating this change are coded as follows.
   120203-B △A 120204-B △A

5. R-105 has been changed from 1 meg to 1.5 meg to center the range of the vertical size control. Chassis incorporating this change are coded as follows.
   120203-B △B 120204-B △B

CONDITIONS FOR TAKING VOLTAGE AND RESISTANCE READINGS

The voltage and resistance measurements listed were taken on chassis 120205-B, coded with a triangle. △A

Due to component variations, voltage and resistance readings may vary slightly from those given here. Slight variations may also be noticed if chassis is not coded as mentioned above. Slight variations may be noticed on chassis 120179-B, 120203-B & 120204-B due to difference in coding for same triangle change.

The deflection yoke and high voltage circuits were connected to take the following readings and waveshapes.

1. Antenna disconnected and antenna terminals shorted on tuner and connected to chassis (use short leads).
2. Line voltage 117 volts (Disconnect power for resistance readings).
3. 3 volt bias battery connected to A.G.C. circuit, positive terminal to chassis, negative terminal to junction of R-10, C-8, R-16 BIAS BATTERY USED FOR VOLTAGE READINGS ONLY.
4. All controls in position for normal picture. (Varied when it directly effects reading).
5. All measurements taken with a vacuum tube voltmeter and ohmmeter.
6. All readings listed in tables were taken between points shown and chassis.
7. Resistance readings are given in ohms unless otherwise noted.
8. N.C. denotes no connection.

VOLTAGE READINGS

SYMBOL	TUBE PIN NUMBERS								
	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V-1	-3V.	.8V.	6.3V. A.C.	0V.	158V.	158V.	0V.		
V-2	-3V.	.7V.	6.3V. A.C.	0V.	158V.	158V.	0V.		
V-3	0V.	2.1V.	6.3V. A.C.	0V.	160V.	160V.	0V.		
V-4	0V.	~1.5V.	6.3V. A.C.	0V.	~.25V.	0V.	~.1V.		
V-5	-1.6V.	0V. to 2.7V.	6.3V. A.C.	0V.	270V.	160V.	0V. to 2.7V.		
V-6	-.2V.	0V.	0V.	6.3V. A.C.	157V.	155V.	2.2V.		
V-7	~.2V.	0V.	0V.	6.3V. A.C.	157V.	37V.	0V.		
V-8	0V.	-.9V.	0V.	6.3V. A.C.	-.15V.	0V.	-.9V.		
V-9	-.6V.	0V.	0V.	6.3V. A.C.	-.25V.	-.25V.	92V.		
V-10		6.3V. A.C.	235V.	242V.	0V.		0V.	15V.	
V-11	68V.	-.25V.	0V.	6.3V. A.C.	6.3V. A.C.	38V.	~.9V.	0V.	0V.
V-12	-.05V.	-.8V.	.4V.	0V.	0V.	150V.	*0V.	8V.	6.3V. A.C.
V-13	± Approx. .2V.	182V.	6.3V.	-7.5V. to 9.4V.	130V.	6.3V.	6.3V. A.C.	0V.	
V-14		0V.	15.5V.		-21V.		6.3V. A.C.	170V.	
V-15	DO NOT MEASURE								
V-16	DO NOT MEASURE				275V.	6AU4 TUBE USED			
V-17	160V. Fringe Comp. Off	~.6V.	12V. to 37V.	. 0V.	0V.	~.6V.	-24V.	0V.	6.3V. A.C.
V-18	0V.	88V.	3.0V.	-24V. to -30V.	90V. to 125V.	3.0V.	6.3V. A.C.	0V.	
V-19		0V.	250V. to 275V.	250V. to 275V.	-1.5V. to **2.4V.		6.3V. A.C.	24V. to 40V.	
V-20		290V.		280V. A.C.		280V. A.C.		290V.	
V-21		290V.		280V. A.C.		280V. A.C.		290V.	

V-24	PIN 1	PIN 2	PIN 10	PIN 11	PIN 12
	0V.	0V.	550V.	0 to 150V.	6.3V. A.C.

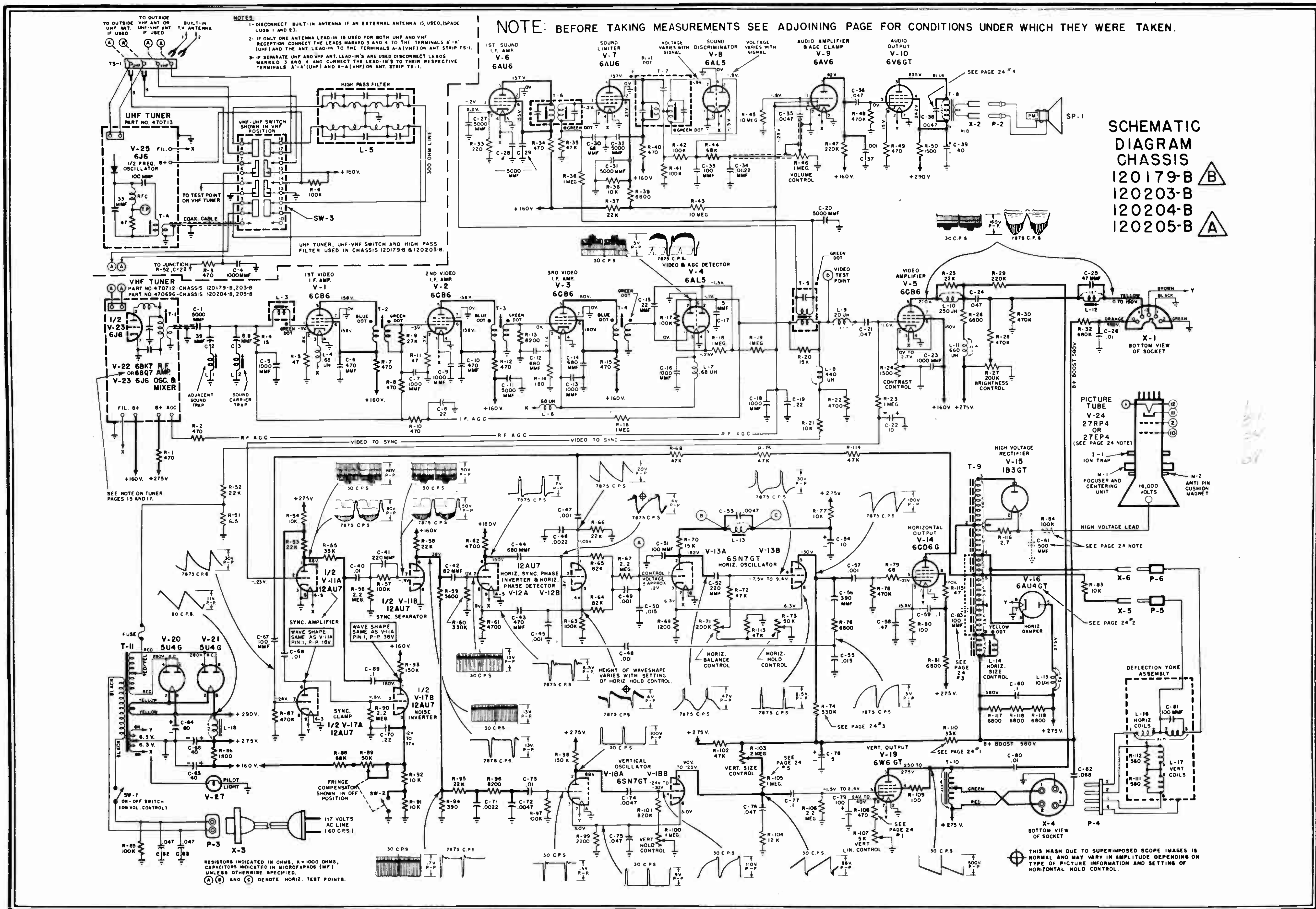
* Varies Depending on Amount of Stray Pickup.
** Voltage Pulsates and Varies with Noise.

RESISTANCE READINGS

SYMBOL	TUBE PIN NUMBERS								
	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V-1	1 MEG.	47	.02	0	*13K	*13K	0		
V-2	1 MEG.	47	0	0	*13K	*13K	0		
V-3	0	180	.02	0	*13K	*13K	0		
V-4	.02	1 MEG.	.6	0	150K	0	4.7K		
V-5	1 MEG.	CONTRAST 0 to 1.5K	.02	0	*22K	*13K	CONTRAST 0 to 1.5K		
V-6	1.05 MEG.	0	0	.02	*13K	*13K	267		
V-7	47K	0	0	.02	*13K	8.8K	0		
V-8	0	100K	0	.02	180K	0	100K		
V-9	10 MEG.	0	0	.02	1.5 MEG.	1.5 MEG.	233K		
V-10	N.C.	.04	*16.5K	*16.5K	470K	V. CONTROL 0 to 210K	0	470	
V-11	*45K	14.7K	0	.02	.02	5.5K	2.3 MEG.	0	0
V-12	22K	264K	100K	0	0	*18K	330K	4.7K	.02
V-13	2.4 MEG.	*37K	1.2K	HORIZ. HOLD CONTROL 100K-140K	440K	1.2K	.02	0	
V-14	N.C.	0	100	*22K	476K	100	.02	*22K	PLATE CAP OF 6CD6 *30K
V-15	PINS 2 AND 7 INFINITE PLATE *30K								
V-16	*32K	N.C.	*32K	N.C.	*14K	N.C.	.05	0	6AU4GT USED
V-18	163K	2.2 MEG	FRINGE COMPENSATOR OFF 18K	0	0	2.2 MEG.	470K	FILAMENT	
V-18	100K	163K	2.2K	VERT. HOLD CONTROL 820 to 1.8K	VERT. SIZE CONTROL 1.5 MEG. to 3.2 MEG.	2.2K	.03	0	
V-19	N.C.	0	*14.2K	14.3K	2.5 MEG.	N.C.	.02	VERT. LIN. CONTROL 470 Ω to 5.4K	
V-20	N.C.	*14K	N.C.	15	N.C.	15	N.C.	*14K	
V-21	N.C.	*14K	N.C.	15	6.5	15	N.C.	*14K	

V-24	PIN 1	PIN 2	PIN 10	PIN 11	PIN 12
	0	0	820K	BRIGHTNESS CONTROL 220K to 240K to 220K	.02

* Varying Resistance – Wait until meter settles (about 30 seconds).


NOTE: BEFORE TAKING MEASUREMENTS SEE ADJOINING PAGE FOR CONDITIONS UNDER WHICH THEY WERE TAKEN.
SCHEMATIC DIAGRAM CHASSIS
120179-B B
120203-B
120204-B
120205-B A
NOTES:
1- DISCONNECT BUILT-IN ANTENNA IF AN EXTERNAL ANTENNA IS USED. (SPADE LUGS 1 AND 2).
UHF TUNER PART NO. 470713
VHF TUNER
HIGH PASS FILTER
UHF TUNER, UHF-VHF SWITCH AND HIGH PASS FILTER USED IN CHASSIS 120179-B & 120203-B
1ST SOUND I.F. AMP. V-6 6AU6
SOUND LIMITER V-7 6AU6
SOUND DISCRIMINATOR V-8 6AL5
AUDIO AMPLIFIER & AGC CLAMP V-9 6AV6
AUDIO OUTPUT V-10 6V6GT
1ST VIDEO I.F. AMP. V-1 6CB6
2ND VIDEO I.F. AMP. V-2 6CB6
3RD VIDEO I.F. AMP. V-3 6CB6
VIDEO & AGC DETECTOR V-4 6AL5
VIDEO AMPLIFIER V-5 6CB6
PICTURE TUBE V-24 27RP4 OR 27EP4
HIGH VOLTAGE RECTIFIER V-15 1B3GT
HORIZONTAL OUTPUT V-14 6CD6G
V-16 6AU4GT
V-13A V-13B 6SN7GT HORIZ. OSCILLATOR
12AU7 HORIZ. SYNC. PHASE INVERTER & HORIZ. PHASE DETECTOR V-12A V-12B
1/2 V-11A 12AU7 SYNC. AMPLIFIER
1/2 V-11B 12AU7 SYNC. SEPARATOR
1/2 V-17B 12AU7 NOISE INVERTER
SYNC. CLAMP 1/2 V-17A 12AU7
V-20 5U4G
V-21 5U4G
VERTICAL OSCILLATOR V-18A V-18B 6SN7GT
VERT. OUTPUT V-19 6W6GT
DEFLECTION YOKE ASSEMBLY
117 VOLTS AC LINE (60 C.P.S.)
RESISTORS INDICATED IN OHMS, K=1000 OHMS, CAPACITORS INDICATED IN MICROFARADS (MF) UNLESS OTHERWISE SPECIFIED.
A B AND C DENOTE HORIZ. TEST POINTS.
THIS HASH DUE TO SUPERIMPOSED SCOPE IMAGES IS NORMAL AND MAY VARY IN AMPLITUDE DEPENDING ON TYPE OF PICTURE INFORMATION AND SETTING OF HORIZONTAL HOLD CONTROL.

WAVE SHAPE ANALYSIS CHART

The waveshapes shown were taken on chassis 120205-B coded triangle. △A

Slight peak to peak voltage differences may be noticed on chassis of later triangle codes.

When taking waveshapes on chassis 120179-B, 120203-B and 120204-B bear in mind that a slight peak to peak variations are possible due to differences in chassis coding for the same change. See Production changes for further information.

The peak to peak voltage given may also vary slightly depending on signal strength and component variations.

To accurately observe the wave shapes, the relatively high input capacity of an oscilloscope must be reduced so as not to change the operating characteristics of the television set. Failure to do this will result in wrong wave shape readings. This is accomplished by using an Emerson low capacity probe as outlined previously in the service note for models 686L, 687L, and 696L using chassis 120142-B which was issued at an earlier date.

1. Connect antenna and tune receiver to channel where best reception has been obtained in the past.
2. Low end of the probe is connected to CHASSIS and the contrast control is set at MAXIMUM CONTRAST.
3. The 30 and 7875 C.P.S. oscilloscope sweep settings are used so as to permit the serviceman to observe two cycles of the wave shape.

NOTE: A wave shape seen in your oscilloscope may be upside down from same wave shape shown here. This will depend on the number of stages of amplification in the oscilloscope used.

CABINET PARTS LIST – CHASSIS 120179-B, 120203-B, 120204-B & 120205-B

PART NUMBERS								DESCRIPTION	LIST PRICE
MODEL 748B	MODEL 748C	MODEL 777B	MODELS 787A-787B	MODEL 796C	MODEL 797B	MODEL 797C	MODEL 798B		
140515	140515						140515	Cabinet – Console – Full Doors – Mah.	272.80
		140579		140579				Cabinet – Console – Mah.	161.00
		140579A		140579A				Cabinet – Console – Blond	161.00
			140559		140559	140559		Cabinet – Console – Full Doors – Mah.	272.80
			140559A		140559A	140559A		Cabinet – Console – Full Doors – Blond.	272.80
460441	460441	460441	460441	460441	460441	460441	460441	Mask	12.90
520198	520198	520198	520198	520198	520198	520198	520198	Safety Glass	24.55
460442	460442	460442	460442	460442	460442	460442	460442	Channel – Glass	.50
411544	411544	411544	411544	411544	411544	411544	411544	Glass Retaining Strip – (Top)	2.40
411545	411545	411545	411545	411545	411545	411545	411545	Glass Retaining Strip – (Sides)	2.40
460252	460252	460252	460252	460252	460252	460252	460252	Control Door	2.45
460253	460253	460253	460253	460253	460253	460253	460253	Control Door Escutcheon	Per Set
587088	587088	587088	587088	587088	587088	587088	587088	Spring – Door	
		460252B	460252B	460252B	460252B	460252B		Control Door – Ivory	2.45
		460253D	460253D	460253D	460253D	460253D		Control Door Escutcheon – Ivory	Per Set
180120	180120	180120	180120	180120	180120	180120	180120	Speaker – 12"	10.30
560330						560330	560330	Masonite Back	2.25
	560356	560356	560356	560356	560356			Masonite Back	2.25
411518						411518	411518	Tube Protector Cup	1.05
	411632	411632	411632	411632	411632			Tube Protector Cup	1.05
620179						620179	620179	Wood Strip – Back	.90
440042	440042	440042	440042	440042	440042	440042	440042	Rubber Guard	.30
560271	560271	560271	560271	560271	560271	560271	560271	Handle Retainer	.20
583206	583206	583206	583206	583206	583206	583206	583206	Line Cord	.80
460424	460424		460424	460424				Knob – Contrast	1.00
460423	460423		460423	460423				Knob – Fine Tuning	.70
460422	460422		460422	460422				Knob – Off-On-Volume	.85
460421	460421		460421	460421				Knob – Channel Selector	1.80
460425	460425		460425	460425				UHF Dial	.50
565273	565273		565273	565273				Mask – Dial	.01
		450138			450138	450138	450138	Knob – Contrast	.30
		450137			450137	450137	450137	Knob – Fine Tuning	.30
		450134			450134	450134	450134	Knob Shank – Off-On-Volume	.50
		460262			460262	460262	460262	Knob Flange – Off-On-Volume	.35
		450133			450133	450133	450133	Knob Shank – Selector	.50
		460261			460261	460261	460261	Knob Flange – Selector	.35
		275047			275047	275047	275047	Spring Washer – Knobs	.05
		587012			587012	587012	587012	Spring Insert	.02
		587011			587011	587011	587011	Spring Insert – 1/4" Shaft	.01
565277			565277					Light Shield	.30

CHASSIS PARTS LIST

CAPACITORS

SYMBOL	PART NO.	DESCRIPTION				PRICE
C-1	928109	5000 MMF (MIN.)	CERAMIC		500V..	.20
C-2	928082	39 MMF	CERAMIC	±5%	500V..	.30
C-3	926084	6.8 MMF	CERAMIC	±10%	500V..	.30
C-4	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
		CHASSIS 120179-B & 120203-B ONLY				
C-5	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
C-6	928081	470 MMF	CERAMIC	±10%	500V..	.40
C-7	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
C-8	922325	.22 MF	PAPER MOLDED	±20%	200V..	.50
C-9	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
C-10	928081	470 MMF	CERAMIC	±10%	500V..	.40
C-11	928109	5000 MMF (MIN.)	CERAMIC		500V..	.20
C-12	928076	680 MMF	CERAMIC	±10%	500V..	.40
C-13	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
C-14	928076	680 MMF	CERAMIC	±10%	500V..	.40
C-15	928012	22 MMF	CERAMIC	±20%	500V..	.20
C-16	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
C-17	928017	5 MMF	CERAMIC	±10%	500V..	.25
C-18	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
C-19	922325	.22 MF	PAPER MOLDED	±20%	200V..	.50
C-20	928109	5000 MMF (MIN.)	CERAMIC		500V.	.20
C-21	922554	.047 MF	PAPER MOLDED	±20%	400V..	.35
C-22	925180	10 MF	ELECTROLYTIC		25V..	.85
C-23	928077	1000 MMF (MIN.)	CERAMIC		500V..	.25
C-24	922554	.047 MF	PAPER MOLDED	±20%	400V..	.35
C-25	PT. OF L-12	47 MMF	MICA		500V..	
C-26	922714	.01 MF	PAPER MOLDED	±20%	600V..	.35
C-27	928109	5000 MMF (MIN.)	CERAMIC		500V..	.20
C-28	928109	5000 MMF (MIN.)	CERAMIC		500V..	.20
C-29	928109	5000 MMF (MIN.)	CERAMIC		500V..	.20
C-30	911161	68 MMF	MICA	±20%	500V..	.20
C-31	928109	5000 MMF (MIN.)	CERAMIC		500V..	.20
C-32	928109	5000 MMF (MIN.)	CERAMIC		500V..	.20
C-33	911182	100 MMF	MICA	±20%	500V..	.20
C-34	922523	.0022 MF	PAPER MOLDED	±20%	400V..	.30
C-35	922553	.0047 MF	PAPER MOLDED	±20%	400V..	.30
C-36	922554	.047 MF	PAPER MOLDED	±20%	400V..	.35
C-37	922513	.001 MF	PAPER MOLDED	±20%	400V..	.30
C-38	922753	.0047 MF	PAPER MOLDED	±20%	600V..	.30
C-39	PT. OF C-65	80 MF	ELECTROLYTIC		400V..	
C-40	922514	.01 MF	PAPER MOLDED	±20%	400V..	.30
C-41	911184	220 MMF	MICA	±20%	500V..	.25
C-42	911160	82 MMF	MICA	±10%	500V..	.25
C-43	911169	470 MMF	MICA	±10%	500V..	.35
C-44	911276	680 MMF	MICA	±10%	500V..	.45
C-45	922513	.001 MF	PAPER MOLDED	±20%	400V..	.30
C-46	922523	.0022 MF	PAPER MOLDED	±20%	400V..	.30
C-47	922913	.001 MF	PAPER MOLDED	±20%	1000V..	.25
C-48	922513	.001 MF	PAPER MOLDED	±20%	400V..	.30
C-49	922513	.001 MF	PAPER MOLDED	±20%	400V..	.30
C-50	922320	.015 MF	PAPER MOLDED	±20%	200V..	.30
C-51	911161	100 MMF	MICA	±10%	500V..	.28
C-52	911165	220 MMF	MICA	±10%	500V..	.30
C-53	922653	.0047 MF	PAPER MOLDED	±10%	600V..	.35
C-54	PT. OF C-65	10 MF	ELECTROLYTIC		400V..	
C-55	922220	.015 MF	PAPER MOLDED	±10%	200V..	.30
C-56	911168	390 MMF	MICA	±10%	500V..	.30
C-57	922413	.001 MF	PAPER MOLDED	±10%	400V..	.35
C-58	922355	.47 MF	PAPER MOLDED	±20%	200V..	.75
C-59	922515	.1 MF	PAPER MOLDED	±20%	400V..	.40
C-60	922715	.1 MF	PAPER MOLDED	±20%	600V..	.50
C-61						
C-62	922200	.047 MF	PAPER MOLDED PHENOLIC		400V..	.35
C-63	922200	.047 MF	PAPER MOLDED PHENOLIC		400V..	.35
C-64	925237	80 MF	ELECTROLYTIC		400V..	3.80
C-65	925236	40 MF	ELECTROLYTIC		300V..	4.05
C-66	PT. OF C-64	40 MF	ELECTROLYTIC		400V..	
C-67	911486	100 MMF	MICA	±20%	1000V..	.30
C-68	922514	.01 MF	PAPER MOLDED	±20%	400V..	.30
C-69	922315	.1 MF	PAPER MOLDED	±20%	200V..	.40
C-70	922325	.22 MF	PAPER MOLDED	±20%	200V..	.50
C-71	922523	.0022 MF	PAPER MOLDED	±20%	400V..	.30
C-72	922553	.0047 MF	PAPER MOLDED	±20%	400V..	.30
C-73	922514	.01 MF	PAPER MOLDED	±20%	400V..	.30
C-74	922453	.0047 MF	PAPER MOLDED	±10%	400V..	.30
C-75	922354	.047 MF	PAPER MOLDED	±20%	200V..	.30
C-76	922454	.047 MF	PAPER MOLDED	±10%	400V..	.40
C-77	922515	.1 MF	PAPER MOLDED	±20%	400V..	.40
C-78	PT. OF C-64	5 MF	ELECTROLYTIC		450V..	
C-79	PT. OF C-65	100 MF	ELECTROLYTIC		50V..	
C-80	922714	.01 MF	PAPER MOLDED	±20%	600V..	.35
C-81	928091	100 MMF	CERAMIC	±5%	2000V..	.30
C-82	922974	.068 MF	PAPER MOLDED	±20%	1000V..	.65
C-83	928114	100 MMF	CERAMIC	±20%	4KV..	.45

RESISTORS

SYMBOL	PART NO.	DESCRIPTION			PRICE
R-1	350412	470 OHM	CARBON	½W.±20%..	.14
R-2	350412	470 OHM	CARBON	½W.±20%..	.14
R-3	350412	470 OHM	CARBON	½W.±20%..	.14
		CHASSIS 120179-B & 120203-B ONLY			
R-4	340052	15 OHM	CARBON	½W.±10%..	.10
R-5	340172	47 OHM	CARBON	½W.±10%..	.17
R-6	350972	100,000 OHM	CARBON	½W.±20%..	.17
		CHASSIS 120179-B & 120203-B ONLY			
R-7	350412	470 OHM	CARBON	½W.±20%..	.14
R-8	350412	470 OHM	CARBON	½W.±20%..	.14
R-9	340832	27,000 OHM	CARBON	½W.±10%..	.10
R-10	350412	470 OHM	CARBON	½W.±20%..	.14
R-11	340172	47 OHM	CARBON	½W.±10%..	.17
R-12	350412	470 OHM	CARBON	½W.±20%..	.14
R-13	340712	8,200 OHM	CARBON	½W.±10%..	.14
R-14	340312	180 OHM	CARBON	½W.±10%..	.10
R-15	350412	470 OHM	CARBON	½W.±20%..	.14
R-16	351212	1 MEGOHM	CARBON	½W.±20%..	.17
R-17	350972	100,000 OHM	CARBON	½W.±20%..	.17
R-18	351212	1 MEGOHM	CARBON	½W.±20%..	.17
R-19	351212	1 MEGOHM	CARBON	½W.±20%..	.17
R-20	340772	15,000 OHM	CARBON	½W.±10%..	.10
R-21	340732	10,000 OHM	CARBON	½W.±10%..	.17
R-22	340652	4,700 OHM	CARBON	½W.±10%..	.17
R-23	351212	1 MEGOHM	CARBON	½W.±20%..	.17
R-24	PT. OF R.46	1,500 OHM	CONTRAST CONTROL - FRONT		
R-25	340812	22,000 OHM	CARBON	½W.±10%..	.17
R-26	770692	6,800 OHM	CARBON	2W.±5% ..	.55
R-27	390181	200,000 OHM	BRIGHTNESS CONTROL - FRONT		.70
R-28	351132	470,000 OHM	CARBON	½W.±20%..	.17
R-29	351052	220,000 OHM	CARBON	½W.±20%..	.14
R-30	351132	470,000 OHM	CARBON	½W.±20%..	.17
R-31					
R-32	351172	680,000 OHM	CARBON	½W.±20%..	.14
R-33	340332	220 OHM	CARBON	½W.±10%..	.14
R-34	350412	470 OHM	CARBON	½W.±20%..	.14
R-35	350892	47,000 OHM	CARBON	½W.±20%..	.10
R-36	351212	1 MEGOHM	CARBON	½W.±20%..	.17
R-37	370812	22,000 OHM	CARBON	1W.±10%..	.15
R-38	340732	10,000 OHM	CARBON	½W.±10%..	.17
R-39	340692	6,800 OHM	CARBON	½W.±10%..	.17
R-40	350412	470 OHM	CARBON	½W.±20%..	.14
R-41	340972	100,000 OHM	CARBON	½W.±10%..	.17
R-42	340972	100,000 OHM	CARBON	½W.±10%..	.17
R-43	351452	10 MEGOHM	CARBON	½W.±20%..	.05
R-44	350932	68,000 OHM	CARBON	½W.±20%..	.14
R-45	351452	10 MEGOHM	CARBON	½W.±20%..	.05
R-46	390201	1 MEGOHM	VOLUME CONTROL - FRONT		.60
R-47	351052	220,000 OHM	CARBON	½W.±20%..	.14
R-48	351132	470,000 OHM	CARBON	½W.±20%..	.17
R-49	370412	470 OHM	CARBON	1W.±10%..	.15
R-50	790532	1,500 OHM	CARBON	2W.±20%..	.25
R-51	394135	6.5 OHM	WIRE WOUND	5W.±10%..	.40
R-52	340812	22,000 OHM	CARBON	½W.±10%..	.17
R-53	370812	22,000 OHM	CARBON	1W.±10%..	.15
R-54	340732	10,000 OHM	CARBON	½W.±10%..	.17
R-55	340852	33,000 OHM	CARBON	½W.±10%..	.14
R-56	351292	2.2 MEGOHM	CARBON	½W.±20%..	.14
R-57	350972	100,000 OHM	CARBON	½W.±20%..	.17
R-58	370812	22,000 OHM	CARBON	1W.±10%..	.15
R-59	340672	5,600 OHM	CARBON	½W.±10%..	.17
R-60	351092	330,000 OHM	CARBON	½W.±20%..	.14
R-61	340652	4,700 OHM	CARBON	½W.±10%..	.17
R-62	340652	4,700 OHM	CARBON	½W.±10%..	.17
R-63	340972	100,000 OHM	CARBON	½W.±10%..	.17
R-64	340952	82,000 OHM	CARBON	½W.±10%..	.14
R-65	340952	82,000 OHM	CARBON	½W.±10%..	.14
R-66	340812	22,000 OHM	CARBON	½W.±10%..	.17
R-67	351292	2.2 MEGOHM	CARBON	½W.±20%..	.14
R-68	370892	47,000 OHM	CARBON	1W.±10%..	.15
R-69	330512	1,200 OHM	CARBON	½W.±5% ..	.14
R-70	330772	15,000 OHM	CARBON	½W.±5% ..	.15
R-71	390219	200,000 OHM	HORIZ. BALANCE CONTROL - REAR		.65
R-72	340892	47,000 OHM	CARBON	½W.±10%..	.17
R-73	390183	50,000 OHM	HORIZ. HOLD CONTROL - FRONT		.65
R-74	341112	390,000 OHM	CARBON	½W.±10%..	.14
R-75	370892	47,000 OHM	CARBON	1W.±10%..	.15
R-76	340692	6,800 OHM	CARBON	½W.±10%..	.17
R-77	350732	10,000 OHM	CARBON	½W.±20%..	.17
R-78	341132	470,000 OHM	CARBON	½W.±20%..	.14
R-79	350212	68 OHM	CARBON	½W.±20%..	.14
R-80	394138	100 OHM	WIRE WOUND	4W.±20%..	.40
R-81	780692	6,800 OHM	CARBON	2W.±10%..	.25
R-82					
R-83	370732	10,000 OHM	CARBON	1W.±10%..	.19
R-84					
R-85	370972	100,000 OHM	CARBON	1W.±20%..	.10
R-86	394136	1,800 OHM	WIRE WOUND	10W.±10%..	.45
R-87	341132	470,000 OHM	CARBON	½W.±10%..	.17
R-88	340932	68,000 OHM	CARBON	½W.±10%..	.14
R-89	390225	50,000 OHM	FRINGE COMPENSATOR - REAR		1.00
R-90	351292	2.2 MEGOHM	CARBON	½W.±20%..	.14
R-91	340732	10,000 OHM	CARBON	½W.±10%..	.17
R-92	340732	10,000 OHM	CARBON	½W.±10%..	.17
R-93	341012	150,000 OHM	CARBON	½W.±10%..	.14
R-94	340392	390 OHM	CARBON	½W.±10%..	.14
R-95	340812	22,000 OHM	CARBON	½W.±10%..	.17
R-96	340712	8,200 OHM	CARBON	½W.±10%..	.14
R-97	350972	100,000 OHM	CARBON	½W.±20%..	.17
R-98	341012	150,000 OHM	CARBON	½W.±10%..	.14
R-99	340572	2,200 OHM	CARBON	½W.±10%..	.17
R-100	390156	1 MEGOHM	VERT. HOLD CONTROL - FRONT		.65
R-101	341192	820,000 OHM	CARBON	½W.±10%..	.14
R-102	350892	47,000 OHM	CARBON	½W.±20%..	.10
R-103	390196	2 MEGOHM	VERT. SIZE CONTROL - REAR		.70
R-104	340752	12,000 OHM	CARBON	½W.±10%..	.14
R-105	351212	1 MEGOHM	CARBON	½W.±20%..	.17
R-106	351292	2.2 MEGOHM	CARBON	½W.±20%..	.14
R-107	390197	5,000 OHM	VERT. LINEARITY CONTROL - REAR		1.25
R-108	370412	470 OHM	CARBON	1W.±10%..	.15
R-109	350252	100 OHM	CARBON	½W.±20%..	.14
R-110	380852	33,000 OHM	CARBON	1W.±20%..	.10
R-111	340432	560 OHM	CARBON	½W.±10%..	.14
R-112	340432	560 OHM	CARBON	½W.±10%..	.14
R-113	340892	47,000 OHM	CARBON	½W.±10%..	.17
R-114	370892	47,000 OHM	CARBON	1W.±10%..	.15
R-115	350172	47 OHM	CARBON	½W.±20%..	.17
R-116	397032	2.7 OHM	CARBON	1W.±10%..	.10
R-117	780692	6,800 OHM	CARBON	2W.±10%..	.25
R-118	780692	6,800 OHM	CARBON	2W.±10%..	.25
R-119	780692	6,800 OHM	CARBON	2W.±10%..	.25
R-120	340172	47 OHM	CARBON	½W.±10%..	.17

CHOKES & COILS

SYMBOL	PART NO.	DESCRIPTION	PRICE
L-1	720154	VIDEO I.F. TRAP	1.00
L-2	720149	VIDEO I.F. TRAP	1.00
L-3 OR	720156	VIDEO I.F. INPUT COIL	1.25
L-3	720147	VIDEO I.F. INPUT COIL	1.40
L-4	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20
L-5	720173	HIGH PASS FILTER UNIT	4.90
		CHASSIS 120179-B & 120203-B ONLY	
L-6	705020	R.F. CHOKE HEATER - .68 UH ±20%	.20
L-7	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20
L-8	708114	PEAKING COIL - 440 UH	.30
L-9	705014	R.F. CHOKE - 20 UH	.35
L-10	708100	PEAKING COIL - 250 UH	.40
L-11	708115	PEAKING COIL -660 UH	.35
L-12	708164 OR	4.5 MC TRAP	.80
L-12	708032†	4.5 MC TRAP	
L-13	716084	HORIZ. PHASE COIL	1.20
L-14	708156	HORIZ. SIZE COIL	.85
		CHASSIS 120179-B & 120205-B ONLY	
L-14	708068	HORIZ. SIZE COIL-120203-B & 120204B ONLY	1.15
L-15			
L-16, L-17	705021	R.F. CHOKE - 10 UH ±10%	.20
L-18	708174	DEFLECTION YOKE ASS'Y -COSINE	20.95
	737018	FILTER CHOKE	3.90

TRANSFORMERS

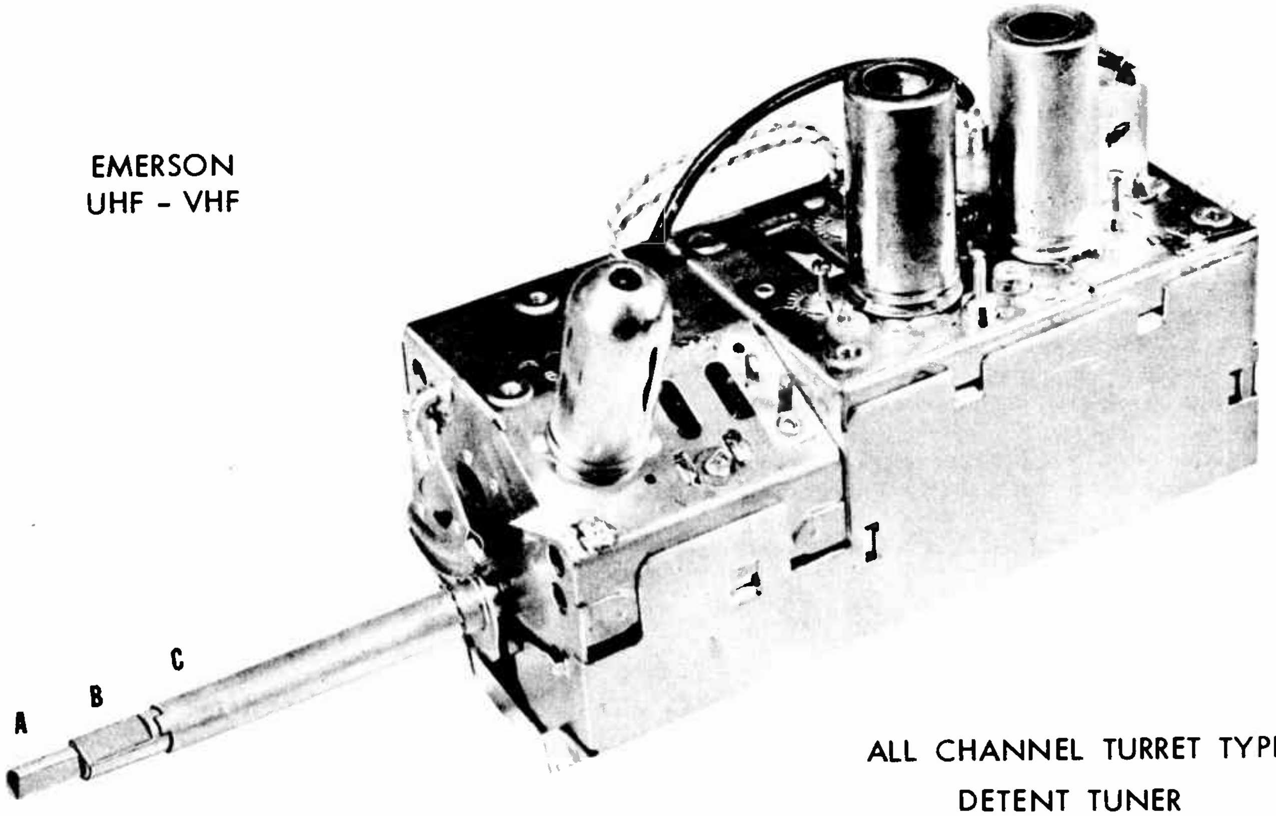
SYMBOL	PART NO.	DESCRIPTION	PRICE
T-1	PT. OF VHF-T	TUNER VIDEO I.F. OUTPUT TRANS.	
T-A	PT. OF UHF-T	TUNER VIDEO I.F. OUTPUT TRANS.	
T-2	720175 OR	2ND VIDEO I.F. TRANS.	1.50
T-2	720148†	2ND VIDEO I.F. TRANS.	1.30
T-3	720175 OR	3RD. VIDEO I.F. TRANS.	1.50
T-3	720148†	3RD. VIDEO I.F. TRANS.	1.30
T-4	720175 OR	4TH. VIDEO I.F. TRANS.	1.50
T-4	720148†	4th VIDEO I.F. TRANS.	1.30
T-5	720185 OR	SOUND TAKE OFF TRANS.	1.95
T-5	720146†	SOUND TAKE OFF TRANS.	2.10
T-6	720182 OR	SOUND I.F. TRANS.	1.85
T-6	720081†	SOUND I.F. TRANS.	1.60
T-7	708175 OR	SOUND DISCRIMINATOR TRANS.	1.75
T-7	708018† OR	SOUND DISCRIMINATOR TRANS.	2.05
T-7	708151†	SOUND DISCRIMINATOR TRANS.	2.20
T-8	734074	AUDIO OUTPUT TRANS.	2.25
T-9	738078	HORIZONTAL OUTPUT TRANS. CHASSIS 120179-B & 120205-B ONLY	18.25
T-9	738087	HORIZONTAL OUTPUT TRANS. CHASSIS 120203-B & 120204-B ONLY	16.60
T-10	738076	VERTICAL OUTPUT TRANS.	4.70
T-11	730041	POWER TRANS. CHASSIS 120179-B & 120205-B ONLY	27.35
T-11	730046	POWER TRANS. CHASSIS 120203-B & 120204-B ONLY	27.75

TUNERS

SYMBOL	PART NO.	DESCRIPTION	PRICE
TUNER	470712	VHF TUNER ASS'Y CHASSIS 120179-B 120203-B ONLY	50.00
TUNER	470713	UHF TUNER ASS'Y CHASSIS 120179-B 120203-B ONLY	50.00
TUNER	470696	VHF TUNER ASS'Y CHASSIS 120204-B & 120205-B ONLY	50.00

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

EMERSON
UHF - VHF



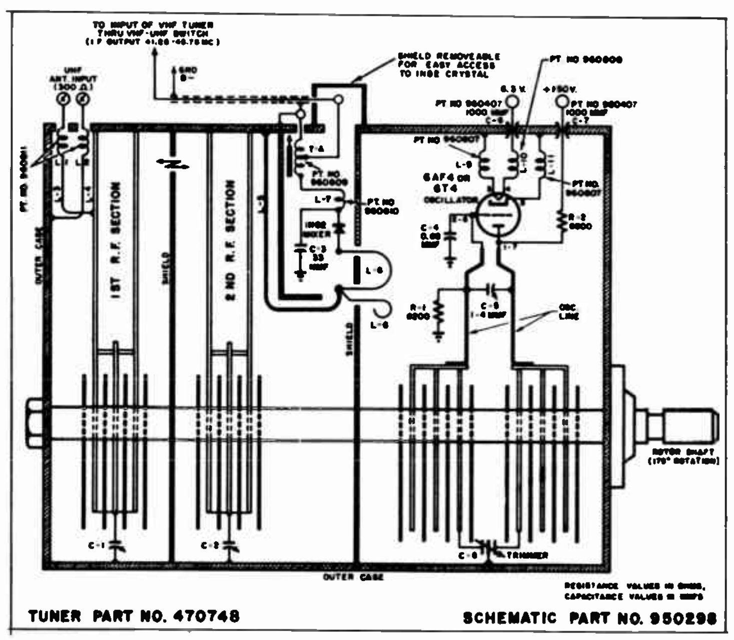
ALL CHANNEL TURRET TYPE
DETENT TUNER
PT. NO. 470738

GENERAL DESCRIPTION

The all-channel tuner is the combination of a VHF tuner and a UHF tuner in a single assembly. Three concentric shafts are brought out to a group of three knobs for simplified tuning. (See Fig. #4)

The rear section of the assembly contains a conventional VHF cascode turret tuner having twelve detent positions. This turret connects to the inner shaft (A) which passes through the UHF tuner section to the front and is controlled by the VHF and UHF unit channel selector knob. The VHF tuner contains an I. F. strip which is actuated by a cam on the rear of the UHF turret. This strip is automatically inserted for UHF reception and converts the VHF tuner into a two stage low noise cascode I. F. amplifier for additional amplification. Fine tuning, controlled by the fine tuning knob (C) is obtained by varying the amount of dielectric between capacitor plates of the VHF oscillator.

The UHF tuner located in front of the VHF section consists of a turret with nine detent positions. It is connected to the middle shaft (B) and controlled by the UHF channel selector knob. One position (VHF) disengages the I. F. strip within the VHF tuner to allow for normal reception of VHF channels 2 to 13. The other eight positions cover all UHF channels in eight major groups by means of a separate coil strip for each group. Each coil strip is further tuned for individual channels within the group by variable dielectric type condensers which are part of each tuned circuit. This inter-group tuning is accomplished in detented steps by turning the inner shaft. (See Fig. #5) Fine tuning controlled by the fine tuning knob is obtained by varying the amount of dielectric between capacitor plates of the UHF oscillator.



SCHEMATIC DIAGRAM OF TUNER #470748
USED IN CHASSIS 120211-F

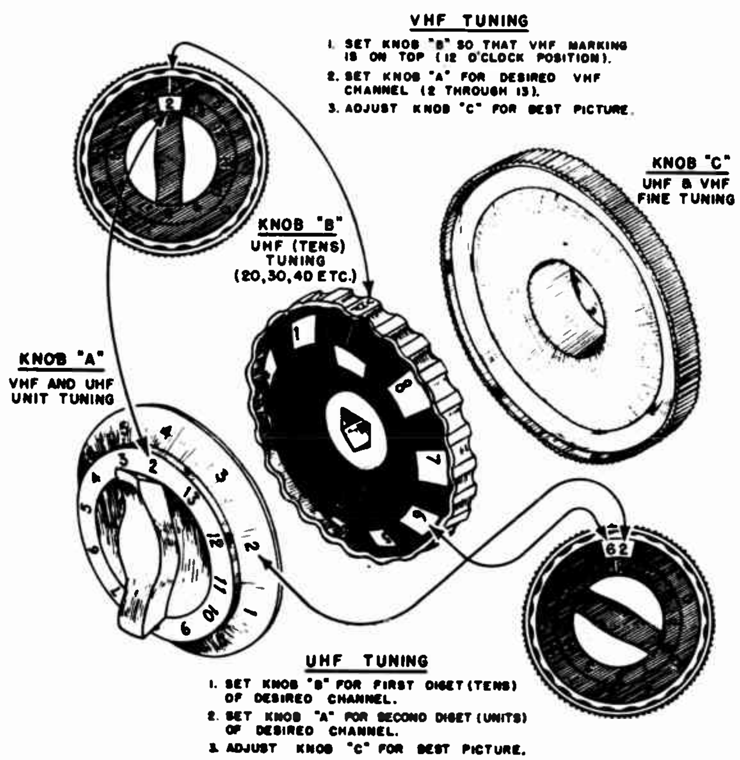


FIGURE 4

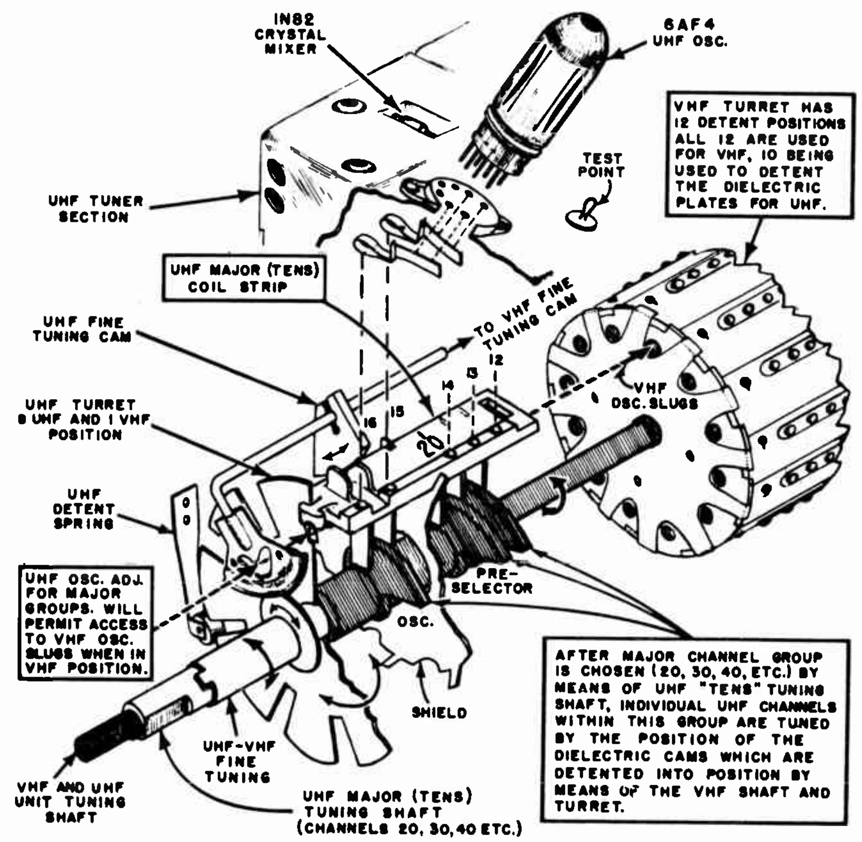
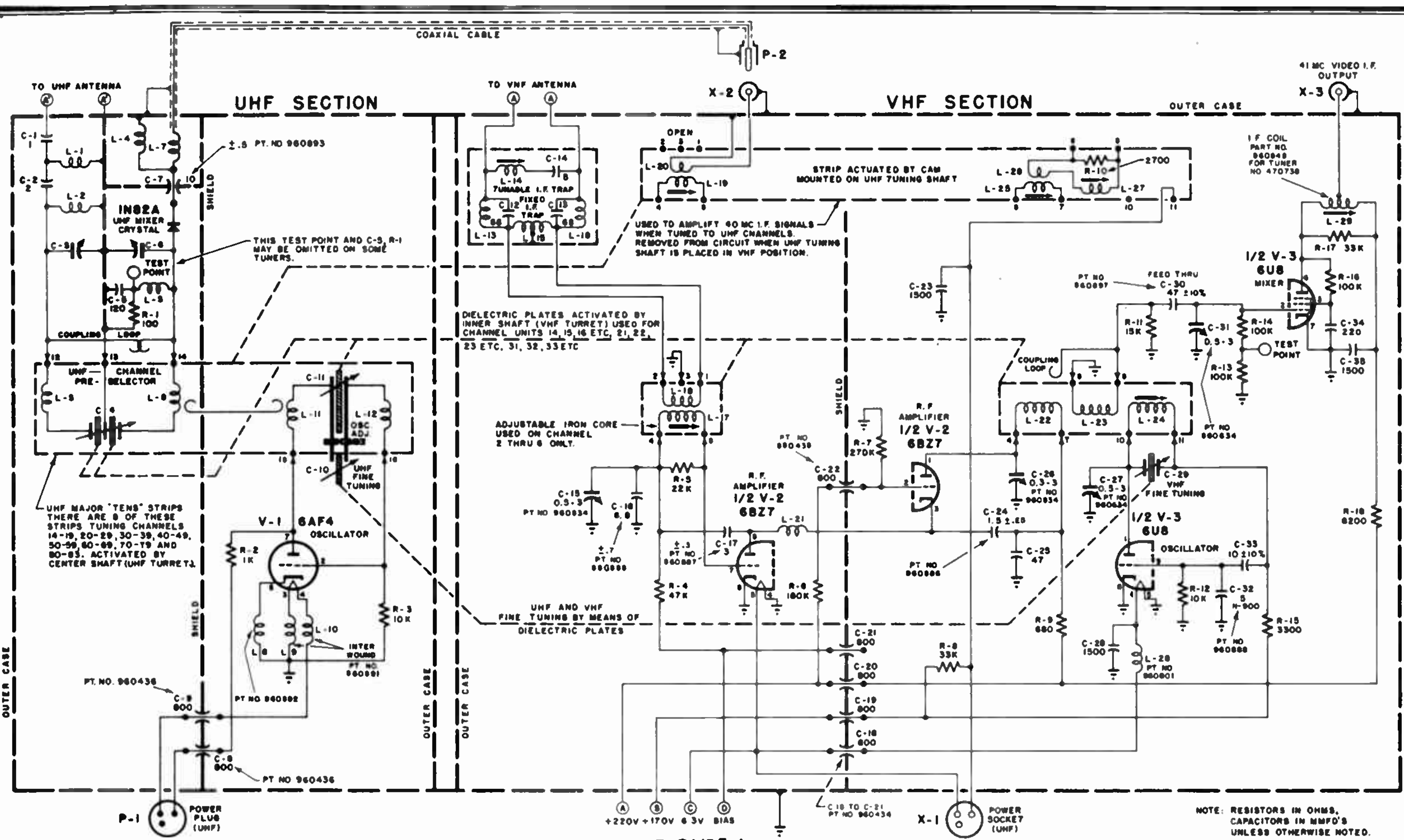
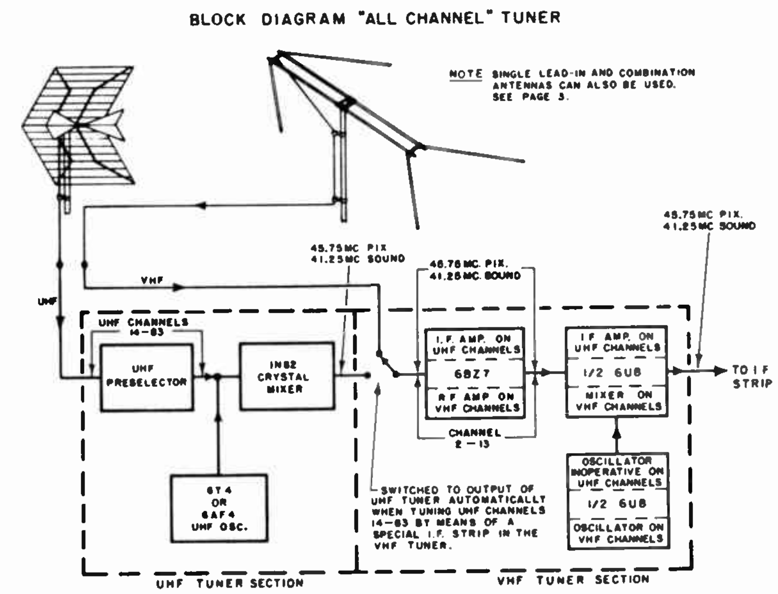


FIGURE 5



TUNER PART NO. 470738 FIGURE 6 SCHEMATIC PART NO. 950269



TUNER TROUBLE SHOOTING CHART

The voltages listed were taken with B+ inputs of 220 volts, 170 volts and a 3 volt AGC battery connected directly to the AGC input of the tuner. A 6.3 volt AC filament source was also provided. Antenna terminals were shorted directly to the tuner chassis using short leads. A VTVM has been used for all voltage and resistance readings. In the event slightly different input voltages are applied to the tuner a proportionate voltage change will occur at the various pin numbers.

Resistance readings are taken with respect to the tuner itself, therefore, disconnect the 220 volt, 170 volt, and AGC input leads from the receiver chassis to the tuner power input board. To assist you in easily localizing a defective component, the resistance has been measured from the pin numbers with respect to three different points (place low side of ohmmeter to proper points). Note: Since readings are taken from the top side of the tube socket, remove only the required tube.

	6BZ7 (6U8 and 6AF4 IN PLACE)				6U8 (6BZ7 and 6AF4 IN PLACE)				6AF4 (6BZ7 and 6U8 IN PLACE)			
PIN NO.	Voltages	RESISTANCE TAKEN FROM PIN NO. TO:			Voltages	RESISTANCE TAKEN FROM PIN NO. TO:			Voltages †	RESISTANCE TAKEN FROM PIN NO. TO:		
		Chassis	170V.	220V.		Chassis	170V.	220V.		Chassis	170V.	220V.
1	220V.	450 ^	INF.	700^	170V.	INF.	3.3K	INF.	165V.	INF.	30K	INF.
2	130V.	270K	INF.	180K	0V.	200K	INF.	650K	0V.	10K	INF.	500K
3	0V.	INF.	INF.	INF.	220V.	590K	INF.	110K	FIL.	1.0^	INF.	550K
4	FIL.	0 ^	INF.	450K	FIL.	1.2^	INF.	450K	FIL.	0 ^	INF.	550K
5	FIL.	1.2^	INF.	450K	FIL.	0^	INF.	450K	0V.	0 ^	INF.	550K
6	0V.	INF.	INF.	INF.	220V.	490K	INF.	8.2K	0V.	10K	INF.	500K
7	-3V.	INF.	*47K	INF.	0V.	0 ^	INF.	450K	165V.	INF.	30K	INF.
8	0V.	0 ^	INF.	450K	0V.	0 ^	INF.	450K	† Above readings taken with tuner set for UHF operation			
9	0V.	0 ^	INF.	450K	0V.	10K	INF.	460K				
VHF Looker Point	-1.8V	100K	INF.	550K	TAKEN WITH ALL TUBES OPERATING IN TUNER VOLTAGE READING WILL VARY FROM CHANNEL TO CHANNEL.							

* Taken with respect to A.G.C. input to tuner.

FIELD ALIGNMENT

Field alignment should be restricted primarily to the proper setting up of the VHF and UHF oscillators. We are assuming that the R.F. and I.F. alignment is correct and has not been tampered with. If you know the immediate area is capable of good pictures and the following adjustments do not improve reception, then a more complete shop alignment will probably be necessary (shown on pages 5, 6 and 7).

The adjustment of the VHF oscillator is conventional in that the VHF portion of the 82 channel UHF-VHF tuner is almost identical to our regular cascode VHF turret tuners. To align the VHF oscillator in the field, use an "on the air" channel and with a 9" fibre alignment tool, adjust the VHF oscillator slug through the hole provided in the fine tuning plate and UHF turret for best picture. This should be done for all VHF channels received in the area. Keep fine tuning in center of mechanical range during these adjustments. Note: There is a tunable I.F. trap (L-14) on this tuner which can be adjusted in the field if necessary to reduce interference due to nearby transmitters which may be operating in the I.F. range.

The UHF oscillator can be adjusted in the field on an "on the air" station as follows:

(a) Set proper knobs to desired channel.
(b) Place fine tuning knob to the middle of its range.
(c) With a fibre alignment tool adjust oscillator slug through fine tuning plate and hole in tuner chassis for best picutre.
(d) Repeat steps a, b and c for all other UHF channels. Note: If you receive two UHF channels which use the same UHF major (tens) coil strips (20-29, 30-39, etc.) set the oscillator for the channel closest to the center of the group (14, 24, 34, etc.).

In the event the UHF preselector trimmers (C-3, C-6) have been misadjusted, they can be reset in the field on the weakest UHF channel. This should only be attempted in areas which have a maximum of about 3 UHF channels. Adjust trimmers (C-3, C-6) for maximum contrast with minimum noise (snow). The antenna coupling should be varied if necessary so that there is always a slight amount of snow in the picture during this preselector alignment. These two preselector trimmers are located between the UHF input terminals and the 6AF4 UHF oscillator tube.

If more than one UHF channel is weak or more than 3 are received, field adjustment of these trimmers are not recommended.

SHOP ALIGNMENT INFORMATION

This tuner can be aligned and repaired in the receiver chassis or in a special jig. If a jig is made, it should supply the necessary B+ and filament voltages which are shown on the schematic. If step 2D is performed (alternate procedure to 2B) a regular chassis will have to be used or a jig which has at least one stage of I.F. and a sound trap.

1 - Equipment Needed

(A) Oscilloscope with a vertical sensitivity of at least .05 volts per inch of deflection, (.01 preferred).
(B) UHF sweep (fundamental preferred) with a sweep width of approximately 40 mc. (± 20 mc). Good linearity and flat output necessary. Generator should have at least .1 volts output, (.5 volts preferred).
(C) VHF sweep should have same characteristics as above except that only a 10 mc sweep width is required. This unit should have a 40 mc sweep position available.
(D) I.F. UHF and VHF marker generator. This could be two separate units or a combination. Fundamental operation preferred but not necessary. An output of at least .05 volts is desirable. Accuracy of marker should be at least 0.5%.

2 - Alignment of UHF Tuner Section

(A) UHF R.F. Alignment (preselectors). Turn the set off during this alignment.

1- Remove the plug (P-2) from the VHF tuner. This is the plug which feeds the I.F. output from the UHF tuner into the VHF tuner. Insert a 100 ohm resistor between center conductor and ground of shielded lead (see figure #8). Connect scope across 100 ohm resistor. Note: If a test point is provided on UHF section (see figure #8) merely connect scope across this point.

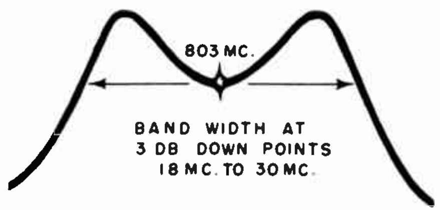
2- Connect unbalanced 300 ohm UHF sweep generator to UHF antenna connections. If 300 ohm generator is not available, match output impedance similar to that shown in figure #8.

3- Turn tuner selector knob to channel 69.

4- Set UHF sweep generator to approximately 803 mc (center of channel 69) with a total sweep width of approximately 40 mc. In the event channel 69 is occupied in your area, use channel 59 for 2A and 2B.

5- Inject market at 803 mc (center of channel 69), as shown in figure #8.

6- Adjust capacitor C-3 and C-6 to obtain an over-coupled pattern with channel 69 marker in the center of the bandpass.



7- Turn the set back on.

(B) Tuner I.F. strip alignment (Rocking Horse). Using separate I.F. and UHF marker generators.

In the event you use a combination marker the alternate procedure (d) should be followed. Note: The complete UHF RF alignment (step 2A) should be attempted first. This insures the proper frequency setting of the UHF sweep generator on channel 69 (or 59) which should not be changed during the following alignment.

1- Remove 100 ohm resistor added in step 2A-1 above, and reconnect shielded lead to VHF tuner.

2- (a) Connect a 3 volt bias battery to tuner AGC and I.F. AGC if tuner is in a regular chassis instead of a jig.

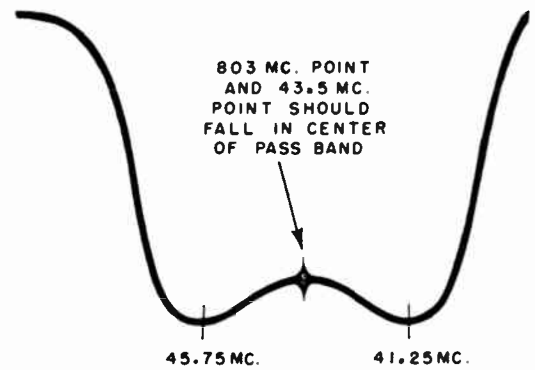
(b) Connect the negative terminal of a 6 volt bias battery to the grid of the horizontal output tube to cut it off (positive terminal to chassis). This will allow for a clear sweep indication.

3- With sweep and UHF market input and setting as in RF alignment above, connect oscilloscope through 10 K resistor to test point on VHF tuner.

4- Inject IF marker 43.5 mc (center of IF band) to the insulation of the shielded lead going from the UHF to VHF section (see figure #9).

5- With the fine tuning at center of its mechanical range adjust oscillator slug (see C-3 below) for zero beat on oscilloscope (set marker and scope gain at or near maximum). Note: In the event the tuner IF strip is completely out of alignment, it might be difficult to get a beat pattern. If this is the case, adjust L-25 a half turn at a time trying then to secure a beat pattern by adjusting the UHF oscillator slug. This beat pattern comes and goes very quickly so adjust slug very slowly keeping scope and marker gains at maximum. It is sometimes easier to observe the two markers on the response curve merely adjusting the UHF oscillator slug so the two markers coincide.

6- Now that the oscillator and sweep generator have been properly set, adjust L-19, L-25 and L-27 in the tuner I.F. strip (rocking horse) to obtain a symmetrical and flat IF bandpass. With I.F. marker connected as shown in Fig. 9, check positions of 41.25 and 45.75 mc markers as indicated in diagram. These coils should be adjusted with a fibre alignment tool. Note: To be sure that the oscillator frequency has been set above and not below the UHF signal the image sweep frequency should be approximately 88 mc higher (803 + 88 = 891 mc). This sweep frequency should cause some response on the oscilloscope providing the UHF sweep generator has sufficient output.



(C) UHF Oscillator Alignment

1- Repeat steps 1, 2 and 3 of section 2B above using channel #14. (Turn knobs to channel 14).

2- Set UHF sweep generator to approximately center of channel #14 (473 mc) and marker generator to 473 mc (sweep and marker connected to UHF input as in RF alignment figure #8).

3- With the fine tuning at center of its mechanical range adjust the oscillator slug from front end of tuner with a fibre alignment tool until an IF pattern is observed with the marker positioned in the center of the IF bandpass.

4- Leaving the fine tuning and generator connections as is, repeat steps 1, 2 and 3 on channels 24, 34, 44, 54, 64, 74 and 80 (frequencies shown in figure #10). Note: As long as channel 69 had a flat response disregard relative tilts of other channels providing it does not exceed about 40%. In the event you want optimum response on a particular weak channel, the UHF preselectors can be set up on that channel.

(D) Alternate Tuner IF Strip Alignment (Rocking Horse)

If only a combination IF, VHF and UHF marker is available, we can make use of the sound trap alignment frequency (41.25 mc) as a reference point. The complete UHF-RF alignment (step A) should be done first. This insures the proper setting of the sweep generator which should not be changed during this tuner IF strip alignment (rocking horse).

1- Make sure the chassis IF circuits have been properly aligned especially with regard to the 41.25 mc sound trap which will be used as a reference.

2- Sweep and marker connected as in UHF RF alignment. Leave sweep frequency unchanged but change marker frequency to sound carrier of channel 69 (805.75 mc) or 59 (745.75 mc).

3- Connect oscilloscope through 10 K resistor to output of video detector. Adjust sweep output and gain of scope for regular IF response curve (do not touch sweep frequency setting).

4- With fine tuning in center of mechanical range, adjust UHF oscillator slug to position 805.75 mc marker in dip of 41.25 mc sound trap.

5- Now that the oscillator is properly set connect scope through 10 K resistor to VHF test point and proceed with step #6 under IF strip alignment (2B).

(B) Connect sweep generator to VHF antenna terminals and connect oscilloscope through 10 K decoupling resistor to VHF test point.

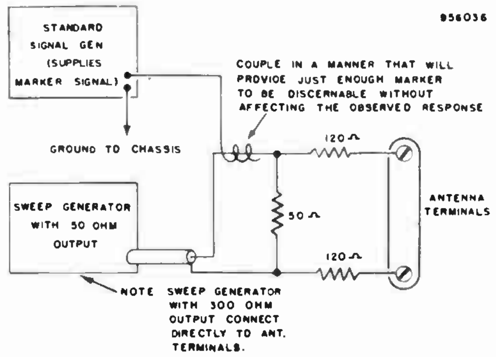
(C) Turn the tuner selector knob to channel 10 or 12 (VHF) whichever is not occupied in area.

(D) Set VHF sweep and marker to center of channel 10 band (195 mc) or 12 band (207 mc).

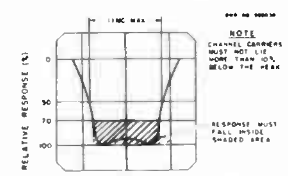
(E) Adjust C-26, C-31 dnd C-15 for response shown. It will be noted that the bandpass characteristics can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as this results in a loss of sensitivity.

(F) Adjust oscillator slug from front end of tuner with a long insulated alignment tool to correct frequency. A clearance hole is provided through the UHF unit when the UHF drum is rotated to VHF position.

The individual oscillator slugs can be set up using an "on the air" TV station or by using a marker generator as indicated in any of our current service notes (models 740 - 792). In the event the 6U8 oscillator tube is replaced, the oscillator trimmer C-27 can be readjusted to compensate for any variations in the tubes interelectrode capacities.



GENERATOR CONNECTIONS FOR VHF R.F. CHANNEL ALIGNMENT.



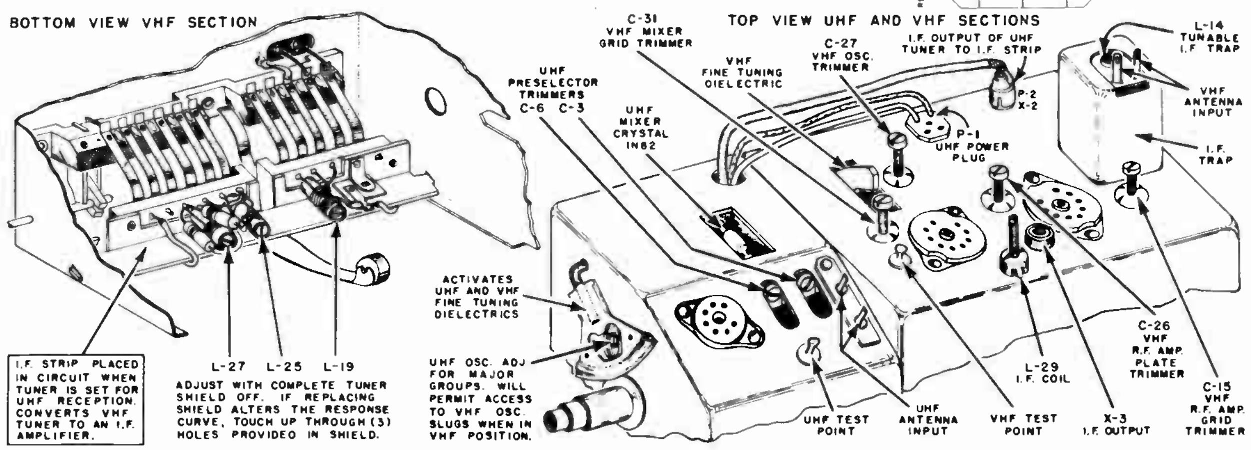


FIGURE 7

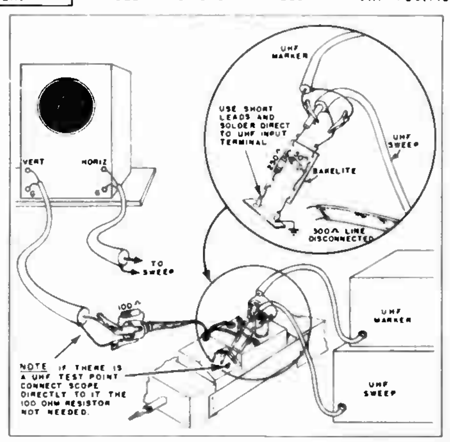


FIGURE 8

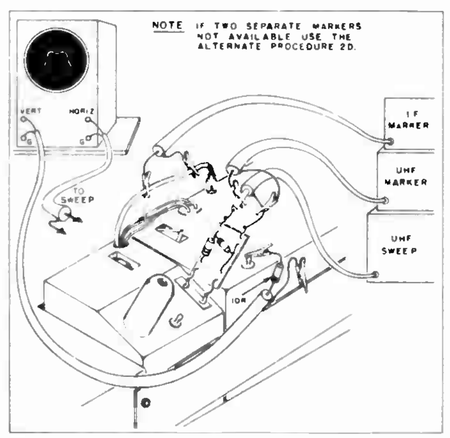
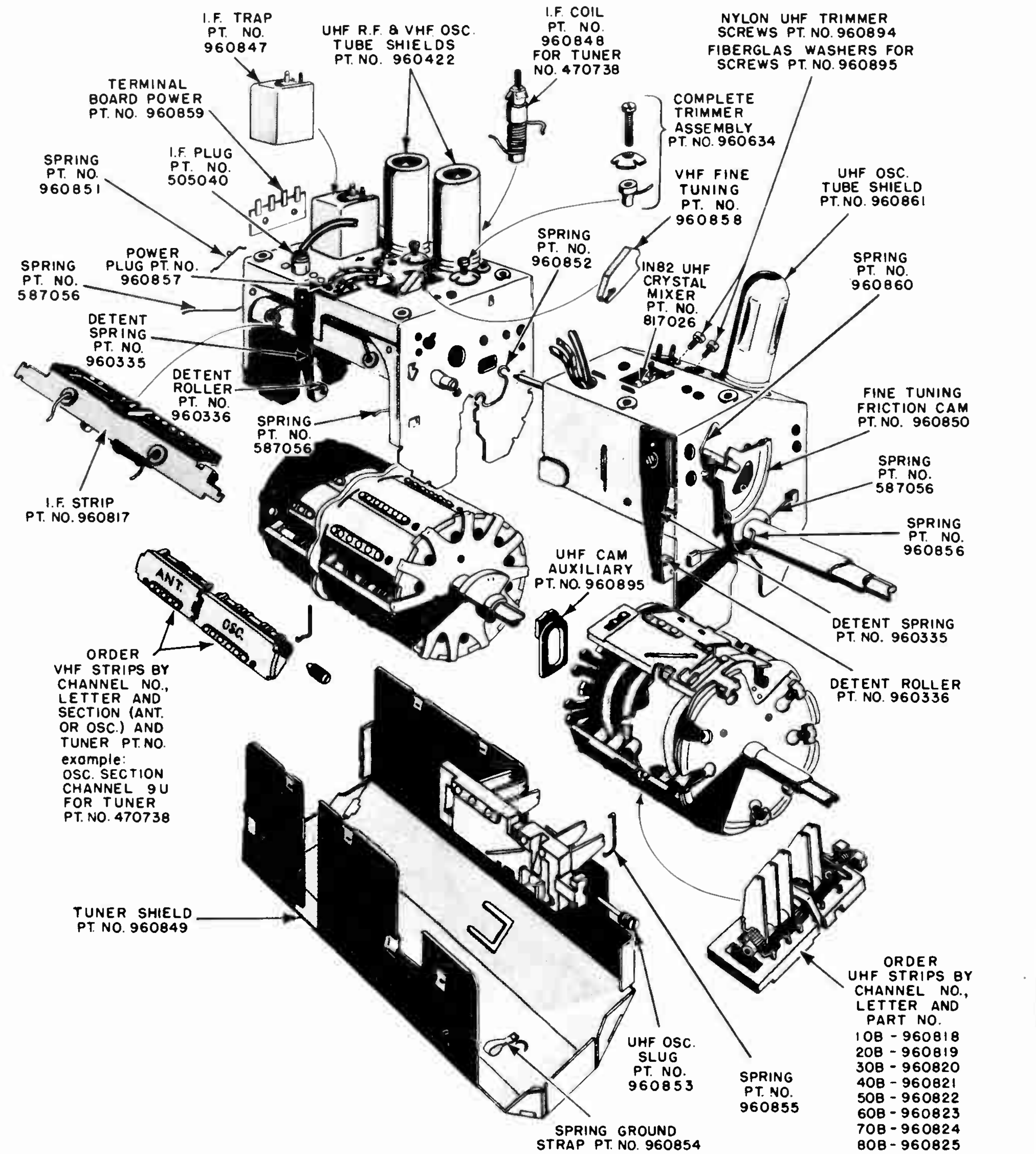


FIGURE 9

All instrument leads should be dressed as shown and kept as short as possible to prevent interaction between input and output leads.

To minimize standing waves it is important that the sweep generator and tuner be properly matched. This can be done with the type of pad shown in figure #8. Use short leads and make direct solder connections to sweep and tuner to obtain a good match. Non-inductive high frequency resistors should be used.

In the event the sweep pattern is unstable when touching sweep cable (standing waves) try moving equipment leads and ground connections for best stability.



EXPLODED DRAWING OF TUNER

The above drawing shows the part numbers and locations of those mechanical parts which may at some time require replacement. When needed, these parts should be ordered through your local Emerson distributor making reference to the tuner part number as well as the part numbers of the parts desired.

In the event a part is needed for which we have not assigned a part number, order by mechanical description, purpose and tuner part number.

Model Numbers	TV Chassis	Tube Size	TV Tuner
752A, 755A, 784A	120174-B	21MP4 (METAL-RECT.)	470712-VHF 470713-UHF
753F, 785C, 785E	120198-D	17LP4 (GLASS-RECT.)	470712-VHF 470729-UHF

MODEL 752A

MODEL 755A

MODEL 784A

ALL CHANNEL UHF-VHF RECEIVERS

The Emerson models listed above are direct view television receivers, designed to receive both VHF channels 2 to 13 and UHF channels 14 to 83. These models incorporate such features as, noise inverter circuit with fringe compensator for superior stability in noisy fringe areas; built in UHF-VHF antenna and provisions for connecting separate external VHF and UHF antennas or a combination UHF-VHF antenna using a common lead in wire; simplimatic UHF-VHF tuning (with illuminated channel selector dial); removable front glass for ease in cleaning picture tube face and mask; black magic contrast; miracle picture lock (automatic horizontal frequency control); multiplex automatic gain control; vertical retrace blanking circuit; electrostatic focusing; minimum operating controls and many other features.

MODEL 753F

RECEIVER CHARACTERISTICS

ITEM	DESCRIPTION
Voltage Rating	115 V. - 600 Cycles A.C.
Power Consumption	190 Watts
Frequency Range VHF	54 - 88 mc.; 174 - 216 mc.
Frequency Range UHF	470 - 890 mc.
Intermediate Frequencies	Video - 45.75 mc. Audio - (intercarrier) 4.5 mc.
Antenna Input Impedance	300 ohms, Balanced
Channel Selection VHF	Twelve Position Rotary Turret
Channel Selection UHF	Continuous Tuning Channels 14 to 83

MODEL 785C
MODEL 785E

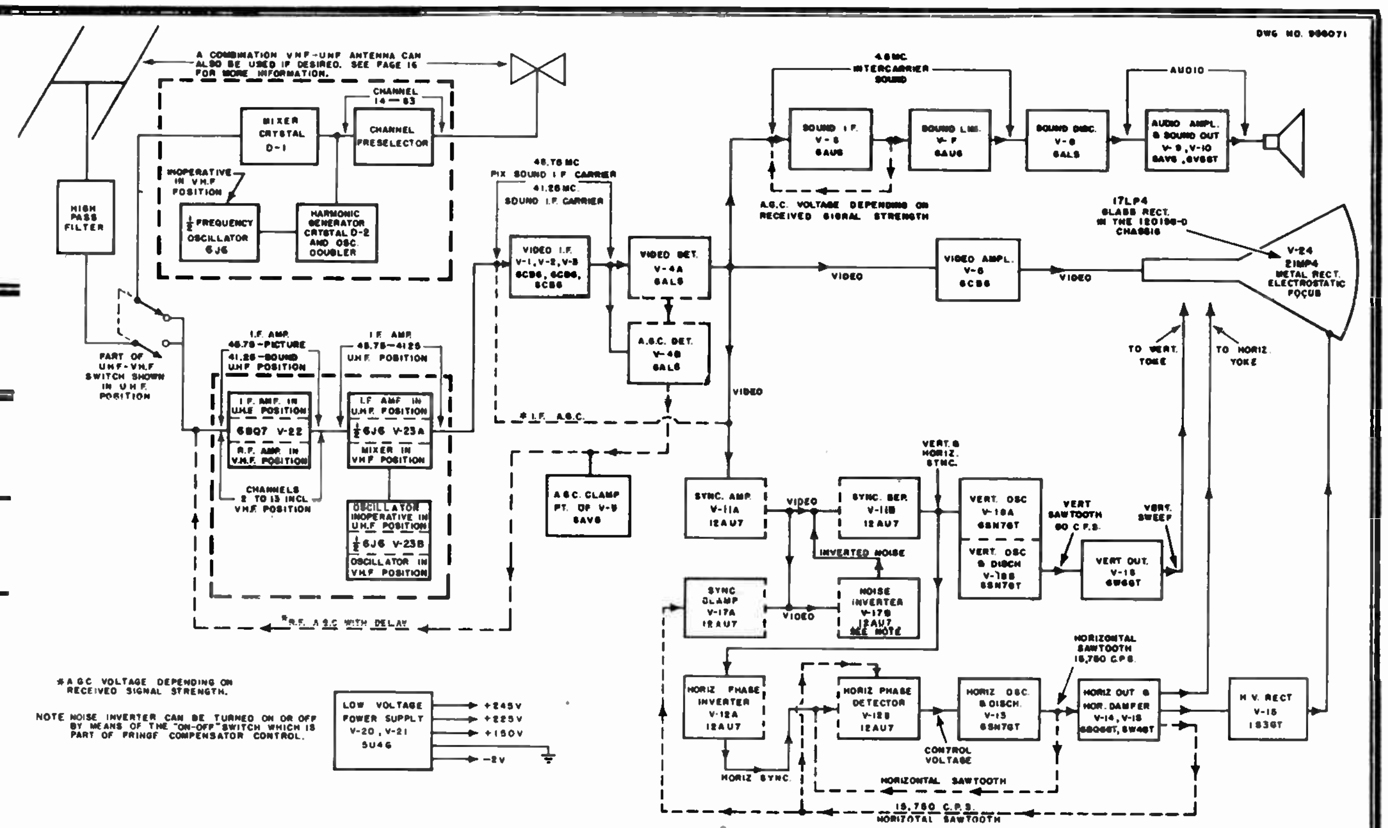


FIGURE 1 - BLOCK DIAGRAM OF CHASSIS 120174-B & 120198-D

TUNERS

Combination V.H.F. and U.H.F. tuning is achieved through the use of two tuners which are connected to the same tuning knobs making V.H.F. or U.H.F. channel tuning very simple. The V.H.F. cascode turret tuner has 13 positions (one more than the conventional type), 12 being used for V.H.F. reception, (channels 2 to 13), while the 13th or U.H.F. position is used to activate the proper U.H.F. circuits and provides additional amplification for the converted 40 mc U.H.F. signals. In this position, a window is provided to observe the continuous tuning of the U.H.F. channels

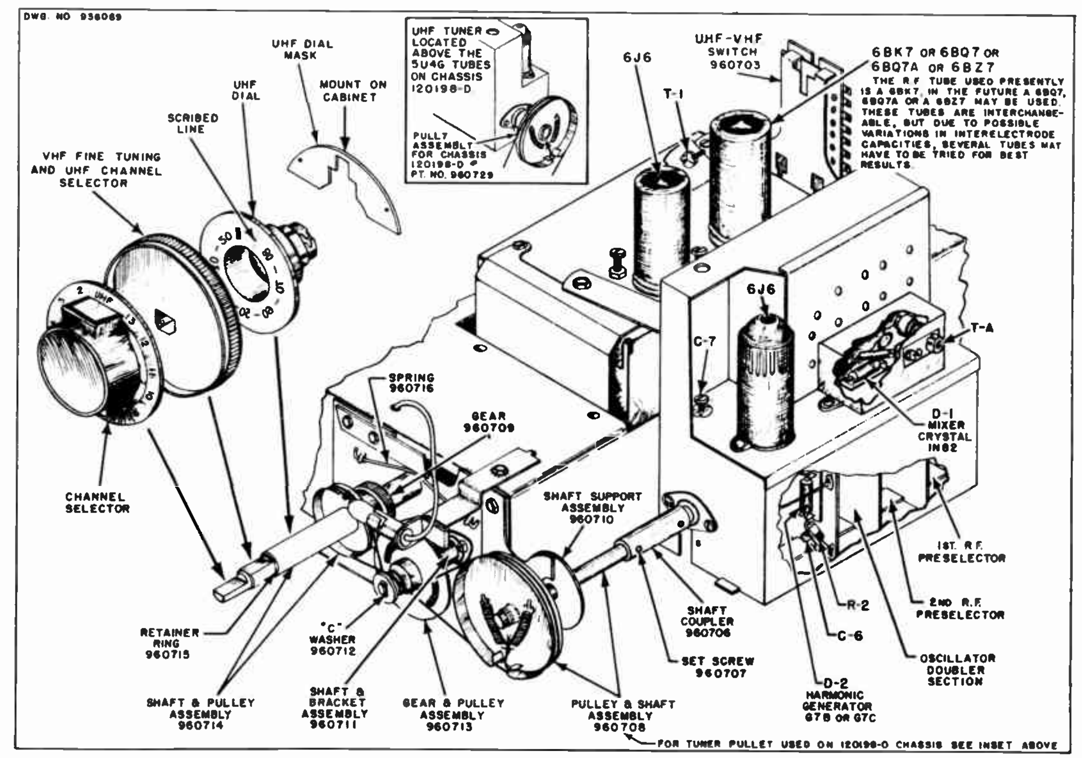


FIGURE 2 - UHF-VHF TUNER ASSEMBLY DRAWING

V.H.F TUNER

The V H.F tuner in this set is a low radiation tuner, having an improved noise factor. The low radiation characteristics greatly reduce local oscillator radiation The improved noise factor becomes apparent in fringe areas where it is of prime importance. From the customer point of view this means a viewable picture with less hash or snow.

The new design features of this tuner are confined to the R.F. amplifier stage (V-22, 6BK7 or 6BQ7 or 6BZ7). The oscillator and mixer section (V-23, 6J6) remain substantially identical to the earlier turret type tuners except that now a metal shield completely encases the turret and additional decoupling and internal shielding have been provided. A 13th or UHF position has also been added to this tuner.

The improved noise factor of this tuner is the result of the development of a circuit permitting the use of a dual triode as an R.F. amplifier which has much less tube noise than pentodes. Previously triodes with useful gain were not used as R.F. amplifiers because of their higher grid to plate capacitance which resulted in excessive oscillator radiation, and overall instability. The dual triode 6BK7 consists of two triodes in a single envelope completely separated by a ground shield. One triode section is used as a grounded cathode amplifier the gain of which is controlled by the A.G.C. applied to the grid. The second triode section is used as a grounded grid amplifier and is directly coupled to the first section. Neutralization of the first section is accomplished by the use of C-10 and C-9.

The combined operation of both triode sections of V-22 (6BK7 or 6BQ7, 6BQ7A or 6BZ7) yield an overall gain which is superior to that of a single well designed pentode stage, (6AG5, 6BC5, 6CB6) and yet the noise generated (snow) is equivalent to that of a triode stage. Due to the use of a 40 mc. I.F., it is necessary to neutralize the mixer tube (1/2 V-23, 6J6). This is accomplished by means of a bridge circuit composed of C-23, T-1 and C-21. The R.F. voltage fed to the grid of the mixer through C-21 cancels any R.F. voltage fed back to the grid through the tube plate to grid capacitance thus neutralizing this stage. In the 13th or U.H.F. position the V.H.F. turret tuner is designed to act as a 40 mc. amplifier for the converted 40 mc. U.H.F. signal.

The V.H.F. antenna input circuit incorporates a high pass filter circuit (L-5) to reduce any interference from nearby transmitters which are operating in the 40 mc. I.F. band. The output of this high pass filter then feeds into the tuner's balanced 300 ohm input circuit. For circuit diagram see Pages 4 and 21.

DESCRIPTION OF UHF TUNER

The tuned elements in this tuner are of the modified coaxial transmission line type. As you can see from the schematic on Page 20, the incoming U.H.F. signal is tuned by means of two R.F. preselectors.

These preselectors are quarter wave end tuned coaxial lines. Capacitive tuning is employed at the open ends to electrically adjust the line to 1/4 wave length and, therefore, effect a resonant condition at any frequency within the U.H.F. band. Two identical preselector circuits are coupled together to provide the proper band pass characteristic. The ganged variable capacitors adjust the two preselector lines and are similar to those used in conventional low frequency circuits. Each line is tuned by four rotor plates. Capacitor trimmers are located behind the coaxial line to preset the high frequency end of the R.F. preselectors. The antenna input in this tuner is coupled to the 1st preselector circuit and is designed to match a balanced 300 ohm transmission line. The output from the preselector stages is fed through an R.F. choke (L-5) to the mixer crystal D-1.

The U.H.F. local oscillator uses a 6J6 (V-25) in a conventional push pull circuit using lumped circuit constants. This oscillator operates at 1/2 the deisred frequency which greatly stabilizes the circuit and permits the use of a thoroughly field tested and debugged tube (6J6). The two outer oscillator capacitor plates are slotted to allow for factory corrections of pass band characteristics.

The output from this oscillator is loop coupled to the oscillator doubler section through L-7. A crystal diode (D-2) is employed in series with this coupling loop to provide rectification of the oscillator signal and thus effect more efficient doubling action. The output from this doubler is fed through L-6 to the mixer crystal D-1 where it beats with the preselected incoming U.H.F. signal. A picture I.F. of 45.75 mc. and a sound I.F. of 41.25 mc. are generated in this fashion. When the receiver is tuned to any V.H.F. channel a 100K ohm resistor (R-6) is inserted in series with the B plus to the U.H.F. tuner as shown in the switch diagram on Page 4 of this note. This is done to prevent weak operation of the U.H.F. oscillator after long periods of inoperation (set used on V.H.F.).

C-7 is used to set the high end of the oscillator and can be used in the field to compensate for slight variations in 6J6s. The range of this trimmer has been limited so as not to effect tuner tracking. Because of this, several 6J6s may have to be tried if adjustment of C-7 does not produce the desired results. Complete tuner shielding is provided to reduce oscillator radiation and stray pickup to a minimum.

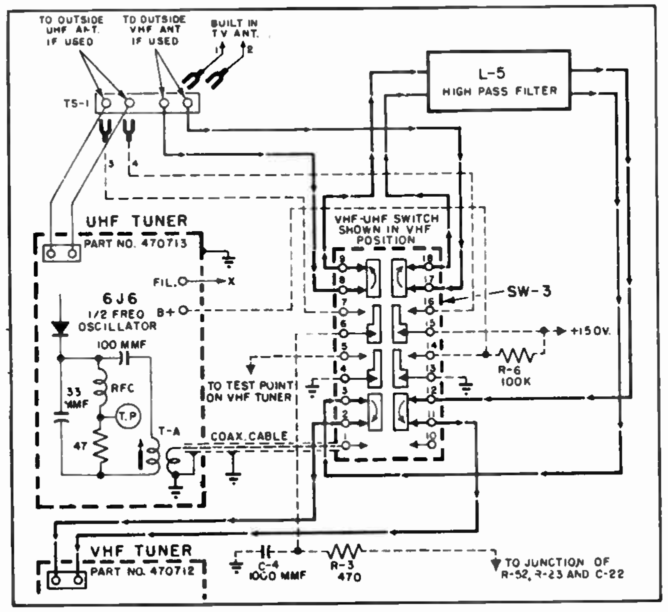
The advantage of using a crystal mixer is its simplicity of design. Since a crystal generally has a higher conversion loss than V.H.F. mixer tubes, it becomes desirable to insert additional I.F. amplification so that the sensitivity of V.H.F. and U.H.F. will be of similar magnitudes.

This is accomplished by feeding the I.F. output from the U.H.F. tuner (T-A) to the input of the V.H.F. tuner. In the 13th or U.H.F. position, the V.H.F. tuner becomes a two stage low noise cascode I.F. amplifier. The tuner input changes from 300 ohm balanced to a 72 ohm unbalanced line to match the I.F. output of the U.H.F. tuner. Since this U.H.F. strip (13th position) does not have any coil section for the V.H.F. oscillator, plate voltage is removed from this section of the 6J6 tube causing it to be inoperative.

OPERATION OF VHF-UHF SWITCH

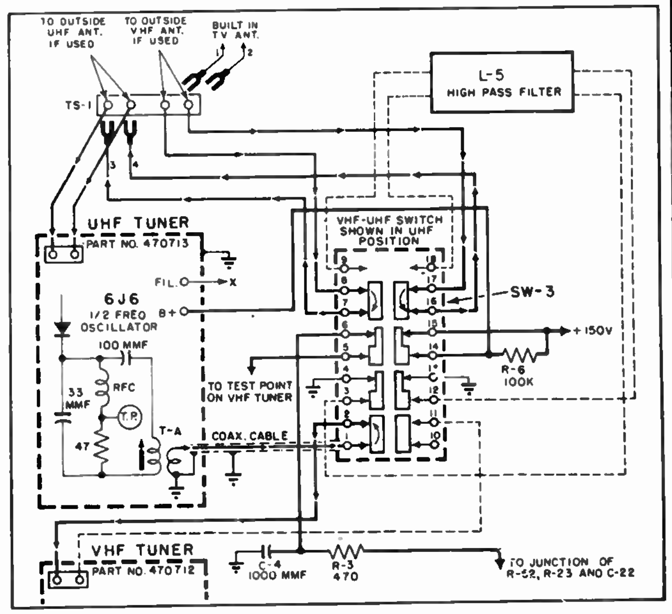
This switch is automatically operated by a cam located on the V.H.F. tuner shaft. This cam changes the switch from its V.H.F. position to U.H.F. whenever the V.H.F. tuner is set for U.H.F. operation.

The following diagram and description should make the operation of this switch clear.



VHF POSITION

The V.H.F. antenna is connected through the switch to the input of the high pass filter L-5. The output of this filter is connected to the input of the V.H.F. tuner through this same switch. B+ is supplied to the U.H.F. tuner through a 100K ohm resistor (R-6) preventing it from oscillating but allowing some current to flow through the 6J6 so that its cathode will not be poisoned during long periods of inoperation (V.H.F. reception.)



UHF POSITION

The VHF antenna or combination VHF-UHF antenna is disconnected from the VHF tuner and connected to the input of the UHF tuner through the switch and terminals 3 & 4 (providing they are connected, see installation instructions for more information). If a separate lead is is used for UHF, then terminals 3 & 4 should not be connected to the UHF antenna terminals.

The single ended output of the UHF tuner is fed through the switch to the input of the VHF tuner.

The 100K resistor R-6 is shorted out by the switch so that full B+ is applied to the UHF tuner.

Since the VHF mixer tube functions as a 40 mc amplifier when tuned to UHF, fixed grid bias is applied to it (test point VHF tuner) through the switch (SW-3).

V.H.F. TUNER OUTPUT - I.F. INPUT, I.F. CIRCUITS & TRAPS

The output of the 6J6 mixer tube which contains the video and audio I.F. carriers (45.75 mc and 41.25 mc) are fed to the first I.F. tube through a low impedance link coupled circuit T-1 and L-3 (T-1 is mounted on tuner while L-3 is mounted on chassis). R-4 which is a 15 ohm resistor determines the coupling between T-1, and L-3 so that they act like a single tuned circuit and, therefore, both input I.F.'s can be peaked to the same frequency without a sweep generator. Because of the low impedance coupling (R-4, 15 ohms) dressing and lead length in this input circuit, which would ordinarily be very critical, have very little effect upon the response curve.

The I.F. signals are then further amplified through V-1, V-2, and V-3 which are all stagger tuned by the use of Bi-Filar transformers.

Both the adjacent sound and sound carrier traps (L-1 and L-2 respectively) are connected across the 15 ohm (R-4) coupling resistor in the low impedance link circuit feeding the first I.F. tube.

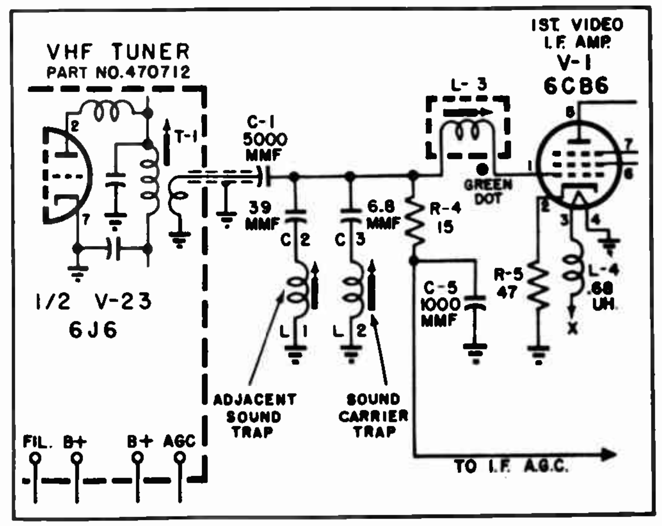


FIGURE 3 - TUNER OUTPUT AND I.F. INPUT CIRCUIT

At each of these sound frequencies (adjacent and carrier) one of the traps (L-1 or L-2) will be in series resonance, thus effectively shorting out the 15 ohm coupling resistor (R-4) and the signal. The adjacent channel sound trap in this chassis is extremely efficient, and as a result appreciably less adjacent channel sound interference should be noticed in those few areas where this type of interference presents a problem.

When using a 40 mc I.F. tube neutralization is necessary. This is accomplished by not fully by-passing the R.F. voltage from the screen grid of the video I.F. tubes. This voltage tends to cancel the R.F. signal which is fed back to the grid, through the grid to plate capacity, thus preventing the tube from oscillating. When replacing components in this circuit make sure they are of the same values, types and placed in their original positions with leads cut as short as possible.

A.G.C. is applied to the grids of V-1 and V-2 so that picture contrast will remain fairly constant over wide variations in received signal strength.

The sound carrier level is maintained just below the point of interference with the video I.F. but is not completely rejected as the audio I.F. must hetrodyne with the video I.F. in the detector (V-4, 6AL5) to produce the 4.5 mc inter-carrier audio I.F. The 4.5 mc beat is obtained across the tuned 4.5 mc trap T-5 and is fed to the first I.F. amplifier (V-6, 6AU6).

A.G.C. WITH TUNER DELAY

This A.G.C. system is designed to give superior performance of the receiver in very weak and strong signal areas. It is accomplished by separate A.G.C. control of the R.F. tube, namely keeping this tube at optimum gain at weak signals and very low gain at strong signals. The I.F. is controlled by simple A.G.C. resulting in an extended control range.

For best operation, a larger variation of R.F. A.G.C. voltage than I.F. A.G.C. voltage is required. This can be obtained by using the D.C. output of the video detector for I.F. A.G.C. and using a circuit which rectifies the peak carrier with a suitable delay for R.F. A.G.C.

This is accomplished by an A.G.C. detector (V-4, Pins 2 and 5), which is used to rectify the positive half of the modulation envelope and is keyed with the negative sync pulses above the average D.C. The D.C. voltage thus obtained across R-18 is equal to the approximate peak to peak carrier voltage less the average of 1/2 the negative modulation envelope. This voltage is superimposed on the negative average D.C. voltage developed by the video detector (V-4 Pins 1 and 7) across R-22 which results in a D.C. voltage approximately equal to the peak to peak carrier.

To operate the R.F. amplifier at maximum gain at low signal level, a positive delay voltage is applied to the A.G.C. buss by means of R-43. A clamping diode (V-9, Pins 2, 5 and 6) is used to keep the A.G.C. voltage on the buss equal to the tube contact potential (approximately minus - 0.7 volts) until the incoming signal is strong enough to develop sufficient bias to overcome the positive delay voltage.

VIDEO DETECTOR

One half of a type 6AL5, (V-4, Pins 1 and 7) is used as the video detector. The demodulated composite video signal is fed to the video amplifier (V-5, 6CB6) through the primary of the transformer (T-5) tuned to 4.5 mc (which minimizes the effect of 4.5 mc in the picture and serves as a sound takeoff). The frequency response of the video detector is extended to the amount necessary for good picture definition by using a low value of load resistor (R-22, 4700 ohms) and series-shunt peaking (primary T-5, R-20, L-8). An R.F. choke L-9 (20 uh) is used to further isolate the I.F. from the video signals.

VIDEO AMPLIFIER

The output of the video detector (V-4) is coupled through T-5, L-9 and C-21 to the grid of the video amplifier which consists of a single high gain stage (V-5, 6CB6). Since only one tube is used, the output of the video amplifier is connected to the cathode of the kinescope so that correct picture phase is realized. Fixed bias, developed across R-51 is applied to the grid of this stage, (V-5, 6CB6). The contrast control varies the tube operating bias and the amount of degeneration thus changing its gain. Series-shunt peaking and a low load resistance (R-26, 6800 ohms) is used in the plate circuit to extend the frequency response of this tube to that necessary for good picture response.

SYNC AMPLIFIER AND SEPARATOR

The composite negatively phased video signal is fed to the grid of the sync amplifier V-11A (Pin #2, 12AU7) where it is amplified and fed to the grid of the sync separator (V-11B, 12AU7).

The sync separator is operated in such a manner (low B+, high grid leak bias) that the picture and blanking information are kept below tube cutoff while the sync pulses which are of greater amplitude will cause the tube to conduct. This effectively separates the vertical and horizontal sync pulses from the picture information.

The horizontal and vertical sync pulses are fed to the vertical cascaded integrating network (R-95, C-71, R-96, C-72). This network due to its relatively long time constant with regard to horizontal pulses effectively filters out horizontal pulses while allowing the vertical sync pulses to trigger the vertical oscillator (V-18, 6SN7) keeping it in synchronism.

SYNC AMPLIFIER AND SEPARATOR (Continued)

Due to the relatively short time constant of C-42 (82 mmf) R-60 (330 K) only the horizontal sync pulses develop a pulse voltage across R-60 which operates the horizontal phase inverter. Since the vertical sync pulses are serrated at a horizontal rate these serrations also cause a pulse to be developed across R-60. This maintains horizontal synchronization even during vertical retrace improving the overall stability of the circuit.

These pulses do not actually trigger the horizontal oscillator as in the case of the vertical pulses but are used as a frequency and phase reference by means of the phase inverter (V-12A) and phase detector (V-12B) for "Horizontal Automatic Frequency Control." This is explained in further detail under "Horizontal Automatic Frequency Control."

NOISE INVERTER, SYNC CLAMP AND FRINGE COMPENSATOR

In electrically noisy fringe areas it is quite possible that the amplitude of the externally caused electrical noise pulses are greater than that of the video sync pulses. It is these relatively high amplitude noise pulses, which are of the same polarity as the sync, that cause picture instability since they upset the operation of the sync separator (V-11B, 12AU7) by charging its grid circuit up to an abnormally high negative value as a result of heavy grid conduction. This condition can cause the loss of a few sync pulses (horizontal or vertical) until the sync separator grid circuit has discharged through R-56 to its normal negative value which is determined by the peak sync amplitude. If these troublesome noise pulses could be eliminated or reduced to a point below the sync level, stability would be greatly improved.

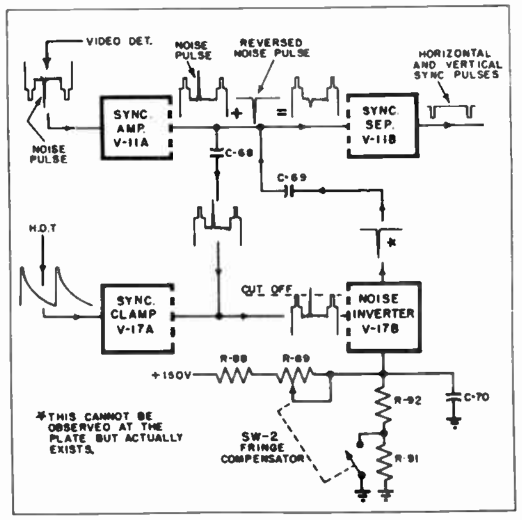


FIGURE 4 - BLOCK DIAGRAM OF NOISE INVERTER CIRCUIT

This reduction in the amplitude of the noise pulse is accomplished by the noise inverter (V-17B, 12AU7), as explained below.

In extremely strong signal areas the noise inverter circuit should be made inoperative. This is accomplished by means of the switch mounted to the "Fringe Compensator Control." This switch when "OFF" effectively increases the bias (inserts an additional 10K resistor R-91 in the cathode circuit) on the noise inverter keeping it well below cut off at all times thus effectively eliminating it from the circuit.

Failure to keep this circuit beyond cut off in strong signal areas may result in vertical roll and or wiggle. The operation of the noise inverter is as follows.

NOISE INVERTER

A composite video signal of positive polarity is taken from the sync amplifier plate (junction R-53 and R-54) and fed to the grid circuit of the noise inverter tube through C-68. The grid bias on this tube is set by adjusting R-89 (fringe compensator) which effectively varies the positive voltage on the cathode of the tube (Pin 3, V-17B) so that the tube does not conduct (is just below the cut off) on sync or video information.

However all positive noise pulses of greater amplitude than the sync pulses will cause this tube to conduct. The peaks of the sync pulses are clamped just below the cut off point of the noise inverter tube by the clamper (V-17A) to prevent their causing conduction of the noise inverter, over wide variations in signal amplitude. The operation of the clamp tube is explained below.

Since positive going noise pulses of greater amplitude than the sync pulses undergo an additional stage of amplification through the noise inverter (V-12B, 12AU7) they are greatly amplified and reversed in polarity so that when they are fed back to the composite video signal (junction R-55, C-40) through C-69 they completely cancel out the noise pulse. As you can see by the block diagram the amplified negative going noise pulse is of greater amplitude than the original thus causing a slight dip on the composite video signal.

This system eliminates those noise pulses which would have otherwise adversely affected the operation of the sync separator.

SYNC CLAMP

In order to keep the tips of the sync pulses below the cut off point of the noise inverter tube over wide variations in input signal level, the peaks of the horizontal sync pulses are clamped to approximately zero volts by automatically varying the bias across R-90 (2.2 meg. noise inverter grid resistor) in accordance with the strength of the horizontal sync pulse. (See Figures 5 and 6).

This is accomplished by the sync clamp tube (V-17A, 12AU7) in the following manner: The first horizontal sync pulse (Figure 5, Item A) will cause plate current to flow (Ip) charging C-68 (.01 mf.) to the peak of the sync pulse.

Due to the relatively long time constant of C-68 and R-90 (2.2 meg.) the voltage developed across R-90 as a result of the discharge of C-68 (.01 mf.) will be equal to the peak of the sync. pulse, (Figure 5, Item B). Stronger signals will cause more plate conduction thereby increasing the bias across R-90 while weak signals will cause less plate conduction thereby decreasing the bias across R-90. (See Figure 6).

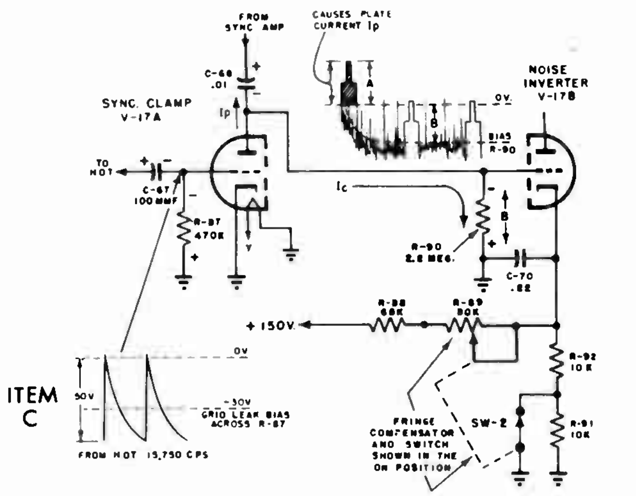


FIGURE 5

As you can see the clamp tube (V-17A) in conjunction with C-68 automatically adjusts the bias across R-90 so that the tips of the sync pulses will be clamped at approximately zero volts over wide variations in signal strength.

The grid to cathode bias of the noise inverter (V-17B) is then set by the "Fringe Compensator" so that the tips of the sync pulses (approximately zero volts to chassis) will be below the cut off point of the noise inverter.

As mentioned above this point is always maintained by the sync clamp tube (V-17A).

In order for the bias across R-90 to be dependent only on the sync amplitude and not noise pulses the sync clamp tube is kept at cut off at all times except during the horizontal sync pulses (15,750 times per second). This is accomplished by triggering the grid of the sync clamp tube at a horizontal rate with a positive pulse from the H.O.T. (See Figure 5, Item C). This pulse (about 50V. P. to P.) drives the grid of the sync clamp tube positive, causing grid conduction.

This conduction charges the grid capacitor (C-67, 100 mmf.) up to the peak value of the positive pulse (approx. -30V).

Due to the relatively long time constant of C-67 (100 mmf.) and R-87 (470K) the voltage across R-87 due to the discharge of C-67 remains at about -30V. until the next horizontal pulse comes along at which time the grid again draws current charging C-67 back to -30V. at which time the above process is repeated (See Figure 6, Item A).

This causes the tube to remain well below cut off except when the grid is driven positive 15,750 times per second (horizontal rate) see Figure 6.

Since the transmitted horizontal sync pulses of the composite video signal which are fed to the plate of the sync clamp tube through C-68 (.01 mf.) occur at the same instant the grid of this tube is driven positive, plate conduction can only occur at this time. Noise pulses which occur between sync pulses cannot possibly cause this tube to conduct since the grid of the sync clamp tube is well below cut off at that time (See Figure 6). BECAUSE OF THIS FACT, THE NEGATIVE VOLTAGE DEVELOPED ACROSS THE NOISE INVERTER GRID RESISTOR (R-90) WILL BE DEPENDENT ONLY ON THE AMPLITUDE OF THE HORIZONTAL SYNC PULSES.

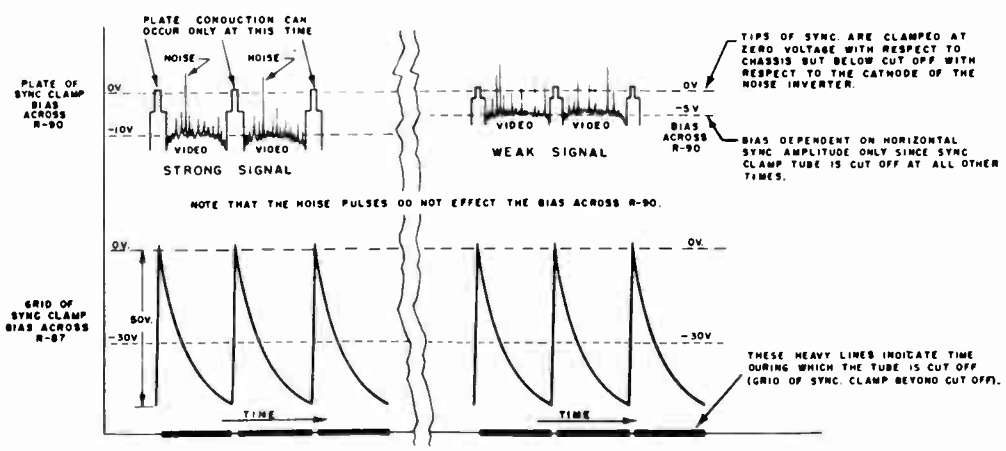


FIGURE 6

HORIZONTAL AUTOMATIC FREQUENCY CONTROL (MIRACLE PICTURE LOCK)

In modern day receivers it is necessary to use some form of automatic frequency control so that the horizontal sync pulses do not directly trigger the horizontal oscillator. This is necessary since occasional noise bursts may prematurely trigger the oscillator, causing the picture to either spear or tear out.

By using A.F.C. the average of a group of sync pulses are used to control the frequency of the oscillator, therefore, if a sync is distorted or masked by noise little effect will be observed on the screen.

HORIZONTAL AUTOMATIC FREQUENCY CONTROL (Continued)

This type of system is especially useful in the fringe areas where the signal to electrical noise interference is very poor.

This particular chassis uses a comparison of phase between the sync signal and the generated sawtooth as a basis for automatic frequency control (A.F.C.). Such a system is little influenced by changes in sync amplitude or occasional noise and, therefore, operates extremely well.

A Phase Detector V-12B compares the difference in phase between the transmitted horizontal sync pulse and the horizontal sawtooth voltage which is generated in the receiver. Whenever the phase of the horizontal multivibrator (V-13) changes, the phase of the sawtooth generated by this tube also changes. This effect changes the phase between the sync and sawtooth voltages causing the sync pulse to ride higher or lower on the sawtooth retrace portion changing the peak amplitude of this composite wave. (See Figure 7). This change in amplitude is detected by the phase detector (V-12B) by means of the grid leak voltage developed across R-65, R-64 and R-63 which is proportional to the peak positive amplitude of this composite wave (sawtooth plus horizontal sync pulse). (See Figure 7).

When the frequency and phase of the sync and sawtooth is correct the negative grid leak voltage developed across R-64 is equal to the positive cathode voltage developed across R-63 (100 K), therefore, the net control voltage applied to the grid of the horizontal oscillator (V-13) is zero. With zero voltage on the grid the oscillator is set to have the proper frequency and phase by means of the horizontal hold control, horizontal balance control and phase coil.

Just as soon as a phase difference develops between the horizontal sync and the sawtooth, a negative or positive control voltage is generated, which immediately corrects the phase of the oscillator, returning the control voltage back to approximately zero (will be slightly positive or negative depending upon the setting of the horizontal hold control R-73).

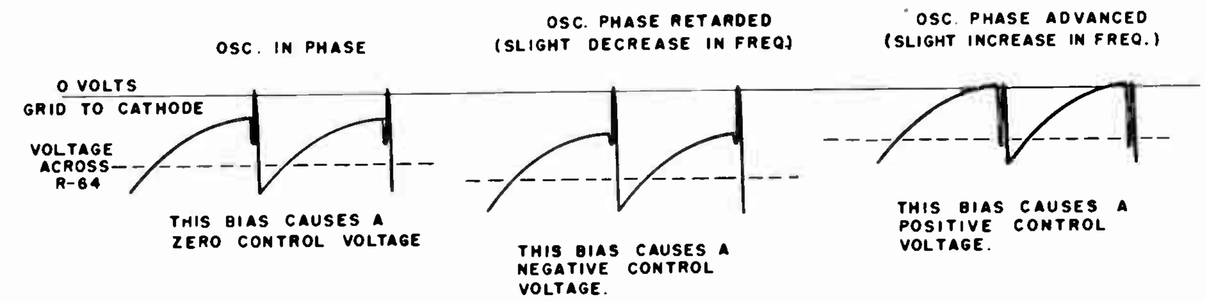


FIGURE 7

The purpose of the phase inverter is to provide a positive and negative going sync pulse of equal amplitude so that noise and sync pulses cancel themselves out at the control voltage take off point (Junction R-65, R-64) making the control voltage proportional only to phase differences.

R-75, R-68, C-47, R-66 and C-46 are used to couple and shape the positive pulse from the horizontal output transformer to a negatively phased sawtooth.

C-56 and C-55 reduce the amplitude of the generated horizontal sawtooth before it is fed to the grid of the phase detector by C-48.

The network of R-67 (2.2 meg.) in parallel with C-49 (.001) used in conjunction with C-50 (.015) tends to filter unwanted high frequency pulses, while permitting the low frequency control voltage to pass.

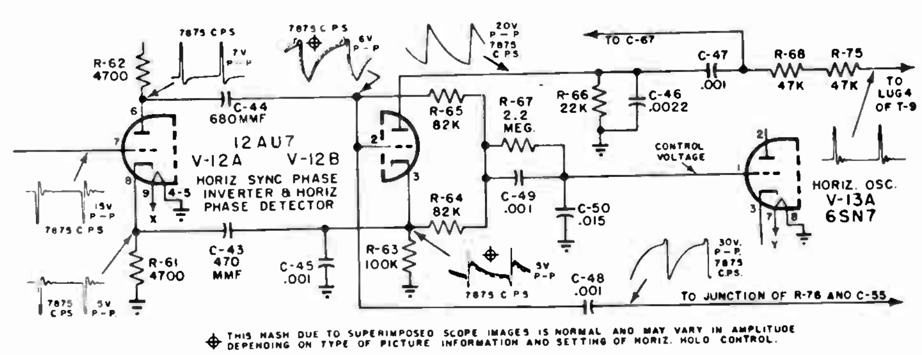


FIGURE 8 - HORIZONTAL AUTOMATIC FREQUENCY CONTROL NETWORK

HORIZONTAL OSCILLATOR, SWEEP, AND OUTPUT

V-13, 6SN7 is a cathode coupled multivibrator whose free running frequency and phase depends upon such factors as setting of R-71 (Horizontal Balance), R-73 (Horizontal Hold), adjustment of L-13 (Horizontal Phase Coil) and the applied plate and grid voltages. Since automatic frequency control is to be used in this circuit, one of the above factors will have to be automatically varied. Since the grid of V-13A offers a convenient control point its voltage will be varied automatically to control the oscillation frequency and phase of V-13. The method of control is outlined under "Horizontal Automatic Frequency Control."

The horizontal phase coil (L-13) is adjusted so that its natural resonant frequency is the same as the horizontal sync rate (15,750 CPS). The abrupt voltage changes in the plate circuit of V-13A shock this circuit into oscillation. Since the frequency of L-13 and C-53 is not effected by voltage changes or other component changes, it greatly stabilizes the operation of the circuit by modulating the plate voltage of V-13A with a 15,750 sine wave. The polarity and phase of this sine wave is such that it maintains the free running frequency at 15,750 C.P.S.

The sweep voltage which is developed across C-56, C-55 as a result of the charge through R-74 (47K) and discharge through the horizontal oscillator tube (V-13B) is coupled to the grid of the 6BQ6GT horizontal output tube. The 6BQ6GT (V-14) is used as a power amplifier so as to supply the necessary horizontal deflection current to the deflection yoke. The horizontal output transformer (T-9) matches the relatively low impedance of the horizontal deflection yoke winding (L-16) to the plate circuit of the 6BQ6GT (V-14) for maximum efficiency. The damper tube V-16 (6W4GT) is effectively connected across the horizontal deflection yoke to damp out oscillations which occur over part of the horizontal scanning cycle. The resultant energy from these damped oscillations provides the boosted B+ voltage.

VERTICAL OSCILLATOR SWEEP AND OUTPUT

A cathode coupled multivibrator is used as the vertical oscillator (V-18, 6SN7). The vertical hold control (R-100) controls the free running frequency of V-18. The intergrated vertical sync pulse causes V-18 to lock in at the proper frequency. The amplitude of the sweep voltage is controlled by the vertical size control (R-103). Since R-103 changes the plate voltage of V-18, its adjustment may require resetting of R-100 (vertical hold control) as well.

The sweep voltage developed across C-76 in series with R-104 is coupled through C-77 to the vertical output tube V-19. The vertical output transformer (T-10) matches the low impedance of the vertical deflection yoke L-17, to the relatively high output impedance of V-19 for maximum efficiency. R-107 (vertical linearity control) changes the operating characteristics of the vertical output tube V-18, thus changing the vertical linearity of the picture.

DEFLECTION

Spot deflection is achieved by means of a deflection yoke (L-16 horizontal deflection coil and L-17 vertical deflection coil), mounted around the neck of the picture tube. Vertical and horizontal deflection currents flowing through these coils set up a magnetic field within the tube which causes the spot to be scanned both vertically and horizontally. R-111 and R-112 damp out the vertical coils to prevent spurious oscillations. C-81 connected across one half of the horizontal yoke winding is used to make both halfs of this winding electrically identical. This in conjunction with R-83 (8200 ohm) connected between the horizontal output transformer and the yoke help to eliminate yoke ringing (rippling of raster lines).

HIGH VOLTAGE SUPPLY

A voltage pulse in the plate circuit of the horizontal output amplifier (V-14, 6BQ6GT) which is developed during horizontal retrace is stepped up by the auto-transformer type primary of the horizontal output transformer T-9. Approximately 15,000 volts are generated in this manner due to the high efficiency of this circuit. A 1B3 (V-15) rectifies this pulse which is then filtered by C-61, (500 mmf.) and R-84, (100K). Filament power for this tube is obtained from a tap on the horizontal output transformer.

LOW VOLTAGE SUPPLY

Two dual rectifiers (V-20, 5U4G, V-21, 5U4G) are used to supply the proper D.C. voltages and currents to the receiver from the applied A.C. power.

Although each tube is connected as a half wave rectifier, together they form a full wave rectifier circuit.

Filtering is accomplished by a condenser input filter (C-64, 80 mf.; L-18, filter choke and C-66, 40 mf.). Voltages of plus 245, 225 and 150 are available from this supply. The B plus 150 volts is further filtered through R-86, (1250 ohm) and C-65, 40 mf. Since the center tap of the power transformer T-11 is above chassis by 8.5 ohms (R-51) a small negative voltage is developed which supplies a fixed bias to the video amplifier tube (V-5, 6CB6). A .6 amp. slow blowing type fuse is placed in series with the center tap of the power transformer (T-11) to protect the receiver in the event a short in the Hi B plus circuit (+245V. and +225V.) should occur.

FOCUS AND CENTERING

The 21MP4 (V-24) is pre-focused electrostatically by means of a focus electrode in the gun assembly operating at a nominal voltage of 150 volts. The voltage on this electrode may be varied between 0 and the boosted B+ voltage of 430 volts by means of the potentiometer marked "Focus" (R-31) at the rear of the chassis in order to secure the best possible focus.

Centering is accomplished by means of a centering unit placed on the neck of the picture tube slightly behind the yoke.

This device consists of two magnetized rings which when rotated together cause the electron beam to shift thus centering the picture. If the centering range is not sufficient a slight rotation of one of the rings with respect to the other will vary the amount of range until the right point is reached. For further information on the use of this centering unit see note on centering procedure.

BEAM BENDER (ION TRAP)

A single magnet type of beam bender is used and should always be adjusted by sliding and rotating the unit for maximum brightness. Do not adjust the trap for removing corner shadows or improving focus if in so doing the brightness is reduced.

If two positions of maximum brightness are found use the one closer to the picture tube socket.

ADJUSTMENT OF NOISE INVERTER (Fringe Compensator)

1) Be sure the miracle picture lock has been properly adjusted (horizontal hold circuits). See Page 15.

2) Tune in a weak station. Turn fringe compensator switch to the "ON" position and adjust the fringe compensator control for best picture stability.

3) Try all channels and readjust fringe compensator if necessary for best overall picture stability.

NOTE: In most locations this added protection will not be necessary and the fringe compensator should remain in the "OFF" position. If this is not done, picture wiggle and or vertical roll might result in strong signal areas.

CENTERING PROCEDURE

1. Set the unit, magnets forward, on the tube so that the magnets are about 1/4" behind the yoke. Adjust the clamp so that the unit is a sliding fit on the tube.
2. Set the magnets so that the adjusting arms are approximately 120° apart (Figure 9).
3. Adjust the ion trap magnet for maximum brightness.
4. Rotate the whole unit, this will cause the picture to move around a circle. Stop where the picture is most nearly centered.
5. Rotate the magnets separately, in equal distances but in opposite directions to complete the centering.
6. Repeat steps 3, 4 and 5 if necessary.
7. Tighten clamp.
8. Readjust the ion trap magnet to give maximum brightness.

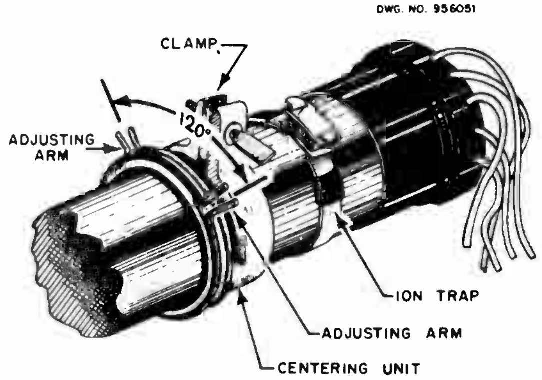


FIGURE 9 - CENTERING UNIT LOCATION DRAWING

CAUTION: It is important that the centering magnets not be operated too close to the yoke as the A-C field from the yoke may cause the centering magnets to become demagnetized.

SETTING OF TUNING KNOBS

1) Make sure chassis has been adjusted in the cabinet so that the tuning shafts are perfectly centered through the cabinet hole.
2) Insert fine tuning knob on shaft and rotate fully counter clockwise (no further rotation of outer U.H.F. dial shaft).
3) Remove fine tuning knob and insert the U.H.F. dial (contains U.H.F. channel Nos.) on U.H.F. dial shaft. Set the scribed line at 12 o'clock before placing on shaft. Do not twist or turn when inserting U.H.F. dial. The scribe line is a hair thickness and is located about 3/16" to the right of the heavy black line near 0 of channel 20.
4) Place fine tuning and selector knobs on their respective shafts.

NOTE: Leave enough space between knobs so that there will not be any binding.

ALIGNMENT V.H.F.

ALIGNMENT

a. Equipment Required - A sweep generator, (10 MC. sweep with center frequency of 44 MC. plus all necessary R.F. sweep frequencies as listed in R.F. Table), accurate marker generator, oscilloscope and V.T.V.M. are required for alignment. The marker generator must supply frequencies of 4.5 MC., 40 to 48 MC. and 50 to 216 MC.

b. Alignment Points - The location of all I.F. transformers, Tuned Circuits, and trimmers shown in Figure 14.

TV R.F. & MIXER ALIGNMENT (V. H. F.)

Connect 3 volt bias battery to both I.F. and R.F. AGC. circuits, positive terminal to chassis, negative terminal to junction of R-19, C-19, C-18. Add a jumper wire from this junction to junction of R-10, R-16, C-8 so that the bias battery is also applied to I.F. AGC.

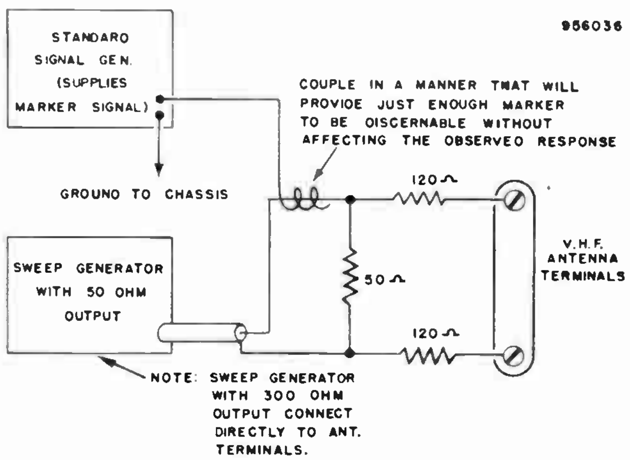


Figure 10. GENERATOR CONNECTIONS FOR TELEVISION R.F. CHANNEL ALIGNMENT.

SWEEP & MARKER GENERATOR CONNECTIONS	SWEEP & MARKER GENERATOR FREQ. RANGE	MARKER GEN. FREQ.	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 10 and adjust sweep controls for width so that complete channel response may be observed as shown in Fig. 11	Channel #12 207 MC. Center Freq.	209.75 MC. Sound Carrier 205.25 MC. Pix Carrier	Vert. input of scope through 10K resistor to test point on tuner Fig. 14 Low side to chassis	Set Channel Selector to #12 NOTE Keep output of R.F. Marker Generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	C-2 R.F. Amp. Input Trimmer C-5 R.F. Plate Trimmer C-6 Mixer Grid Trimmer	Adjust Trimmers C-2, C-5 and C-6 to obtain response shown in Fig. 11 IMPORTANT: When adjusting trimmers C-2, C-5 and C-6 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as Above	#13 213 MC.	*215.75 MC. **211.25 MC.	Same as Above	Set Channel Selector to #13 (See Note Above)		The r-f band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers C-2, C-5 and C-6. Adjust the r-f sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers.
	#11 201 MC.	*203.75 MC. **199.25 MC.		Set Channel Selector to #11 (See Note Above)		
	#10 195 MC.	*197.75 MC. **193.25 MC.		Set Channel Selector to #10 (See Note Above)		
	#9 189 MC.	*191.75 MC. **187.25 MC.		Set Channel Selector to #9 (See Note Above)		
	#8 183 MC.	*185.75 MC. **181.25 MC.		Set Channel Selector to #8 (See Note Above)		
	#7 177 MC.	*179.75 MC. **175.25 MC.		Set Channel Selector to #7 (See Note Above)		
	#6 85 MC.	* 87.75 MC. ** 83.25 MC.		Set Channel Selector to #6 (See Note Above)		
	#5 79 MC.	* 81.75 MC. ** 77.25 MC.		Set Channel Selector to #5 (See Note Above)		
	#4 69 MC.	* 71.75 MC. ** 67.25 MC.		Set Channel Selector to #4 (See Note Above)		
	#3 63 MC.	* 65.75 MC. ** 61.25 MC.		Set Channel Selector to #3 (See Note Above)		
	#2 57 MC.	* 59.75 MC. ** 55.25 MC.		Set Channel Selector to #2 (See Note Above)		

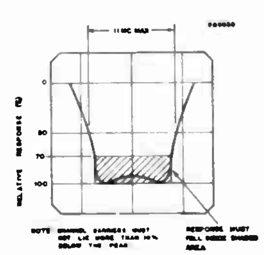


Figure 11 -- TUNER RESPONSE CURVE SHOWING BAND-PASS LIMITS.

The response for all channels should meet with the requirements of Fig. 11. To do so it may be necessary to compromise by slightly changing the initial channel #12 adjustments of C-2, C-5 and C-6 while switched to channel which does not conform.

*Sound Carrier Marker
**Picture Carrier Marker

I.F. ALIGNMENT

1) Tune receiver to unused Channel 10 or 12.

2) Connect 3 volt bias battery with negative terminal to I.F. AGC. (Junction R-10, C-8, R-16) positive terminal to chassis.

3) Connect D.C. V.T.V.M. to video test point (see location in Fig. 13 and 14).

4) Connect terminated marker generator to floating shield of converter tube V-23 6J6. (Shield raised slightly so that it does not make contact with chassis). Use unmodulated marker. See Fig. 13.

MARKER GENERATOR	ADJUST	PROCEDURE
45.75 MC. Unmodulated	T-4	Peak for maximum response. Adjust output of signal generator so that maximum response does not produce more than -2V. D.C. on V.T.V.M.
43.2 MC. Unmodulated	T-3	
42.0 MC. Unmodulated	T-2	
45.0 MC. Unmodulated	L-3 T-1	
41.25 MC. Unmodulated	L-2	Adjust trap for minimum response. Increase output from signal generator so that a true minimum position can be found.

5) Connect vertical input of an oscilloscope instead of V.T.V.M. to video test point with vertical scope gain set at, or near, maximum. (Horizontal scope sweep set at 400 cycles).

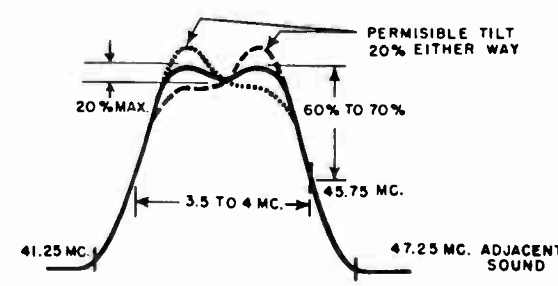
MARKER GENERATOR	ADJUST	PROCEDURE
47.25 MC. 400 Cycles Amp. Mod.	L-1	With signal generator set at maximum output, adjust L-1 for minimum vertical response on scope.

6) Now that all the I.F. coils and transformers have been set, the overall response can be observed and adjusted if necessary.

SIGNAL GENERATOR INPUT CONNECTION	FREQUENCY SWEEP	FREQUENCY MARKER	MEASURING INSTRUMENT	ADJUST	PROCEDURE
Connect terminated sweep and marker as shown in Fig. 13.	Center frequency 44 MC. 10 MC. Sweep	45.75 MC.	Scope connected to Video Test Point	T-4	If 45.75 MC. doesn't lie from 60 to 70% down adjust T-4 (see fig 12) for tolerances. *

Providing overall curve is within tolerances as shown below, no further adjustments are needed. If band width or tilt is not as specified, repeat entire alignment procedure. If still out then a slight retouching is permissible. TRAPS L-1 and L-2 MUST BE ADJUSTED AS INDICATED ABOVE. DO NOT RE-ADJUST WHILE OBSERVING OVERALL I.F. RESPONSE CURVE.

***KEEP OUTPUT OF SIGNAL GENERATOR AS LOW AS POSSIBLE WHEN OBSERVING THE OVERALL I.F. SHAPE SINCE TUBE OVERLOAD MIGHT RESULT AND THE RESPONSE WILL APPEAR INCORRECTLY FLAT AND WIDE.**



NOTE: It may be impossible to observe the 47.25 MC. marker with the average service equipment due to the high attenuation of trap L-1 (adjacent sound).

Figure 12. OVERALL I.F. RESPONSE CURVE

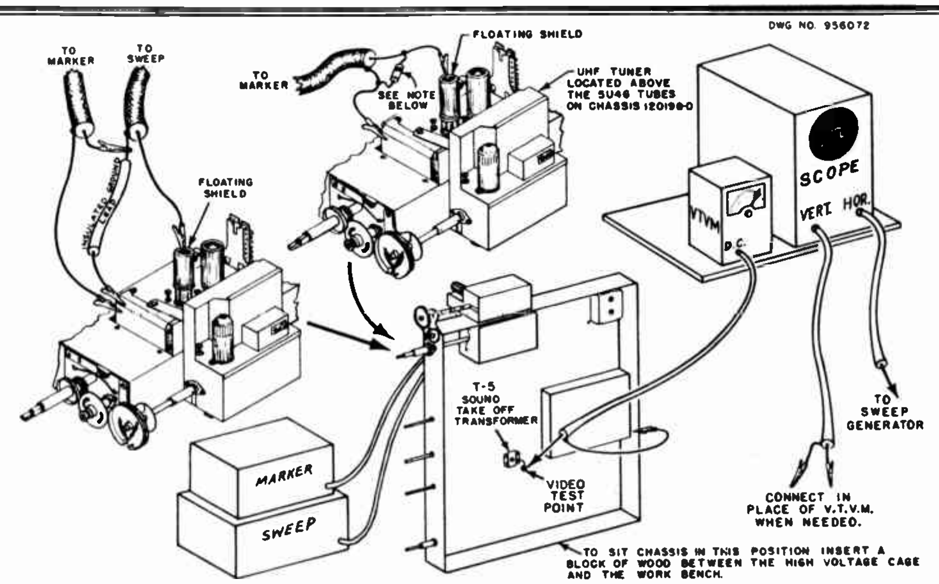


Figure 13. CONNECTIONS FOR I.F. ALIGNMENT.

All instrument leads should be dressed as directed and as short as possible to prevent interaction between input and output leads. Failure to do this may result in an unstable response indication.

NOTE: It is important that the output cable of the sweep and marker generator be properly terminated in their characteristic impedance which is usually from 50 to 75 ohms. If this termination has not been built into the end of the cable by the instrument manufacturer* then a resistor of the proper value (characteristic impedance) should be connected across the output of each generator cable as shown above.

* If in doubt check your instruction book which is issued by the test equipment manufacturer.

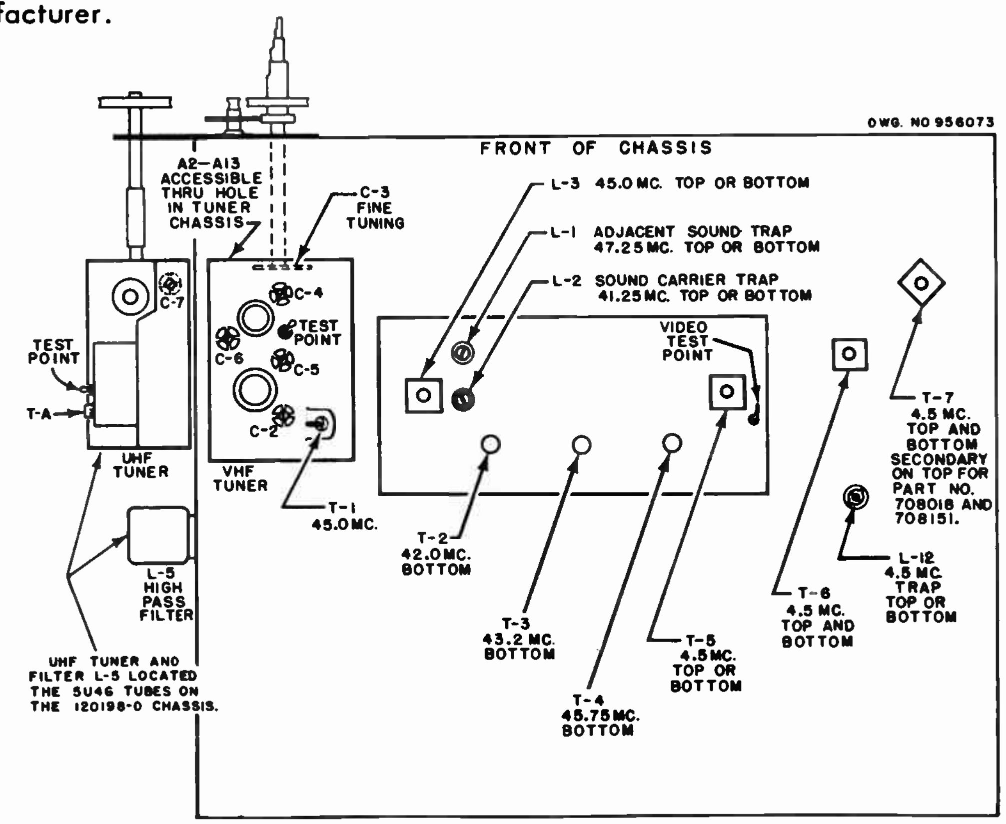
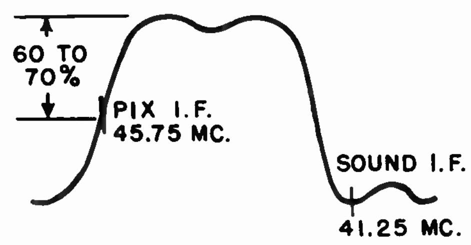


Figure 14 - LOCATION OF ALIGNMENT POINTS (TOP VIEW)

R.F. OSCILLATOR ALIGNMENT (V.H.F.)

1. Connect marker and sweep generator as shown in Figure 10, low side to chassis.
2. Connect scope to video test point (see location Fig. 13 and 14).
3. Connect 3 volt bias battery as described under R.F. Alignment Page 11.
4. Before undertaking oscillator alignment be sure I.F. circuits are correctly aligned for band pass characteristic and trap settings.
5. During oscillator alignment, it is necessary to set the fine tuning control so that the tooth on the fine turning cam points downward.

MARKER SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR FREQUENCY	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
*209.75 MC. **205.25 MC.	Channel #12 Center Frequency 207 MC. 10 MC. Sweep	Be sure that fine tuning control has been properly positioned (tooth on the cam pointing down) NOTE During this step and thru-out all succeeding steps it is necessary to: 1. Keep output of sweep generator at a level that does not allow the reading on a VTVM to exceed minus 1 volt when connected across video detector load at minimum sweep width. 2. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	Adjust Slug A-12	NOTE: Before making the following adjustment, advance the vertical gain control on the scope in order to magnify the sound trap portion of the response curve. Then, use a non-metallic screwdriver to adjust channel #12 oscillator slug (accessible thru hole on front of r-f tuner unit) and shift response curve so that sound carrier marker is located at the position indicated below. Now reduce gain control setting of scope to restore pattern to normal amplitude and observe position of picture carrier marker. This marker should appear on the high frequency side of the characteristic curve. The amplitude of the picture carrier should be between 60 and 70% down from peak response.
*215.75 MC. **211.25 MC.	Channel #13 213 MC.	Set Channel Selector to #13 (See note above)	Adjust the r-f sweep generator and marker generator for operation on other television channels; set marker generator to sound carrier frequency. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of r-f tuner unit. (A-2 to A-13) This permits response curve to be shifted so that sound carrier marker will appear at the position indicated below.	
*203.75 MC. **199.25 MC.	Channel #11 201 MC.	Set Channel Selector to #11 (See note above)		
*197.75 MC. **193.25 MC.	Channel #10 195 MC.	Set Channel Selector to #10 (See note above)		
*191.75 MC. **187.25 MC.	Channel #9 189 MC.	Set Channel Selector to #9 (See note above)		
*185.75 MC. **181.25 MC.	Channel #8 183 MC.	Set Channel Selector to #8 (See note above)		
*179.75 MC. **175.25 MC.	Channel #7 177 MC.	Set Channel Selector to #7 (See note above)		
* 87.75 MC. ** 83.25 MC.	Channel #6 85 MC.	Set Channel Selector to #6 (See note above)		
* 81.75 MC. ** 77.25 MC.	Channel #5 79 MC.	Set Channel Selector to #5 (See note above)		
* 71.75 MC. ** 67.25 MC.	Channel #4 69 MC.	Set Channel Selector to #4 (See note above)		
* 65.75 MC. ** 61.25 MC.	Channel #3 63 MC.	Set Channel Selector to #3 (See note above)		
* 59.75 MC. ** 55.25 MC.	Channel #2 57 MC.	Set Channel Selector to #2 (See note above)		



TYPICAL OVERALL RESPONSE CURVE

NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward).

NOTE: If an unsatisfactory overall response is obtained for a particular channel, observe R-F amp. and Mixer response curve for that channel (as described in R-F Amp. and Mixer Alignment Table). If characteristic curve does not conform reasonably well within the typical curve shown in Figure 11, then do the following things:

1. Check method of connecting scope, voltmeter and generator leads to eliminate possible distortion of observed response, or:
2. Attempt to obtain a better compromise for R.F. response on all channels by realigning R-F Amp. and Mixer circuits, or:
3. Try replacing Antenna, R-F and Oscillator coils for the particular channel.

*Sound Carrier Marker
**Picture Carrier Marker

R.F. OSCILLATOR ALIGNMENT PROCEDURE

SOUND ALIGNMENT

(A) USING 4.5 mc UNMODULATED SIGNAL GENERATOR

1) Short pin #1 of V-3 to Chassis with short jumper wire.
2) Keep output of signal generator low so as to provide a sharp meter indication with adjustment of transformers.

(B) USING TRANSMITTED TV AIR SIGNAL

1) Connect antenna and tune to a good on the air TV station.
2) Adjust fine tuning control for best picture.
3) Adjust antenna coupling for moderate signal so as to provide a sharp meter indication with adjustment of transformers.
4) Meter reading may pulsate due to changes in signal strength; do not confuse with a peak adjustment.

STEP	SIGNAL GENERATOR INPUT		MEASURING INSTRUMENT	ADJUST	PROCEDURE
	CONNECTION	FREQUENCY			
1	Marker Gen. through .01 MF to Pin 7 of V-4 low side to chassis. - or - Connect antenna and tune in a good transmitted TV. signal (any channel)	4.5 MC (Unmodulated) - or - A good on the air TV. channel	Connect D.C. V.T.V.M. (negative scale) through 10K Resistor to Junction of C-30, R-35, R-36 - low side to chassis.	T-5 Top or Bottom T-6 Top and Bottom	Peak for maximum voltage. Adjust output of signal generator to produce about a one volt D.C. rise on meter (1 volt above noise* voltage) If T.V. signal is used adjust ant. coupling to receiver to produce about the same voltage rise.
2	Same as above.	Same as above.	Connect V.T.V.M. through 10K Resistor to Junction of R-44, C-34 - low side to chassis.	T-7 Top and Bottom (Discriminator)	A) Detune Discriminator secondary T-7 (Top Pt. #708018, 708151; Bottom Pt. #708017) for maximum negative meter reading. B) Adjust primary T-7 for maximum negative meter reading. C) Readjust Discriminator secondary (towards original setting) for zero D.C. reading on V.T.V.M. D) Check Audio, if distorted repeat steps A - C.

* The noise voltage is measured under no signal conditions (antenna terminals shorted directly at tuner by means of a short jumper wire; or disconnect 4.5 MC. generator if procedure (A) above is followed.)

4.5 MC VIDEO TRAP ALIGNMENT (L-12)

1. Connect crystal controlled 4.5 mc. signal generator through a .01 mf. condenser to the grid of the video amplifier tube (Pin 1 of V-5, 6CB6) low side to chassis.
2. Set contrast control for maximum contrast (fully clockwise).
3. Connect a V.T.V.M. (D.C. scale) through an R.F. probe to the cathode of the picture tube (Pin 11, yellow lead) low side to chassis.
4. Adjust the 4.5 mc. trap L-12 for minimum reading on the V.T.V.M.

If a crystal controlled generator is not available the video trap can be adjusted in the field by setting the fine tuning control for maximum 4.5 mc. in picture and adjusting the 4.5 mc. trap (L-12) until this 4.5 mc. beat note is reduced. Be sure that video ringing is not introduced from this adjustment since this indicates the trap was aligned at too low a frequency.

ALIGNMENT OF MIRACLE PICTURE LOCK (Horizontal A.F.C. & Osc.)

Before proceeding be sure the Fringe Compensator Switch has been turned "OFF" (fully counter clockwise past click).

1. Tune set to a good channel.
2. Short phase coil (L-13) with a jumper wire, leads have been brought to top of chassis on terminal strip near V-13 horizontal oscillator (see tube location diagram Figure 19 Page 19).
3. Short horizontal control grid to chassis. This point has also been brought to top of chassis on same strip as mentioned in Step 2.
4. Rotate horizontal hold control (R-73) to center of its mechanical range.
5. Adjust horizontal balance control (R-71) (rear of chassis) until picture pulls into synchronism (in most cases picture will sway from side to side).
6. Remove short from horizontal phase coil (L-13) and adjust L-13 for same synchronous condition as Step 5 above.
7. Remove short from horizontal control grid. Horizontal frequency circuits are now properly aligned.
8. When properly adjusted (Steps 1 to 7) the horizontal hold control can be moved slowly over most of its range without throwing the picture out of sync.
9. Readjust horizontal hold control (R-73) so that the picture remains in sync when switching channels (near center of range).

ALIGNMENT (UHF TUNER)

The alignment of the tuner is factory set and will actually not require any additional adjustments other than to compensate for differences in 6J6 oscillator tubes. Because of this fact, the only adjustment to be made in the field is trimmer C-7 which is located next to the 6J6 oscillator tube. (See Figure 2, Page 2)

This trimmer is normally set at the factory to track the highest U.H.F. channel (83). This must be done with a U.H.F. sweep and marker generator. In the field however, this equipment is not readily available and C-7 should therefore be used to track the highest U.H.F. channel received in the area. It is usually best to try a few 6J6 tubes until one is found which more nearly resembles the original, thus requiring only a slight adjustment of C-7.

In the event T-A has been tampered with or replaced, it should be adjusted for best results on all U.H.F. channels received in the area. This I.F. sometimes normally has only a slight effect on the picture or sound.

Before doing any work on this U.H.F. tuner, whether in the field or shop, be sure that the V.H.F. I.F. and R.F. circuits have been properly set up, (this can be checked by viewing an on the air V.H.F. channel or by instruments). Information pertaining to the use of instruments can be found on Pages 11, 12 and 13.

GENERAL INSTALLATION INSTRUCTIONS

ANTENNA

This chassis is designed to operate from either its built in UHF-VHF antenna, an external combination UHF-VHF antenna or separate UHF and VHF antennas using one or two sets of antenna lead in wires.

This set as delivered is ready to operate from its built in UHF-VHF antenna. In most strong UHF-VHF signal areas this will suffice.

If it is necessary to install an external antenna, disconnect the built in antenna by removing the spade lugs (1 and 2) from the VHF antenna terminals.

If one antenna lead in is used for both UHF and VHF reception, it should be connected to the VHF input terminals. When the receiver is set for UHF reception, the UHF-VHF switch automatically transfers the single antenna lead in to the input of the UHF tuner removing it from the VHF tuner. This transfer will only take place providing the jumper twin lead connected to terminals 7 and 16 of the UHF-VHF switch is also connected to the UHF input antenna terminal strip by means of spade lugs 3 and 4.

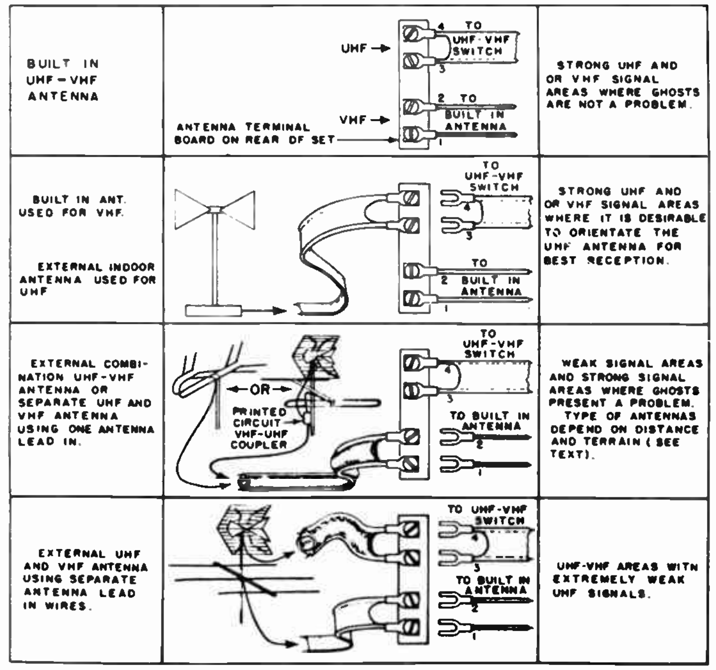
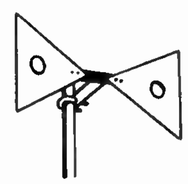


Figure 15. ANTENNA CONNECTIONS

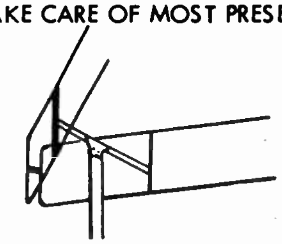
If separate UHF and, or VHF antenna lead in wires are used, they should be connected to their respective antenna input terminals. Under these conditions, spade lugs 3 and 4 must be removed from the UHF input antenna terminals.

For new installations, it would be desirable and economical to install a combination UHF-VHF antenna providing of course that a VHF station has been allocated to that area. In the event that the terrain is hilly or in a metropolitan area, ghosts may present quite a problem and it may be better to install separate UHF and VHF antennas. This may be necessary since combination antennas usually have poor directivity at UHF. Separate UHF and VHF antennas can be connected to one lead in if desired through a printed circuit filter, which is commercially available.

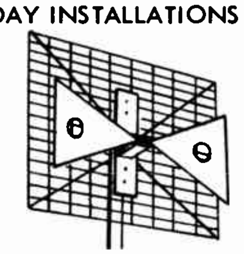
U H F ANTENNAS WHICH WILL TAKE CARE OF MOST PRESENT DAY INSTALLATIONS



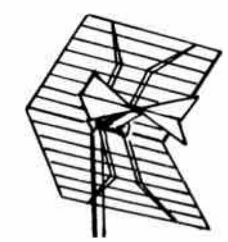
SINGLE BOW TIE
For use in strong signal areas where ghosts do not present a problem.



STACKED V
For use in weak signal areas where ghosts do not present much of a problem. Can also be used for strong VHF signals.



BOW TIE SCREEN RELFECTOR
For use in strong or weak signal areas where ghosts present a problem.



FOLDED BOW TIE CORNER REFLECTOR
For use in strong or fringe areas where ghosts present a problem.

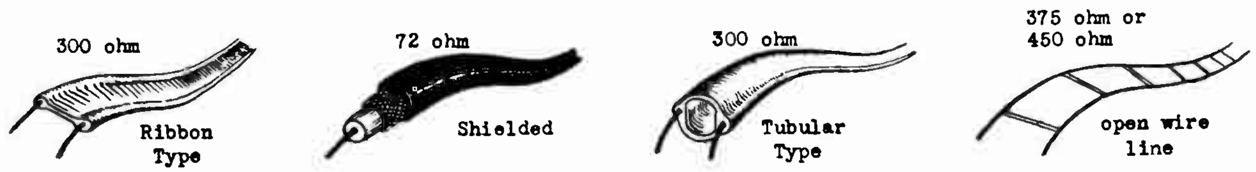
NOTE: All of the above four antennas will operate over all 70 UHF channels.

In UHF the use of free space terminals and rigid construction is an important detail. By free space terminals we mean air insulation between the terminals of each antenna section instead of bakelite or poly. The use of an insulation other than air, tends to collect moisture which creates a signal leakage path thus reducing the signal.

Since UHF frequencies have relatively short wave lengths, rigid elements are very important. The slightest movement could easily become an appreciable part of a wave length which may effect signal pickup.

ANTENNA WIRE

The common type 300 ohm ribbon line will work out satisfactorily only in strong signal areas, since when wet line losses increase by almost 8 times at the high end of the UHF band. The tubular 300 ohm line is much better in this respect as the leakage path is not as readily effected by moisture and it can therefore be used in most signal areas. When wet, tubular line losses increase slightly more than two times at the high end of the UHF band. In the extreme fringe areas the use of open wire line may be best, but it is more difficult to work with. Shielded 72 ohm or 300 ohm transmission line is not at all effected by weather conditions but these lines generally have a higher loss to start with and are comparatively expensive.



Transmission lines other than the shielded type should be mounted away (6 to 7 inches) from all nearby metal objects by use of stand offs, as the closer these lines are to metal, the greater will be the losses. In the event that it is impractical to use stand offs, shielded lines such as RG-59U or RG-11U should be used. Never rest unshielded lines next to metal objects over any appreciable distance as losses will be exceptionally high and will vary to a great extent depending on weather conditions.

If tubular line is used, be sure that the ends are sealed to prevent moisture from entering the line. This is easily done by heating the ends and pressing them together to form a good seal. It is also a good idea to use a small drain hole in the tubular line just before it enters the house so that condensed moisture may leak out.

HEIGHT AND ORIENTATION OF ANTENNAS AT U.H.F.

Since the wave lengths at UHF are much shorter than at VHF, objects which did not appreciably reflect the VHF wave will now reflect UHF waves. Because of this, orientation and the use of directive antennas is much more important to minimize the pickup of reflected or ghost signals.

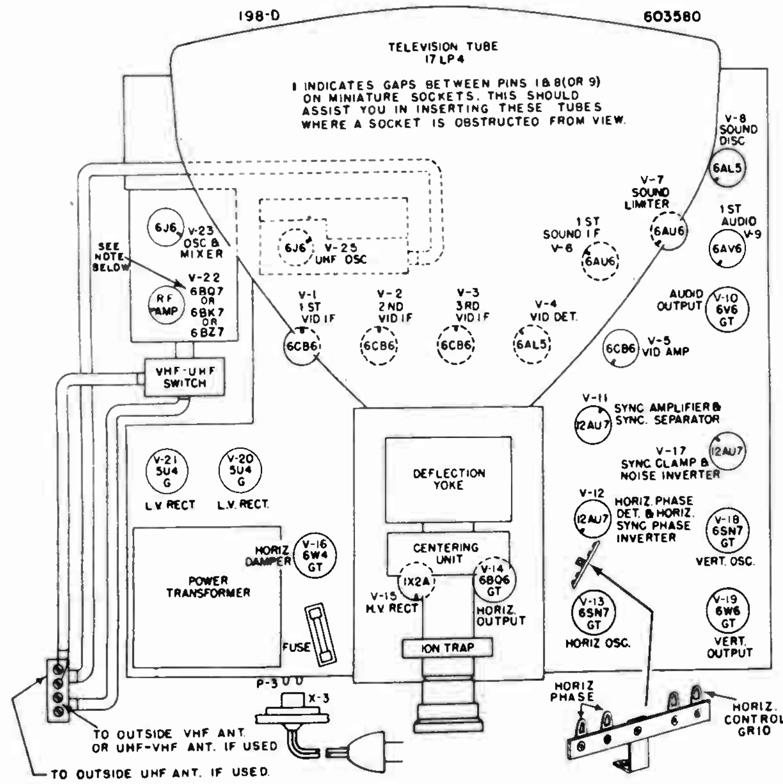
Another effect of these shorter wave lengths is to cause a more rapid variation of signal pickup with antinna height. Because of this fact, it is important that antenna height be probed for maximum signal pickup. A foot higher or lower may yield a marked increase in the signal pickup.

U.H.F. CHANNELS AND THEIR CORRESPONDING FREQUENCIES

Channel	Freq.	Video	Audio	Half Wave (Inches)
14	470-476	471.25	475.75	12.5
15	476-482	477.25	481.75	12.4
16	482-488	483.25	487.75	12.2
17	488-494	489.25	493.75	12.0
18	494-500	495.25	499.75	11.9
19	500-506	501.25	505.75	11.8
20	506-512	507.25	511.75	11.6
21	512-518	513.25	517.75	11.5
22	518-524	519.25	523.75	11.4
23	524-530	525.25	529.75	11.2
24	530-536	531.25	535.75	11.1
25	536-542	537.25	541.75	11.0
26	542-548	543.25	547.75	10.9
27	548-554	549.25	553.75	10.7
28	554-560	555.25	559.75	10.6
29	560-566	561.25	565.75	10.5
30	566-572	567.25	571.75	10.4
31	572-578	573.25	577.75	10.3
32	578-584	579.25	583.75	10.2
33	584-590	585.25	589.75	10.1
34	590-596	591.25	595.75	10.0
35	596-602	597.25	601.75	9.9
36	602-608	603.25	607.75	9.8
37	608-614	609.25	613.75	9.7
38	614-620	615.25	619.75	9.6
39	620-626	621.25	625.75	9.5
40	636-632	627.25	631.75	9.4
41	632-638	633.25	637.75	9.3
42	638-644	639.25	643.75	9.2
43	644-650	645.25	649.75	9.2
44	650-656	651.25	655.75	9.1
45	656-662	657.25	661.75	9.0
46	662-668	663.25	667.75	8.9
47	668-674	669.25	673.75	8.8
48	674-680	675.25	679.75	8.8
49	680-686	681.25	685.75	8.7
50	686-692	687.25	691.75	8.6

Channel	Freq.	Video	Audio	Half Wave (Inches)
51	692-698	693.25	697.75	8.5
52	698-704	699.25	703.75	8.5
53	704-710	705.25	709.75	8.4
54	710-716	711.25	715.75	8.3
55	716-722	717.25	721.75	8.3
56	722-728	723.25	727.75	8.2
57	728-734	729.25	733.75	8.1
58	734-740	735.25	739.75	8.0
59	740-746	741.25	745.75	8.0
60	746-752	747.25	751.75	7.9
61	752-758	753.25	757.75	7.9
62	758-764	759.25	763.75	7.8
63	764-770	765.25	769.75	7.7
64	770-776	771.25	775.75	7.7
65	776-782	777.25	781.75	7.6
66	782-788	783.25	787.75	7.6
67	788-794	789.25	793.75	7.5
68	794-800	795.25	799.75	7.4
69	800-806	801.25	805.75	7.4
70	806-812	807.25	811.75	7.3
71	812-818	813.25	817.75	7.3
72	818-824	819.25	823.75	7.2
73	824-830	825.25	829.75	7.2
74	830-836	831.25	835.75	7.1
75	836-842	837.25	841.75	7.1
76	842-848	843.25	847.75	7.0
77	848-854	849.25	853.75	7.0
78	854-860	855.25	859.75	6.9
79	860-866	861.25	865.75	6.9
80	866-872	867.25	871.75	6.8
81	872-878	873.25	877.75	6.8
82	878-884	879.25	883.75	6.7
83	884-890	885.25	889.75	6.7

TUBE LOCATIONS



NOTE: THE R F AMP TUBE PRESENTLY USED IS A 6BK7. IN THE FUTURE A 6BQ7, 6BQ7A OR A 6BZ7 MAY BE USED. THESE THREE TUBES ARE INTERCHANGEABLE, BUT DUE TO POSSIBLE VARIATIONS IN INTERELECTRODE CAPACITIES, SEVERAL TUBES MAY HAVE TO BE TRIED FOR BEST RESULTS.

Figure 16 - TUBE LOCATIONS DIAGRAM FOR CHASSIS 120198-D

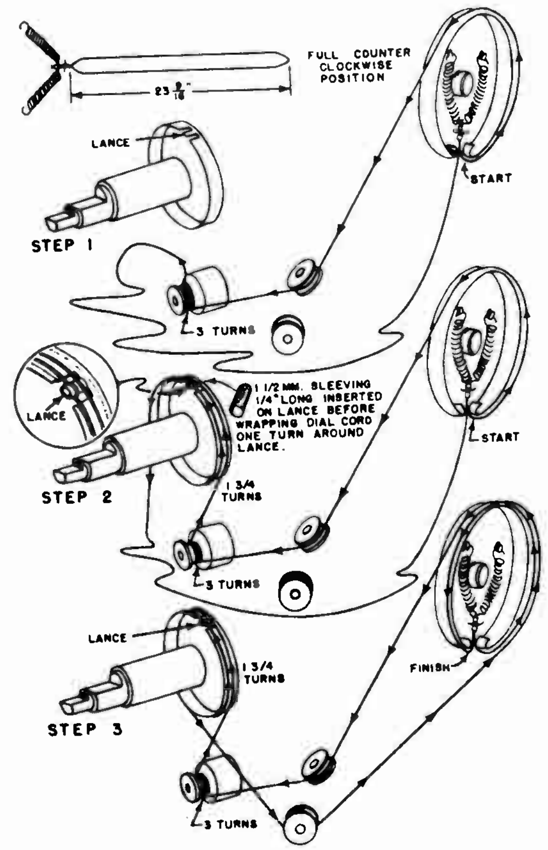


Figure 17 - DIAL CORD STRINGING CHASSIS 120198-D

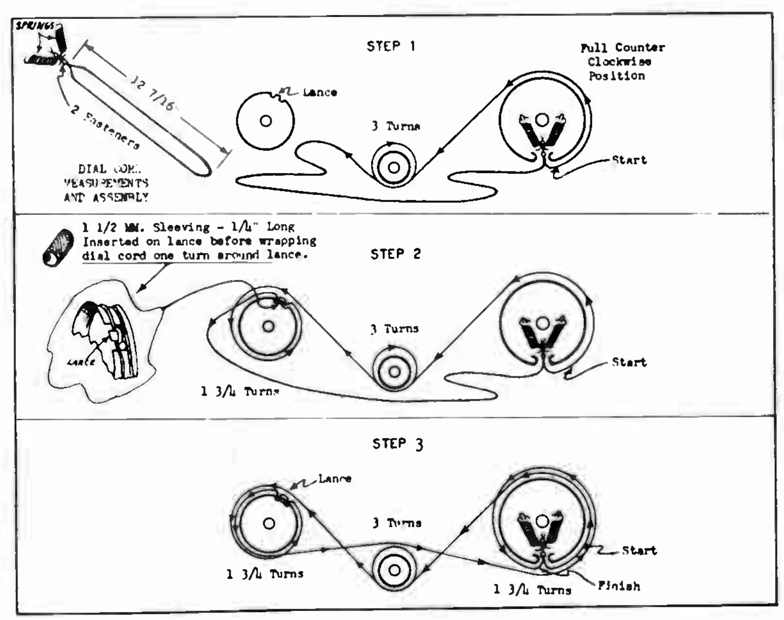


Figure 18 - DIAL CORD STRINGING CHASSIS 120174-B

TUBE LOCATIONS

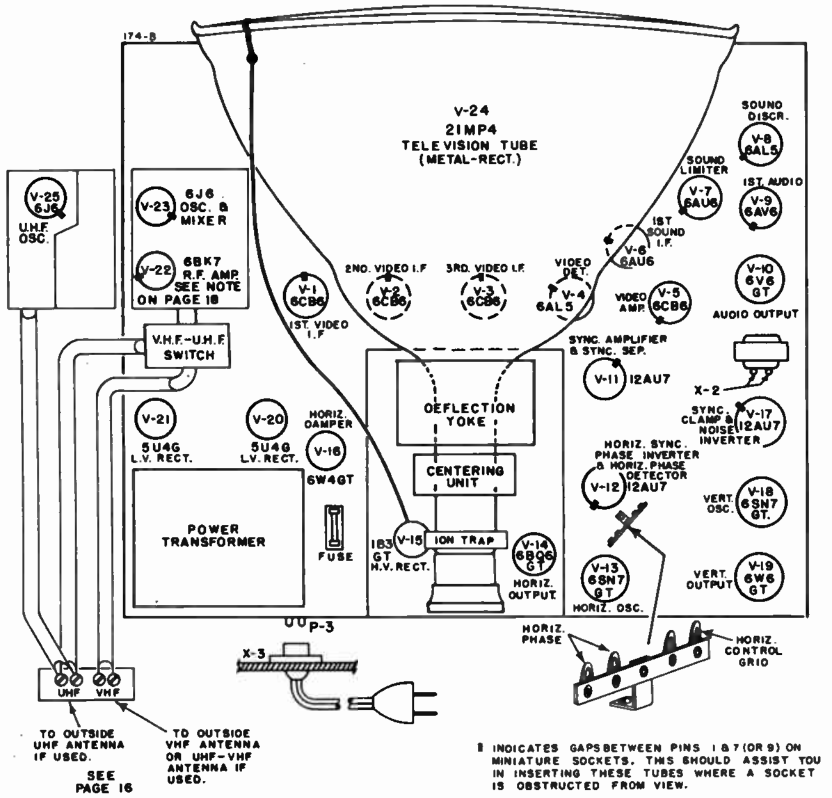


Figure 19 - TUBE LOCATIONS DIAGRAM FOR CHASSIS 120174-B

TUBE TROUBLE ANALYSIS CHART FOR CHASSIS 120198-D & 120174-B

SYMPTOM	CHECK
Weak or no sound nor video (picture), raster normal - UHF only	V-25, D-1, D-2 *
Weak or no sound nor video (picture), raster normal - UHF and or VHF	V-22, V-23, V-1, V-2, V-3, V-4 *
Weak or no sound - Video and raster normal - - - - - UHF and or VHF	V-6, V-7, V-8, V-9, V-10
Weak or no video - Sound and raster normal - - - - - UHF and or VHF	V-5, V-24
Poor or no horizontal nor vertical sync - sound and video normal (contrast control makes video darker or lighter) - UHF and or VHF	V-11, V-17
Poor or no horizontal nor vertical sync - Video weak or distorted, raster normal - sound may or may not be normal - UHF and or VHF	V-22, V-23, V-1, V-2, V-3, V-4
Poor or no horizontal sync - raster normal and sound normal (picture locks in vertically) - - - - - - - - UHF and or VHF	V-11, V-12, V-13, V-17
Poor or no vertical sync - raster normal and sound normal (picture locks in horizontally) - - - - - - - - UHF and or VHF	V-11, V-17, V-18
Horizontal line (no vertical sweep) - sound normal - UHF and or VHF	V-18, V-19
Insufficient horizontal size, sound & video normal - UHF and or VHF	V-14, V-16, V-20, V-21
Insufficient vertical size, or white horizontal bar in picture, horizontal size OK - - - - - - - - - - UHF and or VHF	V-19
No sound, no raster - tubes lit - - - - - - - - - - - - UHF and or VHF	Fuse, V-20, V-21
No sound, no raster - tubes not lit - - - - - - - - - - UHF and or VHF	Plug connection in wall socket, ON-OFF switch, line cord.

By raster we mean the illuminated scanning lines.

* Another very common fault is a shorted or open circuit antenna connection to set.

GENERAL TROUBLE SHOOTING INFORMATION (UHF TUNER)

Since the operation of this tuner is dependent almost entirely on its mechanical configuration, all component parts whether lumped constants or transmission line sections, have been manufactured and mounted as rigid as possible. If it is necessary to replace a component, the exact replacement part should be used. Be sure it is mounted in the same position using the same lead lengths as the original. This is very important since at UHF frequencies a small piece of wire has an appreciable inductance. Stray capacitances between components and chassis also tend to effect the circuit's operation to a marked degree.

Due to the simplicity of design and manufacture of this tuner, little trouble is to be expected. In the event that this tuner becomes defective in any way, the trouble shooting chart in this note can be used to good advantage.

If the crystal D-2 is open or shorted, or the oscillator is inoperative, there will be no bias developed across R-2. If replacing D-2 does not rectify this condition, then it can be assumed that the oscillator is not functioning.

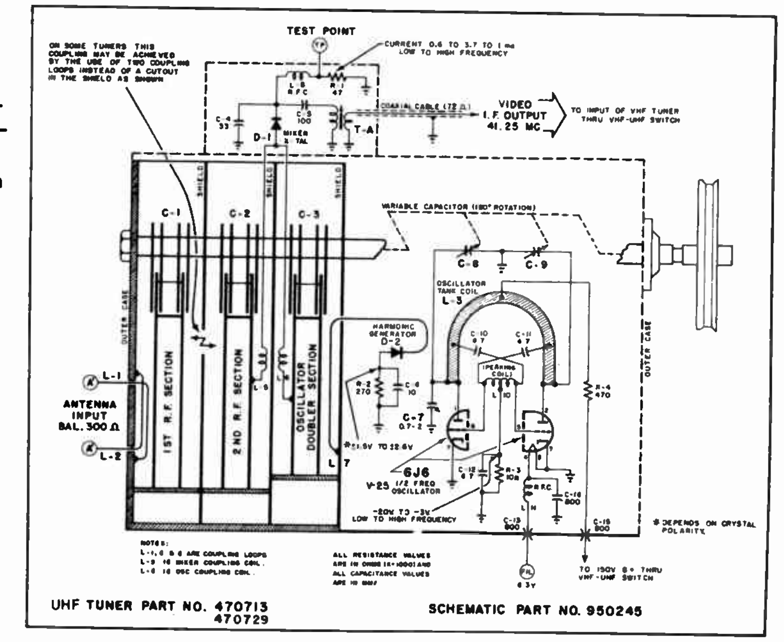


Figure 20 - SCHEMATIC DIAGRAM UHF TUNER 470713 470729

Be sure that the harmonic generator coupling loop (L-7) is not touching the shield. A voltage and resistance check of the 6J6 oscillator circuit should soon locate the trouble.

If the correct bias is measured across the resistor R-2 and the set still operates poorly on UHF, then it can be assumed that the mixer crystal D-1 is defective in some way. This can easily be determined by lifting R-1 off chassis and inserting a D.C. milliameter between it and chassis. In the event that the current readings are abnormally low or high, a new crystal known to be good should be inserted (see trouble shooting chart). If it is desired to localize the difficulty further, C-4 and, or C-5 can be disconnected. When soldering near crystals, be sure to use a small tipped, low wattage iron, placing the pliers between the crystal and the connection so as to absorb the heat thus protecting the crystal. This is important, since excessive heat can easily damage it.

Do not attempt to repair or adjust this tuner by adjusting any of the coupling loops or by moving various components. The only adjustment that can be made in the field is C-7 to compensate for a change in interelectrode capacities when a new 6J6 is used. The proper procedure for this is shown under alignment, Page 16.

Components which are not a part of the R.F. or oscillator tuned circuits such as feed thru condensers, B plus resistors, T-A, etc., can usually be replaced with little difficulty providing the above precautions are observed.

NOTE: In the event that this tuner needs an overall alignment or service of parts, the defective tuner should be returned for repairs through your Emerson distributor.

REPLACEMENT OF TUNERS

If it becomes necessary to return a UHF tuner to your distributor for repair or replacement, remove and retain the extension shaft and pulley. When returning the VHF tuner, remove and retain the VHF-UHF switch and the front plate which consists of a pulley and gear combination. This is important since replacement tuners will not come equipped with the above devices.

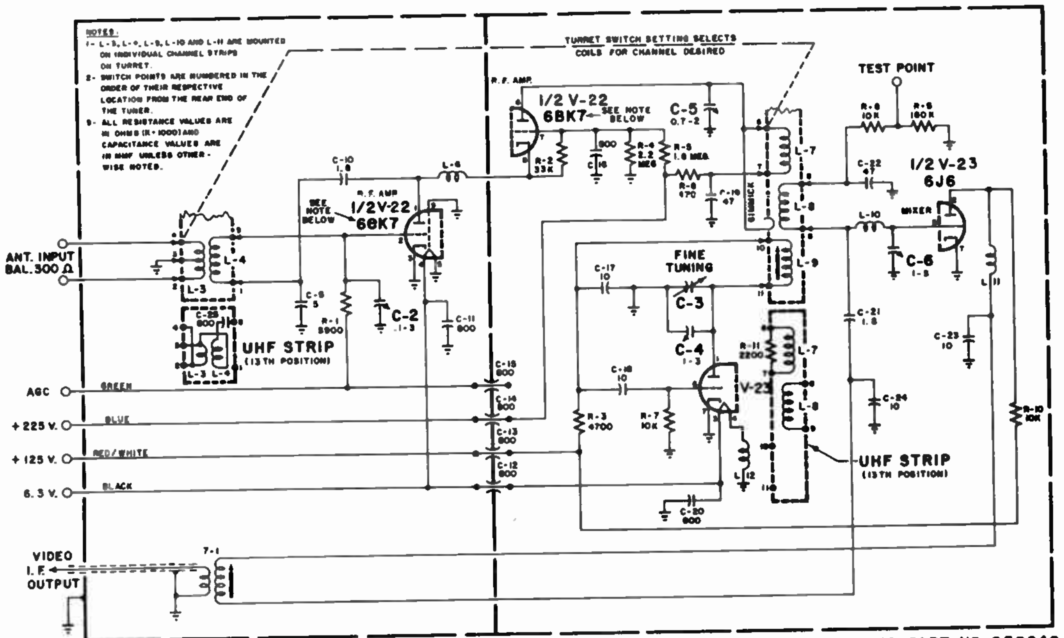
Under no conditions are both the VHF and UHF tuners to be returned as a unit. Before returning for replacement or repair, an honest effort should be made to repair the unit since all special and major parts will be available through your Emerson distributor.

TROUBLE SHOORING CHART (UHF TUNER) -

Component		Variations Low to High Frequency	POSSIBLE TROUBLE (If voltage readings not normal)
6J6	B+ Filament R-3	+150V. 6.3V. A.C. -20V. to -3V.	C-10, C-15, C-11 shorted, the V.H.F.-U.H.F. switch L-11 open, C-14, C-13 shorted R-3 open, C-12 shorted, L-10 open or shorted
0-2 Harmonic Gen. Crystal	R-2	±1.5V. to ±2.6V.	Crystal defective, L-7 shorted to chassis, C-7 shorted Voltage polarity depends upon crystal polarity
D-1 Mixer Crystal	Current thru R-1 Insert Milliameter	0.6 thru 3.7 to 1.00 ma. (current)	0-1 defective, C-4 shorted, L-8 open

NOTE: Voltages taken with receiver in UHF position under same conditions as listed on top of Page 22.

GENERAL TROUBLE SHOOTING INFORMATION (VHF TUNER)



VHF TUNER PART NO. 470712 NOTE: THE R.F. TUBE PRESENTLY USED IS A 6BK7, IN THE FUTURE A 6BQ7,6BQ7A OR A 6BZ7 MAY BE USED. THESE THREE TUBES ARE INTERCHANGEABLE, BUT DUE TO POSSIBLE VARIATIONS IN INTERELECTRODE CAPACITIES, SEVERAL TUBES MAY HAVE TO BE TRIED FOR BEST RESULTS. SCHEMATIC PART NO. 950246

Figure 21 - SCHEMATIC DIAGRAM OF VHF TUNER 470712

REPAIR OF VHF TUNER

The majority of tuner troubles which are not due to defective tubes can usually be detected by a physical examination of the tuner (turret removed), such as burnt resistors, broken parts, bent or dirty contact fingers, cold solder joints, broken socket pins, etc.

If the tuner checks out physically it should then be checked according to the following trouble shooting chart.

It should always be borne in mind that a burnt tuner resistor is usually the result of a shorted condenser or tube.

The part numbers of items which are not generally commercially available are given on the tuner schematic. When replacing parts, leads should be kept as short as possible and components replaced in the same position as the original parts.

More detailed general information on turret tuner repairs can be found in Service Note titled "Emerson Turret Type Tuner #470651" released April 1, 1951.

TUNER TROUBLE SHOOTING CHART VHF TUNER

Measurements taken under same conditions as listed on top of Page 22. To take measurements from 6BK7 socket, remove 6BK7 tube but leave 6J6 tube in its socket, likewise when taking measurements from the 6J6 socket leave 6BK7 tube in its socket.

V-22	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6BK7 or 6BQ7 or 6BQ7A or 6BZ7	Pin 1	130V.	1 meg.	(C-9, 3.3 mmf) shorted
	Pin 2	-2.5 V.	1.8 meg.	(R-2, 15K) or (R-1, 47K) open or shorted
	Pin 3	OV.	0 ^	Cold solder joint
	Pin 6	+215V.	16 K	(C-5) trimmer shorted, (C-18, C-13) shorted, (L-9) open, (R-8, 470 ohm) open or shorted
	Pin 7	+130 V.	1 meg.	(R-3, 330 K),(R-4, 180 K) or (R-5, 100 K) open or shorted, (C-15, 1000 mmf) shorted
	Pin 8	+130 V.	1 meg.	(C-9, 3.3 mmf) shorted
	Pin 9	OV.	0 ^	Cold solder joint

V-23	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6J6	Pin 1	150 V.	16 K	(R-6, 4700 ohm) open or shorted, (C-12, 1000 mmf), (C-16, 10 mmf) or (C-17, 5 mmf) shorted
	Pin 2	150 V.	20 K	(L-13) open, (C-21, 1000 mmf), (C-22, 6.8 mmf) or (C-23, 1000 mmf) shorted, (R-11, 15 K) open or shorted
	Pin 5	OV.	190 K	
	Pin 6	OV.	8.5 K	(C-16, 10 MMF) shorted
	Pin 7	OV.	0 ^	Cold solder joint
	Test Point	-1 V. to -3 V.	200 K	Oscillator injection voltage varies between channels (low frequency channels have higher injection voltage about -4 v.)

CONDITIONS FOR TAKING VOLTAGE AND RESISTANCE READINGS

The resistance measurements listed below are for chassis 120174B and 120198D with no triangle code markings.

Due to component variations, voltage and resistance readings may vary slightly from those given here. Slight variations may also be noticed if chassis is not coded as mentioned above.

The picture tube, deflection yoke and high voltage circuits were connected to take the following readings and waveshapes.

1. Antenna disconnected and antenna terminals shorted on tuner and connected to chassis (use short leads).
2. Line voltage 117 volts (Disconnect power for resistance readings).
3. 3 volt bias battery connected to both I.F. and R.F. A.G.C. circuits, positive terminal to chassis, negative terminal to junction of R-19, C-19, C-18. Add a jumper wire from this junction to junction of R-16, C-8, R-10 so that bias battery is also applied to I.F. A.G.C. BIAS BATTERY USED FOR VOLTAGE READINGS ONLY.
4. All controls in position for normal picture. (Varied when it directly effects reading).
5. All measurements taken with a vacuum tube voltmeter and ohmmeter.
6. All readings listed in tables were taken between points shown and chassis.
7. Resistance readings are given in ohms unless otherwise noted.
8. N.C. denotes no connection.

WAVE SHAPE ANALYSIS CHART FOR CHASSIS 120174B AND 120198D

The information listed below was taken from a chassis with no triangle code markings.

Slight peak to peak voltage differences may be noticed if chassis is not triangle code marked as mentioned above.

The wave shapes shown here are arranged so as to give the serviceman an easy method of signal tracing. The peak to peak voltage given may vary slightly depending on signal strength and component variations.

To accurately observe the wave shapes, the relatively high input capacity of an oscilloscope must be reduced so as not to change the operating characteristics of the television set. Failure to do this will result in wrong wave shape readings. This is accomplished by using an Emerson low capacity probe as outlined previously in the service note for models 686L, 687L, and 696L using chassis 120142-B which was issued at an earlier date.

Connect antenna and tune receiver to channel where best reception has been obtained in the past.

Low end of the probe is connected to CHASSIS and the contrast control is set at MAXIMUM CONTRAST.

The 30 and 7875 C.P.S. oscilloscope sweep settings are used so as to permit the serviceman to observe two cycles of the wave shape.

NOTE: A wave shape seen in your oscilloscope may be upside down from same wave shape shown here. This will depend on the number of stages of amplification in the oscilloscope used.

RESISTANCE READINGS FOR CHASSIS 120174-B AND 120198-D

SYMBOL	TUBE PIN NUMBERS											
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12
V-1	1 meg.	47	.2	0	† 15K	† 15K	0					
V-2	1 meg.	47	.2	0	† 15K	† 15K	0					
V-3	0	180	.2	0	† 15 K	† 15K	0					
V-4	0	1 meg.	.2	0	100K	0	4.7K					
V-5	1 meg.	Contrast 10 - 1.5K	.2	0	† 21K	† 15K	Contrast 10 - 1.5K					
V-6	1 meg.	0	0	.05	† 15K	† 15K	220					
V-7	47K	0	0	.05	† 15K	8.5K	0					
V-8	0	100K	0	.05	170K	0	100K					
V-9	10 meg.	0	0	.05	1.6 meg.	1.6 meg	215K					
V-10	N.C.	.05	† 16K	† 16K	470K	Volume Cont. 0 - 200K	0	470				
V-11	† 47K	15K	0	.05	.05	6K	2.5 meg.	0	0			
V-12	22K	280K	110K	0	0	† 15K	330K	5K	.05			
V-13	2.2 meg.	† 32K	1.2K	Horiz. Hold Control 100K - 150K	150K	1K	.05	0				
V-14	N.C.	0	N.C.	† 22K	500K	N.C.	.05	110	Plate Cap of 6BQ6 † 105K			
V-15	PIN 2 AND 7 INFINITE, PLATE † 105K											
V-16	N.C.	N.C.	† 105K	N.C.	† 15K	N.C.	† 105K	† 105K				
V-17	160K	2 meg.	Fringe Compen. 17K to 9K to 10K	0	0	2 meg.	470K	0	.05			
V-18	100K	180K	2K	Vert. Hold Control 900K-1.9 meg.	Vert. Size Control 1 meg.-2.8 meg.	2.3K	.05	0				
V-19	N.C.	0	† 15K	† 15K	2.2 meg.	260K	.05	Vert. Lin. Control 470 - 5.5K				
V-20	N.C.	† 15K	N.C.	22	N.C.	22	N.C.	† 15K				
V-21	N.C.	† 15K	N.C.	22	10	22	N.C.	† 15K				
V-24	0	0	N.C.	N.C.	N.C.	† Focus Control 0 to 470K to 90K	N.C.	N.C.	N.C.	600K	Brightness Control 200K to 280K	.05

† Varying resistance - wait until meter settles (about 30 seconds).

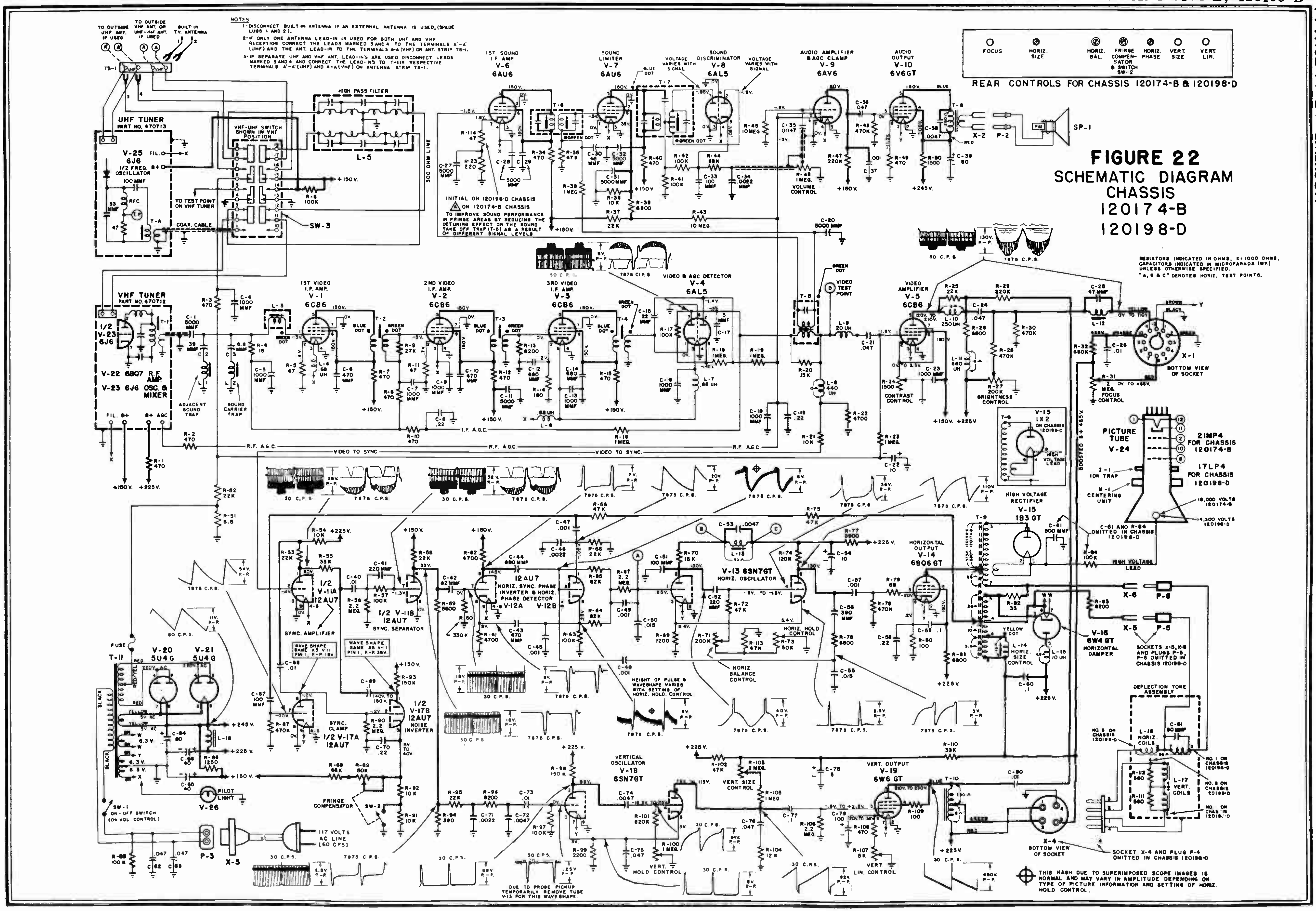


FIGURE 22
SCHEMATIC DIAGRAM
CHASSIS
120174-B
120198-D

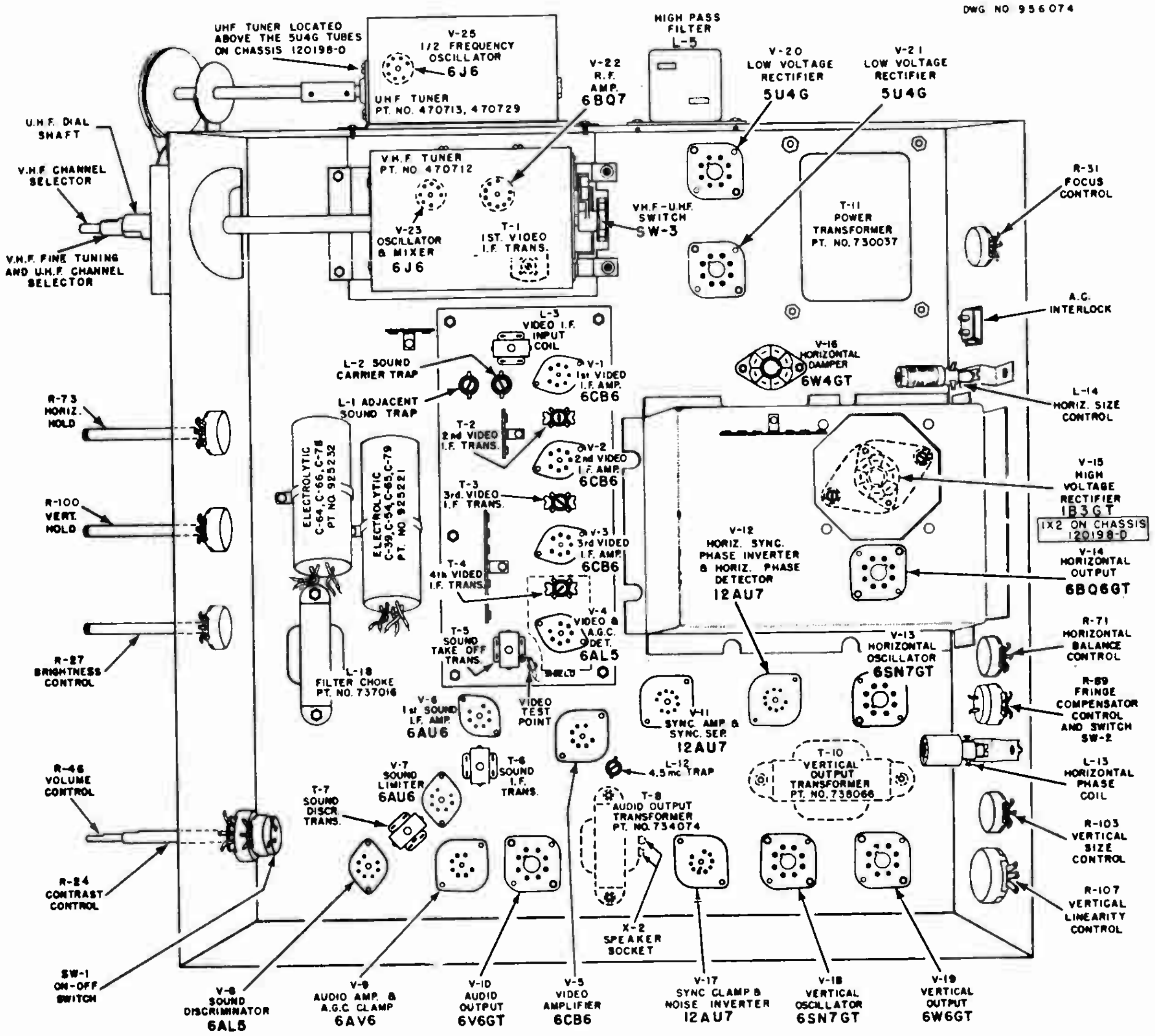


Figure 23 - UNDERSIDE VIEW OF CHASSIS 120174-B AND 120198-D

VOLTAGE READINGS FOR CHASSIS 120174-B AND 120198-D

SYMBOL	TUBE PIN NUMBERS Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12
V-1	-3V.	.4V.	6.3V. AC	0V.	150V.	150V.	0V.					
V-2	-3V.	.7V.	6.3V. AC	0V.	150V.	150V.	0V.					
V-3	0V.	2V.	6.3V. AC	0V.	150V.	150V.	0V.					
V-4	0V.	†-1.4V.	6.3V. AC	0V.	† -.45V.	0V.	† -.3V.					
V-5	-1.9V.	0V. to 3.3V.	6.3V. AC	0V.	120V. to 210V.	150V.	0V. to 3.3V.					
V-6	-1.5V.	0V.	0V.	6.3V. AC	150V.	150V.	1.6V.					
V-7	† -.5V.	0V.	0V.	6.3V. AC	150V.	35V.	0V.					
V-8	0V.	-.9V.	0V.	6.3V. AC	.05V.	0V.	-.85V.					
V-9	-.9V.	0V.	0V.	6.3V. AC	-3V.	-3V.	80V.					
V-10		6.3V.	190V.	200V.	0V.		0V.	-11.5V.				
V-11	60V.	-.4V.	0V.	6.3V. AC	6.3V. AC	33V.	† -3.3V.	0V.	0V.			
V-12	-.05V.	-.9V.	.25V.	0V.	0V.	145V.	† 0V.	8V.	6.3V. AC			
V-13	.25V.	150V.	5.4V.	-9V. to -13V.	130V.	5.4V.	6.3V.	0V.				
V-14		0V.		150V.	-20V.		6.3V.	12V.				
V-15	DO NOT MEASURE											
V-16	DO NOT MEASURE				225V.			DO NOT MEASURE				
V-17	Fringe Compen. 140V. to 150V.	† -.2V.	15V. to 40V.	0V.	0V.	† -.2V.	-30V.	0V.	6.3V. AC			
V-18	0V.	68V.	3V.	-18.5V. to -25V.	75V. to 115V.	3V.	6.3V. AC	0V.				
V-19		0V.	210V. to 230V.	210V. to 230V.	‡ -.9V. to +.25V.		6.3V. AC	20V. to 36V.				
V-20		245V.		220V. AC		220V. AC		245V.				
V-21		245V.		220V. AC		220V. AC		245V.				
V-24	0V.	0V.				0V. to 456V.				435V.	0V. to 110V.	6.3V. AC

‡ Voltage pulsates and varies with noise
† Varies depending on amount of stray pickup

CHASSIS PARTS LIST - CHASSIS 120174-B and 120198-D

CAPACITORS

SYMBOL	PART NO.	DESCRIPTION			PRICE
C-1	928109	5000 MMF (MIN.)		500V...	.20
C-2	928082	39 MMF	±5%	500V...	.30
C-3	928084	6.8 MMF	±10%	500V...	.30
C-4	928077	1000 MMF (MIN.)		500V...	.25
C-5	928077	1000 MMF (MIN.)		500V...	.25
C-6	928081	470 MMF	±10%	500V...	.40
C-7	928077	1000 MMF (MIN.)		500V...	.25
C-8	922325	.22 MF	±20%	200V...	.50
C-9	928077	1000 MMF (MIN.)		500V...	.25
C-10	928081	470 MMF	±10%	500V...	.40
C-11	928109	5000 MMF (MIN.)		500V...	.20
C-12	928076	680 MMF	±10%	500V...	.40
C-13	928077	1000 MMF (MIN.)		500V...	.25
C-14	928076	680 MMF	±10%	500V...	.40
C-15	928012	22 MMF	±20%	500V...	.20
C-16	928077	1000 MMF (MIN.)		500V...	.25
C-17	928017	5MMF	±10%	500V...	.25
C-18	928077	1000 MMF (MIN.)		500V...	.25
C-19	922325	.22 MF	±20%	200V...	.50
C-20	928109	5000 MMF (MIN.)		500V...	.20
C-21	922554	.047 MF	±20%	400V...	.35
C-22	925180	10 MF		25V...	.60
C-23	928077	1000 MMF (MIN.)		500V...	.25
C-24	922554	.047 MF	±20%	400V...	.35
C-25	PT. OF L-12	47 MMF		500V...	
C-26	922714	.01 MF	±20%	600V...	.35
C-27	928109	5000 MMF (MIN.)		500V...	.20
C-28	928109	5000 MMF (MIN.)		500V...	.20
C-29	928109	5000 MMF (MIN.)		500V...	.20
C-30	911181	68 MMF	±20%	500V...	.20
C-31	928109	5000 MMF (MIN.)		500V...	.20
C-32	928109	5000 MMF (MIN.)		500V...	.20
C-33	911182	100 MMF	±20%	500V...	.20
C-34	922523	.0022 MF	±20%	400V...	.30
C-35	922553	.0047 MF	±20%	400V...	.30
C-36	922554	.047 MF	±20%	400V...	.35
C-37	922513	.001 MF	±20%	400V...	.30
C-38	922553	.0047 MF	±20%	400V...	.30
C-39	PT. OF C-65	80 MF		300V...	
C-40	922514	.01 MF	±20%	400V...	.30
C-41	911184	220 MMF	±20%	500V...	.25
*C-42	911160	82 MMF	±10%	500V...	.25
*C-43	911169	470 MMF	±10%	500V...	.35
*C-44	911276	680 MMF	±10%	500V...	.45
C-45	922513	.001 MF	±20%	400V...	.30
C-46	922523	.0022 MF	±20%	400V...	.30
C-47	922713	.001 MF	±20%	600V...	.30
C-48	922513	.001 MF	±20%	400V...	.30
C-49	922513	.001 MF	±20%	400V...	.30
C-50	922320	.015 MF	±20%	200V...	.30
C-51	911161	100 MMF	±10%	500V...	.25
*C-52	911165	220 MMF	±10%	500V...	.30
C-53	922653	.0047 MF	±10%	600V...	.35
C-54	PT. OF C-65	10 MF		450V...	
C-55	922220	.015 MF	±10%	200V...	.30
*C-56	911168	390 MMF	±10%	500V...	.30
C-57	922413	.001 MF	±10%	400V...	.35
C-58	922325	.22 MF	±20%	200V...	.50
C-59	922515	.1 MF	±20%	400V...	.40
C-60	922715	.1 MF	±20%	600V...	.50
C-61	923016	500 MMF		20KV...	2.00
		FOR chassis 120174-B ONLY			
C-62	922200	.047 MF		400V...	.35
C-63	922200	.047 MF		400V...	.35
C-64	925232	80 MF		300V...	3.40
C-65	925221	40 MF		250V...	3.85
C-66	PT. OF C-64	40 MF		300V...	
*C-67	911486	100 MMF	±20%	1000V...	.30
C-68	922514	.01 MF	±20%	400V...	.30
C-69	922315	.1 MF	±20%	200V...	.40
C-70	922325	.22 MF	±20%	200V...	.50
C-71	922523	.0022 MF	±20%	400V...	.30
C-72	922553	..0047 MF	±20%	400V...	.30
C-73	922514	.01 MF	±20%	400V...	.30
C-74	922453	.0047 MF	±10%	400V...	.30
C-75	922354	.047 MF	±20%	200V...	.30
C-76	922454	.047 MF	±10%	400V...	.40
C-77	922515	.1 MF	±20%	400V...	.40
C-78	PT. OF C-64	5 MF		450V...	
C-79	PT. OF C-65	100 MF		50V...	
C-80	922714	.01 MF	±20%	600V...	.35
C-81	928058	50 MMF	±5%	2000V...	.30

RESISTORS

SYMBOL	PART NO.	DESCRIPTION			PRICE
R-1	350412	470 OHM	½W.	±20%...	.14
R-2	350412	470 OHM	½W.	±20%...	.14
R-3	350412	470 OHM	½W.	±20%...	.14
R-4	340052	15 OHM	½W.	±10%...	.10
R-5	340172	47 OHM	½W.	±10%...	.10
R-6	350972	100,000 OHM	½W.	±20%...	.05
R-7	350412	470 OHM	½W.	±20%...	.14
R-8	350412	470 OHM	½W.	±20%...	.14
R-9	340832	27,000 OHM	½W.	±10%...	.10
R-10	350412	470 OHM	½W.	±20%...	.14
R-11	340172	47 OHM	½W.	±10%...	.10
R-12	350412	470 OHM	½W.	±20%...	.14
R-13	340712	8,200 OHM	½W.	±10%...	.10
R-14	340312	180 OHM	½W.	±10%...	.10
R-15	350412	470 OHM	½W.	±20%...	.14
R-16	351212	1 MEGOHM	½W.	±20%...	.05
R-17	350972	100,000 OHM	½W.	±20%...	.05
R-18	351212	1 MEGOHM	½W.	±20%...	.05
R-19	351212	1 MEGOHM	½W.	±20%...	.05
R-20	340772	15,000 OHM	½W.	±10%...	.10
R-21	340732	10,000 OHM	½W.	±10%...	.10
R-22	340652	4,700 OHM	½W.	±10%...	.10
R-23	351212	1 MEGOHM	½W.	±20%...	.05
R-24	PT. OF R-46	1,500 OHM CONTRAST CONTROL F.			
R-25	340812	22,000 OHM	½W.	±10%...	.10
R-26	770692	6,800 OHM	2W.	±5%...	.55
R-27	390181	200,000 OHM BRIGHTNESS CONTROL F			.70
R-28	351132	470,000 OHM	½W.	±20%...	.06
R-29	351052	220,000 OHM	½W.	±20%...	.05
R-30	351132	470,000 OHM	½W.	±20%...	.06
R-31	390196	2 MEGOHM FOCUS CONTROL - R			.70
R-32	351172	680,000 OHM	½W.	±20%...	.05
R-33	340332	220 OHM	½W.	±10%...	.10
R-34	350412	470 OHM	½W.	±20%...	.14
R-35	350892	47,000 OHM	½W.	±20%...	.10
R-36	351212	1 MEGOHM	½W.	±20%...	.05
R-37	370812	22,000 OHM	1W.	±10%...	.15
R-38	340732	10,000 OHM	½W.	±10%...	.10
R-39	340692	6,800 OHM	½W,	±10%...	.10
R-40	350412	470 OHM	½W.	±20%...	.14
R-41	340972	100,000 OHM	½W.	±10%...	.10
R-42	340972	100,000 OHM	½W.	±10%...	.10
R-43	351452	10 MEGOHM	½W.	±20%...	.10
R-44	350932	68,000 OHM	½W.	±20%...	.14
R-45	351452	10 MEGOHM	½W.	±20%...	.10
R-46	390201	1 MEGOHM VOLUME CONTROL - F			2.00
R-47	351052	220,000 OHM	½W.	±20%...	.05
R-48	351132	470,000 OHM	½W.	±20%...	.06
R-49	370412	470 OHM	1W.	±10%...	.15
R-50	790532	1,500 OHM	2W.	±20%...	.25
R-51	394122	8.5 OHM	5W.	±10%...	.40
R-52	340812	22,000 OHM	½W.	±10%...	.10
R-53	370812	22,000 OHM	1W.	±10%...	.15
R-54	340732	10,000 OHM	½W.	±10%...	.10
R-55	340852	33,000 OHM	½W.	±10%...	.10
R-56	351292	2.2 MEGOHM	½W.	±20%...	.06
R-57	350972	100,000 OHM	½W.	±20%...	.05
R-58	370812	22,000 OHM	1W.	±10%...	.15
R-59	340672	5,600 OHM	½W.	±10%...	.17
R-60	351092	330,000 OHM	½W.	±20%...	.14
R-61	340652	4,700 OHM	½W.	±10%...	.10
R-62	340652	4,700 OHM	½W.	±10%...	.10
R-63	340972	100,000 OHM	½W.	±10%...	.10
R-64	340952	82,000 OHM	½W.	±10%...	.10
R-65	340952	82,000 OHM	½W.	±10%...	.10
R-66	340812	22,000 OHM	½W.	±10%...	.03
R-67	351292	2.2 OHM	½W.	±20%...	.06
R-68	370892	47,000 OHM	1W.	±10%...	.15
R-69	330512	1,200 OHM	½W.	±5%...	.14
R-70	330772	15,000 OHM	½W.	±5%...	.15
*R-71	390233	200,000 OHM HORIZ. BAL. CONTROL			1.25
R-72	340892	47,000 OHM	½W.	±10%...	.10
R-73	390183	50,000 OHM HORIZ. HOLD CONTROL			.65
R-74	340992	120,000 OHM	½W.	±10%...	.10
R-75	370892	47,000 OHM	1W.	±10%...	.15
R-76	340692	6,800 OHM	½W.	±10%...	.10

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

* Denotes new Part Number.

CHASSIS PARTS LIST - CHASSIS 120174-B and 120198-D (continued)

RESISTORS (continued)

SYMBOL	PART NO.	DESCRIPTION	PRICE
R-77	340632	3,900 OHM ½W. ±10%...	.10
R-78	341132	470,000 OHM ½W. ±10%...	.10
R-79	350212	68 OHM ½W. ±20%...	.05
R-80	790252	100 OHM 2W. ±20%...	.25
R-81	780692	6,800 OHM 2W. ±10%...	.25
R-82	340132	33 OHM ½W. ±10%...	.10
R-83	370712	8,200 OGM 1W. ±10%...	.16
R-84	380972	100,000 OHM 1W. ±20%... 174-B ONLY	.10
R-85	380972	100,000 OHM 1W. ±20%...	.10
R-86	394116	1,250 OHM 10W. ±10%...	.45
R-87	341132	470,000 OHM ½W. ±10%...	.10
R-88	340932	68.000 OHM ½W. ±10%...	.14
R-89	390225	50,000 OHM FRINGE COMPENSATOR-R	1.00
R-90	351292	2.2 MEGOHM ½W. ±20%...	.06
R-91	340732	10,000 OHM ½W. ±10%...	.10
R-92	340732	10,000 OHM ½W. ±10%...	.10
R-93	341012	150,000 OHM ½W. ±10%...	.10
R-94	340392	390 OHM ½W. ±10%...	.14
R-95	340812	22,000 OHM ½W. ±10%...	.10
R-96	340712	8,200 OHM ½W. ±10%...	.10
R-97	350972	100,000 OHM ½W. ±20%...	.05
R-98	341012	150,000 OHM ½W. ±10%...	.10
R-99	340572	2,200 OHM ½W. ±10%...	.10
R-100	390156	.1 MEGOHM VERT. HOLD CONT.	.65
R-101	341192	820,000 OHM ½W. ±10%...	.10
R-102	350892	47,000 OHM ½W. ±20%...	.10
R-103	390196	2 MEGOHM VERT. SIZE CONT.	.70
R-104	340752	12,000 OHM ½W. ±10%...	.10
R-105	351212	1 MEGOHM ½W. ±20%...	.05
R-106	351292	2.2 MEGOHM ½W. ±20%...	.06
R-107	390197	5,000 OHM VERT. LINEARITY CON.	1.25
R-108	350412	470 OHM ½W. ±20%...	.14
R-109	350252	100 OHM ½W. ±20%...	.14
R-110	350852	33,000 OHM ½W. ±20%...	.05
R-111	340432	560 OHM ½W. ±10%...	.10
R-112	340432	560 OHM ½W. ±10%...	.10
R-113	340892	47,000 OHM ½W. ±10%...	.10
R-114	340172	47 OHM ½W. ±10%...	.10

CHOKES & COILS

SYMBOL	PART NO.	DESCRIPTION	PRICE
L-1	720154	VIDEO I.F. TRAP	1.00
L-2	720149	VIDEO I.F. TRAP	1.00
L-3	720147	VIDEO I.F. INPUT COIL	1.40
L-4	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20
*L-5	720173	HIGH PASS FILTER UNIT	4.90
L-6	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20
L-7	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20
L-8	708114	PEAKING COIL - 440 UH	.30
L-9	705014	R.F. CHOKE - 20 UH	.35
L-10	708100	PEAKING COIL - 250 UH	.40
L-11	708115	PEAKING COIL - 660 UH	.35
L-12	708032	4.5 MC TRAP	.85
L-13	716074	HORIZ. PHASE COIL	1.20
L-14	708156	HORIZ. SIZE COIL	1.15
L-15	705021	R.F. CHOKE - 10 UH ±10%	.20
L-16 } L-17 }	708137	DEFLECTION YOKE ASS'Y - COSINE	9.90
L-18	737016	FILTER CHOKE	2.25
*L-18 or	737017	FILTER CHOKE	2.25

TRANSFORMERS

SYMBOL	PART NO.	DESCRIPTION	PRICE
T-1(A)	PT. OF VHF-T	TUNER VIDEO I.F. OUTPUT TRANSFORMER	
T-1(B)	PT. OF UHF-T	TUNER VIDEO I.F. OUTPUT TRANSFORMER	
T-2	720148	2ND VIDEO I.F. TRANSFORMER	1.30
T-3	720148	3RD VIDEO I.F. TRANSFORMER	1.30
T-4	720148	4TH VIDEO I.F. TRANSFORMER	1.30
T-5	720146	SOUND TAKE OFF TRANSFORMER	2.10
T-6	720081 or	SOUND I.F. TRANSFORMER	1.95
T-6	720081A	SOUND I.F. TRANSFORMER	1.90
T-7	708018 or	SOUND DISCRIMINATOR TRANSFORMER	2.05
T-7	708151	SOUND DISCRIMINATOR TRANSFORMER	2.20
T-8	734074	AUDIO OUTPUT TRANSFORMER	2.25
T-9	738068	HORIZONTAL OUTPUT TRANSFORMER CHASSIS 120174-B	10.15
*T-9	738067	HORIZONTAL OUTPUT TRANSFORMER CHASSIS 120198-D	9.95
T-10	738066	VERTICAL OUTPUT TRANSFORMER	3.40
T-11	730037	POWER TRANSFORMER	22.70

TUNERS

SYMBOL	PART NO.	DESCRIPTION	PRICE
TUNER	470712	VHF TUNER ASS'Y - BEFORE ORDERING TUNER SEE PAGE 20 TITLE "REPLACEMENT OF TUNER"	50.00
*TUNER	470713	UHF TUNER ASS'Y FOR CHASSIS 120174-B	50.00
*TUNER	470729	UHF TUNER ASS'Y FOR CHASSIS 120198-D	50.00

TUBES

SYMBOL	PART NO.	DESCRIPTION	PRICE
V-1	800055	VACUUM TUBE - 6CB6	
V-2	800055	VACUUM TUBE - 6CB6	
V-3	800055	VACUUM TUBE - 6CB6	
V-4	800541	VACUUM TUBE - 6AL5	
V-5	800055	VACUUM TUBE - 6CB6	
V-6	800533	VACUUM TUBE - 6AU6	
V-7	800533	VACUUM TUBE - 6AU6	
V-8	800541	VACUUM TUBE - 6AL5	
V-9	800057	VACUUM TUBE - 6AV6	
V-10	800270	VACUUM TUBE - 6V6GT	
V-11	800026	VACUUM TUBE - 12AU7	
V-12	800026	VACUUM TUBE - 12AU7	
V-13	800380	VACUUM TUBE - 6SN7GT	
V-14	800059	VACUUM TUBE - 6BQ6GT	
V-15	800450	VACUUM TUBE - 1B3GT FOR 120174-B CHASSIS ONLY	
V-15	800067	VACUUM TUBE - 1X2A FOR CHASSIS 120198-D	
V-16	800037	VACUUM TUBE - 6W4GT	
V-17	800026	VACUUM TUBE - 12AU7	
V-18	800380	VACUUM TUBE - 6SN7GT	
V-19	800061	VACUUM TUBE - 6W6GT	
V-20	800290	VACUUM TUBE - 5U4G	
V-21	800290	VACUUM TUBE - 5U4G	
V-22	800065	VACUUM TUBE - 6BQ7 T.V. TUNER	
V-23	800536	VACUUM TUBE - 6J6 - V.H.F.	
V-24	810028	TELEVISION TUBE - 21 MP4 - METAL - FOR THE 120174-B CHASSIS	
V-24	810029	TELEVISION TUBE - 17LP4 - GLASS - FOR THE 120198-D CHASSIS	
V-25	800536	VACUUM TUBE - 6J6 - T.V. TUNER - U.H.F.	
V-26	807000	PILOT LIGHT (#47 BULB)	.11

MISCELLANEOUS

SYMBOL	PART NO.	DESCRIPTION	PRICE
*F-1	808005	FUSE - .6 AMPERE (DELAYED ACTION)	
I-1	708129 or	ION TRAP - SINGLE	.65
I-1	708161	ION TRAP - SINGLE	.55
M-1	708149 or	CENTERING UNIT	.80
M-1	708134	CENTERING UNIT	.80
P-2	580218	PLUG - LEAD & PIN ASS'Y - SPEAKER (2 REQ.)	.20
P-3	505014	PLUG - INTERLOCK SWITCH	.20
*P-4	505028	PLUG - 4 PIN - DEFLECTION YOKE ASS'Y }	
P-5	505016	PLUG - 1 PIN - DEFLECTION YOKE ASS'Y }	.05
P-6	505016	PLUG - 1 PIN - DEFLECTIOB YOKE ASS'Y } FOR 120174-B CHASSIS ONLY	.05
SP-1	180120	SPEAKER - PM - 12"	8.90
SW-1	PT. OF R-46	SWITCH - ON - OFF (POWER)	
SW-2	PT. OF R-89	SWITCH - ON - OFF (FRINGE COMPENSATOR)	
SW-3	PT. OF VHF TUNER	SELECTOR SWITCH - V.H.F. - U.H.F.	
*TS-1	555031	TERMINAL STRIP - V.H.F. - U.H.F. Antenna	.25
X-1	585093	KINESCOPE SOCKET AND CABLE ASSEMBLY FOR 120174-B CHASSIS	1.25
*X-1	585092	KINESCOPE SOCKET AND CABLE ASSEMBLY FOR 120198-D	1.15
X-2	PT. OF T-8	SOCKET - SPEAKER	
X-3	583206	SOCKET & LINE CORD - INTERLOCK SWITCH	.80
X-4	508050	SOCKET - 4 PRONG - DEFLECTION YOKE ASS'Y }	.15
X-5	508004	SOCKET - 1 PRONG - DEFLECTION YOKE ASS'Y }	.15
X-6	508004	SOCKET. 1 PRONG - DEFLECTION YOKE ASS'Y } FOR CHASSIS 120174-B ONLY	.15
	587040	DIAL CORD SPRING	.06
	541005	DIAL CORD FASTENER	.01
	530002	DIAL CORD (SPECIFY LENGTH) PER YD.	.05

PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

*DENOTES NEW PART NUMBER

CABINET PARTS LIST - CHASSIS 120174-B & 120198-D

PART NUMBERS							
MODEL 752A	MODEL 753F	MODEL 755A	MODEL 784A	MODEL 785C	MODEL 785E	DESCRIPTION	LIST PRICE
140517						Cabinet - Console - Open Face	119.60
	140468					Cabinet - Table Model - Mahogany	59.00
		140527				Cabinet - Console - Full Doors	158.30
			140555			Cabinet - Console - Emersonite - Mahogany	98.00
			140555A			Cabinet - Console - Emersonite - Blonde	98.00
				140524A		Cabinet - Table Model - Emersonite - Blonde	29.00
				140524		Cabinet-Table Model-Emersonite-Mahogany	29.00
					140554	Cabinet-Table Model-Emersonite-Mahogany	29.00
					140554A	Cabinet-Table Model-Emersonite-Blonde	29.00
460249		460249	460249			Mask	5.20
	460476			460476	460476	Mask	3.70
520179		520179	520179			Glass	9.50
	520159					Glass	5.50
				520181	520181	Glass	9.35
440051	440051	440051	440051			Rubber Channel - Glass per/ft.	.12
	445023			445023	445023	Rubber Feet	.10
	411294					Retaining Strip - Glass	1.10
				411529	411529	Retainer Bracket - Glass	.10
				460485		Cap Strip - for 140524 Cabinet	1.60
				460452		Side Strip - for 140524 Cabinet	.40
				460485A		Cap Strip - for 140524A Cabinet	1.60
				460452A		Side Strip - for 140524A Cabinet	.40
					460503	Cap Strip	1.60
					460518	Corner Cap - R.H.	.20
					460517	Corner Cap - L.H. for 140554 Cabinet	.20
					460502	Side Strip	.40
					460503A	Cap Strip	1.60
					460518A	Corner Cap - R.H.	.20
					460517A	Corner Cap - L.H. for 140554A Cabinet	.20
					460502A	Side Strip	.40
460252	460252	460252				Control Door	2.45
460253	460253	460253				Control Door Escutcheon	per
587088	587088	587088				Springs - for Door	set
			460252A	460252A	460252A	Control Door - Maroon	1.55
			460253B	460253B	460253B	Control Door Escutcheon - Maroon	per
			587088	587088	587088	Springs - for Door	set
			460253D	460253D	460253D	Control Door Escutcheon - Mottled Ivory	1.55
			460252B	460252B	460252B	Control Door - Mottled Ivory	per
							set
180120		180120	180120			Speaker - 12"	8.90
	180095			180095	180095	Speaker - 6"	4.40
560332		560332	560332			Masonite Back	1.30
	560338					Masonite Back	.90
				560341	560341	Masonite Back	.90
411445	411445	411445	411445	411445	411445	Tube Protector Cup	.60
583206	583206	583206	583206	583206	583206	Line Cord	.80
460424	460424	460424	460424	460424	460424	Knob - Contrast	.70
460423	460423	460423	460423	460423	460423	Knob - Fine Tuning	.70
460422	460422	460422	460422	460422	469422	Knob - Off - On - Volume	.85
460421	460421	469421	460421	460421	460421	Knob - Channel Selector	1.80
460425	460425	460425	460425	460425	460425	UHF Dial	.50
565264		565264				Mask - for UHF Dial	.05
	565273		565273	565273	565273	Mask - for UHF Dial	.01

Prices subject to change without notice.

PRODUCTION CHANGES

In the course of production various changes were incorporated in the order shown below. Changes as listed under a particular letter also include changes as listed under all previous letters unless otherwise noted. All changes released after this note is printed will be sent out to our distributors in the form of field service bulletins. These should be kept together with the service note and entered in the following table for a quick reference. By utilizing this information the schematic can be easily modified to correspond to a chassis of any triangle code.

Triangle Code Letter	F.S.B. No.	Supp. No.	Purpose
A (in triangle)	Service Note	O	See Schematic Page 23.

ADDENDUM SERVICE NOTE

This information should be considered as part of the Service Note for Models 752A, 755A, 784A, 753F, 785C and 785E using chassis 120174-B, 120198-D

Model Numbers	TV Chassis	Tube Size	TV Tuner
753D, 761C	120180-D	17LP4 (Glass-Rect.)	470712 - VHF 470729 - UHF

MODELS 753D, 761C
BUILT IN ALL CHANNEL UHF-VHF RECEIVERS

The above models incorporate Chassis 120180-D which is electrically identical to Chassis 120198-D. The differences between the two chassis are in the physical placement of the 5U4G tubes and the use of a different chassis base.

With the exception of the Cabinet Parts List (below) and the Tube Location Diagram (other side), all technical information pertaining to the models listed above will be found in the Service Note covering Models 752A, 755A, 784A, 753F, 785C and 785E using chassis 120174-B, 120198-D

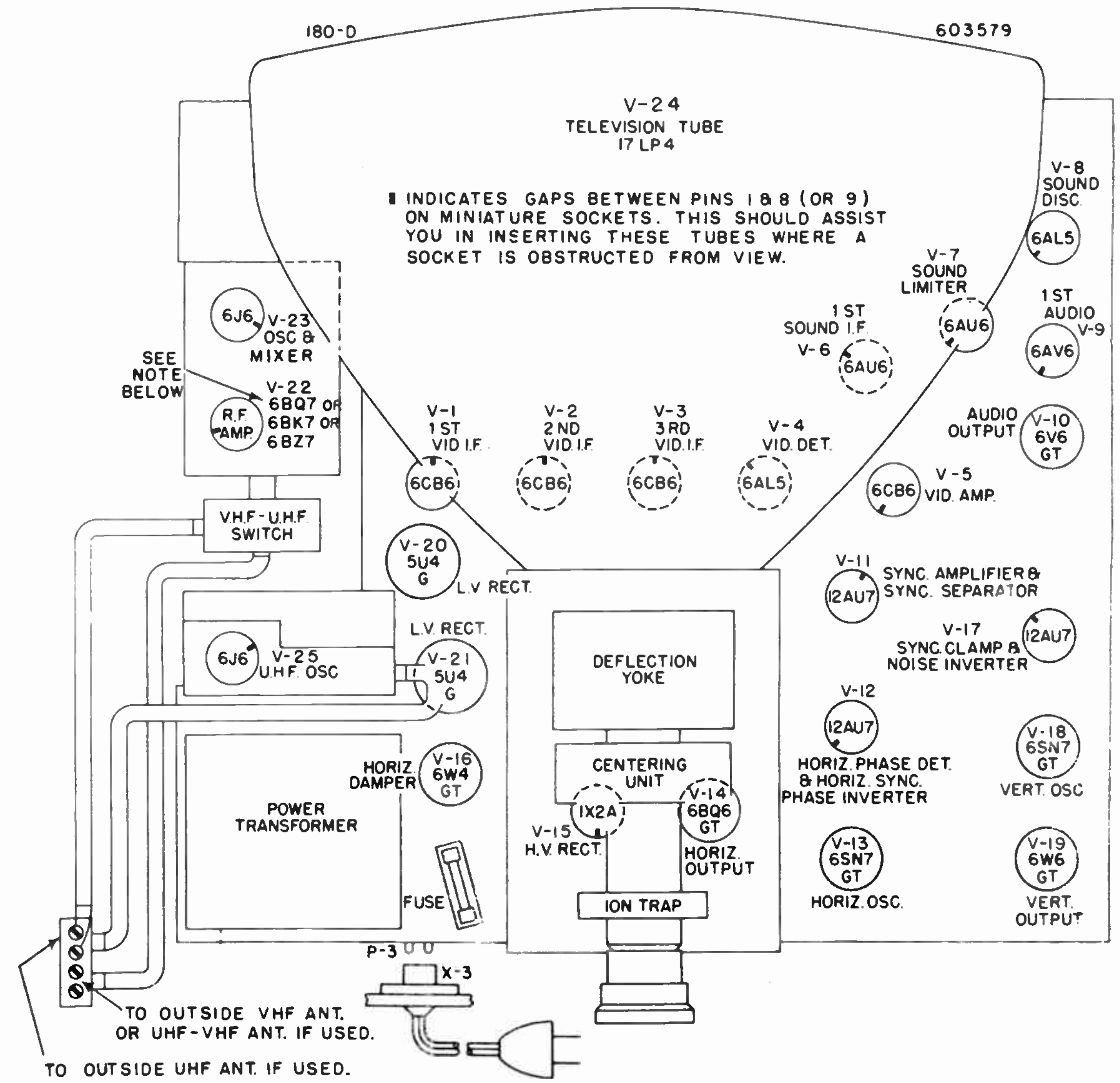
CABINET PARTS LIST - Chassis 120180-D

Part Numbers Model 753D	Part Numbers Model 761C	Description	List Price
140468A		Cabinet - Table Model - Blonde	61.00
140468		Cabinet - Table Model - Mahogany	61.00
	140534	Cabinet - Console - Mahogany	100.00
	140534A	Cabinet - Console - Blonde	106.00
460252B	460252B	Control Door - Mottle Ivory } for 140534A, 140468A	1.55 per set
460253D	460253D	Control Door Escutcheon - Mottle Ivory } for 140534A, 140468A	
587088	587088	Springs for Door	
460252	460252	Control Door - Gold } for 140468, 140534	2.45 per set
460253	460253	Control Door Escutcheon - Gold } for 140468, 140534	
445023		Rubber Feet	.10
460476	460476	Mask	3.70
520159	520159	Glass	5.50
440051	440051	Rubber Channel for Glass per ft.	.12
411294	411294	Retaining Strip for Glass	1.10
180095	180095	Speaker - 6"	4.40
411445	411445	Tube Protector Cup	.60
560336		Masonite Back	.90
	560341	Masonite Back	.90
583206	583206	Line Cord	.80
460424	460424	Knob - Contrast	.70
460423	460423	Knob - Fine Tuning	.70
460422	460422	Knob - Off - On - Volume	.85
460421	460421	Knob - Channel Selector	1.80
460425	460425	UHF Dial	.50
565273	565273	Mask for UHF Dial	.01

Prices Subject to Change Without Notice

Model 753D

Model 761C



NOTE: THE R.F. AMP. TUBE PRESENTLY USED IS A 6BK7. IN THE FUTURE A 6BQ7, 6BQ7A OR A 6BZ7 MAY BE USED. THESE THREE TUBES ARE INTERCHANGEABLE, BUT DUE TO POSSIBLE VARIATIONS IN INTER-ELECTRODE CAPACITIES, SEVERAL TUBES MAY HAVE TO BE TRIED FOR BEST RESULTS.

TUBE LOCATION DIAGRAM CHASSIS 120180-D

ADDENDUM SERVICE NOTE

This information should be considered as part of the Service Note for Models 752A, 755A, 784A, 753F, 785C and 785E using chassis 120174-B, 120198-D

Model 768A

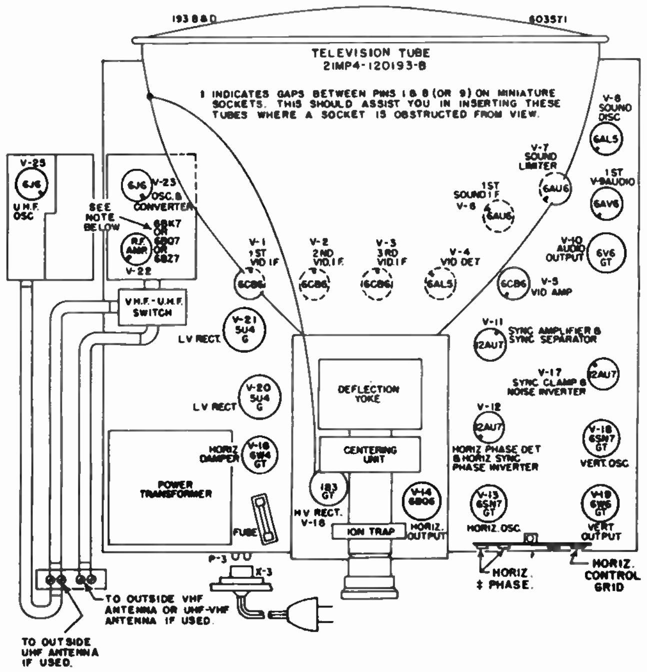
Models 772A

Model 774A

BUILT IN ALL CHANNEL UHF - VHF RECEIVERS

Chassis 120193-B are "ALL CHANNEL UHF - VHF RECEIVERS". Combination UHF and VHF tuning is achieved through the use of two tuners which are connected to the same tuning knobs making VHF or UHF channel tuning very simple. The VHF cascode turret tuner has 13 positions (one more than the conventional type), 12 being used for VHF reception, (channels 2 to 13), while the 13th or UHF position is used to activate the proper UHF circuits and provides additional amplification for the converted 40 mc. UHF signals. In this position, a window is provided to observe the continuous tuning of the UHF channels.

The 120193-B Chassis is electrically identical to the 120174-B Chassis of which this is an Addendum. Dual chassis numbers (120174, 120193) have been assigned since these chassis differ physically in the type of chassis base used and the placement of the 5U4G rectifier tubes.



NOTE: THE R.F. AMP. TUBE PRESENTLY USED IS A 6BK7. IN THE FUTURE A 6BQ7, 6BQ7A OR A 6BZ7 MAY BE USED. THESE THREE TUBES ARE INTERCHANGEABLE, BUT DUE TO POSSIBLE VARIATIONS IN INTERELECTRODE CAPACITIES, SEVERAL TUBES MAY HAVE TO BE TRIED FOR BEST RESULTS.

TUBE LOCATION DIAGRAM CHASSIS 120193-B

‡ The Phase Coil side of the 4 lug terminal strip always has two wires connected to it. The other side has only the one Control Grid wire.

CABINET PARTS LIST - MODELS 768A, 772A, and 774A

Part Numbers				
Model 768A	Model 772A	Model 774A	Description	
140536			Cabinet - Open Face Console - Mahogany	
140536A			Cabinet - Open Face Console - Blonde	
	140537		Cabinet - Console with Doors - Mahogany	
	140537A		Cabinet - Console with Doors - Blonde	
		140538	Cabinet - French Provincial	
520192	520192	520192	Glass	
411492	411492	411492	Retaining Strip - Glass	
411493	411493	411493	Retaining Strip - Glass	
460491*	460491*	460491*	Mask	
411091	411091	411091	Clips for Mask	
180120	180120	180120	Speaker - 12 Inch	
560342	560342	560342	Masonite Back	
411445	411445	411445	Tube Protector Cup	
583206	583206	583206	Line Cord	
460284			Emerson Emblem	
460252	460252	460252	Control Door - Gold	for Mah. Cabinet
460253	460253	460253	Control Door Escutcheon - Gold	
587088	587088	587088	Spring - Door	
460252B	460252B		Control Door - Ivory	for Blonde Cabinet
460253D	460253D		Control Door Escutcheon - Ivory	
460424	460424	460424	Knob - Contrast	
460423	460423	460423	Knob - Fine Tuning	
460422	460422	460422	Knob - OFF-ON-Volume	
460421	460421	460421	Knob - Channel Selector	
460425	460425	460425	U.H.F. Dial	
565273	565273	565273	Mask for Dial	

Changes to part no. 460511 when a glass shell picture tube (21YP4) is used. All other cabinet parts listed above will remain the same.

Corrections to the 120174-B & 120198-B Chassis Service Note

The following corrections should be noted directly on the schematic diagram Pages 23 and 24 of the Service Note:

1) C-34 should read .0022 mf instead of .0022 mmf.
2) R-23 in cathode circuit of V-6 should be changed to R-33.
3) The wave shape shown going to the junction of R-76 and C-55 should be altered to look like wave shape shown here.

ADDENDUM SERVICE NOTE

This information should be considered as part of the Service Note for Models 752A, 755A, 784A, 753F, 785C and 785E using chassis 120174-B, 120198-D

Chassis 120209-D and 120209-F are "ALL CHANNEL UHF - VHF RECEIVERS." Combination UHF and VHF channel tuning is achieved through the use of two tuners which are connected to the same tuning knobs making VHF or UHF channel tuning very simple. The VHF cascode turret tuner has 13 positions (one more than the conventional type), 12 being used for VHF reception, (channels 2 to 13), while the 13th or UHF position is used to activate the proper UHF circuits and provides additional amplification for the converted 40 mc. UHF signals. In this position, a window is provided to observe the continuous tuning of the UHF channels.

The 120209-D chassis is electrically identical to the 120193-B chassis except that a chassis mounted 21YP4 picture tube is used instead of a cabinet mounted 21MP4. Information on the 120193-B chassis was previously released as supplement #2.

The 120209-F chassis is electrically identical to the 120209-D except for the use of a different UHF tuner (pt. #470748). A diagram and brief description of this tuner is given in this addendum service note.

Model 799E

Model 770C

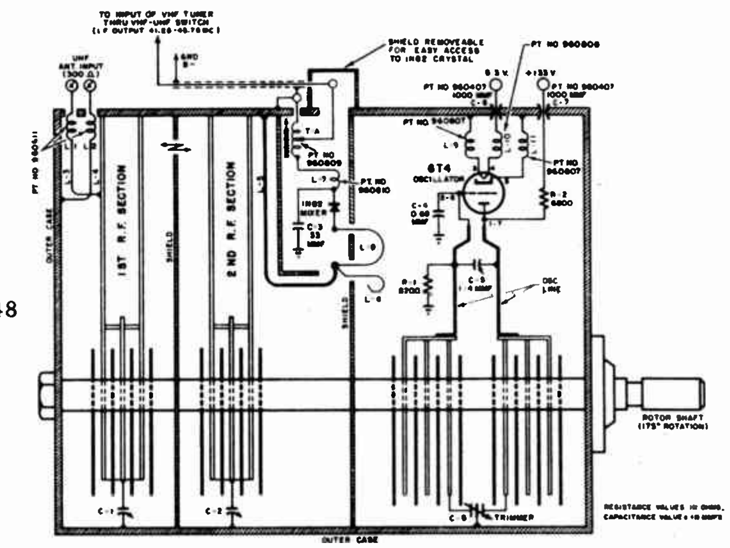
CABINET PARTS LIST - Chassis 120209-D and 120209-F

Part Numbers		Description
Model 770C	Model 799E	
140575		Cabinet - Console - Mah.
140575A		Cabinet - Console - Blond
	140583	Cabinet - Table Model - Mah.
	140583A	Cabinet - Table Model - Blond
520192		Glass
	520211	Glass
411492		Retaining Strip - Glass (sides)
411493		Retaining Strip - Glass (top)
	411711	Retaining Strip - Glass
460524		Mask
	460527	Mask
411091	411091	Clips - Mask
460252	460252	Control Door - Gold
460253	460253	Control Door Escutcheon - Gold
587088	587088	Spring - Door
460252B	460252B	Control Door - Ivory
460253D	460253D	Control Door Escutcheon - Ivory
180120		Speaker - 12"
	180095	Speaker - 6"
583206	583206	Line Cord
560359		Masonite Back
	560358	Masonite Back
411445	411445	Tube Protector Cup
	445017	Rubber Feet
460424	460424	Knob - Contrast
460423	460423	Knob - Fine Tuning
460422	460422	Knob - Off - On - Volume
460421	460421	Knob - Channel Selector
460425		UHF Dial
	460546	Dial - UHF
565273	565273	Mask - Dial

DESCRIPTION OF UHF TUNER PT. NO. 470748

The tuned elements in this tuner are of the modified coaxial transmission line type. As you can see from the schematic, the incoming UHF signal is tuned by means of two R.F. preselectors. These preselectors are quarter wave end tuned coaxial lines. Capacitive tuning is employed at the open ends to electrically adjust the line to 1/4 wave length and, therefore, effect a resonant condition at any frequency within the UHF band. Two identical preselector circuits are coupled together to provide the proper band pass characteristic. The ganged variable capacitors adjust the two preselector lines and are similar to those used in conventional low frequency circuits. Each line is tuned by four rotor plates. Capacitor trimmers (C-1, C-2) are located behind the coaxial lines to preset the high frequency end of the R.F. preselectors.

UHF TUNER PT. NO. 470748



TUNER PART NO. 470748 SCHEMATIC PART NO. 950298

The antenna input in this tuner is coupled to the 1st preselector circuit and is designed to match a balanced 300 ohm transmission line.

The output from the 2nd R.F. preselector (desired UHF channel) is fed by means of L-5 to the mixer crystal D-1 (1N82) through the oscillator coupling loop L-7 where it beats with the oscillator to form the desired I.F. frequencies (45.75 mc picture, 41.25 mc sound). T-A is tuned to pass these frequencies. An oscillator (6AF4) whose resonant frequency is determined by an end tuned coaxial line connected between its plate and grid is used in this UHF tuner. Capacity tuning is employed at the open end of this coaxial line to adjust it to 1/4 wave at the desired frequency of operation (45.75 mc above the R.F. video carrier). Trimmer C-8 is used to set the high frequency end of the oscillator whereas C-5 is used to set the low end for best overall tuner tracking. C-8 can be adjusted in the field to compensate for slight variations between replacement 6AF4 tubes. Several 6AF4 tubes should be tried picking the one which requires the least adjustment of C-8 so that tuner tracking will not be effected.

Complete tuner shielding is provided to reduce oscillator radiation and stray pickup to a minimum.

GENERAL TROUBLE SHOOTING INFORMATION (UHF TUNER)

Since the operation of this tuner is dependent almost entirely on its mechanical configuration, all component parts whether lumped constants or transmission line sections, have been manufactured and mounted as rigid as possible. If it is necessary to replace a component, the exact replacement part should be used. Be sure it is mounted in the same position using the same lead lengths as the original. This is very important since at UHF frequencies a small piece of wire has an appreciable inductance. Stray capacitances between components and chassis also tend to effect the circuit's operation to a marked degree.

Due to the simplicity of design and manufacture of this tuner, little trouble is to be expected.

If the oscillator is working correctly, the injection current (measured with a D.C. milliameter between the tap of T-A and tuner chassis) should be within the range of .5 ma to 4.5 ma.

If the measured reading is not within these limits check the following in the order shown. 6AF4 oscillator, 1N82 crystal, supply voltages to tuner, T-A, C-3, C-68. Make certain that the coupling loop (L-8 and L-6) are not touching the shield between the oscillator and R.F. compartments.

Components which are not a part of the R.F. or oscillator tuned circuits such as feed through condensers, B+ resistors, T-A, etc., can usually be replaced with little difficulty providing the above precautions are observed.

Do not attempt to repair or align this tuner by adjusting any of the coupling loops or by moving various components. The only adjustment that can be made in the field is C-8 to compensate for a slight change in inter-electrode capacities when a new 6AF4 tube is used.

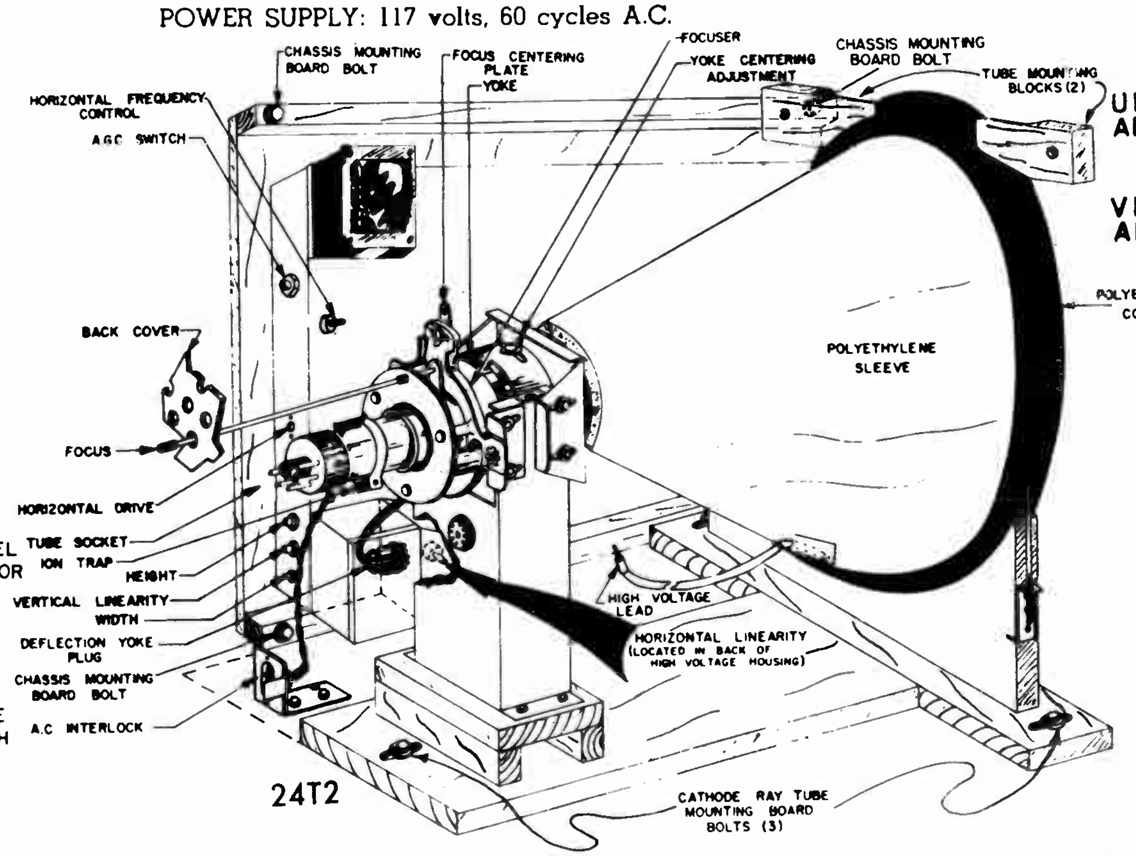
REPLACEMENT OF TUNERS

If it becomes necessary to return a UHF tuner to your distributor for repair or replacement, remove and retain the extension shaft and pulley. When returning the VHF tuner, remove and retain the VHF-UHF switch and the front plate which consists of a pulley and gear combination. This is important since replacement tuners will not come equipped with the above devices.

Under no conditions are both the VHF and UHF tuners to be returned as a unit. Before returning for replacement or repair, an honest effort should be made to repair the unit since all special and major parts will be available through your Emerson distributor.

TUNING RANGE: Channels 2 through 13.
SOUND RATIO DETECTOR FREQUENCY: 4.5MC.
SOUND IF FREQUENCY: 4.5MC.
PICTURE IF FREQUENCY: 26.1MC.
POWER CONSUMPTION: 250 watts.
AUDIO OUTPUT: 3.2 watts.

ANTENNA: "Built-in-Antenna" with provisions for connection of external antenna where necessary.
EXTERNAL ANTENNA IMPEDANCE: Balanced 300 ohms.
POWER SUPPLY: 117 volts, 60 cycles A.C.



24T2

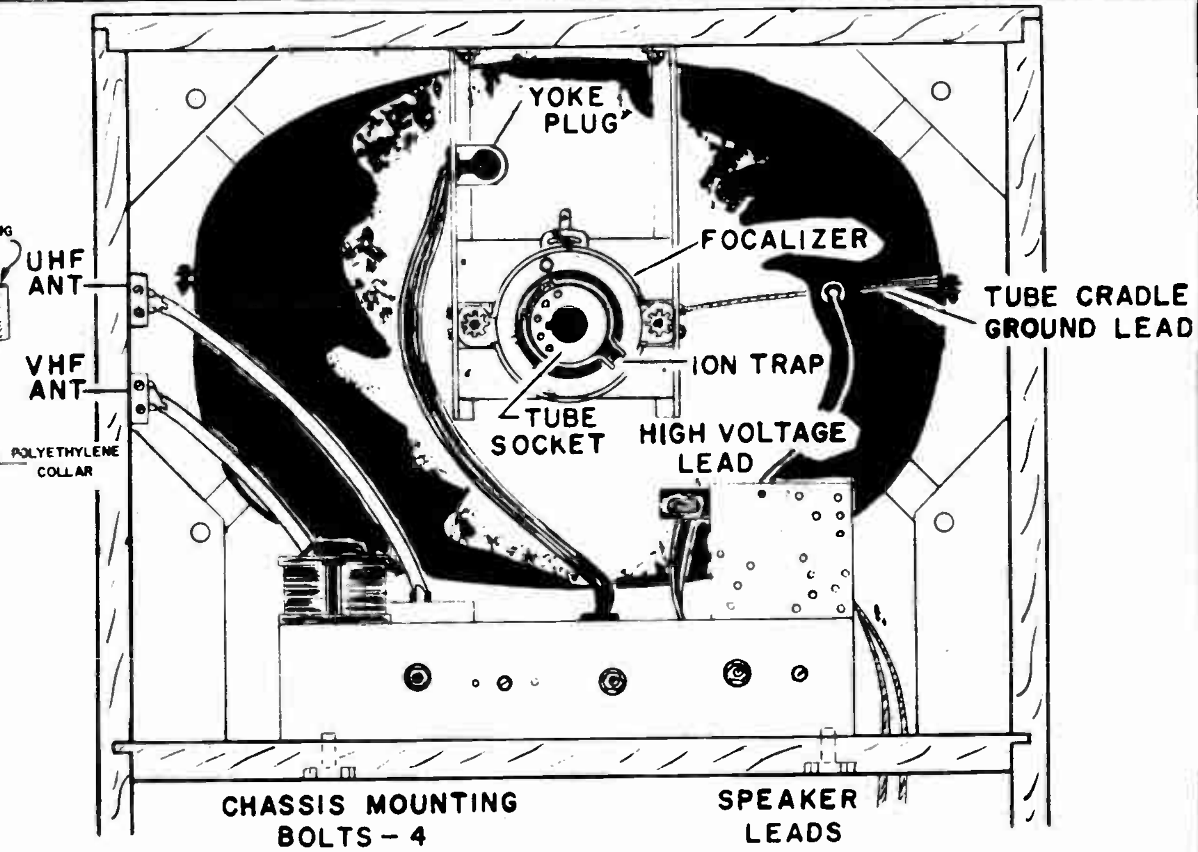
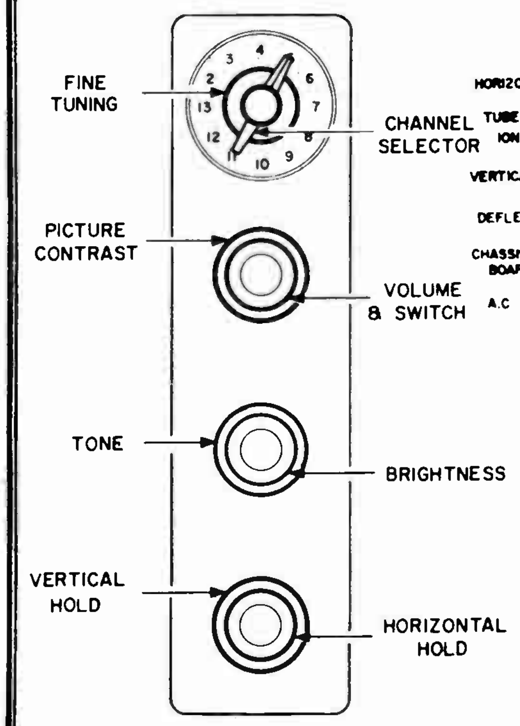
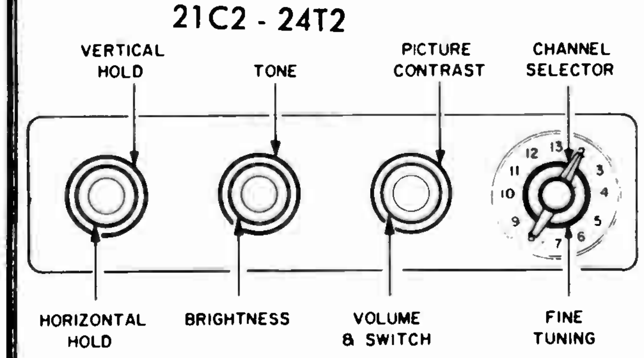


FIG. 1B

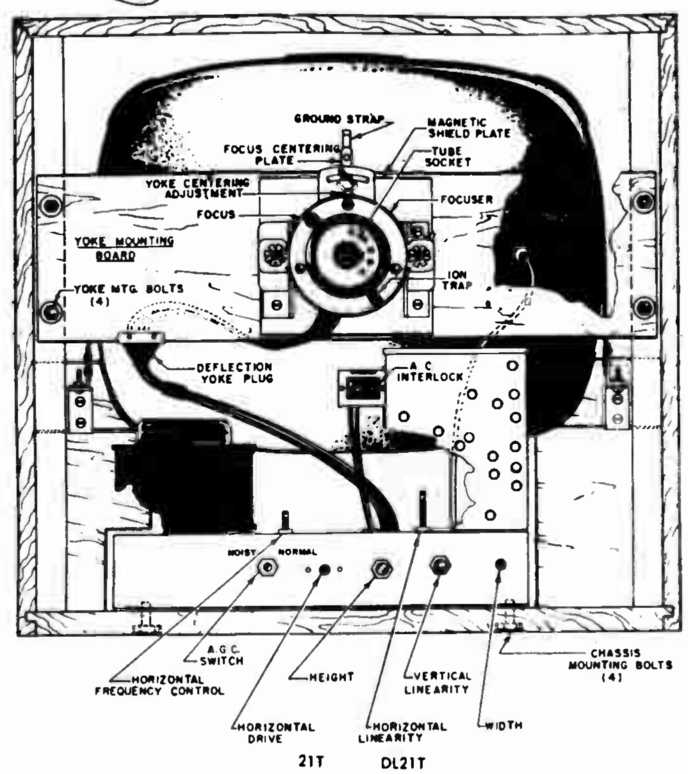


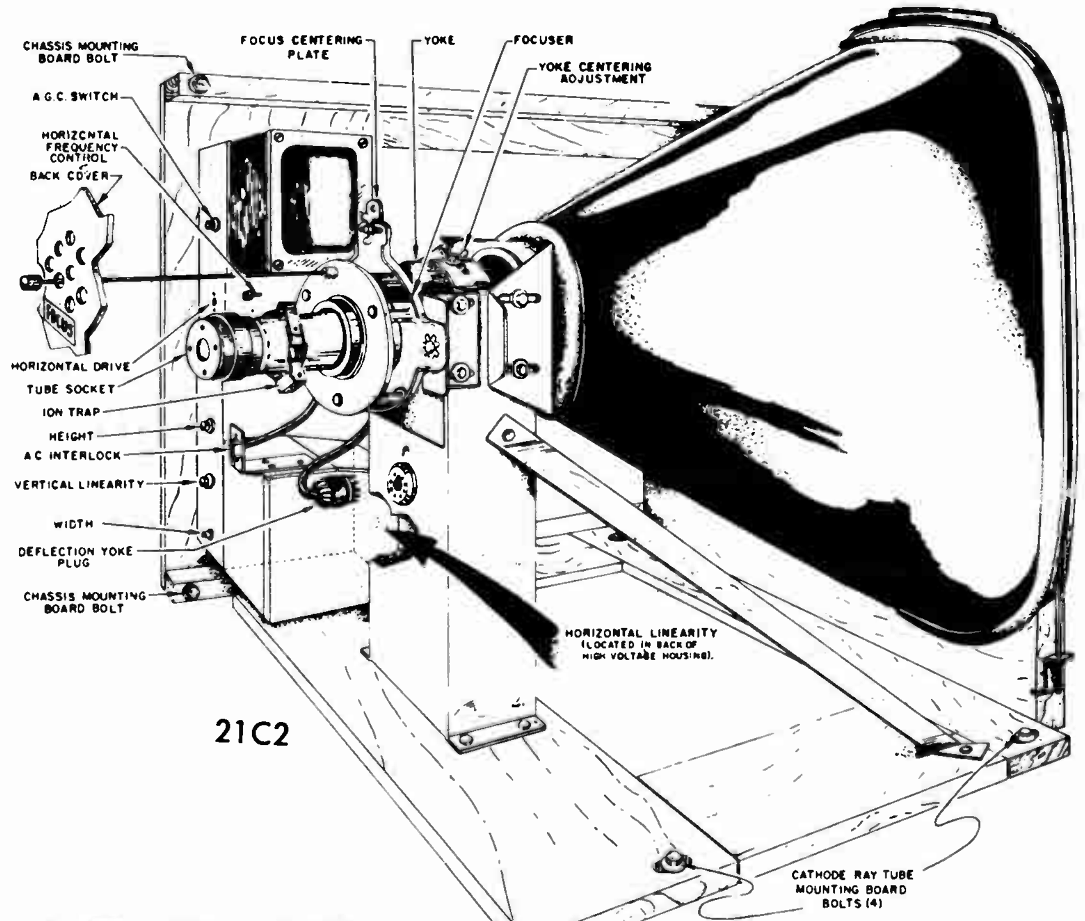
21C2 - 24T2



21T - DL21T

FIG. 1. OPERATING CONTROLS





21C2

FIG. 2. SERVICE ADJUSTMENT AND CONTROLS

SOUND RATIO DETECTOR AND IF ALIGNMENT

1. Connect probe of the VTVM to the diode plate of the ratio detector tube V20B (6T8, pin 2). Common to ground. See Figure 11.

2. Connect high side of the signal generator to the grid of the ratio detector driver. V21 (6AU6, pin 1). Common to ground. See Figure 11.

3. Tune the signal generator to exactly 4.5mc and attenuate the generator so it does not exceed 8 volts on the VTVM.

4. Peak L16 bottom core (FIG. 11) for maximum.

5. Peak L17 top core (FIG. 12) for maximum.

6. Adjust attenuator of signal generator to give exactly eight volts on the VTVM.

7. Move probe of VTVM to junction of R28, C31 and C29. (FIG. 11).

8. Adjust L17 top core (FIG. 12) for exactly 4 volts on the VTVM.

9. Move signal generator to video output tube V8 (6AG7, pin 4) (FIG. 11) and repeat steps number 1 and 3.

10. Peak L12 bottom (FIG. 11) and L13 top (FIG. 12) for maximum.

11. Repeat with care steps 1-3-4-5-6-7-8.

ALTERNATIVE PROCEDURE FOR STEPS 6-7-8:

1. Connect common lead of VTVM to junction of R29 and R30 (FIG. 11).

2. Connect probe of VTVM to junction of R28, C31, and C29. (FIG. 11).

3. Adjust L17 top (FIG. 12) for zero reading on the VTVM.

12. Connect detector probe shown in figure 6 between kinescope cathode (junction of R37 and R38) and ground.

13. Rotate the contrast control to its maximum clockwise position. Connect probe of VTVM to detector.

14. Adjust L12 (bottom slug) for minimum output on VTVM.

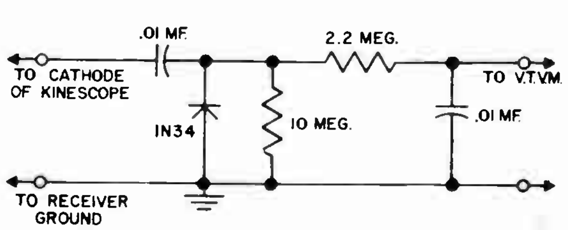


FIG. 6. DETECTOR PROBE

PICTURE I.F. (ROUGH ALIGNMENT)

1. Connect the bias battery as shown in fig. 11. The negative side of the bias battery to the junction of R8, R5, and C81, and the positive side to ground. Disconnect the white wire, that goes to the center terminal of the AGC switch (S2), from the junction of R8, R5, and C81. Connect the output of the signal generator between the test point on the R.F. unit (see fig. 12) and ground.

2. Connect the probe of the VTVM to the junction of L11 and R16 (fig. 11). Common to ground.

3. Set the signal generator to 21.6 mc. and adjust L25, co-channel sound trap, (fig. 12) for minimum output on VTVM.

4. Reset the signal generator to 23.25 mc. Adjust the output of the signal generator for approximately 2.5 volts on the VTVM.

5. Peak first Picture I.F. coil (located on R.F. Unit) and the third Picture I.F. coil L6 (fig. 12) for maximum. Maintain approximately 2.5 volts on the VTVM by adjusting the generator output.

6. Reset signal generator to 25.7 mc.

7. Peak second Picture I.F. coil L3 and the fourth Picture I.F. coil L9 (fig. 12) for maximum.

PICTURE I.F. (FLAT-TOPPING)

1. Remove signal generator and VTVM.

2. Connect the sweep generator between the R.F. test point and ground.

3. Connect the oscilloscope probe to the junction of L11 and R16.

4. Connect the hot side of the signal generator to the chassis side apron nearest the first I.F. stage. Leave the ground side disconnected.

5. With most sweep generators, there is enough output to give an I.F. response curve of sufficient height on the oscilloscope. If there is insufficient output use 3 volts bias instead of 4.5 volts. In adjusting the output of the sweep generator, make sure you do not overload the I.F.'s. This can be ascertained by noticing that the relative shape of the I.F. response does not change with small variations in sweep generator output.

6. Set the signal generator to 26.1 mc. and advance the output until a marker pip is visible on the Picture I.F. curve on the oscilloscope. Be careful not to distort the I.F. curve by advancing the generator output too far. Adjust L3 and L9 so that the marker pip is at the 50% point. See Fig. 7 Picture I.F. curves and Markers.

7. Set the signal generator to 22.7 mc. Adjust the first Picture I.F. coil (located on the R.F. Tuner) and L6 so that the marker pip is at the 50% point. See Fig. 7.

8. Repeat steps 6 and 7 until an acceptable curve is achieved.

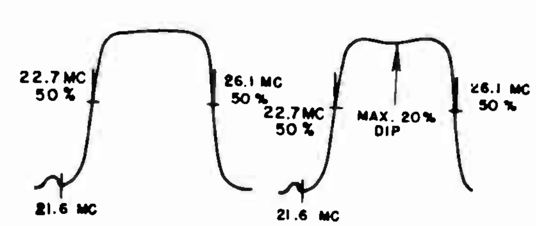


FIG. 7. TYPICAL PICTURE I.F. CURVES AND MARKERS

OSCILLATOR AND R.F. ALIGNMENT

The R.F. Unit is a turret type tuner with separate coil segments for each channel. Normal channel sequence is progressive in a clockwise direction covering channels 2 to 13. The R.F. amplifier is of the cascode type utilizing a 6BQ7 or 6BK7. The converter stage utilizes a 6J6.

OSCILLATOR ALIGNMENT

It should be possible to tune in all channels with the fine tuning control C212 (see figs. 11 and 12) in the middle third of its range. When V3 ages, the oscillator may shift slightly in frequency requiring adjustment. If V3 is defective and must be replaced, several tubes should be tried to find one that requires the least oscillator adjustment.

If an accurately calibrated signal generator that covers all the R.F. frequencies is available then continue with step 1. If not go on to step 10.

1. Remove tube shield on 6J6, V3.

2. Modify a tube shield which will fit snugly over the 6J6 and still remain ungrounded.

3. Remove shorting wire from channel 11 oscillator coil and replace segment and R.F. unit bottom shield.

4. Turn channel selector to channel 12.

5. Set generator to the oscillator frequency which is 231.35 mc. for channel 12.

6. With reference to figure 8 connect the generator to one of the 10 mmf capacitors and connect the other 10 mmf capacitor to the ungrounded tube shield over the 6J6. Connect remaining terminal on probe to vertical input on oscilloscope.

7. Set fine tuning control C212 (fig. 12) to center of its range. Adjust C211 for zero beat pattern on the oscilloscope screen. (The oscillator coil slug which is accessible from the chassis front apron should be in its mechanical mid-position. If the slug should fall in during adjustment, the oscillator coil segment will have to be removed from the turret housing, the little wire spring which normally fits into the slug threads lifted up, and the slug brought forward to its mean position.)

8. Reset the generator for the oscillator frequency of channel 11. Adjust the oscillator coil slug for zero beat on the oscilloscope screen. Use a non-metallic screw-driver in adjusting the oscillator coil slug.

9. Repeat step 8 for the remaining channels, making sure the signal generator is set for the proper frequency on each channel.

When an accurately calibrated generator is not available, then oscillator alignment can only be accomplished when the local T.V. transmitters are on the air.

10. Remove bias battery and replace AGC lead to junction of R8, R5, and C81 (fig. 11).

11. Set fine tuning control C212 (fig. 12) to center of its range.

12. Rotate channel selector control to one of the local T.V. stations and adjust the oscillator coil slug, which is accessible from the front chassis apron (fig. 12), for best picture.

13. Check remaining local stations by rotating the channel selector switch to, each channel in turn and adjusting the oscillator slug for best picture.

14. If on one or two of the channels you do not have enough oscillator range, readjust C211 and repeat steps 12 and 13.

It is possible to adjust the oscillator channel slugs without removing the chassis from the cabinet. The slugs are made accessible by removing the channel selector and fine tuning knobs and by moving the escutcheon plate to one side. Use a long thin fibre or bakelite screwdriver for making adjustments.

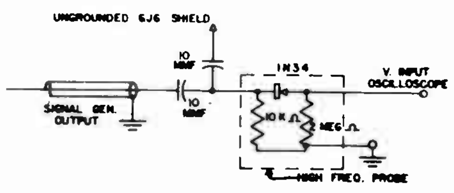


FIG. 8.

R.F. ALIGNMENT

1. Reconnect bias battery as in step 1. Picture I.F. (Rough alignment). Disconnect white AGC wire. Set bias for 3 volts.

2. Connect oscilloscope through 10,000 ohms to test point on R.F. Unit. Connect sweep generator to antenna terminals. If the sweep generator is not terminated for balanced 300 ohms, insert the network shown in fig. 9 below.

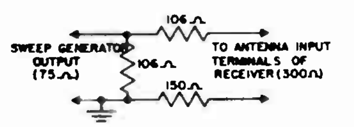


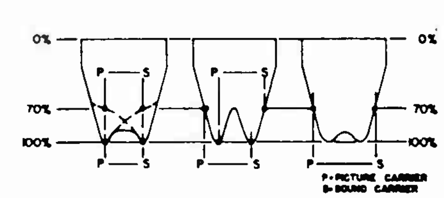
FIG. 9.

3. Set fine tuning control at approximately the midpoint of its tuning range and rotate channel selector to channel 12.

4. Adjust sweep generator to channel 12 and loosely couple signal generator to sweep generator in order to obtain picture carrier and sound carrier markers.

5. Adjust C206, C203, and C213 for flat top response curve. See figure 10 for acceptable R.F. passbands.

6. Check remaining channels. If the response curves obtained on any channel is not acceptable, it might be necessary to return to channel 12 and make a compromise of its response. If one channel is extremely out, that coil section should be repaired or replaced. It is not necessary to remove the tuner from the chassis in order to repair or replace a coil section.



ACCEPTABLE R.F. PASSBAND

FIG. 10.

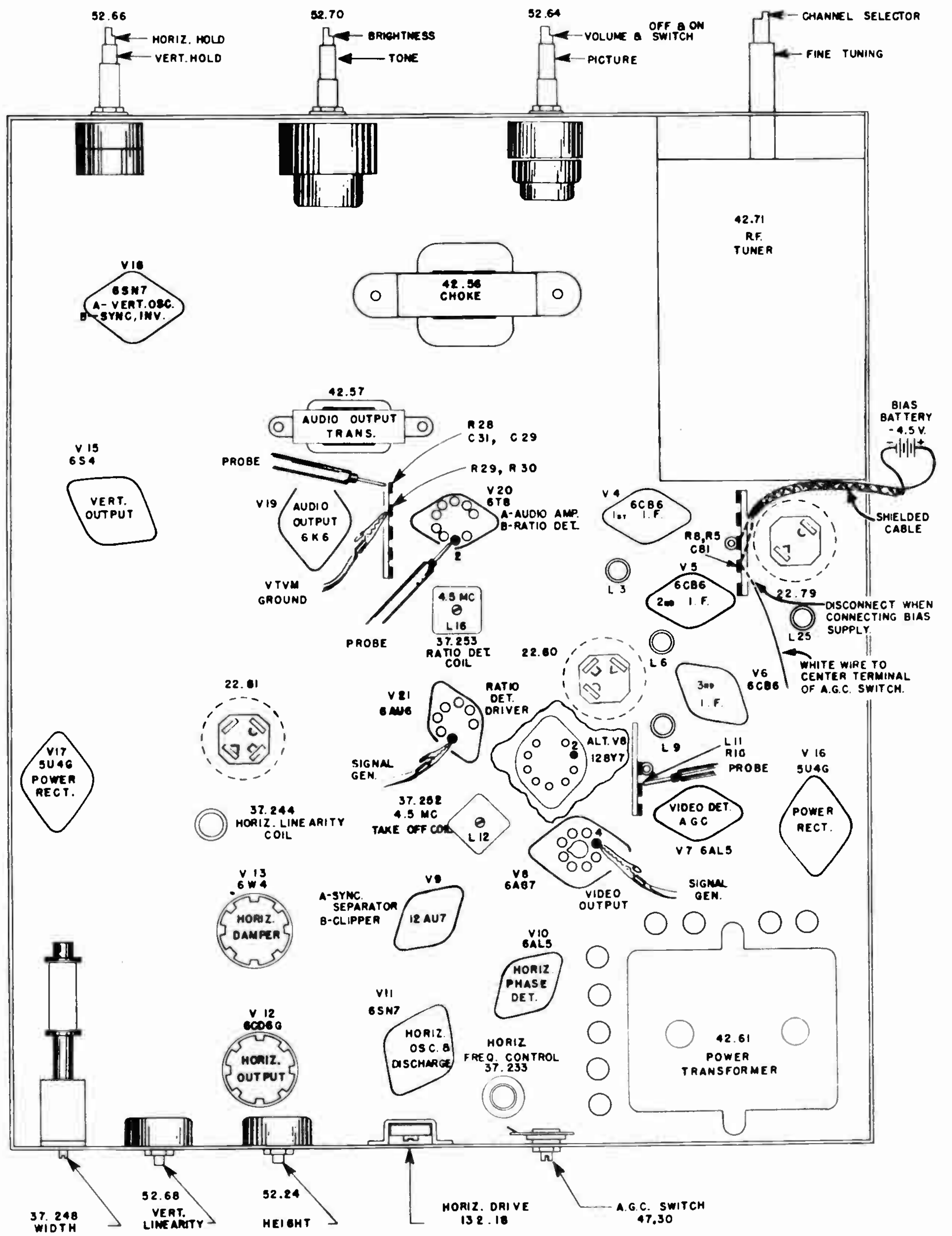


FIG. 11. BOTTOM VIEW OF CHASSIS

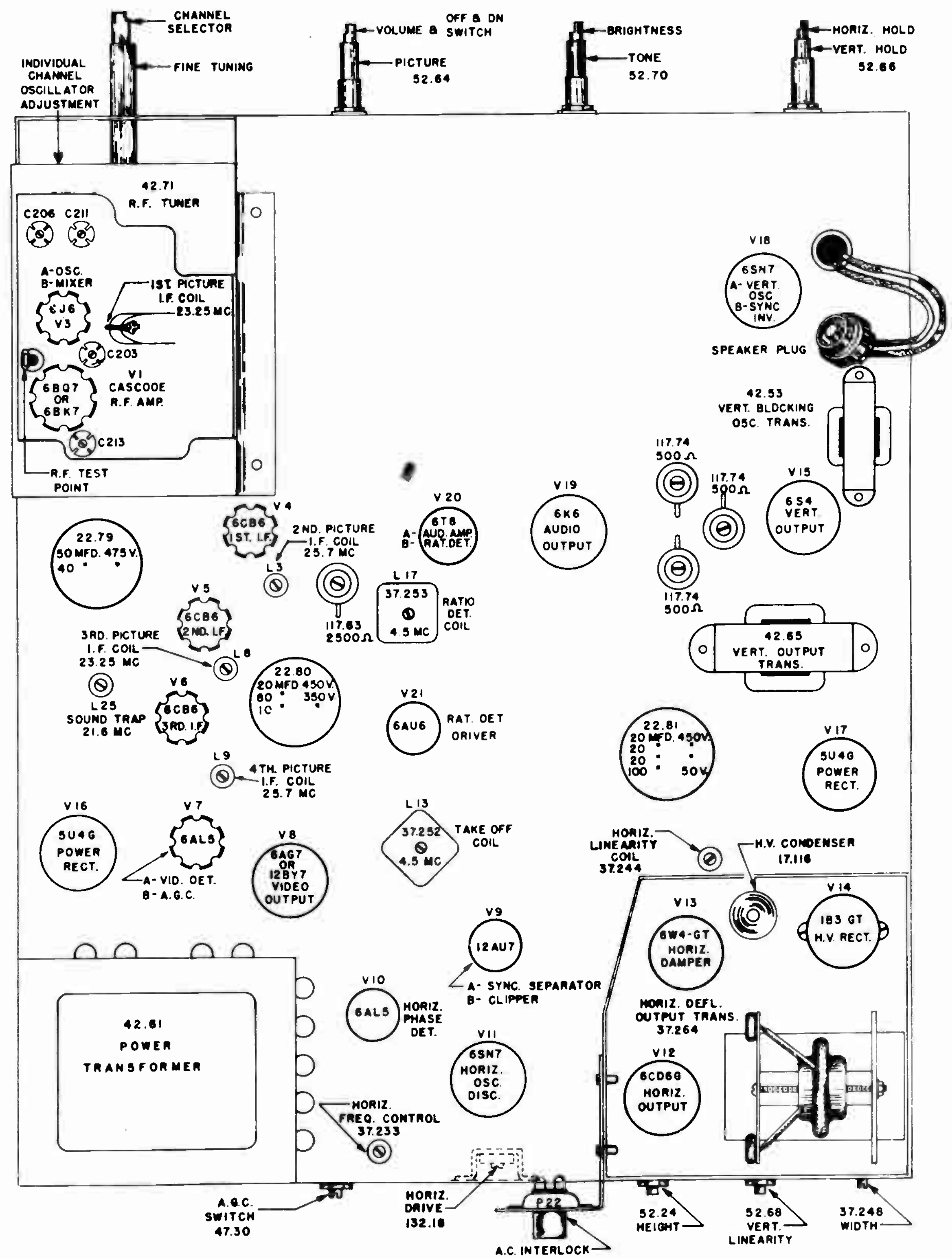
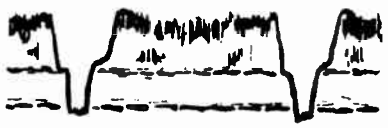
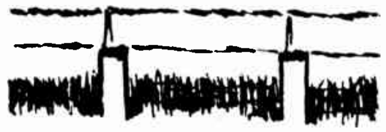


FIG. 12. TOP VIEW OF CHASSIS

WAVE FORMS



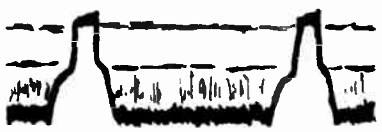
PIN 7 (V7A) 6AL5
VIDEO DETECTOR (HORIZ. SCOPE)
3 VOLTS PP



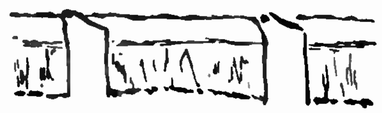
PIN 8 (V8) 6AG7
VIDEO OUTPUT (VERT. SCOPE)
65 VOLTS PP

PIN 1 (V10) 6AL5
HORIZ. PHASE DETECTOR
20 VOLTS PP

PIN 2 (V11) 6SN7GT
HORIZ. OSC. & DISCHARGE
38 VOLTS PP



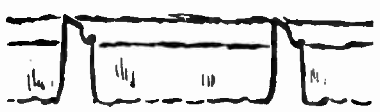
PIN 8 (V8) 6AG7
VIDEO OUTPUT (HORIZ. SCOPE)
65 VOLTS PP



PIN 2 (V9A) 12AU7
SYNC. SEPARATOR (VERT. SCOPE)
45 VOLTS PP

PIN 5 & 7 (V10) 6AL5
HORIZ PHASE DETECTOR
16 VOLTS PP

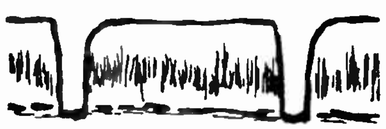
PIN 9 T4
HORIZ. WIDTH COIL
250 VOLTS PP



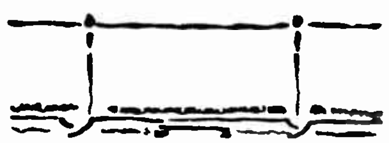
PIN 2 (V9A) 12AU7
SYNC. SEPARATOR (HORIZ. SCOPE)
45 VOLTS PP

PIN 1 (V9A) 12AU7
SYNC. SEPARATOR (VERT. SCOPE)
16 VOLTS PP

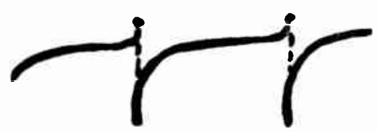
PIN 5 (V12) 6CD6G
HORIZ OUTPUT
65 VOLTS PP



PIN 1 (V9A) 12AU7
SYNC. SEPARATOR (HORIZ. SCOPE)
16 VOLTS PP

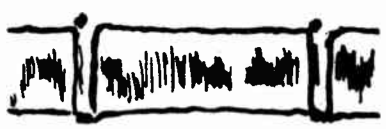


PIN 6 (V9B) 12AU7
SYNC. CLIPPER (VERT. SCOPE)
65 VOLTS PP



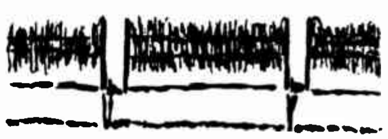
PIN 4 (V18A) 6SN7GT
VERTICAL OSCILLATOR
48 VOLTS PP

PIN 6 (V9B) 12AU7
SYNC. CLIPPER (HORIZ. SCOPE)
65 VOLTS PP



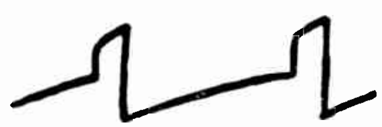
PIN 3 (V18B) 6SN7GT
SYNC. INVERTER (VERT. SCOPE)
25 VOLTS PP

PIN 9 (V15) 6S4
VERTICAL OUTPUT
850 VOLTS PP



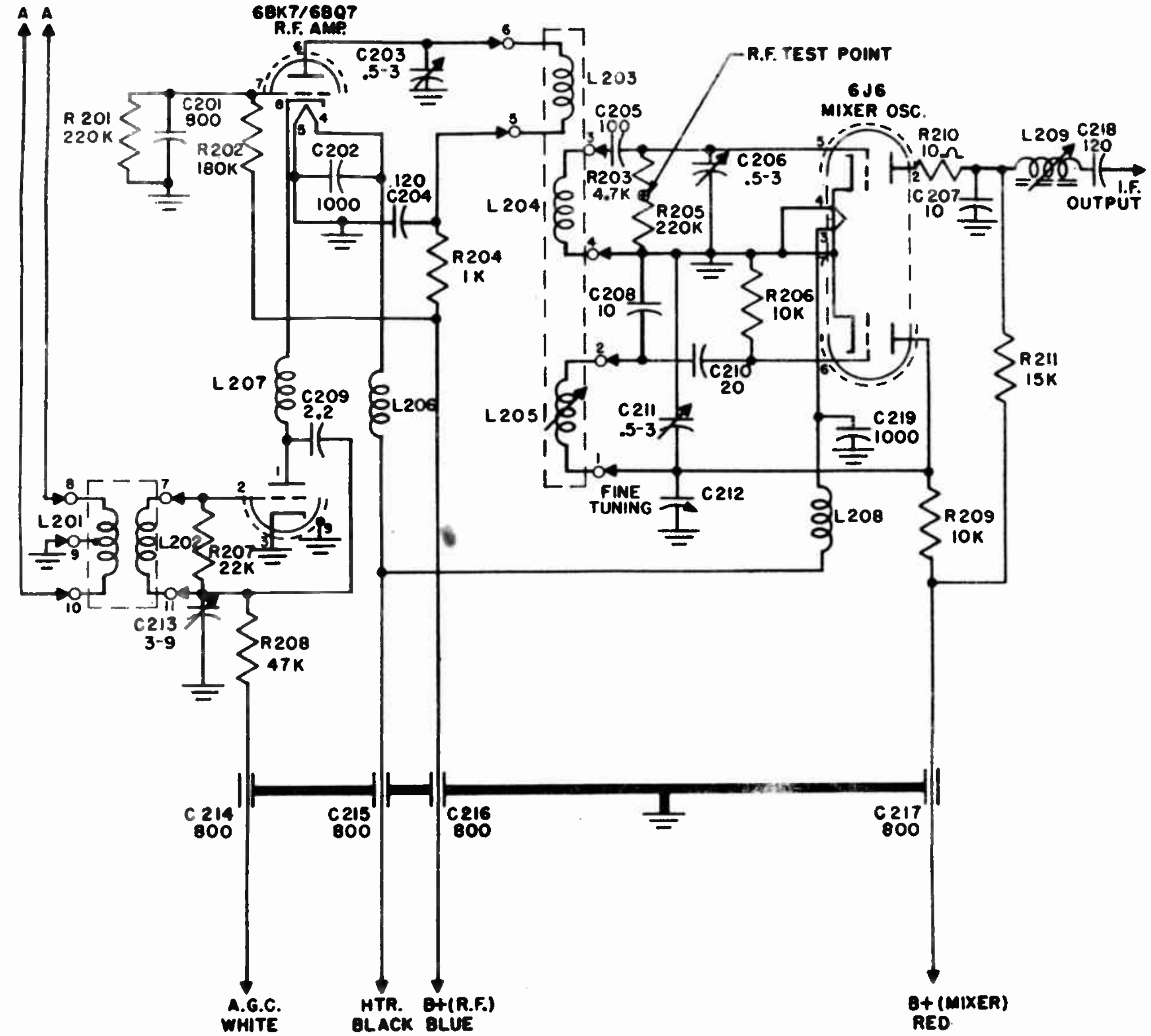
PIN 7 (V7A) 6AL5
VIDEO DETECTOR (VERT. SCOPE)
3 VOLTS PP

PIN 6 (V15) 6S4
VERTICAL OUTPUT
48 VOLTS PP

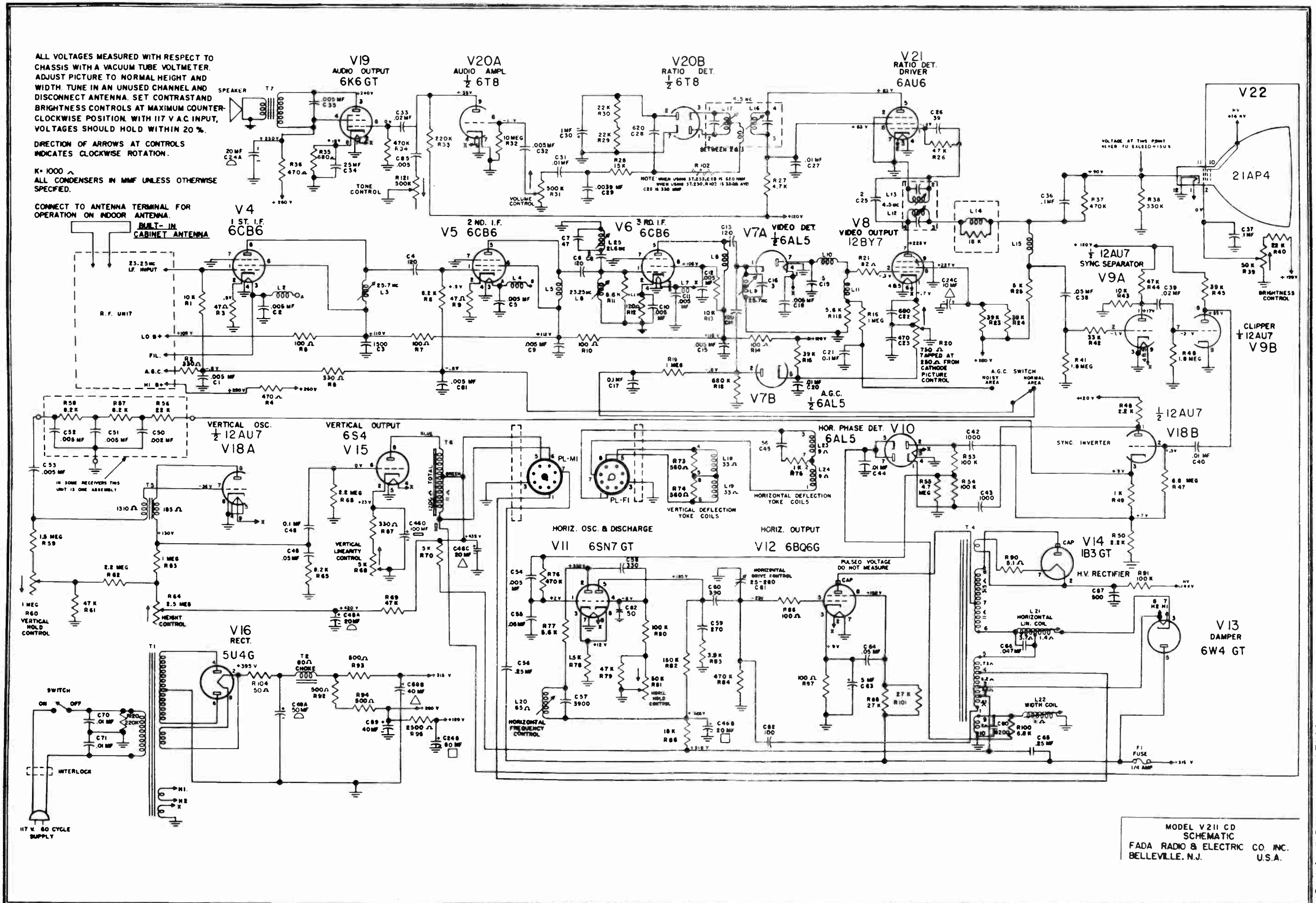


PIN 2 (V10) 6AL5
HORIZ. PHASE DETECTOR
20 VOLTS PP

1. ALL CAPACITANCE VALUES STATED IN MMF.
2. R201 & R202 MAY BOTH BE CODED 220K, BUT ARE SELECTED.
3. INTERCHANGE OF TUBE TYPE IN R.F. AMPLIFIER REQUIRES REALIGNMENT OF C203, C206, & C213.

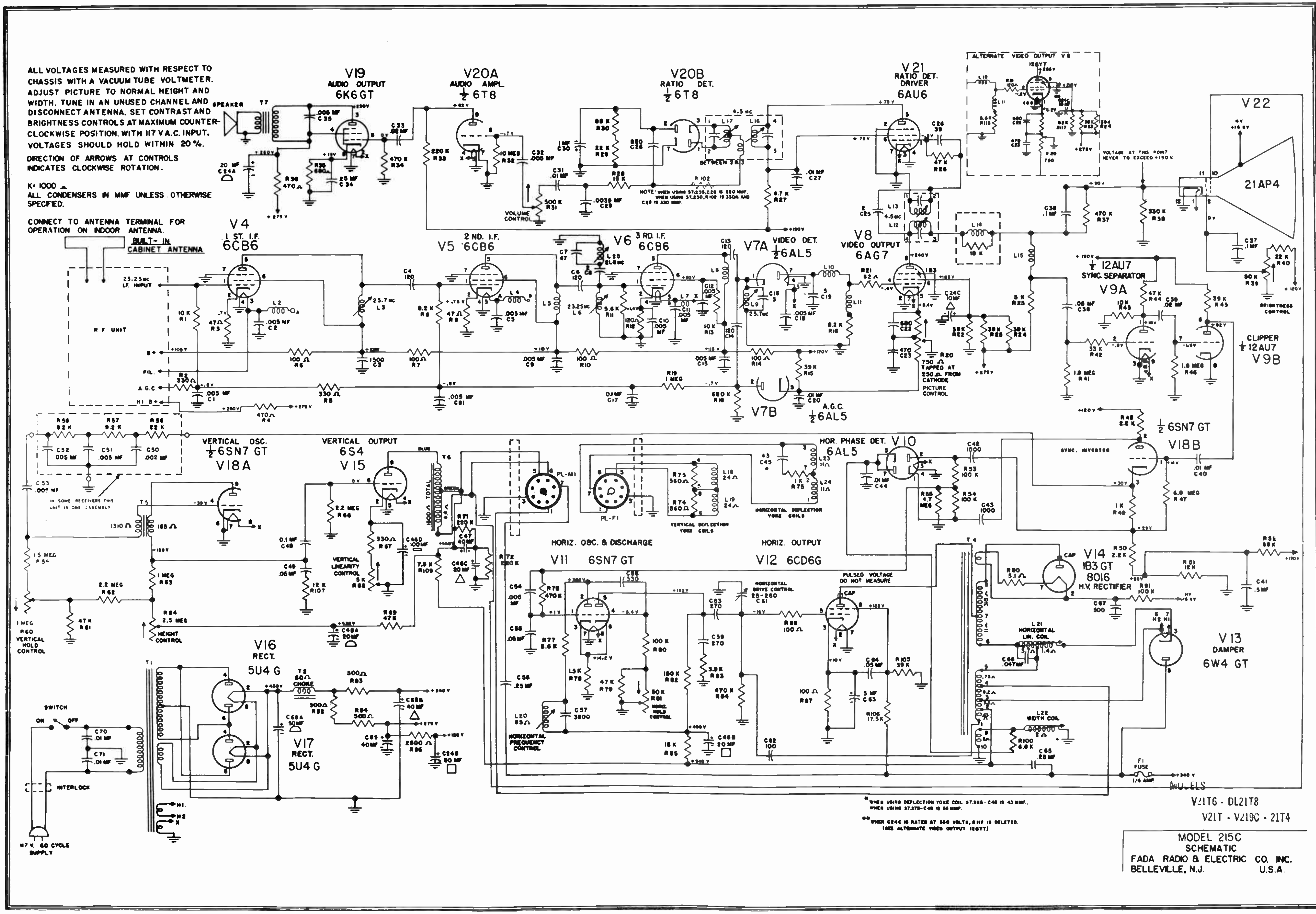


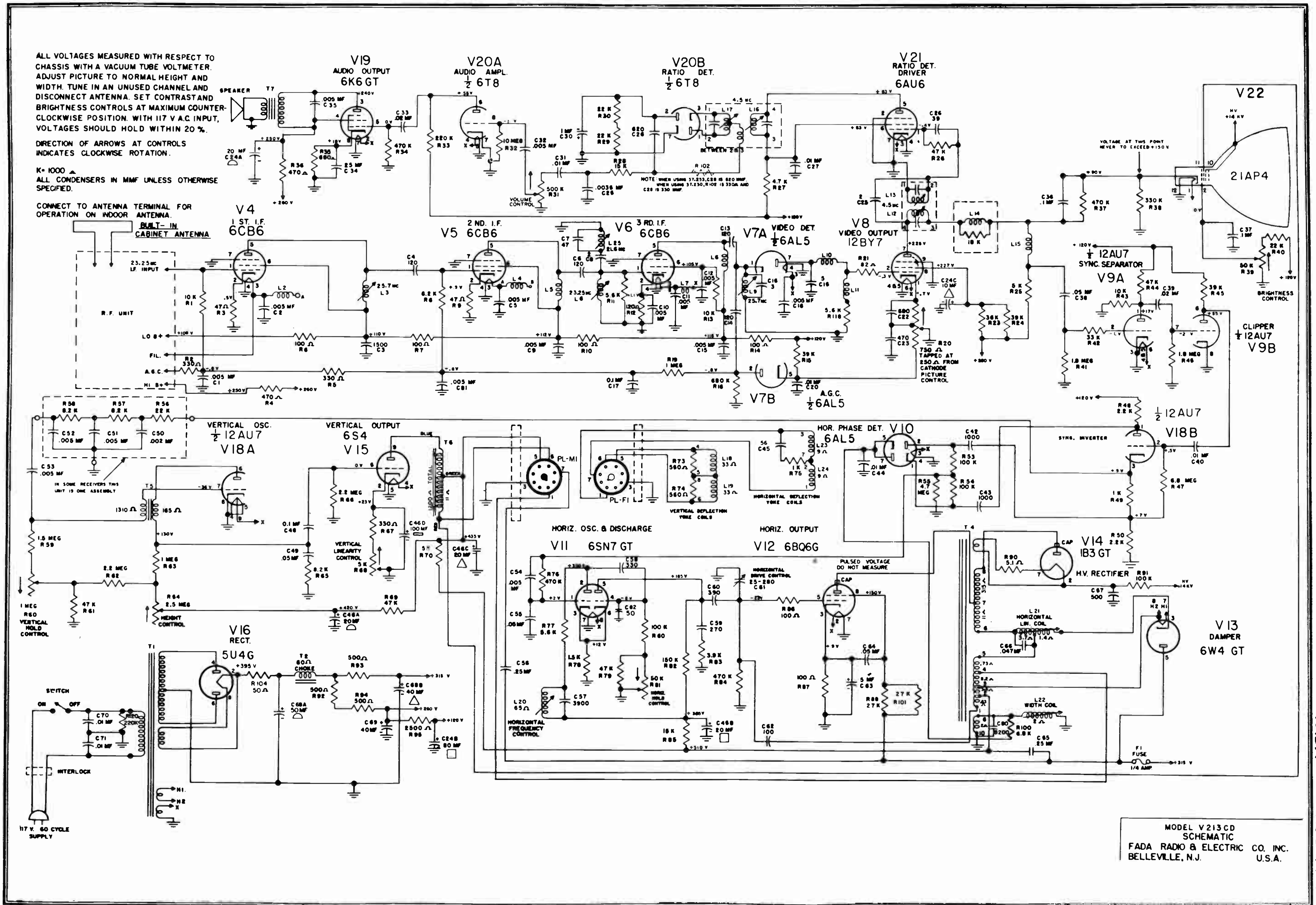
SCHEMATIC R.F. UNIT



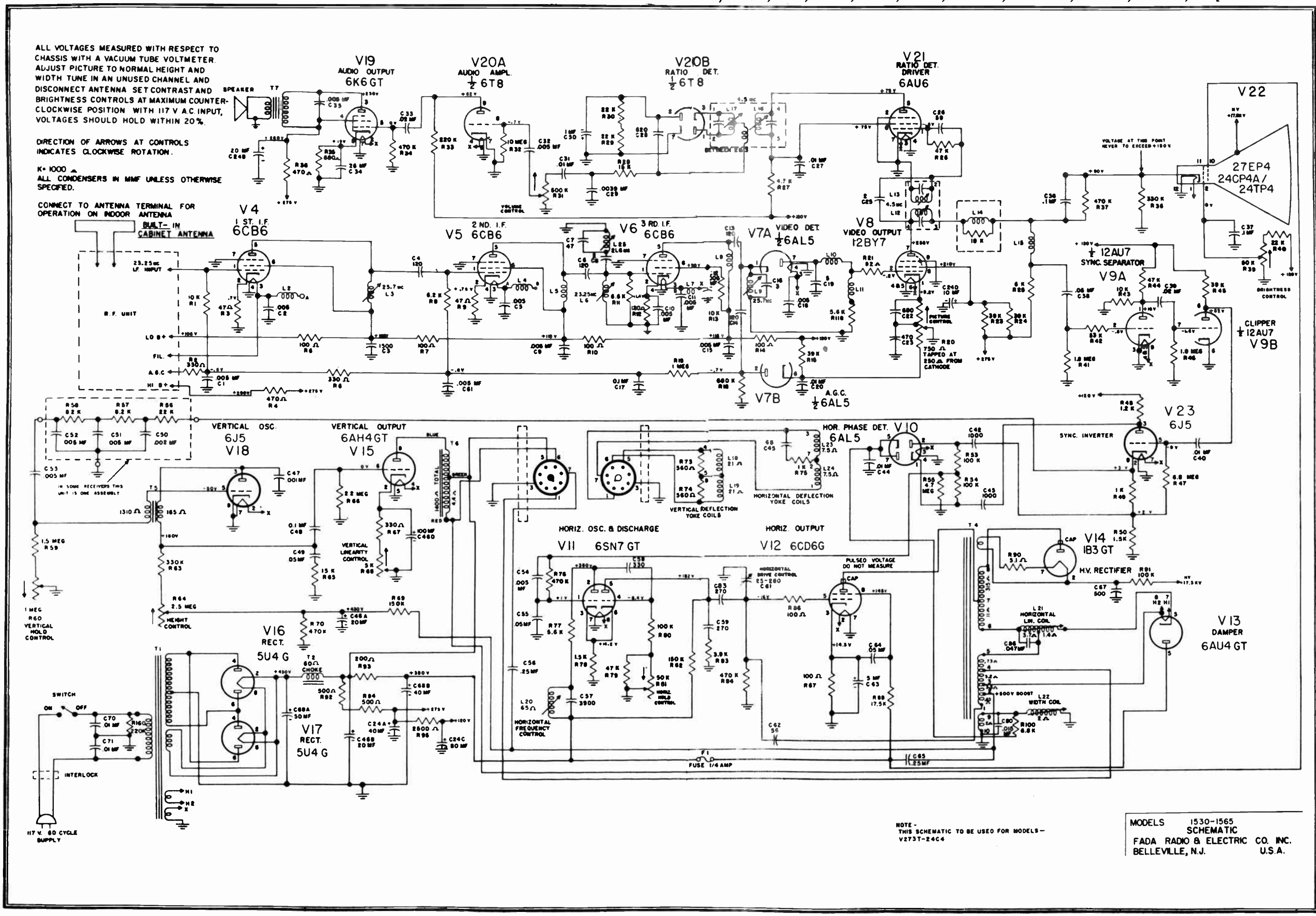
FADA TV PAGE 14-5

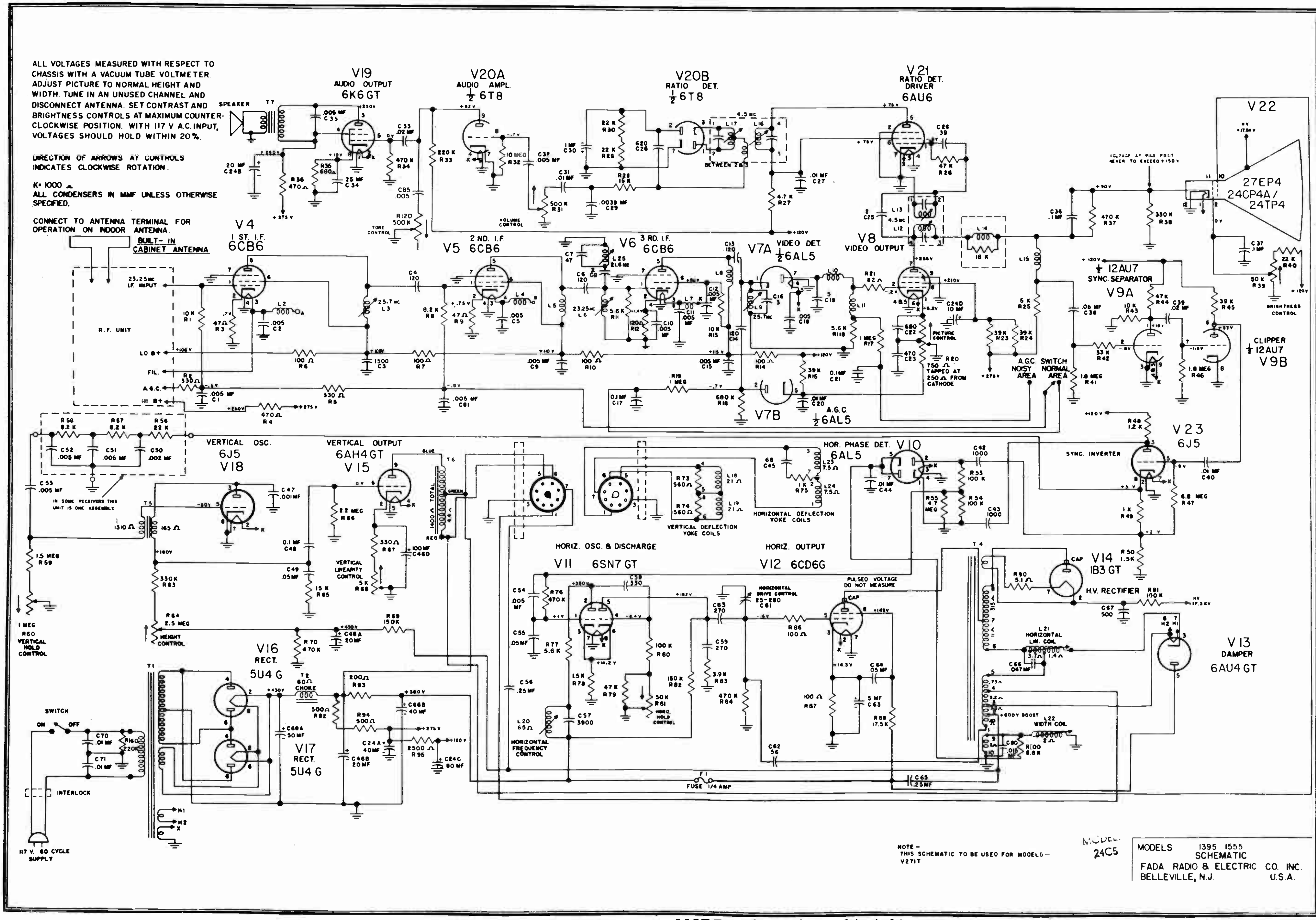
MODELS 21T4, 21T6, 24C4, 215C, DL21T8, V21T, V213CD, V219C, V273T, President Series; 21C2, 21T, 21T2, 24C5, 24T2, DL21T, V211CD, V217C, V271T, Imperial Series


ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER. ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH. TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA. SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION. WITH 117 V.A.C. INPUT. VOLTAGES SHOULD HOLD WITHIN 20%.
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION.
K= 1000 Ω
ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED.
CONNECT TO ANTENNA TERMINAL FOR OPERATION ON INDOOR ANTENNA.
BUILT-IN CABINET ANTENNA
R F UNIT
V19 AUDIO OUTPUT 6K6GT
V20A AUDIO AMPL. 1/2 6T8
V20B RATIO DET. 1/2 6T8
V21 RATIO DET. DRIVER 6AU6
ALTERNATE VIDEO OUTPUT V8
V22 21AP4
V4 1 ST. I.F. 6CB6
V5 2 ND. I.F. 6CB6
V6 3 RD. I.F. 6CB6
V7A VIDEO DET. 1/2 6AL5
V8 VIDEO OUTPUT 6AG7
V7B A.G.C. 1/2 6AL5
1/2 12AU7 SYNC. SEPARATOR V9A
CLIPPER 1/2 12AU7 V9B
VOLUME CONTROL
PICTURE CONTROL
BRIGHTNESS CONTROL
VERTICAL OSC. 1/2 6SN7 GT V18A
VERTICAL OUTPUT 6S4 V15
HOR. PHASE DET. V10 6AL5
1/2 6SN7 GT V18B
SYNC. INVERTER
VERTICAL DEFLECTION YOKE COILS
HORIZONTAL DEFLECTION YOKE COILS
VERTICAL LINEARITY CONTROL
VERTICAL HOLD CONTROL
HEIGHT CONTROL
HORIZ. OSC. & DISCHARGE V11 6SN7 GT
HORIZ. OUTPUT V12 6CD6G
HORIZONTAL DRIVE CONTROL
PULSED VOLTAGE DO NOT MEASURE
HORIZ. HOLD CONTROL
HORIZONTAL FREQUENCY CONTROL
V14 1B3 GT 8016 H.V. RECTIFIER
V13 DAMPER 6W4 GT
HORIZONTAL LIN. COIL
WIDTH COIL
V16 RECT. 5U4 G
V17 RECT. 5U4 G
SWITCH ON OFF
INTERLOCK
117 V. 60 CYCLE SUPPLY
FUSE 1/4 AMP.
MODELS V21T6 - DL21T8 V21T - V219C - 21T4
MODEL 215C SCHEMATIC
FADA RADIO & ELECTRIC CO. INC.
BELLEVILLE, N.J. U.S.A.

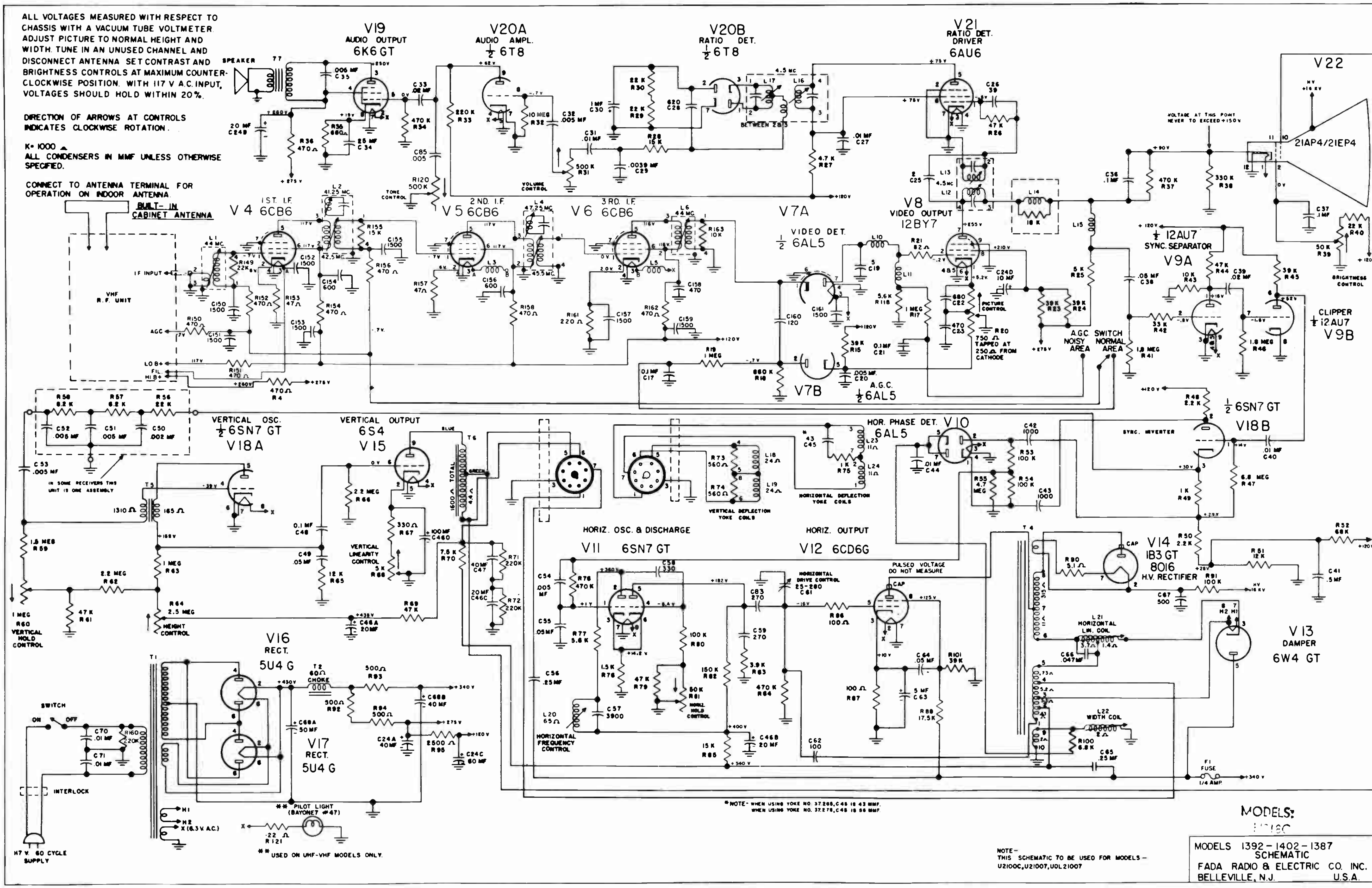


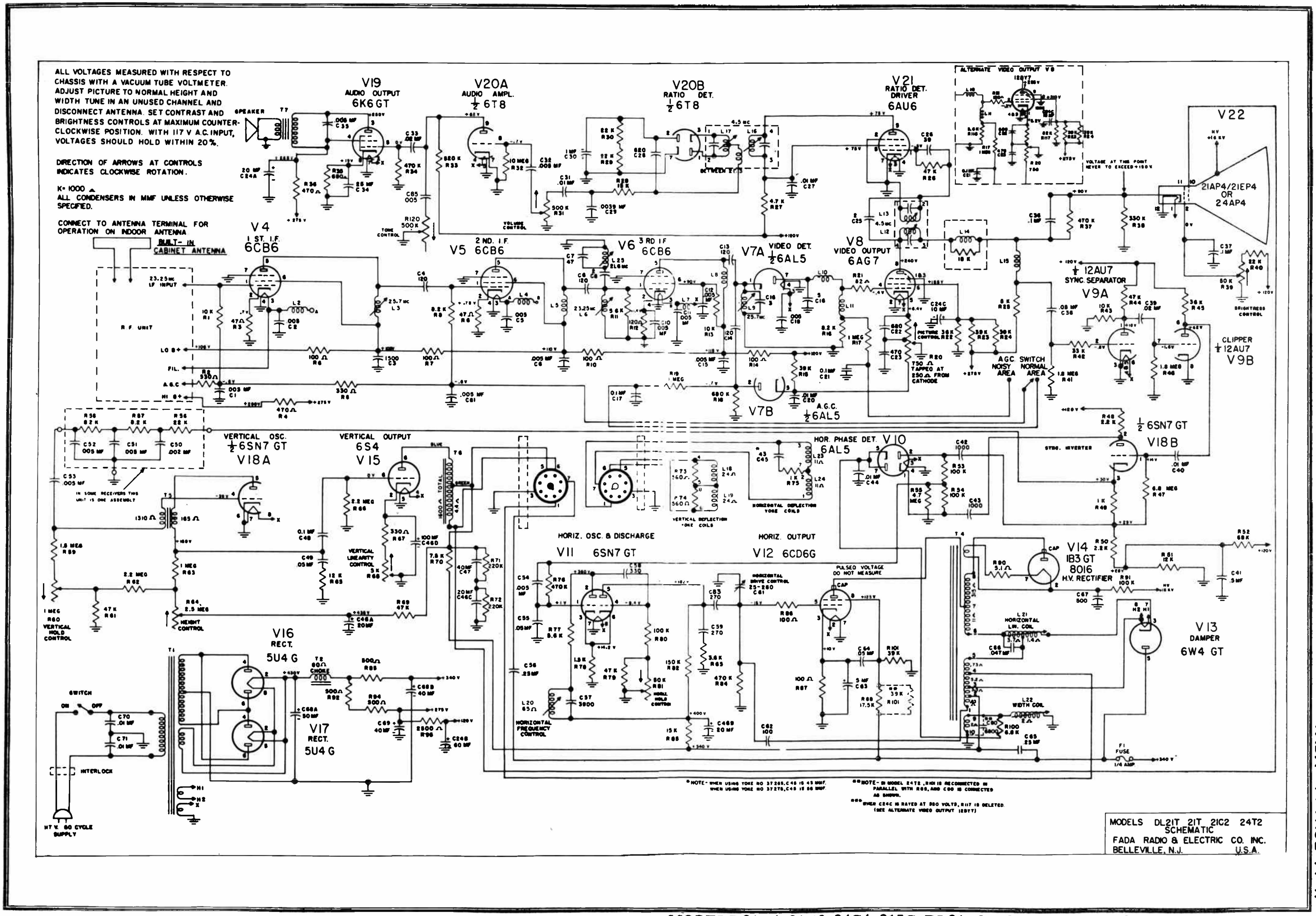
MODELS 21T4, 21T6, 24C4, 215C, DL21T8, V21T, V213CD, V219C, V273T, President Series; 21C2, 21T, 21T2, 24C5, 24T2, DL21T, V211CD, V217C, V271T, Imperial Series


ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER. ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION WITH 117 V A.C. INPUT, VOLTAGES SHOULD HOLD WITHIN 20%.
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION.
K= 1000 Ω
ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED.
CONNECT TO ANTENNA TERMINAL FOR OPERATION ON INDOOR ANTENNA
BUILT-IN CABINET ANTENNA
V19 AUDIO OUTPUT 6K6GT
V20A AUDIO AMPL. ½ 6T8
V21OB RATIO DET. ½ 6T8
V21 RATIO DET. DRIVER 6AU6
V22 27EP4 24CP4A/ 24TP4
V4 1 ST. I.F. 6CB6
V5 2 ND. I.F. 6CB6
V6 3 RD. I.F. 6CB6
V7A VIDEO DET. ½ 6AL5
V8 VIDEO OUTPUT 12BY7
½ 12AU7 SYNC. SEPARATOR V9A
CLIPPER ½ 12AU7 V9B
V7B A.G.C. ½ 6AL5
R.F. UNIT
VERTICAL OSC. 6J5 V18
VERTICAL OUTPUT 6AH4GT V15
HOR. PHASE DET. V10 6AL5
SYNC. INVERTER V23 6J5
VERTICAL DEFLECTION YOKE COILS
HORIZONTAL DEFLECTION YOKE COILS
HORIZ. OSC. & DISCHARGE V11 6SN7 GT
HORIZ. OUTPUT V12 6CD6G
V14 1B3 GT H.V. RECTIFIER
V13 DAMPER 6AU4 GT
V16 RECT. 5U4 G
V17 RECT. 5U4 G
VERTICAL HOLD CONTROL
HEIGHT CONTROL
VERTICAL LINEARITY CONTROL
HORIZONTAL FREQUENCY CONTROL
HORIZ. HOLD CONTROL
HORIZONTAL DRIVE CONTROL
HORIZONTAL LIN. COIL
WIDTH COIL
PULSED VOLTAGE DO NOT MEASURE
VOLUME CONTROL
PICTURE CONTROL
BRIGHTNESS CONTROL
SPEAKER
SWITCH
INTERLOCK
117 V. 60 CYCLE SUPPLY
FUSE 1/4 AMP
NOTE - THIS SCHEMATIC TO BE USED FOR MODELS— V273T-24C4
MODELS 1530-1565
SCHEMATIC
FADA RADIO & ELECTRIC CO. INC.
BELLEVILLE, N.J. U.S.A.



ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER. ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH. TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA. SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION. WITH 117 V A.C. INPUT, VOLTAGES SHOULD HOLD WITHIN 20%.
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION.
K= 1000
ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED.
CONNECT TO ANTENNA TERMINAL FOR OPERATION ON INDOOR ANTENNA.
BUILT-IN CABINET ANTENNA
R.F. UNIT
V19 AUDIO OUTPUT 6K6GT
V20A AUDIO AMPL. ½ 6T8
V20B RATIO DET. ½ 6T8
V21 RATIO DET. DRIVER 6AU6
V22 27EP4 24CP4A/ 24TP4
V4 1 ST. I.F. 6CB6
V5 2 ND. I.F. 6CB6
V6 3 RD. I.F. 6CB6
V7A VIDEO DET. ½ 6AL5
V7B A.G.C. ½ 6AL5
V8 VIDEO OUTPUT
½ 12AU7 SYNC. SEPARATOR V9A
CLIPPER ½ 12AU7 V9B
V23 6J5 SYNC. INVERTER
VERTICAL OSC. 6J5 V18
VERTICAL OUTPUT 6AH4GT V15
HOR. PHASE DET. V10 6AL5
HORIZ. OSC. & DISCHARGE V11 6SN7GT
HORIZ. OUTPUT V12 6CD6G
V14 1B3GT H.V. RECTIFIER
V13 DAMPER 6AU4GT
V16 RECT. 5U4G
V17 RECT. 5U4G
VERTICAL DEFLECTION YOKE COILS
HORIZONTAL DEFLECTION YOKE COILS
VERTICAL HOLD CONTROL
HEIGHT CONTROL
VERTICAL LINEARITY CONTROL
HORIZONTAL FREQUENCY CONTROL
HORIZ. HOLD CONTROL
HORIZONTAL DRIVE CONTROL
HORIZONTAL LIN. COIL
WIDTH COIL
VOLUME CONTROL
TONE CONTROL
PICTURE CONTROL
BRIGHTNESS CONTROL
A.G.C. SWITCH NOISY AREA NORMAL AREA
SPEAKER
SWITCH ON OFF
INTERLOCK
117 V. 60 CYCLE SUPPLY
FUSE 1/4 AMP
IN SOME RECEIVERS THIS UNIT IS ONE ASSEMBLY.
NOTE - THIS SCHEMATIC TO BE USED FOR MODELS - V271T
MODEL 24C5
MODELS 1395 1555 SCHEMATIC
FADA RADIO & ELECTRIC CO. INC. BELLEVILLE, N.J. U.S.A.


ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH. TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION. WITH 117 V A.C. INPUT, VOLTAGES SHOULD HOLD WITHIN 20%.
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION.
K= 1000
ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED.
CONNECT TO ANTENNA TERMINAL FOR OPERATION ON INDOOR ANTENNA
BUILT-IN CABINET ANTENNA
VHF R.F. UNIT
V19 AUDIO OUTPUT 6K6 GT
V20A AUDIO AMPL. 1/2 6T8
V20B RATIO DET. 1/2 6T8
V21 RATIO DET. DRIVER 6AU6
V22 21AP4/21EP4
V4 1ST. I.F. 6CB6
V5 2ND. I.F. 6CB6
V6 3RD. I.F. 6CB6
V7A VIDEO DET. 1/2 6AL5
V8 VIDEO OUTPUT 12BY7
V7B A.G.C. 1/2 6AL5
V9A 1/2 12AU7 SYNC. SEPARATOR
V9B CLIPPER 1/2 12AU7
AGC SWITCH NOISY AREA NORMAL AREA
VERTICAL OSC. 1/2 6SN7 GT V18A
VERTICAL OUTPUT 6S4 V15
HOR. PHASE DET. V10 6AL5
V18B 1/2 6SN7 GT SYNC. INVERTER
VERTICAL DEFLECTION YOKE COILS
HORIZONTAL DEFLECTION YOKE COILS
HORIZ. OSC. & DISCHARGE V11 6SN7 GT
HORIZ. OUTPUT V12 6CD6G
V14 1B3 GT 8016 H.V. RECTIFIER
V13 DAMPER 6W4 GT
V16 RECT. 5U4 G
V17 RECT. 5U4 G
VERTICAL HOLD CONTROL
HEIGHT CONTROL
VERTICAL LINEARITY CONTROL
HORIZONTAL DRIVE CONTROL
HORIZONTAL FREQUENCY CONTROL
HORIZ. HOLD CONTROL
HORIZONTAL LIN. COIL
WIDTH COIL
PICTURE CONTROL
BRIGHTNESS CONTROL
VOLUME CONTROL
TONE CONTROL
SPEAKER
SWITCH ON OFF
INTERLOCK
117 V. 60 CYCLE SUPPLY
PILOT LIGHT (BAYONET #47)
** USED ON UHF-VHF MODELS ONLY.
IN SOME RECEIVERS THIS UNIT IS ONE ASSEMBLY
VOLTAGE AT THIS POINT NEVER TO EXCEED +150V
PULSED VOLTAGE DO NOT MEASURE
FUSE 1/4 AMP
*NOTE- WHEN USING YOKE NO. 37.266, C45 IS 43 MMF. WHEN USING YOKE NO. 37.275, C45 IS 56 MMF.
NOTE- THIS SCHEMATIC TO BE USED FOR MODELS - U2100C, U21007, U0L21007
MODELS:
MODELS 1392-1402-1387 SCHEMATIC
FADA RADIO & ELECTRIC CO. INC.
BELLEVILLE, N.J. U.S.A.



FADA TV PAGE 14-11

MODELS 21T4, 21T6, 24C4, 215C, DL21T8, V21T, V213CD, V219C, V273T, President Series; 21C2, 21T, 21T2, 24C5, 24T2, DL21T, V211CD, V217C, V271T, Imperial Series

LIST OF PARTS

Symbol	Part No.	Description
R1	32.11	10K 10% ½W.
R2	32.67	330 10% ½W.
R3	32.197	47 10% ½W.
R4	32.173	470 20% ½W.
R5	32.67	330 10% ½W.
R6	32.2	100 10% ½W.
R7	32.2	100 10% ½W.
R8	32.77	8.2K 10% ½W.
R9	32.197	47 10% ½W.
R10	32.2	100 10% ½W.
R11	32.126	5.6K 10% ½W.
R12	32.118	120 10% ½W.
R13	32.11	10K 10% ½W.
R14	32.2	100 10% ½W.
R15	32.103	39K 10% 1W.
R16	32.77	8.2K 10% ½W.
R17	32.33	1 megohm 10% ½W.
R18	32.35	680K 10% ½W.
R19	32.33	1 megohm 10% ½W.
R20	52.64	750 tapped at 250 (Contrast)
R21	32.125	82 10% ½W.
R22	32.103	39K 10% 1W.
R23	32.660	39K 10% 2W.
R24	32.660	39K 10% 2W.
R25	117.80	5K 10% 10W. W.W.
R26	32.15	47K 10% ½W.
R27	32.74	4.7K 10% 1W.
R28	32.12	15K 10% ½W.
R29	32.13	22K 10% ½W.
R30	32.13	22K 10% ½W.
R31	52.64	500K (Volume)
R32	32.99	10 megohm 20% ½W.
R33	32.18	220K 20% ½W.
R34	32.92	470K 10% ½W.
R35	32.115	680 10% 1W.
R36	32.399	470 10% 1W.
R37	32.92	470K 10% ½W.
R38	32.205	330K 10% ½W.
R39	52.70	50K (Brightness)
R40	32.183	22K 20% ½W.
R41	32.208	1.8 megohm 10% ½W.
R42	32.14	33K 10% ½W.
R43	32.11	10K 10% ½W.
R44	32.15	47K 10% ½W.
R45	32.103	39K 10% 1W.
R46	32.208	1.8 megohm 10% ½W.
R47	32.46	6.8 megohm 10% ½W.
R48	32.60	2.2K 10% ½W.
R49	32.8	1K 10% ½W.
R50	32.60	2.2K 10% ½W.
R51	32.142	12K 10% ½W.
R52	32.411	68K 10% 1W.
R53	32.89	100K 10% ½W.
R54	32.89	100K 10% ½W.
R55	32.98	4.7 megohm 10% ½W.
*R56	32.13	22K 10% ½W.
*R57	32.77	8.2K 10% ½W.
*R58	32.77	8.2K 10% ½W.
R59	32.147	1.5 megohm 10% ½W.
R60	52.66	1 megohm (Vertical Hold)
R61	32.15	47K 10% ½W.
R62	32.34	2.2 megohm 10% ½W.
R63	32.33	1 megohm 10% ½W.
R64	52.24	2.5 megohm (Height)
R65	32.142	12K 10% ½W.
R66	32.34	2.2 megohm 10% ½W.
R67	32.67	330 10% ½W.
R68	52.68	5K (Vertical Linearity)
R69	32.15	47K 10% ½W.
R70	117.81	7.5K 10% 10W. W.W.
R71	32.18	220K 20% ½W.
R72	32.18	220K 20% ½W.
R73	32.68	560 10% ½W.
R74	32.68	560 10% ½W.
R75	32.8	1K 10% ½W.
R76	32.92	470K 10% ½W.
R77	32.126	5.6K 10% ½W.
R78	32.265	1.5K 5% ½W.
R79	32.15	47K 10% ½W.
R80	32.89	100K 10% ½W.
R81	52.66	50K (Horizontal Hold)
R82	32.90	150K 10% ½W.
R83	32.202	3.9K 10% ½W.
R84	32.92	470K 10% ½W.
R85	32.655	15K 10% 2W.
R86	32.2	100 10% ½W.
R87	32.635	100 10% 2W.
R88	117.71	17.5K 10% 10W. W.W.
R90	32.137	5.1 10% ½W. I.R.C.-W.W.
R91	32.373	100K 20% 1W.
R92	117.74	500 10% 20W. W.W.
R93	117.74	500 10% 20W. W.W.
R94	117.74	500 10% 20W. W.W.
R95	117.83	2500 10% 25W. W.W.
R100	32.10	6.8K 10% ½W.
R101	32.660	39K 10% 2W.
R117	32.412	82K 10% 1W.
R118	32.126	5.6K 10% ½W.
R120	52.70	500K ohms (Tone)
*R56 *R57 *R58	167.1	Vertical Integrator. Three Resistors in one unit, plus C50, C51, C52.
C1	17.44	.005 mf GMV Disc 500V.
C2	17.44	.005 mf GMV Disc 500V.
C3	17.45	1500 mmf 20% 500V. Ceramic
C4	17.106	120 mmf 20% 500V. Ceramic
C5	17.44	.005 mf GMV Disc 500V.
C6	17.106	120 mmf 20% 500V. Ceramic
C7	17.130	47 mmf 10% NPO 500V. Ceramic
C8	17.127	2 mmf 10% 500V. Ceramic
C9	17.44	.005 mf GMV Disc 500V.
C10	17.44	.005 mf GMV Disc 500V.
C11	17.44	.005 mf GMV Disc 500V.
C12	17.44	.005 mf GMV Disc 500V.
C13	17.106	120 mmf 20% 500V. Ceramic
C14	17.106	120 mmf 20% 500V. Ceramic
C15	17.44	.005 mf GMV Disc 500V.
C16	17.131	3 mmf 20% 500V. Ceramic
C17	12.49	.1 mf 20% 200V.
C18	17.44	.005 mf GMV Disc 500V.
C19	17.79	5 mmf 10% 500V. Ceramic
C20	12.72	.01 mf 20% 400V.
C21	12.49	.1 mf 20% 200V.
C22	17.108	680 mmf 20% 500V. Ceramic
C23	17.107	470 mmf 10% 500V. Ceramic
C24A	22.80D	25 mf 450V. Electrolytic
C24B	22.80D	80 mf 350V. Electrolytic
C24C	22.80D	10 mf 350V. Electrolytic
C25	17.59	2 mmf 20% 500V. Ceramic
C26	17.105	39 mmf 20% 500V. Ceramic
C27	17.80	.01 mf GMV Disc 350V.
C28	17.125	620 mmf 10% 350V. Ceramic or Mica
C29	12.71	.0039 mf 20% 400V.
C30	22.70	1 mf 150V. Electrolytic
C31	12.72	.01 mf 20% 400V.
C32	12.68	.005 mf 20% 400V.
C33	12.82	.02 mf 20% 400V.
C34	22.66	25 mf 50V. Electrolytic
C35	12.68	.005 mf 20% 400V.
C36	12.60	.1 mf 20% 600V.
C37	12.75	.1 mf 20% 400V.
C38	12.67	.05 mf 20% 400V.
C39	12.82	.02 mf 20% 400V.
C40	17.80	.01 mf GMV Disc 500V.
C41	12.92	.5 mf 20% 200V.
C42	17.109	1000 mmf 10% 500V. Ceramic
C43	17.109	1000 mmf 10% 500V. Ceramic
C44	12.72	.01 mf 20% 400V.
C45	17.132	43 mmf 5% 1500V. Mica
C46A	22.81	20 mf 450V. Electrolytic
C46B	22.81	20 mf 450V. Electrolytic
C46C	22.81	20 mf 450V. Electrolytic
C46D	22.81	100 mf 50V. Electrolytic
C47	22.85	40 mf 350V. Electrolytic
C48	12.75	.1 mf 20% 400V.
C49	12.67	.05 mf 20% 400V.
*C50	12.86	.002 mf 20% 400V.
*C51	12.68	.005 mf 20% 400V.
*C52	12.68	.005 mf 20% 400V.
C53	12.83	.005 mf 20% 600V.
C54	12.68	.005 mf 20% 400V.
C55	12.67	.05 mf 20% 400V.
C56	12.77	.25 mf 20% 400V.
C57	17.113	3900 mmf 5% 500V. Silver Mica
C58	17.69	330 mmf 10% 500V. Silver Mica
C59	17.123	270 mmf 10% 500V. Mica
C61	132.18	25-280 mmf Ceramic Trimmer
C62	17.129	100 mmf 10% 1000V. Mica
C63	22.56	5 mf 50V. Electrolytic
C64	12.66	.05 mf 20% 600V.
C65	12.77	.25 mf 20% 400V.
C66	12.67	.047 mf 20% 400V.
C67	17.116	500 mmf 20KV. H.V. Condenser
C68A	22.79	50 mf 475V. Electrolytic
C68B	22.79	40 mf 475V. Electrolytic
C69	22.82	40 mf 450V. Electrolytic
C70	17.136	.01 mf GMV Disc 500V.
C71	17.136	.01 mf GMV Disc 500V.
C80	17.35	6800 mmf 20% 350V. Ceramic
C81	17.44	.005 mf GMV Disc 350V.
C83	17.123	270 mmf 10% 500V. Mica
C85	12.68	.005 20% 400V
*C50 C51 C52	167.1	Vertical Integrator. Three Capacitors in One Unit Plus R56, R57, R58.

Model DL21T Part No.	Model 21T Part No.	Description
107.46	107.46	Speaker

Model 24T2 Part No.	Model 21C2 Part No.	Description
107.53	107.47	Speaker

Symbol	Part No.	Description
L2	37.89	Filament Choke
L3	37.99	I.F. Coil
L4	37.89	Filament Choke
L5	37.197	I.F. Choke
L6	37.99	I.F. Coil
L7	37.89	Filament Choke
L8	37.197	I.F. Choke
L9	37.99	I.F. Coil
L10	37.234	Video Coil 120uh
L11	37.235	Video Coil 600uh
L12	37.252	4.5 Mc Take-Off Coil
L13	37.252	4.5 Mc Take-Off Coil
L14	37.236	Video Coil 190uh + 18K-R
L15	37.237	Video Coil 245uh
L16	37.253	4.5 Mc Ratio Detector
L17	37.253	4.5 Mc Ratio Detector
L18	37.265	Vertical Yoke Coil
L19	37.265	Vertical Yoke Coil
L20	37.233	Horizontal AFC Coil
L21	37.244	Horizontal Linearity Coil
L22	37.248	Width Coil
L23	37.265	Horizontal Yoke Coil
L24	37.265	Horizontal Yoke Coil
L25	37.268	I.F. Sound Trap
T1	42.61	Power Transformer
T2	42.56	Choke
T4	37.264	Horiz. Defl. Output Trans.
T5	42.53	Vert. Osc. Trans.
T6	42.65	Vert Output Trans.
T7	42.57	Audio Output Trans.
	42.71	R.F. Unit and Tubes

LIST OF PARTS — R.F. UNIT

Symbol	Description
C201	800 mmf, GMV, Disc Ceramic on centershield assembly
C202	1000 mmf GMV Ceramic
C203	0.5-3 mmf Ceramic Trimmer
C204	120 mmf 5% N750 Ceramic
C205	100 mmf 20% N750 Ceramic
C206	0.5-3 mmf Ceramic Trimmer
C207	10 mmf 5% NPO Ceramic
C208	10 mmf 5% N750 Ceramic
C209	2.2 mmf ± .25 mmf N330 ± 500 Ceramic
C210	20 mmf 10% NPO Ceramic
C211	0.5-3 mmf Ceramic Trimmer
C212	Fine Tuning Variable Capacitor
C213	3-9 mmf Ceramic Trimmer
C214 C215 C216 C217	800 mmf GMV Feed Thru Capacitors on Centershield Assembly
C218	120 mmf 10% N750 Ceramic
C219	1000 mmf GMV Ceramic

Symbol	Description
R201	220 K ohms 20% ½ Watt
R202	180 K ohms 10% ½ Watt
R203	4.7 K ohms 10% ½ Watt
R204	1.0 K ohm 20% ½ Watt
R205	220 K ohms 20% ½ Watt
R206	10 K ohms 10% ½ Watt
R207	22 K ohms 20% ½ Watt
R208	47 K ohms 20% ½ Watt
R209	10 K ohms 10% ½ Watt
R210	10 K ohms 10% ½ Watt
R211	15 K ohms 20% ½ Watt

COILS

Symbol	Description
L201	Antenna Section, separate for each channel
L202	Antenna Section, separate for each channel
L203	R.F. Section, separate for each channel
L204	R.F. Section, separate for each channel
L205	R.F. Section, separate for each channel
L206	Heater Choke
L207	Neutralizing Coil
L208	Heater Choke
L209	Tuned I.F. Coil

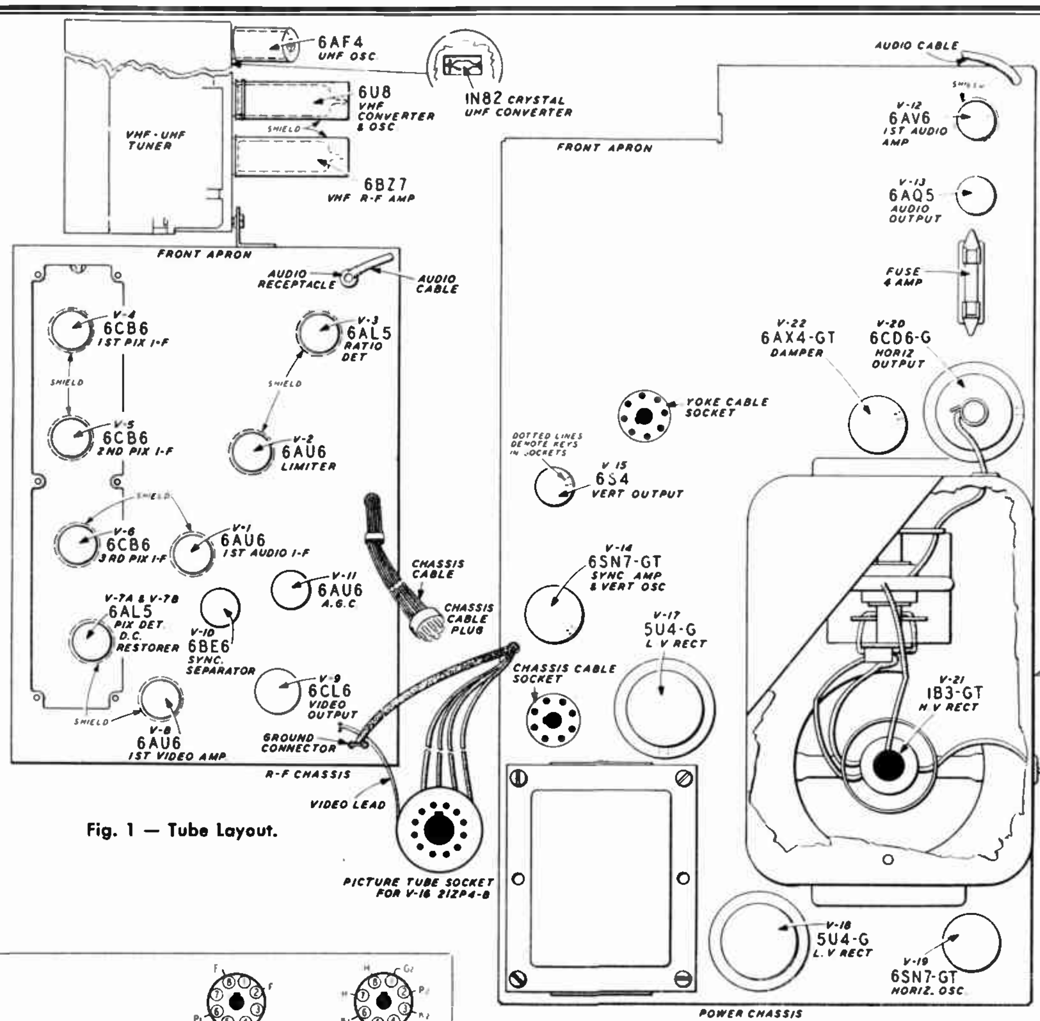
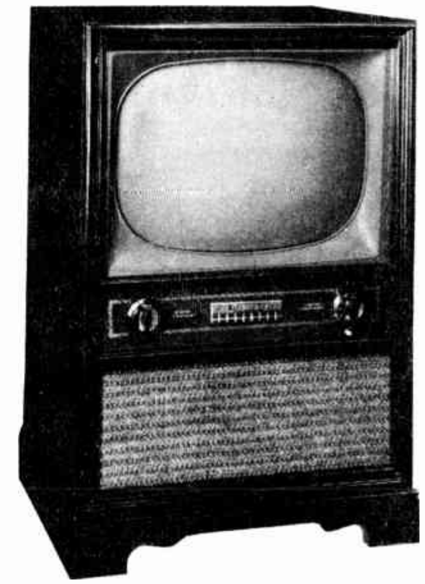


Fig. 1 — Tube Layout.

ELECTRICAL SPECIFICATIONS

Power Supply	117 Volts AC 60 cycles only
Power Consumption	250 Watts
Tuning Ranges	VHF — Channels 2 thru 13 UHF — Channels 14 thru 83
Power Output	2.5 Watts (Max.) 1.5 Watts 10% Distortion
Intermediate Frequencies	Picture — 45.75 MC Sound — 41.25 MC
Intercarrier Sound System	4.5 MC
Antenna Input Imp.	300 Ohms Balanced
Focus	Magnetic
Sweep Deflection	Magnetic
Loud Speaker	10" PM Dynamic
Voice Coil Imp.	3.2 Ohms 400 Cycles



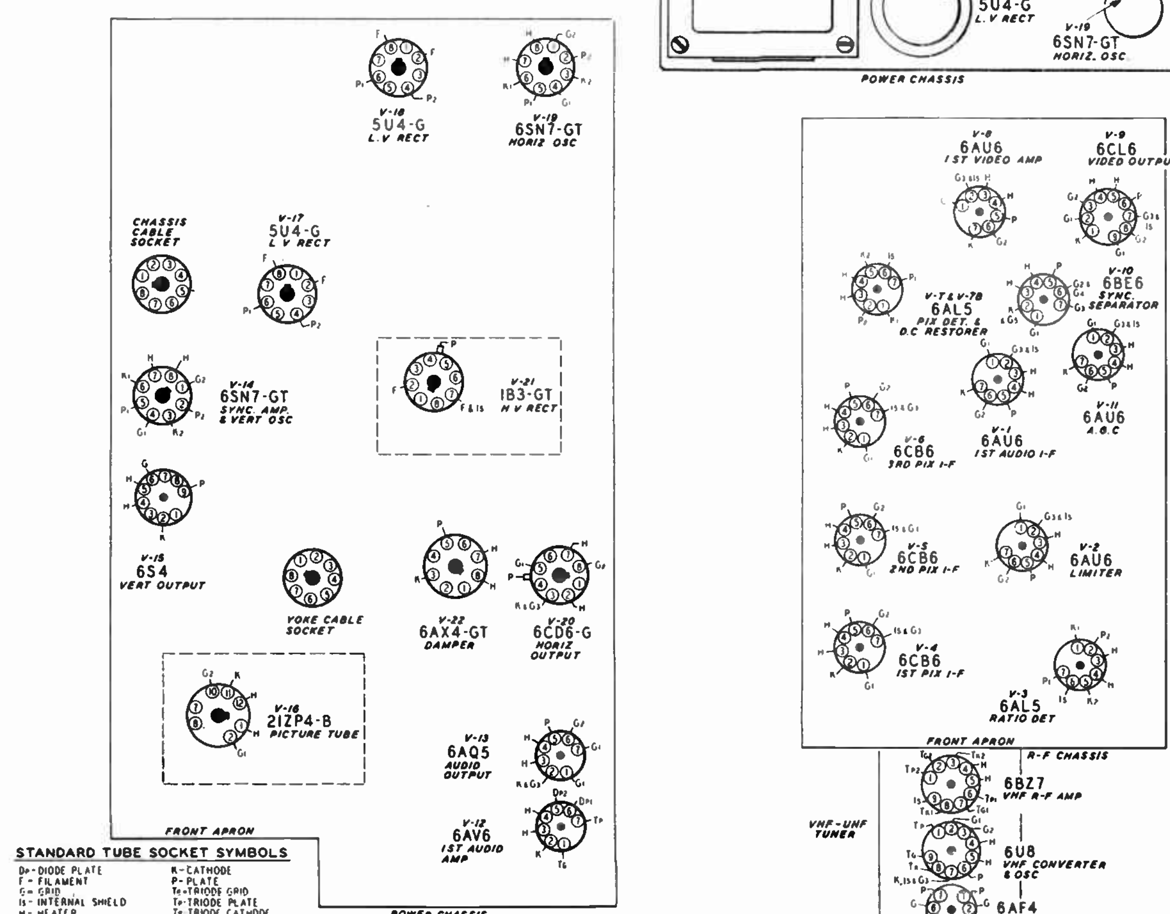


Fig. 2 — Bottom Socket.

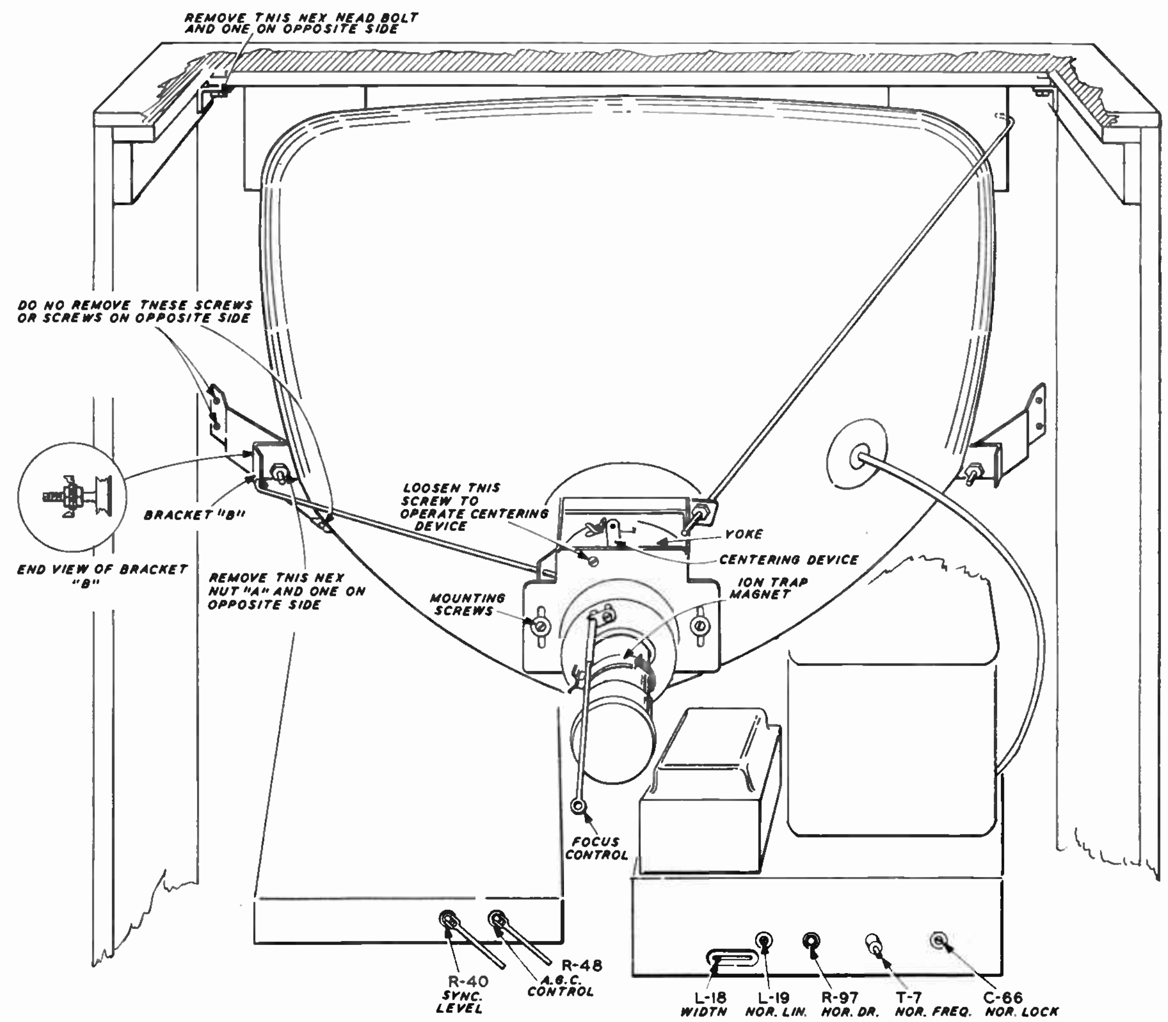


Fig. 4 — Tube Removal and Rear Chassis Controls.

HORIZONTAL WAVE FORM ADJUSTMENT — This is a factory adjustment and it should not be necessary to re-adjust unless the setting has been disturbed. However, if it is found that re-adjustment is required, follow this procedure: With the picture in sync. connect an oscilloscope through about a 10 mmf isolation condenser to Terminal C of T-7. Adjust the horizontal wave form (T-7 inside chassis) until the two peaks of the wave form shown in Fig. 6 are equal. NOTE· Picture must be in sync. during this adjustment.

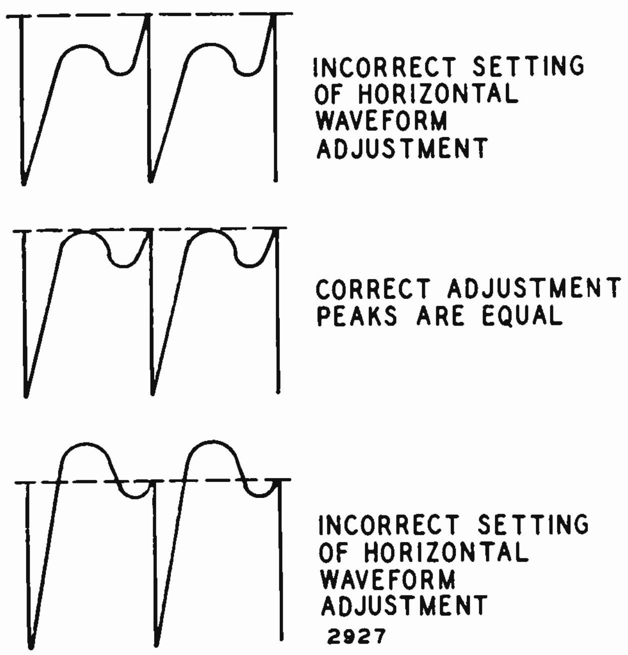


Fig. 6 — Settings of Waveform Adj.

HORIZONTAL LOCKING RANGE ADJUSTMENT — Set the horizontal hold control to the extreme counter-clockwise position. Momentarily remove the signal by switching off channel and then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync. If more than 3 bars are present just before the picture pulls into sync. adjust the horizontal locking range trimmer (C-66) slightly clockwise. If less than 2 bars are present, adjust the trimmer slightly counter-clockwise. Turn the horizontal hold counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 to 3 bars are present. Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the condition specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

WIDTH, DRIVE AND LINEARITY ADJUSTMENT — While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-65) up so that the picture appears washed out. Adjust width control (L-18) until the picture fills the mask. Turn the horizontal drive control (R-97) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-19) for best linearity. If adjustment of the horizontal linearity control (L-19) is required, readjustment of the horizontal drive control (R-97) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet.

TEST PROCEDURE

1. Turn the large Channel Selector control knob until the letters VHF appear centered at top of the knob.
2. Turn the small Channel Selector to receive desired channel.
3. Remove the two Channel Selector knobs.
4. Set Fine Tuning control in center of its range.
5. With a 10" or longer bakelite type screwdriver adjust oscillator slug for best picture resolution.
6. Repeat steps 2, 4 and 5 on all Channels used.

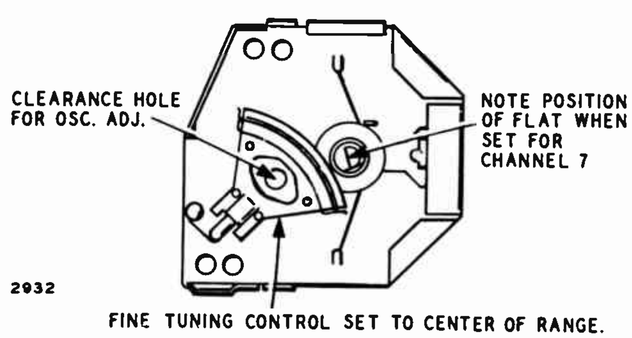


Fig. 7 — VHF Osc. Adj.

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.
1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective.
If fuse continually burns out, check
(A) Horizontal output tube V-20 (6CD6-G)
(B) Check damper tube V-22 (6AX4-GT)
(C) Check horizontal oscillator tube V-19 (6SN7-GTA) for proper operation.
(D) With an ohm meter, check for a short between terminal 3 of the horizontal output transformer (T-8) and the chassis.
(E) Check DC resistance of T 8.
3: No high voltage. Check V-20, V-21 and V-22 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 3 of T-8, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6CD6-G plate and 1B3 plate is open, tube V-21 is defective, its filament circuit is open, R-105 and C-86 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:
1: Vertical oscillator tube V-14B and vertical output tube V-15 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.
1: Check variable resistors R-59 and R-60.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-44, C-45, C-48 or C-73C and Resistors R-56-57-61-64-62 defective.
4: V-8 defective, check voltages.
5: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
6: Vertical deflection coils (L-23) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:
1: Check or replace horizontal output tube V-20.
2: Check or replace damper tube V-22 (6AX4-GT).
3: Check capacitors C-84, C-85, C-81 and horizontal linearity control (L-19) for defects.
4: Horizontal deflection coils (L-22) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:
1: Defective yoke, transformer T-8, or R-111.
2: V-22 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:
1: Low +B or line voltage. Check V-17 & V-18 (5U4G).
2: Insufficient output from horizontal output tube V-20. Replace tube.
3: Insufficient output from vertical oscillator (V-14B) and vertical output tube V-15. Replace tubes.
4: Incorrect setting of horizontal drive control R-97.
5: V-22 (6AX4-GT) defective.
6: Incorrect setting of (L-18) width control and height and linearity controls.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:
1: No signal on picture tube grid. Check V-8 (6AU6) and V-9 (6CL6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-11) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:
1: Defective sync separator V-10 or sync amplifier V-14A.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-11 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:
1: Vertical integrating network defective.
2: Vertical hold control (R-53) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY
1: V-19 defective.
2: Improper setting of (T-7) horizontal frequency control.
3: Check V-19 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:
1: Defective pix I-F tubes V-4, 5 & 6, (6CB6's).
2: Defective picture detector V-7A, (6AL5) or video amplifier V-8 or video output V-9 (6LC6) and associated circuits.
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-9, L-10, L-13, L-14, L-15 and L-16 for continuity. Note that L-9, L-14 and L-16 have shunting resistors.
5: Leakage in V-9 (6CL6) grid capacitor C-29. If the capacitor is not found to be defective, check the following:
1: Check all potentials in video circuits.
2: Check picture tube grid circuit for poor or dirty contact.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:
1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-9 (6CL6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.

SERVICE SUGGESTIONS—(continued)

3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc.):
1: Check sound I-F tubes V-1, V-2 or V-3 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S—ING
1: Check sync level control adjustment.
2: V-20 (6CD6-GT) defective or V-19 (6SN7-GTA) defective.
3: Check sync separator tube V-10 (6BE6) and V-8 (6AU6) video amplifier.
4: Check AGC threshold control.
5: Check wave form adjustment (T-7 inside chassis).

PICTURE NORMAL — NO SOUND OR WEAK OR DISTORTED SOUND
1: Check sound I-F alignment.
2: Check V-1 (6AU6) V-2 (6AU6) V-3 (6AL5) V-13 (6AQ5) V-12 (6AV6) and associated circuits.
3: Check pix I-F alignment.

RASTER ON TUBE BUT NO PICTURE OR SOUND
This condition can be caused by:
1: Defective pix I-F Amplifier tubes V-4, V-5 or V-6.
2: Defective pix detector tube V-7A (6AL5). Check tube and its associated circuit.
3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.
4: UHF-VHF switch defective.

POOR FOCUS
1: Improper setting of focus control or defective pix tube.

PICTURE JITTER:
1: Horizontal instability may be due to unstable transmitted sync.
2: Check receiver AGC system for proper operation.
3: Check sync separator V-10 (6BE6) or sync amp V-14A and associated circuits.
4: Check for improper setting of sync level control.
5: Check AGC threshold control.
6: Check antenna for loose connections.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND IN UHF POSITION
If this condition is encountered
1: Check to see whether or not a UHF station is operating in the vicinity.
2: The 6AF4 oscillator tube or the IN82 crystal may be defective.
3: Pre-selector in UHF section of tuner defective.
4: Defective switch on UHF section of tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
38 to 90 mc, 10 mc sweep width
170 to 225 mc, 10 mc sweep width
470 to 890 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat ouput in all attenuator positions.
(e) A source of the following Markers:

41.25 Mc	Cathode Trap
42.25 Mc	
42.50 Mc	1st Pix I-F Coil (Bottom)
43.9 Mc	3rd Pix I-F Coil
44.5 Mc	
45.3 Mc	2nd Pix I-F Coil
45.75 Mc	
47.25 Mc	1st Pix I-F Coil (Top)

CATHODE-RAY OSCILLOSCOPE with good low frequency response in vertical amplification and an input calibrating source.
BIAS BATTERY —1.5V & —4.5V
VTVM
DIODE DETECTOR

40 Mc I.F. ALIGNMENT

Connect sweep output to ungrounded shield of converter tube in tuner (6U8). With short leads connect crystal diode detector (Fig. 8) to plate of 1st I-F tube. Connect —1.5 V to A.G.C. line (Junction of R-1, R-3 & C-3A). Connect oscilloscope to detector output. Adjust sweep output to give adequate deflection.

A.	FREQUENCY	ADJUST
1.	47.25 Mc	1st Pix I-F Coil (L-1 Top) to center notch over 47.25 Mc marker.
2.		Converter Plate Coil (L-210 Top of Tuner) 1st I-F Grid Coil (L-4) and Input Coupling Coil (L-5) to give the response shown in figure 9.

The converter plate and 1st I-F grid coils control the shape of the top. The input coupling coil controls the position of the 41.25 marker. This adjustment must be made accurately or the sound rejection will not be correct (41.25 Mc 31 to 36 db down from top of overall P.I.F. response). 45.75 Mc marker must be set exactly on peak or the position of the 44.50 Mc marker in the overall response curve will not be correct.

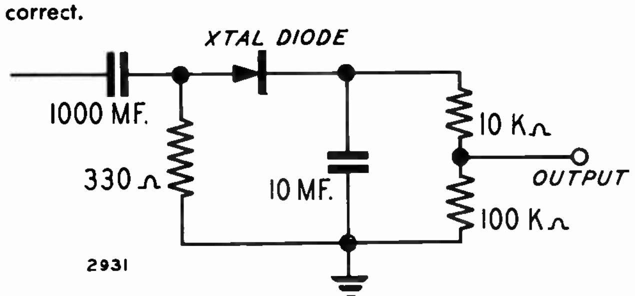


Fig. 8 — Crystal Diode Detector.

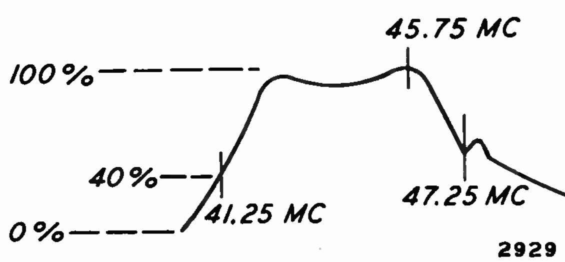


Fig. 9 — Input Circuit Response.

ALIGNMENT PROCEDURE—(continued)

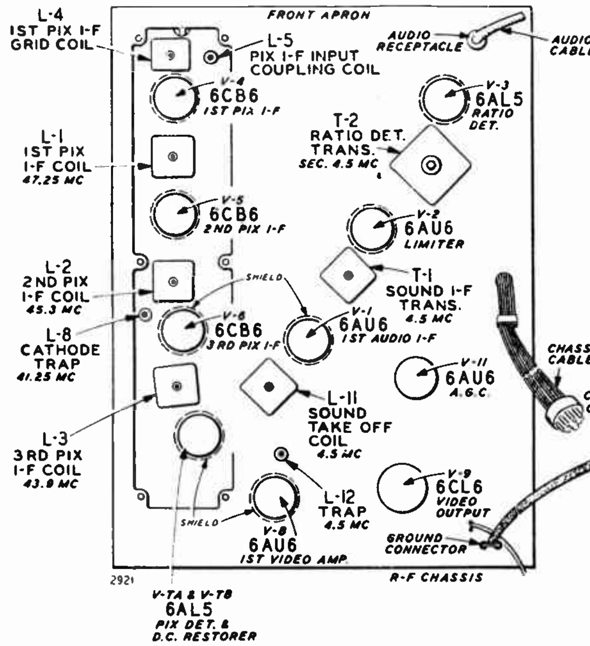


Fig. 10 — Top Chassis Adj.

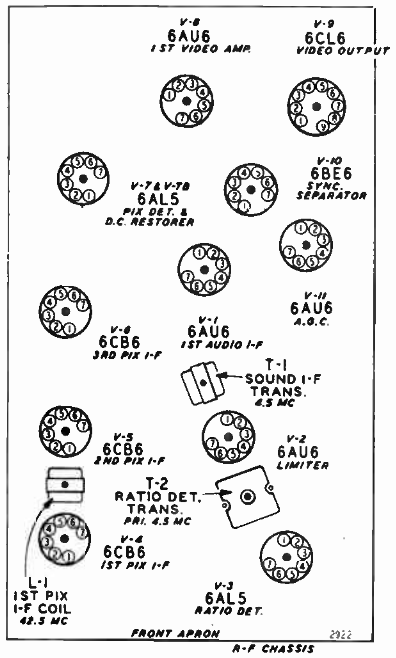


Fig. 11 — Bottom Chassis Adj.

B. When the input circuit is aligned place —4.5 V bias on the A.G.C. line. Remove the crystal detector and connect oscilloscope and VTVM to the 2nd Pix detector load resistor R-25. Adjust sweep output to give 1.0 VDC at detector.

	FREQUENCY	ADJUST
1.	42.5 Mc	1st Pix I-F Coil (L-1 Bottom) for maximum height of 42.5 Mc marker.
2.	45.3 Mc	2nd Pix I-F Coil (L-2 Top) for maximum height of 45.3 Mc marker.
3.	43.9 Mc	3rd Pix I-F Coil (L-3 Top) for maximum height of 43.9 Mc marker.
4.	41.25 Mc	Cathode Trap (L-8 Top) for minimum height of 41.25 Mc marker.

These adjustments may be made with a single frequency generator if it is more convenient to do so.

C. After these adjustments have been made recheck the peak to peak output on the oscilloscope. If the shape of the curve is not as shown in figure 12, it will be necessary to retouch the adjustments. A small fraction of a turn is all that is necessary if the strip is operating correctly. The position of the 44.5 Mc marker is critical (98%). The 43.9 Mc transformer (3rd I-F) controls the symmetry of the top. The 45.3 Mc transformer (2nd I-F) controls the height of the 45.75 Mc marker. The 43.5 Mc transformer (1st I-F) controls the height of the 42.25 Mc marker. This adjustment will very seldom need retouching.

DO NOT RETOUCH the converter plate coil or the input grid coil. These coils MUST be adjusted correctly with the diode detector. Recheck position of 41.25 Mc and 47.25 Mc markers. Reset if necessary.

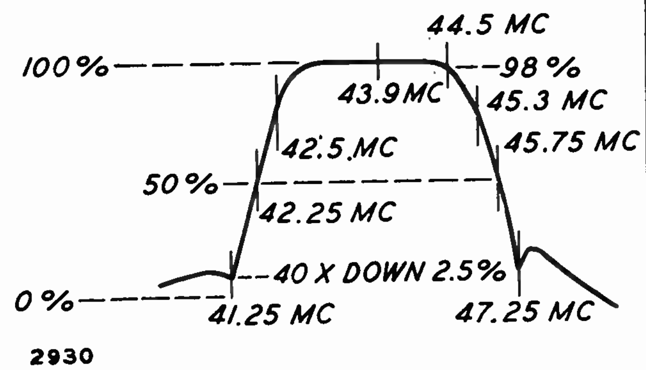


Fig. 12 — Overall Response Curve.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 2-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-12 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-17 and C-23, adjust sound take-off coil (L-11 Top) and sound I-F transformer slugs (T-1 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-3 (6AL5) adjust the ratio detector primary (T-2 Bottom) for maximum. In the above adjustment to avoid limiting or overloading of the amplifiers, use as little output from signal generator as possible.

3: With VTVM connected to junction of R-21, R-24 and C-27, adjust ratio detector secondary (T-2 Top) for cross over (zero voltage) on lowest scale.
NOTE — If desired, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

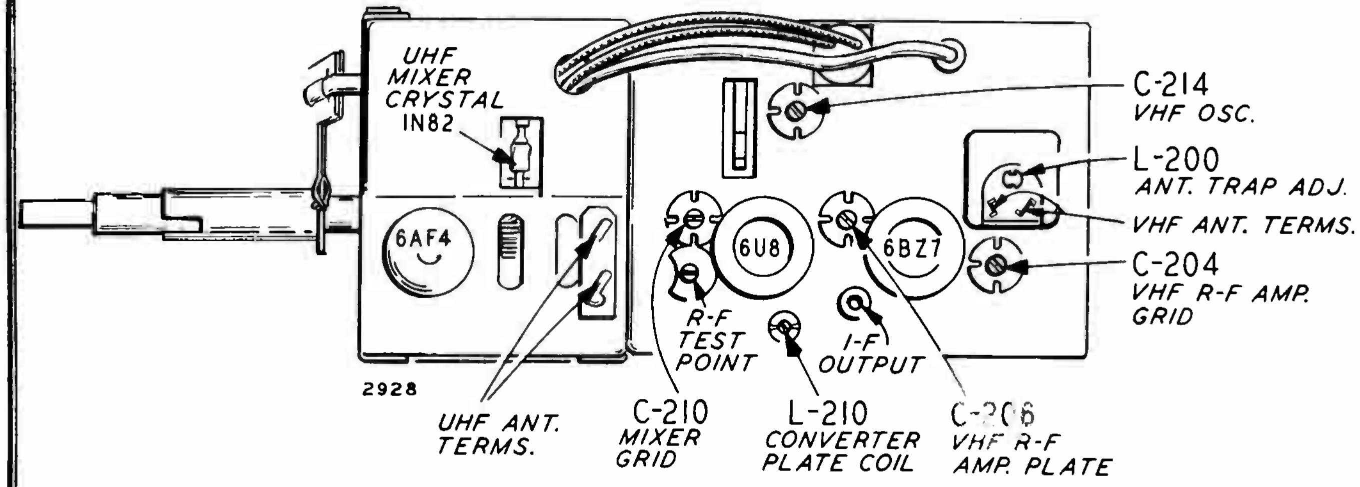


Fig. 13 — Top Tuner Adjustment.

VHF TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect —3V bias to AGC line at junction of R-45, R-47 and C-36 on the receiver.

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-204 slightly favoring the Pix carrier, then adjust C-206 and C-210 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-204, C-206, and C-210. Recheck all channels.

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-3 and C-3A.

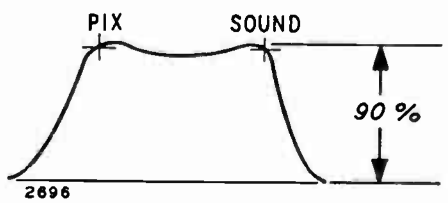


Fig. 14 — Pix & Audio Markers.

2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

UHF TUNER ALIGNMENT

Aligning or servicing the UHF section of the 82 position tuner is not recommended in the field because replacement of any component within the R-F circuit may disturb the band pass characteristics of the tuner. However the tubes and the IN82 crystal may be replaced in the tuner if found to be defective.

Antenna trap L-200 is a trap to reduce interference caused by signals which fall within the pix I-F pass band (40-48 Mc). It is best tuned by observing the interference in the picture and tuning the slug for minimum interference. This trap is located in the shield can to which the VHF antenna lead is connected.

Do not adjust the UHF oscillator slugs unless the fine tuning control cannot be tuned through the point of best picture resolution. Before attempting to adjust any of the slugs, check to see if the UHF oscillator tube (6AF4) is firmly seated and straight in the socket. Each coil strip in the UHF section tunes 10 channels. For example, strip 20B covers channels 20 through 29 etc. If there are two UHF channels in the vicinity, perhaps channels 20 and 26, the oscillator slug should be adjusted so that the fine tuning control will tune both channels through the point of best picture quality. The position of the fine tuning control will not necessarily be the same for all channels. Always use a bakelite type screwdriver for the oscillator slug adjustments.

IMPORTANT
HORIZONTAL OUTPUT TRANSFORMERS

In early production the 53X337 horizontal output transformer did not have a center tap on the winding coupling the deflection yoke. All service orders for the 53X337 transformer will be filled with a 53X338 transformer which will necessitate removing two 83 mmf ceramic condensers from the deflection yoke socket. These condensers will no longer be required because the 53X338 transformer has a center tap at terminal number six (6) which should be connected to pin 5 on the deflection yoke socket. The schematic diagram shows the circuitry of the 53X338 transformer together with all the latest circuit changes listed below.

Various changes were made during production in the Power Supply and R-F Chassis. Each change can be identified by a color code mark on the back of the chassis.

CHANGE NO. I

TO INCREASE SYNC STABILITY
RED PAINT MARK ON BACK OF R-F CHASSIS

1. The sync separator tube (V-10) was changed from a type 6BE6 to a type 6CS6.
2. The sync separator grid condenser (C-31) was changed in value from .01 mf 400V to .047 mf 400V.
3. Condensers C-91, C-92, C-93, C-94 and resistor R-112 were added to the circuit.

CHANGE NO. II

TO IMPROVE NOISE IMMUNITY
ORANGE PAINT MARK ON BACK OF R-F CHASSIS

1. The AGC filter (C-34) 4 mf dry electrolytic was changed to a 1000 mmf ceramic condenser.
2. A .47 mf condenser (C-95) was added to the I-F AGC circuit.

CHANGE NO. III

TO REDUCE JITTERS AND BENDING IN PICTURE
ORANGE PAINT MARK ON BACK OF POWER SUPPLY CHASSIS

1. R-80 (Sync Amp plate resistor) was changed in value from 4.7K ohms to 10K ohms.
2. R-51 formerly a 3.9K ohm sync plate resistor was changed to a 820K ohm sync amp cathode resistor.
3. C-68 (sync coupling condenser) was changed in value from 36 mmf to 18 mmf.
4. C-90 a 220 mmf condenser was added to the circuit.

CHANGE NO. IV

SO THAT ANY MANUFACTURERS 6AU6 TUBES
CAN BE USED FOR REPLACEMENT PURPOSES
YELLOW PAINT MARK ON BACK OF R-F CHASSIS

1. R-15 (1st Sound I-F cathode resistor) was changed in value from 68 ohms to 100 ohms.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-93
Height	R-59
Brightness	R-65
Vertical Hold	R-53
Tone	R-75
Vertical Linearity	R-60

NON-OPERATING CONTROLS REAR OF CHASSIS

Horizontal Centering	Part of Focus Mag. Assy.
Vertical Centering	Part of Focus Mag. Assy.
Focus Control	Part of Focus Mag. Assy.
Ion Trap Magnet	See paragraph, page 6
Deflection Yoke	Wing Screw
Width	L-18
Horizontal Locking Range	C-66
Horizontal Linearity	L-19
Horizontal Drive	R-97
Horizontal Frequency (Outside Chassis)	T-7
Wave Form (Inside Chassis)	T-7
Sync Level	R-40
AGC Threshold Control	R-48

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, loosen the screw holding centering device in place (Figure 4. and adjust the lever for proper centering. Moving the lever up and down moves the picture side to side and moving the lever side to side moves the picture up and down.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel and then back. Normally the picture may be out of sync. Turn the control slowly clockwise. The number of diagonal bars will be gradually reduced and when only 2 to 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control.
At the extreme clockwise position the picture should be just starting to pull out of sync.
If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned.

ION TRAP MAGNET ADJUSTMENT — The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance.

DEFLECTION YOKE ADJUSTMENT — The deflection yoke should be positioned as far forward on the neck of the tube as the bell will allow. Then, if the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Upon completion of this adjustment, tighten the yoke adjustment wing screw.

TUBE COMPLEMENT

Symbol	Type	Function
Tuner	6AF4	UHF R-F Oscillator
Tuner	6U8	VHF Converter and Oscillator
Tuner	63Z7	VHF R-F Amplifier
Tuner	IN82	UHF Crystal Converter
V-1	6AU6	1st Audio I-F
V-2	6AU6	Limiter
V-3	6AL5	Ratio Detector
V-4	6CB6	1st Pix I-F Amplifier
V-5	6CB6	2nd Pix I-F Amplifier
V-6	6CB6	3rd Pix I-F Amplifier
V-7 A & B	6AL5	Pix Det. and DC Restorer
V-8	6AU6	1st Video Amp.
V-9	6CL6	Video Output
*V-10	6BE6	Sync. Separator
V-11	6AU6	Automatic Gain Control
V-12	6AV6	1st Audio Amp.
V-13	6AQ5	Audio Output
V-14 A & B	6SN7-GTA OR 6SN7-GT	Sync. Amplifier & Vertical Osc.
V-15	6S4	Vertical Output
V-16	21ZP4-B	Pix Tube 21" Glass, Aluminized
V-17 & V-18	5U4-G	Low Voltage Rectifier
V-19	6SN7-GTA OR 6SN7-GT	Horizontal Oscillator
V-20	6CD6-G	Horizontal Output
V-21	1B3-GT	High Voltage Rectifier
V-22	6AX4-GT	Damper

*In the issue "B" receivers V-10 was changed to a type 6CS6 tube.

IMPORTANT HORIZONTAL OUTPUT TRANSFORMERS

In early production the 53X337 horizontal output transformer did not have a center tap on the winding coupling the deflection yoke. All service orders for the 53X337 transformer will be filled with a 53X338 transformer which will necessitate removing two 83 mmf ceramic condensers from the deflection yoke socket. These condensers will no longer be required because the 53X338 transformer has a center tap at terminal number six (6) which should be connected to pin 5 on the deflection yoke socket. The schematic diagram shows the circuitry of the 53X338 transformer together with all the latest circuit changes listed below.

Various changes were made during production in the Power Supply and R-F Chassis. Each change can be identified by a color code mark on the back of the chassis.

CHANGE NO. I

TO INCREASE SYNC STABILITY
RED PAINT MARK ON BACK OF R-F CHASSIS

1. The sync separator tube (V-10) was changed from a type 6BE6 to a type 6CS6.
2. The sync separator grid condenser (C-31) was changed in value from .01 mf 400V to .047 mf 400V.
3. Condensers C-91, C-92, C-93, C-94 and resistor R-112 were added to the circuit.

CHANGE NO. II

TO IMPROVE NOISE IMMUNITY
ORANGE PAINT MARK ON BACK OF R-F CHASSIS

1. The AGC filter (C-34) 4 mf dry electrolytic was changed to a 1000 mmf ceramic condenser.
2. A .47 mf condenser (C-95) was added to the I-F AGC circuit.

CHANGE NO. III

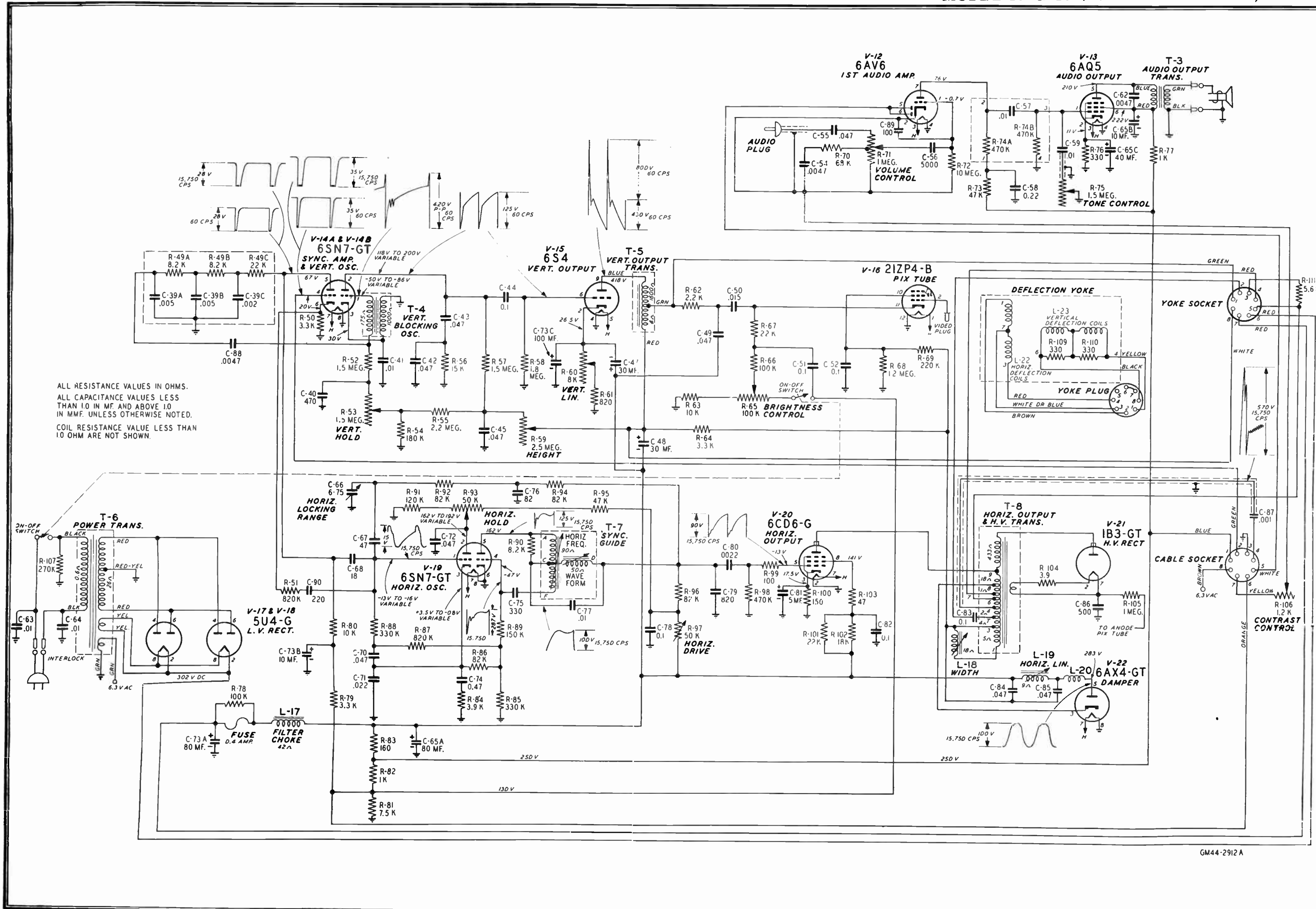
TO REDUCE JITTERS AND BENDING IN PICTURE
ORANGE PAINT MARK ON BACK OF POWER SUPPLY CHASSIS

1. R-80 (Sync Amp plate resistor) was changed in value from 4.7K ohms to 10K ohms.
2. R-51 formerly a 3.9K ohm sync plate resistor was changed to a 820K ohm sync amp cathode resistor.
3. C-68 (sync coupling condenser) was changed in value from 36 mmf to 18 mmf.
4. C-90 a 220 mmf condenser was added to the circuit.

CHANGE NO. IV

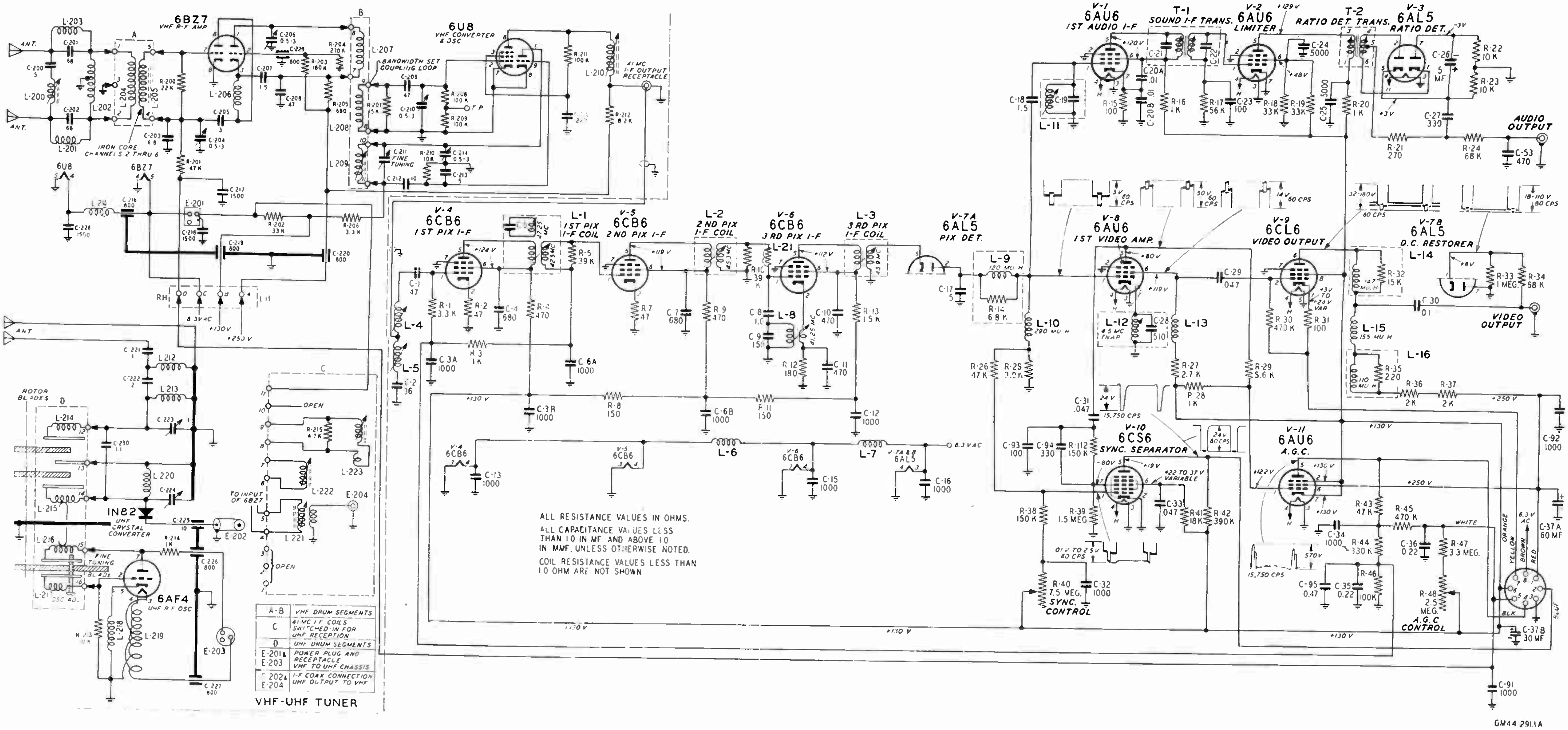
SO THAT ANY MANUFACTURERS 6AU6 TUBES CAN BE USED FOR REPLACEMENT PURPOSES
YELLOW PAINT MARK ON BACK OF R-F CHASSIS

1. R-15 (1st Sound I-F cathode resistor) was changed in value from 68 ohms to 100 ohms.


ALL RESISTANCE VALUES IN OHMS.
ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF. UNLESS OTHERWISE NOTED.
COIL RESISTANCE VALUE LESS THAN 1.0 OHM ARE NOT SHOWN.
V-12 6AV6 1ST AUDIO AMP.
V-13 6AQ5 AUDIO OUTPUT
T-3 AUDIO OUTPUT TRANS.
AUDIO PLUG
R-71 1 MEG. VOLUME CONTROL
R-75 1.5 MEG. TONE CONTROL
V-14A & V-14B 6SN7-GT SYNC. AMP. & VERT. OSC.
T-4 VERT. BLOCKING OSC.
V-15 6S4 VERT. OUTPUT
T-5 VERT. OUTPUT TRANS.
V-16 21ZP4-B PIX TUBE
VIDEO PLUG
DEFLECTION YOKE
L-23 VERTICAL DEFLECTION COILS
L-22 HORIZ. DEFLECTION COILS
YOKE PLUG
YOKE SOCKET
R-53 1.5 MEG. VERT. HOLD
R-60 8K VERT. LIN.
R-59 2.5 MEG. HEIGHT
R-65 100K BRIGHTNESS CONTROL
ON-OFF SWITCH
C-66 6-75 HORIZ. LOCKING RANGE
R-93 50K HORIZ. HOLD
T-7 SYNC. GUIDE
HORIZ FREQ.
WAVE FORM
V-19 6SN7-GT HORIZ. OSC.
V-20 6CD6-G HORIZ. OUTPUT
R-97 50K HORIZ. DRIVE
T-8 HORIZ. OUTPUT & H.V. TRANS.
V-21 1B3-GT H.V. RECT
TO ANODE PIX TUBE
CABLE SOCKET
R-106 1.2K CONTRAST CONTROL
L-18 WIDTH
L-19 HORIZ. LIN.
V-22 6AX4-GT DAMPER
T-6 POWER TRANS.
INTERLOCK
V-17 & V-18 5U4-G L.V. RECT.
302 V DC
FUSE 0.4 AMP.
L-17 FILTER CHOKE 42Ω
250 V
130 V
GM44-2912 A

OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms shown on the schematic diagrams were taken with the receiver tuned to a normal picture. The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequency accompanying each waveform indicates the repetition rate of the waveform not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown on the schematic diagram and the amplitude of any high frequency pulse will tend to be less.



REPLACEMENT PARTS LIST

CAPACITORS

C-1	47X603	47 mmf	500 V	Ceramic......
C-2	47X626	36 mmf	500 V	Ceramic......
C-3A, C-3B, C-6A, C-6B	80X3	1000 mmf		Dual Ceramic.
C-4, C-7	80X5	680 mmf	500 V	Ceramic......
C-5	Part of L-1 (1st Pix I-F Trans.)			
C-8	47X588	1.0 mmf		Composition...
C-9	RCM15E151K	150 mmf	500 V	Silver Mica...
C-10, C-11	80X4	470 mmf	500 V	Ceramic......
C-12, C-13, C-15, C-16, C-32, C-34, C-91, C-92	80X1	1000 mmf		Ceramic......
C-17	47X562	5 mmf	500 V	Ceramic......
C-18	47X584	1.5 mmf		Ceramic......
C-19	Part of L-11			
C-20A, C-20B	80X6	.01 mf		Dual Ceramic.
C-21, C-22	Part of T-1 (Sound I-F Trans)			
C-23, C-89, C-93	47X604	100 mmf	500 V	Ceramic......
C-24, C-35, C-56	47X507	5000 mmf		Ceramic......
C-26, C-81	45X378	5 mf	25 V	Dry Electrolytic
C-27, C-94	47X570	330 mmf	500 V	Ceramic......
C-28	Part of L-12			
C-29, C-31, C-33, C-72, C-84, C-85	RCP10M4473M	.047 mf	400 V	Tubular......
C-30, C-78, C-82, C-83	RCP10M4104M	0.1 mf	400 V	Tubular......
C-35, C-36	RCP10M2224M	0.22 mf	200 V	Tubular......
C-37A, C-37B	45X408	60 mf 30 mf	350 V 350 V	Dry Electrolytic
C-39A, C-39B, C-39C	Part of 76X7 (See Miscellaneous)			
C-40, C-53	RCM20B471K	470 mmf	500 V	Molded Mica..
C-41, C-59, C-77	RCP10M2103M	.01 mf	200 V	Molded Mica..
C-42, C-55, C-70	RCP10M2473M	.047 mf	200 V	Tubular......
C-43, C-45, C-49	RCP10M6473M	.047 mf	600 V	Tubular......
C-44, C-52	RCP10M6104M	0.1 mf	600 V	Tubular......
C-47, C-48	45X393	30 mf	400 V	Dry Electrolytic
C-50	RCP10M6153M	.015 mf	600 V	Tubular......
C-51	RCP10M2104M	0.1 mf	200 V	Tubular......
C-54	RCP10M4472M	.0047 mf	400 V	Tubular......
C-57	Part of 76X5 (See Miscellaneous)			
C-58	RCP10M4224M	0.22 mf	400 V	Tubular......
C-62	RCP10M6472M	.0047 mf	600 V	Tubular......
C-63, C-64	47X615	.01 mf		Ceramic......
C-65A, C-65B, C-65C	45X407	80 mf 10 mf 40 mf	350 V 350 V 50 V	Dry Electrolytic
C-66	17A268	6-75 mmf		Trimmer, Horiz. Lock. Range
C-67	RCM20B470K	47 mmf	500 V	Molded Mica..
C-68	RCM20B180K	18 mmf	500 V	Molded Mica..
C-71	RCP10M2223M	.022 mf	200 V	Molded Mica..
C-73A, C-73B, C-73C	45X409	80 mf 10 mf 100 mf	350 V 350 V 50 V	Dry Electrolytic
C-74, C-95	RCP10M2474M	.47 mf	200 V	Tubular......
C-75	RCM20B331K	330 mmf	500 V	Molded Mica..
C-76	RCM20B820K	82 mmf	500 V	Molded Mica..
C-79	RCM25B821K	820 mmf	500 V	Molded Mica..
C-80	RCP10M4222M	.0022 mf	400 V	Tubular......
C-86	47X667	500 mmf		Ceramic......
C-87	47X569	1000 mmf	1000 V	Molded Mica..
C-88	RCM30B472J	4700 mmf	500 V	Molded Mica..
C-90	RCM20B221K	220 mmf	500 V	Ceramic......

RESISTORS

		Ohms	Watts	
R-1	B83332	3.3 K	0.5	Carbon......
R-2, R-7	B83470	47	0.5	Carbon......
R-3	B84102	1 K	0.5	Carbon......
R-4, R-9	B85471	470	0.5	Carbon......
R-5, R-10	B83393	39 K	0.5	Carbon......
R-8, R-11	B85151	150	0.5	Carbon......
R-12	B84181	180	0.5	Carbon......
R-13	B84152	1.5 K	0.5	Carbon......
R-14	Part of L-9			
R-15, R-31	B84101	100	0.5	Carbon......
R-16, R-20, R-28	B85102	1 K	0.5	Carbon......
R-17	B84563	56 K	0.5	Carbon......
R-18, R-19	B84333	33 K	0.5	Carbon......
R-21	B84271	270	0.5	Carbon......
R-22, R-23	B83103	10 K	0.5	Carbon......
R-24, R-34, R-70	B84683	68 K	0.5	Carbon......
R-25	B83392	3.9 K	0.5	Carbon......
R-26, R-43	B84473	47 K	0.5	Carbon......
R-27	B83272	2.7 K	0.5	Carbon......
R-29	B84562	5.6 K	0.5	Carbon......
R-30, R-45, R-98	B84474	470 K	0.5	Carbon......
R-32	Part of L-14			
R-33	B84105	1.0 Meg.	0.5	Carbon......
R-35	Part of L-16			
R-36, R-37	DB3202	2 K	2.0	Carbon......
R-38, R-89, R-112	B84154	150 K	0.5	Carbon......
R-39, R-52, R-57	B84155	1.5 Meg.	0.5	Carbon......
R-40	40X370	7.5 Meg.		Sync Level...
R-41	C84183	18 K	1.0	Carbon......
R-42	B84394	390 K	0.5	Carbon......
R-44, R-85, R-88	B84334	330 K	0.5	Carbon......
R-46	B84104	100 K	0.5	Carbon......
R-47	B84335	3.3 Meg.	0.5	Carbon......
R-48	40X369	2.5 Meg.		A.G.C. Control
R-49A, R-49B, R-49C	Part of 76X7 (See Miscellaneous)			
R-50	C84332	3.3 K	1.0	Carbon......
R-51, R-87	B84824	820 K	0.5	Carbon......
R-53	40X373	1.5 Meg.		Vertical Hold.
R-54	B84184	180 K	0.5	Carbon......
R-55	B84225	2.2 Meg.	0.5	Carbon......
R-56	B84153	15 K	0.5	Carbon......
R-58	B84185	1.8 Meg.	0.5	Carbon......
R-59	40X369	2.5 Meg.		Height.......
R-60	40X375	8 K		Vertical Linearity
R-61	D84821	820	2.0	Carbon......
R-62	B84222	2.2 K	0.5	Carbon......
R-63	B85103	10 K	0.5	Carbon......
R-64, R-79	B84332	3.3 K	0.5	Carbon......
R-65	40X372	100 K		Brightness Control
R-66	B85104	100 K	0.5	Carbon......
R-67	B84223	22 K	0.5	Carbon......
R-68	B84125	1.2 Meg.	0.5	Carbon......
R-69	B84224	220 K	0.5	Carbon......
R-71, R-106	78X18	1.0 Meg. 1.2 K		Volume and Contrast Control
R-72	B85106	10.0 Meg.	0.5	Carbon......
R-73, R-95	B85473	47 K	0.5	Carbon......
R-74A, R-74B	Part of 76X5 (See Miscellaneous)			
R-75	40X373	1.5 Meg.		Tone Control..
R-76	C84331	330	1.0	Carbon......
R-77	D84102	1 K	2.0	Carbon......
R-78	D85104	100 K	2.0	Carbon......
R-80	C84103	10 K	1.0	Carbon......
R-81	43X284	7.5 K	5.0	Wirewound...
R-82	43X281	1 K	15.0	Wirewound...
R-83	43X282	160	10.0	Wirewound...
R 84	B84392	3.9 K	0.5	Carbon......
R-86, R-92, R-94	B84823	82 K	0.5	Carbon......
R-90	B84822	8.2 K	0.5	Carbon......
R-91	B84124	120 K	0.5	Carbon......
R-93	40X374	50 K		Horizontal Hold
R-96	C84823	82 K	1.0	Carbon......
R-97	40X374	50 K		Horizontol Drive
R-99	B85101	100	0.5	Carbon......
R-100	43X280	150	5.0	Wirewound...
R-101	D84223	22 K	2.0	Carbon......
R-102	D84183	18 K	2.0	Carbon......
R-103	B85470	47	0.5	Carbon......
R-104	43X251	3.9	0.5	Wirewound...
R-105	C85105	1.0 Meg.	1.0	Carbon......
R-107	B85274	270 K	0.5	Carbon......
R-109, R-110	Part of Deflection Yoke			
R-111	B85562	5.6 K	0.5	Carbon......

TRANSFORMERS AND COILS

L-1	9A2317	Transformer, 1st Pix I-F ....
L-2	9A2318	Transformer, 2nd Pix I-F ....
L-3	9A2319	Transformer, 3rd Pix I-F ....
L-4	9A2316	Coil, Grid, 1st I-F ....
L-5	9A2320	Coil, Coupling Input ....
L-6, L-7	9A2033	Choke, R-F Heater ....
L-8	9A2321	Cathode, Trap (41.25 MC.) ....
L-9	36A21	Coil, Peaking (120 mu.h) ....
L-10	36A22	Coil, Peaking (290 mu.h) ....
L-11	9A2201	Coil, Sound Take-Off (4.5 MC.) ....
L-12	9A2074	Trap (4.5 MC.) ....
L-13	36A10	Coil, Peaking (60 mu.h) ....
L-14	36A17	Coil, Peaking (147 mu.h) ....
L-15	36A18	Coil, Peaking (155 mu.h) ....
L-16	36A19	Coil, Peaking (110 mu.h) ....
L-17	52X94	Choke, Filter ....
L-18	9A2292	Coil, Width ....
L-19	9A2293	Coil, Horizontal Linearity Control ......
L-20	35A11	Choke, Parasitic ....
L-21	9A2322	Choke, Parasitic ....
L-22, L-23	Part of Deflection Yoke	
T-1	9A2323	Transformer, Sound I-F (4.5 MC.) ......
T-2	9A2295	Transformer, Ratio Detector (4.5 MC.) ...
T-3	51X165	Transformer, Audio Output ....
T-4	54X9	Transformer, Vertical Blacking ....
T-5	51X156	Transformer, Vertical Output ....
T-6	53X336	Transformer, Power ....
T-7	9A2294	Transformer, Horizontal Oscillator ....
T-8	53X33	Transformer, Horizontal Output ....
	12A519	Speaker 10" PM ....
	25A1112	Tuner, VHF/UHF ....

TUNER PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-200	12T-AE223K	22 K	±10%	0.5
R-201	12T-AE473M	47 K	±20%	0.5
R-202	12T-AE333M	33 K	±20%	0.5
R-203	12T-AE184K	180 K	±10%	0.5
R-204	12T-AE274K	270 K	±10%	0.5
R-205	12T-AE681K	680	±10%	0.5
R-206	12S-AE332K	3.3 K	±10%	1.0
R-207	12T-AE153K	15 K	±10%	0.5
R-208, R-209, R-211	12T-AE104K	100 K	±10%	0.5
R-210, R-213	12T-AE103M	10 K	±20%	0.5
R-212	12T-AE822K	8.2 K	±10%	0.5
R-214	12T-AE102K	1 K	±10%	0.5
R-215	12T-AE472K	4.7 K	±10%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-200, C-201, C-202	Part of VHF	Antenna Assembly	
C-203	13L-8C6R8N	6.8 mmf	±0.7 mmf
C-204	31A-056-2	0.5-3 mmf	
C-206, C-210, C-214	31A-056-1	0.5-3 mmf	
C-205	13L-8C030H	3 mmf	±0.3 mmf
C-207	13L-831R5C	1.5 mmf	−0.25 mmf
C-208	13L-80470K	47 mmf	±10%
C-209	13M-20U470K	47 mmf	±10%
C-211	Part of VHF	Fine Tuning	
C-212	13L-8U100F	10 mmf	±1 mmf
C-213	13L-8UA050C	5 mmf	
C-215	13L-12D221K	220 mmf	
C-216, C-219, C-220, C-226, C-227, C-229	13M-23E801Z	800 mmf	
C-217, C-218, C-228	13L-8XA152Z	1500 mmf	
C-221, C-222	Part of UHF	Antenna Assembly	
C-223, C-224	Part of UHF	R-F Assembly	
C-225	13M-20A-100D-N-1	10 mmf	−0.5 mmf
C-230		1.1 mmf	

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picture tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a. 4.5 megacycles

b. 22.25 megacycles

c. 25.4 megacycles

d. 23.6 megacycles

e. 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (⁄1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel, preferably 30% Amplitude-Modulated.

3 – Cathode Ray Oscilloscope with good low frequency response.

4 – 3 volt bias battery.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE COLOR PLUG FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on the inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to pin 1 of 6AU6 1st Video Amplifier (V12), ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L201 and L203 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.25 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L11, L202-top (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set i-f signal generator to 23.6 mc. with sufficient output to read approximately 3 volts on the VTVM.

8 – Carefully adjust L205 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator out-put to keep meter reading approximately 3 volts.

9 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient defection on VTVM.

10 – Adjust L202-bottom for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 Ohms).

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. Filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to pin 1 of 6AU6 1st Vid. Amp. (V12) ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Connect 3 volt battery positive terminal to chassis negative terminal to AGC buss (see schematic diagram).

5 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display (see figure 1) having 5 volts vertical defection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

6 – Adjust L205 slightly to even the height of peaks and to obtain an untilted bandpass.

7 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier visible on bandpass and adjust sound trap (L114) to minimize effect to sound carrier marker.

NOTE: If the fine tuning control is at end of range or out of range so that video carrier cannot be set at 50%, follow R-F OSCILLATOR ALIGNMENT procedure outlined below.

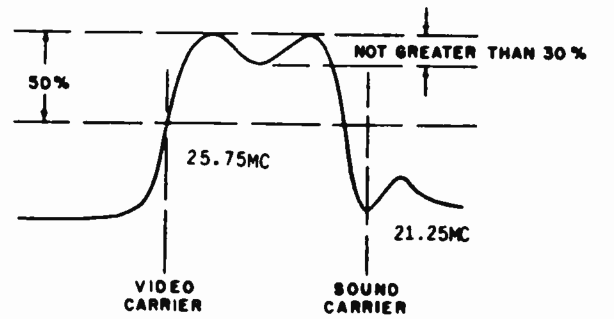
8 – Check all channels.

R-F OSCILLATOR ALIGNMENT

If all channels are not within range of FINE TUNING control (as evidenced by inability to eliminate "sound bars" from picture or by poor picture quality), the individual oscillator slugs may require readjustment.

1 – Repeat the set-up as for SWEEP ALIGNMENT CHECK, steps 1 through 7.

2 – Set FINE TUNING CONTROL to center of range, and with long fiber screwdriver alignment tool, adjust the individual oscillator slugs of each channel. (Accessible through the front of the tuner) so that video carrier markers fall 50% down on curve. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than the converter plate unit, L11, during I.F. alignment.



IDEAL BANDPASS X59908

SOUND ALIGNMENT

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 4.5 mc. amplifier (V13).

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL5 (V15) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L206, L101, and bottom of T102 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K (⁄1%) resistors across R106 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to centertap of 100K resistors, and connect ground wire of V.T.V.M. to top of C109 (Audio take-Off of T102).

6 – Adjust top of T102 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER 4.5 mc. TRAP

When necessary, the video amplifier 4.5 mc. trap (L104) should be adjusted as follows:

1 – Connect 4.5 mc. signal generator to pin 1 of 6AU6 1st video amplifier (V12).

2 – Adjust signal generator output till 4.5 mc. dot pattern is clearly visible on screen of picture tube.

3 – Adjust L104 to minimize the dot pattern.

HORIZONTAL OSCILLATOR ALIGNMENT

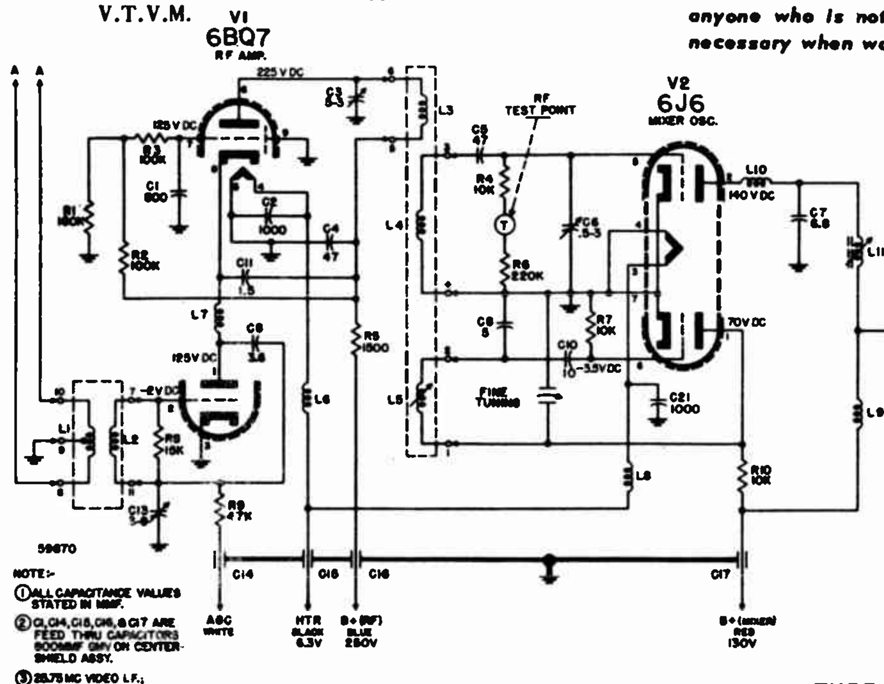
If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

PICTURE TUBE HANDLING PRECAUTIONS

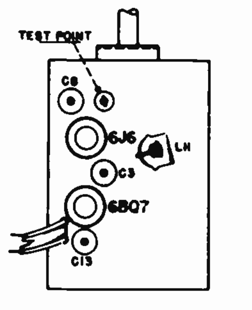
The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

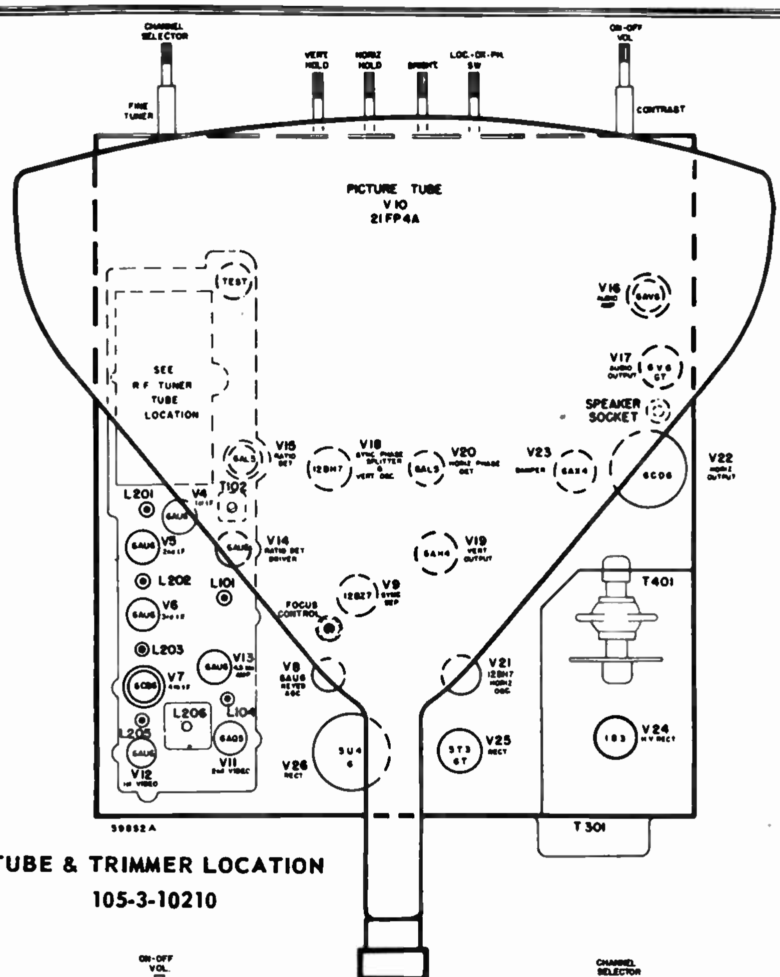
Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.



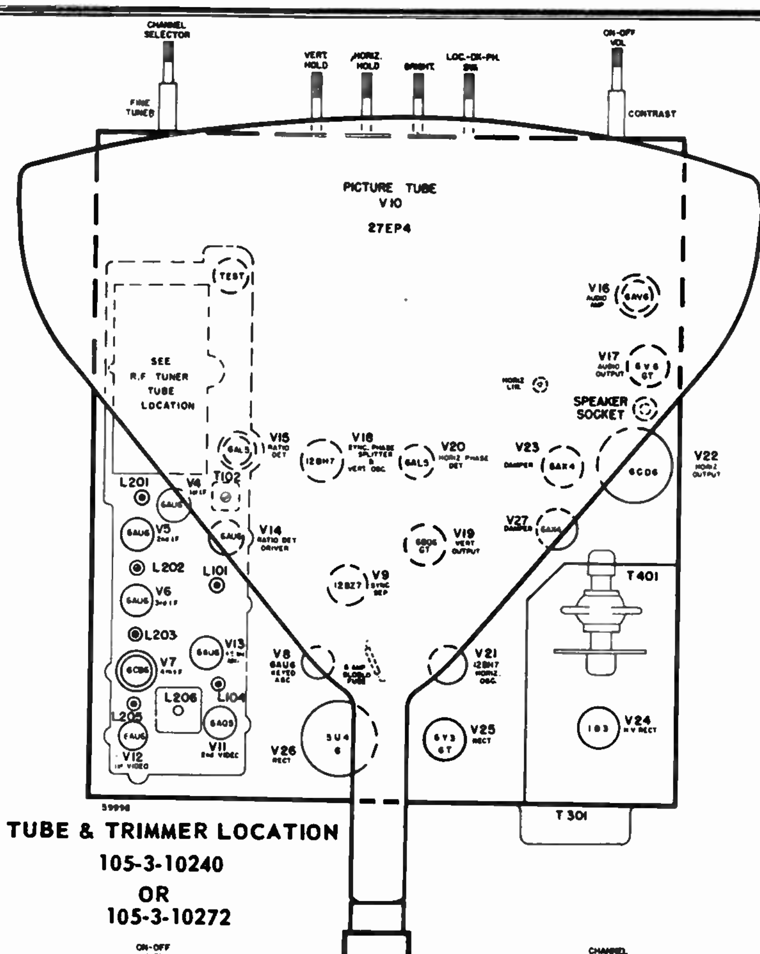
SCHEMATIC FOR CASCODE TUNER PC-541215



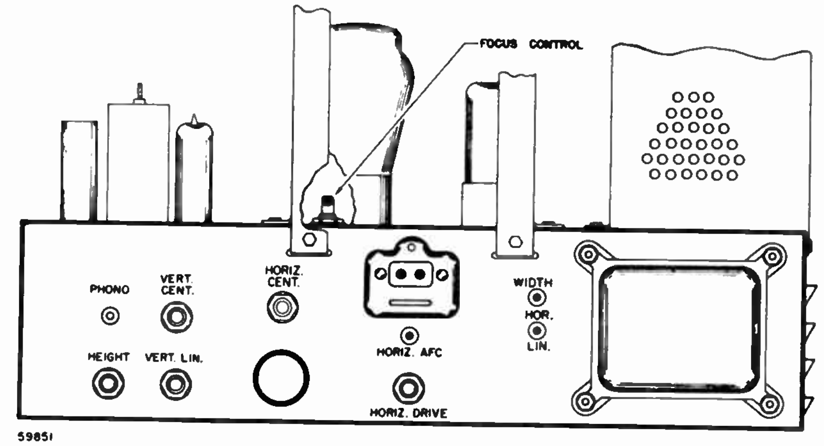
TUBE & TRIMMER LOCATION PC-541215 TUNER



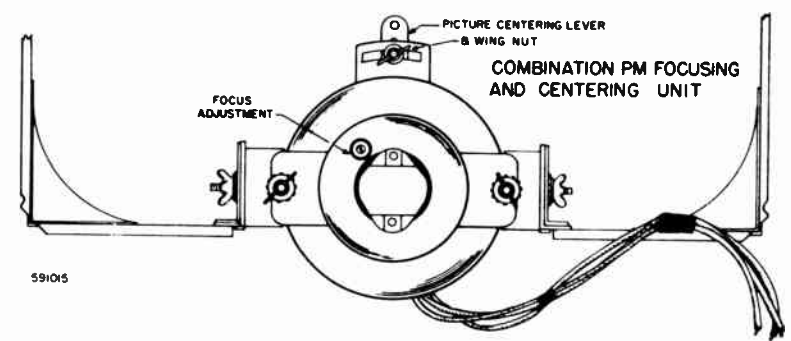
TUBE & TRIMMER LOCATION
105-3-10210

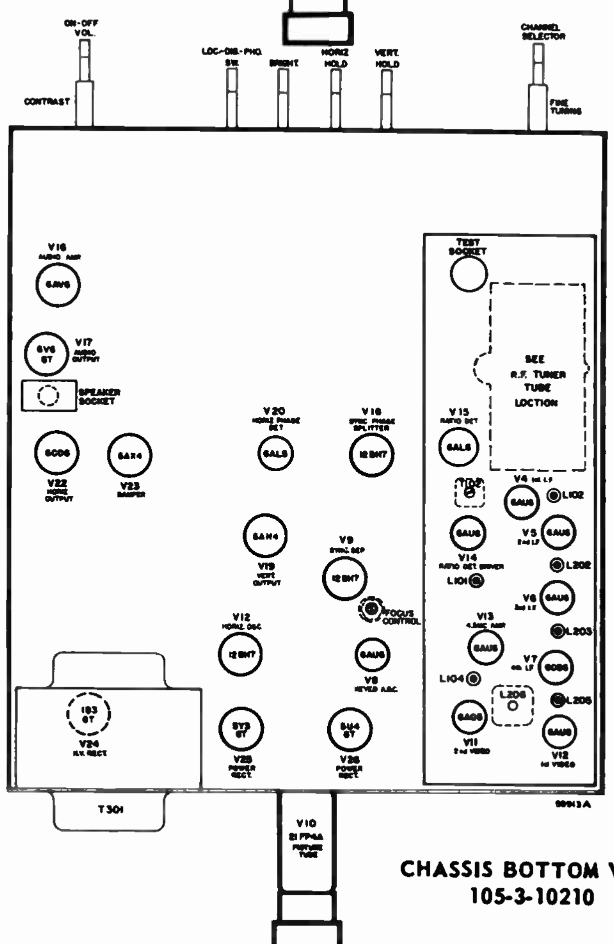


TUBE & TRIMMER LOCATION
105-3-10240
OR
105-3-10272

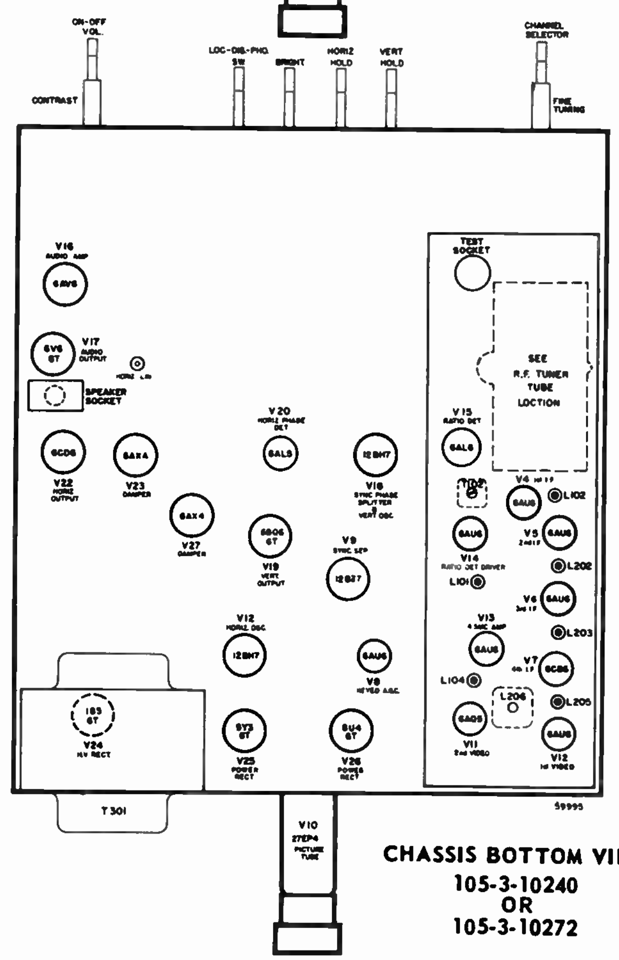


REAR CONTROLS
105-3-10210

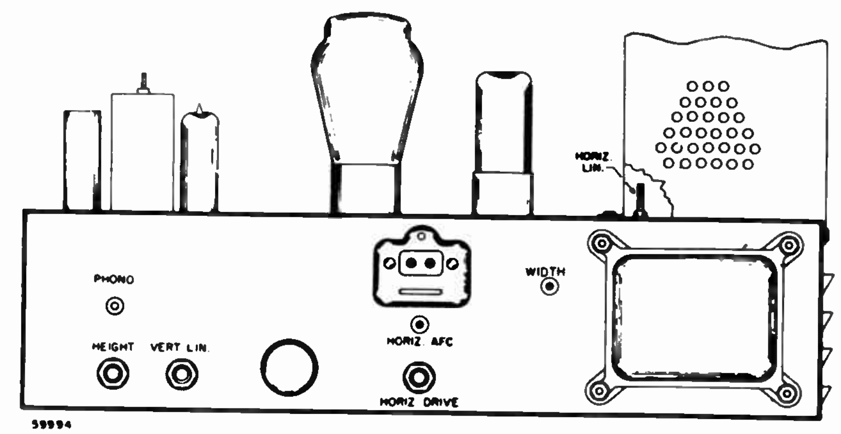




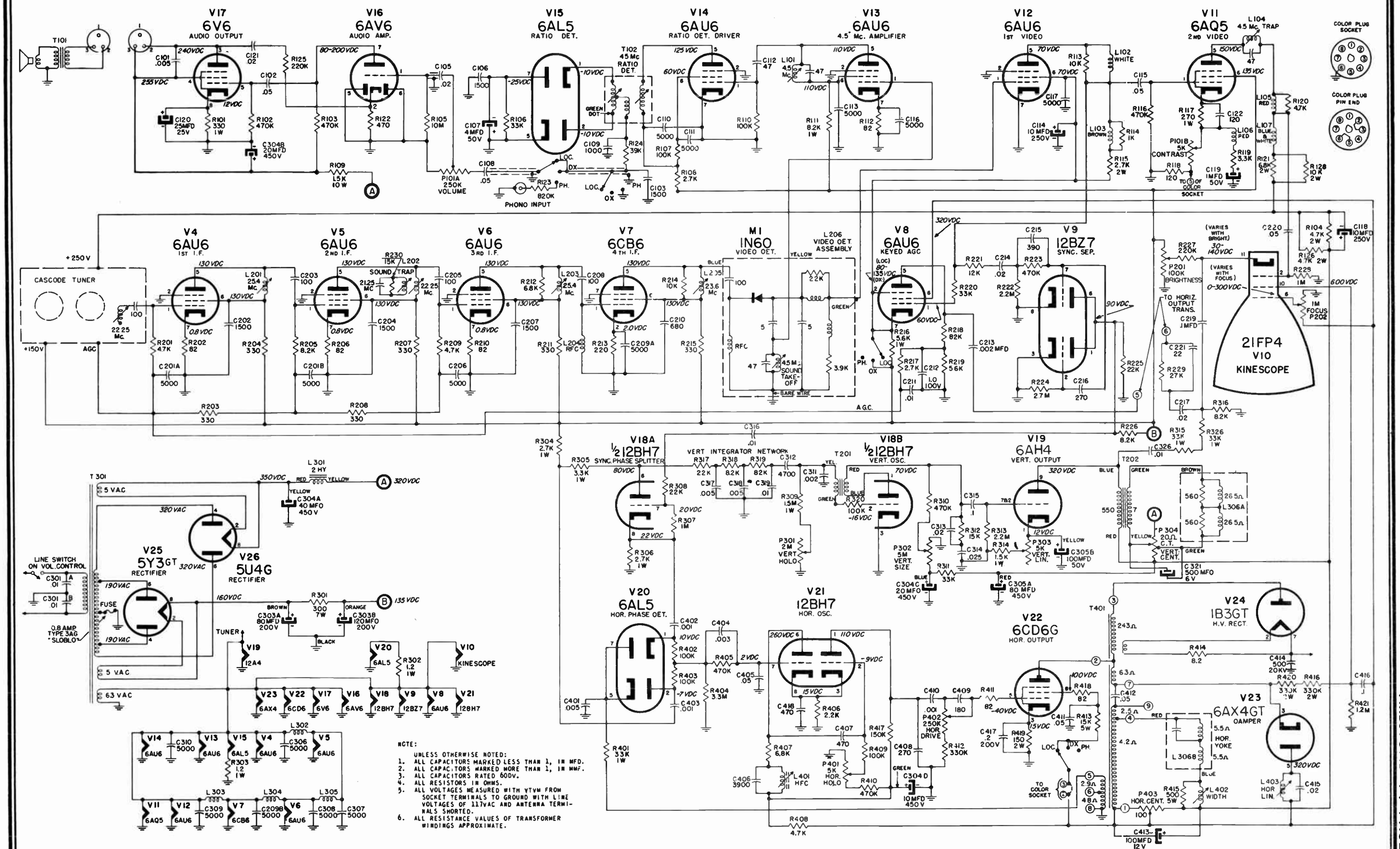
CHASSIS BOTTOM VIEW
105-3-10210



CHASSIS BOTTOM VIEW
105-3-10240
OR
105-3-10272



REAR CONTROLS
105-3-10240
OR
105-3-10272



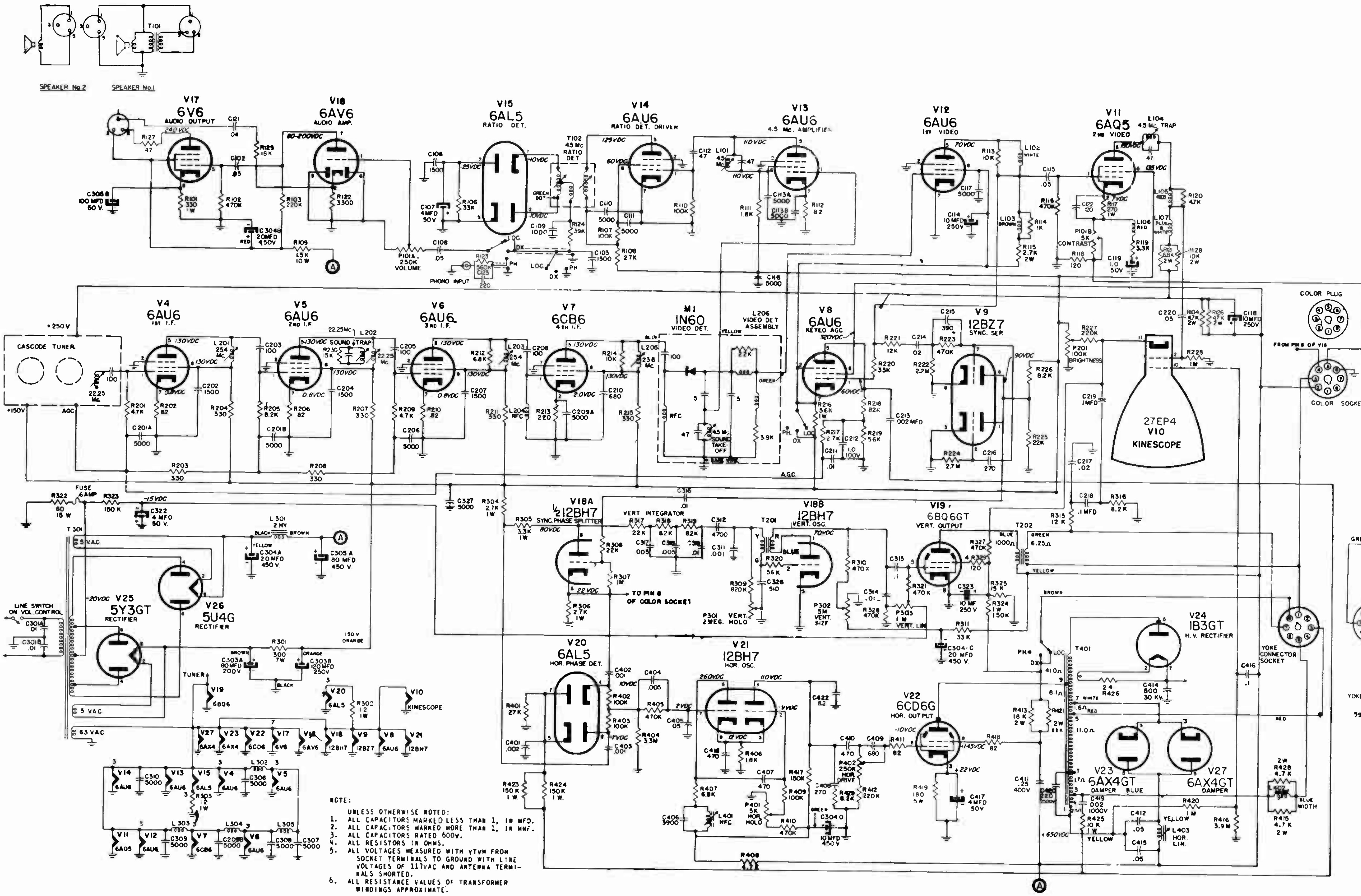
NOTE:

UNLESS OTHERWISE NOTED:

1. ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
2. ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
3. ALL CAPACITORS RATED 600V.
4. ALL RESISTORS IN OHMS.
5. ALL VOLTAGES MEASURED WITH VTVM FROM SOCKET TERMINALS TO GROUND WITH LINE VOLTAGES OF 117VAC AND ANTENNA TERMINALS SHORTED.
6. ALL RESISTANCE VALUES OF TRANSFORMER WINDINGS APPROXIMATE.

SCHEMATIC

105-3-10210



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6. ALL RESISTANCE VALUES OF TRANSFORMER WINDINGS APPROXIMATE.

TELEVISION RECEIVER
SCHEMATIC

105-3-10272
105-3-10242

	STOCK NO. 13-G-151	STOCK NO. 13-G-152	STOCK NO. 13-G-152A	STOCK NO. 13-G-155	STOCK NO. 13-G-153
Speaker #1	PC5812	PC5812	PC5812	A58133 - 6" PM	A58133 - 6" PM
Speaker #2	—	—	—	A58132 - 6" PM	A58132 - 6" PM

PARTS LIST

CAPACITORS

SYMB. NO.	PART NO.	DESCRIPTION
C101	PE194-151	Paper, .005 mfd 600V ±20%
C102	PE194-160	Paper .05 mfd 600V ±20%
C103	PE556-238	Ceramic Tubular, 1500mmf 300V ±10%
C105	PE194-156	Paper, .02 mfd 600V ±20%
C106	PA19148	Ceramic Disc Single 1500 mmf
C107	PA20149	Electrolytic 4 mfd 50V
C108	PE194-160	Paper, .05 mfd 600V ±20%
C109	PE555-136-2	Ceramic Tubular, 1000 mmf 350V ±20% (Noninsulated NPO)
C110	PA19109	Ceramic Disc Single 5000 mmf
C111	PA19109	Ceramic Disc Single 5000 mmf
C112	PE555-113-2	Ceramic Tubular 47 mmf 500V ±20% (Noninsulated NPO)
C113	PA19109	Ceramic Disc Single 5000 mmf
C114	PA20145	Electrolytic 10 mfd 250V
C115	PE194-160	Paper, .05 mfd 600V ±20%
C116	PA19109	Ceramic Disc Single 5000 mmf
C117	PA19109	Ceramic Disc Single 5000 mmf
C118	PA20145	Electrolytic 10 mfd 250V
C119	PA20138	Electrolytic, 1 mfd 50V
C120	PA20142	Electrolytic 25mfd, 25V
C121	PE194-156	Paper, .02mfd 600V ±20%
C122	PE190-125	Mica, 120mmf 500V ±10%
C123	A555-123	Ceramic Tubular, 220 mmf 500V ±20%
C201	PA19163	Ceramic Disc, Dual 5000 mmf
C202	PA19148	Ceramic Disc Single 1500 mmf
C203	PE556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insulated NPO)
C204	PA19148	Ceramic Disc Single 1500 mmf
C205	PE556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insulated NPO)
C206	PA19109	Ceramic Disc Single 5000 mmf
C207	PA19148	Ceramic Disc Single 1500 mmf
C208	PE556-118-2	Ceramic Tubular 100 mmf 500V ±20% (Insulated NPO)
C209	PA19163	Ceramic Disc, Dual 5000 mmf
C210	PE190-143	Mica 680 mmf 500V ±10%
C211	PE194-155	Paper .01 mfd 600V ±20%
C212	PE194-21	Paper 1.0 mfd 100V ±20%
C213	PE194-146	Paper .002 mfd 600V ±20%
C214	PE194-156	Paper .02 mfd 600V ±20%
C215	PE190-137	Mica 390 mmf 500V ±10%
C216	PE190-133	Mica 270 mmf 500V ±10%
C217	PE194-156	Paper .02 mfd 600V ±20%
C218	PE194-162	Paper .1 mfd 600V ±20%
C219	PE194-162	Paper .1 mfd 600V ±20%
C220	PE194-160	Paper .05 mfd 600V ±20%
C221	PP19220	Mica, 22mmf 600V ±10%
C301	PA19198	Ceramic Shielded Dual Disc .01mfd GMV
C303A,B	PB20170	Electrolytic 80 mfd 200V, 120 mfd 200V
C304	PB20168	Electrolytic 40-20-20-10 mfd 450V
C305A,B	PB20169	Electrolytic 80 mfd 450V, 100 mfd 50V
C306	PA19109	Ceramic Disc Single 5000 mmf
C307	PA19109	Ceramic Disc Single 5000 mmf
C308	PA19109	Ceramic Disc Single 5000 mmf
C309	PA19109	Ceramic Disc Single 5000 mmf
C310	PA10109	Ceramic Disc Single 5000 mmf
C311	PE194-146	Paper, .002 mfd 600V ±20%
C312	PE192-163	Mica 4700 mmf 500V ±10%
C313	PE194-151	Paper .005 mfd 600V ±10%
C314	PE194-157	Paper, .025mfd 600V ±20%
C315	PE194-162	Paper .1 mfd 600V ±20%
C316	PE194-155	Paper .01 mfd 600V ±20%
C317	PE194-151	Paper .005 mfd 600V ±20%
C318	PE194-151	Paper .005 mfd 600V ±20%
C319	PE194-155	Paper .01 mfd 600V ±20%
C321	PA20171	Electrolytic, 500 mfd 6V (Non-Polarized)
C322	A20149	Electrolytic, 4 mfd 50V
C323	A20145	Electrolytic 10 mfd 250V
C326	A190-140	Mica 510 mmf 500V ±10%
C327	A19109	Ceramic Single Disc 5000 mmf GMV
C401	PE194-151	Paper, .005 mfd 600V ±20%
C402	PE194-145	Paper, .001 mfd 600V ±20%
C403	PE194-145	Paper, .001 mfd 600V ±20%
C404	PE194-148	Paper, .003 mfd 600V ±20%
C405	PE194-160	Paper, .05 mfd 600V ±20%
C406	PE195-261	Silver Mica, 3900 mmf 500V ±10%
C407	PE190-139	Mica 470 mmf 500V ±10%
C408	PE190-133	Mica 270 mmf 500V ±10%
C409	PE190-129	Mica, 180 mmf 500V ±10%
C410	PE194-145	Paper, .001mfd 600V ±20%
C411	PE194-160	Paper, .05 mfd 600V ±20%
C412	PE194-160	Paper, .05 mfd 600V ±20%
C413	PA20141	Electrolytic 100 mfd 12V
C414	PB19175-3	Ceramic 500 mmf 20kv
C415	PE194-156	Paper, .02 mfd 600V ±20%
C416	PE194-162	Paper, .1 mfd 600V ±20%
C417	PP19156	Paper, .2 mfd 200V ±20%
C418	PE190-139	Mica 470 mmf 500V ±10%
C419	A197-194	Molded Tubular .002 mfd 1000V ±20%
C420	A19136	Mica, 220 mmf 2500V ±10%
C421	A194-146	Paper, 002 mfd 600V ±20%
C422	A190-121	Mica 82 mmf 500V ±10%

RESISTORS

SYMB. NO.	PART NO.	DESCRIPTION
R101	PE232-1137	Carbon 330 Ohm 1w ±10%
R102	PE231-1213	Carbon 470K Ohm 1/2w ±10%
R103	PE231-1213	Carbon 470K Ohm 1/2w ±10%
R104	PE233-1165	Carbon, 4700 ohm, 2W ±10%
R105	PE231-2345	Carbon 10 Megohm 1/2w ±20%
R106	PE231-1185	Carbon 33K Ohm 1/2w ±10%
R107	PE231-1197	Carbon 100K Ohm 1/2w ±10%
R108	PE231-1159	Carbon 2700 Ohm 1/2w ±10%
R109	PC21134-12	Wirewound 1500 Ohm 10w ±10%
R110	PE231-1197	Carbon 100K Ohm 1/2w ±10%
R111	PE232-1171	Carbon, 8200 ohm, 2W ±10%
R112	PE231-1123	Carbon 82 Ohm 1/2w ±10%
R113	PE231-1173	Carbon 10K Ohm 1/2w ±10%
R114	PE231-1149	Carbon, 1000 ohm, ½W ±10%
R115	PE233-1159	Carbon 2700 Ohm 2w ±10%
R116	PE231-1213	Carbon 470K Ohm 1/2w ±10%
R117	PE232-1135	Carbon 270 Ohm 1w ±10%
R118	PE231-1127	Carbon 120 Ohm 1/2w ±10%
R119	PE231-1161	Carbon 3300 Ohm 1/2w ±10%
R120	PE231-1165	Carbon 4700 Ohm 1/2w ±10%
R121	PE233-1169	Carbon, 6800 ohm, 2W ±10%
R122	PE231-1141	Carbon, 470 ohm ½W ±10%
R123	PE231-1219	Carbon, 820K ohm ½W ±10%
R124	PE231-1187	Carbon, 39K ohm, ½W ±10%
R125	PE231-1205	Carbon, 220K ohm, ½W ±10%
R126	PE233-1165	Carbon, 4700 ohm, 2W ±10%
R127	A231-1117	Carbon, 47 ohm 1/2w ±10%
R128	PE233-1173	Carbon, 10K ohm 2W ±10%
R201	PE231-1165	Carbon 4700 Ohm 1/2w ±10%
R202	PE231-1123	Carbon 82 Ohm 1/2w ±10%
R203	PE231-1137	Carbon 330 Ohm 1/2w ±10%
R204	PE231-1137	Carbon 330 Ohm 1/2w ±10%
R205	PE231-1171	Carbon 8200 Ohm 1/2w ±10%
R206	PE231-1123	Carbon 82 Ohm 1/2w ±10%
R207	PE231-1137	Carbon 330 Ohm 1/2w ±10%
R208	PE231-1137	Carbon 330 Ohm 1/2w ±10%
R209	PE231-1165	Carbon 4700 Ohm 1/2w ±10%
R210	PE231-1123	Carbon 82 Ohm 1/2w ±10%
R211	PE231-1137	Carbon 330 Ohm 1/2w ±10%
R212	PE231-1169	Carbon 6800 Ohm 1/2w ±10%
R213	PE231-1133	Carbon 220 Ohm 1/2w ±10%
R214	PE231-1173	Carbon 10K Ohm 1/2w ±10%
R215	PE231-1137	Carbon 330 Ohm 1/2w ±10%
R216	PE232-1167	Carbon 5600 Ohm 1w ±10%
R217	PE231-1159	Carbon 2700 Ohm 1/2w ±10%
R218	PE231-1195	Carbon 82K Ohm 1/2w ±10%
R219	PE231-1191	Carbon, 56K ohm ½W ±10%
R220	PE231-1185	Carbon 33K Ohm 1/2w ±10%
R221	PE231-1175	Carbon 12K Ohm 1/2w ±10%
R222	PE231-1229	Carbon 2.2 Megohm 1/2w ±10%
R223	PE231-1213	Carbon 470K Ohm 1/2w ±10%
R224	PE231-1231	Carbon 2.7 Megohm, 1/2w ±10%
R225	PE231-1181	Carbon 22K Ohm 1/2w ±10%
R226	PE231-1171	Carbon 8200 Ohm 1/2w ±10%
R227	PE231-1205	Carbon 220K Ohm 1/2w ±10%
R228	PE231-1221	Carbon 1.0 Megohm 1/2w ±10%
R229	PE231-1183	Carbon, 27K ohm ½W ±10%
R230	PE231-1177	Carbon, 15K ohm ½W ±10%
R301	PC21134-11	Wirewound 300 Ohm 7w ±10%
R302	PE23151	Wirewound 1.2 Ohm 1w ±10%
R303	PE23151	Wirewound 1.2 Ohm 1w ±10%
R304	PE232-1159	Carbon 2700 ohm 1W ±10%
R305	PE232-1161	Carbon 3300 Ohm 1w ±10%
R306	PE232-1159	Carbon 2700 ohm 1W ±10%
R307	PE231-1221	Carbon 1.0 Megohm 1/2w ±10%
R308	PE231-1181	Carbon 22K Ohm 1/2w ±10%
R309	PE232-1219	Carbon 800K ohm 1W ±10%
R310	PE231-1213	Carbon 470K Ohm 1/2w ±10%
R311	PE231-1185	Carbon 33K Ohm 1/2w ±10%
R312	PE231-1177	Carbon 15K Ohm 1/2w ±10%
R313	PE231-1229	Carbon 2.2 Megohm 1/2w ±10%
R314	PE232-1153	Carbon 1500 ohm 1W ±10%
R315	PE232-1185	Carbon 33K ohm 1W ±10%
R316	PE231-1171	Carbon 8200 ohm 1/2W ±10%
R317	PE231-1181	Carbon 22K Ohm 1/2w ±10%
R318	PE241-1171	Carbon 8200 ohm 1/2W ±10%
R319	PE231-1171	Carbon 8200 ohm 1/2W ±10%
R320	PE231-1190	Carbon 100K ohm 1/2W ±10%
R321	A231-1213	Carbon 470K Ohm 1/2w ±10%
R322	A21134-17	Wirewound 60 Ohm 15w ±10%
R323	A231-1201	Carbon 150K Ohm 1/2w ±10%
R324	A232-1201	Carbon 150K Ohm 1w ±10%
R325	A231-1177	Carbon 15K Ohm 1/2w ±10%
R326	PE232-1185	Carbon 33K ohm 1W ±10%
R327	A231-1213	Carbon, 470K ohm 1/2w ±10%
R328	A231-1213	Carbon, 470K ohm 1/2w ±10%
R401	PE232-1185	Carbon 33K Ohm 1w ±10%
R402	PE231-1197	Carbon 100K Ohm 1/2w ±10%
R403	PE231-1197	Carbon 100K Ohm 1/2w ±10%
R404	PE231-1233	Carbon 3.3 Megohm 1/2w ±10%
R405	PE231-1213	Carbon 470K Ohm 1/2w ±10%
R406	PE231-1157	Carbon 2200 Ohm 1/2w ±10%
R407	PE231-1169	Carbon 6800 Ohm 1/2w ±10%
R408	PE231-1165	Carbon 4700 Ohm 1/2w ±10%
R409	PE231-1197	Carbon 100K Ohm 1/2w ±10%
R410	PE231-1213	Carbon 470K Ohm 1/2w ±10%
R411	PE231-1123	Carbon 82 Ohm 1/2w ±10%
R412	PE231-1209	Carbon 330K Ohm 1/2w ±10%
R413	PC21134-26	Wirewound, 15K ohm 5W ±10%
R414	PP23158	Carbon 8.2 Ohm 1/2w ±10%
R415	PC21134-10	Wirewound 500 Ohm 5w ±10%
R416	PE233-1209	Carbon 330K Ohm 2w ±10%
R417	PE231-1201	Carbon 150K Ohm 1/2w ±10%
R418	PE231-1123	Carbon 82 Ohm 1/2w ±10%
R419	PE233-1129	Carbon 150 Ohm 2w ±10%
R420	PE233-1209	Carbon 330K Ohm 2w ±10%
R421	PE231-1223	Carbon 1.2 Megohm 1/2W ±10%
R423	A232-1201	Carbon 150K Ohm 1w ±10%
R424	A232-1201	Carbon 150K Ohm 1w ±10%
R425	A232-1173	Carbon 10K Ohm 1w ±10%
R426	A23162	Carbon 2.4 Ohm 1/2w ±10%
R428	A233-1165	Carbon 4700 Ohm 2w ±10%
R429	A231-1171	Carbon 8200 Ohm 1/2w ±10%

CHOKES & COILS

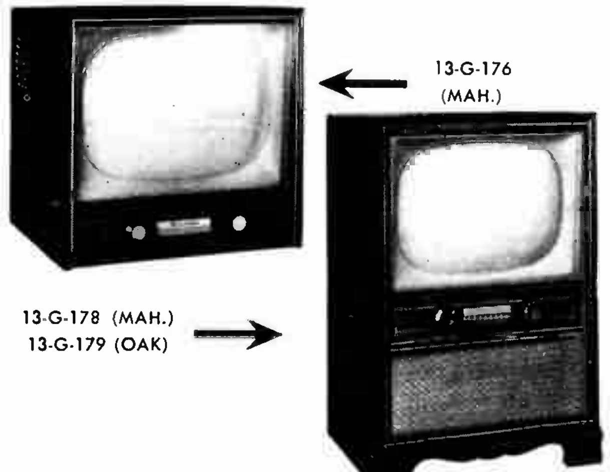
SYMB. NO.	PART NO.	DESCRIPTION
L101	PA28286	Coil Audio Takeoff
L102	PC28255-11	Coil Peaking (Blue and White)
L103	PC28255-8	Coil Peaking (Brown)
L104	PA28286	Coil 4.5 mc Trap
L105	PC28255-1	Coil Peaking (Red)
L106	PC28255-1	Coil Peaking (Red)
L107	PC28255-11	Coil Peaking (Blue and White)
L201	PB3392	Coil Pix. I.F.
L202	PB28320	Coil Pix. I.F. w/Trap
L203	PB3392	Coil Pix. I.F.
L204	PA28253	Coil R.F. Choke
L205	PB3392	Coil Pix. I.F.
L206	PB28321	Coil, Video Detector Peaking Coil Assembly
L301	PB1414	Coil Filter Choke
L302	PA28276	Coil Filament Choke
L303	PA28276	Coil Filament Choke
L304	PA28276	Coil Filament Choke
L305	PA28276	Coil Filament Choke
L306	PC28317-1	Coil Deflection Yoke
L401	PA28263	Coil Horizontal Frequency Control
L402	PA28318	Coil Width Control
L403	PA28318	Coil Horizontal Linearity

TRANSFORMER

SYMB. NO.	PART NO.	DESCRIPTION
T102	PB1201 or PB1202	Transformer Ratio Detector
T201	PB10106-2	Transformer Vertical Block Osc.
T202	PC10115-6	Transformer Vertical Output
T301	PC10148	Transformer Power
T401	PC10147	Transformer Horizontal Output

CONTROLS

SYMB. NO.	PART NO.	DESCRIPTION
P101A,B	PA24136	Control Volume Contrast 250K-5K (Dual Front)
P201	PA24134	Control Brightness 100K (Front)
P202	PA24112	Control Focus 1 Megohm (Rear)
P301	PA24146	Control Vertical Hold 1 Megohm (Front)
P302	PA24111	Height 5 Megohm (Rear)
P303	PA24135	Control Vertical Linearity 5K 2w (Rear)
P304	PA24118	Control Vertical Centering 20 Ohm C.T. (Rear)
P401	PA24137	Control Horizontal Hold 5K (Front)
P402	PA24138	Control Horizontal Drive 250K (Rear)
P403	PA24116	Control Horizontal Centering 100 Ohm Wirewound (Rear)



ELECTRICAL SPECIFICATIONS

Power Supply	117 Volts AC 60 Cycles Only
Power Consumption	200 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Range	VHF—Channels 2 thru 13
Intermediate Freq. (Tel.)	Picture—45.75 MC Sound—41.25 MC
Tel. Antenna Input Imp.	300 Ohms Balanced
Intercarrier Sound System	4.5 MC
Loud Speaker	See Parts List
Voice Coil Impedance	3.2 Ohms 400 Cycles
Focus	Magnetic
Sweep Deflection	Magnetic

DEFLECTION YOKE ADJUSTMENT — The deflection yoke should be positioned as far forward on the neck of the tube as the bell will allow. Then, if the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Upon completion of this adjustment, tighten the yoke adjustment wing screw.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

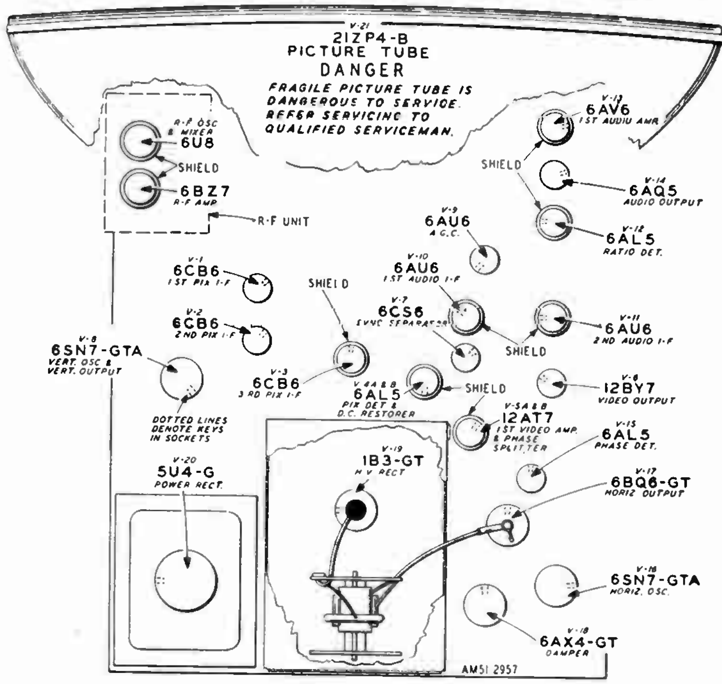


Fig. 1—Tube Layout.

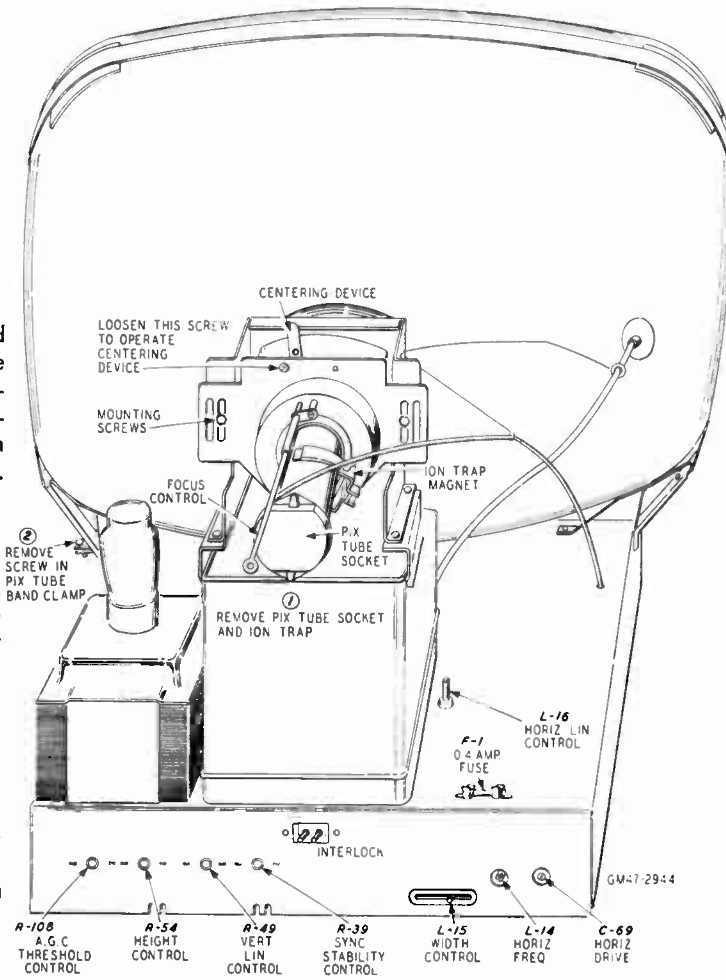


Fig. 2—Removal of Picture Tube and Rear Chassis Controls

*For replacement purposes a 6BQ7 tube may be used in place of a 6BZ7 tube.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (C-69) clockwise until the picture appears cramped near the center then turn the control counter-clockwise until the cramping disappears. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (C-69) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (C-69) will be necessary. Adjust the picture centering device to align the picture with the mask.

ANTENNA TRAP ADJUSTMENT—Antenna trap L-50 is a trap to reduce interference caused by signals which fall within the pix I-F pass band (40-48 Mc.) It is best tuned by observing the interference in the picture and tuning the slug for minimum interference. This trap is located in the shield can to which the VHF antenna lead is connected.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft and slide the pilot light socket off the bracket.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

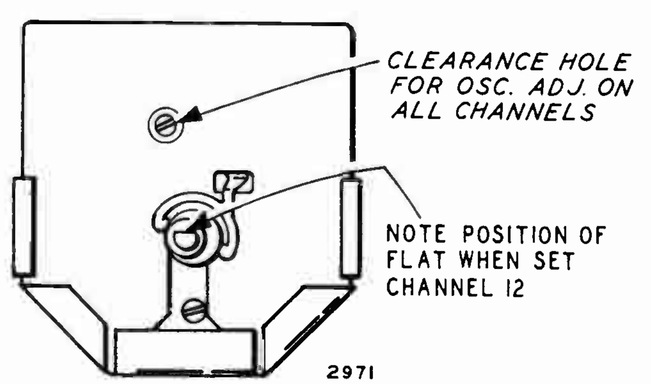


Fig. 3—Tuner Oscillator Adjustments

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective, or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A or C-70 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitors C-37 & C-38 or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:

1: Defective yoke.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:

1: Low +B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control C-69.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (12BY7).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (12BY7) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
   1: Check all potentials in video circuits.
   2: Check picture tube grid circuit for poor or dirty contact.
   3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (12BY7), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

RASTER ON TUBE BUT NO PICTURE OR SOUND

This condition can be caused by,

1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3
2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

BENDING OR S-ING

1: Check sync stability control adjustment.
2: Check capacitors C-35B and C-79B.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6CS6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

POOR FOCUS

1: Improper setting or defective focus magnet.
2: Defective picture tube.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6CS6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:
    38 to 90 mc, 10 mc sweep width
    170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat ouput in all attenuator positions.
(e) A source of the following Markers:

41.25 Mc	Cathode Trap
42.25 Mc	
42.50 Mc	1st Pix I-F Coil (Bottom)
43.9 Mc	3rd Pix I-F Coil
44.5 Mc	
45.3 Mc	2nd Pix I-F Coil
45.75 Mc	
47.25 Mc	1st Pix I-F Coil (Top)

CATHODE-RAY OSCILLOSCOPE with good low frequency response in vertical amplification and an input calibrating source.

BIAS BATTERY —1.5V & —4.5V

VTVM

DIODE DETECTOR

40 Mc I.F. ALIGNMENT

Connect sweep output to ungrounded shield of converter tube in tuner (6U8). With short leads connect crystal diode detector (Fig. 6) to plate of 1st I-F tube. Connect —1.5 V to A.G.C. line (Junction of R-1, R-4 & C-21A). Connect oscilloscope to detector output. Adjust sweep output to give adequate deflection.

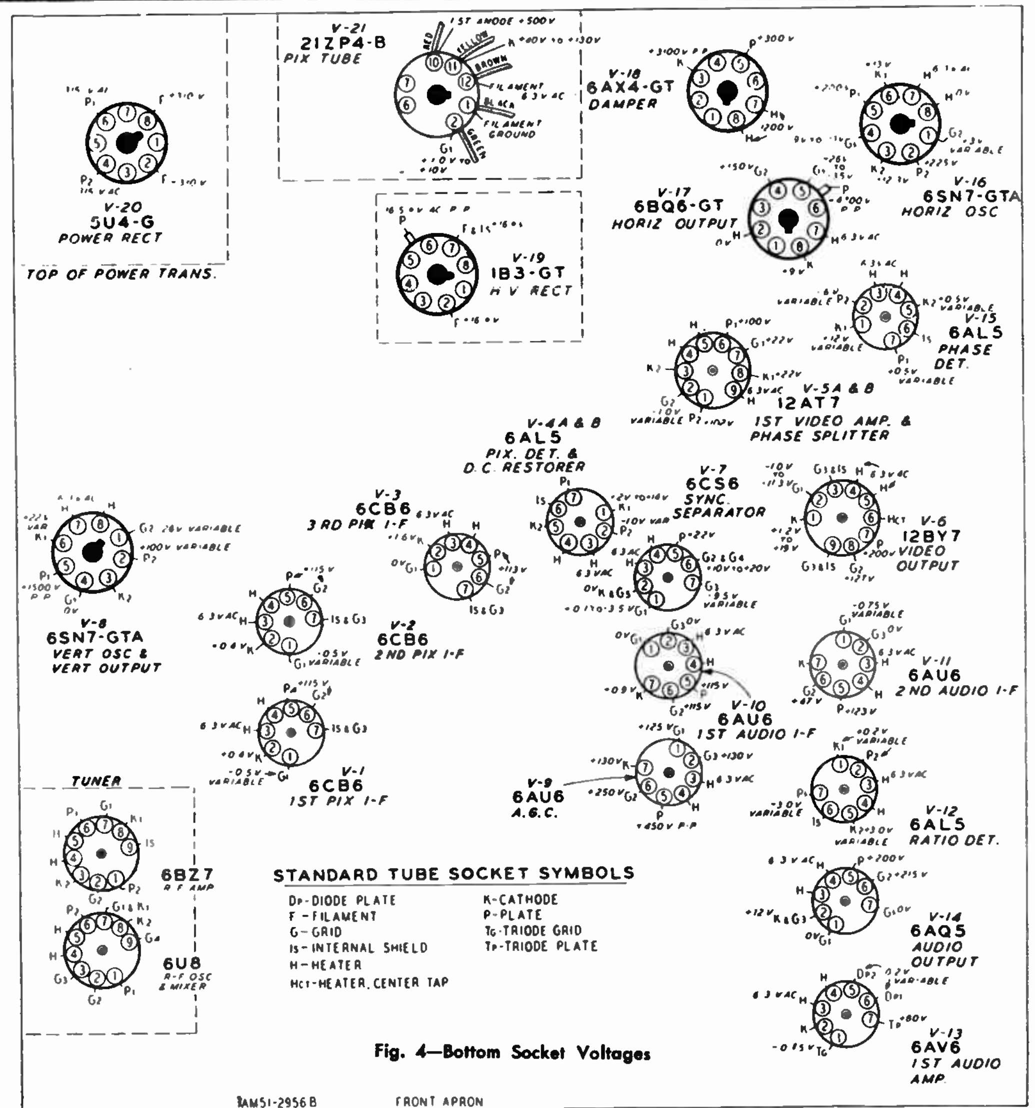


Fig. 4—Bottom Socket Voltages

A. FREQUENCY	ADJUST
1. 47.25 Mc	1st Pix I-F Coil (T-1 Top) to center notch over 47.25 Mc marker.
2.	Converter Plate Coil (L-61 Top of Tuner) 1st I-F Grid Coil (L-1) and Input Coupling Coil (L-2) to give the response shown in figure 7.

The converter plate and 1st I-F grid coils control the shape of the top. The input coupling coil controls the position of the 41.25 marker. This adjustment must be made accurately or the sound rejection will not be correct (41.25 Mc 31 to 36 db down from top of overall P.I.F. response). 45.75 Mc marker must be set exactly on peak or the position of the 44.50 Mc marker in the overall response curve will not be correct.

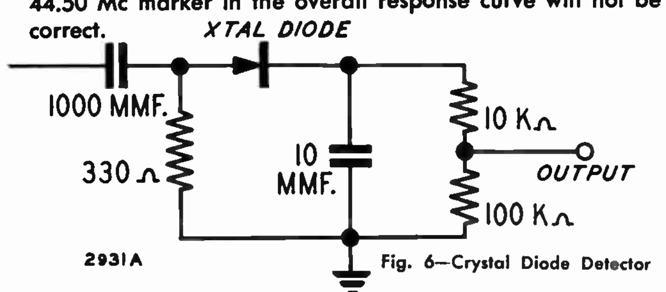


Fig. 6—Crystal Diode Detector

B. When the input circuit is aligned place —4.5 V bias on the A.G.C. line. Remove the crystal detector and connect oscilloscope and VTVM to the 2nd Pix detector load resistor R-100. Adjust sweep output to give 1.0 VDC at detector.

FREQUENCY	ADJUST
1. 42.5 Mc	1st Pix I-F Coil (T-1 Bottom) for maximum height of 42.5 Mc marker.
2. 45.3 Mc	2nd Pix I-F Coil (T-2 Top) for maximum height of 45.3 Mc marker.
3. 43.9 Mc	3rd Pix I-F Coil (T-3 Top) for maximum height of 43.9 Mc marker.
4. 41.25 Mc	Cathode Trap (L-4 Top) for minimum height of 41.25 Mc marker.

These adjustments may be made with a single frequency generator if it is more convenient to do so.

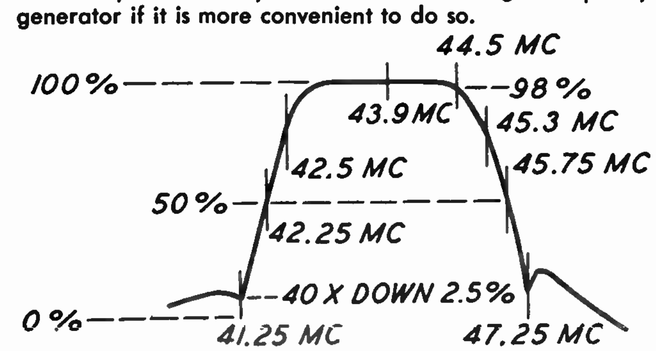


Fig. 8—Overall Response Curve.

C. After these adjustments have been made recheck the peak to peak output on the oscilloscope. If the shape of the curve is not as shown in figure 8, it will be necessary to retouch the adjustments. A small fraction of a turn is all that is necessary if the strip is operating correctly. The position of the 44.5 Mc marker is critical (98%). The 43.9 Mc transformer (3rd I-F) controls the symmetry of the top. The 45.3 Mc transformer (2nd I-F) controls the height of the 45.75 Mc marker. The 43.5 Mc transformer (1st I-F) controls the height of the 42.25 Mc marker. This adjustment will very seldom need retouching.

DO NOT RETOUCH the converter plate coil or the input grid coil. These coils MUST be adjusted correctly with the diode detector. Recheck position of 41.25 Mc and 47.25 Mc markers. Reset if necessary.

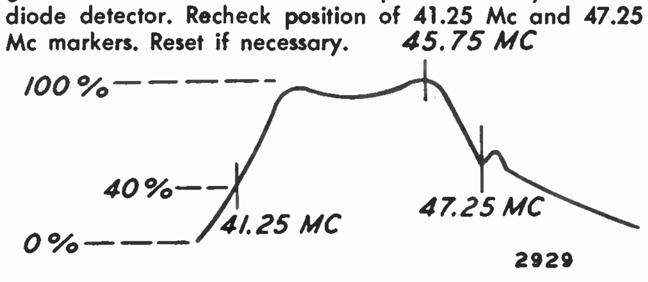


Fig. 7—Input Circuit Response

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 2-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

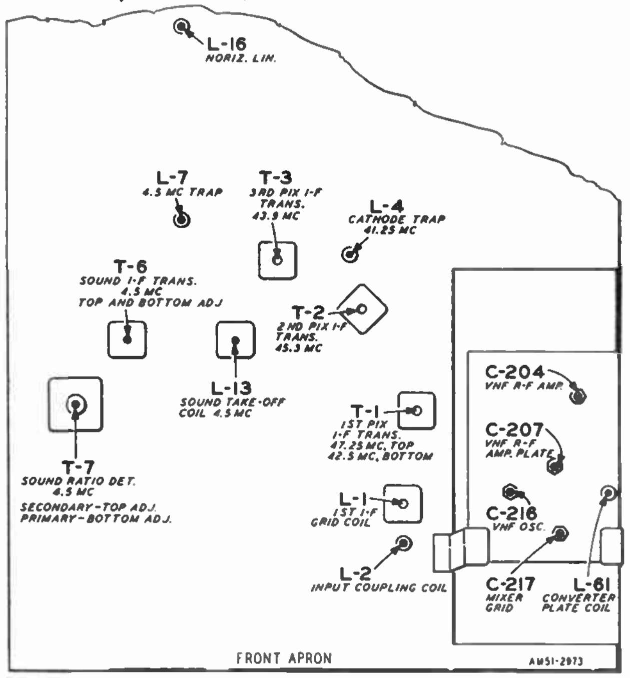


Fig. 9—Video & Audio I-F Adjustments

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" Figure 10 on tuner. Connect —3 V bias to AGC line at junction of R-33 and C-20 on the receiver.

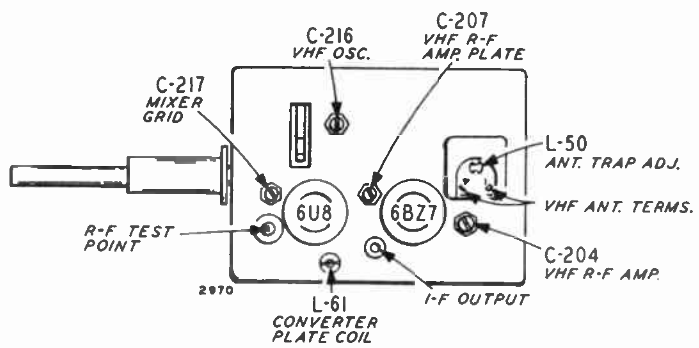


Fig. 10—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-204 slightly favoring the Pix carrier, then adjust C-207 and C-217 for response as in Figure 11. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-204, C-207, and C-217. Recheck all channels.

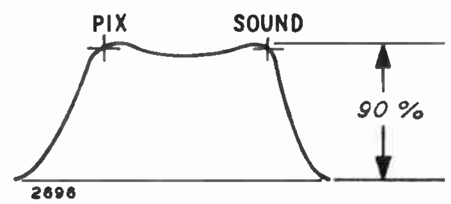


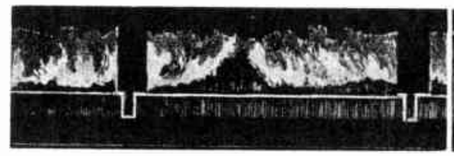
Fig. 11—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

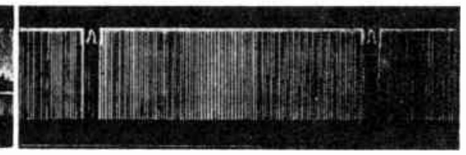
1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21A.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 8).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. If fine tuning on all channels is off in the same direction, adjust the oscillator trimmer C-216.

OSCILLOSCOPE WAVEFORM PATTERNS

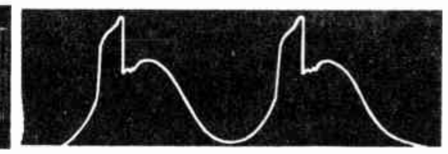
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicate the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



No. 1—6AL5 Pix Det. Plate
2.8V P-P 60 C.P.S.
No. 4—6CS6 Sync Sep.
Grid No. 1 .26V P-P 60 C.P.S.

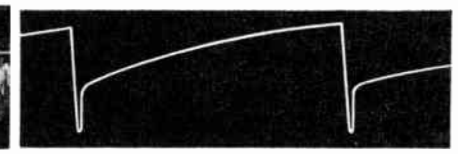


No. 7—12AT7 Phase Splitter Plate
30V P-P 60 C.P.S.

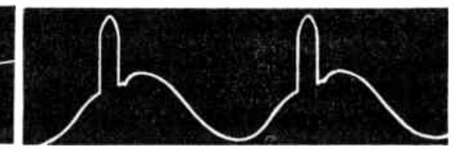


No. 14—6SN7-GTA—Hor. Osc. Plate
44V P-P 15,750 C.P.S.

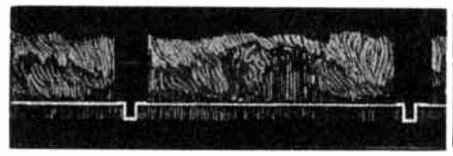
No. 2—12AT7 Plate
44V P-P 60 C.P.S.
No. 2—12BY7 Grid
9.5V P-P 60 C.P.S.



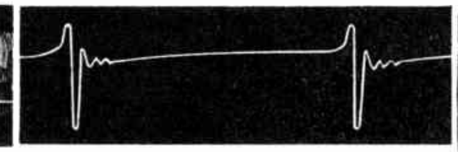
No. 8—6SN7-GTA—Vert. Osc. Plate
80V P-P 60 C.P.S.
No. 10—6SN7-GTA Vert. Output Grid
80V P-P 60 C.P.S.



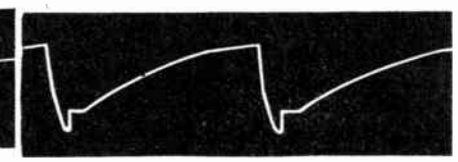
No. 15—6SN7-GTA Hor. Osc. Grid
42V P-P 15,750 C.P.S.



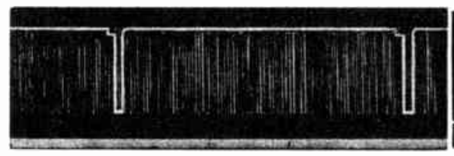
No. 3—Pix Tube Grid
23-150V P-P 60 C.P.S.



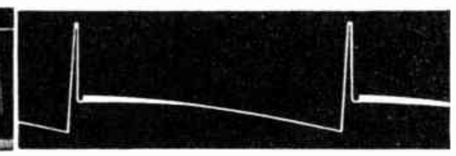
No. 9—6SN7-GTA Vert. Osc. Grid
160V P-P 60 C.P.S.



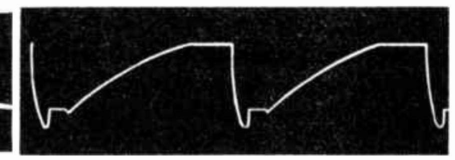
No. 16—6SN7-GTA Hor. Osc. Plate
190V P-P 15,750 C.P.S.



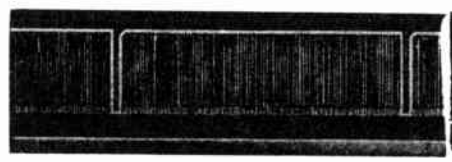
No. 5—6CS6 Sync Sep. Plate
36V P-P 60 C.P.S.



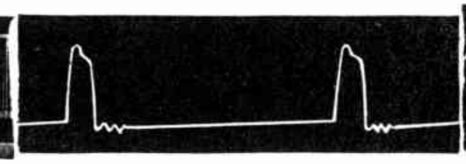
No. 11—Vert. Def. Coil
75V P-P 60 C.P.S.



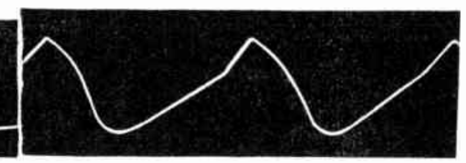
No. 17—6BQ6 Grid
150V P-P 15,750 C.P.S.



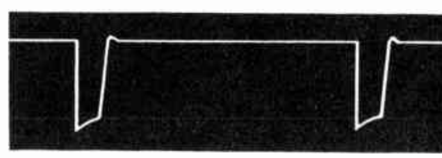
No. 6—12AT7 Phase Splitter Cathode
33V P-P 60 C.P.S.



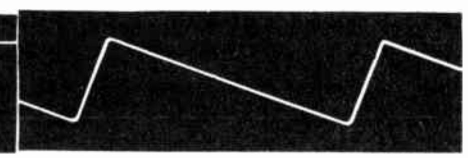
No. 12—6AU6 A.G.C.
510V P-P 15,750 C.P.S.



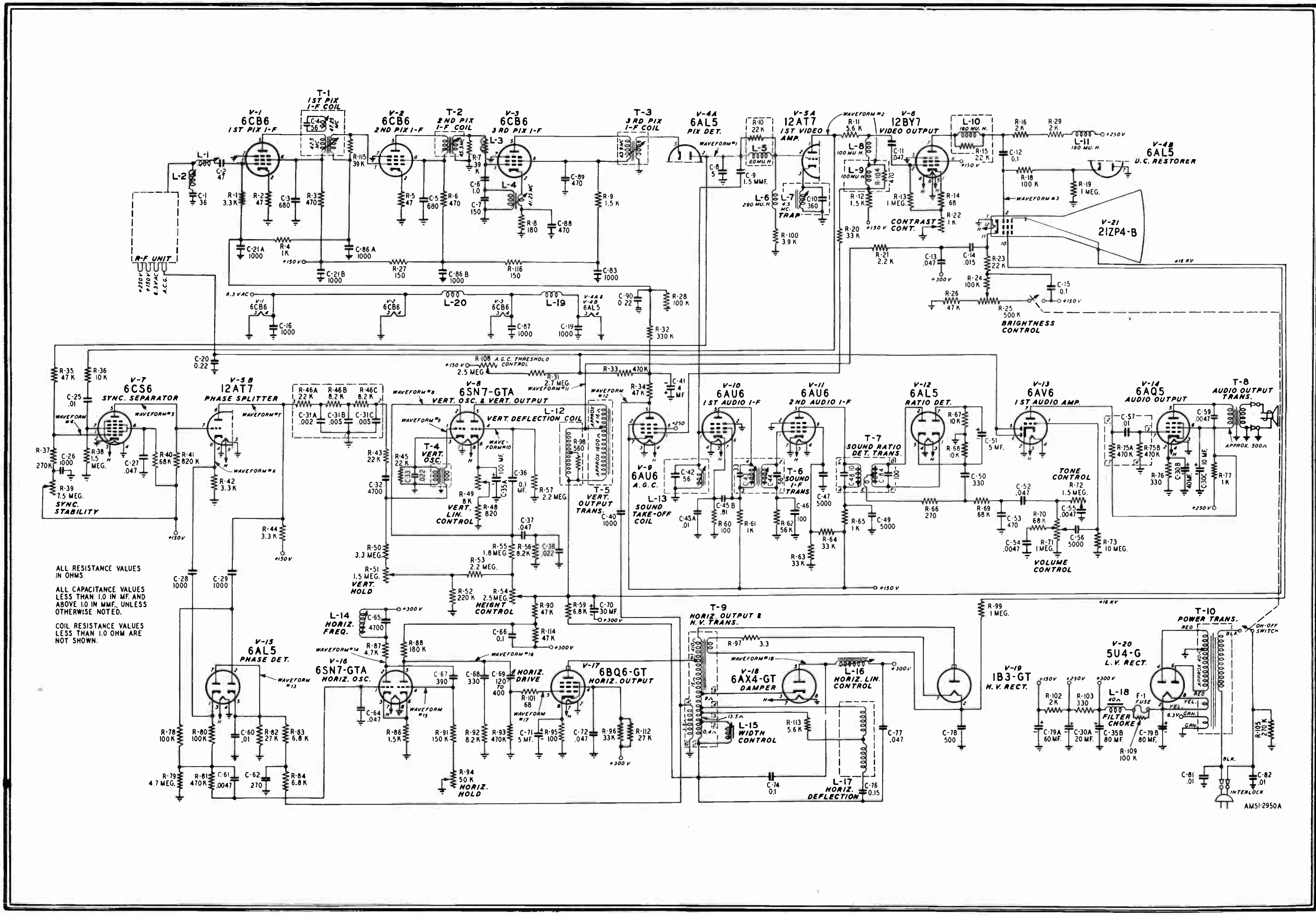
No. 18—6AX4—GT Damper Plate
115V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
33V P-P 15,750 C.P.S.



No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.


V-1 6CB6 1ST PIX I-F
T-1 1ST PIX I-F COIL
V-2 6CB6 2ND PIX I-F
T-2 2ND PIX I-F COIL
V-3 6CB6 3RD PIX I-F
T-3 3RD PIX I-F COIL
V-4A 6AL5 PIX DET.
V-5A 12AT7 1ST VIDEO AMP.
V-6 12BY7 VIDEO OUTPUT
V-4B 6AL5 D.C. RESTORER
V-21 21ZP4-B
R-F UNIT
CONTRAST CONT.
BRIGHTNESS CONTROL
V-7 6CS6 SYNC. SEPARATOR
V-5B 12AT7 PHASE SPLITTER
SYNC. STABILITY
V-8 6SN7-GTA VERT. OSC. & VERT. OUTPUT
T-4 VERT. OSC.
L-12 VERT. DEFLECTION COIL
T-5 VERT. OUTPUT TRANS.
VERT. LIN. CONTROL
VERT. HOLD
HEIGHT CONTROL
R-108 A.G.C. THRESHOLD CONTROL
V-9 6AU6 A.G.C.
L-13 SOUND TAKE-OFF COIL
V-10 6AU6 1ST AUDIO I-F
V-11 6AU6 2ND AUDIO I-F
T-6 SOUND I-F TRANS.
V-12 6AL5 RATIO DET.
T-7 SOUND RATIO DET. TRANS.
V-13 6AV6 1ST AUDIO AMP.
V-14 6AQ5 AUDIO OUTPUT
T-8 AUDIO OUTPUT TRANS.
TONE CONTROL
VOLUME CONTROL
ALL RESISTANCE VALUES IN OHMS.
ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF., UNLESS OTHERWISE NOTED.
COIL RESISTANCE VALUES LESS THAN 1.0 OHM ARE NOT SHOWN.
V-15 6AL5 PHASE DET.
L-14 HORIZ. FREQ.
V-16 6SN7-GTA HORIZ. OSC.
HORIZ. HOLD
HORIZ. DRIVE
V-17 6BQ6-GT HORIZ. OUTPUT
T-9 HORIZ. OUTPUT & H.V. TRANS.
V-18 6AX4-GT DAMPER
L-16 HORIZ. LIN. CONTROL
L-15 WIDTH CONTROL
L-17 HORIZ. DEFLECTION
V-19 1B3-GT H.V. RECT.
T-10 POWER TRANS.
V-20 5U4-G L.V. RECT.
L-18 FILTER CHOKE
F-1 FUSE
ON-OFF SWITCH
INTERLOCK
AM51-2950A

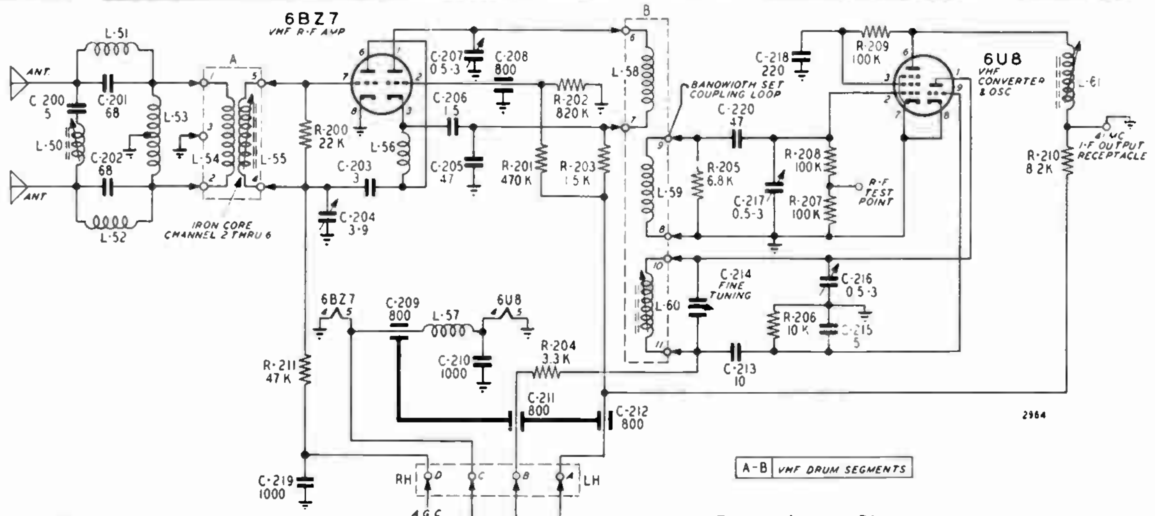


Fig. 12—Tuner Schematic Diagram.

PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-200	12T-AE223K	22 K	±10%	0.5
R-201	12T-AE474K	470 K	±10%	0.5
R-202	12T-AE824K	820 K	±10%	0.5
R-203	12S-AE152K	1.5 K	±10%	1.0
R-204	12S-AE332K	3.3 K	±10%	1.0
R-205	12T-AE682K	6.8 K	±10%	0.5
R-206	12T-AE103M	10 K	±20%	0.5
R-207, R-208, R-209	12T-AE104K	100 K	±10%	0.5
R-210	12T-AE822K	8.2 K	±10%	0.5
R-211	12T-AE473M	47 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-200, C-201, C-202	Part of Antenna Input Filter Assembly		±.25 mmf
C-203	13L-8C030K	3 mmf	±10%
C-204	31A-079	3.9 mmf	±10%
C-205	13L-8Q470K	47 mmf	±10%
C-206	13L-8C1R5C	1.5 mmf	±.25 mmf
C-207, C-216, C-217	31A-056-1	0.5-3 mmf	Trimmer
C-208, C-209, C-211, C-212	13M-28N102Z-03 Center Shield Assembly Feed-Thru		
C-210, C-219	13L-8X102Z	1000 mmf	GMV
C-213	13L-8T100A	10 mmf	±1 mmf
C-214	Part of Fine Tuning Assembly		
C-215	13L-8UA050C	5 mmf	±.25 mmf
C-218	13L-12D221K	220 mmf	±10%
C-220	13M-20U470K-R	47 mmf	±10%

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
L-50, L-51, L-52, L-53	31K-225-01	Antenna Input Filter Assembly	
L-54, L-55	Part of VHF Drum Segments (Antenna)		
L-56	318-727	Choke, Coil	
L-57	34A-704	Choke, Heater	
L-58, L-59, L-60	Part of VHF Drum Segments (Osc.)		
L-61	31K-109	I-F Coil Assembly	

CAPACITORS

C-1	47X626	36 mmf	500 V	Ceramic.....
C-2	47X603	47 mmf	500 V	Ceramic.....
C-3, C-5	80X5	680 mmf	500 V	Ceramic.....
C-4	Part of T-1			
C-6	47X588	1.0 mmf	500 V	Composition..
C-7	RCM15E151K	150 mmf	500 V	Silver Mica...
C-8	47X562	5 mmf	500 V	Ceramic......
C-9	47X584	1.5 mmf		Composition..
C-10	47X568	360 mmf	500 V	Molded Mica..
C-11, C-27, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular......
C-12, C-66, C-74	RCP10M4104M	.1 mf	400 V	Tubular......
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular......
C-14	RCP10M6153M	.015 mf	600 V	Tubular......
C-15	RCP10M2104M	.1 mf	200 V	Tubular......
C-16, C-19, C-26, C-28, C-29, C-40, C-83, C-87	80X1	1000 mmf		Ceramic......
C-20, C-90	RCP10M2224M	.22 mf	200 V	Tubular......
C-21A, C-21B, C-86A, C-86B	80X3	1000 mmf		Dual Ceramic.
C-25, C-60	RCP10M4103M	.01 mf	400 V	Tubular......
C-30A, C-30B, C-30C	45X392	20 mf 40 mf 10 mf	400 V 50 V 400 V	Dry Electrolytic
C-31A, C-31B, C-31C	Part of 76X7 (See Miscellaneous)			
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica..
C-33, C-38	RCP10M2223M	.022 mf	200 V	Molded Mica..
C-35A, C-35B	45X391	100 mf 80 mf	50 V 400 V	Dry Electrolytic
C-36	RCP10M6104M	.1 mf	600 V	Tubular......
C-41	45X361	4 mf	100 V	Dry Electrolytic
C-42	Part of L-13			
C-43, C-44	Part of T-6			
C-45A, C-45B	80X6	.01 mf	500 V	Dual Ceramic.
C-46	47X604	100 mmf	500 V	Ceramic......
C-47, C-49, C-56	47X507	5000 mmf		Ceramic......
C-48, C-84	Part of T-7			
C-50, C-68	47X570	330 mmf	500 V	Molded Mica..
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular......
C-53	47X525	470 mmf	500 V	Molded Mica..
C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular......
C-57	Part of 76X5 (See Miscellaneous)			
C-59	RCP10M6472M	.0047 mf	600 V	Tubular......
C-62	RCM20A271K	270 mmf	500 V	Molded Mica...
C-67	RCM208391J	390 mmf	500 V	Molded Mica...
C-69	17A269	120-400 mmf		Horizontal Drive
C-70	45X393	30 mf	400 V	Dry Electrolytic
C-76	RCP10M4154M	.15 mf	400 V	Tubular......
C-78	47X560	500 mmf	20 KV	Ceramic.....
C-79A, C-79B	45X390	60 mf 80 mf	400 V 400 V	Dry Electrolytic
C-81, C-82	47X615	.01 mf		Ceramic......
C-88, C-89	80X4	470 mmf	500	Ceramic.....

RESISTORS

		Ohms	Watts	
R-1, R-42, R-44	883332	3.3 K	0.5	Carbon......
R-2, R-5	883470	47	0.5	Carbon......
R-3, R-6	885471	470	0.5	Carbon .....
R-4, R-61, R-65	885102	1 K	0.5	Carbon.....
R-7, R-115	B83393	39 K	0.5	Carbon......
R-8	884181	180	0.5	Carbon......
R-9, R-12	884152	1.5 K	0.5	Carbon......
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon......
R-13, R-19	B84105	1.0 Meg.	0.5	Carbon......
R-14	884680	68	0.5	Carbon......
R-15	Part of L-10			
R-16, R-29	D83202	2 K	2.0	Carbon......
R-18, R-28, R-78, R-80	884104	100 K	0.5	Carbon......
R-20, R-63, R-64	B84333	33 K	0.5	Carbon......
R-21	884222	2.2 K	0.5	Carbon......
R-22, R-71	78X21	1.0 K 1.0 meg.		Contrast and Volume Control
R-23, R-43, R-45	B84223	22 K	0.5	Carbon......
R-24	B85104	100 K	0.5	Carbon......
R-25	40X333	500 K		Brightness Control
R-26	885473	47 K	0.5	Carbon......
R-27, R-116	885151	150	0.5	Carbon .....
R-31	B84275	2.7 meg.	0.5	Carbon......
R-32	883334	330 K	0.5	Carbon......
R-33, R-93	B84474	470 K	0.5	Carbon......
R-34, R-35, R-114	884473	47 K	0.5	Carbon......
R-36	884103	10 K	0.5	Carbon......
R-37	B84274	270 K	0.5	Carbon......
R-38	884155	1.5 meg.	0.5	Carbon......
R-39	40X370	7.5 meg.		Sync. Stability Control
R-40, R-69, R-70	884683	68 K	0.5	Carbon......
R-41	884824	820 K	0.5	Carbon......
R-46A, R-46B, R-46C	Part of 76X7 (See Miscellaneous)			
R-48	B84821	820	0.5	Carbon......
R-49	40X375	8 K		Vertical Lin. Control
R-50	B84335	3.3 meg.	0.5	Carbon......
R-51	40X334	1.5 meg.		Vertical Hold Control
R-52	884224	220 K	0.5	Carbon......
R-53, R-57	B84225	2.2 meg.	0.5	Carbon......
R-54	40X369	2.5 meg.		Height Control
R-55	884185	1.8 meg.	0.5	Carbon......
R-56, R-92	B84822	8.2 K	0.5	Carbon......
R-59	D84682	6.8 K	2.0	Carbon......
R-60	B84101	100	0.5	Carbon......
R-62	884563	56 K	0.5	Carbon......
R-66	B84271	270	0.5	Carbon......
R-67, R-68	883103	10 K	0.5	Carbon......
R-72	40X334	1.5 meg.		Tone Control.
R-73	B85106	10.0 meg.	0.5	Carbon......
R-75A, R-75B	Part of 76X5 (See Miscellaneous)			
R-76	C84331	330	1.0	Carbon......
R-77	D84102	1 K	2.0	Carbon......
R-79	B85475	4.7 meg.	0.5	Carbon......
R-81	B85474	470 K	0.5	Carbon......
R-82	884273	27 K	0.5	Carbon......
R-83, R-84	C84682	6.8 K	1.0	Carbon......
R-86	883152	1.5 K	0.5	Carbon......
R-87	B83472	4.7 K	0.5	Carbon......
R-88	B84184	180 K	0.5	Carbon......
R-90	C84473	47 K	1.0	Carbon......
R-91	B83154	150 K	0.5	Carbon......
R-94	40X361	50 K		Horizontal Hold Control
R-95	D84101	100	2.0	Carbon......
R-96	D84333	33 K	2.0	Carbon......
R-97	43X238	3.3	0.5	Wirewound...
R-98	Part of Deflection Yoke			
R-99	C85105	1.0 meg.	1.0	Carbon......
R-100	883392	3.9 K	0.5	Carbon......
R-101	B85680	68	0.5	Carbon......
R-102	43X285	2 K	10.0	Wirewound...
R-103	43X273	330	10.0	Wirewound...
R-104	Part of L-9			
R-105	885274	270 K	0.5	Carbon......
R-108	40X369	2.5 meg.		AGC........
R-109	D85104	100 K	2.0	Carbon......
R-112	D84273	27 K	2.0	Carbon......
R-113	884562	5.6 K		Carbon......

TRANSFORMERS AND COILS

L-1	9A2316	1st I-F Grid Coil..................
L-2	9A2320	Input Coupling Coil................
L-3	9A2322	Choke, Parasitic...................
L-4	9A2321	Cathode Trap 41.25 MC..............
L-5	36A10	Peaking Coil 60 mh ....
L-6	36A22	Peaking Coil 290 mh ....
L-7	9A2074	4.5 M.C. Trap ....
L-8	36A1	Peaking Coil 100 mh ....
L-9	36A25	Peaking Coil 100 mh ....
L-10	36A12	Peaking Coil 160 mh ....
L-11	36A2	Peaking Coil 190 mh ....
L-12, L-17	Part of Deflection Yoke Assembly	
L-13	9A2201	Sound Take-Off Coil ....
L-14	9A2096	Horizontal Frequency Coil ....
L-15	9A2183	Width Control ....
L-16	9A2262	Horizontal Linearity Control ......
L-18	52X95	Filter Choke ....
L-19, L-20	9A2033	R-F Heater Choke...................
T-1	9A2317	1st Pix I-F Transformer............
T-2	9A2318	2nd Pix I-F Transformer............
T-3	9A2319	3rd Pix I-F Transformer............
T-4	54X10	Vertical Osc. Transformer ....
T-5	51X168	Vertical Output Transformer ....
T-6	9A2323	Sound I-F Transformer ....
T-7	9A2295	Sound Ratio Det. Transformer ......
T-8	51X166	Audio Output Transformer ....
T-9	53X330	Horizontal Output Transformer .....
T-10	53X339	Power Transformer ....
	25A1119	Tuner, R-F (Standard Coil) ....
	12A519	10" PM Speaker.....................
	12A518	8" PM Speaker......................
	12A516	6" PM Speaker......................
	2A438-2	Focus Magnet Assembly..............
	76X5	Multiple Resistor Capacitor Assembly ..
	76X7	Multiple Resistor Capacitor Assembly .
	9A2334-1	Deflection Yoke Assembly ....
	2A421	Ion Trap Magnet ....

Kenwood

MODEL 45TV13-43-9081A

(21" RECTANGULAR PICTURE TUBE)

Cambridge

MODEL 45TV13-43-9038A

(21" RECTANGULAR PICTURE TUBE)

TUBE COMPLEMENT

V1	6CB6	1st I.F. Amplifier	V11	6AX4GT	Horizontal Damping
V2	6CB6	2nd I.F. Amplifier	V12	5U4G	Rectifier
V3	6CB6	3rd I.F. Amplifier	V13	6AU6	Sound I.F. Amp.—Limiter
V4	12BY7	Video Amplifier	V14 A&B	6T8	Sound Discriminator—Sound Amplifier—A.G.C. Clamp
V5	6AU6	Keyer—A.G.C.			
V6	6BE6	Gated Sync. Separator	V15	6AQ5	Sound Output
V7 A&B	12AU7	Sync. Amplifier—Vertical Blocking Oscillator	V16	6AH4GT	Vertical Scanning Output
			V17	21MP4	Picture Tube
V8 A&B	6SN7GT	Horiz. A.F.C.—Horiz. Block. Osc.	V18	6BQ7, 6BQ7A or 6BZ7	V.H.F. R.F. Amplifier U.H.F. I.F. Amp.
V9	6BQ6GT	Horiz. Scanning Output	V19	6J6	V.H.F. Mixer—Oscillator U.H.F. I.F. Amp.
V10	1B3GT	High Voltage Rectifier			
			V20	6AF4	U.H.F. Oscillator

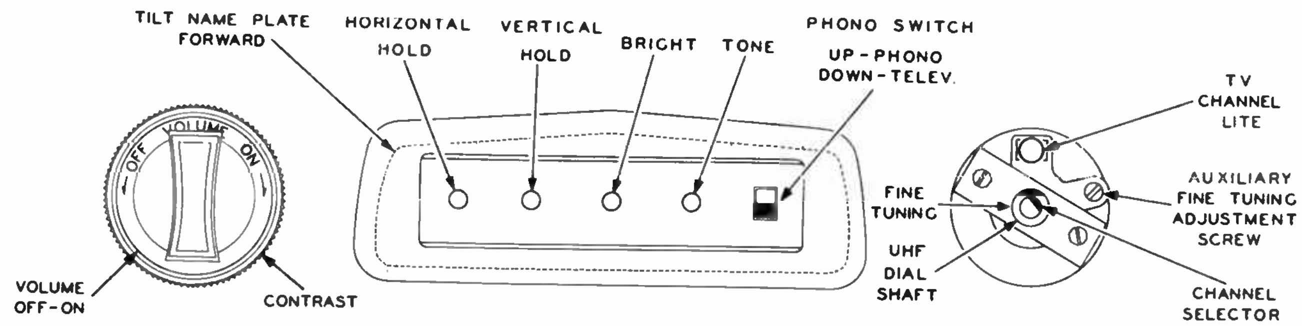


Fig. 11—LOCATIONS OF PRE-SET CONTROLS

GENERAL SPECIFICATIONS

DIMENSIONS

Model	Height	Width	Depth
45TV13-43-9081A	37⅞"	24½"	22⅞"
45TV13-43-9038A	22⅞"	24½"	22⅝"

WEIGHT (packed)

Model	Weight
45TV13-43-9081A	122 lbs.
45TV13-43-9038A	103 lbs.

SPEAKER

Model	Type	Size	V.C. Imped.
45TV13-43-9081A	P.M. Dynamic	6" x 9"	3.2 Ohms
45TV13-43-9038A	P.M. Dynamic	6"	3.2 Ohms

R. F. TUNER

V.H.F.—Turret type.
U.H.F.—Continuous tuning type.

I.F. SYSTEM

Three Stages—overcoupled—for composite signal.
One additional stage for sound channel.

DETECTOR

Sound—Ratio type
Picture—Germanium crystal type
U.H.F. Mixer—Silicone crystal type

RETRACE LINE SUPPRESSOR

Eliminates retrace lines thruout the normal range of picture brightness and contrast.

INTERMEDIATE FREQUENCIES

Sound Carrier —41.25 Mc.
Picture Carrier—45.75 Mc.

POWER REQUIREMENTS

117 volts 60 cycles 220 watts

ANTENNA INPUT IMPEDANCE

300 ohms—balanced to ground.

PICTURE SIZE

21" Rectangular

DEFLECTION

Magnetic

FOCUS

Electrostatic

HORIZONTAL SYNCHRONIZATION

Automatic frequency control provides excellent picture stability.

HIGH VOLTAGE POWER SUPPLY

"Fly-back" type. Completely enclosed in a shielded compartment.

BUILT-IN ANTENNA

Broad band dipole.

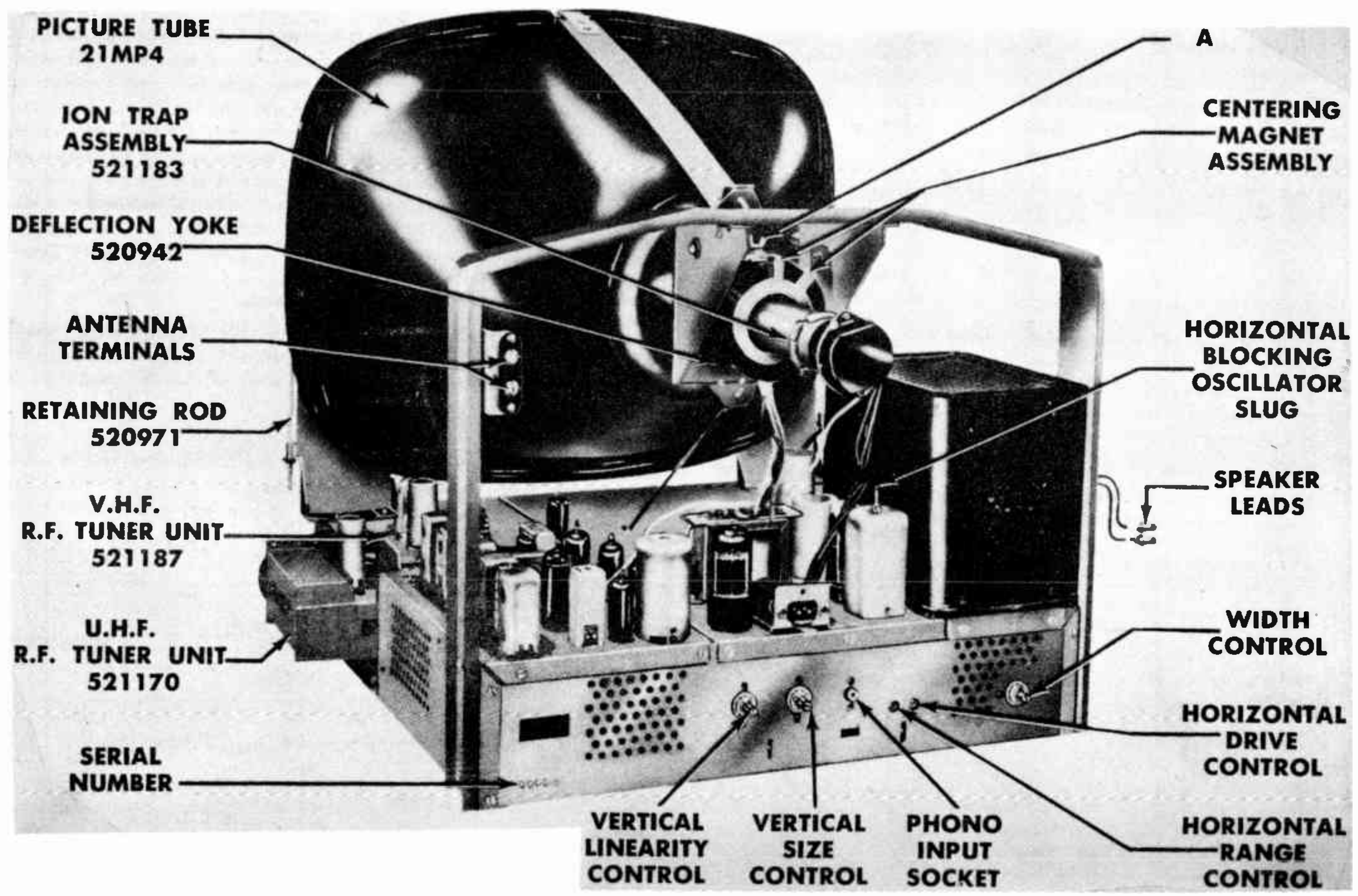


Fig. 15—CHASSIS AND PICTURE TUBE ASSEMBLY

ALIGNMENT PROCEDURE

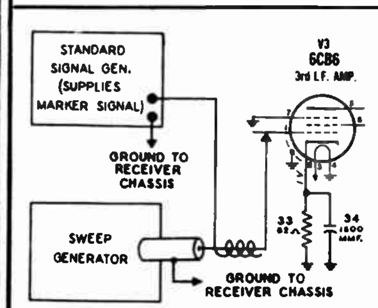
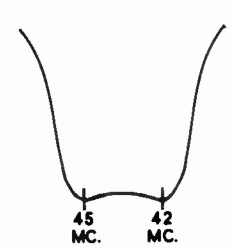
SOUND CHANNEL ALIGNMENT PROCEDURE

1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and Contrast control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. A small screwdriver (preferably non-metallic) can be used for alignment of Sound IF. The blade of this tool will fit the slot in the core of the transformer.

STANDARD SIGNAL GENERATOR		VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNEC-TIONS	FREQUENCY				
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Contrast control to its maximum counter-clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in Fig. 3. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V1, V2 or V3). This will prevent noise in the RF stages from affecting the voltage reading while adjusting the sound trap.	**#1** 4.5 MC Sound Trap (See Fig. 10)	Adjust for minimum reading on VTVM.
Same as above	Same as above.	Connect as shown in Fig. 4.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	**#2** Discriminator Secondary (See Fig. 10)	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary (See Fig. 8)	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 5.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 5.	**#2** Discriminator Secondary (See Fig. 10)	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.

Replace the type 6CB6 tube previously removed in the above procedure and turn set on. Tune in to a local channel and should there be an unusual amount of "Intercarrier Buzz" refer to procedure on adjoining page to remove this aforementioned fault.

IF CHANNEL ALIGNMENT PROCEDURE

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR **42 Mc. & 45 Mc.** SWEEP GENERATOR **45 Mc.** Sweep Width 10 Mc.	Detune 2nd IF transformer by soldering a short piece of wire or connecting a clip to pin 5 of V2 (6CB6, 2nd IF Amp.) Other end of wire or clip is left unconnected.	**#5 and #6** 3rd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

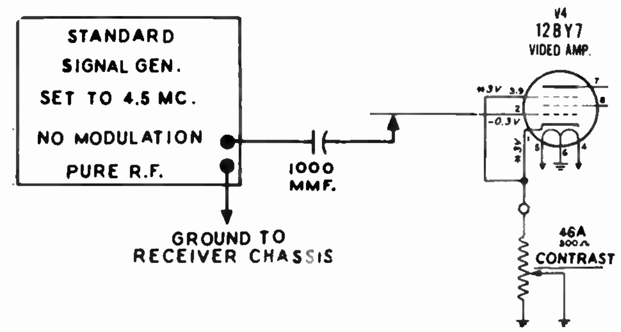


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

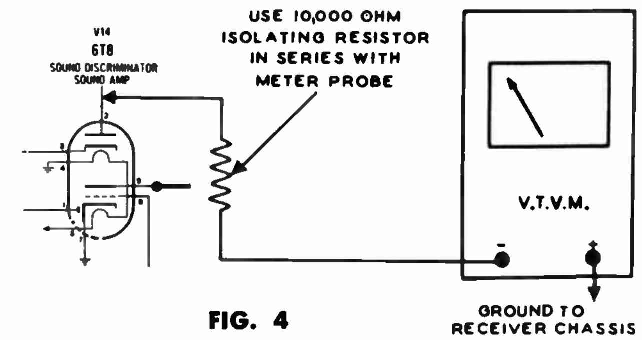


FIG. 4
VTVM Connections for Sound IF Alignment

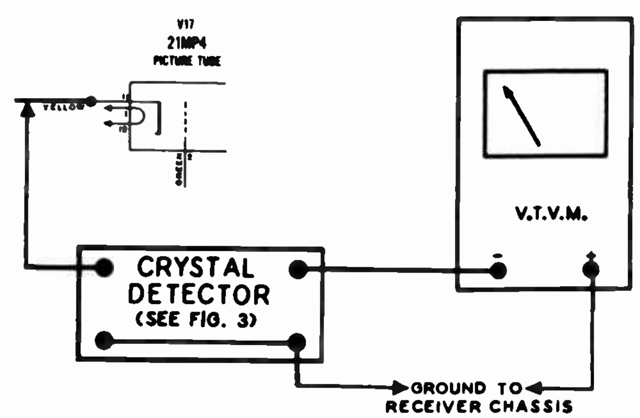


FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

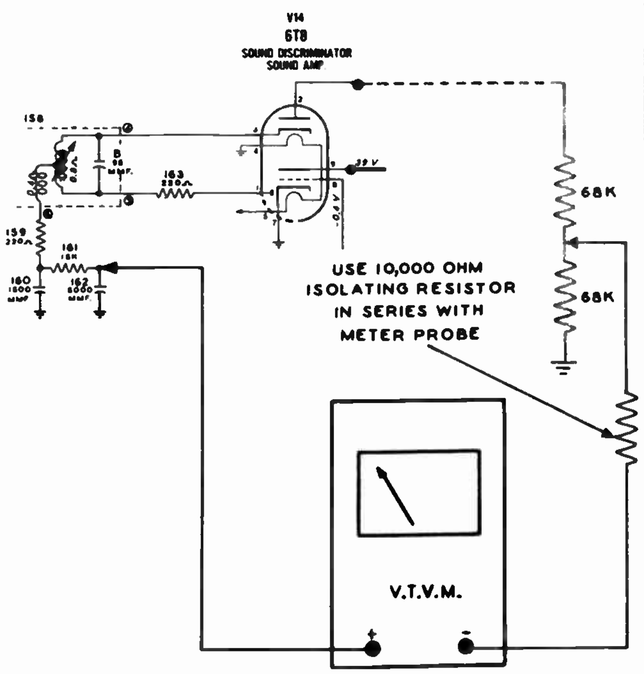


FIG. 5
VTVM Connections for Sound Discriminator Alignment

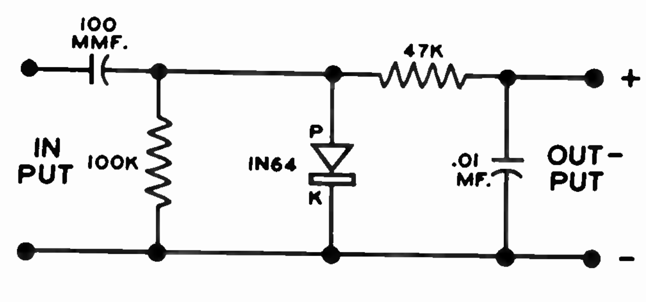
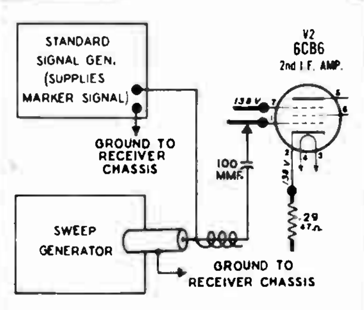
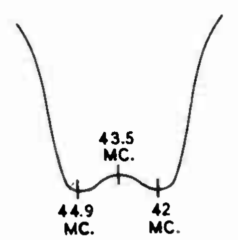
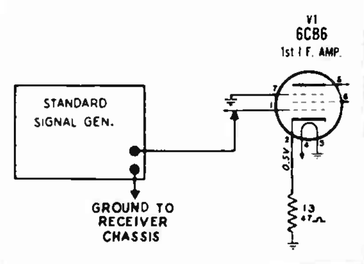
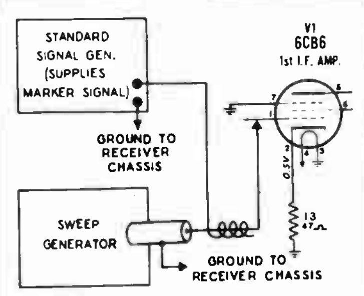
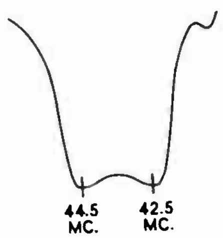
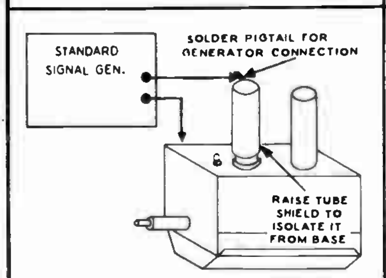


FIG. 3
Circuit Diagram for Crystal Detector shown in Fig. 2

REDUCTION OF INTERCARRIER BUZZ

Under actual reception conditions slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under these conditions.

Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

 	**STANDARD SIGNAL GENERATOR** **42 Mc., 43.5 Mc. & 44.9 Mc.** **SWEEP GENERATOR** **45 Mc.** Sweep Width 10 Mc.	Remove detuning clip discussed in previous step. Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	**# 7 and # 8** 2nd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
 	**STANDARD SIGNAL GENERATOR** **41.25 Mc.** **SWEEP GENERATOR** Not Used	Disconnect 3 volt AGC battery from receiver.	**# 9** Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR **47.25 Mc.** **SWEEP GENERATOR** Not Used	Same as above.	**# 10** Adjacent Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
 	**STANDARD SIGNAL GENERATOR** **42.5 Mc. & 44.5 Mc.** **SWEEP GENERATOR** **45 Mc.** Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	**# 11** 2nd IF Grid Coil **and** **# 12** 1st IF Plate Coil (See Fig. 9)	Adjust trimmers for maximum amplitude bandwidth and correct positioning of markers as shown. 
 	**STANDARD SIGNAL GENERATOR** **39.75 Mc.** **SWEEP GENERATOR** Not Used	Disconnect 3 volt AGC battery from receiver.	**# 13** Adjacent Picture IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.

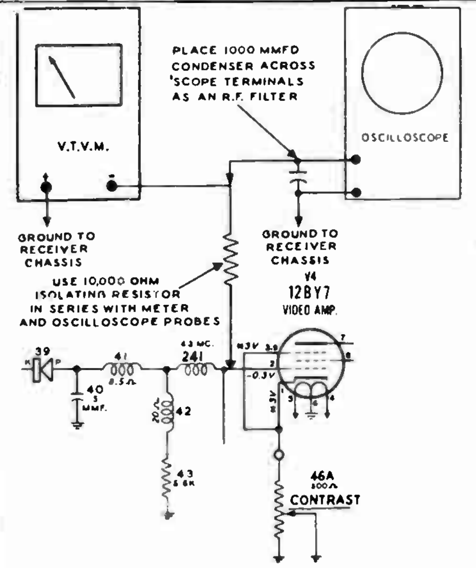


FIG. 7
VTVM and Oscilloscope Connections for IF Channel Alignment

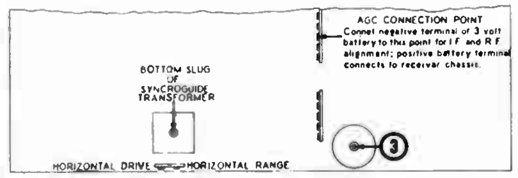


FIG. 8
Bottom View of Chassis

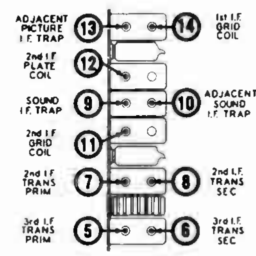


FIG. 9
View of IF Strip

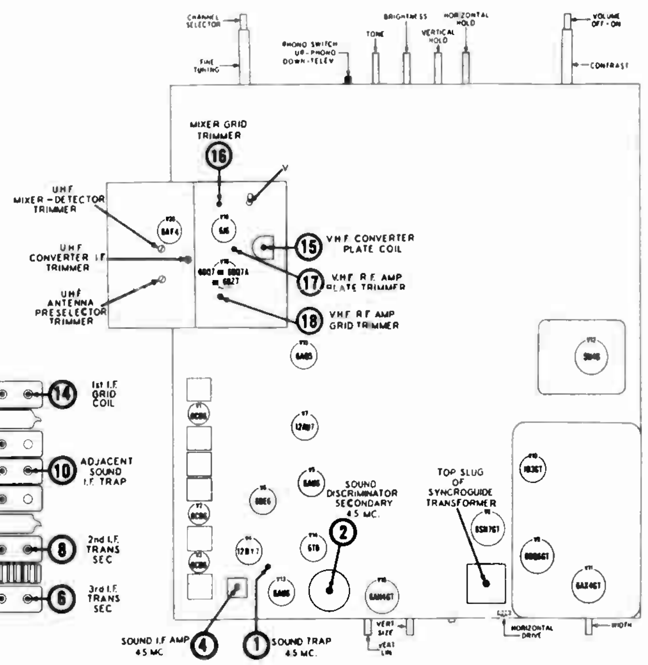
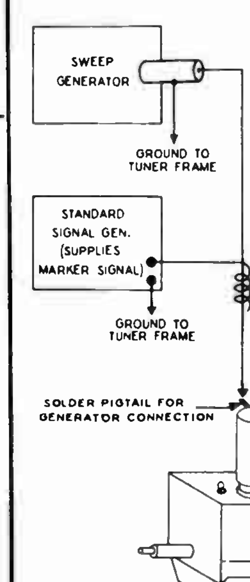
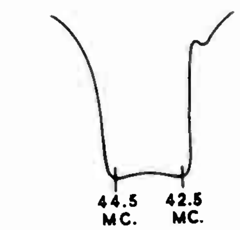
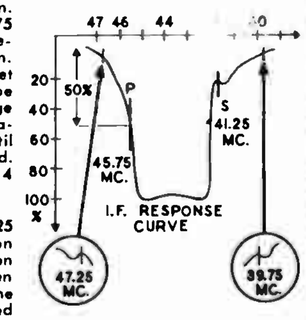


FIG. 10
Top View of Chassis

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
 	**STANDARD SIGNAL GENERATOR** **42.5 Mc. & 44.5 Mc.** **SWEEP GENERATOR** **45 Mc.** Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	**# 14** 1st IF Grid Coil (See Fig. 9) **#15** Converter Plate Coil (See Fig. 10)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR **39.75 Mc., 41.25 Mc., 45.75 Mc. & 47.25 Mc.** **SWEEP GENERATOR** **45 Mc.** Sweep Width 10 Mc.	Same as above.	The general shape of the overall IF response curve and position of markers should compare with that shown. The picture carrier marker (45.75 Mc.) should appear at approximately the 50% amplitude position. Should this observation fail to meet the above requirement, it will be necessary to make a small change in the setting of one or a combination of the following trimmers until the desired results are achieved. Trimmers, # 5, 6, 7, 8, 11, 12, 14 and slug 15. The sound carrier marker (41.25 Mc.) should appear at the position shown on the curve. If the position of this marker is not correct, then it will be necessary to readjust the setting of trimmer # 9 as explained previously in this procedure. To properly observe the position of the adjacent channel picture carrier (39.75 Mc.) and the adjacent channel sound carrier (47.25 Mc.), it will be necessary to increase the vertical gain control on the 'scope and the output of the sweep and standard signal generators. Also, be sure to disconnect the 3 volt AGC battery from receiver. If these markers do not compare favorably with that shown, repeat the adjustment of trimmers # 10 and 13 as explained previously in this procedure, exercising greater care in obtaining a minimum reading on the VTVM.	

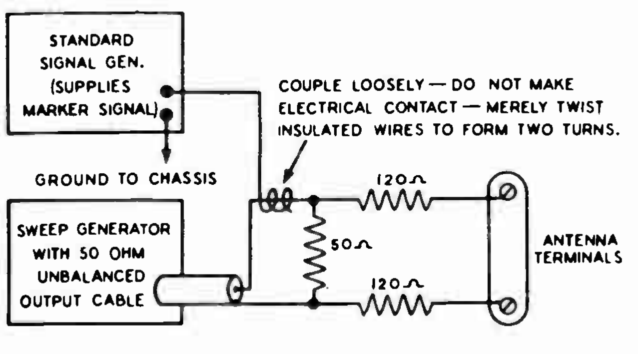
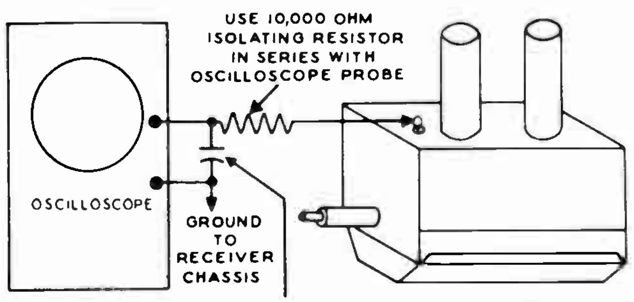


FIG. 11
Generator Connections for RF Channel Alignment



PLACE 1000 MMF. CONDENSER ACROSS SCOPE TERMINALS AS AN R.F. FILTER

FIG. 12
Oscilloscope Connections for RF Amp. and Mixer Alignment

GAMBLE-SKOGMO TV PAGE 14-3

MODELS 45TV13-43-9038A, Cambridge; 45TV13-43-9081A, Kenwood

VHF RF CHANNEL ALIGNMENT PROCEDURE

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR CONNECTIONS	SWEEP GENERATOR FREQ.	VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 11.	209.75 MC. Sound Carrier 205.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Not used.	Connect as shown in Fig. 12.	Set Channel Selector to #12. IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	#16 Mixer Grid. (See Fig. 18) #17 RF Amp. Plate. (See Fig. 18) #18 RF Amp. Grid. (See Fig. 18)	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 15. Use Mixer Grid trimmer #16; and RF Amplifier Plate trimmer #17 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #18 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. IMPORTANT: When adjusting trimmers #16, 17 and 18 it will be noted that the bond pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Not used.	Same as above.	Set channel selector to channel being observed.		The RF bond pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #16, 17 and 18. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. Band pass characteristic of these channels should conform close to the RF response curve in Fig. 15. If necessary, a compromise may be obtained to compensate for large variations in channel response by returning to channel #12 and making slight changes in the settings of trimmers #16, 17 and 18.

OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in IF alignment procedure.
2. During oscillator alignment, it is necessary to set the Fine Tuning control so that the tooth on the fiber fine tuning cam points downward (correct position for this control is shown in Fig. 17).
3. During this step and thru-out all succeeding steps it is necessary to: keep output of sweep generator at a level that does not allow reading on VTVM to exceed one volt.
4. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR CONNECTIONS	SWEEP GENERATOR FREQ.	VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 11.	209.75 MC. Sound Carrier Marker. 205.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Connect as shown in Fig. 13.	Connect as shown in Fig. 13.	Set Channel Selector to #12. Be sure that generator's output does not exceed voltage specified in instructions #3 and 4 above.	Using a non-metallic screwdriver to adjust channel #12 oscillator slug (accessible thru hole on front of RF Tuner Unit—see Fig. 17) shift response curve so that picture carrier marker is located at the position indicated in Fig. 16. Position of sound carrier marker should appear as indicated in Fig. 16.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Same as above.	Same as above.	Set channel selector to channel being observed.	Adjust the RF sweep generator and marker generator for operation on the other television channels. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of RF Tuner Unit (see Fig. 17). This permits response curve to be shifted so that picture and sound carriers markers will appear at the position indicated in Fig. 16. NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 17).

If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel. If characteristic does not conform reasonably well within the typical curve shown in Fig. 15, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

CHANNEL NUMBER	PICTURE CARRIER MARKER FREQ.	SOUND CARRIER MARKER FREQ.
13	211.25 MC.	215.75 MC.
12	205.25 MC.	209.75 MC.
11	199.25 MC.	203.75 MC.
10	193.25 MC.	197.75 MC.
9	187.25 MC.	191.75 MC.
8	181.25 MC.	185.75 MC.
7	175.25 MC.	179.75 MC.
6	83.25 MC.	87.75 MC.
5	77.25 MC.	81.75 MC.
4	67.25 MC.	71.75 MC.
3	61.25 MC.	65.75 MC.
2	55.25 MC.	59.75 MC.

FIG. 14

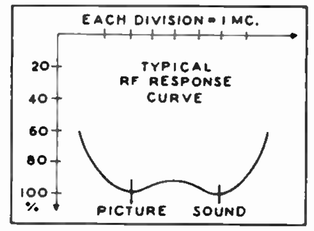


FIG. 15

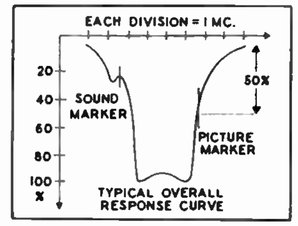


FIG. 16

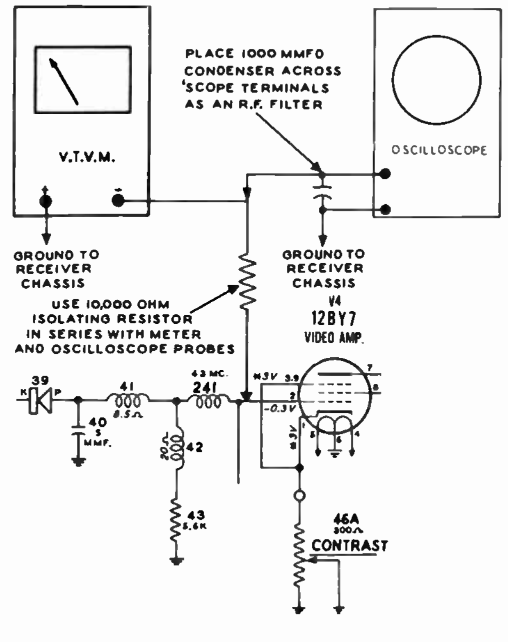


FIG. 13
VTVM and Oscilloscope Connections for Oscillator Alignment

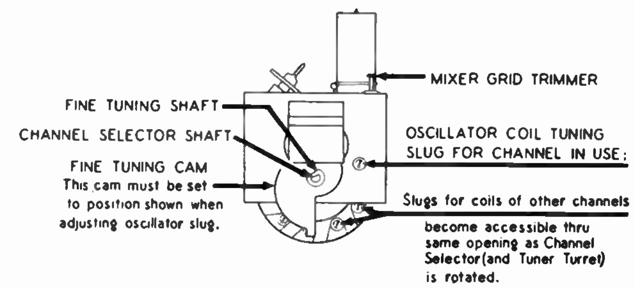


FIG. 17
Front View of VHF RF Tuner Unit

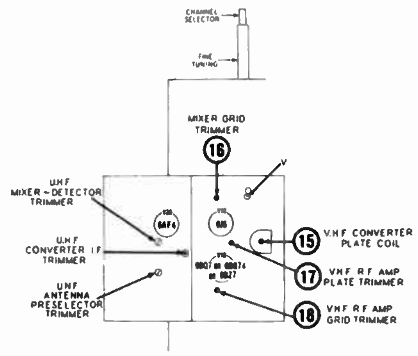
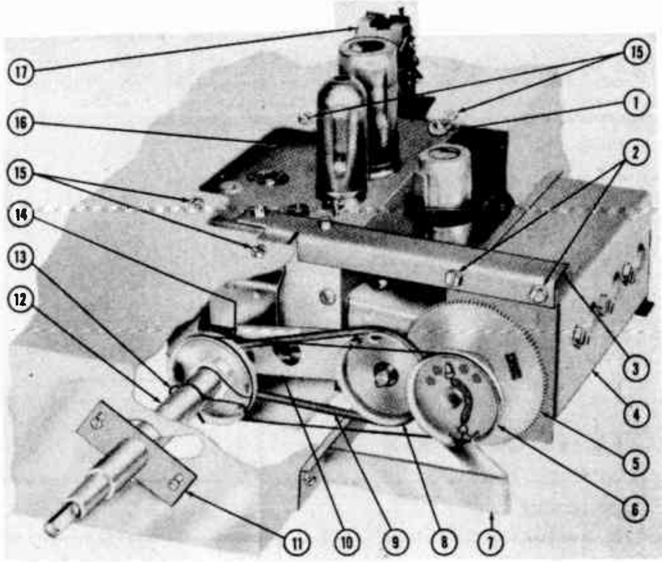


FIG. 18
Trimmer Location of VHF RF Tuner

V.H.F.–U.H.F. TUNER SERVICING PROCEDURE



The tuning mechanism of this receiver comprises two R.F. tuning units—a 13-position V.H.F. tuner which covers the 12 V.H.F. channels and a continuous type U.H.F. tuner which covers all of the U.H.F. television channels.

When it is necessary to remove the tuning units for service, it can be accomplished by following the procedure given in the following paragraphs. For simplicity, there is a separate removal procedure for each of the tuners.

Instructions for replacing the U.H.F. tuning belt and the dial drive cord are also given below.

REMOVING U.H.F. TUNER

(Numbers which appear after parts mentioned in text refer to parts shown in illustration above.)

1. Disconnect leads marked S, R and T on "Bottom View of Chassis Showing Connections of R.F. Tuners." Also disconnect 300-ohm twin-lead to U.H.F. Tuner (4) at V.H.F. Selector Switch (17); terminals S3 and S12.
2. Remove Bracket and Triangular Shaped Guard (7) shielding U.H.F. Tuning Gear (5).
3. Turn fine tuning knob until U.H.F. tuner shaft is fully counter-clockwise, then loosen two set screws and slide U.H.F. Dial Drive Pulley (6) off of shaft. (To avoid the necessity of restringing U.H.F. dial drive cord, hold Drive Pulley (6) so that cord does not slip off and clamp cord tightly around pulley by wrapping "scotch" tape around the two strands of cord as near as possible to the pulley. Also clamp cord around Dial Pulley and Shaft (12) in this manner.)
4. Remove the two U.H.F. Tuner Mounting Screws (2) and a third screw (not shown in illustration) located underneath chassis on Mounting Bracket (1).
5. Loosen the two set screws on U.H.F. Tuning Gear (5) and free tuner from mounting by pulling away from bottom of chassis. Tuner may now be completely removed by sliding it toward rear of chassis, thus disengaging unit from Gear (5) and Pulley Brackets (10).

If tuner is returned to factory for repair it must be shipped with all parts removed as indicated above.

REMOVING V.H.F. TUNER

(Numbers which appear after parts mentioned in text refer to parts shown in illustration above.)

1. Remove U.H.F. tuner as described above.
2. Disconnect leads marked M, N, P, Q and U on "Bottom View of Chassis Showing Connections of R.F. Tuners." Also disconnect the two white and yellow leads from the tuner to the V.H.F. Selector Switch (17); at terminals S8 and S17.
3. Rotate Channel Selector knob until V.H.F. Selector Switch Actuator Cam is completely disengaged from Switch (17) and remove the two switch mounting screws.
4. Remove channel Selector knob, Fine Tuning knob and U.H.F. Dial from their shafts by pulling them forward.
5. Remove Fiber Bracket (11) which supports tuner operating shafts. Also remove fiber dial lite shield which is fastened by one of the fiber bracket mounting screws.
6. Remove the four Tuner Mounting Screws (15) and lift V.H.F. tuner (16) from chassis.
7. Remove Clip (13) which retains U.H.F. Dial Shaft and Pulley (12) and slide shaft and pulley off of inner shaft.
8. Remove U.H.F. Tuning Belt (9) from pulleys.
9. Loosen two set screws and remove U.H.F. Tuning Pulley (14).
10. Remove U.H.F. Tuning Pulley and Bracket Assembly (10).
11. Remove Front Mounting Bracket (3) and Rear Mounting Bracket (1).
12. Loosen set screw and remove V.H.F. Selector Switch Actuator Cam mounted on rear of turret shaft.

If tuner is returned to factory for repair it must be shipped with all parts removed as indicated above.

REINSTALLING TUNERS

The reinstallation of the tuner can be made in the reverse order given in the removal procedure, observing the following precautions.

1. Remount V.H.F. Tuner (16) in mounting holes that place tuner as far back on chassis as possible.
2. Position coaxial cable lead so that it completely clears the V.H.F. Selector Switch Actuator Cam.
3. When reinstalling U.H.F. Dial Drive Pulley (6), turn U.H.F. tuning shaft to its extreme counter-clockwise position and turn Drive Pulley (6) until the opening in its rim is as shown in **lower** illustration before tightening pulley set screws.
4. When removing "scotch" tape from U.H.F. dial drive card, hold drive pulleys so that cord is sufficiently taut to prevent it from sliding off of pulleys.
5. Before replacing U.H.F. dial, be sure that **"Fine Tuning" shaft** is in a fully counter-clockwise position or until U.H.F. dial shaft is fully **clockwise.** Place U.H.F. dial on its shaft so that the number 83 is in top center position.

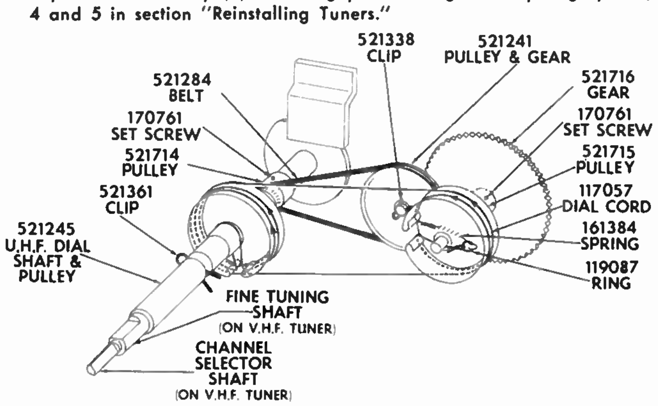
REPLACING U.H.F. DIAL DRIVE CORD

As it is necessary to remove drive cord when replacing U.H.F. Tuning Belt (9), the belt should be replaced at this time if it is worn. The method of accomplishing this is given in a separate procedure outlined below.

1. Remove Bracket and Triangular Shaped Guard (7).
2. Turn U.H.F. tuner shaft fully counter-clockwise and if necessary loosen set screws and turn Drive Pulleys (6) and (12) until opening in their rims are located as shown in **lower** illustration.
3. String drive cord by placing ring at end of cord over tongue of Drive Pulley (6) and winding cord around pulleys as shown in **lower** illustration.
4. Replace U.H.F. dial by following procedure given in paragraph 5 in section entitled "Reinstalling Tuners."

REPLACING U.H.F. TUNING BELT

1. Follow steps 2 and 3 in procedure entitled "Removing U.H.F. Tuner" and step 4 in procedure entitled "Removing V.H.F. Tuner."
2. Remove old Tuning Belt (9) by pulling it over Drive Pulleys (6) and (12) and through shaft opening on front of chassis.
3. Install new belt by using reverse of procedure given in step 2 above.
4. Replace Drive Pulley (6) following procedure given in paragraphs 3, 4 and 5 in section "Reinstalling Tuners."



DIAL DRIVE CORD ARRANGEMENT

SYNCROGUIDE TRANSFORMER ALIGNMENT

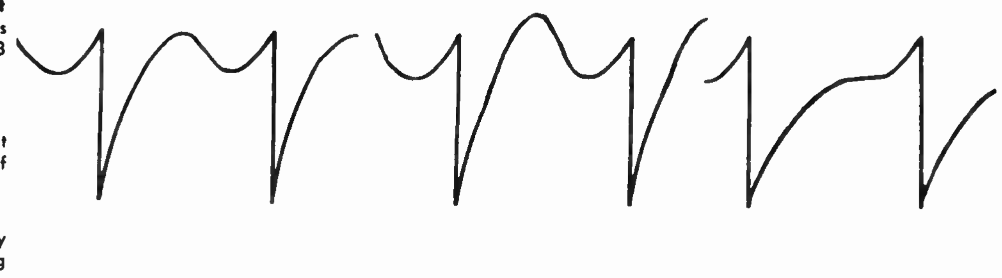
(Chassis that do not include series "E" change)

Alignment of the Syncroguide transformer, circuit diagram #128, which is used in the Horizontal Oscillator circuit on those receivers that **do not** include the letter "E" in the series designation at the rear of the chassis, can be accomplished by utilizing the procedure outlined below. To perform this alignment, it will be necessary to use an oscilloscope, preferably one that has a 2 megacycle response and a low input capacity probe—under 100 mmfd. to ground.

1. Set the "Top Slug" and "Bottom Slug" of the Syncroguide transformer to their maximum counter-clockwise positions.
2. Short together terminals C and D of the Syncroguide transformer.
3. Set "Horizontal Range" control, located on rear of chassis pan, to its maximum clockwise position.
4. Set "Horizontal Hold" control, located at front of chassis to its maximum counter-clockwise position.
5. Turn on receiver and tune in any local TV channel.
6. Adjust "Top Slug" clockwise until picture just locks in horizontally.
7. Remove short from terminals C and D. If picture does not hold sync when short is removed, adjust "Bottom Slug" clockwise until picture locks in.
8. Connect 'scope to terminal C of Syncroguide transformer and adjust sweep rate of 'scope until two cycles of oscillogram remain stationary. Turn "Bottom Slug" clockwise until wave form peaks are equal in height as shown in Fig. 1.

IMPORTANT: The first peak of the wave form should never be higher than the second peak nor should the first peak be lower than the second peak by more than 3%. Also when adjusting the "Bottom Slug," the picture must be in sync, therefore it may be necessary to turn the "Horizontal Hold" control clockwise when performing this step. After this adjustment has been completed, disconnect 'scope from receiver.

9. Set "Horizontal Hold" control counter-clockwise and adjust "Top Slug" until picture is locked in and does not lose sync when switching "Channel Selector" knob. Then, turn "Top Slug" slowly counter-clockwise until picture is just ready to lose sync as shown in Fig. 4.
10. Horizontal holding action of receiver should now be as follows:
    a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 4 or be out of sync.
    b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.
    c. When "Horizontal Hold" control is in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.
11. If the foregoing steps fail to correct for loss of horizontal holding action under normal receiver operation, be sure that condenser 130 (.01 mfd.) connected across terminals C and D of the Syncroguide transformer is part 512311, tubular, .01 mfd., 400 V. Do not use a substitute part.



CORRECT
Fig. 1

INCORRECT
Fig. 2

INCORRECT
Fig. 3

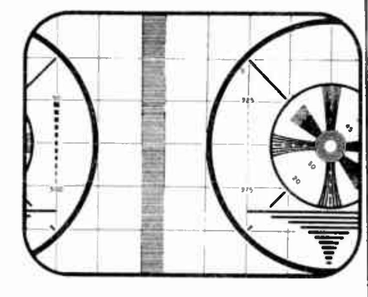


Fig. 4

SYNCROGUIDE TRANSFORMER ALIGNMENT

(Series "E" type chassis)

Alignment of the Syncroguide transformer, circuit diagram #128, which is used in the Horizontal Oscillator circuit can be accomplished by utilizing the procedure outlined below. To perform this alignment, it will be necessary to use an oscilloscope, preferably one that has a 2 megacycle response and a low input capacity probe—under 100 mmfd. to ground.

1. Set the "Top Slug" and "Bottom Slug" of the Syncroguide transformer to their maximum counter-clockwise positions.
2. Short together terminals C and D of the Syncroguide transformer.
3. Adjust "Horizontal Drive" control, located on rear of chassis pan one-half turn out from its maximum clockwise position.
4. Set "Horizontal Hold" control, located at front of chassis, to its maximum clockwise position.
5. Turn on receiver and tune in any local TV channel.
6. Adjust "Top Slug" clockwise until picture just locks in horizontally.
7. Remove short from terminals C and D. If picture does not hold sync when short is removed, adjust "Bottom Slug" clockwise until picture locks in.
8. Connect 'scope to terminal C of Syncroguide transformer and adjust sweep rate of 'scope until two cycles of oscillogram remain stationary. Turn "Bottom Slug" clockwise until wave form peaks are equal in height as shown in Fig. 1.

IMPORTANT: The first peak of the wave form should never be higher than the second peak nor should the first peak be lower than the second peak by more than 3%. Also, when adjusting the "Bottom Slug," the picture must be in sync, therefore, it may be necessary to turn the "Horizontal Hold" control counter-clockwise when performing this step. After this adjustment has been completed, disconnect 'scope from receiver.

9. Set "Horizontal Hold" control counter-clockwise and adjust "Top Slug" until picture is locked in and does not lose sync when switching "Channel Selector" knob. Then, turn "Top Slug" slowly counter-clockwise until picture is just ready to lose sync as shown in Fig. 4.
10. Horizontal Holding action of receiver should now be as follows:
    a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 4 or be out of sync.
    b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.
    c. When "Horizontal Hold" control is in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.

PRODUCTION CHANGES

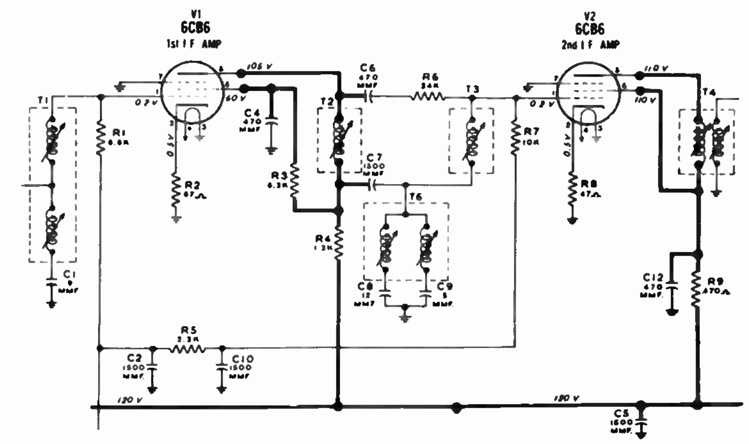
The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. The coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES 8E" does not include changes "A" or "C" or "D".

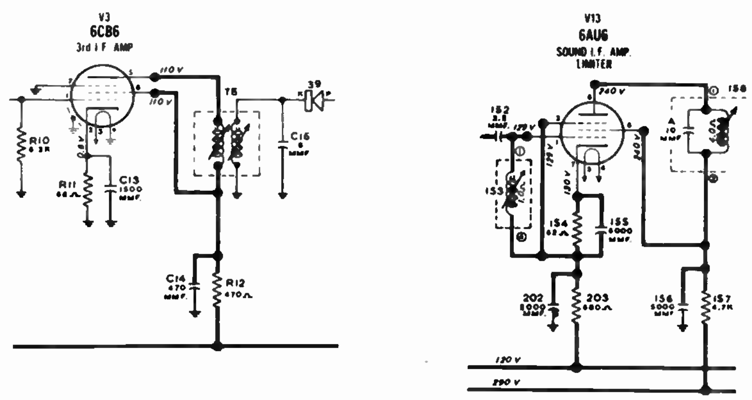
The circuit shown on this page applies to "SERIES ABCDEFGHJK" chassis

A letter following the component circuit diagram number thus—201^A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
UNCODED	**INITIAL PRODUCTION**

"A" The following changes were incorporated to provide for the use of an alternate type of I. F. system.
1. The voltage supply of the various elements of tube V1 (1st I.F. Amp.) and V2 (2nd I.F. Amp.) and V13 (Sound I.F. Amp-Limiter) as well as components to these elements were changed. The circuit, for tubes V1, V2, V3, and V13 for chassis that do not incorporate the letter "A" is shown below:





"B" The following changes were incorporated to improve interlace and vertical hold action.
1. Change condenser 71 in plate circuit of tube V7B (Vert. Blocking Osc.) from 5000 Mmfd. to .03 Mfd.
2. Change resistor 186 in grid circuit of tube V78 (Vert. Blocking Osc.) from 1.5 Meg. to 1.2 Meg.

"C" The following change was incorporated to reduce current drain.
1. Omit resistor 208 (7500 Ohms) connected between the 120 volt supply and the 270 volt supply.

This change should only be undertaken when the letter "A" is incorporated in series designation at rear of chassis.

"D" The following change was incorporated to prevent regeneration in I.F. system.
1. Add trap coil 241 (Part 522020) between the grid of tube V4 (Video Amp.) and perking coil 41.

"E" The following changes were incorporated to extend the useful range of the Horizontal Hold control.
1. Change Horizontal Range 108-A control in the grid circuit of V8A (Horizontal A.F.C.) from a variable condenser (10-160 Mmfd.) to a fixed condenser 218 (47 Mmfd.).
2. Change resistor 113 in grid circuit of tube V8A (Horizontal A.F.C.) from 150,000 Ohms to 220,000 Ohms.
3. Change resistor 114 in grid circuit of tube V8A (Horizontal A.F.C.) from 330,000 Ohms to 1 Meg.
4. Add resistor 212 (150,000 Ohms) from the junction of condenser 109 (47 Mmfd.) and resistor 114 (1 Meg.) to chassis ground.
5. Remove resistor 133 (10,000 Ohms) in grid circuit of tube V9 (Horizontal Scanning Output) and replace with condenser 133 (270 Mmfd.).
6. Change resistor 97 in grid circuit of tube V6 (Gated Sync. Separator) from 820,000 Ohms to 1.5 Meg.
7. Change resistor 106 from 10,000 Ohms to 4700 Ohms and add resistor 105 (4700 Ohms) in series with resistor 106 and plate of tube V7A. Resistor 182 (18,000 Ohms) remains connected to the plate of tube V7A—12AU7 while condenser 107 (100 Mmfd.) is reconnected to the junction of resistors 105 and 106.

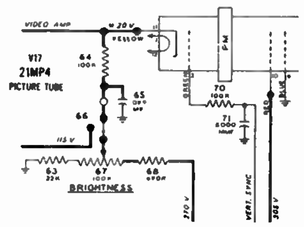
In addition to the above changes the Syncroguide transformer must be re-adjusted in accordance with the procedure (for a Series "E" chassis) given in the service data section of the manual.

The following changes were incorporated to improve the blanking during horizontal retrace interval.
1. Add resistor 213 (150,000 Ohms) between cathode of tube V9 (Horizontal Scanning Output) and the grid circuit of tube V17 (Picture Tube).
2. Add resistor 214 (1 Meg.) between pin 1 of the horizontal output transformer and grid circuit of tube V17 (Picture Tube).
3. Add resistor 215 (56,000 Ohms) from the junction of resistors 213 and 214 to chassis ground.
4. Add condenser 216 (100 Mmfd.) from the junction of resistors 213 and 214 to the grid of tube V17 (Picture Tube).

The following change was incorporated to reduce illumination of picture tube with minimum setting of the Brightness Control.
1. Change resistor 68 in the brightness circuit from 470,000 Ohms to 330,000 Ohms.

"F" The following change was incorporated to minimize frequency drift in the syncroguide circuit.
1. Change condenser 130 from a .01 Mfd. to a .01 Mfd. (Special characteristic) part 512311 only.

"G" The following changes were incorporated to improve the useful range of the Contrast control.
1. Change connection of Brightness control 67A associated circuit from cathode of tube V17 (Picture tube) to grid of the same tube. The Brightness circuit for chassis that do not incorporate the letter "G" is shown at the right:

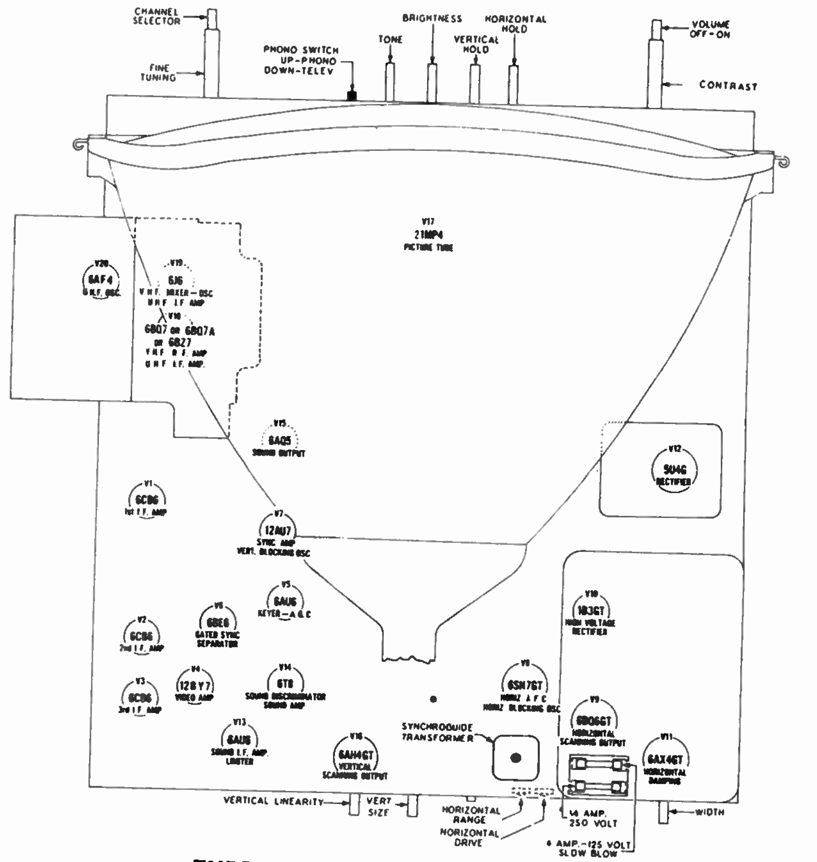


2. Add resistor 219 (470,000 Ohms) in parallel with condenser 62 (.1 Mfd.) located in cathode circuit of tube V17 (Picture tube).
3. Change resistor 70 in plate circuit of tube V7B (Vert. Blocking Osc.) from 100,000 Ohms to 47,000 Ohms and add condenser 210 (.1 Mfd.) in series with resistor 70. Connect other end of condenser 210 to the junction of condenser 190 (.047 Mfd.) and resistor 191 (8200 Ohms).

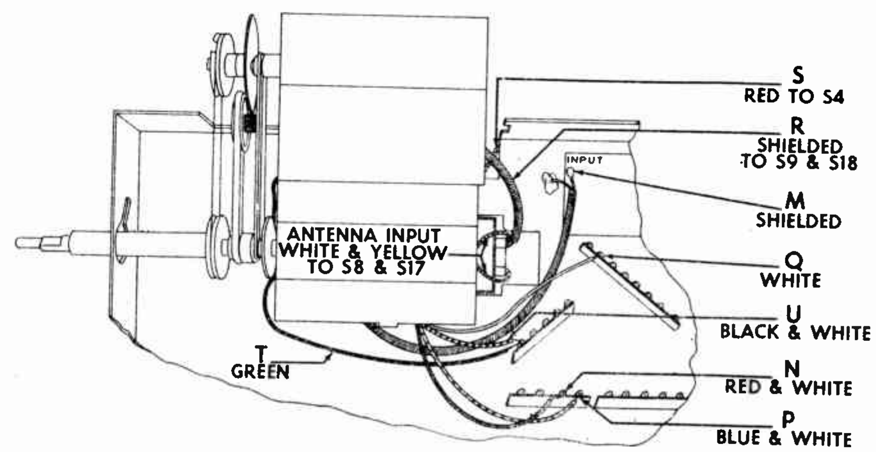
"H" The following changes were incorporated to improve the video response.
1. Change peaking coil 51 in plate circuit of tube V4 (Video Amp.) from part 520984 to 520689.
2. Change resistor 52 in parallel with peaking coil 51 from 15,000 Ohms to 12,000 Ohms.
3. Change peaking coil 53 in plate circuit of tube V4 (Video Amp.) from part 520986 to part 509342.
4. Change resistor 54 in plate circuit of tube V4 (Video Amp.) from 3900 Ohms to 2200 Ohms.
5. Change resistor 55 in plate circuit of tube V4 (Video Amp.) from 1500 Ohms to 1800 Ohms.

"J" The following change was incorporated to maintain proper focus for the normal range of the brightness control.
1. Change resistor 68 in brightness circuit from 100,000 Ohms to 220,000 Ohms.

"K" The following change was incorporated to permit the use of the I.F. system in various type chassis.
1. Add condenser 240 (680 Mmfd.) between the grid of tube V1 (1st I.F. Amp.) and I.F. transformer 9.



TUBE AND CONTROL LOCATIONS



BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNITS

PARTS LIST

Notice: Some parts listed below have special characteristics. Do not use substitutes for replacement purposes.

CONDENSERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
C 1	513447	Condenser—ceramic 9 Mmfd. ±10% 500v.
C 2	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 3	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 4	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.
C 5	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 6	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.
C 7	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 8	513448	Condenser—ceramic 12 Mmfd. ± 5% 500v.
C 9	513449	Condenser—ceramic 5 Mmfd. ±10% 500v.
C 10	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 11	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 12	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.
C 13	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 14	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.
C 15	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.
C 16	513443	Condenser—ceramic 8 Mmfd. ±10% 500v. (The above condensers were used when letter "A" is not included in series designations at rear of chassis.)
2	513038	Condenser—ceramic 1500 Mmfd. 400 volt
3	513038	Condenser—ceramic 1500 Mmfd. 400 volt
4	513038	Condenser—ceramic 1500 Mmfd. 400 volt
5	513013	Condenser—ceramic 5000 Mmfd. 450 volt
6	513013	Condenser—ceramic 5000 Mmfd. 450 volt
10	513455	Condenser—ceramic 8.2 Mmfd. ±5% 400 volt (Temperature compensating)
11	513038	Condenser—ceramic 1500 Mmfd. 400 volt
14	513037	Condenser—ceramic 470 Mmfd. 400 volt
18	513037	Condenser—ceramic 470 Mmfd. 400 volt
19	513038	Condenser—ceramic 1500 Mmfd. 400 volt
20	513448	Condenser—ceramic 12 Mmfd. ±5% 500 volt (Temperature compensating)
24	513449	Condenser—ceramic 5 Mmfd. ±1% 500 volt (Temperature compensating)
28	513038	Condenser—ceramic 1500 Mmfd. 400 volt
30	513037	Condenser—ceramic 470 Mmfd. 400 volt
34	513038	Condenser—ceramic 1500 Mmfd. 400 volt
35	513044	Condenser—ceramic 680 Mmfd. 400 volt
38	513454	Condenser—ceramic 4 Mmfd. ±1% 500 volt (Temperature compensating) (The above condensers were used when letter "A" is included in series designation at rear of chassis.)
40	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)
45	513013	Condenser—ceramic 5000 Mmfd. 450 volt
47	512238	Condenser—.22 Mfd. 200 volt
50	513438	Condenser—ceramic 47 Mmfd. ±5% 500 v. (Temperature compensating)
58	512239	Condenser—.47 Mfd. 200 volt
61	513032	Condenser—ceramic 220 Mmfd. 1000 volt
62	512216	Condenser—.1 Mfd. 200 volt
65	512235	Condenser—.047 Mfd. 200 volt
71	512210	Condenser—.03 Mfd. 200 volt (used when letter "B" is included in series designation at rear of chassis)
	513013	Condenser—ceramic 5000 Mmfd. 450 volt (used when letter "B" is not included in series designation at rear of chassis)
77	513013	Condenser—ceramic 5000 Mmfd. 450 volt
79	513013	Condenser—ceramic 5000 Mmfd. 450 volt
81	513013	Condenser—ceramic 5000 Mmfd. 450 volt
82	513013	Condenser—ceramic 5000 Mmfd. 450 volt
85-A,B,C	508072	Condenser—electrolytic A—40 Mfd. 450 volt; B—40 Mfd. 450 volt; C—40 Mfd. 450 volt
89	160095	Condenser—electrolytic 40 Mfd. 300 volt
90-A,B	509002	Condenser—electrolytic A—80 Mfd. 250 volt; B—100 Mfd. 50 volt
91	504719	Condenser—electrolytic 4 Mfd. 450 volt
95	512235	Condenser—.047 Mfd. 200 volt
98	512239	Condenser—.47 Mfd. 200 volt
103	512205	Condenser—.01 Mfd. 400 volt
107	512502	Condenser—mica 100 Mmfd. ±10% 500 volt
108	508071	Condenser—trimmer 10-160 Mmfd. (Horizontal Drive) (used when letter "E" is included in series designation at rear of chassis)
	520991	Condenser—trimmer assembly A—10-160 Mmfd. (Horizontal Range); B—10-160 Mmfd. (Horizontal Drive) (used when letter "E" is not included in series designation at rear of chassis)
109	513030	Condenser—ceramic 47 Mmfd. 1000 volt
110	512232	Condenser—.0022 Mfd. 400 volt
115	512235	Condenser—.047 Mfd. 200 volt

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
119	512239	Condenser—.47 Mfd. 200 volt
121	512236	Condenser—.047 Mfd. 400 volt
122	512233	Condenser—.022 Mfd. 400 volt
127	513427	Condenser—ceramic 200 Mmfd. ±2% (Temperature compensating)
130	512311	Condenser—.01 Mfd. 400 volt (Special characteristic) Do not use substitute.
131	512547	Condenser—mica 820 Mmfd. ±5% 500 volt
132	513009	Condenser—ceramic 1000 Mmfd. 500 volt
133	513006	Condenser—ceramic 270 Mmfd. 500 volt (used when letter "E" is included in series designation at rear of chassis)
135	512238	Condenser—.22 Mfd. 200 volt
137	512218	Condenser—.1 Mfd. 600 volt
141	512237	Condenser—.047 Mfd. 600 volt
142	512234	Condenser—.022 Mfd. 600 volt
144	520990	Condenser—ceramic 500 Mmfd. 20,000 volt
147	512235	Condenser—.047 Mfd. 200 volt
150	513027	Condenser—ceramic 56 Mmfd. ±10% 1500 v.
152	513001	Condenser—ceramic 2.2 Mmfd. 500 volt
155	513013	Condenser—ceramic 5000 Mmfd. 450 volt
156	513013	Condenser—ceramic 5000 Mmfd. 450 volt
158-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)
158-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)
160	513010	Condenser—ceramic 1500 Mmfd. 350 volt
162	513013	Condenser—ceramic 5000 Mmfd. 450 volt
165	513013	Condenser—ceramic 5000 Mmfd. 450 volt
166	512235	Condenser—.047 Mfd. 200 volt
167	513013	Condenser—ceramic 5000 Mmfd. 450 volt
170	505174	Condenser—electrolytic 10 Mfd. 150 volt
171	513010	Condenser—ceramic 1500 Mmfd. 350 volt
173	513006	Condenser—ceramic 270 Mmfd. 500 volt
174	512205	Condenser—.01 Mfd. 400 volt
175	512204	Condenser—.01 Mfd. 200 volt
179	513013	Condenser—ceramic 5000 Mmfd. 450 volt
183-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)
183-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)
183-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)
183-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)
185	512533	Condenser—mica 4700 Mmfd. ±5% 1000 v.
190	512236	Condenser—.047 Mfd. 400 volt
192	504719	Condenser—electrolytic 4 Mfd. 450 volt
194	512218	Condenser—.1 Mfd. 600 volt
206	513013	Condenser—ceramic 5000 Mmfd. 450 volt
210	512216	Condenser—.1 Mfd. 200 volt (used when letter "G" is included in series designation at rear of chassis)
216	512502	Condenser—mica 100 Mmfd. 500 volt (used when letter "E" is included in series designation at rear of chassis)
218	513030	Condenser—ceramic 47 Mmfd. 1000 volt (used when letter "E" is included in series designation at rear of chassis)
240	513044	Condenser—ceramic 680 Mmfd. 400 volt (used when letter "K" is included in series designation at rear of chassis)
404	509064	Condenser—trimmer 3-9 Mmfd.
406	513453	Condenser—ceramic 3 Mmfd. ±10% 500 v. (Temperature compensating)
408	513033	Condenser—ceramic 1.5 Mmfd. 500 volt
409	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)
415	513041	Condenser—ceramic 1000 Mmfd. 500 volt
417	509063	Condenser—trimmer 0.5-3 Mmfd.
418	513040	Condenser—ceramic 68 Mmfd. ±10% 500 v.
421	513450	Condenser—ceramic 5 Mmfd. ±5% 500 v.
422	*	Condenser—fine tuning (3-5 Mmfd)
423	520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)
426	513437	Condenser—ceramic 10 Mmfd. ±10% 500 volt (Temperature compensating)
427	509063	Condenser—trimmer 0.5-3 Mmfd
430	513041	Condenser—ceramic 1000 Mmfd. 500 volt
432	513451	Condenser—ceramic 6.8 Mmfd. ±5% 500 v.
435	513009	Condenser—ceramic 1000 Mmfd. 500 volt
436	513452	Condenser—ceramic 110 Mmfd. ±5%

*—This part is not supplied as a Service replacement item.
‡—This part is not supplied as a Service replacement item. Tuner to be returned to factory for repair.

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
437	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)
438	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)
439	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)
440	513041	Condenser—ceramic 1000 Mmfd. 500 volt
442	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)
443	513041	Condenser—ceramic 1000 Mmfd. 500 volt
503	‡	Condenser—ceramic 1.0 Mmfd. ±10% 500 v.
504	‡	Condenser—ceramic 1.0 Mmfd. ±10% 500 v.
506	‡	Condenser—trimmer 0.8-6.5 Mmfd.
508	‡	Condenser—ceramic 2.7 Mmfd. 500 v.
510	‡	Condenser—ceramic 0.25 Mmfd. ±10% 500 v.
511	‡	Condenser—ceramic 0.25 Mmfd. ±10% 500 v.
512	‡	Condenser—ceramic 100 Mmfd. ±10% 500 v.
513	‡	Condenser—ceramic 8.0 Mmfd. 500 v.
516	‡	Condenser—trimmer 0.8-6.5 Mmfd.
518	‡	Condenser—ceramic 2.5 Mmfd. ±10% 500 v.
519	‡	Condenser—ceramic 2.2 Mmfd. ±10% 500 v.
522	‡	Condenser—ceramic 0.68 Mmfd. ±10% 500 v.
524	‡	Condenser—trimmer 3-10 Mmfd.
529	‡	Condenser—ceramic 6.0 Mmfd. 500 v.
530	‡	Condenser—ceramic 68 Mmfd. 500 v.
532	‡	Condenser—ceramic 68 Mmfd. 500 v.

RESISTORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
R 1	510151	Resistor—carbon 6800 Ohms ±10% ½ watt
R 2	510112	Resistor—carbon 47 Ohms ±10% ½ watt
R 3	510153	Resistor—carbon 8200 Ohms ±10% ½ watt
R 4	510138	Resistor—carbon 1200 Ohms ±10% ½ watt
R 5	510142	Resistor—carbon 2200 Ohms ±10% ½ watt
R 6	510783	Resistor—carbon 24,000 Ohms ±5% ½ watt
R 7	510154	Resistor—carbon 10,000 Ohms ±10% ½ watt
R 8	510112	Resistor—carbon 47 Ohms ±10% ½ watt
R 9	510130	Resistor—carbon 470 Ohms ±10% ½ watt
R 10	510153	Resistor—carbon 8200 Ohms ±10% ½ watt
R 11	510114	Resistor—carbon 56 Ohms ±10% ½ watt
R 12	510130	Resistor—carbon 470 Ohms ±10% ½ watt (The above resistors were used when letter "A" is not included in series designation at rear of chassis.)
7	510118	Resistor—carbon 100 Ohms ±10% ½ watt
8	510348	Resistor—carbon 4700 Ohms ±10% 2 watt
12	510151	Resistor—carbon 6800 Ohms ±10% ½ watt
13	510112	Resistor—carbon 47 Ohms ±10% ½ watt
15	510151	Resistor—carbon 6800 Ohms ±10% ½ watt
17	510138	Resistor—carbon 1200 Ohms ±10% ½ watt
21	510783	Resistor—carbon 24,000 Ohms ±5% ½ watt
23	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.
26	510151	Resistor—carbon 6800 Ohms ±10% ½ watt
27	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.
29	510112	Resistor—carbon 47 Ohms ±10% ½ watt
32	510153	Resistor—carbon 8200 Ohms ±10% ½ watt
33	510117	Resistor—carbon 82 Ohms ±10% ½ watt
36	510130	Resistor—carbon 470 Ohms ±10% ½ watt (The above resistors were used when letter "A" is included in series designation at rear of chassis.)
43	510150	Resistor—carbon 5600 Ohms ±10% ½ watt
44	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.
48	510153	Resistor—carbon 8200 Ohms ±10% ½ watt
52	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt (used when letter "H" is included in series designation at rear of chassis)
	510744	Resistor—carbon 15,000 Ohms ±5% ½ watt (used when letter "H" is not included in series designation at rear of chassis)
54	510242	Resistor—carbon 2200 Ohms ±10% 1 watt (used when letter "H" is included in series designation at rear of chassis)
	510247	Resistor—carbon 3900 Ohms ±10% 1 watt (used when letter "H" is not included in series designation at rear of chassis)
55	510141	Resistor—carbon 1800 Ohms ±10% ½ watt (used when letter "H" is included in series designation at rear of chassis)
	510139	Resistor—carbon 1500 Ohms ±10% ½ watt (used when letter "H" is not included in series designation at rear of chassis)
56	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.
57	510701	Resistor—carbon 3.3 Meg. ±10% ½ watt
59	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.
60	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.
63	510157	Resistor—carbon 15,000 Ohms ±10% ½ w. (used when letter "G" is not included in series designation at rear of chassis)
64	510186	Resistor—carbon 560,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is not included in series designation at rear of chassis)

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION
68	510178	Resistor—carbon 220,000 Ohms ±10% ½ w. (used when letter "J" is included in series designation at rear of chassis)
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)
	510181	Resistor—carbon 330,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)
	510184	Resistor—carbon 470,000 Ohms ±10% ½ w. (used when letters "E," "G" and "J" are not included in series designation at rear of chassis)
70	510167	Resistor—carbon 47,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is not included in series designation at rear of chassis)
77	510101	Resistor—carbon 10 Ohms ±10% ½ w.
83	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.
84	510782	Resistor—wire wound 50 Ohms ±10% 5 w.
87	510741	Resistor—wire wound 600 Ohms ±10% 10 w.
88	510779	Resistor—wire wound 400 Ohms ±10% 10 w.
92	510139	Resistor—carbon 1500 Ohms ±10% ½ watt
93	510357	Resistor—carbon 15,000 Ohms ±10% 2 w.
94	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.
96	510193	Resistor—carbon 2.2 Meg. ½ watt
97	510752	Resistor—carbon 1.5 Meg. ±10% ½ watt (used when letter "E" is included in series designation at rear of chassis)
	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt (used when letter "E" is not included in series designation at rear of chassis)
99	510171	Resistor—carbon 82,000 Ohms ±10% ½ w.
100	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.
102	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.
104	510197	Resistor—carbon 10 Meg. ½ watt
105	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)
	510145	Resistor—carbon 3300 Ohms ±10% ½ w. (used when letter "E" is not included in series designation at rear of chassis)
106	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)
	510254	Resistor—carbon 10,000 Ohms ±10% 1 w. (used when letter "E" is not included in series designation at rear of chassis)
111	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.
112	510189	Resistor—carbon 820,000 Ohms ±10% ½ w.
113	510178	Resistor—carbon 220,000 Ohms ±10% ½ w. (used when letter "Q" is included in series designation at rear of chassis)
	510175	Resistor—carbon 150,000 Ohms ±10% ½ w. (used when letter "Q" is not included in series designation at rear of chassis)
114	510190	Resistor—carbon 1 Meg. ±10% ½ w. (used when letter "Q" is included in series designation at rear of chassis)
	510181	Resistor—carbon 330,000 Ohms ±10% ½ w. (used when letter "Q" is not included in series designation at rear of chassis)
116	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.
117	510281	Resistor—carbon 330,000 Ohms ±10% 1 w.
118	510148	Resistor—carbon 4700 Ohms ±10% ½ watt
120	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.
124	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.
125	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.
126	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.
129	510269	Resistor—carbon 68,000 Ohms ±10% 1 w.
133	510154	Resistor—carbon 10,000 Ohms ±10% ½ w. (used when letter "E" is not included in series designation at rear of chassis)
134	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.
136	510318	Resistor—carbon 100 Ohms ±10% 2 watt
138	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.
139	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt
143	510725	Resistor—carbon 3.3 Ohms ±10% ½ watt
145	510190	Resistor—carbon 1 Meg. ±10% ½ watt
146	510134	Resistor—carbon 680 Ohms ½ watt
154	510117	Resistor—carbon 82 Ohms ±10% ½ watt
157	510249	Resistor—carbon 4700 Ohms 1 watt
159	510124	Resistor—carbon 220 Ohms ±10% ½ watt
161	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.
163	510124	Resistor—carbon 220 Ohms ±10% ½ watt
164	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.
168	510197	Resistor—carbon 10 Meg. ½ watt
169	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.
172	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.
177	510778	Resistor—carbon 560,000 Ohms ±5% ½ w.
178	510747	Resistor—carbon 820,000 Ohms ±5% ½ w.
182	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.
183-B	508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)
183-D	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)
183-F	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)

*—This part is not supplied as a Service replacement item.
‡—This part is not supplied as a Service replacement item. Tuner to be returned to factory for repair.

RESISTORS—Continued

186	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt (used when letter "B" is included in series designation at rear of chassis)
	510767	Resistor—carbon 1.5 Meg. ±5% ½ watt (used when letter "B" is not included in series designation at rear of chassis)
188	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.
191	510153	Resistor—carbon 8200 Ohms ±10% ½ w.
193	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.
195	510193	Resistor—carbon 2.2 Meg. ½ watt
197	510129	Resistor—carbon 390 Ohms ±10% ½ watt
199	510132	Resistor—carbon 560 Ohms ±10% ½ watt
200	510132	Resistor—carbon 560 Ohms ±10% ½ watt
201	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.
204	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.
205	510348	Resistor—carbon 4700 Ohms ±10% 2 watt
207	510344	Resistor—carbon 2700 Ohms ±10% 2 watt
208	510727	Resistor—wire wound 7500 Ohms ±10% 5 w. (used when letter "C" is not included in series designation at rear of chassis)
209	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.
212	510175	Resistor—carbon 150,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)
213	510175	Resistor—carbon 150,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)
214	510190	Resistor—carbon 1 Meg. ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)
215	510168	Resistor—carbon 56,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)
217	510130	Resistor—carbon 470 Ohms ±10% ½ watt (used when letter "A" or "K" is included in series designation at rear of chassis)
219	510184	Resistor—carbon 470,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)
221	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is included in designation at rear of chassis)
403	510158	Resistor—carbon 15,000 Ohms ½ watt
405	510167	Resistor—carbon 47,000 Ohms ½ watt
410	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.
411	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.
414	510130	Resistor—carbon 470 Ohms ±10% ½ w.
416	510100	Resistor—carbon 10 Ohms ±10% ½ w.
419	510131	Resistor—carbon 470 Ohms ½ w.
420	510149	Resistor—carbon 4700 Ohms ½ watt
424	510158	Resistor—carbon 15,000 Ohms ½ watt
425	510179	Resistor—carbon 220,000 Ohms ½ watt
428	510155	Resistor—carbon 10,000 Ohms ½ watt
434	510158	Resistor—carbon 15,000 Ohms ½ watt
501	‡	Resistor—carbon 470,000 Ohms ½ watt
502	‡	Resistor—carbon 470,000 Ohms ½ watt
509	‡	Resistor—carbon 22 Ohms ½ watt
520	‡	Resistor—carbon 22 Ohms ½ watt
525	‡	Resistor—carbon 12,000 Ohms ±10% ½ w.

COILS AND TRANSFORMERS

T 1	521782	Coil—1st I.F. Grid and Adjacent Picture I.F. Trap
T 2	521783	Coil—1st I.F. Plate
T 3	521784	Coil—2nd I.F. Grid
T 4	521786	Transformer—2nd I.F.
T 5	521787	Transformer—3rd I.F.
T 6	521785	Trap—Sound I.F. and Adjacent Sound I.F. (The above coils and transformers were used when letter "A" is not included in series designation at rear of chassis)
9	521782	Coil—1st I.F. grid and Adjacent Picture I.F. Trap (used when letter "A" is included but letter "J" is not included in series designation at rear of chassis)
	522087	Coil—1st I.F. grid and Adjacent Picture I.F. Trap (used when letters "A" and "J" are included in series designation at rear of chassis)
16	521783	Coil—1st I.F. plate
22	521785	Trap—sound I.F. and Adjacent Sound I.F.
25	521906	Coil—2nd I.F. Grid
31	521786	Transformer—2nd I.F.
37	521907	Transformer—3rd I.F. (The above coils and transformers were used when letter "A" is included in series designation at rear of chassis)
41	520620	Coil—peaking
42	520985	Coil—peaking
49	509603	Coil—4.5. Mc. trap (includes slug and condenser #50)
	507357	Slug core for 4.5 Mc. trap coil
51	520689	Coil—peaking (used when letter "H" is included in series designation at rear of chassis)
	520984	Coil—peaking (used when letter "H" is not included in series designation at rear of chassis)

COILS AND TRANSFORMERS—Continued

53	509342	Coil—peaking (used when letter "H" is included in series designation at rear of chassis)
	520986	Coil—peaking (used when letter "H" is not included in series designation at rear of chassis)
76	520951	Transformer—power
86	508341	Choke—filter
128	520943	Transformer—syncroguide
	521064	Slug core for syncroguide transformer
140	521066	Transformer—horizontal output
151-A,B	520942	Yoke—picture tube deflection (includes leads, connectors and resistors #199 and #200)
153	509378	Transformer—audio take-off
158	509706	Transformer—TV sound discriminator (includes condensers 158A and 158B)
180	509376	Transformer—audio output
184	520980	Transformer—vertical blocking oscillator
198	520975	Transformer—vertical output (includes connectors for deflection yoke leads)
241	522020	Coil—43 Mc. trap (used when letter "D" is included in series designation at rear of chassis)
401	521821	Coil—U.H.F. I.F. Coupling (Coded "•1Q•") (includes resistors 414, 416 and condenser 415)
402	521822	Coil—antenna; channel #2 (Coded "•2Q•")
	521823	Coil—antenna; channel #3 (Coded "•3Q•")
	521824	Coil—antenna; channel #4 (Coded "•4Q•")
	521825	Coil—antenna; channel #5 (Coded "•5Q•")
	521826	Coil—antenna; channel #6 (Coded "•6Q•")
	521827	Coil—antenna; channel #7 (Coded "•7Q•")
	521828	Coil—antenna; channel #8 (Coded "•8Q•")
	521829	Coil—antenna; channel #9 (Coded "•9Q•")
	521830	Coil—antenna; chan. #10 (Coded "•10Q•")
	521831	Coil—antenna; chan. #11 (Coded "•11Q•")
	521832	Coil—antenna; chan. #12 (Coded "•12Q•")
	521833	Coil—antenna; chan. #13 (Coded "•13Q•")
407	520701	Coil—cathode coupling
412	521841	Coil—U.H.F. I.F. Coupling (Coded "•1R•")
413	521842	Coil—R.F. & osc.; chan. #2 (Coded "•2R•")
	521843	Coil—R.F. & osc.; chan. #3 (Coded "•3R•")
	521844	Coil—R.F. & osc.; chan. #4 (Coded "•4R•")
	521845	Coil—R.F. & osc.; chan. #5 (Coded "•5R•")
	521846	Coil—R.F. & osc.; chan. #6 (Coded "•6R•")
	521847	Coil—R.F. & osc.; chan. #7 (Coded "•7R•")
	521848	Coil—R.F. & osc.; chan. #8 (Coded "•8R•")
	521849	Coil—R.F. & osc.; chan. #9 (Coded "•9R•")
	521850	Coil—R.F. & osc.; ch. #10 (Coded "•10R•")
	521851	Coil—R.F. & osc.; ch. #11 (Coded "•11R•")
	521852	Coil—R.F. & osc.; ch. #12 (Coded "•12R•")
	521853	Coil—R.F. & osc.; ch. #13 (Coded "•13R•")
	507786	Slug for osc. coil; auxiliary fine tuning adj.
429	521834	Coil—neutralizing
431	521835	Choke—mixer plate
433	521836	Coil
441	520518	Coil—choke
444	520520	Coil—choke
505	‡	Industor—Ant. End
507A	‡	Inductor—Antenna Preselector tuning
507B	‡	Inductor—Mixer-Detector tuning
507C	‡	Inductor—Oscillator tuning
514	‡	Transformer—U.H.F. converter I.F.
515	‡	Inductor—Mixer End
517	‡	Coil—choke
523	‡	Inductor—Oscillator End
526	‡	Coil—choke
527	‡	Coil—choke
528	‡	Coil—choke
531	‡	Cail—choke

CONTROLS

46-A,B,C	521288	Contrast and Volume potentiometers (includes On-Off switch) A—Contrast (300 Ohms ½ watt) B—On-Off Switch C—Volume (1 Meg. ¼ watt)
66-A, B	520563	Switch, "PHONO-TELEV."
67	509893	Brightness potentiometer (100,000 Ohms ¼ watt)
108	508071	Horizontal Drive Condenser (10-160 Mmfd.) (used when letter "E" is included in series designation at rear of chassis)
	520991	Horizontal Range and Horizontal Drive trimmer condenser assembly A—Horizontal Range (10-160 Mmfd.) B—Horizontal Drive (10-160 Mmfd.) (used when letter "E" is not included in series designation at rear of chassis)
123	521059	Horizontal Hold potentiometer (50,000 Ohms ¼ watt)
148	520996	Width potentiometer (400 Ohms ±10% 4 w.)
176	520746	Tone potentiometer (500,000 Ohms ¼ watt)
187	521058	Vertical Hold potentiometer (1 Meg. ¼ w.)
189	520944	Vertical Size potentiometer (2.5 Meg. ¼ w.)
196	520945	Vertical Linearity potentiometer (5000 Ohms ½ watt)
422	*	Fine Tuning condenser (3-5 Mmfd.)

*—This part is not supplied as a Service replacement item.
‡—This part is not supplied as a Service replacement item. Tuner to be returned to factory for repair.

OTHER ELECTRICAL PARTS

39	509386	Crystal detector
69	521183	Ion trap
72	521267	Centering magnets (included with back cover of yoke)
75	521803	Fuse; 4 amp. 125 volt "Slow Blow"
78	118921	Channel lite (Mazda #47) 6-8V. 150 Ma.
149	508713	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt
181	508174	Speaker—P.M. Dynamic (6"x9"); Mod. 9081A
	509398	Speaker—P.M. Dynamic (6"); Model 9038A
183-A to G	508062	Integrator coupling unit A—Condenser—ceramic .01 Mfd. 450 v. B—Resistor—carbon 22,000 Ohms ⅕ w. C—Condenser—ceramic 2000 Mmfd. 450 v. D—Resistor—carbon 8200 Ohms ⅕ w. E—Condenser—ceramic 5000 Mmfd. 450 v. F—Resistor—carbon 8200 Ohms ⅕ w. G—Condenser—ceramic 5000 Mmfd. 450
239	521188	Switch, V.H.F.-U.H.F. selector
400	509695	Built-in antenna

MECHANICAL PARTS OF 521187 V.H.F. R.F. TUNER

(for electrical parts see preceding classified listings of condensers, resistors and coils)

521187	R.F. Tuner; 12 channels V.H.F., 1 position U.H.F. (includes tubes and tuning coils, LESS: U.H.F. dial shaft, pulleys, brackets, selector switch, and actuating cam)
521324	Bracket, pulley support
521321	Bracket, supports U.H.F. and V.H.F. tuners (front)
521322	Bracket, supports U.H.F. and V.H.F. tuners (rear)
521713	Cam, switch actuator (includes set screws)
507339	Clip for mounting converter plate coil
521361	Clip, retains U.H.F. dial shaft and pulley
521837	Fine tuning cam and shaft
521714	Pulley, U.H.F. tuning (includes set screws)
508708	Roller—detent
170761	Screw, set; #6-32 x ⅛" "Allen type"; retains tuning pulley
13392	Screw, set; #8-32 x 3/16" "Allen type"; retains cam
521245	Shaft and pulley far U.H.F. dial
520535	Shield, bottom cover
520536	Shield, side cover
520519	Shield, tube; miniature for 6BQ7, 6BQ7A or 6BZ7 tube
520534	Shield—tube; miniature for 6J6 tube
507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)
520521	Socket—miniature (9 pin) for 6BQ7, 6BQ7A or 6BZ7 (includes base for mounting shield)
507986	Slug for osc. coil fine tuning adjustment
509062	Slug core for converter plate coil
508709	Spring—detent
507967	Spring—turret shaft retaining
507966	Spring contactar washer (on front turret shaft)
507990	Spring—retains osc. fine tuning slug
520517	Stator contact assembly (includes 11 contacts and metal frame)
521838	Tuner turret and shaft assembly (less coils)
507965	Washer, fiber spacer (on turret shaft)

MECHANICAL PARTS OF 521170 U.H.F. R.F. TUNER

(for electrical parts see preceding classified listings of condensers, resistors and coils)

521170	R.F. Tuner; U.H.F. tuner, channels 14-83; (includes tubes, tuning segments and coils, LESS: pulleys, gears and brackets)
522018	Belt, U.H.F. tuning
521324	Bracket, pulley support
521321	Bracket, supports U.H.F. and V.H.F. tuners (front)
521322	Bracket, supports U.H.F. and' V.H.F. tuners (rear)
521338	Clip, retains U.H.F. tuning pulley and gear
117057	Cord—dial drive (3 ft. required)........per ft.
521282	Dial, U.H.F.
521716	Gear, U.H.F. tuning (includes set screws)
521715	Pulley, U.H.F. dial drive (includes set screws)
521241	Pulley and gear for U.H.F. tuning
170761	Screw, set; #6-32 x ⅛" "Allen type"; retains gear
111766	Spring, anti-backlash
161384	Spring—dial cord tension

CABINET PARTS

521106	Back for cabinet (less cup and power cord)
521971	Cabinet for Model 9038A
521969	Cabinet for Model 9081A
520492	Caster far console cabinet
520135	Cup for cabinet back

CABINET PARTS—Continued

521282	Dial, U.H.F.
520937	Glass window for picture tube
521278	Knob, Channel Selector
521281	Knob, Contrast
521280	Knob, V.H.F. Fine Tuning and U.H.F. Tuning
521279	Knob, "OFF-VOLUME-ON"
521102-A	Mask for picture tube
521757	Nameplate (includes spring and hinge)
520927	Screw—#6x1" oval head; mounts glass retaining strip
18807	Screw—#14x1"; mounts TV chassis
521455	Strip, wood; retains glass window
507351	Terminal strip for antenna connection

MISCELLANEOUS PARTS

521120	Base for mounting tube shield (9 pin)
522018	Belt, U.H.F. Tuning
520950	Bracket, bridge, supports rear of picture tube
521855	Bracket, chassis support at U.H.F. Tuner
520312	Bracket for mounting picture tube (front left hand)
520311	Bracket for mounting picture tube (front right hand)
521652	Bracket mounts antenna terminal strip
520952	Bracket; mounts rubber ring and supports flared neck of picture tube
509673	Bracket, mounts yoke
521324	Bracket; pulley support
521321	Bracket; supports U.H.F. and V.H.F. tuners (front)
521322	Bracket supports U.H.F. and V.H.F. tuners (rear)
521713	Cam; switch actuator (includes set screw)
521054	Clamp (plastic), for antenna lead
521267	Centering magnet (included with back cover of yoke)
508149	Clip for mounting antenna terminal strip
505101	Clip for mounting sound take-off transformer
507339	Clip for mounting V.H.F. video converter plate and trap coil
521065	Clip—retains horizontal output transformer
521361	Clip; retains U.H.F. dial shaft and pulley
521338	Clip; retains U.H.F. tuning pulley and gear
117057	Cord; dial drive (3 ft. required)...........Per ft.
521184	Connector for filament lead of 1B3GT tube (includes cap and lead)
521282	Dial; U.H.F.
520989	Fuse holder
521716	Gear; U.H.F. tuning (includes set screws)
521122	H.V. connector with Insulated lead
521123	H.V. connector with braided lead
521183	Ion trap
507699	Power cord assembly includes plugs at both ends
500966	Plug (1 pin) for Phono, input socket
521382	Plug (5 pin) for interconnection of chassis
521241	Pulley and gear for U.H.F. tuning
521715	Pulley; U.H.F. dial drive (includes set screws)
521714	Pulley; U.H.F. tuning (includes set screws)
520313	Ring, insulating; for mounting picture tube
115327	Rod, anchor; lower (insulated)
520971	Rod, picture tube retaining
520966	Rubber ring; supports flared neck of picture tube
170761	Screw—set; #6x32 x ⅛" "Allen type"; retains tuning pulleys and gear
13392	Screw—set; #8x32 x 3/16" "Allen type"; retains cam
18807	Screw—#14 x 1"; mounts chassis
512245	Shaft and pulley for U.H.F. dial
521052	Shield for 1B3GT socket
521614	Shield for crystal detector
115284	Shield—H.V. compartment
521121	Shield—tube (9 pin)
507357	Slug core for 4.5 Mc. trao coil
521064	Slug for syncroguide transformer
521620	Socket and cable assembly for picture tube
521269	Socket and mounting bracket for TV dial lite
522146	Socket assembly—octal; for 1B3GT (includes resistors 143 and 144, filament lead, high voltage lead, and soldering lug)
115267	Socket male, power cord interlock (includes mounting bracket)
160039	Socket (1 pin) for phono. pick-up cable
521383	Socket (5 pin) for interconnection of chassis
507364	Socket—tube (7 pin)
506220	Socket—tube (octal)
521053	Socket—(octal) for 1B3GT tube
508044	Socket—tube (9 pin)
111766	Spring, anti-backlash
161384	Spring, dial cord tension
115326	Strap, anchor; upper (insulated)
521063	Strip, retains H.V. lead
520981	Support for tuner shaft (plastic)
521095	Terminal strip for deflection yoke connections (fits on vertical output transformer)
507351	Terminal strip for TV antenna connection
170741	Wing screw—#8-32; for mounting or forward adj. af yoke

*—This part is not supplied as a Service replacement item.
‡—This part is not supplied as a Service replacement item. Tuner to be returned ta factory for repair.

CHARACTERISTICS

Intermediate frequencies (i.f.)
- Video – 25.1 Mc
- Sound – 20.6 Mc
- Audio strip – 4.5 Mc

Receiver input impedance
- 300 – ohms

Speaker voice – coil impedance
- 3.2 ohms at 400 cps

Power supply input
- 117 volts, 60 cps, a.c.

Power consumption
- 170 watts

Tube complement
- 18 tubes – 2 selenium rectifiers and 1 crystal diode as follows:
  - R-F amplifier – 6BK7A or 6BZ7
  - Mixer-oscillator – 6J6
  - 1st video i-f amplifier – 6CB6
  - 2nd video i-f amplifier – 6CB6

Tube complement – *con't*
- 3rd video i-f amplifier – 6CB6
- Crystal video detector – 1N64
- Video amplifier – 6CB6
- Sound driver-amplifier – 6AU6
- Sound detector-amplifier – 6BN6
- Audio output – 25L6
- Sync clipper and sync splitter – 12AU7
- Vertical sweep oscillator and d-c restorer – 12AU7
- Vertical output amplifier – 25L6
- Horizontal afc phase detector – 6AL5
- Horizontal sweep oscillator – 6SN7
- Horizontal sweep output amplifier – 25BQ6
- Horizontal damper – 25W4
- High voltage rectifier – 1B3G
- Picture tube – 17BP4, 21EP4, or 21ZP4
- Low voltage rectifiers (selenium) – SR-300

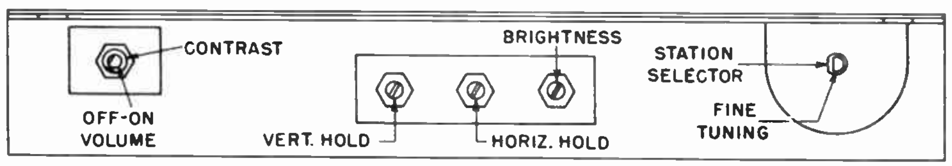


Fig. 6. Front panel operating controls with the cabinet removed.

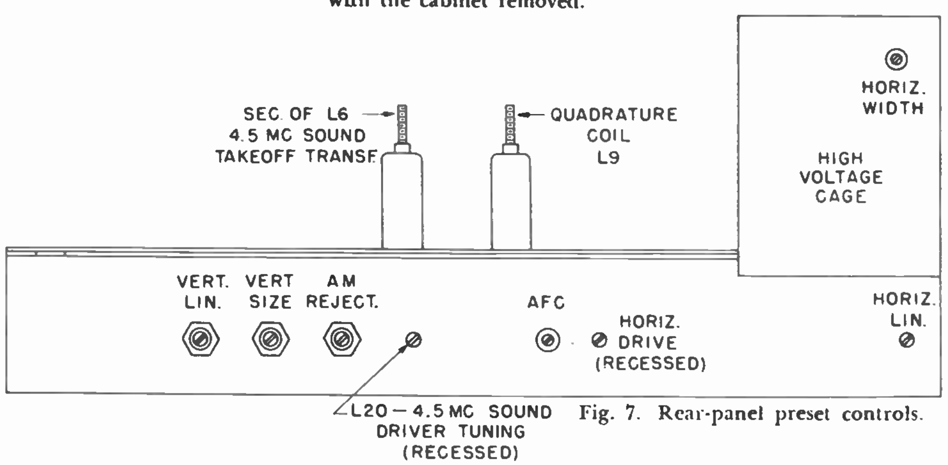


Fig. 7. Rear-panel preset controls.

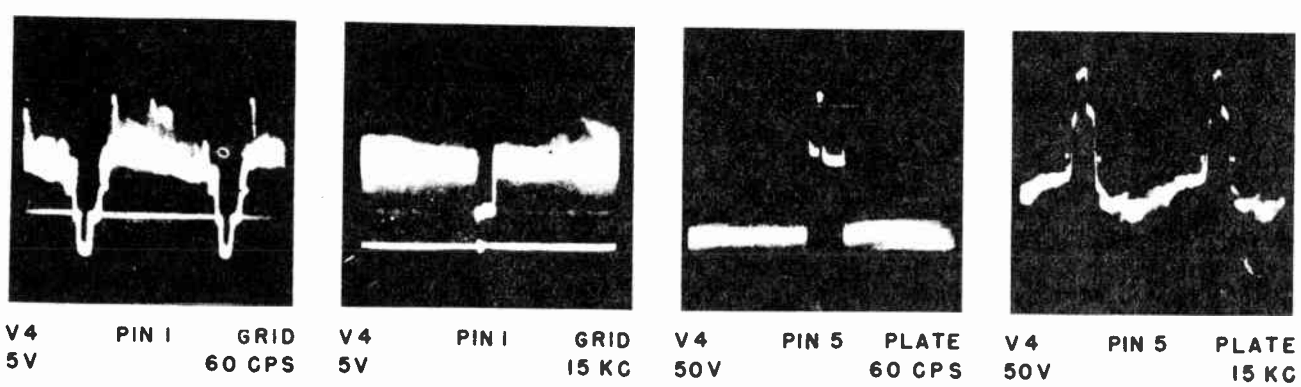
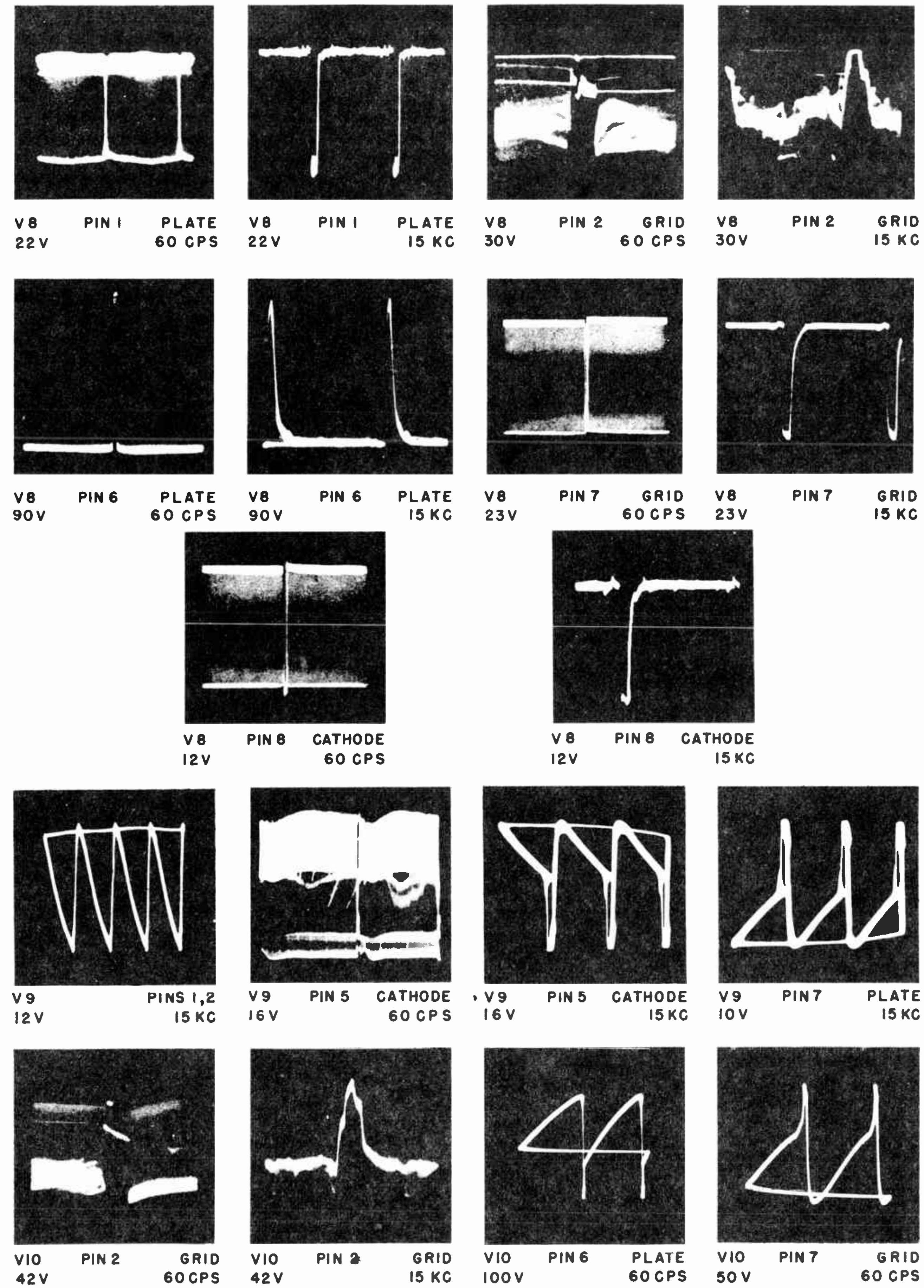


Fig. 8. Video, sync, and sweep waveforms chart indicating the tube pin number where each waveform exists and the peak-to-peak voltages.



RAM FOR CORONADO TELEVISION
3-43-9038A & 45TV13-43-9081A

OSCILLOGRAMS

All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Contrast control adjusted to give 50 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within 20% at 2 MC.

Number appearing to the left of oscillogram specifies setting of horizontal sweep frequency control on 'Scope.

VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

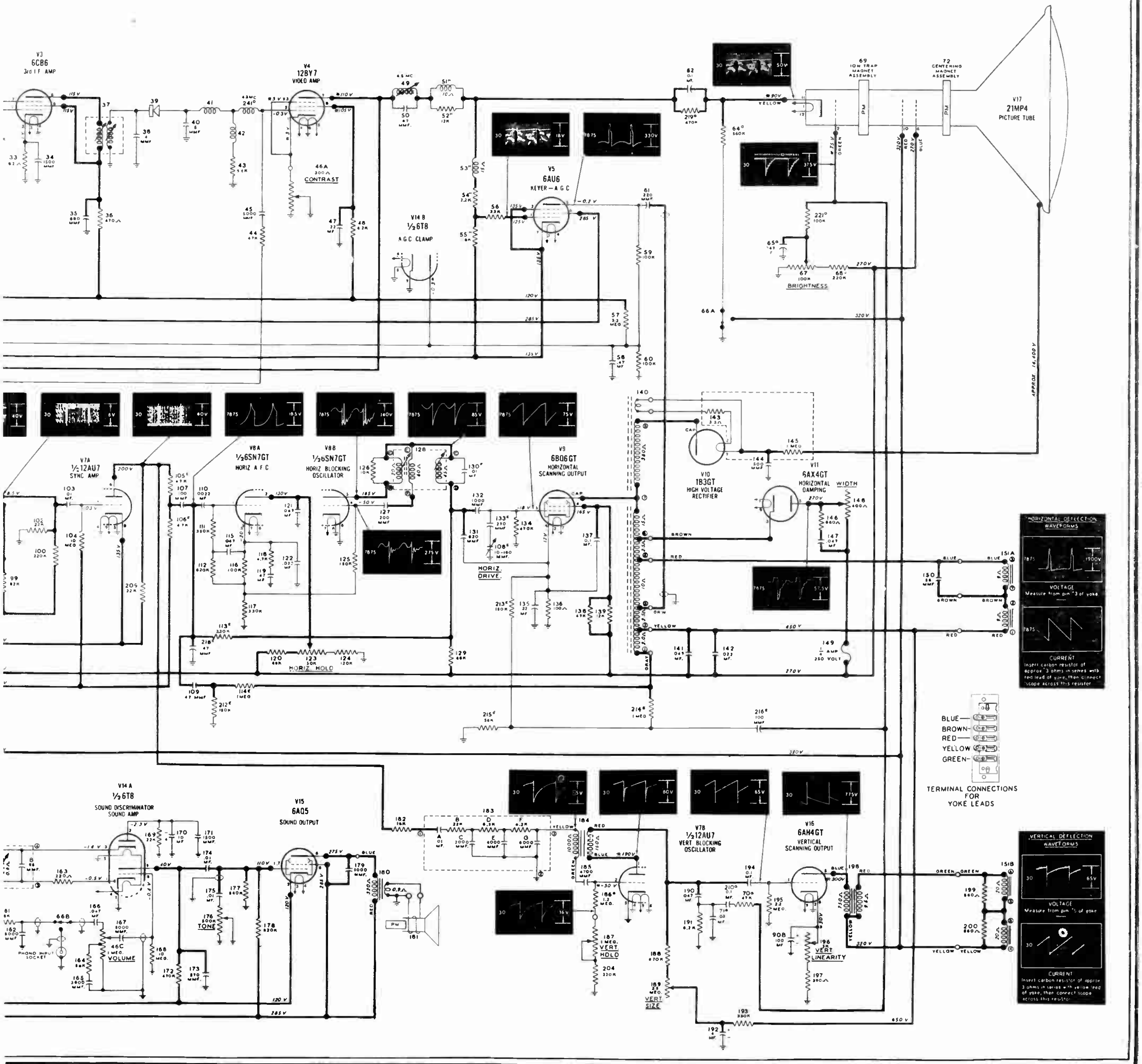
Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception—Contrast control completely counterclockwise.

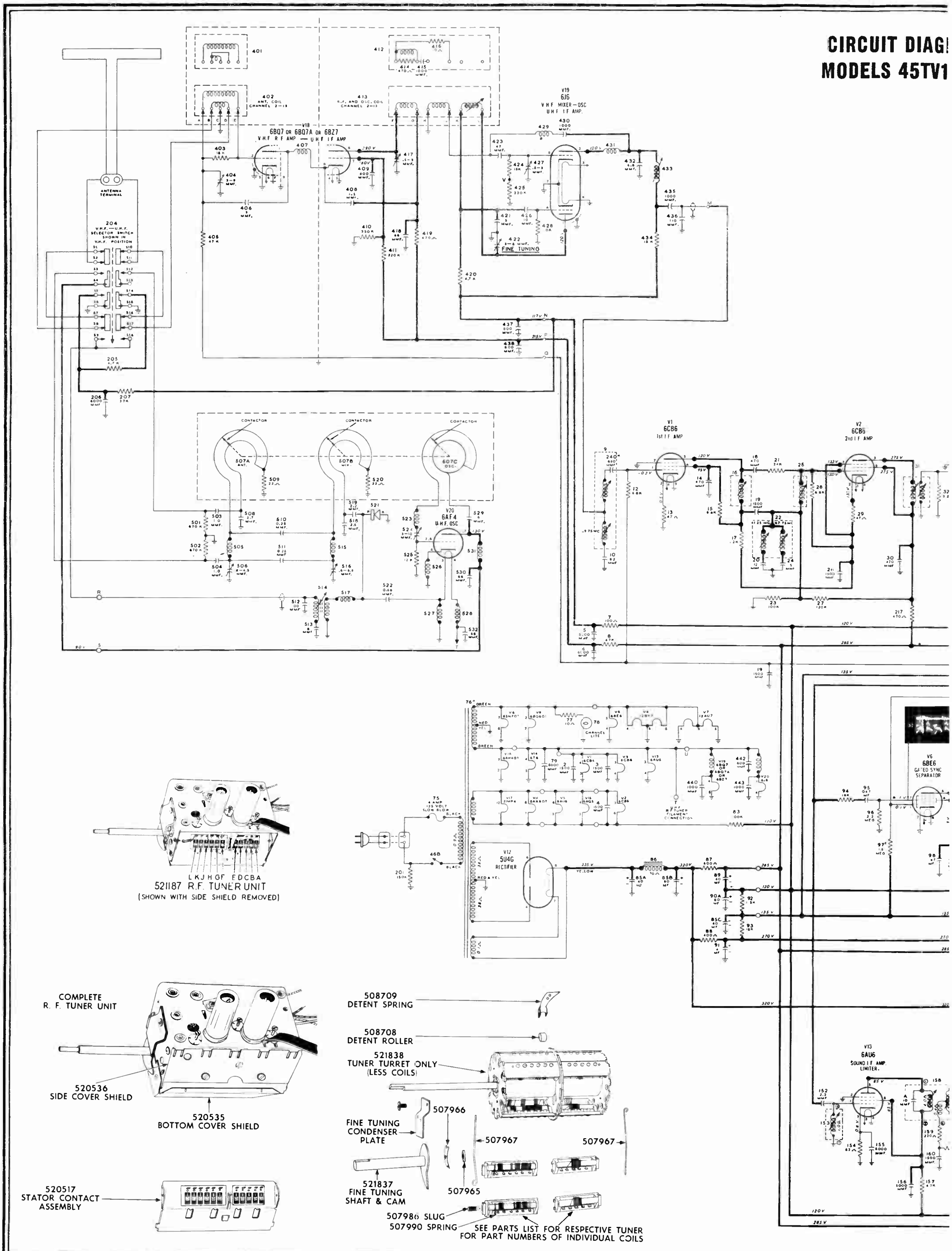
Voltages marked with an asterisk (*) will vary widely with control settings.

R.F. tuner voltages were measured with tubes removed from socket.

No voltage reading at a tube element indicate zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.



CIRCUIT DIAG
MODELS 45TV1



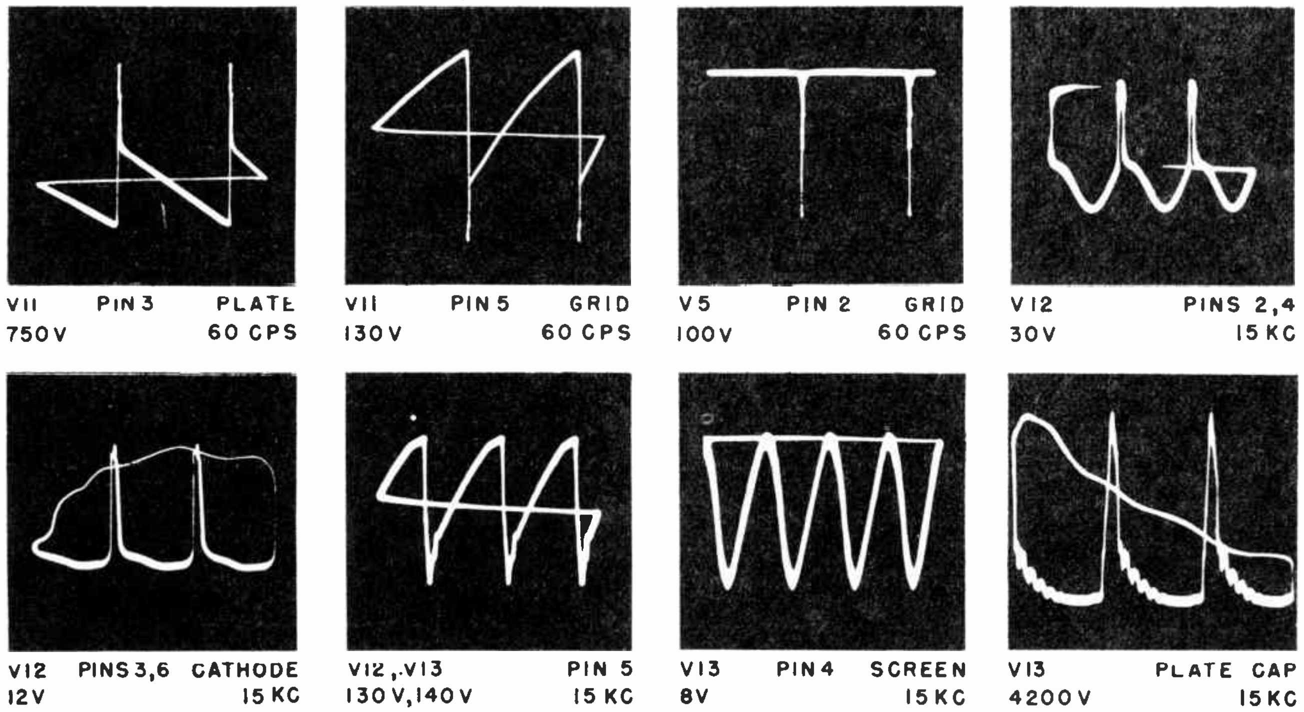


Fig. 8. *Continued.*

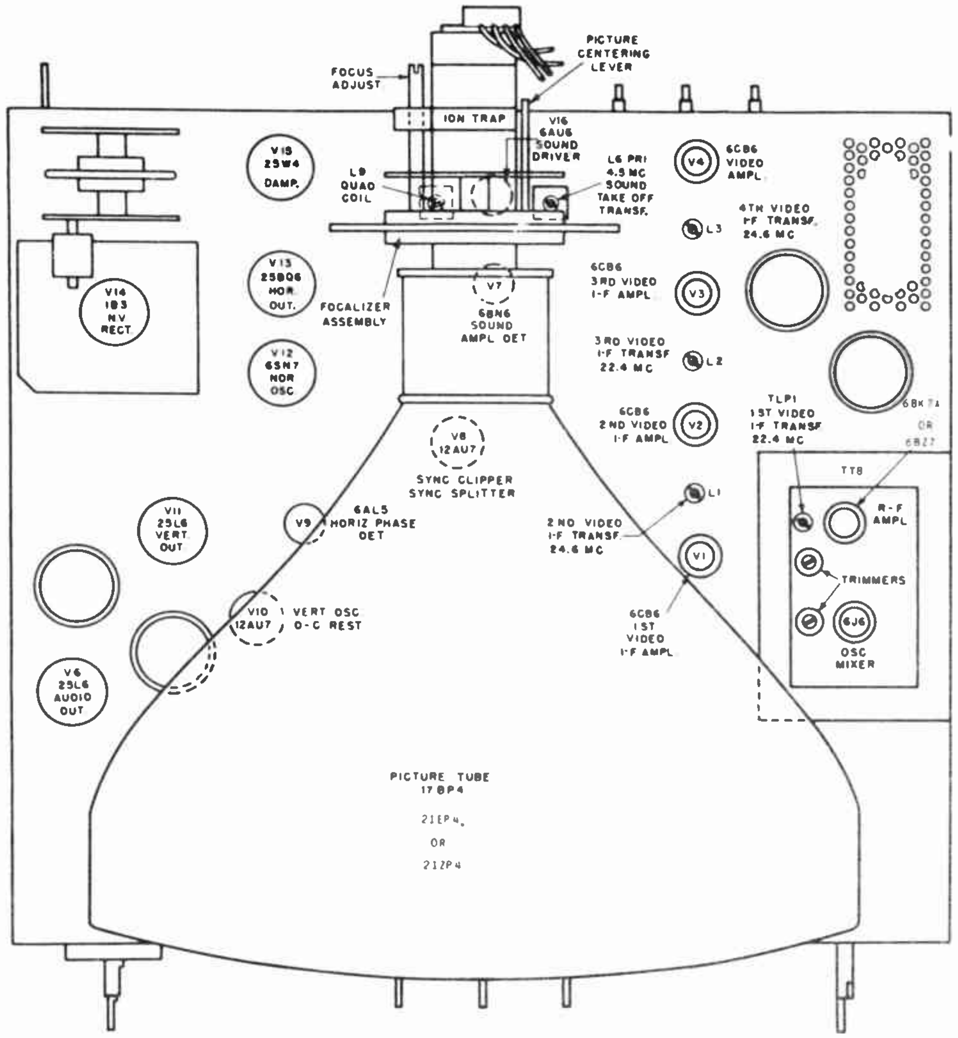


Fig. 9. Top chassis view showing the layout and alignment points.

ALIGNMENT PROCEDURE

Test Equipment

The test equipment required for the alignment of this receiver is as follows:

Marker Generator	(RCA WR39B or equivalent)
Sweep Generator	(RCA WR59B or equivalent)
Oscilloscope	(RCA WO55B or equivalent)
VTVM	(RCA WV97A or equivalent)

The marker generator is an r-f signal generator used for peaking the i-f coils and also to supply marker pips on the response pattern. The required frequency range of this generator should be approximately from 20 to 30 Mc. The accuracy of the frequency calibration of this generator is very important.

The sweep generator should have its output continually variable in frequency. In this alignment, only one output sweep signal is needed, that sweeping between 20 to 30 Mc. The oscilloscope used should be a high-gain, general-purpose type employed for test purposes. The frequency response and size of the screen is unimportant. The VTVM is of the standard type with a high input impedance. It should have provision for a-c and d-c measurements. The use of test equipment for sound and oscillator alignment is not required. For all adjustments use a good insulated screwdriver alignment tool.

Alignment

For the alignment points of the different sections of the receiver refer to the figure indicated in the discussion. Aside from the oscillator adjustments most of the other alignment points are located on top of the chassis as indicated in the top chassis view of Fig. 9. It is recommended that the order of alignment in the following procedure be adhered to if alignment is found necessary. The ground leads of the test instruments should be connected to the top chassis plate (B minus) of the receiver.

Video I-F Alignment

Connect the oscilloscope or the VTVM to the junction of *R118* and *L5*. Adjust the contrast control to its minimum setting. Feed the output signal of the marker generator through a tube shield placed over the mixer tube. *Be certain that this shield is not grounded.*

Set the marker generator at 22.4 Mc, amplitude modulated 30 per cent at 400 cycles. Adjust *TLP1*, the first video i-f coil, which is located on top of the tuner, for maximum deflection on the oscilloscope or VTVM. Repeat this process with the third video i-f coil *L2*. Leaving the generator connected as is, reset its frequency to 24.6 Mc and tune the second and fourth video i-f coils, *L1* and *L3* respectively, for maximum response on either indicating device. The screwdriver adjustments for all the above i-f coils are located on the top of the chassis as shown in Fig. 9.

Over-all Picture Response

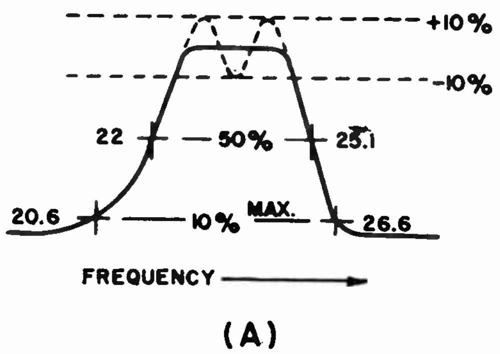
With the sweep generator adjusted for a 10-Mc sweep with a center frequency of about 25 Mc (i.e., sweeping 20-30 Mc) connect the sweep output cable to the mixer tube similar to the method in the video i-f alignment. *Loosely couple* the marker generator to the same mixer tube. Inject individual markers of 25.1 Mc, 22 Mc, 20.6 Mc, and 26.6 Mc in the order indicated and note the position of the marker pips on the response curve for each case. If necessary, readjust the four video i-f coils for an over-all picture response as indicated in Fig. 10 (A). The solid line at the top of the curve is the ideal straight line response. The dotted portions of this part of the curve indicate the possible limitations and variations that usually exist and which are permissible for correct alignment. In part (B) of Fig. 10 is an actual over-all video i-f alignment curve taken on a "XT-100" chassis

NOTE: The 25.1-Mc and 22-Mc markers should fall approximately halfway down the slope on either side of the curve. The 20.6-Mc marker should be well down on the base of the low side of the curve. (This is the frequency of the sound i-f output from the mixer tube.) Coil *TLP1* will effectively peak the low side, while coils *L1* and *L3* affect the high side of the curve. Coil *L2* should be used as the final adjustment for a symmetrical pass-band.

Sound Alignment

This is the alignment of the 4.5-Mc section of the receiver. For the quickest method of aligning this section, an actual station transmission is used as the basic signal instead of any meter or visual method of alignment. No measuring or indicating devices are needed for this method of alignment.

In order to correctly align coils *L6* and *L20*, an input television signal must be used that is *below* the



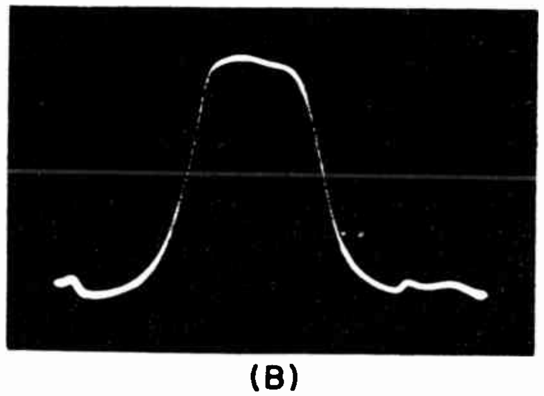


Fig. 10. Over-all video i-f response; (A) drawing showing marker points, and allowable variations in shape, (B) an actual response curve.

limiting level of the 6BN6 gated-beam tube. This level can easily be identified by the "hiss" which appears in the sound output. Some method of attenuation must be employed to reduce this signal. Although various methods are possible some sort of attenuator between the antenna and input terminals is preferred. A simple resistance pad similar to that indicated in Fig. 11 will suffice. If not enough attenuation is secured with one pad, add another or more until there is sufficient attenuation. Conversely, in order to properly align the quadrature coil *L9* and the a-m rejection control, *P12*, a signal above the limiting value is necessary.

The sound alignment is as follows:

1. Tune in a station that has a steady signal with no fading. A station with a tone signal (test pattern) on the air is preferred, otherwise any available signal will do.

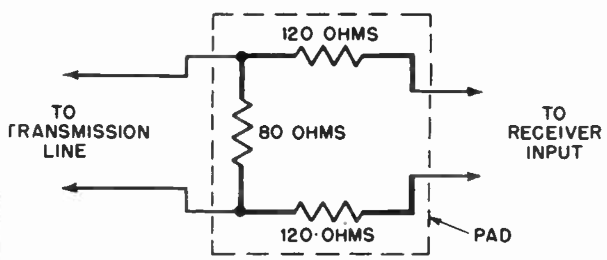


Fig. 11. A typical attenuation pad.

2. Adjust the attenuator until the signal coming in is reduced to the level where a "hiss" is heard with the sound output. Next adjust the primary and secondary of the 4.5-Mc sound take-off coil *L6*. The secondary adjustment of *L6* is made from the underside of the chassis as indicated in Fig. 12; the primary adjustment is made from the top of the chassis. The 4.5-Mc sound driver coil *L20* is adjusted next for maximum sound output regardless of any hiss or buzz. If any of these sound adjustments may cause the "hiss" to disappear, the attenuator should be readjusted so that the "hiss" reappears.

3. When the maximum sound output is attained, adjust the attenuator in the opposite direction so that the "hiss" disappears. This raises the signal above the limiting level of the 6BN6 gated-beam tube.

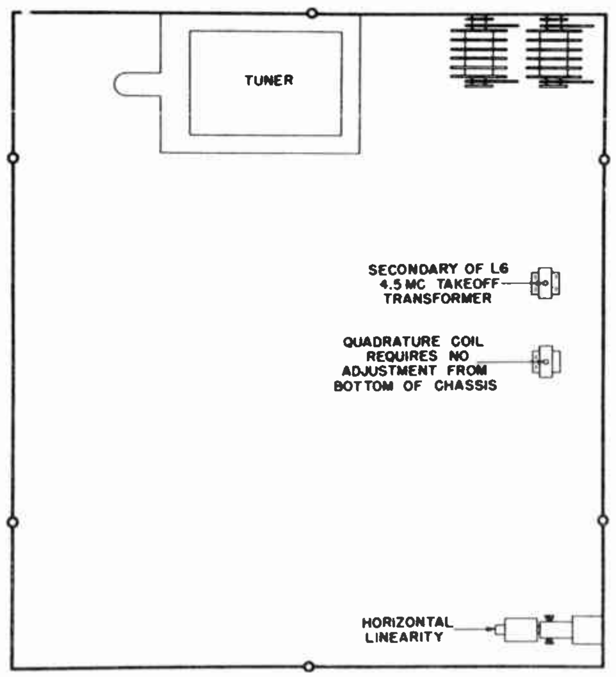


Fig. 12. Underside of chassis indicating location of L6 primary.

4. Next adjust the quadrature coil, *L9*, for maximum sound output. For this, it is recommended that a station of average signal strength in your area be used. The a-m rejection control *P12* is then adjusted until the intercarrier buzz is eliminated. Then repeat the *L9* and *P12* adjustment.

Proper alignment of the sound system can be checked easily at any time by turning the a-m rejection control first to the right and then to the left of the final setting. Whatever happens in one direction, such as the appearance of buzz or decrease of the f-m output, should also occur in the opposite direction. If this does not happen, then realign once again in the same manner as set forth above.

Alternate Method. An a-m or marker generator may also be used to align the takeoff transformer *L6*, and the sound driver coil *L20*.

Set the generator to 4.5 Mc, amplitude modulated 30% at 400 cycles. Connect the output cable of the generator to the junction of the .05 mf capacitor (*C118*) and the two peaking coils *L4* and *L5* in the grid circuit of the 6CB6 video amplifier. Place the vertical input terminals of an oscilloscope or VTVM across the voice coil or the volume control *PD10*. Set the volume and contrast controls at maximum.

Adjust the a-m rejection control for the first maximum response on the oscilloscope or VTVM as the control is turned in a clockwise direction. Lower the generator output until a "hiss" is heard from the speaker. Next peak the primary and then the secondary of the takeoff transformer *L6* for maximum response on the oscilloscope or VTVM. If the "hiss" disappears, lower the generator output until it reappears. Then adjust the sound driver coil *L20* in the same fashion.

The quadrature coil *L9* can then be aligned either by ear as in the first method, or by use of a tone modulated pattern transmission from an actual station. If the latter is available, the input is set above the limiting level of the 6BN6 (no hiss in the output) and the quadrature coil is peaked for maximum response on the oscilloscope or VTVM.

Oscillator Alignment

As far as the r-f tuner is concerned only the oscillator alignment is discussed here. Alignment of the r-f section is not included because it is felt that very seldom will it require alignment. If any trouble is suspected in the r-f section it is suggested that the receiver or tuner be returned to the manufacturer or an authorized service agency.

This tuner employs the principle of incremental inductances as you move from channel 13 down to channel 2. Oscillator adjustments, therefore, are made sequentially from channel 13 through channel 2. No instruments are needed for this alignment, station transmissions on each channel are the only signal sources. The alignment procedure is as follows:

The fine tuning control is first set to the midrange of its adjustment. Set the channel selector switch to channel 13. Adjust the oscillator slug for this channel (see Fig. 13) until the best picture and sound is received. Bear in mind that the a-m rejection control must be properly adjusted beforehand for the clearest sound as discussed in alignment of the sound section. Next, repeat this procedure for channel 12, then channel 11 and so on down the line.

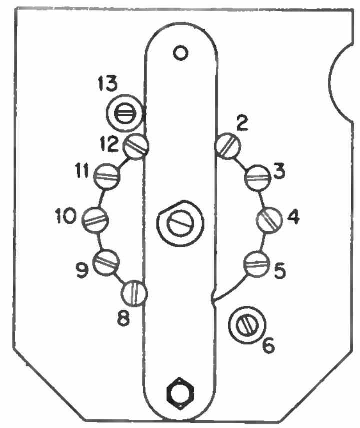


Fig. 13. Oscillator alignment points.

There is no oscillator adjustment for channel 7, alignment of the channel 8 oscillator automatically assures proper alignment of the channel 7 oscillator. After the high-frequency channels are aligned (13 through 7), although each low frequency can be aligned individually, the oscillator slug for channel 6 can be used to shift the complete low-frequency band if desired. Position of all the oscillator slugs for both bands are indicated in Fig. 13.

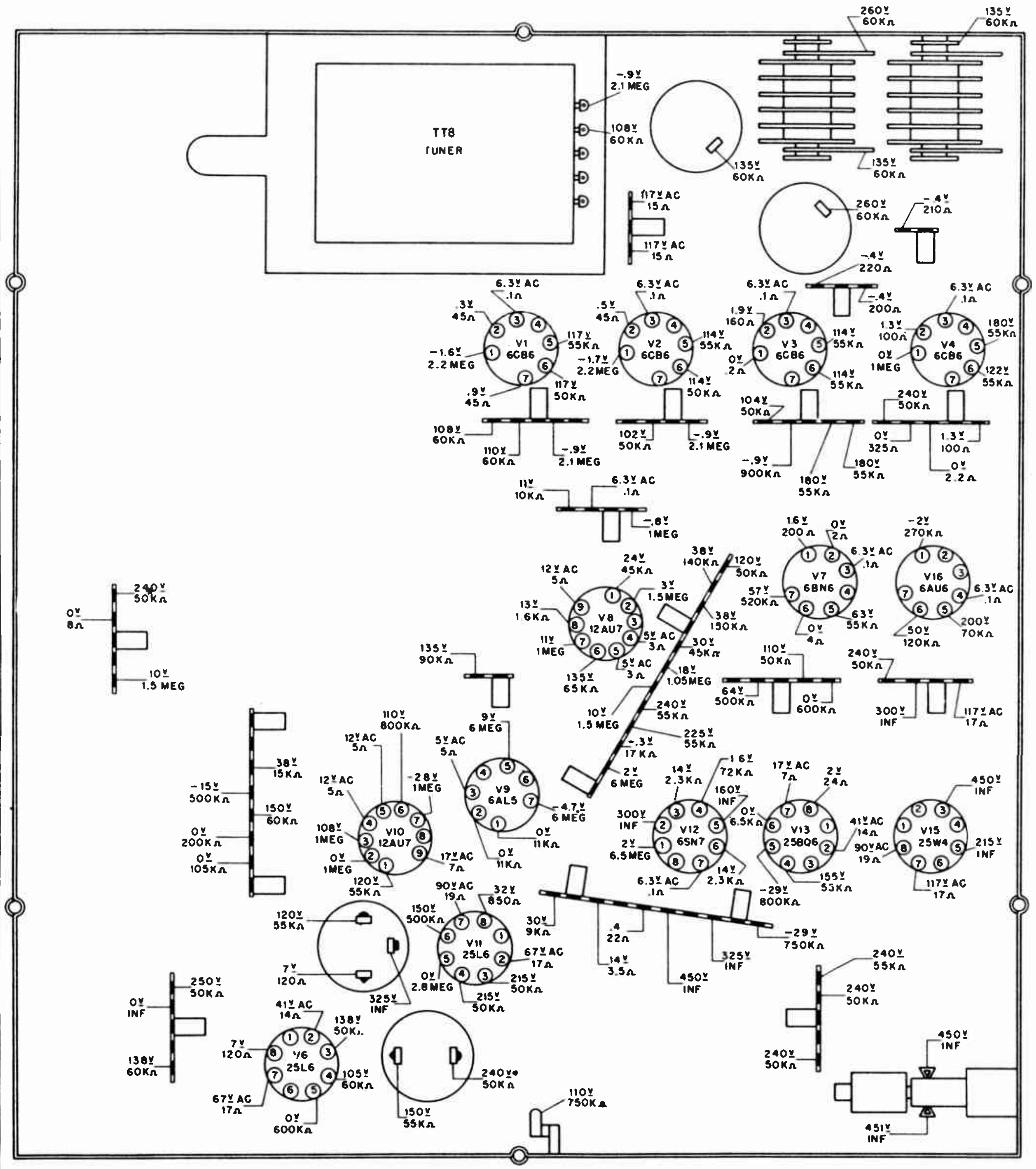


Fig. 17. Bottom view of receiver showing voltage and resistance values.

COMBINATION RADIO

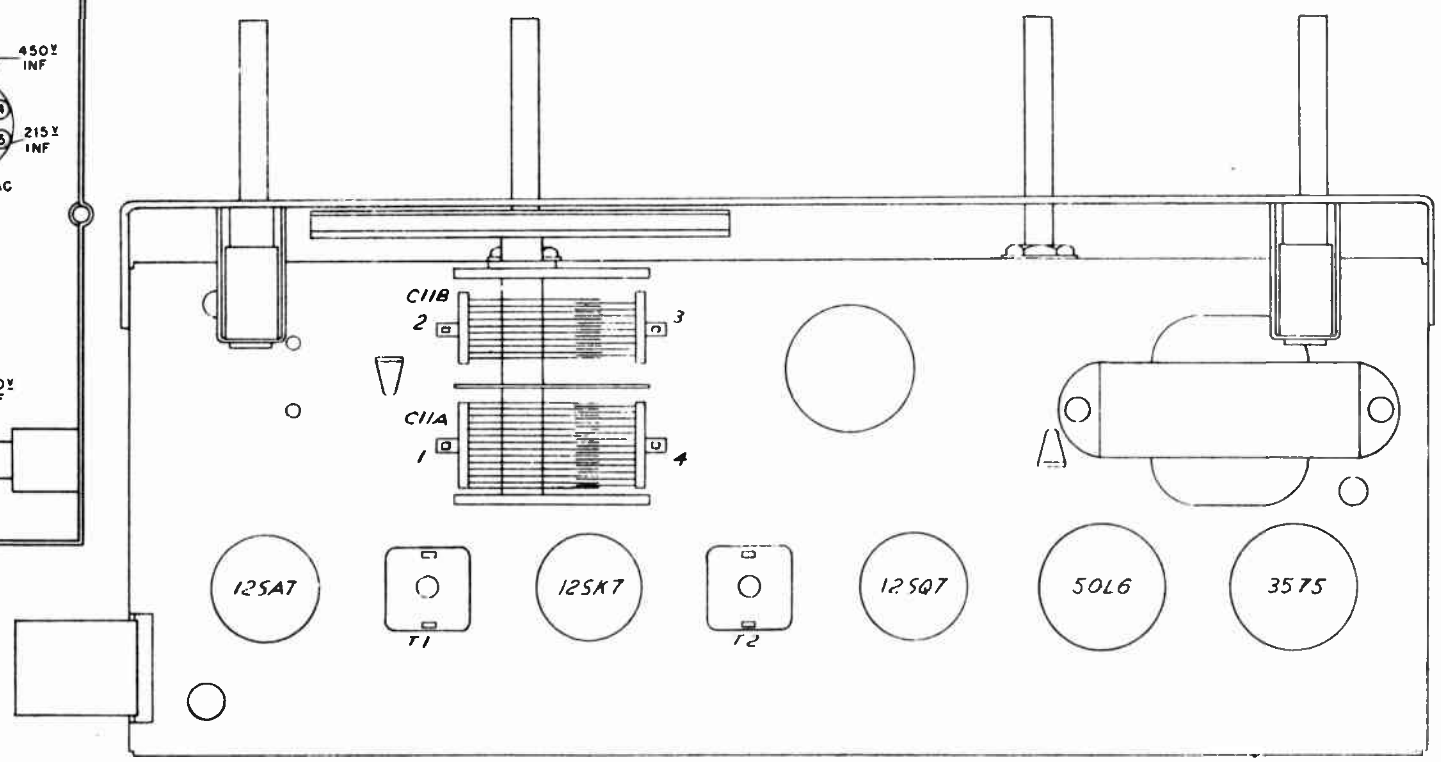
CHASSIS No. RE-2A

LINE VOLTAGE: 117 VOLTS AC					FULL VOLUME CONTROL — NO SIGNAL			
TUBE COMPLEMENT	PINS							
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
35Z5	—	117 AC	—	—	—	117 AC	90 AC	120 V
50L6	—	90 AC	110 V	95 V	0 V	—	38 AC	7 V
12SQ7	—	—.8 V	0 V	—.7 V	—.7 V	52 V	12.5 AC	0 AC
12SK7	—	38 AC	0 V	—.8 V	0 V	96 V	25 AC	96 V
12SA7	—	25 AC	96 V	96 V	—.7 V	0 V	12.5 AC	—.8 V

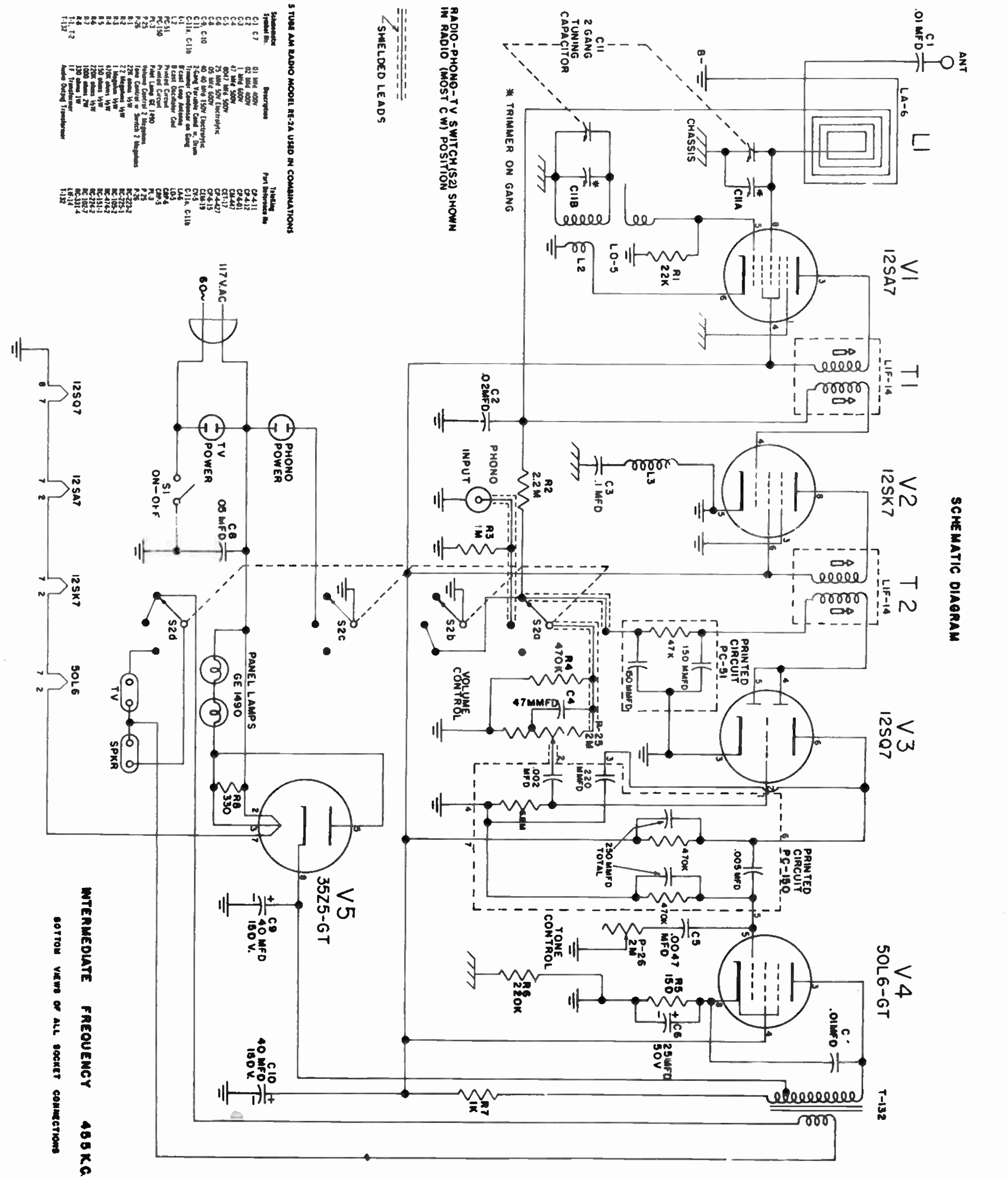
Voltage readings made with V.T.VM from pins designated to B—

ALIGNMENT CHART

STEPS	ALIGN	DUMMY ANTENNA	GENERATOR FREQUENCY	DIAL SETTING	CONNECT GENERATOR TO	ADJUST	OUTPUT METER ACROSS VOICE COIL
1	2nd I.F.	.05	455 KC	High Freq. End	Pin 8—12SA7 Converter Grid	T-2 Double Slug	Peak for Max.
2	1st I.F.	.05	455 KC	High Freq. End	Pin 8—12SA7 Converter Grid	T-1 Double Slug	Peak for Max.
3	Osc.	.05	1650 KC	High Freq. End	Pin 8—12SA7 Converter Grid	C11B Osc. Tuner Trim	Peak for Max.
4	Loop Ant.	Radiate into Loop Ant.	1500 KC	1500 KC	Several Turns Around Loop	C11A Loop Tuner Trim	Peak for Max.
5	Repeat Steps 3 and 4						



TOP VIEW



SCHEMATIC DIAGRAM

INTERMEDIATE FREQUENCY 455 KC.

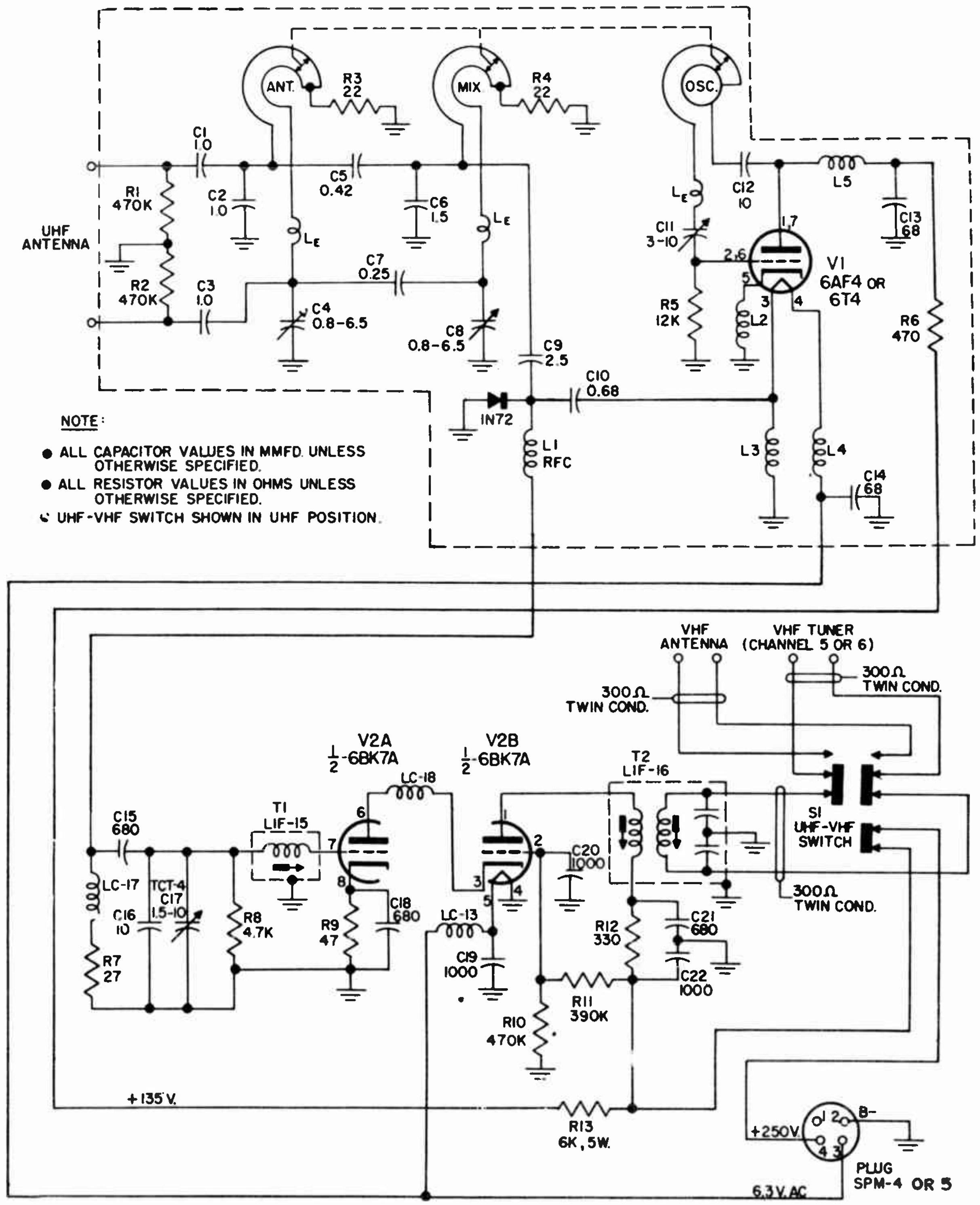
UHF TUNERS

The UHF Tuner found in the XT-100 series receivers may be either a Mallory Inductuner of a Radio Receptor UHF Tuner.

Because of the critical nature of the UHF Tuners, field servicing other than replacement of tubes or crystal mixer is not recommended. If major trouble that cannot be corrected by tube or crystal replacement occurs, remove the UHF Tuner unit only and return to the factory for repair.

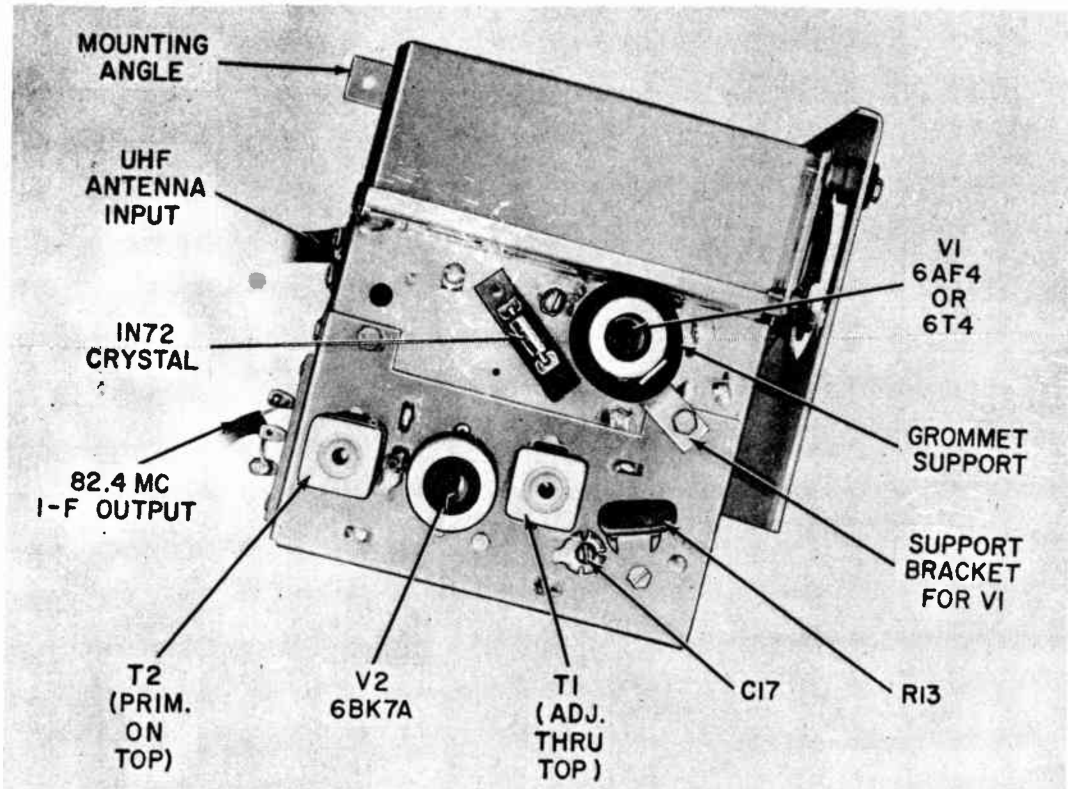
To identify the two types of UHF Tuners and understand the functions of each, refer to the following photos and schematics.

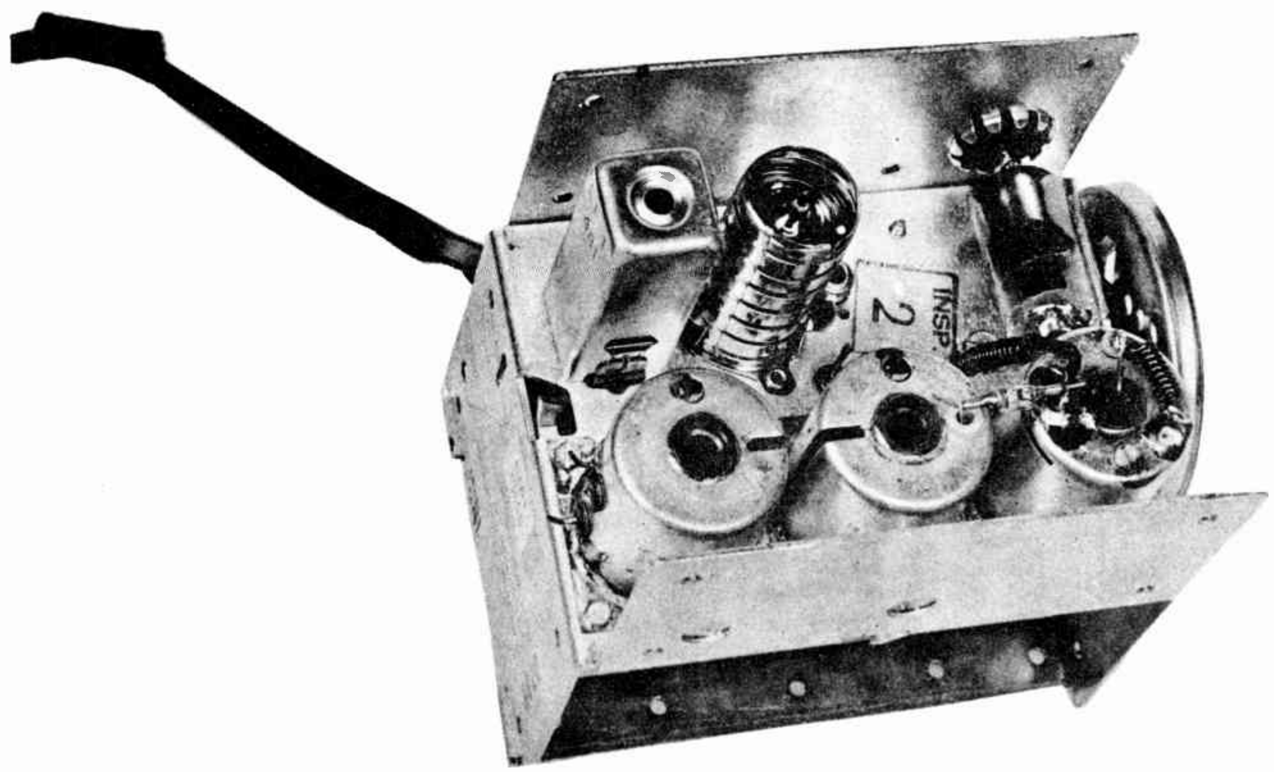
MALLORY INDUCTUNER



NOTE:

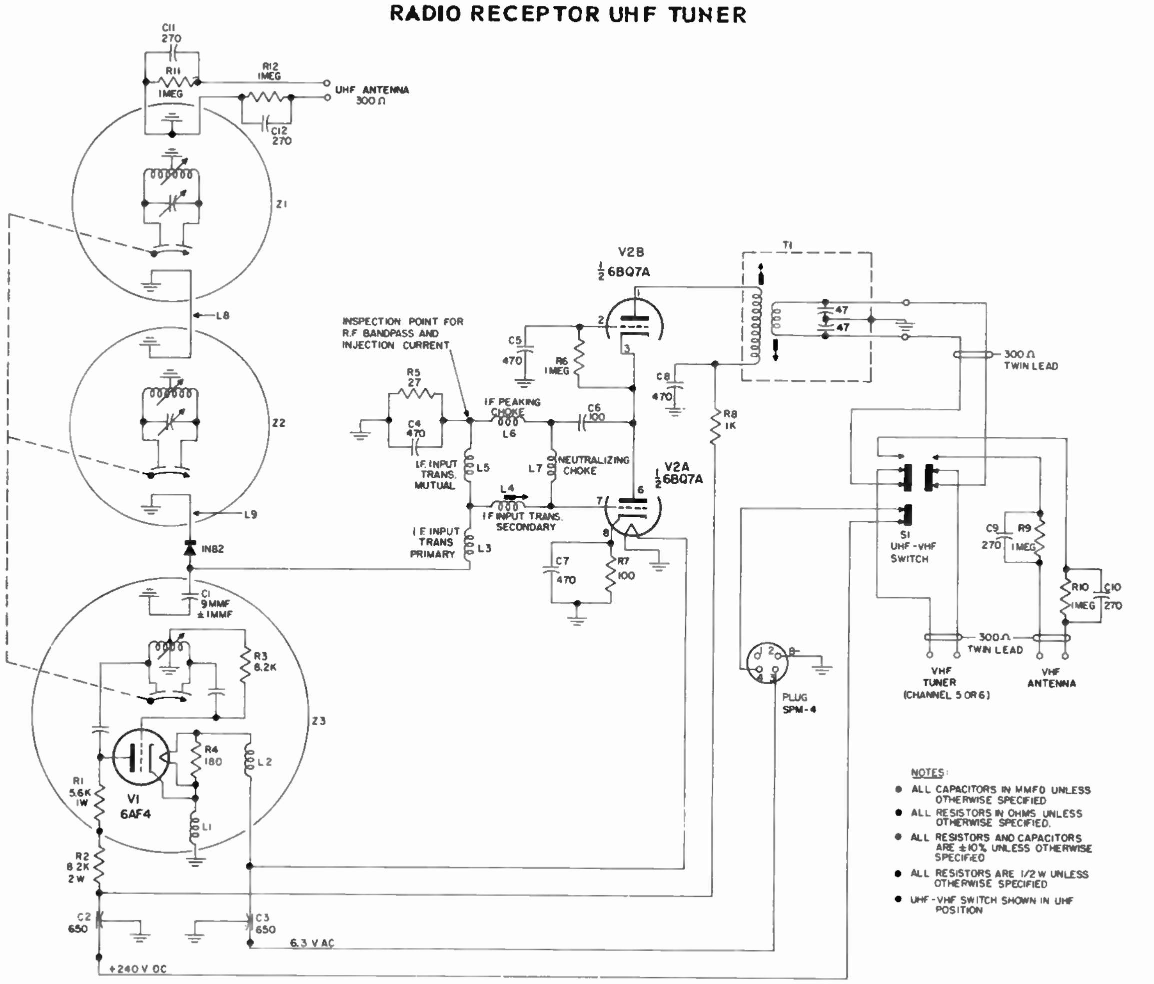
- ALL CAPACITOR VALUES IN MMFD UNLESS OTHERWISE SPECIFIED.
- ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
- UHF-VHF SWITCH SHOWN IN UHF POSITION.





Dial cord stringing data.

RADIO RECEPTOR UHF TUNER



Since the tuning section of the converter is continuous, a dial cord drive and pulley system is required. Figure 1, illustrates two different types of dial cord stringing diagrams. Part (A) shows arrangement which may be found on some converters, and Part (B) is the arrangement which will be found on most converter units. On the latter type, the dial-cord arrangement varies slightly (shown by the dotted lines) for 21-inch picture tube receivers.

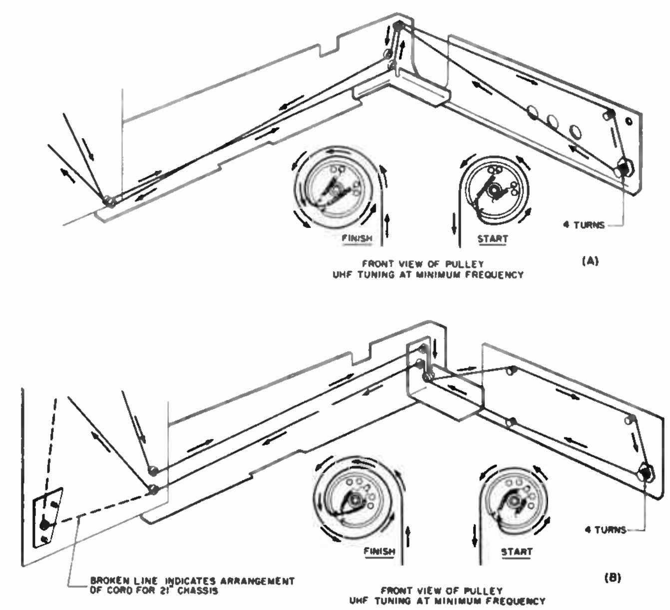
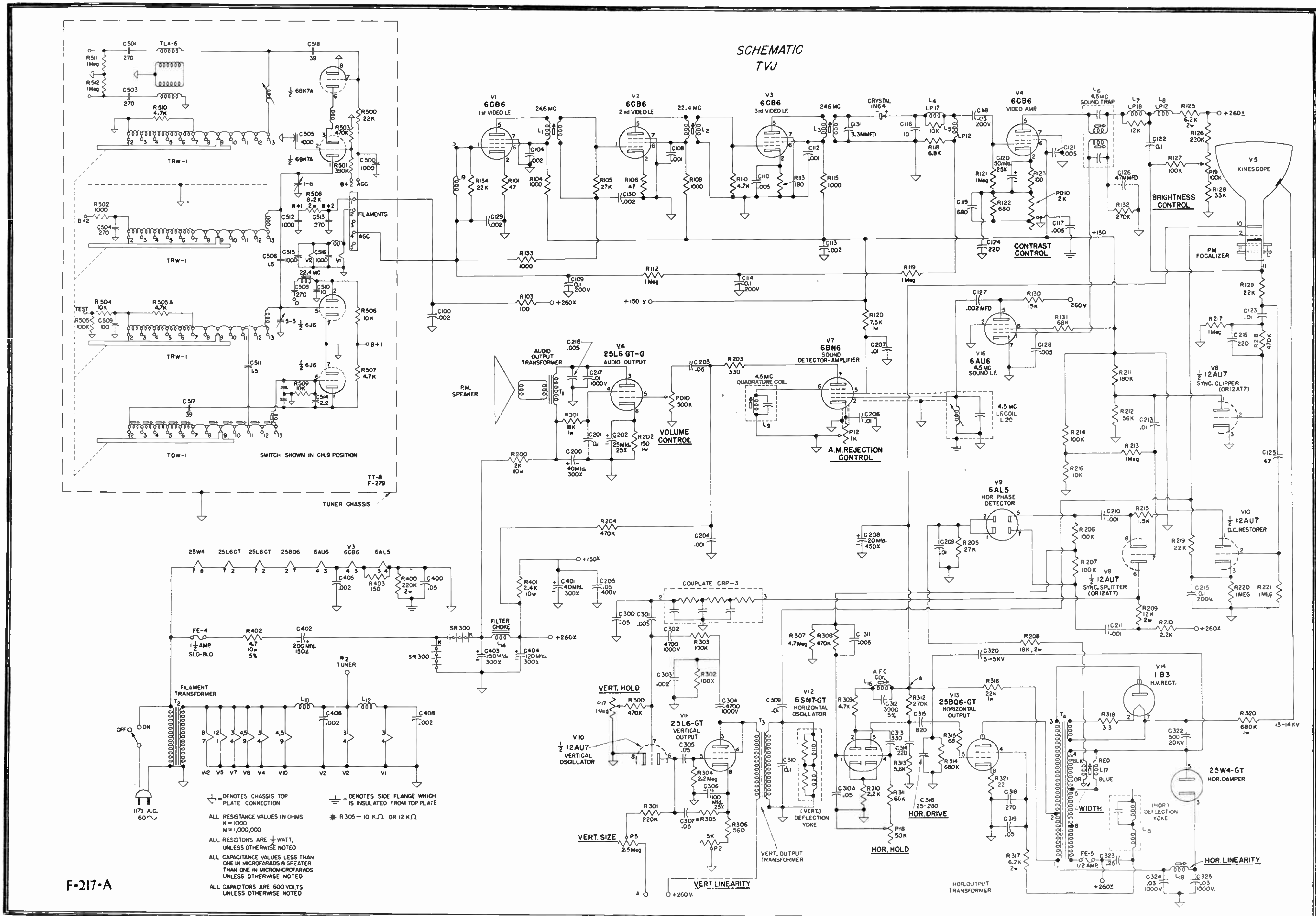


Figure 1.



MODELS 45TV11-43-9027A, 28A, 85A, 86A, 87A, 88A, 89A, 90A, 91A, 92A, 93A, 94A, 95A, 96A, 97A, 98A, -9130A, 31A; XT-100 Series

TELEVISION PARTS LIST

CAPACITORS

REFERENCE NO.	DESCRIPTION	PART NO.
C100, C104, C113, C127, C129, C130, C405, C406, C408	0.002 mfd., GMV, ceramic disc	CC-22
C108, C112	0.001 mfd., tubular ceramic, durex coated, 20%	CC-21
C109, C114, C215	0.1 mfd., 200V, paper	CP-2-01
C110, C117. C121, C128, C218	0.005 mfd., ceramic disc	CC-25
C116	10 mmfd., 20% ceramic	CC-41
C118	0.05 mfd., 200V, paper	CP-2-15
C119	680 mmfd., 20%, tubular ceramic	CC-368
C120	50 mfd., 25V, tubular electrolytic	CET-8
C122	0.1 mfd., 400V, paper	CP-4-01
C123, C206, C209 C213, C309	0.01 mfd., 600V, paper	CP-6-11
C124	220 mmfd., 20%, tubular ceramic	CC-322
C125, C126	47 mmfd., 10% ceramic	CC-447
C131	3.3 mmfd., miniature ceramic disc	CS-533
C200, C404	40, 120 mfd., 300 volt can electrolytic	CEM-11
C201	0.1 mfd., 600V, paper	CP-6-01
C202, C208, C401	25 mfd., 25V, 20, 40mfd., 3 section electrolytic	CEM-12
C203, C300, C305 C310A, C319, C400	0.05 mfd., 600V, paper	CP-6-15
C204, C210, C211	0.001 mfd., 600V, paper	CP-6-21
C205	0.05 mfd., 400V, paper	CP-4-15
C207	0.02 mfd., 600V, paper	CP-6-12
C216, C314	220 mmfd., 10%, 500V, mica	CM-322
C217	0.01 mfd., 20%, 1000V, paper	CP-10-11
C301, C311	0.005 mfd., 600V, paper	CP-6-25
C302, C304	4700 mmfd, 10%, 800V-1600V test mica	CM-247A-1
C303	0.002 mfd., 600V, paper	CP-6-22
C306	100 mfd., 25V, tubular electrolytic	CET-5
C307	0.05 mfd., 600V paper, 5%	CP-6-15-9
C310	0.1 mfd., -5%-20%, 600V, paper	CP-6-01-3
C312	3900 mmfd., 500V, 5% silver mica	CM-239
C313	330 mmfd., 10%, 800V, silver mica	CM-333A
C315	820 mmfd., 20%, 500V, mica	CM-382
C316	25-280 mmfd., 10% mica insulated trimmer	CT-6
C318	270 mmfd., 20%, 500V, mica	CM-327
C320	5 mmfd., 5000V, tubular ceramic, durex coated	CHV-55-5K
C322	0.005 mfd., 20,000V, ceramic	CHV-35-20A
C323	0.25 mfd., 400V paper	CP-4-025
C324, C325	0.03 mfd., 1000V, paper, oil impregnated	CO-10-13
C402	200 mfd., 150V, can electrolytic	CEM-9-E
C403	150 mfd., 300V, can electrolytic	CEM-10-E
CRP-3	Vertical integrator, ceramic couplate	CRP-3

TUBES

REFERENCE NO.	DESCRIPTION	PART NO.
	RF Amplifier	6BK7A or 6BZ7
	Oscillator Mixer	6J6
V1	1st video i-f amplifier	6CB6
V2	2nd video i-f amplifier	6CB6
V3	3rd video i-f amplifier	6CB6
V4	Video amplifier	6CB6
V5	Picture tube	17BP4, 21EP4, or 21ZP4
V6	Audio output amplifier	25L6
V7	Gated beam discriminator	6BN6
V8	Sync clipper and splitter	12AU7
V9	Horizontal phase detector	6AL5
V10	Vertical oscillator and d-c restorer	12AU7
V11	Vertical output amplifier	25L6
V12	Horizontal sweep oscillator	6SN7
V13	Horizontal sweep output amplifier	25BQ6
V14	High voltage rectifier	1B3G
V15	Horizontal damper	25W4
V16	Sound i-f driver amplifier	6AU6
IN64	Germanium crystal video detector	IN64
SR300	Selenium rectifiers, 300Ma	SR-300

RESISTORS

REFERENCE NO.	DESCRIPTION	PART NO.
R101, R106	47 ohm, 10%, ½W.	RC-470-2
R103, R111, R123	100 ohm, 10%, ½W.	RC-101-2
R104, R109, R115, R203	330 ohm, 10%, ½W.	RC-331-2
R105, R205	27K, 10%, ½W.	RC-273-2
R110, R309	4.7K, 10%, ½W.	RC-472-2
R112, R119, R121, R213, R217, R220, R221	1 meg., 10%, ½W.	RC-105-2
R113	180 ohm, 10%, ½W.	RC-181-2
R118	6.8K, 5%, ½W.	RC-682-3
R120	7.5K, 10%, 1W.	RC-752-5
R122	680 ohm, 10%, ½W.	RC-681-2
R125	6.2K, 5%, 2W.	RC-622-9
R126, R301	220K, 10%, ½W.	RC-224-2
R127, R206, R207, R214	100K, 10%, ½ W.	RC-104-2
R128	33K, 10%, ½W.	RC-333-2
R129, R134, R219	22K, 10%, ½ W.	RC-223-2
R130	15K, 10%, ½ W.	RC-153-2
R131, R311	68K, 10%, ½ W.	RC-683-2
R132, R312	270K, 10%, ½W.	RC-274-2
R133	1K, 20%, ½ W.	RC-102-2
R200	2K, 10%, 10 W.	RW-202-17
R201	18K, 10%, 1 W.	RC-183-5
R202	150 ohm, 10%, 1 W.	RC-151-5
R204, R218, R300, R308	470K, 10%, ½ W.	RC-474-2
R208	18K, 10%, 2 W.	RC-183-8
R209	12K, 10%, 1W.	RC-123-8
R210, R310	2.2K, 10%, ½ W.	RC-222-2
R211	180K, 10%, ½ W.	RC-184-2
R212	56K, 10%, ½ W.	RC-563-2
R215	1.5K, 10%, ½ W.	RC-152-2
R216	10K, 10%, ½ W.	RC-103-2
R302, R303	100K, 5%, ½W.	RC-104-3
R304	2.2 meg., 5%, ½ W.	RC-225-3
R305	5.6K, 10%, ½W. (for G.E. yokes only)	RC-562-2
	10K, 5%, ½ W. (for all other yokes)	RC-103-3
R306	560 ohm, 10%, ½ W.	RC-561-2
R307	4.7 meg., 10%, ½ W.	RC-475-2
R313	5.6K, 10%, ½ W.	RC-562-2
R314	680K, 10%, ½ W.	RC-684-2
R315	68ohm, 10%, ½ W.	RC-680-2
R316	22K, 10%, 1 W.	RC-223-5
R317	6.2K, 10%, 2 W.	RC-622-8
R318	3.3 ohm, 10%, ½ W.	RC-33G-2
R320	680K, 10%, 1 W.	RC-684-5
R321	22 ohm, 10%, ½ W.	RC-220-2
R400	220K, 10%, 2W.	RC-224-8
R401	2400 ohm, 10T, 10W candohm, W. W.	RW-242-17
R402	4.7 ohm, 5%, 10W.	RW-47G-15
R403	150 ohm, 5%, ½W.	RC-151-3

TRANSFORMERS

REFERENCE NO,	DESCRIPTION	PART NO.
T1	Audio output	T-123B
T2	Filament	T-129
T3	Vertical output	T-116-B
T4	Horizontal output	T-124-D

COILS AND CHOKES

REFERENCE NO.	DESCRIPTION	PART NO.
L1, L2, and L3	Video I.F. Bifilar	LV-9
L4	Peaking Coil	LP-17
L5, L8	Peaking Coil	LP-12A
L6	4.5 MC take-off coil	LTO-13
L7	Peaking Coil	LP-18
L9	4.5 MC quadrature Coil	LIF-8-C
L19, L12	Filament Choke	LC-1
L14	Filter Choke	LC-9
L15	Deflection Yoke (70° Ferrite)	DY-12-M
L16	AFC Coil	LHO-2-E
L17	Width Coil	L-M77J4-3
L18	Linearity Coil	LM77J4
L19	1st Video I.F. Choke	LC-11
L20	4.5-MC I.F. Coil	LIF-11

CONTROLS-POTENTIOMETERS

REFERENCE NO.	DESCRIPTION	PART NO.
P2	Vertical linearity, 5K, ¼W	P-2-D
P5	Vertical size, 2.5 meg, ¼w	P-5-D
P12	A-M rejection control, 1K, 30% ¼w	P-12-D
P17	Vertical hold, 1 meg, ¼w	P-17-B
P18	Horizontal hold, 50K, ¼w	P-18-B
P19	Brightness, 100K, ¼w	P-19-B
PD-10	Dual, control; Volume, 500K, audio taper w/switch; contrast, 2K, ½w, tapped at 600 ohms	PD-10 (for 17") PD-11 (for 21")

MISCELLANEOUS

REFERENCE NO.	DESCRIPTION	PART NO.
FE-4	1½ slow blow fuse with pigtails	FE-4
FE-5	½ amp., 250v, fuse with pigtails	FE-5
LF-8	PM focus unit	LF-8
	PM focus unit	LF-7
	Ion trap	IT-IA or IT-5
TT8	Tuner	TT-8

KNOBS

	All Models with 8-1007 Escutcheon Door	Other Models
On-Off-Volume	KM46	KM56
Contrast	KM47	KM57
Channel Selector	KM45	KM55
Fine Tuning	KM44	KM54
Brightness	KM26A	KM26
Vertical Hold	KM26A	KM26
Horizontal Hold	KM26A	KM26
VHF-UHF Switch	KM58	KM58
UHF Tuning	KM59	KM59

CABINET PARTS

MODEL	MASK	SPEAKER	BACK	ESCUTCHEON	ESCUTCHEON DOOR	GLASS
45TV11-43-9027A	4-1049-2	PMS-1	MB62	8-1006	8-1007	3-1033
45TV11-43-9028A	4-1049-2	PMS-1	MB62	*	8-1007	3-1033
45TV11-43-9085A	4-1104-2	PMS-1	MB69	**	none	3-1037
45TV11-43-9086A	4-1104-2	PMS-1	MB69	***	none	3-1037
45TV11-43-9087A	4-1104-2	PMS-1	MB69	8-1006	8-1007	3-1046
45TV11-43-9088A	4-1104-2	PMS-1	MB69	*	8-1007	3-1046
45TV11-43-9089A	4-1104-2	PMS-1	MB69	8-1006	8-1007	3-1046
45TV11-43-9090A	4-1104-2	PMS-1	MB69	*	8-1007	3-1046
45TV11-43-9091A	4-1104-2	PMS-3	MB69	8-1006	8-1007	3-1046
45TV11-43-9092A	4-1104-2	PMS-3	MB69	*	8-1007	3-1046
45TV11-43-9093A	4-1104-2	PMS-3	MB69	8-1006	8-1007	3-1046
45TV11-43-9094A	4-1104-2	PMS-3	MB69	*	8-1007	3-1046
45TV11-43-9095A	4-1104-2	PMS-3	MB69	8-1006	8-1007	3-1046
45TV11-43-9096A	4-1104-2	PMS-3	MB69	*	8-1007	3-1046
45TV11-43-9097A	4-1104-2	PMS-3	MB69	8-1006	8-1007	3-1046
45TV11-43-9098A	4-1104-2	PMS-3	MB69	*	8-1007	3-1046
45TV11-43-9130A	4-1104-2	PMS-4	MB73	*	8-1007	3-1046
45TV11-43-9131A	4-1104-2	PMS-4	MB73	*	8-1007	3-1046

* Part No. 8-1010 (Blue or Black dial bezel) used with Mallory UHF Tuner and Part No. 8-1014 (Green dial bezel) used with Radio Receptor UHF Tuner.

** Uses EU7A - Channel Selector Escutcheon and EU12A - On, Off, Volume, Contrast Escutcheon.

Used EU7A and EU12A Escutcheons. Also used 8-1009 (Blue or Black) dial bezel for Mallory UHF Tuner and 8-1013 (Green) dial bezel for Radio Receptor UHF Tuner.

PHONOGRAPH REFERENCE

Models 45TV11-43-9130A and 45TV11-43-9131A, Television-Radio-Phonograph Combinations, may be equipped with either a VM Model 950 record changer or a Webster-Chicago Model 114 record changer

Both changers are orginally equipped with an Astatic type ACD-M cartridge and an Astiatic type A-1 (J)

RADIO PARTS LIST

SCHEMATIC SYMBOL NUMBERS	DESCRIPTION	PART NO.
	Dial Scale Back Plate	BK-163
C-9, C-10	40/40 Mfd. 150 V. Electrolytic Capacitor	CEM-19
C-6	25 Mfd. 50 V. Tubular Electrolytic Capacitor	CET-17
C-4	47 Mfd. 500 V. 20% Mica Capacitor	CM-447
C-5	.0047 Mfd. 400 V. Paper Capacitor	CP-4-247
C-1, C-7	.01 Mfd. 400 V. Paper Capacitor	CP-4-11
C-2	.02 Mfd. 400 V. Paper Capacitor	CP-4-12
C-8	.05 Mfd. 600 V. Paper Capacitor	CP-6-15
C-3	.1 Mfd. 600 C. Paper Capacitor	CP-6-01
	Printed Circuit - Centralab No. PC-150	CRP-5
	Printed Circuit - Centralab No. PC-51	CRP-6
C-11	2-Gang Variable Condenser w/drum	CV-5
	Glass Dial Scale	GD-3
L-1	Broadcast Loop Antenna	LA-6
T-1, T-2	I.F. Transformer	LIF-14
L-2	Broadcast Oscillator Coil	LO-5
P-25	Volume Control Potentiometer - 2M	P-25
P-26	Tone Control Potentiometer W-switch - 2M	P-26
	Dial Pointer	PB-4
R-5	150 Ohms ½W. 20% Carbon Resistor	RC-151-1
R-1	22K Ohms ½W. 10% Carbon Resistor	RC-223-2
R-6	220K Ohms ½W. 10% carbon Resistor	RC-224-2
R-4	470K Ohms ½W. 10% carbon Resistor	RC-474-2
R-3	1 Meg Ohms :W. 10% Carbon Resistor	RC-105-2
-2	2.2 Meg Ohms ½ W. 20% Carbon Resistor	RC-225-1
R-8	330 Ohms 1 W. 20% Carbon Resistor	RC-331-4
R-7	1000 Ohms 2 W. 20% Carbon Resistor	RC-102-7
	Power Outlet	SAC-1
	Phono Jack	SC-1
	Pilot Lamp Socket	SPL-3
	Selector Switch	SW-9
	Audio Output Transformer	T-132
	Zip Coed (approx. 40" long)	WZC-1
	Rodio Dial Escutcheon	GD-3

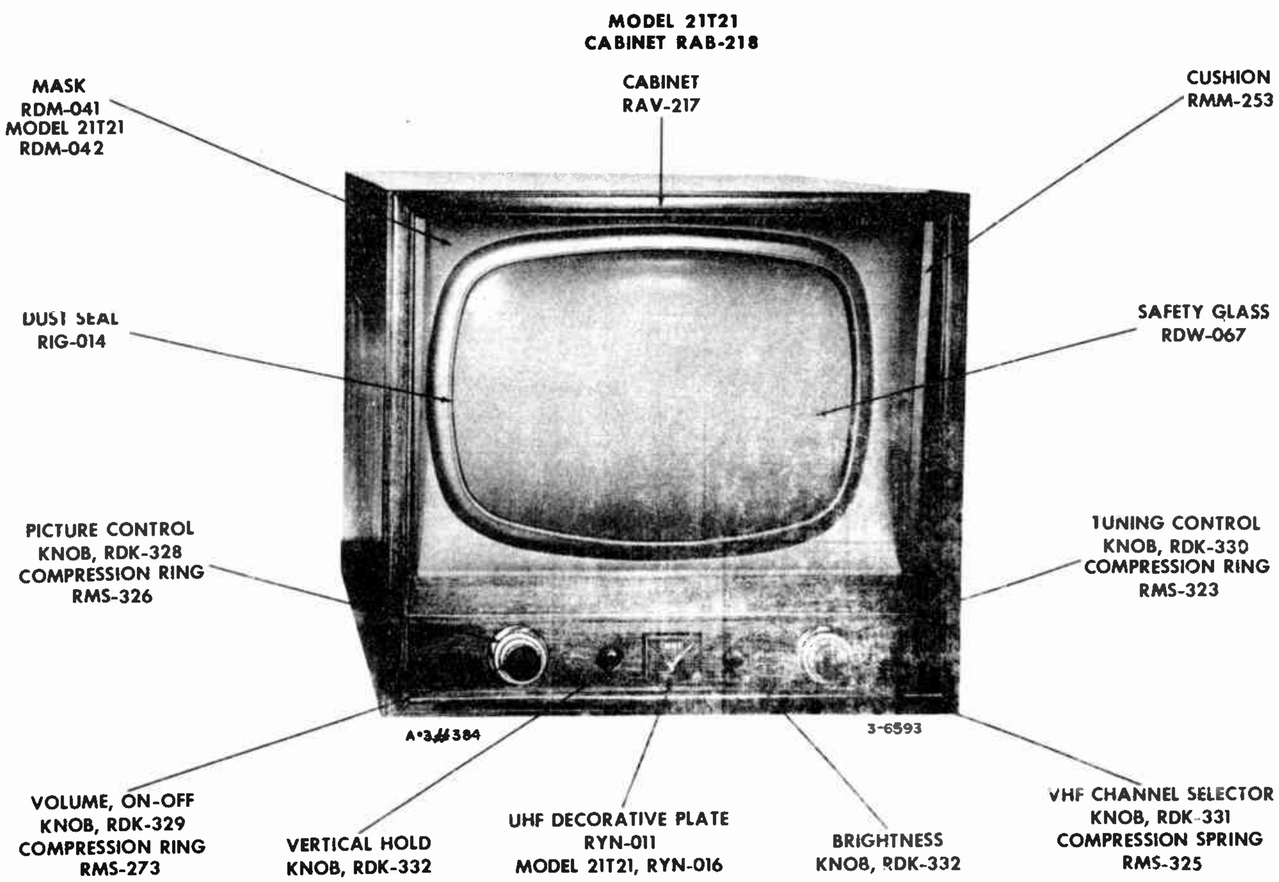
MODEL 21C226
CABINET RAV-220

MODEL 21C225
CABINET RAV-219

MODEL 21C229
CABINET RAV-222

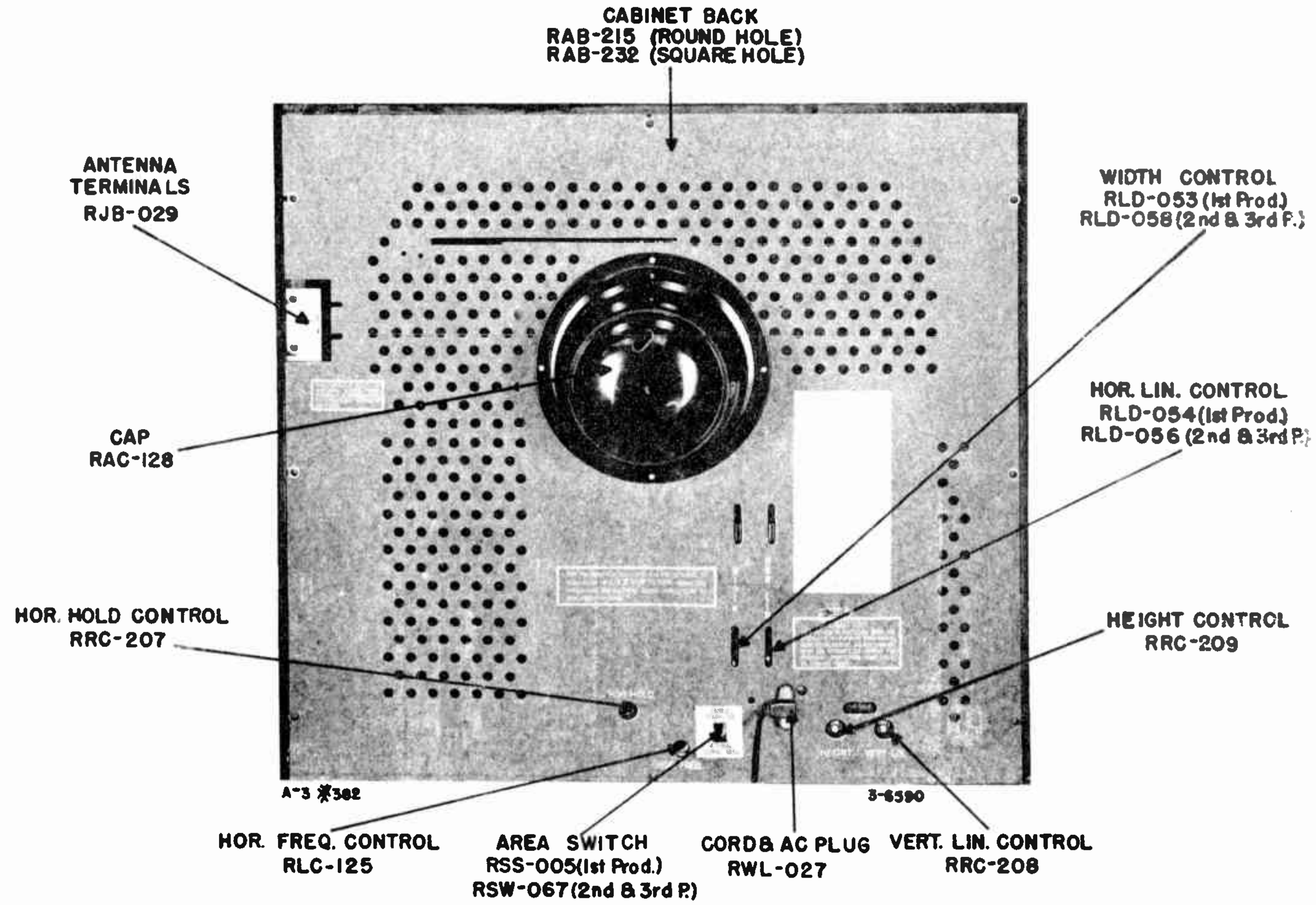
MODEL 21C230
CABINET RAV-231

MODEL 21C231
CABINET RAV-232



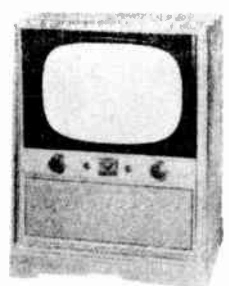
NOTE: For catalogue numbers of other models refer to Replacement Parts List, page 31.

MODEL 21T20 & 21T21

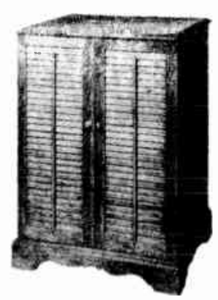


REAR VIEW, MODEL 21T20-T21

MODEL 21C227
CABINET RAV-221

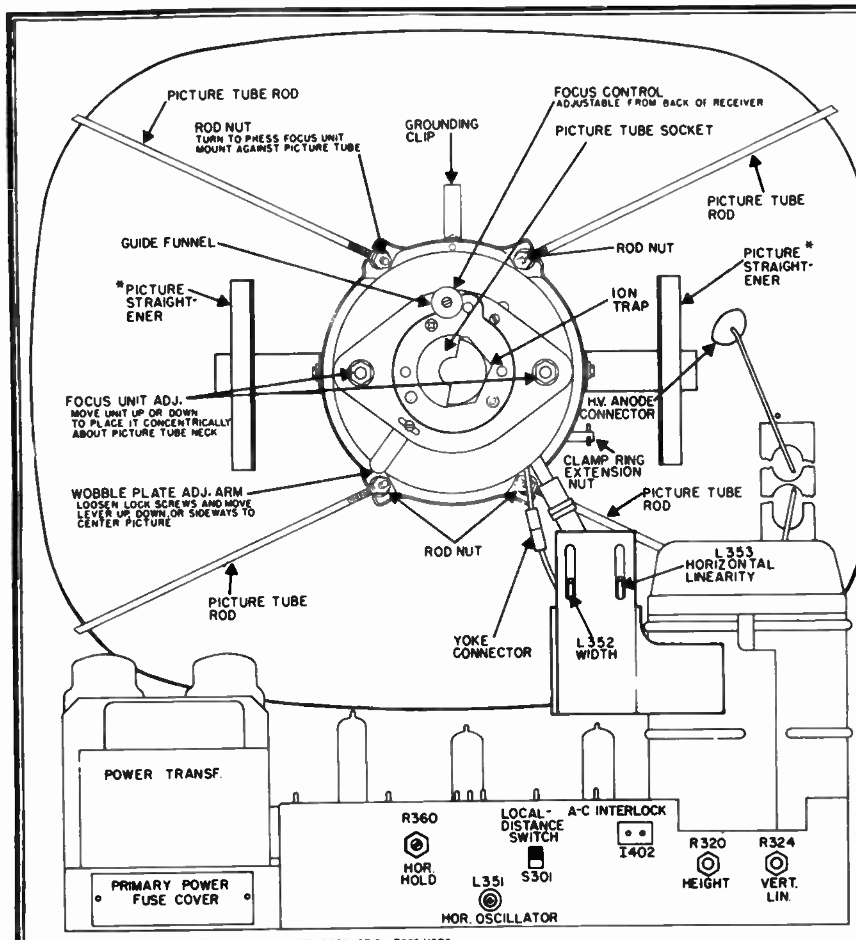


MODEL 21C228
CABINET RAV-215



MODEL 21C232
CABINET RAV-230

MODEL 21C233
CABINET RAV-233



* NOT USED ON LATE PRODUCTION RECEIVERS

Fig. 1. Chassis and Picture Tube Assembly

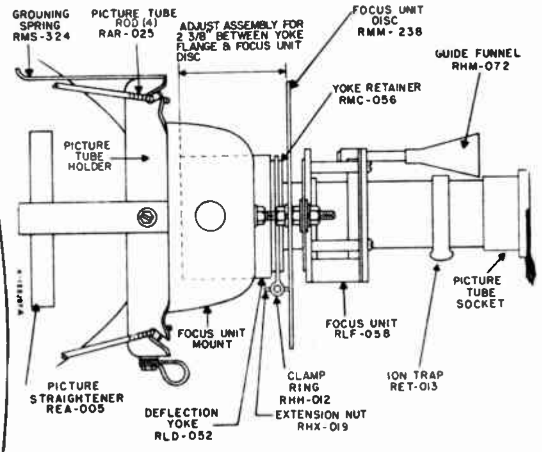


Fig. 2. Side View of Picture Tube Mount Assembly

SPECIFICATIONS

CABINET DIMENSIONS

MODEL	FINISH	HEIGHT INCHES	WIDTH INCHES	DEPTH INCHES	WEIGHT LB
21C225	Mahogany	35¼	25 9/16	20 15/16	138
21C226	Black Cherry	35¼	26 1/16	21⅛	138
21C227	Mahogany	35½	25 9/16	20 15/16	138
21C228	Blond	34¼	26	21¼	138
21C229	Mahogany	37	27¼	23 3/16	163
21C230	Black Cherry	37	26 13/16	23 3/16	163
21C231	Mahogany	37¾	27¼	23⅜	163
21C232	Cherry	37	27	23 1/16	163
21C233	Limed Oak	37¼	27¼	23¼	163
21T20	Mahogany	24 3/16	25 9/16	20 7/16	124
21T21	White Oak	24 3/16	25 9/16	20 15/16	124

INSTALLATION ADJUSTMENTS

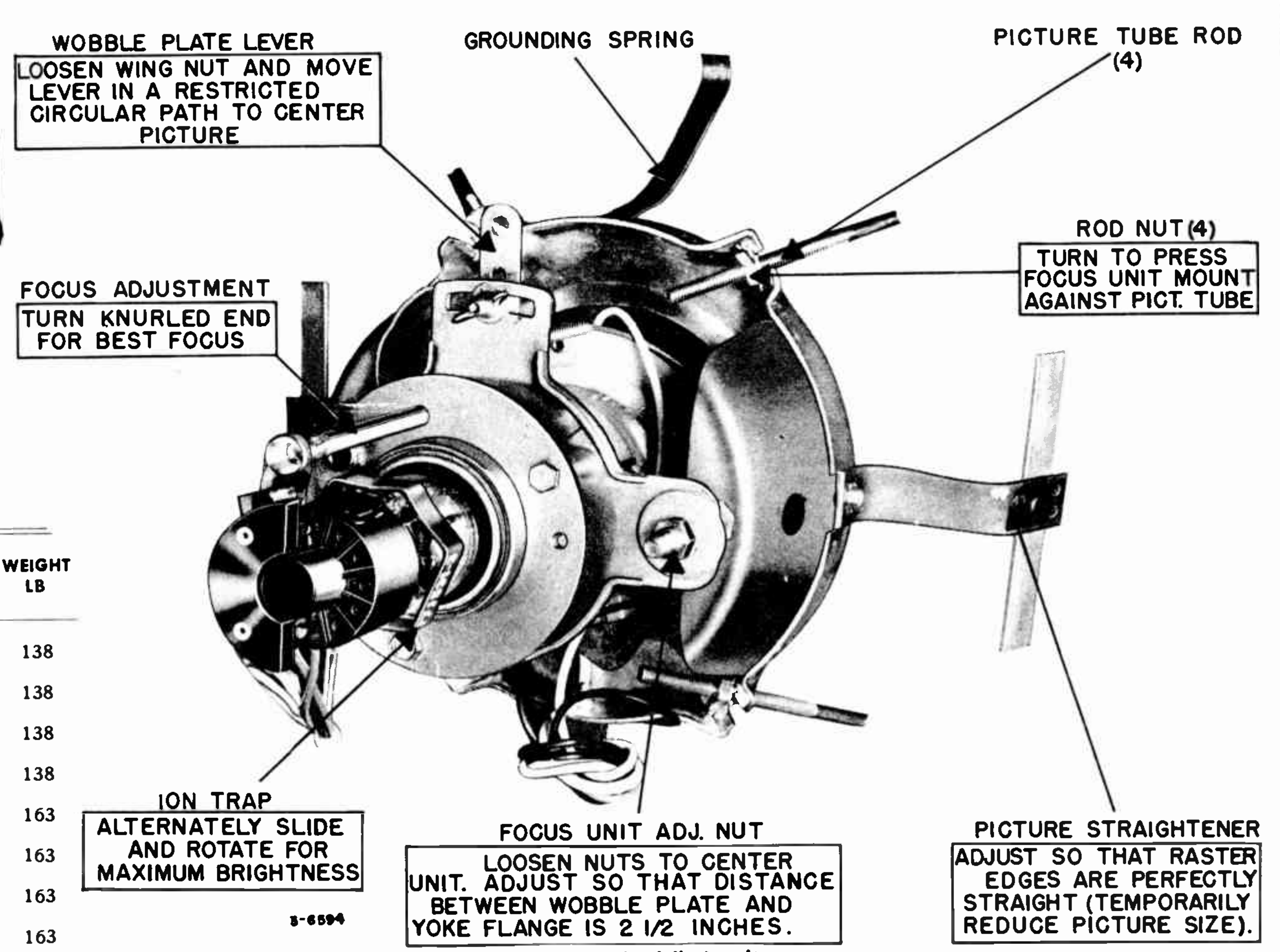


Fig. 3. Picture Tube Adjustments

A-3#377

TUBE & CRYSTAL COMPLEMENT

SYMBOL	PURPOSE	TYPE
V101	1st R-F Amplifier	6AB4
	("B-K" Tuner)	6BK7A
V102	2nd R-F Amplifier	6AK5
V103	Mixer-Oscillator	12AT7
V104	1st I-F Amplifier	6AU6
V105	2nd I-F Amplifier	6AU6
V106	3rd I-F Amplifier	6AU6
V107	4th I-F Amplifier	6CB6
V108	1st Video Amplifier & AGC Keyer	6U8
V109	2nd Video Amplifier	6AQ5 or 6CL6
V110	Picture Tube	21EP4-A or 21EP4-B
V111	Audio I-F Amplifier (4.5 mc)	6CB6
V112	Audio I-F Limiter	6AU6
V113	Ratio Detector, 1st Audio Amplifier, AGC Clamp	6T8
V114	Audio Output	6V6-GT
V115	Sync Amplifier & Noise Inverter	12AT7
V116	Clipper & Horizontal Blanking	12AX7
V117	Vertical Oscillator	12BH7
V118	Vertical Output	6AH4-GT
V119	Horizontal Phase Detector & Reactance Control	12AU7
V120	Horizontal Osc. & Discharge	12AU7
V121	Horizontal Output	6CD6
V122	High Voltage Rectifier	1B3-GT
V123	Horizontal Damper	6AX4-GT
V124	Power Rectifier	5U4-G
V125	Power Rectifier	5U4-G
Y151	I-F Detector Diode	Special, RED-003

POWER INPUT RATING:	Frequency ... 60 cycles Voltage ... 115 volts Wattage ... 275 watts
R-F FREQUENCY:	Channels ... No. 2 thru No. 13 Frequencies ... 54–88 mc, 174–216 mc
RECEIVERS EQUIPPED WITH UHF:	Channels ... No. 2 thru No. 83 Frequencies ... 54–88 mc, 174–216 mc, 470–890 mc (For complete Channel Frequency chart see page 4)
INTERMEDIATE FREQUENCIES:	Picture I-F Carrier ... 45.75 mc Adjacent Channel audio trap ... 47.25 mc Sound I-F carrier ... 41.25 mc Adjacent channel video trap ... 38.00 mc Intercarrier sound take-off ... 4.5 mc
PRIMARY FUSE:	Type ... Cartridge-type Rating ... 4 amp, 125 volts, slow-blow Size ... 1¼ in. x ¼ in. dia.
HIGH-VOLT. FUSE:	Type ... Pig-tail Rating ... ¼ or ⅜ amp, 250V Size ... 1¼ in. x ¼ in. dia.
AUDIO POWER OUTPUT:	Undistorted ... 1.5 watts Maximum ... 2.5 watts

PICTURE TUBE:	Type ... 21EP4-A or -B Size ... 21 inches Construction ... Glass, rectangular Deflection Angle ... 70 degrees Mask ... Rectangular, elliptical sides Picture size ... 13½ inches high x 18¾ inches wide

FOCUS UNIT: Loosen the focus unit securing nuts and laterally adjust the focus unit for the dimension shown in Fig. 2. Make sure the circular focus magnet remains concentric about and perpendicular to the tube neck. Tighten the focus unit securing nuts. Adjust the focus control screw for best focus. Some receivers use a slightly different focus unit as illustrated in Fig. 3.

PICTURE CENTERING: The wobble plate lever which is located on the forward end of the focus unit is the centering control. Loosen its two securing screws and move the lever in a restricted circular path until the picture is centered. Readjust the focus control if the picture centering process disturbed the focus adjustment. Refer to Fig. 3 for a different type of lever on top of unit.

PICTURE STRAIGHTENERS: These are the two anti-pincushioning magnets mounted near the bell of the picture tube. Adjust these magnets as follows:

(a) Reduce the picture size so that the raster edges are visible.

(b) Adjust the straightening magnets so that the raster edges are perfectly straight. These magnets will have an effect upon the width, but their important function is to keep the raster edges from being "bowed" in or out.

(c) Return picture to normal size with the size controls.

A. TO REMOVE PICTURE TUBE

1. Disconnect all cables and leads. Remove chassis.
2. Lay cabinet face down on a soft, nonscratching surface.
3. Remove ion trap.
4. Loosen and remove nuts and washers which secure the mounting rods to the picture tube strap assembly.
5. Remove entire picture tube mount assembly.
6. Remove picture tube assembly and picture tube.
7. Remove picture tube strap and remove tube from mask.

B. TO REPLACE PICTURE TUBE

1. Replace picture tube in mask and replace strap and tighten it.
2. Replace, in reverse order, all yoke and focus assembly parts removed in "A" above.
3. The nuts on each side of the flux shield (large disk) should be set for proper distance between the disk and the flange as shown in Fig. 2 and 3. Next, tighten the nut behind the forward plate of the focus unit thus maintaining it in its maximum forward position.
4. Replace ion trap.
5. Replace chassis and connect all leads and cables.

R-F TUNER UNIT

GENERAL DESCRIPTION

The r-f amplifier, converter and local oscillator are constructed as a complete subassembly unit which can be easily dismounted from the main chassis. This unit is designed and shielded to reduce oscillator radiation to a minimum.

The r-f tuner unit uses two r-f amplifiers, a converter and an oscillator. The intermediate output frequencies are: 45.75 megacycles for picture and 41.25 megacycles for sound.

The circuits are tuned by series coils and their distributed capacity, the tube capacity, and the capacity of three trimmers. As the channel selector is switched to lower channels, coils are added in series to lower the frequency. The oscillator section has a tuning adjustment for each channel so that the oscillator frequency may be correctly adjusted for every channel with one setting of the fine tuning control at the center of its range:

The antenna is coupled to the cathode of the first r-f amplifier by a balanced input transformer to reduce noise pick-up.

The r-f tuner unit includes an intermediate frequency trap in the cathode circuit of the first r-f amplifier to remove interfering frequencies, in the intermediate frequency pass-band, which may be picked by the antenna system. The trap is connected into the circuit when the receiver is tuned to the critical Channels, 2 through 6. Late production tuners incorporate a tunable cathode coil, L100.

Two major versions of tuners were used during the production run of these receivers. The 1st production receivers incorporate an "EE" version which uses a 6AB4 tube as 1st r-f tube, while the 2nd and 3rd production receivers incorporate a "BK" version using a 6BK7 tube as a 1st r-f amplifier. Refer to pages 14 and 25B for further details.

Delayed automatic gain control bias is applied to the second r-f amplifier. The i-f output of the converter is applied to the first i-f amplifier through a low-impedance coupling line to the i-f input coil. A test point "I" is added at the converter grid which is isolated from the grid by a resistor.

SERVICE ON R-F TUNER UNIT

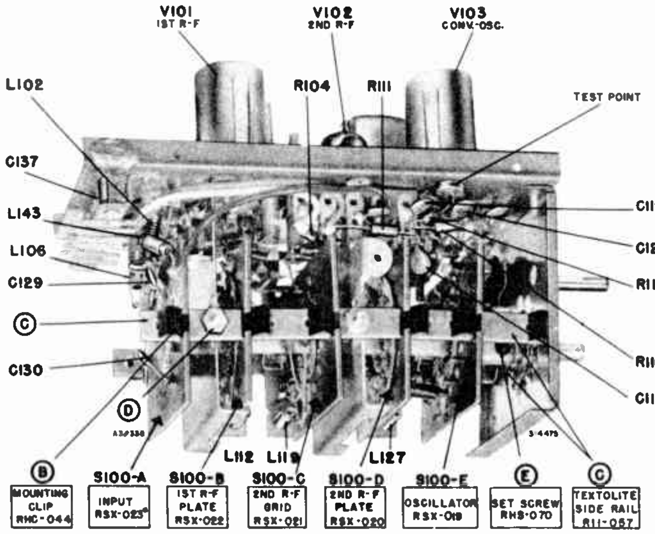
The r-f tuner unit has been carefully designed for trouble-free operation and ease in servicing. All parts including the switch wafers with the coils mounted are readily replaceable.

It is recommended that any trouble be definitely located before removing the r-f tuner unit. Make the following checks to help ascertain whether or not the trouble is in the r-f tuner.

1. If video or sound is present this usually eliminates the r-f tuner unit as a source of trouble. If both video and sound are absent, but the raster is normal, the trouble may be in the video i-f stages as well as in the r-f tuner unit.
2. If a noise pattern is evident on the screen, it usually indicates that the r-f tuner unit, the video i-f and the video amplifier circuits are operating normally. Check for a short or an open circuit in the antenna or antenna input circuits or first r-f stage.
3. Replace r-f tuner tubes with known good tubes. Note: When a new tube is used, slight differences in interelectrode capacities between tubes may cause a slight detuning of r-f circuits. If an oscillator tube is replaced, the fine tuning range should be checked.
4. Check for proper AGC bias voltage at test point No. X. A normal signal should produce approximately −3 volts VTVM reading.
5. The oscillator may be checked by measuring the voltage at test point No. I. If the oscillator is functioning it should develop approximately −3 volts as by a vacuum tube voltmeter. If the oscillator is inoperative the voltage at test point No. I will drop below 1 volt.
6. Check the i-f output coupling for open or short circuit.
7. Couple a 44-megacycle 400-cycle amplitude modulated signal to test point No. I. If the 400-cycle modulation is present at the output of the video amplifier plate as seen on an oscilloscope or observed on the screen of the picture tube in the form of horizontal bars, it is highly probable that the trouble lies somewhere in the r-f tuner unit ahead of the converter, V103B, grid (pin 7). However, should this 400-cycle information fail to appear in the receiver output, a check should be made of the video i-f amplifier stages, the crystal diode and the video amplifiers.
8. Check r-f tuner socket voltages shown in Fig. 27, page 24.

REMOVAL OF TUNER UNIT FROM CHASSIS—

1. Disconnect the antenna transmission line and the tuner output i-f coupling at the i-f assembly.
2. Remove self-tapping screws holding the tuner to the mounting brackets at the front and rear of the tuner.
3. Disconnect the following leads from the r-f tuner terminals: AGC, 6.3-volt heater, high B+ and low B+, see Fig. 19.



*Late production RSW-101

Fig. 12. R-F Tuner, Side View

4. Disconnect the black phenolic coupling from the r-f tuner switch shaft. The tuner assembly is now free for removal.

REPLACEMENT OF SWITCH WAFERS—See Fig. 12 and 13.

1. Remove the r-f tuner unit from the chassis and remove its shield.
2. Loosen setscrew (E) which holds Textolite switch shaft into the brass coupling RMK-007 and slide shaft out of the rear of the switch.
3. Remove the spring clips (B) which secure the switch wafer to the Textolite side rails (C). There are six of these springs on each side. These may be removed by lifting the tab out of the hole in the Textolite side rails.
4. Unscrew the four hex nuts (D) which secure the side rails (C) to the shields. The side rails may be lifted out of the switch wafers.
5. Unsolder the connections to the wafer to be removed and replace with the new wafer.

TO REMOVE THE OSCILLATOR WAFER ONLY—See Fig. 12 and 13.

1. Remove the r-f tuner from the chassis and remove the r-f tuner unit shield.
2. Loosen the Allen setscrew (E) which holds the Textolite switch shaft to the coupling and pull the shaft out of the oscillator wafer.
3. Remove the four spring clips (B) which secure the Textolite side rails (C) to the r-f tuner unit front apron and the oscillator wafer.
4. Remove the two self-tapping screws (A) which hold the r-f tuner unit front apron to the chassis, and pull the front apron forward so that the oscillator wafer may be removed. Use care not to break the connection to the tuning capacitor, C118.
5. Unsolder the connections to the oscillator wafer and remove it by springing up the Textolite side rails (C).

When reassembling the r-f tuner unit and replacing switch wafers, use care not to damage or distort any of the coils mounted on the switch wafers. Reassemble the r-f tuner unit in the reverse order that it was disassembled.

REMOVAL OF TUNING CAPACITOR OR DETENT ASSEMBLY—See Fig. 12 and 13.

1. Remove the r-f tuner unit from the chassis as outlined.
2. Remove the r-f tuner unit shield.
3. Remove the two spring clips (B) which hold the Textolite side rails.
4. Loosen the rear setscrew which holds the Textolite shaft into the brass coupling (RMK-007) and slide the Textolite shaft out of the coupling.
5. Remove the two self-tapping screws which secure the front apron to the r-f tuner unit chassis.
6. Spring up the Textolite side rails (C) to release the front apron for access to the tuning capacitor.
7. Unsolder the tuning capacitor lead at the 12AT7 socket.
8. To remove the detent assembly, remove the "C" washer on brass shaft.

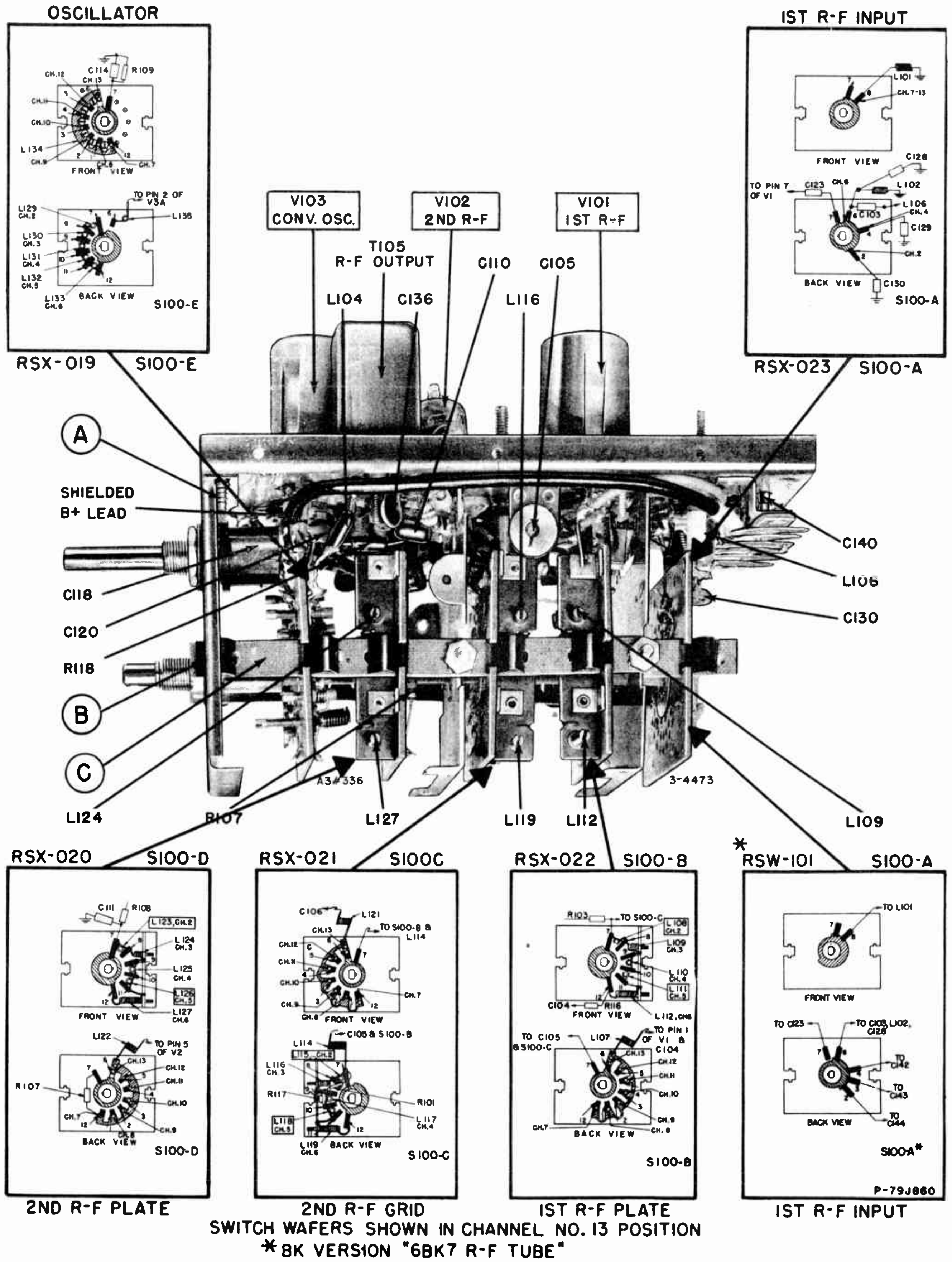
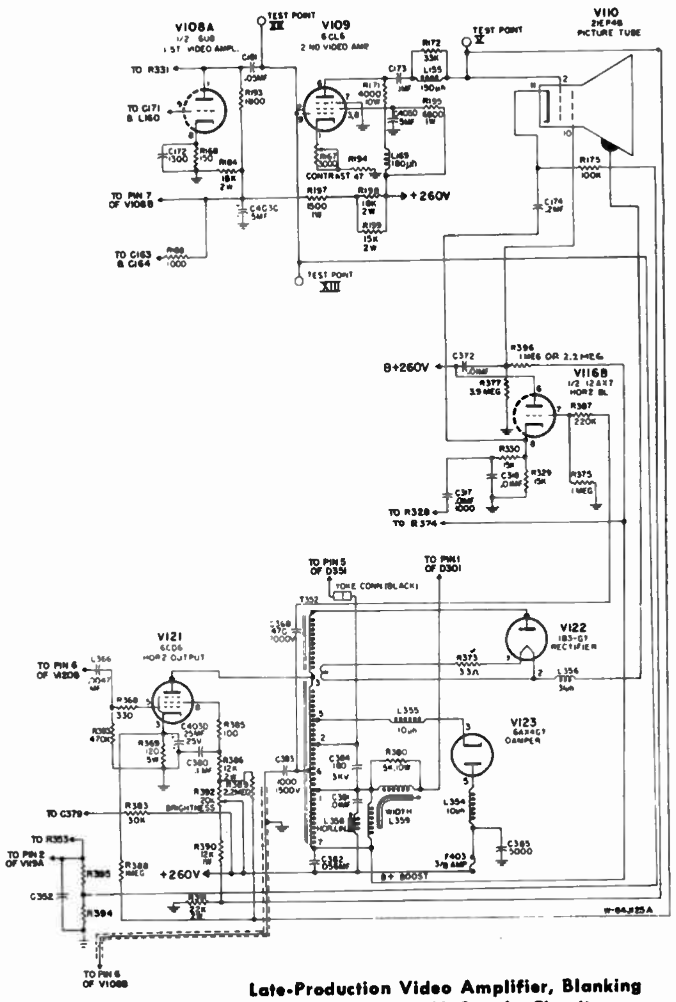


Fig. 13. R-F Tuner and Switch, Wafer Wiring



Late-Production Video Amplifier, Blanking Circuit and H. V. Supply Circuit

R-F Alignment

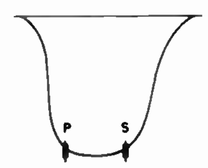
NOTES:

1. The r-f tuner may be aligned without removing it from the main chassis. Disconnect the 300-ohm transmission line from the antenna input transformer, T100 and disconnect the B+ to the oscillator, see Fig. 19. To remove B+ from the oscillator, clip the jumper between the center terminal lugs and transpose 250-volt lead from top feed through capacitor to lug No. 3 (reading left to right, looking down at top of tuner). Be sure to replace jumper and properly connect 250-volt lead after alignment.
2. Connect the sweep generator to the r-f tuner antenna input transformer using the G-E ST-8A balanced adapter to obtain 300 ohms output, see Fig. 14. The adapter should be connected to the r-f tuner through approximately three feet of 300-ohm transmission line and a resistor pad, as shown in Fig. 16A. When using other test equipment of the unbalanced output type, a pad as shown in Fig. 16B should be used instead.
3. Connect a 3-volt battery to the AGC terminal of the r-f tuner, see Fig. 19, with the positive lead of the battery connected to the tuner chassis.
4. Should it become difficult to obtain proper tracking on Channels 7–13 with the indicated adjustments, proper tracking may be achieved by dressing the coil L122. This coil is available through the opening of the tuner shield as shown in Fig. 17. This coil should be dressed with an insulated tool to prevent a B+ short.
5. It is possible to obtain two different settings of C105, Fig. 17, that will give the proper r-f bandwidth. The correct setting may be determined by switching from Channel 13 to Channel 12 and observing the change in bandwidth. The correct setting will result in a slightly greater bandwidth on Channel 12.
6. When proper tracking on the low channels cannot be achieved with the provided screw adjustments, the inductance of the coils L110, L111, L117, L118, L125 and L126 (Fig. 13) may be varied by inserting a knife blade between the windings. This method of adjustment requires the removal of the tuner shield, a procedure which will detune the circuits. However, in most cases the provided screw-type adjustments will suffice to achieve proper tracking through all channels after the shield has been replaced.
7. The picture and sound carrier marker should not be less than 75% of the peak of the r-f response curve. Refer to the "limits" curves shown in the accompanying alignment chart.
8. Seal trimmer screw of C105 and the brass cores in the coils L114, L112, L109, L119, L116, L127 and L124, Fig. 17, with wax to prevent detuning. Seal the tuning screws in trimmers C104, C106 and C108, Fig. 18, with glue. Reconnect the B+ oscillator lead on the r-f tuner terminal board and connect the transmission line to r-f tuner input transformer.
9. For receiver over-all alignment check, see page 19 (Step 3 and 4 of I-F Alignment Chart).

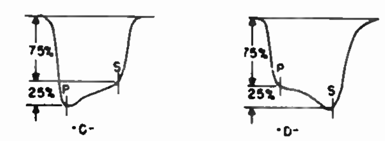
R-F Alignment Chart

(a) Set generator sweep width to 10–15 mc.
(b) Signal input point at r-f tuner input transformer, T100.
(c) Observe response curve at test point I, Fig. 18, through 10,000-ohm resistor. Connect test equipment ground lead to r-f tuner chassis.
(d) Adhere to following order when performing a complete alignment.
(e) When following the procedure below, an attempt should be made to obtain the indicated ideal response curves. Minor deviations from the ideal curves may occur, the maximum limits of "tilt" and/or bandwidth being shown in the "Remarks" column.

STEP	RECEIVER AND SWEEP GENERATOR CHANNEL	MARKER GENERATOR FREQUENCY MC	ADJUST	REMARKS
1	No. 13	211.25 215.75	C104, C105 and C108 (Fig. 17 and 18) for maximum gain and proper bandwidth of 4.5 mc to obtain curve "A" below. Limits are shown in last column.	Retune C108 and/or redress L122 (Fig. 17) for proper tracking; see note 4; C105 controls bandwidth, C104, C106 and C108 bring circuits into resonance.
2	No. 12	205.25 209.75	Adjust L100 on Channel 12 for maximum amplitude of *center* of response curve. Do not adjust beyond this point even if peaks tend to increase in amplitude. ("BK" version only)	
3	No. 11	199.25 203.75		
4	No. 10	193.25 197.75		
5	No. 9	187.25 191.75	No adjustments; check tracking; obtain curve "A"; limits shown in last column.	
6	No. 8	181.25 185.75		
7	No. 7	175.25 179.75		
8	No. 6	83.25 87.75	L112, L114, L119 and L127, Fig. 17, for maximum gain, optimum curve flatness and 4.5 mc bandwidth; see curve "B"	
9	No. 5	77.25 81.75	No adjustments, check tracking; see curve "B"	
10	No. 4	67.25 71.75		
11	No. 3	61.25 65.75	L109, L116 and L124, Fig. 17, for maximum gain and optimum curve flatness. See curve "B"	
12	No. 2	55.25 59.75	No adjustments, check tracking; see curve "B"	See note 6.



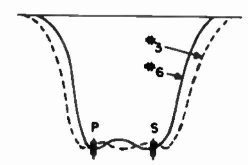
A
Ideal curve



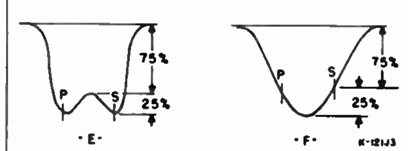
Sound Carrier 25% down

Picture Carrier 25% down

Tilt Limit Curves



B
Ideal curve



Wide limit

Narrow limit

Bandwidth Limit Curves

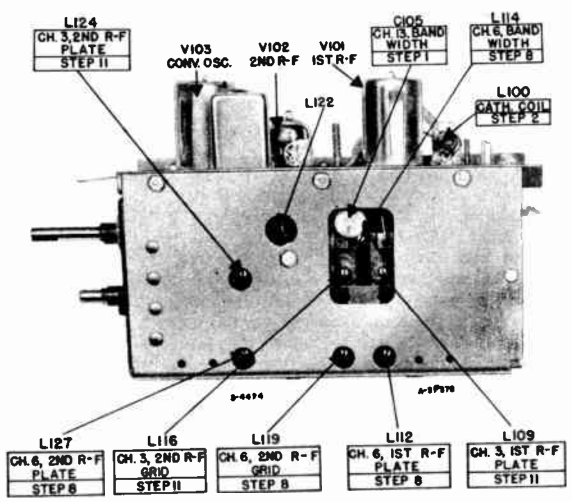


Fig. 17. R-F Tuner Adjustment, Side View ("BK" Version)

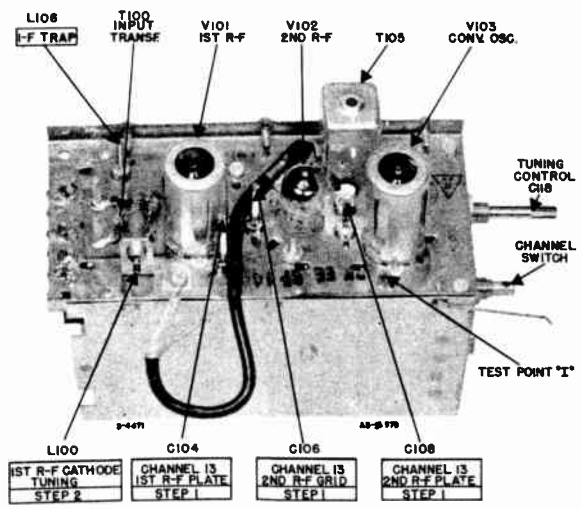
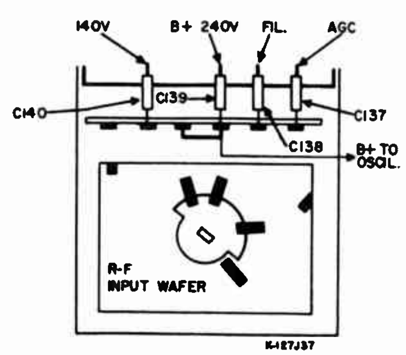
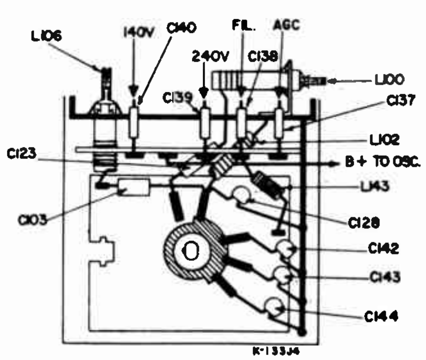


Fig. 18. R-F Tuner Adjustment, Top View ("BK" Version)



A. "EE" Version Tuner



B. "BK" Version Tuner

Fig. 19. R-F Tuner Terminal Board Wiring

Oscillator Alignment

GENERAL. Two methods of oscillator frequency adjustment are given below. The first method uses a transmitting station for the adjustment while the second method requires a sweep generator to align the oscillator coils.

A. *"ON Station Signal" Alignment*

R-F and video i-f alignment must be correct before attempting oscillator alignment. A transmitted station signal is needed for each one of the coils being adjusted. Tune in the stations starting with the highest frequency channels and adjust the tuning screws for all available stations so that with the fine tuning control in the full-clockwise position, audio is just visible in the picture. Then, check to see that best picture response on all channels takes place approximately in the center of the oscillator fine tuning range.

B. *Sweep Alignment*

1. R-F and video i-f must be properly aligned before aligning the oscillator.
2. Connect a 3-volt battery to the AGC terminal of the r-f tuner, see Fig. 19, with the positive lead of the battery connected to the tuner chassis.
3. Disconnect the 300-ohm transmission line from the antenna terminals to the r-f terminals and connect the sweep generator to the r-f tuner terminals as described in note 2 on page 14.
4. Set the fine tuning knob 180° (½ turn) from the counter-clockwise limit of its rotation, i.e. rotate the fine tuning knob counterclockwise to the end of its travel, then turn the fine tuning control knob 180° (½ turn) clockwise. This setting of the fine tuning control should be maintained for all oscillator adjustments.
5. Make the indicated adjustments so that the picture carrier marker for the channel falls at 50% on the high frequency side of the response curve.

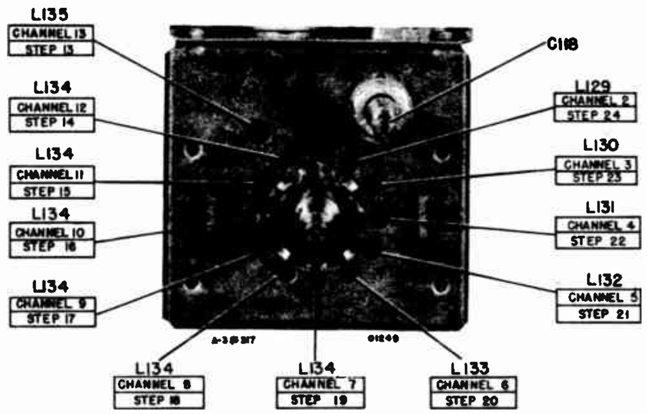


Fig. 20. Oscillator Adjustments

OSCILLATOR ALIGNMENT CHART

Sweep Generator Sweep Width 10–15 MC

STEP NO.	RECEIVER AND MARKER POSITION	MARKER GENERATOR FREQUENCY	SIGNAL INPUT POINT	OBSERVE RESPONSE CURVE AT	ADJUST	SEE NOTE
13	No. 13	211.25 MC			L135 Channel No. 13 oscillator adjustment.	
14	No. 12	205.25 MC			L134 Channel No. 12 oscillator adjustment.	
15	No. 11	199.25 MC	Antenna terminals (see Note 3)	Test Point IV (Video detector diode load)	L134 Channel No. 11 oscillator adjustment.	1, 2, 3, 4, 5
16	No. 10	193.25 MC			L134 Channel No. 10 oscillator adjustment.	
17	No. 9	187.25 MC			L134 Channel No. 9 oscillator adjustment.	
18	No. 8	181.25 MC			L134 Channel No. 8 oscillator adjustment.	
19	No. 7	175.25 MC			L134 Channel No. 7 oscillator adjustment.	
20	No. 6	83.25 MC			L133 Channel No. 6 oscillator adjustment.	
21	No. 5	77.25 MC			L132 Channel No. 5 oscillator adjustment.	
22	No. 4	67.25 MC			L131 Channel No. 4 oscillator adjustment.	
23	No. 3	61.25 MC			L130 Channel No. 3 oscillator adjustment.	
24	No. 2	55.25 MC			L129 Channel No. 2 oscillator adjustment.	

AUDIO I-F ALIGNMENT

NOTES:

1. Tune in a television signal. This will provide a 4.5 mc signal source for audio alignment. Keep the Volume control turned down unless the speaker is connected.

2. Figure 21 shows a simple resistor network needed for the alignment of T202 secondary. These two 100,000-ohm resistors should be chosen as accurately as possible, for equal resistance. Be sure to remove these resistors after completing the alignment. Align as follows:

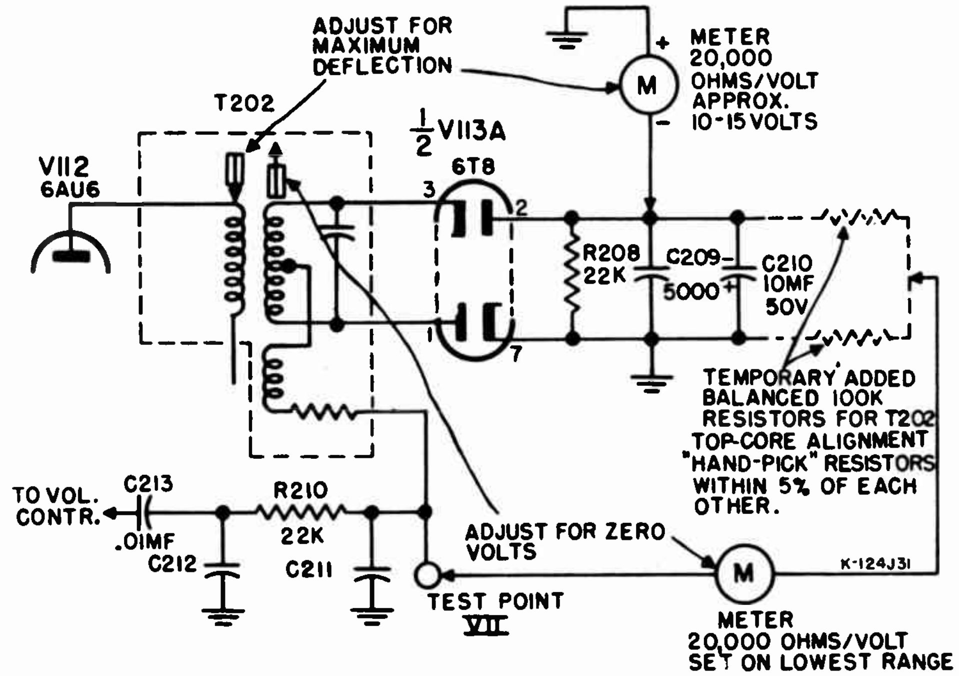


Fig. 21. Audio I-F Meter Connections

AUDIO I-F ALIGNMENT CHART

STEP	CONNECT VTVM OR 20,000 OHMS/VOLTMETER	ADJUST	METER INDICATION	REMARKS
1	To test point VI and chassis.	L157 and T201 (top and bottom cores).	Adjust for maximum deflection.	Voltage to be read is negative with respect to chassis.
2	V113A, pin 2 and chassis.	T202 primary (bottom core).		
3	Test Point VII and center of two 100K ohms resistors. See Fig. 21.	T202 secondary (top core).	Adjust for zero volts d-c output.	Repeat steps 1, 2 and 3 to assure proper final adjustment.

L106 TRAP ADJUSTMENT

ALIGNMENT OF L106 I-F TRAP

The trap, L106 (Fig. 18) is incorporated in the r-f tuner to remove or attenuate any interfering frequency in the i-f range. The trap should be aligned by tuning for minimum i-f channel interference pattern on the screen. If the interference is intermittent and the interfering frequency is known, L106 may also be aligned by the use of a calibrated signal generator.

NOTES:

1. Connect 3 volts bias from the AGC line on the r-f tuner (see Fig. 19) to chassis with the positive terminal of the battery connected to chassis.

2. Use an accurate marker generator to furnish a signal of the same frequency as the interfering frequency and a sweep generator with its center frequency set approximately at the interference frequency. Connect the scope to view the response curve at the output of the video detector.

3. Use the GEST-8A balanced adapter and a 3-foot piece of 300-ohm transmission line to couple the r-f sweep to the antenna terminals of the receiver.

4. Be sure, in tuning the trap, that it does not attenuate Channel No. 2.

L106 ALIGNMENT CHART

MARKER FREQUENCY	SWEEP FREQUENCIES AND INPUT POINT	OBSERVE RESPONSE CURVE AT	CHANNEL SWITCH SETTING	ADJUST
Interference frequency	40 to 50 mc to antenna terminals	Test Point IV	2	Core of L106 for minimum amplitude of curve at marker

RECEIVER ALIGNMENT

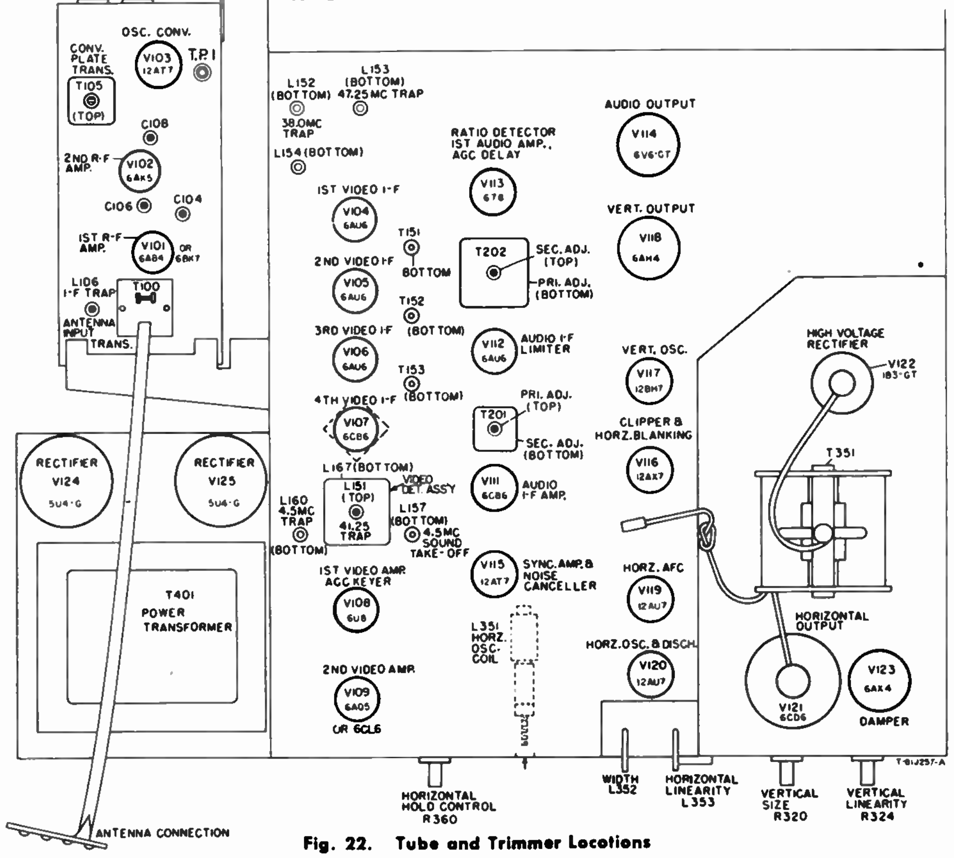


Fig. 22. Tube and Trimmer Locations

VIDEO I-F ALIGNMENT

Introduction:

The following alignment data is divided into two separate procedures. Because of the extremely high adjacent channel trap attenuation, the conventional method of sweep observation of these traps becomes difficult. Hence all traps shall be pretuned by applying an amplitude-modulated signal and adjusted for minimum signal output.

The second portion of this procedure involves the shaping of the i-f response curve in the conventional manner by the application of a sweep generator signal. During this procedure, observe the usual precautions regarding warm-up time, equipment cable lead dress and generator output cable termination, see Fig. 15.

TRAP ALIGNMENT

GENERAL:

As noted above, an AM signal is required for trap alignment. In many cases, the technician will have a suitable AM signal generator available. It should cover the range of 37 to 48 megacycles at fundamental frequency, with available internal 400-cycle modulation. When this type of signal is used, the traps should be adjusted for minimum 400-cycle signal as observed on the oscilloscope.

Owners of General Electric sweep alignment equipment may obtain the required amplitude-modulated carrier frequencies by a simple manipulation of the equipment controls as noted below.

Those technicians who do not have either of the above equipment available are advised to omit the trap alignment procedure. With the exception of the video amplifier 4.5 mc trap L160, the traps will not become seriously misaligned due to tube changes. The above-mentioned 4.5 mc trap may be sweep-aligned, if desired, in which case a 4.5 mc sweep signal should be used in step 3, of trap alignment chart. The trap may then be tuned to minimum response at 4.5 mc which should be crystal marker calibrated.

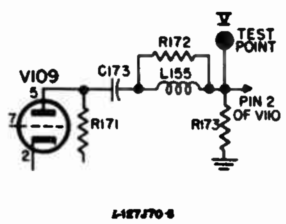
OBTAINING AM OUTPUT FROM G-E SWEEP EQUIPMENT

The General Electric ST-4A Sweep Generator will provide 60-cycle square-wave amplitude-modulated signal. To obtain this signal proceed as follows:

1. Turn the sweep generator sweep width control fully counter-clockwise. This will provide a steady (zero sweep) carrier.
2. Turn the sweep generator blanking switch "on." This will square-wave-modulate the carrier at a 60-cycle rate.
3. The next step is to calibrate the frequency of this AM carrier.
   a. Turn the marker generator "on" and set the dial to the desired frequency (4.5 mc, 38.0 mc, 41.25 mc or 47.25 mc).
   b. Slowly tune the sweep generator through the desired frequency. As the desired frequency is approached, a strong beat signal will be observed on the oscilloscope. At *exact* resonance, a zero beat condition will be noticed, on each side of which will appear a beat pattern. Minor sweep generator back-and-forth frequency drift may be noted. However, this drift is insignificant and may be disregarded.
   c. Turn off the marker output.
4. Apply this AM signal according to the instructions in the chart on page 19.
5. The signal observed on the oscilloscope appears as two parallel lines. When the traps are properly tuned the distance between these lines will be at a minimum. NOTE: It may be necessary to use full output of the sweep generator and near maximum oscilloscope gain to observe proper trap tuning.

ALIGNMENT NOTES:

1. Remove V121 plate cap. Temporarily connect a 2500-ohm, 25-watt resistor from B+ 260 V to Chassis.
2. Remove tube V115 from its socket.
3. Turn the Volume control to minimum and the Picture Contrast control to maximum. Turn the Brightness control fully counterclockwise.
4. Set Channel Selector to Channel 11 position. Set the fine tuning control to its maximum counterclockwise position.
5. Connect oscilloscope to test point V (picture tube grid).
6. Allow receiver and test equipment to warm up for 15 minutes. Refer to Fig. 22 for alignment adjustments location.



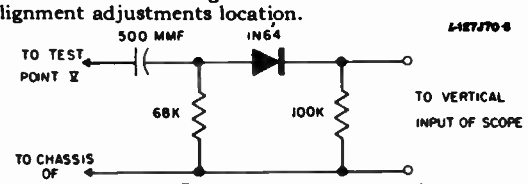
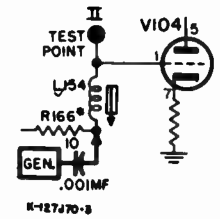


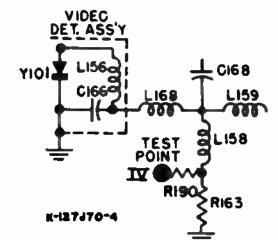
Fig. 23. Detector Network

TRAP ALIGNMENT CHART

STEP	AM—GENERATOR INPUT POINT	AM—GENERATOR FREQUENCY	ADJUST FOR MINIMUM OUTPUT	REMARKS
1	Through .001 mf capacitor to junction of R178 and L154; connect generator cable shield to receiver chassis (see figure below)	41.25 mc	L151	May require maximum oscilloscope vertical gain.
		47.25 mc	L153	
		38.0 mc	L152	
2	Test Point IV (Diode Load) (see figure below)	4.5 mc	L160	Connect detector network between oscilloscope input and receiver test point V as shown in Fig. 23. Remove V107 during this step.



* R178 (Mid and Late Prod.)



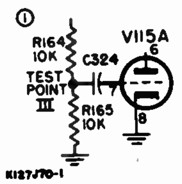
I-F SYSTEM SWEEP ALIGNMENT

GENERAL:—

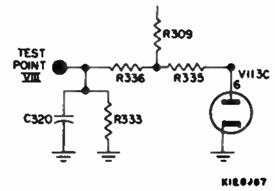
Now that the traps have been set at their proper frequencies the i-f curve may be shaped.

NOTES:—

1. Turn Picture Contrast control to minimum.
2. Connect oscilloscope to test point III (junction of R164 and R165).
3. Apply a negative 4½-volt battery bias voltage to test point

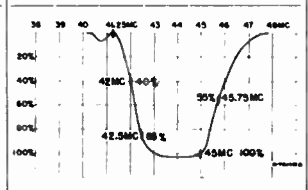
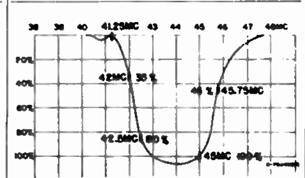


VIII. Connect positive lead of battery to chassis.



4. Calibrate the vertical gain of the oscilloscope to provide a 2-inch deflection with applied signal, 1¾ volts peak-to-peak.
5. Note that the following procedure uses 45.0 mc as the 100% reference point. Maintain the sweep generator output so that the baseline-to-45.0 mc marker amplitude equals 2 inches. Align as indicated in the alignment chart below.

I-F ALIGNMENT CHART

STEP	CONNECT SWEEP GENERATOR	ADJUST	DESIRED RESPONSE	REMARKS
1	Into Test Point II and chassis through .001 mf capacitor. Center sweep frequency approx. 44.0 mc. Sweep width approx. 10 mc.	T151 for proper 42.0 mc response. T153 for proper 45.75 mc response. T152 & L167 for zero "tilt" and maximum gain without "saddle-back."		Make indicated adjustments to obtain maximum gain consistent with proper curve. Corners of curve peak must show slight rounding. Peak of curve may extend 10% (max.) beyond 45.0 mc marker.
2	Into Test Point I and chassis through .001 mf capacitor. Center sweep frequency approx. 44.0 mc. Sweep width approx. 10 mc.	L154 and T105 (R-F Tuner) for maximum gain and proper marker position.		Obtain maximum gain and proper marker positions. Peak of curve should extend 15% beyond 45.0 mc marker, with slight rounding.
3	Into R-F Tuner input through balanced adapter and 300-ohm pad and line. Sweep Channels 2–13. Sweep width approx. 10 mc.	C108 (R-F Tuner)	Align for zero "tilt" on ch. 10. Check chs. 7–13 and make further compromise adjustment so that each channel will have no more than ±20% "tilt" with the Fine Tuning adjusted to provide the proper sound and picture i-f markers.	
4		L124 & L127 (R-F Tuner)	Align for zero "tilt" on Channels 3 and 5. Check chs. 2–6 and make further compromise adjustment, so that each channel will have no more than ±20% "tilt" with the Fine Tuning adjusted to provide the proper sound and picture i-f markers.	

TROUBLE SHOOTING

In many cases a circuit difficulty may be localized by observing the picture or test pattern and by noting the presence or absence of sound. In general, the tubes in defective circuits should be checked first since this check does not take much time and the probability of failure is higher in tubes than in components. When substituting tubes in r-f or video i-f circuits, the original tube should be replaced in the socket if it is found to be satisfactory.

Always make sure that all tubes are making good socket contact. In some cases it may be necessary to clean the tube pins to eliminate intermittances.

To facilitate trouble shooting, the waveforms of Fig. 31 should be consulted. Alignment equipment may be used to isolate defective r-f or video i-f stages by checking for the response curves given in the alignment procedure.

General Service Information

1. CRITICAL LEAD DRESS

To prevent the effects of undesired 4.5 mc harmonic radiation, it is essential that all audio and video i-f components be replaced in exactly the same position they occupied when they were wired in at the factory. All r-f, video and sync carrying leads should be made as short as possible. Check lead dress of picture tube anode lead to prevent high-voltage arc-over.

2. NOISE INVERTER CHECK

A simple oscillographic check may be performed which will display the operation of the noise inverter. The procedure is based upon noise pulse inversion in the absence of signal.

1. Turn on receiver. Set channel selector switch to an unoccupied channel.
2. Connect oscilloscope to Junction of C303 and C304.
3. Bias off the noise inverter (V115B) by connecting a 100,000-ohm resistor between its pin No. 3 and +250 volts.
4. Supply a moderate-amplitude noise signal to the antenna input terminals. A suitable noise source would be an electric shaver or similar "spark" type noise generator.
5. Observe positive polarity of noise pulses on oscilloscope. Removal of the temporarily added 100,000-ohm resistor should cause the noise signal to reverse itself and hence become negative in polarity.

3. KEYER TUBE CHECK

The proper operation of the AGC Keyer tube V108B may be checked by shorting pins 2 and 7 and observing the AGC voltage. This voltage should reach a value of approximately 40 volts as measured at the AGC terminal of the r-f tuner (see Fig. 19).

SYMPTOM	CHECK FOR
DEFECTS OF THE R-F AND I-F CIRCUITS	
A. No sound, no picture	1. Inoperative local oscillator, V103A 2. Open video i-f coupling capacitor, C167 3. Improper or no screen or plate voltage at r-f or i-f tubes due to shorted screen by-pass capacitor or open resistor 4. Open video detector crystal, Y151
B. No picture, sound possibly weak, raster satisfactory	1. Shorted capacitor, C168 2. Open coupling capacitor, C167 3. Defective crystal diode, Y151
C. Noisy picture (Low signal strength)	1. Open input circuit and components of antenna input circuit, such as open capacitors, C183, C184, or open transformer, T100 2. Defective antenna, or antenna transmission line 3. Antenna orientation 4. Open filament, V101
D. Wiggles in picture background, trailing whites, sound normal	1. Alignment of i-f amplifier and associated traps 2. Low value resistor, R163
E. "Motorboat" or flutter in picture and/or audio	1. Open by-pass C319 2. Open AGC filter capacitor C320 3. Alignment of r-f and video i-f amplifiers
F. Lack of picture detail (Focus satisfactory)	1. Misalignment of video i-f amplifier 2. Misalignment of r-f amplifier 3. Mismatch of input impedances at antenna input terminals of receiver 4. Overloading of r-f stages
G. Sound bars in picture	1. Microphonic tubes: V101, V102, V103, V104, V105, V106, V107, V108, V109 and V110 2. Misalignment of adjacent channel sound trap L153 or misalignment of accompanying sound trap L151
DEFECTS OF THE VIDEO AMPLIFIER	
A. No picture, sound satisfactory	1. Open compensating choke L162 2. Shorted capacitor, C403C in cathode circuit V108B 3. Open coupling capacitor, C181 to tube V109 4. Open plate resistors at tube V108A or V109. Check plate voltages 5. Short of grid to cathode in picture tube
B. Lack of picture detail (focus satisfactory)	1. Shorted peaking coils 2. Open peaking coils (only those coils shunted by resistors) 3. Increase in value of diode load and video amplifier plate resistors
C. Trailing Whites	1. Decrease in value of diode load and/or video amplifier plate resistors

SYMPTOM	CHECK FOR
DEFECTS OF THE SYNC SECTION	
A. Weak or no horizontal sync; vertical sync, picture and sound satisfactory	1. Sync amplitude at input to discriminator tube, V119A 2. Bias and plate voltage on control tube, V119B 3. Sine-wave oscillator components, L351, C361, C357, R358 and R359 4. Leaky or shorted capacitors, C354 and C355 5. Waveform feedback components, C364, R365, R366 and C365
B. Weak or no composite sync, otherwise picture and sound normal	1. Defective coupling capacitor C303 or C304 to clipper tube 2. Incorrect value of plate resistor, R312 of clipper tube, V116A 3. Insufficient amplitude of composite signal applied to sync amplifier from video detector; check video detector circuit
C. No vertical sync, horizontal sync satisfactory	1. Sync pulse at input of vert. oscillator, check integrator plate P301 2. Vert. oscillator frequency, if far off from 60 cps, check vert. oscillator components such as C311 and R317 3. Leakage in feedback capacitor, C315
D. Picture displaced to left, right edge wavy	1. Open or low value of capacitor, C304
E. Horizontal sync out, bright bar or bars in picture	1. Shorted, open or leaky capacitor, C360 2. Improper value resistor, R361
F. "Gear Tooth" effect	1. Open or low value capacity of C356 2. Open or high resistance of R357
G. Noise "tearing" picture (noise inverter failure)	1. Low value, R340 2. Open C302 3. Open or high value, R305
H. Poor composite sync (attributable to noise inverter failure)	1. Open or high value of R340 2. Low value R305 3. Leaky or shorted C302
DEFECTS OF THE VERTICAL DEFLECTION CIRCUIT	
A. Poor vertical linearity, inadequate height	1. Low emission of sweep output tube, V118 2. Improper grid input "drive" voltage at V118 3. Defective sweep output transformer T301 4. Low B+ voltage to sweep output tube V118 5. Low value of cathode capacitor, C402C
B. Inadequate picture height	1. Rise in resistance value of vert. oscillator plate resistor, R319 or R374 2. Leakage in capacitor C312 3. Incorrect value of plate, or grid voltages on putout tube, V118 4. Low value capacitor in cathode of vert. output tube, C402C (This usually results in poor linearity) 5. Weak vertical deflection tube, V117 or V118
C. No vertical deflection	1. Open vertical deflection coils, D301 2. Defective sweep output transformer, T301 3. Shorted capacitor C312, C314 4. Poor contacts in yoke plug
D. Poor vertical linearity, height satisfactory	1. Defective linearity control components such as cathode capacitor, C402C, or improper value of R323 2. Open capacitor, C314 3. Leaky capacitor, C316 4. Vertical output tube, V118
E. Excessive height	1. Too low value of resistor R319 or R374 or defective height control, R320
F. Poor vertical linearity, fold-over at bottom of picture, picture height excessive	1. Low resistance leakage of capacitor, C313, C316
G. Vertical keystoning	1. External short across vertical deflection coils 2. Defective vertical deflection coil, D301
DEFECTS OF THE HORIZONTAL DEFLECTION CIRCUITS	
A. Too great sweep width, reception normal otherwise	1. Open width control coil 2. Open winding between width coil taps on horizontal output transformer
B. Inadequate sweep width	1. Correct waveshape and amplitude of input "drive" voltage at grid of V121 2. Shorted width control or defective deflection coil, D351 3. Defective horizontal output transformer shorted turns or arc-over 4. Low emission of tube, V121, V123 5. Low B+ voltage to tubes V120A, V120B, V121
C. Single vertical line in center, sound normal	1. Open horizontal deflection coils, D351 2. Open yoke plug connection

TROUBLE SHOOTING

DEFECTS OF THE HORIZONTAL DEFLECTION CIRCUITS (Cont'd)

SYMPTOM	CHECK FOR
D. Poor horizontal linearity	1. Shorted linearity control 2. Defective yoke, D351 3. Defective capacitors, C376, C367 or C382
E. Poor horizontal linearity, bright vertical bars, inadequate width	1. Open or low value of capacitor, C367 or C382 2. Defective damper tube, V123
F. Black "beady" vertical line or lines, receiver normal otherwise	1. Defective output tube, V121 2. Defective horizontal sweep output transformer 3. Defective deflection yoke, D351
G. No raster—sound satisfactory	1. Defective sweep output tube, V121 or damper tube, V123 2. Defective tubes, V120B, V120A 3. Shorted capacitor C367 or C382 4. No screen voltage on V121 5. Adequate drive at grid of V121 6. Open linearity control 7. Defective horizontal sweep output transformer 8. Open fuse, F402

DEFECTS OF THE POWER SUPPLY

SYMPTOM	CHECK FOR
A. No raster, no sound	1. Power supply interlocks and/or fuses open 2. Power cord plug and cable 3. Rectifier components 4. Open filter choke 5. Defective power transformer 6. Yoke plug not connected
B. Picture size small, brilliance low, sound normal	1. Open or low value of input filter capacitor, C402 of power supply 2. Defective rectifier, V124 or V125
C. Picture blooms	1. Defective H.V. rectifier, V122 2. Defective picture tube
D. Hum bar in picture, waviness in edges of raster ("Mae West" movement)	1. Open or low value of filter capacitor, C401B
E. Low picture brilliance, sound satisfactory	1. Low voltage at H.V. anode of picture tube, caused by defective rectifier V122 2. Improper adjustment of ion trap 3. Defective brightness control circuit 4. Low voltage at 1st anode of picture tube (pin 10) 5. Defective picture tube

MISCELLANEOUS DEFECTS

SYMPTOM	CHECK FOR
A. No raster—sound satisfactory	1. Open or shorted picture tube heater 2. No voltage at 1st anode of picture tube (pin 10) 3. Excessively high bias voltage at cathode of picture tube 4. Defective picture tube, check by substitution
B. Receiver overloads on moderate to strong signals	1. Shorted C305 2. V108B inoperative
C. Brightness control partially or completely inoperative	1. Defective brightness control, R176 or circuit components 2. Defective (short or leaky) capacitor, C173 3. Defective capacitor C174
D. Picture pulled out of shape on one side or corner	1. Proper orientation of the Picture Straighteners
E. Poor focus	1. Proper focus unit adjustment and position 2. Defective picture tube
F. Vertical retrace lines visible	1. Open input capacitor to blanking circuit, C317 2. Check for shorted capacitor in blanking circuit, C318 3. Open coupling capacitor C174 to picture tube cathode
G. Horizontal blanking inoperative	1. Defective horizontal blanking tube, V116B 2. Open capacitor, C368 or C369 3. Shorted capacitor, C371

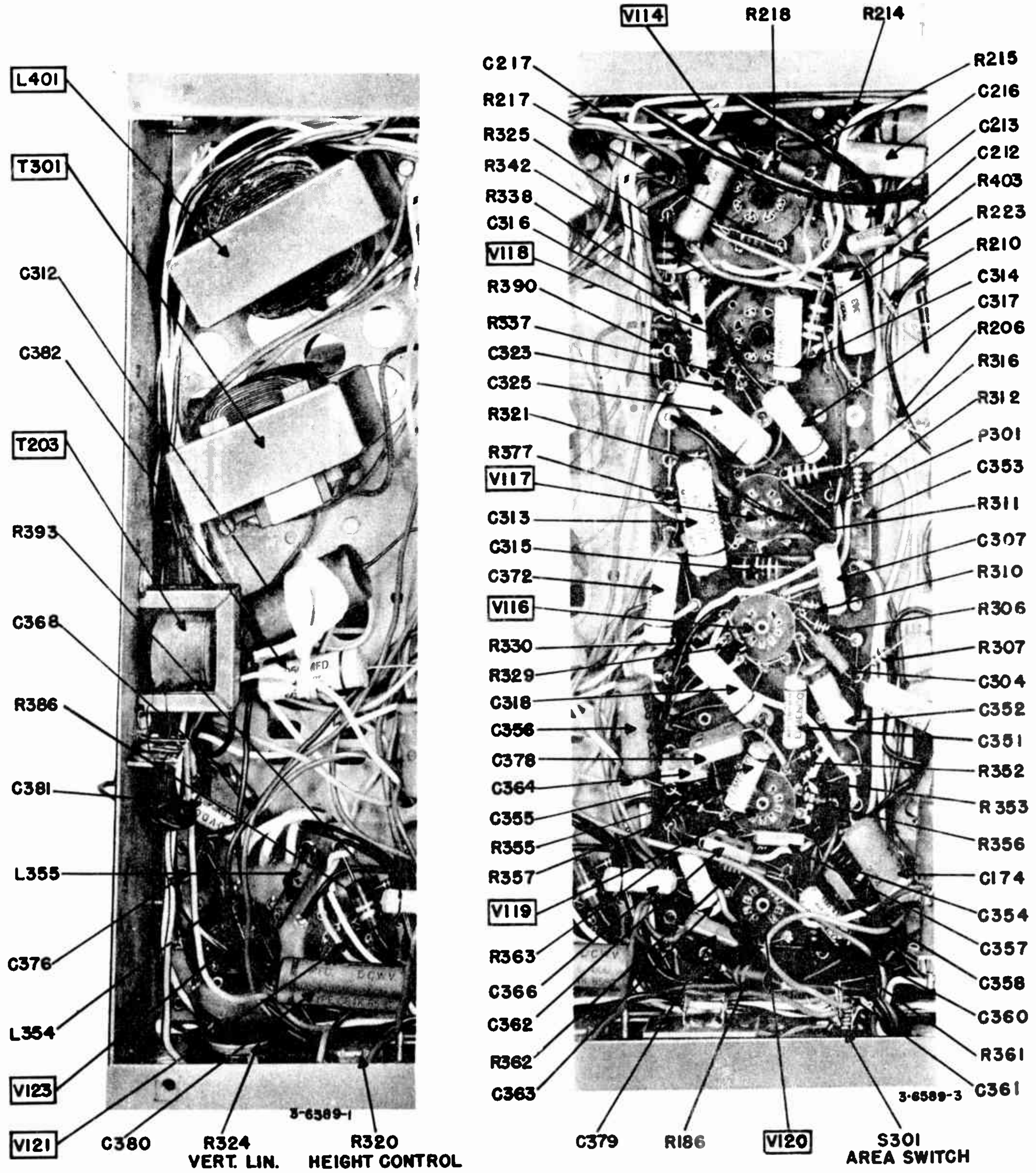
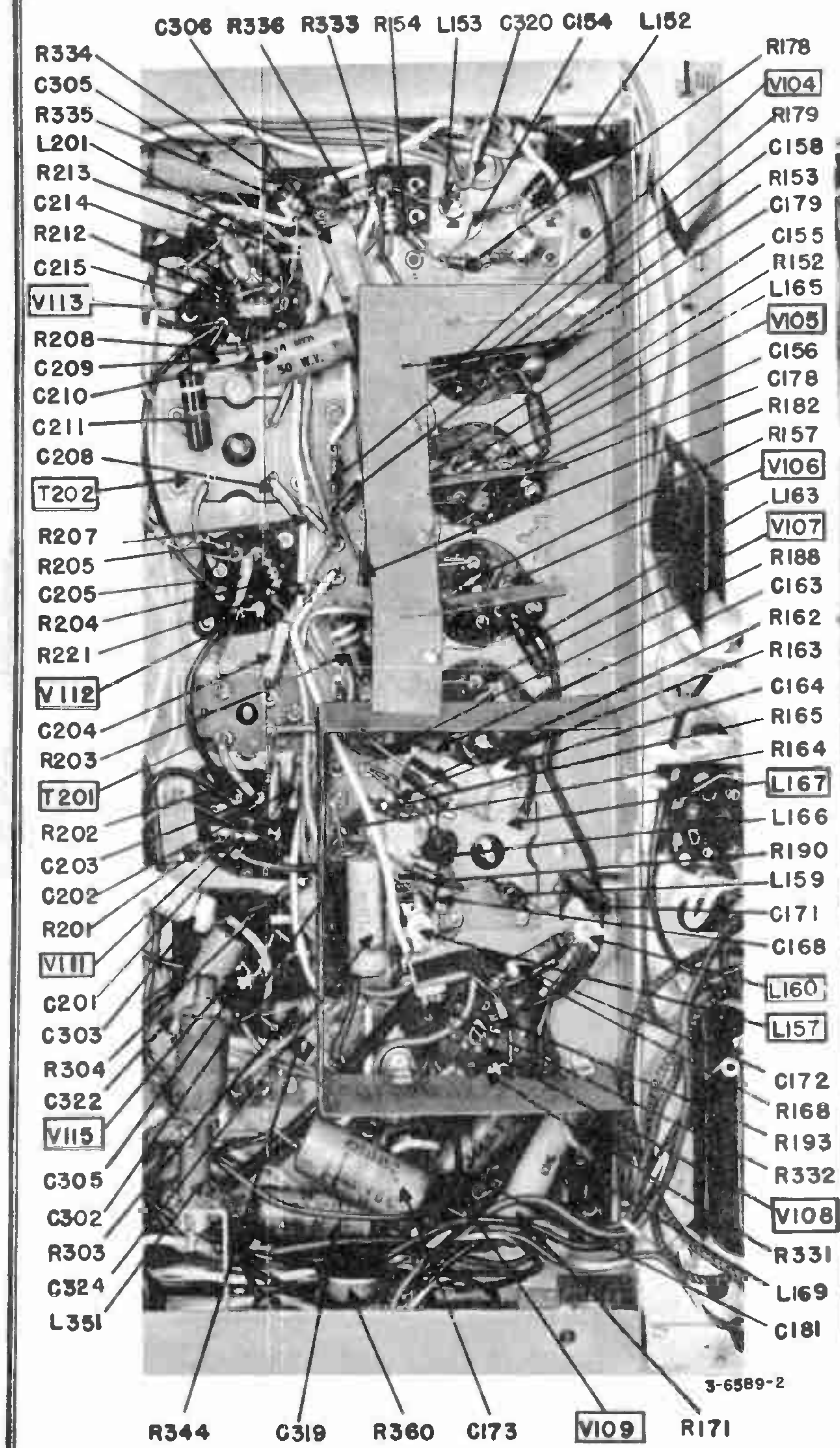
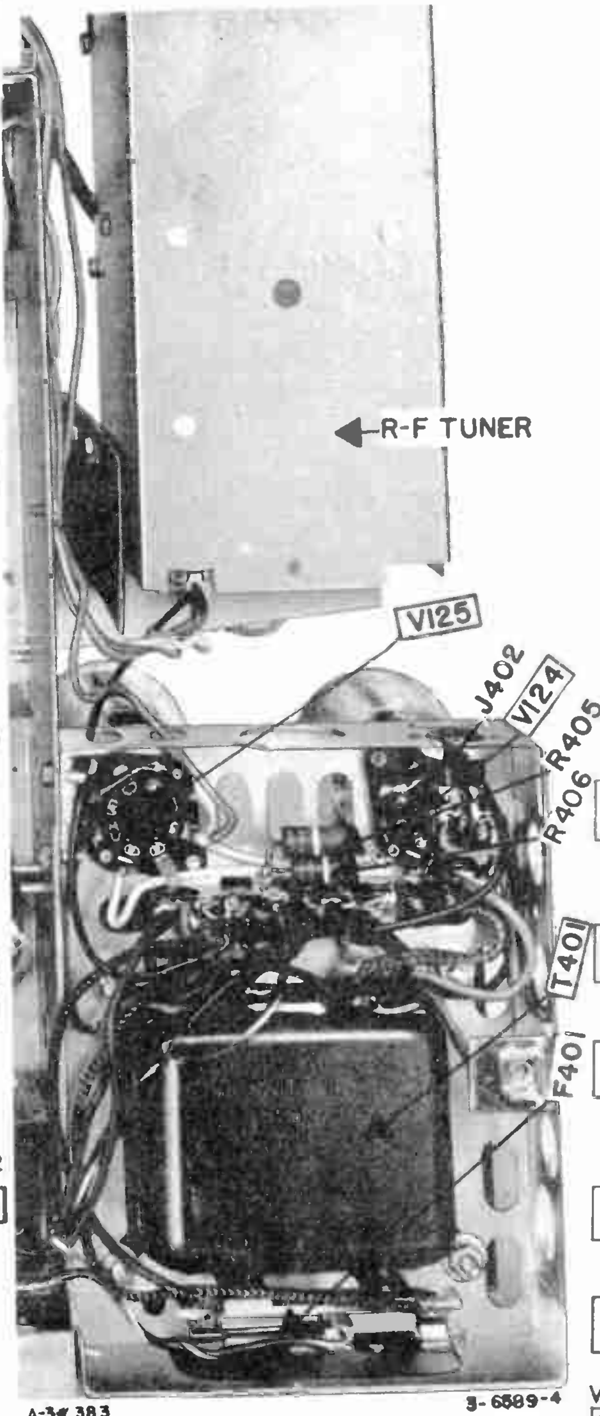


Fig. 24. Bottom View of Chassis





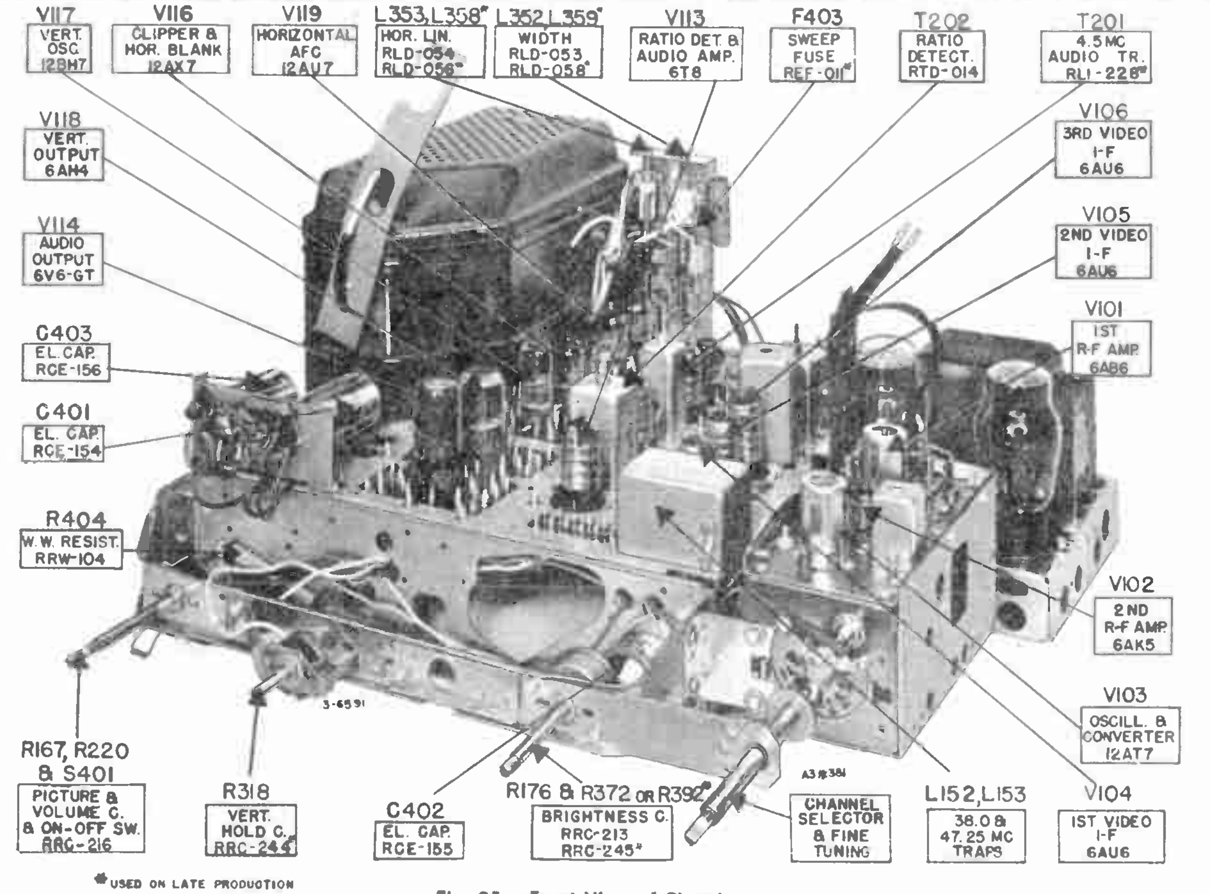
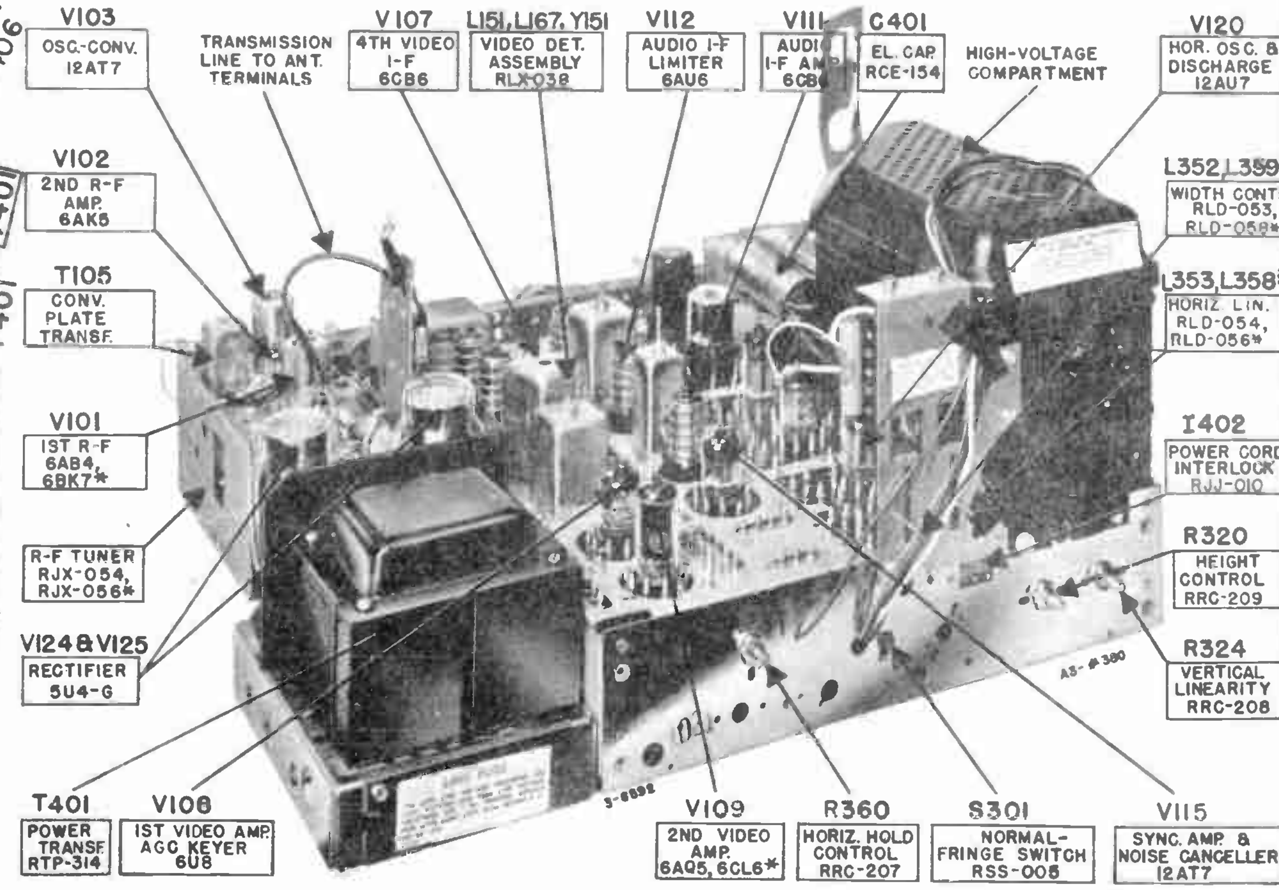


Fig. 25. Front View of Chassis



*3rd production only

Fig. 26. Rear View of Chassis

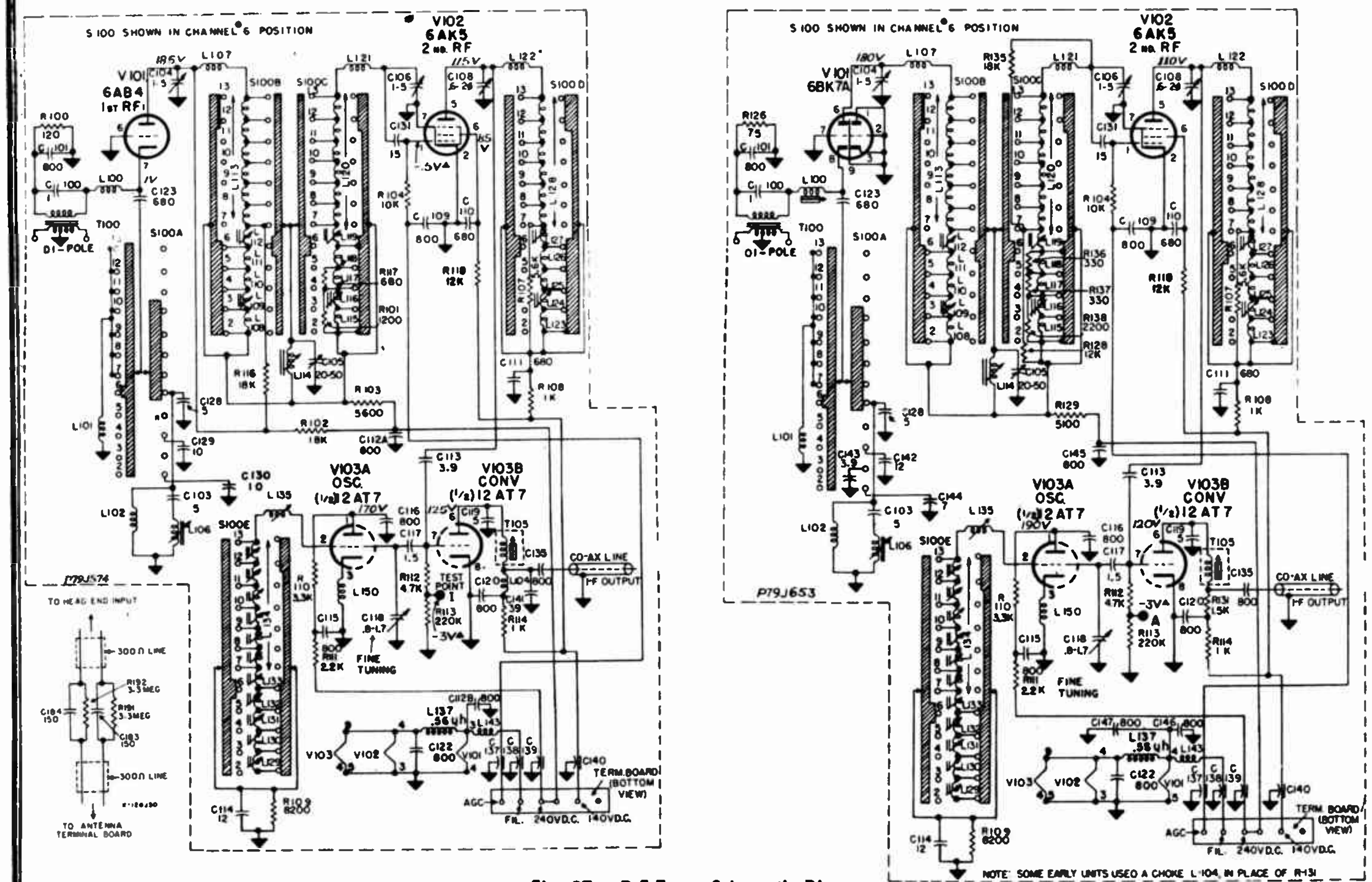
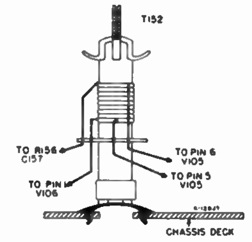


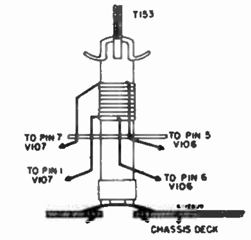
Fig. 27. R-F Tuner Schematic Diagram

A. Early Production ("EE" Version)

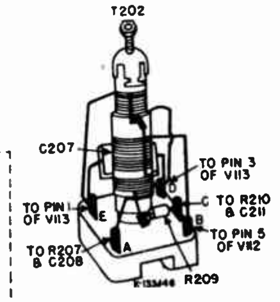
B. Late Production ("BK" 6BK7 Version)



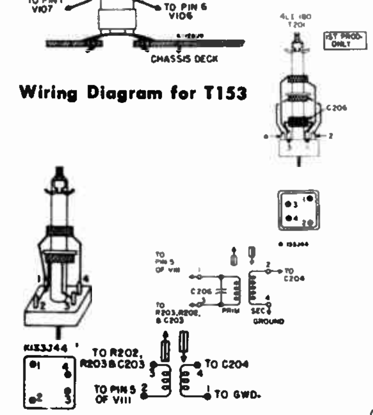
Wiring Diagram for T152



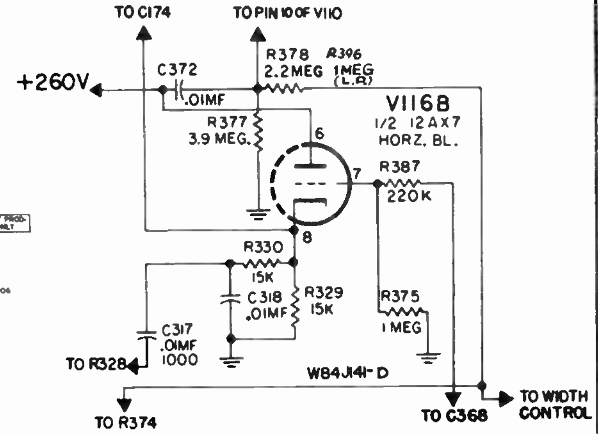
Wiring Diagram for T153



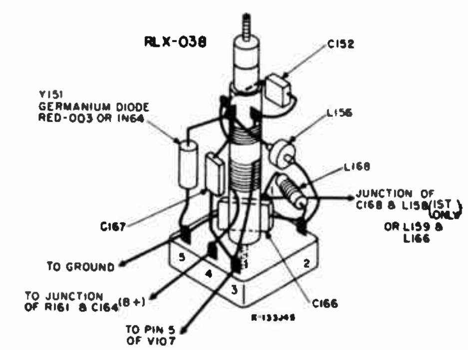
Ratio Detector Wiring



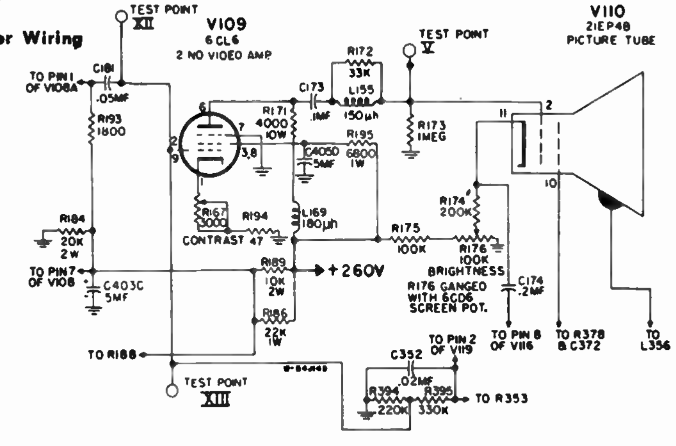
4.5 mc Interstage Transformer Wiring



Horizontal Blanking Circuit (Late Prod.)



Video Detector Wiring Diagram



Mid- & Late-Production Video Amplifier

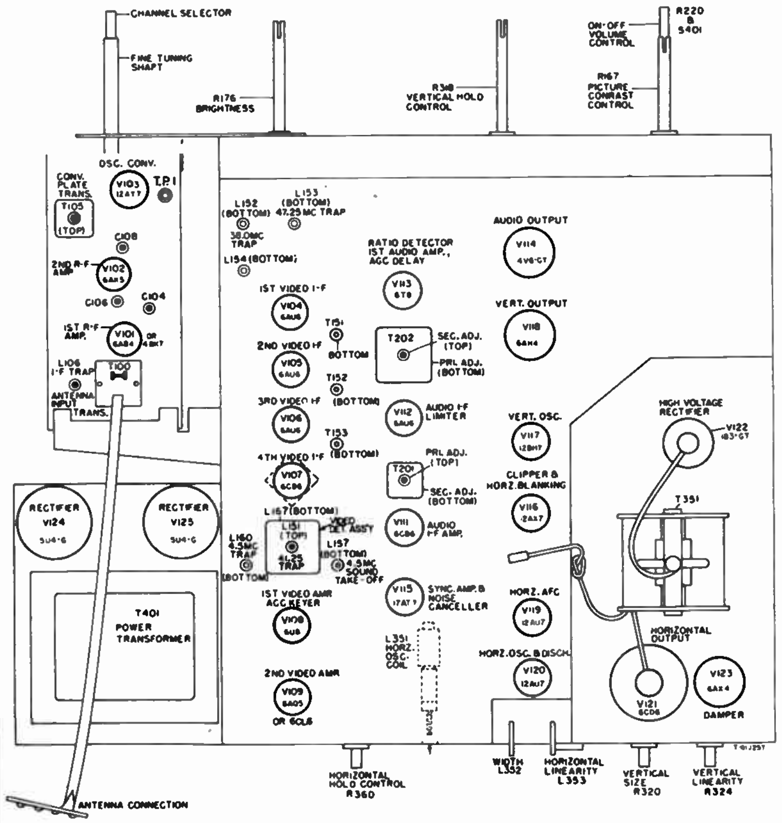


Fig. 28. Tube and Trimmer Location

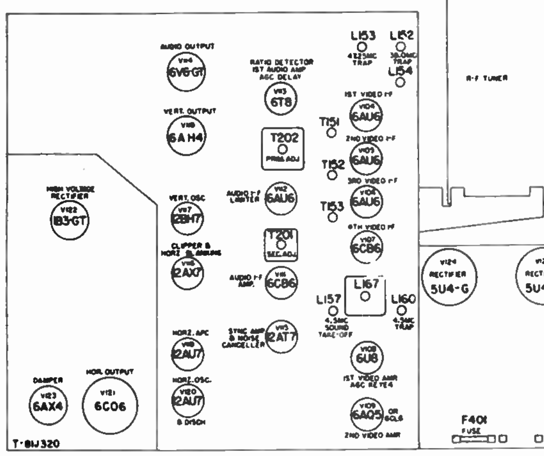


Fig. 29. Tube Location, Bottom View

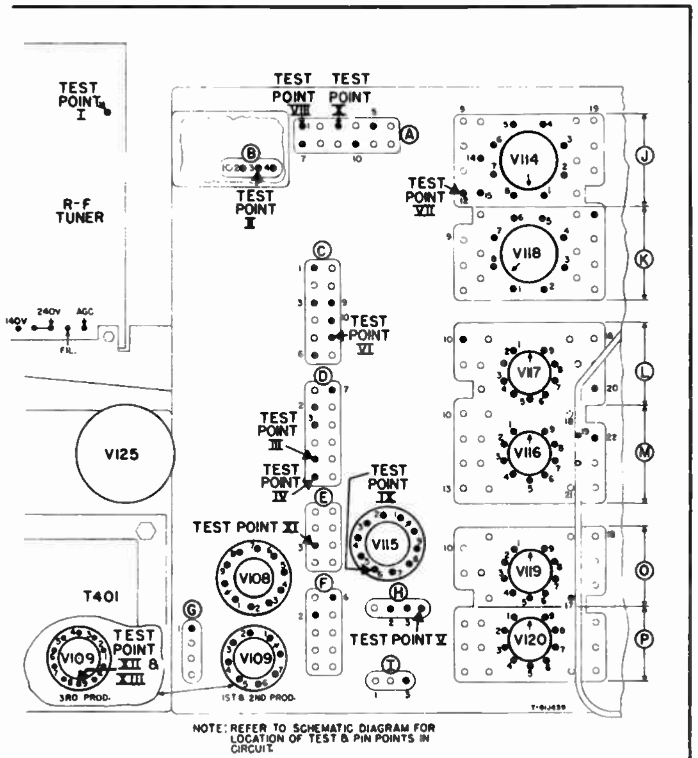
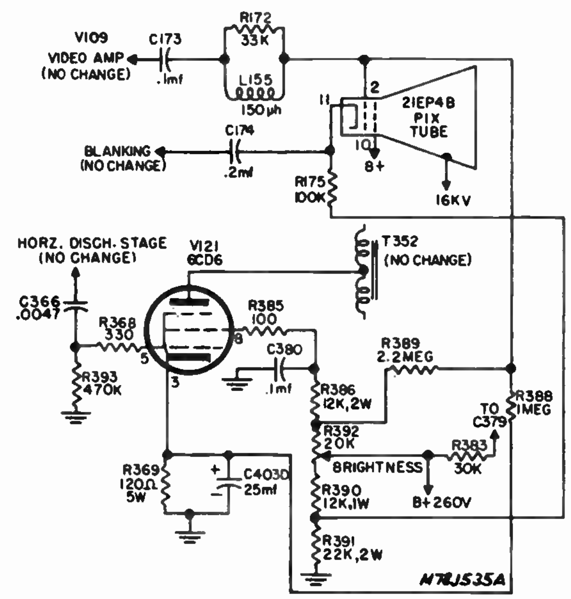


Fig. 30. Test Point Diagram



Brightness Control Circuit (Mid & Late Prod.)

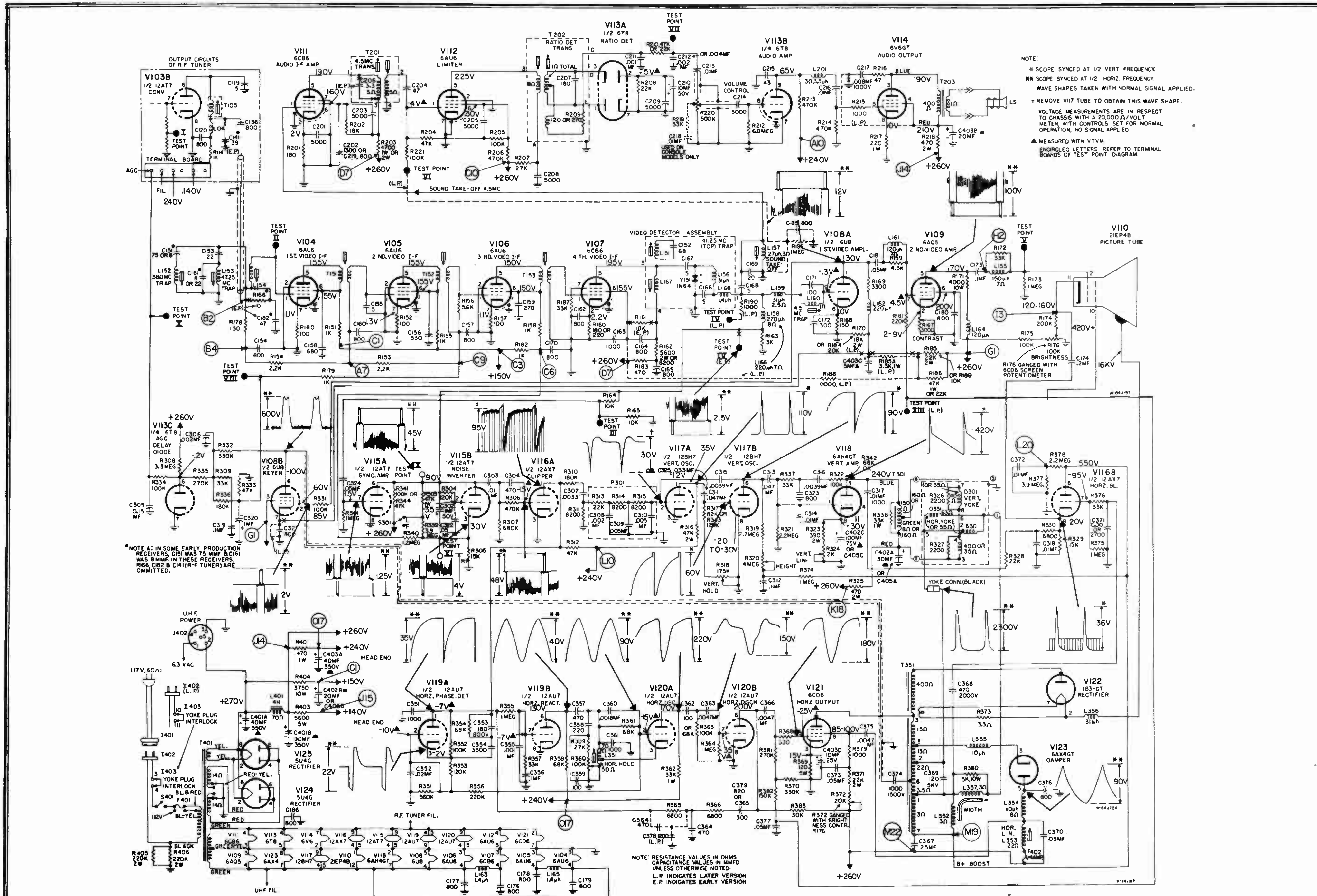


Fig. 31. Schematic Diagram

GENERAL ELECTRIC TV PAGE 14-11

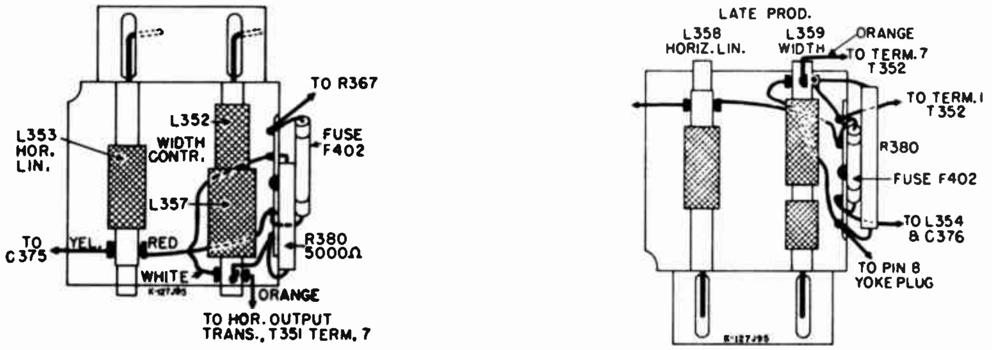


Fig. 32. Width and Horizontal Linearity Control Wiring

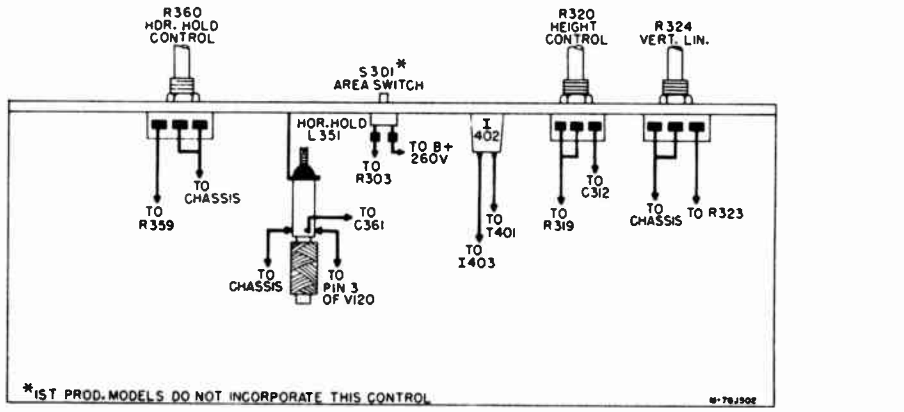


Fig. 33. Rear Apron Control Wiring

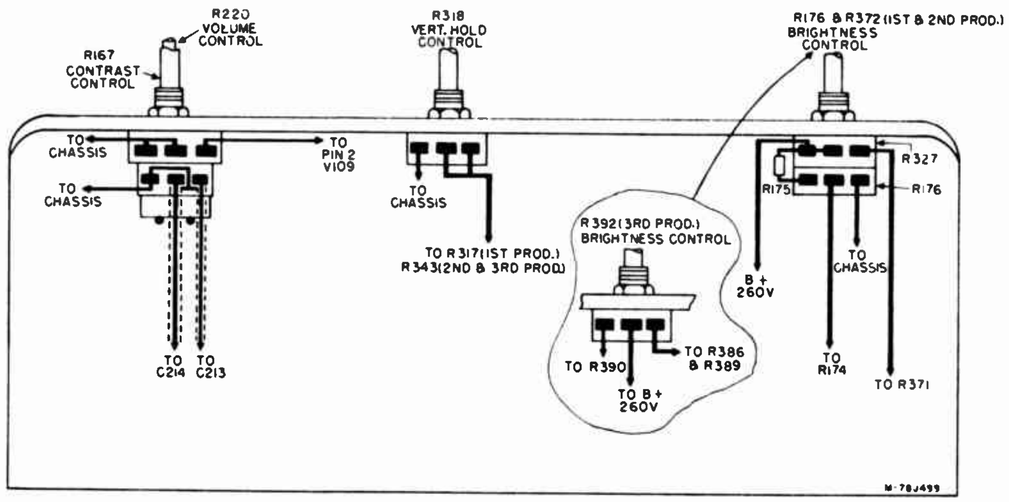


Fig. 34. Front Panel Control Wiring

PRODUCTION CHANGES

1. VIDEO I-F AMPLIFIER

During early production capacitor C151 in 38.0 mc trap circuit was changed from 75 to 8 mmf, capacitor C161 in 47.25 mc trap circuit was changed from 8 to 22 mmf. Together with this change capacitor R182, 47 mmf and R166, 10 ohms at the bottom end of the i-f grid coil, L154, were removed and the coil directly connected to the coaxial link from the r-f tuner.

In receivers bearing these changes, capacitor C141, 39 mmf, at the output of the r-f tuner is omitted. For early production receivers use replacement r-f tuner RJX-056.

2. R-F TUNERS

During the 1st production of these receivers two different types of the "EE" version tuner were used. Both types incorporate a 6AB4 tube as 1st r-f amplifier. The early version incorporates the capacitor C141, see Fig. 27A; this type is used together with the early type traps L152 and L153 using R166 and C182 in the video input i-f circuit, see Fig. 35. Receivers using the later type traps without R166 and C181 in the input circuit use a "EE" tuner without the capacitor C141.

During the 2nd and 3rd production the "BK" version tuner was incorporated in the receiver, using a 6BK7 tube as 1st r-f amplifier. Receivers with this tuner are stamped with the number "453" or higher. The tuner is easily identifiable by the tunable cathode choke coil, L100, mounted at the input transformer T100, see Fig. 18.

Early type tuners incorporate capacitor C141, so that they may be used with the early type traps L152 and L153. This capacitor is connected between the coaxial link and ground.

3. HORIZONTAL SWEEP OUTPUT CIRCUIT

The linearity of the horizontal sweep was improved by incorporating a new circuit which used the following new items:

RLD-056 Horizontal Linearity Coil
RLD-058 Horizontal Width Coil
RTO-146 Horizontal Output Transformer

These items should not be used as replacement in earlier production chassis.

Chassis incorporating this production change bear a rubber stamp "548" and in most cases also bear a label on the high-voltage cage which calls attention to the above listed electrical items.

4. REDUCTION OF I-F INTERFERENCE

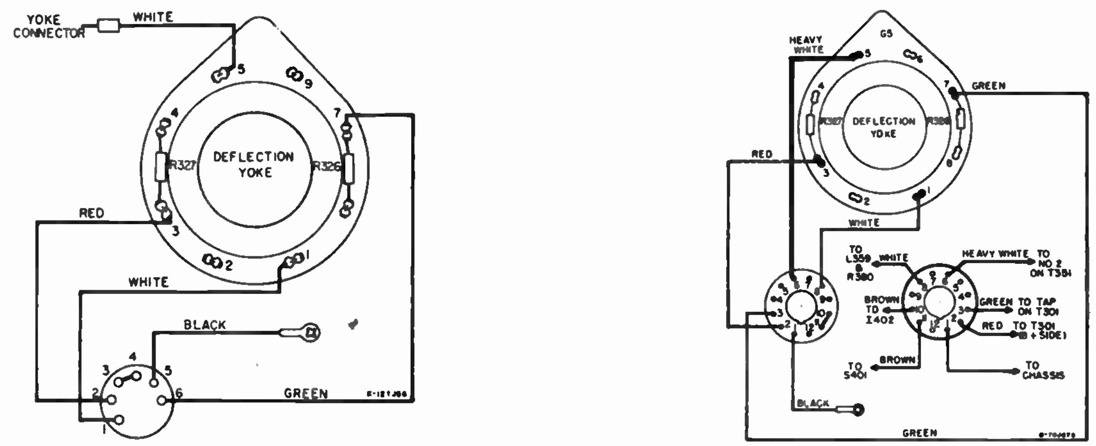
To assist in the reduction of i-f interference chassis bottom plate, RHS-119 and adjacent channel trap shield can, RHS-112 was added during the production run.

5. VIDEO AMPLIFIER

The video output tube 6AQ5 was changed to 6CL6 and the circuitry has been slightly modified as illustrated in Fig. 35. Receivers incorporating this circuit may be identified by noting the 6CL6 tube type on the tube layout label affixed to the cabinet back.

6. BRIGHTNESS CONTROL CIRCUIT

To provide greater consistancy of raster size with respect to changes in the brightness level a new brightness control circuit was used in late production receivers. Refer to Fig. 33 for complete diagram of this circuit. The new brightness control Cat. No. is RRC-245.

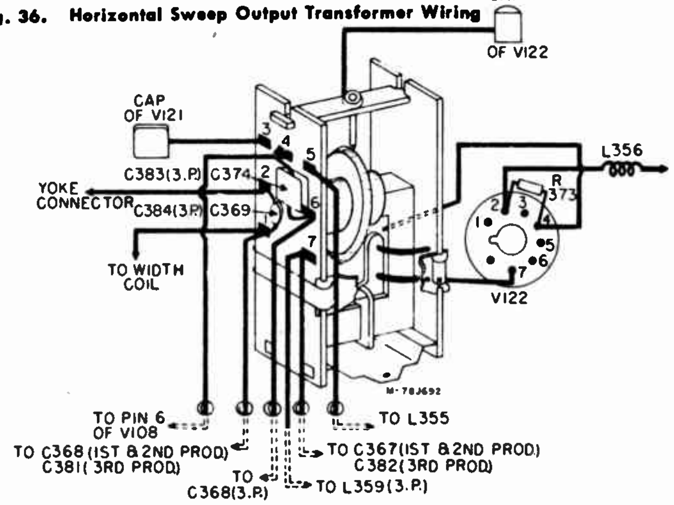


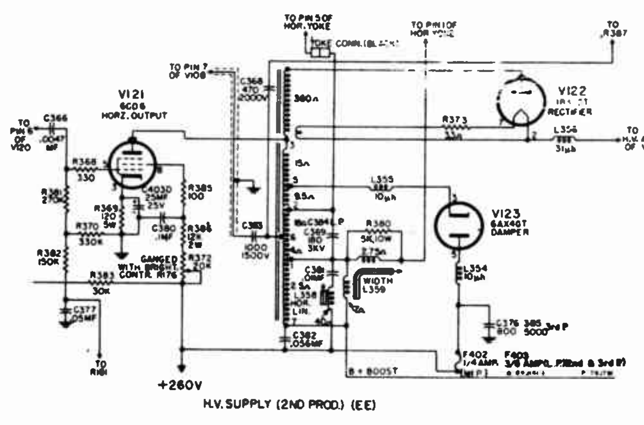
Early Production

Late Production

Fig. 35. Deflection Yoke Wiring

Fig. 36. Horizontal Sweep Output Transformer Wiring





Mid-Production H. V. Supply Circuit

ULTRA HIGH FREQUENCY TUNERS

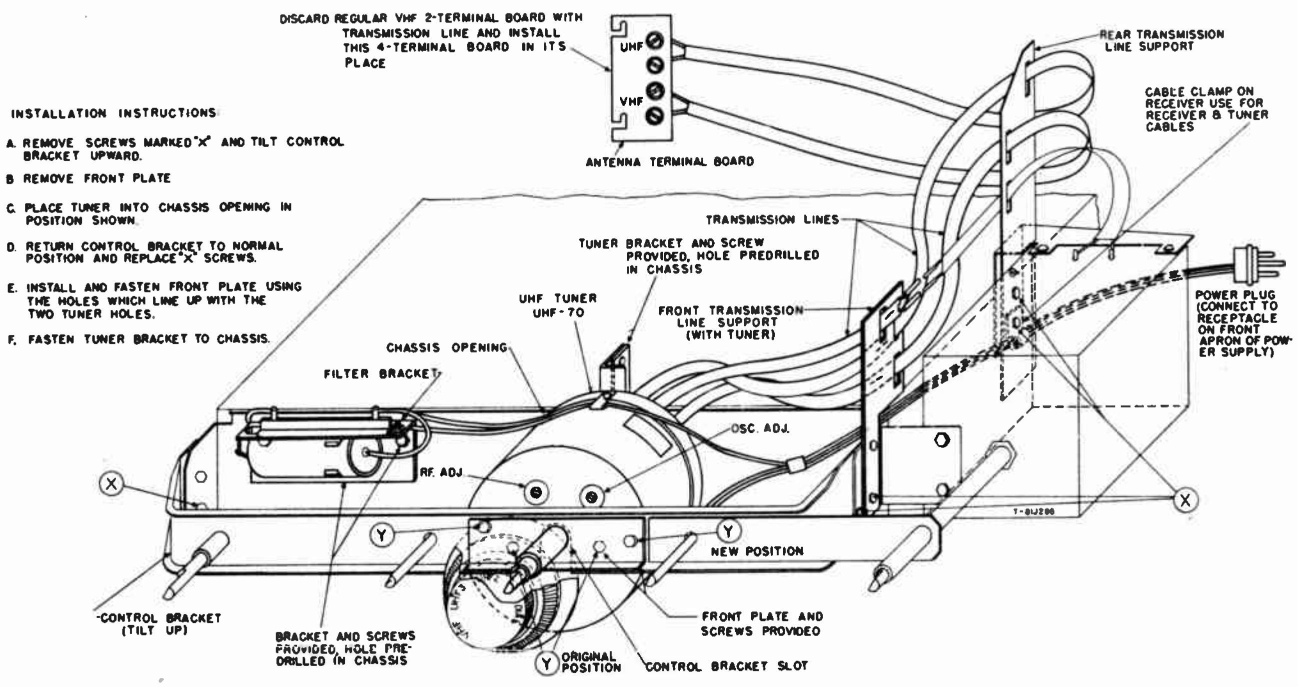


Fig. 37. UHF-70 Tuner Assembly & Wiring Diagram

Two types of UHF tuners were used in these receivers; one type, the Model UHF-70 has two fixed UHF- positions and one position for continuous tuning. Refer to Fig. 37 for tuner assembly and lead connections. The other type, Model UHF-90 is a continuous tuner mostly used in late production receivers. Refer to Fig. 45 for tuner assembly and lead connections. The label affixed to the back of the television receiver indicates which of the two tuners is used in a particular model.

ALIGNMENT CHART

Oscillator Alignment

STEP	RF GEN. SETTING	UHF MARKER & SWEEP	TUNE	DESIRED RESPONSE	REMARKS
1.	82 mc	460 mc	C521	82 MC & 460MC MARKERS COINCIDE	Set UHF tuner drum shaft fully counter clockwise.
2.	82 mc	910 mc	"L_e" oscillator	82MC & 910MC MARKERS COINCIDE (K-135J38)	Set UHF tuner drum fully clockwise; also see note 2.
3.			Repeat steps 1 and 2		Tune across band & check for note 3.

R. F. Alignment

STEP	RF GEN. SETTING	UHF MARKER & SWEEP	TUNE	DESIRED RESPONSE	REMARKS
1.		550 mc	C503 & C506	550MC	Tune for maximum symmetrical response
2.		850 mc	"L_e" R.F. "L_e" Mixer	850 MC	Tune for max. symmetrical response. See Note 2.
3.			Repeat steps 1 and 2		Produce as near ideal curve as possible.
4.		910 mc	L502	Check crystal current.	Connect meter between test point & chassis. See Note 4. Disconnect R-F generator during current test.

I-F Alignment

STEP	RF GEN. SETTING	UHF MARKER & SWEEP	TUNE	DESIRED RESPONSE	REMARKS
1.	82 mc	550 mc	See "Remarks"	82MC 550MC	Adjust tuner shaft so that 550 mc marker coincides with 82 mc marker.
2.	76.5 mc & 88.5 mc	550 mc	T501 T502	550MC 76.5MC 88.5MC (K-135J39)	Tune for max. response & 12 mc bandwidth between peaks.
3.		Check at 460 mc thru 910 mc	Check converter tracking from 460 mc to 910 mc.		Neither marker should fall below 30% at any point thruout tuning range. If 30% "tilt" tolerance cannot be met, recheck steps 1 & 2.

NOTES:
1. Crystal polarity is important to r-f tracking. Crystal must be inserted with cathode to front of chassis as shown in Fig. 43.
2. "L_e" is a short variable inductance between the tuned line and the tube socket and is varied by bending with a polystyrene rod through holes in bottom of converter chassis.
3. In cases where the output falls off severely, or pattern shape varies extremely, change oscillator tube and recheck steps 1 and 2.
4. As converter is tuned through complete range, crystal current should not fall below .5 ma or be greater than 4 ma.

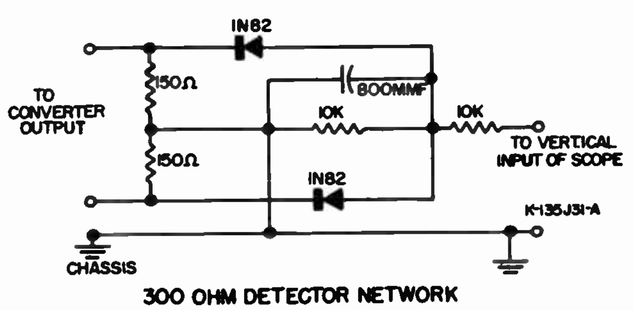


Fig. 41. Detector network

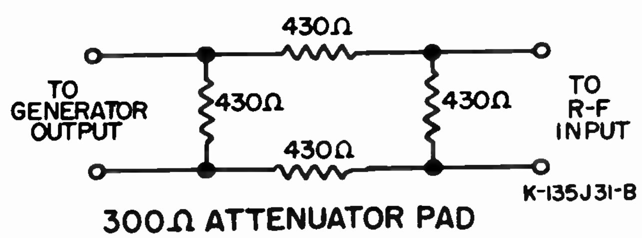


Fig. 42. Attenuator Pad

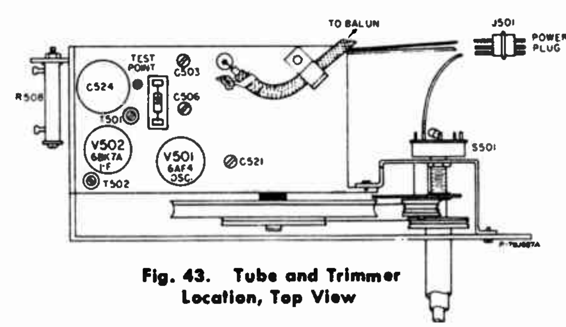


Fig. 43. Tube and Trimmer Location, Top View

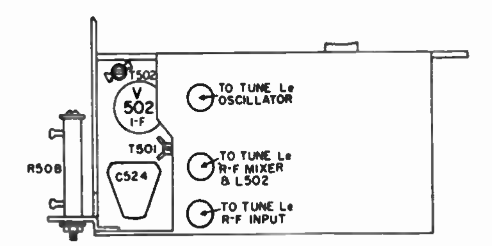


Fig. 44. Tube and Trimmer Location, Bottom View

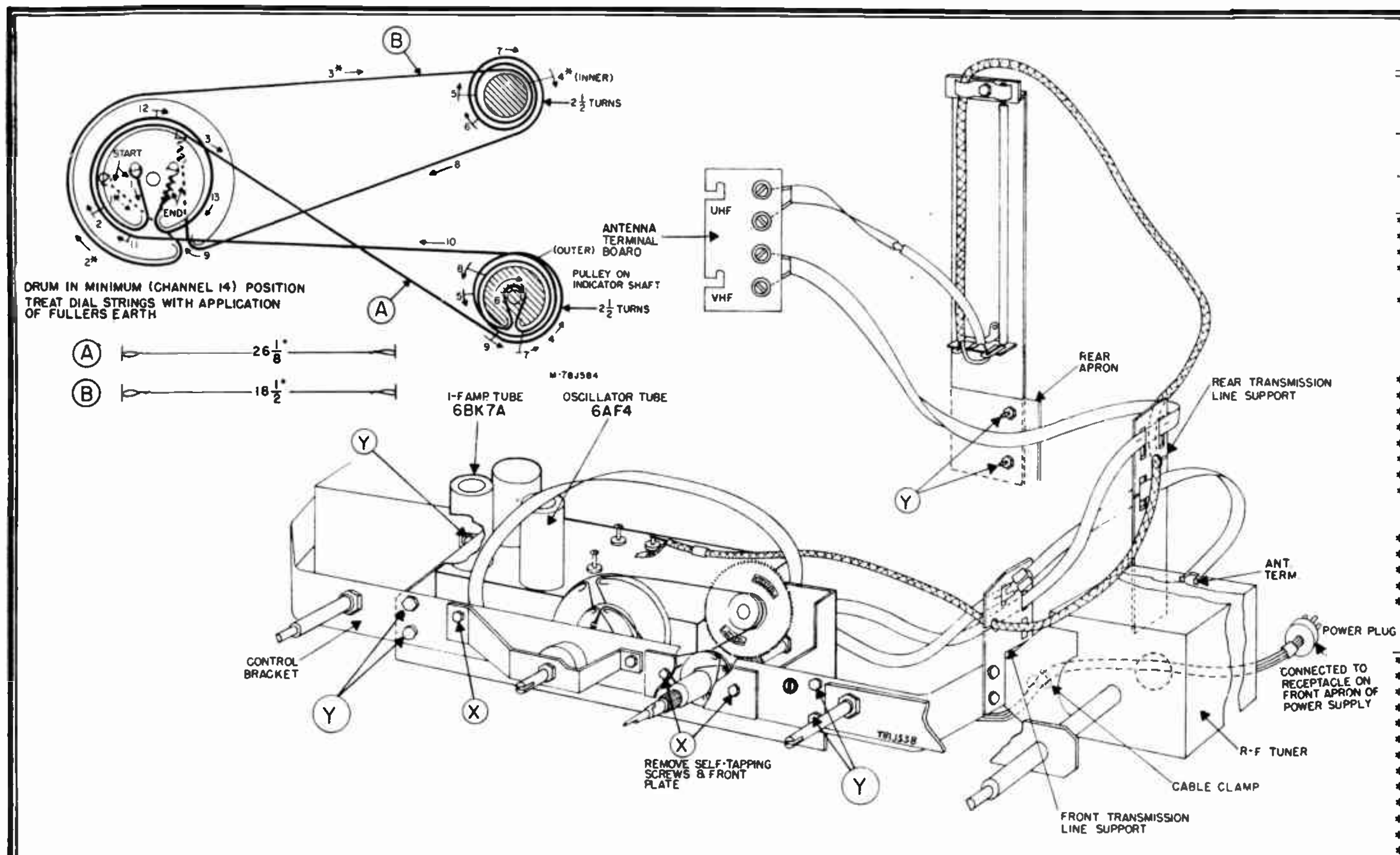


Fig. 45. UHF-90 Tuner Assembly and Wiring & Dial Stringing Diagram

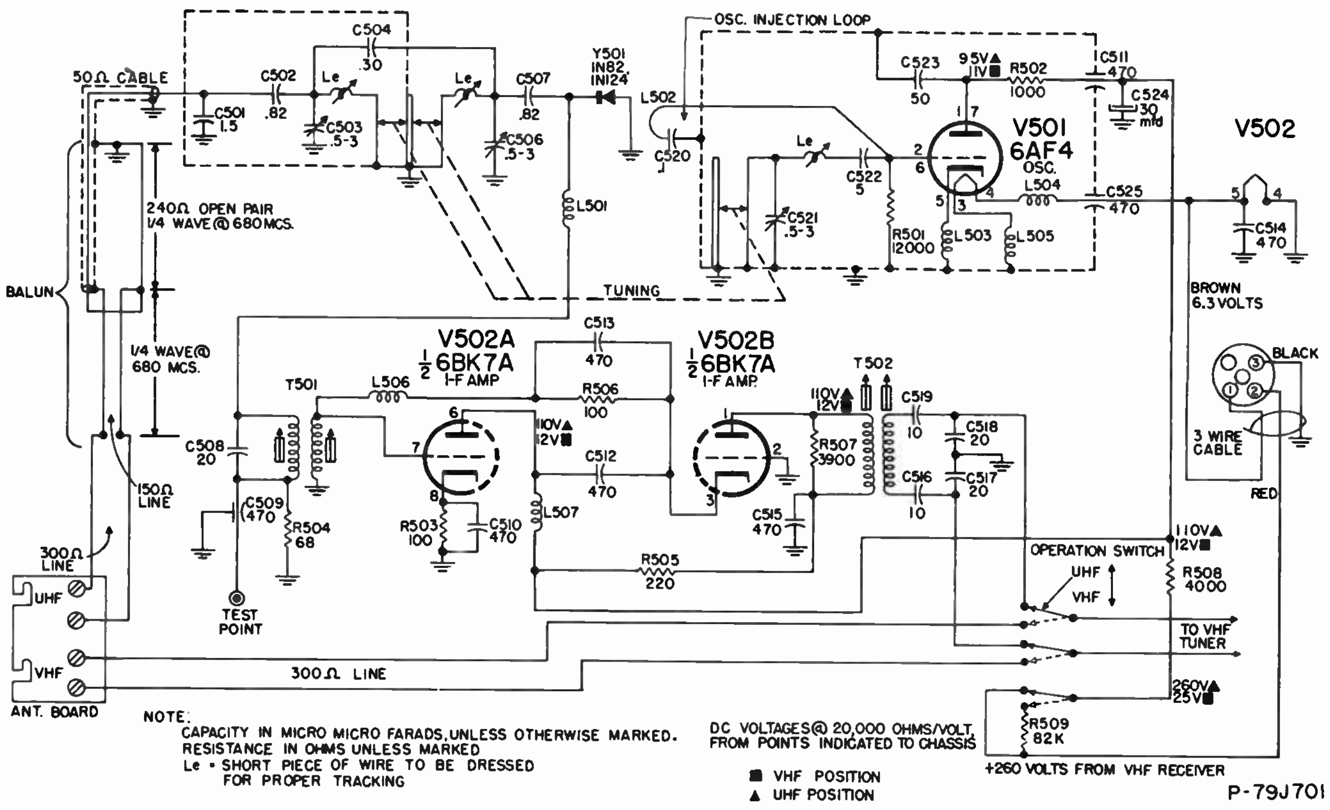


Fig. 46. Schematic Diagram, UHF-90

REPLACEMENT PARTS LIST

CAT. NO.	SYMBOL	DESCRIPTION	UNIT PRICE
		R-F TUNER UNIT	
		CAPACITORS, FIXED & VARIABLE	
*RCN-001	C100	1 mmf (used on T100), ceramic	$0.20
*RCN-027	C112A, B	800/800 mmf-450 V., dual, ceramic	.65
*RCN-055	C113, 143	3.9 mmf., mica	.25
*RCW-3027	C111	680 mmf., 500 V., ceramic threaded stud mounting	.90
*RCW-3037	C101, 109, 115, 116, 120, 122, 136, 145, 146, 147	800 mmf., 500 V., ceramic	.25
*RCW-3045	C110, 123	680 mmf.-500 V., ceramic	.30
*RCW-3046	C117	1.5 mmf., ceramic	.60
*RCW-3057	C128	5 mmf., ±5% -500 V., ceramic	.25
*RCW-3066	C129, 130	10 mmf., ±5%, 500 V., ceramic	.25
*RCW-3074	C114, 142	12 mmf., ±5%, 500 V., ceramic	.25
*RCW-3076	C131	15 mmf., 500 V., ceramic	.25
*RCW-3092	C141	39 mmf., ±5%, 500 V., ceramic	.30
*RCW-3095	C137, 138, 139, 140	1000 mmf., 500 V., ceramic feed-through capacitor	.35
RCW-3102	C144	7 mmf., ceramic	.30
*RCY-048	C108	.6-2.4 mmf., trimmer	.40
*RCY-065	C104, 106	1-5 mmf., glass tube type trimmer	.50
*RCY-066	C105	20-50 mmf., trimmer	1.25
*RCY-067	C118	.8-1.7 mmf., fine tuning control	2.00
*UCG-1005	C103, 119	5 mmf., 500 V., mica	.35
		RESISTORS	
*URD-027	R100	120 ohms	.13
*URD-037	R136, 137	330 ohms ±10%	.13
*URD-045	R117	680 ohms	.13
*URD-049	R108, 114	1000 ohms	.13
*URD-051	R101	1200 ohms	.13
*URD-053	R131	1500 ohms, ±10%	.13
*URD-057	R111, 138	2200 ohms	.13
*URD-061	R110	3300 ohms	.13
*URD-065	R130	4700 ohms, ±10%	.13
*URD-067	R107	5600 ohms	.13
*URD-071	R109	8200 ohms	.13
*URD-073	R104, 112	10,000 ohms	.13
*URD-075	R118	12,000 ohms	.13
*URD-079	R102, 116	18,000 ohms	.13
*URD-105	R113	220,000 ohms	.13
*URD-1022	R126	75 ohms, ±5%	.13
*URE-067	R103	5600 ohms, 1 watt	.17
URF-1066	R129	5100 ohms, ±5%, 2 watt	.24
		COILS AND TRANSFORMERS	
*RLA-037	T100, C100	TRANSFORMER—Antenna input	1.80
RLA-040	T100	TRANSFORMER—Ant "B-K" version	2.40
RLI-142	L143	CHOKE—Flament choke 1.4 uh., ±5%	.45
*RLI-144	L137	CHOKE—R-F choke, 56 uh	.25
*RLI-145	L150	CHOKE—R-F choke, 1.4 uh	.35
*RLI-159	L106	TRAP—I-F trap and tuning core	.75
*RLI-165	L100	CHOKE—R-F choke, 1.4 uh	.35
RLI-191	L104	CHOKE—Choke, 44 mc-6.8 uh	.40
RLI-219	L100	COIL—Cathode compensating win tuning core and clip ("B-K" versio)	.55
RLI-286	L102	COIL—RF input	
RLI-287	L101	COIL—RF input	
RTL-146	T105	TRANSFORMER—Mixer plate	.35

UHF TUNER UHF-90

The Model UHF-90 Tuner unit is a continuous-tuning type UHF tuner and covers the entire band between 470 to 890 megacycles. Reception of UHF television signals with this unit is accomplished by double-conversion to either VHF Channel 5 or 6. The choice of either of these channels will depend essentially upon local VHF interference considerations.

If the UHF tuner is operating in an area with VHF stations operation on Channel 5 or 6, switch the television receiver to the channel of least interference. It is quite obvious that if the VHF station on Channel 5 is fairly strong, it will be picked up by the television receiver even when the UHF tuner is operating, and therefore affect the picture quality. The i-f circuits of the UHF tuner are designed to give good reception for both channels, so that no additional adjustments of the i-f are necessary.

CAT. NO.	SYMBOL	DESCRIPTION	UNIT PRICE
		MAIN CHASSIS	
		CAPACITORS	
		Paper	
RCC-046	C380**, 380†	.1 mf., 600 V.	.45
*RCC-102	C181, 373*	.05 mf., 600 V.	.40
*RCC-103	C319, 356	.1 mf., 200 V.	.35
*RCC-104	C173	.1 mf., 600 V.	.45
*RCC-105	C322, 377	.05 mf., 200 V.	.25
*RCN-025	C314, 381†	.01 mf., 600 V., molded	.35
RCN-030	C317	.01 mf., 1000 V., molded	.60
*RCN-033	C360	.0018 mf., 600 V., molded	.35
*RCN-034	C315	.0039 mf., 600 V., molded	.35
*RCN-041	C311*, 313	.047 mf., 600 V., molded	.55
*RCN-051	C363, 366, 375	.0047 mf., 600 V., molded	.40
RCN-058	C316*, 316**	.0039 mf., 1000 V., molded	.40
*RCN-062	C351, 355	.001 mf., 600 V., molded	.40
*RCN-063	C303, 372, 318	.01 mf., 600 V., molded	.35
RCN-064	C382†	.056 mf., 600 V., paper, molded	.55
*RCN-066	C354	.0033 mf., 600 V., molded, ±10%	.30
RCN-071	C211	.001 mf., 600 V., molded	.30
RCN-072	C307	.0033 mf., 600 V., molded	.30
RCN-080	C325	.033 mf., 600 V., molded	.40
*UCC-004	C212*, 212†	.004 mf., 200 V.	.20
*UCC-036	C212**, 306	.002 mf., 600 V.	.25
*UCC-040	C218, 216	.01 mf., 600 V.	.25
*UCC-041	C352	.02 mf., 600 V.	.25
*UCC-042	C370*	.03 mf., 600 V.	.30
*UCC-049	C305	.15 mf., 600 V.	.25
UCC-050	C174, 367* 367**	.25 mf., 600 V.	.55
*UCC-061	C217	.008 mf., 1000 V.	.30
UCC-068	C312	.1 mf., 1000 V.	.75
		Electrolytics	
*RCE-090	C210*, 302, 320	1 mf., 50 V.	1.20
RCE-154	C401A, B	40 mf. @ 350 V., 90 mf. @ 350 V.	5.50
RCE-155	C402A, B, C	30 mf. @ 350 V., 20 mf. @ 350 V., 100 mf. @ 75 V. (1st prod.)	4.30
RCE-156	C403A, B, C, D	40 mf. @ 350 V., 20 mf. @ 350 V., 5 mf. @ 350 V., 10 mf. @ 25 V. (1st prod.)	4.50
RCE-167	C403A, B, C, D	40 mf., 20 mf., 5 mf. @ 350 V., 25 mf. @ 25 V.	5.15
RCE-168	C405A, B, C, D	30 mf., 20 mf., 5 mf. @ 350 V., 100 mf. @ 75 V. (2nd & 3rd prod.)	5.10
RCE-170	C210**, 210†	10 mf., 50 V.	1.25
		Micas & Ceramics	
*RCN-028	C206	3.3 mmf., 500 V., silver mica	.35
RCN-077	C151*, 161*	8 mmf., ±5 mmf., 500 V., silver mica	.35
RCU-285	C371*	1500 mmf., ±5%, 500 V., mica	.60
*RCU-307	C353	180 mmf., 800 V., mica	.40
*RCU-308	C365†	300 mmf., 500 V., mica	.35
*RCU-309	C358	220 mmf., 500 V., mica	.35
RCU-311	C368	470 mmf., 2000 V., mica	.75
RCU-312	C374, 383†	1000 mmf., 1500 V., mica (part of T351 or T352)	.90
RCU-314	C361	1000 mmf., 500 V., mica	.65
*RCW-2032	C156	330 mmf., ±5%, 500 V., ceramic	.60
*RCW-3014	C201, 203, 205, 208, 209, 214, 385†	5000 mmf., 500 V., disk ceramic	.25
*RCW-3037	C154, 157, 160, 162, 164, 165, 170, 176, 177, 178, 179, 180, 185, 321, 323, 376	800 mmf., 500 V., disk ceramic	.25
*RCW-3051	C158	680 mmf., 350 V., ceramic	.30
*RCW-3052	C163†	820 mmf., 500 V., ceramic	.30
*RCW-3053	C172, 202	1300 mmf., 500 V., ceramic	.25
*RCW-3054	C213	.01 mf., 450 V., disk ceramic	.35
RCW-3093	C159	270 mmf., 350 V., ceramic	.35
RCW-3096	C369*	130 mmf., 3 KV, disk ceramic (part of T351)	.35
RCW-3098	C163*	1000 mmf., 350 V., ceramic	.40
RCW-3106	C316†	3900 mmf., 600 V., ceramic	.90
RCW-3107	C219†	1800 mmf., 300 V., ceramic	.35
RCW-3108	C369**, 369†, 384†	180 mmf., 3 KV, disk ceramic (part of T352)	.35
*UCG-1005	C155, 166, 167, 168	5 mmf., 500 V., silver mica	.35
UCG-1019	C215	43 mmf., 500 V., silver mica	.35
UCG-1020	C182†	47 mmf., 500 V., silver mica	.25

REPLACEMENT PARTS LIST—MODEL UHF-90

CAT NO.	SYMBOL	DESCRIPTION	UNIT PRICE
RESISTORS			
URD-021	R504	68 ohms, ±10%, ½ watt, carbon	$0.13
URD-025	R503, 506	100 ohms, ±10%, ½ watt, carbon	.13
*URD-033	R505	220 ohms, ±10%, ½ watt, carbon	.13
URD-049	R502	1000 ohms, ±10%, ½ watt, carbon	.13
URD-063	R507	3900 ohms, ±10%, ½ watt, carbon	.13
*URD-075	R501	12,000 ohms, ±10%, ½ watt, carbon	.13
*URE-095	R509	82,000 ohms, ±10%, 1 watt, carbon	.17
RRW-109	R508	4000 ohms, 10 watts, w.w.	
CAPACITORS			
RCE-171	C524	30 mf., 350 volts, electrolytic	3.10
RCN-084	C509, 511 525	470 mmf., feed-thru	.35
RCW-3127	C516, 519	10 mmf., 500 volts, ceramic	
RCW-3128	C510, 512 513, 514 515	470 mmf., 450 volts, ceramic, disc	
RCW-3129	C522	5 mmf., ceramic	.65
RCW-3130	C502, 507	.82 mmf., ±1 mmf., 500 volts, ceramic	.60
RCW-3131	C504	.3 mmf., ±10%, 500 volts, ceramic	.25
RCW-3132	C520	.1 mmf., ±10%, 500 volts, ceramic	.45
RCW-3133	C508, 517, 518	20 mmf., 500 volts, ceramic	.25
RCW-3135	C523	50 mmf., ceramic, disc	
RCW-3134	C501, 502	.8 mmf. and 1.6 mmf., dual ceramic	
RCY-076	C503	.5-3 mmf., R-F., complete with nut and screw	.50
RCY-077	C521	.5-3 mmf., oscillator complete with nut and screw	.50
COILS AND TRANSFORMERS			
RLI-248	L504	CHOKE—Filament	.60
RLI-249	L501, 503	CHOKE—Crystal and cathode	.15
RLI-250	L507	CHOKE—I-F plate	.15
RLI-251	L505	CHOKE—Filament	.55
RLI-252	L506	CHOKE—I-F grid	
RLL-057		LOOP—UHF loop antenna	1.00
RTL-157	T501	TRANSFORMER—Input I-F	1.40
RTL-158	T502	TRANSFORMER—Output I-F	3.55

REPLACEMENT PARTS LIST—MODEL UHF-70

CAT. NO.	SYMBOL	DESCRIPTION	UNIT PRICE
RESISTORS			
RRW-104	R17	3750 ohms, ±10%, 10 w., w.w.	$0.80
URD-017	R8	47 ohms, ½ w., carbon	.13
*URD-025	R1, 4	100 ohms, ½ w., carbon	.13
*URD-033	R2, 3	220 ohms, ½ w., carbon	.13
URD-067	R9	5600 ohms, ½ w., carbon	.13
*URD-069	R5	6800 ohms, ½ w., carbon	.13
*URD-073	R10	10,000 ohms, ½ w., carbon	$0.13
*URD-101	R6, 7	150,000 ohms, ½ w., carbon	.13
*URD-117	R14	680,000 ohms, ½ w., carbon	.13
URE-045	R15	680 ohms, 1 w., carbon	.17
URF-061	R16	3300 ohms, 2 w., carbon	.25
CAPACITORS			
RCE-159	C29	30 mf, +150% −10%, 350 v., electrolytic	$1.95
*RCN-001	C11	1 mmf, ±20%, 500 v., ceramic	.20
*RCW-3037	C12, 13, 20, 21, 23, 24	800 mmf, ceramic (Hi-K)	.25
*RCW-3070	C1, 2, 3, 4	2-2-5-5 mmf, ±.5 mmf, ceramic	1.75
*RCW-3082	C5, 6	2 mmf, ±.25 mmf, 500 v., ceramic	.25
*RCW-3083	C7, 8	1 mmf, ±.25 mmf, 500 v., ceramic	.25
*RCW-3084	C9	1.5 mmf, ±.25 mmf, 500 v., ceramic	.25
*RCW-3085	C19	10 mmf, ±10%, 500 v., ceramic	.25
RCW-3086	C18	18 mmf, ±10%, 500 v., ceramic	.25
*RCW-3087	C22	47 mmf, ±20%, 500 v., ceramic	.25
RCW-3100	C10, 14	6 mmf, ±.5 mmf, 500 v., ceramic	.45
COILS AND TRANSFORMERS			
*RLI-122	L9	CHOKE—I-F choke, molded, 2.2 uh	.25
RLI-167	L14, 15, 16	CHOKE—R-F choke (15 turns)	.35
*RLI-168	L7, 8	CHOKE—R-F choke (10 turns)	.35
*RLI-187	L11	COIL—Neutralizer coil	.85
*RLI-188	L12	COIL—Interstage tuning coil	.60
RLI-218	L17, 18	CHOKE—R-F choke, (air-wound, 10 turns)	.40
*RTL-140	T1	TRANSFORMER—I-F input transf.	1.20
*RTL-141	T2	TRANSFORMER—I-F output transf.	1.65

REPLACEMENT PARTS LIST

CAT. NO.	SYMBOL	DESCRIPTION	UNIT PRICE
COILS AND TRANSFORMERS (Cont'd)			
*RLI-142	L163, 165, 168	COIL—Filament choke, 1.4 uh (L168 part of video detector)	$0.45
*RLI-154	L201	COIL—3.3 uh choke	.25
*RLI-180	T201, C206*, C206**	TRANSFORMER—I-F, 4.5 mc (1st and 2nd prod. can stamped M77J507-2, includes capacitor)	3.25
*RLI-182	L157, C168, 169	COIL—4.5 mc audio take-off	2.10
RLI-192	L154	COIL—1st Video I-F	.90
RLI-193	L155, R172	COIL—150 uh choke coil wound on R172, 33K, ½ w.	.45
RLI-195	L159	COIL—31 uh choke coil	.45
RLI-197	L166**, 166†, 162*	COIL—Peaking, 220 uh	.40
RLI-199	L151	COIL—Trap coil (part of trans. RLX-038)	.15
RLI-200	L152, C151*	COIL—Trap coil, 38 mc (1st prod. with C151, 75 mmf.)	1.40
RLI-201	L153, C153, 161*	COIL—Trap coil, 47.25 mc (1st prod. with C161, 8 mmf.)	1.80
RLI-203	L159, 160, C171	COIL—4.5 mc trap, includes L159 and C371	2.50
RLI-205	L164*, 164**	COIL—120 uh choke	.40
RLI-209	L158*	COIL—270 uh choke	.40
RLI-212	L161*, R159*	COIL—120 uh choke wound on R159	.45
RLI-213	L152, C151**, 151†	COIL—Trap, 38 mc (2nd & 3rd prod. with C151, 8 mmf.)	1.30
RLI-217	L153, C153, 161**, 161†	COIL—Trap, 47.25 mc (2nd & 3rd prod. with C161, 22 mmf.)	1.65
RLI-220	L169	COIL—Peaking, 180 uh	.45
RLI-226	L157, C168, 169	COIL—4.5 mc audio take-off	2.95
RLI-228	T201	TRANSFORMER—4.5 mc audio (3rd prod. can stamped M77J507-3, does not use capacitor noted in RLI-180)	3.10
RLX-038	L151, 156, 167, Y151, C152, 167	TRANSFORMER — Video detector, ass'y, includes crystal detector, coils with tuning core and capacitors	6.75
RTD-014	T202, C207	TRANSFORMER—Ratio detector	3.75
RTL-144	T151, 152	TRANSFORMER—1st and 2nd video i-f	1.65
RTL-145	T153	TRANSFORMER—3rd video i-f	1.50
RTO-131	T351*	TRANSFORMER—Horiz. sweep output, must be used with RLD-053 and RLD-054	12.00
RTO-134	T203	TRANSFORMER—Audio output (table models)	2.70
RTO-135	T203	TRANSFORMER—Audio output (console models)	3.50
RTO-136	T301	TRANSFORMER—Vertical output	7.50
RTO-146	T352**, T352†	TRANSFORMER—Horiz. sweep output, must be used with RLD-056 and RLD-058	13.25
RTP-314	T401	TRANSFORMER—Power	34.00
S-650D	21T20-T21	SPEAKER—6½ in., 3.2 ohms, Alnico PM	6.10
S-1212D	21C225-C226-C227-C228-C229-C230-C231-C231-C232-C233	SPEAKER—12 in., 3.3 ohms, Alnico PM	12.95

Type Alnico PM, Voice coil impedance @ 400 cycles..........3.2 ohms

Cone Diameter	Models
6½"	21T20-T21
12"	21C225-C226-C227-C228-C229-C230-C231-C232.

CAT. NO.	SYMBOL	DESCRIPTION	UNIT PRICE
CAPACITORS (Cont'd)			
Micas & Ceramics			
UCG-1028	C171	100 mmf., 500 V., silver mica	$0.35
*UCG-2011	C169	20 mmf., ±5%, 500 V., silver mica	.25
*UCG-2012	C153, 161**, 161†	22 mmf., ±5%, 500 V., silver mica	.30
UCG-2025	C151†	75 mmf., ±5%, 500 V., silver mica	.30
*UCU-520	C204	47 mmf., 500 V., mica	.30
UCU-532	C183†, 184†	150 mmf., 500 V., mica	.30
*UCU-544	C304	470 mmf., 500 V., mica	.30
*UCU-1528	C359, 362	100 mmf., 500 V., mica	.30
*UCU-1544	C357, 364**, 364†	470 mmf., 500 V., mica	.35
UCU-1550	C379**, 379†	820 mmf., 500 V., mica	.35
*UCU-1562	C371**	2700 mmf., 500 V., mica	.70
UCU-2054	C378**, 378†	1200 mmf., ±5%, 500 V., mica	.40
RESISTORS			
Carbon, ½ watt			
*URD-001	R166*	10 ohms	.13
*URD-017	R194, 216	47 ohms	.13
*URD-027	R209†	120 ohms (part of T202)	.13
*URD-029	R168	150 ohms	.13
*URD-031	R201	180 ohms	.13
URD-033	R160	220 ohms	.13
*URD-035	R209*, 209**	270 ohms (part of T202)	.13
*URD-037	R368	330 ohms	.13
*URD-041	R183	470 ohms	.13
*URD-049	R151, 155, 158, 179, 182, 188†, 190, 215†, 379	1000 ohms	.13
URD-055	R193**, 193†	1800 ohms	.13
*URD-057	R153, 154	2200 ohms	.13
*URD-061	R169*	3300 ohms	.13
*URD-069	R330*, 365, 366	6800 ohms	.13
*URD-071	R311	8200 ohms	.13
*URD-073	R164, 165	10,000 ohms	.13
*URD-077	R305, 329**, 329†, 330**, 330†	15,000 ohms	.13
*URD-079	R161*, 202	18,000 ohms	.13
*URD-081	R210**, 210†, 208, 328, 329*	22,000 ohms	.13
*URD-083	R207, 359	27,000 ohms	.13
*URD-085	R187, 219, 309, 337, 357, 367, 376*	33,000 ohms (R219 tone compensation console models only)	.13
*URD-089	R204, 210*, 312, 333	47,000 ohms	.13
*URD-093	R354, 358, 361, 363†, 342**, 342†	68,000 ohms	.13
*URD-095	R317	82,000 ohms	.13
*URD-097	R175, 205, 221, 322, 331, 334, 352, 363*, 363**, 341**	100,000 ohms	.13
*URD-099	R304, 353	120,000 ohms	.13
*URD-101	R382	150,000 ohms	.13
*URD-103	R310, 336	180,000 ohms	.13
*URD-105	R181*, 181**, 356, 387**, 387†, 394**, 394†	220,000 ohms	.13
*URD-107	R335, 381*, 381**	270,000 ohms	.13
*URD-109	R332, 370*, 395**, 395†	330,000 ohms	.13
*URD-113	R206, 213, 214, 306, 393†	470,000 ohms	.13
*URD-115	R351	560,000 ohms	.13
*URD-117	R307	680,000 ohms	.13
*URD-121	R173, 196†, 301**, 301†, 302*, 355, 364, 374, 375, 388**, 388†, 396†	1 megohm	.13

CAT. NO.	SYMBOL	DESCRIPTION	UNIT PRICE
RESISTORS (Cont'd)			
Carbon, ½ watt			
URD-123	R340**, 340†	1.2 megohm	$0.13
*URD-129	R321, 378*, 378**	2.2 megohms	.13
*URD-131	R319	2.7 megohms	.13
URD-133	R191, 192, 308	3.3 megohms	.13
*URD-135	R339**, 339†, 377	3.9 megohms	.13
*URD-141	R212	6.8 megohms	.13
*URD-1025	R152, 157, 180, 385**, 385†	100 ohms, ±5%	.24
*URD-1029	R178	150 ohms, ±5%	.24
URD-1060	R163	3000 ohms, ±5%	.24
*URD-1067	R156	5600 ohms, ±5%	.24
URD-1084	R383	30,000 ohms, ±5%	.24
*URD-1104	R174*, 174**	200,000 ohms, ±5%	.24
Carbon, 1 watt			
*URE-033	R217	220 ohms	.17
*URE-041	R401	470 ohms	.17
URE-053	R197**, 197†	1500 ohms	.17
URE-061	R185-A*	3300 ohms	.17
*URE-065	R203*	4700 ohms	.17
*URE-069	R195	6800 ohms	.17
URE-075	R390†	12,000 ohms	.17
URE-081	R186**, 186†	22,000 ohms	.17
*URE-085	R338, 362	33,000 ohms	.17
*URE-089	R186, 303*, 344†	47,000 ohms	.17
Carbon, 2 watt			
*URF-039	R323	390 ohms	.25
*URF-041	R218, 325	470 ohms	.25
URF-055	R193	1800 ohms	.25
URF-057	R218	2200 ohms	.25
URF-065	R203**, 203†	4700 ohms	.25
URF-067	R162*	5600 ohms	.25
*URF-071	R162**, 162†	8200 ohms	.25
*URF-073	R189**, 189†	10,000 ohms	.25
URF-075	R386**, 386†	12,000 ohms	.25
URF-077	R199	15,000 ohms	.25
URF-079	R184†, 170*	18,000 ohms	.25
*URF-081	R185*, 371*, 391†	22,000 ohms	.25
*URF-089	R316	47,000 ohms	.25
*URF-105	R405, 406	220,000 ohms	.25
*URF-1080	R184**	20,000 ohms, ±5%	.40
Wirewound & Special			
*RRW-053	R171	4000 ohms, 10 watts	.85
*RRW-079	R403	5600 ohms, 5 watts	.60
RRW-103	R369	120 ohms, 5 watts	.60
RRW-104	R404	3750 ohms, 5 watts	.80
RRW-105	R373	3.3 ohms, ½ watt	.20
RRW-106	R380	5000 ohms, 10 watts	1.00
Potentiometers			
RRC-207	R360	100,000 ohms, Horiz. Hold control	1.25
RRC-208	R324	2000 ohms, Vert. Linearity control	1.75
RRC-209	R320	4 megohms, Height control	1.25
RRC-213	R176*, 372*	100,000 ohms—20,000 ohms dual Brightness control	3.00
RRC-215	R318*	175,000 ohms Vertical Hold control (long shaft)	1.30
RRC-216	R167, 220, S401	500,000 ohms, 3,000 ohms Volume and Contrast control (console models)	4.60
RRC-217	R167, 220, S401	500,000 ohms, 3000 ohms Volume and Contrast control (table models)	4.50
RRC-244	R318**, 318†	175,000 ohms Vertical Hold (short shaft for bracket mounting)	1.00
RRC-245	R392**, 392†	20,000 ohms, Brightness control	2.35
COILS AND TRANSFORMERS			
RLC-091	L351	COIL—Horizontal oscillator	1.75
RLD-052	D301, 351, R326, 327	COIL—Deflection yoke with resistors & choke coil	13.50
RLD-053	L352*, 357*	COIL—Width	2.35
RLD-054	L353*	COIL—Horizontal linearity	2.10
RLD-056	L358**, 358†	COIL—Horizontal linearity must be used with RTO-146	2.40
RLD-058	L359**, 359†	COIL—Width, must be used with RTO-146	2.10
RLF-024	L156, 356†	COIL—Choke, 31 uh (L156 part of video detector)	.65
RLF-061	L401	CHOKE—Filter, 4 hy.	6.75
*RLI-138	L354, 355	CHOKE—10 uh coil	.25

VIDEO IF ALIGNMENT

Connect positive terminal of a tapped 4½ volt "C" battery to chassis, -1½ volt tap to junction of C213 and R224, and -3 volt tap to junction of C212 and R223. Set "Fringe-Local" switch to local position and Contrast control fully counter-clockwise (min. contrast).

SWEEP GEN. COUPLING	SWEEP GEN. FREQUENCY	MARKER GEN. COUPLING	MARKER GEN. FREQUENCY	CONNECT SCOPE	ADJUSTMENTS
1st IF grid (test point TP1 on main chassis)	43mc. Adjust gain so trap suckout is visible.	Converter grid. (Use test point lead wire thru top of VHF Tuner)	47.25mc modulated. Adjust gain so pip is just visible.	Across vid. det. load R211. Place 10K res. in series with probe.	Adjust trap (top of T202) to center pip in suckout. See Fig. 1. Max. attenuation is at two core positions, use one with slug furthest out.
"	43 mc. Set gen. output for approx. 2V P/P output at scope.	"	Unmodulated 42.75 mc. 45.0 mc. 45.75 mc.	"	Check for response curve similar to Fig. 2. Tune T203 for max. gain between 42.75 mc and 45.75 mc. Tune T202 (bottom slug) to place 45.75 mc marker at 60% response. Tune T201 to place 42.75 mc marker at 60% of response. Recheck 47.25 mc trap.
Converter grid (use wire test point lead fed thru top of VHF Tuner)	"	Loosely couple	Same as above	"	Set VHF Tuner to clear channel (6-13). Tune converter plate coil L3 for max. gain with 45.75 mc marker at 50% response. (See Fig. 2.) Tune 1st IF grid coil T201 for max. gain and proper tilt. Interaction might require repeating these two adjustments until Fig. 2 is duplicated.
VHF ant. terms. Use network in Fig. 4 if cable is not balanced.	Channels 2 thru 13 R.F.	"	Same as above	"	Check all channels for bandwidth, slope and position of carrier. Use oscillator trimmer to set osc. at high VHF channel for middle of fine tuner range. Refer to Magnavox Manual 5250 for complete VHF Tuner alignment.
UHF crystal term. nearest UHF osc. tube use 1K isolation resistor.	43 mc. same gain	"	Same as above	"	Set VHF Tuner to UHF position. Adjust R.F. amp. grid coil A41 for min. tilt (slug of A41 is at top rear of VHF Tuner). Response should conform to Fig. 2.

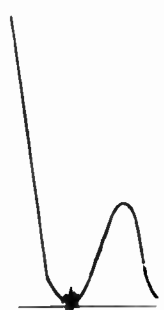


Fig. 1

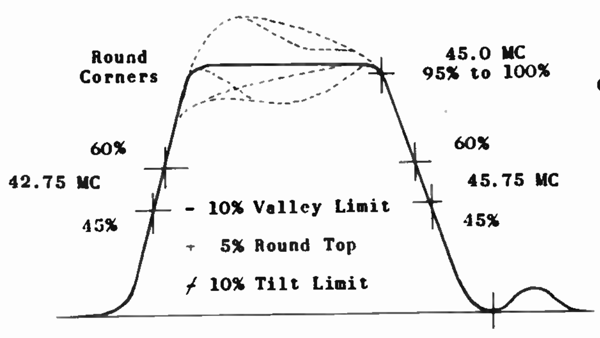
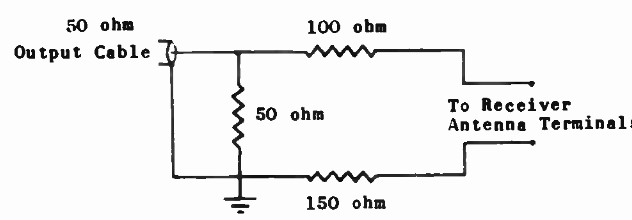
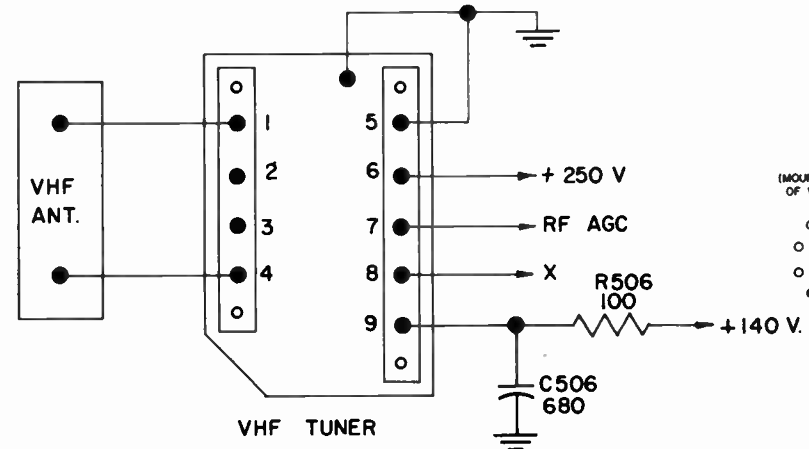


Fig. 2

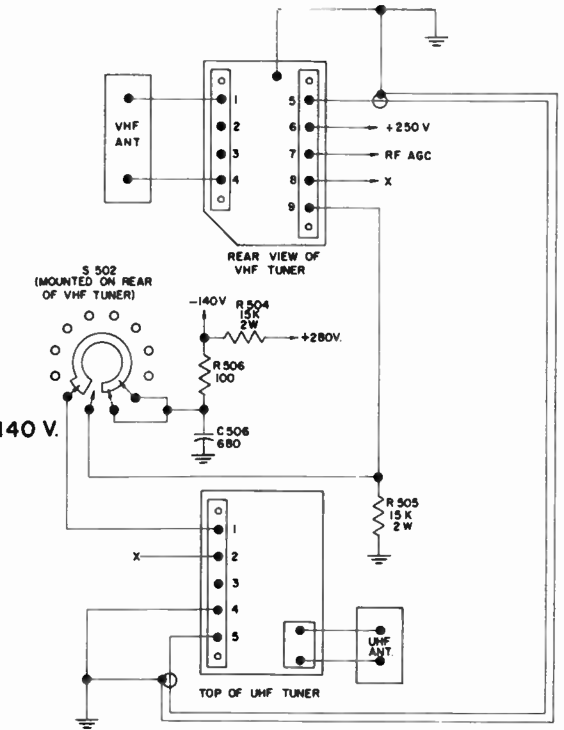


IMPEDANCE MATCHING NETWORK

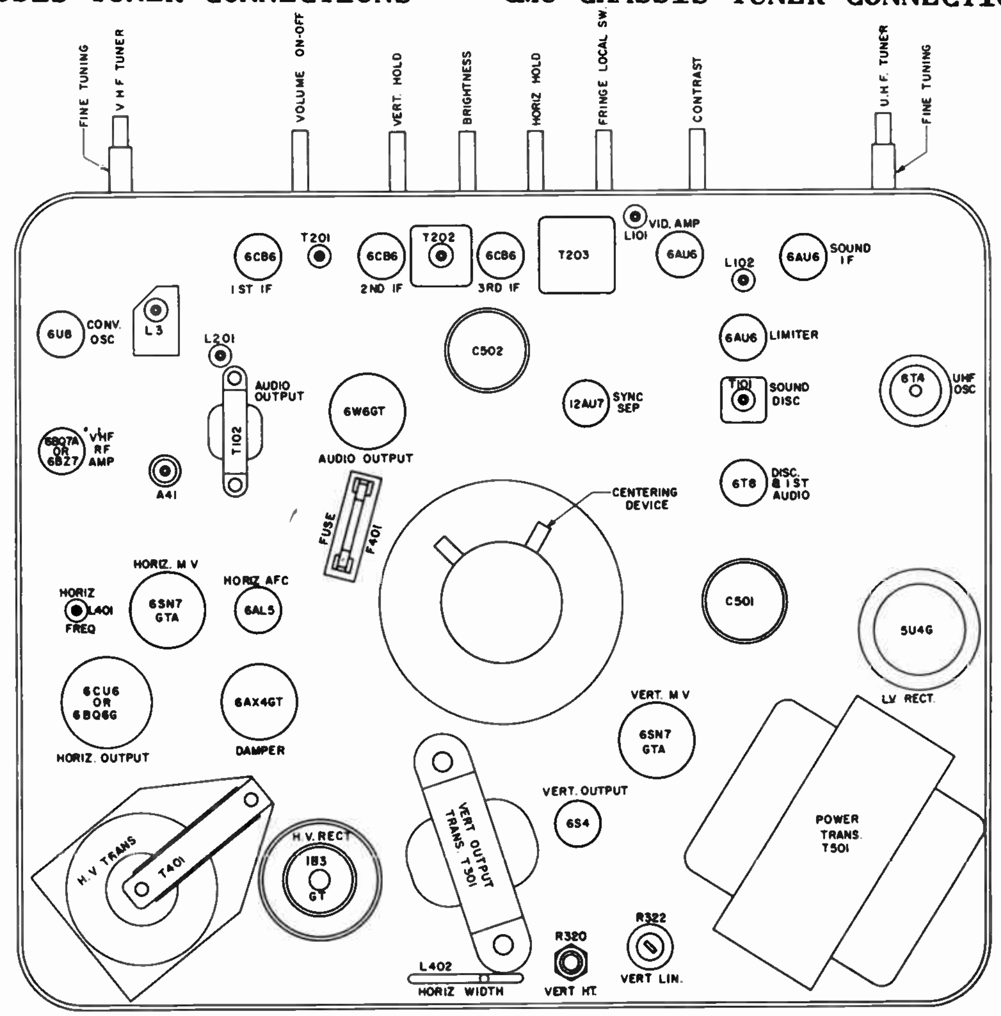
Fig. 3



CT CHASSIS TUNER CONNECTIONS



CMU CHASSIS TUNER CONNECTIONS



CHASSIS LAYOUT REAR VIEW

SOUND IF ALIGNMENT

SIG. GEN. COUPLING	SIG. GEN. FREQUENCY	VTVM CONNECTION	ADJUSTMENTS
Couple thru .005 mfd. capacitor to terminal "D" of video detector transformer.	Unmodulated 4.5mc ±.01%	Probe to pin 3 of 6T8 discriminator tube in series with 10K isolation resistor at probe end, low side of meter to chassis.	Tune primary of T101, L102 and L101 all for max. output on meter. Keep reading between 6.5-7 V. for accuracy by adjusting signal input or detuning section of T101.
"	"	"	Tune secondary of T101 descriminator transformer for zero indication on meter. True indication is point where indicating voltage swings positive or negative.

SYMBOL	DESCRIPTION	PART NO.
	CAPACITORS	
C601	Molded, .68 mmf, 500 V.	250209-112
C602	Molded, .68 mmf, 500 V.	250209-112
C603	Steatite	250188-2
C604	Molded, 1.0 mmf, 500 V.	250209-114
C605	Molded, 1.0 mmf, 500 V.	250209-114
C607	Molded, .47 mmf, 500 V.	250209-109
C608	Steatite	250188-2
C609	Molded, 2.2 mmf, 500 V.	250209-118
C610	Choke	350049-2
C611	Molded, 1.0 mmf, 500 V.	250209-114
C612	Molded, .12 mmf, 500 V.	250209-102
C613	Molded, 56 mmf, 500 V.	250209-137
C614	Ceramic	250196-1
C615	Ceramic Trimmer	250197-1
C616	Molded, 56 mmf, 500 V.	250209-137
C619	Ceramic, 100 mmf, 500 V.	250207-46
C620	Ceramic Disc, 470 mmf.	250175-8
C621	Ceramic Disc, 470 mmf.	250175-8
C622	Ceramic Disc, 470 mmf.	250175-8
C623	Ceramic Disc, 470 mmf.	250175-8
C624	Ceramic Disc, 470 mmf.	250175-8
C625	Ceramic Disc, 470 mmf.	250175-8
C626	Molded, 2.2 mmf, 500 V.	250209-118
C627	Molded, 3.3 mmf, 500 V.	250209-121
	RESISTORS	
R601	Carbon, 12,000 ohms, ½ W.	230104-75
R602	Carbon, 1500 ohms, ½ W.	230104-64
R603	Carbon, 1500 ohms, ½ W.	230104-64
R604	Carbon, 12,000 ohms, 1 W.	230105-75
R605	Carbon, 12,000 ohms, 1 W.	230105-75
R606	Carbon, 100,000 ohms, ½ W.	230104-86
R607	Carbon, 150 ohms, ½ W.	230104-52
R608	Carbon, 120,000 ohms, ½ W.	230104-87
R609	Carbon, 120,000 ohms, ½ W.	230104-87
R610	Carbon, 1000 ohms, ½ W.	230104-62
R611	Carbon, 100,000 ohms, ½ W.	230104-86
R612	Carbon, 3300 ohms, ½ W.	230104-68
R613	Carbon, 220 ohms, ½ W.	230104-54
	Crystal	530035-1
	PARTS LIST FOR THE 700426 UHF TUNER	
	COILS - TRANSFORMERS	
L604	RF coupling	360415-44
L607	Input IF	360571-1
L608	IF coupling choke	360522-6
L609	Crystal return choke	360522-5
L611	Osc. plate choke	360522-7
L612	Osc. fil. choke	360574-8
L613	Osc. fil. choke	360574-8
L614	Osc. cathode choke	360574-8
L615	Fil. choke	360574-8
L616	Fil. choke	360574-10
L617	Output IF	360572-1
	CAPACITORS	
C601	Molded, .82 mmf.	250221-113
C602	Molded, .82 mmf.	250221-113
C603	Trimmer	250188-8
C604	Molded, 2.7 mmf.	250221-119
C605	Molded, 2.7 mmf.	250221-119
C606	Trimmer	250188-7
C607	Molded, 1.2 mmf.	250221-115
C608	Ceramic, 10 mmf.	250207-3
C609	Ceramic disc, 8 mmf.	250175-11
C610	Trimmer	250188-8
C611	Fine tuning trimmer	260120-1
C612	Trimmer	250220-2
C613	Molded, .1 mmf.	250221-101
C614	Ceramic disc, 470 mmf.	250175-8
C615	Ceramic disc, 470 mmf.	250175-8
C616	Ceramic disc, 470 mmf.	250175-8
C617	Ceramic disc, 470 mmf.	250175-8
C618	Ceramic disc, 470 mmf.	250175-8
C619	Ceramic, 470 mmf.	250207-50
C620	Ceramic disc, 470 mmf.	250175-8
C621	Ceramic, 56 mmf.	250207-81
C622	Ceramic disc, 470 mmf.	250175-8
C623	Ceramic disc, 470 mmf.	250175-8
C624	Molded, .68 mmf.	250221-112
C625	Molded, 6.8 mmf.	250221-125
C626	Ceramic disc, 470 mmf.	250175-8
	RESISTORS	
R601	100,000 ohms, ½ W.	230104-86
R602	100,000 ohms, ½ W.	230104-86
R603	22,000 ohms, ½ W.	230104-78
R604	1200 ohms, 1 W.	230105-63
R605	100,000 ohms, ½ W.	230104-86
R606	100,000 ohms, ½ W.	230104-86
R607	100 ohms, ½ W.	230104-50
R608	470,000 ohms, ½ W.	230104-94
R609	470,000 ohms, ½ W.	230104-94
R610	1000 ohms, ½ W.	230104-62
R611	100 ohms, ½ W.	230104-50
R612	10,000 ohms, 1 W.	230105-74
R613	10,000 ohms, 1 W.	230105-74
R614	10,000 ohms, 1 W.	230105-74
R615	220 ohms, ½ W.	230104-54
R616	150,000 ohms, ½ W.	230104-88
	CRYSTAL	
X601	1N124	530036-1
	TRANSFORMERS	
T101	Ratio Detector	360482-1
T201	IF Input and Trap	360545-1
T202	1st IF and Trap	360546-1
T203	2nd IF and Trap	360546-1
T204	3rd IF and Trap	360546-1
T205	4th IF and Video Detector	360549-1
T301	Vertical Output (106 & 400 Series)	330034-1
	Vertical Output (358AA, BA only)	330035-1
	Vertical Output (All Other 107 & 500 Series)	330035-2
T401	H.V. Transformer (106 Series)	360561-1
	H.V. Transformer (400 Series)	360594-1
	H.V. Transformer (107 & 500 Series)	360593-2
T402	AFC Sawtooth	360590-1
T501	Power, (106 & 400 Series, Audio Version)	300067-4
	Power, (106 & 400 Series, No Audio Version)	300069-2
	Power, (107 & 500 Series)	300068-4
	COILS	
L101	4.5 MC Sound Takeoff	360535-1
L102	4.5 MC Sound IF	360481-1
L201	Peaking, Orange, Orange, Green	360443-23
L202	Peaking, Yellow, Yellow, Yellow	360443-24
L203	Peaking, Gray, Gray	360443-19
L204	Peaking, Orange, Orange, Red, 1000 ohm (400 Series)	360443-33
	Peaking, Green, Green, Green, (All Others)	360443-25
L205	Peaking, Blue, Blue, Blue	360443-26
L206	Trap Coil Assembly	360554-1
L207	4.5 MC Trap	360481-2
L301	Choke, .47 uh	360372-1
L401	Horizontal Oscillator (106 & 107 Series)	360499-4
	Horizontal Oscillator (400 Series)	360579-1
	Horizontal Oscillator (500 Series)	360591-1
L402	Keyer and Horizontal Width	360570-1
L403	Horizontal Linearity	360533-1
L404	Deflection Yoke (106 Series)	360566-2
	Deflection Yoke (400 Series)	360566-3
	Deflection Yoke (107 Series)	360556-5
	Deflection Yoke (500 Series)	360556-4
L501	Filter Reactor (106 & 400 Series)	320065-1
	Filter Reactor (107 & 500 Series)	320064-1
	CAPACITORS	
C101	Ceramic, 10 mmf. 500 V.	250207-3
C102	Ceramic, 10,000 mmf. 500 V.	250175-2
C103	Ceramic, 5000 mmf, 500 V.	250175-1
C104	Ceramic, 5000 mmf, 500 V.	250175-1
C105	Ceramic, 5000 mmf, 500 V.	250175-1
C106	Ceramic, 5000 mmf, 500 V.	250175-1
C107	Mica, 68 mmf, 500 V.	250159-80
C108	Mica, 56 mmf, 500 V.	250159-79
C109	Ceramic, 5000 mmf, 500 V.	250175-1
C110	Ceramic, 5000 mmf, 500 V.	250175-1
C111	Electrolytic, 10 mfd, 350 V.	270027-4
C112	Mica, 470 mmf. 500 V.	250159-90
C113	Ceramic, 1000 mmf, 350 V.	250088-46
C114	Paper, .0033 mfd, 600 V.	250201-4
C115	Paper, .0033 mfd, 600 V. (106 & 400 Series)	250201-4
C115	Paper, .01 mfd, 600 V. (107 & 500 Series)	250201-7
C117	Mica, 680 mmf, 500 V. (106 & 400 Series)	250160-62
	Mica, 470 mmf, 500 V. (107 & 500 Series)	250159-90
C118	Paper, .047 mfd, 600 V.	250201-11
C119	Paper, .047 mfd, 600 V.	250201-11
C120	Paper, .0015 mfd, 600 V.	250201-2
C121	Paper, .0015 mfd, 600 V.	250201-2
C122	Ceramic, 150 mmf, 500 V.	250207-17
C201	Ceramic, 470 mmf, 450 V.	250175-9
C202	Ceramic, 470 mmf, 450 V.	250175-9
C203	Ceramic, 470 mmf, 450 V.	250175-9
C204	Ceramic, 470 mmf, 450 V.	250175-9
C205	Ceramic, 470 mmf, 450 V.	250175-9
C206	Ceramic, 470 mmf. 450 V.	250175-9
C207	Ceramic, 470 mmf. 450 V.	250175-9
C208	Ceramic, 470 mmf, 450 V.	250175-9
C209	Ceramic. 470 mmf, 450 V.	250175-9
C210	Ceramic, 470 mmf, 450 V.	250175-9
C211	Ceramic, 470 mmf, 450 V.	250175-9
C212	Ceramic, 680 mmf, 450 V.	250218-4
C213	Ceramic, 470 mmf, 450 V.	250175-9
C214	Ceramic, 680 mmf, 450 V.	250218-4
C215	Ceramic, 100 mmf, 500 V. (106 & 107 Series)	250207-46
	Electrolytic, 5 mfd, 350 V. (400 & 500 Series)	270027-24
C216	Paper, .1 mfd, 400 V.	250211-13
C217	Ceramic, 20,000 mmf, 450 V.	250175-7
C218	Mica, 150 mmf. 500 V.	250159-2051
C219	Paper, .0033 mfd, 600 V.	250201-4
C220	Paper, .01 mfd, 600 V.	250201-7
C222	Paper, .22 mfd, 200 V.	250202-15
C223	Paper, .01 mfd, 600 V.	250201-7
C224	Paper, .1 mfd, 200 V.	250202-13
C225	Paper, .047 mfd, 200 V.	250202-11
C226	Paper, .01 mfd, 600 V.	250201-7
C227	Paper, .22 mfd, 200 V.	250202-15
C228	Ceramic, 1 mmf, 500 V.	250209-114
C229	Ceramic, 680 mmf, 450 V.	250218-4
C302	Paper, .22 mfd. 200 V.	250202-15
C303	Ceramic, 1500 mmf, 500 V.	250175-3
C304	Mica, 240 mmf, 500 V.	250159-56
C305	Ceramic. 10,000 mmf, 500 V.	250175-2
C306	Paper, .0047 mfd, 600 V.	250201-5
C307	Paper. .0047 mfd, 600 V.	250201-5
C308	Mica, 2700 mmf, 500 V.	250160-48
C309	Paper. .047 mfd. 600 V.	250201-11
C310	Paper, .1 mfd, 600 V. (106A Series only)	250201-13
	Paper, .22 mfd. 600 V. (All Other 106 Series)	250211-15
C311	Electrolytic. 10-30-5/350 V, 200/25 V.	270021-46
C312	Paper, .047 mfd, 600 V.	250201-11
C401	Paper, .001 mfd, 400 V. (500 Series)	250211-1
	Paper, .047 mfd. 600 V. (All Others)	250201-11
C402	Mica. 47 mmf, 500 V. (106 & 107 Series)	250159-78
	Paper, .001 mfd. 400 V. (400 & 500 Series)	250211-1
C403	Paper. .0047 mfd, 400 V. (500 Series)	250211-5
	Paper, .47 mfd, 200 V. (All Others)	250202-17
C404	Paper, .022 mfd, 200 V. (106 & 107 Series)	250202-9
	Paper. .0047 mfd. 400 V. (400 & 500 Series)	250211-5
C405	Paper. .047 mfd, 200 V.	250202-11
C406	Mica, 82 mmf, 500 V. (106 & 107 Series)	250159-81
	Mica, 390 mmf. 500 V. (400 & 500 Series)	250159-5061
C407	Silver Mica, 3900 mmf. 500 V. (400 & 500 Series)	250161-5041
	Mica, 68 mmf, 500 V. (106 & 107 Series)	250159-80
C408	Mica. 180 mmf, 500 V. (106 & 107 Series)	250159-53
	Mica, 510 mmf. 500 V. (400 & 500 Series)	250159-64
C409	Mica. 10,000 mmf, 300 V. (106 & 107 Series)	250161-47
	Mica, 330 mmf, 500 V. (400 & 500 Series)	250159-5059
C410	Mica, 560 mmf, 500 V. (106 Series)	250160-61
	Mica, 470 mmf, 500 V. (107 Series)	250159-90
	Paper, .0047 mfd, 400 V. (400 Series)	250211-5
	Paper, .001 mfd, 400 V. (500 Series)	250211-1
C411	Electrolytic, 10 mfd, 350 V. (500 Series)	270027-23
	Variable, Mica Dialectric (All Others)	260116-1
C412	Mica, 680 mmf, 500 V. (107 Series)	250159-131
	Mica, 680 mmf, 500 V. (106 & 400 Series)	250160-62
C413	Electrolytic, 10 mfd, 500 V. (106 & 400 Series)	270027-19
	Electrolytic, 20 mfd, 350 V. (107 Series)	270027-20
C414	Electrolytic, 20 mfd, 350 V.	270027-20
C415	Paper, .047 mfd, 600 V.	250201-11
C417	Paper, .0022 mfd, 600 V.	250201-3
C419	Paper, .033 mfd, 600 V. (106 & 400 Series)	250201-10
	Paper, .047 mfd, 600 V. (107 & 500 Series)	250201-11
C420	Paper, .033 mfd, 600 V. (107 Series)	250201-10
	Paper, .047 mfd, 600 V. (All Others)	250201-11
C421	High Voltage (106 & 400 Series)	250189-1
	High Voltage (107 & 500 Series)	250189-2
C501	Electrolytic, 40-30-30-30/350 V.	270021-43
C502	Electrolytic, 40-5/350 V, 30/25 V. (106 & 107 Series)	270021-49
	Electrolytic, 40-20-5/350 V, 30/25 V. (400 & 500 Series)	270021-53
C503	Ceramic, .01 mfd, 1000 V.	250219-2
C504	Electrolytic, 30 mfd/350 V. (106 Series)	270021-50
	Electrolytic, 30-20/350 V. (400 Series)	270021-54
C505	Ceramic, 2 x .01 mfd, 1000 V.	250219-3
	RESISTORS	
R101	470,000 ohms, ½ W.	230104-94
R102	82 ohm, ½ W.	230104-49
R103	100 ohm, ½ W.	230104-50
R104	39,000 ohm, ½ W.	230104-81
R105	470 ohm, ½ W.	230104-50
R106	27,000 ohm, ½ W.	230104-79
R107	3300 ohm, ½ W.	230104-68
R108	220 ohm, ½ W.	230104-54
R109	15,000 ohm, ½ W.	230104-76
R111	68,000 ohm, ½ W.	230104-84
R115	680,000 ohm, ½ W. (106 & 400 Series)	230104-96
	1 megohm, ½ W. (107 & 500 Series)	230104-98
R117	2200 ohm, ½ W.	230104-66
R118	82,000 ohm, ½ W.	230104-85
R119	150,000 ohm, ½ W.	230104-88
R120	150,000 ohm, ½ W.	230104-88
R121	220,000 ohm, ½ W.	230104-90
R122	220,000 ohm, ½ W.	230104-90
R123	4700 ohm, ½ W.	230104-70
R124	330 ohm, 2 W.	230106-56
R125	560,000 ohm, ½ W.	230104-95
R126	10,000 ohm, 1 W.	230105-74
R127	10,000 ohm, 1 W.	230105-74
R128	150,000 ohm, ½ W.	230104-88
R201	1000 ohm, ½ W.	230104-62
R202	47 ohm, ½ W.	230104-46
R203	1000 ohm, ½ W.	230104-62
R204	47 ohm, ½ W.	230104-46
R205	1000 ohm, ½ W. (500 Series)	230104-62
	10,000 ohm, ½ W. (All Others)	230104-74
R206	330,000 ohm, ½ W.	230104-92
R207	180,000 ohm, ½ W.	230104-89
R208	1000 ohm, ½ W.	230104-62
R209	1000 ohm, ½ W.	230104-62
R210	47 ohm, ½ W.	230104-46
R211	56,000 ohm, ½ W.	230104-83
R212	18,000 ohm, ½ W.	230104-77
R213	2200 ohm, 1 W.	230105-66
R214	180 ohm, ½ W.	230104-53
R215	470 ohm, ½ W.	230104-58
R216	3900 ohm, ½ W.	230104-69
R217	1000 ohm, ½ W. (400 Series)	230104-62
	22,000 ohm, 1 W. (All Others)	230105-78
R218	3300 ohm, ½ W. (106 & 107 Series)	230104-68
	33,000 ohm, 1 W. (400 Series)	230105-80
	1200 ohm, ½ W. (500 Series)	230104-63
R219	2200 ohm, 1 W. (106 & 107 Series)	230105-66
	1200 ohm, ½ W. (400 Series)	230104-63
	1000 ohm, ½ W. (500 Series)	230104-62
R220	470,000 ohm, ½ W.	230104-94
R222	5600 ohm. 2 W. (106 & 107 Series)	230106-71
	33,000 ohm, ½ W. (400 & 500 Series)	230104-80
R223	3300 ohm, 10 W.	240021-31
R224	2.2 megohm, ½ W.	230104-102
R225	1 megohm, ½ W.	230104-98
R226	56,000 ohm, ½ W. (500 Series)	230104-83
	68,000 ohm, ½ W. (All Others)	230104-84
R228	27,000 ohm, ½ W. (500 Series)	230104-79
	47,000 ohm, ½ W. (All Others)	230104-82
R229	150,000 ohm, ½ W.	230104-88
R231	180,000 ohm, ½ W.	230104-89
R232	18,000 ohm, ½ W.	230104-77
R233	33,000 ohm, ½ W.	230104-80
R234	8.2 megohm, ½ W. (106 & 400 Series)	230104-109
	7.5 megohm, ½ W. (107 & 500 Series)	230094-252
R235	680,000 ohm. ½ W.	230104-96
R236	39,000 ohm, ½ W.	230104-81
R237	270,000 ohm, ½ W.	230104-91
R238	100,000 ohm, ½ W.	230104-86
R240	6800 ohm, ½ W.	230104-72
R241	10,000 ohm, ½ W.	230104-74
R242	15,000 ohm, ½ W.	230104-76
R243	3900 ohm, ½ W.	230104-69
R244	22,000 ohm, ½ W.	230104-78
R245	2.2 megohm, ½ W.	230104-102
R301	270,000 ohm, ½ W.	230104-91
R302	68,000 ohm, ½ W.	230104-84
R303	680,000 ohm, ½ W.	230104-96
R305	470,000 ohm. ½ W. (500 Series)	230104-94
	330,000 ohm. ½ W. (All Others)	230104-92
R306	4.7 megohm. ½ W.	230104-106
R307	22,000 ohm, ½ W.	230104-78
R308	56,000 ohm, ½ W.	230104-83
R309	1 megohm, ½ W.	230104-98
R310	3900 ohm, ½ W. (106 & 107 Series)	230104-69
	2700 ohm, ½ W. (400 Series)	230094-169
	1800 ohm, ½ W. (500 Series)	230094-165
R311	390 ohm, ½ W.	230104-57
R312	8200 ohm, ½ W.	230104-73
R313	100,000 ohm, 1 W.	230105-86
R315	2.7 megohm, ½ W. (106 & 400 Series)	230104-103
	2.2 megohm, ½ W. (107 & 500 Series)	230104-102
R317	1.5 megohm, ½ W.	230104-100
R318	22,000 ohm, ½ W.	230104-78
R319	1000 ohm, ½ W.	230104-62
R321	47 ohm, ½ W. (106 & 400 Series)	230104-46
	150 ohm, 1 W. (107 & 500 Series)	230105-52
R322	2.2 megohm, ½ W. (106A Version)	230104-102
	1 megohm, ½ W. (All Other 106 & 400 Series)	230104-98
	1.5 megohm, ½ W. (107 & 500 Series)	230104-100
R323	68,000 ohm, 2 W. (106 & 400 Series)	230106-84
	4700 ohm, 1 W. (107 Series)	230105-70
	120,000 ohm, 1 W. (500 Series)	230105-87
R324	15,000 ohm, 1 W.	230105-76
R325	1.2 megohm, ½ W. (106 & 400 Series)	230104-99
	2.2 megohm, ½ W. (107 & 500 Series)	230104-102
R326	100,000 ohm, ½ W.	230104-86
R327	2700 ohm, ½ W. (400 Series)	230094-169
	1800 ohm, ½ W. (500 Series)	230094-165
R328	68,000 ohm, 2 W.	230106-84
R329	12,000 ohm, ½ W.	230104-75
R351	150,000 ohm, ½ W.	230104-88
R352	47 ohm, ½ W.	230104-46
R401	120,000 ohm, ½ W. (106 & 107 Series)	230104-87
	100,000 ohm, ½ W. (400 & 500 Series)	230094-207
R402	100,000 ohm, ½ W. (400 & 500 Series)	230094-207
R403	120,000 ohm, ½ W. (106 & 107 Series)	230104-87
	470,000 ohm, ½ W. (400 & 500 Series).	230104-94
R404	3900 ohm, ½ W. (106 & 107 Series)	230104-69
	4.7 megohm, ½ W. (400 & 500 Series)	230104-106
R405	330,000 ohm. ½ W. (106 & 107 Series)	230104-92
	1800 ohm, ½ W. (400 & 500 Series)	230094-165
R406	82,000 ohm, ½ W. (106 & 107 Series)	230104-85
	5600 ohm, ½ W. (400 & 500 Series)	230094-177
R407	330,000 ohm, ½ W. (106 & 107 Series)	230104-92
	150,000 ohm, ½ W. (400 & 500 Series)	230104-88
R408	820,000 ohm, ½ W. (106 & 107 Series)	230104-97
R409	150,000 ohm, ½ W. (106 & 107 Series)	230104-88
	220,000 ohm, ½ W. (400 Series)	230094-215
	120,000 ohm, ½ W. (500 Series)	230094-209
R410	150,000 ohm, ½ W. (106 & 107 Series)	230104-88
	1500 ohm, ½ W. (400 & 500 Series)	230104-64
R411	8200 ohm, ½ W. (106 & 107 Series)	230104-73
	24.000 ohm. ½ W. (500 Series)	230094-192
R412	47,000 ohm, 1 W. (106 & 107 Series)	230105-82
	6800 ohm, ½ W. (400 & 500 Series)	230094-179
R413	10,000 ohm, 1 W.	230105-74
R414	100 ohm, ½ W.	230104-50
R415	56,000 ohm, ½ W.	230104-83
R416	7500 ohm, 2 W. (106 Series)	230096-180
	10.000 ohm. 2 W. (400 Series)	230096-183
	8200 ohm. 2 W. (107 & 500 Series)	230106-73
R417	15,000 ohm, 1 W.	230105-76
R418	1.8 ohm, ½ W. (500 Series)	230109-1
	2.7 ohm, 1 W. (107 Series)	230107-2
R419	1 megohm. 1 W.	230105-98
R420	8200 ohm, ½ W. (107 Series)	230104-73
	1000 ohm, ½ W. (All Others)	230104-62
R421	100 ohm. ½ W.	230104-50
R422	10 ohm, 1 W.	230105-38
R501	125 ohm. 10 W. (106 & 400 Series)	240021-11
	125 ohm. 15 W. (107 & 500 Series)	240021-34
R502	650 ohm. 10 W.	240021-33
R503	175 ohm, 10 W.	240021-38
R504	500 ohm. 10 W.	240021-2
R505	270,000 ohm, ½ W.	230104-91
R506	330 ohm, 2 W.	230106-56
	CONTROLS	
R112	Tone, 500.000 ohm, ¼ W.	220126-28
	Tone, 500.000 ohm. ¼ W. (With Switch)	220127-3
R113	Volume, 1 megohm, ¼ W.	220126-25
	Volume, 1 megohm, ¼ W. (With Switch)	220118-2
R221	Contrast, 2000 ohm. 2 W. (With Switch)	220126-30
R227	Brightness, 100,000 ohm, ¼ W.	220126-31
R304	Noise Bias, 500.000 ohm. ¼ W.	220126-35
R314	Vertical Linearity, 2.5 megohm, ¼ W.	220076-5
R316	Vertical Hold, 1 megohm, ¼ W.	220126-32
R320	Vertical Height, 600 ohm, 2 W. (106 & 400 Series)	220126-12
	Vertical Height, 400 ohm. 2 W. (107 & 500 Series)	220126-34
R402	Horizontal Hold, 50,000 ohm. ¼ W. (106 & 107 Series)	220126-33
R408	Horizontal Hold, 25,000 ohm, ¼ W. (400 & 500 Series)	220126-38
R411	Horizontal Drive, 25,000 ohm, ¼ W. (400 Series only)	220126-41
	MISCELLANEOUS	
PC301	Printed Circuit	250186-1
J101	Socket, Phono	180466-1
J103	Socket, Speaker	180504-16
J501	Socket, AC (106 Series)	180476-1
	Socket. AC (All Others)	180547-1
J502	Outlet, AC	180428-1
J503	Power Receptacle, Phono	180520-4
S101	Switch, Phono (381AB, 358AA. BA)	160229-1
	Switch, Phono (381AD, 358AB, BB)	160232-2
	Switch. UHF-VHF (CU Models)	160230-2
	Switch. UHF-VHF (CMU Models)	160237-1
S113	Switch (Part of R113)	
	VHF Tuner (CT & CU Models)	700379-34
	VHF Tuner (CMU Models)	700379-44
	UHF Converter	700359-24
	UHF Tuner	700426-21
	Focus Unit & Centering Device (107 & 500)	360569-1
	Focus Unit & Centering Device (106 & 400)	360569-2
	Beam Corrector (106 & 400 Series)	360557-1
	Beam Corrector (107 & 500 Series)	360576-1
	Ion Trap	360492-2

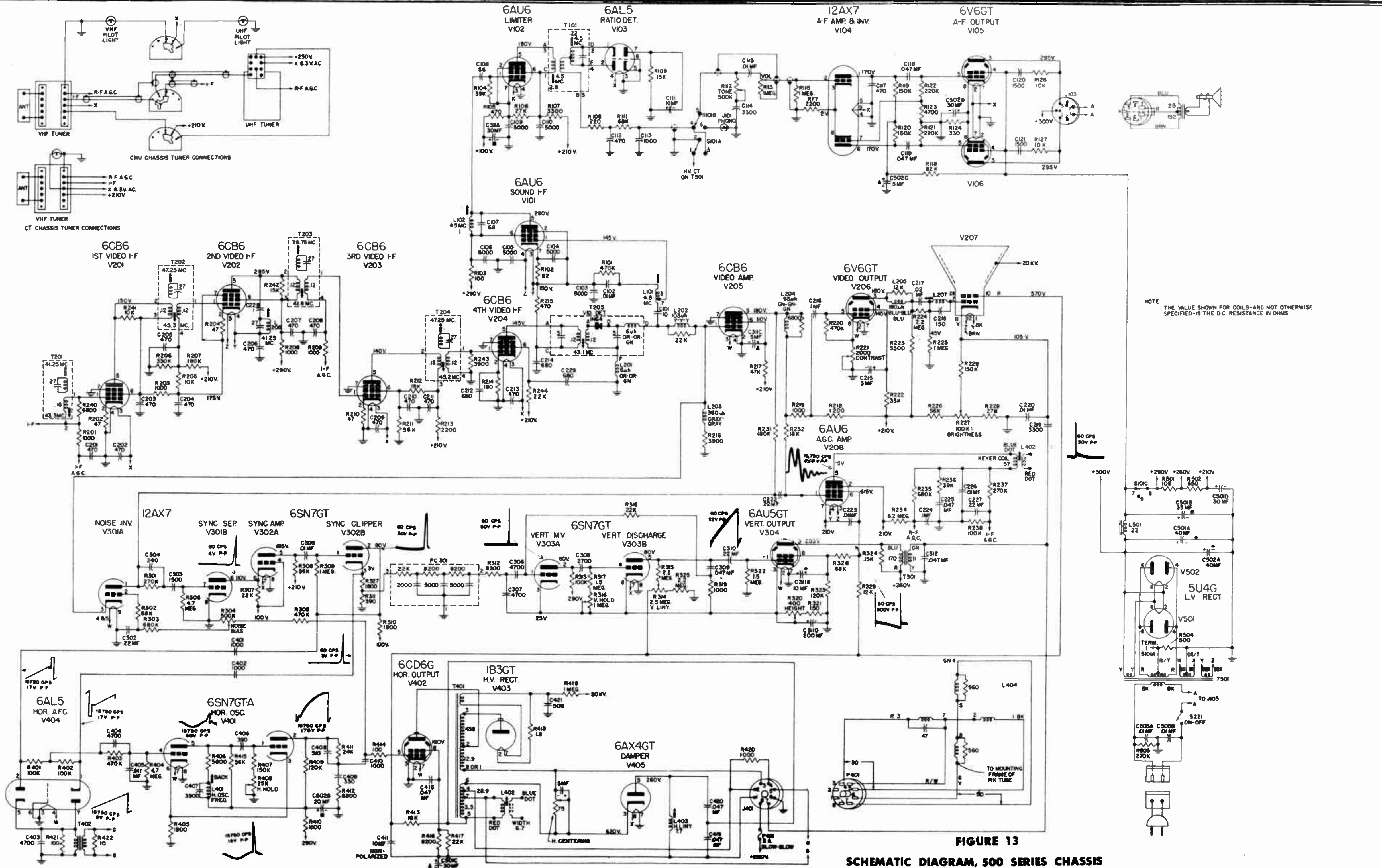


FIGURE 13

SCHEMATIC DIAGRAM, 500 SERIES CHASSIS

PARTS LIST

PARTS LIST FOR THE 700379 VHF TUNER

SYMBOL	DESCRIPTION	PART NO.
	COILS-TRANSFORMERS	
T 1	Antenna	360490-2
L 1	RF Choke, 3.3 uh.	360372-6
L 2	Choke	360415-66
L 3	Converter	360540-1
L 4	RF Choke, 47 uh.	360372-1
L 5	RF Choke, 47 uh.	360372-1
L 6	Antenna Trap	360415-64
L 7	Antenna Trap	360415-64
	CAPACITORS	
C 1	Trimmer	250188-6
C 2	Ceramic, 470 mmf, 500 V.	250207-50
C 3	Ceramic, 470 mmf, 500 V.	250207-50
C 4	Ceramic, 470 mmf, 500 V.	250207-50
C 5	Ceramic, 470 mmf, 500 V.	250207-50
C 6	Ceramic, .10 mmf, 500 V.	250216-2
C 7	Ceramic, 470 mmf, 500 V.	250207-50
C 8	Ceramic, 470 mmf, 500 V.	250207-50
C 9	Molded, .68 mmf, 500 V.	250209-112
C10	Molded, .68 mmf, 500 V.	250209-112
C11	Ceramic, 15 mmf, 500 V.	250207-5
C12	Molded, 3.3 mmf, 500 V.	250209-121
C13	Ceramic, 470 mmf, 500 V.	250207-50
C14	Ceramic, 470 mmf, 500 V.	250207-50
C15	Ceramic, 15 mmf, 500 V.	250088-112
C16	Oscillator Adjustment Trimmer	250188-1
C17	Fine Tuner	634360-1
C18	Ceramic, 20 mmf, 500 V.	250088-113
C19	Ceramic, 470 mmf, 500 V.	250207-50
C20	Ceramic, .0015 mfd, 500 V.	250175-3
C21	Ceramic, 82 mmf, 500 V. (400 & 500 Series)	250207-80
	Ceramic, 68 mmf, 500 V. (106 & 107 Series)	250207-82
C22	Ceramic, 24 mmf, 500 V.	250207-83
C23	Ceramic, 24 mmf, 500 V.	250207-83
	RESISTORS	
R 1	Carbon, 22,000 ohms, ½ W.	230104-78
R 2	Carbon, 470,000 ohms, ½ W.	230104-94
R 3	Carbon, 470,000 ohms, ½ W.	230104-94
R 4	Carbon, 6800 ohms, ½ W.	230104-72
R 5	Carbon, 1000 ohms, ½ W.	230104-62
R 6	Carbon, 3300 ohms, ½ W.	230104-68
R 7	Carbon, 330,000 ohms, ½ W.	230104-92
R 8	Carbon, 33,000 ohms, ½ W.	230104-80
R 9	Carbon, 68,000 ohms, ½ W.	230104-84
R10	Carbon, 22,000 ohms, ½ W.	230104-78
R11	Carbon, 22,000 ohms, ½ W.	230104-78
R12	Carbon, 6800 ohms, 1 W.	230105-72
R13	Carbon, 150 ohms, ½ W.	230104-52
R14	Carbon, 10,000 ohms, ½ W.	230104-74
R15	Carbon, 8200 ohms, 1 W.	230105-73
R16	Carbon, 8200 ohms, 1 W.	230105-73

PARTS LIST FOR THE 700359 UHF CONVERTER

SYMBOL	DESCRIPTION	PART NO.
	COILS-TRANSFORMERS	
T601	Output I.F	360490-3
L601	Tuning Unit	700358-3
L605	Choke, Mixer Coupling (Green)	360522-3
L606	Choke, Osc. & Filament (Blue)	360522-2
L607	Choke, Osc. & Filament (Blue)	360522-2
L608	Choke, Osc. & Filament (Blue)	360522-2
L609	Choke, Osc. Cathode (Yellow)	360522-4
L611	Choke, Osc. & Filament (Blue)	360522-2
L612	Input I.F.	360523-1
L613	Input I.F.	360415-64
L614	Input I.F.	360415-64

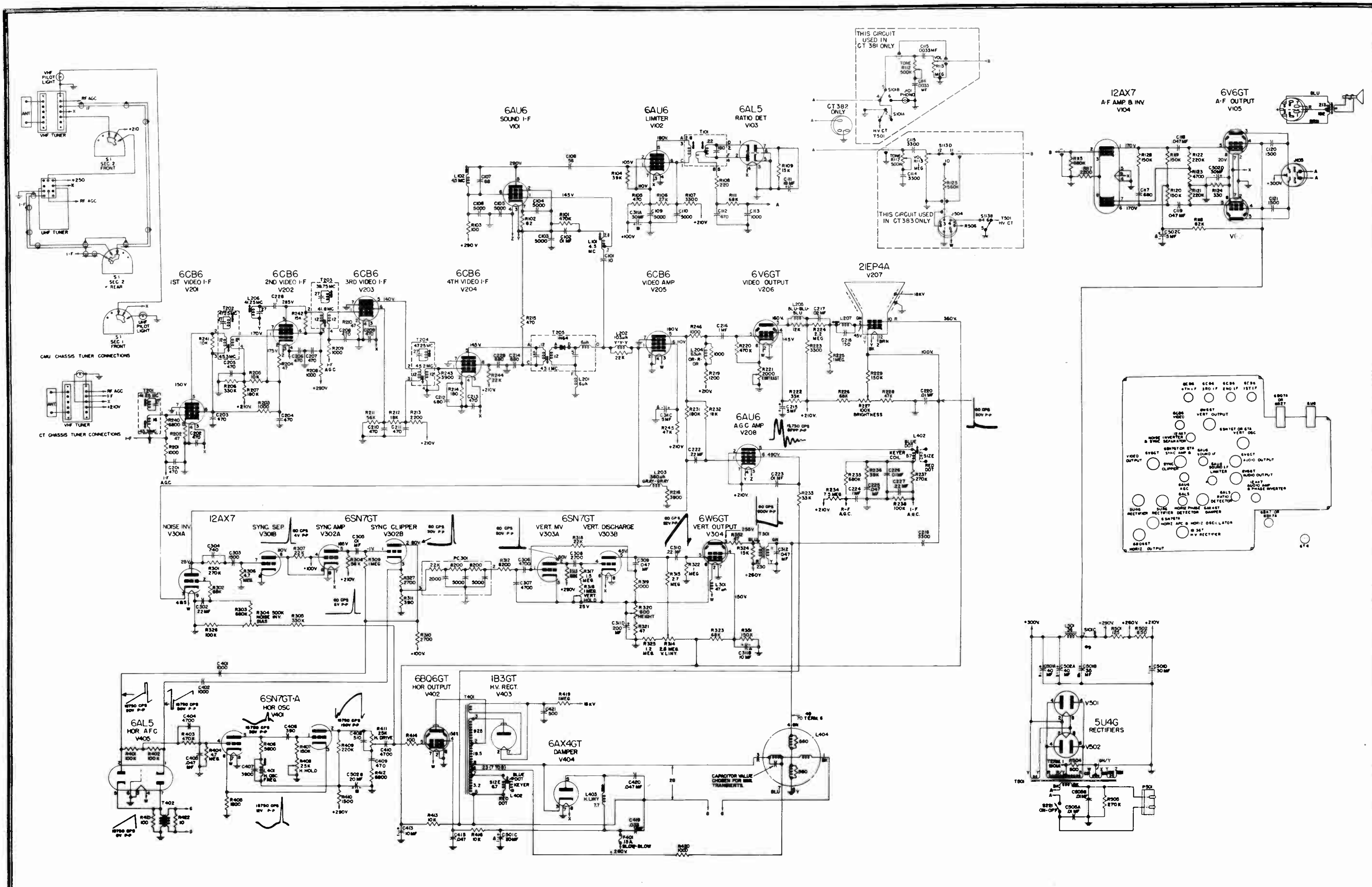


FIGURE 12

SCHEMATIC DIAGRAM, 400 SERIES CHASSIS

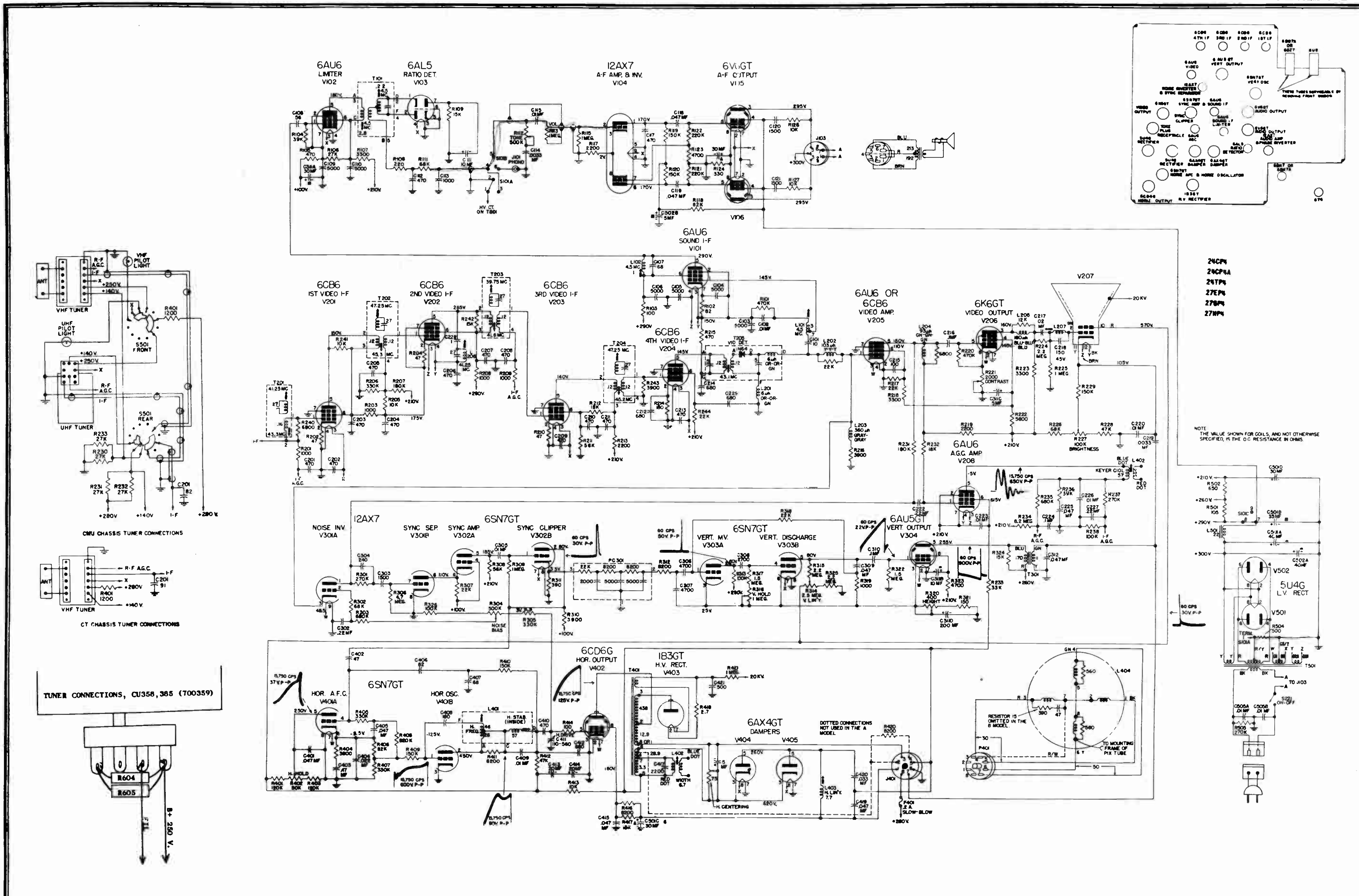


FIGURE 11

SCHEMATIC DIAGRAM, 107 SERIES CHASSIS

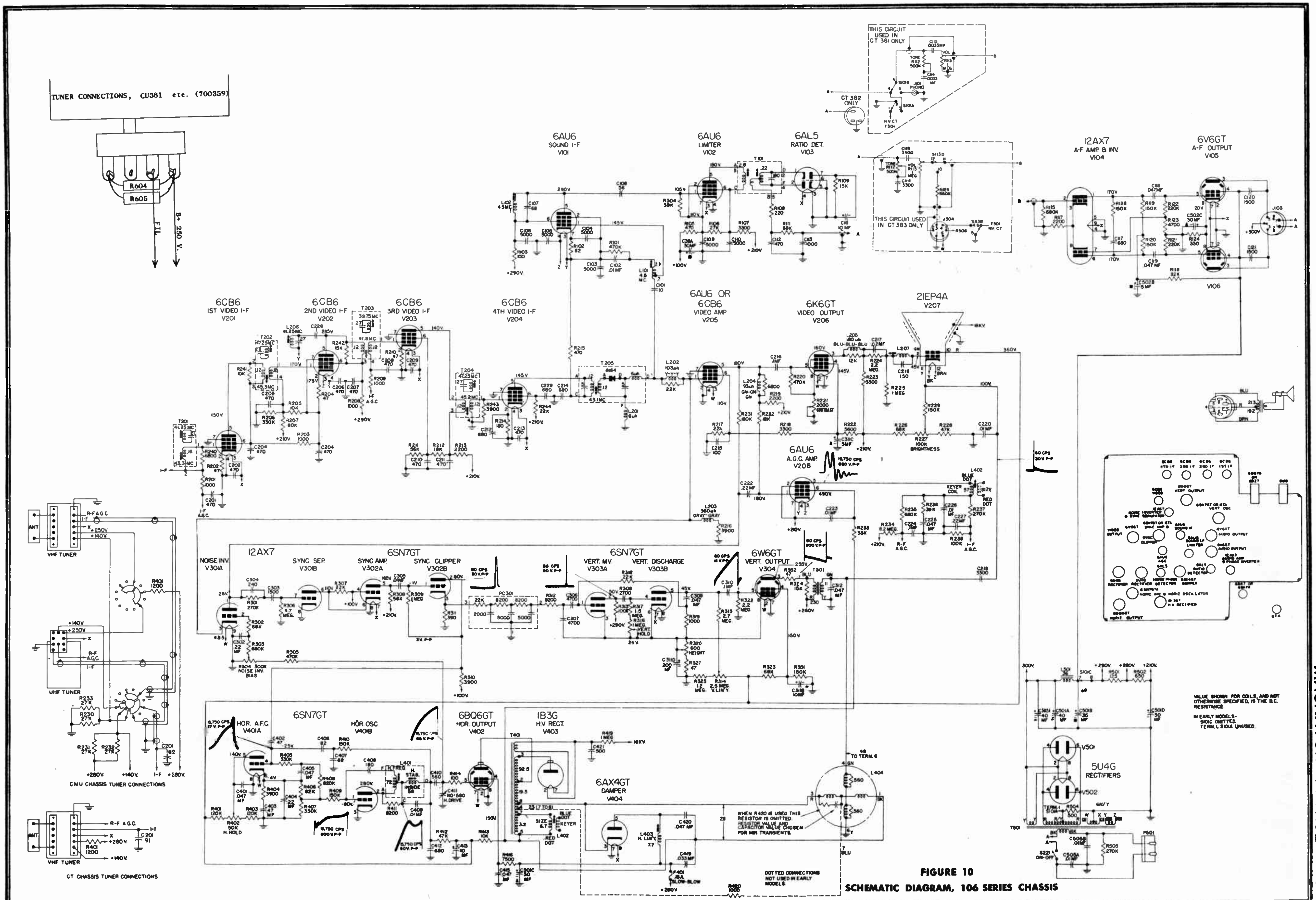


FIGURE 10
SCHEMATIC DIAGRAM, 106 SERIES CHASSIS

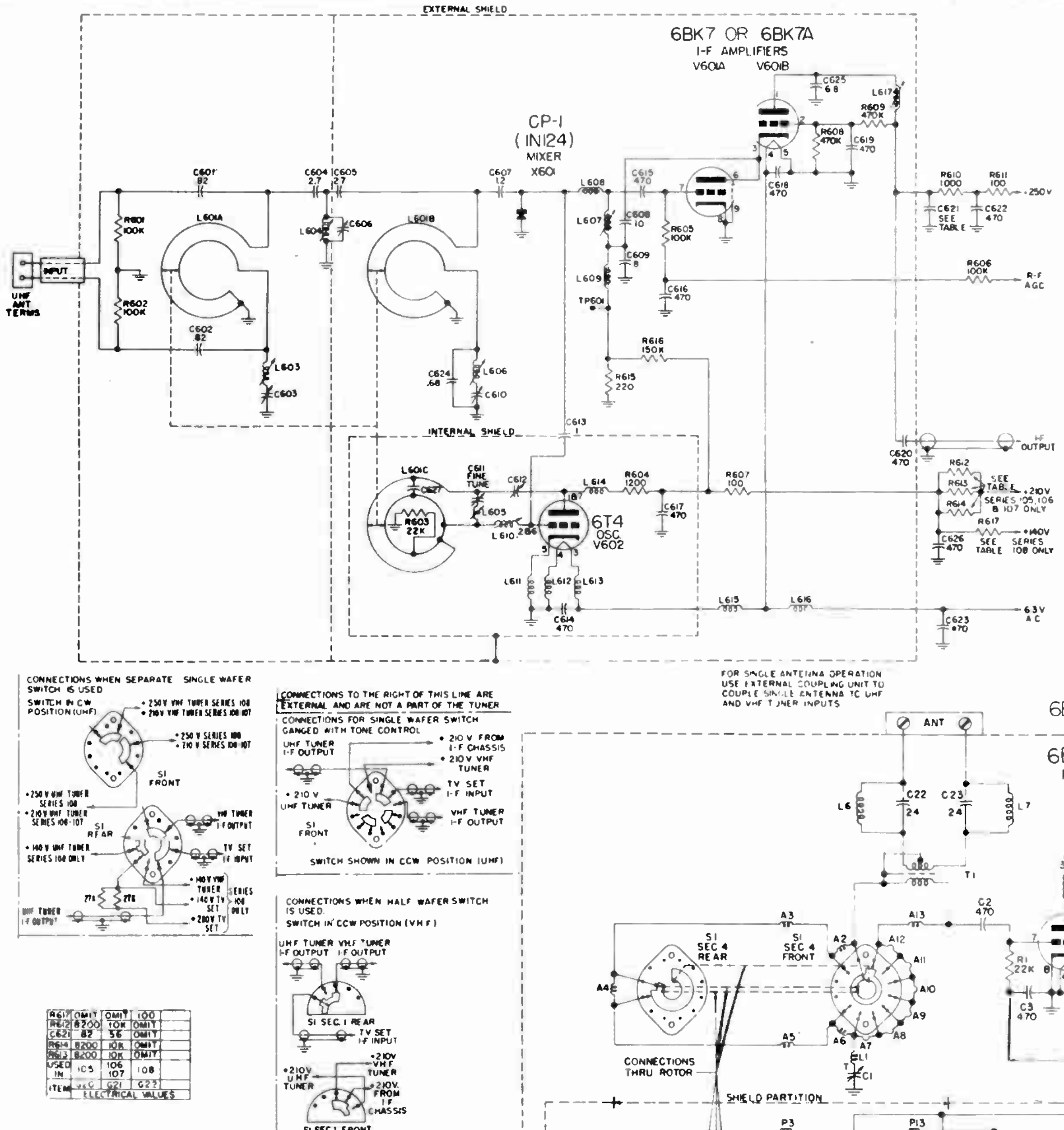


FIGURE 9

SCHEMATIC DIAGRAM, 700426 UHF TUNER

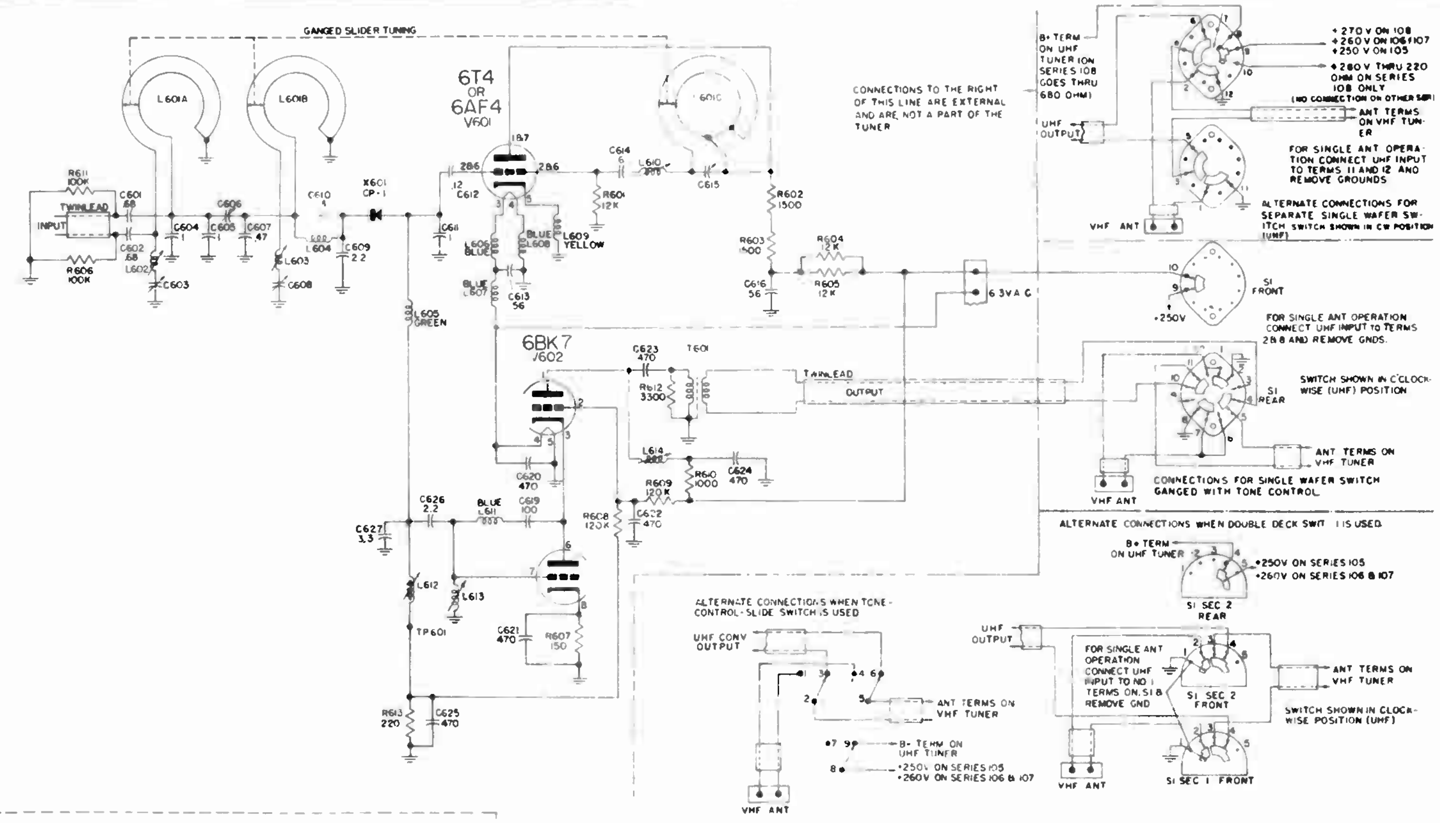


FIGURE 8

SCHEMATIC DIAGRAM, 700359 UHF CONVERTER

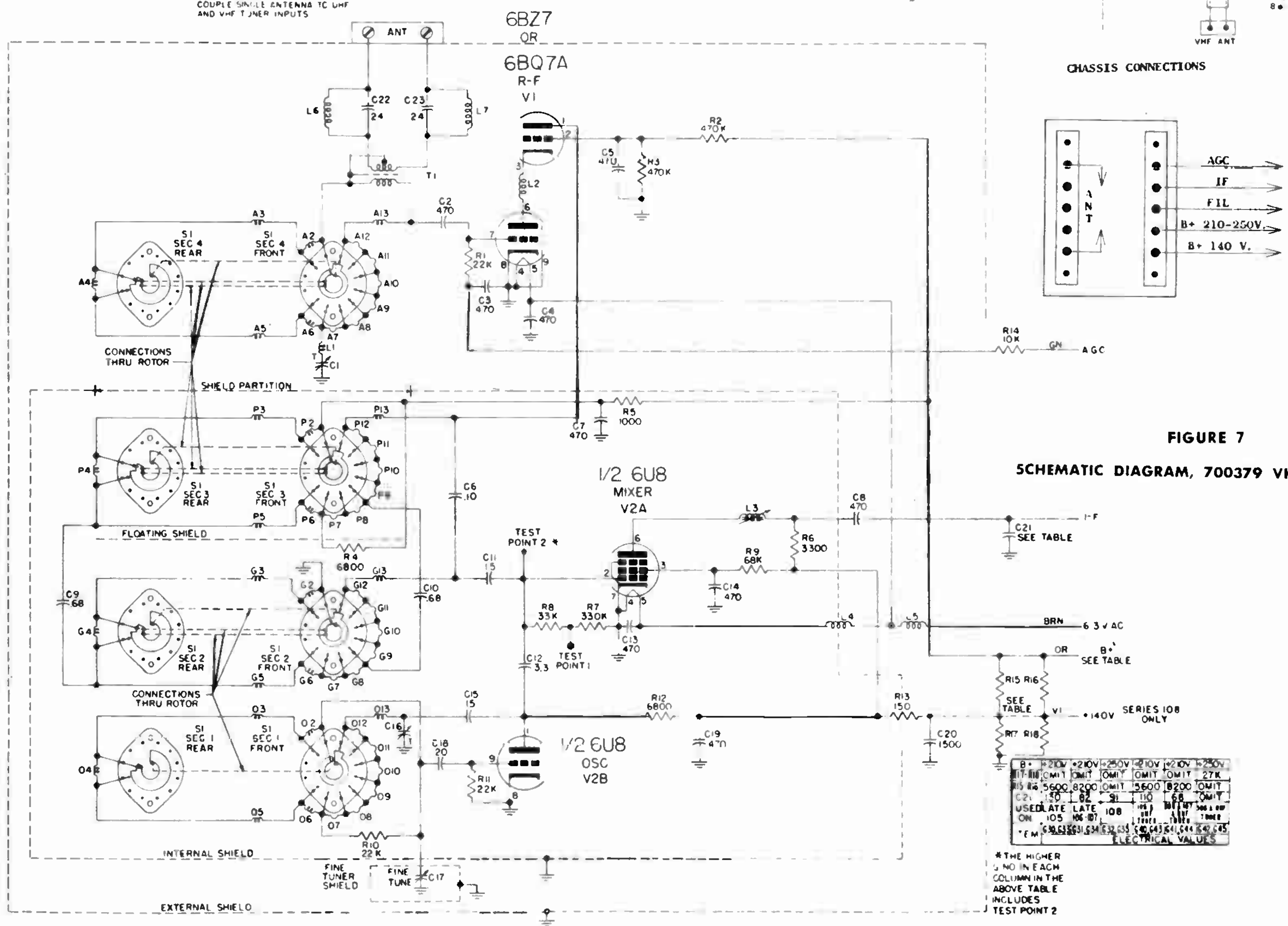


FIGURE 7

SCHEMATIC DIAGRAM, 700379 VHF TUNER

markers on the scope, determine which rotation of the vernier causes the markers to move closer together. If it is clockwise, reset the vernier to the midrange position and close the channel 13 oscillator coil. If it is counter-clockwise open the coil. Adjust for a zero beat. The channel 13 coil moves all high band channels. The channel 6 coil moves all low band channels.

Tune the sweep generator to channel 12. The signal generator to the channel 12 video carrier frequency. Set channel selector to 12. Adjust the channel 12 oscillator coil for a zero beat of the markers.

Repeat the procedure for channels 11 through 2. Recheck channels 13 through 7. The high channel coils are adjusted by moving them up or down and the low channel coils by spreading or pushing together.

ANTENNA, R-F AMPLIFIER AND CONVERTER ALIGNMENT

The desired pattern to be applied to the IF amplifiers is the result of three variables. These three variables are the ANTENNA COIL (rear wafer), the RF COIL (second wafer from rear) and the CONVERTER COIL (third wafer from rear).

These coils must be very carefully adjusted with only a slight movement. It is imperative that the following sequence of adjustment is followed to obtain the desired pattern. Antenna coils first, RF coils second, and the converter coil last. The RF wafer has B+ on it and should not be touched with the hand or a metal tool. The oscillator coils (fourth wafer from rear) are properly adjusted and should not be touched.

The RF tuner has been properly aligned at the factory and should not require any additional adjustment except when tubes are replaced in the tuner. Proper selection of the replacement tube will eliminate the necessity of making these coil adjustments. Try several tubes while observing their effects on the pattern. It is important that the tuner cover be in place when observing the pattern.

UHF TUNER

OSCILLATOR ALIGNMENT

Turn on the receiver and turn UHF-VHF switch to UHF. Connect oscilloscope to TP601, 300 ohm sweep cable to UHF antenna terminals and loosely couple signal generator to the preselector as in R. F. alignment.

Set the sweep generator center frequency to 553 mc. Turn channel selector to channel 20. Set marker signal to 565 mc, turn fine tuner fully clockwise and adjust C612 to place oscillator marker at 565 mc. Set marker signal to 541 mc., turn fine tuner fully counter-clockwise and bend the fine tuner stop to place oscillator marker at 541 mc.

Set the sweep generator to 895 mc., turn channel selector to channel 77 and fine tuner fully clockwise. Set marker signal to 907 mc., and adjust L610 inductance lead on oscillator grid by bending lead to center the oscillator marker at 907 mc. Set marker signal to 883 mc., turn fine tuner fully counter-clockwise and carefully adjust L605, inductance lead on the glass fine tuner, to center the marker at 883 mc.

Because of interaction between high end and low end oscillator adjustments, recheck the low frequency setting.

Set the channel selector to channel 50 and sweep generator frequency to 733 mc. Set marker signal to 743 mc. and turn fine tuner fully clockwise. Oscillator marker must be at 743 mc. or above. Set marker signal to 723 mc. then turn fine tuner fully counter-clockwise. Oscillator marker must be at 723 mc. or below.

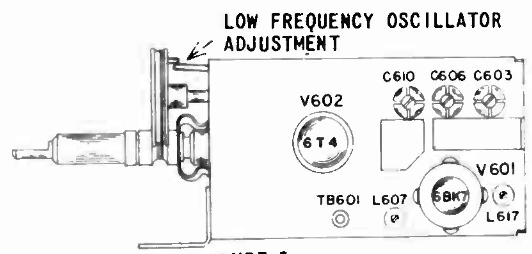


FIGURE 5
TOP VIEW OF TUNER

UHF CONVERTER

OSCILLATOR ALIGNMENT

A. Remove the shield and 6BK7 tube from its socket.

B. Connect the UHF marker generator, through a .5 mmf. capacitor, to the junction of X601, L605, C611 and C612.

C. Connect the oscilloscope to test point 602, through a 10,000 ohm isolating resistor.

D. Tune the converter to its lowest frequency (extreme counter-clockwise) position.

E. Set the marker generator frequency on 378 mc. and adjust the oscillator trimmer C615 for a beat on the scope.

F. Tune the converter to its highest frequency (extreme clockwise) position.

G. Set the marker generator frequency to 828 mc. and adjust the end inductor L610 for a beat on the scope.

H. Recheck both high and low frequency positions so the beats appear without further adjustment.

SERVICE INFORMATION

HIGH VOLTAGE WARNING

The danger accompanying shocks is always present when the receiver is operated outside the cabinet or when the rear cover is removed from the cabinet. Only a person familiar with the precautions to be observed when working with high-voltage equipment should service this receiver.

PICTURE TUBE HANDLING

Shatterproof goggles and heavy gloves should be worn at all times when handling a picture tube. The tube should not be handled in the vicinity of any person not so equipped. When handling the tube, always keep it away from the body.

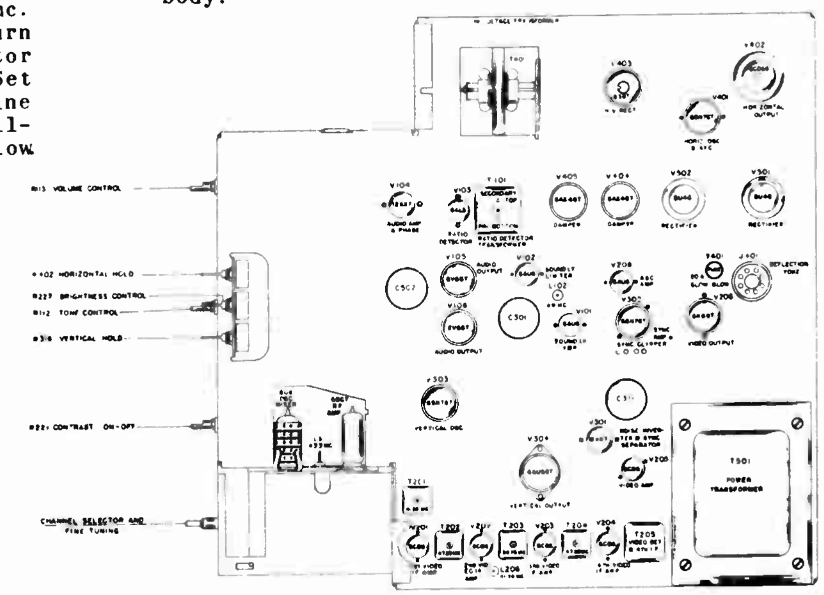


FIGURE 6
TOP VIEW OF CHASSIS

Due to the large surface area of the tube and the high vacuum contained within, more than ordinary care is required to prevent shattering the tube. The large end of the bulb, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure. If the tube binds during removal or replacement, determine the cause of the trouble. DO NOT FORCE THE TUBE.

PICTURE TUBE REPLACEMENT

If it becomes necessary to replace the picture tube, it should be done in the following manner:

1. Remove the tube socket from the rear of the picture tube, then remove the ion trap.

2. Remove the safety glass assembly by taking out the screws which hold the glass rail in position.

3. Loosen the nuts that secure the tube strap over the rim of the tube, and remove the strap.

4. Remove the high voltage anode connector and lift out the tube.

5. Install the replacement picture tube being careful not to force the neck when inserting through the deflection coil.

6. Install the HV connector, replace the support strap, and fasten it down securely with the nuts removed in Step 3.

7. Loosen the thumbscrew on top of the deflection yoke, so the yoke moves freely. Loosen the two hex-head screws on each side of the deflection yoke mounting bracket, and push the top section forward until the rubber bumper fits against the bell of the tube, all the way around. Then tighten the screws. Then press the deflection yoke forward as far as possible, and tighten the thumbscrew.

8. Loosen the two screws which secure the focus magnet, and move it so the neck of the tube is properly centered in it. Then tighten the screws and adjust the ion trap.

9. HORIZONTAL and VERTICAL CENTERING of the picture is accomplished by moving the "centering device" on the front side of the focus magnet. Readjustment of the ion trap may be necessary after this plate has been adjusted.

SERVICE HINTS

IMPROVED HIGH VOLTAGE TRANSFORMERS. 107 & 500 SERIES CHASSIS

Always use #360593-2 HV transformer when replacement becomes necessary. This has been used in late production with favorable results.

TROUBLE SHOOTING SYNC CIRCUITS

A separate DC bias supply consisting of a 15 volt battery across an approximately 50.000 ohm potentiometer is helpful in trouble shooting. Remove the AGC amplifier tube and connect the bias supply from the plate circuit of the AGC amplifier to chassis. Try various values of bias and trace the sync pulse throughout the circuits with a scope. This will eliminate the effects of AGC malfunction and facilitate locating the trouble should it not be in the AGC system.

INTERCARRIER BUZZ

1. Check alignment of secondary (top slug) of discriminator transformer. Adjust for minimum buzz on transmitted signal.

2. Check 4.5 mc. sound alignment as outlined in service manual.

3. Check response curve on video IF. Align if necessary.

4. Buzz may be due to overmodulation at the transmitter. If more than one station is available, try all stations. Buzz on only one station will confirm this condition.

F. Remove the short between terminals "C" and "D" of the stabilizing coil and connect oscilloscope through a 15 mmf. capacitor to terminal "C".

G. Adjust stabilizing coil (L401 inside chassis) so the sharp and the rounded peaks of the pattern obtained are of equal amplitude. If necessary, adjust horizontal hold control to maintain sync.

Remove oscilloscope lead and turn horizontal hold to full clockwise. Turn brightness control fully clockwise and adjust horizontal frequency coil until blanking bar appears at left side of picture. Then back off until blanking bar and wiggle at top of picture is no longer present.

H. Adjust noise bias control for best noise immunity.

HORIZONTAL AFC, 400 & 500 CHASSIS

Tune receiver to an acceptable channel. Set noise bias control fully clockwise.

A. Turn horizontal hold control to the center of its range.

B. Adjust horizontal frequency coil (L401, on rear chassis apron) until picture locks horizontally. The vertical lines near the top should not "hook" to the right or left.

C. Adjust horizontal drive control (in models that use one) for maximum sweep until compression appears at center (drive lines), then back off control until compression is just eliminated.

D. Adjust horizontal linearity coil (L403) on rear chassis apron, for proper linearity. If two positions seem to be correct, use the one with the core farthest out.

E. Adjust width control (L402) on rear chassis apron for proper size.

F. Turn horizontal hold control fully clockwise and switch off channel. Turn the control fully counter-clockwise and switch off channel. The picture should hold in sync over the entire range of the horizontal hold control or should have the same number of blanking bars at each end of its range.

G. Adjust noise bias control for best noise immunity.

4.5 MC. TRAP ALIGNMENT

A. Remove V203 (6CB6) 3rd video IF amplifier or short 4th video IF grid (V204-1, 6CB6) to ground, to prevent noise from masking the output indication.

B. Connect the 4.5 mc. signal to Terminal "D" of T205 video detector. The input signal should not exceed 0.2 V. RMS.

C. Connect the crystal probe of the oscilloscope or VTVM to Pin 2 of V207 picture tube grid lead.

D. Turn contrast control fully clockwise.

E. Adjust the core of L207 for minimum output.

SOUND I-F ALIGNMENT

A. Connect the 4.5 mc. signal to Terminal "D" of T205 video detector.

B. Connect probe of VTVM to high side of diode load resistor R109, 15 K ohm (V103-7) and negative lead to chassis ground. Adjust VTVM for zero center.

C. Adjust L102 Sound IF and primary of T101, ratio detector (bottom core) for maximum reading. This reading must not exceed -5.0 V. at any time, to prevent possibility of overload.

D. Remove 4.5 mc. signal from Terminal D of T205 and connect it to junction of R216 (3.9 K) and L203 (360 uh) with negative lead to chassis ground.

E. Adjust L101, sound takeoff coil, for maximum reading. This reading must not exceed -5.0 volts at any time to prevent possibility of overload.

F. Remove VTVM from high side of R109 and chassis ground. Connect two 100 K ohms 5% resistors in series across R109: Connect negative lead of VTVM to junction of these two resistors and the probe to junction of R108 (220 ohms) and C112 (470 mmf). Adjust secondary of ratio detector (top core) for zero reading.

VIDEO I-F ALIGNMENT

A. Connect external bias to 1st IF grid return (junction R201, 1 K and C201, 470 mmf.) and RF grid return (junction R234, 8.2 meg. and R235, 680 K). Adjust IF bias to minus 4.5 V. and RF bias to minus 1.5 V. DC. A battery with 1.5 V. and 4.5 V. taps or an equivalent low impedance source may be used.

B. Connect oscilloscope and VTVM to junction of R216 (3.9 K) and L203 (360 uh) and chassis ground.

C. Connect the IF signal to converter grid wafer lug (cut-out in VHF tuner cover) and adjust the corresponding circuits for the DC output indicated below. During alignment, reduce the signal input if necessary so the detector output does not exceed -1.5 V.

41.25 mc.	T201 & L206 (top)	Minimum
47.25 mc.	T202 & T204 (top)	Minimum
39.75 mc.	T203 (top)	Minimum
43.3 mc.	T201 (bottom and L3 (on tuner)	Maximum
45.3 mc.	T202 (bottom)	Maximum
41.8 mc.	T203 (bottom)	Maximum
45.2 mc.	T204 (bottom)	Maximum
43.1 mc.	T205 (bottom)	Maximum

Note: T201 and L3 comprise a double-tuned circuit and must be aligned as follows:

a. Detune Primary (L3) by backing slug all the way out.

b. Adjust secondary (T201) for maximum output.

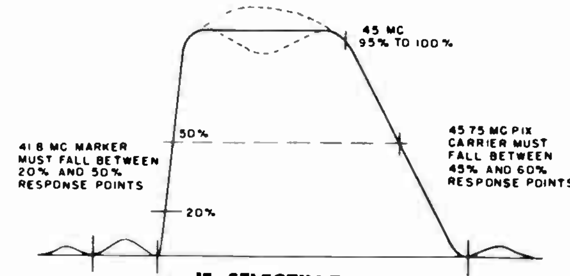
c. Adjust primary (L3) for maximum output.

d. Do not re-set secondary (T201).

Recheck the 41.25 mc., 47.25 mc. and 39.75 mc. trap adjustments after completing peaking.

D. Remove signal from converter grid wafer lug. Connect IF sweep to converter grid (test point #2 on tuner). Loosely couple in IF markers.

E. Check response for symmetry and bandwidth as shown in the following curve.



IF SELECTIVITY CURVE

FIGURE 2

If necessary, readjust slugs in T202 and T205 to set overall IF response to nominal limit (no tilt). Do not readjust T201 for any reason.

F. If receiver has a UHF Tuner, remove IF sweep from converter grid and connect to UHF Tuner at the high side (front end) of the UHF crystal holder. Use a 1000 ohm isolation resistor in the very end of the hot side of the IF sweep cable, the low side of the cable going to ground. Turn UHF-VHF switch to UHF position.

Note: If balanced output cable for sweep generator is not available, the impedance matching network shown below should be used.

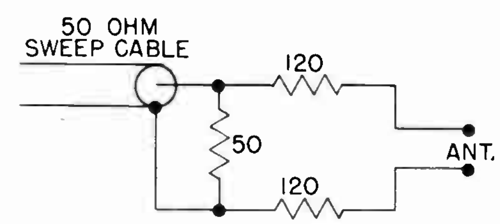


FIGURE 3

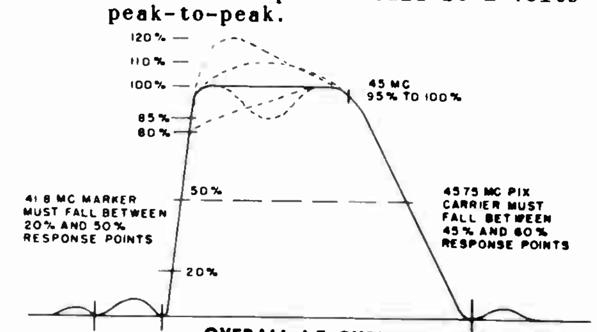
ANTENNA IMPEDANCE MATCHING NETWORK

G. Remove UHF tuner shield cover and adjust IF amplifier plate coil (L617) with insulated screw driver (using slot in bottom of iron core) for maximum gain while setting the 45.75 mc. marker at 50%. Adjust IF amplifier grid coil (L607) with short aligning tool for maximum gain and proper tilt. Check to see that the response curve is within limits. Do not readjust T201 for any reason.

H. Remove IF sweep from UHF Tuner. Switch UHF-VHF switch to VHF if receiver has UHF. Connect RF sweep to VHF antenna terminals. Switch the sweep generator and the receiver to channel 13.

I. With RF oscillator on frequency, check overall RF-IF response for symmetry and bandwidth as shown below.

Note: Oscilloscope must be calibrated to provide accurate marker setting. Detector output should be 2 volts peak-to-peak.



OVERALL I-F CURVE

FIGURE 4

J. Switch RF sweep and receiver channels and check to make sure overall response is within limits of overall selectivity curve on all channels when the RF oscillator is on frequency. Do not readjust any IF coils after step (E) above.

VHF TUNER
TOUCH-UP OSCILLATOR ALIGNMENT

Oscillator alignment should be made only when the fine tuning control tunes in the extreme clockwise or counter-clockwise position, or if it will not tune at all within its tuning range.

If some channels do not tune at all, or not near enough to the center of the fine tuning range, adjust the oscillator trimmer for the best compromise tuning on all channels. If, for example all channels tune near one side of the control, adjustments of the trimmer will bring them all near the center. However, if some channels tune near one end and others tune at the other end of the control, adjustment will move some to the center and move the others beyond the range of the control. In this case the oscillator coils will have to be adjusted individually as follows.

COMPLETE OSCILLATOR ALIGNMENT

Connect a sweep generator to the antenna terminals of the receiver. Connect an unmodulated signal generator to the antenna terminals and tune it to the channel 13 video carrier frequency. TV signals may be used.

Loosely couple an unmodulated signal generator to the first IF grid and tune it to 45.75 mc. Connect an oscilloscope across the video detector load resistor through a 10 K ohm resistor.

Turn on the receiver and set the vernier to the midrange position. When the receiver has warmed up, if there are two

DESCRIPTION & SPECIFICATIONS

The Magnavox 106, 107, 400 and 500 Series Television Chassis are direct view receivers, each constructed on a single chassis. The 106 and 400 series are designed to accommodate a 21" rectangular picture tube. The 107 and 500 series will allow the use of either a 24" or 27" picture tube without any change in circuitry.

Features of these Chassis include:

- A low-noise VHF Tuner, with a cascode RF Amplifier for extreme fringe area performance.
- A choice of VHF only, UHF Converter or UHF Tuner. Each of the latter covers all UHF channels without the need of adaptors or other accessories.
- A four-stage, stagger-tuned Inter-carrier IF section for good resolution, ease of alignment and freedom from the effect of oscillator drift.
- Push-pull Audio Amplifier.
- Fast acting keyed Automatic Gain Control for instantaneous control of receiver gain.
- Noise suppressor stage.
- Vertical retrace blanking to eliminate retrace lines regardless of control settings.
- Three basic versions. For TV only, TV in conjunction with a radio chassis, and TV with power provisions for a radio tuner.

IMPEDANCE

300 ohm input.....Speaker Voice Coil 3.2 ohms

POWER REQUIREMENTS

106 & 400 Series, TV with Audio............................280 watts, 117v, 60cps
106 & 400 Series, TV without Audio.........................230 watts, 117v, 60cps
106 & 400 Series, TV with Audio & Radio Tuner..............280 watts, 117v, 60cps
(Radio-TV Switch in TV Position)

107 & 500 Series, TV with Audio............................320 watts, 117v, 60cps
107 & 500 Series TV with Audio & Radio Tuner...............320 watts, 117v, 60cps
(Radio-TV Switch in TV Position)

CHASSIS DIFFERENCES

Maintenance information on the 106, 107, 400 and 500 Series Chassis is so similar that it has been included in one service manual.

Prefix letters CT indicate the use of 700379 VHF Tuner only; CU uses the VHF Tuner and a 700359 UHF Converter; while CMU uses the VHF Tuner and a 700426 UHF Tuner.

The basic chassis differences are as follows:

106 SERIES

BASIC CHASSIS NO.	PIX TUBE	CHASSIS DIFFERENCES
CT,CU or CMU381AA,AB,AC,AD,BC & BD	21"	Audio on chassis
CT,CU or CMU382AA,AB,AC,AD,BC & BD	21"	No audio
CT,CU or CMU383AA,AB,AC,AD,BC & BD	21"	Audio and radio input

107 SERIES

CT,CU or CMU358AA,AB,BA,BB & CB	27"	Audio on chassis
CT,CU or CMU359AA,AB,BA,BB & CB	27"	Audio and radio input
CT,CU or CMU385AA,AB,BA,BB & CB	24"	Aluminized Picture Tube
CT,CU or CMU386AA,AB,BA,BB & CB	24"	Non-aluminized Picture Tube

400 SERIES

CT,CU or CMU381CE & CF	21"	Audio on chassis
CT,CU or CMU382CE & CF	21"	No audio
CT,CU or CMU383CE & CF	21"	Audio and radio input

Additional prefix letter added: A indicates audio on chassis; B indicates no audio; C indicates audio and radio input.

CTA,CUA or CMUA381CJ & CK	21"	Audio on chassis
CTB,CUB or CMUB382CJ & CK	21"	No audio
CTC,CUC or CMUC383CJ & CK	21"	Audio and radio input

500 SERIES

CTA,CUA or CMUA358DC & DD	27"	Audio on chassis
CTA,CUA or CMUA359DC & DD	27"	Audio and radio input
CTA,CUA or CMUA385DC & DD	24"	Aluminized Picture Tube
CTA,CUA or CMUA386DC & DD	24"	Non-aluminized Picture Tube

TUBE COMPLEMENT

SYMBOL	TUBE	FUNCTION	SYMBOL	TUBE	FUNCTION
V1	6BZ7 / 6BQ7A	RF Amplifier, VHF	V204	6CB6	4th Video IF
V2	6U8	Mixer, Osc., VHF		IN64	Video Detector
V601	6T4 / 6AF4	Osc., UHF Converter	V205	6AU6 / 6CB6	Video Amplifier
X601	IN72	Crystal Mixer, UHF Conv.	V206	6K6GT	Video Output
V602	6BK7	IF Amplifier, UHF Conv.	V207	See List	Picture Tube
V601	6BK7 / 6BK7A	IF Amplifier, UHF Tuner	V208	6AU6	AGC Amplifier
V602	6T4	Osc., UHF Tuner	V301	12AX7	Noise Inverter & Sync Sep.
X601	IN124	Crystal Mixer, UHF Tuner	V302	6SN7GT	Sync Amplifier & Clipper
V101	6AU6	Sound IF	V303	6SN7GT	Vert. MV & Discharge
V102	6AU6	Limiter	V304	6W6GT	Vert. Output, 106 & 400
V103	6AL5	Ratio Detector	V304	6AU5GT	Vert. Output, 107 & 500
V104	12AX7	AF Amplifier & Inverter	V401	6SN7GT	Horiz. AFC & Osc.
V105	6V6GT	AF Output	V402	6BQ6GT	Horiz. Output, 106 & 400
V106	6V6GT	AF Output	V402	6CD6G	Horiz. Output, 107 & 500
V201	6CB6	1st Video IF	V403	1B3GT	HV Rectifier
V202	6CB6	2nd Video IF	V404	6AX4GT	Damper, 106, 400 & 107
V203	6CB6	3rd Video IF	V405	6AX4GT	Damper, 107 & 500
			V501	5U4G	LV Rectifier
			V502	5U4G	LV Rectifier

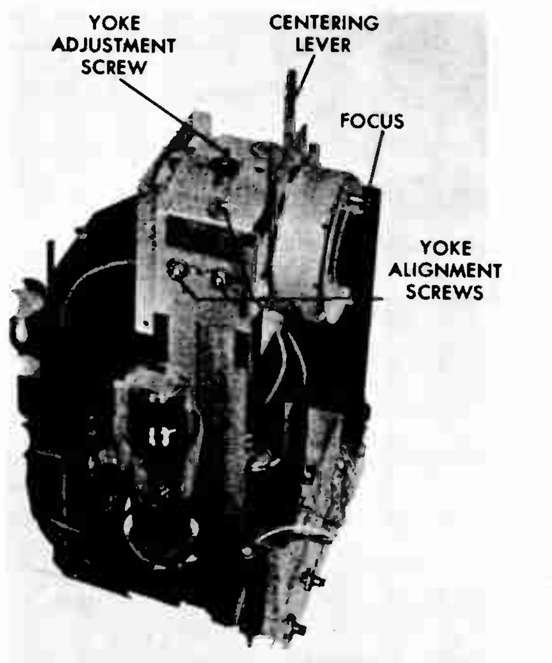


FIGURE 1
PICTURE TUBE ADJUSTMENTS

ALIGNMENT

HORIZONTAL AFC, 106 & 107 CHASSIS

Tune receiver to weakest channel available. Set noise bias control fully clockwise. Set horizontal drive trimmer about 1/2 turn from full clockwise position.

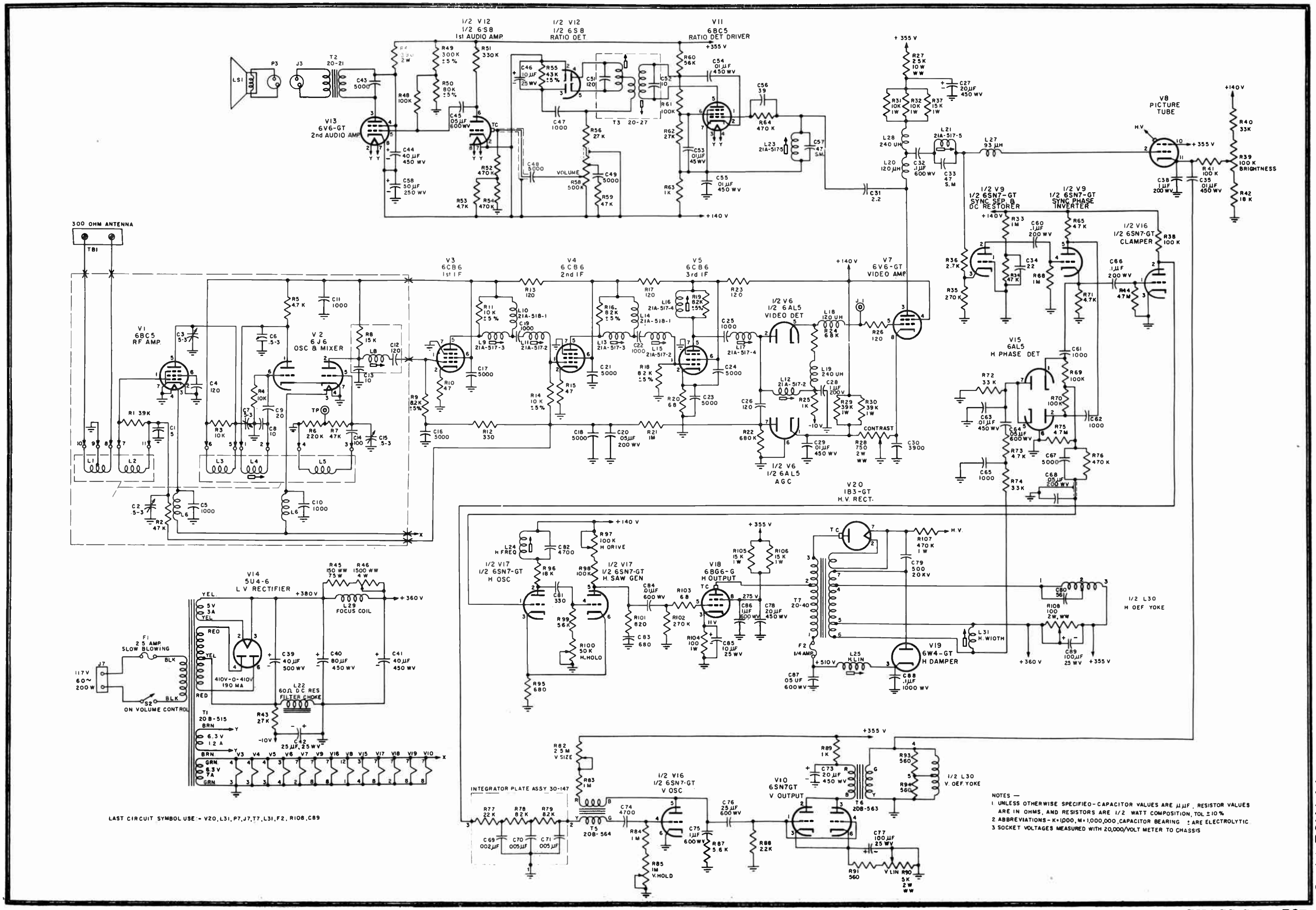
A. Short out terminals "C" and "D" of horizontal stabilizing coil (L401), and turn horizontal hold control fully clockwise.

B. Adjust horizontal frequency coil (L401, on rear chassis apron) until picture locks horizontally.

C. Adjust horizontal drive trimmer for maximum sweep. Turn counter-clockwise until compression appears at center (drive lines), then clockwise until compression is just eliminated.

D. Adjust horizontal linearity coil (L403) on rear chassis apron for proper linearity. If two positions seem to be correct, use the one with the core farthest out.

E. Adjust width control (L402) on rear chassis apron for proper size.



1/2 V12 1/2 6S8 1st AUDIO AMP
1/2 V12 1/2 6S8 RATIO DET
V11 6BC5 RATIO DET DRIVER
V13 6V6-GT 2nd AUDIO AMP
V8 PICTURE TUBE
BRIGHTNESS
300 OHM ANTENNA
V1 6BC5 RF AMP.
V2 6J6 OSC & MIXER
V3 6CB6 1st I F
V4 6CB6 2nd I F
V5 6CB6 3rd I F
1/2 V6 1/2 6AL5 VIDEO DET
V7 6V6-GT VIDEO AMP
1/2 V9 1/2 6SN7-GT SYNC SEP. & DC RESTORER
1/2 V9 1/2 6SN7-GT SYNC PHASE INVERTER
1/2 V16 1/2 6SN7-GT CLAMPER
V15 6AL5 H PHASE DET
1/2 V6 1/2 6AL5 AGC
CONTRAST
VOLUME
V20 1B3-GT H.V. RECT.
1/2 V17 1/2 6SN7-GT H OSC
1/2 V17 1/2 6SN7-GT H. SAW GEN
V18 6BG6-G H OUTPUT
V19 6W4-GT H DAMPER
1/2 L30 H DEF YOKE
L31 H. WIDTH
V14 5U4-G L V RECTIFIER
L29 FOCUS COIL
L22 60Ω DC RES FILTER CHOKE
F1 2.5 AMP SLOW BLOWING
117V 60~ 200 W
S2 ON VOLUME CONTROL
INTEGRATOR PLATE ASSY 30-147
1/2 V16 1/2 6SN7-GT V OSC
V10 6SN7GT V OUTPUT
1/2 L30 V. DEF YOKE
V SIZE
V.HOLD
V LIN
H FREQ
H DRIVE
H.HOLD
H.LIN
LAST CIRCUIT SYMBOL USE:- V20, L31, P7, J7, T7, L31, F2, R108, C89
NOTES —
1 UNLESS OTHERWISE SPECIFIED-CAPACITOR VALUES ARE µµF, RESISTOR VALUES ARE IN OHMS, AND RESISTORS ARE 1/2 WATT COMPOSITION, TOL ±10%
2 ABBREVIATIONS - K=1,000, M=1,000,000, CAPACITOR BEARING ± ARE ELECTROLYTIC
3 SOCKET VOLTAGES MEASURED WITH 20,000/VOLT METER TO CHASSIS

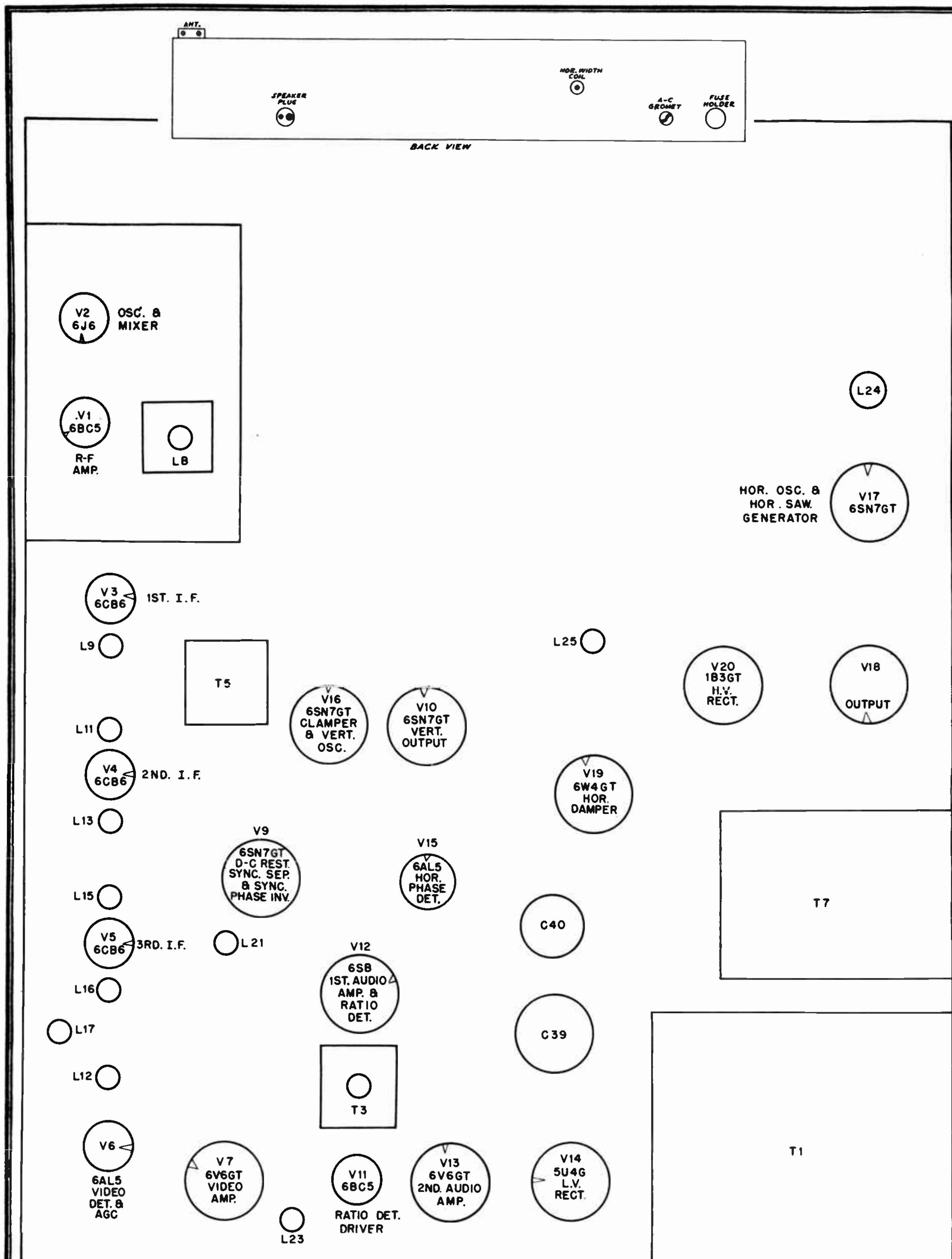
R No.	Value	Type	Watt Rate	Tolerance
1	3.9k ohms	carbon	½ Watt	10%
2	47k ohms	carbon	½ Watt	10%
3	10k ohms	carbon	½ Watt	10%
4	10k ohms	carbon	½ Watt	10%
5	4.7k ohms	carbon	½Watt	10%
6	220k ohms	carbon	½ Watt	10%
7	4.7k ohms	carbon	½ Watt	10%
8	15k ohms	carbon	½ Watt	10%
9	8.2k ohms	carbon	½ Watt	10%
10	47 ohms	carbon	½ Watt	10%
11	10k ohms	carbon	½ Watt	10%
12	330 ohms	carbon	½ Watt	10%
13	120 ohms	carbon	½ Watt	10%
14	10k ohms	carbon	½ Watt	5%
15	47 ohms	carbon	½ Watt	10%
16	8.2k ohms	carbon	½ Watt	5%
17	120 ohms	carbon	½ Watt	10%
18	8.2k ohms	carbon	½ Watt	5%
19	8.2k ohms	carbon	½ Watt	5%
20	68 ohms	carbon	½ Watt	10%
21	1 megohm	carbon	½ Watt	10%
22	680k ohms	carbon	½ Watt	10%
23	120 ohms	carbon	½ Watt	10%
24	6.8k ohms	carbon	½ Watt	10%
25	1k ohms	carbon	½ Watt	10%
26	120 ohms	carbon	½ watt	10%
28	750 ohms	Wirewound Potentiometer	2 watt	
29	39k ohms	carbon	1 watt	10%
30	39k ohms	carbon	1 watt	10%
31	10k ohms	carbon	1 watt	10%
32	10k ohms	carbon	1 watt	10%
33	1 megohm	carbon	½ watt	10%
34	47k ohms	carbon	½ watt	10%
35	270k ohms	carbon	½ watt	10%
36	2.7k ohms	carbon	½ watt	10%
37	15k ohms	carbon	1 watt	10%
38	100k ohms	carbon	½ watt	10%
39	100k ohms brightness control	carbon potentiometer	1 watt	10%
40	33k ohms	carbon	½ watt	10%
41	100k ohms	carbon	½ watt	10%
42	18k ohms	carbon	½ watt	10%
43	27k ohms	carbon	½ watt	10%
44	4.7 megohms	carbon	½ watt	10%
45	150 ohms	wirewound	7.5 watts	
46	1500 ohms focus control	wirewound rheostat	4 watts	
47	390 ohms	carbon	2 watts	10%
48	100k ohms	carbon	½ watt	10%
49	300k ohms	carbon	½ watt	5%
50	180K ohms	carbon	½ watt	5%
51	330k ohms	carbon	½ watt	10%
52	470k ohms	carbon	½ watt	10%
53	4.7k ohms	carbon	½ watt	10%
54	470k ohms	carbon	½ watt	10%
55	43k ohms	carbon	½ watt	5%
56	27k ohms	carbon	½ watt	10%
58	500k ohms volume control	carbon potentiometer	1 watt	
59	47k ohms	carbon	½ watt	10%
60	56k ohms	carbon	½ watt	10%
61	100k ohms	carbon	½ Watt	10%
62	27k ohms	carbon	½ watt	10%
63	1k ohms	carbon	½ watt	10%
64	470k ohms	carbon	½ watt	10%
65	4.7k ohms	carbon	½ watt	10%
68	1 megohm	carbon	½ watt	10%
69	100k ohms	carbon	½ watt	10%
70	100k ohms	carbon	½ watt	10%
71	4.7k ohms	carbon	½watt	10%
72	33k ohms	carbon	½ watt	10%
73	4.7k ohms	carbon	½ watt	10%
74	3.3k ohms	carbon	½ watt	10%
75	4.7 megohm	carbon	½ watt	10%
76	470k ohms	carbon	½ watt	10%
77	22k ohms	integrator network		
78	8.2k ohms	integrator network		
79	8.2k ohms	integrator network		
82	2.5 megohms vertical size control	carbon potentiometer	1 watt	
83	1 megohm	carbon	½ watt	10%
84	1 megohm	carbon	½ watt	10%
85	1 megohm vertical hold control	carbon potentiometer	1 watt	
87	5.6k ohm	carbon	½ watt	10%
88	2.2 megohm	carbon	½ watt	10%
89	1k ohm	carbon	½ watt	10%
90	5k ohms	wirewound	2 watts	
91	560 ohms	carbon	½ watt	10%
93	560 ohms	carbon	½ watt	10%
94	560 ohms	carbon	½ watt	10%
95	680 ohms	carbon	½ watt	10%
96	18k ohms	carbon	½ watt	10%
97	100k ohms horizontal drive control	carbon rheostat	1 watt	
98	100k ohms	carbon	½ watt	10%
99	56k ohms	carbon	½ watt	10%
100	50k ohms horizontal hold control	carbon rheostat	1 watt	
101	820 ohm	carbon	½ watt	10%
102	270k ohm	carbon	½ watt	10%
103	68 ohm	carbon	½ watt	10%
104	100 ohm	carbon	1 watt	10%
105	15k ohm	carbon	1 watt	10%

PARTS LIST

C No.	Description	Capacity	Voltage
1	ceramic	5mmf	600
2	ceramic	.5-3mmf	
3	ceramic	.5-3mmf	
4	ceramic	120mmf	600
5	ceramic	1000mmf	600
6	ceramic	.5-3mmf	
7	ceramic	.5-3mmf	
8	ceramic	10mmf	600
9	ceramic	20mmf	600
10	ceramic	1000mmf	600
11	ceramic	1000mmf	600
12	ceramic	120mmf	600
13	ceramic	10mmf	600
14	ceramic	100mmf	600
15	ceramic	.5-3mmf	
16	disc	5000mmf	600
17	disc	5000mmf	600
18	disc	5000mmf	600
19	disc	1000mmf	600
20	paper	.05mf	200
21	disc	5000mmf	600
22	ceramic	1000mmf	600
23	disc	5000mmf	600
24	disc	5000mmf	600
25	ceramic	1000mmf	600
26	mica	120mmf	600
27	electrolytic	40mf	450
28	paper	.1mf	200
29	paper	.01mf	450
30	mica	3900mmf	1000
31	ceramic	2.2mmf	600
32	paper	.1mf	600
33	mica	47mmf	600
34	mica	27 mmf	450
35	paper	.01mf	450
38	paper	.1mf	200
43	ceramic	5000mmf	600
44	electrolytic	40mf	450
45	paper	.05mf	600
46	electrolytic	10mf	25
47	disc	5000mmf	600
48	disc	5000mmf	600
49	disc	5000mmf	600
51	ceramic	20mmf	600
52	ceramic	20mmf	600
53	paper	.01mf	450
54	paper	.01mf	450
55	paper	.01mf	450
56	mica	39mmf	600
57	mica	47mmf	600
58	paper	.1mf	200
60	paper	.1mf	200
61	ceramic	1000mmf	600
62	ceramic	1000mmf	600
63	paper	.01mf	450
64	paper	.05mf	600
65	ceramic	1000mmf	600
66	paper	.1mf	200
67	disc	5000mmf	600
68	paper	.05mf	200
74	mica	4700 mmf	600
81	mica	330 mmf	600
82	mica	680 mmf	600

R No.	Value	Type	Watt Rate	
106	15k ohm	carbon	1 watt	10%
107	470k ohm	carbon	1 watt	10%
108	100 ohm	wirewound	2 watt	
109	56K ohm	Carbon	1/2 watt	
110	47K ohm	Carbon	1/2 watt	

R90	Potentiometer, 5 K, 2 W, W.W., linear
R82	Potentiometer, 2.5 meg., 1/2W, linear, composition
R58, S2	Potentiometer, 500 K tapped, 1/2 W, audio taper, with AC switch
R85	Potentiometer, 1 meg., 1/2W, linear, composition
R100	Potentiometer, 50 K, 1/2 W, linear
R39, R97	Potentiometer, 100 K, 1/2 W, linear
R28	Potentiometer, 750 ohm, 2 W, W.W., linear
R108	Potentiometer, 100 ohm, 2 W, W.W.
R46	Potentiometer, 1500 ohm, linear, 4 W, W.W.
T2	Audio output transformer
T3	Ratio detector transformer
T7	Horizontal output transformer
T1	Power transformer
T6	Vertical output transformer
T5	Vertical blocking oscillator transformer
L25	Horizontal linearity coil
L29	Focus coil
L24	Horizontal oscillator coil
L30	Deflection yoke
L19, L28	Inductor, video peaking, 240 uh
L18, L20	Inductor, video peaking, 120 uh
L27	Inductor, video peaking, 93 uh.
L11, L15, L12	Inductor, variable
L9, L13, L16	Inductor, variable
L17	Inductor, variable
L21, L23	Inductor, variable
L10, L14	Inductor, fixed
L22	Filter choke



RESISTANCE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	21K	34K	.2	0	280K	9K	0		
V2	2 meg	0	.2	0	20K	20K	0		
V3	2 meg	50.2	Ground	.2	18K	18K	Ground		
V4	2 meg	50	0	.2	18K	16K	0		
V5	10K	69	0	.2	18K	18K	0		
V6	700	18K	.2	0	26K	0	680K		
V7	0	0	17K	19K	25K	N.C.	.2	.8	
V9	0	47K	270K	1 meg	22K	4.7K	.2	0	
V10	3M	17K	600	3M	17K	600	.2	0	
V11	500K	20K	16K	16K	90K	50K	20K		
V12	NC	18K	70K	600K	500K	600K	18K	16K	
V 13	NC	18K	140K	140K	300K	NC	16K	18K	
V 14	NC	150K	NC	120	NC	120	NC	150K	
V 15	5 meg	5 meg	.2	0	33K	0	33K		
V 16	4.7 meg	110K	0	2.meg	2.4 meg	2.4 meg	0	.2	0
V 17	5.2 meg	38K	680	110K	110K	110K	680	.2	0
V18	NC	0	100	NC	340K	340K	.2	150	
V 19	NC	NC	Inf	NC	110K	Inf	.2	0	
V 20	NC	Inf	Inf T.P.	N.C	NC	NC	Inf	NC	
V 6	0	340K	NC	NC	NC	NC	NC	Nc	
V	PIN 10	PIN 11	PIN 12						
V 8	17K	14K	.2						

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1									
V 2									
V 3	-3.1	.8	0	A.C. 6.3	110	110	0		
V 4	-.8	-.8	0	A.C. 6.3	110	110	0		
V 5	0	.3	0	A.C. 6.3	110	110	0		
V 6	4.2	9-	A.C. 6.3	0	7.3-	0	-7.2		
V 7	0	0	200	110	-7.2	0	A.C 6.3	0	
V 9	0	8	4	0	140	6	A.C. 6.3	0	
V 10	-7	340	6	-7	340	6	A.C. 6.3	0	
V 11	150	150	0	A.C 6.3	270	180	150		
V 12	NC	150	150	150	150	280	0	A.C. 6.3	
V 13	NC	A.C. 6.3	270	280	120	NC	0	150	
V 14	NC	400	NC	400	NC	400	NC	400	
V 15	2.4	-1.6	6.3	0	0	0	0		
V 16	.9	39	0	-60	160	0	6.3	0	
V 17	.4	90	3.4	9	70	3.8	6.3	0	
V 18	NC	0	6.6	NC	-16	T.P. -18	6.3	290	
V 19	NC	NC	620	NC	380	T.P. 620	A.C. 6.3	0	
V 20	NC	12KV	12KV	NC	NC	NC	12KV	NC	
V 6	6.3	4	NC	NC	NC	NC	NC	NC	NC
V 8	PIN 10 380	PIN 11 21	PIN 12 0						

I. F. Alignment Procedure, IT-76R Chassis
Models 776, 1176, and 1376

REFERENCE:

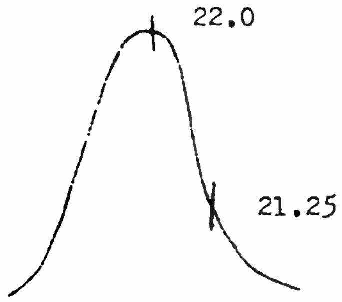
Circuit Diagram E-734

EQUIPMENT:

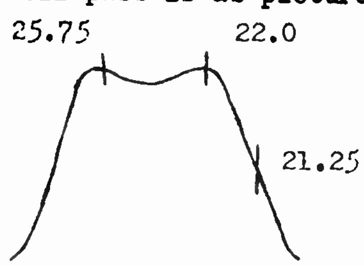
1. Sweep generator, 23.5 mc. center frequency, 10 mc. sweep width.
2. Marker generator, 21.25 mc., 22.0 mc., and 25.75 mc.
3. Crystal oscillator, variable output, 4.5 mc. unmodulated.
4. Oscilloscope.
5. 20,000 ohm per volt meter.

PROCEDURE, VIDEO I.F.:

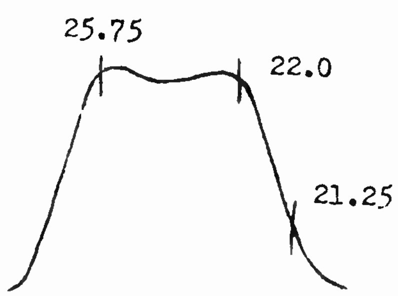
1. Connect oscilloscope to J1 test point.
2. Move tuner between channels to disconnect coils.
3. Connect sweep generator, decoupled with 1000 uuf., to pin 1 of V5. Turn the slug on L17 until it is centered in the coil. (This narrows the band pass of this stage.) Adjust L12 and L16 until the pass appears as below:



Now adjust L17 until pass is as pictured:

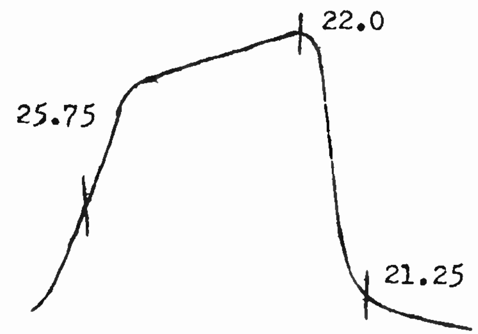


5. Move sweep generator to pin 1 of V4. Adjust L15 until pass balances, adjust L13 until pass balances. When properly adjusted, pass will look as pictured below:



6. Move sweep generator to pin 1 of V3. Adjust L11 and L9 as in above step. Pass will now be as pictured:

7. Move sweep generator to test point on tuner (can be located as a loop of wire between V1 and V2 on top of tuner chassis); adjust L8 (square can on tuner) until the pass rocks through a tilt and leave adjusted with a 10% tilt in the pass, as pictured below:



The video I.F. is now correctly aligned.

INTERCARRIER SOUND SYSTEM:

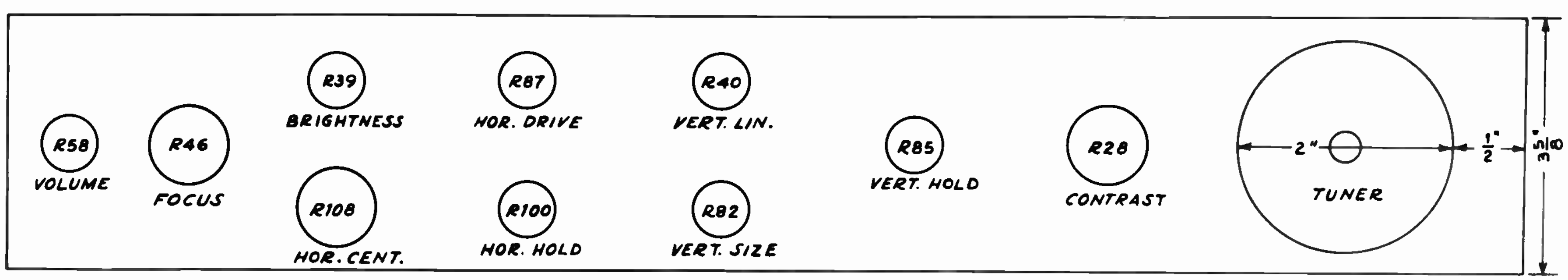
1. Connect voltmeter, set on 10 volt scale across C46, observing polarity.
2. Insert 4.5 mc. generator, capacity decoupled, in J1.
3. Reduce signal so that voltmeter reads a maximum of 3.0 volts, and continue to reduce as adjustments are made so as not to exceed this value.

Adjust in the order given, the following transformer slugs for maximum output:

a. Bottom slug, T3.
b. L23.
c. Top slug, T3.

Repeat to insure accurate setting.

Intercarrier sound system is now properly aligned.



FRONT VIEW

PARTS LIST

NOTE: Unless otherwise noted all condensers are 600 volt, molded phenolic type, ± 20% tolerance with whole number values given in micromicrofarads and decimal fraction values given in microfarads. GMC - guaranteed minimum capacity.

NOTE: Unless otherwise noted all resistors are 1/2 watt, composition type, ± 10% tolerance with values given in ohms.

SYMBOL	PART NO.	VALUE	TOL.	VOLTS	TYPE
C100	4069	2.2	10%	500V	
C101	4046	68	10%	500V	
C102	4036	.004	GMV	500V	
C103	4036	.004			
C104	4042	680	20%	500V	
C105	4209	5MF		50V	
C106	4174	.001	20%	400V	
C107	4029	.005	GMV	500V	
C108	4026	220	20%	500V	
C109	4127	.0047	20%	400V	
C110	4127	.0047	20%	400V	
C111	Part of 4275	20MF		300V	
C112	4148	.047	20%	400V	
C113	4127	.0047	20%	400V	
C114	4152	.033	20%	400V	
C115	4148	.047	20%	400V	
C116	4152	.033	20%	400V	
C117	4148	.047	20%	400V	
C118	Part of 4270	50MF		50V	
C201	4029	.005	+100% -0	500V	
C202	14050	470	10%	600V	
C203		24	5%	1000V	
C204		20	5%	1000V	
C205	14031	1000		500V	
C206	14031	1000		500V	
C207	14009	470	10%	600V	
C208	14009	470	10%	600V	
C209	14031	1000		500V	
C210		470	10%	600V	
C211	14031	1000		500V	
C212		2.2	10%	600V	
C213	14031	1000		500V	
C214	14031	1000		500V	
C215	14009	470	10%	600V	
C216	14031	1000		500V	
C217	14031	1000		500V	
C218	14009	470	10%	600V	
C219		10		600V	
C301	4029	.005	+100% -0	500V	
C302	4131	.22	20%	200V	
C303	4131	.22	20%	200	
C401	4131	.22	20%	200V	
C402	4029	.005	± 100% -0	500V	
C403	4172	.47	20%	200V	
C404	4029	.005	+100% -0	500V	
C501	4158	.047	10%	200V	
C502	4127	.0047	20%	400V	
C601	14113	.0039	10%	400V	
C602	4158	.04y	10%	200V	
C603	4144	.1	20%	600V	
C604	4144	.1	20%	600V	
C605	Part of 4270	30MF		50V	
C606	4129	.22	10%	600V	
C607		20MF		450V	
C608	4124	.022	20%	600V	
C609	4124	.022	20%	600V	
C610		470	10%	3KV	
C701	4175	.001	10%	400V	
C702	4175	.001	10%	400V	
C703	4185	.0047	10%	400V	
C704	4158	.047	10%	200V	
C705	4085	.0039	10%	500V	
C706	Part of 4275	10MF		300V	
C707		470	10%	500V	
C708	4175	.001	10%	400V	
C709		390	10%	500V	
C710	4029	.005	+100% -0	500V	
C711	4144	.1	20%	600V	
C712	4173	.47	10%	200V	
C713	4144	.1	20%	600V	
C714		140	10%	3KV	
C715	14048	47	10%	3KV	
C801	Part of 4245	140MF		150V	Electrolytic
C802	" " 4270	140MF		150V	"
C803	" " 4275	100MF		300V	"
C804	" " 4270	40MF		150V	"

RESISTORS

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
R101	4616	150	10%		
R102	4650	2.2K	10%		
R103	14618	180	10%		
R104	4597	10K	10%		
R105	4586	33K	10%		
R106	4597	10K	10%		
R107	4976	2M			Control, treble
R108	24670	82K	10%		
R109	4976	2M			Control, bass
R110	4555	680K	20%		
R111	4504	47K	20%		
R112	4912	2M			Control, volume
R113	4505	10M	20%		
R114	4506	470K	20%		
R115	4506	470K	20%		
R116	4505	10M	20%		
R117	4586	33K	10%		
R118	4602	270K	10%		
R119	4571	100K	10%		
R120	14639	270	10%	2 Watt	
R121	4602	270K	10%		
R122	4782	3.3	10%	1 Watt	
R201	4542	1K	20%		
R202	4616	150	10%		
R203	4638	470	10%		
R204	4666	33	10%		
R205	4639	47	10%		
R206	4664	470	20%		
R207	4546	120	10%		
R208	4664	470	20%		
R209	4628	22K	10%		
R210	4639	47	10%		
R211	4664	470	20%		
R212	4651	8.2K	10%		
R213	14618	180	10%		
R214	4664	470	20%		
R215	4646	12K	10%		
R216	24627	33K	20%		
R217	4576	4.7K	10%		
R301	4666	33	10%		
R302	4910	500			Contrast Control
R303	4612	3.3K	10%	1 Watt	
R304	4612	3.3K	10%	1 Watt	
R305	4967	50K			Brightness Control
R306	4500	220K	20%		
R307	4501	22K	20%		
R401	4664	470	20%		
R402	4664	470	20%		
R403	34620	2.2M	5%		
R404	4548	120K	10%		
R405	4622	470K	10%		
R406	4521	15K	20%		
R407	4504	47K	20%		
R408	34602	1.5M	5%		
R409	4506	470K	20%		
R410	24541	3.3K	20%		
R411	4964	50K			AGC Control
R412	4521	15K	20%		
R413	34659	4.7M	10%		
R501	4511	100K	20%		
R502	4963	1M			Noise Control
R503	4501	22K	20%		
R504	4605	1.5M	10%		
R505	4633	390K	10%		
R506	4665	15K	20%	2 Watt	
R507	4557	6.8K	10%		
R508	24525	2.2K	5%		
R509	4650	2.2K	10%		
R510	4640	1.8K	10%		
R511	24517	1.8K	5%		
R512	14644	330	10%		
R601	4544	4.7M	20%		
R602	34507	180K	10%	1 Watt	
R603	4659	1K	10%		
R604	34571	680K	10%	1 Watt	
R605	34593	1.2M	10%		
R606	4963	1M			Vertical Hold
R607	4629	5.6K	10%		
R608	4965	2M			Vertical Size
R609	4625	10K	20%	1 Watt	
R610	4924	2K			Vertical Linearity
R611	4664	470	20%		
R612	4547	100	20%		
R613	4546	120	10%		
R614	4576	4.7K	10%		
R615	4507	560	10%		
R616	4507	560	10%		
R701	4571	100K	10%		
R702	4571	100K	10%		
R703	4622	470K	10%		
R704	4544	4.7M	20%		
R705	4629	5.6K	10%		
R706	4548	120K	10%		
R707	4630	1.5K	10%		
R708	4571	100K	10%		
R709	4962	25K			Horizontal Hold
R710	4859	25K			Horizontal Drive
R711	4547	100	20%		
R712	4651	8.2K	10%		
R713	4622	470K	10%		
R714	4657	120	10%	2 Watt	
R715	24662	68K	10%	1 Watt	
R716	4631	18K	10%	2 Watt	
R707	4783	2.7 ohms	10%		
R718	4638	470	10%		
R801	4798	7.5	10%	7.5 Watt	
R802	4784	120.	10%	15 Watt	
R803	4772	1.5 K	10%	20 Watt	
R804	4677	330K	20%		

TRANSFORMERS

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
T101	5235A				Ratio Detector
T102	5117A				Audio Output
T201	5538				1st I.F. Transformer
T202	5538				2nd I.F. Transformer
T203	5538				3rd I.F. Transformer
T204	5242A				4th I.F. Transformer
T601	5188				Vertical Output
T701	5118A				Horizontal Output
T801	5055-1				Power Transformer

COILS

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
L101	5454				4.5 MC Sound Take-Off
L201	5240A				39.75 MC Trap
L202	5241A				47.25 MC Trap
L203	5243A				I.F. Input
L701	5447				Horizontal Frequency
L702	5266				Damper Choke
L703	5464				Width Control

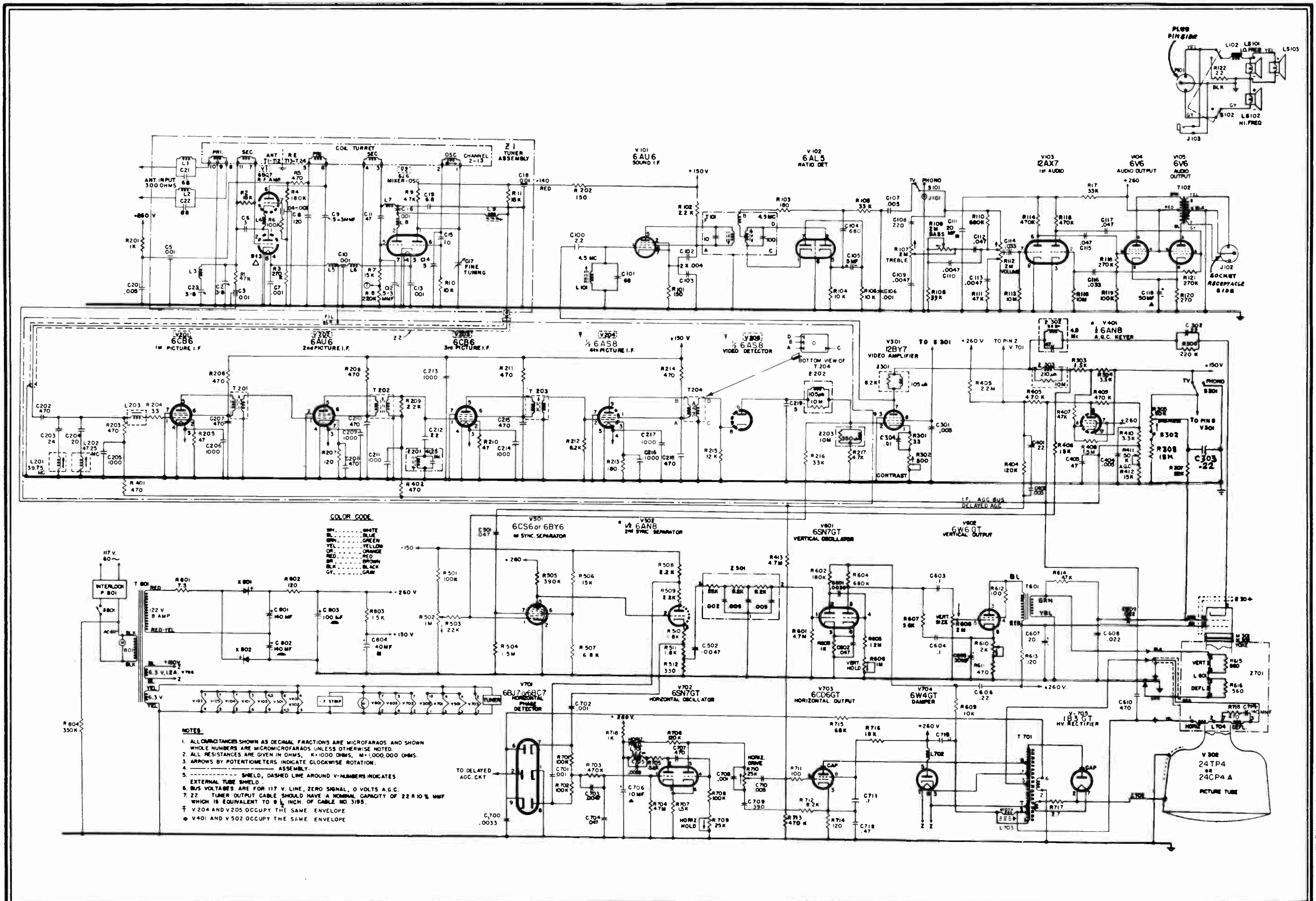
MISCELLANEOUS

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
I801	9505				Pilot Light
J101	6121				Phono Receptacle
J102	6198				Speaker Socket
J103	6245				Earphone Receptacle
J801	6108				A.C. Outlet
M301	9694				Ion Trap
M302	9789				Focuser
P101	6235				Speaker Plug
P801	6126				Receptacle Power Interlock
S101	Part of 4967				
S102	6043				L.S. Earphone Switch
S301	Part of 4967				
X801	10,009 or				Selenium Rectifier
X802	assembly 99735				" "

ASSEMBLIES

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
Z1	9786 or 9814				VHF 40MC Std. Coil UHF-VHF 40MC Std. Coil Tuners
Z2					Tuner output Cable 22 uuf ± 10% which is equiv. to 9 1/2" of cable #3195
Z201	5438				41.25 MC Trap
Z202	5545				Series Peaking
Z203	5340				Shunt Peaking
Z301	5547				Series Peaking
Z302	5211A				4.5MC Video Trap
Z303	5548				Shunt Peaking
Z304	6127A				Picture Tube Socket
Z501	9695				Vert. Integrator
Z701	5121A				Deflection Yoke
Z702	6253				Plug-Anode Connector with lead
Z801	4910				V.C. C.C. & Power Sw.

To insure receipt of identical replacement parts, use part numbers when ordering from your Hoffman Distributor.



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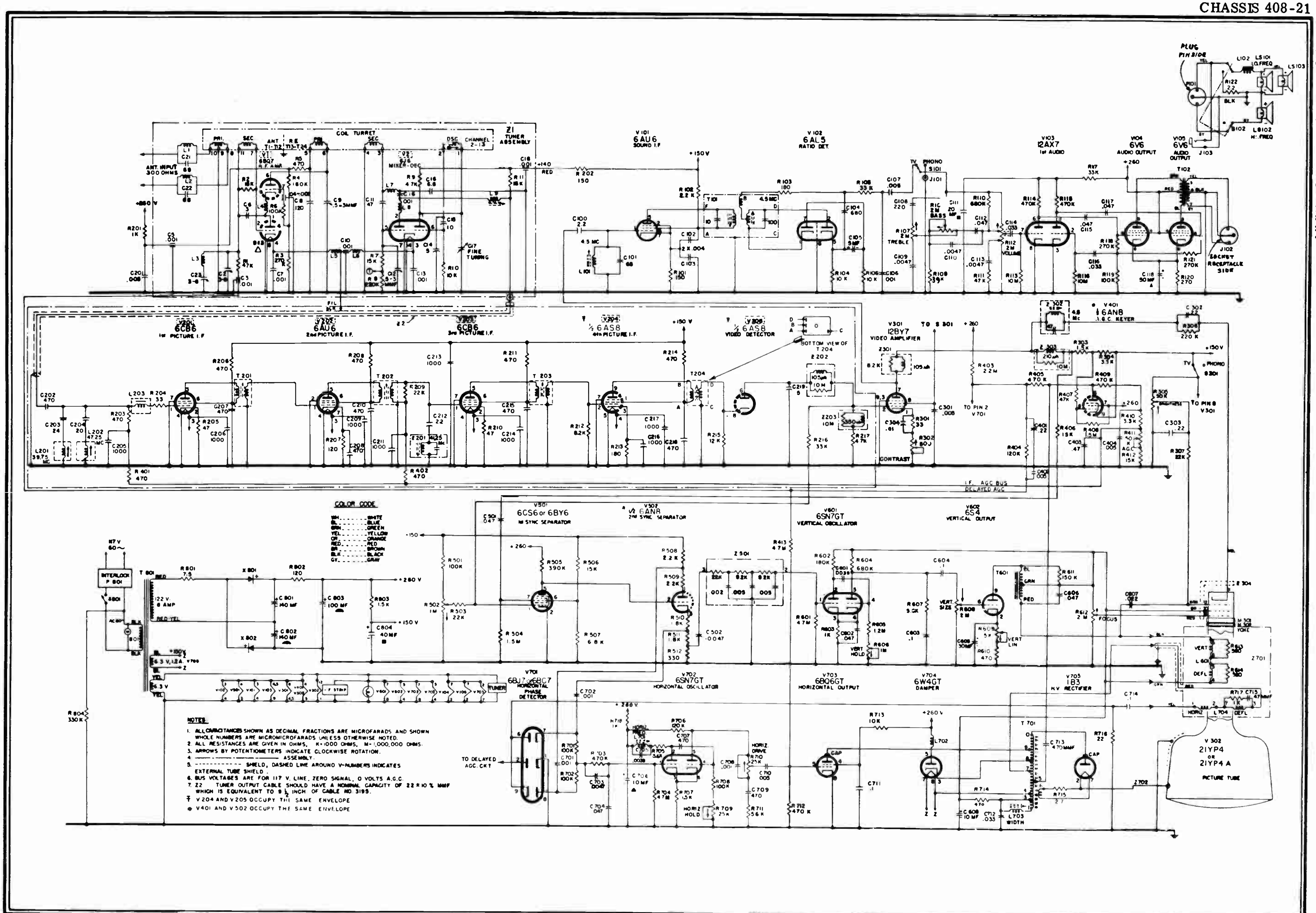
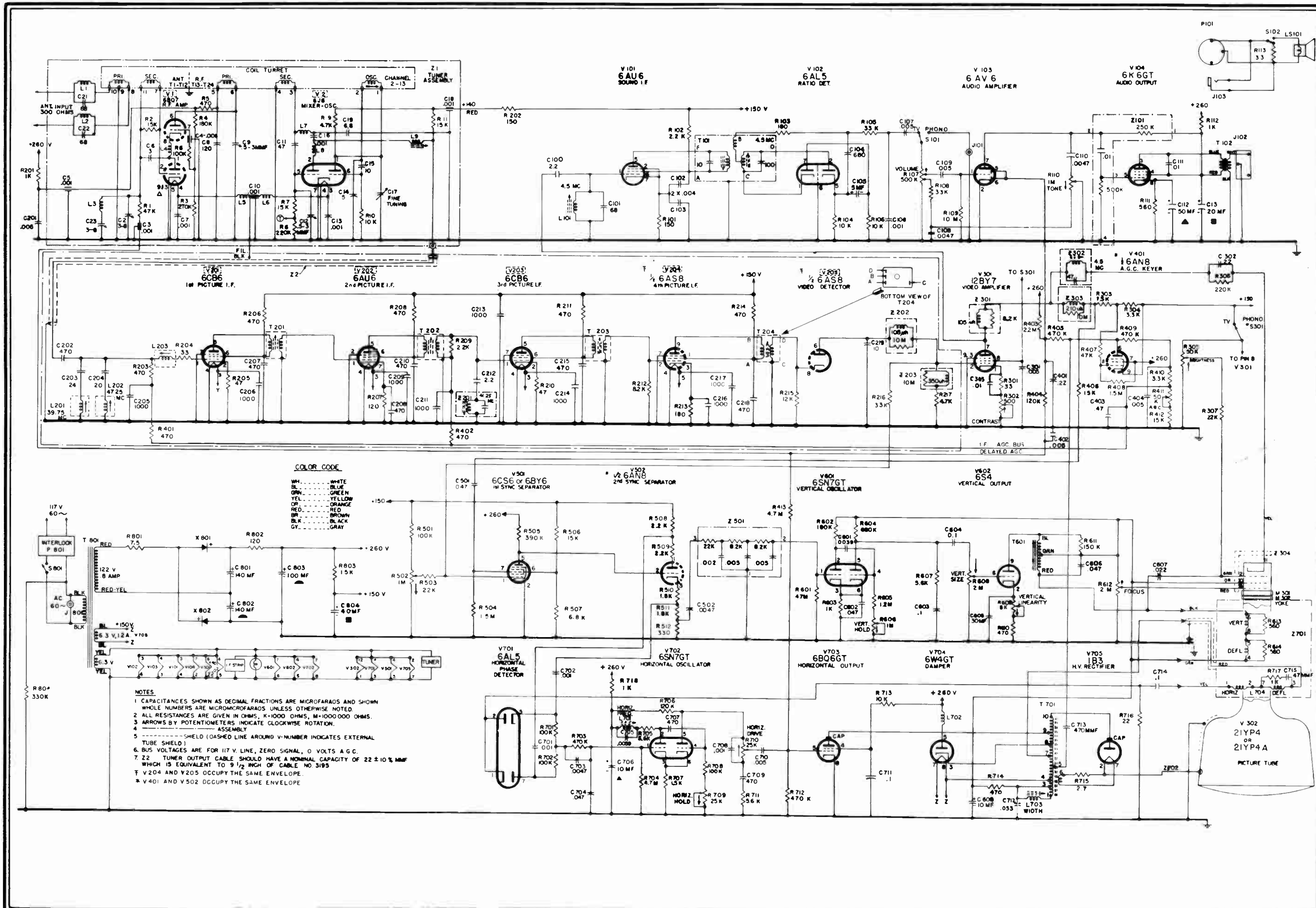
CHASSIS 410-24



CHASSIS 408-21
COLOR CODE
WH. — WHITE
BL. — BLUE
GRN. — GREEN
YEL. — YELLOW
OR. — ORANGE
RED — RED
BR. — BROWN
BLK. — BLACK
GY. — GRAY
V101 6AU6 SOUND I.F.
V102 6AL5 RATIO DET.
V103 12AX7 1st AUDIO
V104 6V6 AUDIO OUTPUT
V105 6V6 AUDIO OUTPUT
V201 6CB6 1st PICTURE I.F.
V202 6AU6 2nd PICTURE I.F.
V203 6CB6 3rd PICTURE I.F.
V204 ½ 6AS8 4th PICTURE I.F.
V205 ½ 6AS8 VIDEO DETECTOR
V301 12BY7 VIDEO AMPLIFIER
V401 ½ 6AN8 A.G.C. KEYER
V501 6CS6 or 6BY6 1st SYNC SEPARATOR
V502 ½ 6AN8 2nd SYNC SEPARATOR
V601 6SN7GT VERTICAL OSCILLATOR
V602 6S4 VERTICAL OUTPUT
V701 6BJ7 or 6BC7 HORIZONTAL PHASE DETECTOR
V702 6SN7GT HORIZONTAL OSCILLATOR
V703 6BQ6GT HORIZONTAL OUTPUT
V704 6W4GT DAMPER
V705 1B3 H.V. RECTIFIER
V302 21YP4 or 21YP4A PICTURE TUBE
Z1 TUNER ASSEMBLY
COIL TURRET
CHANNEL 2-13
ANT. INPUT 300 OHMS
NOTES
1. ALL CAPACITANCES SHOWN AS DECIMAL FRACTIONS ARE MICROFARADS AND SHOWN WHOLE NUMBERS ARE MICROMICROFARADS UNLESS OTHERWISE NOTED.
2. ALL RESISTANCES ARE GIVEN IN OHMS, K=1000 OHMS, M=1,000,000 OHMS.
3. ARROWS BY POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
4. ———— ASSEMBLY.
5. - - - - - - SHIELD, DASHED LINE AROUND V-NUMBERS INDICATES EXTERNAL TUBE SHIELD.
6. BUS VOLTAGES ARE FOR 117 V. LINE, ZERO SIGNAL, 0 VOLTS A.G.C.
7. Z2 TUNER OUTPUT CABLE SHOULD HAVE A NOMINAL CAPACITY OF 22 ± 10 % MMF WHICH IS EQUIVALENT TO 9 ½ INCH OF CABLE NO 3195.
V204 AND V205 OCCUPY THE SAME ENVELOPE
V401 AND V502 OCCUPY THE SAME ENVELOPE



COIL TURRET
Z1 TUNER ASSEMBLY
CHANNEL 2-13
ANT. INPUT 300 OHMS
V1 6BQ7 R.F. AMP
V2 6J6 MIXER-OSC
V101 6AU6 SOUND I.F
V102 6AL5 RATIO DET.
V103 6AV6 AUDIO AMPLIFIER
V104 6K6GT AUDIO OUTPUT
V201 6CB6 1st PICTURE I.F.
V202 6AU6 2nd PICTURE I.F.
V203 6CB6 3rd PICTURE I.F.
V204 ½ 6AS8 4th PICTURE I.F.
V205 ½ 6AS8 VIDEO DETECTOR
BOTTOM VIEW OF T204
V301 12BY7 VIDEO AMPLIFIER
V401 ½ 6AN8 A.G.C. KEYER
I.F. AGC BUS
DELAYED AGC
COLOR CODE
WH.......WHITE
BL.......BLUE
GRN......GREEN
YEL......YELLOW
OR.......ORANGE
RED......RED
BR.......BROWN
BLK......BLACK
GY.......GRAY
V501 6CS6 or 6BY6 1st SYNC SEPARATOR
V502 ½ 6AN8 2nd SYNC SEPARATOR
V601 6SN7GT VERTICAL OSCILLATOR
V602 6S4 VERTICAL OUTPUT
117 V 60~
INTERLOCK P 801
V701 6AL5 HORIZONTAL PHASE DETECTOR
V702 6SN7GT HORIZONTAL OSCILLATOR
V703 6BQ6GT HORIZONTAL OUTPUT
V704 6W4GT DAMPER
V705 1B3 H.V. RECTIFIER
V302 21YP4 OR 21YP4A PICTURE TUBE
NOTES
1 CAPACITANCES SHOWN AS DECIMAL FRACTIONS ARE MICROFARADS AND SHOWN WHOLE NUMBERS ARE MICROMICROFARADS UNLESS OTHERWISE NOTED.
2 ALL RESISTANCES ARE GIVEN IN OHMS, K=1000 OHMS, M=1000 000 OHMS.
3 ARROWS BY POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
4 ———·——— ASSEMBLY
5 - - - - - - - - - SHIELD (DASHED LINE AROUND V-NUMBER INDICATES EXTERNAL TUBE SHIELD)
6. BUS VOLTAGES ARE FOR 117 V. LINE, ZERO SIGNAL, 0 VOLTS A G C.
7. Z2 TUNER OUTPUT CABLE SHOULD HAVE A NOMINAL CAPACITY OF 22 ± 10 % MMF WHICH IS EQUIVALENT TO 9 1/2 INCH OF CABLE NO. 3195
Ŧ V204 AND V205 OCCUPY THE SAME ENVELOPE.
* V401 AND V502 OCCUPY THE SAME ENVELOPE

TABLE III - TV ALIGNMENT PROCEDURE

STEP NO.	SIGNAL GENERATOR FREQUENCY, MC	CONNECT SIGNAL TO	OUTPUT INDICATOR	ADJUST	INSTRUCTIONS	SPECIAL CONNECTIONS AND SETTINGS
			SOUND I. F. AND RATIO DETECTOR			
1	4.5 CW	Pin 2 of V301	Meter across pin 7 of V102 and ground.	T101 Pri. (bottom) L101	Tune for maximum reading on meter.	Signal level should be low enough to obtain approximately 4 to 7 volts on meter. Use isolation networks shown in Figures 2 and 3.
2	4.5 CW	"	Meter across ground and junction of R105 and C108.	T101 Sec. (top)	Tune for zero meter reading; use same signal level as in step 1.	Repeat tuning of T101 primary and secondary until adjustments do not change.
			TRAPS AND PICTURE I. F.			
3	4.5 CW	Pin 2 of V301	Meter connected through detector network to picture tube cathode lead.	L302	Tune for minimum reading on meter.	Detector and isolating networks shown in Figures 2 and 4.
4	41.25 CW	Mixer Grid	Voltmeter across R217.	Z201	Tune for minimum reading on meter.	Apply -4V bias to AGC buss. See text for connection to mixer grid. Keep generator output low. Set contrast control for maximum contrast. Adjust signal level throughout I. F. alignment so that a 1 volt DC output is maintained across R217.
5	43 CW	"	"	T204	Tune for maximum.	
	44.00CW	"	"	T203	"	
	42.5CW	"	"	T202	"	
	45.3CW	"	"	T201	Tune for maximum reading on meter.	
6	45 CW	"	"	L9	Tune for minimum reading on meter.	
7	45 CW	"	"	L203	Tune for maximum.	
8	39.75 CW	"	"	L201	Tune for minimum.	
9	47.25 CW	"	"	L202	Tune for minimum.	
10	REPEAT STEP NUMBER 7					
11	45 CW	"	"	L9	Tune for maximum.	
12	Approximately 43.5 with 10 mc sweep. Marker required.	Mixer Grid	High gain scope across R217	Adjust T201, T202, T203, T204 if necessary.	Set 45.75 mc marker at 50% point.	See Figure 5 for isolation network. Use markers to determine bandpass between picture carrier and 50% point on opposite skirt. Bandpass should be between 3.65mc and 3.85mc.

VOLTAGE CHART

TUBE	TYPE	FUNCTION	PLATE PIN	PLATE VOLTS	CATHODE PIN	CATHODE VOLTS	GRID PIN	GRID VOLTS	SCREEN PIN	SCREEN VOLTS
V101	6AU6	Sound I. F.	5	128	7	1.3	1	0	6	124
V102	6AL5	Ratio Det.	7	-11.5	1	-5				
			2	7	5	12.7				
V103	6AV6	Audio Amplifier	7	100	2	0	1	0		
V104	6K6GT	Audio Output	3	216	8	14	5	0	4	227
V201	6CB6	1st Pix I. F.	5	132	2	0	1	-3.9	6	140
V202	6AU6	2nd Pix I. F.	5	132	7	-1.2	1		6	135
V203	6CB6	3rd Pix I. F.	5	133	2	0	1	-4	6	140
V204	1/2 6AS8	4th Pix I. F.	9	107	3	2	2	0	1	135
V205	1/2 6AS8	Video Det.	6	-1.5	8	0				
V301	12BY7	Video Amp.	7	118	1	1.6	2	-1.5	8	140
V401	1/2 6AN8	AGC Keyer	6	-50	9	140	8	131	7	250
V501	6CS6 or 6BY6	1st Sync Sep.	5	43	2	0	1	-.5	6	29
V502	1/2 6AN8	2nd Sync Sep.	1	95	3	42	2	43		
V601	6SN7GT	Vert. Osc.	2	67	3		1	0		
			5	166	6	2.2	4	-40		
V602	6S4	Vert. Output	9	420	2	27	6	0		
V701	6AL5	Horiz. Phase Detector	5	10	2	0				
			7	-11	1					
V702	6SN7GT	Horiz. Osc.	2	220	3		1	0		
			5	137	6	7.5	4	-7		
V703	6BQ6GT	Horiz. Output	*		8	0	5	-26	4	137
V704	6W4GT	Damper	5	250	3	470				
	408-21 & 410-24 CHASSIS									
V103	12AX7	1st Audio	6	84	8	0	7	-.4		
			1	82	3	0	2	-.4		
V104	6V6	Audio Output	3	258	8	15.8	5	0	4	260
V105	6V6	Audio Output	3	258	8	15.8	5	0	4	260
	410-24 CHASSIS ONLY									
V602	6W6GT	Vertical Output	3	240	8	29	5	-29	4	240
V703	6CD6GT	Horiz. Output	*		3	18	5	-18	8	135

* Do not measure with meter. Spikes of voltage may damage meter. D. C. value of voltage will be approximately 460 volts.

Boost voltage may be measured at width coil and will be about 550 volts on 410-24 chassis and approximately 460 volts on 407-21 and 408-21 chassis.

Voltages indicated in voltage chart were taken with Simpson Model 260 meter. Receiver was operating on 117 volt AC with all controls set for normal operation of channel received. Detected signal at plate of video detector developed negative 1 1/2 volts. All voltages read to chassis ground. These voltages are intended as a reference to be used in service and repair of this chassis and are not to be considered as maximum or minimum limits for operation. The normal allowable variations in component values, as well as line voltage and signal variation, will cause slight differences in voltages read on chassis of the same model.

IDENTIFICATION

The 407-21, 408-21 and 410-24 chassis are variations of the super deluxe chassis used in the above named models of Hoffman television receivers. The All-Wave models are identified by a "U" following the model number. Chassis 407-21 is a Super Deluxe chassis with single ended audio section. Chassis 408-21 and 410-24 have a push-pull hi-fi audio circuit. Chassis 410-24 is the same as 408-21, except the sweep circuits which are designed to accommodate a 24" picture tube. All three chassis have a four stage 40mc I. F. strip and cascode tuner with negative bias supplied by a keyed AGC system. The low voltage power supply uses selenium rectifiers connected as a voltage doubler.

An unusual feature of the chassis is the addition of a secondary control for operation in noisy signal areas. This control is located under the plastic escutcheon plate on front control panel. Its use is explained under Operating Instructions.

Earphone jacks with speaker switch are used on above listed models. Reference to the schematics will show that the earphone jack is operative at all times, and that speakers can be either on or off depending upon the position of the speaker switch.

Some models using above chassis will have three speakers. Reference to the schematic will show that the two low frequency speakers are in parallel with each other. A single high frequency or tweeter speaker is used. A frequency divider network feeds the audio to the proper speaker for reproduction.

TABLE I ELECTRICAL & MECHANICAL DATA

Operating Voltage	115 Volts AC, 60CPS
Power Consumption	407-21 170 Watts 408-21 180 Watts 410-24 215 Watts
VHF Tuner Range	2 through 13
All-Wave Tuner Range	2 through 83
Intermediate Frequencies	Picture Carrier 45.75mc Audio Carrier 41.25mc
Intercarrier Sound I. F. Freq.	4.5mc
Audio Output Impedance	407-21 3.2 ohms 408-21 6.4 ohms center tapped 410-24 6.4 ohms center tapped
Maximum Undistorted Audio Output	407-21 3 Watts 408-21 10 Watts 410-24 10 Watts
Antenna Input Impedance	3.2 ohms balanced
Picture Tube Size	21" Rectangular 407-21, 408-21 24" Rectangular 410-24
Focus	Electrostatic Focus 407-21 and 408-21 Magnetic Focus 410-24
Video Response	to 3.75mc

TABLE II HOFFMAN TUBE COMPLEMENT

TUBE	CHASSIS 407-21	CHASSIS 408-21 & 410-24	FUNCTION
V1+	6BQ7A	6BQ7A	R. F. Amplifier
V2+	6J6	6J6	Oscillator Mixer
V1*	6T4 or 6AF8	6T4 or 6AF8	UHF Oscillator
V2*	6BQ7A	6BQ7A	VHF R. F. Amplifier UHF 1st I. F.
V3*	6U8	6U8	VHF Oscillator Mixer UHF 2nd I. F.
V101	6AU6	6AU6	Sound I. F. Amplifier
V102	6AL5	6AL5	Ratio Detector
V103	6AV6		Audio Amp. & AGC Delay
V103		12AX7	Audio Driver
V104	6K6	6V6	Audio Output
V105		6V6	Audio Output
V201	6CB6	6CB6	1st Picture I. F.
V202	6AU6	6AU6	2nd Picture I. F.
V203	6CB6	6CB6	3rd Picture I. F.
V204	1/2 6AS8	1/2 6AS8	4th Picture I. F.
V205	1/2 6AS8	1/2 6AS8	Video Detector
V301	12BY7	12BY7	Video Amplifier
V401	1/2 6AN8	1/2 6AN8	AGC Keyer
V501	6CS6 or 6BY6	6CS6 of 6BY6	1st Sync Separator
V502	1/2 6AN8	1/2 6AN8	2nd Sync Separator
V601	6SN7GT	6SN7GT	Vertical Oscillator
V602	6S4	6S4 (408-21) 6W6 (410-24)	Vertical Output
V701	6AL5		Horizontal Phase Detector
V701		6BJ7 or 6BC7	Horizontal Phase Detector & AGC Delay
V703	6BQ6GT	6CD6GT	Horizontal Output
V704	6W4GT	6W4GT	Damper
V705	1B3GT	1B3GT	H. V. Rectifier
X801	Sel. Rect.	Sel. Rect.	L. V. Rectifier
X802	Sel. Rect.	Sel. Rect.	L. V. Rectifier
V302	21YP4	or 21YP4A	407-21 & 408-21 Pix Tube
V302	24TP4	or 24CP4A	410-24 Pix Tube

\+ VHF Tuner Only * UHF Tuner Only

ALIGNMENT

The following discussion describes recommended methods and equipment to be used and precautions to be observed during the alignment procedure. Table III offers a ready reference alignment guide to be followed after the more detailed procedure has been studied.

For best results it is important that alignment be performed on a metal topped bench with all instruments and equipment securely bonded together and to ground. All leads should be as short as is practicable, particularly in the input grid circuits. Allow about fifteen minutes for the test equipment and receiver to warm before beginning the alignment. Isolation circuits will be required for both the input and output connections. It is important that composition resistors, preferably the half-watt size, and disc type ceramic condensers be used in making up these isolation networks so that a minimum amount of external inductance is added to the tuned circuits being adjusted.

The following equipment will be required in order to align the picture and sound I. F. stages of the receiver properly.

1. Accurate CW signal generator covering the following frequencies:

4.5 mc	39.75 mc
41.25 mc	44.00 mc
42.00 mc marker freq.	45 mc
43 mc	45.3 mc
42.5 mc	45.75 marker freq.
	47.25 mc

The generator must have an attenuation control which can be used to vary its output signal level.

2. Sweep frequency generator with a sweep center frequency of approximately 43.5 mc and a 10 mc sweep width.
3. Cathode ray oscilloscope with at least a moderately high vertical gain. Must have external sweep input or internal sweep frequency equal to the sweep generator sweep frequency and capable of phase control.
4. DC voltmeter with sensitivity of 20,000 ohms per volt or higher and voltage scale ranges which include approximately 10 volts and 3 volts (full scale deflection). VTVM with zero center scale adjustment is an ideal type.
5. -4 volt bias source such as a battery.
6. Detector network shown in Figure 4.
7. .005 uf isolating condenser.
8. 10K ohm, 1/2 watt composition resistor.
9. .001 uf condenser for shunting oscilloscope input.

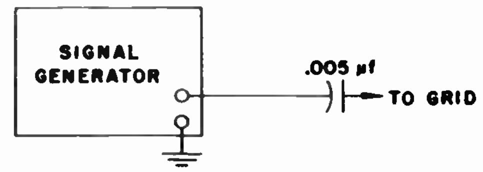


Figure 2. Signal Generator Isolation

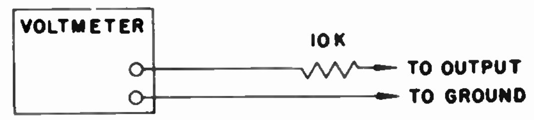


Figure 3. Voltmeter Isolation

TUNING PICTURE I. F. COILS

Equipment: Instruments and setup remain the same as for trap alignment during the first part of the procedure. For final adjustment the sweep frequency generator is also used and the voltmeter should be replaced by the oscilloscope. See Figure 5 for oscilloscope isolation details.

Procedure: Tune the I. F. coils by setting the coil frequency on the CW generator and adjusting the coil for maximum voltmeter reading. The CW generator output must be attenuated so that the DC output voltage of the video detector (indicated on the voltmeter), remains at 1 volt as the I. F. coils are tuned. The order of tuning is from the last I. F. stage toward the tuner. Repeat the trap and I. F. alignment procedure until no additional change in adjustments is necessary.

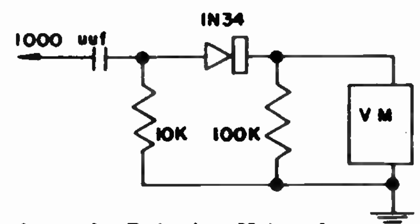


Figure 4. Detector Network

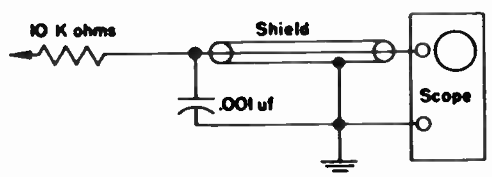


Figure 5. Oscilloscope Isolation

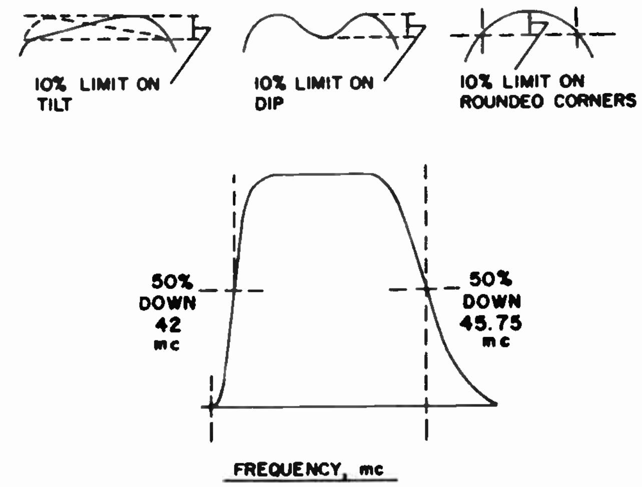


Figure 6. Picture I-F Response Curve

PARTS LIST

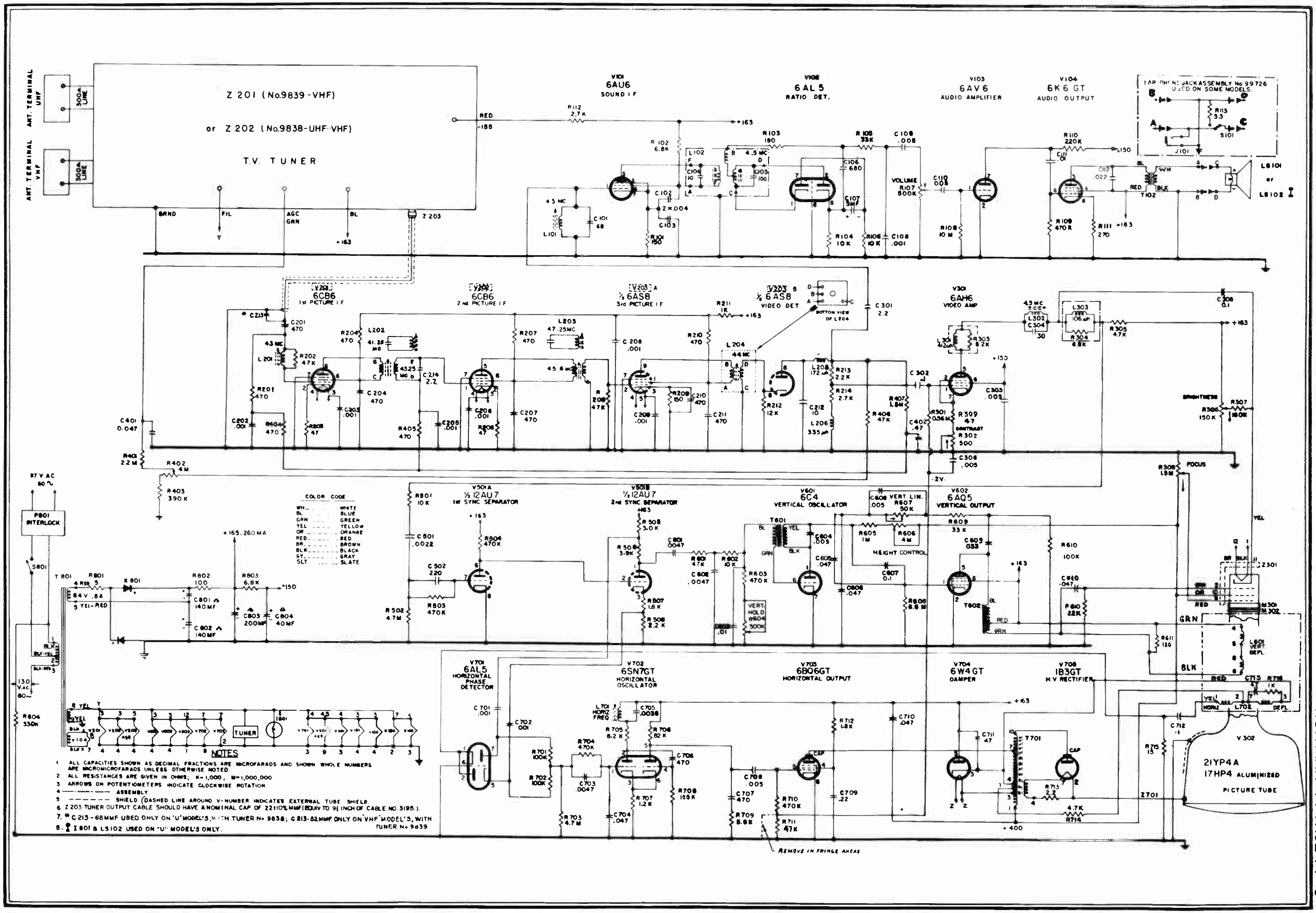
Unless otherwise noted all condensers are 600 volt, molded phenolic type, 20% tolerance with whole number values given in micromicro-farads and decimal values given in microfarads. Guaranteed minimum capacity.

Symbol	Part No.	Value	Tol.	Watts or Volts	Type
C101	4046	68	10%	500V	Ceramic Tubular
C102	4036	.004			Hi K Ceramic Disc
C103	4036	.004			" " " "
C104		10			Part of L102
C105		100			" " "
C106	4042	680			
C107	4277	5MF		50V	Electrolytic
C108	14031	.001		500V	Hi K Ceramic Disc
C109	4029	.005		500V	Ceramic Disc
C110	4029	.005		500V	Ceramic Disc
C111	4142	.01			
C112	4190	.022			
C201	14050	470	10%	500V	Ceramic
C202	14031	.001		500V	Hi K Ceramic Disc
C203	14031	.001		500V	" " " "
C204	14050	470	10%	500V	Ceramic
C205	14031	.001		500V	Hi K Ceramic Disc
C206	14031	.001		500V	" " " "
C207	14050	470	10%	500V	Ceramic
C208	14031	.001		500V	Hi K Ceramic Disc
C209	14031	.001		500V	" " " "
C210	14050	470	10%	500V	Ceramic
C211	14050	470	10%	500V	"
C212	14058	10	10%		Ceramic
C213	4046	68			"
C213		82			"
C214	4069	2.2	10%	500V	"
C301	4069	2.2	10%	500V	"
C302	4143	.1		200V	"
C303	4029	.005		500V	Ceramic
C304	4043	30	10%	500V	"
C305	4150	0.1		400V	
C306	4029	.005		500V	Ceramic
C401	4147	.047		200V	
C402	4172	.47		200V	
C501	4136	.0022	10%	400V	
C502	4084	220	10%	500V	Ceramic
C601	4127	.0047		400V	
C602	4185	.0047		400V	
C603	4134	.01		400V	
C604	4029	.005		500V	Ceramic
C605	4133	.047			
C606	4133	.047			
C607	4143	0.1			
C608	4029	.005			Ceramic
C609	14127	.033			
C610	4133	.047			
C701	4174	.001		400V	
C702	4174	.001		400V	
C703	4127	.0047		400V	
C704	4147	.047			
C705	4085	.0039	10%	500V	Silver Mica
C706	14050	470			Mica
C707	14050	470			Mica
C708	4029	.005		500V	Ceramic
C709	4131	.22		200V	
C710	4133	.047			
C711	14049	47	10%	3000V	Ceramic
C712	4143	0.1			
C713	14048	47	10%	3000V	Ceramic
C107	4277	5MF		50V	Electrolytic
C801	4295	140MF		100V	"
C802	4298	200MF		200V	"
C803	4298	40MF		200V	"
C804	4298	140MF		100V	"
		RESISTORS			
R101	4616	150	10%	1/2 Watt	
R102	4557	6.8K	10%	1/2 Watt	
R103	14618	180	10%	1/2 Watt	
R104	4597	10K	10%	1/2 Watt	
R105	4586	33K	10%	1/2 Watt	
R106	4597	10K	10%	1/2 Watt	
R107	4910	500K			Volume Control
R108	4505	10M	20%	1/2 Watt	
R109	4622	470K	10%	1/2 Watt	
R110	4618	220K	20%	1/2 Watt	
R111	4663	270	10%	1/2 Watt	
R112	4579	2.7K	10%	1/2 Watt	
R113	4782	3.3	10%	1 Watt	
R					
R201	4638	470	10%	1/2 Watt	
R202	4559	47K	10%	1/2 Watt	
R203	4639	47	10%	1/2 Watt	
R204	4664	470	20%	1/2 Watt	
R205	4559	47K	10%	1/2 Watt	
R206	4639	47	10%	1/2 Watt	
R207	4667	470	20%	1/2 Watt	
R208	4559	47K	10%	1/2 Watt	
R209	4616	150	10%	1/2 Watt	
R210	4664	470	20%	1/2 Watt	
R211	14697	1K	20%	2 Watt	
R212	4646	12K	10%	1/2 Watt	
R213	4650	2.2K	10%	1/2 Watt	
R214	4579	2.7K	10%	1/2 Watt	
R301	4590	56M	10%	1/2 Watt	
R302	4910	500			Contrast Control
R303	Part of L301				
R304	Part of L303				
R305	24558	4.7K	10%	2 Watt	
R306	4974	150K			Brightness Control
R307	4634	180K	10%	1/2 Watt	
R308	4929	1.5M			Focus Control
R309	4508	47 ohm	20%	1/2 Watt	
R401	4502	2.2M	20%	1/2 Watt	
R402	4969				
	4970	4M			AGC Control
R403	4633	390K	10%	1/2 Watt	
R404	4664	470	20%	1/2 Watt	
R405	4664	470	20%	1/2 Watt	
R406	4504	47K	20%	1/2 Watt	
R407	4674	1.5M	20%	1/2 Watt	
R501	4597	10K	10%	1/2 Watt	
R502	4544	4.7M	20%	1/2 Watt	
R503	4622	470K	10%	1/2 Watt	
R504	4622	470K	10%	1/2 Watt	
R505	34538	3K	5%	1/2 Watt	
R506	4527	3.9K	10%	1/2 Watt	
R507	24517	1.8K	5%	1/2 Watt	
R508	4650	2.2K	10%	1/2 Watt	
R601	4559	47K	10%	1/2 Watt	
R602	4597	10K	10%	1/2 Watt	
R603	4622	470K	10%	1/2 Watt	
R604	4975	500K			Vert. Hold Control
R605	4513	1M	20%	1/2 Watt	
R606	4969	4M			Height Control
	4970				
R607	4972	50K			Vert. Linearity Control
	4973				
R608	4604	6.8M	10%	1/2 Watt	
R609	4586	33K	10%	1/2 Watt	
R610	4571	100K	10%	1/2 Watt	
R611	4628	22K	10%	1/2 Watt	
R70					
R701	4571	100K	10%	1/2 Watt	
R702	4571	100K	10%	1/2 Watt	
R703	4544	4.7M	20%	1/2 Watt	
R704	4622	470K	10%	1/2 Watt	
R705	4651	8.2K	10%	1/2 Watt	
R706	24670	82K	10%	1/2 Watt	
R707	4652	1.2K	5%	1/2 Watt	
R708	4571	100K	10%	1/2 Watt	
R709	4629	5.6K	10%		
R710	4622	470K	10%	1/2 Watt	
R711	4559	47K	10%	1/2 Watt	
R712	24517	1.8K	10%	1 Watt	

Unless otherwise noted, all resistors are ½ watt, composition type 10% tolerance with values given in ohms.

Symbol	Part No.	Value	Tol.	Watts or Volts	Type
R713	4735	2.2K	10%	1/2 Watt	Wire-wound
R714	4576	4.7K	10%	1/2 Watt	
R715	14509	15	10%	2 Watt	
R716	4659	1K	10%	1/2 Watt	Part of L702
R801	4787	5	10%	2 Watt	
R802	4796	100 ohm	10%	10 Watt	Wire-wound
R803	4557	6.8K	10%	1/2 Watt	
R804	4677	330K ohm	20%		
		COILS			
L101	5454	4.5MC			4.5 MC Sound Take-off
L102	5235A				Ratio Detector
L201	5219A				I. F. Input
L202	5220A				1st I. F. with 41.25 MC Trap
L203	5221A				2nd I. F. with 47.25 MC Trap
L204	5222A				3rd I. F. (in can)
L205	5448	172 uh			Peaking Series Det.
L206	5449	335 uh			Peaking Shunt Det.
L301	5450	412 uh			Peaking Series Video
L302	5453	4.5 MC			4.5 MC Trap
L303	5451	106 uh			Peaking Shunt Video
L701	5236A				Horizontal Frequency
		TRANSFORMERS AND CHOKES			
T102	5116A				Audio Output
T601	5176				Blocking Oscillator
T602	5106A				Vertical Output
T701	5197				Horizontal Output
R801	5052				Power Isolation
		CONTROLS AND SWITCHES			
R107					Volume Control 1M
S801	4910				Off-On Switch
R304					Contrast 500 ohm
R306	4974				Brightness Control
R308	4971 or 4929				Focus Control 1.5M
R402	4969 or 4970				AGC Control (4M)
R604	4975				Vert. Hold Control 500K
R606	4969 or 4970				Height Control 4M
R607	4972 or 4973				Vert. Linearity Control 50K
		MISCELLANEOUS			
L601	99723				Yoke Deflection
L702	99723				
LS101	5 1/4"				Speaker-Table Model
LS102	10"				Speaker-Console Model
M301	9702				Ion Trap
M302	9722				Centering Magnet
P801	6126				Receptacle - Pwr. Inter.
X801	10008				Rectifier-Selenium, doubler
Z201	9839 or 9786				Tuner-VHF
Z202	9838 or 9814				Tuner-UHF-VHF
Z301	6108A				Socket-Picture Tube
Z701	6252				Plug-Anode
Z203	33110				Cable Assembly-Tuner Output

To insure receipt of identical replacement parts, use part number when ordering from your Hoffman distributor.



Z 201 (No.9839-VHF)
or Z 202 (No.9838-UHF-VHF)
T.V. TUNER
ANT. TERMINAL UHF
ANT. TERMINAL VHF
V101 6AU6 SOUND I F
V102 6AL5 RATIO DET.
V103 6AV6 AUDIO AMPLIFIER
V104 6K6 GT AUDIO OUTPUT
V201 6CB6 1st PICTURE I F
V202 6CB6 2nd PICTURE I F
V203 A ½ 6AS8 3rd PICTURE I F
V203 B ½ 6AS8 VIDEO DET
V301 6AH6 VIDEO AMP
V501A ½ 12AU7 1st SYNC SEPARATOR
V501B ½ 12AU7 2nd SYNC SEPARATOR
V601 6C4 VERTICAL OSCILLATOR
V602 6AQ5 VERTICAL OUTPUT
V701 6AL5 HORIZONTAL PHASE DETECTOR
V702 6SN7GT HORIZONTAL OSCILLATOR
V703 6BQ6GT HORIZONTAL OUTPUT
V704 6W4GT DAMPER
V705 1B3GT H.V. RECTIFIER
V302 21YP4A 17HP4 ALUMINIZED PICTURE TUBE
COLOR CODE
WH. WHITE
BL. BLUE
GRN. GREEN
YEL. YELLOW
OR. ORANGE
RED RED
BR. BROWN
BLK. BLACK
GY. GRAY
SLT. SLATE
NOTES
1 ALL CAPACITIES SHOWN AS DECIMAL FRACTIONS ARE MICROFARADS AND SHOWN WHOLE NUMBERS ARE MICROMICROFARADS UNLESS OTHERWISE NOTED.
2 ALL RESISTANCES ARE GIVEN IN OHMS; K=1,000, M=1,000,000
3 ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION
4 ASSEMBLY
5 SHIELD (DASHED LINE AROUND V-NUMBER INDICATES EXTERNAL TUBE SHIELD.
6 Z 203 TUNER OUTPUT CABLE SHOULD HAVE A NOMINAL CAP OF 22±10% MMF (EQUIV TO 9½ INCH OF CABLE NO. 3198.).
7. * C 213 - 68MMF USED ONLY ON 'U' MODEL'S WITH TUNER No 9838; C 213-82MMF ONLY ON 'VHF' MODEL'S, WITH TUNER No 9839
8. I 801 & LS102 USED ON "U" MODEL'S ONLY.
REMOVE IN FRINGE AREAS

OSCILLATOR ALIGNMENT

The procedure given below makes use of the picture I. F. stages common to the sound stages, the sound I. F. stages and the ratio detector. Therefore, the accuracy of the oscillator setting is dependent upon the accuracy of the alignment of the aforementioned stages.

EQUIPMENT:

Connect the "hot" lead of the marker generator (CW source) to one antenna terminal and connect the generator ground lead to ground. Set the generator for unmodulated output. Connect the voltmeter to measure the ratio detector balance voltage at sound I. F. Use center scale of the voltmeter if available.

PROCEDURE:

Set the fine tuning control at the center of its tuning range. Set the tuner to Channel 12 and the signal generator to the sound carrier frequency of Channel 12 (209.75 mc). Using a non-metallic alignment screwdriver, adjust C12 for zero reading on the voltmeter. With C12 correctly adjusted, tune the brass slug through the hole in the front of the chassis and tuner for zero voltmeter reading on each of the other eleven channels, using a non-metallic screwdriver. Switch the signal generator to the correct sound carrier frequency for each channel. C12 is an all-channel adjustment and should not be altered after adjusting it for Channel 12. If difficulty is encountered in obtaining a zero voltmeter reading on a particular channel, check the coil board containing the oscillator winding.

TABLE IV

CHANNEL NUMBER	PICTURE CARRIER FREQ. MC	SOUND CARRIER FREQ. MC	SWEEP GENERATOR FREQ. MC
2	55.25	59.75	57
3	61.25	65.75	63
4	67.25	71.75	69
5	77.25	81.75	79
6	83.25	87.75	85
7	175.25	179.75	177
8	181.25	185.75	183
9	187.25	191.75	189
10	193.25	197.75	195
11	199.25	203.75	201
12	205.25	209.75	207
13	211.25	215.75	213

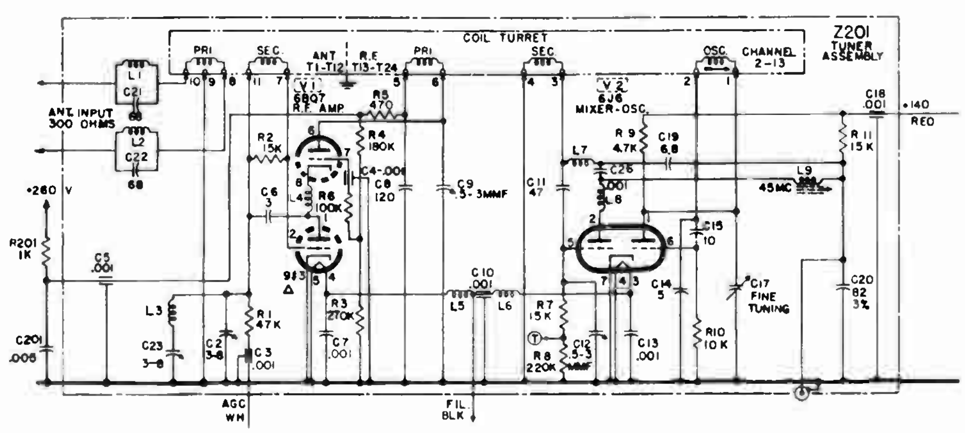


Figure 7. Schematic Diagram for VHF Tuner

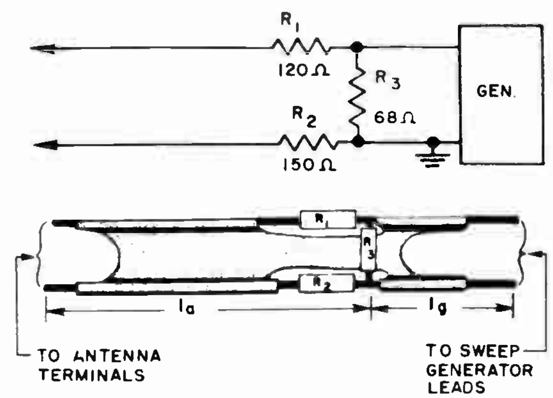


Figure 5. Matching Network

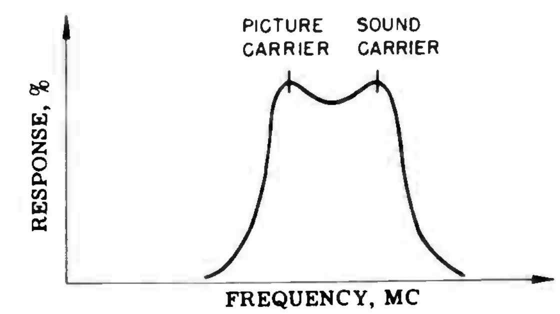


Figure 6. Tuner Bandpass Curve

VOLTAGE CHART

TUBE NO.	TUBE TYPE	FUNCTION	PLATE PIN	PLATE VOLTS	CATHODE PIN	CATHODE VOLTS	GRID PIN	GRID VOLTS	SCREEN PIN	SCREEN VOLTS
V101	6AU6	Sound I. F.	5	83V	7	+0.8	1	0	6	+83
V102	6AL5	Ratio Det.	7 2	-6 4	1 5	+1.3 +6				
V103	6AV6	Audio Amp.	7	77	2	0	1	-0.4		
V104	6K6GT	Audio Output	3	157	8	8.3	5	0	4	167
V201	6CB6	1st Pix I. F.	5	127	2	0.4	1	0.2	6	130
V202	6CB6	2nd Pix I. F.	5	125	2	0.4	1	0.2	6	130
V203A	1/2 6AS8	3rd Pix I. F.	9	125	3	1.5	2	0	1	130
V203B	1/2 6AS8	Video Det.	6	-2.5	8	0				
V301	6AH6	Video Amp.	5	133	7	1.0	1		6	153
V501A	1/2 12AU7	1st Sync Sep.	6	34	8	0	7	-5.6		
V501B	1/2 12AU7	2nd Sync Sep.	1	104	3	36	2	34		
V601	6C4	Vert. Osc.	1	117	7	0	6	-18		
V602	6AQ5	Vert. Output	5	153	2	0	1	-8	6	166
V701	6AL5	Hor. Ph. Det.	7 2	-10 0	1 5	0 9.5				
V702	6SN7GT	Hor. Osc.	2 5	141 89	3 6	4.5 4.5	1 4	-0.2 -2.3		
V703	6BQ6GT	Hor. Output	Cap	*	8	0	5	-22	4	144
V704	6W4GT	Damper	5	166	3	405				

* Do not measure - High amplitude spikes of D. C. may damage meter. D. C. value will be about same as boost voltage. Boost voltage at pin #1 of horizontal output transformer about 400 volts.

Voltages taken with Simpson #260 meter on 303-21 chassis operating as follows: AC line voltage 115 volts, receiver tuned to station with normal setting of all controls, negative 2.5 volts developed at plate of video detector by signal received. All voltages are positive D. C. unless otherwise indicated.

These readings are prepared as a service reference and should not be considered as minimum or maximum specifications for the operation of this chassis. Variations within limits will be noted, due to operating conditions and the normal allowable tolerances in component values.

Fine tuning is accomplished by a shaft concentric with the channel selector shaft. Slight rubbing of the dielectric rotor against the grounded stator plate is intentional, in order to avoid vibration with resulting interference. However, the dielectric rotor should not be allowed to rub or contact the silvered ceramic disc riveted to the chassis. If the fine tuning shaft binds, it should be removed and cleaned with carbon tetrachloride (using a light canvas cloth) and both the dielectric blade and the drum shaft should be lubricated with switch grease or vaseline.

Erratic operation on any one channel requires checking of the coil boards for that channel. Both contact points and windings should be checked. Clean the contact points with a light canvas cloth dampened with carbon tetrachloride. If the operation is still unsatisfactory, press the contact springs lightly with an insulated screwdriver. If the tuner cannot be made to operate, more contact spring pressure is required. Contact rise should be approximately 1/32 inch. To adjust contact rise, several sets of coil boards should be removed from the tuner. To remove a coil board insert a screwdriver between the coil retainer spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward and remove. Rotate the drum so that no coil board is under the contact springs. Press the contact springs down slightly to give increased pressure. With the coil boards removed, clean the contact surfaces of the contact springs with carbon tetrachloride (using a small stiff brush) and lubricate with a pure mineral oil. Replace the coil boards, and check all channels.

If oscillator slugs fall into the coil form, remove the coil board, move the slug retaining spring aside, and tap the coil board until the slug slips forward. Reset the slug retaining spring.

Noisy channel switching may be due to the detent spring roller not rotating on the detent plate. Lubricate both surfaces with switch grease or vaseline.

For microphonism produced by tapping the tubes or tuner chassis, or in case of intermittent video and sound, first replace the tubes. If the trouble persists, clean contact surfaces and lubricate surfaces as explained above.

TROUBLE SHOOTING

Tube substitution is recommended first for localizing the trouble. The presence of oscillator grid voltage is very important. Lack of it indicates that the oscillator is not operating. This voltage may be checked from pin 6 of the 6J6 tube to ground by using an isolating resistor of 25,000 ohms on the voltmeter test probe. The isolating resistor is required to prevent excessive loading of the oscillator circuit. Lack of voltage at test point, when the oscillator is operating, indicates trouble in the mixer grid circuit. This voltage should be at least 2 volts on the high channels and 3 volts on the low channels, measured with VTVM or 20,000 ohms per voltmeter between test point and chassis. Resistance checks should reveal the source of trouble when incorrect voltage or abnormal operation is noted.

ALIGNMENT

The tuned circuits are very stable and normally do not require adjustment unless a tube or component part has been replaced or the adjustment of the trimmer condensers have been indiscriminantly changed by an inexperienced individual.

The following alignment procedure describes alignment of the R-F, mixer and oscillator stages of the tuner with the exception of the converter output coil, L9. The latter adjustment is described in the IF alignment procedure section of the individual chassis data bulletins. Table IV offers a ready reference guide to be followed after the detailed procedure has been studied.

The following equipment will be necessary in order to align the tuner. DO NOT ATTEMPT ANY ALIGNMENT BEYOND THE "FIELD ADJUSTMENTS OF OSCILLATOR" UNLESS THE EQUIPMENT IS AVAILABLE.

1. Accurate AM signal generator covering the television picture and sound carrier frequencies listed in Table IV, with low impedance output and calibrated attenuator.

2. R-F sweep generator covering the frequency band of the twelve television channels, preferably with 300 ohm balanced output to match its output to antenna input. Sweep width at least 12 mc wide.

3. D.C. voltmeter with at least 20,000 ohms per volt sensitivity and low range.

4. An oscilloscope with at least a moderate sensitivity.

5. A 3 volt bias battery.

Most sweep generators have an output impedance less than 300 ohms. In order to match the generator to its load (tuner input), a matching network is used. A suggested network can be made up from several inches of 300 ohm twin lead and three composition type, 1/2 watt resistors of suitable value. Figure 5 shows the details. The length of lead l_g should be as short as is practicable so as not to provide a 300 ohm line between network and generator. Lead l_a should be just long enough to keep network and generator leads from shorting against TV chassis or tuner chassis. The network can be taped to further eliminate possible shorts. The values given for R1, R2 and R3 are the result of a compromise between making the network a universal one for all generators with output impedances of approximately 50 to 75 ohms, and availability of resistors of a desired value. More exact values for a particular generator are usually given in the instruction manual supplied with the generator.

The AM signal generator is used as a marker generator for the video and sound carrier frequencies, and it is also used as a CW source in adjusting the oscillator frequencies. Therefore, it is most desirable, from the standpoint of accuracy and alignment time, that the generator provide pairs of controlled or crystal calibrated channel picture and sound carrier frequencies. However, if pairs of frequencies are not available, the signal marker frequency can be shifted from the picture to sound carrier frequency for each step in the alignment procedure. A VTVM is recommended for the D.C. voltmeter because the sensitivity is very high and a zero-center scale is available on most models. Shielded leads should be used for all connections. All ground leads and equipment should be well bonded together. Composition resistors must be used in the matching and isolating networks. Before beginning the alignment procedure, allow about 15 minutes for receiver and test equipment to warm up to operating temperature.

R.F. AND MIXER ALIGNMENT

EQUIPMENT:

Disconnect antenna from the receiver if one is being used, and connect the sweep generator to the antenna terminals. Use matching network if necessary. Loosely couple marker generator to antenna terminal, using unmodulated signal to obtain marker pips of video and sound R.F. carriers. This may be done by clipping the marker generator "hot" lead to an insulated part of the sweep generator lead, or by coupling with a small capacitor (2 or 3 uuf). Avoid distortion of response curve by keeping the marker generator output at a minimum, marker pips being just barely visible. Temporarily disconnect the tuner AGC lead from the AGC buss and connect it to the negative terminal of the bias source. Connect positive terminal of bias source to chassis ground. Connect synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection or set the scope to internal 60 cycle sweep if the sweep frequency of the generator is 60 cycles. Connect the vertical input lead of the scope through a 10K ohm resistor to point T, the wire loop on top of the tuner. Tuner alignment adjustments are located as follows:

1. C12 is near front side of oscillator mixer tube socket.
2. C9 is between the two tuner tube sockets.
3. C2 is near back side of R.F. amplifier tube socket.
4. C23 is beside C2 adjustment.

PROCEDURE:

Set the channel selector to Channel 12 (at this setting the coil boards marked "8" are at the bottom center position). Channel 12 is the reference channel for trimmer alignment. Set the fine tuning control at the center of its tuning range. Set the sweep generator to approximately 207 mc. Insert the picture and sound markers. Remember that the sound marker is higher in frequency than the picture marker before conversion to the I.F. Adjust C2, C9 and C23 for an approximately flat top response curve which should be located symmetrically between the markers and be of maximum amplitude. See Figure 6 for appearance of curve. Normally this curve appears somewhat overcoupled (double humped) with a 10% or 15% peak to valley excursion, and the markers occur at approximately maximum response. In general the adjustment performed for Channel 12 is sufficient to give satisfactory response curves on all channels. Check the response of Channels 2 through 11 and Channel 13 by switching the receiver channel selector, sweep generator and marker generator to each of these channels and observe the response obtained. Curves obtained should approximate those shown in Figure 6, although variation is to be expected between different units. However, in general, the peak to valley excursion should never exceed 30%, and the markers should never occur at points below 70% of the maximum amplitude of the curve. If reasonable alignment is not obtained on a particular channel, (a) check to see that coil boards have not been intermixed; (b) adjust C2, C9 and C23 as a compromise adjustment, favoring this particular channel and recheck all channels to see that they have not been seriously affected; (c) try replacing the coil board for the weak channel.

ALIGNMENT

TABLE III - TV ALIGNMENT PROCEDURE

STEP NO.	SIGNAL GENERATOR FREQUENCY MC	CONNECT SIGNAL TO	OUTPUT INDICATOR	ADJUST	INSTRUCTIONS	SPECIAL CONNECTIONS AND SETTINGS
			SOUND I. F. AND RATIO DETECTOR			
1	4.5 CW	Pin 1 of V301	Meter across pin 7 of V102 and ground.	L102 Pri. (bottom) L101	Tune for maximum reading on meter.	Signal level should be low enough to obtain approximately 4 to 6 volts on meter. Use isolation networks shown in Figures 2 and 3.
2	4.5 CW	"	Meter across ground and junction of R105 and C108.	L102 Sec. (top)	Tune for zero meter reading; use same signal level as in step 1.	Repeat tuning of L102 primary and secondary until adjustments do not change.
			TRAPS AND PICTURE I. F.			
3	4.5 CW	Pin 1 of V301	Meter connected through detector network to picture tube cathode lead.	L302	Tune for minimum reading on meter.	Detector and isolating networks shown in Figures 2 and 4.
4	41.25 CW	Mixer grid	Voltmeter across Pin #6 of V203	Top of L202	Tune for minimum reading on meter.	Apply -3V bias to AGC buss. See text for connection to mixer grid. Keep generator output low. Set contrast control for maximum contrast. Adjust signal level throughout I. F. alignment so that a -1 volt DC output is maintained across video detector load.
5	47.25 CW	"	"	Top of L203	"	
6	44. CW	"	"	L204	Tune for maximum.	
7	45.4 CW	"	"	L203	"	
8	43.25 CW	Mixer Grid	"	L202	Tune for maximum reading on meter.	
9	43 CW	"	"	L9	Tune for minimum reading on meter.	
10	43 CW	"	"	L201	Tune for maximum.	
11	45 CW	"	"	L9	Tune for maximum.	
			Repeat steps 4 through 10 until adjustments do not change.			
12	Approximately 43.5 with 10- mc sweep. Marker required.	Mixer grid	High gain scope across Pin 1 of V301 and ground.	Adjust L202, L203 and L204 if necessary.	Set 45.75 mc marker at 50% point with L202. Eliminate tilt with L204.	See Figure 5 for isolation network. Use markers to determine bandpass between picture carrier and 50% point on opposite skirt. Bandpass should be between 3.15 mc and 3.35 mc.

VHF TUNER

FIELD ADJUSTMENT OF RF OSCILLATOR

The following alignment procedure is intended only as a field operation, using television transmitter signals to correct minor misalignment of the oscillator on a few channels. This is generally evidenced by inability to peak the picture at or near the mid-point of the fine tuning control range.

The coils for each channel are independent of all other coils, and are switched in and out of the tuned circuits by rotating the turret. Access to the oscillator coil adjustment slugs is obtained through the hole above and to the right of the channel selector shaft with the fine tuning control in mid-range position.

To trim the oscillator on an individual channel, turn the selector switch to that channel and, using an insulated alignment tool, adjust the slug available through the access hole until the picture reception is peaked. This process may be repeated on all channels as required.

If these adjustments do not correct the condition, or if either sound or picture reception on all channels is below normal, it may be necessary to perform the complete bench alignment procedure as outlined in the alignment section.

TUNER MAINTENANCE

The entire turret drum, with coils in place, may be removed from the tuner chassis by removing the retaining springs at each end of the unit. This gives access to the components and tube sockets which are not accessible from the side of the tuner.

The high frequencies used in television make it necessary that extreme care be exercised in handling or servicing tuners. Location and lead dress of components and wiring are very critical. At high frequencies, wiring leads tend to act as small inductances and stray capacities; consequently any change made may appreciably alter the electrical characteristics of critical circuits. Parts location and ground connections should be maintained as originally made. When replacing components, it is important that they be replaced with parts of identical electrical characteristics and physical size.

TUBE REPLACEMENT

Replacement of tubes (especially 6J6 oscillator-mixer tubes) may cause excessive change in frequency of tuner circuits. This is due to differences of inter-electrode capacitances, unavoidable in the manufacture of tubes. When replacing a 6J6 tube, it is recommended that several tubes be tried in order to select a tube which will cause the least oscillator frequency shift. This practice will in most cases eliminate the need for realignment of the tuner.

CLEANING AND LUBRICATION

1. Remove the ground plate of the fine tuning assembly and slide the fine tuning shaft and blade off the drum shaft. Remove bottom cover plate. Remove the drum retaining springs at either end of the chassis. The complete drum may now be removed from the chassis.

2. Clean the coil board contacts and stator contacts with carbon tetrachloride applied with a light canvas cloth and lubricate with a pure, sulphur-free, mineral oil, such as "Nujol". Clean all bearing surfaces and lubricate these with switch grease or white "Vaseline". CAUTION: No abrasive should be used in cleaning contacts as some of the abrasive material may become imbedded in the silver contact causing excessive wear and noisy contacts.

MECHANICAL TROUBLES

Apart from tube failures, most troubles are likely to be mechanical. Firstly, if mechanical parts are broken, it must be determined whether to repair or replace the unit.

The turret drum, including coil boards may be removed from the tuner chassis by removing the turret retaining springs at each end.

IDENTIFICATION

The 303 chassis series includes all deluxe chassis used in the above indicated models of Hoffman television receivers. This service data applies to both VHF and All-Wave model receivers. Models using the All-Wave tuner are identified by a U following the Model number. If the All-Wave tuner is used, refer to Service Data #500 for service information. VHF tuner data is provided in this bulletin.

The 303 chassis has a power transformer with an additional 130 volt tap in the primary. This feature may be utilized in areas where power supply varies from the normal 117 volt AC. If the receiver is operated with line voltage around 130 volts, this connection may be used to provide correct operating voltage and assure added protection for all components in the chassis. Another feature added to improve set operation in extreme fringe areas is a removable jumper across R711. This jumper is easily reached by removal of bottom cover and may be clipped loose at one end to provide a negative 2 volt bias to grid of the video amplifier. (See General Circuit Description)

TABLE I
ELECTRICAL AND MECHANICAL DATA

Operating Voltage	115 volts AC 60 cps
Power Consumption	125 watts
VHF Tuner Range	Channels 2 through 13
All-Wave Tuner Range	Channels 2 through 83
Intermediate Frequencies	Sound Carrier 41.25 MC Picture Carrier 45.75 MC
Intercarrier Sound I.F.	4.5 MC
Audio Output Impedance	3.2 ohms
Audio Output	1.5 watts
Loudspeaker	P.M. type 3.2 ohm V.C.
Antenna Input Impedance	300 ohm balanced
Picture Tube Size	21" and 17" rectangular 70° deflection
Focus	Electrostatic
Video Response	To 3.25 MC

TABLE II
HOFFMAN TUBE COMPLEMENT

TUBE	TYPE	FUNCTION
V1 +	6BQ7A, 6BZ7	R.F. Amplifier
V2 +	6J6	Oscillator Mixer
V1 *	6T4, 6AF4	UHF Oscillator
V2 *	6BQ7A, 6BZ7	VHF R.F. Amplifier UHF I.F. Amplifier
V3 *	6U8	VHF Oscillator Mixer UHF I.F. Amplifier
V101	6AU6	Sound I.F. Amplifier
V102	6AL5	Ratio Detector
V103	6AV6	Audio Amplifier
V104	6K6GT	Audio Output
V201	6CB6	1st Picture I.F.
V202	6CB6	2nd Picture I.F.
V203A	1/2 6AS8	3rd Picture I.F.
V203B	1/2 6AS8	Video Detector
V301	6AH6	Video Amplifier
V501A	1/2 12AU7	1st Sync Separator
V501B	1/2 12AU7	2nd Sync Separator
V601	6C4	Vertical Oscillator
V602	6AQ5	Vertical Output
V701	6AL5	Horizontal Phase Det
V702	6SN7GT	Horizontal Oscillator
V703	6BQ6GT	Horizontal Output
V704	6W4GT	Damper
V705	1B3	High Voltage Rectifier
V302	21YP4A or 17HP4A	Picture Tube
X801	Sel. Rect.	Low Voltage Rectifier

* All Wave Tuner Only + VHF Tuner Only

The following equipment will be required in order to align the picture and sound I.F. stages of the receiver properly.

1. Accurate CW signal generator covering the following frequencies:

4.5 mc	43.25 mc
41.25 mc	45 mc
42.5 mc marker freq	45.4 mc
45.75 mc marker freq	47.25 mc
43 mc	44 mc

The generator must have an attenuation control which can be used to vary its output signal level.

2. Sweep frequency generator with a sweep center frequency of approximately 43.5 mc and a 10 mc sweep width.
3. Cathode ray oscilloscope with at least a moderately high vertical gain. Must have external sweep input or internal sweep frequency equal to the sweep generator sweep frequency and capable of phase control.
4. D. C. voltmeter with sensitivity of 20,000 ohms per volt or higher and voltage scale ranges which include approximately 10 volts and 3 volts (full scale deflection). VTVM with zero center scale adjustment is an ideal type.
5. 3 volt bias source such as a battery.
6. Detector network shown in Figure 1.
7. .005 uf isolating condenser.
8. 10K ohm, 1/2 watt composition resistor.
9. .001 uf condenser to shunt oscilloscope input.

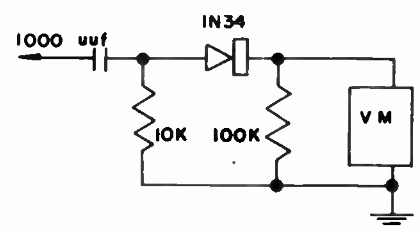


Figure 1. **Detector Network**

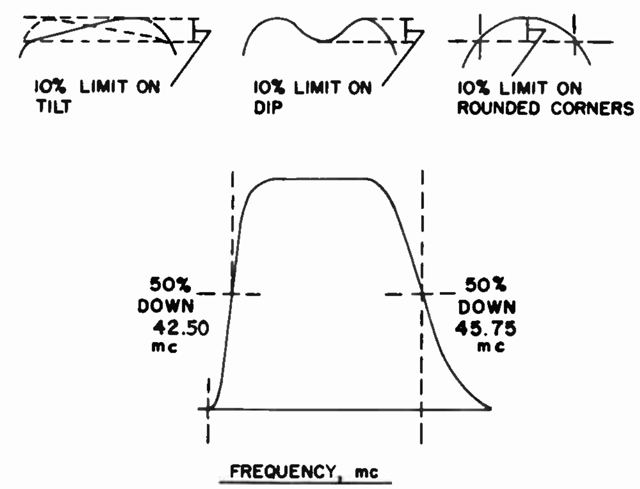


Figure 2. **Picture I-F Response Curve**

Before alignment is begun, tune the tuner off-channel by turning the tuner channel selector shaft so that the detent roller rests on one of the high points of the drum disc. In all steps of video I.F. alignment, the input signal should be maintained to a level of approximately one (1) volt D.C. output across video detector load. This is to insure against false tuning due to overloading.

It is important that the alignment be performed in order listed, with the exception of items 1 and 2, because there is some interaction within the various stages.

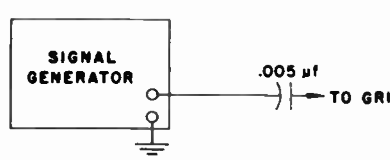


Figure 3. Signal Generator Isolation

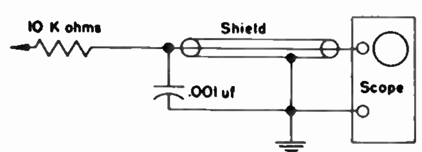


Figure 4. Oscilloscope Isolation

F-M SOUND CHANNEL ALIGNMENT

1. Connect 4.5 MC generator, 400 cycle 30% AM, to video amplifier grid (Pin 8).
2. Connect detector and oscilloscope (See Fig. 5 for circuit) to picture tube cathode.
3. Set contrast control to max. clockwise rotation, and volume control to one-half max. clockwise rotation.
4. Turn slug in primary (video amplifier plate winding) of ((L-109) sound take-off transformer completely out of coil winding in direction of chassis.
5. Turn slug in secondary (4.5 MC amplifier grid winding) of L-109 completely out of coil winding in direction away from chassis.
6. Turn slug in primary of L-109 into coil until a minimum oscilloscope deflection is obtained.
7. Remove detector and oscilloscope from picture tube cathode.
8. Connect oscilloscope input directly across secondary of audio output transformer.
9. Change 4.5 MC generator modulation from 400 cycles 30% AM to 400 cycles 7.5 KC FM.
10. Set buzz control approximately 90° from clockwise stop.
11. Reduce generator input below level where output limiting occurs.
12. Starting with slug completely out of coil winding on chassis side, adjust quadrature coil (L-106) for maximum oscilloscope indication. Turn volume control down as required to maintain pattern size on scope.
13. Adjust secondary of L-109 for maximum output indication on oscilloscope. Reduce generator output as required to keep signal level below output limiting.
14. Adjust L-111, sound coupling transformer between 4.5 MC amplifier plate and sound detector grid for maximum output indication on oscilloscope. Reduce generator output as required to keep signal level below output limiting.
15. Increase signal generator output to level above output limiting.
16. Change 4.5 MC generator modulation from 400 cycles 7.5 KC FM to 400 cycles 30% AM.
17. Adjust buzz control R-132 for minimum indication on oscilloscope.
18. Change 4.5 MC generator modulation from 400 cycles 30% AM to 400 cycles 7.5 KC FM.
19. Readjust quadrature coil L-106 for maximum output indication.
20. Reduce generator output below level of output limiting and recheck steps 13 and 14.

HORIZONTAL OSCILLATOR ALIGNMENT

1. Preset horizontal lock trimmer to one-half turn from full tight.
2. Connect receiver antenna terminals to source of test pattern signal of approximately 10,000 microvolts.
3. Adjust R-164 (horizontal hold) and/or T-108, horizontal frequency control to bring pattern into horizontal synchronization. Adjust all other controls for normal picture.
4. Connect oscilloscope, with 10 mmf in series, to terminal 4 of horizontal oscillator transformer. Adjust horizontal oscillator trap coil slug for waveform of Fig. 6. Readjust horizontal hold and/or horizontal frequency control as required to keep pattern in sync during this trap coil adjustment.
5. Disconnect scope lead.
6. Turn horizontal hold control fully counterclockwise.
7. Turn horizontal frequency adjustment out (counterclockwise) until picture is out of horizontal sync with diagonal bars sloping downward from left to right.
8. Turn horizontal frequency adjustment in (clockwise) until picture is just ready to fall in sync, as indicated by a wide balck vertical or diagonal bar.
9. Turn horizontal hold control clockwise until pattern falls out of sync. If pattern is still in sync at clockwise end of control, interrupt signal momentarily to knock picture out of sync.
10. Turn horizontal hold control slowly counterclockwise until picture just falls into sync. Observe number of diagonal bars present just before picture falls in sync.
11. If number of bars in step 10 is more than three, adjust horizontal lock control slightly clockwise. If number of bars in step 10 is less than two, adjust horizontal lock control slightly counter-clockwise.
12. Repeat steps 6 through 11 as required until number of bars in step 10 is two or three.
13. Check point on rotation of horizontal hold control at which picture just pulls in sync in step 10. Must be at least 60 degrees from maximum counterclockwise rotation.

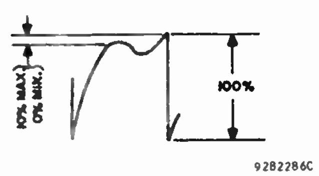


Fig. 6. Response Curve

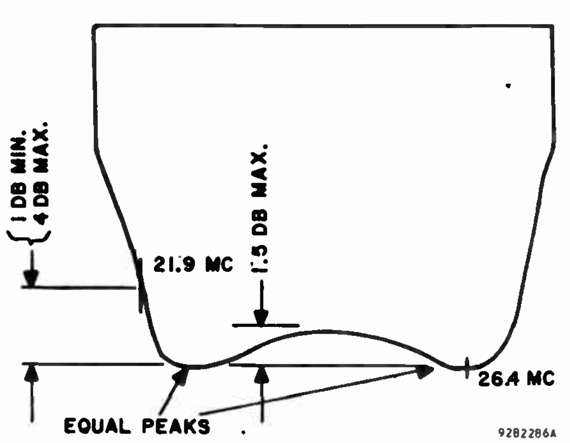


Fig. 7. Response Curve

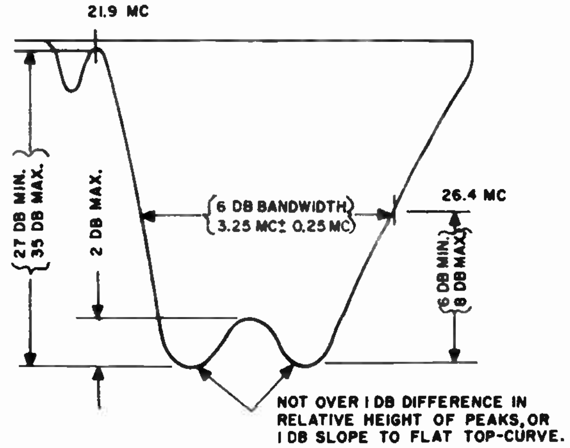


Fig. 8. Response Curve

SERVICE PARTS LIST

TRANSFORMERS AND COILS

Schematic Symbol	Description	Hallicrafters Part Number
T-101	Transformer, I-F output	50A623
T-102	Transformer, Heater	52C322
T-105	Transformer, Audio Output	55B248
T-106	Transformer, Vertical Blocking Oscillator	55B250
T-107	Transformer, Vertical Output	55C249
T-108	Transformer, Horizontal Blocking Oscillator	50B622
T-109	Transformer, Flyback; With H.V. Lead	55D251
L-101	Coil, I-F Input	51A1861
L-102	Coil, Coupling; 1st-2nd I-F	51A1854
L-103	Coil, Coupling; 2nd-3rd I-F with Trap	51A1862
L-104	Choke, Tweet Filter	53A307
L-105	Coil, Video Peaking; Wound on R-123 (4700 ohms 1/2 watt)	51A1855
L-106	Coil, Quadrature Grid (V-116)	51A1857
L-107	Coils, Deflection Yoke; including C-154	53D324
L-108	Choke, Filter	56B187
L-109	Coil, Sound Take-off	51A1858
L-110	Choke, Heater	53A292
L-111	Coil, Sound Coupling	51A1859
L-112	Coil, Video Peaking; wound on R-172 (27,000 ohms 1/2 watt)	51A1856

CAPACITORS

Schematic Symbol	Description	Hallicrafters Part Number
C-101	470 mmf. 2000 V., ceramic disc	47A472
C-102	470 mmf. 2000 V., ceramic disc	47A472
C-103	1000 mmf. 500 V., ceramic disc	47A230
C-104	1000 mmf. 500 V., ceramic disc	47A230
C-105	5000 mmf. 500 V., ceramic disc	47A168
C-106	5000 mmf. 500 V., ceramic disc	47A168
C-107	68 mmf. part of L-103	-------
C-108	5000 mmf. 500 V., ceramic disc	47A168
C-109	5000 mmf. 500 V., ceramic disc	47A168
C-110	1000 mmf. 500 V., ceramic disc	47A230
C-111	0.25 mfd. 25 V., paper tubular	46A242
C-112	10 mmf. 500 V., ceramic tubular	47CA20100F
C-113	0.1 mfd. 150 V., paper tubular	46A243
C-114	4.7 mmf. 500 V., ceramic tubular	47A160-6
C-115	33 mmf. 500 V., ceramic tubular	47A478
C-116	68 mmf. 500 V., ceramic tubular	47A479
C-117	0.1 mfd. 400 V., paper tubular	46AV104J
C-118	5000 mmf. 500 V., ceramic disc	47A168
C-119	0.01 mfd. 400 V., molded paper	46BR103E4
C-120	0.01 mmf. 200 V., paper tubular	46AU103J
C-121	33 mmf. 500 V., ceramic tubular	47A478
C-122	5000 mmf. 500 V., ceramic disc	47A168
C-123	0.01 mfd. 200 V., paper tubular	46AU103J
C-124	5000 mmf. 500 V., ceramic disc	47A168
C-125	15 mmf. 500 V., ceramic tubular	47A480
C-126	1000 mmf. 500 V., ceramic disc	47A230
C-127	0.02 mfd. 600 V., paper tubular	46AZ203J
C-128	0.02 mfd. 200 V., paper tubular	46AU203J
C-130	0.05 mfd. 200 V., paper tubular	46AU503J
C-132	5-200 mfd. 150 V., electrolytic	45B260
C-133	470 mmf. 500 V., ceramic tubular	47CA20471K
C-134	0.047 mfd. 400 V., molded paper	46BR473L4
C-135	0.033 mfd. 400 V., molded paper	46BR333E4
C-136	5000 mmf. 500 V., ceramic disc	47A168
C-137	5000 mmf. 500 V., ceramic disc	47A168
C-138	20 mfd. 450 V., electrolytic	45B261
C-139	140 mfd. 300 V., electrolytic	45B262
C-140	140-5 mfd. 300 V., 30-200 mfd. 150 V., electrolytic	45B263
C-141	20 mmf. 500 V., ceramic tubular	47CA20200K
C-142	10-160 mfd. HORIZONTAL LOCK TRIMMER	44A448
C-143	0.05 mfd. 400 V., paper tubular	46AW503J
C-144	0.25 mfd. 25 V., paper tubular	46A242
C-145	0.02 mfd. 200 V., paper tubular	46AU203J
C-146	33 mmf. 500 V., ceramic tubular	47A478
C-147	220 mmf. 500 V., ceramic tubular	47X20B221K
C-148	0.01 mfd. 400 V., paper tubular	46C244
C-149	1300 mmf. 500 V., mica	47X30B132K
C-150	560 mmf. 500 V., ceramic tubular	47CA25561K
C-151	0.05 mfd. 400 V., paper tubular	46AW503J
C-152	68 mmf. 3000 V., ceramic disc	47A473
C-153	0.1 mfd. 200 V., paper tubular	46AU104J
C-154	47 mmf. part of L-107	---------
C-155	1000 mmf. 500 V., ceramic disc	47A230
C-156	1000 mmf. 500 V., ceramic disc	47A230
C-157	270 mmf. part of PC-101	---------
C-158	0.01 mfd. part of PC-101	---------
C-159	25 mmf. part of PC-101	---------
C-160	0.005 mfd. part of PC-102	---------
C-161	0.005 mfd. part of PC-102	---------

RESISTORS

Schematic Symbol	Description	Hallicrafters Part Number
R-101	470,000 ohms 1/2 watt, carbon	23X20X474K
R-102	470,000 ohms 1/2 watt, carbon	23X20X474K
R-103	220 ohms 1/2 watt, carbon	23X20X221K
R-104	1000 ohms 1/2 watt, carbon	23X20X102K
R-105	2700 ohms 1/2 watt, carbon	23X20X272K
R-106	47 ohms 1/2 watt, carbon	23X20X470K

RESISTORS (Cont.)

Schematic Symbol	Description	Hallicrafters Part Number
R-107	15,000 ohms 1/2 watt, carbon	23X20X153K
R-108	4700 ohms 1/2 watt, carbon	23X20X472K
R-109	1000 ohms 1/2 watt, carbon	23X20X102K
R-110	1000 ohms 1/2 watt, carbon	23X20X102K
R-111	47 ohms 1/2 watt, carbon	23X20X470K
R-112	1000 ohms 1/2 watt, carbon	23X20X102K
R-113	12,000 ohms 1/2 watt, carbon	23X20X123K
R-114	180 ohms 1/2 watt, carbon	23X20X181K
R-115	1000 ohms 1/2 watt, carbon	23X20X102K
R-116	1000 ohms 1/2 watt, carbon	23X20X102K
R-117	1 megohm 1/2 watt, carbon	23X20X105K
R-118	5600 ohms 1/2 watt, carbon	23X20X562K
R-119	1 megohm 1/2 watt, carbon	23X20X105K
R-120	1500 ohms CONTRAST CONTROL	25B1102
R-122	39,000 ohms 1 watt, carbon	23X30X393K
R-123	4700 ohms 1/2 watt, part of L-105	-----------
R-124	10,000 ohms 2 watt, carbon	23X40X103K
R-125	8200 ohms 1/2 watt, carbon	23X20X822K
R-126	5 megohm BRIGHTNESS CONTROL	25B1096
R-127	100,000 ohms 1/2 watt, carbon	23X20X104K
R-128	15,000 ohms 2 watt, carbon	23X40X153K
R-130	150 ohms 1/2 watt, carbon	23X20X151K
R-131	18,000 ohms 1/2 watt, carbon	23X20X183K
R-132	500 ohm BUZZ CONTROL	25A1095
R-133	5600 ohms 1 watt, carbon	23X30X562K
R-134	470 ohms 1/2 watt, carbon	23X20X471K
R-135	330,000 ohm VOLUME CONTROL & ON-OFF SWITCH	25B1101
R-136	470,000 ohms 1/2 watt, carbon	23X20X474K
R-137	560,000 ohms 1/2 watt, carbon	23X20X564K
R-138	820,000 ohms 1/2 watt, carbon	23X20X824K
R-139	22,000 ohms 1/2 watt, carbon	23X20X223K
R-140	6800 ohms 1 watt, carbon	23X30X682K
R-141	4700 ohms 1/2 watt, carbon	23X20X472K
R-142	100 ohms 1/2 watt, carbon	23X20X102K
R-143	1.25 megohms VERTICAL HOLD CONTROL	25B1097
R-144	5600 ohms 1/2 watt, carbon	23X20X562K
R-145	15,000 ohms 1/2 watt, carbon	23X20X153K
R-146	5 megohm HEIGHT CONTROL	25B1098
R-147	750 ohm VERTICAL LINEARITY CONTROL	25B1099
R-148	18,000 ohms 2 watt, carbon	23X40X183K
R-149	120 ohms 1/2 watt, carbon	23X20X121K
R-150	390,000 ohms 1/2 watt, carbon	23X20X394K
R-151	820,000 ohms 1/2 watt, carbon	23X20X824K
R-152	7.2 ohms 5 watts, wirewound fuse type; with plug	25B1011
R-155	18,000 ohms 1 watt, carbon	23X30X183K
R-156	47,000 ohms 1 watt, carbon	23X30X473K
R-159	560,000 ohms 1/2 watt, carbon	23X20X564K
R-160	150,000 ohms 1/2 watt, carbon	23X20X154K
R-161	150,000 ohms 1/2 watt, carbon	23X20X154K
R-162	100,000 ohms 1/2 watt, carbon	23X20X104K
R-163	8200 ohms 1/2 watt, carbon	23X20X822K
R-164	145,000 ohm HORIZ. HOLD CONTROL	25B1100
R-165	27,000 ohms 1/2 watt, carbon	23X20X273K
R-166	100,000 ohms 1/2 watt, carbon	23X20X104K
R-167	150 ohms 1/2 watt, carbon	23X20X154K
R-168	2.7 megohms 1/2 watt, carbon	23X20X275K
R-169	18,000 ohms 1/2 watt, carbon	23X20X183K
R-170	470,000 ohms 1/2 watt, carbon	23X20X474K
•R-171	18,000 ohms 2 watt, carbon	23A096
R-172	27,000 ohms 1/2 watt; part of L-112	-----------
R-173	22 ohms 1/2 watt, carbon	23X20X220K
R-174	18,000 ohms 1/2 watt, carbon	23X20X183K
R-175	680,000 ohms 1/2 watt, carbon	23X20X684K
R-176	33,000 ohms 1 watt, carbon	23X30X333K
R-177	10,000 ohms 1/2 watt, part of PC-101	-----------
R-178	330,000 ohms 1/2 watt, part of PC-101	-----------
R-179	2.2 megohms 1/2 watt, part of PC-101	-----------
R-180	22,000 ohms 1/2 watt, part of PC-102	-----------
R-181	10,000 ohms 1/2 watt, part of PC-102	-----------

TUBES AND RECTIFIER COMPLEMENT

Schematic Symbol	Description	Hallicrafters Part Number
V-1	6BC5; R-F amplifier	90X6BC5
V-2	6J6; mixer/oscillator	90X6J6
V-101	6CB6; first i-f amplifier	90X6CB6
V-102	6CB6; second i-f amplifier	90X6CB6
V-103	6AM8; third i-f amplifier & video detector	90X6AM8
V-104	6AN8; video amplifier & sync clipper	90X6AN8
V-105	6U8; 4.5 mc amplifier & sync amplifier	90X6U8
V-106	6BN6; limiter detector & audio amplifier	90X6BN6

• Use Exact Replacement Part Only.

TUBES AND RECTIFIER COMPLEMENT (Cont.)

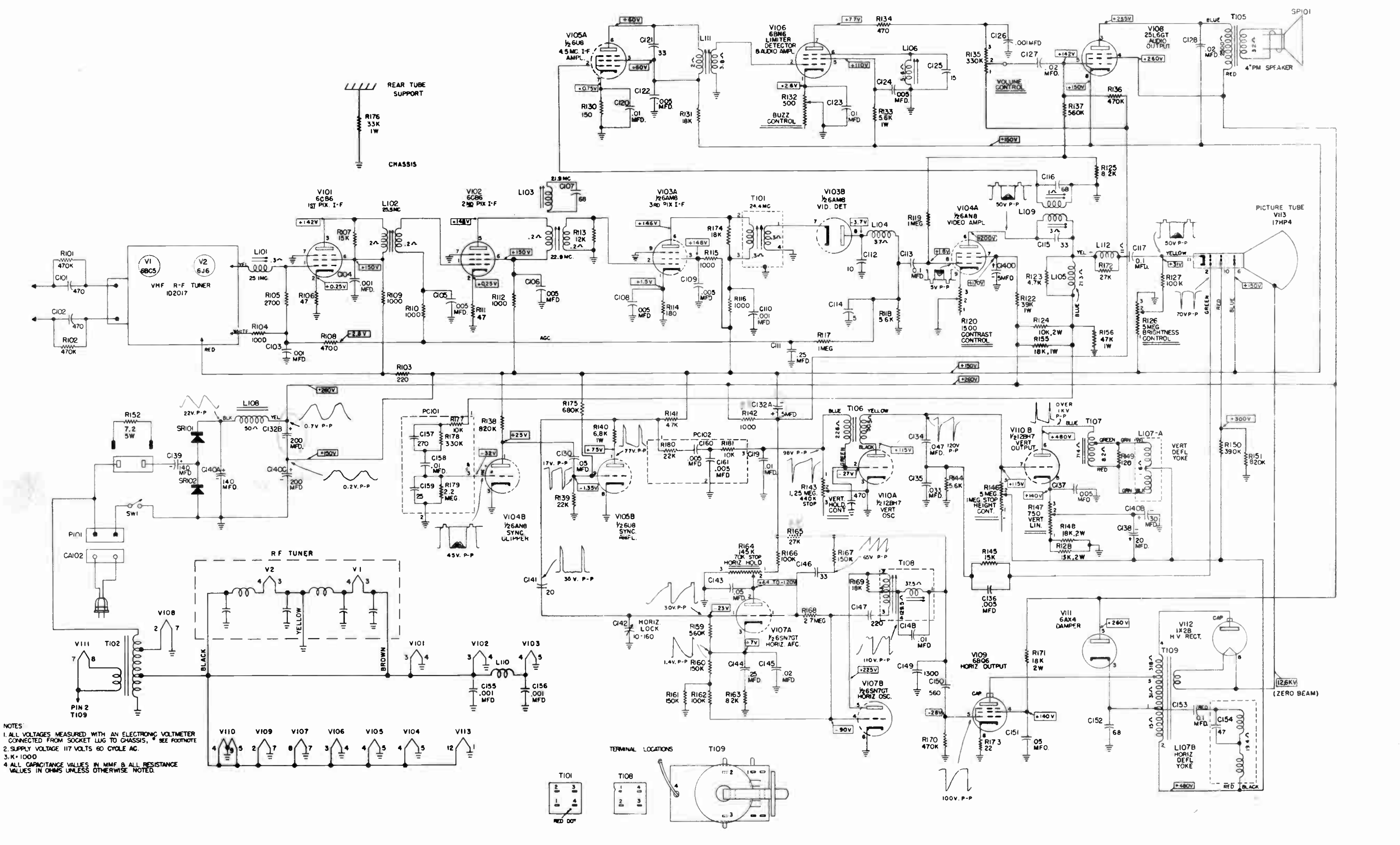
Schematic Symbol	Description	Hallicrafters Part Number
V-107	6SN7-GT; horiz. a.f.c. & horizontal oscillator	90X6SN7GT
V-108	25L6-GT; audio output	90X25L6GT
V-109	6BQ6-GT; horizontal output	90X6BQ6GT
V-110	12BH7; vertical oscillator & output	90X12BH7
V-111	6AX4; damper	90X6AX4
V-112	1X2B; high voltage rectifier	90X1X2B
V-113	17HP4; picture tube	90X17HP4
SR-101	Selinium rectifier: 300 mas	27A173
SR-102	Selinium rectifier: 300 mas	27A173

MISCELLANEOUS PARTS

Description	Hallicrafters Part Number
Board, chassis and pix tube mtg.; 17T310W	78F1131-1
Board, chassis and pix tube mtg.; 17T310M	78A1137-1
Board, chassis and pix tube mtg.; 17T310B	78A1138-1
Bracket, control mounting	67B2654
Bracket, deflection yoke mounting	67B2655
Bracket, front stop; left pix tube mtg.	67C2732
Bracket, front stop; right pix tube mtg.	67C2731
Bracket, rear tube support	67C2663
Bracket, top chassis support	67B2715
Channel, rubber; front pix tube mtg.	16A498
Channel, rubber; rear pix tube mtg.	16A411
Clip, C-140 mtg.	76A1258
Clip, shield; 9 pin miniature tubes	76A549
Clip, shield; 7 pin miniature tubes	76A402
Cushion, felt; pix tube mtg.	14A389
Grommet, rear tube support	8B2499
Ion trap	21B188
Network, sync takeoff; including C-157, 158, & 159 and R-177, 178, & 179	49A045
Network, vert. int; including C-160 & 161 and R-180 & 181	49A044
Pad, rubber; for pix tube stop mtg. brackets	16A353
Plate, rear tube support	63A1110
Rod, tie; left	74B734
Rod, tie; right	74B733
Shield, miniature tube; for V-101 & V-102	69A232
Shield, tube; for V-103	69A667
Shield, tube; for V-106	69A666
Socket, interlock; male	10A498
Socket, 9 pin min. wafer; 1-1/8" mtg. ctrs.	6A334
Socket, 9 pin min. wafer; 1-1/8" mtg. ctrs; with dummy lug	6B616
Socket, 9 pin molded mica filled, 1-1/8" mtg. ctrs.	6A441
Socket, octal molded; 1-1/2" mtg. ctrs.; pins 1 & 4 deleted	6A440
Socket, octal molded; 1-5/16" mtg. ctrs.	6A436
Socket, pix tube	6A622
Socket, 7 pin wafer; 1" mtg. ctrs.	6B340
Socket, 7 pin wafer; 1" mtg. ctrs.; with dummy lug	6A434
Socket, two prong; R-152 mtg.	10A499
Spring, pix tub ground	75B312
Strap assembly; pix tube mtg.	76B1025
VHF tuner with tubes	1D2017

CABINET PARTS

Description	Hallicrafters Part Number
Cabinet, 17" table; walnut wood (17T310W)	78F1131
Cabinet, 17" table; mahogany wood (17T310M)	78A1137
Cabinet, 17" table; blonde wood (17T310B)	78A1138
Cabinet back	8C2486
Cabinet back assembly; complete	41A25598
Cabinet back assembly; less snap-in pix tube shield	41A25599
Glass retainer clip	76A1260
Glass, safety	22C423
Knob, fine tuning	15D762
Knob, channel selector	15D761
Knob, control	15A775
Line cord and plugs	87B1668-1
Mask, picture tube	7C574
Shield picture tube	69C668
Speaker, 4" P.M. dynamic	35C175



NOTES:

1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS, * SEE FOOTNOTE
2. SUPPLY VOLTAGE 117 VOLTS 60 CYCLE AC.
3. K=1000
4. ALL CAPACITANCE VALUES IN MMF & ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.

* SOME VOLTAGES ARE VARIABLE, & VOLTAGES SHOWN WERE MEASURED WITH A NORMAL PICTURE ON THE PICTURE TUBE AND THE CONTRAST AND BRIGHTNESS CONTROL SET FOR 50 VOLTS PEAK TO PEAK ON THE CATHODE (PIN 11) OF THE PICTURE TUBE. SOCKET VOLTAGE TOLERANCE ± 10%.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF
17" CHASSIS
A1600D RUN 1
SCHEMATIC DIAGRAM

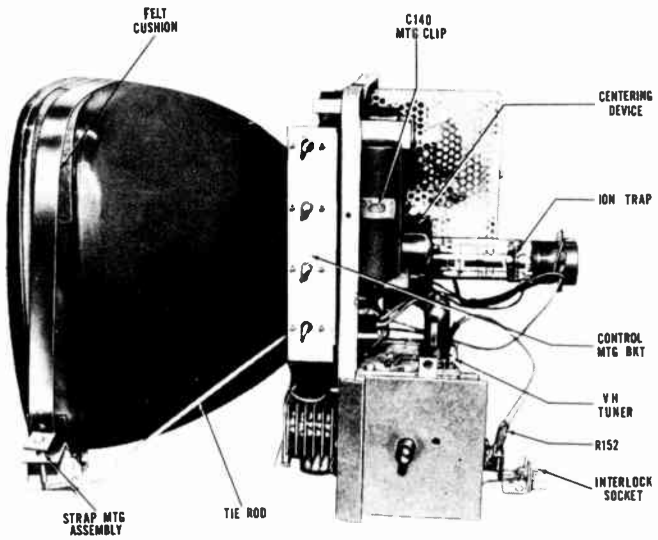
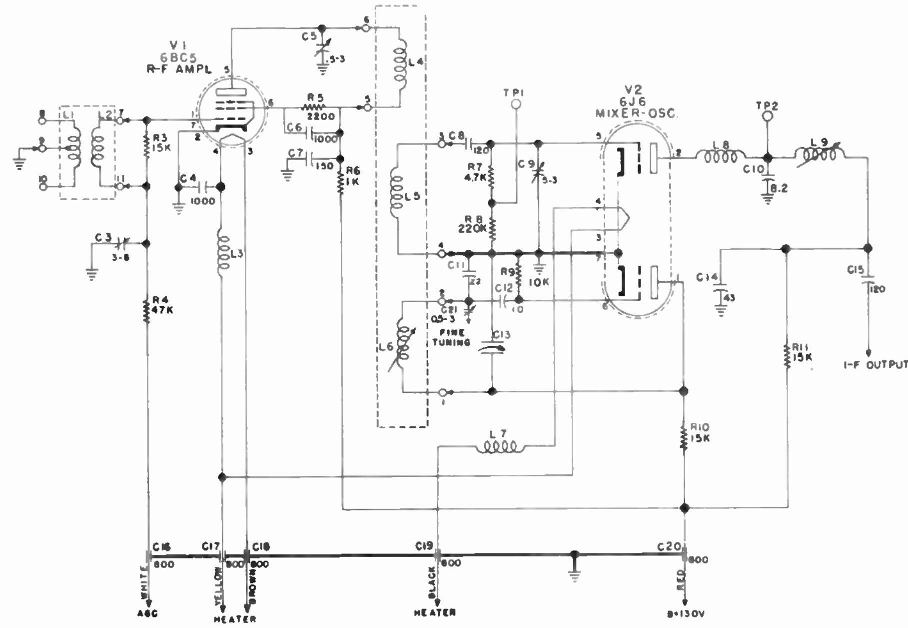


Fig. 1. Picture Tube Mounting A1600D Chassis

92X2283



NOTES:
1. ALL CAPACITANCE IN MMF, AND ALL RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. K=1000.

Fig. 3. Schematic 1D2017 VHF Tuner

89D604

GENERAL SPECIFICATIONS

TUBES	15 plus 2 Selinium Rect.
ANTENNA	Built-in or External
ANTENNA INPUT	300 Ohms
TUNING	12 Channels 2-13
PICTURE TUBE	17HP4
PICTURE CARRIER I-F	26.25 MC
SOUND CARRIER I-F	21.75 MC
SOUND I-F	4.5 MC
POWER SUPPLY	110-120 volts 60 cycles
POWER CONSUMPTION	150 watts

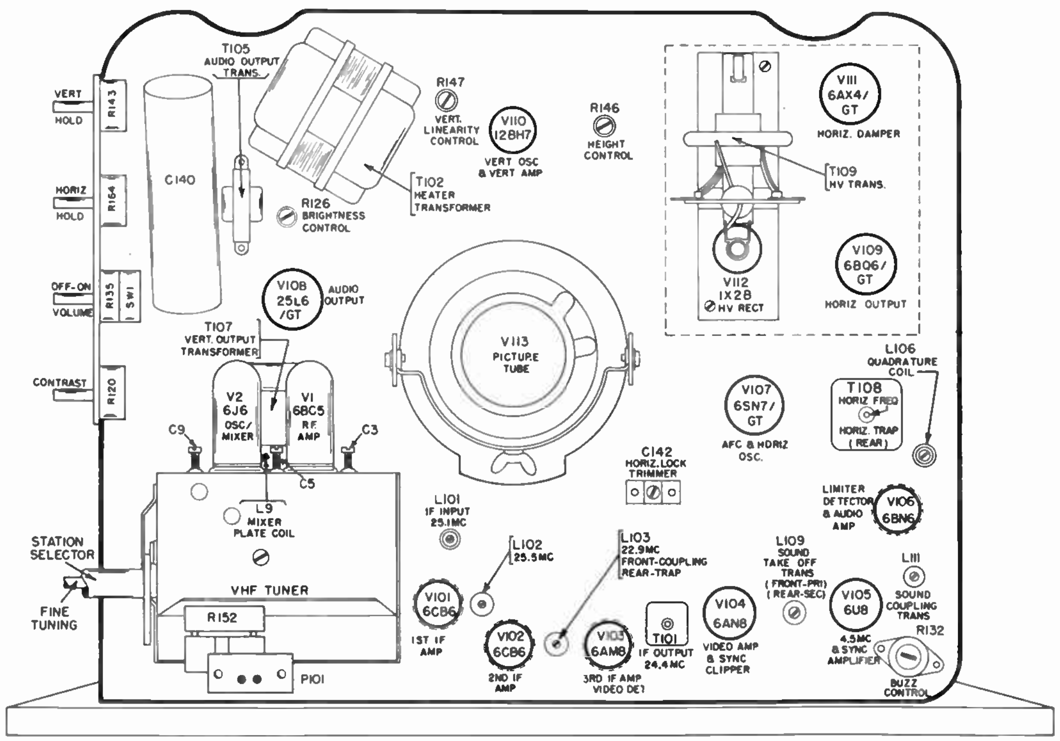


Fig. 2. Tube and Alignment Locations 1600D Chassis

GENERAL ALIGNMENT INSTRUCTIONS

1. Maintain AC supply voltage at 117 volts.
2. Disable horizontal output amplifier. (Example: by removing 6AX4 damper tube from socket.)
3. Use suitable resistance load (2250 ohms - 30 watts) to simulate DC current drain of horizontal output amplifier.

I-F ALIGNMENT

1. Turn tuner channel selector to Channel 13.
2. Connect sweep generator output to mixer grid through access hole provided for this purpose in side of tuner case. Use the shortest and most direct leads possible to make this connection.
3. Apply - 3 volts bias to IF AGC circuit.
4. Connect a detector and oscilloscope (See Fig. 4 for circuit) to plate (Pin 5) of 1st IF amplifier.
5. Adjust mixer plate coil and 1st IF amplifier grid coil as required to obtain the response curve shown in Fig. 7.
6. Remove detector and oscilloscope from plate of 1st IF amplifier tube.
7. Connect oscilloscope input across video detector load resistor, using 3300 ohm isolation resistor in series with "high" side.
8. Adjust remaining three IF coils as required to obtain a response curve within the specifications of Fig. 8. In order to accomplish this, it is necessary to:
   - a) tune the 1st IF amplifier plate coil (L102) toward the high frequency end of the desired pass band.
   - b) tune the 2nd IF amplifier plate coil (L103) toward the low frequency end of the desired pass band, keeping the trap coil on this coil form adjusted for a response minimum at 21.9 mc.
   - c) tune the third IF amplifier plate coil (T101) approximately to the center of the desired pass band.

NOTES

(1) The construction of some picture IF coils on the chassis proper is such that each has two positions of the tuning slug which may appear as proper tuning points. The sound trap on the 2nd IF amplifier plate coil (L103) should be tuned with the slug entering the coil from the end away from the chassis pan. All others should be tuned with the slug entering the coil from the end nearest the chassis pan.

(2) Care should be taken during all steps of the picture IF alignment to use a combination of oscilloscope gain and sweep generator signal level which will result in a response curve display of adequate size without overload.

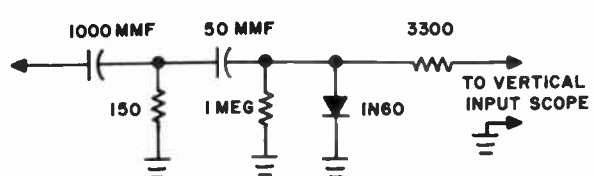


Fig. 4. Detector Circuit

92B2285A

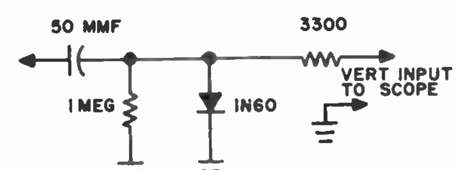


Fig. 5. Detector Circuit

92B2285B

PICTURE TUBE MOUNTING COMPONENTS

Schematic Symbol	Description	Hallicrafters Part Number For Chassis A1300D B1300D C1300D D1300D	E1300D F1300D	H1300D J1300D 17"	H1300D J1300D 21"
V-116	Picture tube	90X17HP4	90X21AP4	90X17HP4	90X21YP4
	Bracket, deflection yoke mtg.	67C1244	67C1244	67C1244	67C1244
	Bracket, focus magnet mtg.	------	67B2271	------	------
	Bracket, front right pix tube support	67D2312	67C2030	67D2312	67C2610
	Bracket, front left pix tube support	67D2313	67C2031	67D2313	67C2609
	Bracket, rear pix tube support	67A1987	67A2035	67A1987	67A2035
	*Bracket, spacer; front	------	8E2296	------	------
	*Bracket, spacer; rear	------	8E2295	------	------
	Bracket, strap mounting	------	------	------	67A2215
	Centering device	21C158	------	21C158	21C158
	Collar, rubber; pix tube mtg.	16A346	16A346	16A346	16A346
	Cushion, sponge rubber; pix tube mtg.	16A316	------	16A316	16A329
L-118	Deflection yoke	53A271	------	------	------
L-118-1	Deflection yoke	------	53C303	------	------
L-118-2	Deflection yoke	------	------	53C320	53C320
	Focus magnet with centering control	------	See Model Data	------	------
	Ion trap	21A145	21A146	21A145	21A145
	Keeper, pix tube anode lead	8A1375	------	8A1375	8A1375
	Pad, pix tube mtg.; rubber channel	16A354	------	16A237	16B392
	Pad, stop; rubber	16A353	16A291	16A353	16A405
PL-101	Plug, pix tube anode; with lead	10A500	------	10A500	10A500
	Plug, deflection yoke	10A407	------	------	------
	Polyethylene mtg. ring; metal pix tube	------	7E313	------	------
	Rod, rear bracket support	------	------	74A696	74A731
	Screw, deflection yoke adjustment	3A1610	3A1610	3A1610	3A1610
	Sleeve, insulating; anode lead	65A542	65A542	65A542	65A542
	Sleeve, insulating; high voltage	------	65A535	------	------
	Socket, assembly, picture tube	6A465	6A484	6A465	6A465
	Spacer, deflection yoke adj. screw	73A580	73A580	73A580	73A580
	Spring, anode keeper; 1-1/2" long	75A202	------	75A202	75A315
	Spring, anode keeper; 3-1/4" long	75A203	------	75A315	75A203
	Spring, pix tube ground and shield	75B246	------	76B246	76B246
	Spring, rear support; pix tube	75A268	75A272	------	------
	Strap, pix tube mounting	------	------	------	76A1071
	Strap, pix tube mounting; with end brackets	76B1025	76A848	76B1024	------
	Strap, copper; anode connector	------	76A371	------	------
	Wire, high voltage; second anode	------	87A4173	------	------
	Yoke cap	------	8C2222	------	------

* Not found on all chassis.

1E1855 TUNER

L-304	I-F output coil	83-62978	121A294
V-301	6T4: Oscillator tube	74-45038	90X6T4
X-301	1N82: mixer crystal; less leads	63-63309	121A295
C-305	Butterfly trimmer assembly	9A63307	121A296
C-307	33 mmf. 5% ceramic disc	73-45118	121A297
C-308 & 311	800 mmf. ceramic feed thru; 1/8" diam. body	73-63002	121A298
C-308 & 311	800 mmf. ceramic feed thru; 3/16" diam. body	73-63532	121A240
	Adjustment slug for C-309	9525	121A302
	Bottom cover	47-62387	121A299
	Looker point (test terminal)	8-59793	121A300
	Tube shield	7-62666	121A301

SERVICE PARTS LISTS FOR 1E1846 & 1B1969 CASCODE VHF TUNERS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
	CAPACITORS		
¶C-1	800 mmf. GMV. 1/8" diam. ceramic feed thru	73-45199	121A239
C-2	1.8 mmf. 5% ceramic gimmick	73-44371	121A241
C-3	1-3 mmf. tubular trimmer (r-f grid)	9-59989	121A242
C-4	5.0 mmf. 5% NPO ceramic disc	73-45111	121A243
C-5	0.7-2 mmf. tubular ceramic trimmer (r-f plate)	9-59990	121A244
C-6	800 mmf. GMV. ceramic disc	73-45119	121A245
¶C-7	800 mmf. GMV. 1/8" diam. ceramic feed-thru	73-62905	121A246
C-8	47 mmf. 10% CP-1 ceramic disc	73-45117	121A247
C-9	47 mmf. 10% CP-1 ceramic disc	73-45117	121A247
C-10	1-3 mmf. tubular ceramic trimmer (mixer grid)	9-59989	121A242
C-11	10 mmf. 10% NPO ceramic disc	73-45109	121A248
*C-12	82 mmf. ceramic tubular	Part of antenna input assembly	
*C-13	82 mmf. ceramic tubular	Part of antenna input assembly	
¶C-14	800 mmf. GMV. 1/8" diam. ceramic feed-thru	73-45199	121A239
C-15	10 mmf. 10% N750 ceramic disc	73-45116	121A249
C-16	10 mmf. 10% N750 ceramic disc	73-45116	121A249
C-17	1.0-3 mmf. tubular ceramic trimmer (osc. plate)	9-59989	121A242
C-18	Fine tuning control	See Miscellaneous Parts List	
*C-19	4.7 mmf. 5% ceramic gimmick	Part of antenna input assembly	
C-20	800 mmf. GMV. ceramic disc	73-45119	121A245
C-21	800 mmf. GMV. ceramic disc	73-45119	121A245
C-22	Adjustable wire gimmick	73-60025	121A250
C-23	1.5 mmf. 5% ceramic gimmick	73-44369	121A251
C-24	10 mmf. 10% NPO ceramic disc	73-45109	121A248
¶C-25	800 mmf. GMV. 1/8" diam. ceramic feed thru	73-45199	121A239

* - Not found on all tuners.
¶ - This capacitor may be furnished with 3/16" diameter . . . 73-63532 . . . 121A240

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
	RESISTORS		
R-1	3900 ohms 1/2 watt, carbon	74-37991	23X20X392K
R-4	2.2 megohms 1/2 watt, carbon	74-38107	23X20X225K
R-5	1.8 megohms 1/2 watt, carbon	74-38103	23X20X185K
R-6	470 ohms 1/2 watt, carbon	74-37953	23X20X471K
R-7	10,000 ohms 1/2 watt, carbon	74-38009	23X20X103K
R-8	180,000 ohms 1/2 watt, carbon	74-38061	23X20X184K
R-9	10,000 ohms 1/2 watt, carbon	74-38009	23X20X103K
R-10	4700 ohms 1/2 watt, carbon	74-37995	23X20X472K
R-11	10,000 ohms 1/2 watt, carbon	74-38009	23X20X103K
	TUBES		
V-1	6BK7A Cascode R-F amplifier	77-45037	90X6BK7A
V-2	6J6 Oscillator/Mixer	77-40167	90X6J6
	COILS		
L-1,2,3,4,5	Plug-in coil strip; Channel 2	83A63586	121A252
L-1,2,3,4,5	Plug-in coil strip; Channel 3	83A60257	121A253
L-1,2,3,4,5	Plug-in coil strip; Channel 4	83A60258	121A254
L-1,2,3,4,5	Plug-in coil strip; Channel 5	83A60259	121A255
L-1,2,3,4,5	Plug-in coil strip; Channel 6	83A60260	121A256
L-1,2,3,4,5	Plug-in coil strip; Channel 7	83A60261	121A257
L-1,2,3,4,5	Plug-in coil strip; Channel 8	83A60262	121A258
L-1,2,3,4,5	Plug-in coil strip; Channel 9	83A60263	121A259
L-1,2,3,4,5	Plug-in coil strip; Channel 10	83A60264	121A260
L-1,2,3,4,5	Plug-in coil strip; Channel 11	83A60265	121A261
L-1,2,3,4,5	Plug-in coil strip; Channel 12	83A60266	121A262
L-1,2,3,4,5	Plug-in coil strip; Channel 13	83A60267	121A263
L-6	Coil, Plate/Cathode coupling	83A60269	121A264
L-7	Choke, mixer grid	83-60024	121A265
L-8	Choke, mixer plate	83A60479	121A266
L-9	Coil, output coupling	83-60276	121A267
L-10	Choke, mixer heater	83-61101	121A268
*L-11	Coil, 41 MC antenna series trap	Part of antenna input assembly	
*L-12	Coil, 41 MC antenna parallel trap	Part of antenna input assembly	
*L-13	Coil, 41 MC antenna parallel trap	Part of antenna input assembly	

SERVICE PARTS LIST FOR 1E1852 VHF TUNERS

COILS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
L-6	Choke, Heater; 6BZ7	34A-546	121A049
L-7	Coil, Plate/cathode coupling	31B-629	121A050
L-8	Choke, Heater; 6J6	31B-575	121A051
L-9	Coil, Output peaking adj.	31B-682	121A150
L-10	Coil, Peaking; 6J6 plate	31B638-1	121A151
L-11	Coil, Neutralizing	34A-680	121A152
L-12	Trap, fixed antenna; wound on C-1	31B-649	121A153
L-13	Trap, fixed antenna; wound on C-2 (Black)	31B-601	121A154
L-14	Trap, 40-54 MC antenna	31B-289	121A155

CAPACITORS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
C-1	68 mmf. 500 V., ceramic; part of L-12	-------	-------
C-2	68 mmf. 500 V., ceramic; part of L-13	-------	-------
C-3	0.5 to 3 mmf. ceramic trimmer; r-f plate adj.	31A-056	121A158
C-4	800 mmf. 500 V., GMV. ceramic feed-thru	31D-196	121A156
C-5	3.0 mmf. ± .25 mmf. NPO. ceramic disc	13L8C-030C	121A157
C-6	0.5 to 3 mmf. ceramic trimmer; mixer grid adj.	31A-056	121A158
C-7	1000 mmf. 500 V., GMV. ceramic disc	13L8X-102Z	121A159
C-8	5.0 mmf. ± .25 mmf. N900 ceramic disc	13L8UA-050C	121A160
C-9	47 mmf. 10% N1400 ceramic disc	13L8Q-470K	121A161
C-10	10 mmf. 10% NPO ceramic disc	13L10C-100K	121A162
C-11	6.8 mmf. ± .4 mmf. NPO ceramic disc	13L8C-6R81	121A163
C-12	120 mmf. 10% 500 V., ceramic disc	13L8D-121K	121A164
C-13	3 to 9 mmf. ceramic trimmer; r-f grid adj.	31A-079	44A434
C-14	800 mmf. 500 V., GMV. ceramic feed-thru	13D-153	121A048
C-15	800 mmf. GMV. 500 V., ceramic feed-thru	13D-153	121A048
C-16	800 mmf. GMV. 500 V., ceramic feed-thru	13D-153	121A048
C-17	800 mmf. GMV. 500 V., ceramic feed-thru	13D-153	121A048
C-18	1000 mmf. GMV. 500 V., ceramic disc	13L8X-102Z	121A159
C-19	Fine Tuning Air Trimmer	See Miscellaneous Parts	
C-20	75 mmf. 3% 500 V., N470 ceramic disc	13XR1-30TU750H.	121A166
C-21	1000 mmf. GMV. 500 V., ceramic disc	13L8X-102Z	121A159
C-22	1000 mmf. GMV. 500 V., ceramic disc	13L8X-102Z	121A159
C-23	3 to 9 mmf. ceramic trimmer; 40-54 mc. trap	31A-079	44A434
C-24	3.0 mmf. ± .5 mmf. NPO ceramic disc	13L8C-030D	121A167
C-25	Wire Gimmick	31B-120	121A168

RESISTORS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
R-1	330,000 ohms 1/2 watt, carbon	12TAE334K	23X20X334K
R-2	220,000 ohms 1/2 watt, carbon	12TAE224K	23X20X224K
R-3	222,000 ohms 1/2 watt, carbon	12TAE224K	23X20X224K
R-4	15,000 ohms 1/2 watt, carbon	12TAE153K	23X20X153K
R-5	470 ohms 1/2 watt, carbon	12TAE471K	23X20X471K
R-6	4700 ohms 1/2 watt, carbon	12TAE472K	23X20X472K
R-7	10,000 ohms 1/2 watt, carbon	12TAE103K	23X20X103K
R-8	15,000 ohms 1/2 watt, carbon	12TAE153K	23X20X153K
R-9	47,000 ohms 1/2 watt, carbon	12TAE473K	23X20X473K
R-10	15,000 ohms 1/2 watt, carbon	12TAE153K	23X20X153K

MISCELLANEOUS

Schematic Symbol	*	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
V-1	1	Tube, R-F amplifier	6BZ7	90X6BZ7
V-2	2	Tube, Oscillator Mixer	6J6	90X6J6
	3	Shield, R-F tube	16S-010	121A169
	4	Shield, Oscillator/mixer tube	16S-009	121A170
	5	Shield, side	31B-143	121A046
	6	Shield, bottom cover	31B-103	121A045
	7	Roller, detent	31B-016	121A027
	8	Spring, detent	31B-005	121A031
	9	Spring, front shaft retaining	31B-030	121A030
	10	Spring, rear shaft retaining	31B-030	121A030
	11	Spring, fine tuning shaft ground	Part of drum assembly	
	12	Plate, fine tuning ground	31B-124	121A171
	13	Strap, fine tuning mounting	31B-021	76A1096
	14	Washer, fiber	11D-022	121A028
	15	Fine tuning hot plate and lead	31B-252	87A4174

SERVICE PARTS LISTS FOR 1E1852 VHF TUNERS (Cont.)

Schematic Symbol	*	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
C-13	16	Trimmer, ceramic; with lead; r-f grid	31A-079	121A063
C-3	17	Trimmer, ceramic; with lead; r-f	31A-056	121A060
C-6	18	Trimmer, ceramic; with lead; mixer grid	31A-056	121A060
	19	Nut, trimmer spring	10E-401	121A257
	20	Screw, trimmer adjustment	9A-410-7	121A061
	21	Contact bracket assembly	31B-278	121A044
C-23	22	Trimmer, ceramic; with lead; 40-54 mc trap	31A-079	121A063
	25	Core, oscillator adjustment	31B-041	121A172
	26	Spring, core retaining	31A-010	121A034
	27	"C" Ring	31A-152	121A105
	28	Fine tuning shaft and spring	31A-083-14	121A173
	29	Drum assembly, less coils; with fine tuning shaft and blade	31B-701-16	121A174
	38	Core, I-F output coil adjustment	20C-055	77A631
L-9	40	Coil, I-F output; complete assembly	31B-682	121A175
L-1, 2	41	Antenna strip, Channel 2	31M-012-2R	121A176
L-1, 2	42	Antenna strip, Channel 3	31M-012-3R	121A177
L-1, 2	43	Antenna strip, Channel 4	31M-012-4R	121A178
L-1, 2	44	Antenna strip, Channel 5	31M-012-5R	121A179
L-1, 2	45	Antenna strip, Channel 6	31M-012-6R	121A180
L-1, 2	46	Antenna strip, Channel 7	31M-012-7R	121A181
L-1, 2	47	Antenna strip, Channel 8	31M-012-8R	121A182
L-1, 2	48	Antenna strip, Channel 9	31M-012-9R	121A183
L-1, 2	49	Antenna strip, Channel 10	31M-012-10R	121A184
L-1, 2	50	Antenna strip, Channel 11	31M-012-11R	121A185
L-1, 2	51	Antenna strip, Channel 12	31M-012-12R	121A186
L-1, 2	52	Antenna strip, Channel 13	31M-012-13R	121A187
L-3,4,5	53	Oscillator strip, Channel 2	31M-112-2R	121A188
L-3,4,5	54	Oscillator strip, Channel 3	31M-112-3R	121A189
L-3,4,5	55	Oscillator strip, Channel 4	31M-112-4R	121A190
L-3,4,5	56	Oscillator strip, Channel 5	31M-112-5R	121A191
L-3,4,5	57	Oscillator strip, Channel 6	31M-112-6R	121A192
L-3,4,5	58	Oscillator strip, Channel 7	31M-112-7R	121A193
L-3,4,5	59	Oscillator strip, Channel 8	31M-112-8R	121A194
L-3,4,5	60	Oscillator strip, Channel 9	31M-112-9R	121A195
L-3,4,5	61	Oscillator strip, Channel 10	31M-112-10R	121A196
L-3,4,5	62	Oscillator strip, Channel 11	31M-112-11R	121A197
L-3,4,5	63	Oscillator strip, Channel 12	31M-112-12R	121A198
L-3,4,5	64	Oscillator strip, Channel 13	31M-112-13R	121A199
	--	Socket, 9 pin; R-F tube	27B-014	121A200
	--	Socket, 7 pin; Osc. Mixer tube	27A-016	121A201

* Refers to Corresponding Number in Fig. 65A.

1E1660 TUNER

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
V-301	6J6: Oscillator tube	77-45872	90X6J6
X-301	1N82: Mixer crystal; less leads	63-60544	121A339
X-302	G7B: Crystal harmonic generator	63-61863	121A102
C-304	33 mmf. 5% ceramic disc. capacitor	73-45118	121A297
C-306	10 mmf. ceramic capacitor	73-45109	121A337
C-312 & 316	800 mmf. ceramic feed-thru; 1/8" diam.	73-63002	121A298
C-312 & 316	800 mmf. ceramic feed-thru; 3/16" diam	73-63532	121A240
R-302	270 ohms 1/2 watt, carbon	74-37942	23X20X271K
	Adjustment for C-309; 6-32 screw	1479D	121A334
	Bottom cover	47-60403	121A338
	Pulley	26-29309	121A336
	Tension nut for C-309 adj.	37-33505	121A333
	Tube shield	7-61903	121A335

SERVICE PARTS LIST FOR 12 POSITION 1C1717 TUNERS

TRANSFORMERS AND COILS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
T-1	Transformer, VHF antenna input	1921-1	51A1684
L-2	Coil, R-F grid assembly; part of S1A	----	----
L-3	Coil, R-F plate; Channel 13 Adj.	1984-14	51A1685
L-6	Coil, Mixer grid; Channel 13 Adj.	1785-52	51A1686
L-7	Coil, Osc. grid; Channel 13 Adj.	2051-1	121A146
L-8	Coil, Osc. grid; Channel 6 Adj.	2051-4	121A147
L-9	Coil, Output coupling Adj.	1790-10	121A148
L-11	Coil, cathode/plate coupling	1785-49	51A1690
L-12	Choke, heater	1894-1	53A296
L-13	Choke, heater	1894-2	53A297
L-14	Coil, neutralizing	1911-5	121A149

TUBES

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
V-1	6BZ7 Dual Triode R-F Amplifier	55	90X6BZ7
V-2	6J6 Dual Triode Oscillator/Mixer	50	90X6J6

CAPACITORS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
C-1	7.5 mmf. 10% ceramic stand-off	2043-1	47A362
C-2	4 mmf. 5% NPO ceramic tubular	163-040	121A114
C-3	1.6 mmf. ceramic gimmick	2101-169	121A071
C-4	800 mmf. GMV. ceramic disc	2033-2	47A355
C-5	470 mmf. ceramic feed-thru.	2023-2	47A357
C-6	100 mmf. ceramic tubular; part of S1B	137-1	121A115
C-7	800 mmf. GMV. ceramic disc	2033-2	47A355
C-8	1.2 mmf. ceramic gimmick	2101-129	121A121
C-9	0.56 mmf. ceramic gimmick	2101-568	121A073
C-10	0.33 mmf. ceramic gimmick	2101-338	121A122
C-11	Fine tuning air trimmer	1713-502	121A117
C-12	1.5 mmf. ± 25 mmf. ceramic tubular	166-159	121A123
C-13	10 mmf. 5% ceramic tubular	168-100	121A118
C-14	0.39 mmf. ceramic gimmick.	2101-398	121A124
C-15	15 mmf. 10% ceramic tubular	162-150	121A119
C-16	140 mmf. 5% ceramic tubular	181-141	121A125
C-17	5000 mmf. GMV. ceramic disc	2033-7	47A168
C-19	470 mmf. 20% special tubular	136-1	121A826
C-20	800 mmf. GMV. ceramic disc	2033-2	47A355
C-21	800 mmf. GMV. ceramic disc	2033-2	47A355

CAPACITORS (Cont.)

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
C-22	800 mmf. GMV. ceramic disc	2033-2	47A355
C-23	62 mmf. 10% ceramic tubular	161-620	121A126

RESISTORS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
R-1	4700 ohms ½ watt, carbon.	106-472	23X20X472K
R-2	1 megohm 5% ½ watt, carbon	101-105	23X20X105K
R-3	750,000 ohms 5% ½ watt, carbon	101-754	23X20X754J
R-4	470 ohms ½ watt, carbon	106-471	23X20X471K
R-5	220,000 ohms ½ watt, carbon	106-224	23X20X224K
R-6	15,000 ohms ½ watt, carbon	106-153	23X20X153K
R-7	8200 ohms ½ watt, carbon.	106-822	23X20X822K
R-8	2700 ohms ½ watt, carbon.	106-272	23X20X272K
R-9	10,000 ohms ½ watt, carbon	106-103	23X20X103K

SERVICE PARTS LIST FOR VHF 16 POSITION 1E1670 & 1E1718 TUNERS

CAPACITORS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
C-1	800 mmf. GMV ceramic disc.	2033-2	47A355
C-2	15 mmf. ceramic tubular, part of S1A	162-150	121A119
C-3	22 mmf. ceramic tubular	162-220	121A143
C-4	3 mmf. ceramic tubular	163-030	121A142
C-5	1000 mmf. GMV. ceramic disc.	2033-3	47A356
C-6	470 mmf. GMV ceramic feed thru.	2023-2	47A357
C-7	470 mmf. ceramic tubular; part of S1C	136-1	121A110
C-8	15 mmf. ceramic tubular; part of S1D	162-150	121A119
C-9	36 mmf. ceramic gimmick; part of S1D	2101-368	121A132
C-10	1.6 mmf. ceramic gimmick	2101-169	121A133
C-11	.30 mmf. ceramic gimmick	2101-308	121A134
C-12	.75 mmf. ceramic gimmick	2101-758	121A135
C-13	10 mmf. ceramic tubular	162-100	121A144
C-14	800 mmf. GMV. ceramic disc	2033-2	47A355
C-15	1000 mmf. mini. ceramic disc	2033-3	47A356
C-16	1000 mmf. GMV. ceramic disc	2033-3	47A356
C-17	1.5 mmf. ceramic tubular	166-159	121A123
C-18	10 mmf. ceramic tubular; part of S1E	163-100	121A136
C-19	1.6 mmf. ceramic gimmick	2101-169	121A133
C-20	Fine tuning control; air trimmer	1713-502	121A117
C-21	1.5 mmf. ceramic gimmick; part of S1E	2101-159	121A136
C-22	110 mmf. ceramic tubular	181-111	121A145
C-23	7.5 mmf. ceramic gimmick	2101-759	121A138
C-24	1000 mmf. ceramic disc	2033-3	47A356

CAPACITORS (Cont.)

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
C-25	800 mmf. miniature ceramic disc	2033-2	47A355
C-26	800 mmf. miniature ceramic disc	2033-2	47A355

RESISTORS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
R-1	4700 ohms 1/2 watt, carbon	106-472	23X20X472K
R-2	1000 ohms 1/2 watt, carbon (part of S1C)	106-102	23X20X102K
R-3	750,000 ohms 5%, 1/2 watt, carbon (part of S1C)	101-754	23X20X754J
R-4	1 megohm 5%, 1/2 watt, carbon	101-105	23X20X105J
R-5	220,000 ohms 1/2 watt, carbon	106-224	23X20X224K
R-6	3900 ohms 1/2 watt, carbon (part of S1D)	106-392	23X20X392K
R-7	470 ohms 1/2 watt, carbon (part of S1D)	106-471	23X20X471K
R-8	1000 ohms 1/2 watt, carbon	106-102	23X20X102K
R-9	2200 ohms 1/2 watt, carbon	106-222	23X20X222K
R-10	15,000 ohms 1/2 watt, carbon	106-153	23X20X153K
R-11	220 ohms 1/2 watt, carbon	106-221	23X20X221K
R-12	4700 ohms 1/2 watt, carbon	106-472	23X20X472K
R-13	1000 ohms 1/2 watt, carbon	106-102	23X20X102K

TRANSFORMERS AND COILS

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
T-1	Transformer, VHF antenna input coupling	1964-5	51A1674
L-1	Coil, UHF input coupling (adjustable iron core)	2110-2	121A131
L-2	Channel 13 RF grid adj. (assembly)	1984-13	51A1676
L-3	Channel 13 RF plate adj.	1984-12	51A1677
L-4	Cascode Plate/Cath. coupling coil	1785-51	51A1678
L-5	Choke, heater; iron core	1894-1	53A296
L-6	Channel 13 Mixer Grid adj. (assembly)	1984-16	51A1679
L-7	Osc. coil & form assembly (channel 13)	2051-3	51A1680
L-8	Osc. coil & form assembly (channel 6)	2031-1	51A1681
L-9	Coil, i-f output (assembly)	1790-13	51A1682

TUBES

Schematic Symbol	Description	Mfgrs. Cross Reference	Hallicrafters Part Number
V-1	6BZ7 dual triode R.F. amp.	55	90X6BZ7
V-2	6X8 triode - pentode osc./mixer	52	90X6X8

CAPACITORS (Cont.)

Schematic Symbol	Description	Hallicrafters Part Number
C-401	0.5 to 3.0 mmf. trimmer	44B442
C-402	470 mmf. G. M. V. 500 V., ceramic	47C20A471N or 47B20A471N5
C-403	4.7 mmf. 500 V., ceramic	47X20UK047K/D
C-404	470 mmf. G. M. V. 500 V., ceramic.	47C20A471N or 47B20A471N5
C-405	470 mmf. G. M. V., 500 V., ceramic.	47C20A471N or 47B20A471N5
C-406	1000 mmf. ceramic feed thru	47B402
C-407	100 mmf. 5%, 500 V., ceramic	47C20A101J or 47B20A101J5
C-407-1	82 mmf. 5%, 500 V., ceramic.	47C20A820J or 47B20A820J5
C-408	1000 mmf. ceramic feed thru	47B402
C-409	470 mmf. G. M. V. 500 V., ceramic	47C20A471N or 47B20A471N5
C-410	1000 mmf. ceramic feed thru	47B402

RESISTORS

Schematic Symbol	Description	Hallicrafters Part Number
R-101	220 ohms 1/2 watt, carbon	23X20X221K
R-102	6800 ohms 1/2 watt, carbon	23X20X682K
R-103	1000 ohms 1/2 watt, carbon	23X20X102K
R-104	47 ohms 1/2 watt, carbon.	23X20X470K
R-105	470 ohms 1/2 watt, carbon.	23X20X471K
R-106	22,000 ohms 1/2 watt, carbon.	23X20X223K
R-107	1000 ohms 1/2 watt, carbon	23X20X102K
R-108	47 ohms 1/2 watt, carbon.	23X20X470K
R-109	100 ohms 1/2 watt, carbon.	23X20X101K
R-110	470 ohms 1/2 watt, carbon.	23X20X471K
R-111	100 ohms 1/2 watt, carbon.	23X20X101K
R-112	15,000 ohms 1/2 watt, carbon.	23X20X153K
R-113	150 ohms 1/2 watt, carbon.	23X20X151K
R-114	470 ohms 1/2 watt, carbon.	23X20X471K
R-115	1.5 megohms 1/2 watt, carbon.	23X20X155K
R-116	390,000 ohms 1/2 watt, carbon	23X20X394K
R-117	22,000 ohms 1 watt, carbon	23X30X223K
R-118	5600 ohms 1/2 watt, carbon	23X20X562K
R-120	1.5 megohms 1/2 watt, carbon	23X20X155K
R-121	2.2 megohms 1/2 watt, carbon	23X20X225K
R-122	1 megohm 1/2 watt, carbon	23X20X105K
R-123	150 ohms 1/2 watt, carbon.	23X20X151K
R-124/176	1000/1,000,000 ohms dual contrast/volume control	25B1056
R-125	22,000 ohms 1/2 watt, carbon; part of L-106	-------
R-126	15,000 ohms 2 watts, carbon	23X40X153K
R-127	8200 ohms 2 watts, carbon.	23X40X822K
R-128	10,000 ohms 2 watts, carbon.	23X40X103K
R-129	3300 ohms, 1/2 watt; part of L-109	-------
R-130	10,000 ohms 1/2 watt, carbon.	23X20X103K
R-131	470,000 1/2 watt, carbon	23X20X474K
R-132	2.2 megohms 1/2 watt, carbon	23X20X225K
R-133	820,000 ohms 1/2 watt, carbon	23X20X824K
R-134	2200 ohms 1/2 watt, carbon	23X20X222K
R-135	47,000 ohms 1/2 watt, carbon	23X20X473K
R-136	560,000 ohms 1 watt, carbon	23X30X564K
R-137	6800 ohms 1/2 watt, carbon	23X20X682K
R-138	33,000 ohms 1/2 watt, carbon.	23X20X333K
R-139	10,000 ohms 1 watt, carbon	23X30X103K
R-140	10,000 ohms 1/2 watt, carbon.	23X20X103K
R-141/182	1,100,000/50,000 ohms dual vert. hold/brightness control	25B1047
R-142	2200 ohms 1/2 watt, carbon	23X20X222K
R-143	22,000 ohms 1 watt, carbon	23X30X223K
R-144	3300 ohms 1/2 watt, carbon	23X20X332K
R-145	15,000 ohms 1/2 watt, carbon.	23X20X153K
R-146	5 megohms, vertical height control	25B998
R-147	750 ohms, vertical linearity control	25B999
*R-148	8700 ohms 5 watt, wirewound	24A971
R-149	120 ohms 1/2 watt, carbon.	23X20X121K
R-150	2.2 ohms 1/2 watt, carbon	23X20X022K
R-151	100,000 ohms 1/2 watt, carbon.	23X20X104K
R-152	220 ohms 1/2 watt, carbon.	23X20X221K
R-152-1	2200 ohms 1 watt, carbon	23X30X222K
R-153	7.2 ohms 5%, 5 watt, fuse type	25B1011
R-154	100,000 ohms 1/2 watt, carbon	23X20X104K
R-155	100,000 ohms.1/2 watt, carbon	23X20X104K

RESISTORS (Cont.)

Schematic Symbol	Description	Hallicrafters Part Number
R-156	4.7 megohms 1/2 watt, carbon.	23X20X475K
R-157	4.7 megohms 1/2 watt, carbon.	23X20X475K
R-158	1500 ohms 5% 1/2 watt, carbon	23X20X152J
R-159	8200 ohms 1/2 watt, carbon; part of L-113	-------
R-160	33,000 ohms 1/2 watt, carbon.	23X20X333K
R-160-1	82,000 ohms 1/2 watt, carbon.	23X20X823K
R-160-2	39,000 ohms 1/2 watt, carbon	23X20X393K
R-160-3	56,000 ohms 1/2 watt, carbon	23X20X563K
R-161/179	120,000/10,000 ohms dual horiz. hold/tone control	25B1046
R-161-1/179-1	120,000/10,000 ohms dual horiz. hold/tone control	25B1090
R-162	100,000 ohms, 1/2 watt, carbon	23X20X104K
R-162-1	220,000 ohms 1/2 watt, carbon	23X20X224K
R-163	10,000 ohms 1/2 watt, carbon.	23X20X103K
R-163-1	8200 ohms 1/2 watt, carbon.	23X20X822K
R-164	470,000 ohms 1/2 watt, carbon	23X20X474K
R-165	8200 ohms 2 watts, carbon.	23X40X822K
R-165-1	10,000 ohms 2 watts, carbon.	23X40X103K
R-166	4700 ohms 1 watt, carbon.	23X30X472K
R-167	3.3 ohms; part of T-107.	-------
R-167-1	2.2 ohms; part of T-107-1	-------
R-168	1 megohm 1 watt, carbon.	23X30X105K
R-169	15 ohms 1 watt, carbon.	23X30X150K
R-170	150 ohms 1/2 watt, carbon.	23X20X151K
R-171	2200 ohms 1/2 watt, carbon	23X20X222K
R-172	270 ohms 1/2 watt, carbon.	23X20X271K
*R-173	10,000 ohms 5%, 1/2 watt, carbon	23X20X103J
*R-174	10,000 ohms 5%, 1/2 watt, carbon.	23X20X103J
R-175	33,000 ohms 1/2 watt, carbon	23X20X333K
R-176/124	1 megohm/1000 ohm dual volume/contrast control.	25B1056
R-177	1200 ohms 1/2 watt, carbon	23X20X122K
R-178	33,000 ohms 1/2 watt, carbon.	23X20X333K
R-179/161	10,000/120,000 ohms dual tone/horiz. hold control	25B1046
R-179-1/161-1	10,000/120,000 ohms dual tone/horiz. hold control	25B1090
R-180	470,000 ohms, carbon.	23X20X474K
R-181	5 ohms hum balancing control; part of speaker	-------
R-182/141	50,000/1,100,000 ohms brightness/vert. hold control	25B1047
R-183	100,000 ohms 1/2 watt, carbon	23X20X104K
R-184	470,000 ohms 1/2 watt, carbon	23X20X474K
R-185	470,000 ohms 1/2 watt, carbon	23X20X474K
R-186	470,000 ohms 1/2 watt, carbon	23X20X474K
R-187	470,000 ohms 1/2 watt, carbon	23X20X474K
R-189	1.5 megohms; focus control	25B1003
R-190	.50 ohms, horizontal centering; part of T-107-1	-------
R-191	22,000 ohms 1/2 watt, carbon.	23X20X223K
R-192	33,000 ohms 1 watt, carbon	23X30X333K
R-193	180,000 ohms 1/2 watt, carbon	23X20X184K
R-194	1200 ohms 1/2 watt, carbon	23X20X122K
R-195	1800 ohms 1/2 watt, carbon	23X20X182K
R-196	10 megohms 1/2 watt, carbon	23X20X106K
R-197	1000 ohms 1/2 watt, carbon; part of L-118	-------
R-198	47 ohms 1 watt, carbon	23X30X470K
R-199	220 ohms 1/2 watt, carbon	23X20X221K
R-200	3300 ohms 1/2 watt, carbon (may be part of L-103)	23X20X332K
R-202	560 ohms 1/2 watt; part of L-118	-------
R-202-1	270 ohms 1/2 watt; part of L-118	-------
R-203	560 ohms 1/2 watt; part of L-118	-------
R-203-1	270 ohms 1/2 watt; part of L-118	-------
R-401	120 ohms 1/2 watt, carbon	23X20X121K
R-402	100,000 ohms 1/2 watt, carbon	23X20X104K
R-402-1	1.5 megohms 1/2 watt, carbon	23X20X155K
R-403	1000 ohms 1/2 watt, carbon	23X20X102K
R-404	1.5 megohms 1/2 watt, carbon	23X20X155K
R-405	10,000 ohms 1/2 watt, carbon.	23X20X103K

* USE EXACT REPLACEMENT PARTS ONLY

SERVICE PARTS LIST

TRANSFORMERS AND COILS

Schematic Symbol	Description	Hallicrafters Part Number
T-101	Transformer, 1st I-F	50B573
T-102	Transformer, 2nd I-F	50B574
T-103	Transformer, 3rd I-F	50B575
T-104	Transformer, vertical blocking oscillator	55B190
T-105	Transformer, vertical output	55C192
T-106	Transformer, heater	52D290
T-106-1	Transformer, heater	52C258
*T-107	Transformer, horizontal output	55D223 or 55D235
T-107-1	Transformer, horizontal output	55D197
T-108	Transformer, ratio detector	50B473
T-109	Transformer, audio output	55C191

*T-107 (55D223) may be used with either 51B1788 or 51B1835 Width Coil
T-107 (55D235) may be used only with 51B1788 Width Coil

Schematic Symbol	Description	Hallicrafters Part Number
L-101	Coil, tuner I-F coupling	51B1643
L-101-1	Coil, tuner I-F coupling	51A1841
L-102	Coil, tweet filter	53A307
L-103	Coil, video peaking	51B1709 or 51B1838
L-104	Coil, video peaking	51B1710
L-105	Coil, A.G.C. network	53A304
L-106	Coil, video peaking; wound on R-125	51B1711
L-107	Coil, 4.5 mc. trap	51B1541
L-108	Coil, video peaking	51B1712
L-109	Coil, video peaking; wound on R-129	51B1713
L-110	Choke, heater	53A282
L-111	Choke, heater	53A282
L-113	Coil, horizontal stabilizer (includes C-147 & R-159)	51B1642
L-114	Coil, 4.5 mc. amplifier grid adj.	51B1542
L-115	Voice coil,; part of speaker	-----
L-116	Hum bucking coil; part of speaker	-----
L-117	Field coil; part of speaker	-----
L-118	Deflection coils	53C303
L-118-1	Deflection coils	53A271
L-118-2	Deflection coils	53C320
L-119	Coil, yoke coupling; wound on C-172	-----
L-120	Coil, width control	[redacted] 51B1835
L-121	Choke, damper tube	53A307
L-401	Coil, coupling; input cascode amplifier	51A1754
L-402	Coil, neutralizing; cascode I-F amplifier	51A1755
L-403	Coil, cascode amplifier output	51A1756
L-403-1	Coil, cascode amplifier output	51A1759
L-404	Coil, peaking	51A1757
L-405	Lead inductance	-----
L-406	Coil, input cascode grid	51A1761

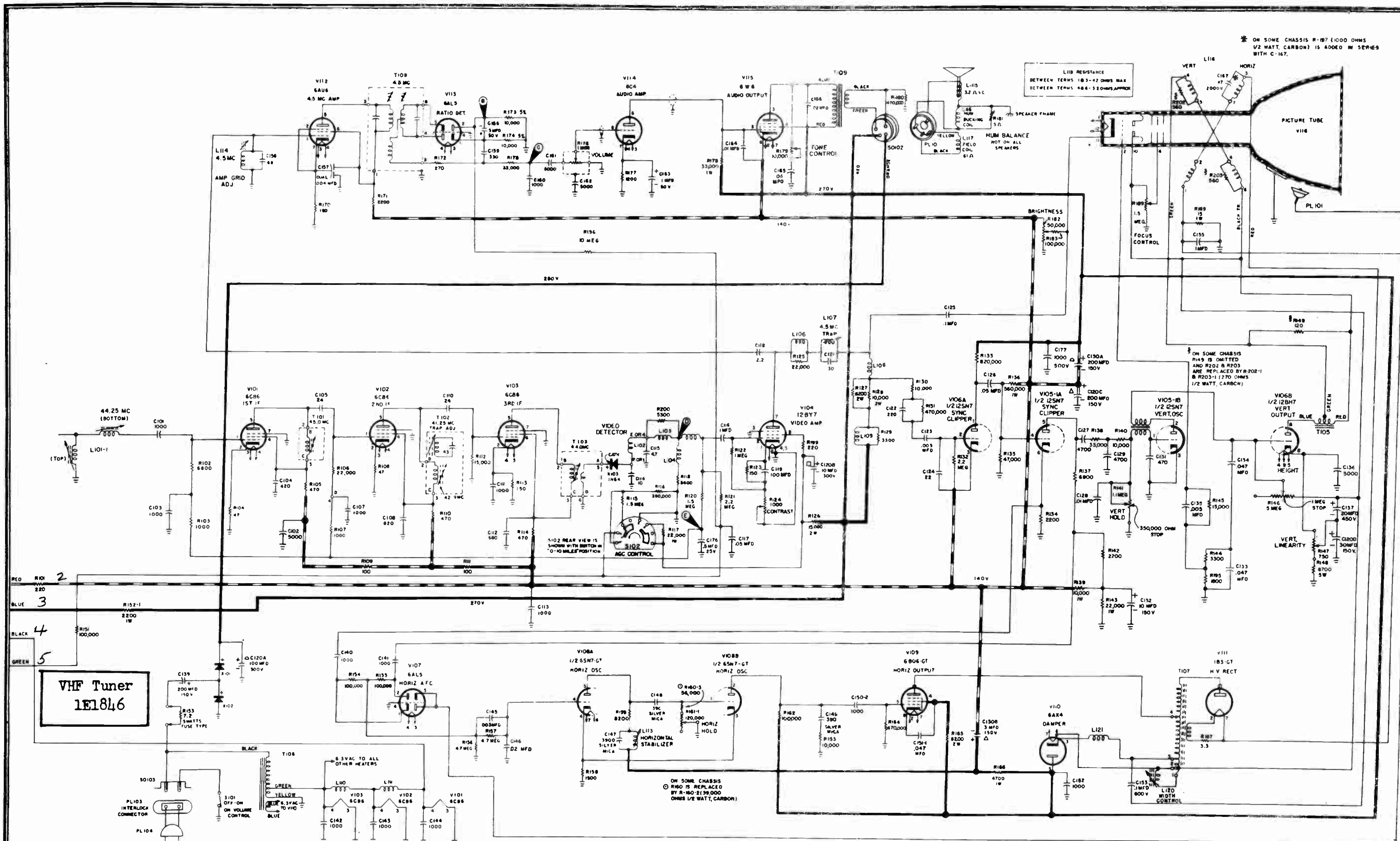
CAPACITORS

Schematic Symbol	Description	Hallicrafters Part Number
C-101	1000 mmf. 500 V., ceramic tubular	47B230
C-102	5000 mmf. 500 V., ceramic disc	47A168
C-103	1000 mmf. 500 V., ceramic disc	47B230
*C-104	820 mmf. 500 V., 5%, ceramic tubular	47B320
C-105	24 mmf. 500 V., ceramic tubular	47CA20A240J or 47B20A240K5
C-107	1000 mmf. 500 V., ceramic disc	47B230
C-108	820 mmf. 500 V., 5%, ceramic tubular	47B320
C-108-1	1000 mmf. 500 V., ceramic disc	47B230
C-110	24 mmf. 500 V., ceramic tubular	47CA20A240J or 47B20A240K5
C-111	1000 mmf. 500 V., ceramic disc	47B230
*C-112	680 mmf. 500 V., ceramic tubular	47A319
C-113	1000 mmf. 500 V., ceramic disc	47B230
*C-114	10 mmf. 500 V., ceramic tubular	47CA20100F or 47B20100K5
C-115	4.7 mmf. 500 V., 10% ceramic tubular	47A160-6
C-116	0.1 mfd. 400 V., paper tubular	46AV104J
C-117	0.05 mfd. 200 V., paper tubular	46AU503J
*C-118	2.2 mmf. 500 V., ceramic tubular	47A160-4

CAPACITORS

Schematic Symbol	Description	Hallicrafters Part Number
C-119	100 mfd. 10 V., electrolytic	45B170
C-120	100-10 mfd. 300 V., 200-30 mfd. 150 V., electrolytic	45C209
C-121	30 mmf. 500 V., ceramic tubular	47X25PG300K
C-122	220 mmf. 500 V., ceramic tubular	47CA20221K or 47B20221K5
C-123	0.005 mfd. 600 V., paper tubular	46AY502J
C-124	22 mmf. 500 V., ceramic tubular	47CA20220M or 47B20220M5
C-125	0.1 mfd. 400 V., paper tubular	46AV104J
C-126	0.05 mfd. 400 V., paper tubular	46AW503J
C-127	4700 mmf. 400 V., paper tubular	46BS472L4
C-128	0.01 mfd. 400 V., paper tubular	46BS103L4
C-129	4700 mmf. 400 V., paper tubular	46BS472L4
C-130	200-5 mfd. 150 V., electrolytic	45C210
C-131	470 mmf. 150 V., mica	47X20B471K
C-132	10 mfd. 150 V., electrolytic	45A097
C-133	0.047 mfd. 400 V., paper tubular	46BS473L4
C-134	0.047 mfd. 400 V., paper tubular	46BS473L4
C-135	5000 mmf. 500 V., ceramic disc	47A168
C-136	5000 mmf. 500 V., ceramic disc	47A168
C-137	20 mfd. 450 V., electrolytic	45B208
C-139	200 mfd. 150 V., electrolytic	45B217
C-140	1000 mmf. 500 V., ceramic tubular	47C20A102M or 47B20A102M5
C-141	1000 mmf. 500 V., ceramic tubular	47C20A102M or 47B20A102M5
C-142	1000 mmf. 500 V., ceramic disc.	47A230
C-143	1000 mmf. 500 V., ceramic disc.	47A230
C-144	1000 mmf. 500 V., ceramic disc.	47A230
*C-145	0.003 mfd. 400 V., paper tubular	46AW302J
C-146	0.02 mfd. 400 V., paper tubular	46AW203J
C-146-1	0.01 mfd. 400 V., paper tubular	46AW103J
*C-147	3900 mmf. 10%, 500 V., silver mica; part of L-113	--------
*C-148	390 mmf. 10%, 500 V., silver mica	47X20D391K
*C-149	390 mmf. 10%, 500 V., silver mica	47X20D391K
C-150	5000 mmf. 500 V., ceramic disc	47A168
C-150-1	560 mmf. 500 V., 10% silver mica	47X20D561K
C-150-2	1000 mmf. 500 V., ceramic disc	47A443
C-151	0.1 mfd. 600 V., paper tubular	46S104L6
C-151-1	0.047 mfd. 400 V., paper tubular	46BS473L4
C-152	1000 mmf. 500 V., ceramic disc	47A230
C-152-1	1000 mmf. 500 V., ceramic disc	47A443
C-153	0.1 mfd. 600 V., paper tubular	46BS104L6
C-154	500 mmf. 20,000 V., ceramic.	47A308
C-155	0.1 mfd. 200 V., paper tubular.	46AU104J
C-156	68 mmf. 500 V., ceramic tubular	47X30TH680K
C-157	0.004 mfd. 500 V., dual ceramic disc	47A218
C-158	5 mfd. 50 V., electrolytic.	45B175
C-159	330 mmf. 500 V., ceramic tubular.	47C20331M or 47B20331M5
C-160	1000 mmf. 500 V., ceramic disc.	47A230
C-161	5000 mmf. 500 V., ceramic disc.	47A168
C-162	5000 mmf. 500 V., ceramic disc.	47A168
C-163	1 mfd. 50 V., electrolytic.	45A163
C-164	0.01 mfd. 400 V., paper tubular.	47A224
C-165	0.05 mfd. 600 V., paper tubular.	46AY503J
C-166	0.02 mfd. 600 V., paper tubular.	46AY203J
C-167	47 mmf. 2000 V., part of L-118, 118-1, or 118-2	--------
C-168	330 mmf. 1500 V., ceramic disc	47A447
C-169	330 mmf. 1500 V., ceramic disc	47A447
C-170	330 mmf. 1500 V., ceramic disc	47A447
C-171	330 mmf. 1500 V., ceramic disc	47A447
C-172	0.1 mfd. 200 V., paper tubular (part of L-119).	--------
C-173	0.006 mfd. 600 V., paper tubular.	46AZ602F
C-174	0.0047 mfd. 1000 V., paper tubular	46BS472L10
C-175	0.1 mfd. 600 V., paper tubular	46AY104J
C-176	0.5 mfd. 25 V., paper tubular.	46A177
C-177	1000 mmf. 500 V., ceramic disc.	47A230

* USE EXACT REPLACEMENT PART ONLY



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

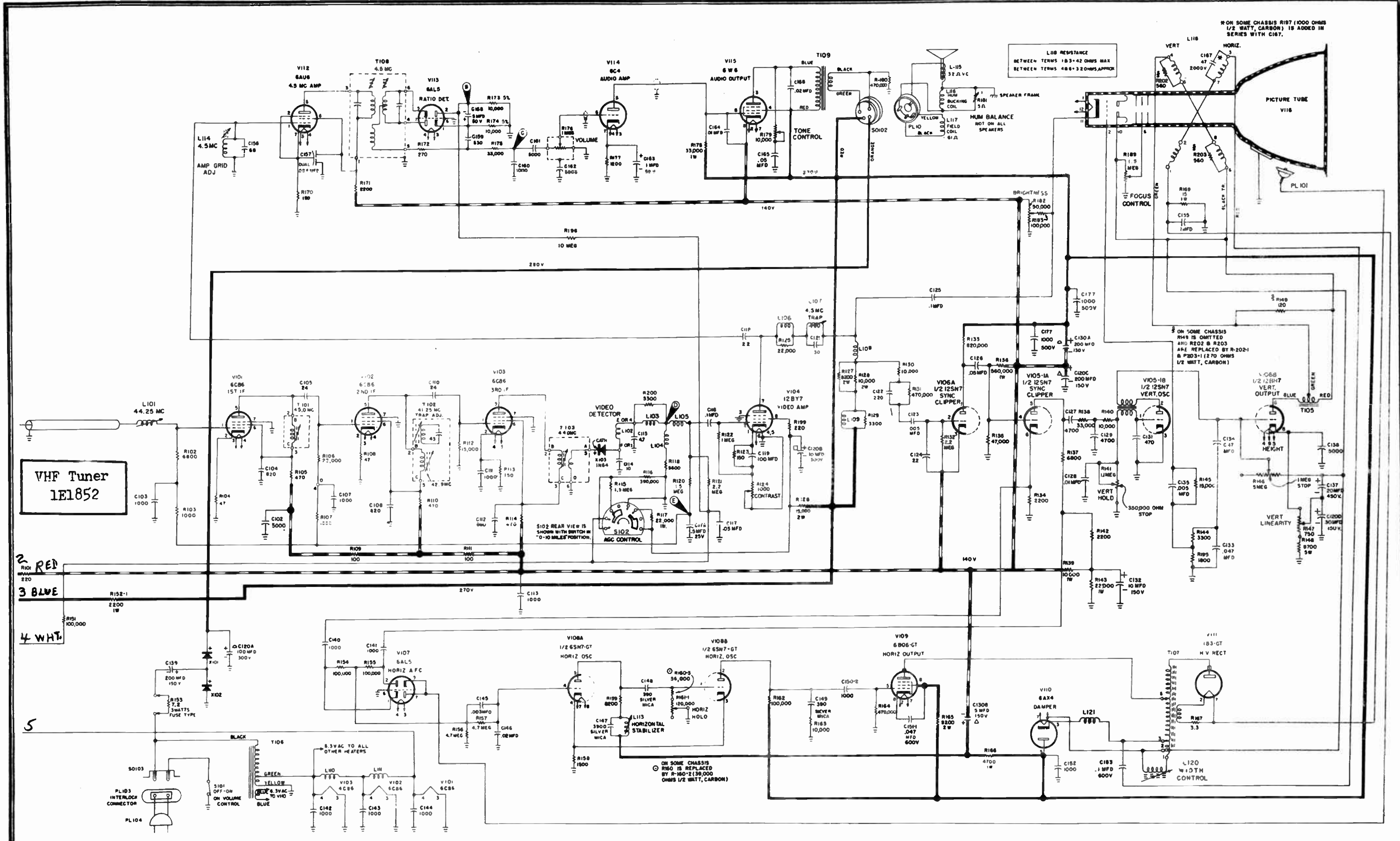
ON ALL (-2) RUNS OF ALL CHASSIS THE FOLLOWING CHANGES ARE MADE:
A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

VHF

17-21" CHASSIS

J1300D

RUNS 1AB & 1AB-2



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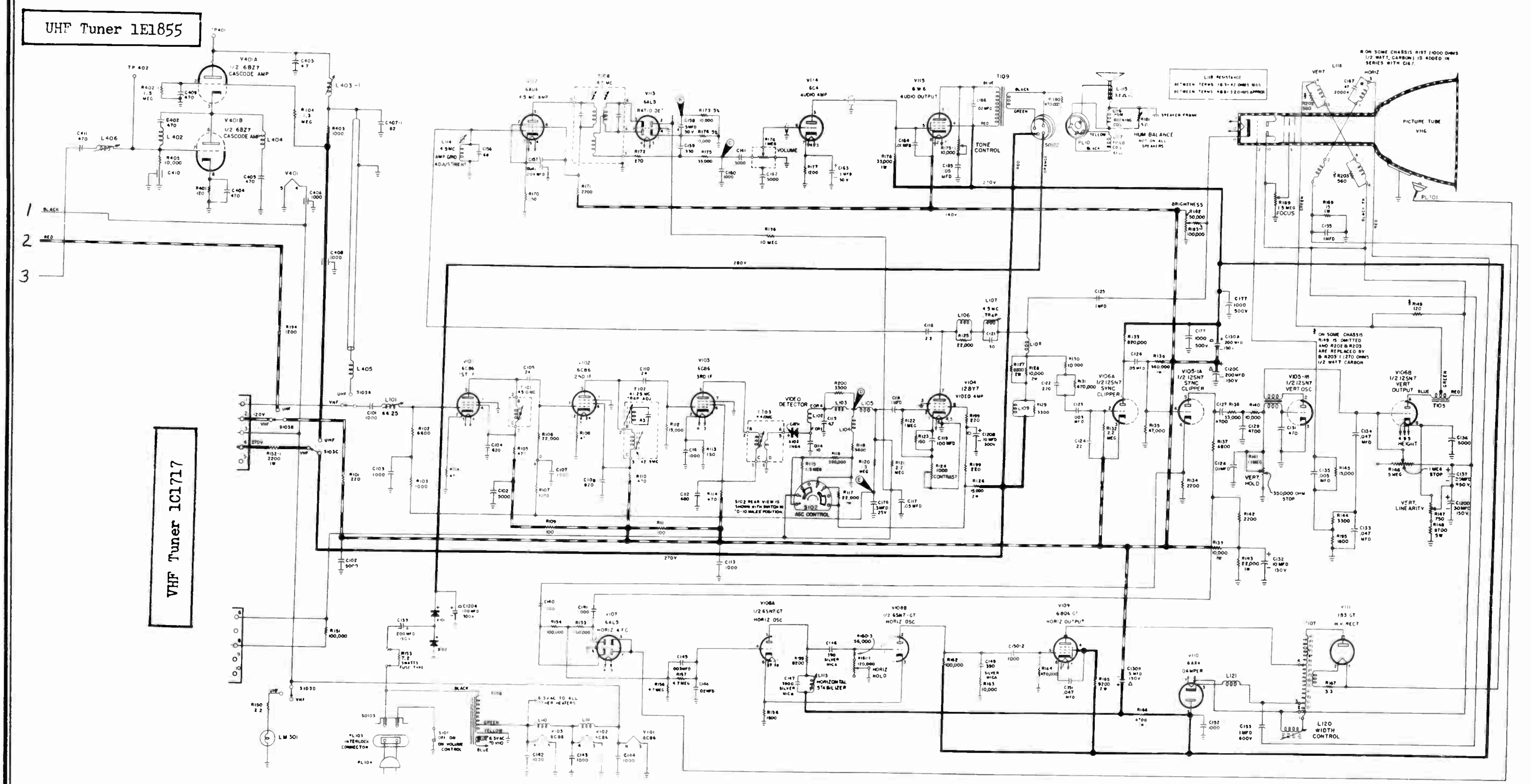
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

VHF
17-21" CHASSIS
J1300D
RUNS 1B & 1B-2



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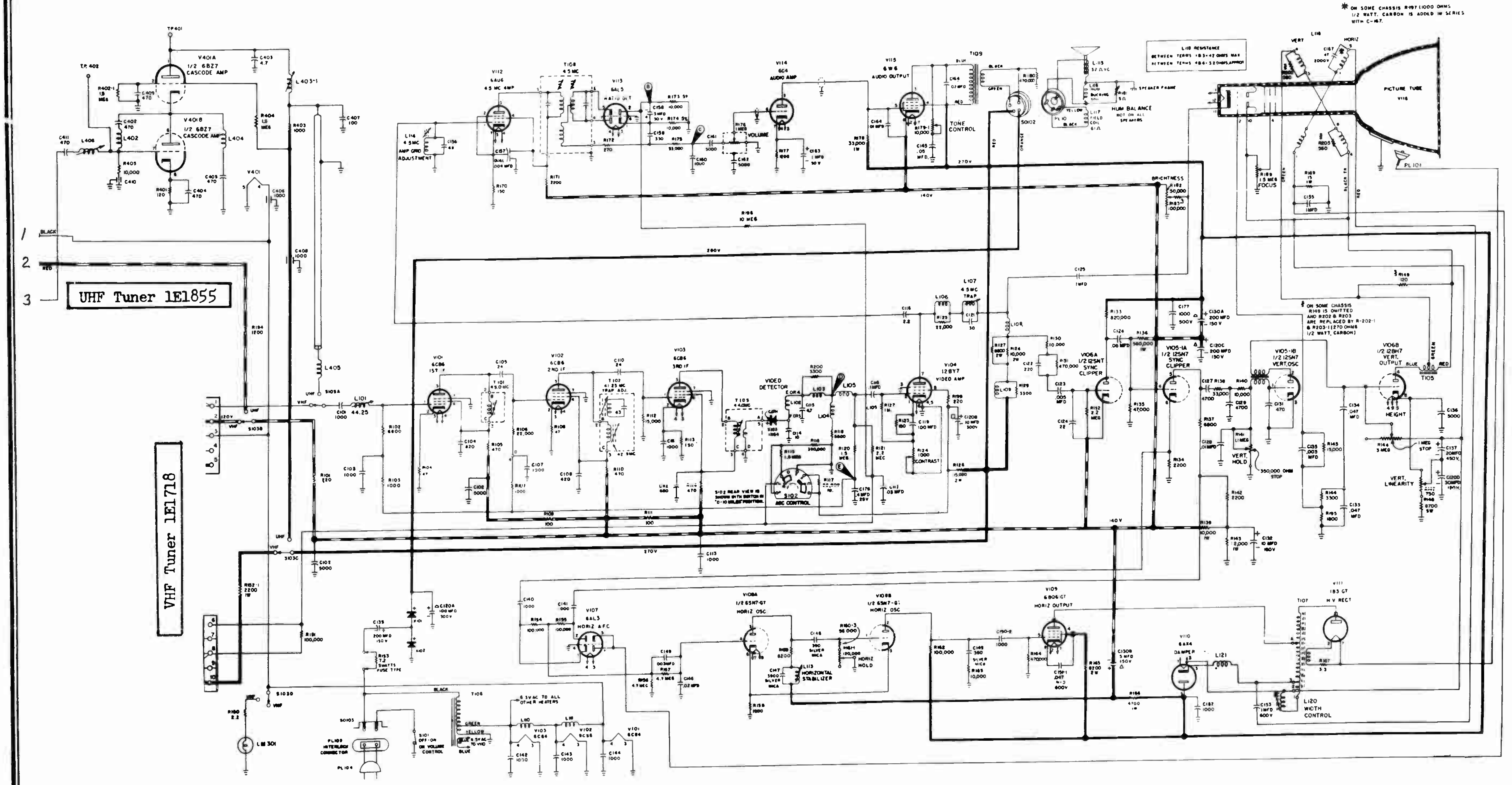
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

VHF-UHF

17-21" CHASSIS

H1300D

RUNS 2B & 2B-2



VHF-UHF

17-21" CHASSIS

H1300D

RUNS 1AB & 1AB-2

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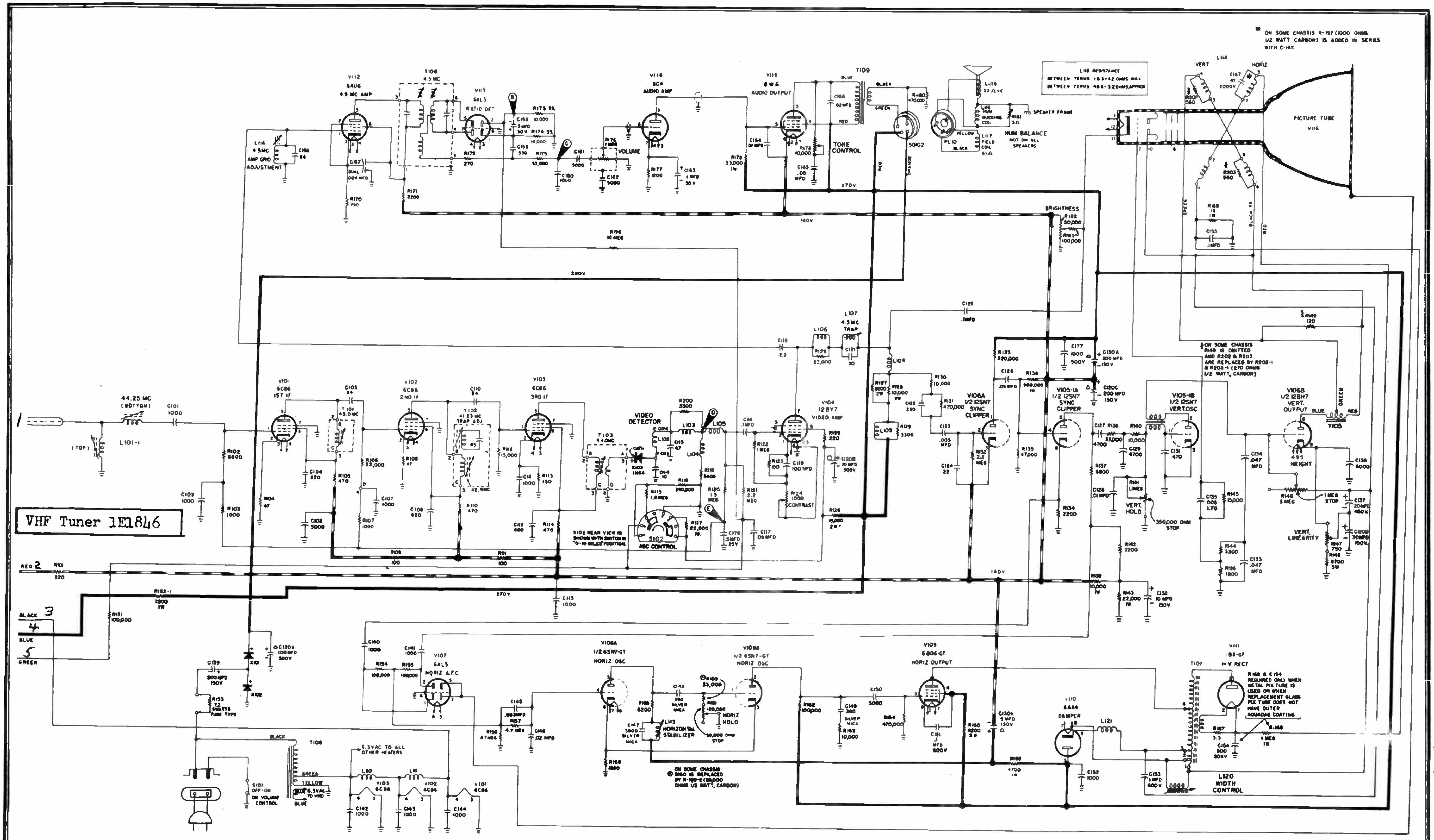
ON ALL (-2) RUNS OF ALL CHASSIS THE FOLLOWING CHANGES ARE MADE:
A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.



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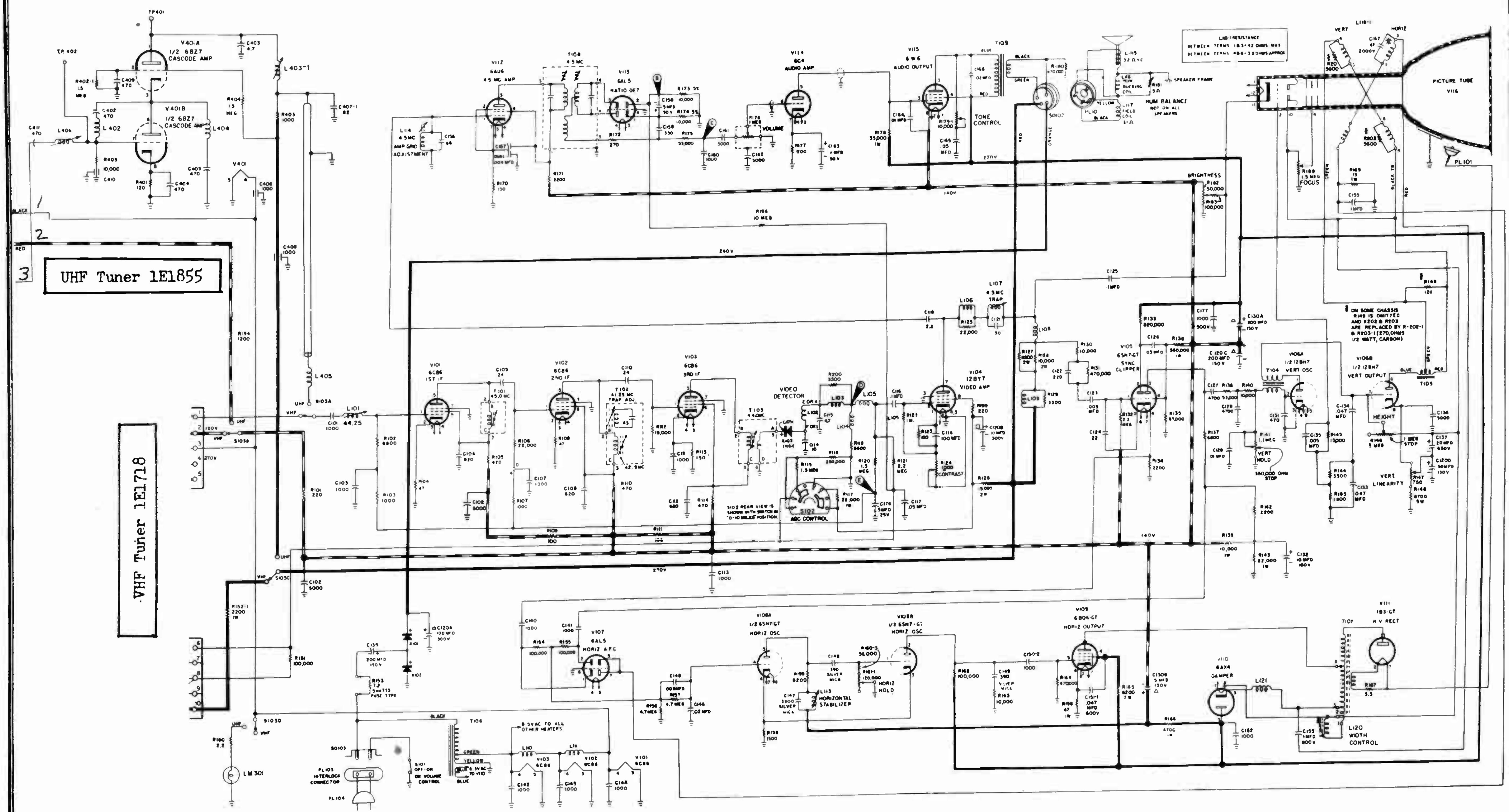
VHF

21" CHASSIS

E1300D

RUN 2B-2



VHF-UHF

17-21" CHASSIS

H1300D

RUNS 1A & 1A-2

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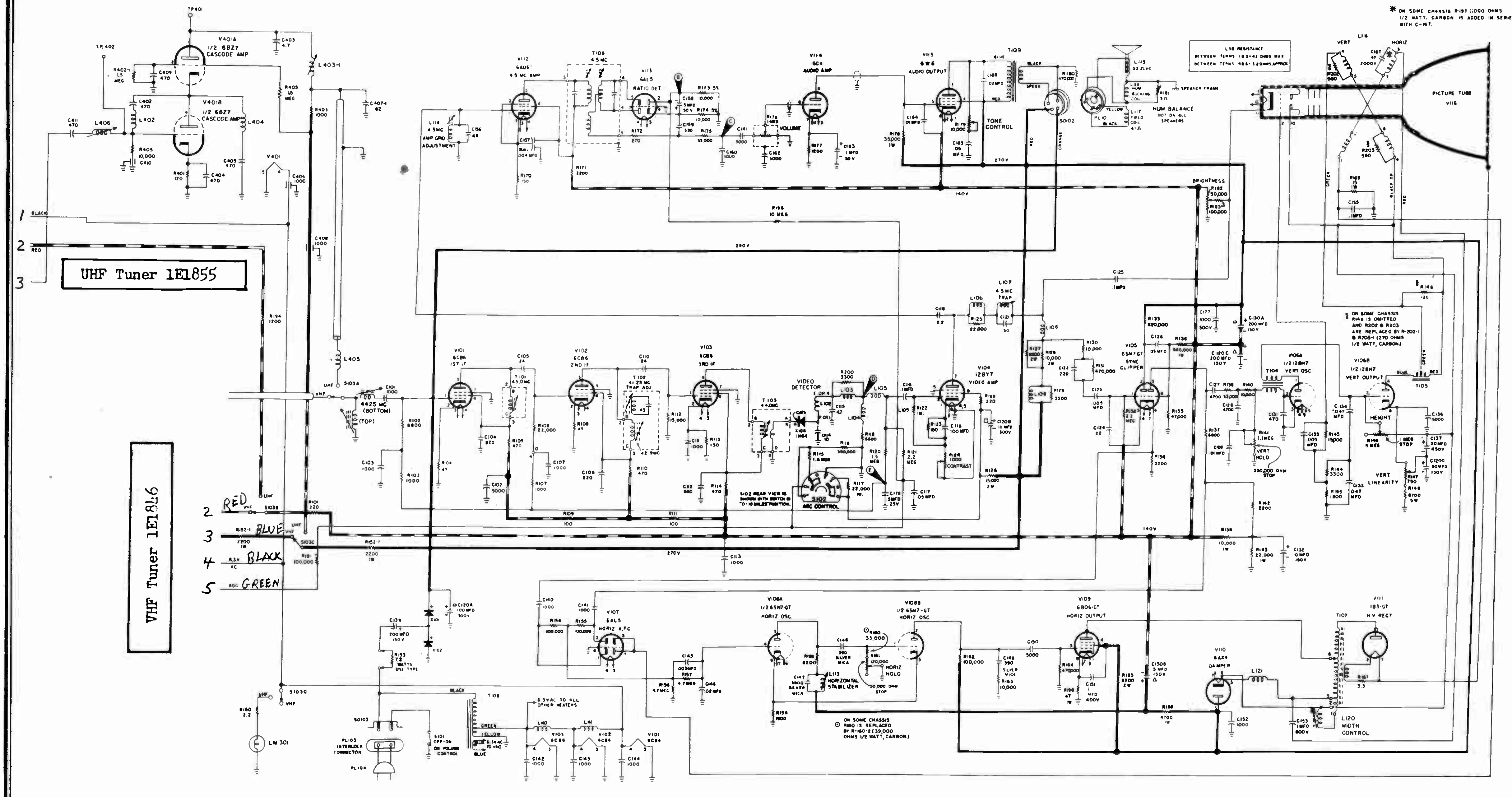
A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.



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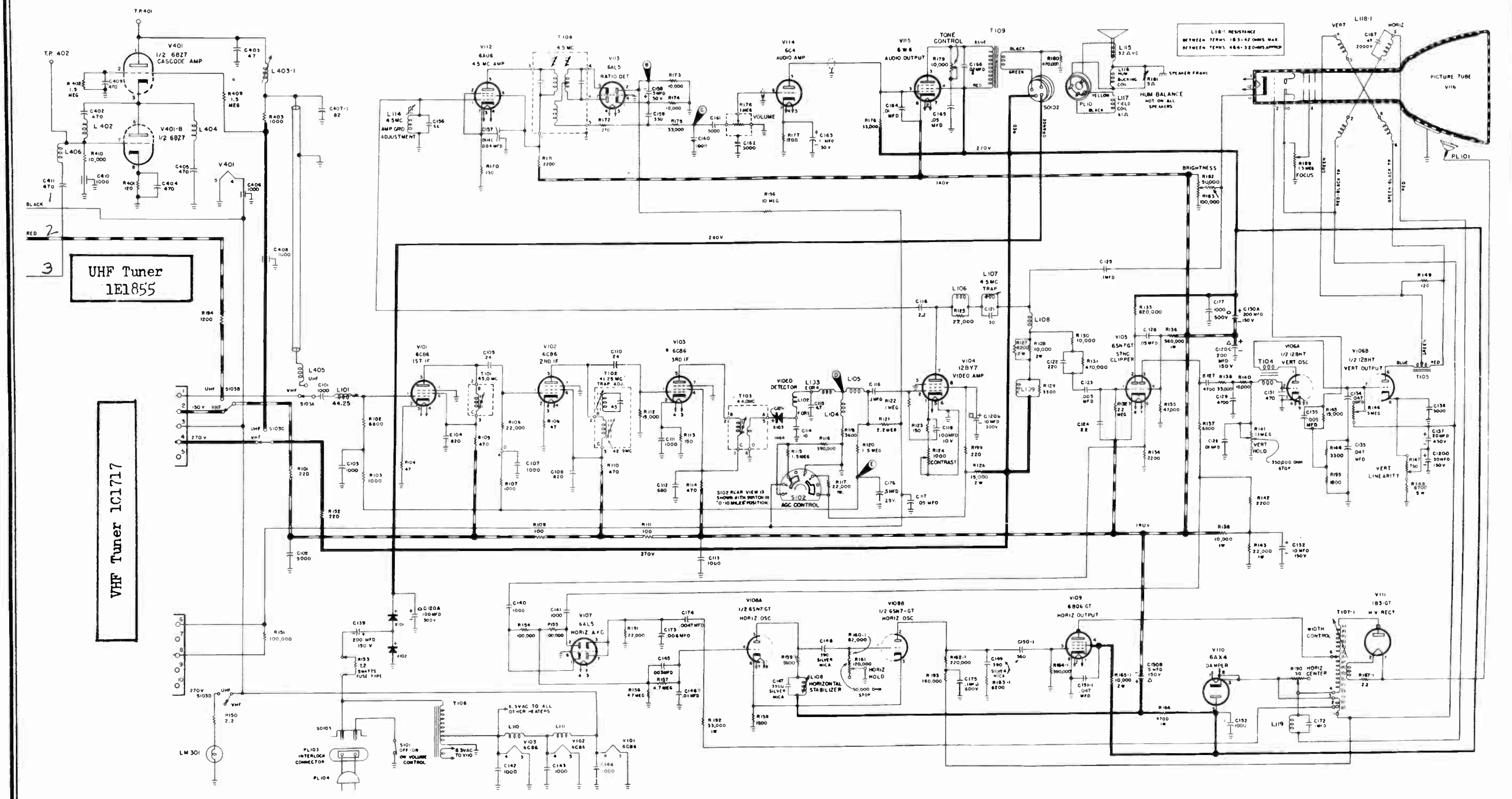
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

VHF-UHF

21" CHASSIS

F1300D

RUNS 5 & 5-2



ON D-1300D RUN 3-1 CHASSIS THE FOLLOWING CHANGES HAVE BEEN MADE:

A. THE 17HP4 PIX TUBE IS REPLACED BY 21AP4 METAL TUBE.
B. THE HIGH VOLTAGE LEAD (PIN 7, V-111) IS CONNECTED TO R-168 (1 MEGOHM 1 WATT, CARBON). THE OTHER SIDE OF R-168 IS CONNECTED TO THE METAL CONE OF THE 21AP4.
C. C-154 (500 MMF. 20,000 V., CERAMIC) IS CONNECTED BETWEEN PIN 7 OF V-111 AND GROUND.
D. R-189 (1.5 MEGOHMS) FOCUS CONTROL IS DELETED.
E. PIN 6 OF PICTURE TUBE SOCKET IS DELETED.

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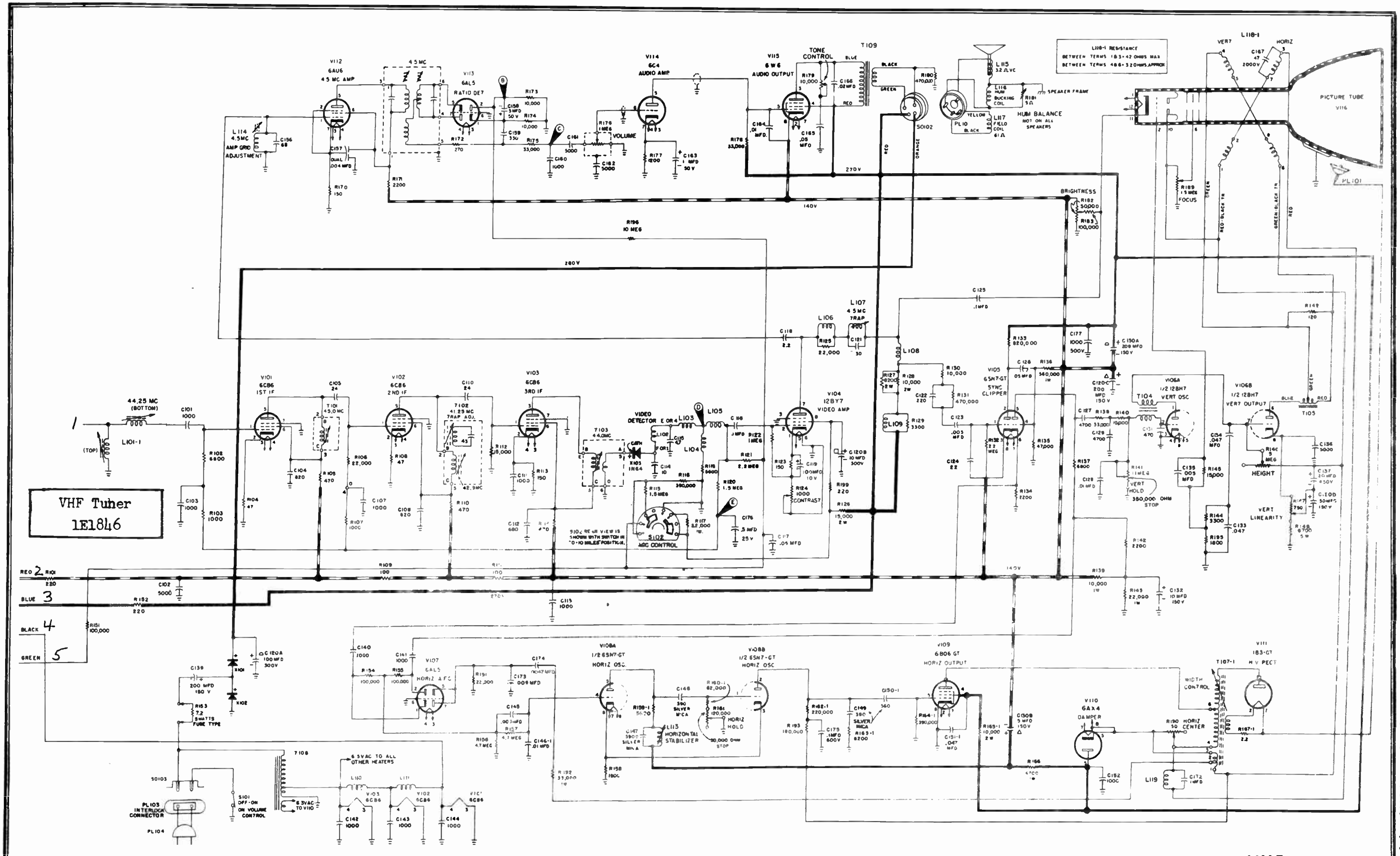
VHF-UHF

17" CHASSIS 21" CHASSIS

D1300D

RUN 3 RUN3-1



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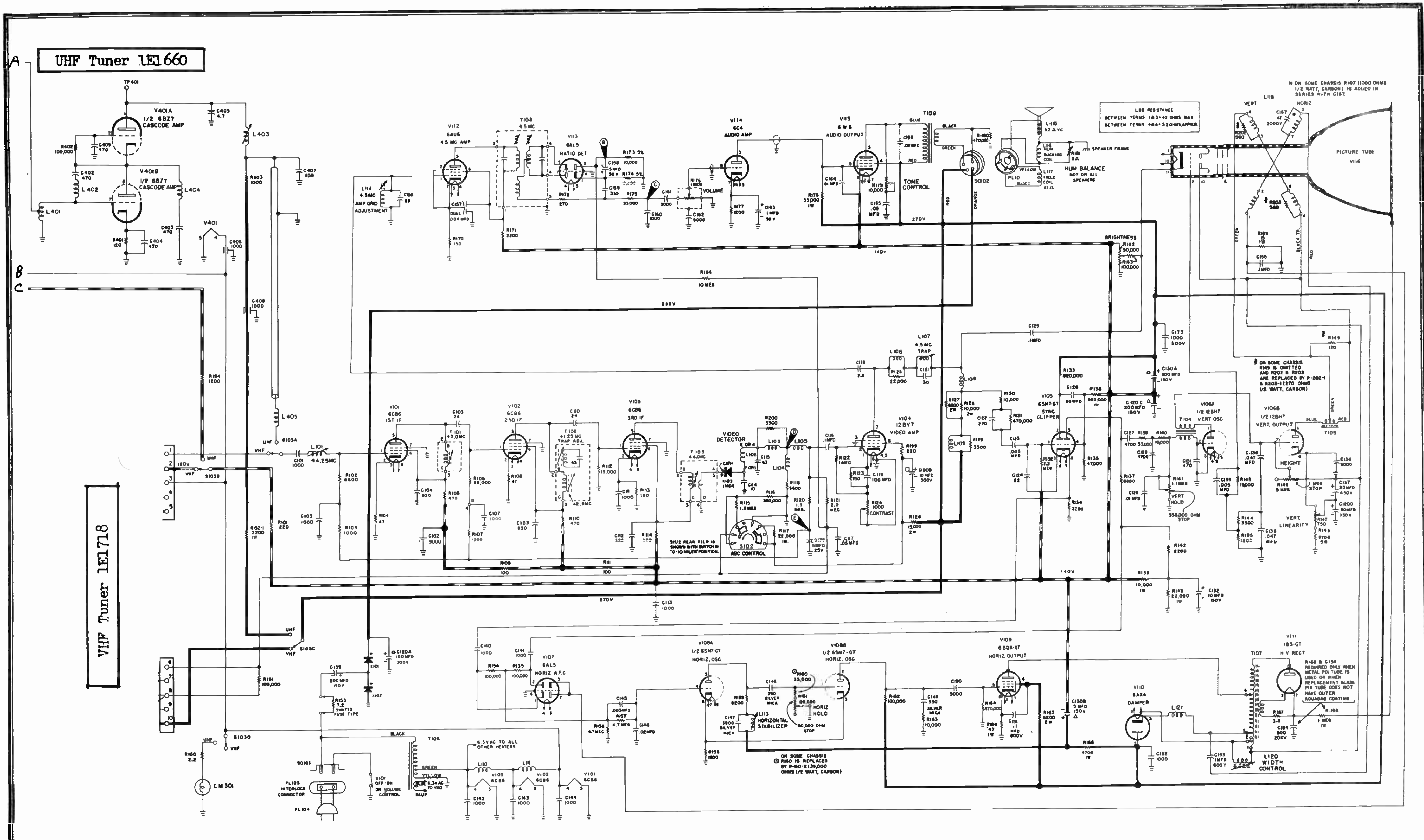
1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 270 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VHF

17" CHASSIS

C1300D

RUN 3



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VHF-UHF

21'' CHASSIS

F1300D

RUN 3

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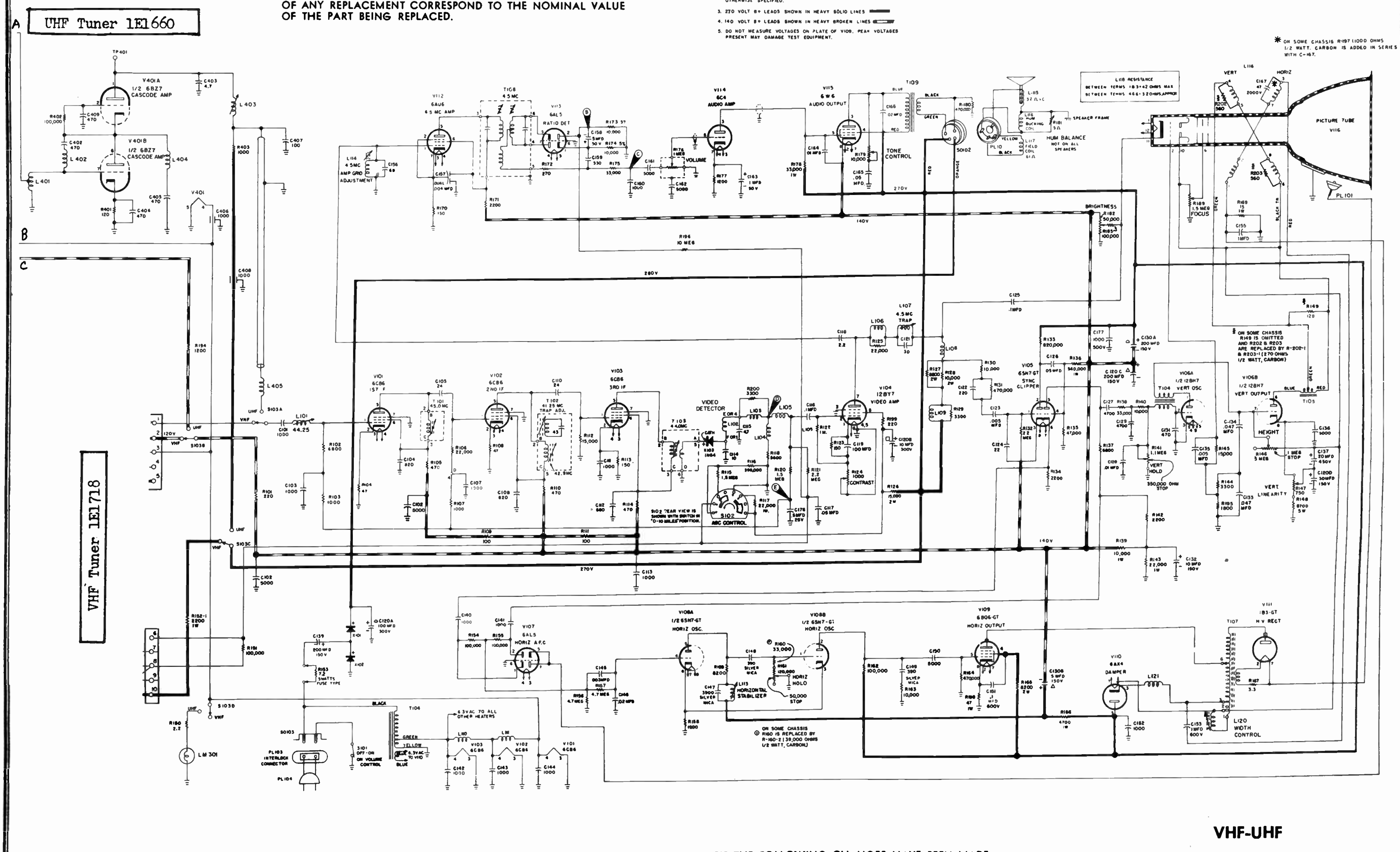
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

* ON SOME CHASSIS R-197 (1000 OHMS 1/2 WATT, CARBON) IS ADDED IN SERIES WITH C-167.



ON ALL (-2) RUNS OF ALL CHASSIS THE FOLLOWING CHANGES ARE MADE:
A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

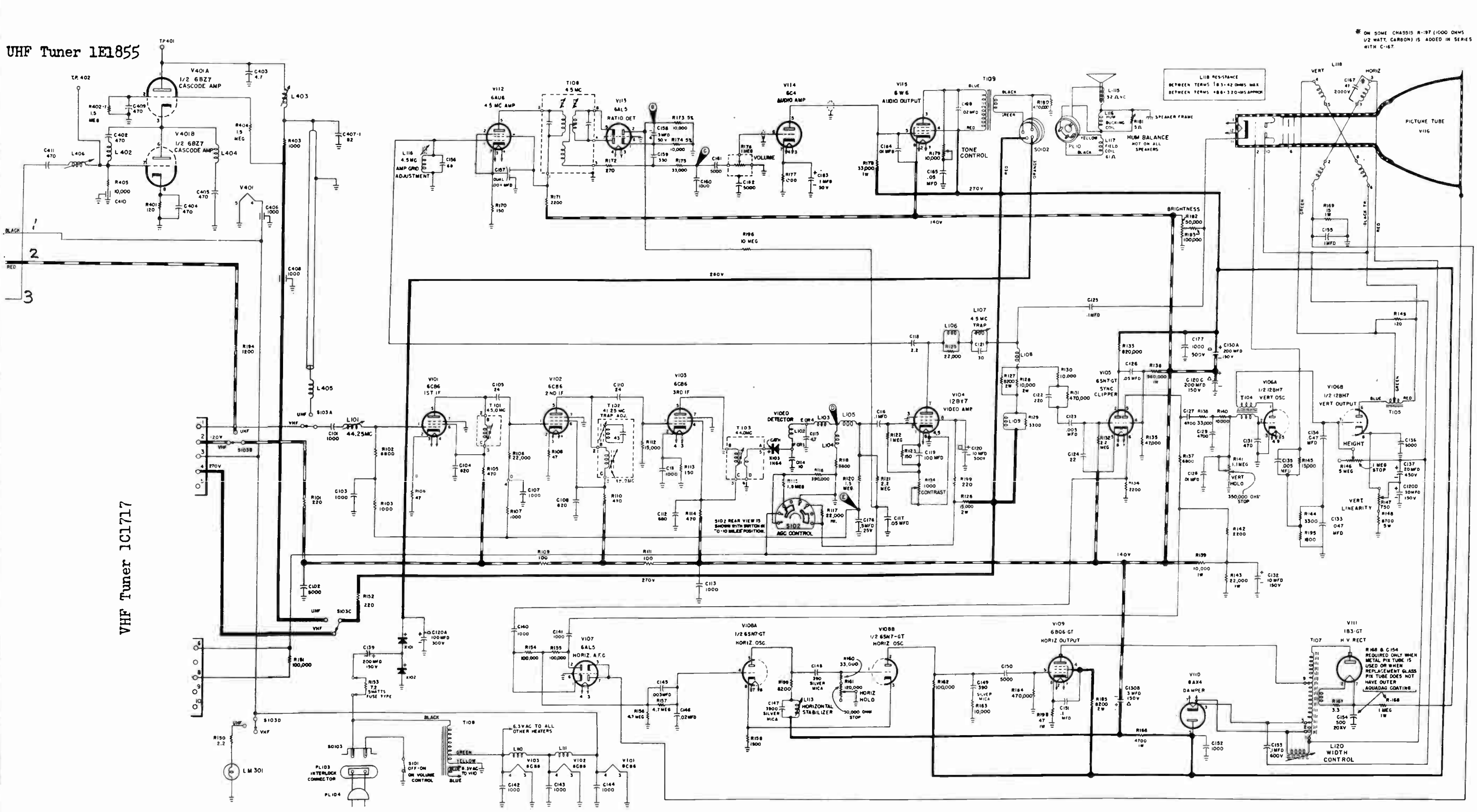
ON H1300D CHASSIS THE FOLLOWING CHANGES HAVE BEEN MADE:
A. C-150 IS REPLACED BY C-150-2 (1000 MMF. 500 V., CERAMIC DISC.)
B. C-151 IS REPLACED BY C-151-1 (.047 MFD. 400 V., PAPER TUBULAR.)
C. R-160 IS REPLACED BY R-160-3 (56,000 OHMS 1/2 WATT, CARBON.)
D. R-161 IS REPLACED BY R-161-1 WHICH IS IDENTICAL TO R-161 EXCEPT FOR DELETION OF 50,000 OHM STOP.
E. L-118 DEFLECTION YOKE IS REPLACED BY L-118-2 (53C320)

VHF-UHF

17" CHASSIS 17-21"

B1300D H1300D

RUN 3 RUN 1 & 1-2



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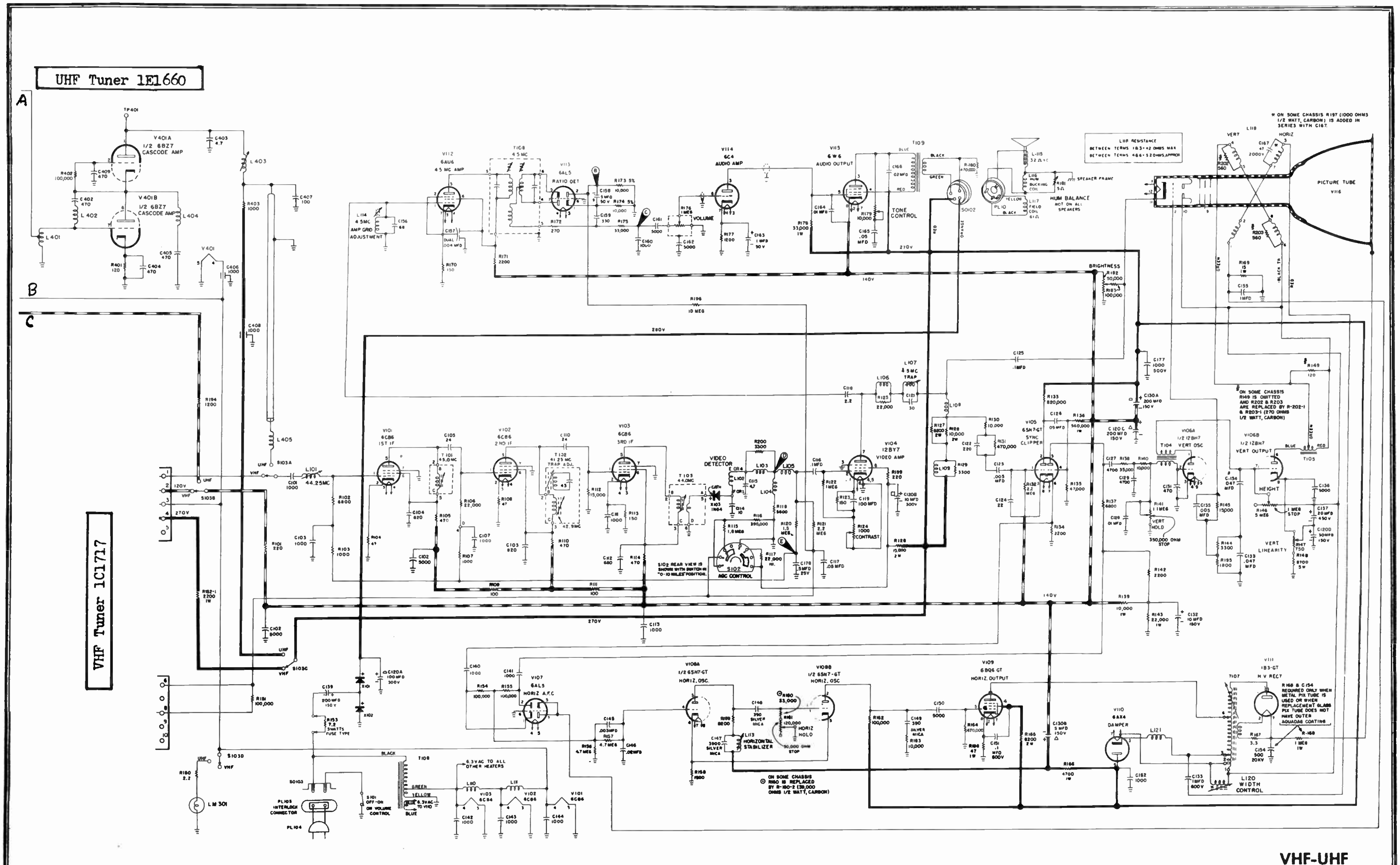
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 270 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

ON ALL (-2) RUNS OF ALL CHASSIS THE FOLLOWING CHANGES ARE MADE:

A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

VHF-UHF
21" CHASSIS
F1300D
RUNS 2 & 2-2



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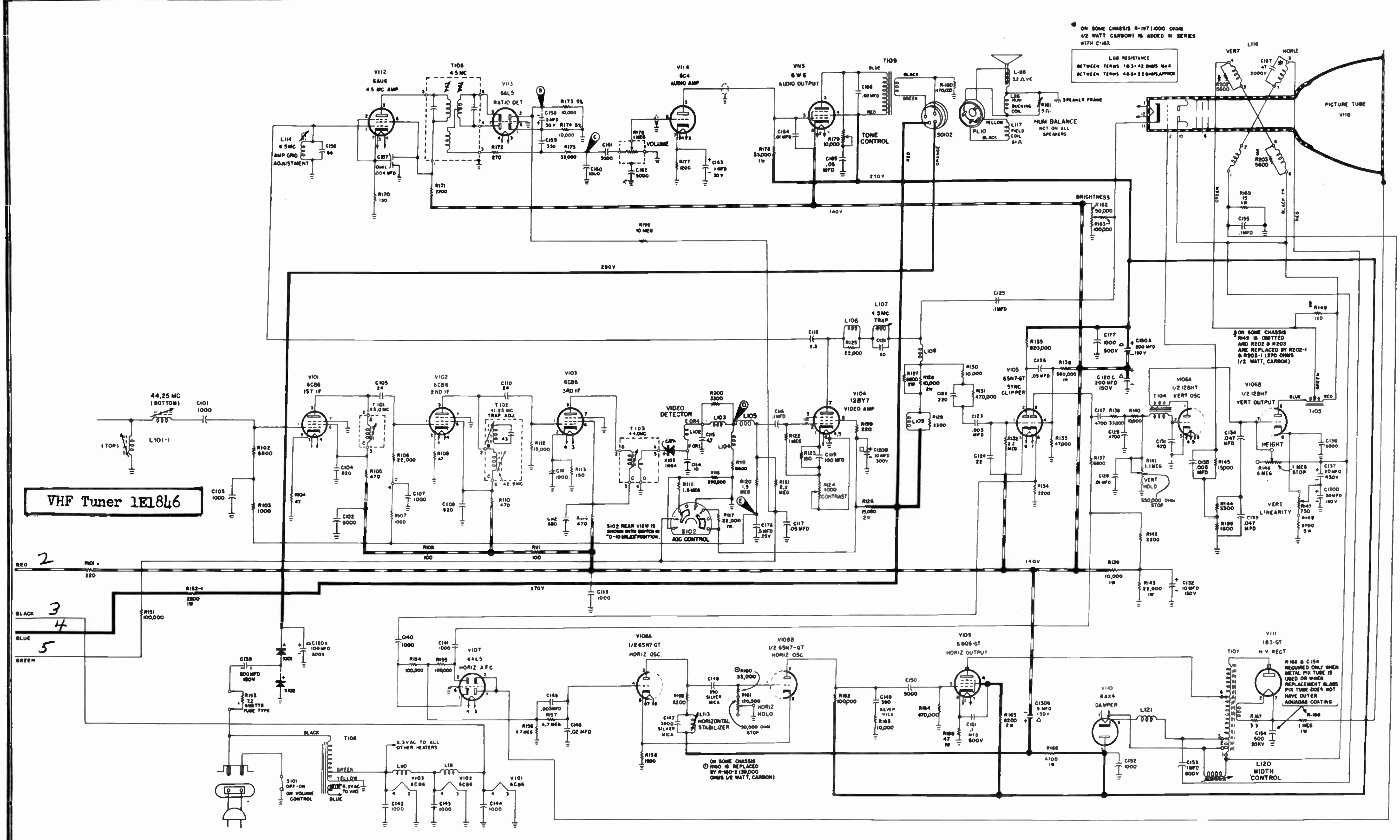
VHF-UHF

21" CHASSIS

F1300D

RUN 1



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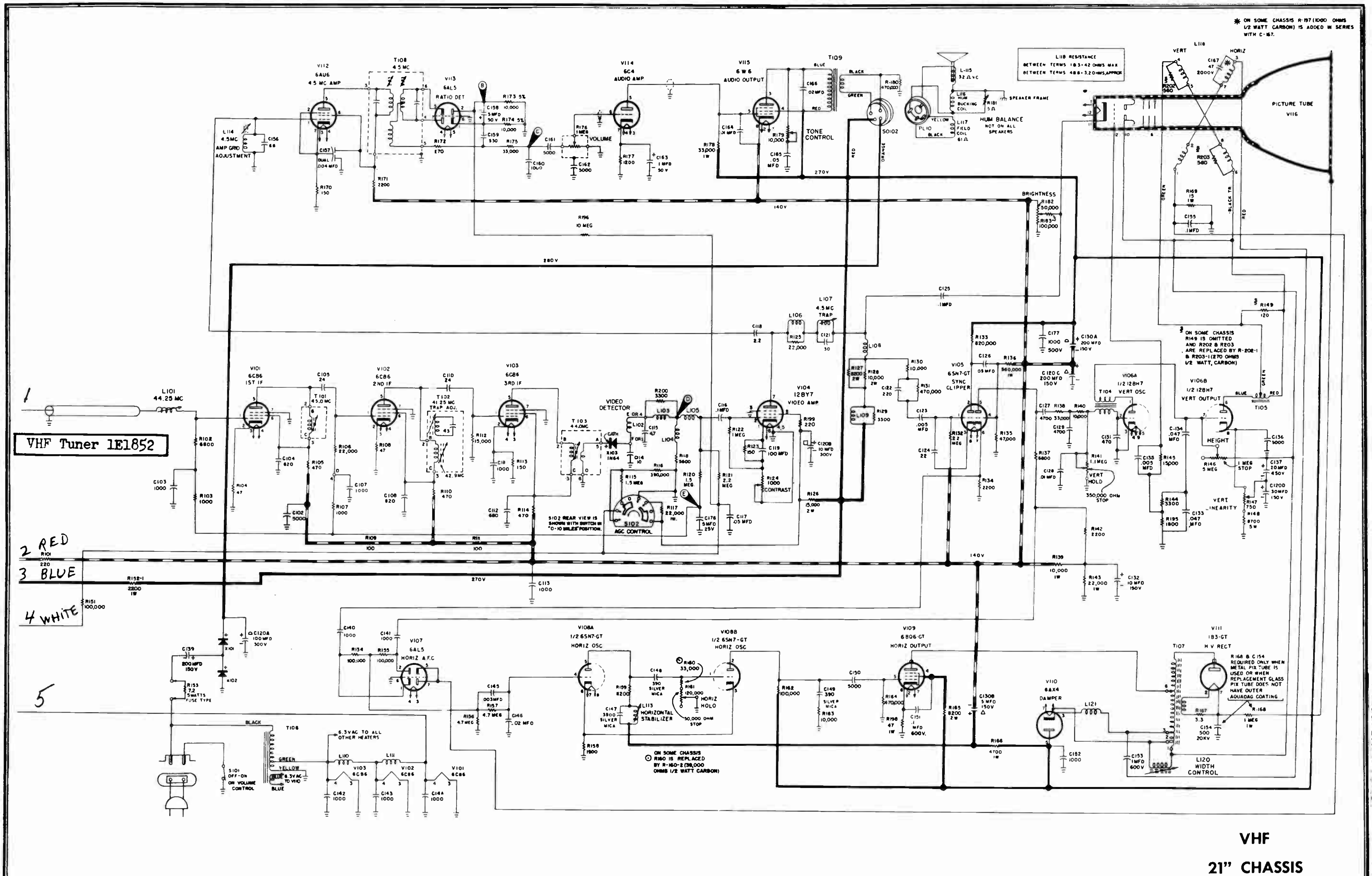
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

VHF

21" CHASSIS

E1300D

RUNS 2 & 2-2



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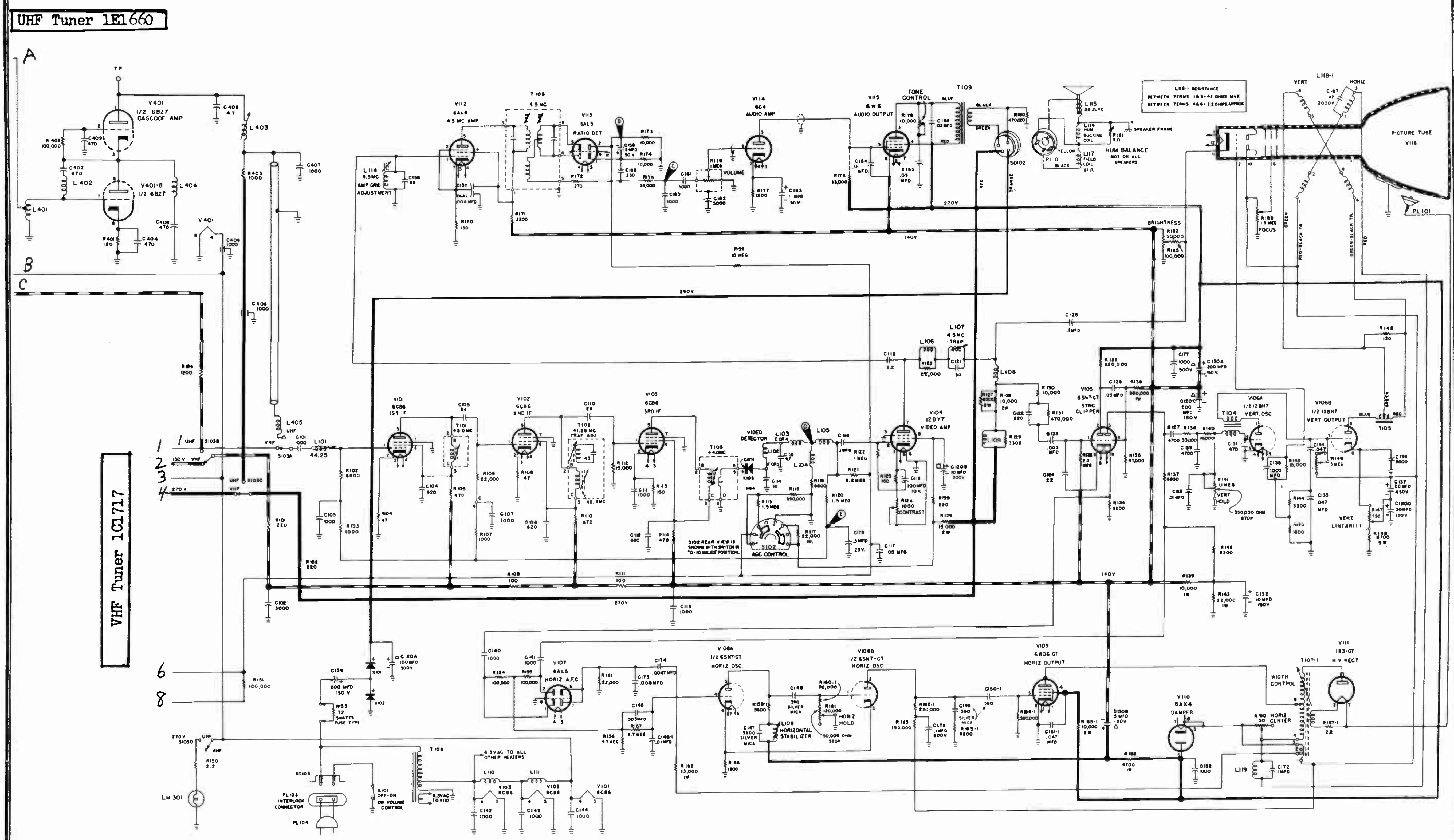
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

VHF
21" CHASSIS
E1300D
RUNS 1 & 1-2



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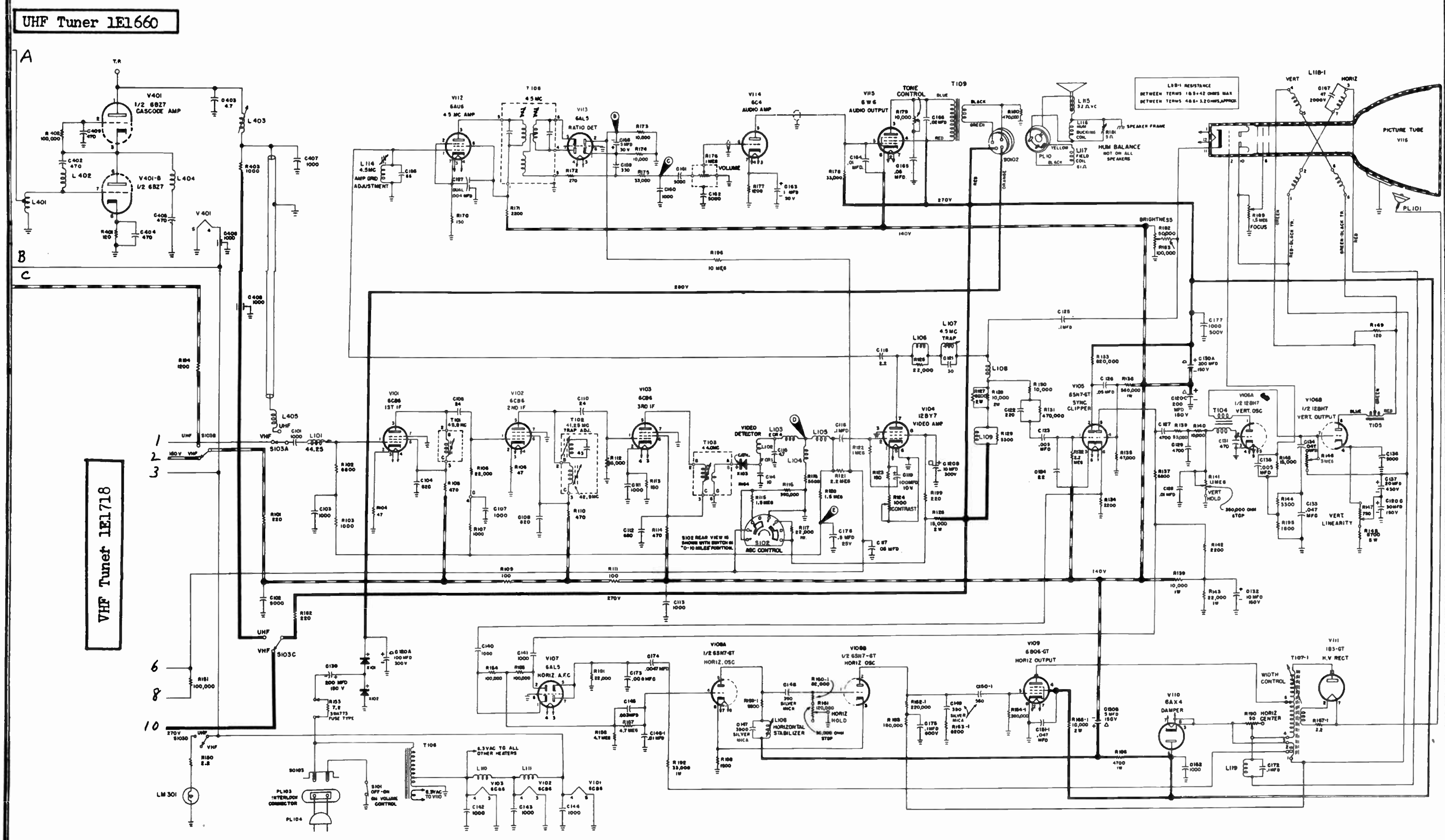
VHF-UHF 17" CHASSIS

D1300D

RUN 2



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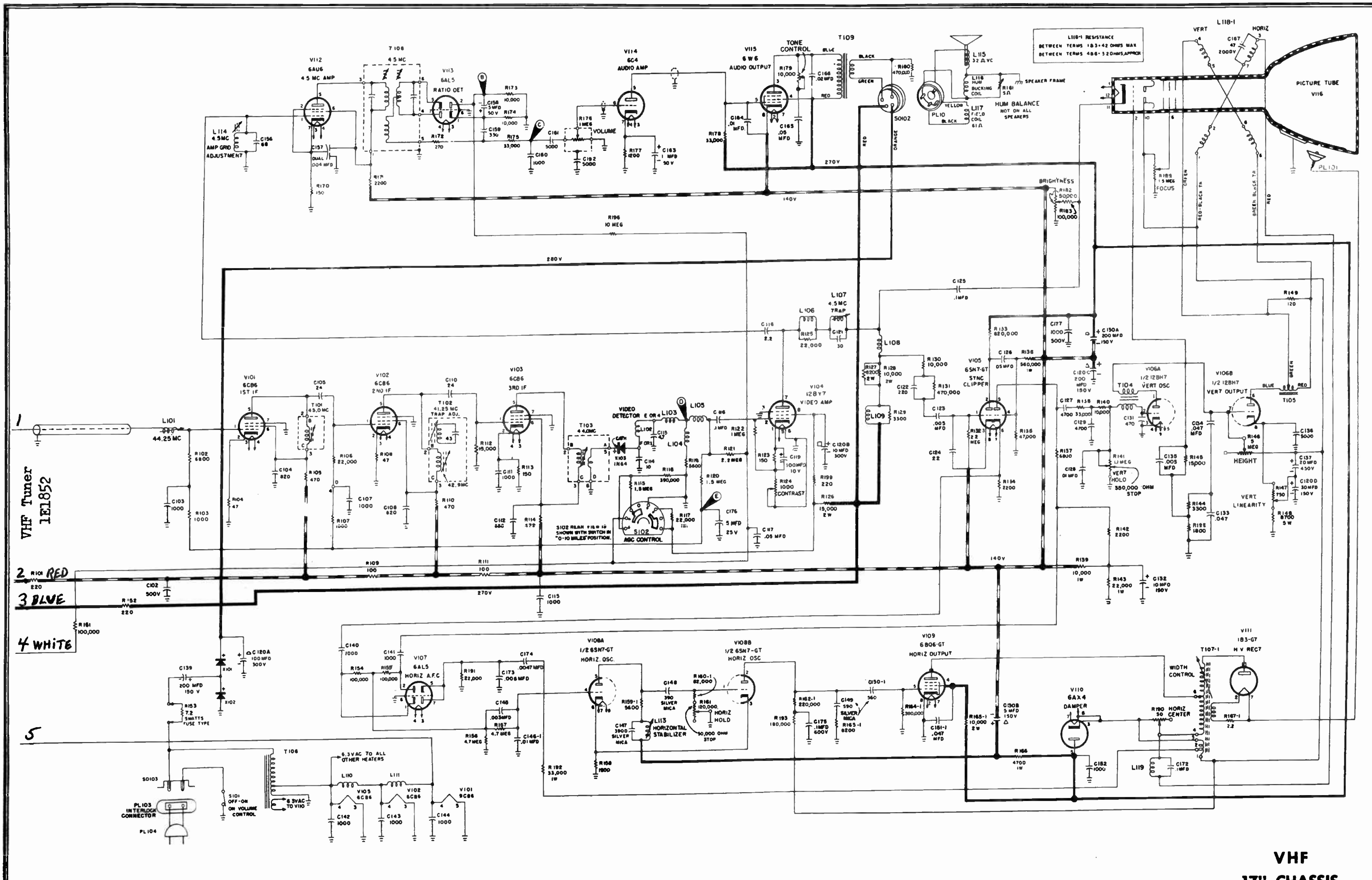
VHF-UHF
17" CHASSIS
D1300D
RUN 1



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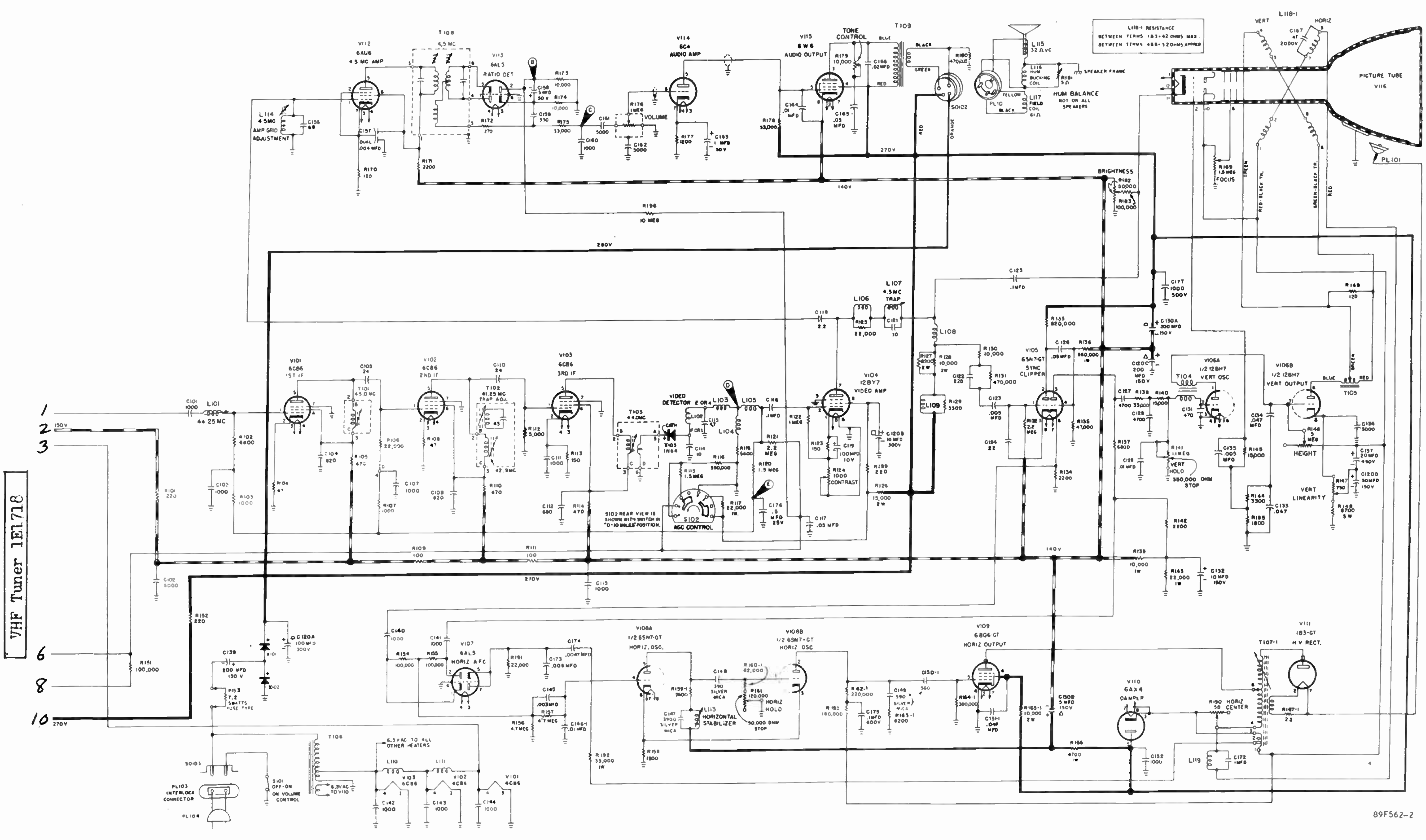
VHF
17" CHASSIS
C1300D
RUN 2



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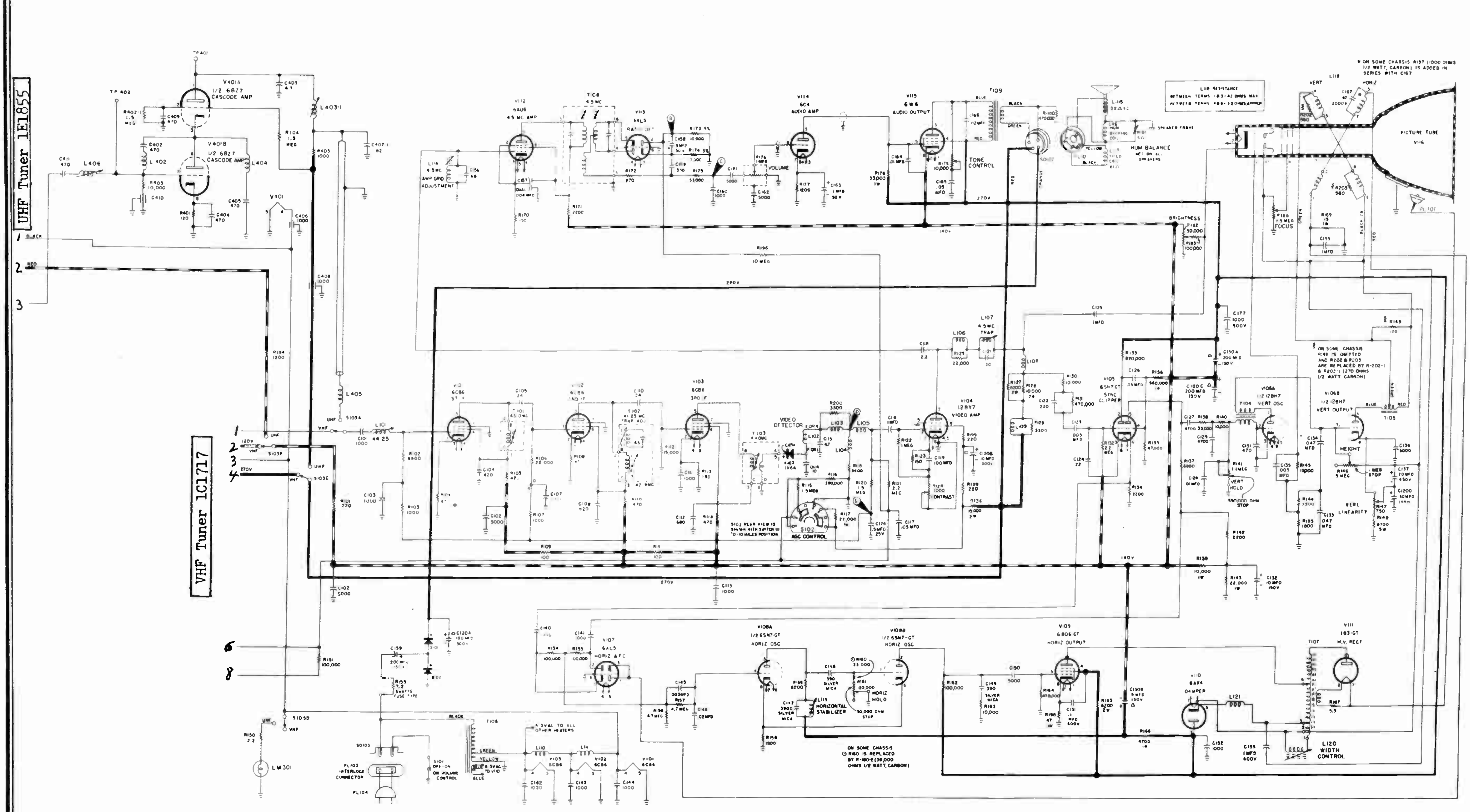
3. 270 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF
17" CHASSIS
C1300D
RUN 1

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.



ON ALL (-2) RUNS OF ALL CHASSIS THE FOLLOWING CHANGES ARE MADE:
A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

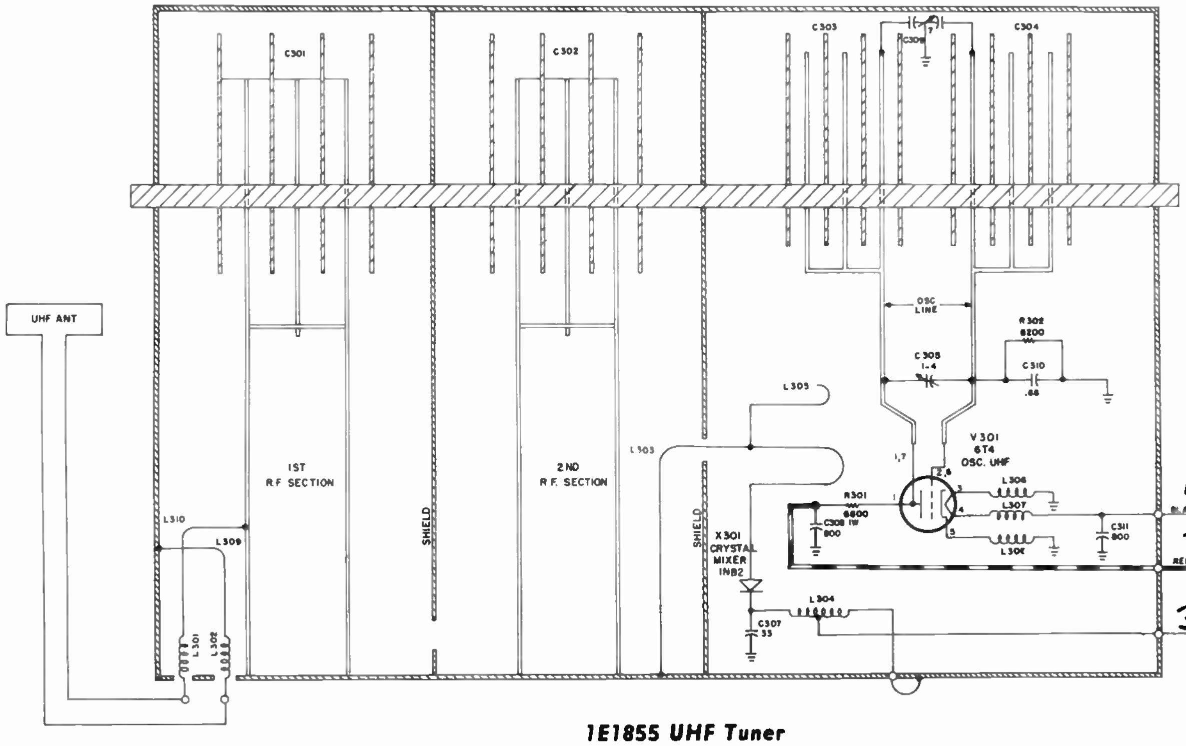
ON H1300D CHASSIS THE FOLLOWING CHANGES HAVE BEEN MADE:
A. C-150 IS REPLACED BY C-150-2 (1000 MMF. 500 V., CERAMIC DISC.)
B. C-151 IS REPLACED BY C-151-1 (.047 MFD. 400 V., PAPER TUBULAR.)
C. R-160 IS REPLACED BY R-160-3 (56,000 OHMS 1/2 WATT, CARBON.)
D. R-161 IS REPLACED BY R-161-1 WHICH IS IDENTICAL TO R-161 EXCEPT FOR DELETION OF 50,000 OHM STOP.
E. L-118 DEFLECTION YOKE IS REPLACED BY L-118-2 (53C320)

VHF-UHF

17" CHASSIS 17-21"

B1300D H1300D

RUN 2 RUN 2 & 2-2

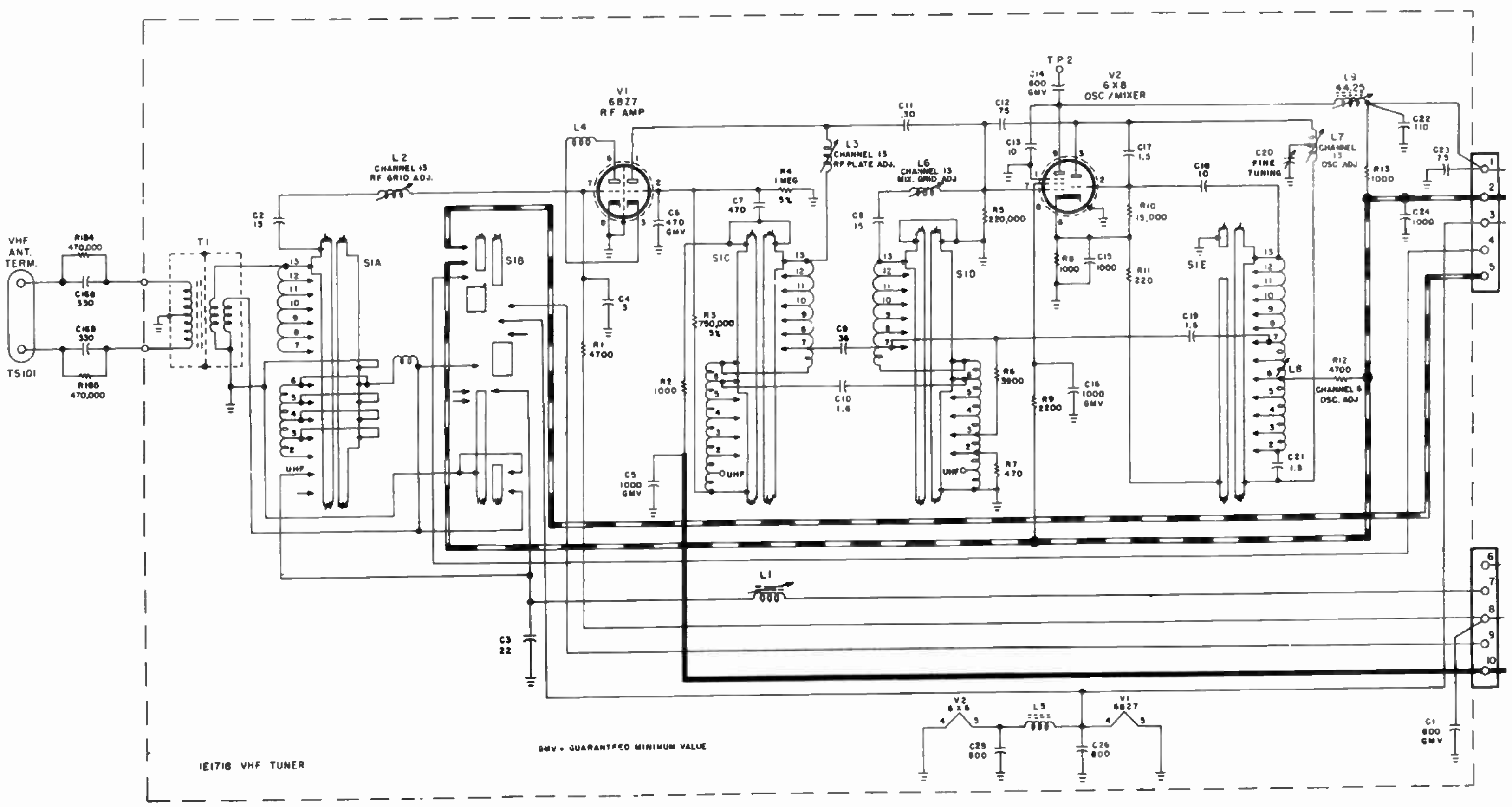


1E1855 UHF Tuner

PICTURE TUBE REMOVAL

1. Remove the chassis from the cabinet. Note that on chassis with the horizontal and vertical hold controls on the rear apron the knobs on the control shafts and the A.G.C. control switch must be removed before the cabinet back may be removed. These are push-on type knobs.
2. Insure the discharge of the high voltage power supply by disconnecting the anode plug and shorting it to the chassis. Also short the anode socket or metal cone of the picture tube to the chassis.
3. Remove the picture tube socket from the base of the tube.
4. Slip the ion trap and the centering device from the neck of the tube. On some chassis, the centering device is an integral part of the deflection yoke assembly.
5. Carefully remove the rear support tension spring on each side of the picture tube. If a glass cone picture tube is involved, remove the metalized paper picture tube shield and ground by unhooking the springs on each side and the hook on the top center of the picture tube mounting strap.
6. Remove the mounting strap from the front rim of the picture tube.
7. Lift the front of the picture tube just far enough to clear the front mounting brackets and slip the tube forward until the neck is clear of the deflection yoke and the rubber collar. Use a slight twisting pull to break the cone of the tube from the rubber collar if the two are stuck together. Loosen the deflection yoke adjustment screw if required for clearance when raising the front of the picture tube over the front mounting brackets.

CAUTION - IF THE TUBE FAILS TO SLIP OUT EASILY, INVESTIGATE AND REMOVE THE CAUSE OF TROUBLE. DO NOT USE FORCE AS THE NECK OF THE PICTURE TUBE IS EASILY BROKEN.



SERVICE ADJUSTMENTS

VERTICAL AND HORIZONTAL HOLD CONTROLS - These two controls should be adjusted until a single steady picture is obtained. With average signal strength it should be possible to switch from one active channel to another without losing sync when these two controls are properly adjusted. These two controls will be found on the front apron of some chassis.

CENTERING — (C1300D & D1300D Chassis only)

Place the horizontal centering control, located on the rear apron of the chassis, in the approximate center of its range. Rotate the two ring magnets by the ears around the neck of the picture tube until the picture is properly centered. Slight readjustment of the ion trap may then be necessary. The horizontal centering control may now be used for fine adjustment.

(A1300D, B1300D, H1300D, & J1300D Chassis only)

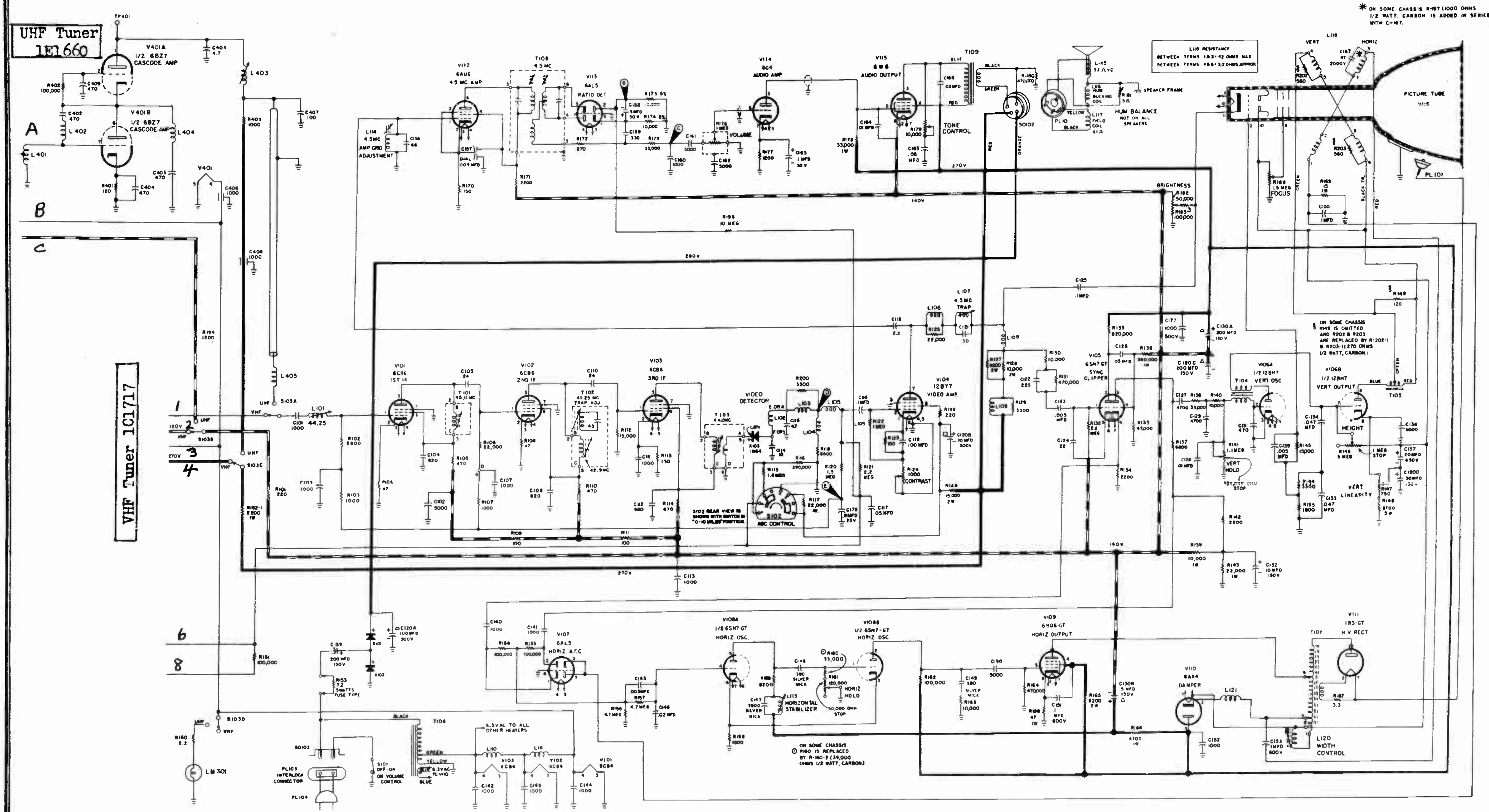
Same as above except horizontal control on rear apron omitted.

(E1300D & F1300D Chassis only)

Move the centering lever a short distance in any direction, up or down, or to either side. Slight readjustment of the ion trap setting may then be necessary.

HEIGHT CONTROL AND VERTICAL LINEARITY ADJUSTMENT - A test pattern will be required for the proper adjustment of these two controls. The height control has a pronounced effect on the overall picture height and at the same time the adjustment of this control will expand or contract the top of the picture more than the bottom. The vertical linearity control will affect the height somewhat but will have a more pronounced effect on the bottom portion of the picture. The interaction between these two controls makes it necessary to adjust both for proper picture height and vertical linearity.

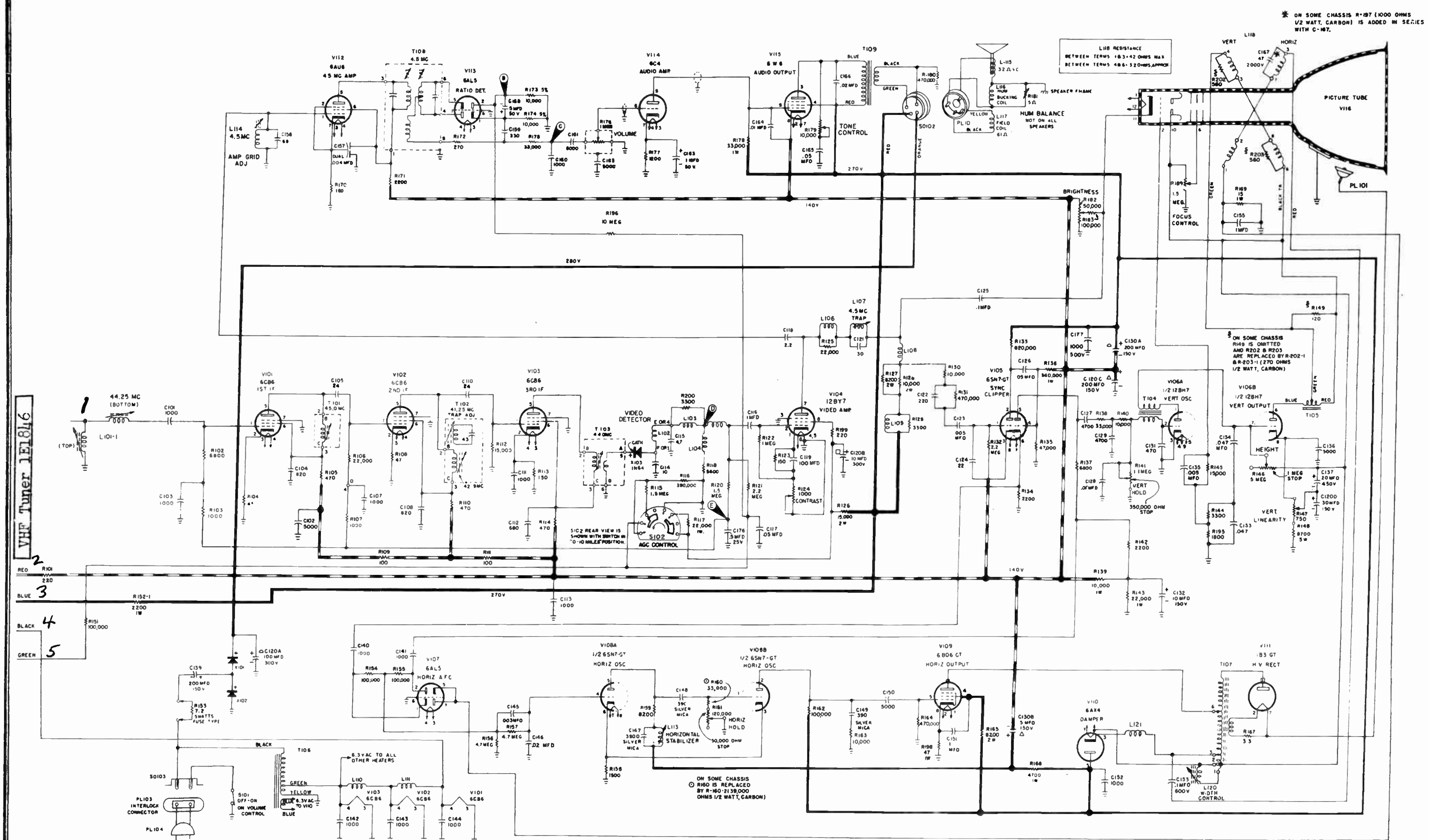
1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 270 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF-UHF
17" CHASSIS

B1300D
RUN 1



ON ALL (-2) RUNS OF ALL CHASSIS THE FOLLOWING CHANGES ARE MADE:

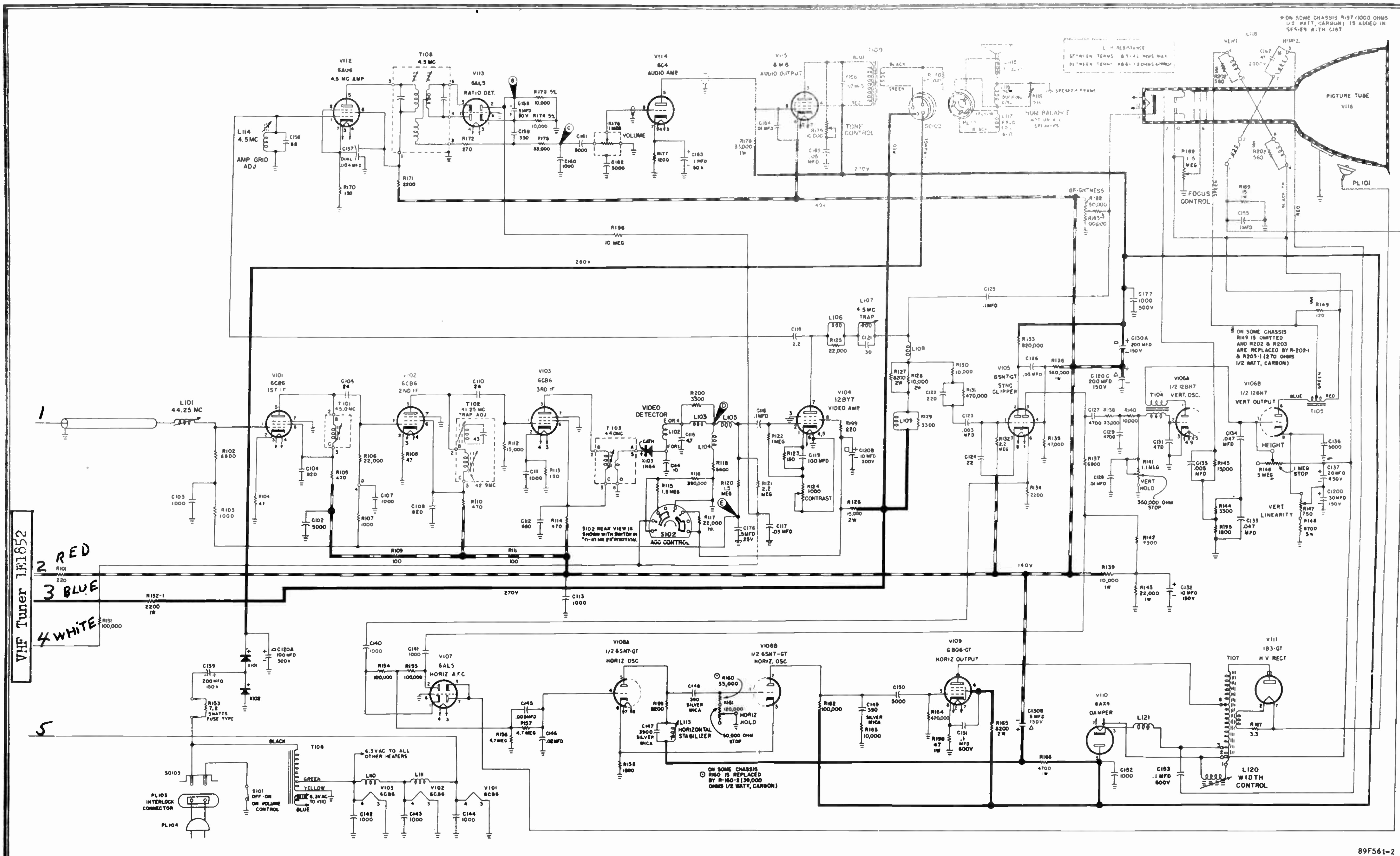
A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

ON J1300D CHASSIS THE FOLLOWING CHANGES HAVE BEEN MADE:

A. C-150 IS REPLACED BY C-150-2 (1000 MMF. 500 V., CERAMIC DISC.)
B. C-151 IS REPLACED BY C-151-1 (.047 MFD. 400 V., PAPER TUBULAR.)
C. R-160 IS REPLACED BY R-160-3 (56,000 OHMS 1/2 WATT, CARBON.)
D. R-161 IS REPLACED BY R-161-1 WHICH IS IDENTICAL TO R-161 EXCEPT FOR DELETION OF 50,000 OHM STOP.
E. L-118 DEFLECTION YOKE IS REPLACED BY L-118-2 (53C320)

VHF

17"	CHASSIS	17-21"
A1300D		**J1300D**
RUN 2 & 2-2		**RUN 1A & 1A-2**



VHF

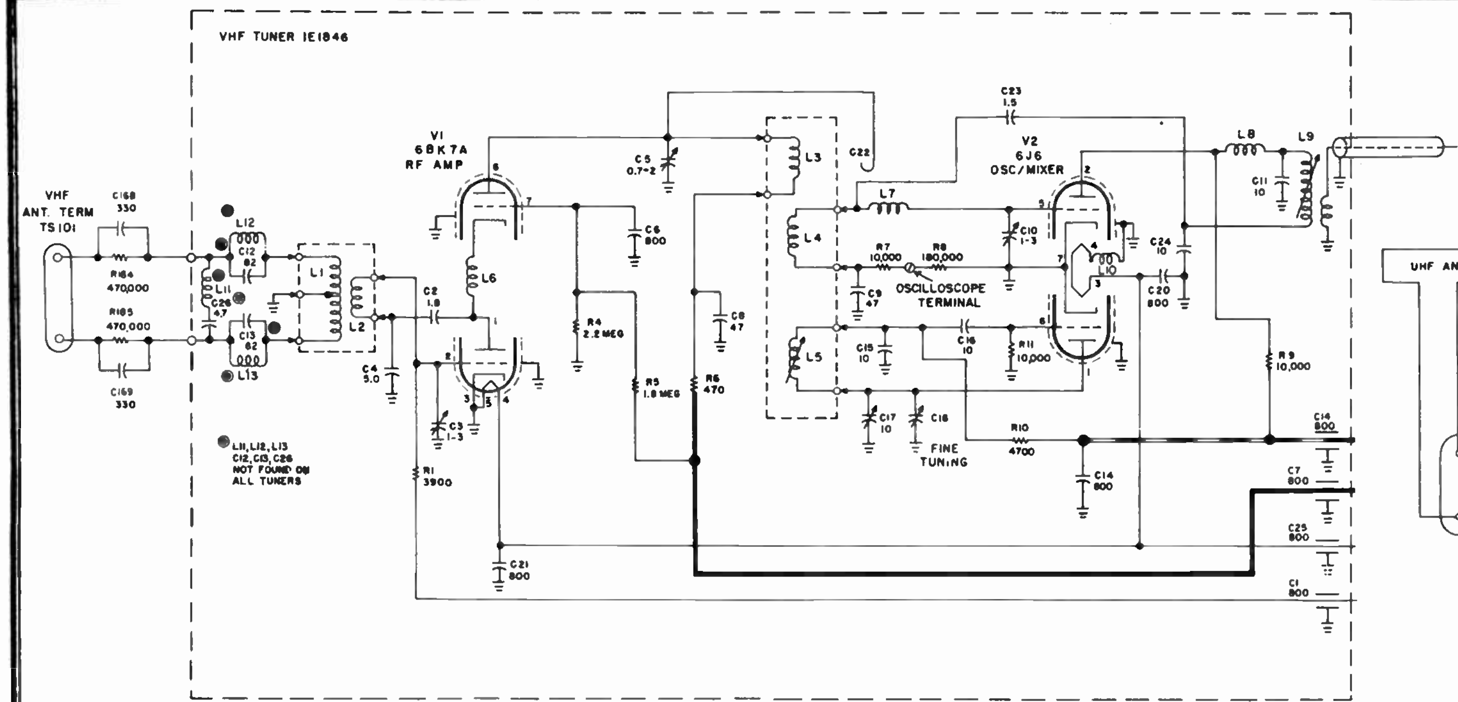
17" CHASSIS 17-21"

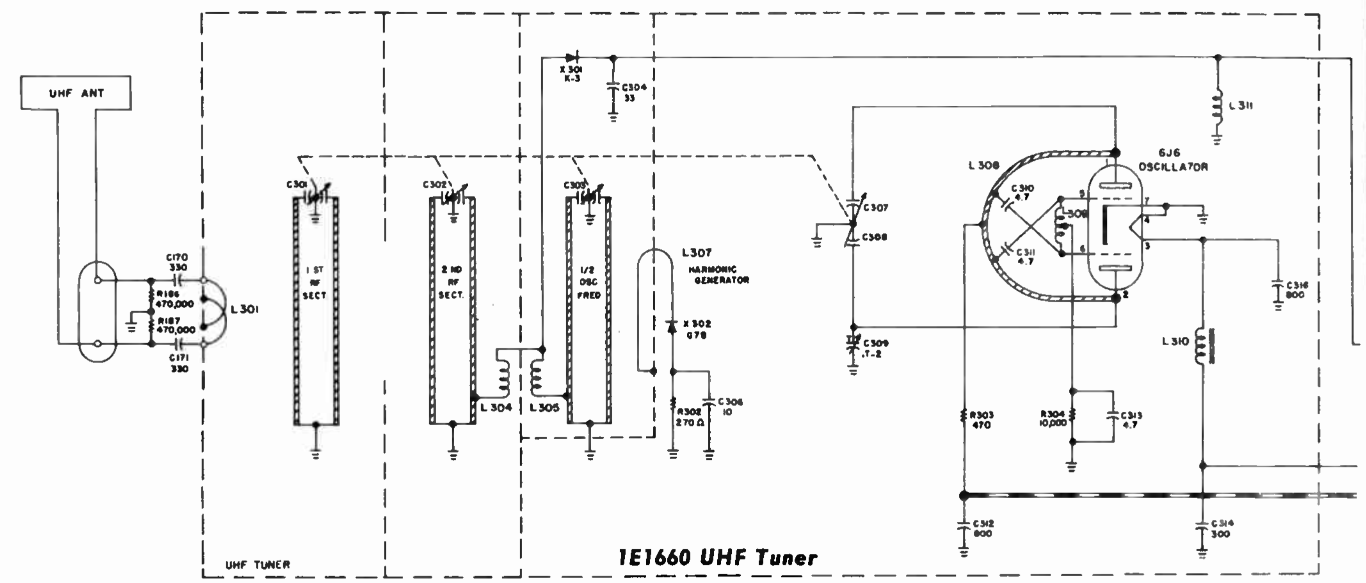
A1300D J1300D

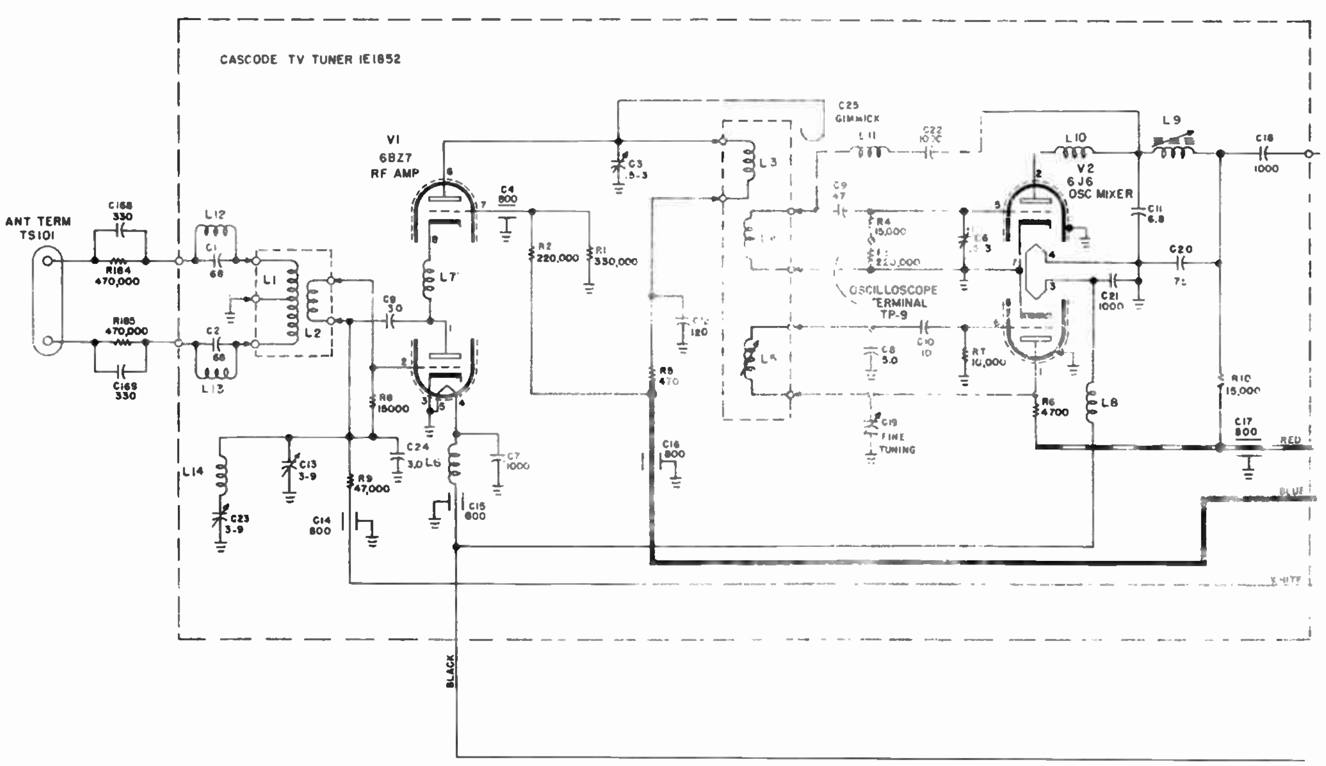
RUN 1 & 1-2 RUN 1 & 1-2

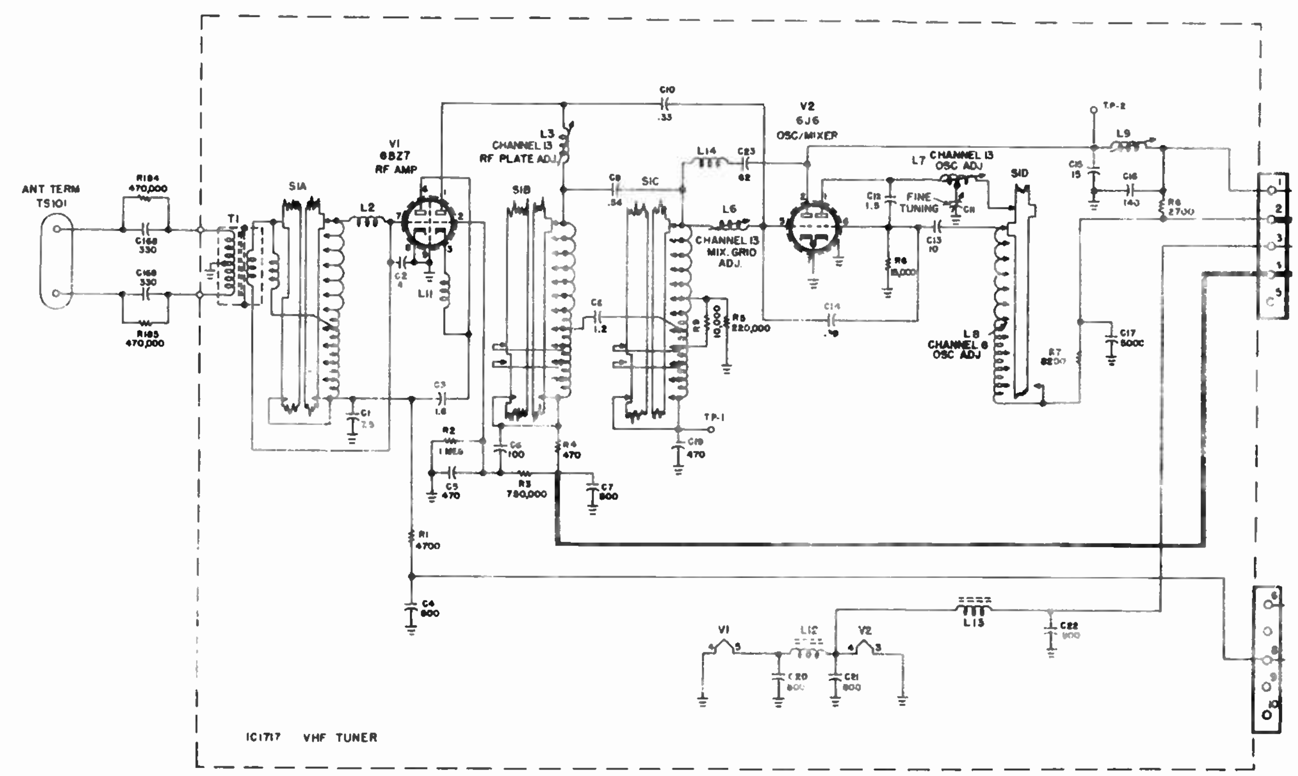
ON ALL (-2) RUNS OF ALL CHASSIS THE FOLLOWING CHANGES ARE MADE:
A. T-106 IS REPLACED BY T-106-1 (52C258) WHICH INCLUDES 12V. LEAD.
B. V-105 IS REPLACED BY V-105-1 (12SN7GT).
C. R-198 (47 OHMS 1 WATT, CARBON) DELETED.

ON J1300D CHASSIS THE FOLLOWING CHANGES HAVE BEEN MADE:
A. C-150 IS REPLACED BY C-150-2 (1000 MMF. 500 V., CERAMIC DISC.)
B. C-151 IS REPLACED BY C-151-1 (.047 MFD. 400 V., PAPER TUBULAR.)
C. R-160 IS REPLACED BY R-160-3 (56,000 OHMS 1/2 WATT, CARBON.)
D. R-161 IS REPLACED BY R-161-1 WHICH IS IDENTICAL TO R-161 EXCEPT FOR DELETION OF 50,000 OHM STOP.
E. L-118 DEFLECTION YOKE IS REPLACED BY L-118-2 (53C320)









1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 270 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V108. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

HORIZONTAL AMPLIFIER, DAMPER AND HIGH VOLTAGE RECTIFIER

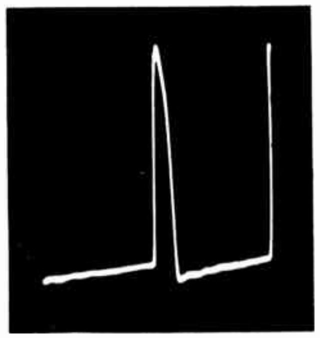
Before endeavoring to view the following waveforms read the notes and instructions at the beginning of this section pertaining to waveforms. The high voltage probe shown below must be used to prevent damage to the test equipment being used.

V-110
Damper

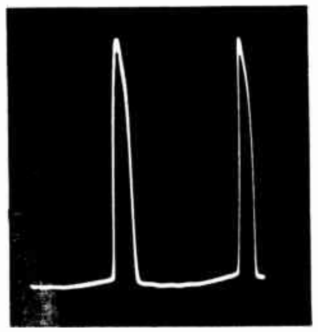
Cath. Pin 3

Sweep Freq.
7875 cps

Voltage Ratio
1 time



92X1784-Q



92X1784-S

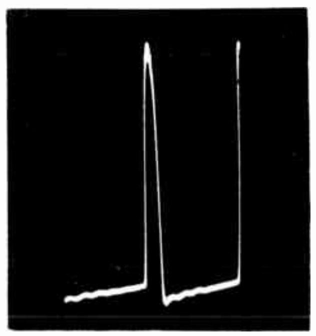
Across Horiz. Yoke

Red Wires

Sweep Freq.
7875 cps

Voltage Ratio
1 time

NOTE: When observing this test pattern the oscilloscope must not be grounded since the ground side of the scope is connected to B+ of the power supply. Do not touch the tv chassis and the scope during this observation as a severe shock will result. The "hot" lead of the scope should be connected to the red wire and the other scope lead should be connected to the red wire with black tracer.



92X1784-P

V-109
Horiz. Out.

Plate Cap

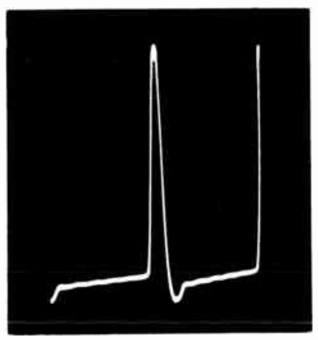
Sweep Freq.
7875 cps

Voltage Ratio
1.7 times

V-111
High Volt.
Rectifier
Plate Cap

Sweep Freq.
7875 cps

Voltage Ratio
5.5 times



92X1784-R

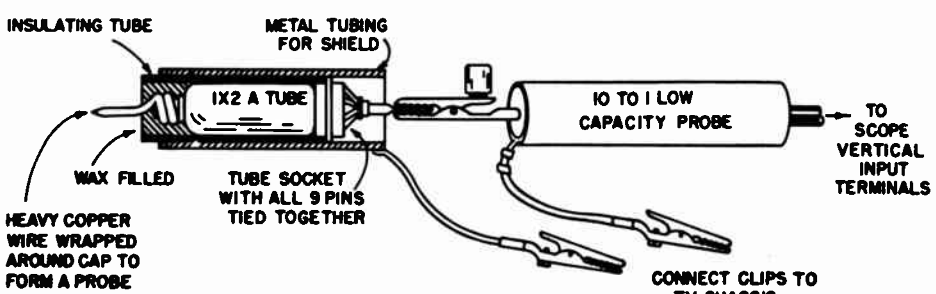


Fig. 50A. High Voltage Probe for Waveform Observations

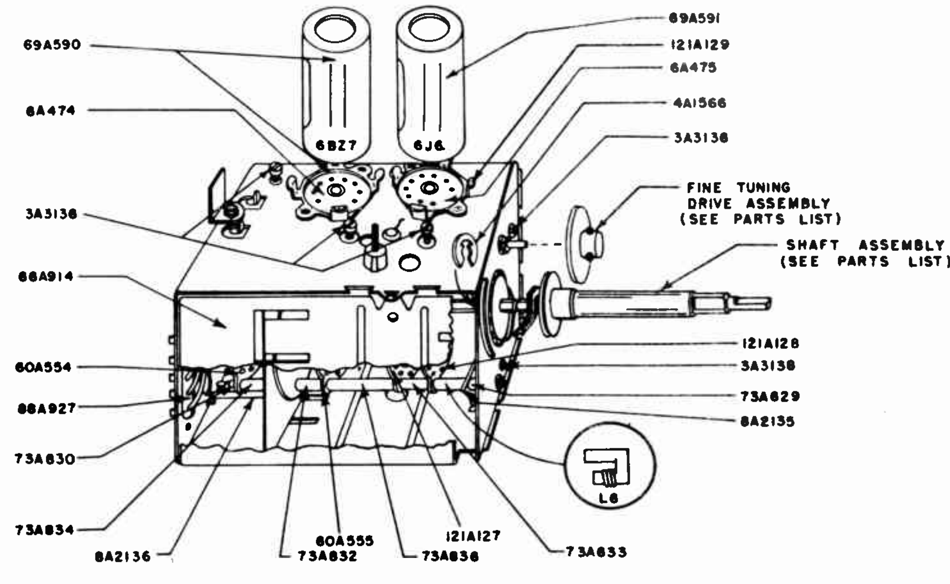


Fig. 60A. Parts Identification for 1C1717 Cascode Tuner

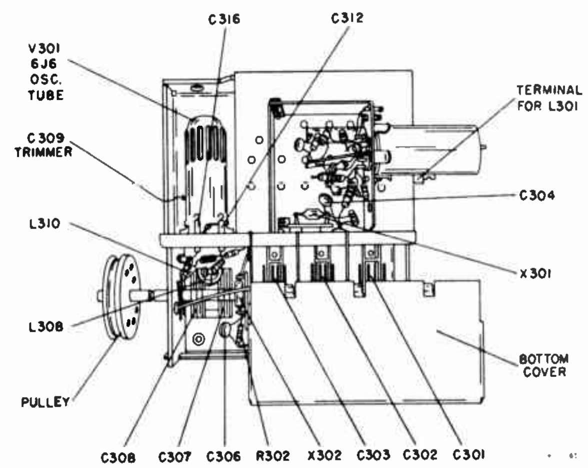


Fig. 70A. Parts Identification of 1E1664 UHF Tuner

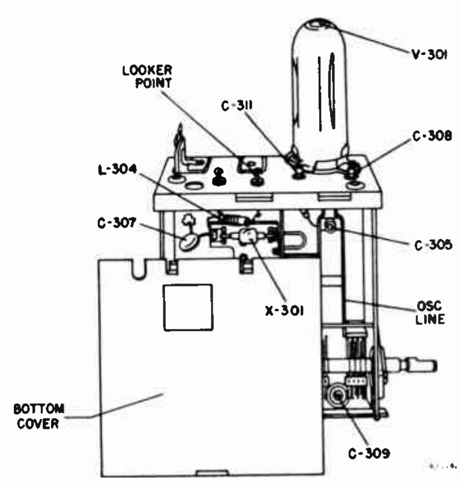


Fig. 70B. Parts Identification of 1E1855 UHF Tuner

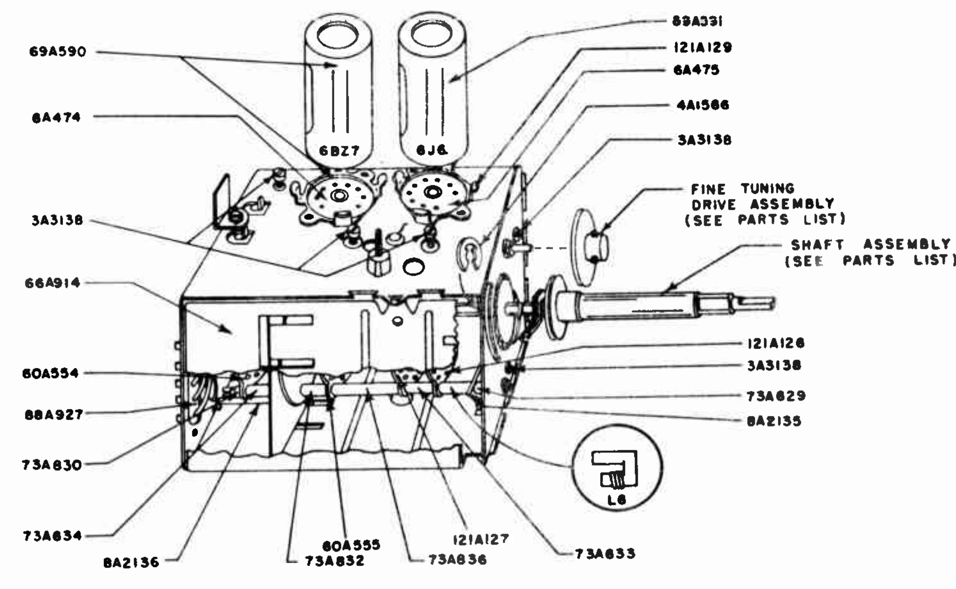
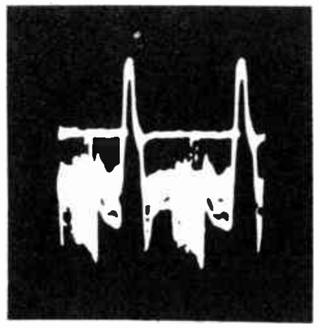


Fig. 62A. Parts Identification for 1E1403, 1E1670, & 1E1718 VHF Tuners

TYPICAL OSCILLOSCOPE PATTERNS

VIDEO AMPLIFIER



V-104
Video Amp.

Plate pin 7

Sweep Freq.
7875 cps

Voltage P/P
set 60 volts

Adjust the contrast control to give a 60 volt peak to peak reading. Do not change this setting when taking other waveforms.

SYNC. CLIPPER

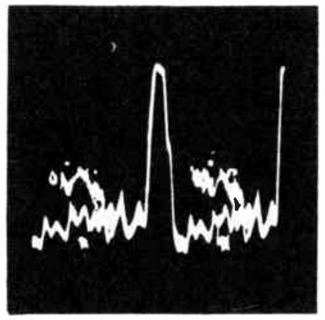
Before viewing the following waveforms set the contrast control for the 60 volt peak to peak reading and the pattern shown on page 1954-47.

V-105
Sync. Clip

Grid Pin 1

Sweep Freq.
7875 cps

Voltage P/P
45 volts



V-105
Sync. Clip.

Plate Pin 2

Sweep Freq.
7875 cps

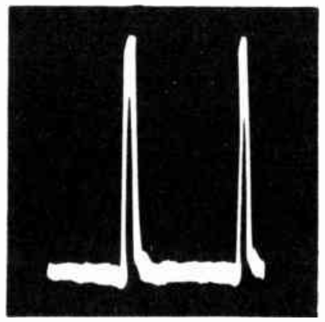
Voltage P/P
45 volts

V-105
Sync. Clip.

Plate Pin 5

Sweep Freq.
7875 cps

Voltage P/P
35 volts



VERTICAL OSCILLATOR AND VERTICAL AMPLIFIER

Junction of
R-138, R-140
& C-129

Sweep Freq.
30 cps

Voltage P/P
45 volts

V-106A
Vert. Osc.

Grid Pin 2

Sweep Freq.
30 cps

Voltage P/P
130 volts

V-106B
Vert. Out.

Grid Pin 7

Sweep Freq.
30 cps

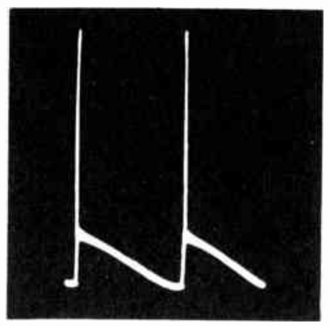
Voltage P/P
90 volts

V-106B
Vert. Out.

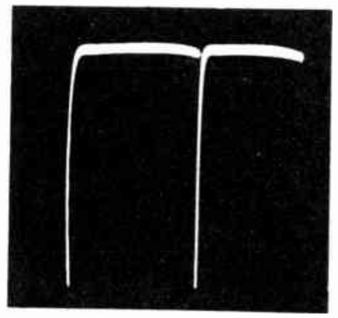
Plate Pin 6

Sweep Freq
30 cps

Voltage P/P
1500 volts



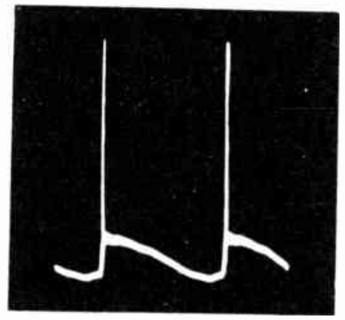
PIX TUBE GRID AND VERTICAL YOKE



V-116
Pix Tube

Grid Pin 2
Green Lead
Sweep Freq.
30 cps

Voltage P/P
30 volts



Across Vert.
Yoke

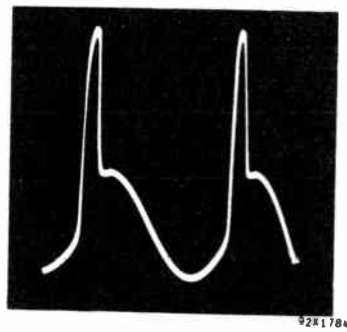
Green Leads

Sweep Freq.
30 cps

Voltage P/P
30 volts

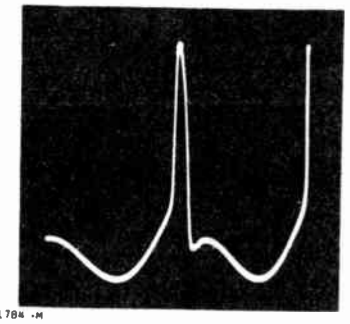
NOTE: When observing this test pattern the oscilloscope must not be grounded since the ground side of the scope is connected to B+ of the power supply. Do not touch the tv chassis and the scope during this observation as a severe shock will result. The "hot" lead of the scope should be connected to the green wire and the other scope lead should be connected to the green wire with black tracer.

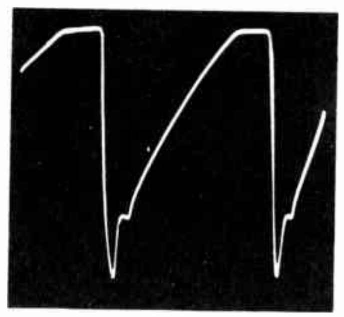
HORIZONTAL OSCILLATOR AND HORIZONTAL AMPLIFIER DRIVE



V-108
Horiz. Osc.
Plate Pin 5
Sweep Freq.
7875 cps
Voltage P/P
45 volts

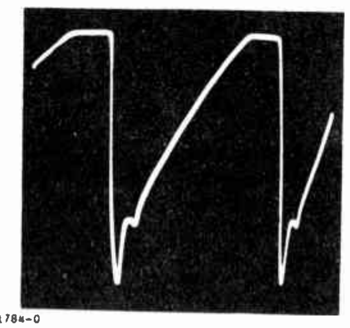
V-108
Horiz. Osc.
Grid Pin 1
Sweep Freq.
7875 cps
Voltage P/P
45 volts





V-108
Horiz. Osc.
Plate Pin 2
Sweep Freq.
7875 cps
Voltage P/P
145 volts

V-109
Horiz. Out.
Grid Pin 5
Sweep Freq.
7875 cps
Voltage P/P
140 volts



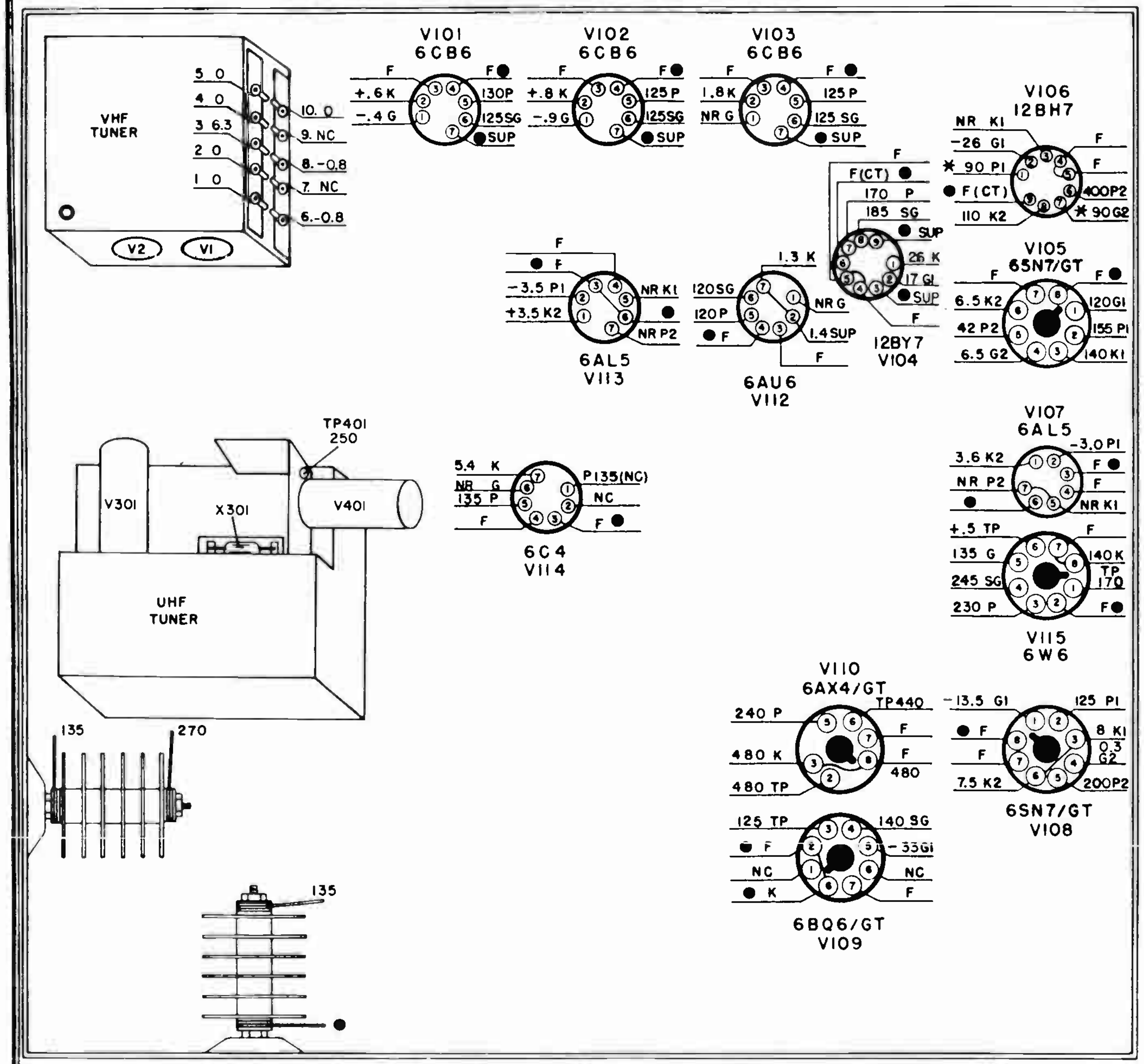


Fig. 45A. Voltage Chart for Chassis D1300D (Runs 1 & 2)

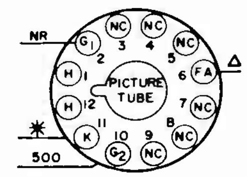
KEY

- ✱ VARIES FROM 50 TO 160V. DEPENDING UPON THE SETTING OF THE HEIGHT CONTROL.
- ● INDICATES GROUND LUGS
- TP TIE POINT.
- NC NO CONNECTION.
- NR NOT READABLE.
- ○ FOR TUNER VOLTAGE FOR VHF OPERATION SEE PAGE 1954-40

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. CHANNEL SELECTOR SET TO UHF POSITION.
3. BRIGHTNESS CONTROL MAXIMUM.
4. CONTRAST CONTROL MINIMUM.
5. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
6. ALL OTHER CONTROLS SET FOR NORMAL RASTER
7. LINE VOLTAGE 117 V 60 ∿ AC.
8. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
9. ALL READINGS TAKEN WITH A VTVM.

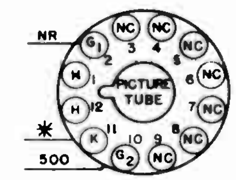


✱ 30 BRIGHTNESS MAX
150 BRIGHTNESS MIN

△ 0 FOCUS CONTROL MIN
500 FOCUS CONTROL MAX

PICTURE TUBE LEAD COLOR CODE		
PIN NO	COLOR	ELEMENT
1	BLACK	HEATER & GND.
2	GREEN	GRID
6	BLUE	FOCUS GRID
10	RED	ANODE GRID
11	YELLOW	CATHODE
12	BROWN	HEATER

Fig. 46A. Picture Socket Voltages 17HP4 & 21YP4



✱ 25 BRIGHTNESS MAX
138 BRIGHTNESS MIN

PICTURE TUBE LEAD COLOR CODE		
PIN NO	COLOR	ELEMENT
1	BLACK	HEATER & GND
2	GREEN	GRID
10	RED	ANODE GRID
11	YELLOW	CATHODE
12	BROWN	HEATER

Fig. 46B. Picture Tube Socket Voltages 21AP4

VHF & UHF TUNING UNITS

Chassis	Run	VHF Tuner Cascode	R-F Amp	Osc./ Mixer	UHF Tuner	Osc.	Mixer	Harmonic Generator
A1300D C1300D E1300D J1300D	1, 1-2 2 1, 1-2 1, 1-2, 1B,1B-2	1E1852	90X6BZ7	90X6J6	------	------	--------------	-------------
A1300D C1300D E1300D J 1300D	2, 2-2 3 2, 2-2, 2B-2 1AB, 1AB-2	1E1846	90X6BK7A	90X6J6	------	------	--------------	-------------
C1300D	1	1E1718	90X6BZ7	90X6X8	------	------	--------------	-------------
B1300D D1300D F1300D	1 2 1	1C1717	90X6BZ7	90X6J6	1E1660	90X6J6	*121A339(1N82)	121A102 (G7B)
B1300D D1300D F1300D H1300D	2 3, 3-1 2, 2-2 2, 2-2, 2B-2	1C1717	90X6BZ7	90X6J6	1E1855	90X6T4	121A295 (1N82)	-------------
B1300D D1300D F1300D H1300D	3 1 3 1, 1-2, 1B-2	1E1670 or 1E1483	90X6BZ7	90X6X8	1E1660	90X6J6	*121A339 (1N82)	121A102 (G7B)
H1300D	1A, 1A-2, 1AB, 1AB-2	1E1670 or 1E1483	90X6BZ7	90X6X8	1E1855	90X6T4	121A295 (1N82)	-------------
F1300D	5, 5-2	1B1969	90X6BK7A	90X6J6	1E1660	90X6J6	*121A339 (1N82)	121A102 (G7B)

* 121A101 (K3) found on some tuners but use 121A339 for replacement.

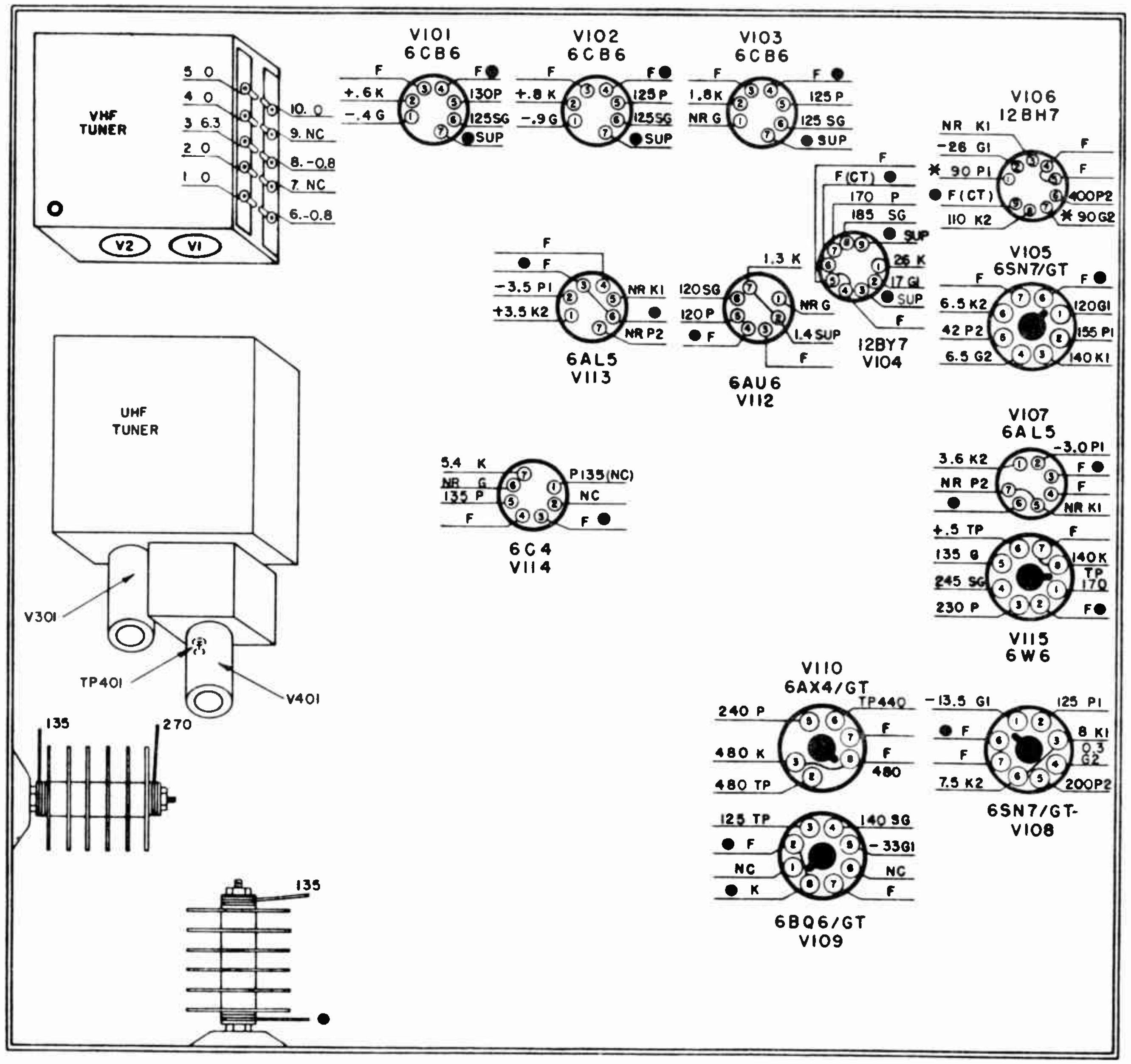


Fig. 43A. Voltage Chart for Chassis D1300 (Runs 3 & 3-1)

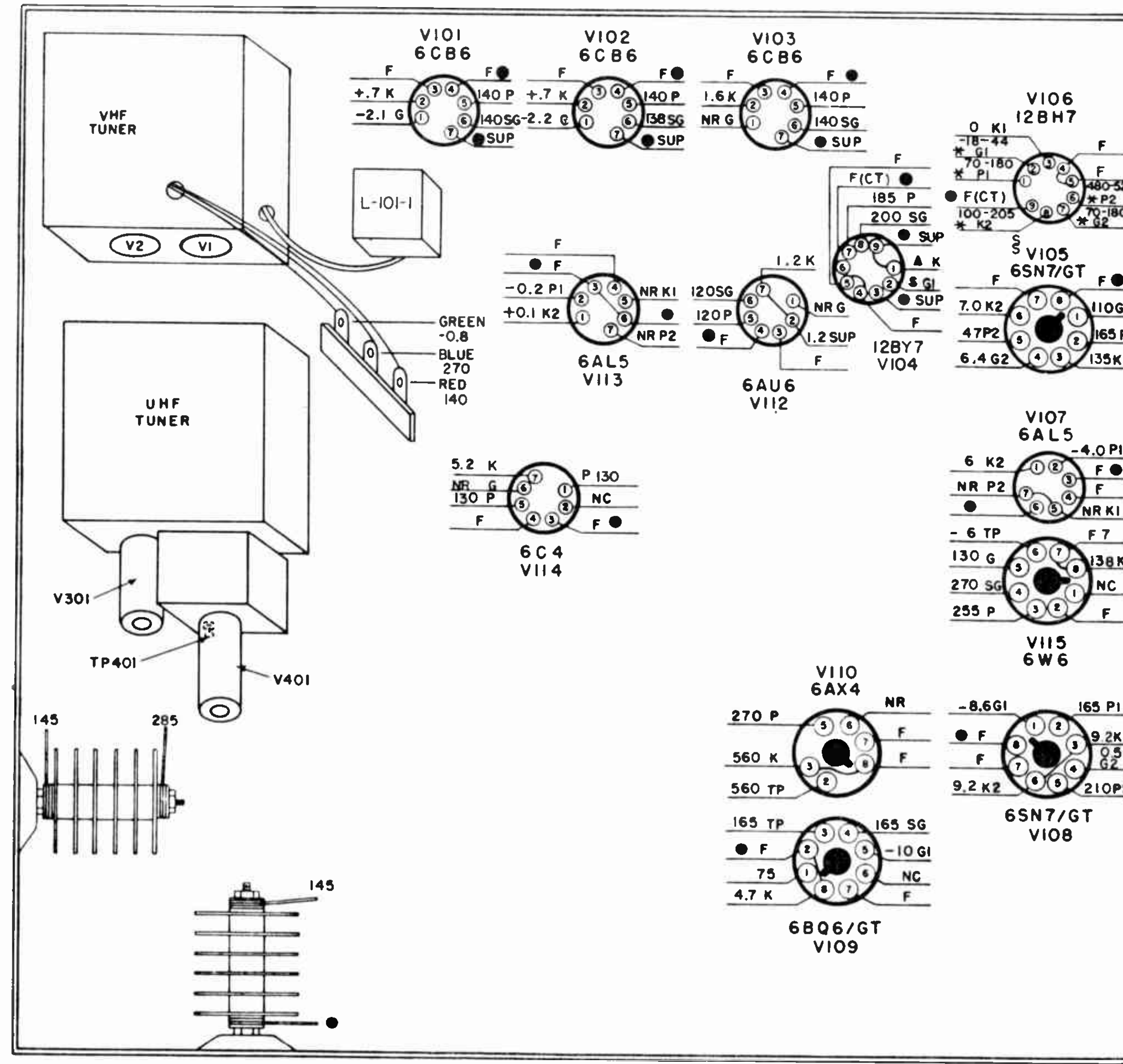


Fig. 44A. Voltage Chart for Chassis F1300D (Runs 5 & 5-2)

KEY

* VARIES FROM 50 TO 160V. DEPENDING UPON THE SETTING OF THE HEIGHT CONTROL.
● INDICATES GROUND LUGS

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.
O FOR TUNER VOLTAGE FOR VHF OPERATION SEE PAGE 1954-40

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. CHANNEL SELECTOR SET TO UHF POSITION.
3. BRIGHTNESS CONTROL MAXIMUM.
4. CONTRAST CONTROL MINIMUM.
5. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
6. ALL OTHER CONTROLS SET FOR NORMAL RASTER.
7. LINE VOLTAGE 117 V 60 ∿ AC.
8. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
9. ALL READINGS TAKEN WITH A VTVM.

KEY

* DEPENDS UPON THE SETTING OF THE HEIGHT CONTROL.
● INDICATES GROUND LUGS.

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.

▲ VARIES FROM 3 TO 34V. DEPENDING ON SETTING OF CONTRAST CONTROL.
$ VARIES FROM 0-16 V. DEPENDING ON SETTING OF CONTRAST CONTROL.
O FOR VOLTAGES OF VHF TUNER ON VHF SEE PAGE 1953-528.
§ ON RUN 5-2 CHASSIS V-105 IS REPLACED BY V-105-1 (12SN7GT)

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS.

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. BRIGHTNESS CONTROL MAXIMUM.
3. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE. POSITION.
4. ALL OTHER CONTROLS SET OR NORMAL RASTER.
5. LINE VOLTAGE 117 V 60 ∿ AC.
6. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
7. ALL READINGS TAKEN WITH A VTVM.
8. CHANNEL SELECTOR SET TO UHF.

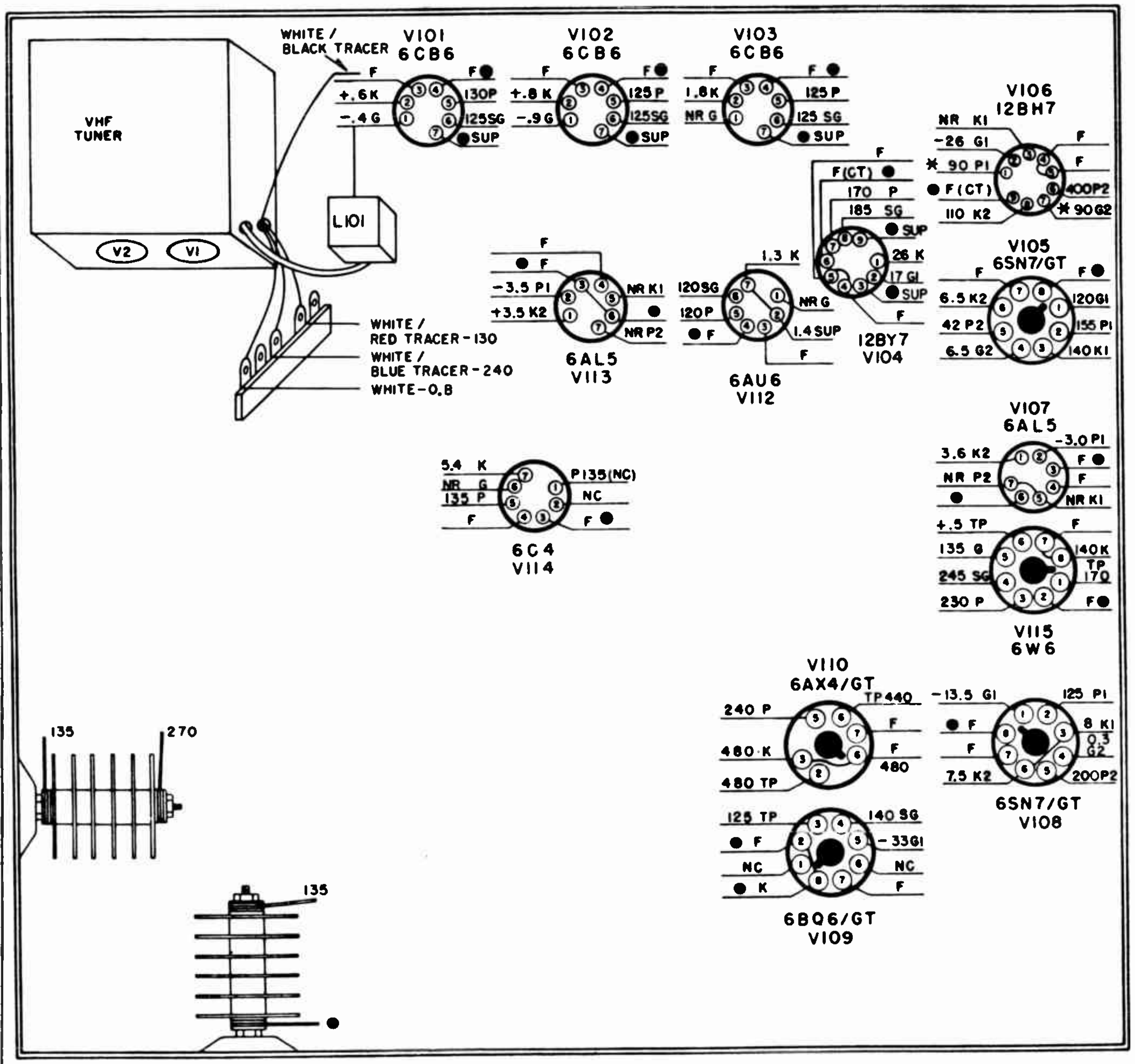


Fig. 41A. Voltage Chart for Chassis C1300D (Run 2)

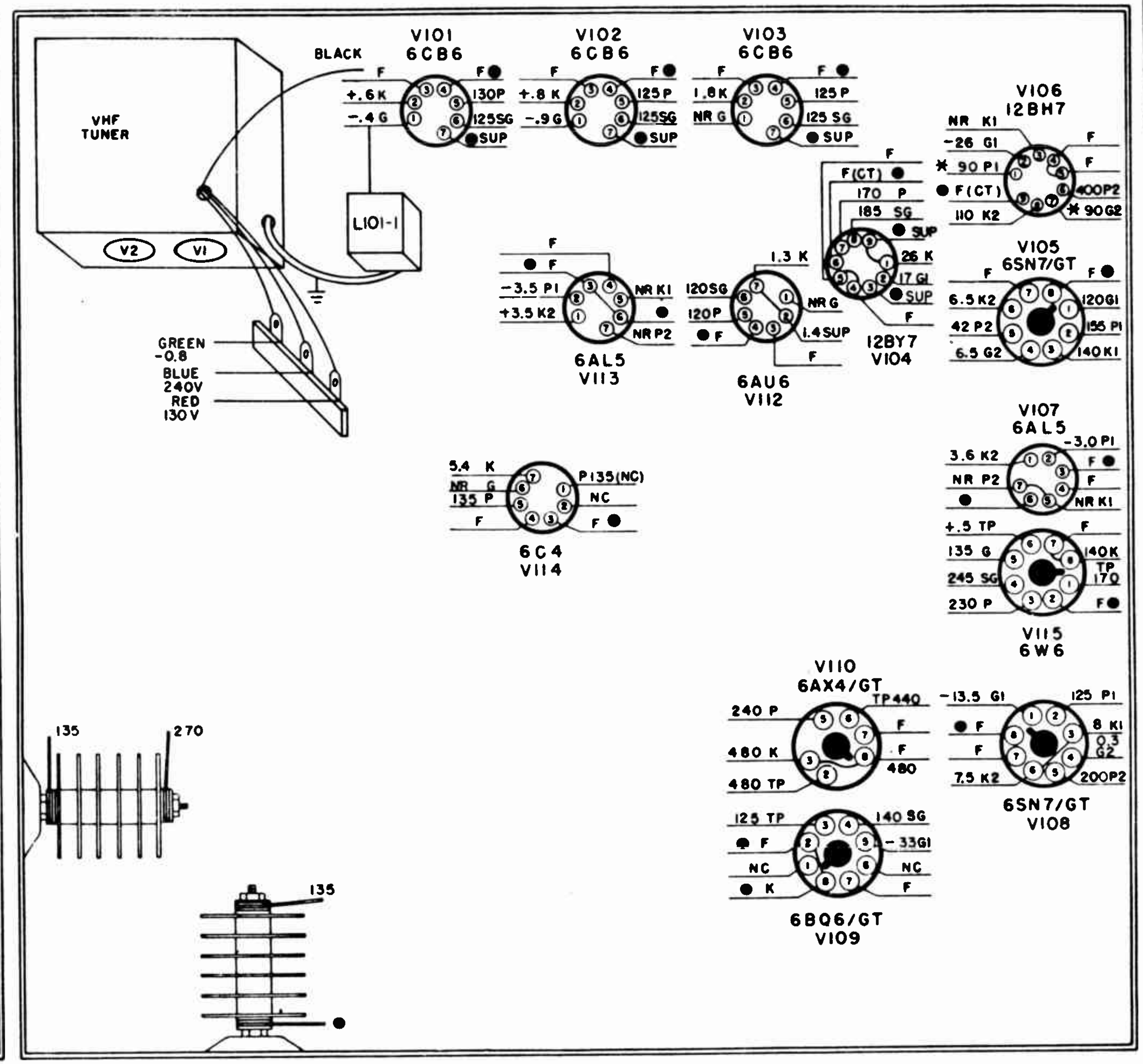


Fig. 42A. Voltage Chart for Chassis C1300D (Run 3)

KEY

* VARIES FROM 50 TO 160V. DEPENDING UPON THE SETTING OF THE HEIGHT CONTROL.
● INDICATES GROUND LUGS

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. ALL READINGS TAKEN WITH A VTVM.
3. BRIGHTNESS CONTROL MAXIMUM.
4. CONTRAST CONTROL MINIMUM.
5. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
6. ALL OTHER CONTROLS SET FOR NORMAL RASTER.
7. LINE VOLTAGE 117V 60 ∿ AC.
8. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.

KEY

* VARIES FROM 50 TO 160V. DEPENDING UPON THE SETTING OF THE HEIGHT CONTROL.
● INDICATES GROUND LUGS

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. ALL READINGS TAKEN WITH A VTVM.
3. BRIGHTNESS CONTROL MAXIMUM.
4. CONTRAST CONTROL MINIMUM.
5. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
6. ALL OTHER CONTROLS SET FOR NORMAL RASTER.
7. LINE VOLTAGE 117V 60 ∿ AC.
8. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.

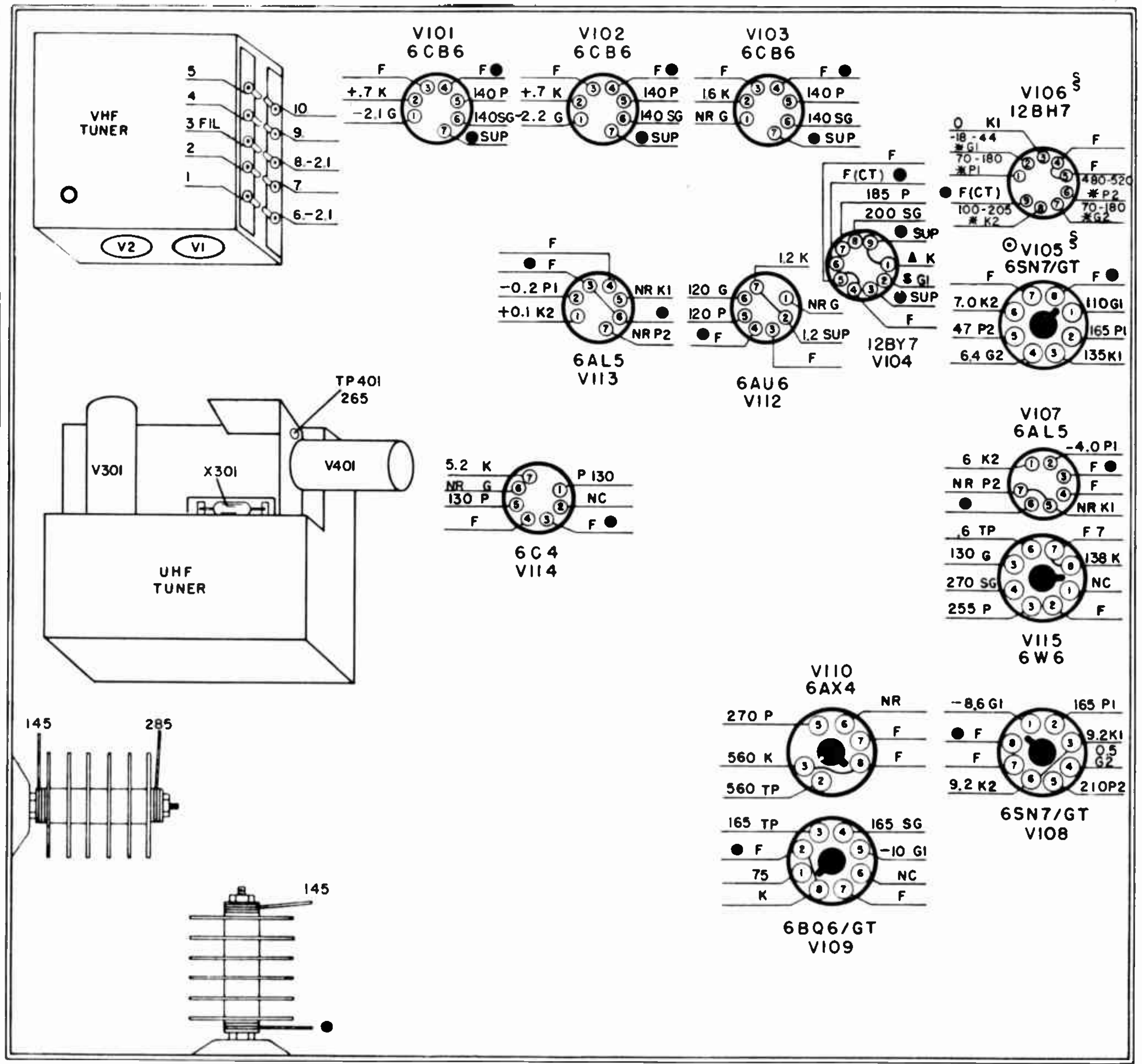


Fig. 39A. Voltage Chart for Chassis B1300D & F1300D (Runs 1&3) and H1300D (Runs 1 & 1-2)

KEY

§ ON RUNS 1AB-2 & 1B-2 ONLY

	PIN	V105-1	PIN	V106
K1	3	0	3	135
G1	1	✱ -(18-44)	2	110
P1	2	✱ 70-180	1	165

✱ DEPENDS UPON THE SETTING OF THE HEIGHT CONTROL.

● INDICATES GROUND LUGS.

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.
■ NC OR READING ON 16 POSITION TUNERS
▲ VARIES FROM 3 TO 24V. DEPENDING ON SETTING OF CONTRAST CONTROL.
$ VARIES FROM 0-16 V. DEPENDING ON SETTING OF CONTRAST CONTROL.
○ FOR VOLTAGES OF VHF TUNER ON VHF SEE PAGE 1954-40
⊙ ON RUN 1-2 CHASSIS V-105 IS REPLACED BY V-105-1 (12SN7)

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. BRIGHTNESS CONTROL MAXIMUM
3. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
4. ALL OTHER CONTROLS SET OR NORMAL RASTER.
5. LINE VOLTAGE 117 V 60 ∿ AC.
6. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
7. ALL READINGS TAKEN WITH A VTVM.
8. CHANNEL SELECTOR SET TO UHF

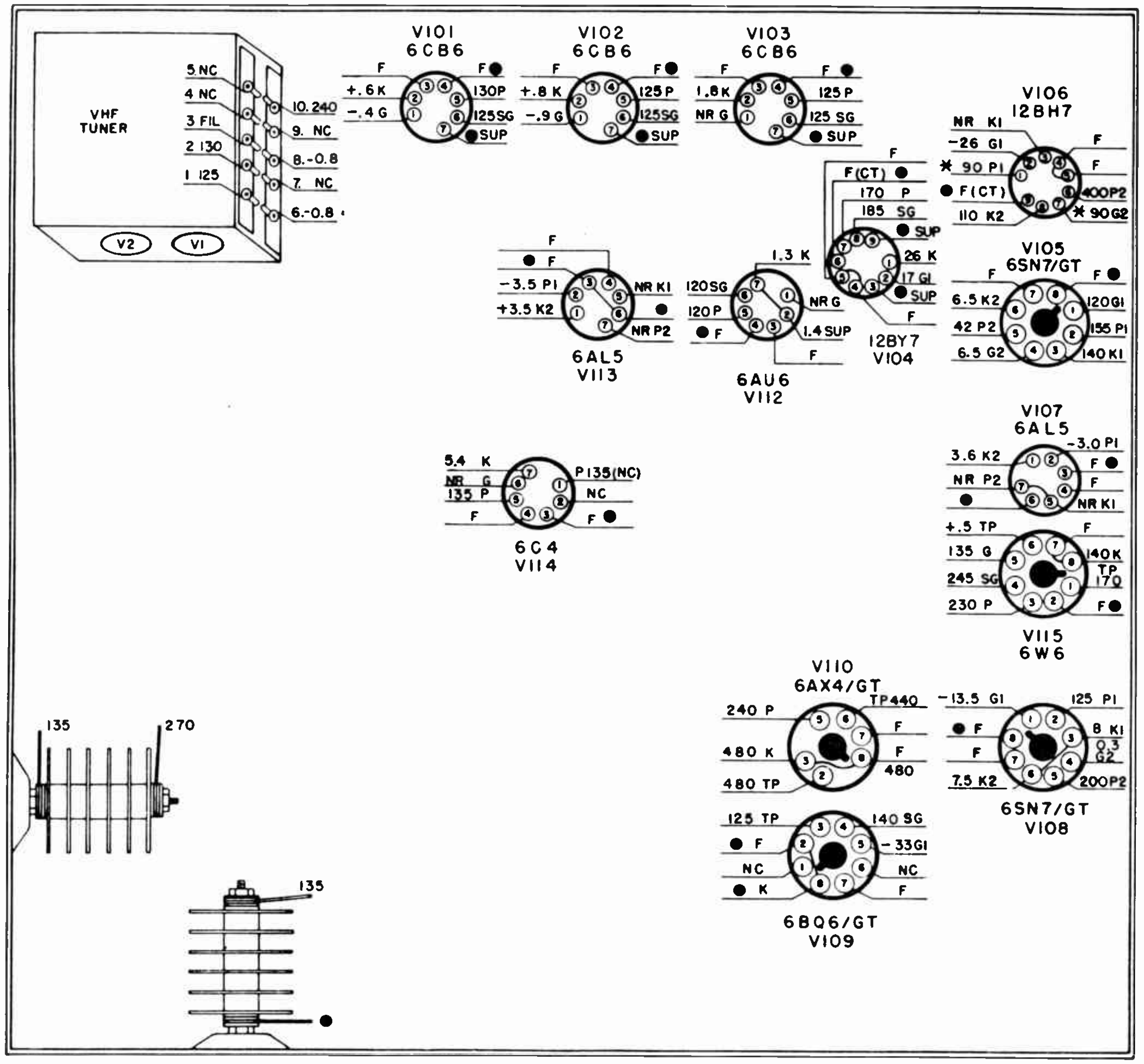


Fig. 40A. Voltage Chart for Chassis C1300D (Run 1)

KEY

✱ VARIES FROM 50 TO 160V. DEPENDING UPON THE SETTING OF THE HEIGHT CONTROL.

● INDICATES GROUND LUGS

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. ALL READINGS TAKEN WITH A VTVM.
3. BRIGHTNESS CONTROL MAXIMUM.
4. CONTRAST CONTROL MINIMUM.
5. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
6. ALL OTHER CONTROLS SET FOR NORMAL RASTER.
7. LINE VOLTAGE 117V 60 ∿ AC.
8. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.

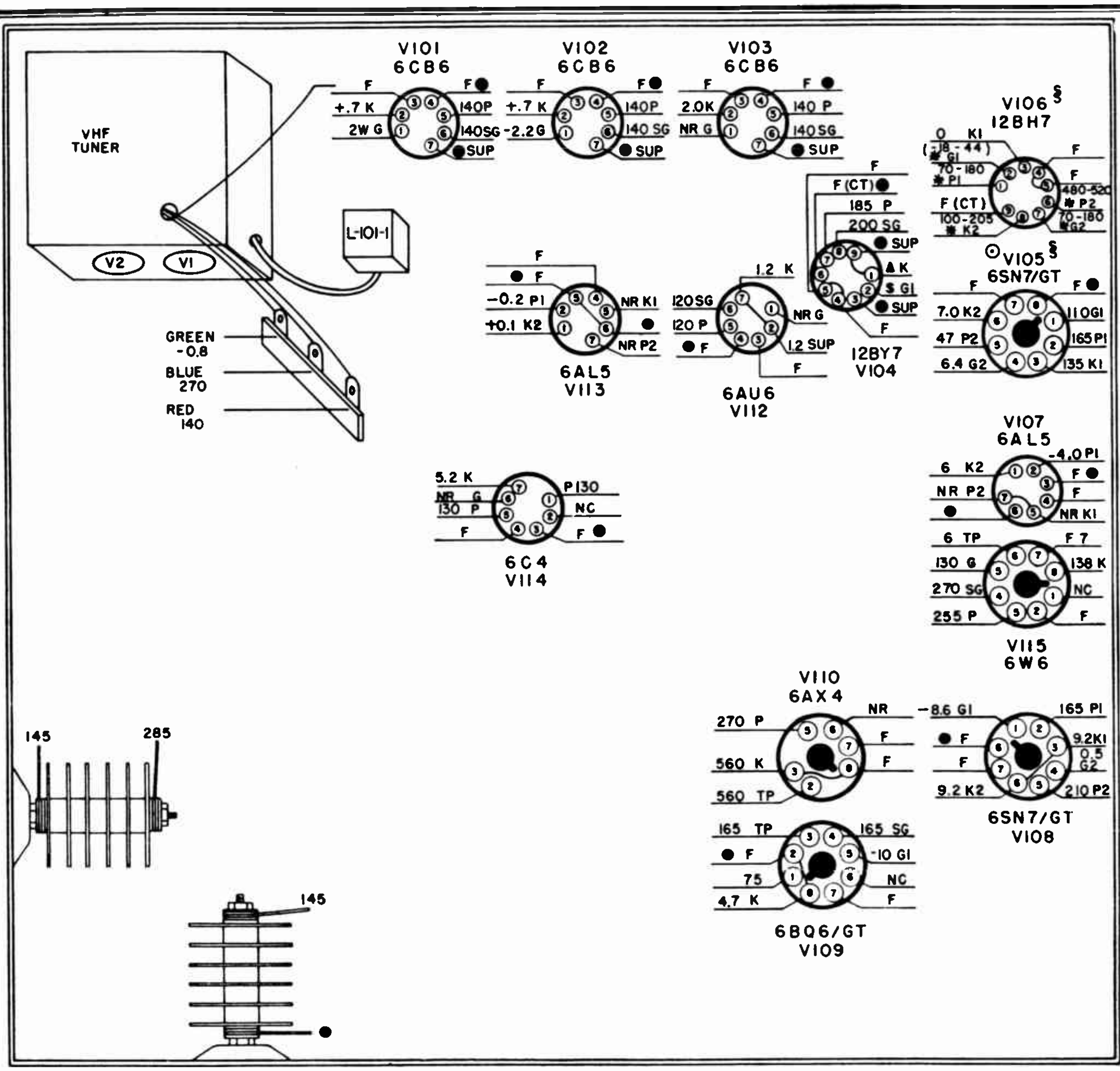


Fig. 37A. Voltage Chart for Chassis A1300D & E1300D (Runs 2, 2-2, & 2B-2) and J1300D, (Runs 1A, 1AB, 1A-2 & 1AB-2)

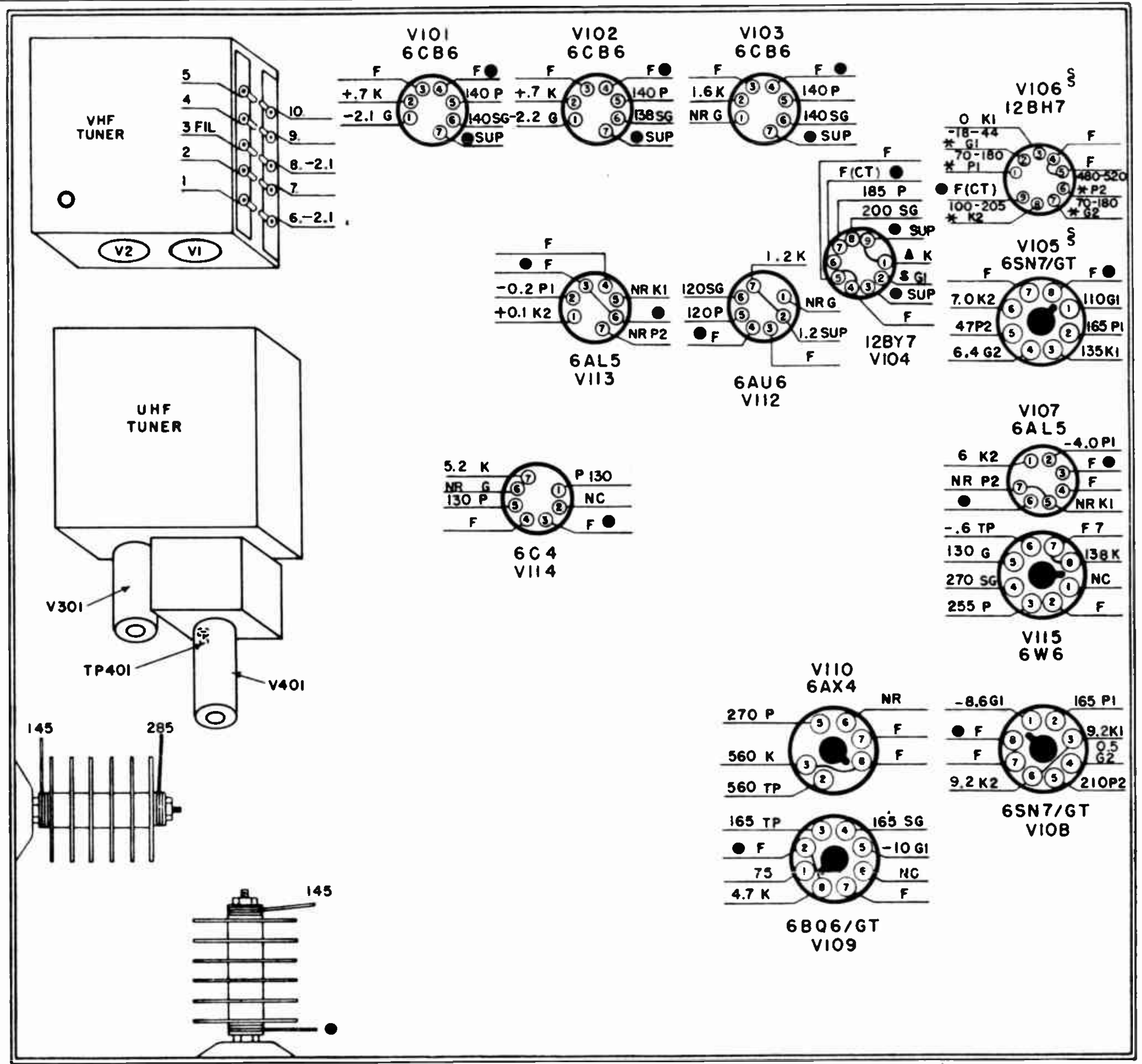


Fig. 38A. Voltage Chart for Chassis B1300D & F1300D (Runs 2 & 2-2) and H1300D (Runs 1A, 1AB, 1A-2, 1AB-2, 2, 2-2 & 2B-2)

KEY

§ ON RUNS (2B-2) ONLY

	PIN	V105-1	PIN	V106
K1	3	0	3	135
G1	1	*-(18-44)	2	110
P1	2	*70-180	1	165

* DEPENDS UPON THE SETTING OF THE HEIGHT CONTROL.
● INDICATES GROUND LUGS

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.
■ NC OR READING ON 16 POSITION TUNERS
▲ VARIES FROM 3 TO 24 V. DEPENDING ON SETTING OF CONTRAST CONTROL.
$ VARIES FROM 0-16 V DEPENDING ON SETTING OF CONTRAST CONTROL.
⊙ ON RUN 2-2 CHASSIS V-105 IS REPLACED BY V-105-1 (12SN7)

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. BRIGHTNESS CONTROL MAXIMUM
3. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
4. ALL OTHER CONTROLS SET FOR NORMAL RASTER.
5. LINE VOLTAGE 117V 60 ∿ AC.
6. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
7. ALL READINGS TAKEN WITH A VTVM.

KEY

§ ON RUNS 1AB-2 & 1B-2 ONLY

	PIN	V105-1	PIN	V106
K1	3	0	3	135
G1	1	* -(18-44)	2	110
P1	2	* 70-180	1	165

* DEPENDS UPON THE SETTING OF THE HEIGHT CONTROL.
● INDICATES GROUND LUGS.

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.

▲ VARIES FROM 3 TO 34V. DEPENDING ON SETTING OF CONTRAST CONTROL.
$ VARIES FROM 0-16 V. DEPENDING ON SETTING OF CONTRAST CONTROL.
○ FOR VOLTAGES OF VHF TUNER ON VHF SEE PAGE 1954-40.

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. BRIGHTNESS CONTROL MAXIMUM.
3. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
4. ALL OTHER CONTROLS SET OR NORMAL RASTER.
5. LINE VOLTAGE 117 V 60 ∿ AC.
6. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
7. ALL READINGS TAKEN WITH A VTVM.
8. CHANNEL SELECTOR SET TO UHF.

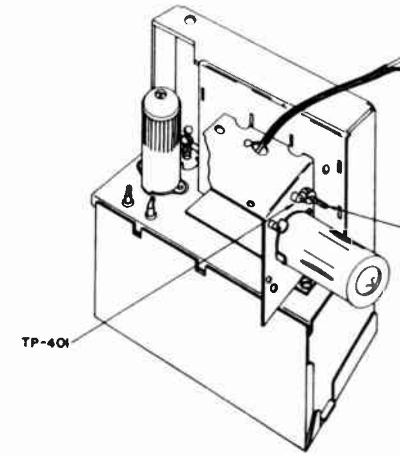


Fig. 33A. Alignment Adjustments for 1E1660 UHF Tuner with Cascode Amplifier

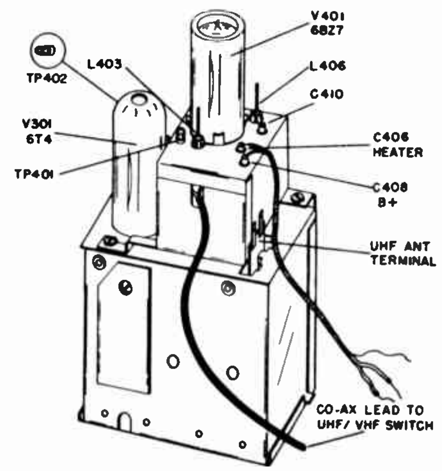


Fig. 33B. Alignment Adjustments for 1E1855 UHF Tuner with Cascode Amplifier

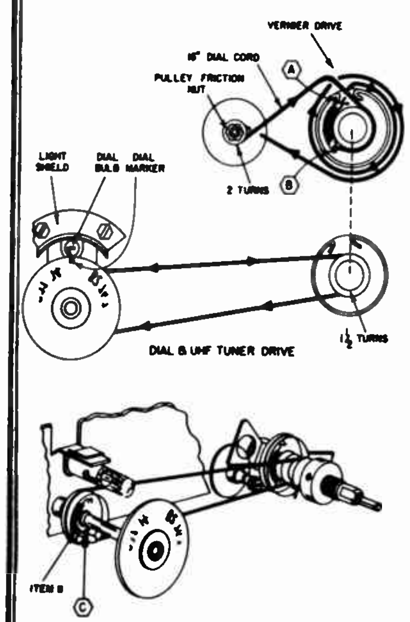


Fig. 34A. 1E1660 UHF Tuner Drive Mechanism Stringing

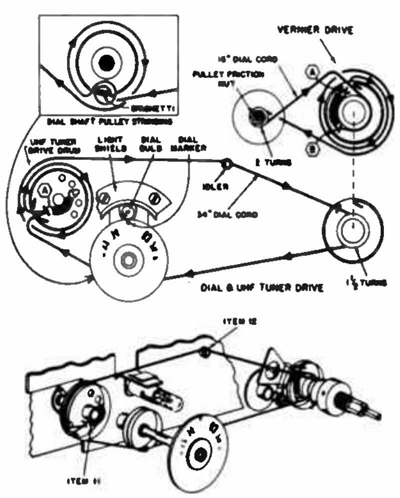


Fig. 34B. 1E1855 UHF Tuner Drive Mechanism Stringing

SERVICE PARTS LIST FOR UHF TUNER VERNIER DRIVE MECHANISM

The items in the following parts list are identified in Fig. 35A, except items 11 & 12 shown in Fig. 34A, by means of the item numbers. WHEN ORDERING REPLACEMENT PARTS ORDER BY PART NUMBER ONLY.

ITEM	DESCRIPTION	PART NO.	ITEM	DESCRIPTION	PART NO.
1	Collar	77A615	7	Screw, set; 6-32 x ½" bristol	3A1803
2	Dial shaft & pulley assembly	28B154	8	Spring, drive string tension	75A163
3	E ring	76A1075	9	Stop, pulley	67A2225
4	Pin, stop	74A586	10	Washer, spring	4A1557
5	Pulley and idler assembly	28B149	11	Spring, drive string tension	75A173
6	Pulley, idler	28A139	12	Pulley, idler	28A021

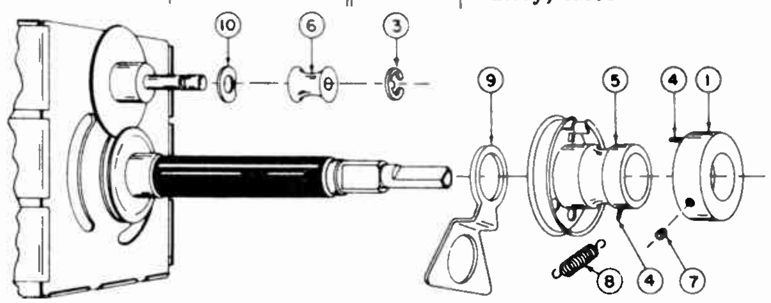


Fig. 35A. Drive Mechanism Exploded View

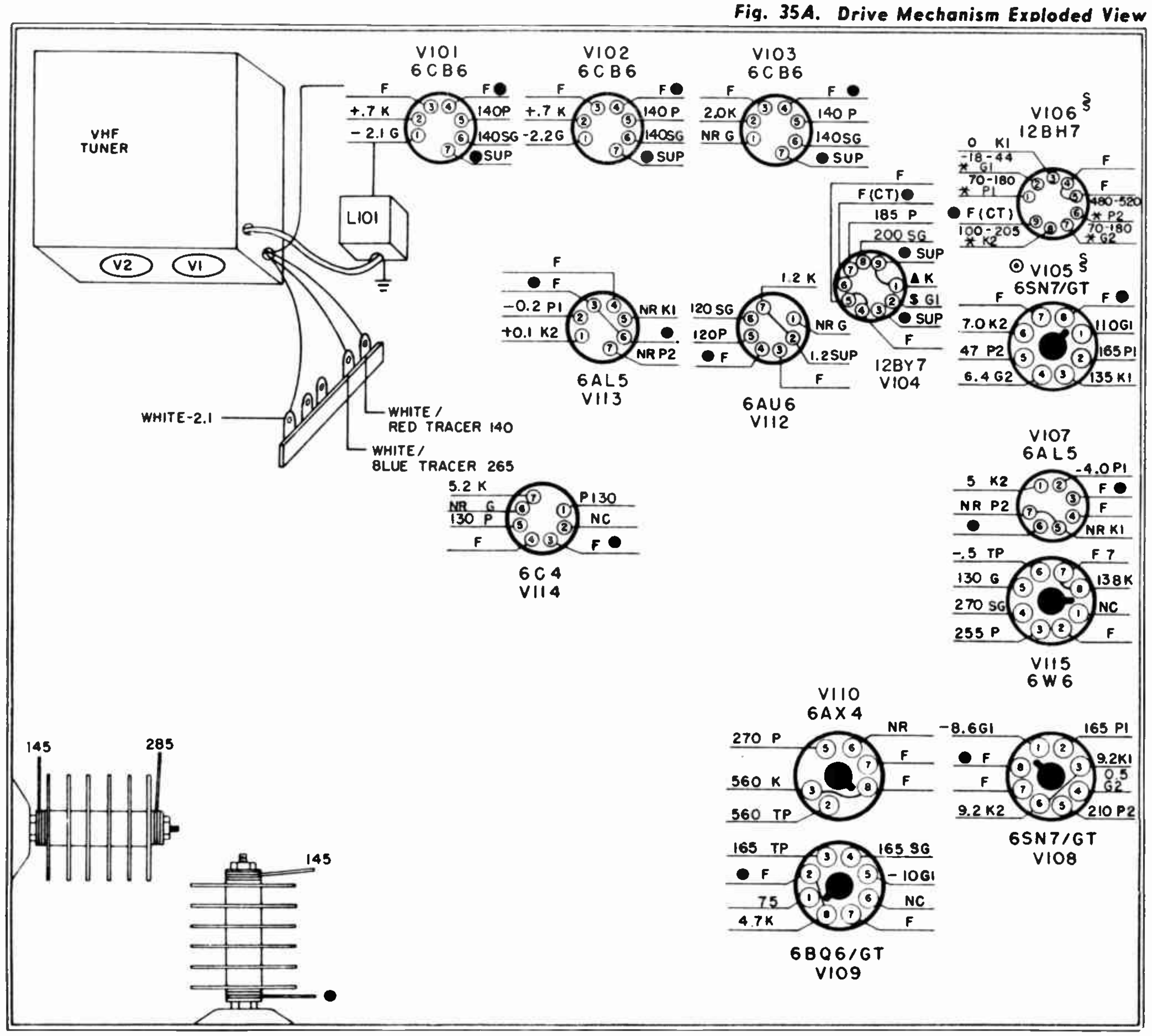


Fig. 36A. Voltage Chart for Chassis A1300D, E1300D & J1300D (Runs 1, 1-2, 1B, & 1B-2)

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. BRIGHTNESS CONTROL MAXIMUM
3. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
4. ALL OTHER CONTROLS SET FOR NORMAL RASTER
5. LINE VOLTAGE 117 V 60 ∿ AC.
6. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
7. ALL READINGS TAKEN WITH A VTVM.

KEY

$ ON RUN 1A8-2 & 1B-2 CHASSIS ONLY

	PIN	V105-1	PIN	V106
K1	3	0	3	135
G1	1	*-(18-44)	2	110
P1	2	* 70-180	1	165

* DEPENDS UPON THE SETTING OF THE HEIGHT CONTROL.

● INDICATES GROUND LUGS.

TP TIE POINT.
NC NO CONNECTION.
NR NOT READABLE.

▲ VARIES FROM 3 TO 34 V. DEPENDING ON SETTING OF CONTRAST CONTROL.

$ VARIES FROM 0-16 V DEPENDING ON SETTING OF CONTRAST CONTROL.

⊙ ON RUN 1-2 CHASSIS V-105 IS REPLACED BY V-105-1 (12SN7)

BAND PASS ALIGNMENT OF 1C1717 TV TUNERS

CAUTION: Band pass alignment is carefully made at the factory. Attempt this alignment only with proper equipment and set-up. The tube shields and the bottom cover for the tuner must be in place. The oscillator adjustment given on page 1954-29 must be completed before the band pass alignment is started.

1. Complete the set-up procedure given on page 1954-29.
2. Connect the leads from the sweep and marker generators to the tuner antenna terminals.
3. Turn the channel selector to channel 13. Adjust the generators to the correct frequencies for channel 13 as shown in the chart on page 1954-25.
4. Adjust L-3 (channel 13 rf plate), and L-6 (channel 13 mixer grid) adjusting screws (see Fig. 29B) for a band pass characteristic containing both carriers with steep sides and maximum gain.

If the factory adjustment of the incremental loops and coils has not been disturbed, alignment on the rf plate, rf grid, and mixer grid should be complete after the completion of step 4 unless extensive repairs have been made on the tuner. Check the other channels for a similar band pass characteristic as shown in Fig. 30A. If they have the correct characteristics further alignment is not necessary. If they do not, repeat step 4 and adjust L-2 by spreading or compressing the turns of the coil before continuing with steps 5 and 6.

5. Adjust the coils of the rf plate, rf grid, and mixer grid for channels 12 through 7 starting with channel 12. Adjust the signal generators for each channel to the frequencies given in the chart on page 1954-25. Pushing the half turn coil loops towards the center of the switch so that they are closer to the switch wafer will increase the frequency while pulling them out and away from the switch wafer will decrease the frequency. Adjust for a band pass characteristic containing both carriers with steep sides and maximum gain.
6. Adjust the coils of the rf plate, rf grid, and mixer grid for channels 6 through 2 starting with channel 6. Adjust the signal generators for each channel to the frequencies given in the chart on page 1954-25. Spreading the turns of the coils will increase the frequency while squeezing the turns together will decrease the frequency. Adjust for a band pass characteristic containing both carriers with steep sides and maximum gain. A tuning wand may be used to determine what change is necessary.

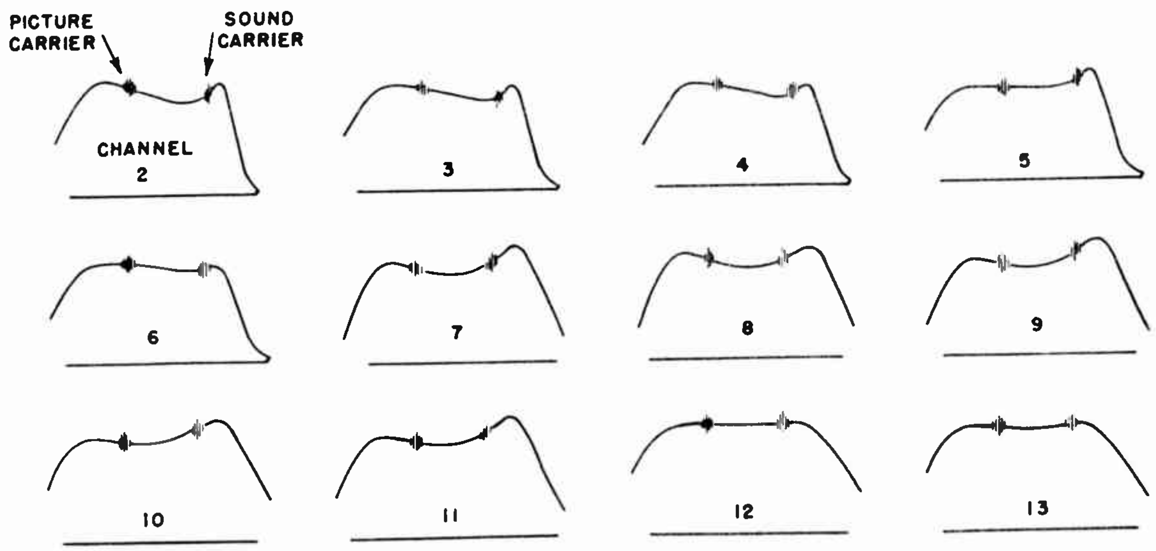


Fig. 30A. Typical Channel Response Curves for TV Tuners

ALIGNMENT OF THE 1E1660 AND 1E1855 UHF TUNERS

These tuners have been carefully aligned at the factory by personnel using precision equipment. Minor adjustments of the tuner may be necessary after making tube or part replacement. When replacing tubes in a tuner use the same tube type as the original tube which was removed. It is advisable to try several tubes and select the one that gives the best performance. Realignment of the tuner will probably not be required if a selected tube is used for replacement. For those service engineers who are properly equipped as specified, the following alignment procedure is included. DO NOT ATTEMPT THIS PROCEDURE UNTIL THE TV RECEIVER IS KNOWN TO BE FUNCTIONING PROPERLY AND THE I-F ALIGNMENT IS CORRECT.

THE HALLICRAFTERS SERVICE DEPARTMENT PROVIDES A TUNER EXCHANGE SERVICE FOR A NOMINAL FEE. THE SERVICE TECHNICIAN IS URGED TO AVAIL HIMSELF OF THAT SERVICE RATHER THAN TO ATTEMPT FIELD ALIGNMENT OF THESE TUNERS.

OSCILLATOR ALIGNMENT

Step	Signal Generator Connection	Frequency	Output Connection	Adjust	Comments
1	Through circuit of Fig. 31A to junction of L304 & L305 (1E1660) or diode clip nearest oscillator section (1E1885)	945.0 mc. or 475.5 mc. (2nd. harmonic) or 236.25 mc. (4th harmonic)	Detector network of Fig. 31B to T.P. 401 on Cascode amplifier. Output of detector to Vertical Input of Score.	C-309 for zero beat on scope, signal tracer, or hi gain audio amp.	With VHF/UHF switch in UHF position set UHF Tuner rotor to full clockwise position (maximum freq.). Use a long screwdriver through hole in Tuner cradle. Use only sufficient output from Signal Generator to give zero beat. Large Signal Generator output may cause UHF oscillator to "pull" and mixer crystal to burn out.
2	Through circuit of Fig. 31A to junction of L304 & L305 (1E1660) or diode clip nearest oscillator section (1E1855)	504.0 mc. or 252.0 mc. (2nd. harmonic) or 126.0 mc. (4th harmonic)	Detector network of Fig. 31B to T.P. 401 on Cascode amplifier. Output of detector to Vertical Input of Scope.	See comments.	With VHF/UHF switch in UHF position set UHF Tuner rotor to full counterclockwise position (minimum freq.) **1E1660** Zero beat must occur at 504.0 mc. ± 3 MC. If it does not, repeat step 1 with new 6J6 tube. **1E1855** Adjust C305 for zero beat at 504.0 mc. Repeat steps 1 and 2 until satisfactory. After completing alignment, replace crystal shield.

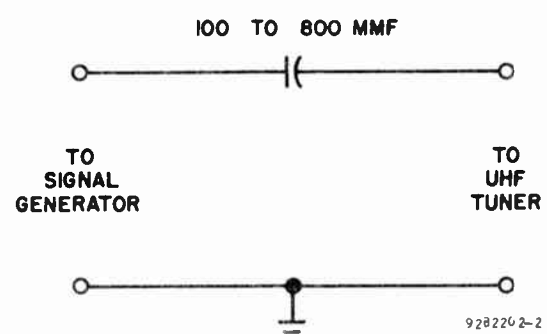


Fig. 31A. Sweep Generator Coupling

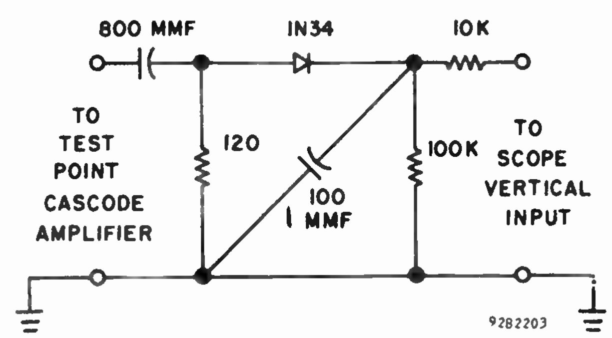


Fig.31 B. Detector Circuit

BAND-PASS ALIGNMENT FOR 16 POSITION VHF TUNERS 1E1483, 1E1670, & 1E1718

DO NOT ATTEMPT THIS ALIGNMENT UNTIL THE I-F ALIGNMENT OF THE RECEIVER HAS BEEN CHECKED AND IS KNOWN TO BE CORRECT. THE OSCILLATOR ADJUSTMENT PROCEDURE GIVEN ON PAGE 1954-26 MUST ALSO BE COMPLETED BEFORE STARTING THIS ALIGNMENT.

1. Connect the balanced sweep output from a signal generator to the VHF tuner antenna terminals through the 300 ohm pad shown in Fig. 26A. Set the sweep generator for 20 MC or maximum sweep.

2. Connect the negative side of the $1\frac{1}{2}$ volt bias supply through a 1000 ohm resistor to terminal 8 of the VHF tuner. Connect the positive side of the bias supply to the chassis.

3. Connect the oscilloscope and band-pass detector circuit shown in Fig. 18A to Test Point TP-2 shown in Fig. 27B.

4. Set the VHF tuner channel selector to channel 13.

5. Loosely couple the high side of the marker generator to the band-pass detector circuit by clipping the lead over the germanium diode in the detector circuit. Connect the ground side of the generator to the chassis of the VHF tuner.

6. Set the sweep generator for channel 13 and turn the VHF tuner channel selector to channel 13.

7. Adjust L-2 (channel 13 r-f grid), L-3 (channel 13 r-f plate), and L-6 (channel 13 mixer grid) adjusting screws (see Fig. 27B) for a band pass characteristic containing both carriers with steep sides and maximum gain. See curves shown on page 1953-26. The r-f grid adjustment (L-2) must be adjusted for maximum mid-band gain regardless of the shape of the skirts. The slope and position of the skirts are primarily controlled by the r-f plate adjustment (L-3) while the mixer grid adjustment (L-6) controls the slope of the flat topped portion of the curve. Always adjust to place the picture carrier marker on a peak of the curve.

If the factory adjustment of the incremental loops and coils has not been disturbed, alignment of the r-f plate, r-f grid and mixer grid should be complete after the completion of step 7, unless extensive repairs have been made on the tuner. Check the other channels for a similar band-pass characteristic as shown in Fig. 27A. If they have the correct characteristics further alignment is not necessary. If they do not, proceed with the following steps.

8. Adjust the coils of the r-f plate, r-f grid and mixer grid for channels 12 through 7 starting with channel 12. Adjust the signal generators for each channel to the frequencies given in the chart on page 1954-25. Pushing the half turn incremental loops toward the center of the switch so that they are closer to the switch wafer will increase the frequency while pulling them out and away from the switch wafer will decrease the frequency. Always adjust the r-f grid coils for maximum mid-band gain and the r-f plate and mixer grid coil loops as outlined in step 7.

9. Adjust the coils of the r-f plate, r-f grid and mixer grid for channels 6 through 2 starting with channel 6. Adjust the signal generators for each channel to the frequencies given in the chart on page 1954-25. Spreading the turns of the coils will increase the frequency while squeezing the turns together will decrease the frequency. Always adjust the r-f grid coils for maximum mid-band gain and the r-f plate and mixer grid coil loops as outlined in step 7.

10. Repeat step 7 as final adjustment for channel 13.

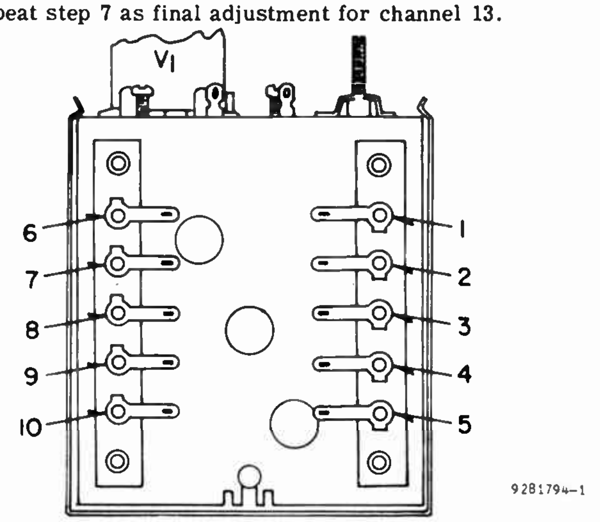


Fig. 28A. Numbering of Tuner Terminals

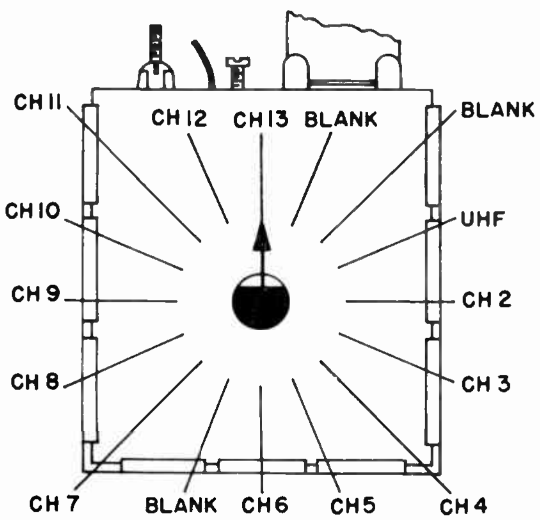


Fig. 28B. Channel Selector Switch Positions

ALIGNMENT FOR 1C1717 12 POSITION VHF CASCODE TUNERS

These tuners have been carefully aligned at the factory by personnel using precision equipment. Minor alignment adjustments of the tuner may be necessary after making tube or part replacements. When replacing tubes in a tuner use the same tube type as the original tube which was removed from the tuner and also try several different tubes and select the one which gives best performance. Realignment of the tuner probably will not be required if a selected tube is used for replacement. Use of an alternate tube may require a complete realignment of the TV tuner. For those service engineers who are properly equipped as specified, the following alignment procedure is included. Balance of TV receiver must be functioning properly before aligning tuner.

EQUIPMENT REQUIRED FOR TV TUNER ALIGNMENT

1. Sweep generator .... RCA type WR-59B or equiv.
2. Marker Generator .... RCA type WR-39C Television Calibrator or equivalent.
3. Oscilloscope .... RCA type WO-56A or equiv.
4. Bias Source .... 1.5 volt battery.
5. Isolation Transformer .... 150 watt rating or higher

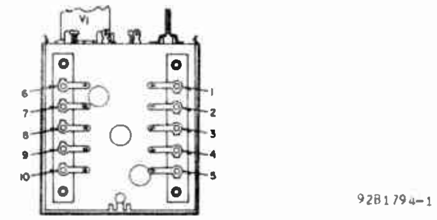


Fig. 29A. Numbering of Tuner Terminals

SET-UP PROCEDURE FOR TUNER ALIGNMENT

1. Check to be sure that the tube shields and the bottom cover for the tuner are in place.
2. Connect all test equipment and the television chassis to a common ground. Be sure to use an isolation transformer for the receiver chassis. Allow at least a 5 minute warm-up period for the receiver chassis.
3. Connect the negative terminal of a 1.5 volt bias source through a 1.000 ohm resistor to terminal 8 of the TV tuner. See Fig. 29A for terminal numbering. Connect the positive side of the bias source to any convenient ground point on the chassis.
4. Connect the hot lead from the oscilloscope through a 10,000 ohm carbon resistor to test point T.P.-1. See figure 29B. Connect the ground lead from the oscilloscope to any convenient ground point on the TV tuner chassis. Set the scope sweep oscillator to roughly 120 cycles.

OSCILLATOR ADJUSTMENT

1. Turn the channel selector to channel 13
2. Set the marker generator to 257 mc. and connect generator leads to the antenna terminals.
3. Rotate the fine tuning control until a zero beat is indicated on the scope. When the fine tuning control is rotated a band will appear across the face of the scope. As the point of zero beat is approached this band will increase in amplitude and then decrease sharply until a minimum is reached which is the point of zero beat. If the fine tuning control is rotated farther in the same direction the amplitude of the band will increase sharply and then decrease. The point of zero beat should fall in the approximate center of the range over which the fine tuning control may be rotated. If it does not, set the fine tuning control at the approximate center of its range and adjust L-7 (Channel 13 Oscillator Adjustment) for the zero beat. Do not disturb the setting of the fine tuning control after this adjustment.
4. Set the channel selector to channel 6.
5. Set the marker generator to 129 mc.
6. Adjust L-8 (Channel 6 Oscillator Adjustment) for the zero beat indication on the scope.

NOTE: Adjustment of the channel 13 and channel 6 oscillator coils automatically brings all other channel into adjustment. The adjustment screws cover their entire electrical range within eight full revolutions counterclockwise from the tight position. Any further rotation of these screws may cause them to fall out. Counterclockwise rotation of the screws will decrease the oscillator frequency. Best results will be obtained if a non-metallic screwdriver is used.

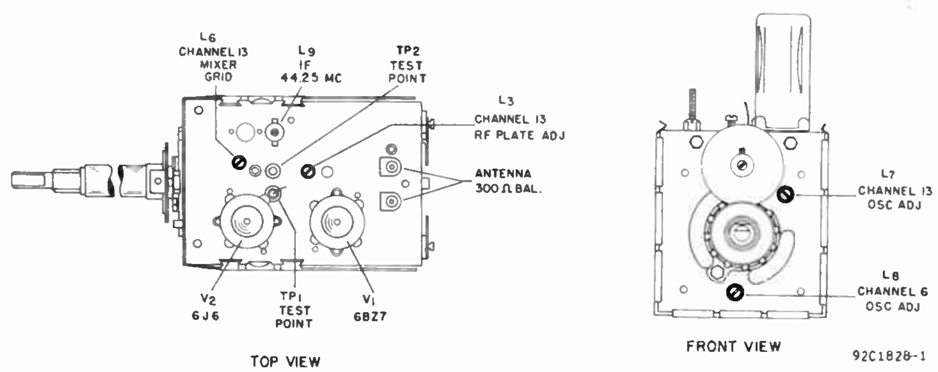


Fig. 29B. 1C1717 Cascode TV Tuner Alignment Adjustments

ALIGNMENT FOR 1E1483, 1E1670, & 1E1718 VHF 16 POSITION CASCODE TUNERS

These tuners have been carefully aligned at the factory by personnel using precision equipment. Minor adjustments of the tuner may be necessary after making tube or part replacements. When replacing tubes in a tuner use the same tube type as the original tube which was removed from the tuner and also try several different tubes and select the one which gives best performance. Realignment of the tuner probably will not be required if a selected tube is used for replacement. For those service engineers who are properly equipped as specified, the following alignment procedure is included. DO NOT ATTEMPT TUNER ALIGNMENT UNTIL THE TV RECEIVER IS KNOWN TO BE FUNCTIONING PROPERLY AND THE I-F ALIGNMENT OF THE RECEIVER IS CORRECT.

EQUIPMENT REQUIRED FOR VHF TUNER ALIGNMENT

Sweep Generator	RCA type WR-59B or equiv.
Marker Generator	RCA type WR-39C or equiv.
Oscilloscope	RCA type WO-56A or equiv.
Bias Source	$1\frac{1}{2}$ volt battery or equiv.
Detector Circuit	See Fig. 18A.
Isolation Transformer	150 watt rating or higher

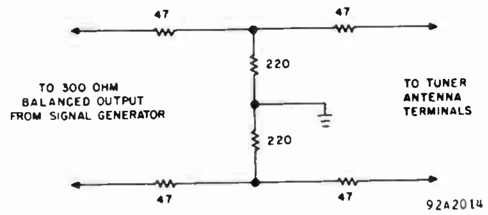


Fig. 26A. Sweep Generator 300 Ohm Pad

OSCILLATOR ADJUSTMENT FOR 16 POSITION TUNERS

1. Connect the balanced sweep output from a signal generator to the VHF tuner antenna terminals through the 300 ohm pad shown in Fig. 26A. Set sweep generator for 20 MC or maximum sweep.

2. Connect the negative side of $1\frac{1}{2}$ volt bias supply through a 1000 ohm resistor to terminal 8 of the VHF tuner. Connect the positive side of the bias supply to the chassis.

3. Connect the oscilloscope and band-pass detector circuit shown in Fig. 18A to Test Point TP-2 shown in Fig. 27B.

4. Set the VHF tuner channel selector to channel 13.

5. Loosely couple the high side of the marker generator to the antenna input terminals by clipping the lead over the insulation of one sweep generator lead. Connect the ground side of the generator to the chassis of the VHF tuner. Set the marker generator to the channel 13 picture carrier frequency of 211.25 MC.

6. Carefully note the position of the marker pip on the response curve. Use a grease pencil if necessary to mark the position on the face of the cathode ray tube.

7. Loosely couple the high side of the marker generator to the band-pass detector circuit by clipping the lead over the germanium diode in the detector circuit. Connect the ground side of the generator to the chassis of the VHF tuner. Set the marker generator to 45.75 MC.

8. Rotate the fine tuning control of the VHF tuner until the 45.75 MC marker is in the same spot as the marker in steps 5 and 6. If this cannot be accomplished by adjustment of the fine tuning control, adjust the channel 13 oscillator adjustment (L-7) to position the 45.75 MC marker. DO NOT DISTURB THE SETTING OF THE FINE TUNING CONTROL AFTER THIS ADJUSTMENT.

9. Switch the VHF tuner channel selector and sweep generator to channel 12.

10. Repeat steps 5 and 6 except use the picture carrier frequency for channel 12 (205.25 MC) in step 5.

11. Repeat step 7 using the same marker frequency of 45.75 MC.

12. Adjust the incremental oscillator coil for the channel until the 45.75 MC marker pip is in the same position on the curve as the marker pip for the picture carrier was in step 10.

13. Repeat steps 9, 5, 6, 7 and 12 for channels 11, 10, 9, 8 and 7 in that order. In each case switch the channel selector and sweep generator to the channel being aligned. The marker generator frequency for step 5 will be the picture carrier frequency for the channel being aligned. See the chart on page 1954-25 for the picture carrier frequency of each channel:

14. Switch the channel selector and sweep generator to channel 6 and repeat steps 5 and 6 except use the picture carrier frequency for channel 6 (83.25 MC) in step 5.

15. Repeat step 7 using the same marker frequency of 45.75 MC.

16. Adjust the channel 6 oscillator adjustment until the 45.75 MC marker pip is in the same position on the curve as the marker pip in step 14. See Fig. 27B.

17. Repeat step 9, 5, 6, 7 and 12 for channels 5, 4, 3 and 2 in that order. In each case switch the channel selector and sweep generator to the channel being aligned. The marker generator frequency for step 10 will be the picture carrier frequency for the channel being aligned. See the chart on page 1954-25 for the picture carrier frequency of each channel.

NOTE: If two marker generators are available the alignment can be greatly simplified by using one generator for the picture carrier marker and the other for the 45.75 MC marker. Both generators are connected to the receiver at all times as directed in the above instructions. The use of two generators will produce two pips on the pattern. The adjustments outlined above will make these two pips coincide on the oscilloscope pattern.

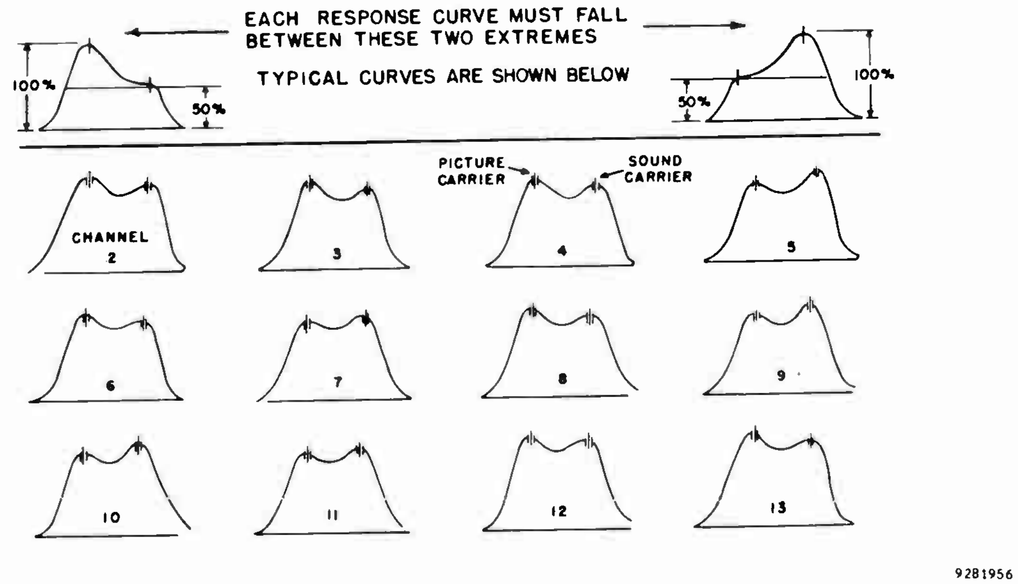


Fig. 27A. 16 Position VHF Tuner Typical Channel Response Curves

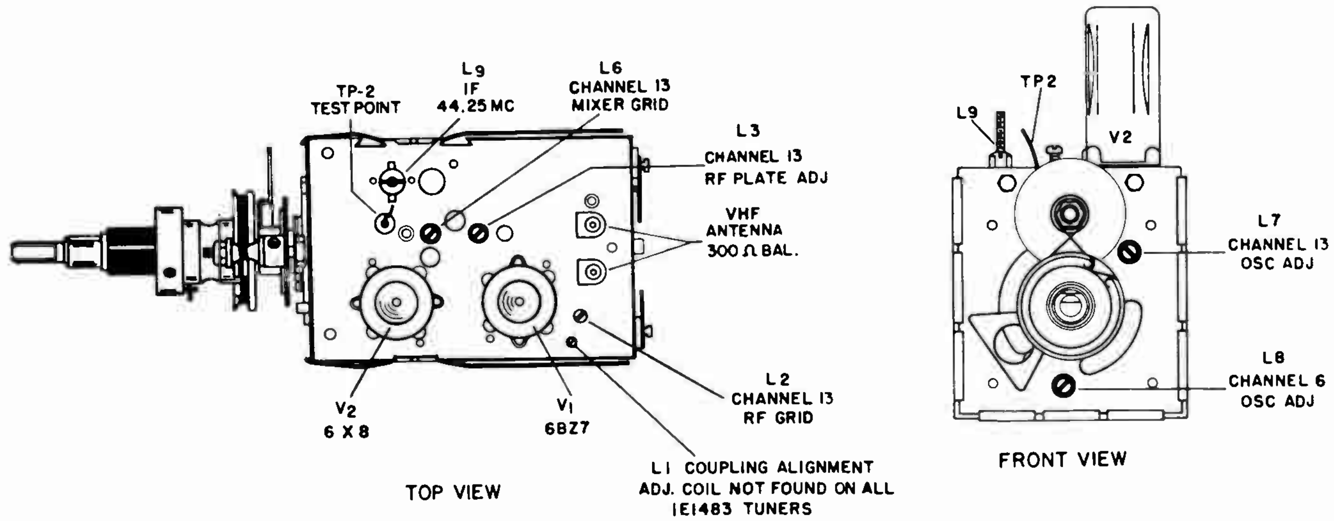


Fig. 27B. Alignment Adjustments for 1E1483, 1E1670, or 1E1718 Tuners

ALIGNMENT OF 1E1846 & 1B1969 CASCODE VHF TUNERS

SET-UP PROCEDURE FOR TUNER ALIGNMENT

1. Set the channel selector switch to channel 13.
2. Connect the oscilloscope through a 10,000 ohm carbon resistor to the test point on the top of the tuner chassis.
3. Connect the negative side of the bias source through a 1000 ohm isolation resistor to the terminal where the AGC (green wire) lead from the tuner is connected. Connect the positive side of the bias source to the receiver chassis.
4. Set the fine tuning control at the approximate midpoint of its tuning range.
5. Connect the sweep generator to the antenna terminals through the balanced pad shown in Fig. 19B and adjust the output to sweep channel 13.
6. Couple the output from the marker generator to the antenna circuit by connecting the hot lead from the generator to the junction of the four 220 ohm resistors of the pad shown in Fig. 19B. Connect the ground lead to the r-f tube shield in the VHF tuner. Use the minimum amount of signal from the marker generator required to give a good marker or pip on the oscilloscope pattern.

NORMAL ANTENNA AND R-F CIRCUIT ADJUSTMENT

1. Complete the set-up procedure.
2. Adjust C-3, C-5, and C-10 for a flat-top response curve and maximum gain.
3. Check the position of the markers on all channels. They should fall in place automatically. Correct marker frequencies for each channel are given in the Picture Carrier and Sound Carrier columns of the chart on page 1954-25. The response curves in Fig. 20A are ideal curves and the adjustments should be made to approach these curves as nearly as possible.
4. If the proper response curves can not be obtained repeat steps 1, 2, and 3 with a different set of selected tubes in the tuner.

COMPLETE ANTENNA AND R-F CIRCUIT ADJUSTMENT

If the "Normal" adjustment described above does not give the desired response curves a complete realignment of the tuner will be required. Before this alignment can be completed it will be necessary to remove the tuner from the chassis without disconnecting the electrical connections to the tuner. It may be necessary to insert extention leads on the red, blue, black, and green wires from the tuner. Do not disturb the shielded output cable or attempt to insert an extention in this cable. The side shield plate must also be removed from the tuner in order to get at the internal adjustments.

To prevent the possibility of the tuner circuits in the antenna input circuit from effecting the response curves obtained in the steps 1-10 a 330 ohm, $\frac{1}{2}$ watt resistor may be connected across L-2 while making these adjustments. However, this will introduce loss and the output of the signal generators or the gain of the oscilloscope used may not be high enough to obtain a useable oscilloscope indication. With this resistor in place the valleys of the response curves will appear deeper and the band width will be wider than shown in the tuner response curves.

1. Set the channel selector switch to channel 5.
2. Connect the oscilloscope through a 10,000 ohm carbon resistor to the test point on the top of the tuner chassis.
3. Complete steps 3 and 4 as given under SET-UP PROCEDURE.
4. Connect the sweep generator as given in step 5 of the SET-UP PROCEDURE and adjust the output to sweep channel 5.
5. Connect the marker generator as given in step 6 of the SET-UP PROCEDURE and adjust the output for channel 5 sound and picture carrier frequencies. See chart on page 1954-25.

ALIGNMENT OF 1E1846 & 1B1969 CASCODE VHF TUNERS

COMPLETE ANTENNA AND R-F CIRCUIT ADJUSTMENT (Cont.)

6. Adjust C-22 (wire gimmick) to change the bandwidth over a narrow range. Push the free end of C-22 towards the contact terminals to increase the band width or pull it away to decrease band width. CAUTION -- THIS GIMMICK MUST NOT TOUCH THE CHASSIS OF THE TUNER OR THE SIDE SHIELD PLATE. IF IT DOES, R-6 WILL BE BURNED OUT.
7. Switch the channel selector and the test equipment to channel 13.
8. Adjust L-7 to control the tilt of the response curve and Capacitors C-8 and C-9 for the desired bandwidth. To reduce the picture carrier side of the response curve it is necessary to increase the inductance of L-7 by spreading or unwinding the turns. To increase the amplitude of the picture carrier side of the response curve it is necessary to decrease the inductance of L-7 by compressing or winding up the turns. Capacitors C-8 and C-9 are fixed disc ceramic units and they themselves are not adjustable. However, the physical distance between these two capacitors will effect band width on the higher channels. Moving the two capacitors together will narrow the band width while moving them apart will widen the band width.
9. Adjust C-5 and C-10 for a flat-top response curve and maximum gain.
10. Repeat steps 1 through 9.
11. Check channels 7 to 13 for the depth of the valley in the center of the response curve and adjust L-8 for optimum results on these channels. Decreasing the inductance of L-8 by spreading the turns will decrease the depth of the valley.
12. Remove the 330 ohm resistor if it has been used for the previous steps.
13. Set channel selector and test equipment to channel 13.
14. Adjust C-3 for maximum gain and a flat top response curve.
15. Disconnect all alignment equipment and replace the shield on the side of the tuner and air check the receiver on all active channels.
16. Remount the tuner in the chassis and check the alignment of the tuned circuits in the output circuit of the tuner and the grid circuit of the first i-f amplifier stage. Instructions for this alignment are given under the i-f alignment procedure.

OSCILLATOR CIRCUIT ADJUSTMENT

1. Set the fine tuning control at the approximate midpoint of its tuning range.
2. Place a non-metallic screwdriver through the openings provided in the front of the chassis and tuner assembly and adjust the oscillator coil slug for each active VHF channel to give the best possible picture.

NOTE -- If the slug in the oscillator coil does not have enough range on any channel, place the slug in the approximate center of its range and adjust C-17 for the best possible picture. It will then be necessary to adjust all of the oscillator coils as directed in steps 1 and 2. When replacing 6J6 tubes, C-17 may be adjusted for the best possible picture on any one active channel and thereby eliminate the necessity of adjusting each individual oscillator core.

ALIGNMENT FOR THE 1E1852 TV TUNER

OSCILLATOR CIRCUIT ADJUSTMENT

1. Set the fine tuning control at the approximate midpoint of its tuning range.

2. Place a non-metallic screwdriver through the openings provided in the front of the chassis and the tuner assembly and adjust the oscillator coil slug for each active VHF channel to give best possible picture.

NOTE- Adjustment of the oscillator slugs may be accomplished on some models while the chassis is in the cabinet by removing the front knob escutcheon. An access hole for this adjustment is provided in the cabinets with removable front safety glass, but not in the knob escutcheons.

40 to 54 MC TRAP - The antenna input circuit of the VHF tuner contains a trap that may be adjusted to attenuate or eliminate interference within the range of 40 to 54 MC. If interference is encountered adjust C-23 on the top of the VHF tuner for minimum picture interference. Improper adjustment of this trap may affect the frequency response of channel 2. Care must be exercised that this does not happen.

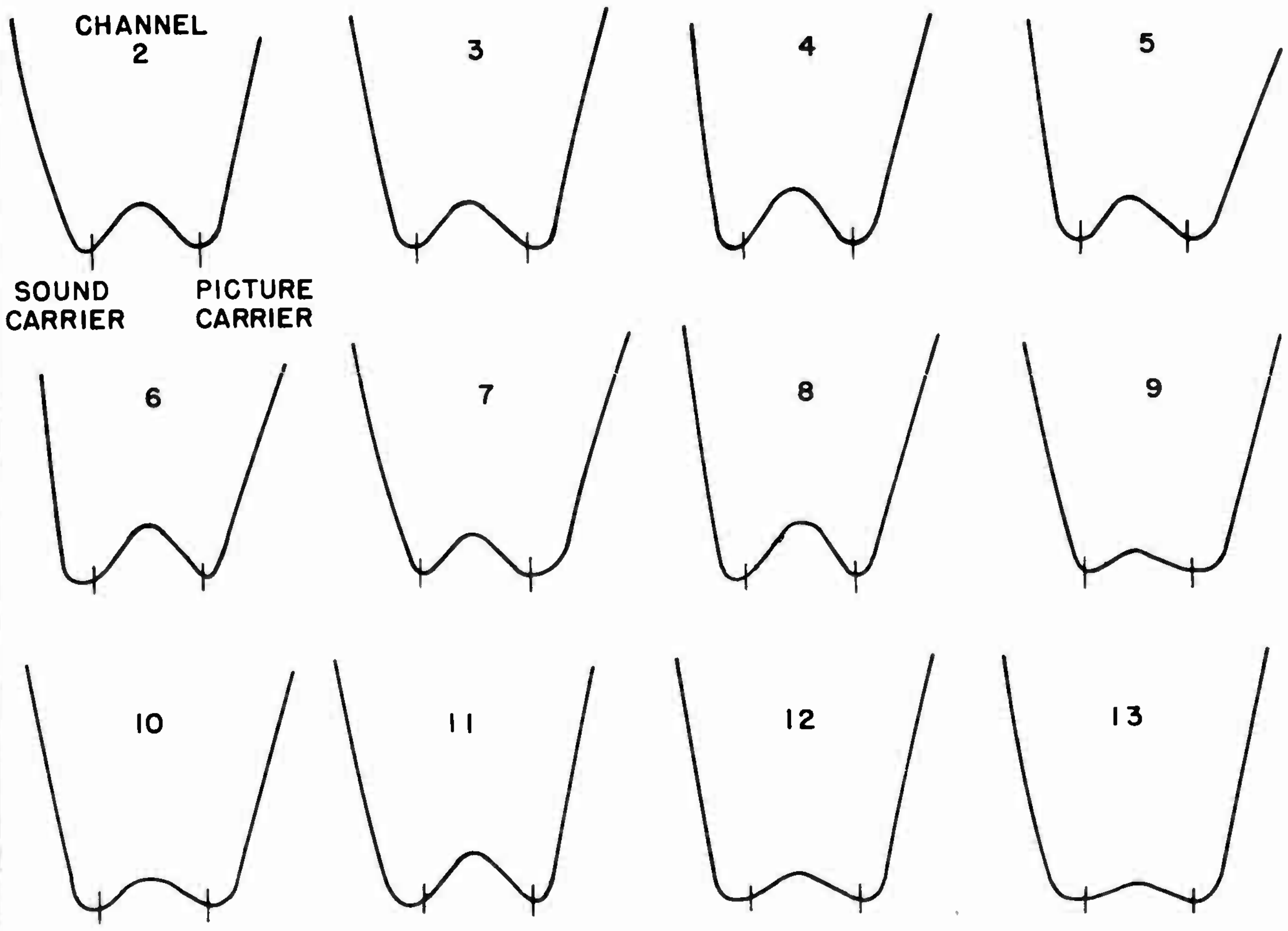


Fig. 20A. Typical Response Curves for VHF Channels

SERVICING AND ALIGNING THE 1E1846 & 1B1969 VHF CASCODE TUNERS

NO ATTEMPT TO REALIGN THE TUNER SHOULD BE MADE UNTIL THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITIONS AND IS PROPERLY ALIGNED.

This tuner was carefully aligned at the factory and should not require complete realignment under normal operating conditions. When replacing tubes it is of utmost importance that several different tubes are tried and the one giving the best performance selected for use. The use of selected tubes will, in the majority of cases, eliminate the necessity of tuner alignment when tubes are replaced. When replacing tubes use the same type as those found in the tuner. When selecting tubes tune the receiver to the highest active channel as slight differences in the tube will show up more clearly on the high channels.

When the oscillator tube has been replaced it may be necessary to adjust the individual oscillator coil slugs even though a selected tube has been used. However, before adjusting the individual oscillator coil slugs try adjusting C-17 for the desired results. This capacitor is in parallel with the fine tuning capacitor and determines the tuning range of the fine tuning capacitor. If C-17 is adjusted to obtain the desired picture on one active channel, all other active channels should automatically give proper reception.

Whenever it is necessary to replace components within the tuner the following precautions must be observed to prevent the necessity of tuner realignment after the service work has been completed. The physical location of all components and wires must not be changed. If a new component is installed it must have the same lead length as the old part and be placed in the same location. The position and settings of the various air core coils must not be changed. Note that the series coil (L-6) in the r-f plate/cathode circuit requires special test equipment for adjustment and, every precaution should be used to prevent disturbing the setting of this coil.

In order to adjust L-6 a grid dip oscillator capable of tuning from 230 to 235 MC will be required. This coil must be resonated at a frequency between 230 and 235 MC in order to provide increased gain on the higher VHF channels. It is resonated by the plate to ground capacitance of the first triode section and the cathode to ground capacitance of the second triode section. With the plate voltage (blue wire) removed and the heater voltage applied to the cascode amplifier the turns of L-6 may be compressed or expanded until it resonates at a frequency between 230 and 235 MC. This adjustment may be made at any time and will require a grid dip oscillator as an indicator.

If the service work on the tuner is confined to components in the oscillator/mixer stage it is necessary to align only the oscillator/mixer stage. It will not be necessary to adjust C-3 in the grid circuit of the first triode section of the cascode amplifier. In the great majority of cases, if care is used when servicing the tuner, it will only be necessary to adjust C-5, C-10 & C-17 after working on the oscillator/mixer section.

Similarly, if the service work has been done in the first triode section of the cascode amplifier an adjustment of C-3 only should restore the tuner to normal provided L-6 has been adjusted as outlined above.

EQUIPMENT REQUIRED FOR TUNER ALIGNMENT

VHF Sweep Generator - - -	RCA type WR-59B or equiv.
VHF Marker Generator - - -	RCA type WR-39C or equiv.
Oscilloscope - - - - - - - -	RCA type WO-56A or equiv.
Bias Source - - - - - - - - -	3 volt battery or equiv.
Input Pad - - - - - - - - - -	See Fig. 19B.

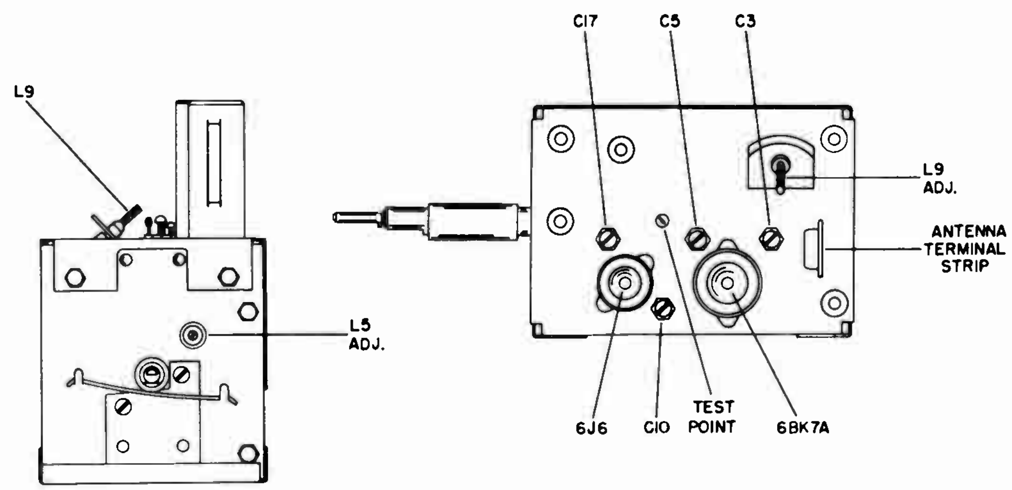


Fig. 24A. Alignment Adjustments for 1E1846 & 1B1969 VHF Tuner

ALIGNMENT OF THE CASCODE I-F AMPLIFIER IN UHF/VHF CHASSIS

NO ATTEMPT SHOULD BE MADE TO PERFORM THE FOLLOWING PROCEDURE UNTIL THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITION AND THE REGULAR I-F ALIGNMENT HAS BEEN COMPLETED. (See Fig. 33A or 33B for location of adjustments and Fig. 18B for response curve.)

EQUIPMENT REQUIRED

Sweep Generator	RCA type WR-59B or equiv.
Marker Generator	RCA type WR-39C or equiv.
Oscilloscope	RCA type WO-56A or equiv.
Detector Circuit	Shown 12 Fig. 18A.
Isolation Transformer	150 watt rating or higher.

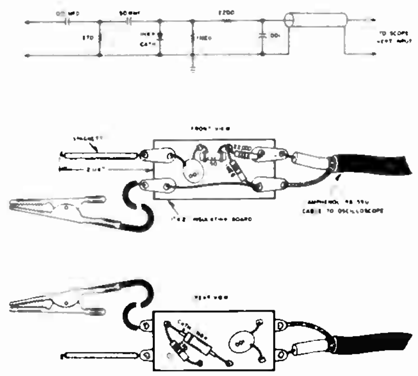


Fig. 18A. Detector Circuit for Cascode I-F Alignment

PROCEDURE

1. Set the UHF/VHF switch to UHF position. Select an inactive channel between 35 and 45.
2. Connect all test equipment and the television chassis to a common ground. Be sure to use an isolation transformer for the receiver chassis. Allow at least a 5 minute warm-up in this position.
3. Connect the hot lead of the sweep generator to pin 7 of V-401 (Cascode I-F amplifier). Set the generator to sweep from 40 to 48 mcs.
4. Connect the oscilloscope to the plate circuit of V-101 through the detector circuit of Fig. 18A.
5. Loosely couple the hot lead of the marker generator to the hot side of the sweep generator through a 22 mmf. capacitor. This coupling may also be accomplished by clipping the hot lead from the marker generator over the crystal diode in the detector circuit in Fig. 18A.
6. Adjust L-403 to place the 45.75 marker on one peak of the response curve on the oscilloscope. Note the position of the 42.75 marker.
7. Adjust L-405 by compressing or spreading its turns to equalize the two peaks on the response curve on the scope.

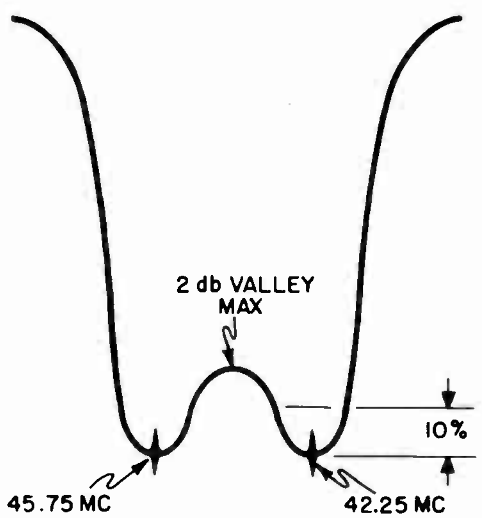


Fig. 18B. Response Curve for Cascode I-F Alignment

ALIGNMENT FOR THE 1E1852 TV TUNER

The tuner was carefully aligned at the factory and should not require complete realignment under normal operating conditions. A slight readjustment of the individual oscillator slugs may be required as the tubes in the tuner age or are replaced. Use of selected tubes is recommended to obtain the best possible results without aligning the tuner. NO ATTEMPT TO REALIGN THE TUNER SHOULD BE MADE UNTIL THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITION AND IS PROPERLY ALIGNED.

EQUIPMENT REQUIRED

VHF Sweep Generator	RCA type WR-59B or equiv.
VHF Marker Generator	RCA type WR-39C or equiv.
Oscilloscope	RCA type WO-56A or equiv.
Bias source	3 volt battery or equiv.

SET-UP PROCEDURE

1. Set the channel selector switch to Channel 10.
2. Connect the oscilloscope through a 10,000 ohm resistor to TP-9 shown in Fig. 19A.
3. Connect the negative side of the bias source through a 1000 ohm isolation resistor to the terminal where the AGC lead (white wire) from the tuner is connected. Connect the positive side of the bias source to the receiver chassis.
4. Set the fine tuning control by placing widest point on cam on left side of shaft.
5. Connect the sweep generator to the antenna terminals through the pad shown in Fig. 19B. and adjust the output to sweep channel 10.
6. Couple the output from the marker generator to the antenna circuit by connecting the hot lead from the generator to the junction of the four 220 ohms resistors in the pad shown in Fig. 19B. Connect the ground lead to the r-f tube shield in the VHF tuner. Use minimum amount of signal from generator necessary to obtain good pip in scope pattern.

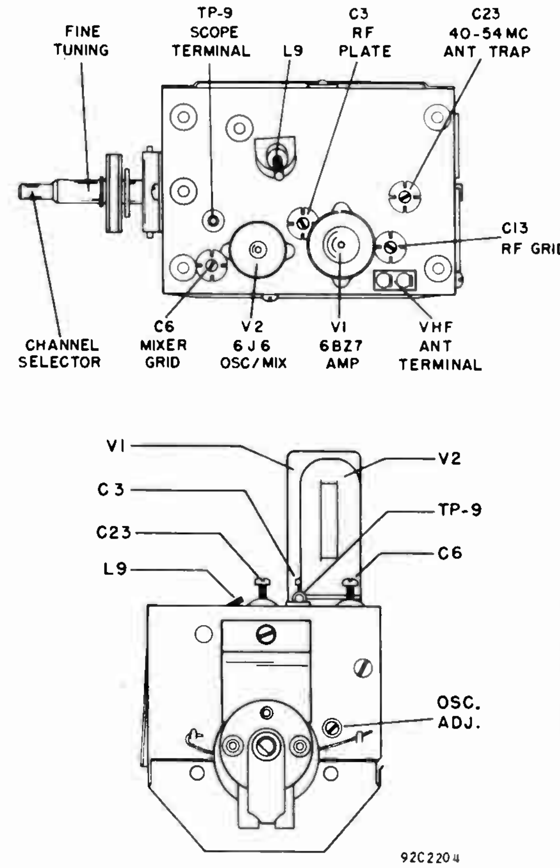


Fig. 19A. Alignment Adjustments for 1E1852 TV Tuner

ANTENNA AND R-F CIRCUIT ADJUSTMENT

7. Adjust C-13, C-3, and C-6 for a flat-top response curve and maximum gain. Check the position of the markers on all channels. They should fall in place automatically on all channels. Correct marker frequencies for each channel are given in the Picture Carrier and Sound Carrier columns of the chart on page 1954-25. The response curves shown in Fig. 20A. should be used as a guide to show the various shapes that the response curves may have and still be satisfactory. If necessary adjust C-25 (gimmick) to change bandwidth over a narrow range (approx. 2 mc.) on Channel 10. To increase bandwidth, push the gimmick closer to the contact terminals. CAUTION: This gimmick must not touch the tuner chassis as it is connected to the plate of the r-f stage.
8. Disconnect the bias source and test equipment.
9. Air check the receiver on all active VHF channels. If it is possible to receive a normal picture on all active channels by adjusting the fine tuning control, further alignment is not absolutely necessary.

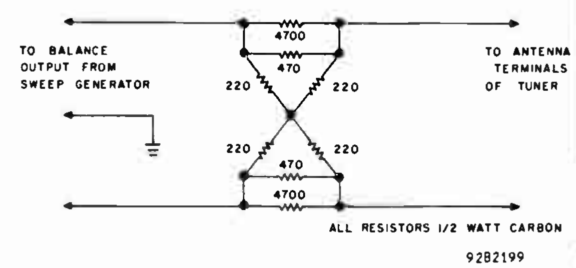


Fig. 19B. Sweep Generator Pad

I-F AMPLIFIER ALIGNMENT FOR 1300D CHASSIS

EQUIPMENT REQUIRED

SWEEP GENERATOR	RCA type WR-59B or equivalent.
MARKER GENERATOR	RCA type WR-39C Television Calibrator or equivalent.
OSCILLOSCOPE	RCA type WO-56A or equivalent.
VACUUM TUBE VOLTMETER (VTVM)	RCA type WV-97A or equivalent.
BIAS SOURCE	Three volt battery.
TEST CIRCUIT	Shown in Fig. 16A.
ISOLATION TRANSFORMER	150 watt rating or higher.

PROCEDURE

1. Set the UHF/VHF switch to the VHF position. Set the channel selector to channel 3 or 4, whichever is vacant.

2. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety. Allow a 15 minute warm up period.

3. Set the AVC switch on the rear chassis apron to the 0-10 MILE (counterclockwise) position.

4. Connect the negative side of a 3 volt battery supply to test point Ⓔ through a 1,000 Ω resistor. Connect the positive side of the supply to the TV chassis. See schematic diagram.

5. Connect a VTVM to test point Ⓓ through a 47,000 ohm carbon resistor Connect the ground side of the meter to the TV chassis. See Fig. 13A or 14A.

6. Connect the high side of a marker generator to the shield of the osc./mixer tube. This connection will capacitively couple the generator output to the tube. Make sure the shield is ungrounded by raising it above the grounded clips that hold it in place.

7. Set the marker generator output (unmodulated) for a two volt negative dc reading on the VTVM and adjust the three i-f transformers, L-9, and L-101 according to the I-F AMPLIFIER ALIGNMENT CHART shown below. Readjust the signal generator output as required to maintain the two volt VTVM reading.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment	Transformer or Coil Location	VTVM Indication
45.0 MC	T-101	See Fig. 13A or 14A	Maximum
42.8 MC	T-102 (bottom)		Maximum
44.0 MC	T-103		Maximum
41.25 MC	T-102 (top)		Minimum
42.8 MC	T-102 (bottom)		Maximum
44.25 MC	§*L-101 (top) or L-101-1 (bottom)		Maximum
44.25 MC	#L-9		Maximum

IMPORTANT — The wax in the end of the coil forms holding the iron core in position may be softened for adjustment of the core by means of a heated screwdriver or a small pencil type soldering iron inserted into the wax. Remelt wax after adjustment.

* NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 16A to the tuner test point TP-2 when making this adjustment on all tuners except the 1E1852 or 1E1846. With the 1E1852, 1E1846, or 1B1969 tuner hold the channel selector between channels when making this adjustment.

§ NOTE: Top adjustment of L-101-1 may be used in conjunction with L-9 of 1E1846 or 1B1969 tuner to give proper band width response.

\# NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 16A to the grid (pin 1) of V-101 the 6CB6 first i-f amplifier when making this adjustment.

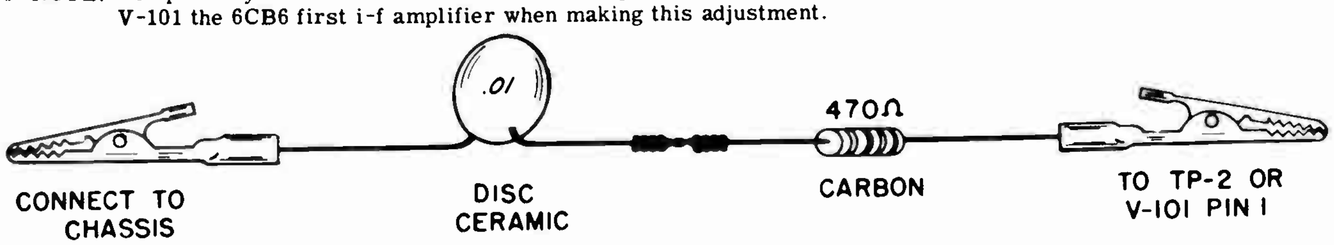


Fig. 16A. Test Circuit for I-F Amplifier Alignment

8. Disconnect the VTVM and marker generator connected in steps 4 and 5. The balance of the set-up should be as directed in steps 1, 2, 3 and 6.

9. Capacitively couple the high side of the sweep generator r-f output to the osc./mixer tube by connecting to the tube shield which has been raised above its grounding clips. The ground side of the sweep generator should be connected to the receiver chassis. Adjust the generator to sweep from 40.5 to 46.5 MC.

10. Loosely couple the high side of the marker generator to the high side of the sweep generator by clipping the marker generator r-f lead over the insulation of the sweep generator r-f lead. The ground side of the marker generator should be connected to the receiver chassis.

IMPORTANT — To prevent overloading of the i-f amplifier keep the output of the sweep and marker generators as low as possible. The marker generator output should be just high enough to produce visible pips on the pattern. In some cases the 41.25 MC pip will not be visible unless the r-f output of the marker generator is increased to overcome the attenuation of the 41.25 MC signal by the trap in the top of T-102.

11. Connect the sweep output terminals on the sweep generator to the input of the horizontal amplifier in the oscilloscope.

12. Connect one side of a 47,000 ohm 1/2 watt resistor to test point Ⓓ shown in the schematic diagrams. Connect the other end of the resistor to the high side of the input terminals for the vertical amplifier in the oscilloscope. The scope ground terminal connects to the receiver chassis. Keep the scope leads away from the internal chassis wiring, particularly the horizontal output section.

13. Reduce the r-f output of the sweep generator and increase the gain of the vertical amplifier in the oscilloscope as much as possible without introducing an excessive amount of noise on the test pattern. This will prevent overloading of the i-f system.

14. Check the position of the markers shown in Fig. 17A. Adjust only the bottom cores of T-101, T-102 and T-103 for a response curve of maximum amplitude with a slightly tilted flat topped appearance as shown in Fig. 17A. This tilt is required to compensate for the capacitive coupling used for the signal generators. The actual response obtained will be flat when the pattern viewed on the oscilloscope has this tilt. The bottom core of T-103 will primarily control the tilt of this central portion of the curve.

The bottom core of T-101 should be adjusted to position the 45.75 MC marker in the 50% position shown in Fig. 517A.

The bottom core of T-101 should be adjusted to determine the slope of the curve between 41.25 MC and 42.8 MC with the 42.25 MC marker down 50% on the curve as shown in Fig. 17A.

Under no circumstances should an attempt be made to adjust L-9, L-101 and the 41.25 MC trap in the top of T-102 by means of an oscilloscope and sweep generator. Maladjustment of these coils does not give a noticeable indication on the oscilloscope. Align these coils by following the procedure given in steps 1 through 7 only.

I-F AMPLIFIER SENSITIVITY MEASUREMENT

To determine the i-f amplifier sensitivity, disconnect the r-f output lead from the tuner where it connects to L-101. Temporarily connect one side of a .005 mfd. mica or ceramic capacitor to grid pin 1 of the first 6CB6 i-f amplifier tube V-101. Connect the unmodulated r-f output of a marker generator to the other side of the capacitor and the ground side of the generator to the TV chassis. Set the marker generator to 43.75 MC. Connect a VTVM as directed in step 5 of the alignment procedure. The 3 volt battery must be removed. If a generator output of 200 to 400 microvolts produces a 1 volt reading on the VTVM, the i-f amplifier sensitivity is normal.

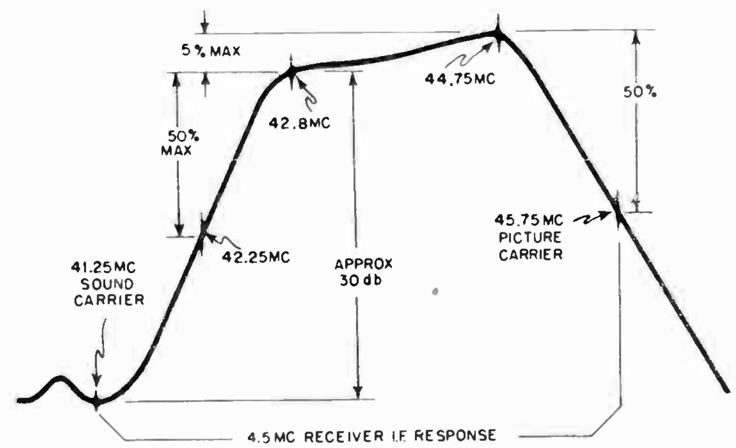


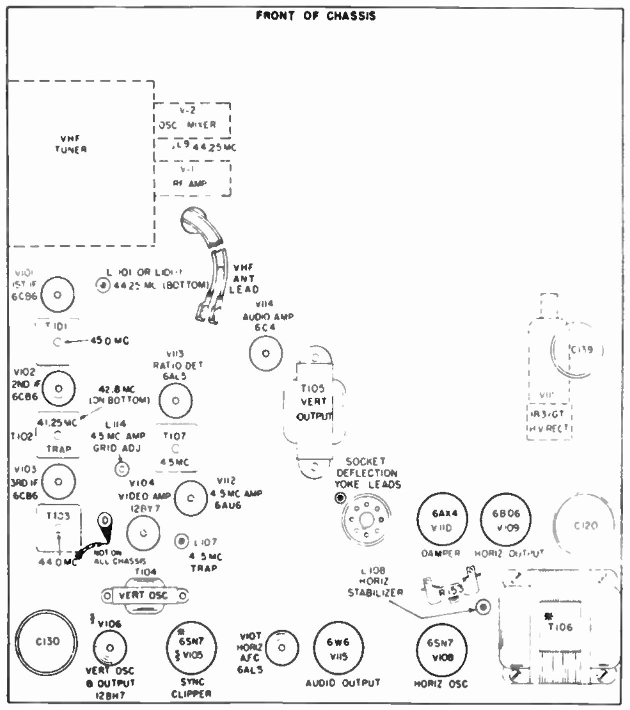
Fig. 17A. Typical Response for 41.25 to 45.75 MC I-F Amplifiers

TUBE AND RECTIFIER COMPLEMENT

Schematic Symbol	Description	Hallicrafters Part Number
V-1	R-F. amplifier: VHF tuner	See below
V-2	Osc./mixer; VHF tuner	See below
V-101	1st I-F amplifier	90X6CB6
V-102	2nd I-F amplifier	90X6CB6
V-103	3rd I-F amplifier	90X6CB6
V-104	Video Amplifier	90X12BY7
*V-105	Sync clipper	90X6SN7GT
*V-105-1	Sync clipper	90X12SN7GT
*V-106	Vertical oscillator and output	90X12BH7
V-107	Horizontal AFC	90X6AL5
V-108	Horizontal oscillator	90X6SN7GT
V-109	Horizontal output	90X6BQ6GT
V-110	Damper	90X6AX4
V-111	High voltage rectifier	90X1B3GT
V-112	Sound I-F amplifier (4.5 mc)	90X6AU6
V-113	Ratio detector	90X6AL5
V-114	Audio amplifier	90X6C4
V-115	Audio output amplifier	90X6W6
V-116	Picture tube -- See page 1953-542	- - - - - - -
V-301	Oscillator; UHF tuner	See below
V-401	UHF Cascode I-F amplifier	90X6BZ7

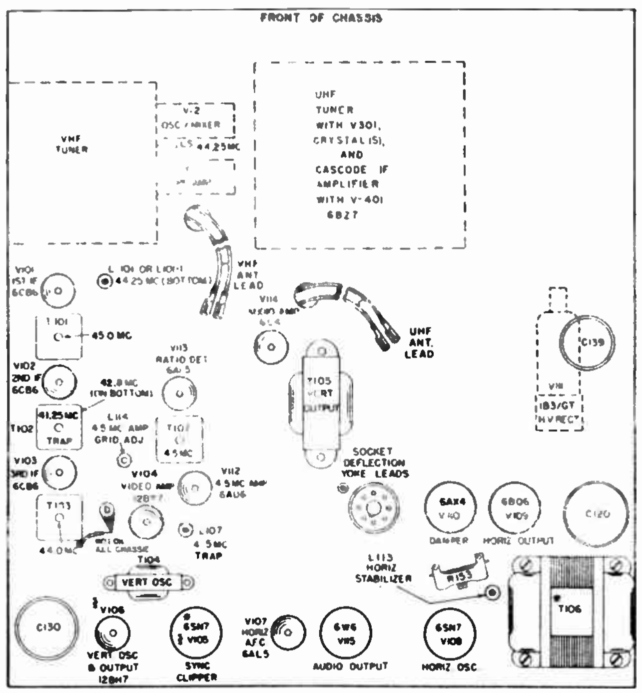
* On all (#B-2) Chassis the first triode section (pins 1, 2, and 3) of V-105-1 and V-106 are interchanged, making V-105-1A the vertical oscillator, V-105-1B & V-106A the sync clipper. V-106B remains the vertical output tube.

Schematic Symbol	Description	Hallicrafters Part Number
X-101	Selinium rectifier (300 ma.)	27A173
X-102	Selinium rectifier (300 ma.)	27A173
X-103	Video detector (1N64 germanium diode)	19B1864



* ON ALL (-2) RUNS, V105 (6SN7) IS REPLACED BY V-105-1 (12SN7) AND T-106 IS REPLACED BY T-106-1 (52C258)
◉ SOCKET NOT FOUND ON H1300D CHASSIS
‡ ON ALL (#B-2) RUNS, V105-1A AND V106A INTERCHANGED.

Fig. 13A. Top View Alignment Locations for Chassis A1300D, C1300D, E1300D, & J1300D.



* ON ALL (-2) RUNS, V105 (6SN7) IS REPLACED BY V-105-1 (12SN7) AND T-106 IS REPLACED BY T-106-1 (52C258)
◉ SOCKET NOT FOUND ON H1300D CHASSIS.
‡ ON ALL (#B-2) RUNS, V105-1A AND V106A INTERCHANGED.

Fig. 14A. Top View Chassis Alignment Locations for Chassis B1300D, D1300D, F1300D & H1300D.

LAYOUT OF CONTROLS

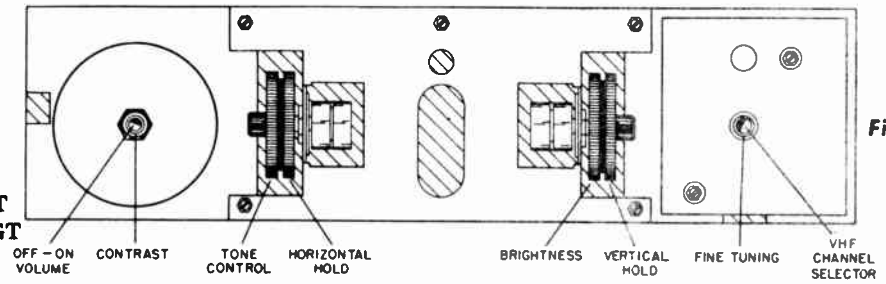


Fig. 15A. Front Controls VHF Chassis A1300D, C1300D, E1300D, & J1300D.

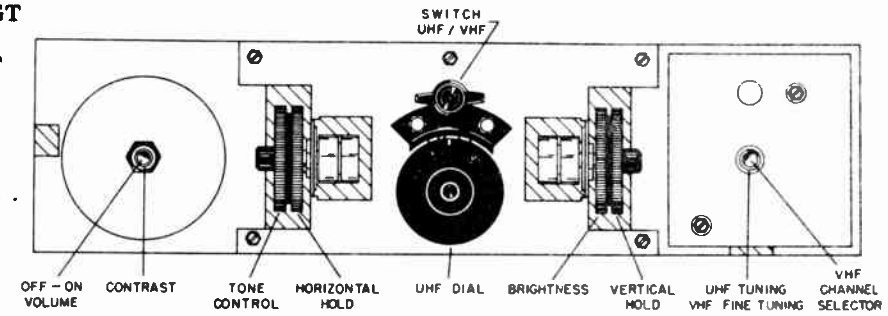


Fig. 15B. Front Controls VHF-UHF Chassis B1300D, D1300D, F1300D & H1300D.

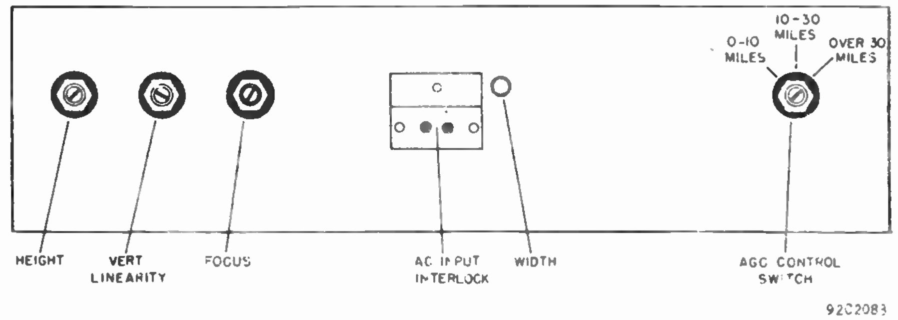


Fig. 15C. Rear Controls for A1300D, B1300D, H1300D and J1300D

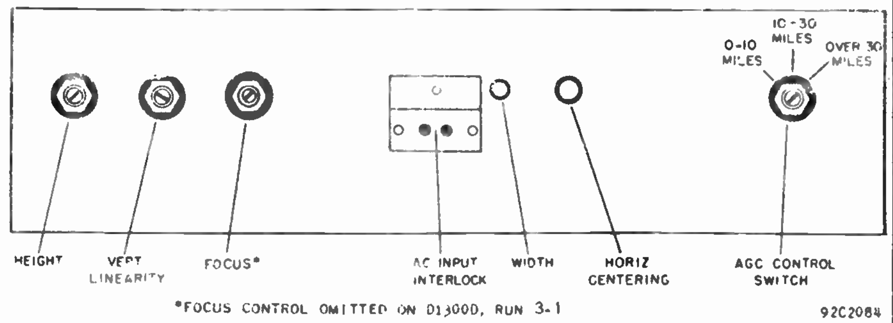


Fig. 15D. Rear Controls for C1300D and D1300D

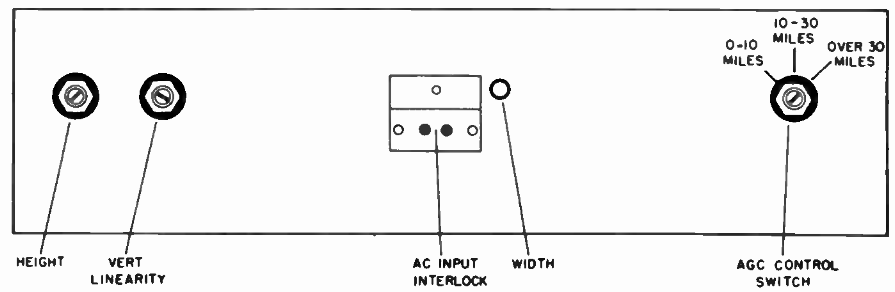


Fig. 15E. Rear Controls for E1300D and F1300D

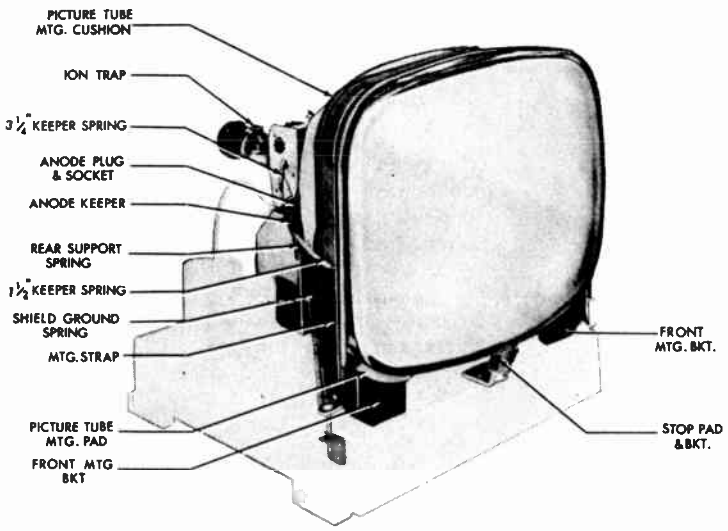


Fig. 9A. 17" Glass Pix Tube Mounting

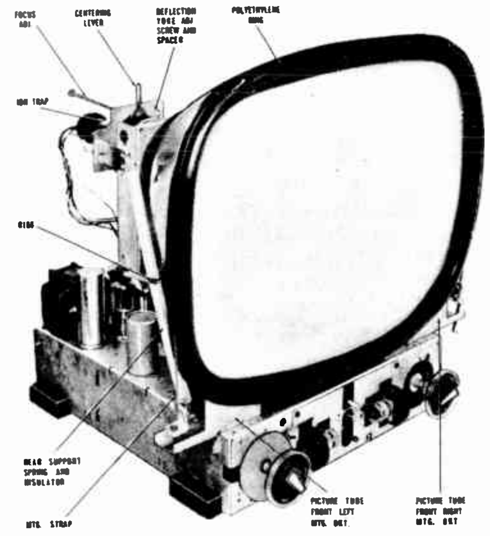


Fig. 9B. 21" Metal Pix Tube Mounting

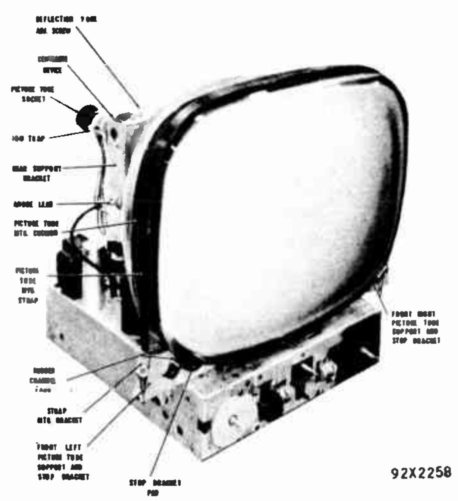


Fig. 9C. 21" Glass Pix Tube Mounting

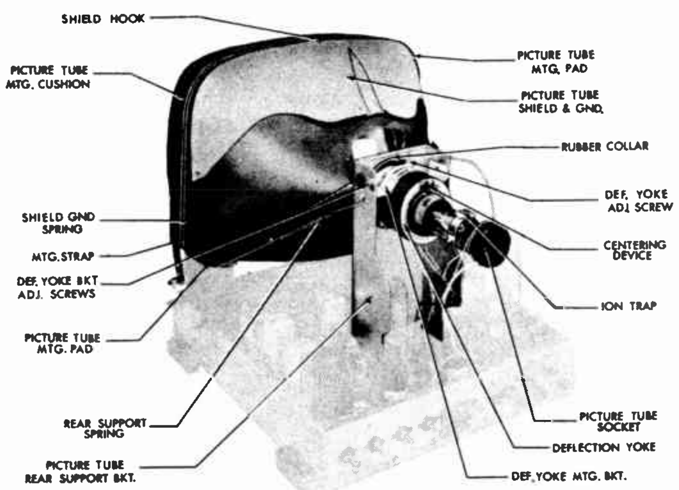


Fig. 11A. 17" Glass Pix Tube Mounting

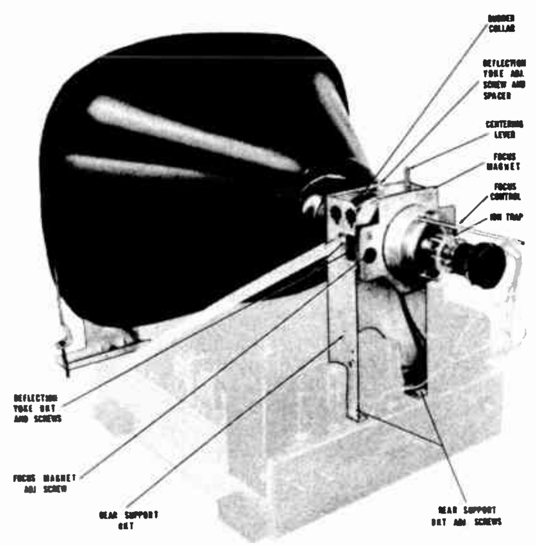


Fig. 11B. 21" Metal Pix Tube Mounting.

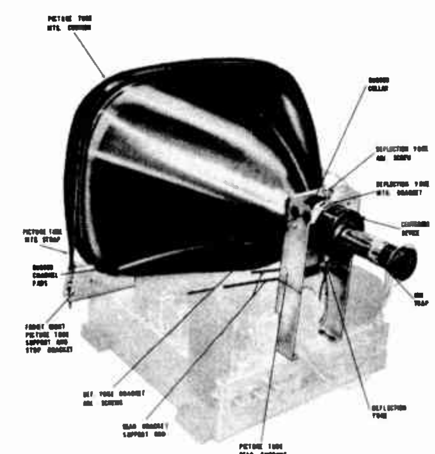


Fig. 11C. 21" Glass Pix Tube Mounting

FM SOUND CHANNEL ALIGNMENT FOR 1300D SERIES CHASSIS

EQUIPMENT REQUIRED

Signal generator covering 4 to 30 mc. unmodulated.

Vacuum tube voltmeter (VTVM).

Sound alignment test circuit shown in Fig. 12A.

Power line isolation transformer.

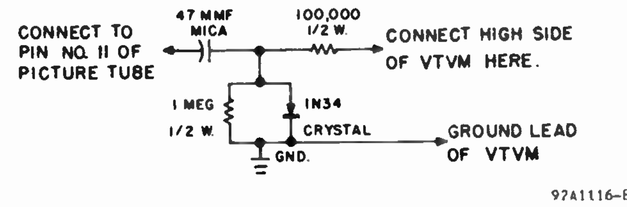


Fig. 12A. Sound Alignment Test Circuit

PROCEDURE

1. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety.

2. Set the channel selector to any vacant channel and the contrast control at minimum.

3. Connect the signal generator output through a .005 mfd. capacitor to test point (D) shown in schematic diagram. Ground the shield of the generator output cable to the chassis.

4. Connect the sound alignment detector circuit and VTVM as shown in Fig. 12A. Adjust the 4.5 mc. generator output (unmodulated) to give a 1 volt reading on the VTVM.

5. Adjust the 4.5 mc. trap adjustment (L-107) at 4.5 mc. for a minimum VTVM reading.

6. Disconnect the test circuit and connect the VTVM to test terminal (B) (Pin 2 of FM detector, V-113). See schematic diagram.

7. Adjust the 4.5 mc. amplifier grid adjustment (L-114) and the primary of T-108 (bottom core) at 4.5 mc. for a maximum VTVM reading.

8. Connect the VTVM to test terminal (C), shown in the schematic diagram. Adjust the secondary of T-108 (top core) at 4.5 mc. for the zero reading which occurs between the positive and negative peaks. If the zero reading occurs at more than one setting, use the position nearest the top limit of the core.

9. Shift the signal generator an equal amount on either side of 4.5 mc. and touch up the primary of T-108 (bottom core) for approximately equal peaks. Use just enough signal output to obtain one volt peaks for best results.

HORIZONTAL OSCILLATOR ADJUSTMENT

If the horizontal hold control fails to restore synchronization, the horizontal stabilizer coil (L-113) should be adjusted. Procedure for this adjustment is as follows:

1. Set the horizontal hold control in the approximate center of the range over which it may be rotated.

2. Set the channel selector to an active channel and adjust the horizontal stabilizer for a single steady picture. See Fig. 12B.

3. Rotate the horizontal hold control full clockwise. The picture may or may not remain in sync. If it does, momentarily switch the channel selector to another channel and return it to the original channel. The picture should now be slightly out of sync.

4. Rotate the horizontal hold control full counterclockwise. The picture may or may not remain in sync. If it does, momentarily switch the channel selector to another channel and return it to the original channel. The picture should now be slightly out of sync.

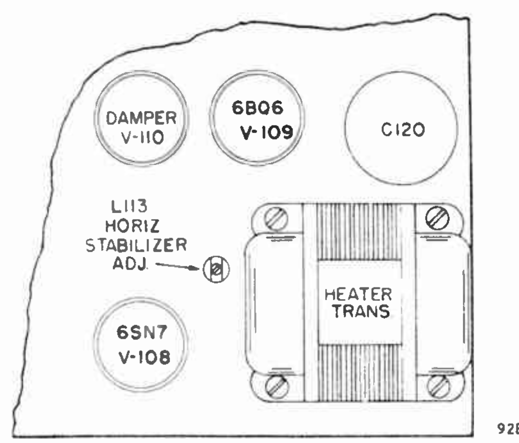


Fig. 12B. Horizontal Oscillator Adjustment Point

When the horizontal stabilizer coil is properly adjusted the results outlined in steps 3 and 4 will be obtained. If the correct results are not obtained, repeat steps 2, 3 and 4 until they are.

SERVICE PARTS LISTS FOR 1C1345 & 1E1492 VHF PENTODE TV TUNERS (Cont.)

CAPACITORS

Schematic Symbol	Description	Cross Reference	Hallicrafters Part Number
C-1	.56 mmf. ceramic gimmick	1874-11	47A364
C-2	12 mmf. ceramic tubular	R3CC20CK120K	47X20CK120K
C-3	15 mmf. ceramic tubular	R3CC20SL150K	47X20SL150K
C-4	500 mmf. miniature ceramic disc	2033-2	47A355
C-5	500 mmf. miniature ceramic disc	2033-2	47A355
C-6	470 mmf. ceramic tubular	R5CC25ZY471MX	47A367
C-7	1.8 mmf. ceramic gimmick	1874-40	47A368
C-8	1.8 mmf. ceramic gimmick	1874-23	47A370
C-9	.56 mmf. ceramic gimmick	1874-11	47A364
C-10	470 mmf. ceramic tubular	R5CC25ZY471MX	47A367
C-11	Fine Tuning air trimmer	1713-501	44A432
C-12	4.0 mmf. ceramic tubular	R3CC20SK040D	47X20SK040D
C-13	10 mmf. ceramic tubular	R3CC20UK100D	47X20UK100D
C-14	.27 mmf. ceramic gimmick	1874-3	47-369
C-15	5000 mmf. ceramic disc	2033-7	47A168
C-16	15 mmf. ceramic tubular	R3CC20SL150K	47X20SL150K
C-17	5000 mmf. ceramic disc	2033-7	47A168
C-18	500 mmf. miniature ceramic disc	2033-2	47A355
C-19	500 mmf. miniature ceramic disc	2033-2	47A355
C-20	500 mmf. miniature ceramic disc	2033-2	47A355
C-21	500 mmf. miniature ceramic disc	2033-2	47A355
C-22	500 mmf. miniature ceramic disc	2033-2	47A355

SERVICE PARTS LISTS FOR 1C1376 & 1E1677 VHF CASCODE TV TUNERS

TRANSFORMERS AND COILS

Schematic Symbol	Description	1C1376 Mfgrs. Cross Reference	1C1376 Hallicrafters Part Number	1E1677 Mfgrs. Cross Reference	1E1677 Hallicrafters Part Number
T-1	Transformer, VHF antenna input	1921-1	51A1684	1921-1	51A1584
L-2	Coil, channel 13; r-f grid (part of S1A)	- - - - -	- - - - -	- - - -	- - - - -
L-3	Coil, channel 13; r-f plate adj. (assembly)	1984-14	51A1685	1984-14	51A1685
L-6	Coil, channel 13; mixer gird adj. (assembly)	1785-52	51A1686	1785-52	51A1686
L-7	Coil, channel 13; osc. adj. (assembly)	2051-5	51A1687	2051-5	51A1687
L-8	Coil, channel 6; osc. adj. (assembly)	2051-2	51A1688	2051-2	51A1688
L-9	Coil, output coupling	1994-1	51A1689	1994-1	51A1689
L-10	Choke, output peaking	1911-6	53A299	1911-6	53A299
L-11	Coil, cath./plate. coupling	1785-49	51A1690	1785-49	51A1690
L-12	Choke, heater	1894-1	53A296	1894-1	53A296
L-13	Choke, heater	1894-2	53A297	1894-2	53A297

RESISTORS

Schematic Symbol	Description	1C1376 Mfgrs. Cross Reference	1C1376 Hallicrafters Part Number	1E1677 Mfgrs. Cross Reference	1E1677 Hallicrafters Part Number
R-1	4700 ohms $\frac{1}{2}$ watt, carbon	RC20AE472K	23X20X472K	RC20AE472K	23X20X472K
R-2	1 megohm $\frac{1}{2}$ watt, 5% carbon	RC20AE105J	23X20X105J	RC20AE105J	23X20X105J
R-3	750,000 ohms $\frac{1}{2}$ watt, 5% carbon	RC20AE754J	23X20X754J	RC20AE754J	23X20X754J
R-4	470 ohms $\frac{1}{2}$ watt, carbon	RC20AE471K	23X20X471K	RC20AE471K	23X20X471K
R-5	220,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE224K	23X20X224K	RC20AE224K	23X20X224K
R-6	15,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE153K	23X20X153K	RC20AE153K	23X20X153K
R-7	10,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE103K	23X20X103K	RC20AE103K	23X20X103K
R-8	3300 ohms $\frac{1}{2}$ watt, carbon	RC20AE332K	23X20X332K	RC20AE332K	23X20X332K

Speaker, 8" Electrodynamic; 61 Ohms Field (Cold Resistance) 85A133

Speaker, 6-1/2" Electrodynamic; 61 Ohms Field (Cold Resistance) 85A135

SERVICE PARTS LISTS FOR 1C1376 & 1E1677 VHF CASCODE TV TUNER (Cont.)

CAPACITORS

Schematic Symbol	Description	Mfg. Cross Reference	Hallicrafters Part Number	Mfg. Cross Reference	Hallicrafters Part Number
C-1	7.5 mmf. ceramic gimmick	2043-1	47A362	2043-1	47A362
C-2	4 mmf. ceramic tubular	R3CC20SL040D	47X20SL040D	R3CC20SL040D	47X20SL040D
C-3	1.6 mmf. ceramic gimmick	1874-22	47A361	2101-169K	121A071
C-4	800 mmf. ceramic disc	2033-2	47A355	2033-2	47A355
C-5	470 mmf. ceramic feed-through	2023-2	47A357	2023-2	47A357
C-6	100 mmf. ceramic tubular (part of S1B)	- - - -	- - - -	- - - -	- - - -
C-7	800 mmf. ceramic disc	2033-2	47A355	2033-2	47A355
C-8	2.2 mmf. ceramic gimmick	1874-25	47A363	2101-229K	121A072
C-9	.56 mmf. ceramic gimmick	1874-11	47A364	2101-568K	121A073
C-10	0.30 mmf. ceramic gimmick	1874-4	47A365	2101-308K	121A074
C-11	Fine tuning air trimmer	1713-501	44A432	1713-501	44A432
C-12	4.0 mmf. ceramic tubular	R3CC20SK040D	47X20SK040D	R3CC20SK040D	47X20SK040D
C-13	10 mmf. ceramic tubular	R3CC20UK100D	47X20UK100D	R3CC20SL150D	47X20UK100D
C-14	.30 mmf. ceramic gimmick	1874-4	47A365	2101-308K	121A074
C-15	15 mmf. ceramic tubular	R3CC20SL150D	47X20SL150D	R3CC20SL150D	47X20SL150D
C-16	5000 mmf. ceramic disc	2033-7	47A168	2033-7	47A168
C-17	5000 mmf. ceramic disc	2033-7	47A168	2033-7	47A168
C-18	.68 mmf. ceramic gimmick	1874-13	47A366	2101-688K	121A075
C-19	470 mmf. ceramic tubular	R5CC25ZY471MX	47A367	R5CC25ZY471MX	47A367
C-20	800 mmf. ceramic disc	2033-2	47A355	2033-2	47A355
C-21	800 mmf. ceramic disc	2033-2	47A355	2033-2	47A355
C-22	800 mmf. ceramic disc	2033-2	47A355	2033-2	47A355
C-23	12 mmf. ceramic tubular	R3CC20CK120K	47X20CK120K	R3CC20CK120K	47X20CK120K

TUBES

Schematic Symbol	Description	Mfg. Cross Reference	Hallicrafters Part Number	Mfg. Cross Reference	Hallicrafters Part Number
V-1	6BZ7 Dual Triode or	6BZ7	90X6BZ7	6BZ7	90X6BZ7
	6BQ7 Dual Triode	6BQ7	90Z6BQ7	- - - - -	- - - - -
V-2	6J6 Dual Triode	6J6	90X6J6	6J6	90X6J6

SERVICE PARTS LIST FOR VHF 16-POSITION 1E1483 & 1E1670 CASCODE TV TUNER

TRANSFORMERS AND COILS

Schematic Symbol	Description	Mfg. Cross Reference	Hallicrafters Part Number
T-1	Transformer, VHF antenna input coupling	1964-5	51A1674
L-1	Coil, UHF input coupling (adjustable iron core)		121A068
L-1	Coil, UHF input coupling (air core fixed)	1785-54	51A1675
L-2	Channel 13 RF grid adj. (assembly)	1984-13	51A1676
L-3	Channel 13 RF plate adj.	1984-12	51A1677
L-4	Cascode Plate/Cath. coupling coil	1785-51	51A1678
L-5	Choke, heater; iron core	1794-1	53A295
L-6	Channel 13 Mixer Grid adj. (assembly)	1984-16	51A1679
L-7	Osc. coil & form assembly (channel 13)	2051-3	51A1680
L-8	Osc. coil & form assembly (channel 6)	2031-1	51A1681
L-9	Coil, i-f output (assembly)	1790-13	51A1682

CAPACITORS

Schematic Symbol	Description	Mfg. Cross Reference	Hallicrafters Part Number
C-1	800 mmf. GMV ceramic disc	2033-2	47A355
C-2	15 mmf. ceramic tubular, part of S1A	- - - -	- - - -
C-3	22 mmf. ceramic tubular	R3CC20CK220K	47X20CK220K
C-4	3 mmf. ceramic tubular	R3CC20CK030D	47X20CK030D
C-5	1000 mmf. GMV. ceramic disc	2033-3	47A356
C-6	470 mmf. GMV ceramic tubular	2023-2	47A357
C-7	470 mmf. ceramic tubular; part of S1C	- - - -	- - - -
C-8	15 mmf. ceramic tubular; part of S1D.	- - - -	- - - -
C-9	.36 mmf. ceramic gimmick; part of S1D	- - - -	- - - -
C-10	1.6 mmf. ceramic gimmick	1874-22	47A361
C-11	.33 mmf. ceramic gimmick	1874-5	47A360
C-12	.75 mmf. ceramic gimmick	1874-14	47A359
C-13	10 mmf. ceramic tubular	R3CC20CK100F	47X20CK100F
C-14	800 mmf. GMV, ceramic disc	2033-2	47A355
C-15	1000 mmf. mini. ceramic disc	2033-3	47A356
C-16	1000 mmf. GMV. ceramic disc	2033-3	47A356
C-17	1.5 mmf. ceramic tubular	R3CC20SK1R5D	47X20SK015D
C-18	10 mmf. ceramic tubular; part of S1E.	- - - - - -	- - - - - -
C-19	1.6 mmf. ceramic gimmick	1874-22	47A361
C-20	Fine tuning control; air trimmer	1713-503	44A431
C-21	1.5 mmf. ceramic gimmick; part of S1E	- - - - -	- - - -
C-22	110 mmf. ceramic tubular	R3CC25SL111J	47X25SL111J
C-23	7.5 mmf. ceramic gimmick	1874-38	47A358
C-24	1000 mmf. ceramic disc	2033-3	47A356
C-25	800 mmf. miniature ceramic disc	2033-2	47A355
C-26	800 mmf. miniature ceramic disc	2033-2	47A355

RESISTORS

Schematic Symbol	Description	Mfg. Cross Reference	Hallicrafters Part Number
R-1	4700 ohms $\frac{1}{2}$ watt, carbon	RC20AE472K	23X20X472K
R-2	1000 ohms 5%, $\frac{1}{2}$ watt, carbon	- - - - - - -	23X20X102J
R-3	750,000 ohms 5%, $\frac{1}{2}$ watt, carbon	RC20AE754J	23X20X754J
R-4	1 megohm 5%, $\frac{1}{2}$ watt, carbon	RC20AE105J	23X20X105J
R-5	220,000 ohms 5%, $\frac{1}{2}$ watt, carbon.	RC20AE224J	23X20X224J
R-6	3900 ohms $\frac{1}{2}$ watt, carbon	- - - - - - -	23X20X392K
R-7	470 ohms $\frac{1}{2}$ watt, carbon	- - - - - - -	23X20X471K
R-8	1000 ohms $\frac{1}{2}$ watt, carbon	RC20AE102K	23X20X102K
R-9	2200 ohms $\frac{1}{2}$ watt, carbon	RC20AE222K	23X20X222K
R-10	15,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE153K	23X20X153K
R-11	220 ohms $\frac{1}{2}$ watt, carbon	RC20AE221K	23X20X221K
R-12	4700 ohms $\frac{1}{2}$ watt, carbon	RC20AE472K	23X20X472K
R-13	1000 ohms $\frac{1}{2}$ watt, carbon	RC20AE102K	23X20X102K

RESISTORS (Cont.)

Schematic Symbol	Description	Hallicrafters Part Number
R-157	4700 ohms ½ watt, carbon	23X20X472K
R-158	330,000 ohms ½ watt, carbon	23X20X334K
R-159	4700 ohms 1 watt, carbon	23X30X472K
R-160	50 ohms rheostat; horizontal centering (part of T-106)	---------
R-161	2.2 ohms ½ watt, carbon (part of T-109)	---------
R-162	150 ohms ½ watt, carbon	23X20X151K
R-163	2200 ohms ½ watt, carbon	23X20X222K
R-164	270 ohms ½ watt, carbon	23X20X271K
*R-165	10,000 ohms ½ watt, 5% carbon	23X20X103J
*R-166	10,000 ohms ½ watt, 5% carbon	23X20X103J
R-167	33,000 ohms ½ watt, carbon	23X20X333K
R-168/118	1,000,000/2500 ohms; dual volume/contrast control	25B997
R-169	1500 ohms ½ watt, carbon	23X20X152K
R-170	33,000 ohms ½ watt, carbon	23X20X333K
R-171	5 megohms; brightness control	25B1000
R-172	1.5 megohms; focus control	25A1003
R-173	220 ohms ½ watt, carbon	23X20X221K
R-174	1000 ohms ½ watt, carbon	23X20X102K
R-175	470,000 ohms ½ watt, carbon	23X20X474K
R-176	1200 ohms ½ watt, carbon	23X20X122K
R-177	33,000 ohms 1 watt, carbon	23X30X333K
R-178	82,000 ohms ½ watt, carbon	23X20X823K
R-179	220,000 ohms ½ watt, carbon	23X20X224K
R-180	8200 ohms ½ watt, carbon	23X20X822K
R-181	390,000 ohms ½ watt, carbon	23X20X394K
R-182	10,000 ohms 2 watts, carbon	23X40X103K
R-183	47,000 ohms ½ watt, carbon	23X20X473K
R-184	2200 ohms ½ watt, carbon	23X20X222K
R-185	1500 ohms ½ watt, carbon	23X20X152K
R-186	470,000 ohms ½ watt, carbon	23X20X474K
R-187	470,000 ohms ½ watt, carbon	23X20X474K
R-188	22,000 ohms 1 watt, carbon	23X30X223K
R-189	470,000 ohms ½ watt, carbon	23X20X474K
R-190	1.2 megohms ½ watt, carbon	23X20X125K
R-191	47,000 ohms ½ watt, carbon	23X20X473K
R-192	10,000 ohms 1 watt, carbon	23X30X103K
R-193	22,000 ohms 1 watt, carbon	23X30X223K
R-194	180,000 ohms ½ watt, carbon	23X20X184K
R-195	22,000 ohms ½ watt, carbon	23X20X223K
R-196	220,000 ohms ½ watt, carbon	23X20X224K
R-197	33,000 ohms ½ watt, carbon	23X20X333K
R-198	220 ohms ½ watt, carbon	23X20X221K
R-199	220,000 ohms, ½ watt, carbon	23X20X224K
R-200	2.2 ohms, ½ watt, carbon	23X20X022K
R-201	22,000 ohms ½ watt, carbon	23X20X223K
R-202	15,000 ohms ½ watt, carbon	23X20X153K
R-203	470 ohms ½ watt, carbon	23X20X471K
R-204	470 ohms ½ watt, carbon	23X20X471K
R-205	470 ohms, ½ watt, carbon	23X20X471K
R-206	6800 ohms ½ watt, carbon	23X20X682K
R-207	100 ohms, 1 watt, carbon	23X30X101K
R-208	3300 ohms ½ watt, carbon	23X20X332K
R-209	220 ohms ½ watt, carbon	23X20X221K
R-210	1 megohm 1 watt, carbon	23X30X105K
R-211	100 ohms ½ watt, carbon	23X20X101K
R-212	10,000 ohms ½ watt, carbon	23X20X103K
R-213	820,000 ohms ½ watt, carbon	23X20X824K

*USE EXACT REPLACEMENT PART ONLY

SERVICE PARTS LISTS FOR 1E1380 CASCODE TV TUNER

COILS

Schematic Symbol	Description	Cross Reference	Hallicrafters Part Number
L-1,2,3,4,5,52	See Page 1953-32J	-----	------
L-6	Choke, r-f heater	34A-546	121A049
L-7	Choke, cascode coupling	31B-629	121A050
L-8	Choke, osc. heater	34A575	121A051
L-10	Choke, mixer plate	31B-638	53A301
L-11	Choke, mixer plate feed	31B-230	53A300

CAPACITORS

Schematic Symbol	Description	Cross Reference	Hallicrafters Part Number
C-1,14,15,16,17	800 mmf. GMV ceramic feed through	13D-153	121A048
C-2,12,21,22	1000 mmf. GMV ceramic disc	CD8X-102A	47A383
C-3,6	.5-3 mmf. trimmer, ceramic & lead; r-f & osc.	31A-056	44A433
C-4,5	47 mmf. ceramic disc	CD8Q-470K	121A047
C-7	6.8 mmf. NPO ceramic disc	CD8C-6R8C	47A385
C-8	5 mmf. N750 ceramic disc	CD8U-050C	47A386
C-9	3 mmf. ceramic disc	CD8C-030C	47A387
C-10	10 mmf. NPO, ceramic disc	CD10C-100K	47A388
C-11	1.5 mmf. NPO, ceramic disc	CD8C-1R5M	47A389
C-13	Trimmer, ceramic & lead; antenna	31A-079	44A434
C-18	300 mmf. ceramic tubular	13D-092	121A078
C-19	Fine tuning control	See Miscellaneous Parts	
C-20	5000 mmf. ceramic disc	-------	47A391

RESISTORS

Schematic Symbol	Description	Cross Reference	Hallicrafters Part Number
R-1	160,000 ohms, ½ watt, carbon	12A-167	23X20X164J
R-2	100,000 ohms, ½ watt, carbon	12A-160	23X20X104J
R-3	220,000 ohms, ½ watt, carbon	12A-094	23X20X224K
R-4,7	10,000 ohms, ½ watt, carbon	12A-040	23X20X103K
R-5	1500 ohms, ½ watt, carbon	12A-027	23X20X152J
R-6	100,000 ohms, ½ watt, carbon	12A-047	23X20X104K
R-8,10	15,000 ohms, ½ watt, carbon	12A-004	23X20X153K
R-9	47,000 ohms, ½ watt, carbon	12A-039	23X20X473K
R-11	3300 ohms, ½ watt, carbon	12A-150	23X20X332K

SERVICE PARTS LISTS FOR 1C1345 & 1E1492 VHF PENTODE TV TUNERS

TRANSFORMERS AND COILS

Schematic Symbol	Description	Mfg. Cross Reference	Hallicrafters Part Number
T-1	Transformer, VHF antenna input	1964-4	51A1691
L-1	Coil, peaking (part of S1A)	--- - -	- - - - -
L-2	Coil assembly, channel 13 r-f grid adj.	1984-21	51A1692
L-3	Coil assembly, channel 13; r-f plate adj.	1984-12	51A1677
L-4	Choke, heater	1785-47	53A296
L-5	Choke, heater	1785-47	53A298
L-6	Coil assembly, channel 13; mixer grid adj.	1984-18	51A1693
L-7	Coil assembly, channel 13; osc. adj.	1788-2	51A1694
L-8	Coil assembly, channel 6 osc. adj.	1787-1	51A1695
L-9	Coil, i-f output	1790-9	51A1696
L-10	Choke, output coupling	1911-6	53A299

RESISTORS

Schematic Symbol	Description	Mfg. Cross Reference	Hallicrafters Part Number
R-1	15,000 ohms 1/2 watt, carbon	RC20AE153K	23X20X153K
R-2	2200 ohms 1/2 watt, carbon	RC20AE222K	23X20X222K
R-3	2200 ohms 1/2 watt, carbon	RC20AE222K	23X20X222K
R-4	220,000 ohms, 1/2 watt, carbon	RC20AE224K	23X20X224K
R-5	470 ohms 1/2 watt, carbon	RC20AE471K	23X20X471K
R-6	10,000 ohms 1/2 watt, carbon	RC20AE103K	23X20X103K
R-7	15,000 ohms 1/2 watt, carbon	RC20AE153K	23X20X153K
R-8	3300 ohms 1/2 watt, carbon	RC20AE332K	23X20X332K

CAPACITORS (Cont.)

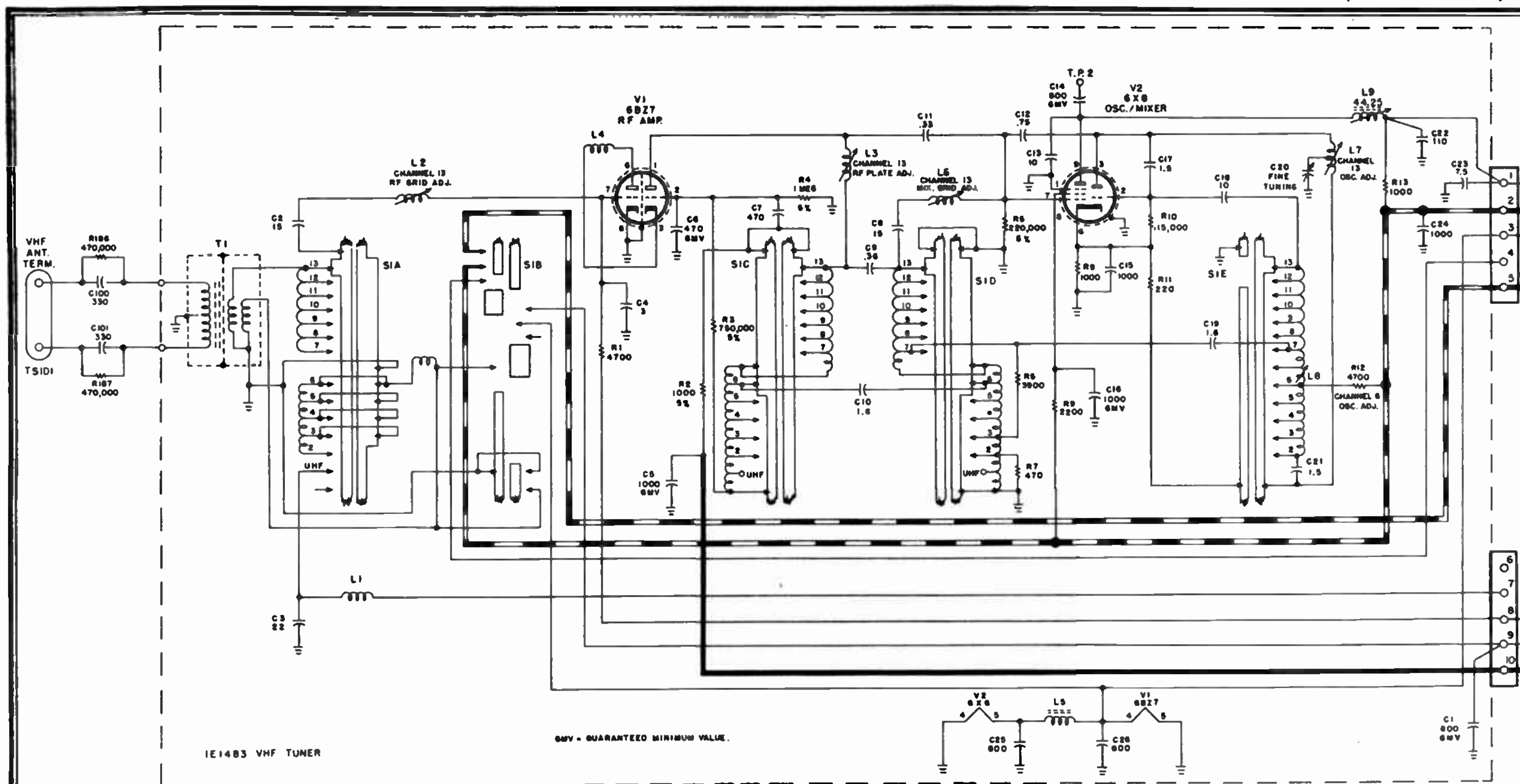
Schematic Symbol	Description	Hallicrafters Part Number
C-155	10 mfd. 50 V., electrolytic	45B211
C-156	.01 mfd. 400 V., paper tubular	46AW103J
C-157	.02 mfd. 600 V., paper tubular	46AY203J
C-158	5000 mmf. 500 V., ceramic disc	47A168
C-159	5000 mmf. 500 V., ceramic disc	47A168
C-160	47 mmf. 2000 V., (part of L-112)	---------
*C-161	200 mfd. 150 V., electrolytic	45B217
C-162	.1 mfd. 600 V., paper tubular	46AY104J
*C-163	390 mmf. 500 V., 10% silver mica	47X20D391K
*C-164	560 mmf. 500 V., 10% silver mica	47X20D561K
C-165	.047 mfd. 400 V., paper tubular	46BS473L4
C-166	500 mmf. 20,000 V., ceramic	47A223
C-167	.005 mfd. 400 V., paper tubular	46AW502H
C-168	.05 mfd. 400 V., paper tubular	46AW503H
C-169	10 mfd. 150 V., electrolytic	45A097
C-171	1000 mmf. 500 V., ceramic disc	47A230
C-172	47 mmf. 500 V., ceramic tubular	47B20470M5
C-173	.05 mfd. 600 V., paper tubular	46AY503J
C-174	.01 mfd. 600 V., paper tubular	46AY103J
C-175	1000 mmf. 500 V., ceramic disc	47A230
C-176	1000 mmf. 500 V., ceramic disc	47A230
C-177	1000 mmf. 500 V., ceramic disc	47A230
C-178	1000 mmf. 500 V., ceramic disc	47A230
C-179	0.01 mfd. 500 V., ceramic disc	47A217
C-180	0.01 mfd. 500 V., ceramic disc	47A217
C-181	1000 mmf 500 V., ceramic disc	47A230
C-182	.0047 mfd. 1000 V., molded paper tubular	46BS472L10
C-200	5000 mmf. 500 V., ceramic disc.	47A168
C-201	1000 mmf. 500 V., ceramic disc	47A230
C-202	1000 mmf. 500 V., ceramic disc	47A230
C-204	1000 mmf. 500 V., ceramic disc	47A230
C-205	1000 mmf. 500 V., ceramic disc	47A230
C-206	1000 mmf. 500 V., ceramic disc	47A230
*C-207	680 mmf. 500 V., 5% ceramic tubular	47A319
*C-208	820 mmf. 500 V., 5% ceramic tubular	47A320
*C-209	820 mmf. 500 V., 5% ceramic tubular	47A320
C-210	24 mmf. 500 V., ceramic tubular	47B20A240K5
C-211	24 mmf. 500 V., ceramic tubular	47B20A240K5
C-214	1 mfd. 50 V., paper tubular	46A226

* USE EXACT REPLACEMENT PART ONLY

RESISTORS

Schematic Symbol	Description	Hallicrafters Part Number
R-100	5 ohm hum balance rheostat (part of speaker)	---------
R-101	100,000 ohms ½ watt, carbon	23X20X104K
R-102	4700 ohm ½ watt, carbon	23X20X472K
R-103	1000 ohms ½ watt, carbon	23X20X102K
R-104	47 ohms ½ watt, carbon	23X20X470K
R-105	1000 ohms ½ watt, carbon	23X20X102K
R-106	10,000 ohms ½ watt, carbon	23X20X103K
R-107	47 ohms ½ watt, carbon	23X20X470K
R-108	1000 ohms ½ watt, carbon	23X20X102K
R-109	8200 ohms ½ watt, carbon	23X20X822K
R-110	150 ohms ½ watt, carbon	23X20X151K
R-111	1000 ohms ½ watt, carbon	23X20X102K
R-112	390,000 ohms ½ watt, carbon	23X20X394K
R-113	1.5 megohms ½ watt, carbon	23X20X155K
R-114	5600 ohms ½ watt, carbon	23X20X562K
R-115	1 megohm ½ watt, carbon	23X20X105K
R-116	1.5 megohms ½ watt, carbon	23X20X155K
R-117	2.2 megohms ½ watt, carbon	23X20X225K
R-118/168	2500/1,000,000 ohms; dual contrast/volume control	25B997
R-119	8200 ohms ½ watt, carbon (part of L-104)	---------
R-120	33,000 ohms 1 watt, carbon	23X30X333K
R-121	4700 ohms 2 watt, carbon	23X40X472K
R-122	6800 ohms ½ watt, carbon (part of L-106)	---------
R-123	3300 ohms ½ watt, carbon (part of L-107)	---------
R-124	10,000 ohms ½ watt, carbon	23X20X103K
R-125	470,000 ohms ½ watt, carbon	23X20X474K
R-126	2.2 megohms ½ watt, carbon	23X20X225K
R-127	680,000 ohms ½ watt, carbon	23X20X684K
R-128	2200 ohms ½ watt, carbon	23X20X222K
R-129	560,000 ohms 1 watt, carbon	23X30X564K
R-130	22,000 ohms ½ watt, carbon	23X20X223K
R-131	6800 ohms ½ watt, carbon	23X20X682K
R-132	3300 ohms ½ watt, carbon	23X20X332K
R-133	22,000 ohms ½ watt, carbon	23X20X223K
R-134	10,000 ohms ½ watt, carbon	23X20X103K
R-135	850,000 ohms; vertical hold control: for mtg.	25B1013
R-136	3300 ohms ½ watt, carbon	23X20X332K
R-137	1800 ohms ½ watt, carbon	23X20X182K
R-138	5 megohms; height control	25B998
R-139	120 ohms ½ watt, carbon	23X20X121K
R-140	750 ohms; vertical linearity control	25B999
*R-141	8700 ohms 5 watts, 5% wire wound	24A971
*R-142	7.5 ohms 5 watts, fuse type wire wound	25B1004
*R-143	190 ohms cold - 19 ohms hot, 5 watts; neg. temp. coeff.	25A1008
*R-144	80 ohms 10 watts, 5% wire wound	24A955
*R-145	42 ohms 3 watts, 5% wire wound	24A957
R-146	100,000 ohms ½ watt, carbon	23X20X104K
R-147	100,000 ohms ½ watt, carbon	23X20X104K
R-148	22,000 ohms ½ watt, carbon	23X20X223K
R-149	4.7 megohms ½ watt, carbon	23X20X475K
R-150	4.7 megohms ½ watt, carbon	23X20X475K
R-151	150,000 ohms 1 watt, carbon	23X30X154K
R-152	150,000 ohms 1 watt, carbon	23X30X154K
R-153	1200 ohms ½ watt, carbon	23X20X122K
R-154	5600 ohms ½ watt, carbon	23X20X562K
R-155	120,000 ohms; horizontal hold control; for mtg.	25B1014
R-156	120,000 ohms 1/2 watt, carbon	23X20X124K

* USE EXACT REPLACEMENT PART ONLY



SERVICE PARTS LIST

TRANSFORMERS AND COILS

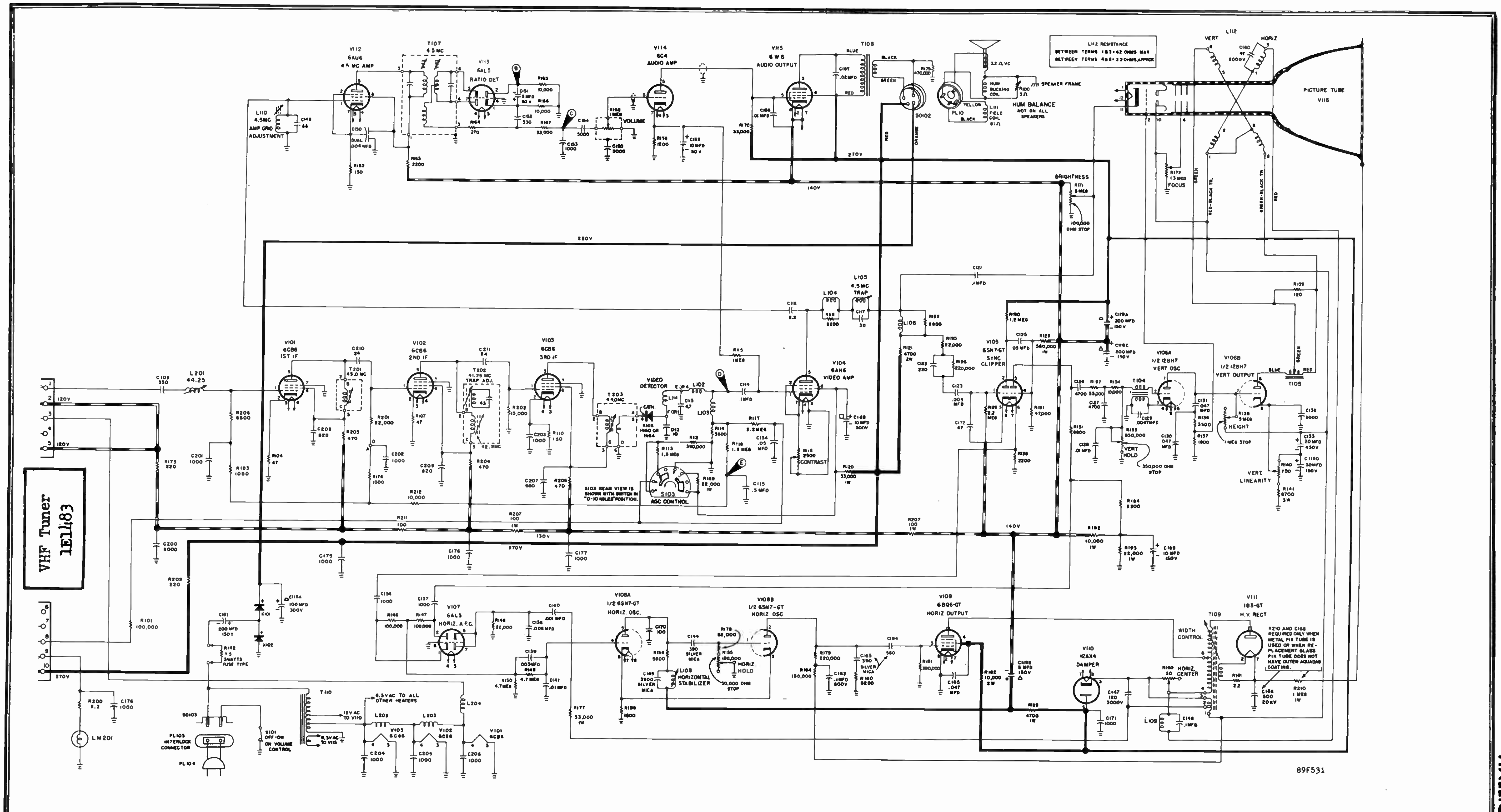
Schematic Symbol	Description	Hallicrafters Part Number
T-101	Transformer, 1st - 2nd I.F.	50B561
T-102	Transformer, 2nd - 3rd I.F.	50B568
T-103	Transformer, 3rd. I.F. - diode detector	50B562
T-104	Transformer, vertical blocking oscillator	55B190
T-105	Transformer, vertical output	55C192
* T-106	Transformer, horizontal output	55D193
T-107	Transformer, ratio detector	50C473
T-108	Transformer, audio output	55C191
* T-109	Transformer, horizontal output	55D197
* T-110	Transformer, heater	52C258
* T-111	Transformer, heater	52C290
T-201	Transformer, 1st - 2nd I.F.	50B573
T-202	Transformer, 2nd - 3rd I.F.	50B574
T-203	Transformer, 3rd. I.F. - diode detector	50B575
L-101	Coil, converter i-f	51B1301
L-102	Coil, video peaking	51A1578
L-103	Coil, video peaking	51A1579
L-104	Coil, video peaking (wound on R-119)	51A1580
L-105	Coil, 4.5 MC trap	51B1541
L-106	Coil, video peaking (wound on R-122)	51A1581
L-107	Coil, video peaking (wound on R-123)	51A1582
L-108	Coil, horizontal stabalizer	51B1642
L-109	Coil, yoke coupling (wound on C-148)	53B264
L-110	Coil, 4.5 MC amplifier grid adjustment	51B1542
L-111	Coil, speaker field (part of speaker)	--------
L-112	Deflection yoke	53A271
L-113	Choke heater	53B294
L-114	Choke, r-f (channel 5 tweet filter)	53B008
L-201	Coil, converter - I.F.	51-1643
L-202	Filament choke	53A282
L-203	Filament choke	53A282
L-204	Filament choke	53A282

* See Schematic for applicable symbol

CAPACITORS

Schematic Symbol	Description	Hallicrafters Part Number
C-100	330 mmf. 500 V., ceramic tubular	47BUL20331M5
C-101	330 mmf. 500 V., ceramic tubular	47BUL20331M5
C-102	330 mmf. 500 V., ceramic tubular	47B20331M5
C-103	5000 mmf. 500 V., ceramic disc	47A168
C-104.	Dual 4000 mmf. 500 v., ceramic disc	47A218
C-105	1000 mmf. 500 V., ceramic disc	47A230
C-106	5000 mmf. 500 V., ceramic disc	47A168
C-107	5000 mmf. 500 V., ceramic disc	47A168
C-108	1000 mmf. 500 V., ceramic disc	47A230
C-109.	5000 mmf. 500 V., ceramic disc	47A168
C-110	5000 mmf. 500 V., ceramic disc	47A168
C-111	1000 mmf. 500 V., ceramic disc	47A230
C-112	10 mmf. 500 V., ceramic tubular	47B20100K5
*C-113	4.7 mmf. 500 V., 10% ceramic tubular	47A160-6
C-114.	0.1 mfd. 200 V., paper tubular	46AU104J
C-115	.5 mfd. 25 V., paper tubular	46A177
*C-116	2.2 mmf. 500 V., 10% ceramic tubular	47A160-4
*C-117	30 mmf. 500 V., 10% ceramic tubular	47X25PG300K
C-118	100-10 mfd. 300 V., 200-30 mfd. 150 V., electrolytic	45C209
C-119.	200-5 mfd. 150 V., electrolytic.	45C210
C-120	5000 mmf. 500 V., ceramic disc	47A168
C-121	.1 mfd. 400 V., paper tubular	46AV104J
*C-122	220 mmf. 500 V., 10% ceramic tubular	47B20221K5
C-123	.005 mfd. 600 V., paper tubular	46AY502J
C-124.	22 mmf. 500 V., ceramic tubular	47B20220M5
C-125	.05 mfd. 400 V., paper tubular	46AW503J
C-126	.0047 mfd. 400 V., molded paper tubular	46BS472L4
C-127	.0047 mfd. 400 V., molded paper tubular	46BS472L4
C-128	.01 mfd. 400 V., molded paper tubular	46BS103L4
C-129.	0.0047 mfd. 400 V., molded paper tubular	46BS472L4
C-130	.047 mfd. 400 V., molded paper tubular	46BS473L4
C-131	.047 mfd. 400 V., molded paper tubular	46BS473L4
C-132	5000 mmf. 500 V., ceramic disc	47A168
C-133	20 mfd. 450 V., electrolytic	45B208
C-134.	0.05 mfd. 200 V., paper tubular	46AU503J
C-135	140 mfd. 150 V., electrolytic	45B207
*C-136	1000 mmf. 500 V., ceramic tubular	47B20A102M5
*C-137	1000 mmf. 500 V., ceramic tubular	47B20A102M5
C-138	.006 mfd. 600 V., paper tubular	46AZ602F
*C-139.	0.003 mfd. 400 V., paper tubular	46AW302J
*C-140	.001 mfd. 1000 V., molded paper tubular	46BS102L10
C-141	.01 mfd. 400 V., paper tubular	46AW103J
*C-143	3900 mmf. 500 V., 10% silver mica	47X30D392K
*C-144.	390 mmf. 500 V., 10% silver mica.	47X20D391K
*C-145	470 mmf. 500 V., 10% silver mica	47X20D471K
C-146	5000 mmf. 500 V., ceramic disc	47A168
*C-147	120 mmf. 3000 V., ceramic disc	47A296
C-148	.1 mfd. 200 V., paper tubular (part of L-109)	---------
*C-149	68 mmf. 500 V., 10% ceramic tubular	47X30TH680K
C-150	Dual 4000 mmf. 500 V., ceramic disc	47A218
C-151	5 mfd. 50 V., electrolytic	45B175
C-152	330 mmf. 500 V., ceramic tubular	47B20331M5
C-153	1000 mmf. 500 V., ceramic disc	47A230
C-154.	5000 mmf. 500 V., ceramic disc	47A168

* USE EXACT REPLACEMENT PART ONLY



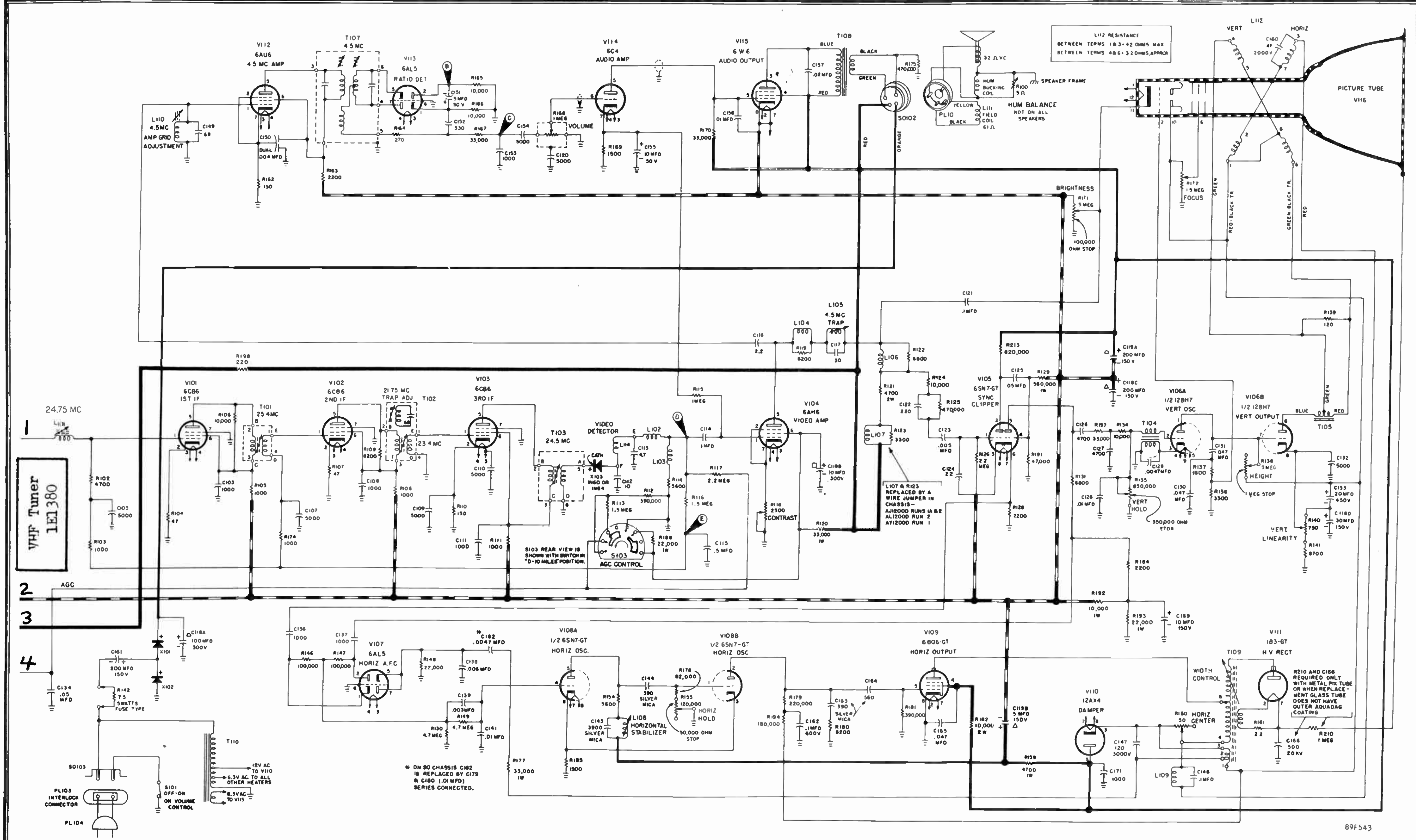
1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 280 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

THE FOLLOWING CHANGES ARE FOUND ON CHASSIS STAMPED BA1200D RUN 3.

A. In the grid circuit (pin 1) of V-105 resistor R-195 (22,000 ohms, 1/2 watt) is replaced by R-124 (10,000 ohms, 1/2 watt) and R-196 (220,000 ohms, 1/2 watt) is replaced by R-125 (470,000, 1/2 watt).
B. In the plate circuit (pin 2) of V-105 resistor R-190 (1.2 megohms, 1/2 watt) is replaced by R-213 (820,000 ohms, 1/2 watt).
C. In the grid and cathode circuits of V-105 (pins 1 & 3) capacitor C-172 (47 mmf.) is replaced by C-124 (22 mmf.).
D. In the plate circuit of V-106A (pin 1) resistors R-136 (3300 ohms, 1/2 watt) and R-137 (1800 ohms, 1/2 watt) are transposed so that R-136 goes to ground and R-137 connects to C-130 and C-131. The junction of the two resistors connects as before.
E. L-107 wound on R-123 is connected in series between R-120 and R-121.
F. Capacitor C-181 (100 mmf. 500V., ceramic disc) is added between the positive terminal of C-1194A (200 mfd. 150 V. electrolytic) and ground.
G. A shield is placed over the bottom of the video detector transformer, T-203.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

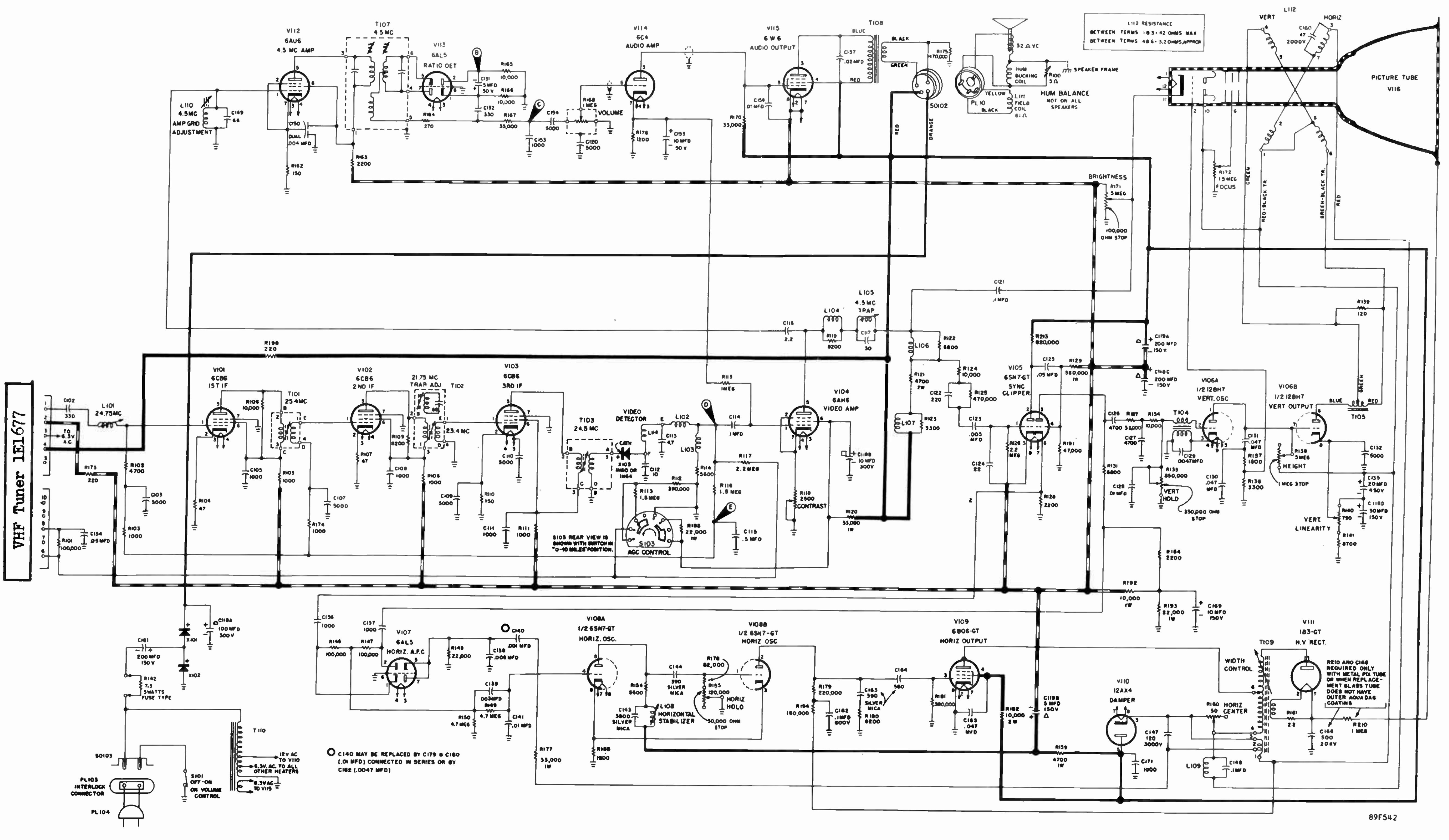
VHF
21" CHASSIS
BA1200D
RUNS 1, 2 & 3



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

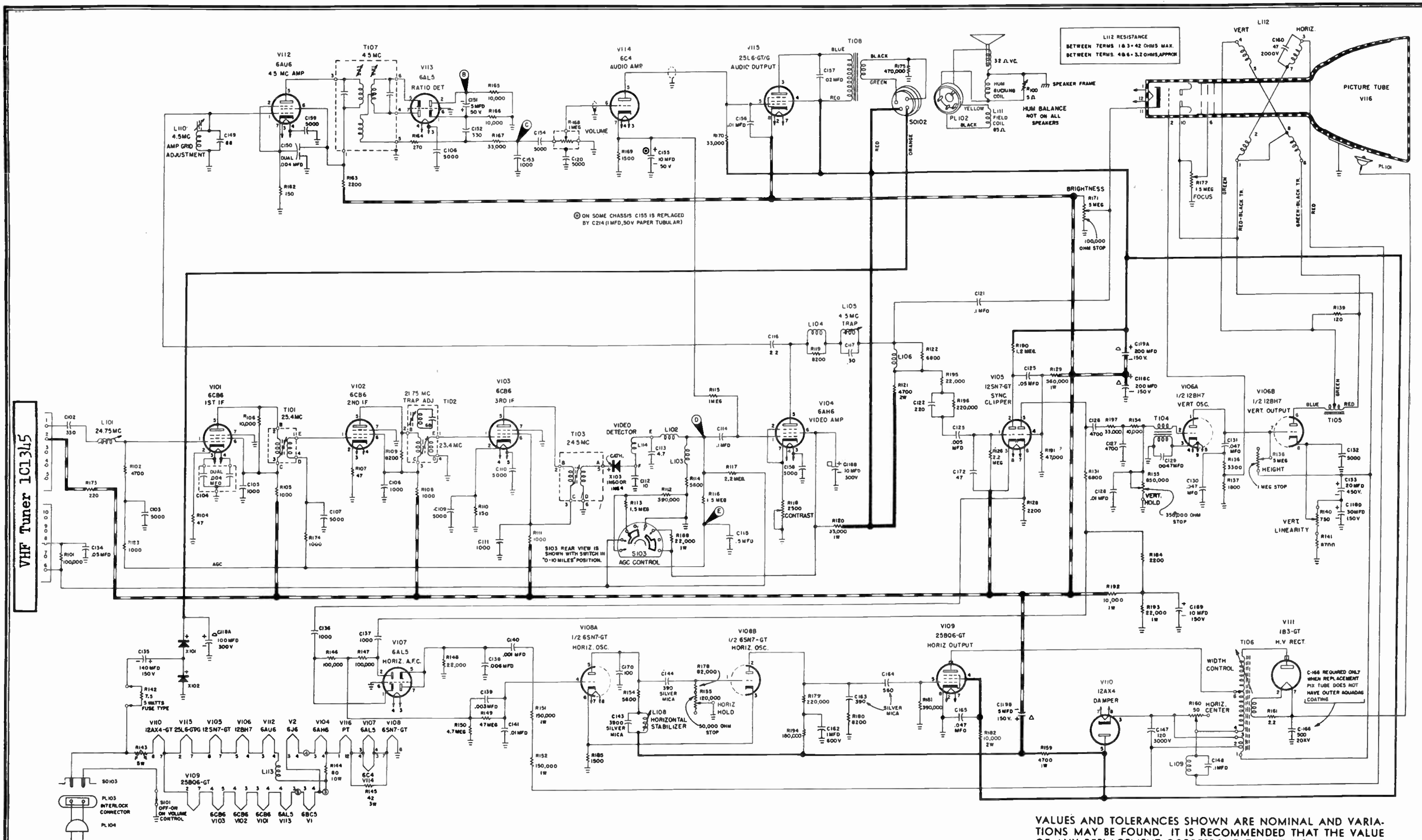
VHF
21" CHASSIS
AZ1200D
RUNS 1, 1A, & 2



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VHF
21" CHASSIS
AY1200D
RUNS 3 & 4



1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT

THE FOLLOWING CHANGES ARE FOUND ON CHASSIS STAMPED AL1200D RUN 4.

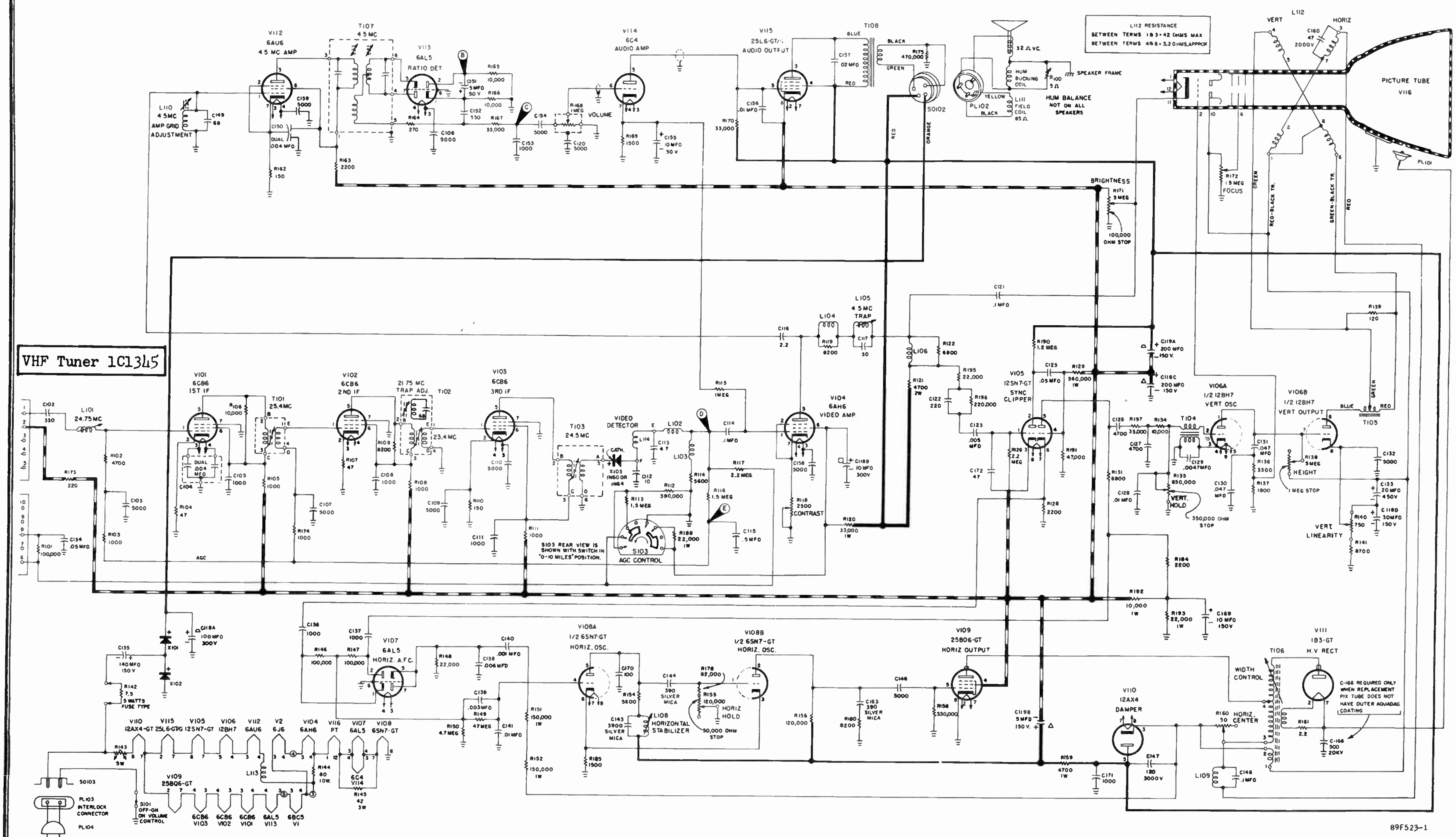
A. In the grid circuit (pin 1) of V-105 resistor R-195 (22,000 ohms, 1/2 watt) is replaced by R-124 (10,000 ohms, 1/2 watt) and R-196 (220,000 ohms, 1/2 watt) is replaced by R-125 (470,000, 1/2 watt).
B. In the plate circuit (pin 2) of V-105 resistor R-190 (1.2 megohms, 1/2 watt) is replaced by R-213 (820,000 ohms, 1/2 watt).
C. In the grid and cathode circuits of V-105 (pins 1 & 3) capacitor C-172 (47 mmf.) is replaced by C-124 (22 mmf.).
D. In the plate circuit of V-106A (pin 1) resistors R-136 (3300 ohms, 1/2 watt) and R-137 (1800 ohms, 1/2 watt) are transposed so that R-136 goes to ground and R-137 connects to C-130 and C-131. The junction of the two resistors connects as before.
E. L-107 wound on R-123 is connected in series between R-120 and R-121.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF

17" CHASSIS

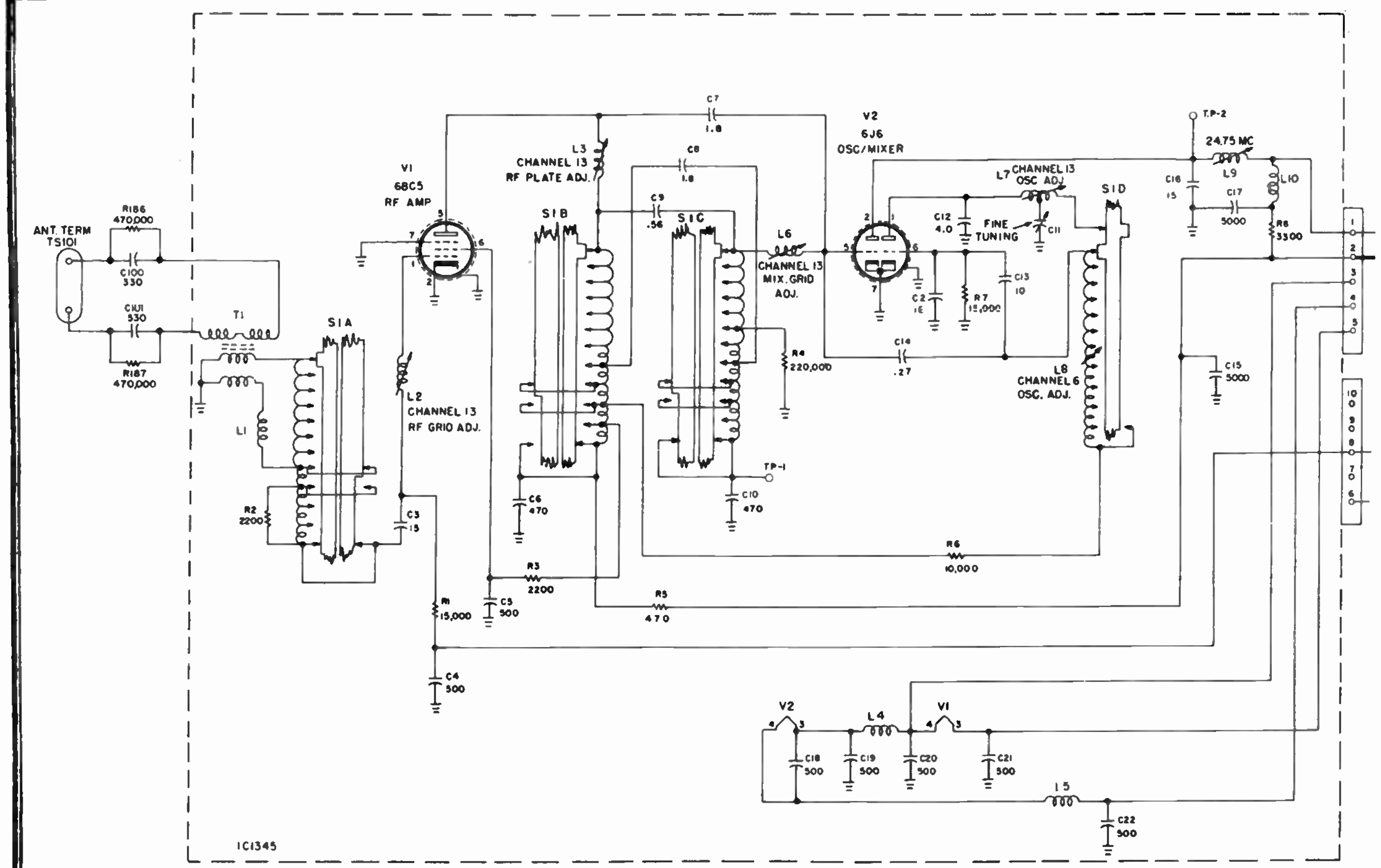
AL1200D	**AX1200D**
RUNS 3 & 4	**RUN 1**



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT

VHF
17" CHASSIS
AL1200D
RUNS 1 & 1A



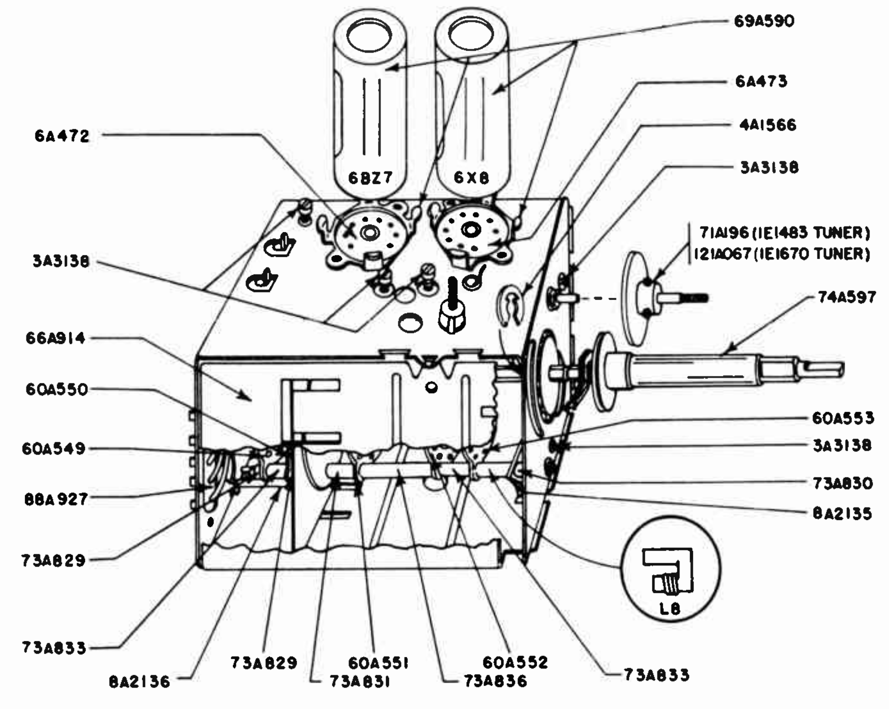
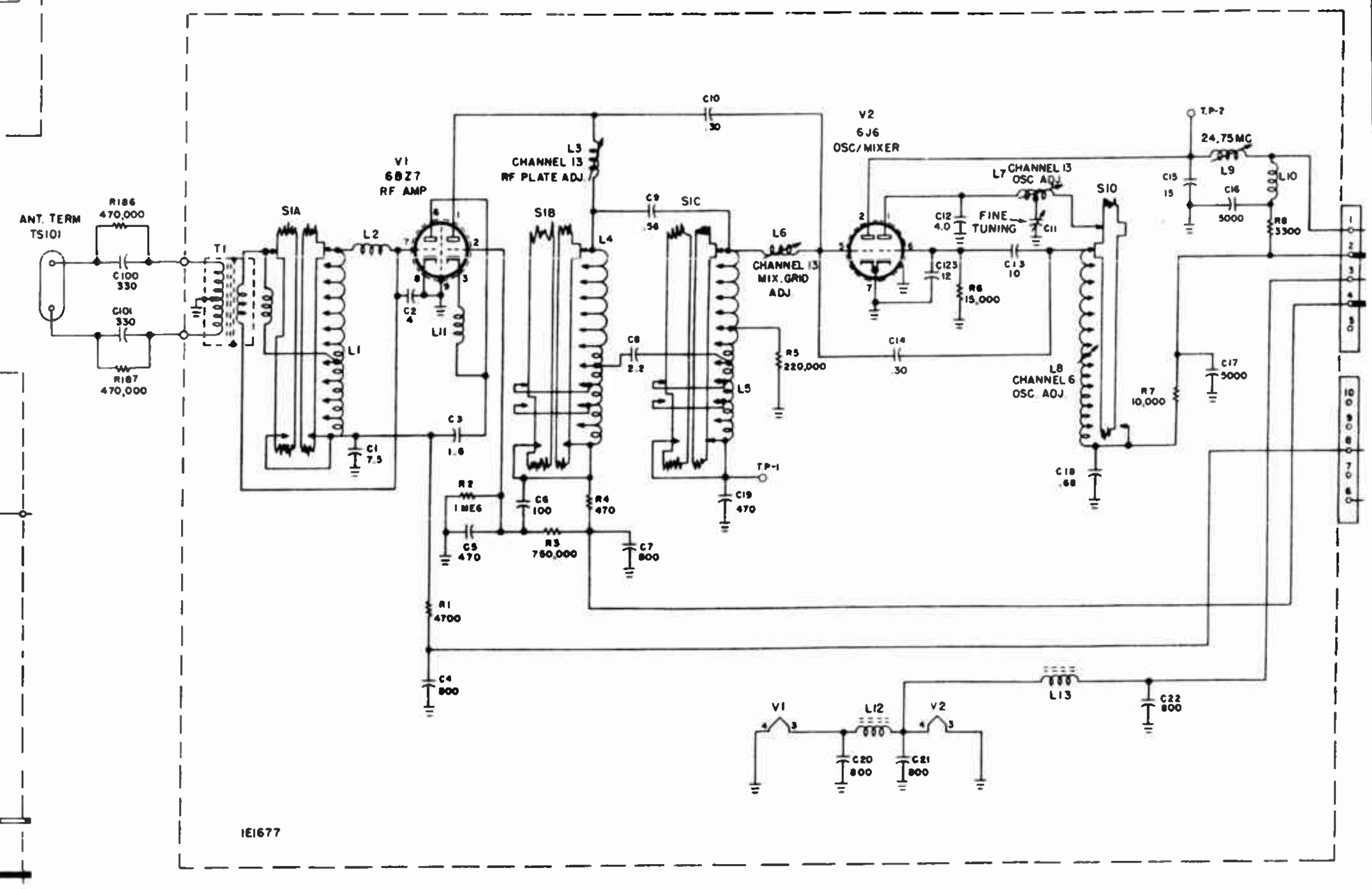
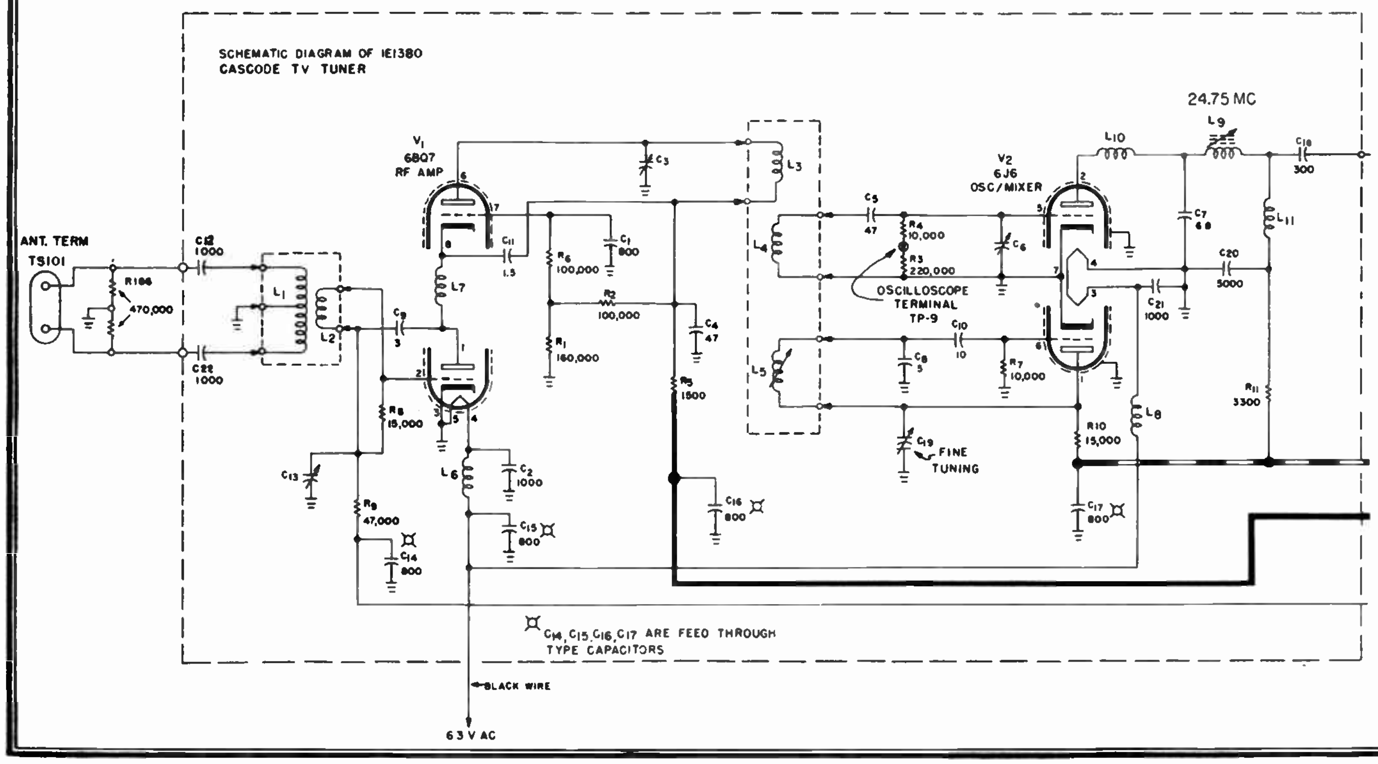
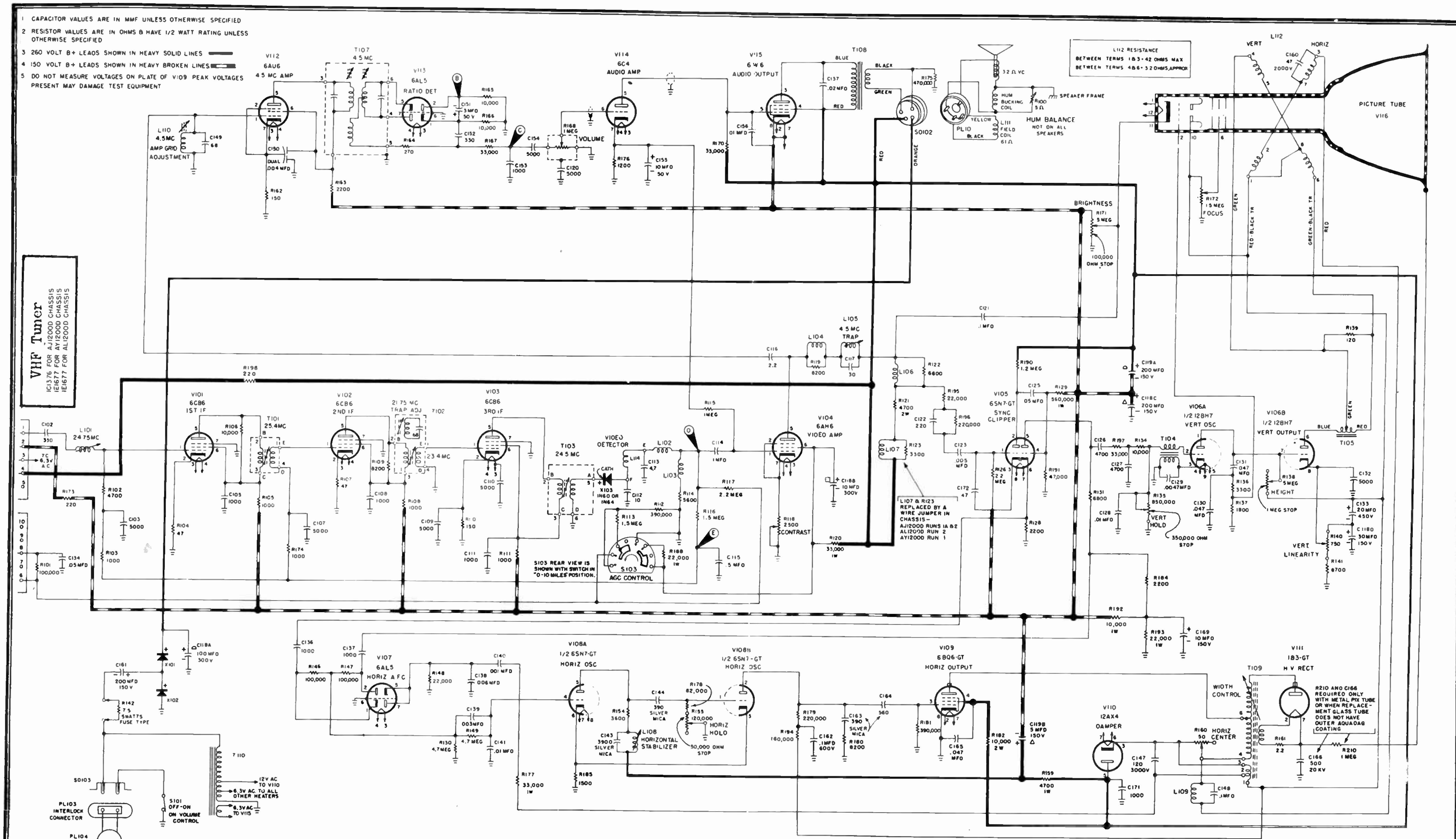


Fig. 32HA. Exploded View of 1E1483 & 1E1670 VHF 16-Position Cascode TV Tuner







THE FOLLOWING CHANGES ARE FOUND ON CHASSIS STAMPED AJ1200D RUN 3.

A. In the grid circuit (pin 1) of V-105 resistor R-195 (22,000 ohms, ½ watt) is replaced by R-124 (10,000 ohms, ½ watt) and R-196 (220,000 ohms, ½ watt) is replaced by R-125 (470,000, ½ watt).

B. In the plate circuit (pin 2) of V-105 resistor R-190 (1.2 megohms, ½ watt) is replaced by R-213 (820,000 ohms, ½ watt).

C. In the grid and cathode circuits of V-105 (pins 1 & 3) capacitor C-172 (47 mmf.) is replaced by C-124 (22 mmf.).

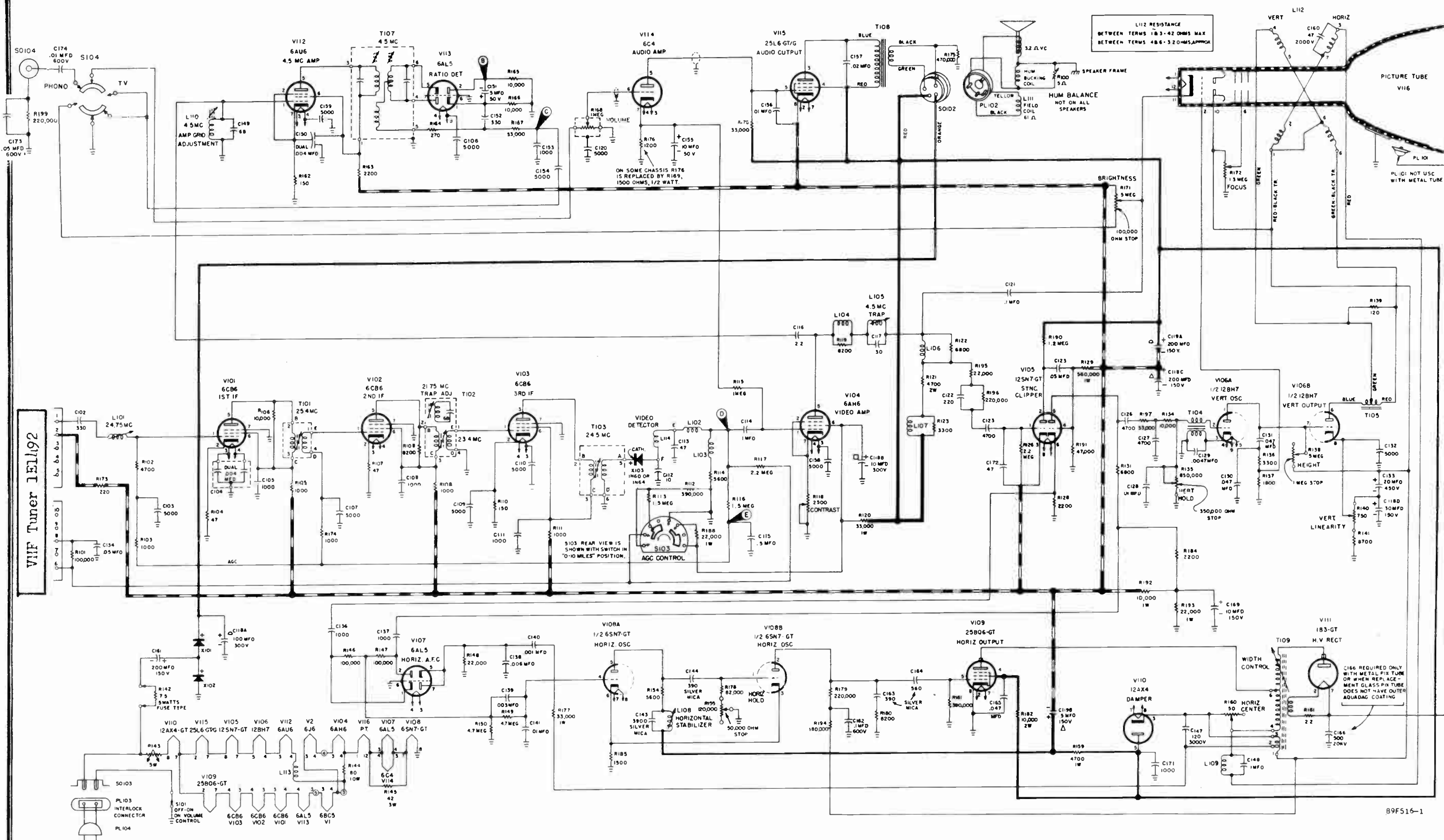
D. In the plate circuit of V-106A (pin 1) resistors R-136 (3300 ohms, ½ watt) and R-137 (1800 ohms, ½ watt) are transposed so that R-136 goes to ground and R-137 connects to C-130 and C-131. The junction of the two resistors connects as before.

E. L-107 wound on R-123 is connected in series between R-120 and R-121.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF

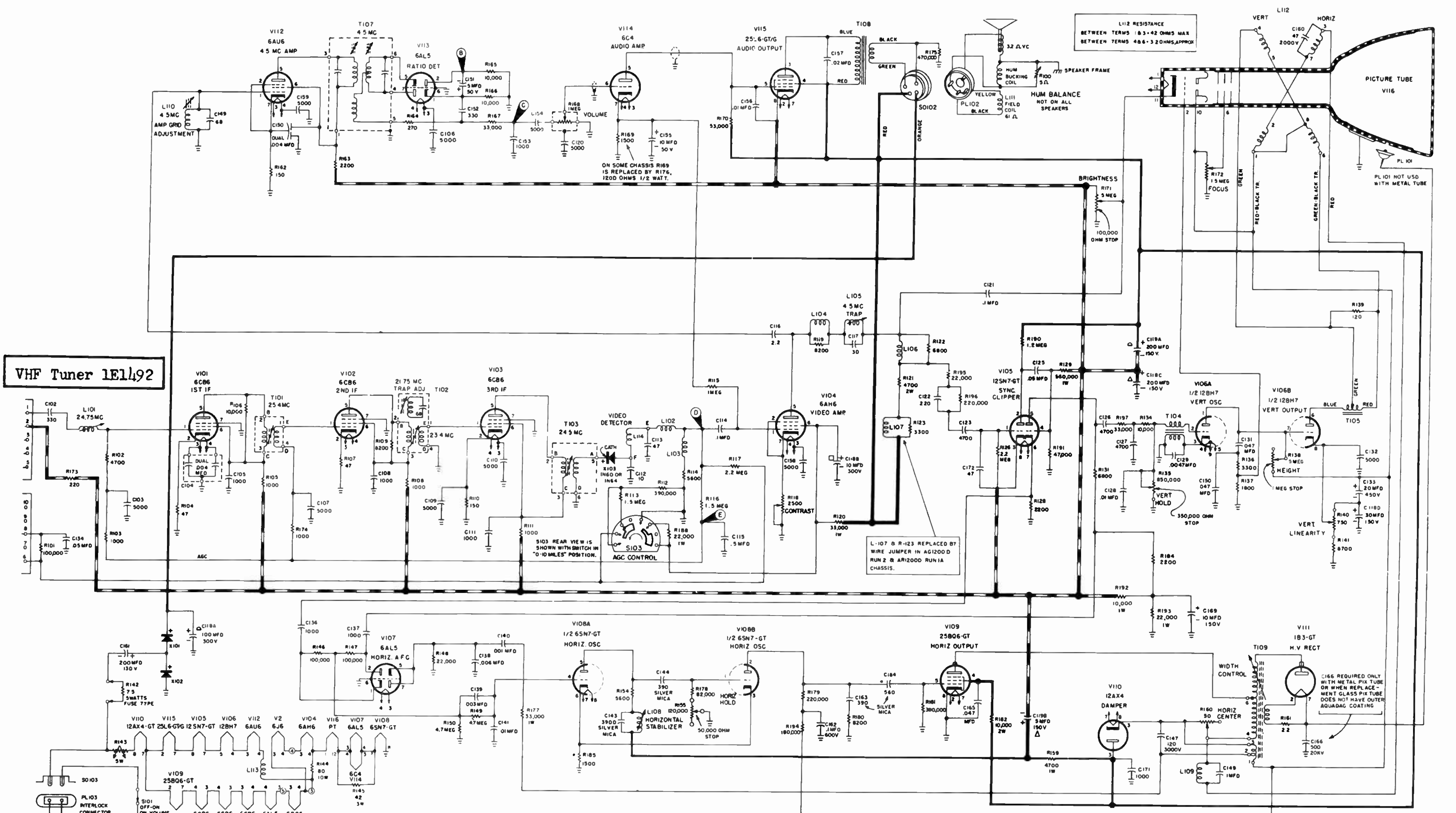
17" CHASSIS	21" CHASSIS	21" CHASSIS
AL1200D	AJ1200D	AY1200D
RUN 2	RUNS 1, 1A, 2 & 3	RUNS 1 & 2



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT

VHF
20" CHASSIS
AH1200D
RUN 1



1 CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2 RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5 DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

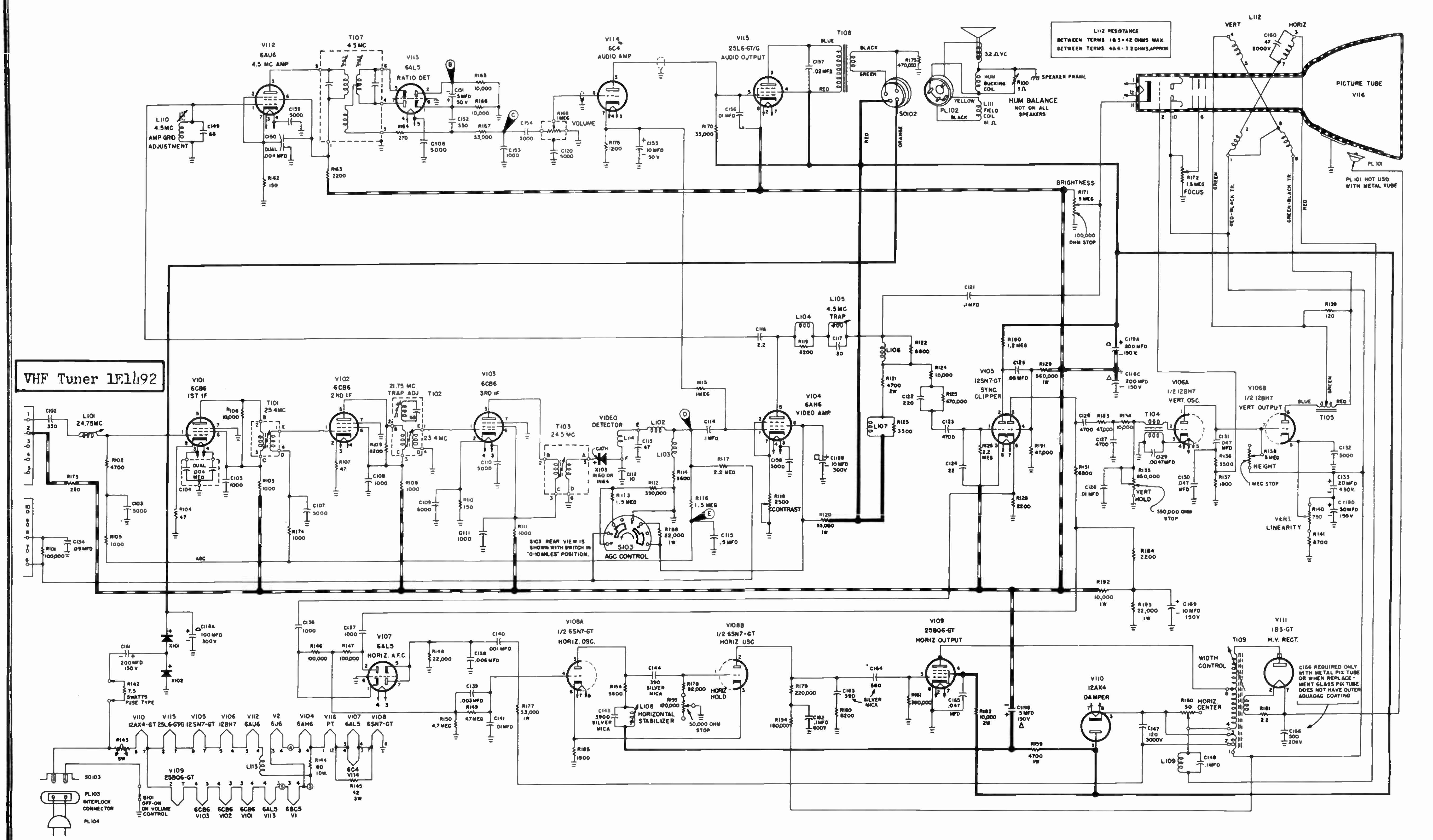
TO IMPROVE VIDEO RESPONSE ON CHASSIS AG1200D RUN 2 AND AR1200D RUN 1A THE FOLLOWING CHANGE WAS MADE: L-107 AND R-123 REPLACED BY JUMPER WIRE.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF

20" CHASSIS AG1200D RUNS 1A & 2

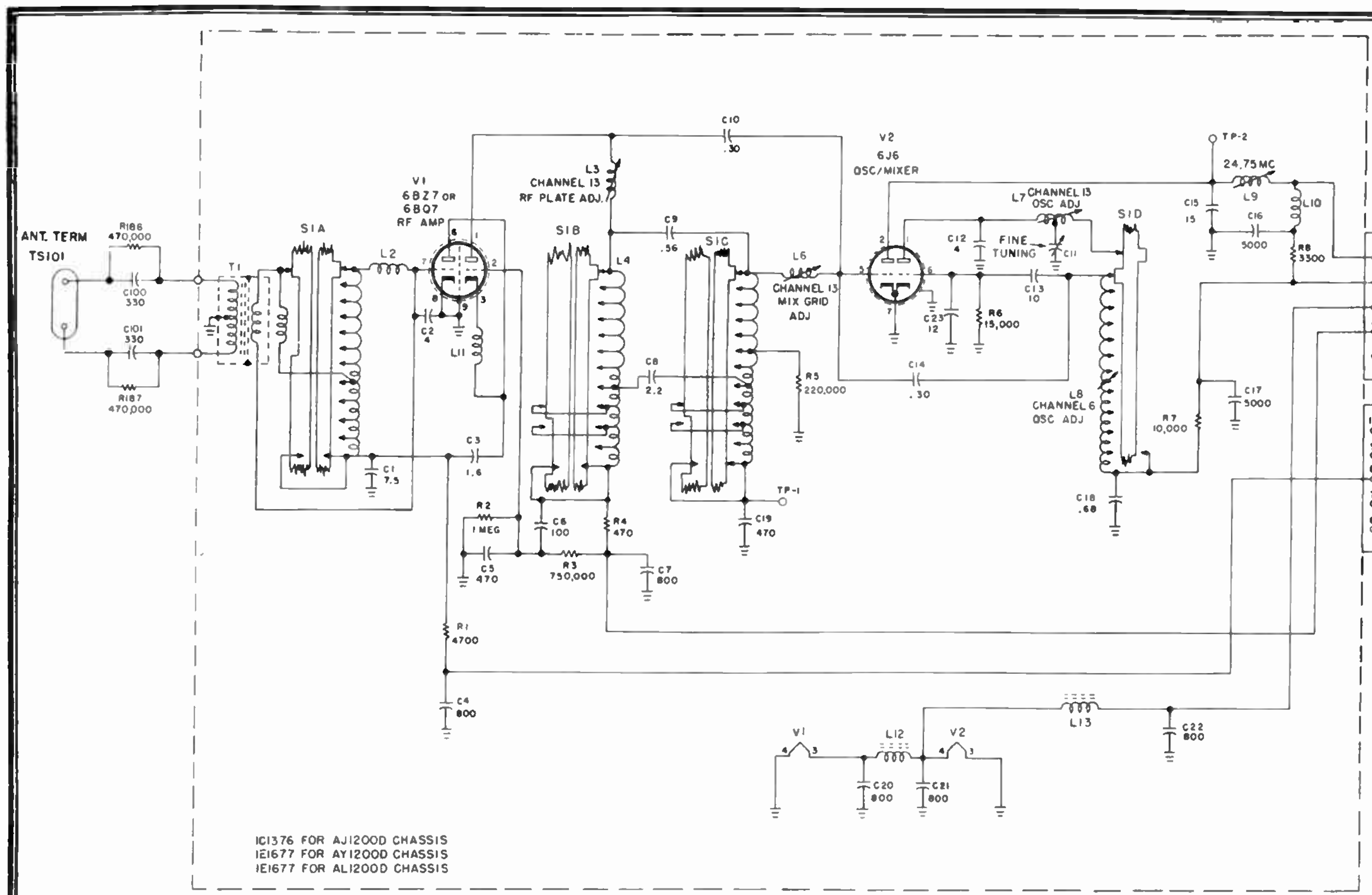
21" CHASSIS AR1200D RUNS 1 & 1A



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VHF
20" CHASSIS
AG1200D
RUN 1



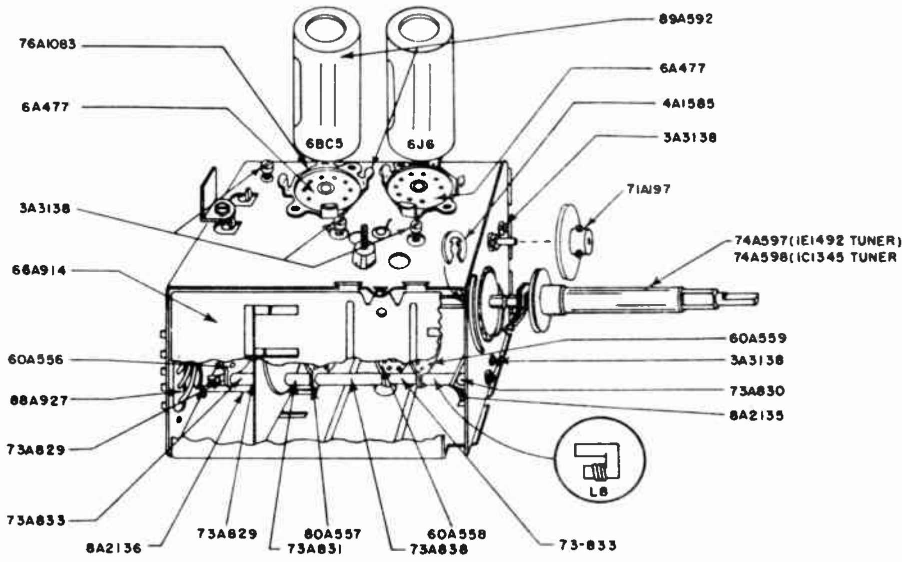


Fig. 328A. Exploded View 1C1345 & 1E1492 VHF Pentode TV Tuner

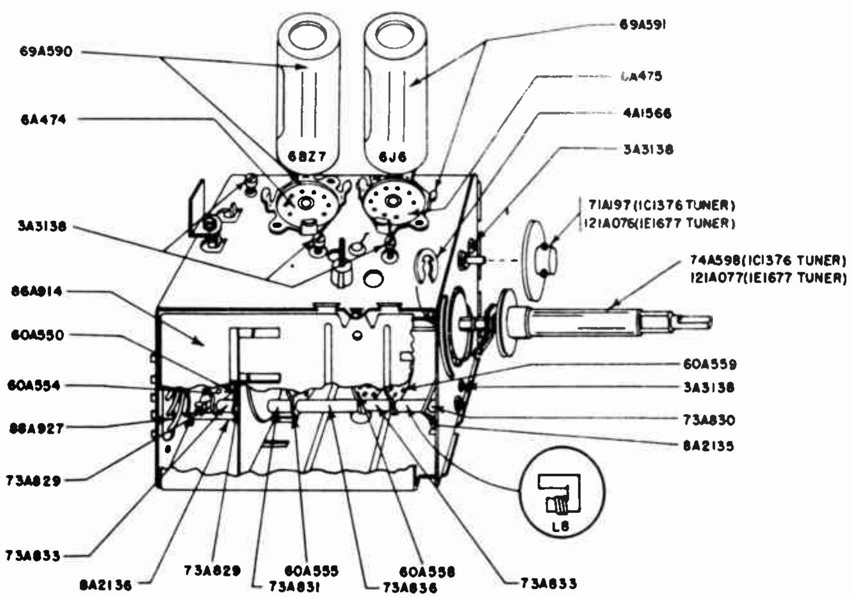
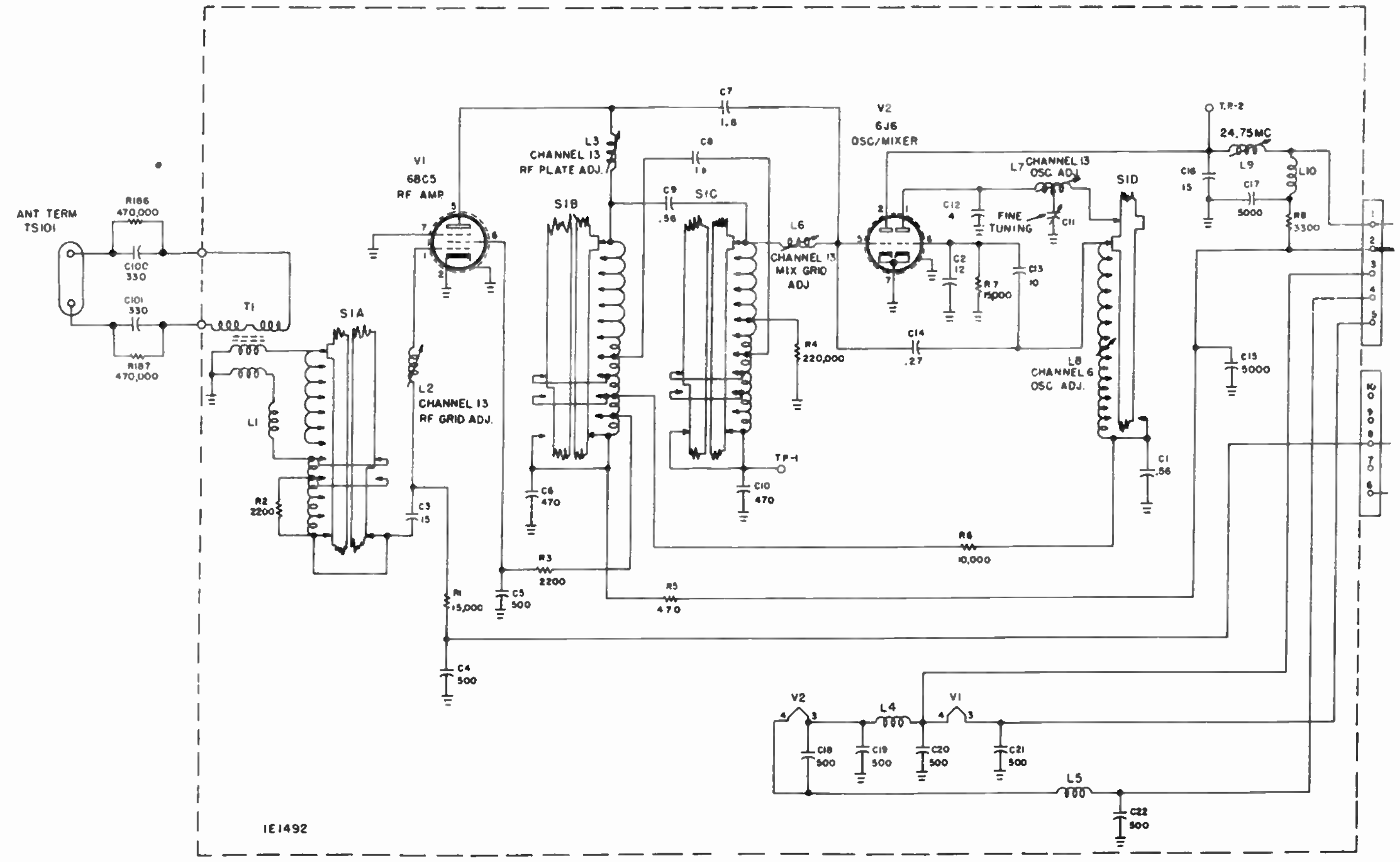


Fig. 328A. Exploded View of 1C1376 & 1677 VHF Cascode TV Tuner

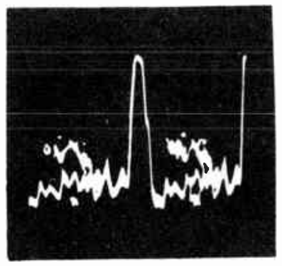


TYPICAL OSCILLOSCOPE PATTERNS

SYNC. CLIPPER

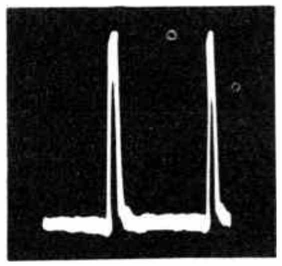
Before viewing the following waveforms set the contrast control for the 60 volt peak to peak reading and the pattern shown on page 1953-21

V-105
Sync. Clip.
Grid Pin 1
Sweep Freq. 7875 cps
Voltage P/P 43 volts



V-105
Sync. Clip.
Plate Pin 2
Sweep Freq. 7875 cps
Voltage P/P 34 volts

V-105
Sync. Clip.
Plate Pin 5
Sweep Freq. 7875 cps
Voltage P/P 40 volts



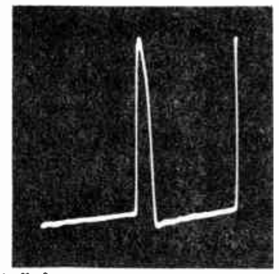
VIDEO AMPLIFIER

V-104
Video Amp.
Plate pin 5
Sweep Freq. 7875 cps
Voltage P/P set 60 volts

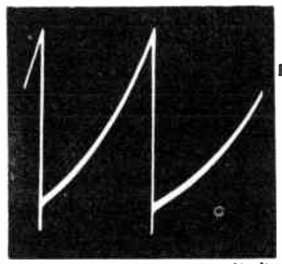
HORIZONTAL AMPLIFIER, DAMPER AND HIGH VOLTAGE RECTIFIER

Before endeavoring to view the following waveforms read the notes and instructions at the beginning of this section pertaining to waveforms. The high voltage probe shown below must be used to prevent damage to the test equipment being used.

V-110
Damper
Cath. Pin 3
Sweep Freq. 7875 cps
Voltage Ratio 1 time

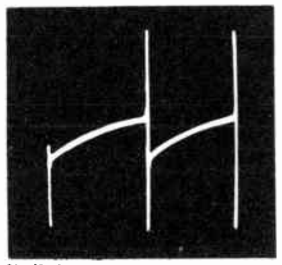


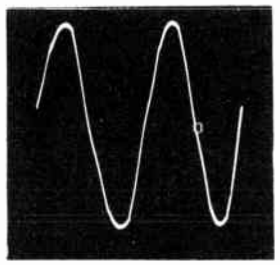
VERTICAL OSCILLATOR AND VERTICAL AMPLIFIER



Junction of R-133, R-134 & C-126
Sweep Freq. 30 cps
Voltage P/P 47 volts

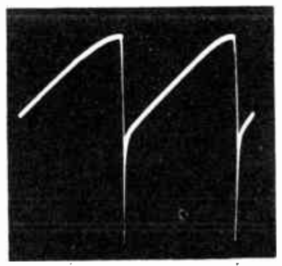
V-106A
Vert. Osc.
Grid Pin 2
Sweep Freq. 30 cps
Voltage P/P 180 volts

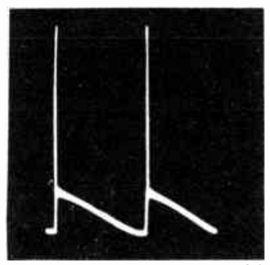




V-106A
Vert. Osc.
Cath. Pin 4
Sweep Freq. 30 cps
Voltage P/P 110 volts

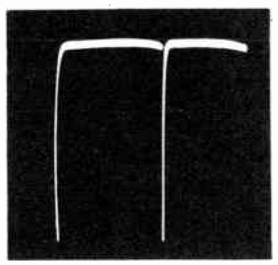
V-106B
Vert. Out.
Grid Pin 7
Sweep Freq. 30 cps
Voltage P/P 90 volts.

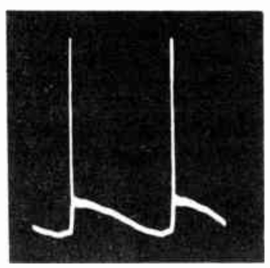




V-106B
Vert. Out.
Plate Pin 6
Sweep Freq. 30 cps
Voltage P/P 1500 volts

V-116
Pix Tube
Grid Pin 2
Green Lead
Sweep Freq. 30 cps
Voltage P/P 14 volts



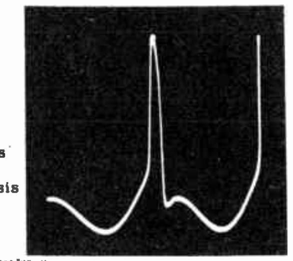


Across Vert. Yoke
Green Leads
Sweep Freq. 30 cps
Voltage P/P 30 volts

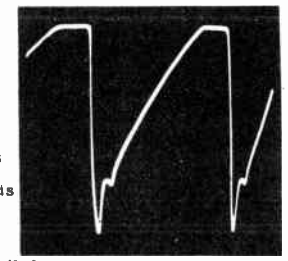
NOTE: When observing this test pattern the oscilloscope must not be grounded since the ground side of the scope is connected to B+ of the power supply. Do not touch the tv chassis and the scope during this observation as a severe shock will result. The "hot" lead of the scope should be connected to the green wire and the other scope lead should be connected to the green wire with black tracer.

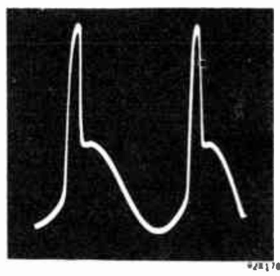
HORIZONTAL OSCILLATOR AND HORIZONTAL AMPLIFIER DRIVE

V-108
Horiz. Osc.
Grid Pin 1
Sweep Freq. 7875 cps
Voltage P/P
For 17" chassis 28 volts
20" & 21" chassis 45 volts

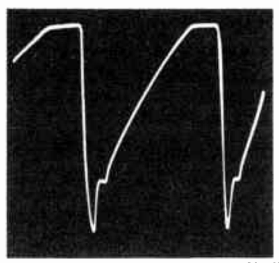


V-109
Horiz. Out.
Grid Pin 5
Sweep Freq. 7875 cps
Voltage P/P
For 17" chassis 95 volts
20" & 21" chassis 140 volts

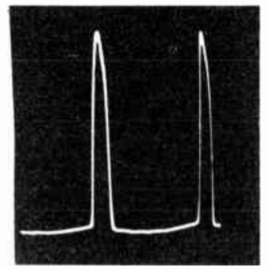




V-108
Horiz. Osc.
Plate Pin 5
Sweep Freq. 7875 cps
Voltage P/P
For 17" chassis 34 volts
20" & 21" chassis 45 volts

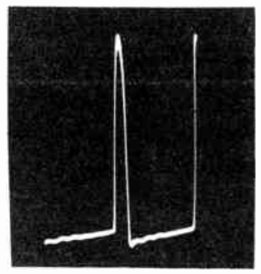


V-108
Horiz. Osc.
Plate Pin 2
Sweep Freq. 7875 cps
Voltage P/P
For 17" chassis 95 volts
20" & 21" chassis 145 volts



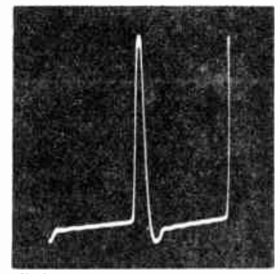
Across Horiz. Yoke
Red Wires
Sweep Freq. 7875 cps
Voltage Ratio 1 time

NOTE: When observing this test pattern the oscilloscope must not be grounded since the ground side of the scope is connected to B+ of the power supply. Do not touch the tv chassis and the scope during this observation as a severe shock will result. The "hot" lead of the scope should be connected to the red wire and the other scope lead should be connected to the red wire with black tracer.



V-109
Horiz. Out.
Plate Cap
Sweep Freq. 7875 cps
Voltage Ratio 1.7 times

V-111
High Volt. Rectifier
Plate Cap
Sweep Freq. 7875 cps
Voltage Ratio 5.5 times



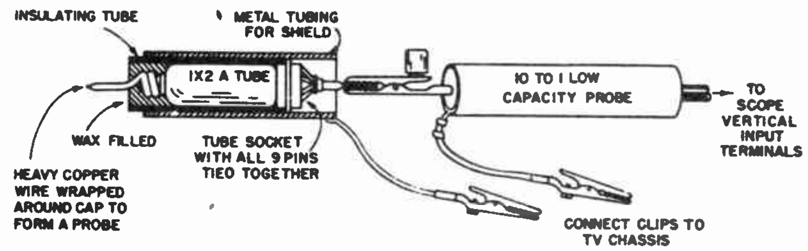


Fig. 24A. High Voltage Probe for Waveform Observations

ALIGNMENT FOR 1E1483 VHF 16-POSITION CASCODE TUNER

These tuners have been carefully aligned at the factory by personnel using precision equipment. Minor adjustments of the tuner may be necessary after making tube or part replacements. When replacing tubes in a tuner use the same tube type as the original tube which was removed from the tuner and also try several different tubes and select the one which gives best performance. Realignment of the tuner probably will not be required if a selected tube is used for replacement. For those service engineers who are properly equipped as specified, the following alignment procedure is included. DO NOT ATTEMPT TUNER ALIGNMENT UNTIL THE TV RECEIVER IS KNOWN TO BE FUNCTIONING PROPERLY AND THE I-F ALIGNMENT OF THE RECEIVER IS CORRECT.

EQUIPMENT REQUIRED FOR VHF TUNER ALIGNMENT

Sweep Generator	RCA type WR-59B or equiv.
Marker Generator	RCA type WR-39C or equiv.
Oscilloscope	RCA type WO-56A or equiv.
Bias Source	1½ volt battery or equiv.
Detector Circuit	See Fig. 20CA.
Isolation Transformer	150 watt rating or higher.

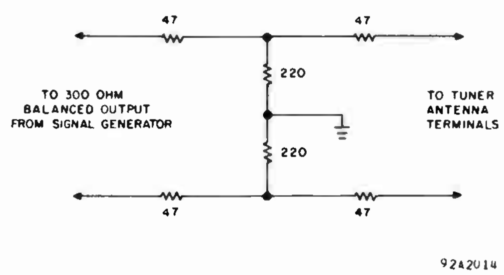


Fig. 20BA. Sweep Generator 300 Ohm Pad

OSCILLATOR ADJUSTMENT FOR 16 POSITION TUNERS

1. Connect the balanced sweep output from a signal generator to the VHF tuner antenna terminal through the 300 ohm pad shown in Fig. 20BA. Set sweep generator for 10 MC sweep.

2. Connect the negative side of 1½ volt bias supply to terminal 8 of the VHF tuner. Connect the positive side of the bias supply to the chassis.

3. Connect the oscilloscope and band-pass detector circuit shown in Fig. 20CA to Test Point TP-2 shown in Fig. 20CB.

4. Set the VHF tuner channel selector to channel 13.

5. Loosely couple the high side of the marker generator to the antenna input terminals by clipping the lead over the insulation of one sweep generator lead. Connect the ground side of the generator to the chassis of the VHF tuner. Set the marker generator to the channel 13 picture carrier frequency of 211.25 MC.

6. Carefully note the position of the marker pip on the response curve. Use a grease pencil if necessary to mark the position on the face of the cathode ray tube.

7. Loosely couple the high side of the marker generator to the band-pass detector circuit by clipping the lead over the germanium diode in the detector circuit. Connect the ground side of the generator to the chassis of the VHF tuner. Set the marker generator to 45.75 MC.

8. Rotate the fine tuning control of the VHF tuner until the 45.75 MC marker is in the same spot as the marker in steps 5 and 6. If this cannot be accomplished by adjustment of the fine tuning control, adjust the channel 13 oscillator adjustment (L-7) to position the 45.75 MC marker. DO NOT DISTURB THE SETTING OF THE FINE TUNING CONTROL AFTER THIS ADJUSTMENT.

9. Switch the VHF tuner channel selector and sweep generator to channel 12.

10. Repeat steps 5 and 6 except the picture carrier frequency for channel 12 (205.25 MC) in step 5.

11. Repeat step 7 using the same marker frequency of 45.75 MC.

12. Adjust the incremental oscillator coil for the channel until the 45.75 MC marker pip is in the same position on the curve as the marker pip for the picture carrier was in step 10.

13. Repeat steps 9, 5, 6, 7 and 12 for channels 11, 10, 9, 8 and 7 in that order. In each case switch the channel selector and sweep generator to the channel being aligned. The marker generator frequency for step 5 will be the picture carrier frequency for the channel being aligned. See the chart on page 1953-14 for the picture carrier frequency of each channel.

14. Switch the channel selector and sweep generator to channel 6 and repeat steps 5 and 6 except use the picture carrier frequency for channel 6 (83.25 MC) in step 5.

15. Repeat step 7 using the same marker frequency of 45.75 MC.

16. Adjust the channel 6 oscillator adjustment until the 45.75 MC marker pip is in the same position on the curve as the marker pip in step 14. See Fig. 20CB.

17. Repeat steps 9, 5, 6, 7 and 12 for channels 5, 4, 3 and 2 in that order. In each case switch the channel selector and sweep generator to the channel being aligned. The marker generator frequency for step 10 will be the picture carrier frequency for the channel being aligned. See the chart on page 1953-14 for the picture carrier frequency of each channel.

NOTE: If two marker generators are available the alignment can be greatly simplified by using one generator for the picture carrier marker and the other for the 45.75 MC marker. Both generators are connected to the receiver at all times as directed in the above instructions. The use of two generators will produce two pips on the pattern. The adjustments outlined above will make these two pips coincide on the oscilloscope pattern.

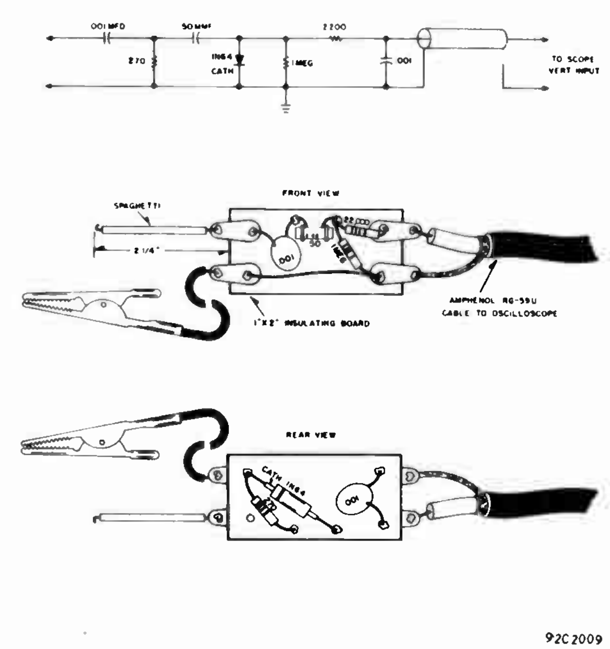


Fig. 20CA. Detector Circuit For Tuner Alignment

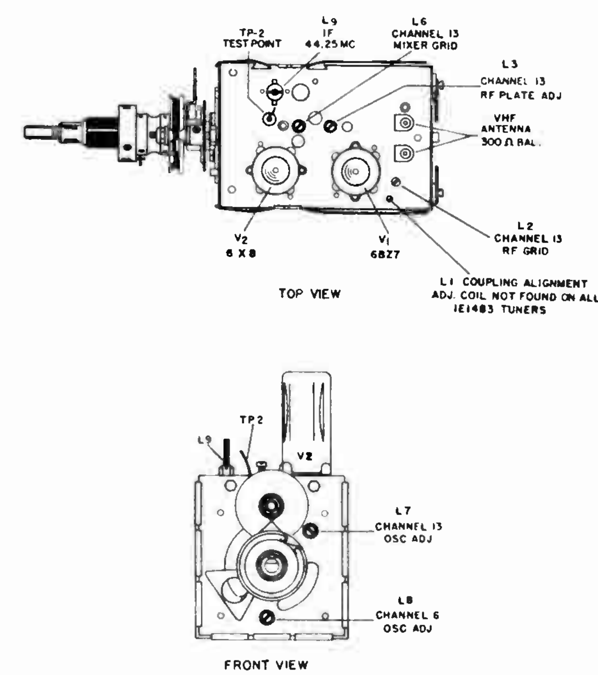


Fig. 20CB. Alignment Adjustments For 1E1483 Tuner

1E1380 CASCODE TV TUNER ALIGNMENT (ANT. & RF CIRCUITS)

The tuner was carefully aligned at the factory and should not require complete realignment under normal operating conditions. A slight readjustment of the individual oscillator slugs may be required as the tubes in the tuner age or are replaced. In some rate cases it will be necessary to realign the tuner after replacing either of the two tubes. If any service work is performed on the tuner, realignment may or may not be required. NO ATTEMPT TO REALIGN THE TUNER SHOULD BE MADE UNTIL THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITION AND IS PROPERLY ALIGNED.

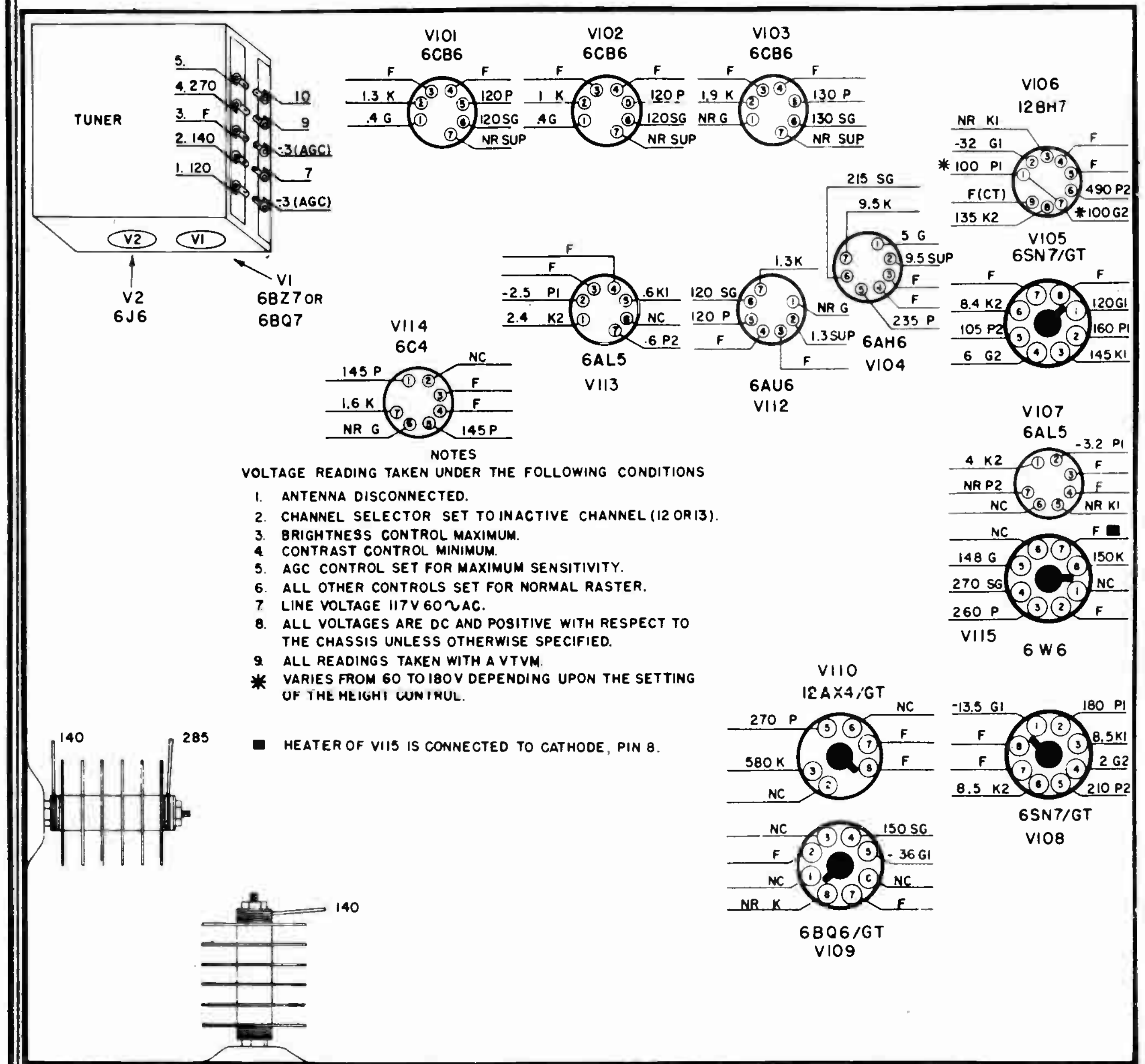


Fig. 20A. Voltage Chart for AJ1200D Chassis with 1C1376 Cascode Tuner AL1200D Run 2 and AY1200D Chassis with 1E1677 Cascode Tuner, and AZ1200D Chassis with 1E1380 Cascode Tuner

EQUIPMENT REQUIRED

1. Sweep generator covering all 12 television channels.
2. Marker generator covering the same range as the sweep generator.
3. Oscilloscope.
4. Vacuum tube voltmeter (VTVM).

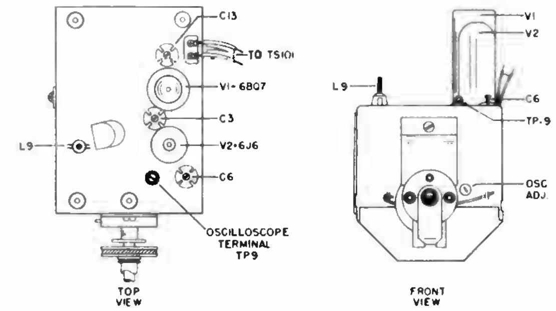


Fig. 20AA. 1E1380 Cascode Tuner Alignment Adjustments

SET-UP PROCEDURE

1. Set the CHANNEL SELECTOR switch to channel 12.
2. Connect the vertical amplifier input of the oscilloscope through a 10,000 ohm resistor to test point TP-9 on the tuner. (See Schematic Diagram and Fig. 20AA). The horizontal amplifier in the oscilloscope should be connected to the oscilloscope sweep voltage output from the sweep generator.
3. Connect the negative pole of a 1.5 volt dry cell to the terminal where the AGC lead (white wire) from the tuner is connected. (Connect the positive pole of the dry cell to the receiver chassis. (See Schematic Diagram).
4. Set the FINE TUNING control at the approximate midpoint of its tuning range.
5. Connect the sweep generator to the antenna terminals and adjust to sweep channel 12. Keep the output of the sweep generator as low as possible to prevent overloading the r-f stage.
6. Loosely couple the r-f output from the marker generator to the antenna terminals. Use the minimum amount of coupling and signal from the marker generator required to give a good marker on pipe on the oscilloscope pattern.

ANTENNA AND RF CIRCUIT ALIGNMENT

7. Adjust C-13, C-3 and C-6 for a flat-top response curve and maximum gain. Check markers on all channels. They should fall in automatically on each channel. Correct marker frequencies for each channel are given in the Picture Carrier and Sound Carrier columns of the chart on page 1953-14. Refer to Fig. 20AB.
8. Disconnect the battery used to obtain negative bias.
9. Disconnect the test equipment and air check the receiver on all active channels. If it is possible to receive a normal picture on all active channels by adjusting the FINE TUNING control, further alignment will not be necessary.

1E1380 CASCODE TV TUNER ALIGNMENT (OSC. CIRCUIT)

1. Set the FINE TUNING control at the approximate midpoint of its tuning range.
2. Place a non-metallic screwdriver through the openings provided in the front of the chassis and the tuner assembly and adjust the oscillator coil slug for each active channel to give the best possible picture.

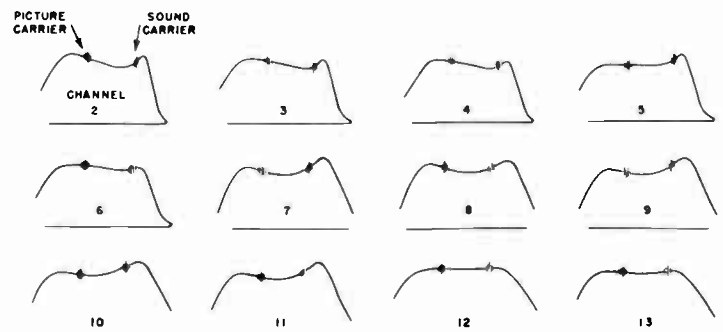


Fig. 20AB. Typical Channel Response Curves for TV Tuners

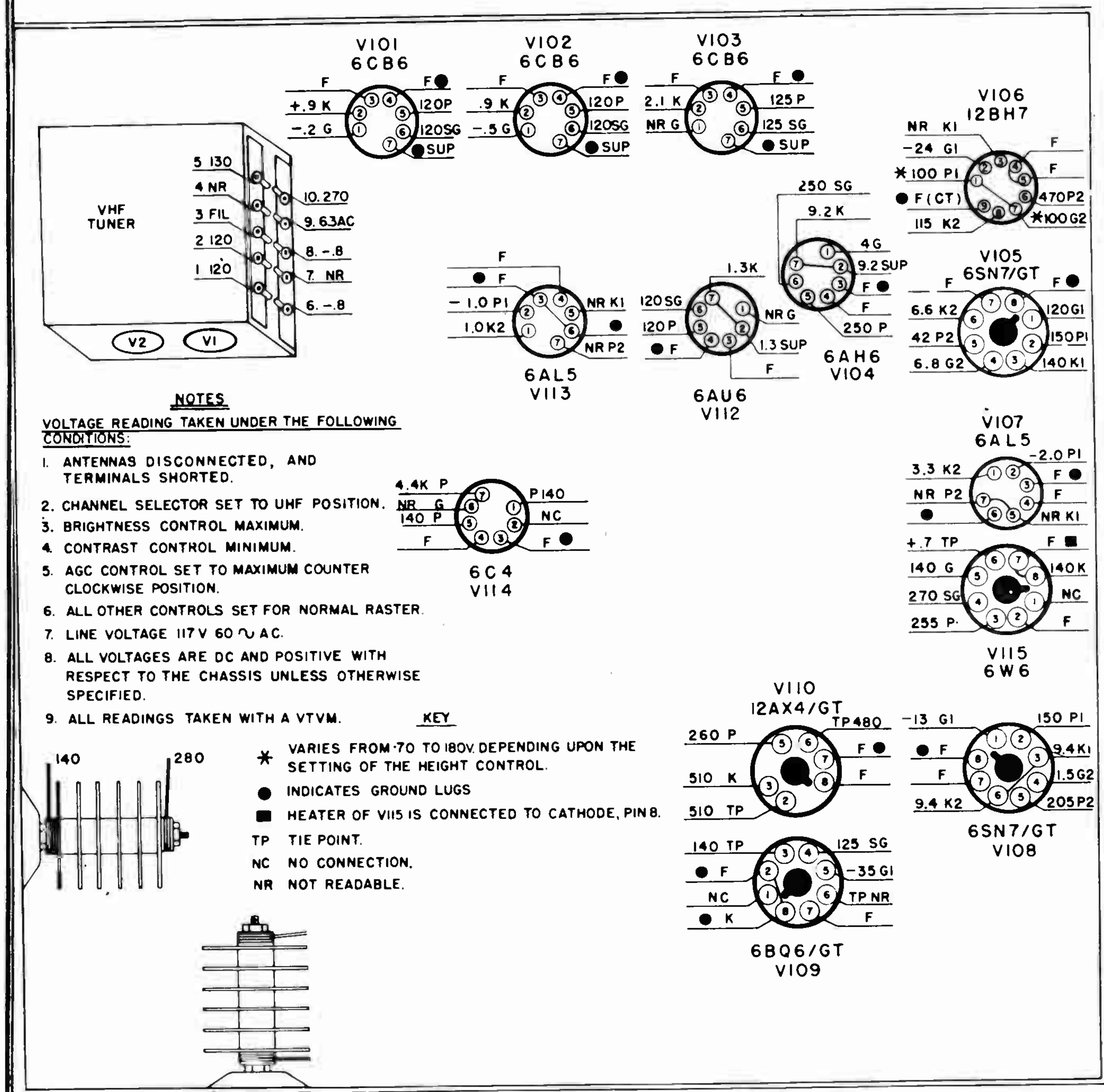


Fig. 18BA. Voltage Chart for BA1200D Chassis with 1E1483 Cascode Tuner

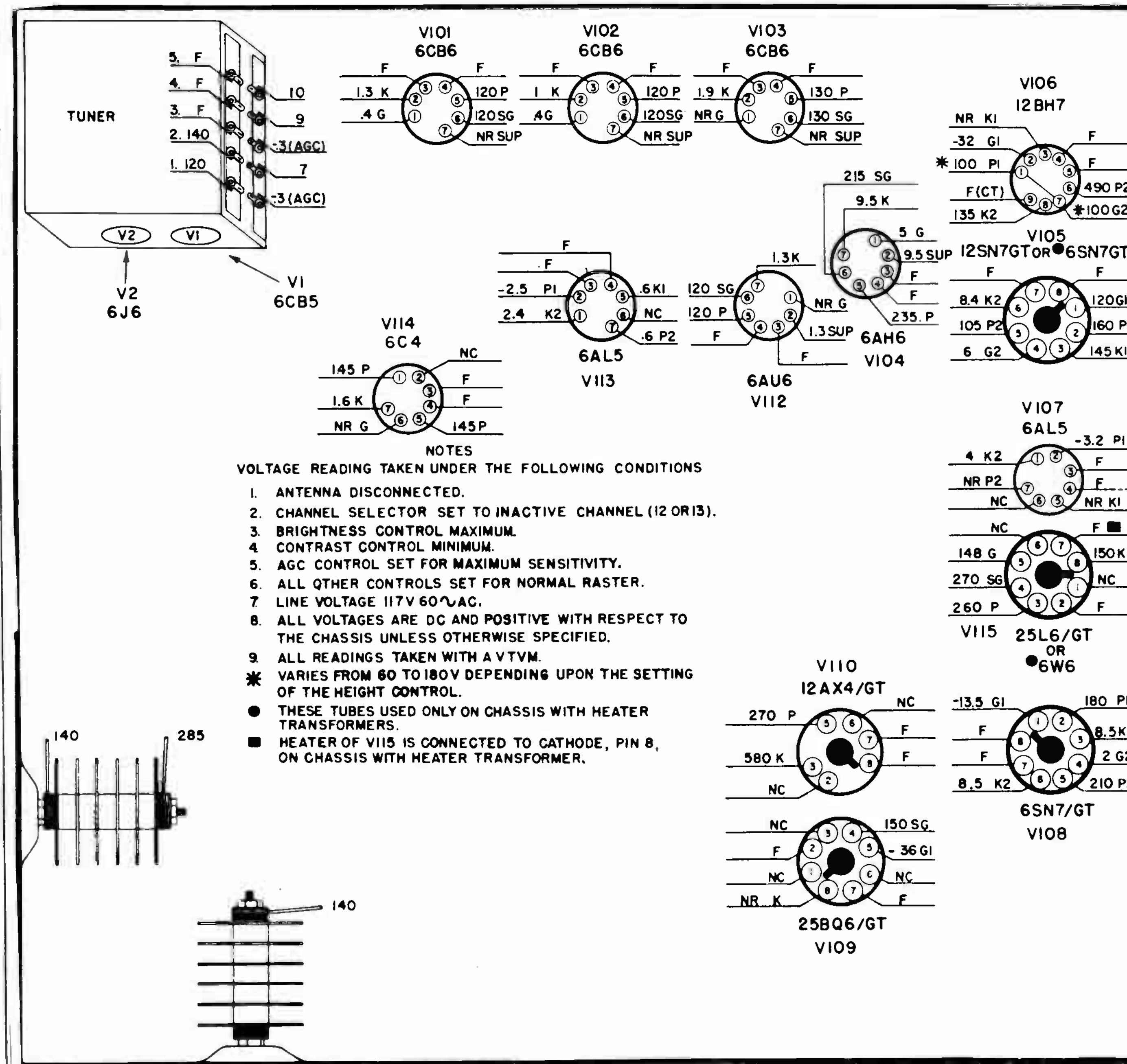


Fig. 19A. Voltage Chart for AG1200D, AH1200D, or AR1200D Chassis with 1E1492 Pentode Tuner and AL1200D (Runs 3 & 4) or AX1200D Chassis with 1C1345 Pentode Tuner

BAND PASS ALIGNMENT OF 1C1345, 1C1376, 1E1492, & 1E1677 TV TUNERS

CAUTION: Band pass alignment is carefully made at the factory. Attempt this alignment only with proper equipment and set-up. The tube shields and the bottom cover for the tuner must be in place. The oscillator adjustment given on page 1953-15 must be completed before the band pass alignment is started.

1. Complete the set-up procedure given on page 1953-15.
2. Connect the leads from the sweep and marker generators to the tuner antenna terminals.
3. Turn the channel selector to channel 13. Adjust the generators to the correct frequencies for channel 13 as shown in the chart on page 1953-14.
4. Adjust L-3 (channel 13 rf plate), L-2 (channel 13 rf grid), and L-6 (channel 13 mixer grid) adjusting screws (see Fig. 16A or 16B) for a band pass characteristic containing both carriers with steep sides and maximum gain. The 1C1376 cascode tuners do not require adjustment of the channel 13 rf grid coil (L-2) and hence a screw for this adjustment will not be found on the top of these tuners.

If the factory adjustment of the incremental loops and coils has not been disturbed, alignment of the rf plate, rf grid, and mixer grid should be complete after the completion of step 4 unless extensive repairs have been made on the tuner. Check the other channels for a similar band pass characteristic as shown in Fig. 17A. If they have the correct characteristics further alignment is not necessary. If they do not, procede with step 5. When aligning the 1C1376 cascode tuners it will first be necessary to repeat step 4 and adjust L-2 by spreading or compressing the turns of the coil before continuing with steps 5 and 6.

5. Adjust the coils of the rf plate, rf grid, and mixer grid for channels 12 through 7 starting with channel 12. Adjust the signal generators for each channel to the frequencies given in the chart on page 1953-14. Pushing the half turn coil loops towards the center of the switch so that they are closer to the switch wafer will increase the frequency while pulling them out and away from the switch wafer will decrease the frequency. Adjust for a band pass characteristic containing both carriers with steep sides and maximum gain.
6. Adjust the coils of the rf plate, rf grid, and mixer grid for channels 6 through 2 starting with channel 6. Adjust the signal generators for each channel to the frequencies given in the chart on page 1953-14. Spreading the turns of the coils will increase the frequency while squeezing the turns together will decrease the frequency. Adjust for a band pass characteristic containing both carriers with steep sides and maximum gain. A tuning wand may be used to determine what change is necessary.

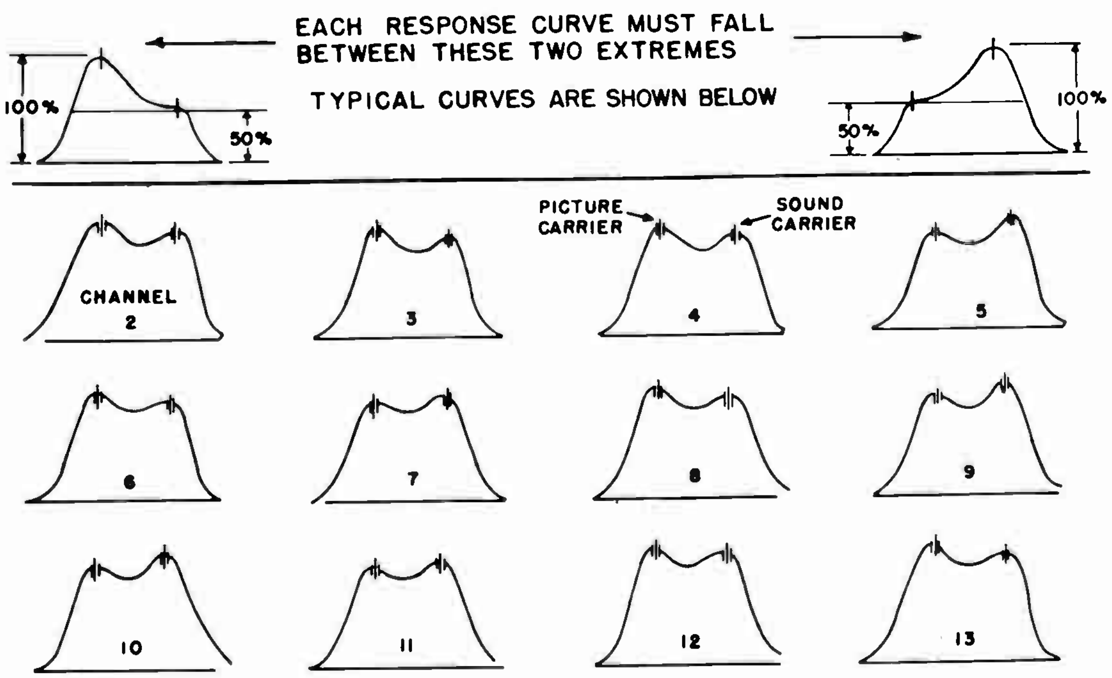


Fig. 17A. Typical Channel Response Curves for TV Tuners

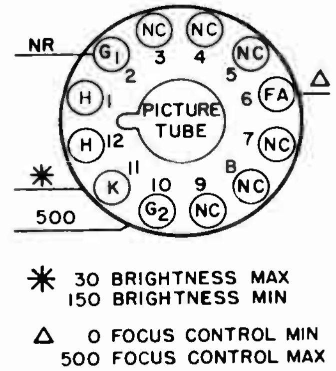


Fig. 18A. Picture Tube Socket Voltages

PICTURE TUBE LEAD COLOR CODE

PIN NO	COLOR	ELEMENT
1	BLACK	HEATER & GND.
2	GREEN	GRID
6	BLUE	FOCUS GRID
10	RED	ANODE GRID
11	YELLOW	CATHODE
12	BROWN	HEATER

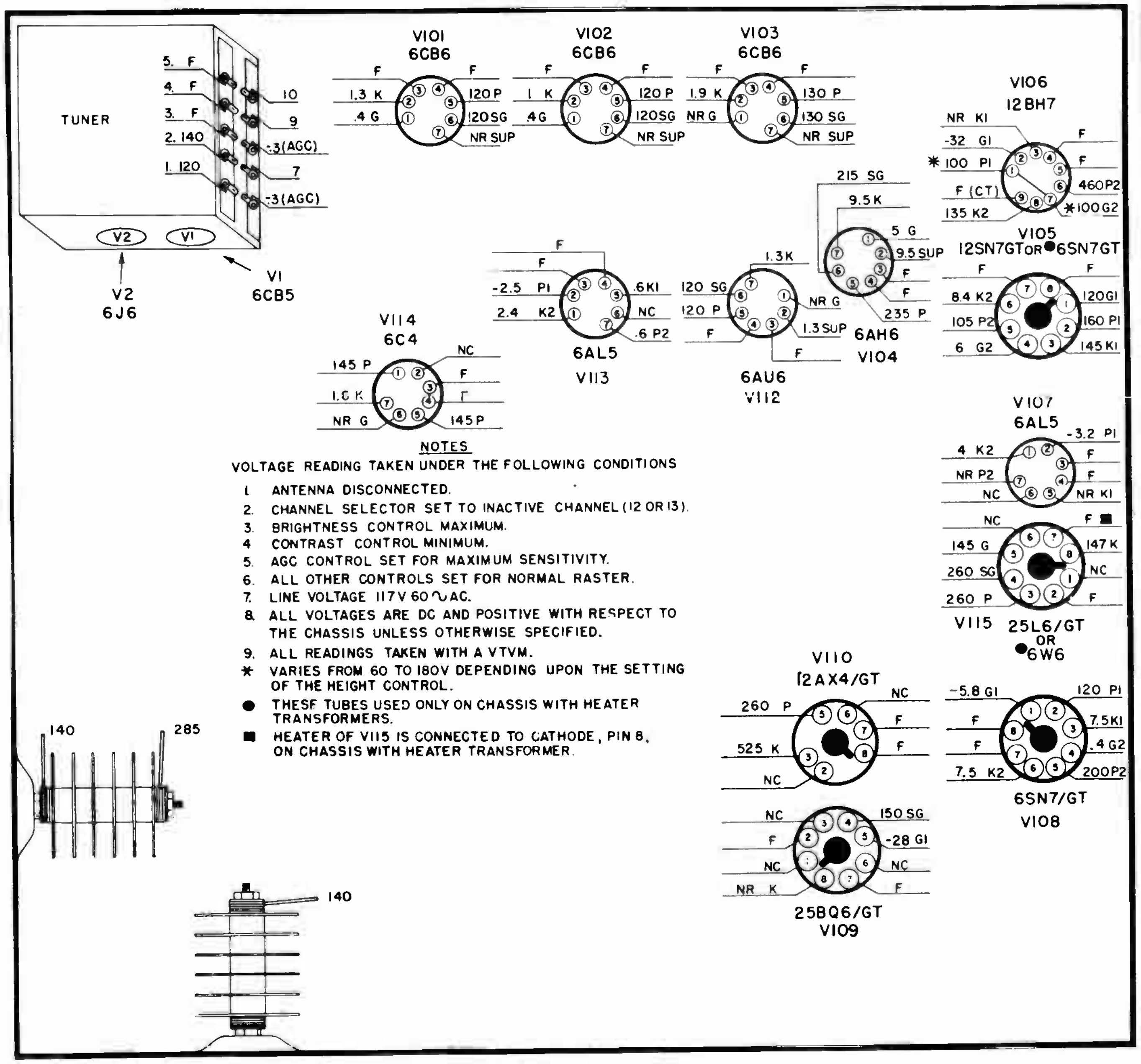


Fig. 18AA. Voltage Chart for 17" AL1200D (Runs 1 & 1A) Chass with 1C1345 Pentode Tuner

ALIGNMENT FOR 1C1345 OR 1E1492 PENTODE- & 1C1376 OR 1E1677 CASCODE TUNERS

These tuners have been carefully aligned at the factory by personnel using precision equipment. Minor alignment adjustments of the tuner may be necessary after making tube or part replacements. When replacing tubes in a tuner use the same tube type as the original tube which was removed from the tuner and also try several different tubes and select the one which gives best performance. Realignment of the tuner probably will not be required if a selected tube is used for replacement. Use of an alternate tube may require a complete realignment of the TV tuner. For those service engineers who are properly equipped as specified, the following alignment procedure is included. Balance of TV receiver must be functioning properly before aligning tuner.

EQUIPMENT REQUIRED FOR TV TUNER ALIGNMENT

1. Sweep generator ____________ RCA type WR-59B or equiv.
2. Marker Generator ____________ RCA type WR-39C Television Calibrator or equivalent.
3. Oscilloscope ____________ RCA type WO-56A or equiv.
4. Bias Source ____________ 1.5 volt battery.
5. Isolation Transformer ________ 150 watt rating or higher

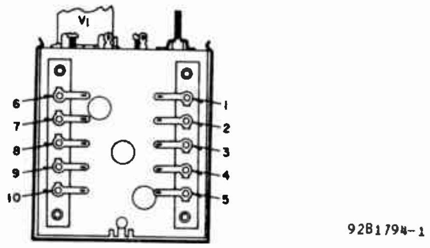


Fig. 15A. Numbering of Tuner Terminals

SET-UP PROCEDURE FOR TUNER ALIGNMENT

1. Check to be sure that the tube shields and the bottom cover for the tuner are in place.
2. Connect all test equipment and the television chassis to a common ground. Be sure to use an isolation transformer for the receiver chassis. Allow at least a 5 minute warm-up period for the receiver chassis.
3. Connect the negative terminal of a 1.5 volt bias source to terminal 8 of the TV tuner. See Fig. 15A for terminal numbering. Connect the positive side of the bias source to any convenient ground point on the chassis.
4. Connect the hot lead from the oscilloscope through a 10,000 ohm carbon resistor to test point T.P.-1 (See page 1953-16). Connect the ground lead from the oscilloscope to any convenient ground point on the TV tuner chassis. Set the scope sweep oscillator to roughly 120 cycles.

OSCILLATOR ADJUSTMENT

1. Turn the channel selector to channel 13.
2. Set the marker generator to 237.5 mc. and connect generator leads to the antenna terminals.
3. Rotate the fine tuning control until a zero beat is indicated on the scope. When the fine tuning control is rotated a band will appear across the face of the scope. As the point of zero beat is approached this band will increase in amplitude and then decrease sharply until a minimum is reached which is the point of zero beat. If the fine tuning control is rotated farther in the same direction the amplitude of the band will increase sharply and then decrease. The point of zero beat should fall in the approximate center of the range over which the fine tuning control may be rotated. If it does not, set the fine tuning control at the approximate center of its range and adjust L-7 (Channel 13 Oscillator Adjustment) for the zero beat. Do not disturb the setting of the fine tuning control after this adjustment.
4. Set the channel selector to channel 6.
5. Set the marker generator to 109.5 mc.
6. Adjust L-8 (Channel 6 Oscillator Adjustment) for the zero beat indication on the scope.

NOTE: Adjustment of the channel 13 and channel 6 oscillator coils automatically brings all other channel into adjustment. The adjustment screws cover their entire electrical range within eight full revolutions counterclockwise from the tight position. Any further rotation of these screws may cause them to fall out. Counterclockwise rotation of the screws will decrease the oscillator frequency. Best results will be obtained if a non-metallic screwdriver is used.

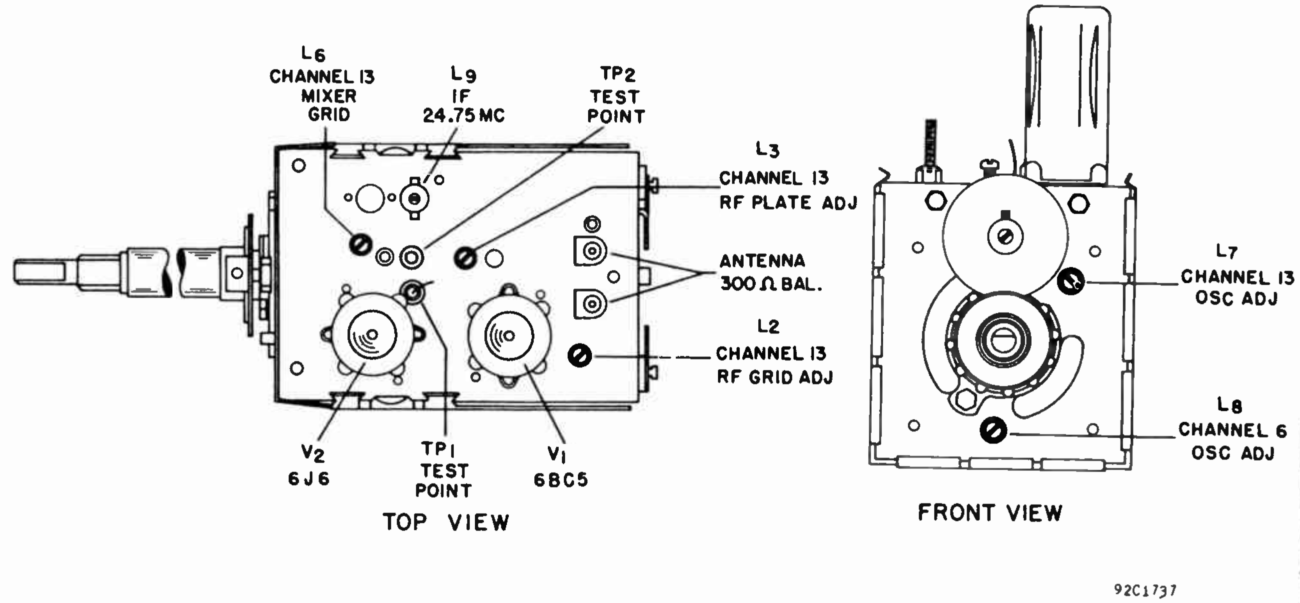


Fig. 16A. 1C1345 or 1E492 Pentode TV Tuner Alignment Adjustments

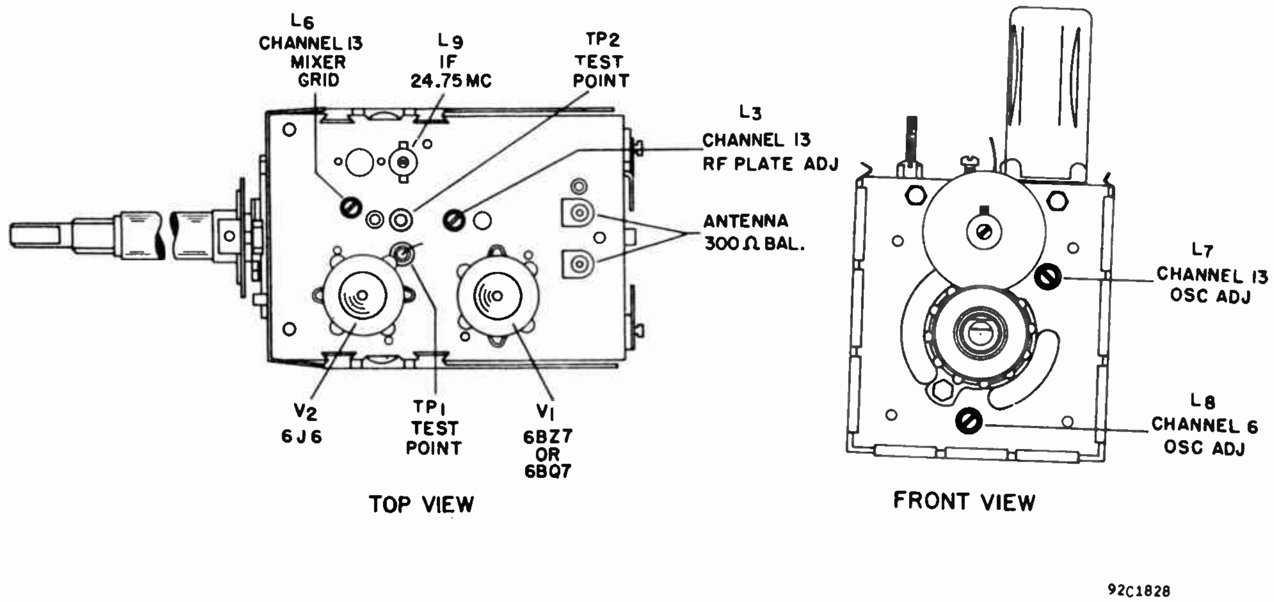


Fig. 16B. 1C1376 or 1E1677 Cascode TV Tuner Alignment Adjustments

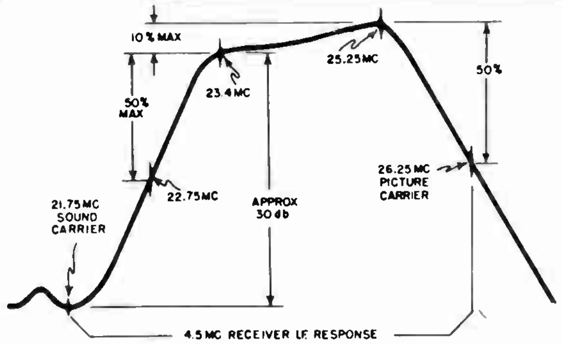


Fig. 14A. Typical Response for 21.75 to 26.25 MC I-F Amplifier

I-F AMPLIFIER ALIGNMENT FOR BA1200D CHASSIS

PROCEDURE

1. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety. Allow a 15 minute warm up period.

2. Set the AVC switch on the rear chassis apron to the 0-10 MILE (counterclockwise) position.

3. Connect the negative side of a 3 volt battery supply to test point Ⓔ. Connect the positive side of the supply to the TV chassis. See schematic diagram.

4. Connect a VTVM to test point Ⓓ through a 47,000 ohm carbon resistor. Connect the ground side of the meter to the TV chassis. See Fig. 11C.

5. Connect the high side of a marker generator to the shield of the osc./mixer tube. This connection will capacitively couple the generator output to the tube. Make sure the shield is ungrounded by raising it above the grounded clips that hold it in place.

6. Set the channel selector to channel 3 or 4, whichever is vacant.

7. Set the marker generator output (unmodulated) for a two volt negative dc reading on the VTVM and adjust the three i-f transformers, L-9, and L-201 according to the I-F AMPLIFIER ALIGNMENT CHART shown below. Readjust the signal generator output as required to maintain the two volt VTVM reading.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment	Transformer or Coil Location	VTVM Indication
45.0 MC	T-201 (bottom)	See Fig. 11C	Maximum
42.8 MC	T-202 (bottom)	Under Chassis	Maximum
44.0 MC	T-203 (bottom)	See Fig. 11C	Maximum
41.25 MC	T-202 (top)	See Fig. 11C	Maximum
42.8 MC	T-202 (bottom)	See Fig. 11C	Maximum
44.25 MC	*L-201	See Fig. 11C	Maximum
44.25 MC	#L-9	See Fig. 11C	Maximum

IMPORTANT - The wax in the end of the coil forms holding the iron core in position may be softened for adjustment of the core by means of a heated screwdriver or a small pencil type soldering iron inserted into the wax. Remelt wax after adjustment.

* NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 12A to the tuner test point TP-2 when making this adjustment.

NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 12A to the grid (pin 1) of V-101 the 6CB6 first i-f amplifier when making this adjustment.

8. Disconnect the VTVM and marker generator connected in steps 4 and 5. The balance of the set-up should be as directed in steps 1, 2, 3 and 6.

9. Capacitively couple the high side of the sweep generator r-f output to the osc./mixer tube by connecting to the tube shield which has been raised above its grounding clips. The ground side of the sweep generator should be connected to the receiver chassis. Adjust the generator to sweep from 40.5 to 46.5 MC.

10. Loosely couple the high side of the marker generator to the high side of the sweep generator by clipping the marker generator r-f lead over the insulation of the sweep generator r-f lead. The ground side of the marker generator should be connected to the receiver chassis.

IMPORTANT — To prevent overloading of the i-f amplifier keep the output of the sweep and marker generators as low as possible. The marker generator output should be just high enough to produce visible pips on the pattern. In some cases the 41.25 MC pip will not be visible unless the r-f output of the marker generator is increased to overcome the attenuation of the 41.25 MC signal by the trap in the top of T-202.

11. Connect the sweep output terminals on the sweep generator to the input of the horizontal amplifier in the oscilloscope.

12. Connect one side of a 47,000 ohm 1/2 watt resistor to test point Ⓓ shown in the schematic diagrams. Connect the other end of the resistor to the high side of the input terminals for the vertical amplifier in the oscilloscope. The scope ground terminal connects to the receiver chassis. Keep the scope leads away from the internal chassis wiring, particularly the horizontal output section.

13. Reduce the r-f output of the sweep generator and increase the gain of the vertical amplifier in the oscilloscope as much as possible without introducing an excessive amount of noise on the test pattern. This will prevent overloading of the i-f system.

14. Check the position of the markers shown in Fig. 14BA. Adjust only the bottom cores of T-201, T-202 and T-203 for a response curve of maximum amplitude with a slightly tilted flat topped appearance as shown in Fig. 14BA. This tilt is required to compensate for the capacitive coupling used for the signal generators. The actual response obtained will be flat when the pattern viewed on the oscilloscope has this tilt. The bottom core of T-203 will primarily control the tilt of this central portion of the curve.

    The bottom core of T-201 should be adjusted to position the 45.75 MC marker in the 50% position shown in Fig. 14BA.

    The bottom core of T-202 should be adjusted to determine the slope of the curve between 41.25 MC and 42.8 MC with the 42.25 MC marker down 50% on the curve as shown in Fig. 14BA.

    Under no circumstances should an attempt be made to adjust L-9, L-201 and the 41.25 MC trap in the top of T-202 by means of an oscilloscope and sweep generator. Maladjustment of these coils does not give a noticeable indication on the oscilloscope. Align these coils by following the procedure given in steps 1 through 7 only.

I-F AMPLIFIER SENSITIVITY MEASUREMENT

To determine the i-f amplifier sensitivity, disconnect the r-f output lead from the tuner where it connects to L-201. Temporarily connect one side of a .005 mfd. mica or ceramic capacitor to grid pin 1 of the first 6CB6 i-f amplifier tube V-101. Connect the unmodulated r-f output of a marker generator to the other side of the capacitor and the ground side of the generator to the TV chassis. Set the marker generator to 43.75 MC. Connect a VTVM as directed in step 4 of the alignment procedure. The 3 volt battery must be removed. If a generator output of 200 to 400 microvolts produces a 1 volt reading on the VTVM, the i-f amplifier sensitivity is normal.

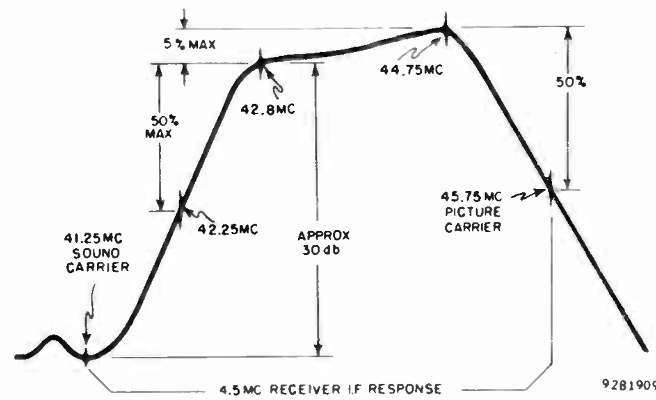


Fig. 14BA. Typical Response for 41.25 to 45.75 MC I-F Amplifiers

I-F AMPLIFIER ALIGNMENT

EQUIPMENT REQUIRED

SWEEP GENERATOR	RCA type WR-59B or equivalent.
MARKER GENERATOR	RCA type WR-39C Television Calibrator or equivalent.
OSCILLOSCOPE	RCA type WO-56A or equivalent.
VACUUM TUBE VOLTMETER (VTVM)	RCA type WV-97A or equivalent.
BIAS SOURCE	Three volt battery.
TEST CIRCUIT	Shown in Fig. 12A.
ISOLATION TRANSFORMER	150 watt rating or higher.

PROCEDURE

1. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety. Allow a 15 minute warm up period.

2. Set the AVC switch on the rear chassis apron to the 0-10 MILE (counterclockwise) position.

3. Connect the negative side of a 3 volt battery supply to test point Ⓔ Connect the positive side of the supply to the TV chassis.

4. Connect a VTVM to test point Ⓓ through a 47,000 ohm carbon resistor. Connect the ground side of the meter to the TV chassis.

5. Connect the high side of a marker generator to the shield of the osc./mixer tube. This connection will capacitively couple the generator output to the tube. Make sure the shield is ungrounded by raising it above the grounded clips that hold it in place.

6. Set the channel selector to any vacant channel.

7. Set the marker generator output (unmodulated) for a two volt negative dc reading on the VTVM and adjust the three i-f transformers, L-9, and L-101 according to the I-F AMPLIFIER ALIGNMENT CHART shown below. Readjust the signal generator output as required to maintain the two volt VTVM reading.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment	Location	VTVM Indication
25.4 MC	T-101 (bottom)	See Fig. 11Aor B	Maximum
23.4 MC	T-102 (bottom)	Under Chassis	Maximum
24.5 MC	T-103 (bottom)	See Fig. 11A or B	Maximum
21.75 MC	T-102 (top)	See Fig. 11A or B	Minimum
23.4 MC	T-102 (bottom)	See Fig. 11A or B	Maximum
24.75 MC	*L-101	See Fig. 11A or B	Maximum
24.75 MC	#L-9	See Fig. 11A or B	Maximum

IMPORTANT — The wax in the end of the coil forms holding the iron core in position may be softened for adjustment of the core by means of a heated screwdriver or a small pencil type soldering iron inserted into the wax. Remelt wax after adjustment.

*NOTE: On chassis with the 1C1345 or 1E1492 Pentode and 1E1376 or 1E1677 Cascode tuners, temporarily connect the series resistor-capacitor combination shown in Fig. 12A to the tuner test point TP-2 when making this adjustment. On chassis with the 1E1380 Cascode tuner, hold the channel selector between channels when making this adjustment.

#NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 12A to the grid (pin 1) of V-101 the 6CB6 first i-f amplifier when making this adjustment.

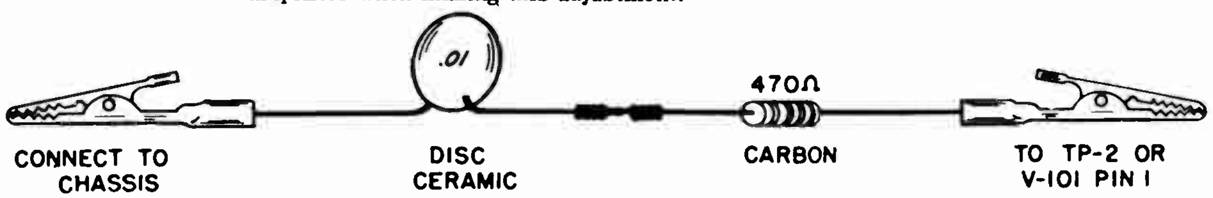


Fig. 12A. Test Circuit for I-F Amplifier Alignment

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8. Disconnect the VTVM and marker generator connected in steps 4 and 5. The balance of the set-up should be as directed in steps 1, 2, 3 and 6.

9. Capacitively couple the high side of the sweep generator r-f output to the osc./mixer tube by connecting to the tube shield which has been raised above its grounding clips. The ground side of the sweep generator should be connected to the receiver chassis. Adjust the generator to sweep from 19 to 29 MC.

10. Loosely couple the high side of the marker generator to the high side of the sweep generator by clipping the marker generator r-f lead over the insulation of the sweep generator r-f lead. The ground side of the marker generator should be connected to the receiver chassis.

IMPORTANT - To prevent overloading of the i-f amplifier keep the output of the sweep and marker generators as low as possible. The marker generator output should be just high enough to produce visible pips on the pattern. In some cases the 21.75 MC pip will not be visible unless the r-f, output of the marker generator is increased to overcome the attenuation of the 21.75 MC signal by the trap in the top of T-102.

11. Connect the sweep output terminals on the sweep generator to the input of the horizontal amplifier in the oscilloscope.

12. Connect one side of a 47,000 ohm 1/2 watt resistor to test point Ⓓ shown in the schematic diagrams. Connect the other end of the resistor to the high side of the input terminals for the vertical amplifier in the oscilloscope. The scope ground terminal connects to the receiver chassis. Keep the scope leads away from the internal chassis wiring, particularly the horizontal output section.

13. Reduce the r-f output of the sweep generator and increase the gain of the vertical amplifier in the oscilloscope as much as possible without introducing an excessive amount of noise on the test pattern. This will prevent overloading of the i-f systems.

14. Check the position of the markers shown in Fig. 14A. Adjust only the bottom cores of T-101, T-102 and T-103 for a response curve of maximum amplitude with a slightly tilted flat topped appearance as shown in Fig. 14A. This tilt is required to compensate for the capacitive coupling used for the signal generators. The actual response obtained will be flat when the pattern viewed on the oscilloscope has this tilt. The bottom core of T-103 will primarily control the tilt of this central portion of the curve.

The bottom core of T-101 should be adjusted to position the 26.25MC marker in the 50% position shown in Fig. 14A.

The bottom core of T-102 should be adjusted to determine the slope of the curve between 21.75 MC and 23.4 MC with the 22.75 MC marker down 50% on the curve as shown in Fig. 14A.

Under no circumstances should an attempt be made to adjust L-9, L-101 and the 21.75 MC trap in the top of T-102 by means of an oscilloscope and sweep generator. Maladjustment of these coils does not give a noticeable indication on the oscilloscope. Align these coils by following the procedure given in steps 1 through 7 only.

MEASUREMENT OF I-F AMPLIFIER SENSITIVITY

To determine the i-f amplifier sensitivity, disconnect the r-f output lead from the tuner where it connects to L-101. Temporarily connect one side of a .005 mfd. ceramic or mica capacitor to grid pin 1 of the 6CB6 first i-f amplifier tube V-101. Connect the unmodulated r-f output of a marker generator to the other side of the capacitor and the ground side of the generator to the TV chassis. Set the marker generator to 24.75 MC. Connect a VTVM as directed in step 4 of the alignment procedure. The three volt battery must be removed. If a generator output of 200 to 400 microvolts produces a 1 volt reading on the VTVM, the i-f amplifier sensitivity is normal.

FM SOUND CHANNEL ALIGNMENT FOR 1200 SERIES CHASSIS

EQUIPMENT REQUIRED

Signal generator covering 4 to 30 mc unmodulated.

Vacuum tube voltmeter (VTVM).

Sound alignment test circuit shown in Fig. 10A.

Power line isolation transformer.

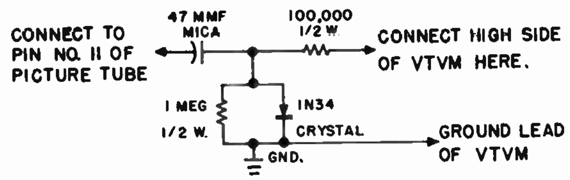


Fig. 10A. Sound Alignment Test Circuit

PROCEDURE

1. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety.

2. Set the channel selector to any vacant channel and the contrast control at minimum.

3. Connect the signal generator output through a .005 mfd. capacitor to test point Ⓓ shown in schematic diagram. Ground the shield of the generator output cable to the chassis.

4. Connect the sound alignment detector circuit and VTVM as shown in Fig. 10A. Adjust the 4.5 mc. generator output (unmodulated) to give a 1 volt reading on the VTVM.

5. Adjust the 4.5 mc. trap adjustment (L-105) at 4.5 mc. for a minimum VTVM reading.

6. Disconnect the test circuit and connect the VTVM to test terminal Ⓑ (Pin 2 of FM detector, V-113). See schematic diagram.

7. Adjust the 4.5 mc. amplifier grid adjustment (L-110) and the primary of T-107 (bottom core) at 4.5 mc. for a maximum VTVM reading.

8. Connect the VTVM to test terminal Ⓒ, shown in the schematic diagram. Adjust the secondary of T-107 (top core) at 4.5 mc. for the zero reading which occurs between the positive and negative peaks. If the zero reading occurs at more than one setting, use the position nearest the top limit of the core.

9. Shift the signal generator an equal amount on either side of 4.5 mc. and touch up the primary of T-107 (bottom core) for approximately equal peaks. Use just enough signal output to obtain one volt peaks for best results.

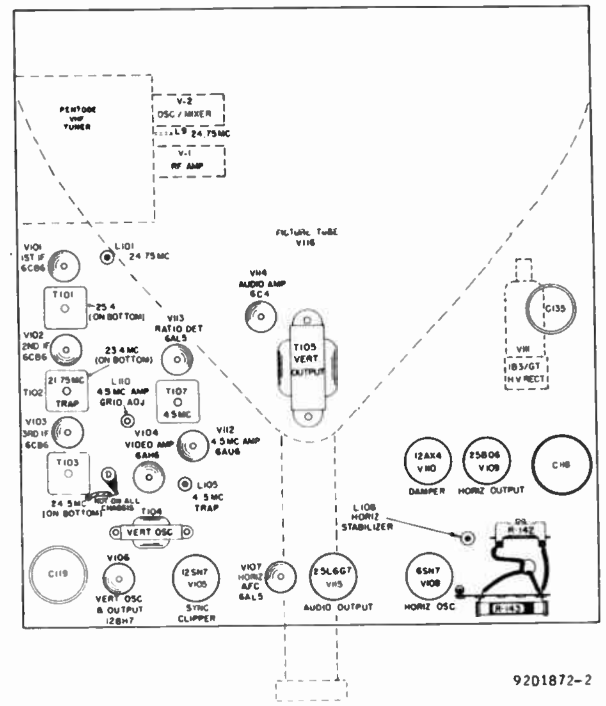


Fig. 11A. Top View Chassis Alignment Locations for Chassis AG1200D, AH1200D, AL1200D (Runs 1; 1A, 3, & 4), AR1200D, & AX1200D.

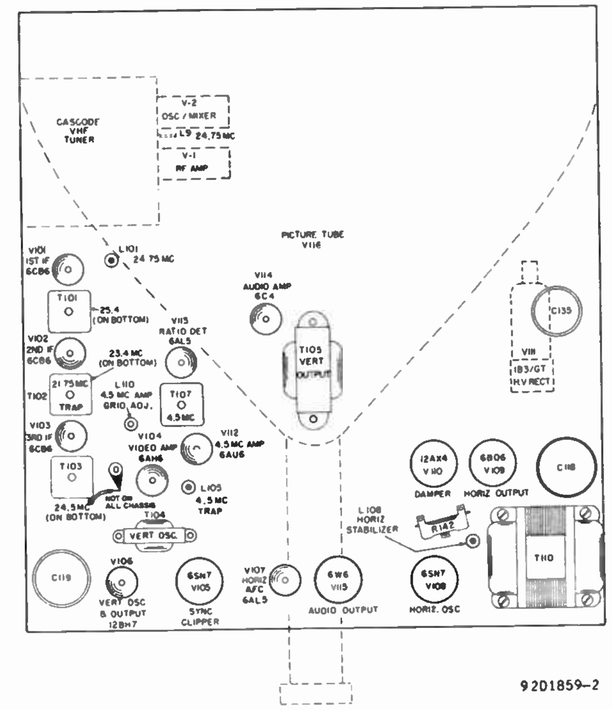


Fig. 11B. Top View Chassis Alignment Locations for Chassis AJ1200D, AL1200D (Run 2), AY1200D and AZ1200D.

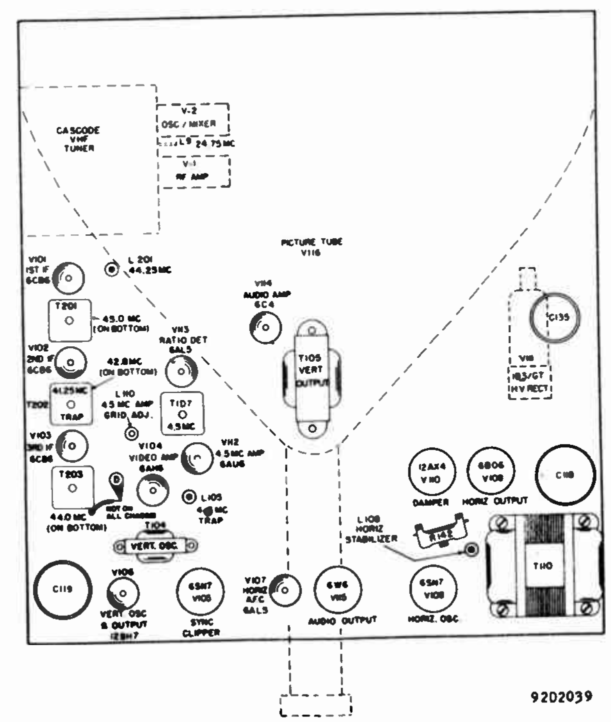


Fig. 11C. Top View Chassis Alignment Locations for Chassis BA1200D

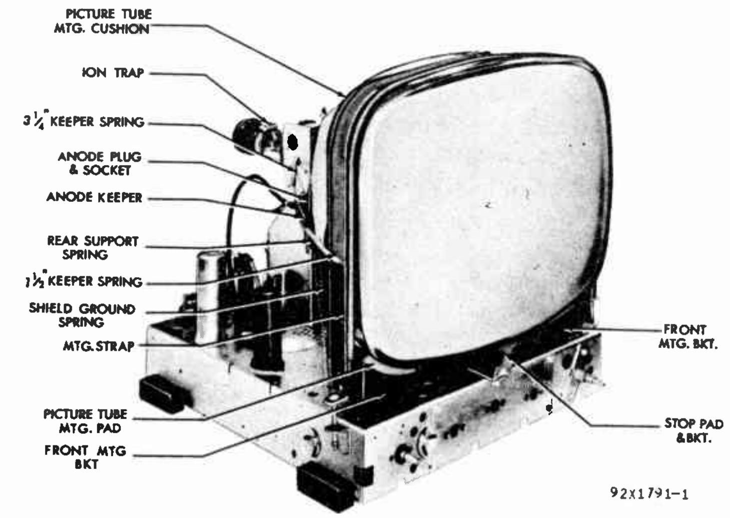


Fig. 5A. 17" Glass Pix Tube Mounting

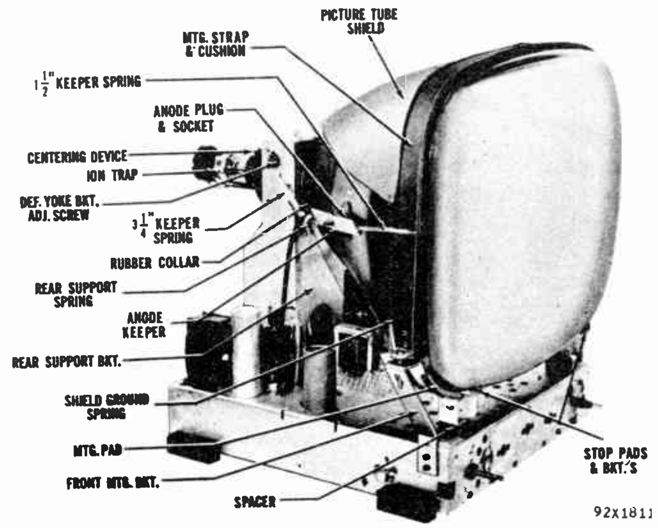


Fig. 5B. 20 or 21" Glass Pix Tube Mounting

LAYOUT OF CONTROLS

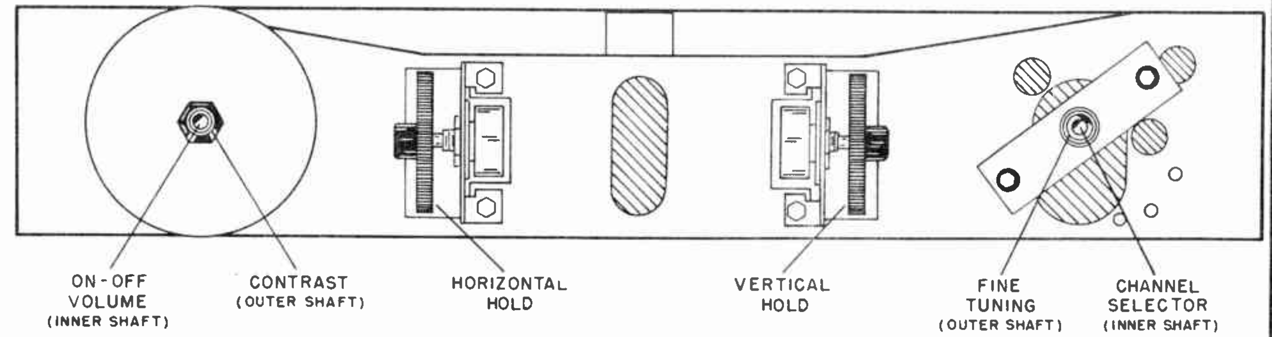


Fig. 9A. Front Controls for Chassis AG1200D, AH1200D, AR1200D, & AY1200D 92C1885

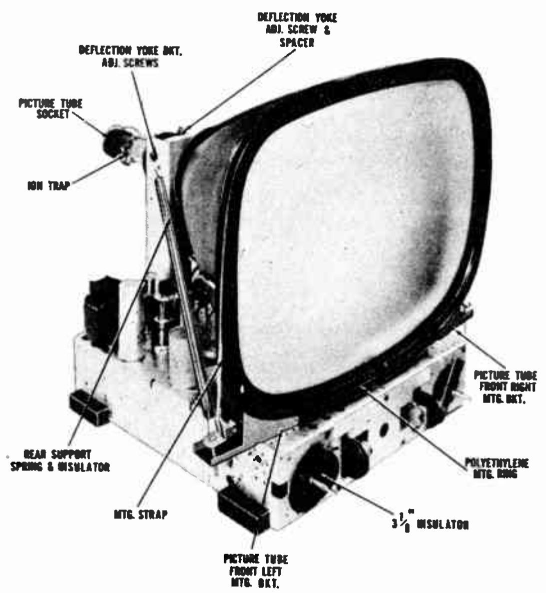


Fig. 5C. 21" Metal Pix Tube Mounting

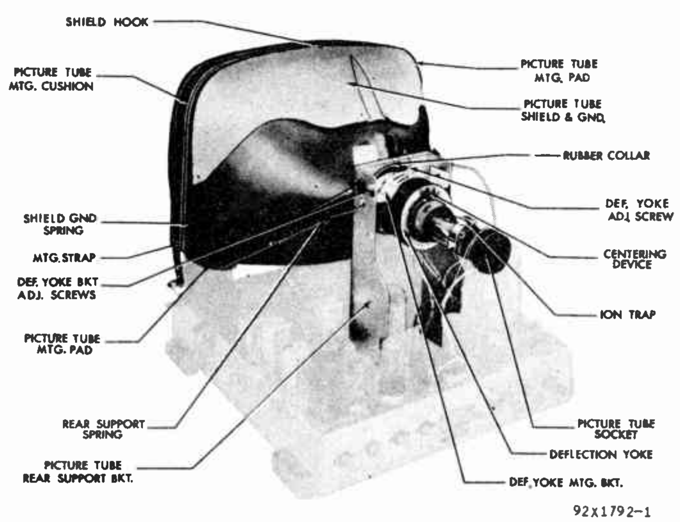
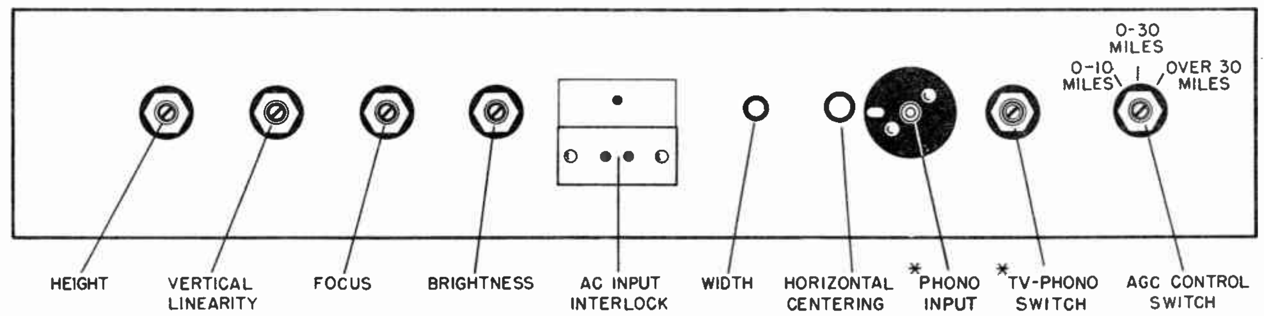


Fig. 7A. 17" Glass Pix Tube Mounting



*THE PHONO INPUT SOCKET AND TV-PHONO SWITCH ARE USED ON CHASSIS AH1200D ONLY

Fig. 9B. Rear Controls for Chassis AG1200D, AH1200D, AR1200D, & AY1200D 92C1955

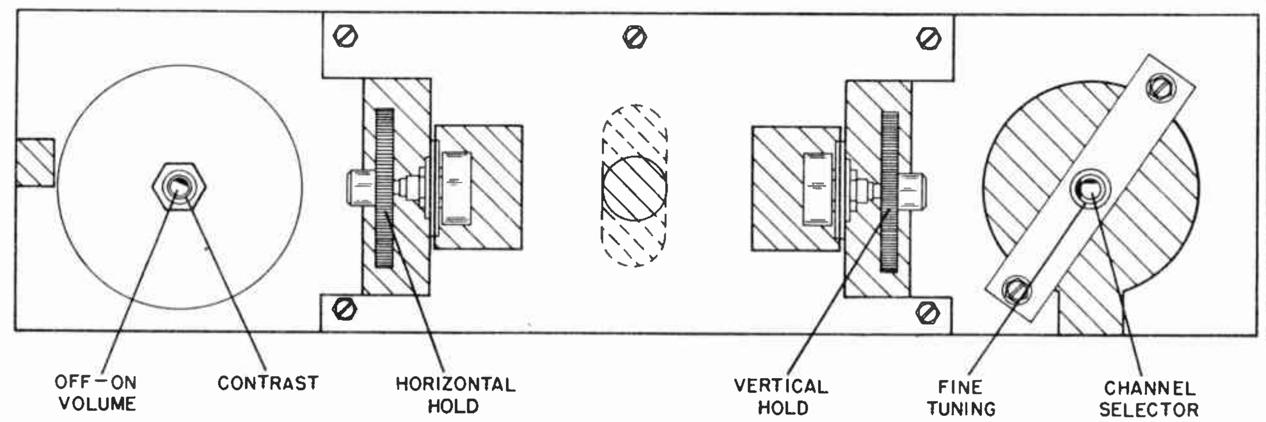


Fig. 9C. Front Controls for Chassis AJ1200D, AL1200D, AX1200D, AZ1200D & BA1200D 92C1867

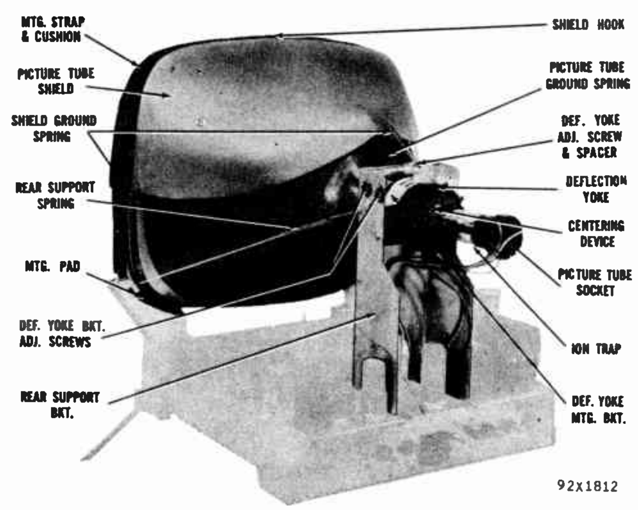


Fig. 7B. 20" Glass Pix Tube Mounting

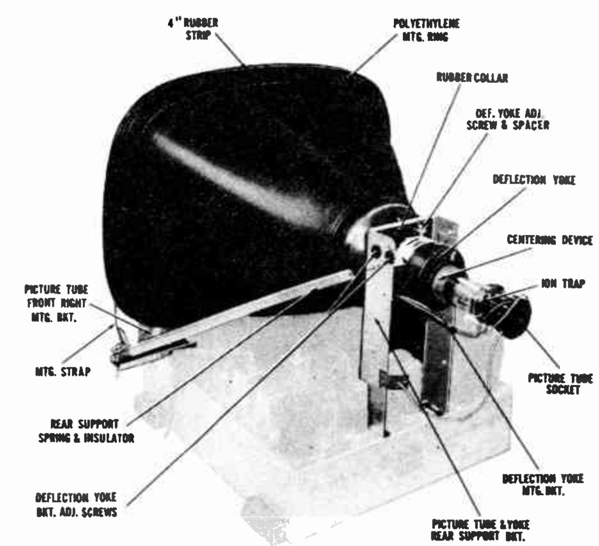


Fig. 7C. 21" Metal Pix Tube Mounting.

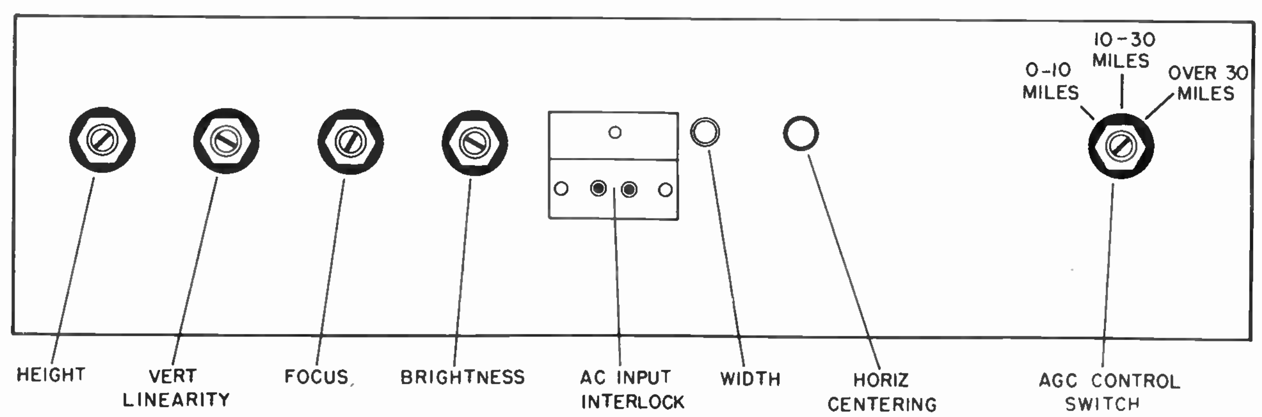


Fig. 9D. Rear Controls for Chassis AJ1200D, AL1200D, AX1200D, AZ1200D & BA1200D 92C1860

Fig. 115A. Models 1088 & 1088A, Mahogany

Fig. 113A. Models 1085 & 1085A, Mahogany

92X1962

Fig. 111A. Model 1081, Blonde

CHASSIS . . . . . AJ1200D AJ1200D

RUN NUMBERS . 1 & 1A 2

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	8" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	BLONDE
PICTURE TUBE	21" RECTANGULAR WITH ELECTROSTATIC FOCUS
TV TUNER	1C1376 CASCODE

TUBE COMPLEMENT

V-1	*6BZ7 or 6BQ7	R-F AMPLIFIER
V-2	*6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-116	21MP4 Metal (1081)	PICTURE TUBE
V-116	21FP4 Glass (1081A)	PICTURE TUBE

CHASSIS AY1200D

RUN NUMBERS . . . . 1 & 2

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	$6\frac{1}{2}$" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	BLONDE WOOD GRAIN PLASTIC
PICTURE TUBE	20" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1E1677 CASCODE

TUBE COMPLEMENT

V-1	6BZ7 or 6BQ7	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-116	20HP4	PICTURE TUBE

Fig. 123A. Model 1074AT, Blonde Wood Grain

Fig. 127A. Model 1075AT, Mahogany Brown

Fig. 131A. Model 1078AT, Mahogany Grain

Fig. 145A. Model 1088C, Mahogany

Fig. 141A. Models 1085C & 1085E, Mahogany

CHASSIS . . . . . AL1200D . . . AL1200D
RUN NUMBERS . 1 & 1A 2

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	6½" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	MAHOGANY LEATHERETTE
PICTURE TUBE	17" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER MODEL 1050	1C1345 PENTODE
TV TUNER MODEL 1050A	1C1376 CASCODE

Fig. 117A. Models 1050 & 1050A, Mahogany Leatherette

SEE SCHEMATIC DIAGRAMS FOR THE DIFFERENCE BETWEEN CHASSIS USED IN MODEL 1050 AND CHASSIS USED IN MODEL 1050A

TUBE COMPLEMENT

V-1	6BC5 or •6BZ7 or 6BQ7	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT or • 6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT or •6BQGT	HORIZONTAL OUTPUT
V-110	12AX4 §6AS4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G or •6W6	AUDIO OUTPUT AMPLIFIER
V-116	17HP4	PICTURE TUBE

Fig. 137A. Models 1081C & 1081E, Blonde

CHASSIS . . . . BA1200D . BA1200D
RUN NUMBERS . 1 . . . . . 2 & 3

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	8" ELECTRODYNAMIC
PICTURE CARRIER IF	45.75 MC
SOUND CARRIER IF	41.25 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	BLONDE
PICTURE TUBE	21" RECTANGULAR WITH ELECTROSTATIC FOCUS
TV TUNER	1E1483 16 POSITION CASCODE

TUBE COMPLEMENT

V-1	*6BZ7 or 6BQ7	R-F AMPLIFIER
V-2	*6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4 or §6AS4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-116	21MP4 Metal (1081C)	PICTURE TUBE
V-116	21FP4 Glass (1081E)	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

Fig. 147A. Model 1092, Mahogany Plastic

CHASSIS AX1200D

RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	6½" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	MAHOGANY PLASTIC
PICTURE TUBE	17" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1C1345 PENTODE

TUBE COMPLEMENT

V-1	6BC5	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4 §6AS4	DAMPER
V-111*	1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G	AUDIO OUTPUT AMPLIFIER
V-116	17HP4	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

Fig. 105A. Model 1075, Mahogany Brown with Optional B-1097 Consobase

Fig. 107A. Model 1077, Mahogany Brown with Optional B-1093 Phono Drawer Base

Fig. 109A. Model 1078, Mahogany Grain with Optional B-1094 Consobase

Fig. 101A. Model 1072, Ebony with Optional T-1096 Tele-Cart

CHASSIS AG1200D

RUN NUMBERS . . . . 1 & 1A

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	6½" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	EBONY PLASTIC
PICTURE TUBE	20" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1E1492 PENTODE

Fig. 103A. Model 1074, Blonde Wood Grain with Optional B-1095 Consobase

TUBE COMPLEMENT

V-1	6BC5	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G	AUDIO OUTPUT AMPLIFIER
V-116	20HP4	PICTURE TUBE

Fig. 119A. Model 1072A, Ebony

Fig. 129A. Model 1078A, Mahogany Grain

Fig. 125A. Model 1075A, Mahogany Brown Plastic.

Fig. 121A. Model 1074A Blonde Wood Grain

CHASSIS AR1200D

RUN NUMBERS . . . . .1 & 1A

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	$6\frac{1}{2}$" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	EBONY PLASTIC
PICTURE TUBE	21" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1E1492 PENTODE

TUBE COMPLEMENT

V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G	AUDIO OUTPUT AMPLIFIER
V-116	21XP4	PICTURE TUBE
V-1	6BC5	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.

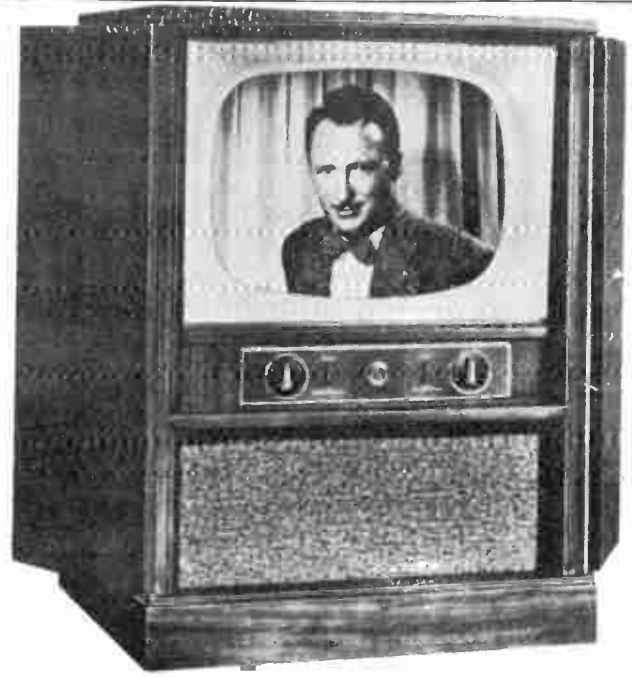


Fig. 143A. Models 1088B & 1088D, Mahogany

Fig. 139A. Models 1085B & 1085D, Mahogany

92X1962

Fig. 135A. Models 1081B & 1081D, Blonde

CHASSIS . . . . AZ1200D . AZ1200D

RUN NUMBERS . 2 . . . . . . 1 & 1A

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	8" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	BLONDE
PICTURE TUBE	21" RECTANGULAR WITH ELECTROSTATIC FOCUS
TV TUNER	1E1380 CASCODE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

TUBE COMPLEMENT

V-1	*6BZ7 or 6BQ7	R-F AMPLIFIER
V-2	*6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4 or §6AS4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-116	21MP4 Metal (1081B)	PICTURE TUBE
V-116	21FP4 Glass (1081D)	PICTURE TUBE

YOUR INTRODUCTION TO ULTRA HIGH FREQUENCIES

The Federal Communication Commission, recognizing the need for many additional television stations, has set aside the ultra high frequency band (470 to 890 megacycles) for commercial television use. This action makes room for thousands of new stations throughout the nation, which will transmit on channels 14 through 83. Reception of these channels is beyond the normal range of your standard VHF television receiver which tunes only channels 2 through 13. In order to receive these higher channels, a UHF converter must be added to your receiver.

The Granco Coaxial Tuned UHF Converter Model MTU, has been specifically designed to permit reception of all UHF stations, present and future, on any standard VHF television receiver. It does this by electronically converting the higher channels to channels 5 or 6 which your set can receive. The conversion takes place simply and efficiently without effecting your normal VHF reception. Installation and operation is as simple as a radio set, as explained in the following instructions.

FIG. 1

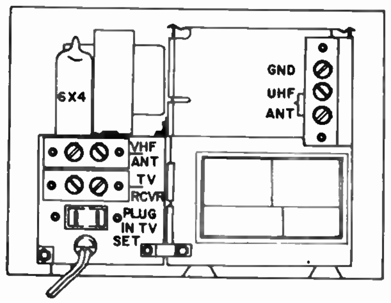
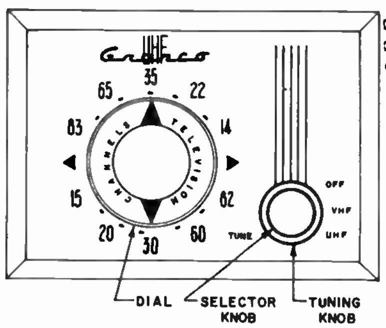


FIG. 2



INSTALLATION

The converter should be located as closely as possible to your television set. The most satisfactory location would be either on top or to the right side of your set because these are closest to the set antenna terminals. All connections are made to the rear of the converter as shown in Figure 1. A label attached to the chassis rear clearly identifies each of the terminal connections, which are further defined as follows:

VHF ANT — Connects to the VHF antenna wire now used with your television set.

TV RCVR — Connects to your television set antenna terminals.

PLUG IN TV SET — Your television set power line cord plugs in here.

UHF ANT — Connect your UHF antenna twin lead here. If coaxial cable is used, connect shield braid to *GND* terminal and insulated inner conductor wire to *ANT* terminal directly below GND terminal.

To insure proper installation the following procedure should be used, however, before starting make sure that the power cord of the converter is not connected to an electrical outlet.

Installation Procedure

1. Connect UHF antenna twin lead to terminals marked *UHF ANT*. If coaxial lead-in is used connect to terminal marked *GND* and adjacent *ANT* terminal.
2. Disconnect wires from TV set antenna terminals and connect to *VHF ANT* terminals on converter.
3. Connect a short piece of twin lead cable between the TV set antenna terminals and converter *TV RCVR* terminals.

   NOTE: In areas of strong local reception on channels 5 or 6, it is advisable to use shielded 300 ohm twin lead to avoid interference with UHF reception.
4. Remove TV set power cord plug from wall outlet and plug into converter receptacle marked *PLUG IN TV SET*. Turn TV set power switch on and leave in this position at all times.
5. Check all connections to be sure that they are tight, and no loose strands are shorting across the terminals.
6. Turn the *SELECTOR* knob (see Figure 2) to *OFF* position and plug the converter power line cord into 117 volt 60 cycle wall receptacle.

OPERATION

Your set has now been converted into a modern 82 channel television receiver, capable of receiving any television transmission in your vicinity. Proper operation requires control of both the converter and television set knobs. The two converter knobs (see Figure 2) control UHF tuning, and OFF — VHF — UHF switching.

The Selector knob position functions are further explained as follows:

OFF — Power to both converter and TV is turned off.

VHF — The TV set and the converter tube filaments are turned on. The VHF antenna is connected to TV by the internal switch. Channels 2 through 13 may now be selected in the normal way.

UHF — Power to both converter and set is on. The VHF antenna is disconnected, shorted, and grounded, to prevent interference. The converter output is connected to the receiver antenna input terminals by the internal switch. With the TV channel selector in channels 5 or 6 position any UHF channel may be selected by turning the UHF tuning knob.

To insure proper operation the following procedure should be used. Be sure TV power switch is on and left on at all times.

Operating Procedure

1. Turn "Selector" knob to *VHF*. Allow a few minutes for warm-up and then operate TV set in normal way if programs on any of channels 2 through 13 are desired.
2. To receive programs on channels 14 through 83 turn "Selector" knob to *UHF* and set TV channel selector to either 5 or 6. *NOTE*: Always select the channel which is *not* being used by a local VHF television station. This will eliminate the possibility of interference with UHF reception.
3. Tune in the desired UHF channel by turning the "Tuning" knob on the converter and adjusting for best picture and sound. Tuning may be further improved by using the TV set fine tuning control.
4. To turn the converter and receiver off, rotate "Selector" knob on converter to *OFF*. *Do not* turn receiver power switch off. Leave on at all times.

HOW TO GET THE MOST FROM YOUR GRANCO UHF CONVERTER

Antenna

One of the most important accessories required for satisfactory reception is a properly installed UHF antenna. Your local service man or television dealer is equipped to select and install an antenna best suited to your requirements.

Service Notes

The Granco Model MTU, UHF Converter has been carefully designed and assembled to give long trouble-free performance. However, occasions may arise when tube changes or minor service adjustments are required. On such occasions it is recommended that you call in your local service man or television dealer, who is trained to make these adjustments most efficiently. The following notes are intended for his guidance.

Tube Replacement

The 6X4 rectifier tube is readily accessible by removing back cabinet cover. The 6AF4 oscillator, 6BQ7A I-F amplifier, and 1N82 detector, are contained within the tuner compartment. For replacement of any of these proceed as follows:

1. Remove knobs and back cover.
2. Remove 4 bottom mounting screws.
3. Remove chassis.
4. Remove top tuner shield by compressing front and back flaps inward using thumb and fore-finger, simultaneously pulling straight up. This action will release friction catches which retain top shield.
5. Replace tubes and reassemble chassis into cabinet, after replacing shield.

NOTE: A plug button opposite the 6AF4 tube may be removed as an aid in replacing this tube. Reinsert button after tube has been changed.

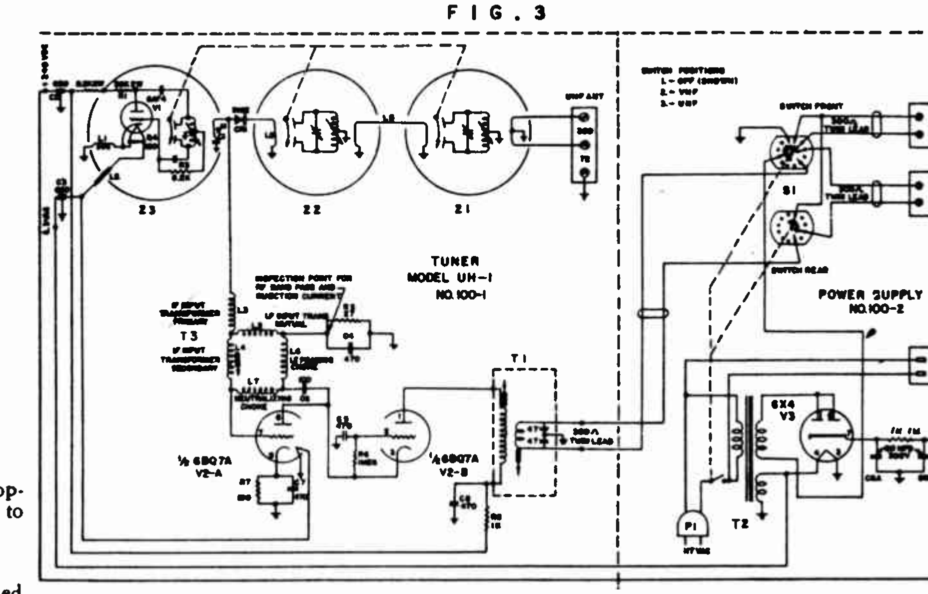
A tube change normally will not require realignment. However, be sure that all tubes are firmly seated in their sockets. This is especially true of the 6AF4 tube.

Component Replacement

All components, including those contained in the tuner compartment may be readily replaced. It is recommended, however, that where trouble is suspected in the tuner, either the entire converter or the tuner section be returned to the factory for retest.

Replacement parts may be ordered from the factory by using the symbol numbers given in Schematic, Figure 3, as well as the chassis serial number printed on rear tube label.

FIG. 3



REPLACEMENT PARTS

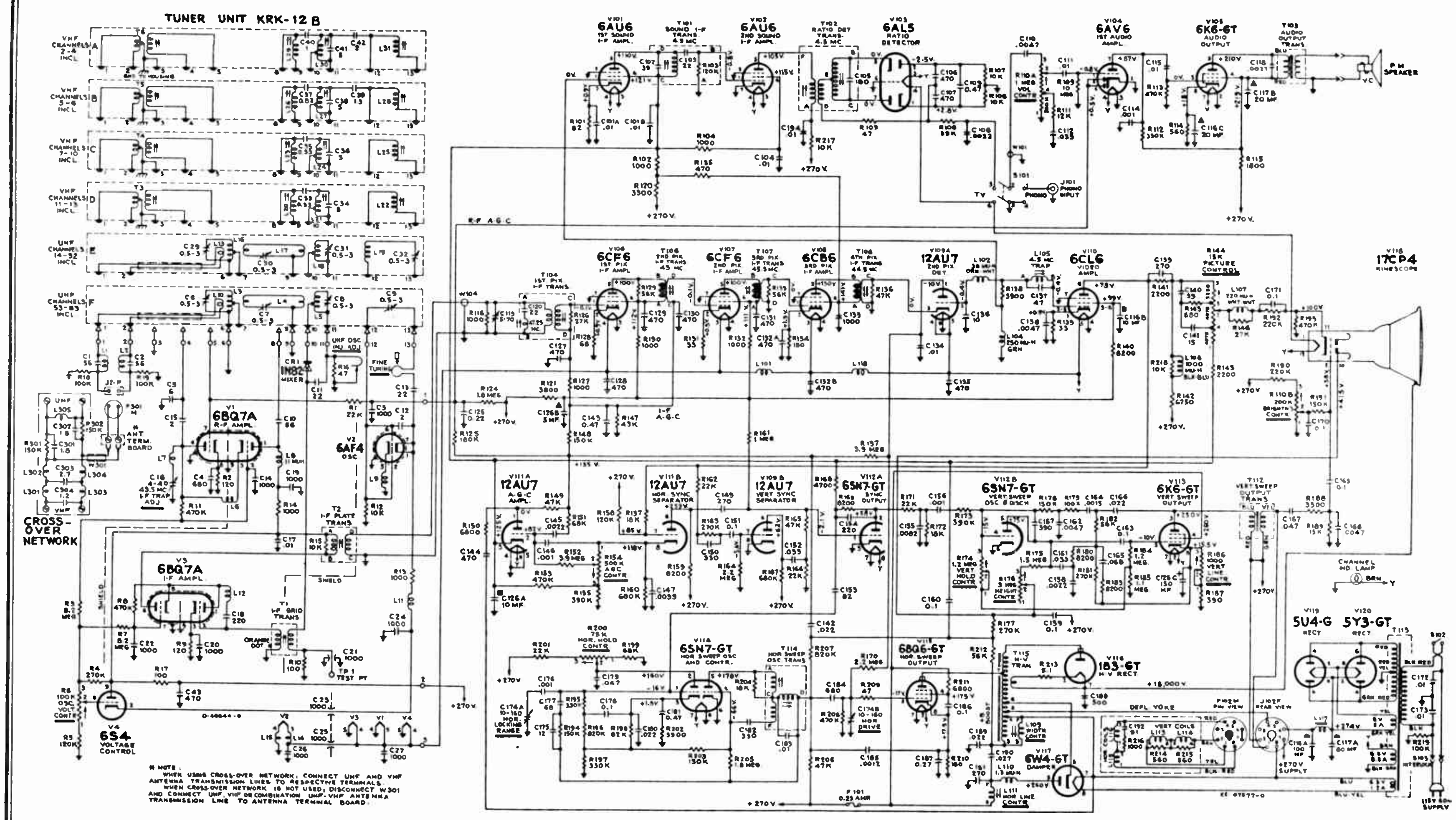
STOCK No.	DESCRIPTION
	RF UNIT ASSEMBLIES
	KRK29
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:
77151	0.8—3.0 mmf. (C11, C21, C25)
77913	0.8—3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:
77084	Feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, 0%, 500 volts (C29, C34, C35)
77252	1000 mmf., +100%, 0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., +100%, 0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K":
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef = -750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, headed-lead:
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31)
71503	3.3 mmf., ±20%, 500 volts (C32)
	Capacitor—Mica trimmer:
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r.f. plate coil (L20)
78224	Coil—Choke coil (.47 muh) (L27)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
76562	Coil—R.F. amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3).
76538	Coil—Shunt coil complete with adjustable core (L2)
	Resistor—Fixed, composition:
503015	15 ohms, ±10%, ½ watt (R19)
503039	39 ohms, ±10%, ½ watt (R18)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Convertor transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—IF trap
76542	Trap—IF trap (41.25 mc) complete with core (L1)
76541	Trap—IF trap (45.75 mc) complete with core (L4)
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C16)
	Capacitor—Ceramic:
77084	Feed-thru, 1000 mmf. (C21, C23, C25)
77615	Stand-off, 1000 mmf. (C3, C19, C24, C26)
	Capacitor—Fixed, ceramic, crystal holder, temp. coef. = -750
77621	22 mmf., ±10% (C11)

STOCK No.	DESCRIPTION
33098	10 mmf., ±1.0 mmf., 500 volts DC (C136)
33380	12 mmf., ±10%, 500 volts DC (C175)
39044	15 mmf., ±10%, 500 volts DC (C141)
73664	39 mmf., ±10%, 500 volts DC (C140)
	Capacitor—Fixed, mica:
76475	68 mmf., 1000 volts (C177)
76474	82 mmf., 1000 volts DC (C153)
39636	220 mmf., 500 volts DC (C154)
39638	270 mmf., 500 volts DC (C139)
76579	270 mmf., 1000 volts DC (C149, C191)
39640	330 mmf., 500 volts DC (C150)
76476	330 mmf., 1000 volts (C182)
73094	390 mmf., 1000 volts DC (C157)
39644	470 mmf., 500 volts DC (C106, C107)
	Capacitor—Ceramic:
76461	500 mmf., 20,000 volts (C188)
	Capacitor—fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, -0%, 500 volts DC (C127, C128, C129, C130, C131, C135, C196 for KCS78F)
77672	Dual 470 mmf., +100%, -0%, 500 volts DC (C132A, C132B)
77252	1000 mmf., +100%, 0%, 500 volts DC (C133)
73960	10,000 mmf., +100%, 0%, 500 volts DC (C104, C134, C194)
76991	Dual 10,000 mmf., +100%, -0%, 500 volts DC (C101A, C101B)
	Capacitor—Fixed, ceramic, insulated:
77673	470 mmf., ±10%, 1500 volts DC (C144)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
	CHASSIS ASSEMBLIES
	KCS 78F VHF Chassis
	KCS 78J UHF/VHF chassis
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
77489	Rectifier—Germanium rectifier IN82 (CR1)
	Resistor—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
78047	2 mmf., ±10%, 500 volts DC (C42)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
	Capacitor—Fixed, ceramic, High "K" disc:
77625	220 mmf., +100%, -0%, 500 volts DC (C18)
77293	470 mmf., +100%, -0%, 500 volts DC (C43)
77624	680 mmf., +100%, -0%, 500 volts DC (C4)
77252	1000 mmf., +100%, -0%, 500 volts DC (C14, C20, C22, C27)
73960	10,000 mmf., +100%, -0%, 500 volts DC (C17)
	Capacitor—Fixed, ceramic, insulated:
77667	Comprising: 1 section of 2 mmf., and 1 section of 22 mmf. (C12, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. -0
77210	2 mmf., ±0.25 mmf., 500 volts DC (C15)
77688	5 mmf., ±.5 mmf., 500 volts DC (C34, C36, C38, C41)
74182	6 mmf., ±0.5 mmf., 500 volts DC (C5)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
71924	56 mmf., ±10%, 500 volts DC (C10)
	Capacitor—Fixed, headed-lead type:
77691	.33 mmf., ±10%, 500 volts DC (C33, C35)
77689	.82 mmf., ±10%, 500 volts DC (C37)
77690	1.0 mmf., ±10%, 500 volts DC (C40)
71500	1.5 mmf., ±10%, 500 volts DC (C39)

STOCK No.	DESCRIPTION
	Capacitor—Mica trimmer:
71496	5-70 mmf. (C119)
75217	Dual 10-160 mmf. (C174A, C174B)
	Capacitor—Electrolytic:
75218	Comprising: 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C126A, C126B, C126C)
77644	Comprising: 1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C117A, C117B)
76970	Comprising: 1 section of 100 mfd., 400 volts, 1 section of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C116A, C116B, C116C)
	Capacitor—Fixed, tubular, paper, oil impregnated:
75643	.001 mfd., 1000 volts (C114, C146, C156, C176)
73595	.0022 mfd., 600 volts (C108, C145, C158)
73818	.0027 mfd., 1600 volts (C118)
73796	.0039 mfd., 600 volts (C147)
73920	.0047 mfd., 600 volts (C110, C138, C162, C168)
73808	.0082 mfd., 1000 volts (C155)
73561	.01 mfd., 400 volts (C111, C115)
73562	.022 mfd., 400 volts (C180)
73798	.022 mfd., 600 volts (C166)
73810	.022 mfd., 1000 volts (C142, C189)
73811	.027 mfd., 1000 volts (C190)
73552	.033 mfd., 400 volts (C112, C152)
73596	.033 mfd., 1000 volts (C161)
73553	.047 mfd., 400 volts (C179)
73592	.047 mfd., 600 volts (C167)
73792	.068 mfd., 400 volts (C165)
73784	0.1 mfd., 200 volts (C171)
73551	0.1 mfd., 400 volts (C151, C159, C169, C170, C178)
73557	0.1 mfd., 600 volts (C160, C163, C186)
73794	0.22 mfd., 400 volts (C125)
73786	0.27 mfd, 200 volts (C187)
73787	0.47 mfd., 200 volts (C109, C143, C181)
	Capacitor—Fixed, tubular, moulded, oil impregnated:
76479	.00068 mfd., 600 volts (C184)
76995	.0012 mfd., 600 volts (C185)
77123	.0015 mfd., 1000 volts (C164)
73594	.01 mfd., 600 volts (C172, C173, C183)
77676	Choke—Filter choke (L117)
73477	Coil—Choke coil (L101, L118)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
76011	Coil—Peaking coil (36 muh) (L102)
77925	Coil—Peaking coil (220 muh) (L107, R146)
71526	Coil—Peaking coil (250 muh) (L104)
77124	Coil—Peaking coil (1000 muh) (L106, R218)
76640	Coil—RF choke coil (1.5 muh) (L110)
76441	Coil—Width coil complete with adjustable core (L109)
76975	Control—AGC control (R154)
77641	Control—Brightness control, volume control and power switch (R110A, R110B, S102)
77924	Control—Height control (R176)
77639	Control—Horizontal hold control (R200)
76445	Control—Picture control (R144)
77642	Control—Vertical hold control (R174)
77643	Control—Vertical linearity control (R186)
	Resistor—Wire wound:
76796	5.1 ohms, 1/3 watt (R213)
76639	180 ohms, 2 watts (R210)
77670	3300 ohms, 7 watts (R120)
77671	3800 ohms, 7 watts (R121)
76642	6750 ohms, 10 watts (R142)
	Resistor—Fixed, composition:
30789	33 ohms, ±5%, ½ watt (R131)
503033	33 ohms, ±10%, ½ watt (R139)
503047	47 ohms, ±10%, ½ watt (R105, R209)
34763	68 ohms, ±5%, ½ watt (R128)
503082	82 ohms, ±10%, ½ watt (R101)
502118	180 ohms, ±5%, ½ watt (R134)
503139	390 ohms, ±10%, ½ watt (R187)
503147	470 ohms, ±10%, ½ watt (R135)
513156	560 ohms, ±10%, 1 watt (R114)
503168	680 ohms, ±10%, ½ watt (R143)
503210	1000 ohms, ±10%, ½ watt (R104, R116, R127, R130, R132)
513210	1000 ohms, ±10%, 1 watt (R02)
523218	1800 ohms, ±10%, 2 watts (R115)
503222	2200 ohms, ±10%, ½ watt (R145)
523222	2200 ohms, ±10%, 2 watts (R141)
503233	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R138)
503239	3900 ohms, ±10%, ½ watt (R202)

STOCK No.	DESCRIPTION
502247	4700 ohms, ±5%, ½ watt (R168)
513268	6800 ohms, ±10%, 1 watt (R150)
523268	6800 ohms, ±10%, 2 watts (R211)
503282	8200 ohms, ±10% ½ watt (R159, R169, R180, R183)
523282	8200 ohms, ±10%, 2 watts (R140)
502310	10,000 ohms, ±5%, ½ watt (R107, R108)
513310	10,000 ohms, ±10%, 1 watt (R217)
503312	12,000 ohms, ±10%, ½ watt (R111)
503315	15,000 ohms, ±10%, ½ watt (R189)
503318	18,000 ohms, ±10%, ½ watt (R157, R172, R204)
503322	22,000 ohms, ±10%, ½ watt (R162, R166, R171, R201)
503339	39,000 ohms, ±10%, ½ watt (R106)
70351	43,000 ohms, ±5%, ½ watt (R147)
503347	47,000 ohms, ±10%, ½ watt (R136, R149, R165)
512347	47,000 ohms, ±5%, 1 watt (R206)
502356	56,000 ohms, ±5%, ½ watt (R129, R133)
503356	56,000 ohms, ±10%, ½ watt (R212)
512356	56,000 ohms, ±5%, 1 watt (R182)
503368	68,000 ohms, ±10%, ½ watt (R151, R199)
503382	82,000 ohms, ±10%, ½ watt (R198)
513410	100,000 ohms, ±10%, 1 watt (R179, R219)
503412	120,000 ohms, ±10%, ½ watt (R158)
502415	150,000 ohms, ±5%, ½ watt (R148)
503415	150,000 ohms, ±10%, ½ watt (R178, R191, R194)
512415	150,000 ohms, ±5%, 1 watt (R203)
502418	180,000 ohms, ±5%, ½ watt (R125)
503422	220,000 ohms, ±10%, ½ watt (R190, R192)
502427	270,000 ohms, ±5%, ½ watt (R181)
503427	270,000 ohms, ±10%, ½ watt (R163, R177)
503433	330,000 ohms, ±10%, ½ watt (R112, R195, R197)
503439	390,000 ohms, ±10%, ½ watt (R155, R173)
503447	470,000 ohms, ±10%, ½ watt (R113, R153, R193, R208)
503468	680,000 ohms, ±10%, ½ watt (R160, R167)
503482	820,000 ohms, ±10%, ½ watt (R196, R207)
503510	1 megohm, ±10%, ½ watt (R161)
502511	1.1 megohm, ±5%, ½ watt (R185)
503512	1.2 megohms, ±10%, ½ watt (R184)
503515	1.5 megohm, ±10%, ½ watt (R175)
11769	1.8 megohm, ±5%, ½ watt (R124, R205)
503522	2.2 megohm, ±10%, ½ watt (R164, R170)
503539	3.9 megohm, ±10%, ½ watt (R137, R152)
503610	10 megohm, ±10%, ½ watt (R109)
76795	Transformer—Hi-voltage transformer (T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable core (T114)
76982	Transformer—Output transformer (T103)
77635	Transformer—Power transformer, 117 volts, 60 cycle (T113)
77112	Transformer—Ratio detector transformer (T102, C105)
76981	Transformer—Sound I.F. transformer complete with adjustable cores (T101, C102, C103, R103)
77636	Transformer—Vertical output transformer (T112)
77637	Transformer—1st pix I.F. transformer complete with adjustable cores (T104, C120, R126)
77638	Transformer—2nd pix I.F. transformer complete with adjustable core (T106)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
76983	Trap—4.5 MC trap (L105, C137)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)
	SPEAKER ASSEMBLIES 971636-1W RL101C5 RMA 274 (For Model 17T352U)
77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971490-3W 971490-3R RL105E6 RMA-274 RMA-285 (For Models 17T361, 17T361U)
75024	Cone—Cone and voice coil (3.2 ohms) for speaker stamped 971490 3W
77129	Cone—Cone and voice coil (3.2 ohms) for speaker stamped 971490 3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

CIRCUIT SCHEMATIC DIAGRAM KCS78J



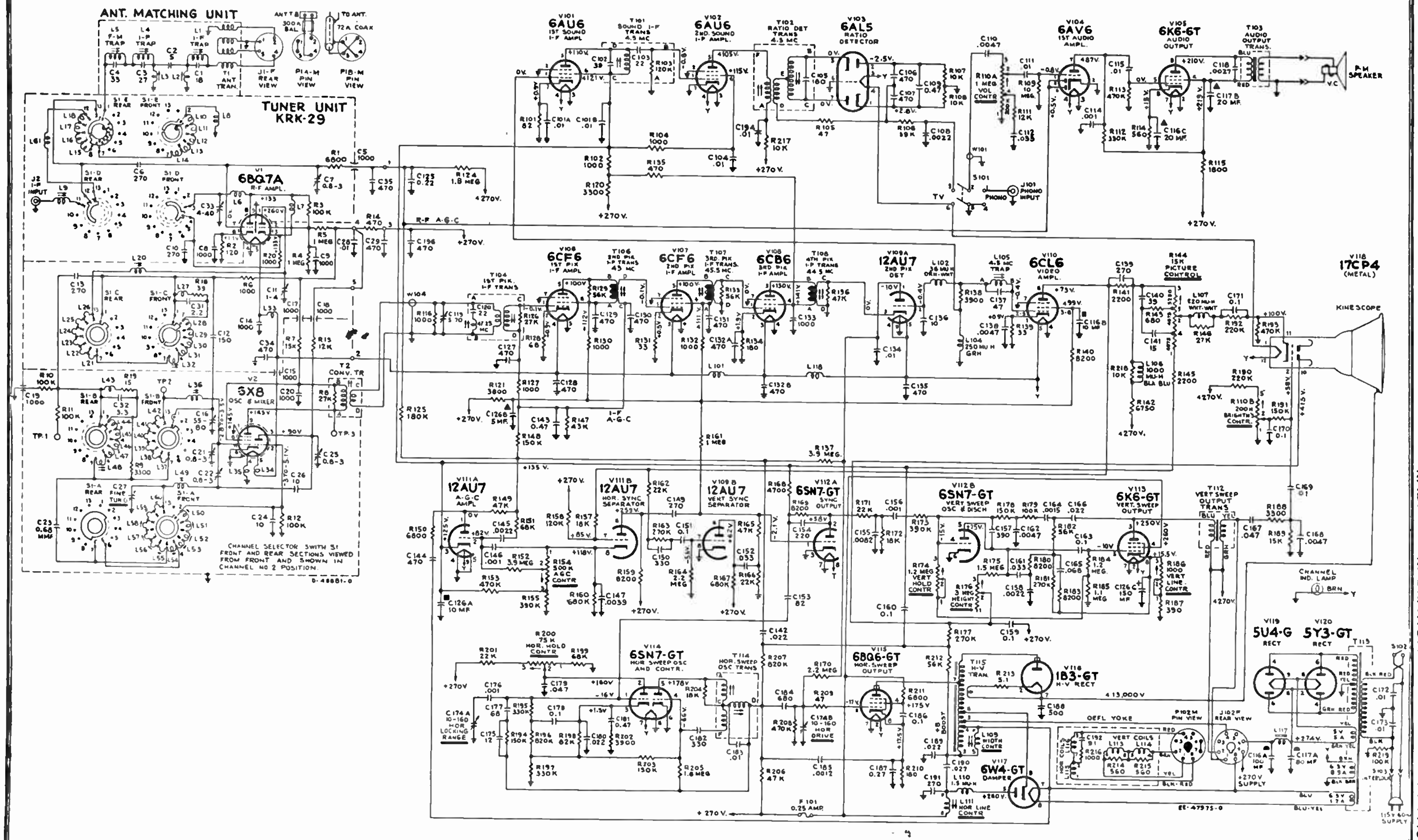
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 28—Circuit Schematic Diagram, KCS78J



All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 27—Circuit Schematic Diagram KCS78F

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 Volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1 KRK29	6BQ7A	R-F Amplifier	15000 Mu. V Signal	6	170	—	—	8	0.1	7	—	
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2		
V2 KRK29	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V1 KRK12B	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	
			No Signal	6	138	—	—	8	1.0	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	260	—	—	3	143	2	97	
			No Signal	1	250	—	—	3	137	2	97	
V2 KRK12B	6AF4	R-F Oscillator	15000 Mu. V. Signal	1 & 7	78	—	—	5	0	2 & 6	−8	
			No Signal	1 & 7	75	—	—	5	0	2 & 6	−6	
V3 KRK12B	6BQ7A	I-F Amplifier	15000 Mu. V. Signal	6	270	—	—	8	148	7	103	
			No Signal	6	260	—	—	8	142	7	99	
		I-F Amplifier	15000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	
			No Signal	1	143	—	—	3	1.2	2	0	
V4 KRK12B	6S4	Voltage Control	15000 Mu. V. Signal	9	270	—	—	2	94	6	*68	*Depends on adjustment of R6
			No Signal	9	260	—	—	2	90	6	*65	
V101	6AU8	1st Sound I-F Amp.	15000 Mu. V. Signal	5	127	6	140	7	1.0	1	0	
			No Signal	5	110	6	121	7	.9	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	125	6	138	7	0	1	−13	
			No Signal	5	105	6	118	7	0	1	*−0.8	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	0.3	—	—	1	7.2	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	0	—	—	1	*2.6	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	89	—	—	2	0	1	−0.6	At min. volume
			No Signal	7	87	—	—	2	0	1	−0.6	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	217	4	225	6	15.2	5	0	At min. volume
			No Signal	3	210	4	219	8	15.0	5	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	202	6	225	2	−0.1	1	−7.5	
			No Signal	5	100	6	112	2	0.9	1	*−0.1	*Unreliable measuring point Make measurement at T104-B
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	205	6	225	2	−0.1	1	−7.5	
			No Signal	5	100	6	111	2	0.5	1	−0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	140	8	155	2	2.1	1	0	
			No Signal	5	130	8	141	2	1.9	1	0	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	−21	—	—	3	0	2	−3.8	
			No Signal	1	−10	—	—	3	0	2	−0.4	
V109B	12AU7	Vert. Sync. Separator	15000 Mu. V. Signal	8	68	—	—	8	0	7	58	
			No Signal	6	62	—	—	8	0	7	−5.6	
V110	6CL6	Video Amplifier	15000 Mu. V. Signal	6	82	3-8	180	1	1.1	2-9	−3.4	AGC control set for normal operation
			No Signal	6	73	3-8	99	1	0.9	2-9	−0.4	AGC control set for normal operation
V111A	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	42	—	—	3	148	2	115	
			No Signal	1	0	—	—	3	125	2	82	
V111B	12AU7	Hor. Sync. Separator	15000 Mu. V. Signal	6	267	—	—	8	171	7	101	
			No Signal	6	259	—	—	8	118	7	85	
V112A	6SN7GT	Sync. Output	15000 Mu. V. Signal	1	60	—	—	3	0	2	−2.7	
			No Signal	1	58	—	—	3	0	2	−2.1	
V112B	6SN7GT	Vertical Oscillator & Discharge	15000 Mu. V. Signal	6	76	—	—	8	0	7	−16	Depends on setting of Vert. hold control
			No Signal	6	75	—	—	8	0	7	−15	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	260	4	270	8	15.9	5	−11	
			No Signal	3	250	4	260	8	15.5	5	−10	
V114A	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	172	—	—	3	−2.2	1	−25	
			No Signal	2	160	—	—	3	1.5	1	−16	
V114B	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	180	—	—	6	0	4	−74	
			No Signal	5	178	—	—	6	0	4	−66	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	180	6	18	5	−17.5	*High Voltage Pulse Present
			No Signal	Cap	*	4	175	6	17.5	5	−17	*High Voltage Pulse Present
V116	1B3GT 8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	14,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	13,000	—	—	*High Voltage Pulse Present
V117	6W4GT	Damper	15000 Mu. V. Signal	5	270	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	260	—	—	3	*	—	—	*High Voltage Pulse Present
V118	21AP4	Kinescope	15000 Mu. V. Signal	Cap	14,000	10	430	11	120	2	76	At average Brightness
			No Signal	Cap	13,000	10	415	11	100	2	58	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 6	285	—	—	
			No Signal	4 & 6	—	—	—	2 & 6	274	—	—	

ALIGNMENT DATA

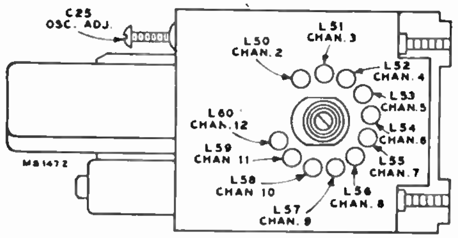


Figure 16—KRK29 R-F Oscillator Adjustments

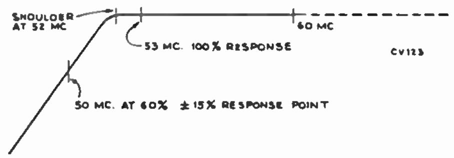


Figure 19—KRK29 Antenna Matching Unit Response

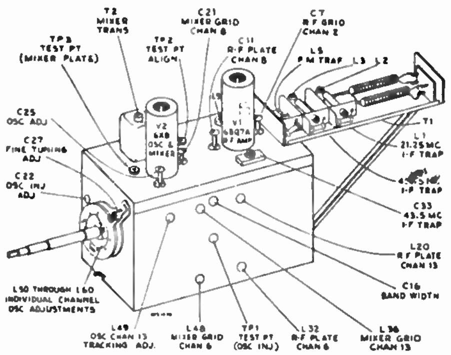


Figure 17—KRK29 Tuner Adjustments

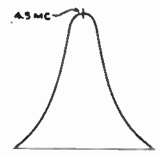


Figure 20
Sound I-F
Response

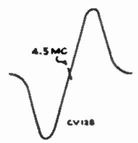


Figure 21
Ratio Det.
Response

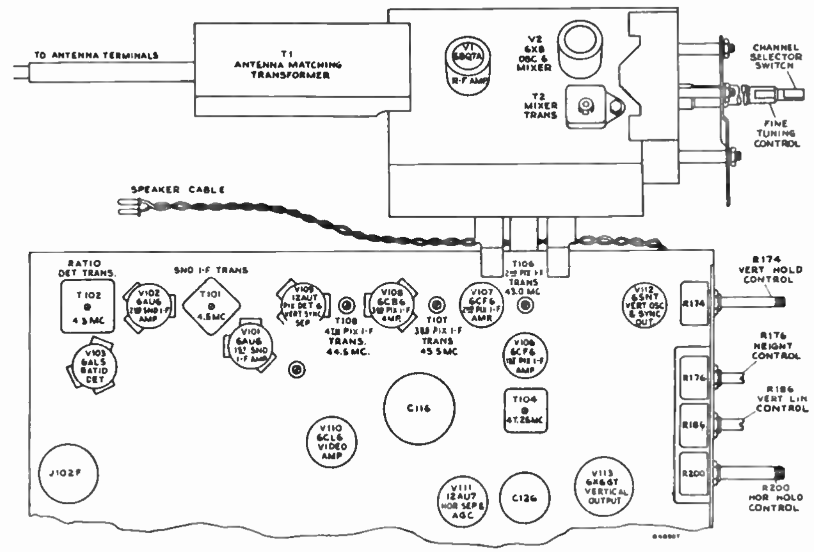


Figure 25—Top Chassis Adjustments (KRK29 Tuner Shown)

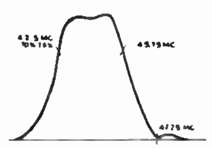


Figure 22
KRK29 T2 and T104
Response

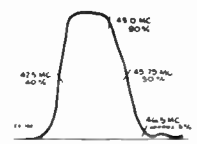
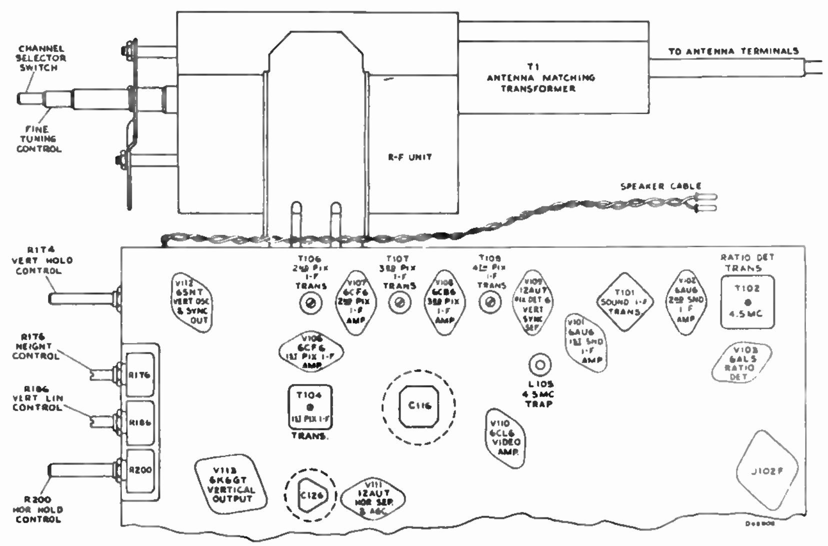


Figure 23
Over-all I-F Response
with KRK29



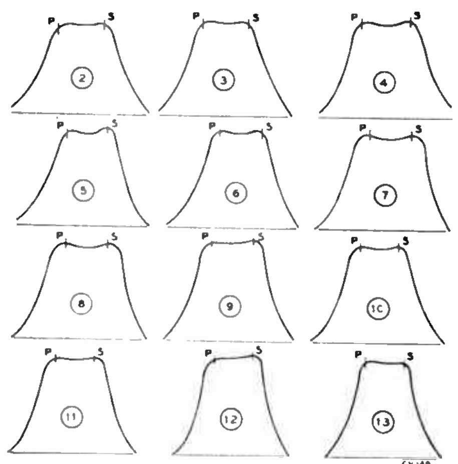


Figure 18—KRK29 R-F Response

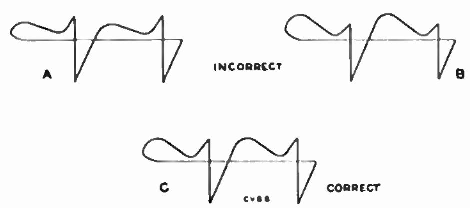


Figure 24—Horizontal Oscillator Wave Forms

Figure 26—Bottom Chassis Adjustments (KRK29 Tuner Shown)

ALIGNMENT PROCEDURE

Connect the potentiometer arm of the second bias supply to the junction of R147 and R148, and ground the positive battery terminal. Adjust the bias potentiometer to produce − 5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to the junction of R138 and L105. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used.

Set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Fig. 14.

Set the UHF marker gen. to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt D.C. scale.

Set oscillator injection adjustment to read .1 volts on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it cannot be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R200, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 24. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counterclockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

ALIGNMENT DATA

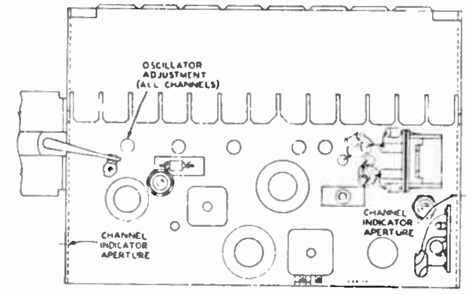


Figure 8—KRK12B Oscillator Adjustment

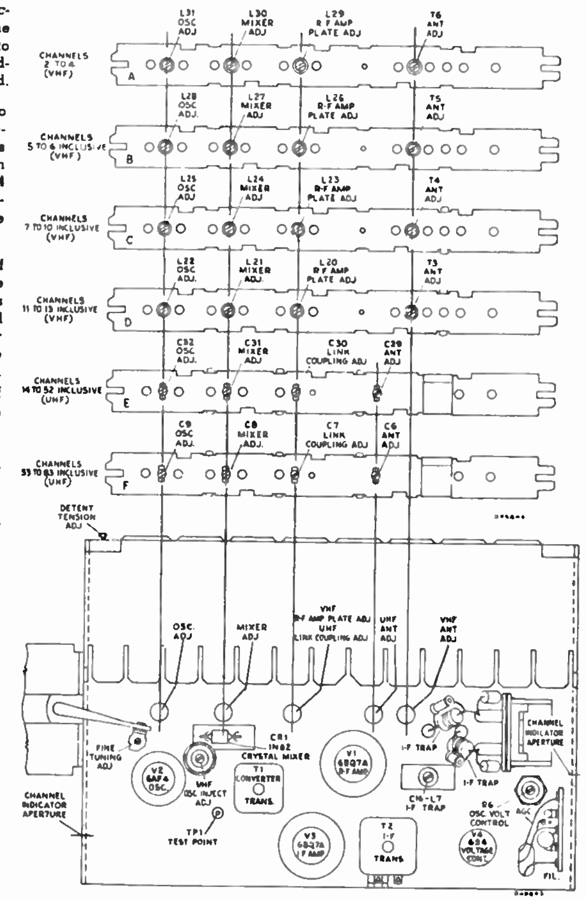


Figure 9—KRK12B Tuner Adjustments

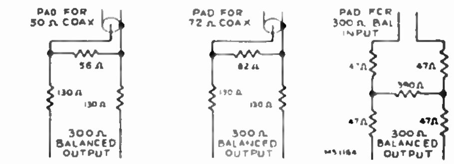


Figure 10—Sweep Attenuator Pads

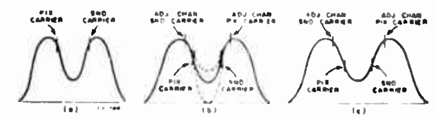


Figure 11—KRK12B VHF Insert Responses

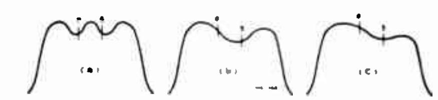


Figure 12—KRK12B UHF Insert Responses

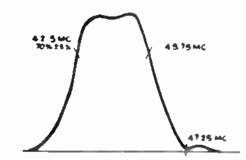


Figure 13 KRK12B T2 and T104 Response

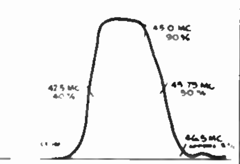


Figure 14 Over-all I-F Response with KRK12B

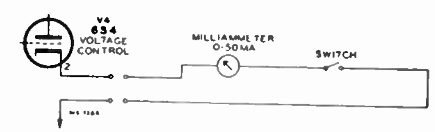


Figure 15—KRK12B Voltage Control Adapter

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 10 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12B TUNER ALIGNMENT

Models 17-T-352U & 17-T-361U

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier, if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L130 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 11. The proper curve shape is shown in Figure 11(b). (See note on page 13 for detailed explanation of adjustments.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R147 and R148, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to the junction of R138 and L105. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to Channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust UHF antenna link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 12. The curve shape will usually vary from Fig. 12 (a) to Fig. 12 (c) going higher in frequency, however any of these responses are acceptable.

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

ALIGNMENT PROCEDURE

NOTE ON KRK12B TUNER ALIGNMENT.—**The use of a crystal mixer makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in Figure 11 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in Figure 11 (b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in Figure 11(a) and 11(c).**

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1, but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12B Tuner. Wiring of adapter is shown in Figure 15.

KRK29 ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R127 and R148. Set the potentiometer to produce approximately –5.0 volts of bias at the junction of R127 and R148.

Connect an oscilloscope to pin 2, V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 10 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in figure 19. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Model 17-T-361

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R147 and R148 and to ground.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction of R147 and R148.

Set the bias to produce approximately —5.0 volt of bias at the junction of R147 and R148.

Connect the "VoltOhmyst" to the juncture of R138 and L105 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst". During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138, L105 with minus 5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R138, L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	T104 top core

Models 17-T-352U & 17-T-361U

Connect the "VoltOhmyst" to the junction of R147 and R148 and to ground.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R147 and R148. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst".

Connect the "VoltOhmyst" to the junction of R138 and L105 and to ground.

Connect the output of the signal generator to the front terminal of the crystal mixer in series with a 1500 mmf ceramic capacitor.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138, L105 with —5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R138, L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	T104 top core

SWEEP ALIGNMENT OF PIX I-F.—

Model 17-T-361

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C119 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (bottom) for maximum gain and with 45.75 mc. at 70% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C119 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 22.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R138 and L105.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in figure 23.

Models 17-T-352U & 17-T-361U

To align the crystal mixer plate circuit, T2 and T104 connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1500 mmf ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C119 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Fig. 13.

Disconnect the diode probe, the 180 ohm and the two 330 ohm resistors.

Connect the oscilloscope to the junction of R138 and L105.

Adjust the bias potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148.

Leave the sweep generator connected to the front terminal of the 1N82 crystal holder with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 14.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK29 TUNER ALIGNMENT

Model 17-T-361

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver chânnel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

CHASSIS TOP VIEW

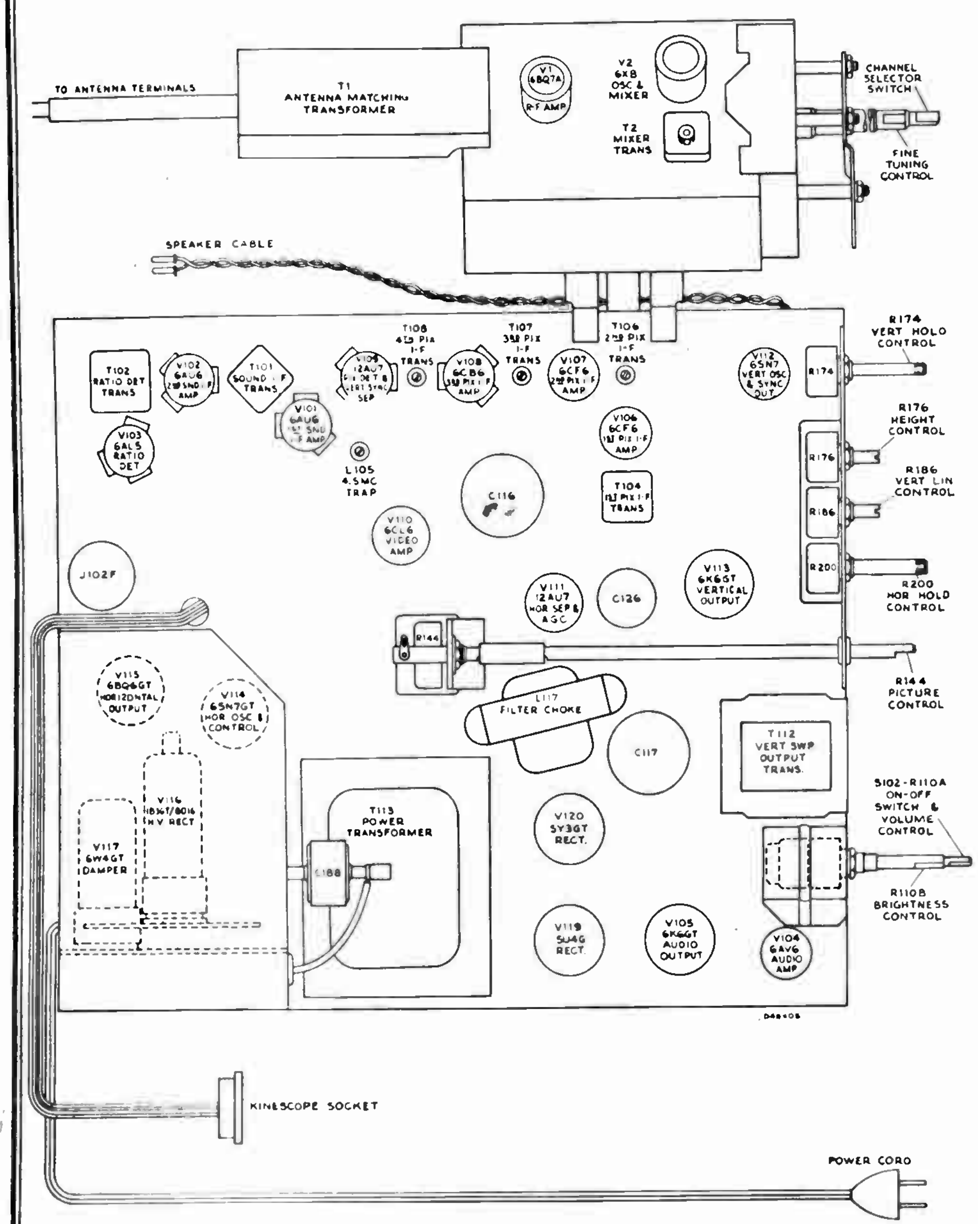


Figure 6—Chassis Top View (shown with KRK29 Tuner)

CHASSIS BOTTOM VIEW

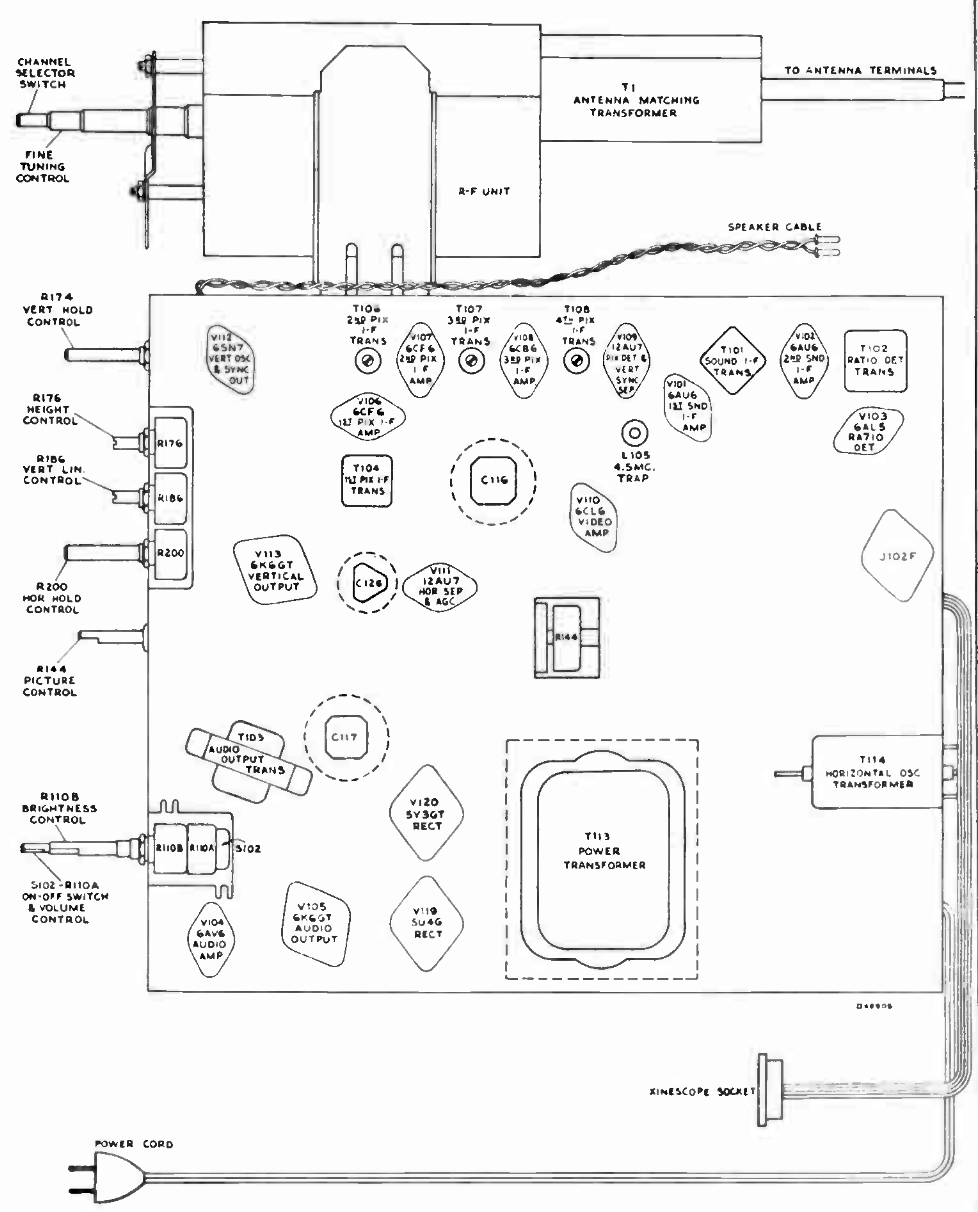


Figure 7—Chassis Bottom View (shown with KRK29 Tuner)

Model 17-T-352U
"Hayes"
Metal-Mahogany Grain

Models 17-T-361, 17-T-361U
"Highland"
Mahogany, Oak

GENERAL DESCRIPTION

Models 17-T-352U, 17-T-361 and 17-T-361U are "17 inch" television receivers. Models 17-T-352U and 17-T-361U are identical except for cabinets, and speakers. Model 17-T-361 has full 12 channel VHF coverage. Models 17-T-352U and 17-T-361U feature full 12 channel VHF coverage plus any 4 UHF channels desired.

All models include intercarrier FM system; ratio detector; improved picture brilliance; pulsed picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; improved sync separator (3.5 mc. band width for picture channel); and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE 146 square inches on a 17CP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Model 17-T-361

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 17-T-352U & 17-T-361U

Any of 70 UHF channels .... 470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency .... 45.75 mc.
Sound I-F Carrier Frequency .... 41.25 mc.

POWER RATING .... 17-T-361-215 watts
17-T-352U & 17-T-361U-230 watts

AUDIO POWER OUTPUT RATING .... 4 watts max.

VIDEO RESPONSE .... To 3.5 mc.

SWEEP DEFLECTION .... Magnetic

FOCUS .... Magnetic

ANTENNA INPUT IMPEDANCE

Model 17-T-361

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 17-T-352U & 17-T-361U

UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29 (17-T-361)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK12B (17-T-352U & 17-T-361U)	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control

A 1N82 crystal is used as a mixer.

Tube Used	Function
All Models	
(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Detector and Vert. Sync. Sep.
(5) RCA 6CL6	Video Amplifier
(6) RCA 6AU6	1st Sound I-F Amplifier
(7) RCA 6AU6	2nd Sound I-F Amplifier
(8) RCA 6AL5	Ratio Detector
(9) RCA 6AV6	1st Audio Amplifier
(10) RCA 6K6GT	Audio Output
(11) RCA 12AU7	Horiz. Sync. Sep. & AGC
(12) RCA 6SN7GT	Vertical Osc. & Sync. Output
(13) RCA 6K6GT	Vertical Sweep Output
(14) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(15) RCA 6BQ6GT	Horizontal Sweep Output
(16) RCA 6W4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
(18) RCA 17CP4	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

ELECTRICAL AND MECHANICAL SPECIFICATIONS (cont'd)

CHASSIS DESIGNATIONS

KCS78F Model 17-T-361 employing a KRK29 Tuner.
KCS78J Models 17-T-352U and 17-T-361U employing a KRK12B Tuner.

WEIGHT & DIMENSIONS

Model		Shipping Weight	Width Inches	Height Inches	Depth Inches
17-T-352U	88 lbs.	105 lbs.	21½	22¾	22
17-T-361	87 lbs.	112 lbs.	24¼	35¾	22
17-T-361U	92 lbs.	117 lbs.	24¼	35¾	22

LOUDSPEAKERS

Model 17-T-352U ..... (971636-1) 5" PM Dynamic, 3.2 ohms
Model 17-T-361 ...... (971490-3) 8" PM Dynamic, 3.2 ohms
Model 17-T-361U ..... (971490-3) 8" PM Dynamic, 3.2 ohms

SCANNING .... Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY .... 15,750 cps

VERTICAL SWEEP FREQUENCY .... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) ..... 30 cps

OPERATING CONTROLS (Front)

Control	
Channel Selector / Fine Tuning	Dual Control Knobs
Picture	Single Control under Panel
Picture Horizontal Hold	Single Control under Panel
Picture Vertical Hold	Single Control under Panel
Sound Volume and On-Off Switch / Brightness	Dual Control Knobs

NON-OPERATING CONTROLS (under Front Panel)

Control	
Height	screwdriver adjustment
Vertical Linearity	screwdriver adjustment

NON-OPERATING CONTROLS (not including R-F and I-F adjustments)

Control	
Picture Centering	top chassis adjustment
Width	rear chassis adjustment
Horizontal Drive	rear chassis screwdriver adjustment
Horizontal Linearity	rear chassis adjustment
Horizontal Oscillator Frequency	rear chassis adjustment
Horizontal Oscillator Waveform	bottom chassis adjustment
Horizontal Locking Range	rear chassis adjustment
Focus	top chassis adjustment
Ion Trap Magnet	top chassis adjustment
Deflection Coil	top chassis wing nut adjustment
AGC Control	rear chassis adjustment

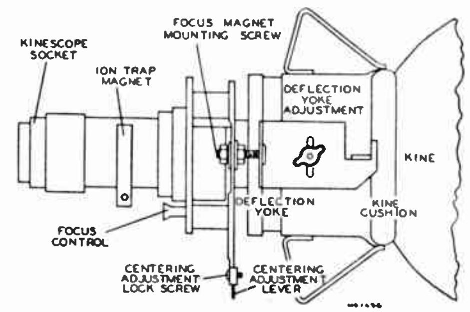


Figure 2—Yoke and Focus Magnet Adjustments

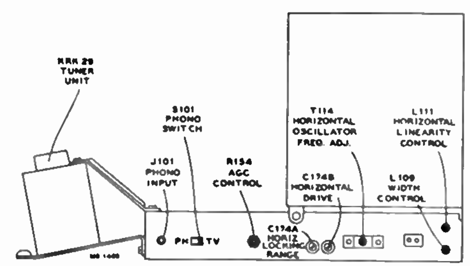


Figure 3—Rear Chassis Adjustments

CHASSIS TOP VIEW

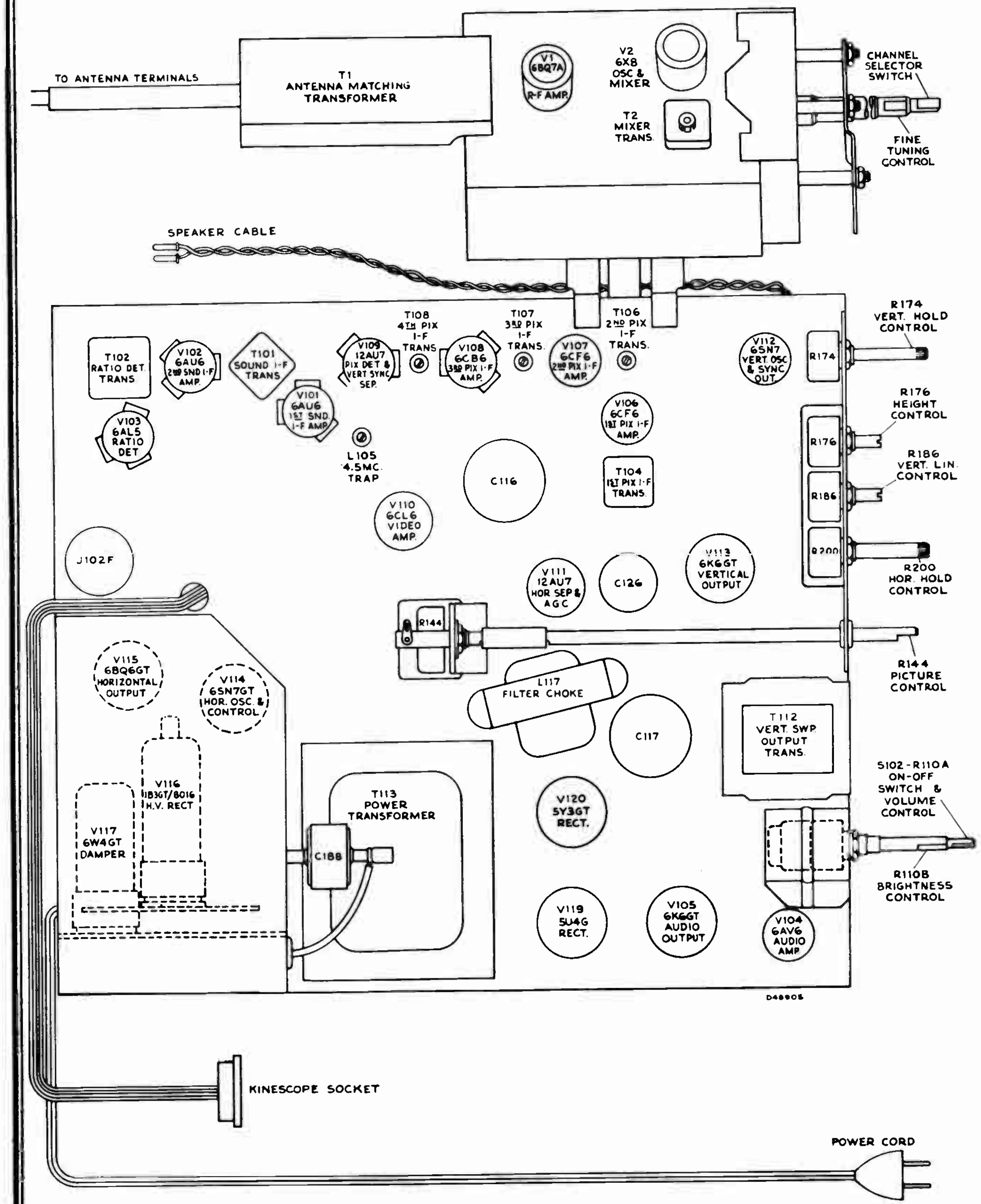


Figure 6—Chassis Top View (shown with KRK29 Tuner)

CHASSIS BOTTOM VIEW

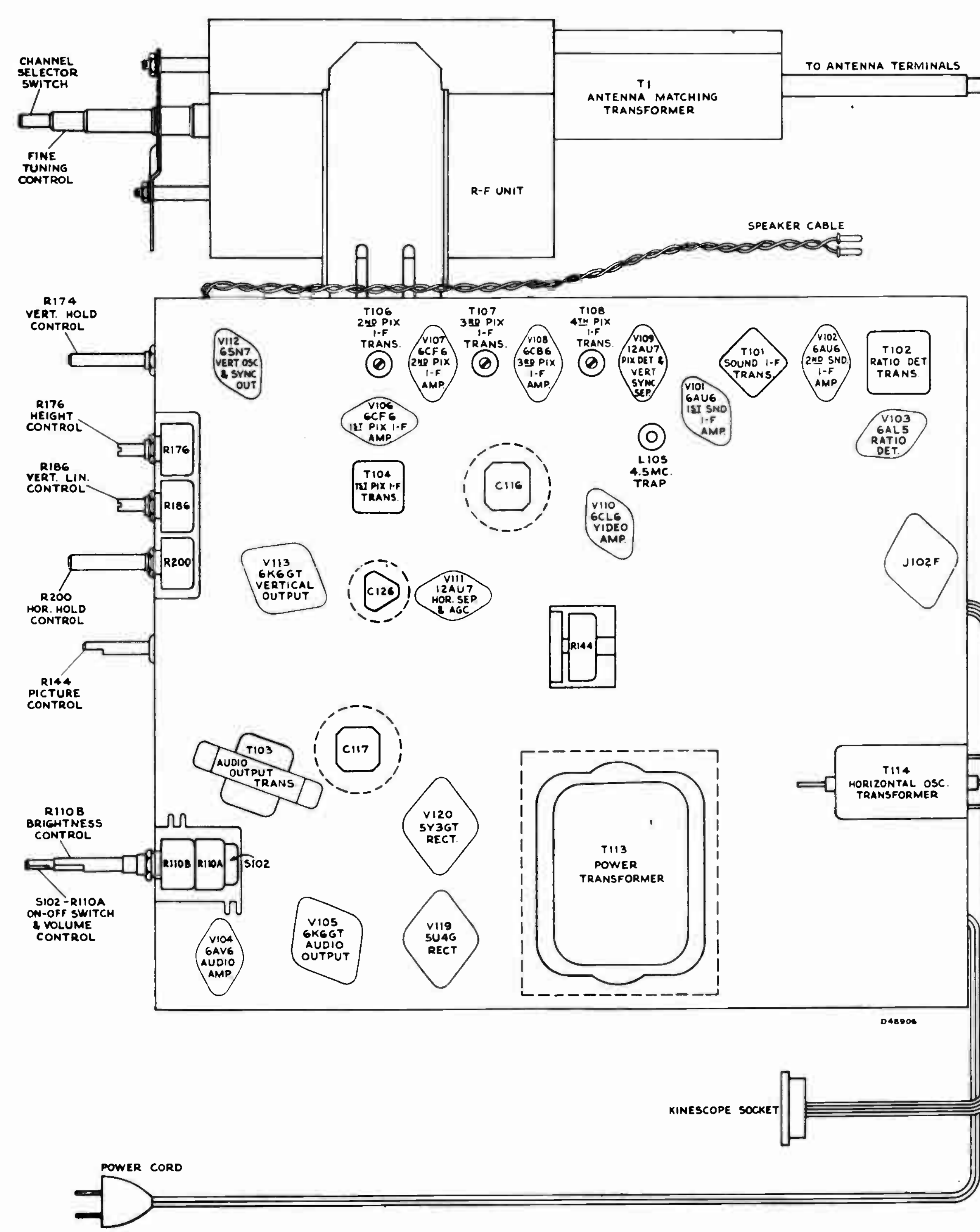


Figure 7—Chassis Bottom View (shown with KRK29 Tuner)

ALIGNMENT PROCEDURE

NOTE ON KRK12B TUNER ALIGNMENT.—The use of a crystal mixer makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in Figure 11 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in Figure 11 (b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in Figure 11(a) and 11(c).

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1, but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
 35 to 90 mc., 1 mc. to 12 mc. sweep width
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(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
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(b) Radio frequencies

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12B Tuner. Wiring of adapter is shown in Figure 15.

KRK29 ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R127 and R148. Set the potentiometer to produce approximately –5.0 volts of bias at the junction of R127 and R148.

Connect an oscilloscope to pin 2, V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 10 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in figure 19. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Model 17-T-361

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R147 and R148 and to ground.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction of R147 and R148.

Set the bias to produce approximately —5.0 volt of bias at the junction of R147 and R148.

Connect the "VoltOhmyst" to the juncture of R138 and L105 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst". During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138, L105 with minus 5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R138, L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. .... T104 top core

Models 17-T-352U & 17-T-361U

Connect the "VoltOhmyst" to the junction of R147 and R148 and to ground.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R147 and R148. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst".

Connect the "VoltOhmyst" to the junction of R138 and L105 and to ground.

Connect the output of the signal generator to the front terminal of the crystal mixer in series with a 1500 mmf ceramic capacitor.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138, L105 with —5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R138, L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. .... T104 top core

SWEEP ALIGNMENT OF PIX I-F.—

Model 17-T-361

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C119 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (bottom) for maximum gain and with 45.75 mc. at 70% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C119 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 22.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R138 and L105.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in figure 23.

Models 17-T-352U & 17-T-361U

To align the crystal mixer plate circuit, T2 and T104 connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1500 mmf ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C119 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Fig. 13.

Disconnect the diode probe, the 180 ohm and the two 330 ohm resistors.

Connect the oscilloscope to the junction of R138 and L105.

Adjust the bias potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148.

Leave the sweep generator connected to the front terminal of the 1N82 crystal holder with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 14.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK29 TUNER ALIGNMENT

Model 17-T-361

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 10 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12B TUNER ALIGNMENT

Models 17-T-352U & 17-T-361U

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier, if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L130 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 11. The proper curve shape is shown in Figure 11(b). (See note on page 13 for detailed explanation of adjustments.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R147 and R148, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to the junction of R138 and L105. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to Channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust UHF antenna link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 12. The curve shape will usually vary from Fig. 12 (a) to Fig. 12 (c) going higher in frequency, however any of these responses are acceptable.

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

ALIGNMENT PROCEDURE

Connect the potentiometer arm of the second bias supply to the junction of R147 and R148, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to the junction of R138 and L105. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used.

Set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Fig. 14.

Set the UHF marker gen. to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt D.C. scale.

Set oscillator injection adjustment to read .1 volts on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it cannot be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R200, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 24. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counterclockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

ALIGNMENT DATA

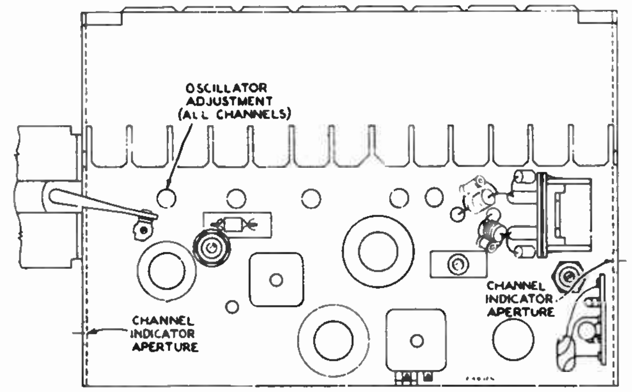


Figure 8—KRK12B Oscillator Adjustment

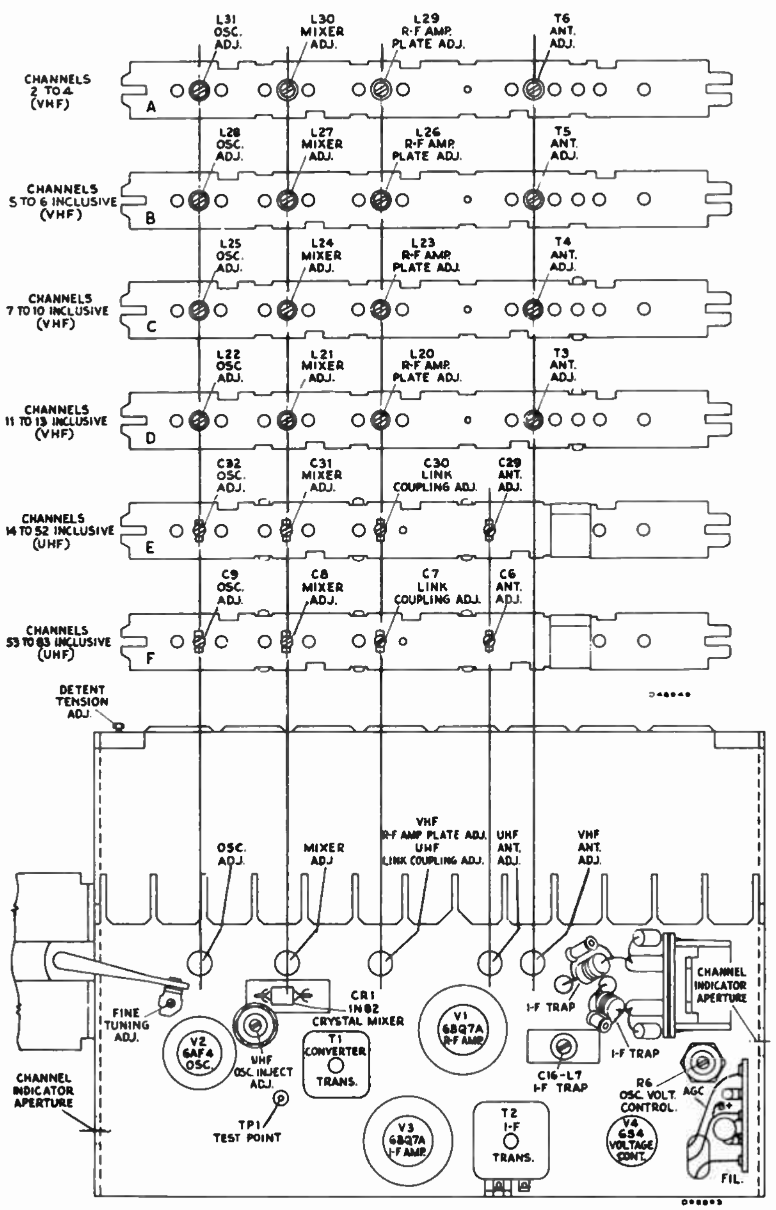


Figure 9—KRK12B Tuner Adjustments

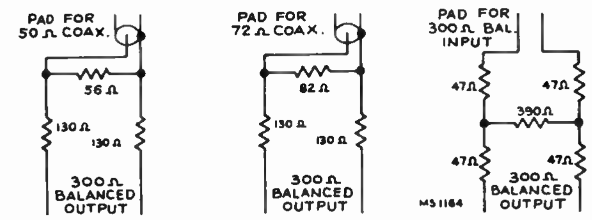


Figure 10—Sweep Attenuator Pads

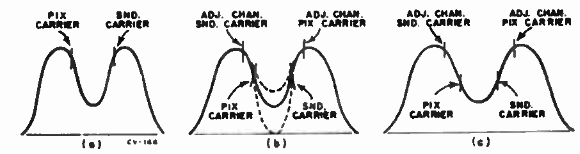


Figure 11—KRK12B VHF Insert Responses

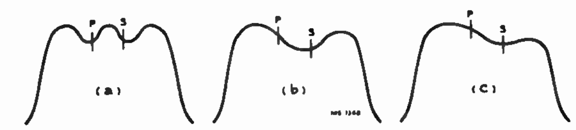


Figure 12—KRK12B UHF Insert Responses

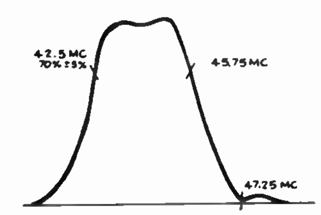


Figure 13 KRK12B T2 and T104 Response

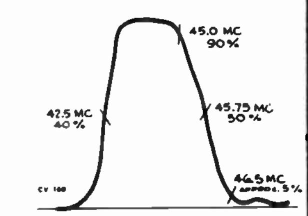


Figure 14 Over-all I-F Response with KRK12B

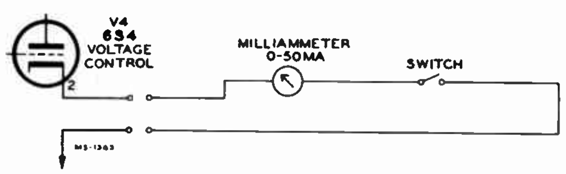


Figure 15—KRK12B Voltage Control Adapter

ALIGNMENT DATA

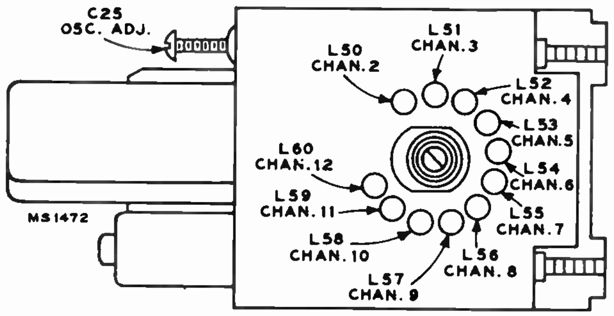


Figure 16—KRK29 R-F Oscillator Adjustments

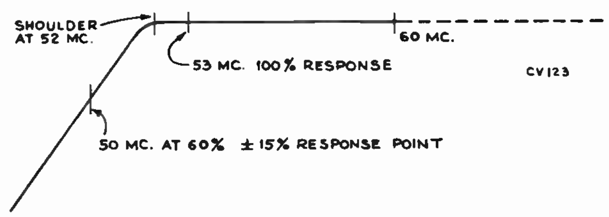


Figure 19—KRK29 Antenna Matching Unit Response

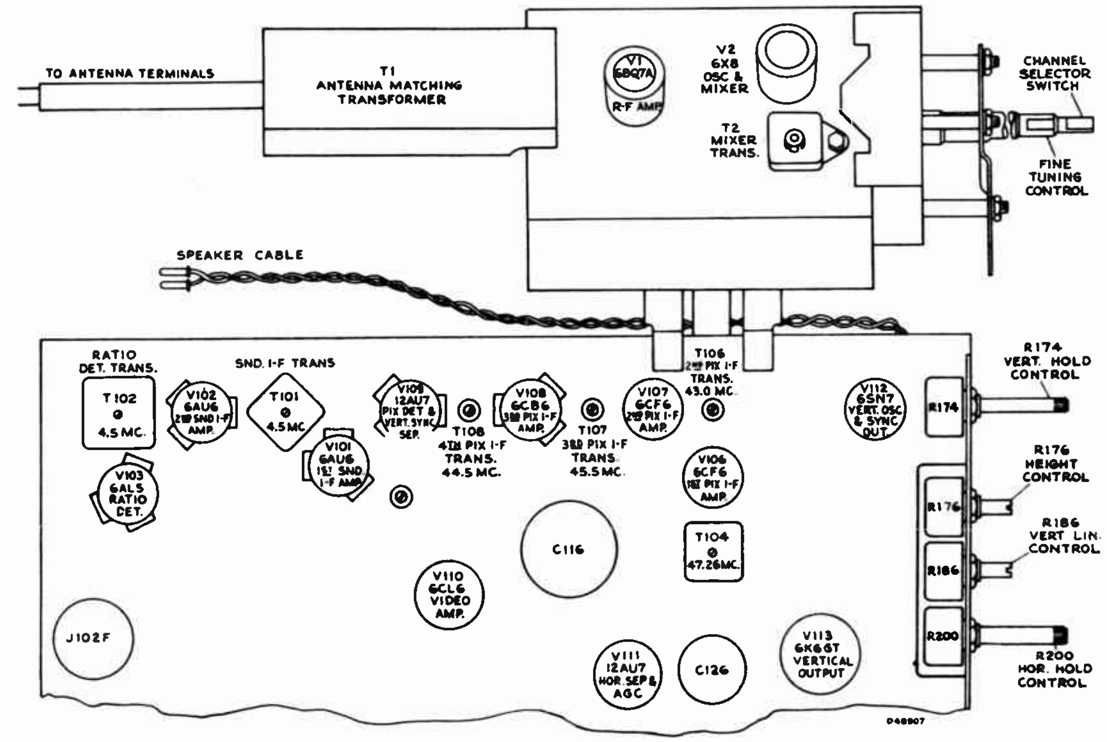


Figure 25—Top Chassis Adjustments (KRK29 Tuner Shown)

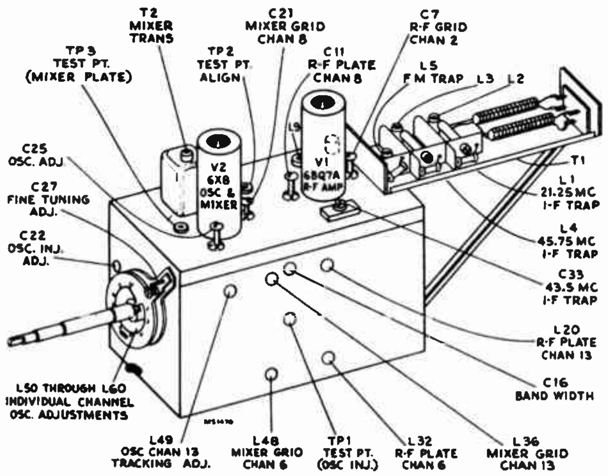


Figure 17—KRK29 Tuner Adjustments

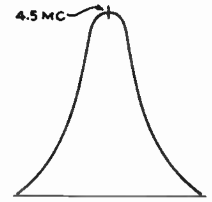


Figure 20
Sound I-F
Response

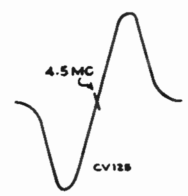


Figure 21
Ratio Det.
Response

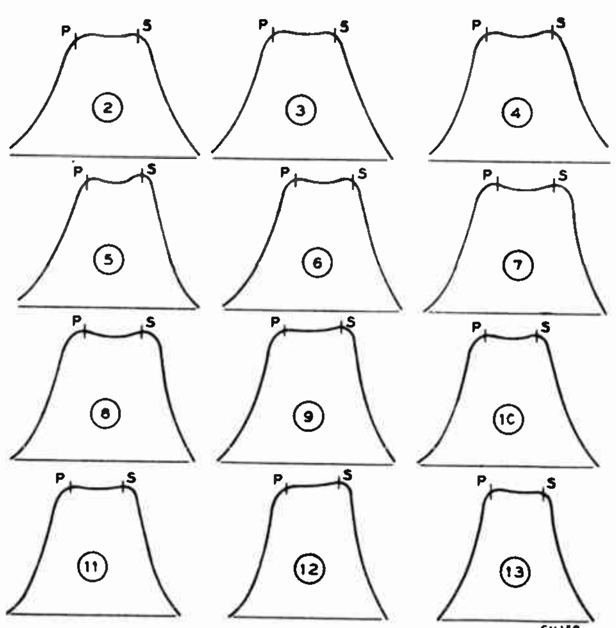


Figure 18—KRK29 R-F Response

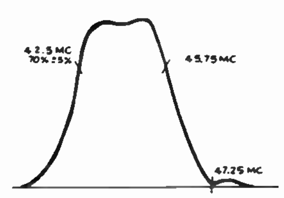


Figure 22
KRK29 T2 and T104
Response

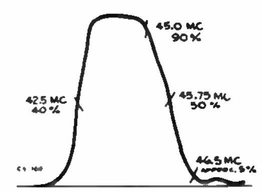


Figure 23
Over-all I-F Response
with KRK29

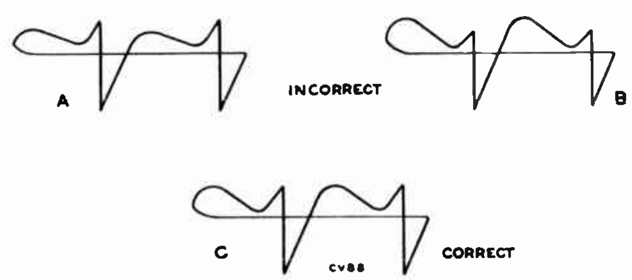


Figure 24—Horizontal Oscillator Wave Forms

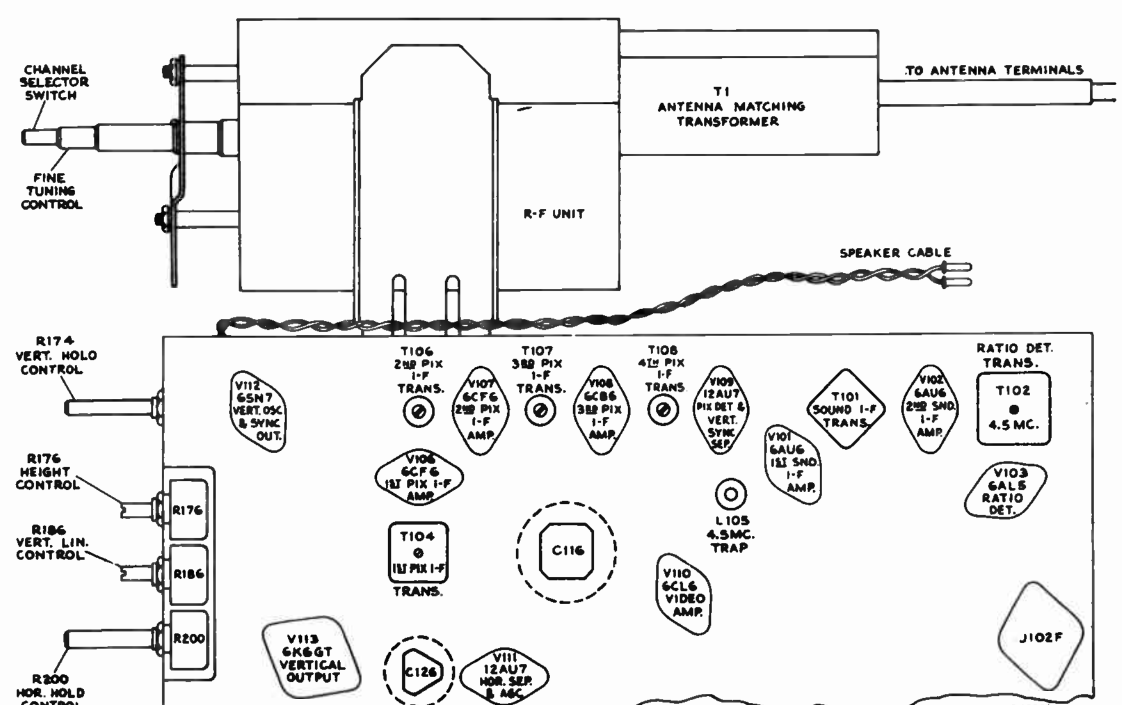
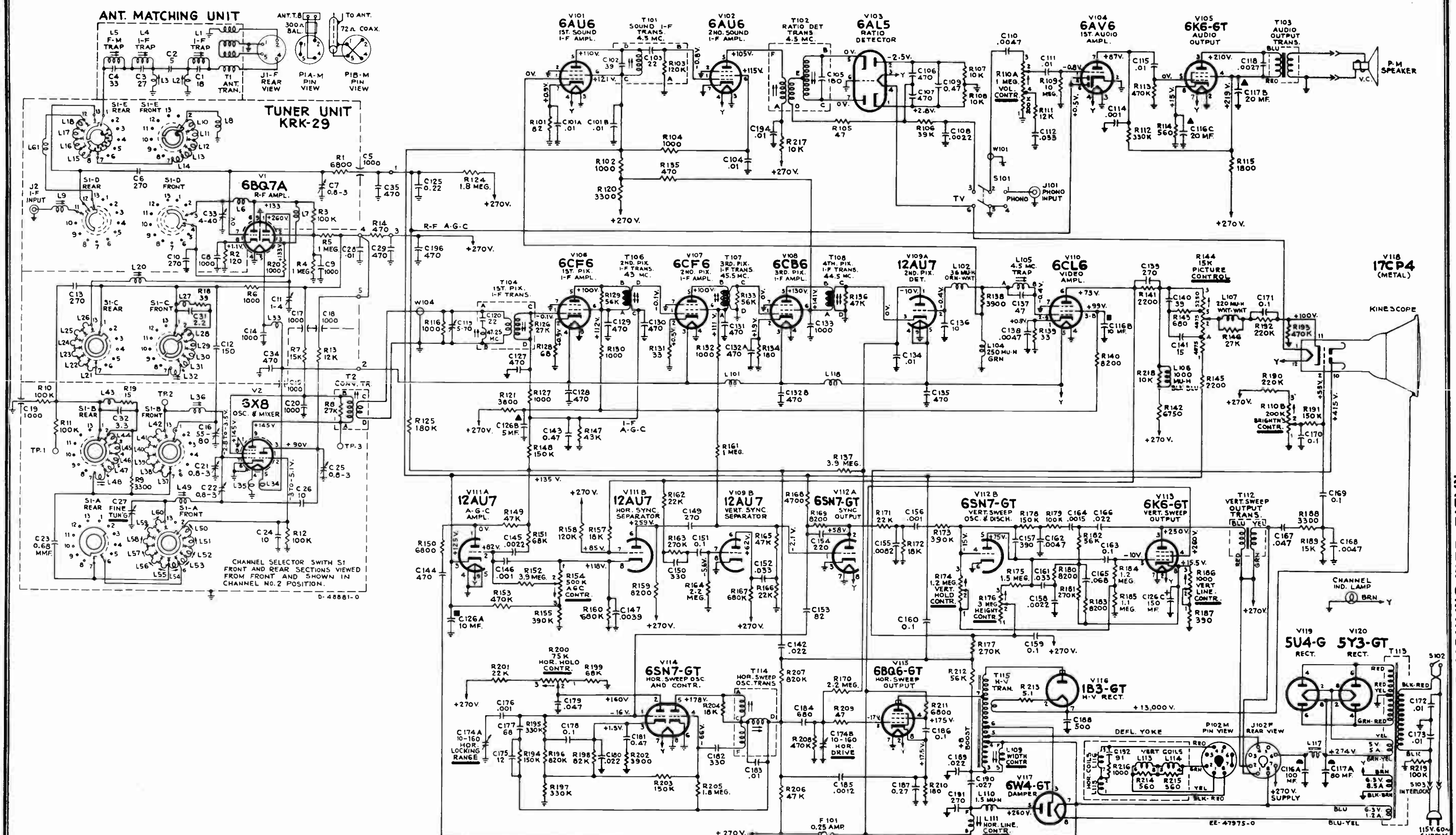


Figure 26—Bottom Chassis Adjustments (KRK29 Tuner Shown)

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 Volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1 KRK29	6BQ7A	R-F Amplifier	15000 Mu. V Signal	6	170	—	—	8	0.1	7	—	
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 KRK29	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V1 KRK12B	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	
			No Signal	6	138	—	—	8	1.0	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	260	—	—	3	143	2	97	
			No Signal	1	250	—	—	3	137	2	97	
V2 KRK12B	6AF4	R-F Oscillator	15000 Mu. V. Signal	1 & 7	78	—	—	5	0	2 & 6	−8	
			No Signal	1 & 7	75	—	—	5	0	2 & 6	−6	
V3 KRK12B	6BQ7A	I-F Amplifier	15000 Mu. V. Signal	6	270	—	—	8	148	7	103	
			No Signal	6	260	—	—	8	142	7	99	
		I-F Amplifier	15000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	
			No Signal	1	143	—	—	3	1.2	2	0	
V4 KRK12B	6S4	Voltage Control	15000 Mu. V. Signal	9	270	—	—	2	94	6	*68	*Depends on adjustment of R6.
			No Signal	9	260	—	—	2	90	6	*65	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	127	6	140	7	1.0	1	0	
			No Signal	5	110	6	121	7	.9	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	125	6	136	7	0	1	−13	
			No Signal	5	105	6	115	7	0	1	*−0.8	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	0.3	—	—	1	7.2	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	0	—	—	1	*2.8	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	89	—	—	2	0	1	−0.8	At min. volume
			No Signal	7	87	—	—	2	0	1	−0.8	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	217	4	225	8	15.2	5	0	At min. volume
			No Signal	3	210	4	219	8	15.0	5	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	202	6	225	2	−0.1	1	−7.5	
			No Signal	5	100	6	112	2	0.9	1	*−0.1	*Unreliable measuring point Make measurement at T104-B
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	205	6	225	2	−0.1	1	−7.5	
			No Signal	5	100	6	111	2	0.5	1	−0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	140	6	155	2	2.1	1	0	
			No Signal	5	130	6	141	2	1.9	1	0	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	−21	—	—	3	0	2	−3.8	
			No Signal	1	−10	—	—	3	0	2	−0.4	
V109B	12AU7	Vert. Sync. Separator	15000 Mu. V. Signal	6	68	—	—	8	0	7	58	
			No Signal	6	62	—	—	8	0	7	−5.6	
V110	6CL6	Video Amplifier	15000 Mu. V. Signal	6	82	3-8	180	1	1.1	2-9	−3.4	AGC control set for normal operation
			No Signal	6	73	3-8	99	1	0.9	2-9	−0.4	AGC control set for normal operation
V111A	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	42	—	—	3	148	2	115	
			No Signal	1	0	—	—	3	125	2	82	
V111B	12AU7	Hor. Sync. Separator	15000 Mu. V. Signal	6	267	—	—	8	171	7	101	
			No Signal	6	259	—	—	8	118	7	85	
V112A	6SN7GT	Sync. Output	15000 Mu. V. Signal	1	60	—	—	3	0	2	−2.7	
			No Signal	1	58	—	—	3	0	2	−2.1	
V112B	6SN7GT	Vertical Oscillator & Discharge	15000 Mu. V. Signal	6	76	—	—	8	0	7	−16	Depends on setting of Vert. hold control
			No Signal	6	75	—	—	8	0	7	−15	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	260	4	270	8	15.9	5	−11	
			No Signal	3	250	4	260	8	15.5	5	−10	
V114A	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	172	—	—	3	−2.2	1	−25	
			No Signal	2	160	—	—	3	1.5	1	−16	
V114B	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	180	—	—	6	0	4	−74	
			No Signal	5	178	—	—	6	0	4	−66	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	180	8	18	5	−17.5	*High Voltage Pulse Present
			No Signal	Cap	*	4	175	8	17.5	5	−17	*High Voltage Pulse Present
V116	1B3GT 8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	14,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	13,000	—	—	*High Voltage Pulse Present
V117	6W4GT	Damper	15000 Mu. V. Signal	5	270	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	260	—	—	3	*	—	—	*High Voltage Pulse Present
V118	21AP4	Kinescope	15000 Mu. V. Signal	Cap	14,000	10	430	11	120	2	78	At average Brightness
			No Signal	Cap	13,000	10	415	11	100	2	58	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	285	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	274	—	—	



All resistance values in ohms. K = 1000.

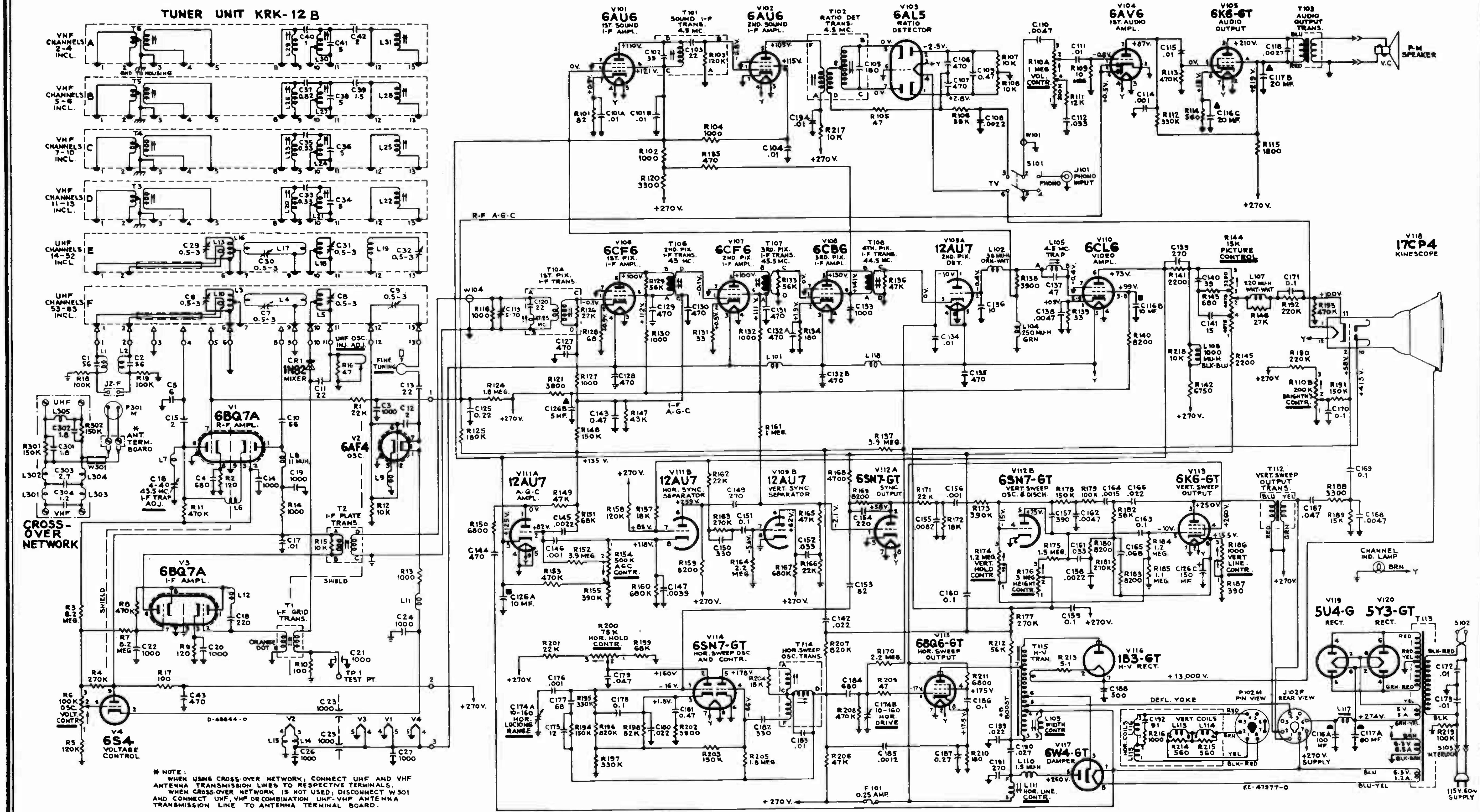
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 27—Circuit Schematic Diagram KCS78F

CIRCUIT SCHEMATIC DIAGRAM KCS78J



All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 28—Circuit Skematic Diagram, KCS78J

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
	RF UNIT ASSEMBLIES
	KRK29
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:
77151	0.8—3.0 mmf. (C11, C21, C25)
77913	0.8—3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:
77084	Feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, -0%, 500 volts (C29, C34, C35)
77252	1000 mmf., +100%, -0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., +100%, -0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K":
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef = -750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, headed-lead:
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31)
71503	3.3 mmf., ±20%, 500 volts (C32)
	Capacitor—Mica trimmer:
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r.f. plate coil (L20)
78224	Coil—Choke coil (.47 muh) (L27)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
76562	Coil—R.F. amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
	Resistor—Fixed, composition:
503015	15 ohms, ±10%, ½ watt (R19)
503039	39 ohms, ±10%, ½ watt (R18)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Convertor transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—IF trap
76542	Trap—IF trap (41.25 mc) complete with core (L1)
76541	Trap—IF trap (45.75 mc) complete with core (L4)
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C16)
	Capacitor—Ceramic:
77084	Feed-thru, 1000 mmf. (C21, C23, C25)
77615	Stand-off, 1000 mmf. (C3, C19, C24, C26)
	Capacitor—Fixed, ceramic, crystal holder, temp. coef. = -750
77621	22 mmf., ±10% (C11)

STOCK No.	DESCRIPTION
33098	10 mmf., ±1.0 mmf., 500 volts DC (C136)
33380	12 mmf., ±10%, 500 volts DC (C175)
39044	15 mmf., ±10%, 500 volts DC (C141)
73664	39 mmf., ±10%, 500 volts DC (C140)
	Capacitor—Fixed, mica:
76475	68 mmf., 1000 volts (C177)
76474	82 mmf., 1000 volts DC (C153)
39636	220 mmf., 500 volts DC (C154)
39638	270 mmf., 500 volts DC (C139)
76579	270 mmf., 1000 volts DC (C149, C191)
39640	330 mmf., 500 volts DC (C150)
76476	330 mmf., 1000 volts (C182)
73094	390 mmf., 1000 volts DC (C157)
39644	470 mmf., 500 volts DC (C106, C107)
	Capacitor—Ceramic:
76461	500 mmf., 20,000 volts (C188)
	Capacitor—fixed, ceramic, High "K" disc:
7 293	470 mmf., +100%, -0%, 500 volts DC (C127, C128, C129, C130, C131, C135, C196 for KCS78F)
77672	Dual 470 mmf., +100%, -0%, 500 volts DC (C132A, C132B)
77252	1000 mmf., +100%, -0%, 500 volts DC (C133)
73960	10,000 mmf., +100%, -0%, 500 volts DC (C104, C134, C194)
76991	Dual 10,000 mmf., +100%, -0%, 500 volts DC (C101A, C101B)
	Capacitor—Fixed, ceramic, insulated:
77673	470 mmf., ±10%, 1500 volts DC (C144)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
	CHASSIS ASSEMBLIES KCS 78F—VHF Chassis KCS 78J—UHF/VHF chassis
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77636	Trap—I.F. trap (L1, C1, L2, C2)
77489	Rectifier—Germanium rectifier IN82 (CR1)
	Resistor—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
78047	2 mmf., ±10%, 500 volts DC (C42)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
	Capacitor—Fixed, ceramic, High "K" disc:
77625	220 mmf., +100%, -0%, 500 volts DC (C18)
77293	470 mmf., +100%, -0%, 500 volts DC (C43)
77624	680 mmf., +100%, -0%, 500 volts DC (C4)
77252	1000 mmf., +100%, -0%, 500 volts DC (C14, C20, C22, C27)
73960	10,000 mmf., +100%, -0%, 500 volts DC (C17)
	Capacitor—Fixed, ceramic, insulated:
77667	Comprising: 1 section of 2 mmf., and 1 section of 22 mmf. (C12, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. -0
77210	2 mmf., ±0.25 mmf., 500 volts DC (C15)
77688	5 mmf., ±.5 mmf., 500 volts DC (C34, C36, C38, C41)
74182	6 mmf., ±0.5 mmf., 500 volts DC (C5)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
71924	56 mmf., ±10%, 500 volts DC (C10)
	Capacitor—Fixed, headed-lead type:
77691	.33 mmf., ±10%, 500 volts DC (C33, C35)
77689	.82 mmf., ±10%, 500 volts DC (C37)
77690	1.0 mmf., ±10%, 500 volts DC (C40)
71500	1.5 mmf., ±10%, 500 volts DC (C39)

STOCK No.	DESCRIPTION
	Capacitor—Mica trimmer:
71496	5-70 mmf. (C119)
75217	Dual 10-160 mmf. (C174A, C174B)
	Capacitor—Electrolytic:
75218	Comprising: 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C126A, C126B, C126C)
77644	Comprising: 1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C117A, C117B)
76970	Comprising: 1 section of 100 mfd., 400 volts, 1 section of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C116A, C116B, C116C)
	Capacitor—Fixed, tubular, paper, oil impregnated:
75643	.001 mfd., 1000 volts (C114, C146, C156, C176)
73595	.0022 mfd., 600 volts (C108, C145, C158)
73818	.0027 mfd., 1600 volts (C118)
73796	.0039 mfd., 600 volts (C147)
73920	.0047 mfd., 600 volts (C110, C138, C162, C158)
73808	.0082 mfd., 1000 volts (C155)
73561	.01 mfd., 400 volts (C111, C115)
73562	.022 mfd., 400 volts (C180)
73798	.022 mfd., 600 volts (C166)
73810	.022 mfd., 1000 volts (C142, C189)
73811	.027 mfd., 1000 volts (C190)
73552	.033 mfd., 400 volts (C112, C152)
73596	.033 mfd., 1000 volts (C161)
73553	.047 mfd., 400 volts (C179)
73592	.047 mfd., 600 volts (C167)
73792	.068 mfd., 400 volts (C165)
73784	0.1 mfd., 200 volts (C171)
73551	0.1 mfd., 400 volts (C151, C159, C169, C170, C178)
73557	0.1 mfd., 600 volts (C160, C163, C186)
73794	0.22 mfd., 400 volts (C125)
73786	0.27 mfd, 200 volts (C187)
73787	0.47 mfd., 200 volts (C109, C143, C181)
	Capacitor—Fixed, tubular, moulded, oil impregnated:
76479	.00068 mfd., 600 volts (C184)
76995	.0012 mfd., 600 volts (C185)
77123	.0015 mfd., 1000 volts (C164)
73594	.01 mfd., 600 volts (C172, C173, C183)
77676	Choke—Filter choke (L117)
73477	Coil—Choke coil (L101, L118)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
76011	Coil—Peaking coil (36 muh) (L102)
77925	Coil—Peaking coil (220 muh) (L107, R146)
71526	Coil—Peaking coil (250 muh) (L104)
77124	Coil—Peaking coil (1000 muh) (L106, R218)
76640	Coil—RF choke coil (1.5 muh) (L110)
76441	Coil—Width coil complete with adjustable core (L109)
76975	Control—AGC control (R154)
77641	Control—Brightness control, volume control and power switch (R110A, R110B, S102)
77924	Control—Height control (R176)
77639	Control—Horizontal hold control (R200)
76445	Control—Picture control (R144)
77642	Control—Vertical hold control (R174)
77643	Control—Vertical linearity control (R186)
	Resistor—Wire wound:
76796	5.1 ohms, 1/3 watt (R213)
76639	180 ohms, 2 watts (R210)
77670	3300 ohms, 7 watts (R120)
77671	3800 ohms, 7 watts (R121)
76642	6750 ohms, 10 watts (R142)
	Resistor—Fixed, composition:
30789	33 ohms, ±5%, ½ watt (R131)
503033	33 ohms, ±10%, ½ watt (R139)
503047	47 ohms, ±10%, ± watt (R105, R209)
34763	68 ohms, ±5%, ½ watt (R128)
503082	82 ohms, ±10%, ½ watt (R101)
502118	180 ohms, ±5%, ½ watt (R134)
503139	390 ohms, ±10%, ½ watt (R187)
503147	470 ohms, ±10%, ½ watt (R135)
513156	560 ohms, ±10%, 1 watt (R114)
503168	680 ohms, ±10%, ½ watt (R143)
503210	1000 ohms, ±10%, ½ watt (R104, R116, R127, R130, R132)
513210	1000 ohms, ±10%, 1 watt (R02)
523218	1800 ohms, ±10%, 2 watts (R115)
503222	2200 ohms, ±10%, ½ watt (R145)
523222	2200 ohms, ±10%, 2 watts (R141)
503233	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R138)
503239	3900 ohms, ±10%, ½ watt (R202)

STOCK No.	DESCRIPTION
502247	4700 ohms, ±5%, ½ watt (R168)
513268	6800 ohms, ±10%, 1 watt (R150)
523268	6800 ohms, ±10%, 2 watts (R211)
503282	8200 ohms, ±10% ½ watt (R159, R169, R180, R183)
523282	8200 ohms, ±10%, 2 watts (R140)
502310	10,000 ohms, ±5%, ½ watt (R107, R108)
513310	10,000 ohms, ±10%, 1 watt (R217)
503312	12,000 ohms, ±10%, ½ watt (R111)
503315	15,000 ohms, ±10%, ½ watt (R189)
503318	18,000 ohms, ±10%, ½ watt (R157, R172, R204)
503322	22,000 ohms, ±10%, ½ watt (R162, R166, R171, R201)
503339	39,000 ohms, ±10%, ½ watt (R106)
70351	43,000 ohms, ±5%, ½ watt (R147)
503347	47,000 ohms, ±10%, ½ watt (R136, R149, R165)
512347	47,000 ohms, ±5%, 1 watt (R206)
502356	56,000 ohms, ±5%, ½ watt (R129, R133)
503356	56,000 ohms, ±10%, ½ watt (R212)
512356	56,000 ohms, ±5%, 1 watt (R182)
503368	68,000 ohms, ±10%, ½ watt (R151, R199)
503382	82,000 ohms, ±10%, ½ watt (R198)
513410	100,000 ohms, ±10%, 1 watt (R179, R219)
503412	120,000 ohms, ±10%, ½ watt (R158)
502415	150,000 ohms, ±5%, ½ watt (R148)
503415	150,000 ohms, ±10%, ½ watt (R178, R191, R194)
512415	150,000 ohms, ±5%, 1 watt (R203)
502418	180,000 ohms, ±5%, ½ watt (R125)
503422	220,000 ohms, ±10%, ½ watt (R190, R192)
502427	270,000 ohms, ±5%, ½ watt (R181)
503427	270,000 ohms, ±10%, ½ watt (R163, R177)
503433	330,000 ohms, ±10%, ½ watt (R112, R195, R197)
503439	390,000 ohms, ±10%, ½ watt (R155, R173)
503447	470,000 ohms, ±10%, ½ watt (R113, R153, R193, R208)
503468	680,000 ohms, ±10%, ½ watt (R160, R167)
503482	820,000 ohms, ±10%, ½ watt (R196, R207)
503510	1 megohm, ±10%, ½ watt (R161)
502511	1.1 megohm, ±5%, ½ watt (R185)
503512	1.2 megohms, ±10%, ½ watt (R184)
503515	1.5 megohm, ±10%, ½ watt (R175)
11769	1.8 megohm, ±5%, ½ watt (R124, R205)
503522	2.2 megohm, ±10%, ½ watt (R164, R170)
503539	3.9 megohm, ±10%, ½ watt (R137, R152)
503610	10 megohm, ±10%, ½ watt (R109)
76795	Transformer—Hi-voltage transformer (T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable core (T114)
76982	Transformer—Output transformer (T103)
77635	Transformer—Power transformer, 117 volts, 60 cycle (T113)
77112	Transformer—Ratio detector transformer (T102, C105)
76981	Transformer—Sound I.F. transformer complete with adjustable cores (T101, C102, C103, R103)
77636	Transformer—Vertical output transformer (T112)
77637	Transformer—1st pix I.F. transformer complete with adjustable cores (T104, C120, R126)
77638	Transformer—2nd pix I.F. transformer complete with adjustable core (T106)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
76983	Trap—4.5 MC trap (L105, C137)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)
	SPEAKER ASSEMBLIES 971636-1W RL101C5 RMA-274 (For Model 17T352U)
77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971490-3W 971490-3R RL105E6 RMA-274 RMA-285 (For Models 17T361, 17T361U)
75024	Cone—Cone and voice coil (3.2 ohms) for speaker stamped 971490-3W
77129	Cone—Cone and voice coil (3.2 ohms) for speaker stamped 971490-3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE.......227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 21-D-358 to 21-D-380 Incl.

All 12 VHF channels......54 mc. to 88 mc., 174 mc. to 216 mc.

Models 21-D-358U to 21-D-380U Incl.

Any of 70 UHF channels..................470 mc. to 890 mc.

Any of 12 VHF channels..54 mc. to 88 mc., 174 mc. to 216 mc.

(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency......................45.75 mc.

Sound I-F Carrier Frequency......................41.25 mc.

POWER RATING.............21-D-358 to 21-D-380 295 watts
21-D-358U to 21-D-380U 305 watts

AUDIO POWER OUTPUT RATING...............4 watts max.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29 (21-D-358 to 21-D-380 Incl.)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

ANTENNA INPUT IMPEDANCE

Models 21-D-358 to 21-D-380 Incl.

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 21-D-358U to 21-D-380U Incl.

UHF—300 ohms balanced.

VHF—300 ohms balanced.

CHASSIS DESIGNATIONS

KCS81F...............In Models 21-D-358, 21-D-368, 21-D-376, 21-D-377, 21-D-378, 21-D-379, 21-D-380

KCS81J............In Models 21-D-358U, 21-D-368U, 21-D-376U, 21-D-377U, 21-D-378U, 21-D-379U, 21-D-380U

VIDEO RESPONSE...............................To 4 mc.

FOCUS...Magnetic

SWEEP DEFLECTION.............................Magnetic

SCANNING............................Interlaced, 525 line

HORIZONTAL SCANNING FREQUENCY............15,750 cps

VERTICAL SCANNING FREQUENCY..................60 cps

FRAME FREQUENCY (Picture Repetition Rate)..........30 cps

RCA TUBE COMPLEMENT

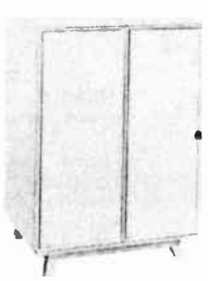
Tube Used	Function
Tuner KRK12B (21-D-358U to 21-D-380U Incl.)	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control
A 1N82 crystal is used as a mixer.	
All Models	
(1) RCA 6AU6	1st Picture I-F Amplifier
(2) RCA 6CB6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 6CB6	4th Picture I-F Amplifier
(5) RCA 6CL6	Video Amplifier
(6) RCA 6AU6	1st Sound I-F Amplifier
(7) RCA 6AU6	2nd Sound I-F Amplifier
(8) RCA 6AL5	Ratio Detector
(9) RCA 6AV6	1st Audio Amplifier
(10) RCA 6AQ5	Audio Output
(11) RCA 12AU7	Vertical Sync Separator and AGC
(12) RCA 12AU7	Horiz. Sync Separator and Sync Amplifier
(13) RCA 6SN7GT	Vert. Sync Amplifier and Vert. Sweep Osc.
(14) RCA 6AQ5	Vertical Sweep Output
(15) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(16) RCA 6CD6G	Horizontal Sweep Output
(17) RCA 6W4GT (2 tubes)	Dampers
(18) RCA 1B3GT/8016	High Voltage Rectifier
(19) RCA 5U4G (2 tubes)	Rectifiers
(20) RCA 21AP4	Kinescope

OPERATING CONTROLS (front panel)

Channel Selector / Fine Tuning	Dual Control Knobs
Brightness / Sound Volume and On-Off Switch	Dual Control Knobs
Picture Horizontal Hold	Single Control (Knurled)
Picture Vertical Hold	Single Control (Knurled)
Picture	Single Control Knob
Tone Switch	Single Control Knob

NON-OPERATING CONTROLS

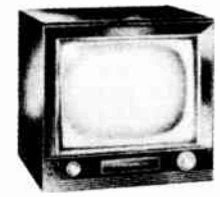
Horizontal Centering	top chassis adjustment
Vertical Centering	top chassis adjustment
AGC	rear chassis adjustment
Height	front panel screwdriver adjustment
Horizontal Linearity	rear chassis adjustment
Horizontal Locking	rear chassis screwdriver adjustment
Vertical Linearity	front panel screwdriver adjustment
Horizontal Drive	rear chassis screwdriver adjustment
Horizontal Oscillator Frequency	rear chassis adjustment
Horizontal Oscillator Waveform	bottom chassis adjustment
Width Link	H.V. compartment adjustment
Focus	top chassis adjustment
Ion Trap Magnet	top chassis adjustment
Deflection Coil	top chassis adjustment
Focus Magnet	top chassis adjustment



Models 21-D-378, 21-D-378U "Newport" Oak, Natural Walnut

Models 21-D-379, 21-D-379U "Bradbury" Mahogany, Walnut

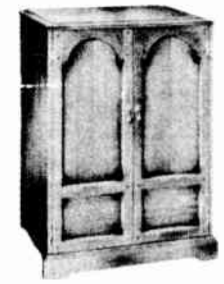
Models 21-D-380, 21-D-380U "Beaumont" Maple, Red Cherry



Models 21-D-358, 21-D-358U "Dunbar" Mahogany, Oak

Models 21-D-368, 21-D-368U "Talmadge" Mahogany, Oak

Models 21-D-376, 21-D-376U "Caldwell" Mahogany, Oak



Models 21-D-377, 21-D-377U "Vincennes" Red Cherry, Natural Cherry

GENERAL DESCRIPTION

All models are "21 inch" television receivers. Models 21-D-358, 21-D-368, 21-D-376, 21-D-377, 21-D-378, 21-D-379 and 21-D-380 are identical except for cabinets and speakers. These models feature full 12 channel VHF coverage. Models 21-D-358U, 21-D-368U, 21-D-376U, 21-D-377U, 21-D-378U, 21-D-379U and 21-D-380U are identical except for cabinets and speakers. These models feature full 12 channel VHF coverage plus any 4 UHF channels desired. All models have an auxiliary audio input jack to permit the use of an external record playing attachment.

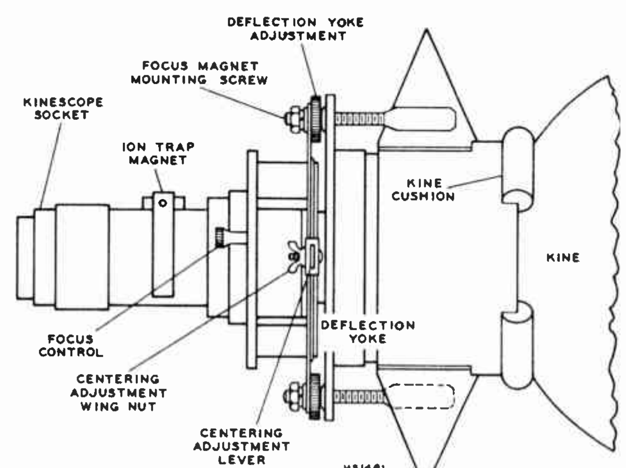


Figure 2—Yoke and Focus Magnet Adjustments

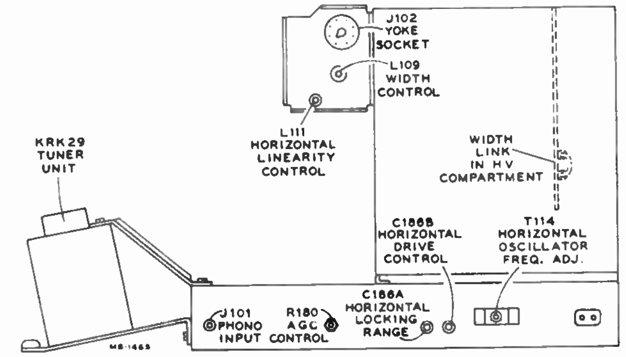


Figure 3—Rear Chassis Adjustments

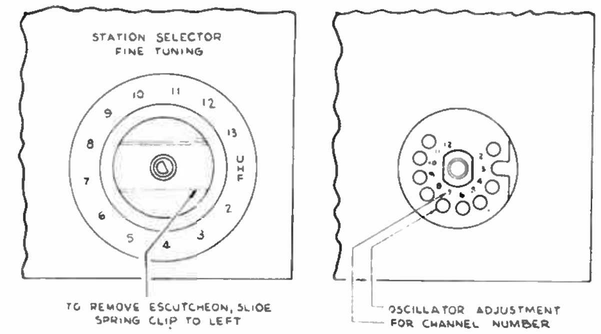


Figure 4—KRK29 R-F Oscillator Adjustments

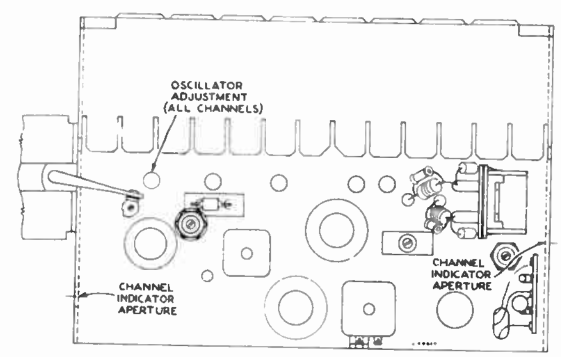


Figure 5—KRK12B Oscillator Adjustment

CHASSIS TOP VIEW

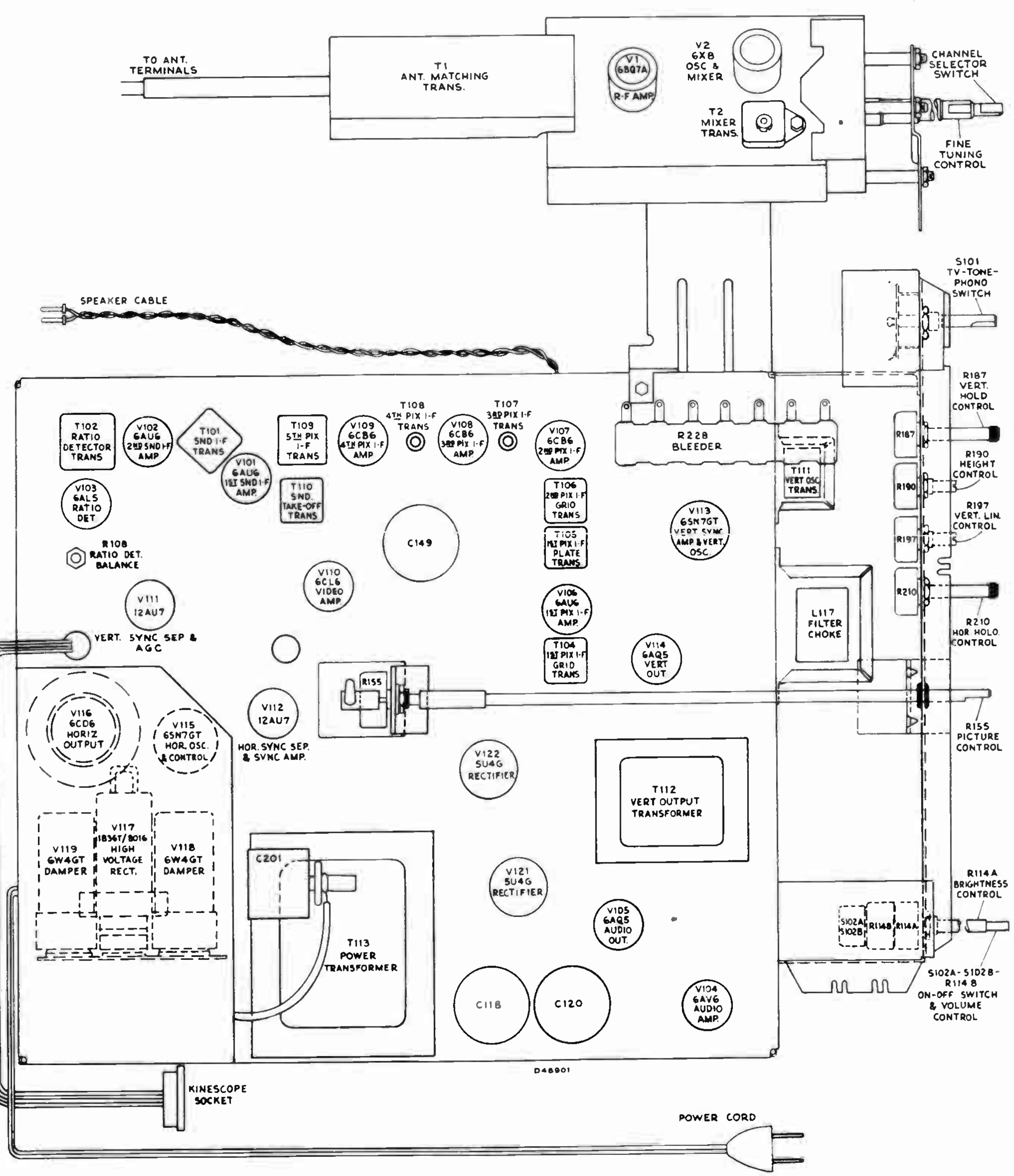


Figure 6—Chassis Top View (shown with KRK29 Tuner)

CHASSIS BOTTOM VIEW

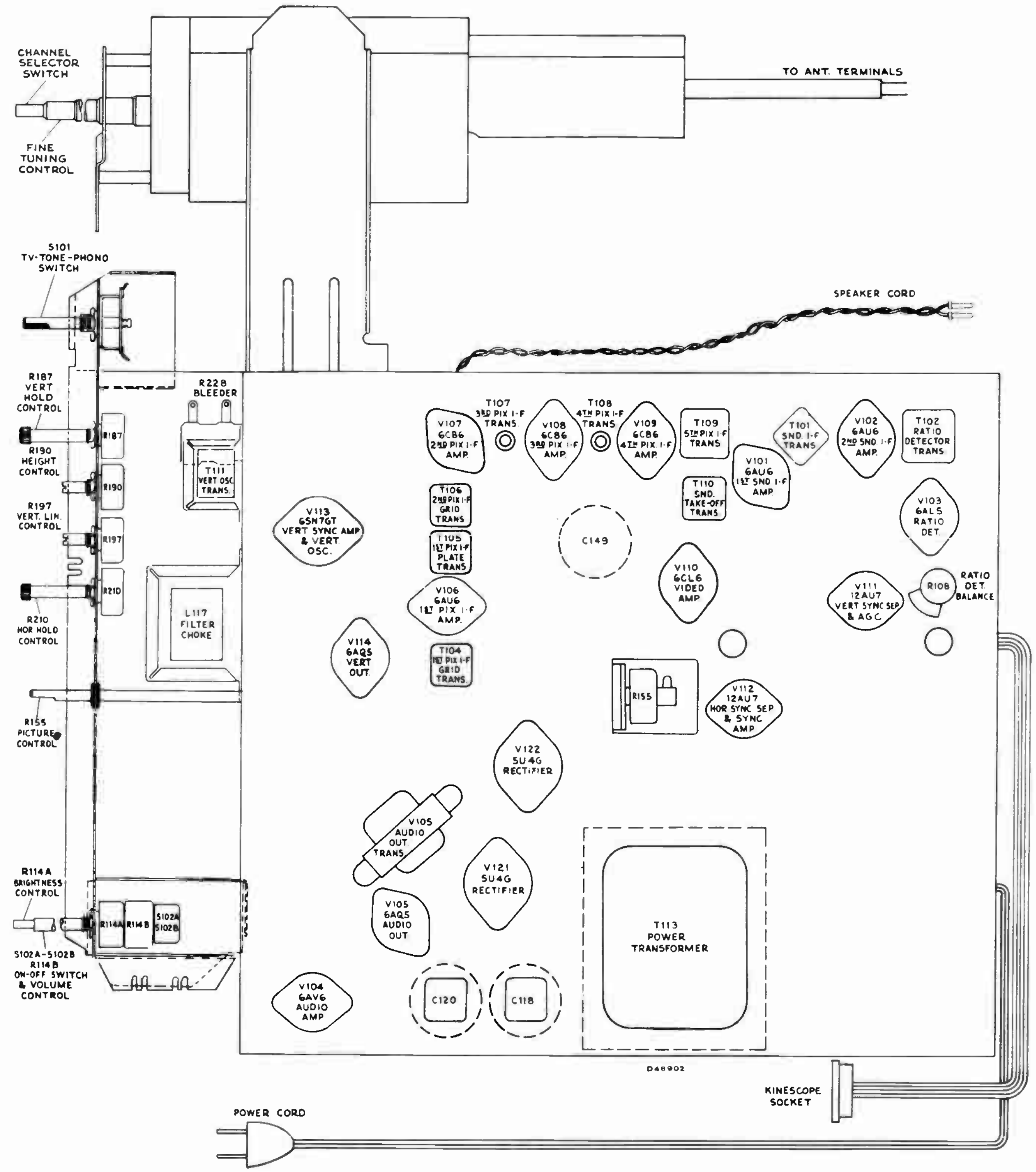


Figure 7—Chassis Bottom View (shown with KRK29 Tuner)

ALIGNMENT PROCEDURE

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 10 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in Figure 19. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

PICTURE I-F TRAP ADJUSTMENT.—Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R133 and C133B.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the positive terminal of one battery to chassis and the potentiometer arm to the junction of R133 and C133B.

Set the bias to produce approximately −1.0 volt of bias at the junction of R133 and C133B.

Connect the "VoltOhmyst" to pin 9 of V110, the 6CL6 video amplifier.

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS.—
Models 21-D-358 to 21-D-380 Incl.

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with −1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to −1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 22. For final adjustment set the output of the sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Adjust C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 23.

Disconnect the diode probe, the 180 ohm and three 330 ohm resistors.

Models 21-D-358U to 21-D-380U incl.

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with −1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to −1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110, the 6CL6 video amplifier.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 22. For final adjustment set the output of the VHF sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align the crystal mixer and T2 and T104, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1,500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals "A" and "B" of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust the shunt trimmer C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 13. Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 13.

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

SWEEP ALIGNMENT OF PICTURE I-F.—
Connect the oscilloscope to pin 9 of V110.

Adjust the bias potentiometer to obtain −6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R133 and C133B.

Leave the sweep generator connected to the mixer grid test point TP2 on KRK29 Tuner or to the front terminal of the 1N82 crystal holder on KRK12B Tuner. Use the shortest leads possible with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T108 and T109 to obtain the response shown in Figure 14. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK29 TUNER ALIGNMENT
Models 21-D-358 to 21-D-380 incl.

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on the side of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce −3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read −3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counterclockwise).

Connect the sweep generator through a suitable attenuator, as shown in Figure 10 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and bandwidth as shown in Figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response bandwidth.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read −3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8 adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency, 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12B TUNER ALIGNMENT

Models 21-D-358U to 21-D-380U incl.

TUNER VHF ALIGNMENT. — Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope through the preamplifier, if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 11. The proper curve shape is shown in Figure 11(b). (Refer to note on page 13 for detailed explanation of adjustments.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise and remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce –3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce –5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum marker indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT. — To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust the UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 12. The curve shape will usually vary from Figure 12 (a) to Figure 12 (c) going higher in frequency; however, any of these responses are acceptable.

Repeat the above steps for all UHF inserts used, adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier, if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce –3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce –5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used, and set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Figure 14.

Set the UHF marker generator to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust the mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt DC scale.

Set oscillator injection adjustment to read .1 volt on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volt. Adjust as necessary to read .3 volt or less at TP1.

RATIO DETECTOR ALIGNMENT. — In order to obtain good ratio detector alignment an AM modulated signal generator that is exceptionally free from FM modulation must be employed. Set the signal generator at 4.5 mc. and connect it to the second sound i-f grid, pin 1 of V102. Set the generator for 30% 400 cycle modulation.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. If used, connect it to the grid of the 4th pix i-f amplifier, pin 1, V109. Set the frequency of the calibrator to 45.75 (pix carrier) and modulate with 4.5 mc. crystal. Also turn on the internal AM audio modulation. The 4.5 mc. signal will be picked off at T110A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to the junction of R111 and C111.

Connect the oscilloscope across the speaker voice coil and turn the volume control for maximum output.

Tune the ratio detector primary, T102 top core for maximum DC output on the "VoltOhmyst." Adjust the signal level from the signal generator for –10 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R110 and C110.

Adjust the T102 bottom core for zero d-c on the meter. Then, turn the core to the nearest minimum AM output on the oscilloscope.

Repeat adjustments of T102 top for maximum DC and T102 bottom for minimum output on the oscilloscope making final adjustment with the 4.5 mc. input level adjusted to produce 10 volts d-c on the "VoltOhmyst" at the junction of R111 and C111.

Connect the "VoltOhmyst" to the junction of R110 and C110 and note the amount of d-c present. If this voltage exceeds ±1.5 volts, adjust R108 by turning it in until zero d-c is obtained. Readjust the T102 bottom core for minimum output on the oscilloscope. Repeat adjustments of R108 and T102 bottom core until the voltage at R110 and C110 is less than ±1.5 volts when T102 bottom core is set for minimum output on the oscilloscope.

Connect the "VoltOhmyst" to the junction of R111 and C111 and repeak T102 top core for maximum d-c on the meter and again reset the generator so as to have –10 volts on the meter.

Repeat the adjustments in the above two paragraphs until the voltage at R110 and C110 is less than ±1.5 volts when the T102 top core is set for maximum d-c at the junction of R111 and C111 and the T102 bottom core is set for minimum indication on the oscilloscope.

SOUND I-F ALIGNMENT. — Connect the sweep generator to the first sound i-f amplifier grid, pin 1 of V101. Adjust the generator for a sweep width of 1 mc. at a center frequency of 4.5 mc.

Insert a 4.5 mc. marker signal from the signal generator into the first sound i-f grid. With the WR39B or WR39C calibrators the 4.5 mc. crystal signal may be obtained at the R-F out terminal by turning the variable osc. switch off, the calibrate switch to 4.5 mc. and the volume control with mod. off.

Connect the oscilloscope in series with a 10,000 ohm resistor to terminal A of T101.

Adjust T101 top and bottom cores for maximum gain and symmetry about the 4.5 mc. marker on the i-f response. The pattern obtained should be similar to that shown in Figure 20.

The output level from the sweep should be set to produce approximately 2.0 volt peak-to-peak at terminal A of T101 when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

Connect the oscilloscope to the junction of R110 and C110 and check the linearity of the response. The pattern obtained should be similar to that shown in Figure 21.

ALIGNMENT PROCEDURE

SOUND TAKE-OFF ALIGNMENT. — Connect the 4.5 mc. generator in series with a 1,000 ohm resistor to terminal "C" of T110. The input signal should be approximately 0.5 volt.

Short the fourth pix i-f grid to ground, pin 1, V109, to prevent noise from masking the output indication.

As an alternate source of signal the RCA WR39B or WR39C calibrator may be used. In such a case, disregard the above two paragraphs. Connect calibrator across link circuit, T104 A, B, and modulate 45.75 with 4.5 mc. crystal.

Connect the crystal diode probe of a "VoltOhmyst" to the plate of the video amplifier, pin 6 of V110.

Adjust the core of T110 for minimum output on the meter.

Remove the short from pin 1 V109 to ground, if used.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment. — Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R210, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C186B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment. — The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and one diagonal black bar sloping down to the right appears on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain one diagonal black bar on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture begins to fall out of sync with the diagonal bar sloping down to the right. Continue to turn the frequency core in the same direction. Additional bars should not appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 25. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment. — Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C186A slightly clockwise. If less than 2 bars are present, adjust C186A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

SENSITIVITY CHECK. — A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

RESPONSE CURVES. — The response curves shown on pages 14 and 15 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON KRK12B TUNER ALIGNMENT. — The use of a crystal mixer in the KRK12B Tuner makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in Figure 11 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in Figure 11(b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in Figures 11(a) and 11(c).

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1 but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

ALIGNMENT DATA

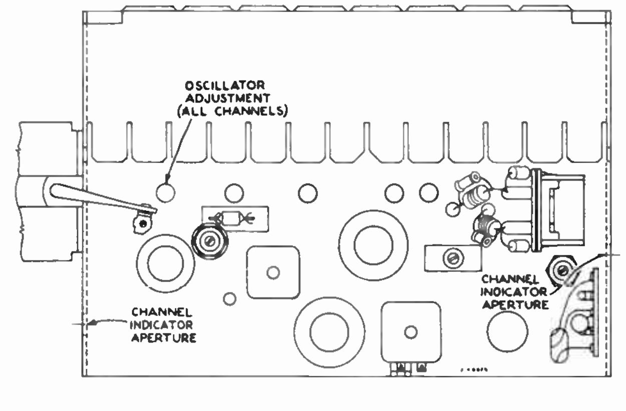


Figure 8—KRK12B Oscillator Adjustment

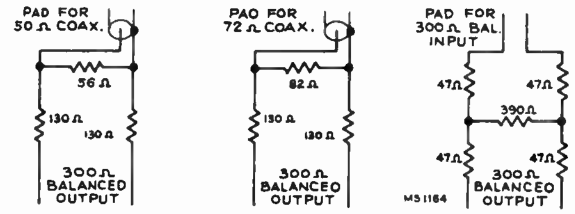


Figure 10—Sweep Attenuator Pads

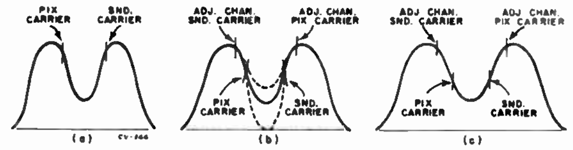


Figure 11—KRK12B VHF Insert Responses

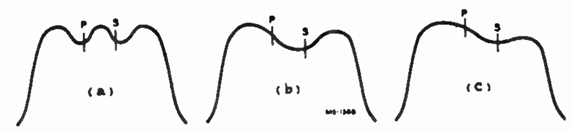


Figure 12—KRK12B UHF Insert Responses

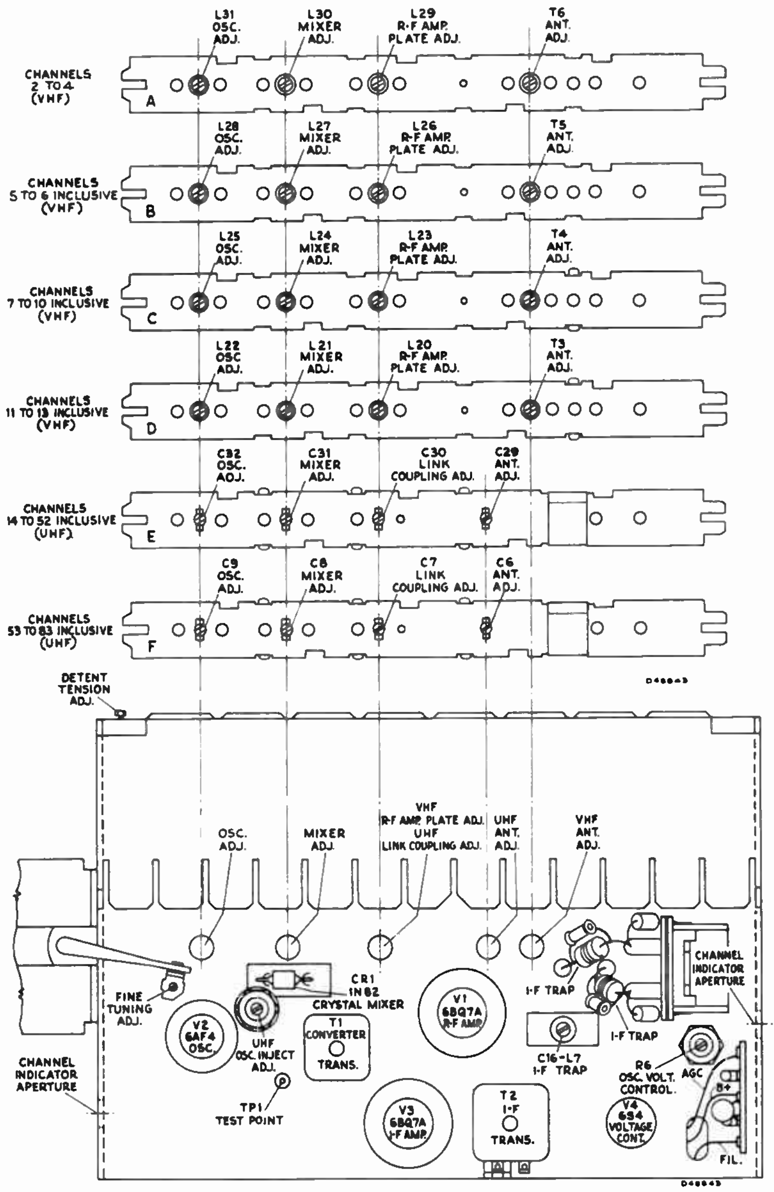


Figure 9—KRK12B Tuner Adjustments

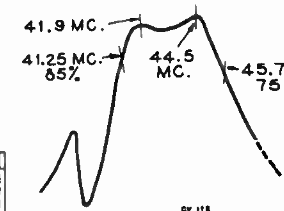


Figure 13—T2 and T104 Response with KRK12B

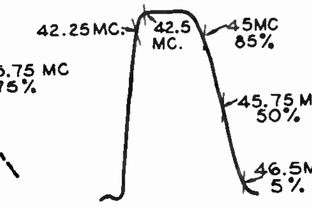


Figure 14—Over-all I-F Response with KRK12B

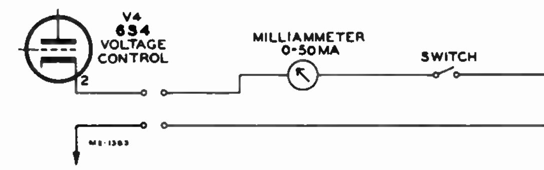


Figure 15—KRK12B Voltage Control Adapter

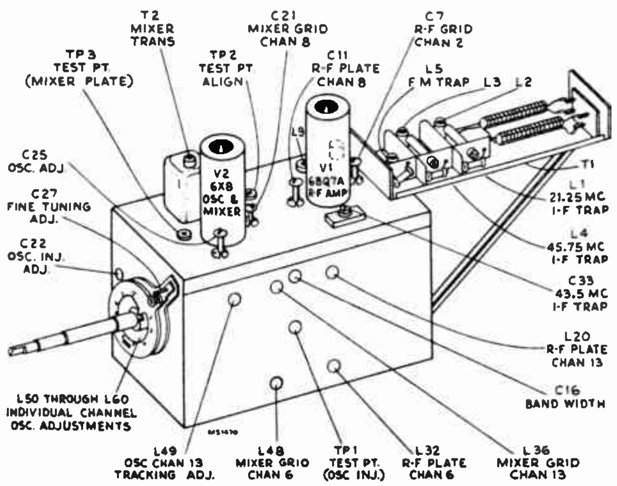


Figure 16—KRK29 Tuner Adjustments

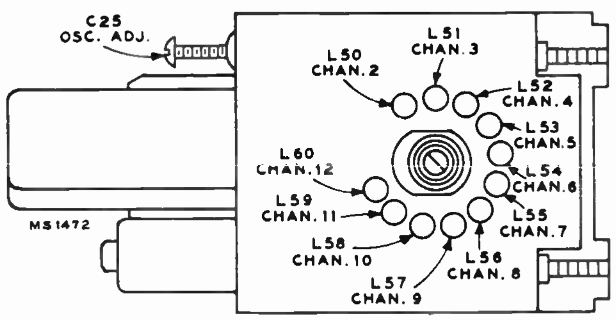


Figure 17—KRK29 R-F Oscillator Adjustments

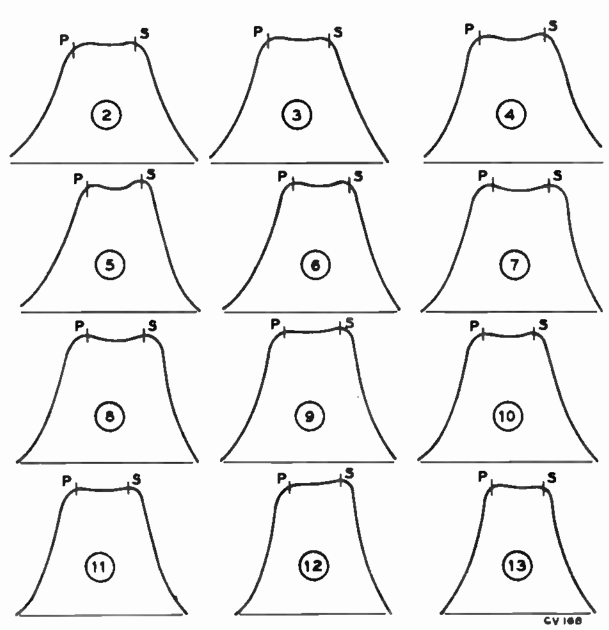


Figure 18—KRK29 R-F Response

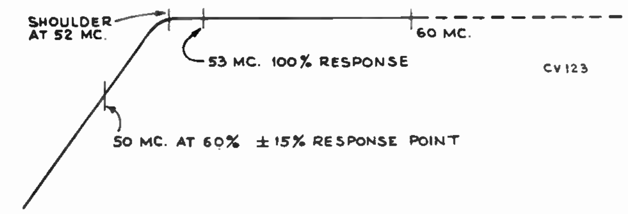


Figure 19—KRK29 Antenna Matching Unit Response

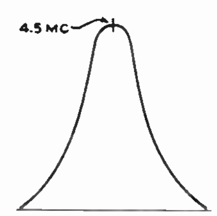


Figure 20—
Sound I-F
Response

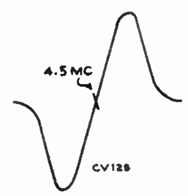


Figure 21—
Ratio Det.
Response

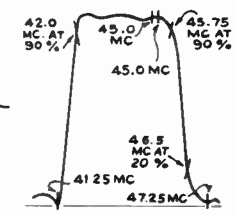


Figure 22—
T105 and T106
Response

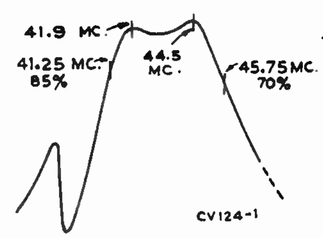


Figure 23—
T2 and T104
Response with KRK29

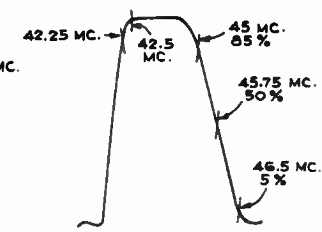


Figure 24—
Over-all I-F
Response with KRK29

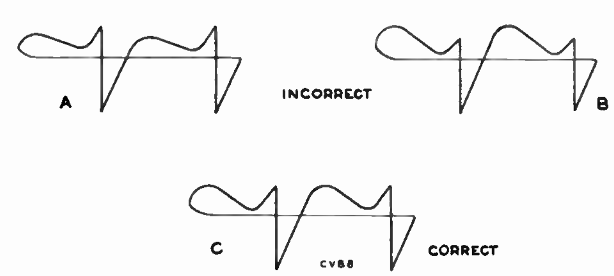


Figure 25—Horizontal Oscillator Wave Forms

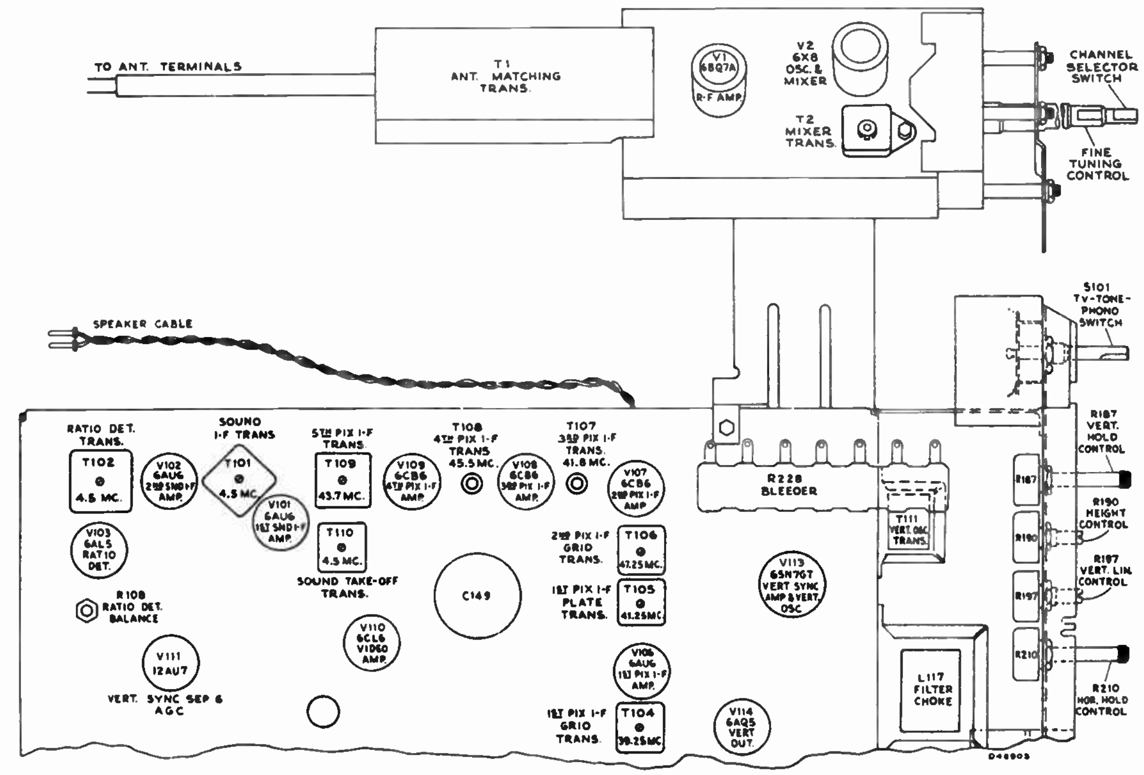


Figure 26—Top Chassis Adjustments (KRK29 Tuner Shown)

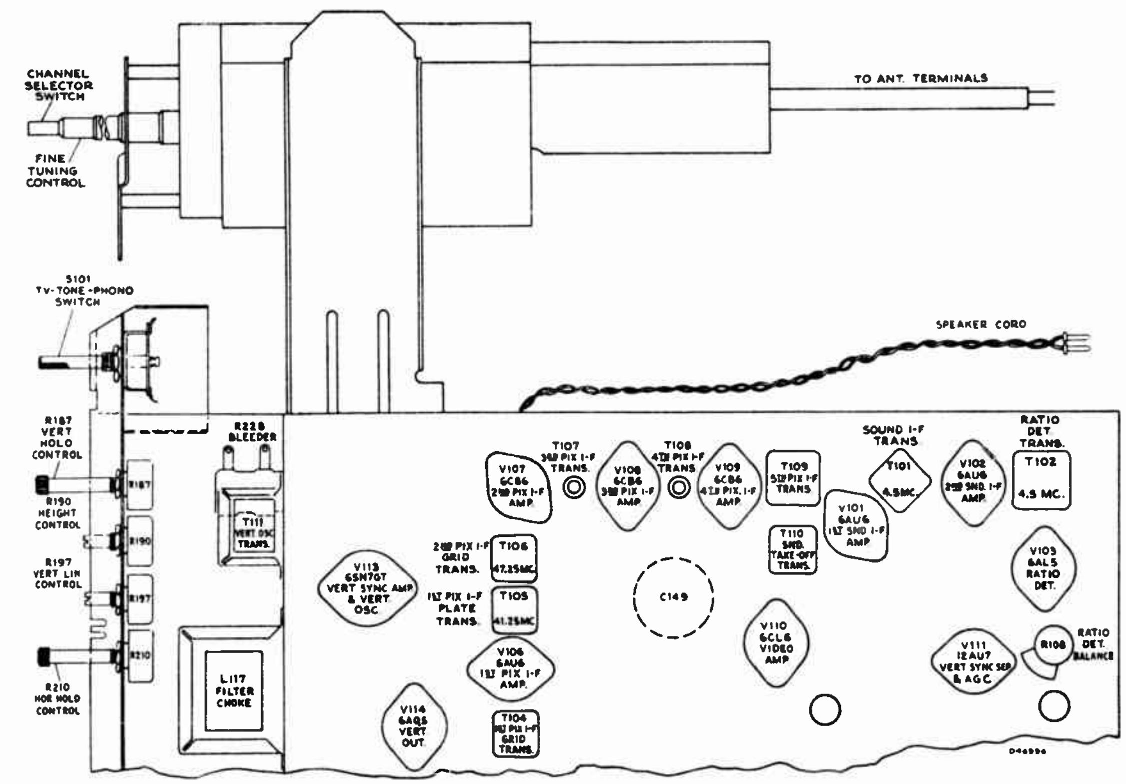


Figure 27—Bottom Chassis Adjustments (KRK29 Tuner Shown)

VOLTAGE CHART

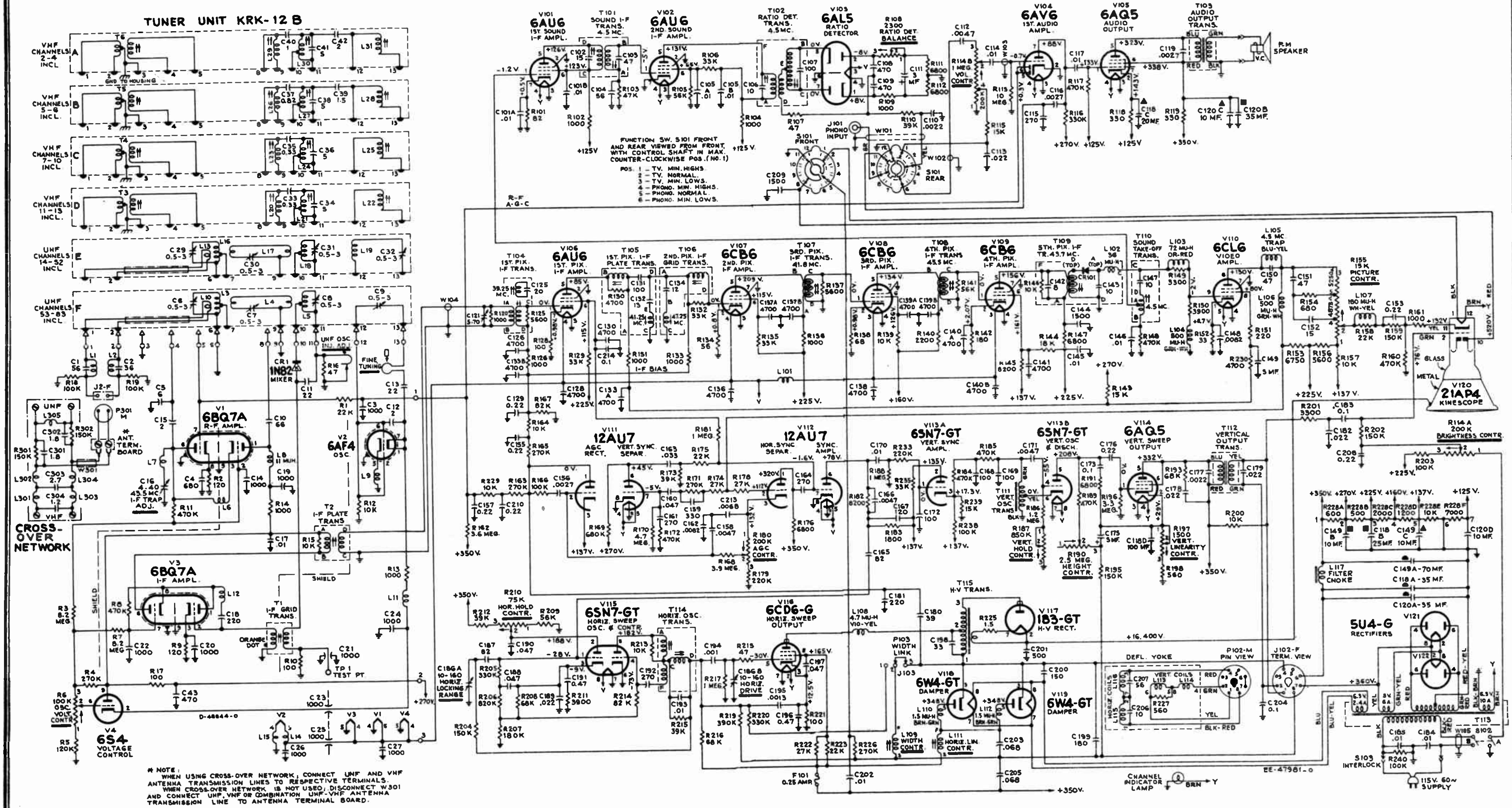
The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V1 KRK29	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	170	—	—	8	0.1	7		—	—	
			No Signal	6	133	—	—	8	1.1	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	
V2 KRK29	6X8	Mixer	5000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	—	—	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	—	—	
		R-F Oscillator	5000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	—	—	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	—	—	
V1 KRK12B	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	—	—	
			No Signal	6	138	—	—	8	1.0	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	260	—	—	3	143	2	97	—	—	
			No Signal	1	250	—	—	3	137	2	97	—	—	
V2	6AF4	R-F Oscillator	5000 Mu. V. Signal	1 & 7	78	—	—	5	0	2&6	−8	—	—	
			No Signal	1 & 7	75	—	—	5	0	2&6	−6	—	—	
V3 KRK12B	6BQ7A	I-F Amplifier	5000 Mu. V. Signal	6	270	—	—	8	148	7	103	—	—	
			No Signal	6	260	—	—	8	142	7	99	—	—	
		I-F Amplifier	5000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	—	—	
			No Signal	1	143	—	—	3	1.2	2	0	—	—	
V4	6S4	Voltage Control	5000 Mu. V. Signal	9	270	—	—	2	94	6	*68	—	—	*Depends on adjustment of R6.
			No Signal	9	260	—	—	2	90	6	*65	—	—	
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	127	6	124	7	0.7	1	−0.4	6.0	3.0	
			No Signal	5	126	6	123	7	0.5	1	−1.2	5.0	3.0	
V102	6AU6	2nd Sound I-F Amp.	5000 Mu. V. Signal	5	132	6	60	7	0	1	−10	2.8	1.2	
			No Signal	5	131	6	65	7	0	1	−5	2.0	1.0	
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	2 7	−9.2 1.0	—	—	5 1	1.0 9.2	—	—	—	—	
			No Signal	2 7	−8.0 0	—	—	5 1	0 8.0	—	—	—	—	
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	90	—	—	2	0	1	−0.7	0.65	—	At min. volume
			No Signal	7	88	—	—	2	0	1	−0.7	0.65	—	
V104	6AV6	R-F Bias Clamp	5000 Mu. V. Signal	5-6	−3.0	—	—	2	0	—	—	—	—	
			No Signal	5-6	0.3	—	—	2	0	—	—	—	—	
V105	6AQ5	Audio Output	5000 Mu. V. Signal	5	327	6	342	2	146	7	136	28	2.0	At min. Volume
			No Signal	5	323	6	338	2	143	7	133	28	2.0	
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	160	6	215	7	0.17	1	−6.6	1.4	.4	
			No Signal	5	85	6	115	7	0.98	1	0	6.5	3.3	

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	227	6	225	2	0.1	1	−6.6	1.5	.25	
			No Signal	5	209	6	115	2	0.8	1	0	10.9	3.3	
V108	6CB6	3rd Pix. I-F Amplifier	5000 Mu. V. Signal	5	138	6	132	2	1.02	1	0	11.4	3.5	
			No Signal	5	134	6	126	2	.98	1	0	10.4	3.1	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	168	6	165	2	2.32	1	0	8.85	2.2	
			No Signal	5	156	6	161	2	2.07	1	0	8.6	2.1	
V110	6CL6	Video Amplifier	5000 Mu. V. Signal	6	130	3-8	159	1	.84	2-9	*−5.0	22.5	5.5	*Depends on picture
			No Signal	6	130	3-8	80	1	0.7	2-9	*−2.0	15.0	4.0	*Depends on picture
V111A	12AU7	AGC Rectifier	5000 Mu. V. Signal	1	−30	—	—	3	142	—	— *	0	—	AGC control set for normal operation
			No Signal	1	0	—	—	3	137	—	—	0	—	
V111B	12AU7	Vert. Sync. Separator	5000 Mu. V. Signal	6	110	—	—	8	0	7	−42	.25	—	
			No Signal	6	45	—	—	8	0	7	*−5	.25	—	*Depends on noise
V112A	12AU7	Hor. Sync. Separator	5000 Mu. V. Signal	1	323	—	—	3	192	2	116	.5	—	
			No Signal	1	320	—	—	3	132	2	112	.5	—	
V112B	12AU7	Sync. Amplifier	5000 Mu. V. Signal	6	78	—	—	8	0	7	−3.5	6.2	—	
			No Signal	6	78	—	—	8	0	7	−1.6	6.2	—	
V113A	6SN7GT	Vert. Sync. Amplifier	5000 Mu. V. Signal	2	140	—	—	3	19.2	1	−.35	0.1	—	
			No Signal	2	135	—	—	3	17.3	1	0	<0.1	—	
V113B	6SN7GT	Vert. Osc. & Discharge	5000 Mu. V. Signal	5	203	—	—	6	0	4	−56	.2	—	
			No Signal	5	208	—	—	6	0	4	−55	.2	—	
V114	6AQ5	Vertical Output	5000 Mu. V. Signal	5	334	6	334	2	30	1	0	17.3	1.2	
			No Signal	5	332	6	332	2	29	1	0	17.3	1.2	
V115	6SN7GT	Horizontal Osc. Control	5000 Mu. V. Signal	2	188	—	—	3	−9	1	−28	0.37	—	Hor. hold at mid-range
			No Signal	2	0	—	—	3	0	1	0	0	—	
		Horizontal Oscillator	5000 Mu. V. Signal	5	184	—	—	6	0	4	−72	2.5	—	Hor. hold at mid-range
			No Signal	5	182	—	—	6	0	4	−73	2.5	—	
V116	6CD6G	Horizontal Output	5000 Mu. V. Signal	Cap	*	8	165	3	12.5	5	−30	110	15.0	*High Voltage Pulse Present
			No Signal	Cap	*	8	165	3	12.5	5	−30	110	15.0	
V117	1B3GT /8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	
V118 V119	6W4GT	Dampers	5000 Mu. V. Signal	5	352	—	—	3	*	—	—	57	—	*High Voltage Pulse Present
			No Signal	5	348	—	—	3	*	—	—	57	—	
V120	21AP4	Kinescope	5000 Mu. V. Signal	Cone	16,000	10	525	11	140	2	*82	0.2	—	At average Brightness
			No Signal	Cone	16,400	10	520	11	132	2	*76	0.2	—	*0 voltage on Phono. position
V121 V122	5U4G	Rectifiers	5000 Mu. V. Signal	4 & 6	364	—	—	2 & 8	364	—	—	*145	—	*Per Tube
			No Signal	4 & 6	360	—	—	2 & 8	360	—	—	*150	—	

KCS81J CIRCUIT SCHEMATIC DIAGRAM



* NOTE: WHEN USING CROSS-OVER NETWORK, CONNECT UHF AND VHF ANTENNA TRANSMISSION LINES TO RESPECTIVE TERMINALS. WHEN CROSS-OVER NETWORK IS NOT USED, DISCONNECT W301 AND CONNECT UHF, VHF OR COMBINATION UHF-VHF ANTENNA TRANSMISSION LINE TO ANTENNA TERMINAL BOARD.

The schematic is shown in the latest condition at the time of printing. All resistance values in ohms. K = 1000.

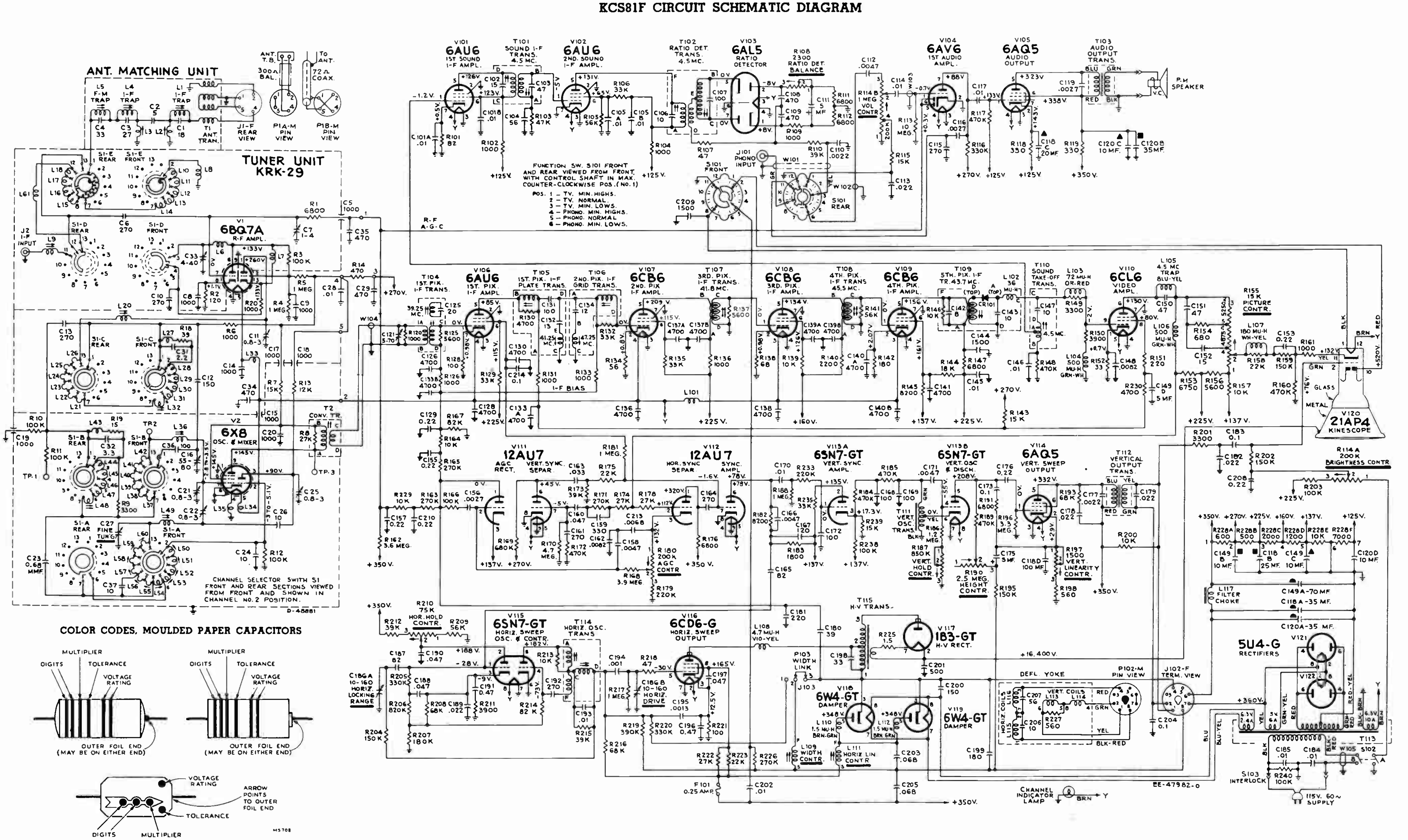
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

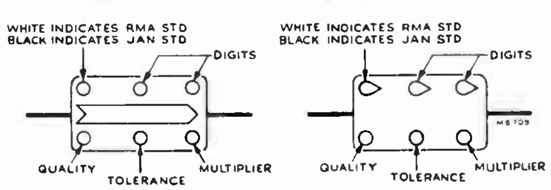
All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 29—Circuit Schematic Diagram, KCS81J

KCS81F CIRCUIT SCHEMATIC DIAGRAM



RMA COLOR CODE, FIXED MICA CAPACITORS



The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

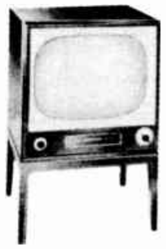
All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 28—Circuit Schematic Diagram, KCS81F

REPLACEMENT PARTS

STOCK No.	PART DESCRIPTION
	R-F UNIT ASSEMBLIES
	KRK29
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78235	Board—Terminal board, 5 contact and ground
78233	Bracket—Side bracket for mounting coil and stators
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:
77151	0.8-3.0 mmf. (C11, C21, C25)
77913	0.8-3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:
77084	Feed-thru, 1,000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0:
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, -0%, 500 volts (C29, C34, C35)
77252	1,000 mmf., +100%, -0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., +100%, -0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K":
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0:
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750:
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, headed-lead:
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31)
71503	3.3 mmf., ±20%, 500 volts (C32)
	Capacitor—Mica trimmer:
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel No. 6 mixer coil (L48)
73460	Coil—Channel No. 6 r-f plate coil (L32)
78401	Coil—Channel No. 6 antenna coil (L61)
77915	Coil—Channel No. 13 oscillator coil (L49)
77919	Coil—Channel No. 13 mixer coil (L36)
77921	Coil—Channel No. 13 r-f plate coil (L20)
78224	Coil—Choke coil (.47 muh) (L27)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I-F input coil complete with adjustable core (L9)
76562	Coil—R-F amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
	Resistor—Fixed, composition:
503015	15 ohms, ±10%, ½ watt (R19)
503039	39 ohms, ±10%, ½ watt (R18)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1,000 ohms, ±10%, ½ watt (R6, R20)
503233	3,300 ohms, ±10%, ½ watt (R9)
503268	6,800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Converter transformer (T2, R8)
76540	Trap—F-M trap complete with adjustable core (L5)
78466	Trap—I-F trap
76542	Trap—I-F trap (41.25 mc.) complete with core (L1)
76541	Trap—I-F trap (45.75 mc.) complete with core (L4)
	R-F UNIT ASSEMBLIES
	KRK12B
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C16)
	Capacitor—Ceramic:
77084	Feed-thru, 1,000 mmf. (C21, C23, C25)
77615	Stand-off, 1,000 mmf. (C3, C19, C24, C26)
	Capacitor—Fixed, ceramic, crystal holder, Temp. coef. = -750:
77621	22 mmf., ±10% (C11)
	Capacitor—Fixed, ceramic, High "K" disc:
77625	220 mmf., +100%, -0%, 500 volts DC (C18)
77293	470 mmf., +100%, -0%, 500 volts DC (C43)
77624	680 mmf., +100%, -0%, 500 volts DC((C4)
77252	1,000 mmf., +100%, -0%, 500 volts DC (C14, C20, C22, C27)
73960	10,000 mmf., +100%, -0%, 500 volts DC (C17)
	Capacitor—Fixed, ceramic, insulated:
77667	Comprising: 1 section of 2 mmf., and 1 section of 22 mmf. (C12, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77210	2 mmf., ±0.25 mmf., 500 volts DC (C15)
77688	5 mmf., ±.5 mmf., 500 volts DC (C34, C36, C38, C41)
74182	6 mmf., ±0.5 mmf., 500 volts DC (C5)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
71924	56 mmf., ±10%, 500 volts DC (C10)
	Capacitor—Fixed, headed-lead type:
77691	.33 mmf., ±10%, 500 volts DC (C33, C35)
77689	.82 mmf., ±10%, 500 volts DC (C37)
77690	1.0 mmf., ±10%, 500 volts DC (C40)
71500	1.5 mmf., ±10%, 500 volts DC (C39)
78047	2 mmf., ±10%, 500 volts DC (C42)
77628	Coil—I-F trap (L7)
77634	Coil—I-F neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—R-F plate coil (L8)
77633	Connector—Formed grounding connector
77612	Contact—Bracket and spring contact assembly for grounding rotor—assembled to base
77618	Contact—Bracket and spring contact assembly for grounding rotor—assembled to oscillator shield
77606	Contact—Contact and support assembly—"L" shape—complete with two (2) contacts
78415	Contact—Contact and support assembly complete with one (1) contact
77620	Contact—Contact and support assembly complete with four (4) contacts and holder for crystal rectifier
77607	Contact—Contact and support assembly complete with five (5) contacts—rear of chassis
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
77489	Rectifier—Germanium rectifier IN82 (CR1)
	Resistor—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1,000 ohms, ±10%, ½ watt (R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
	CHASSIS ASSEMBLIES
	KCS81F — VHF Chassis
	KCS81J — UHF Chassis
77609	Transformer—Mixer I-F transformer complete with adjustable cores (T1)
77610	Transformer—Primary I-F link transformer complete with adjustable cores (T2, R15)
77626	Trap—I-F trap (L1, C1, L2, C2)
	Capacitor—Ceramic:
76488	500 mmf., 30,000 volts (C201)
75166	Stand-off, 1,500 mmf. (C144)
	Capacitor—Fixed, ceramic:
76577	33 mmf., 6,000 volts (C198)
76574	39 mmf., 3,500 volts (C180)
76576	150 mmf., 2,000 volts (C200)
76575	180 mmf., 3,500 volts (C199)
	Capacitor—Fixed, ceramic, High "K" disc:
73748	1,500 mmf., +100%, -0%, 500 volts (C209)
73473	4,700 mmf., +100%, -0%, 500 volts (C126, C128, C130, C136, C138, C141
76470	Dual 4,700 mmf., +100%, -0%, 500 volts (C133A, C133B, C137A, C137B, C139A, C139B, C140A, C140B)
73960	10,000 mmf., +100%, -0%, 500 volts (C145, C146)
75877	Dual 10,000 mmf., +100%, -0%, 500 volts (C101A, C101B, C105A, C105B)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
39044	15 mmf., ±10%, 500 volts (C152)
39042	47 mmf., ±10%, 500 volts (C151)
71924	56 mmf., ±10%, 500 volts (C104)
39396	100 mmf., ±10%, 500 volts (C168, C169, C172)
71614	120 mmf., ±10%, 500 volts (C167)
47617	270 mmf., ±10%, 500 volts (C115, C164)
	Capacitor—Fixed, mica:
76474	82 mmf., 1,000 volts (C165, C187)
75248	220 mmf., 1,000 volts (C181)
39638	270 mmf., 500 volts (C161)
76579	270 mmf., 1,000 volts (C192)
39640	330 mmf., 500 volts (C159)
39644	470 mmf., 500 volts (C108, C109)
	Capacitor—Mica trimmer:
71496	5-70 mmf. (C121)
75217	10-160 mmf. dual (C186A, C186B)
	Capacitor—Electrolytic:
74521	5 mfd., 50 volts (C111)
28417	5 mfd., 450 volts (C175)
76486	Comprising: 1 section of 35 mfd., 450 volts, 1 section of 25 mfd., 450 volts, 1 section of 20 mfd., 200 volts, and 1 section of 100 mfd., 50 volts (C118A, C118B, C118C, C118D)
76485	Comprising: 2 sections of 35 mfd., 450 volts, 1 section of 10 mfd., 450 volts, and 1 section of 10 mfd., 200 volts (C120A, C120B, C120C, C120D)
77657	Comprising: 1 section of 70 mfd., 450 volts, 2 sections of 10 mfd., 450 volts, and 1 section of 5 mfd., 450 volts (C149A, C149B, C149C, C149D)
	Capacitor—Fixed, moulded paper:
73594	.01 mfd., 600 volts (C184, C185)
	Capacitor—Fixed, tubular, paper, oil impregnated:
75643	.001 mfd., 1,000 volts (C194)
73595	.0022 mfd., 600 volts (C110)
73803	.0022 mfd., 1,000 volts (C177)
73599	.0027 mfd., 600 volts (C116, C119, C156)
73920	.0047 mfd., 600 volts (C112, C158, C166)
73789	.0068 mfd., 400 volts (C213)
73808	.0082 mfd., 1,000 volts (C148, C162)
73561	.01 mfd., 400 volts (C114, C117, C170, C202)
73562	.022 mfd., 400 volts (C113, C178, C179, C189)
73798	.022 mfd., 600 volts (C182)
73552	.033 mfd., 400 volts (C163)
73553	.047 mfd., 400 volts (C160, C188, C190)
73592	.047 mfd., 600 volts (C197)
73815	.068 mfd., 1,000 volts (C203, C205)
73551	0.1 mfd., 400 volts (C183, C214)
73557	0.1 mfd., 600 volts (C173, C204)
73794	0.22 mfd., 400 volts (C129, C153, C155, C157, C208, C210)
74957	0.22 mfd., 600 volts (C176)
73787	0.47 mfd., 200 volts (C191, C196)
	Capacitor—Fixed, tubular, moulded paper, oil impregnated:
77727	.0013 mfd., 600 volts (C195)
73920	.0047 mfd., 600 volts (C171)
73594	.01 mfd., 600 volts (C193)
77676	Choke—Filter choke (L117)
76143	Clip—Mounting clip for stand-off capacitor
73477	Coil—Choke coil (L101)
76672	Coil—Filament winding only for hi-voltage transformer (Part of T115)
76483	Coil—Horizontal linearity coil complete with adjustable core (L111)
76646	Coil—Peaking coil (72 muh) (L103, R149)
76647	Coil—Peaking coil (180 muh) (L107, R158)
75252	Coil—Peaking coil (500 muh) (L104, L106)
76640	Coil—R-F choke coil (1.5 muh) (L110, L112)
76510	Coil—R-F choke coil (4.7 muh) (L108)
76484	Coil—Width coil complete with adjustable core (L109)
77654	Control—AGC control (R180)
77655	Control—Brightness control, volume control and power switch (R114A, R114B, S102)
77640	Control—Height control (R190)
77639	Control—Horizontal hold control (R210)
76445	Control—Picture control (R155)
77199	Control—Ratio detector balance control (R108)
77652	Control—Vertical hold control (R187)
77653	Control—Vertical linearity control (R197)
77647	Coupling—Coupling (nylon) for picture control
77136	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
73600	Fuse—0.25 amp., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd anode lead exit
76480	Lead—Anode lead complete with eyelet
76500	Plate—Hi-voltage plate (bakelite) complete less transformer, socket and lead
76649	Radiator—Heat dissipating radiator for V116
76675	Rectifier—Picture detector crystal rectifier (CR101)
	Resistor—Fixed, wire wound:
76468	1.5 ohms, 1/3 watt (R225)
74015	100 ohms, 2 watts (R221)
77651	Comprising: 1 section of 600 ohms, 16 watts, 1 section of 500 ohms, 6 watts, 1 section of 2,000 ohms, 5 watts, 1 section of 1,200 ohms, 1 watt, 1 section of 10,000 ohms, 5 watts, and 1 section of 7,000 ohms, 5 watts (R228A, R228B, R228C, R228D, R228E, R228F)
76642	6,750 ohms, 10 watts (R153)
	Resistor—Fixed, composition:
503033	33 ohms, ±10%, ½ watt (R152)
503047	47 ohms, ±10%, ½ watt (R107, R218)
502056	56 ohms, ±5%, ½ watt (R134)
502068	68 ohms, ±5%, ½ watt (R138)
502082	82 ohms, ±5%, ½ watt (R101)
502110	100 ohms, ±5%, ½ watt (R128)
503118	180 ohms, ±10%, ½ watt (R142)
503122	220 ohms, ±10%, ½ watt (R151)
513133	330 ohms, ±10%, 1 watt (R118, R119)
503156	560 ohms, ±10%, ½ watt (R198)
503168	680 ohms, ±10%, ½ watt (R154)
503210	1,000 ohms, ±10%, ½ watt (R102, R104, R109, R120, R126, R131, R133, R136, R161)
502218	1,800 ohms, ±5%, ½ watt (R183)
503222	2,200 ohms, ±10%, ½ watt (R140)
502233	3,300 ohms, ±10%, ½ watt (R201)
502239	3,900 ohms, ±5%, ½ watt (R150)
503239	3,900 ohms, ±10%, ½ watt (R211)
503247	4,700 ohms, ±10%, ½ watt (R230)
502256	5,600 ohms, ±5%, ½ watt (R137)
513256	5,600 ohms, ±10%, 1 watt (R156)
14659	6,800 ohms, ±5%, ½ watt (R111, R112, R191)
503268	6,800 ohms, ±10%, ½ watt (R176)
513268	6,800 ohms, ±10%, 1 watt (R147)
503282	8,200 ohms, ±10%, ½ watt (R145)
513282	8,200 ohms, ±10%, 1 watt (R182)
503310	10,000 ohms, ±10%, ½ watt (R139, R164, R200, R213, R229)
513310	10,000 ohms, ±10%, 1 watt (R157)
503315	15,000 ohms, ±10%, ½ watt (R115, R239)
523315	15,000 ohms, ±10%, 2 watts (R143)
503318	18,000 ohms, ±10%, ½ watt (R144)
503322	22,000 ohms, ±10%, ½ watt (R175)
522322	22,000 ohms, ±10%, 2 watts (R223)
503327	27,000 ohms, ±10%, ½ watt (R174, R178)
523327	27,000 ohms, ±10%, 2 watts (R222)
503333	33,000 ohms, ±10%, ½ watt (R106, R129, R132, R135, R235)
503339	39,000 ohms, ±10%, ½ watt (R110, R173, R212, R215)
503347	47,000 ohms, ±10%, ½ watt (R103)
502356	56,000 ohms, ±5%, ½ watt (R141)
503356	56,000 ohms, ±10%, ½ watt (R105, R209)
503368	68,000 ohms, ±10%, ½ watt (R208)
512368	68,000 ohms, ±5%, 1 watt (R193)
513368	68,000 ohms, ±10%, 1 watt (R216)
8064	82,000 ohms, ±5%, ½ watt (R167)
513382	82,000 ohms, ±10%, 1 watt (R214)
503410	100,000 ohms, ±10%, ½ watt (R166, R203, R238)
513510	100,000 ohms, ±10%, 1 watt (R240)
503415	150,000 ohms, ±10%, ½ watt (R159, R195, R202, R204)
503418	180,000 ohms, ±10%, ½ watt (R207)
502422	220,000 ohms, ±5%, ½ watt (R179)
503422	220,000 ohms, ±10%, ½ watt (R233)
502427	270,000 ohms, ±5%, ½ watt (R163, R165)
503427	270,000 ohms, ±10%, ½ watt (R171, R226)
503433	330,000 ohms, ±10%, ½ watt (R116, R205, R220)
503439	390,000 ohms, ±10%, ½ watt (R219)
503447	470,000 ohms, ±10%, ½ watt (R117, R148, R160, R172, R184, R185, R189)
503468	680,000 ohms, ±10%, ½ watt (R169)
503482	820,000 ohms, ±10%, ½ watt (R206)
503510	1 megohm, ±10%, ½ watt (R181, R188, R217)
503512	1.2 megohm, ±10%, ½ watt (R186)
503533	3.3 megohm, ±10%, ½ watt (R196)
512536	3.6 megohm, ±5%, 1 watt (R162)
503539	3.9 megohm, ±10%, ½ watt (R168)
503547	4.7 megohm, ±10%, ½ watt (R170)
503610	10 megohm, ±10%, ½ watt (R113)
77198	Transformer—1st pix I-F grid transformer complete with adjustable cores (T104, C125, R125)
77197	Transformer—1st pix I-F plate transformer complete with adjustable cores (T105, C131, C132, R130)
76435	Transformer—2nd pix I-F grid transformer complete with adjustable cores (T106, C134)
76433	Transformer—3rd or 4th pix I-F transformer (T107, T108)
76436	Transformer—5th pix I-F transformer (T109, C142, C143, CR101, L102, R146)
76501	Transformer—Hi-voltage transformer (Part of T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T114)
76997	Transformer—Output transformer (T103)
77649	Transformer—Power transformer, 117 volts, 60 cycle (T113)
76439	Transformer—Ratio detector transformer complete with adjustable cores (T102, C106, C107)
76437	Transformer—Sound take-off transformer complete with adjustable core (T110, C147)
76438	Transformer—Sound I-F transformer complete with adjustable cores (T101, C102, C103)
77650	Transformer—Vertical oscillator transformer (T111)
76494	Transformer—Vertical output transformer (T112)
76482	Trap—4.5 M-C trap (L105, C150)
77585	Washer—"C" washer for picture control extension shaft (2 required)
	YOKE AND MAGNET ASSEMBLIES
76863	Connector—Anode connector complete with contact and terminal
75542	Connector—6 contact male connector for deflection yoke leads (P102)
78309	Cushion—Round rubber cushion for deflection yoke
74956	Cushion—Rubber cushion for deflection yoke hood
78308	Hood—Deflection yoke hood less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
78307	Plate—Metal plate for deflection yoke
78445	Spring—Grounding spring (coil) for deflection yoke
76636	Stud—Adjusting stud complete with guard for focus magnet
78278	Yoke—Deflection yoke complete with 6 contact male connector (L113, L114, L115, L116, C206, C207, R227, P102)
	SPEAKER ASSEMBLIES
	971490-3W 971490-3R
	RL105E6
	RMA-274 RMA-285
	(For Table Models)
75024	Cone—Cone and voice coil for speakers stamped 971490-3W
77129	Cone—Cone and voice coil for speaker stamped 971490-3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES
	92569-12W
	RL111A1
	RMA-274
	(For Console Models)
75682	Cone—Cone and voice coil (3.2 ohms)
76093	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to model number of instruments, number stamped on speaker and full description of part required.



Models 21-S-348, 21-S-348U, 21-S-348G, 21-S-348GU "Master 21" Ebony, Brown Maroon

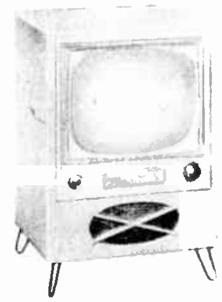
Models 21-S-353, 21-S-353U, 21-S-353G, 21-S-353GU "Barton" Ebony

Models 21-S-357G, 21-S-357GU "Modernette" Oak

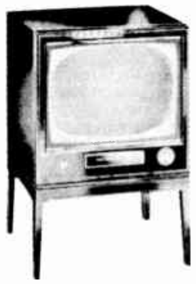
Models 21-S-359G, 21-S-359GU "Barnes" Maroon

Models 21-S-362M, 21-S-362MU, 21-S-362G, 21-S-362GU "Talbot" Mahogany, Oak

Models 21-S-367, 21-S-367U, 21-S-367G, 21-S-367GU "Ft. Knox" Mahogany, Oak



Models 21-S-369G, 21-S-369GU "Farrell" Oak



Models 21-S-354, 21S-354U, 21-S-354G, 21-S-354GU "Blake" Mahogany, Blonde

Models 21-S-355, 21-S-355U, 21-S-355G, 21-S-355GU "Cameron" Brown Maroon

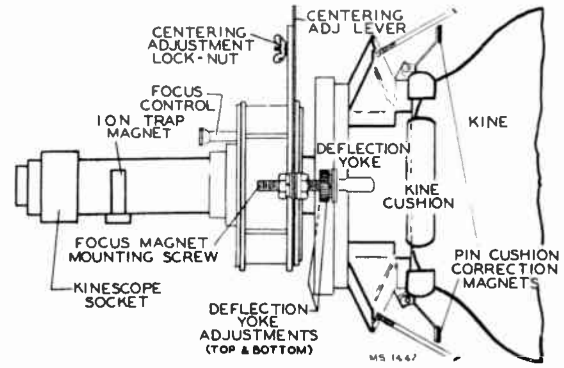


Figure 2—Ion Trap and Centering Magnet Adjustments

GENERAL DESCRIPTION

All models are "21 inch" television receivers. Models without a "U" designation in the model number are VHF only and feature full 12 channel VHF coverage. Models with the "U" designation in the model number are UHF/VHF and feature full 12 channel VHF coverage plus any UHF channels desired. All models have an auxiliary audio input jack to permit the use of an external record playing attachment except Models 21-S-348(U)(G)(GU).

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE .... 227 square inches on a 21AP4, 21EP4A or 21ZP4A Kinescope

TELEVISION R-F FREQUENCY RANGE

All Models without "U" Suffix (VHF only)

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

All Models with "U" Suffix (UHF/VHF)

Any of 70 UHF channels .... 470 mc. to 890 mc.
Any of 12 VHF channels .... 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency .... 45.75 mc.
Sound I-F Carrier Frequency .... 41.25 mc.

POWER RATING .... 215 watts

AUDIO POWER OUTPUT RATING .... 4 watts max.

VIDEO RESPONSE .... To 3.5 mc.

SWEEP DEFLECTION .... Magnetic

FOCUS .... Magnetic

ANTENNA INPUT IMPEDANCE

Models with VHF only

Choice: 300 ohms balanced or 72 ohms unbalanced.

UHF/VHF Models

UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuners KRK22C & KRK29 (Models with VHF only)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29A/27 (UHF/VHF Models)	
(1) RCA 6AF4	UHF Oscillator
(2) RCA 6BQ7A	VHF R-F Amplifier UHF I-F Amplifier
(3) RCA 6X8	VHF R-F Oscillator & Mixer UHF I-F Amplifier
A IN82 crystal is used as the UHF mixer	
All Models	
(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Det. and Horiz. Sync. Sep.
(5) RCA 6X8	Video Amplifier and Vert. Syn. Sep.
(6) RCA 12AU7	Video Output & AGC
(7) RCA 6AU6	1st Sound I-F Amplifier
(8) RCA 6AU6	2nd Sound I-F Amplifier
(9) RCA 6AL5	Ratio Detector
(10) RCA 6AV6	1st Audio Amplifier
(11) RCA 6K6GT	Audio Output
(12) RCA 6SN7GT	Vert. Osc. and Disch. & Sync. Output
(13) RCA 6K6GT	Vertical Sweep Output
(14) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(15) RCA 6BQ6GT	Horizontal Sweep Output
(16) RCA 6AX4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
*(18) RCA 21AP4, 21EP4A or 21ZP4A	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

*Refer to Chassis Designations

21-S-348 to 21-S-369G incl. 21-S-348U to 21-S-369GU incl. ELECTRICAL AND MECHANICAL SPECIFICATIONS (cont'd)

CHASSIS DESIGNATIONS

CHASSIS	TUNER	KINE-SCOPE	MODELS
KCS83	KRK29 (VHF only)	21AP4 (Metal)	21-S-362M 21-S-367
KCS83A	KRK29A/27 (UHF/VHF)	21AP4 (Metal)	21-S-362MU 21-S-367U
KCS83C	KRK29 (VHF only)	21EP4A (Glass)	21-S-353 21-S-354 21-S-355
KCS83C or KCS83PC-"G" Models only (Printed I-F Trans.)	KRK29 (VHF only)	21ZP4 (Glass)	21-S-353G 21-S-354G 21-S-355G 21-S-357G 21-S-359G 21-S-362G 21-S-367G 21-S-369G
KCS83D	KRK29A/27 (UHF/VHF)	21EP4A (Glass)	21-S-353U 21-S-354U 21-S-355U
KCS83D or KCS83PD-"GU" Models only (Printed I-F Trans.)	KRK29A/27 (UHF/VHF)	21ZP4A (Glass)	21-S-353GU 21-S-354GU 21-S-355GU 21-S-357GU 21-S-359GU 21-S-362GU 21-S-367GU 21-S-369GU
KCS83PJ (Printed I-F Trans.)	KRK29 (VHF only)	21EP4A (Glass) 21ZP4A (Glass)	21-S-348 21-S-348G
KCS83PK (Printed I-F Trans.)	KRK22C (VHF only)	21ZP4A (Glass)	21-S-353G 21-S-354G 21-S-355G 21-S-357G 21-S-359G 21-S-362G 21-S-367G 21-S-369G
KCS83PL (Printed I-F Trans.)	KRK22C (VHF only)	21ZP4A (Glass)	21-S-348G
KCS83 PM (Printed I-F Trans.)	KRK29A/27 (UHF/VHF)	21ZP4A (Glass)	21-S-348GU

OPERATING CONTROLS (Front)

Models with VHF only

Channel Selector / Fine Tuning .... Dual Control Knobs

UHF/VHF Models

VHF Channel Selector and UHF Changeover Switch / VHF Fine Tuning and UHF Tuning .... Dual Control Knobs

All Models

Brightness .... Single Control under Panel
Picture Horizontal Hold .... Single Control under Panel
Picture Vertical Hold .... Single Control under Panel
Sound Volume and On-Off Switch / Picture .... Dual Control Knobs
*TV-PH tone switch .... Single Control under Panel

**Except Models 21-S-348(U) (G) (GU)*

NON-OPERATING CONTROLS (under Front Panel)

Height .... screwdriver adjustment
Vertical Linearity .... screwdriver adjustment

NON-OPERATING CONTROLS
(not including R-F and I-F adjustments)

Picture Centering .... top chassis adjustment
Width .... rear chassis adjustment
Horizontal Drive .... rear chassis screwdriver adjustment
Horizontal Linearity .... rear chassis adjustment
Horizontal Oscillator Frequency .... rear chassis adjustment
Horizontal Oscillator Waveform .... bottom chassis adjustment
Horizontal Locking Range .... rear chassis adjustment
Focus .... top chassis adjustment
Ion Trap Magnet .... top chassis adjustment
Deflection Coil .... top chassis adjustment
AGC Control .... rear chassis adjustment

SCANNING .... Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY .... 15,750 cps

VERTICAL SWEEP FREQUENCY .... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) .... 30 cps

CHASSIS TOP VIEW

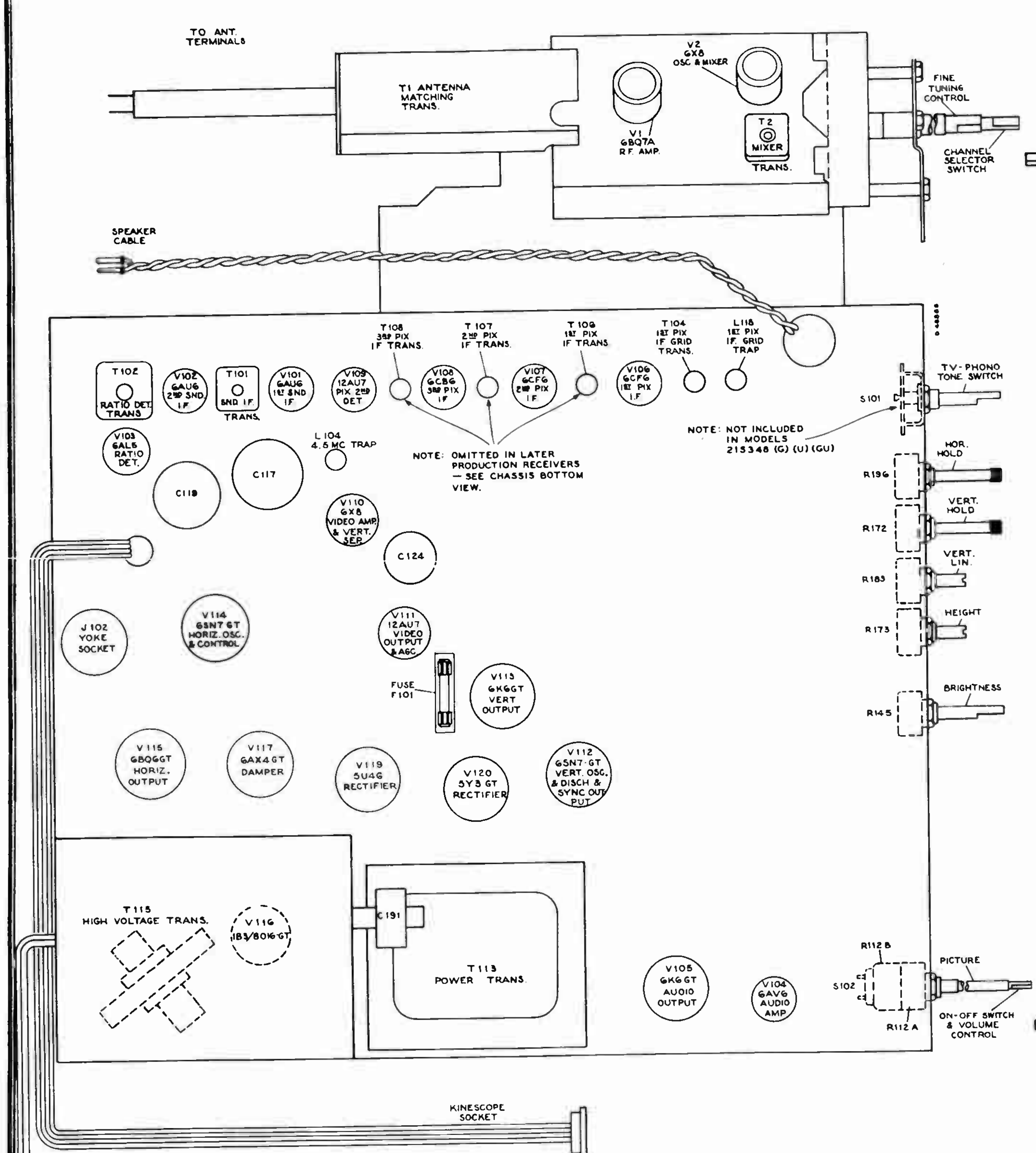


Figure 8—Chassis Top View (shown with KRK29 Tuner)

CHASSIS BOTTOM VIEW

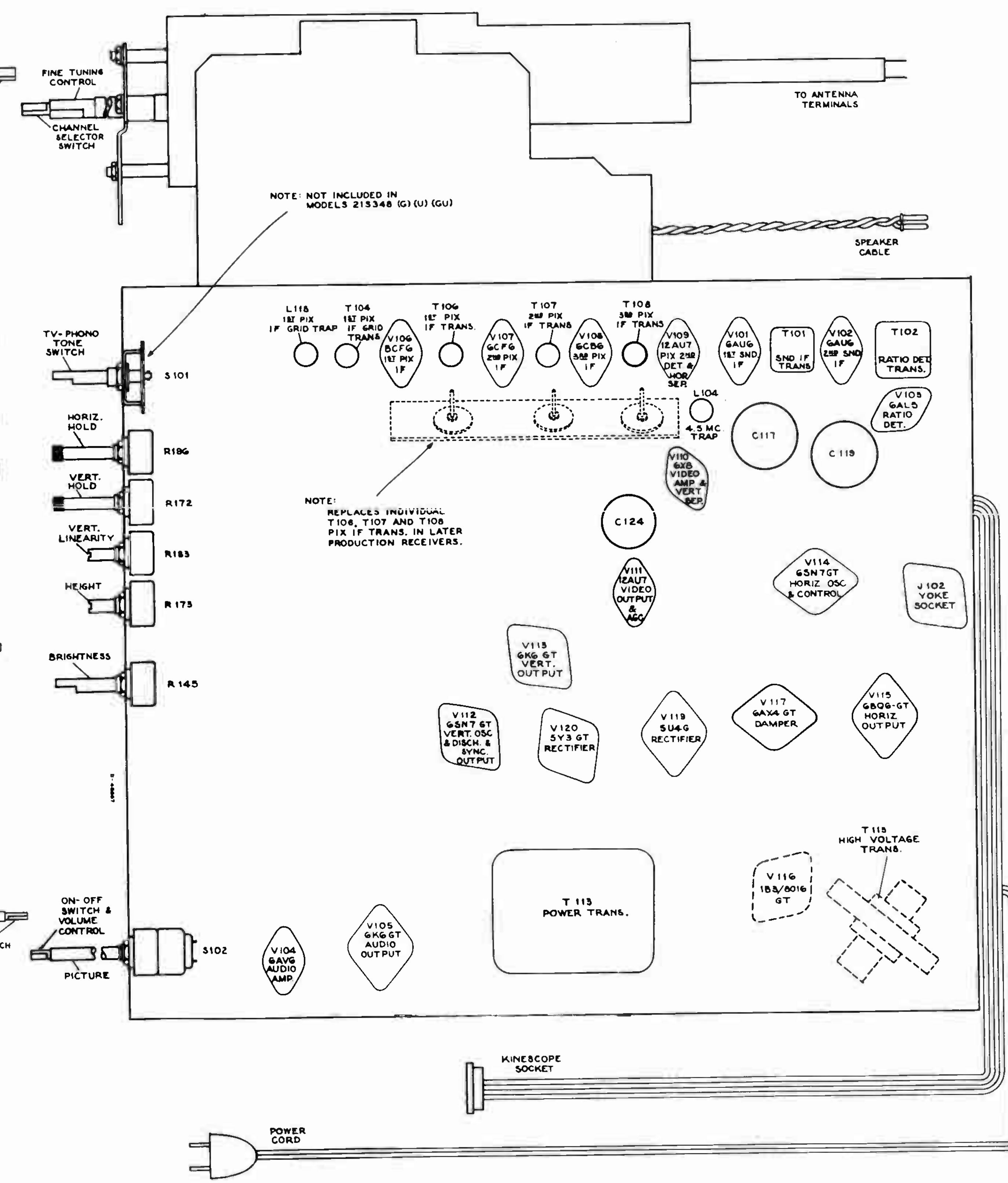


Figure 9—Chassis Bottom View (shown with KRK29 Tuner)

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable preamplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 21-S-348 to 21-S-369G Incl.

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R123 and C142. The second battery will be used later.

Set the bias to produce approximately —5.0 volt of bias at the junction of R123 and C142.

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc. T108
45.5 mc. T107
43.0 mc. T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R135, L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. L118

Models 21-S-348U to 21-S-369GU Incl.

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R123 and C142. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc. T108
45.5 mc. T107
43.0 mc. T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R135 and L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc. L118

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 21-S-348 to 21-S-369G Incl.

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 10. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

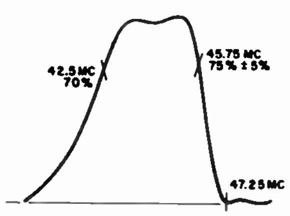


Figure 10—
KRK22C or KRK29
T2 and T104
Response

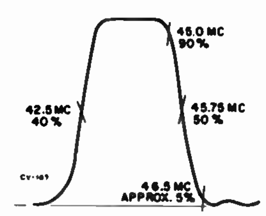


Figure 11—
Overall I-F
Response
with KRK22C or KRK29

Retouch T106, T107 and T108 to obtain the response shown in Figure 11.

Models 21-S-348U to 21-S-369GU Incl.

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 12.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

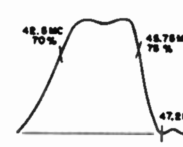


Figure 12—
KRK29A/27-T2
and T104
Response

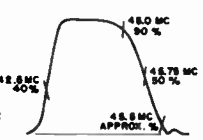


Figure 13—
Overall
I-F Response
with KRK29A/27

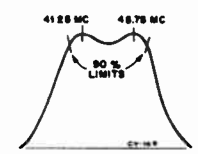


Figure 14—
KRK29A/27
L9 and L307
I-F Response

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplified. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 13.

To align the I-F amplifier circuit of the KRK29A/27, connect the VHF sweep generator to the rear terminal of the 1N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING to channel 47 at 670 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground. Connect the oscilloscope diode probe to the junction between the resistor and capacitor. (See Figure 25.)

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.3 or less peak-to-peak on the oscilloscope.

Adjust L307, on the KRK27 section, and L9, on the KRK29A section, of the tuner for maximum gain with picture and sound carrier markers as shown in figure 14.

ALIGNMENT PROCEDURE

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to the junction of R135 and L102. Use 3.0v. peak-to-peak on the oscilloscope.

Retouch L307 and L9 slightly, if necessary, to produce the curve shown in figure 14. Do not retouch T2, T104, T106, T107 or T108.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at —3.0 V and the I.F bias at —5.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 13. Retouch T107 and T108 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 13, retouching T107 and T108 if necessary to correct any overall tilt.

Remove the sweep and marker generators and the bias supplies.

KRK22C TUNER ALIGNMENT.—

Models 21-S-348 to 21-S-369G Incl.

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst". The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

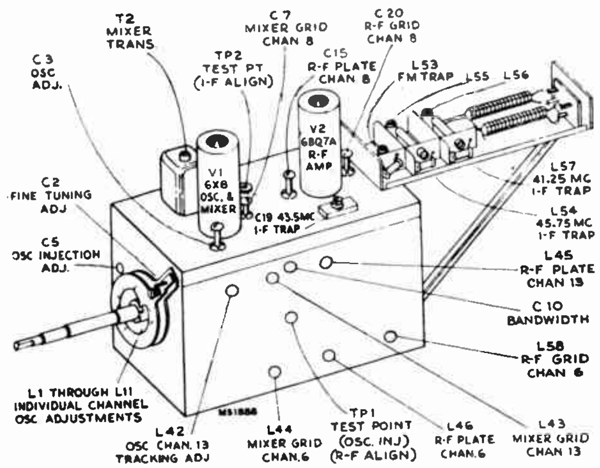


Figure 15—KRK22C Tuner Adjustment

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 16, to the input terminals of the antenna matching unit.

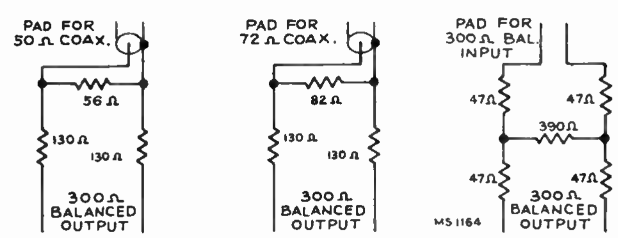


Figure 16—Sweep Attenuator Pads

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in figure 17.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP 1. Adjust C5 to read —3.0 volts dc on the "VoltOhmst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

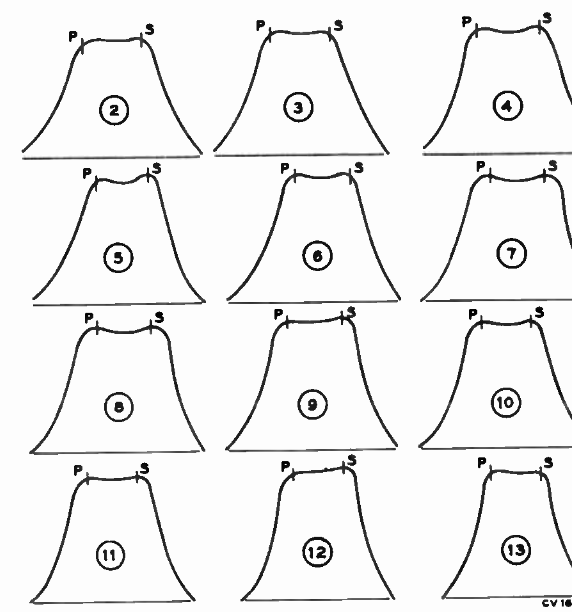


Figure 17—KRK22C R-F Response

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in figure 17.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46 and L58 for proper curve shape as shown in figure 17. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 17 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 17 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

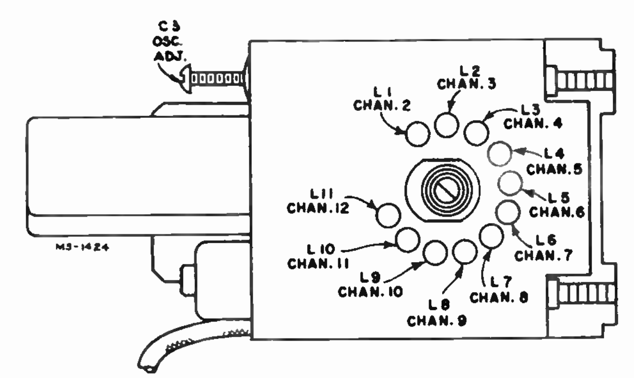


Figure 18—KRK22C Oscillator Adjustments

KRK22C ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L53 to the channel selector switch S4.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

ALIGNMENT PROCEDURE

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R123 and C142. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R123 and C142.

Connect an oscilloscope to the junction of R138 and L105 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L54 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L57 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L53 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L53 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 16 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L55 and L56 to obtain the response shown in figure 19. L55 is most effective in locating the position of the shoulder of the curve at 52 mc. and L56 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L53 and S4. Replace V106.

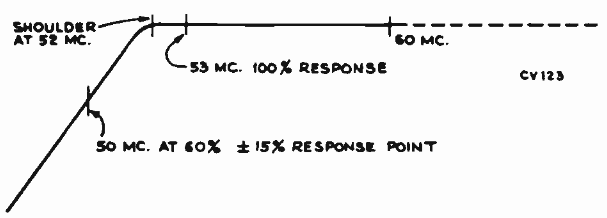


Figure 19—KRK22A Antenna Matching Unit Response

KRK29 TUNER ALIGNMENT

Models 21-S-348 to 21-S-369G Incl.

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

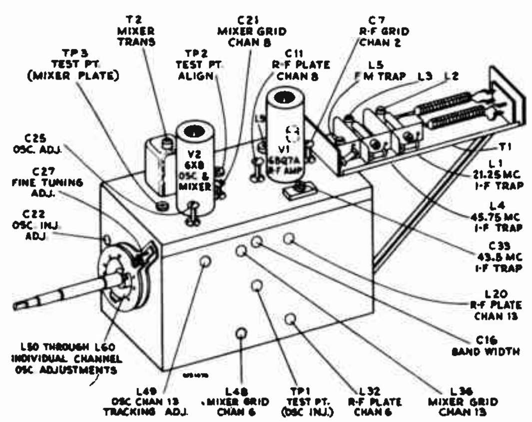


Figure 20—KRK29 Tuner Adjustments

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn the C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in Figure 16, to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

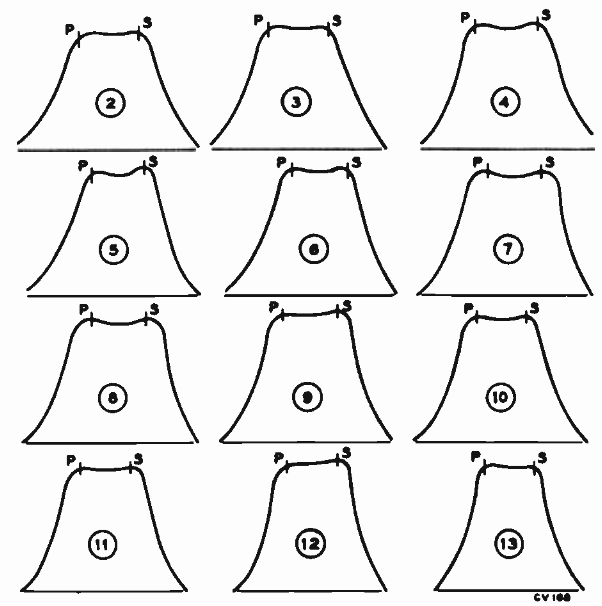


Figure 21—KRK29 R-F Response

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in Figure 21.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 21.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48, and L32 for proper curve shape as shown in Figure 21. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 21 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 21 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21, or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

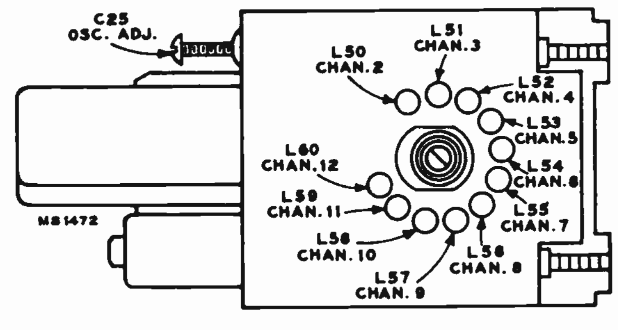


Figure 22—KRK29 R-F Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator

ALIGNMENT PROCEDURE

to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK29 OR KRK29A ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M Trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R123 and C142. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R123 and C142.

Connect an oscilloscope to the junction of R138 and L105 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 16 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

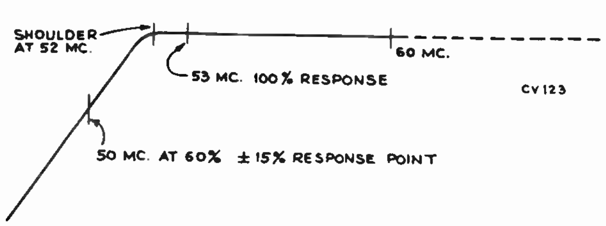


Figure 23—KRK29 or KRK29A Antenna Matching Unit Response

Adjust L2 and L3 to obtain the response shown in figure 23. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

KRK29A/27 TUNER ALIGNMENT

Models 21-S-348U to 21-S-369GU Incl.

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 16 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 24.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 24.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

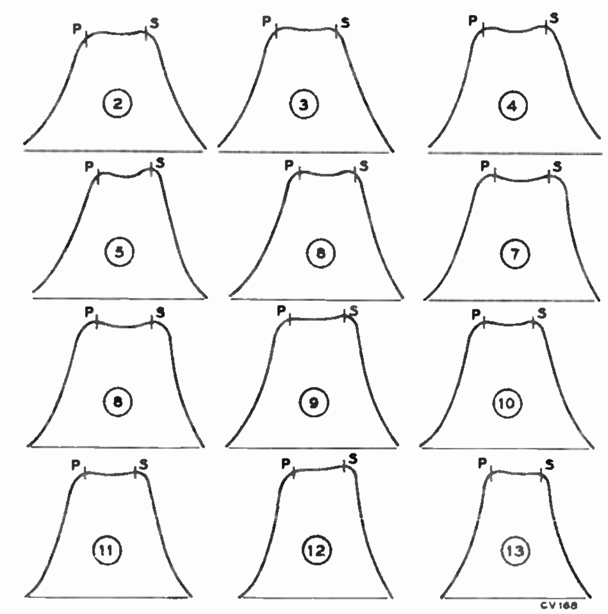


Figure 24—KRK29A R-F Response

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off it may be necessary to adjust the oscillator frequency

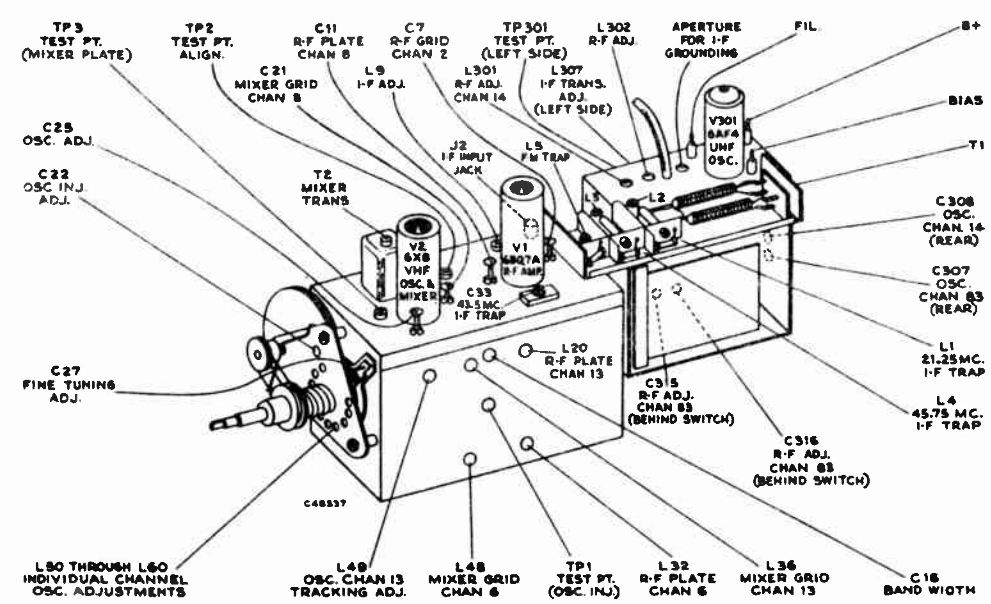


Figure 25—KRK29A/27 Tuner Adjustments

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and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in figure 24. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 24 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 24 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

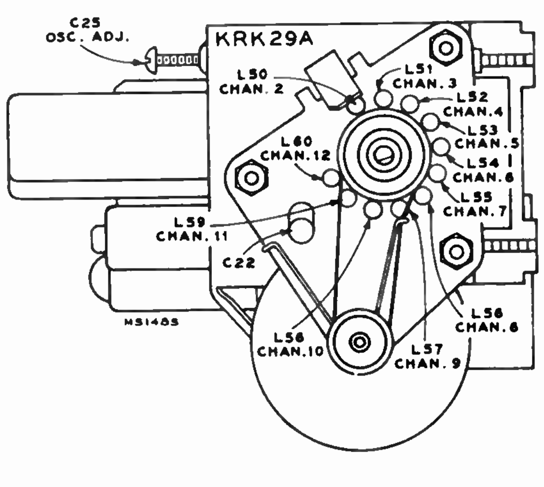


Figure 26—KRK29/27 Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT.—Ground the I-F transformer L307 by inserting a clip lead through the aperture provided in the top of the tuner. Ground the other end of the clip lead to the tuner case.

Connect the oscilloscope to the test point TP301, employing the preamplifier if needed with the oscilloscope used.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 9° and 168° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. By placing a 1/16" shim between the stop pin on the tuner and the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 168°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the rear terminal of the crystal holder and insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitors C315 and C316 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 27(A).

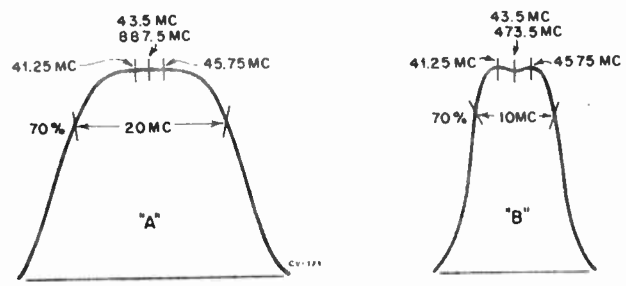


Figure 27—KRK27 R-F Response

Adjust the oscillator trimmer capacitor C307 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 27(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 9°, Channel 14, position.

Adjust R-F coils L1 and L2 for a maximum amplitude overcoupled curve centered at 473.5 mc. as shown in figure 27(B). Adjust the oscillator trimmer C308 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates may be knifed through the two holes provided on the left side of the tuner. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" to test point TP301. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .05 and .4 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 25). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L103 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R108 and C109.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst."

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R108 and C109. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst."

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 100 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 9 of V110.

Adjust the core of L104 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L104 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L104 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 9 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R196, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizon. hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

VOLTAGE CHART

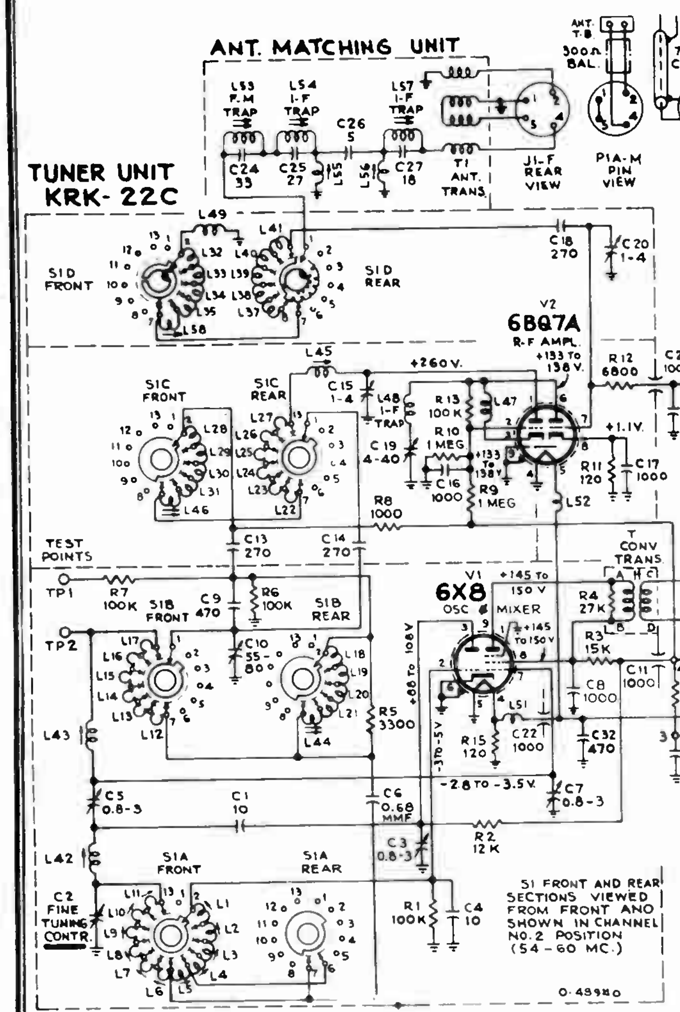
The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

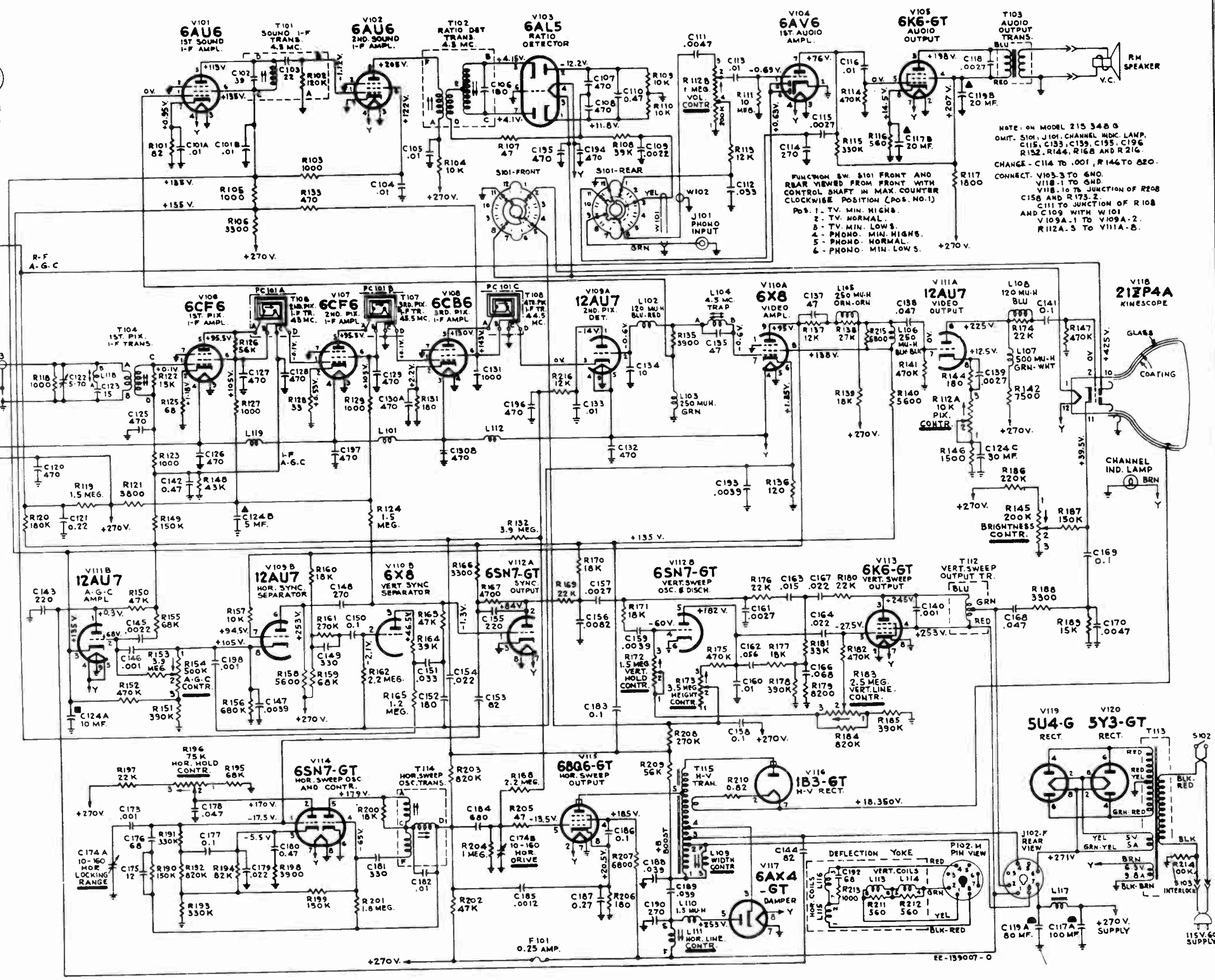
Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1 (V2) KRK22C KRK29 or KRK29A	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 (V1) KRK22C KRK29 or KRK29A	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	122	6	138	7	1.01	1	0	
			No Signal	5	113	6	126	7	.95	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	210	6	130	7	0	1	−2.05	*Unreliable measuring point. Voltage depends on noise.
			No Signal	5	205	6	122	7	0	1	*−1.12	
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	1.7	—	—	1	21	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	4.1	—	—	1	11.8	—	—	
		Ratio Detector	15000 Mu. V. Signal	2	1.7	—	—	5	21	—	—	
			No Signal	2	4.1	—	—	5	11.8	—	—	
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	78	—	—	2	0	1	−.7	At min. volume
			No Signal	7	76	—	—	2	0	1	−.65	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	205	4	220	8	15.2	5	0	At min. volume
			No Signal	3	198	4	207	8	14.5	5	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	218	6	240	2	132	1	−8.2	*Unreliable measuring point. Make measurement at T104-B.
			No Signal	5	95.5	6	105	2	1.18	1	*<0.1	
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	222	6	243	2	<0.1	1	−8.45	
			No Signal	5	95.5	6	105	2	0.53	1	<0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	138	6	150	2	2.3	1	0	
			No Signal	5	130	6	143	2	2.2	1	<0.1	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	−25.8	—	—	3	0	2	−1.85	
			No Signal	1	−14	—	—	3	0	2	−.6	

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V109B	12AU7	Horiz. Sync Separator	15000 Mu. V. Signal	6	260	—	—	8	160	7	122	
			No Signal	6	253	—	—	8	105	7	94.5	
V110A	6X8	Video Amplifier	15000 Mu. V. Signal	9	120	8	147	6	.9	7	−1.85	AGC control set for normal operation
			No Signal	9	95	8	138	6	1.35	7	−.6	AGC control set for normal operation
V110B	6X8	Vert. Sync Separator	15000 Mu. V. Signal	3	79	—	—	6	.90	2	−26.8	
			No Signal	3	46.5	—	—	6	1.35	2	−2.1	
V111A	12AU7	Video Output	15000 Mu. V. Signal	6	231	—	—	8	13	7	0	
			No Signal	6	225	—	—	8	12.5	7	0	
V111B	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	−55	—	—	3	135	2	125	
			No Signal	1	0.3	—	—	3	132	2	68	
V112A	6SN7GT	Sync Output	15000 Mu. V. Signal	1	83	—	—	3	0	2	−3.28	
			No Signal	1	84	—	—	3	0	2	−1.3	
V112B	6SN7GT	Vertical Oscillator & Discharge	15000 Mu. V. Signal	1	80	—	—	8	0	7	−63.5	Depends on setting of Vert. hold control
			No Signal	6	182	—	—	8	0	7	−60	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	253	4	262	8	0	5	−28.8	
			No Signal	3	245	4	253	8	0	5	−27.5	
V114	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	175	—	—	3	−3.5	1	−21	
			No Signal	2	170	—	—	3	−5.5	1	−17.5	
	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	183	—	—	6	0	4	−67	
			No Signal	5	179	—	—	6	0	4	−65	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	193	8	22	5	−14	*High Voltage Pulse Present
			No Signal	Cap	*	4	185	8	20.5	5	−13.5	*High Voltage Pulse Present
V116	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	18,700	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	18,350	—	—	*High Voltage Pulse Present
V117	6AX4GT	Damper	15000 Mu. V. Signal	5	261	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	253	—	—	3	*	—	—	*High Voltage Pulse Present
V118	*21AP4, 21EP4A or 21ZP4A	Kinescope	15000 Mu. V. Signal	Cap	18,700	10	428	11	44.5	2	0	At average Brightness
			No Signal	Cap	18,350	10	425	11	39.5	2	0	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	277	—	—	*Refer to Page 2.
			No Signal	4 & 6	—	—	—	2 & 8	271	—	—	

CIRCUIT SCHEMATIC DIAGRAM KCS83PK, KCS83PL   21-S348 to 21-S-369G incl.

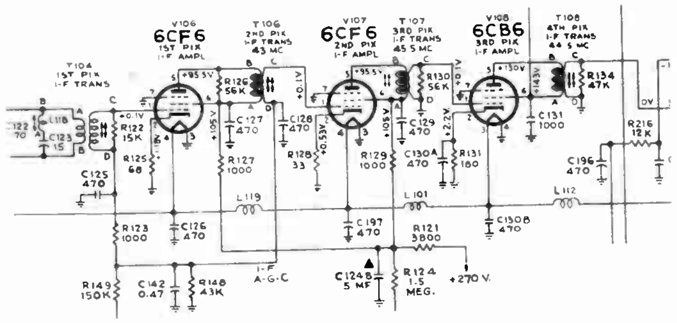




PRODUCTION CHANGES IN KCS83 SERIES CHASSIS

The schematics are shown in the latest condition. The note below tells how early receivers differed from the schematics shown above and on pages 24 and 26.

In early production receivers I-F transformers T106, T107 and T108 were individual and were connected as shown below:



(See page 23 for additional changes.)

The schematic is shown in the latest condition at the time of printing. All resistance value in ohms. K = 1000.

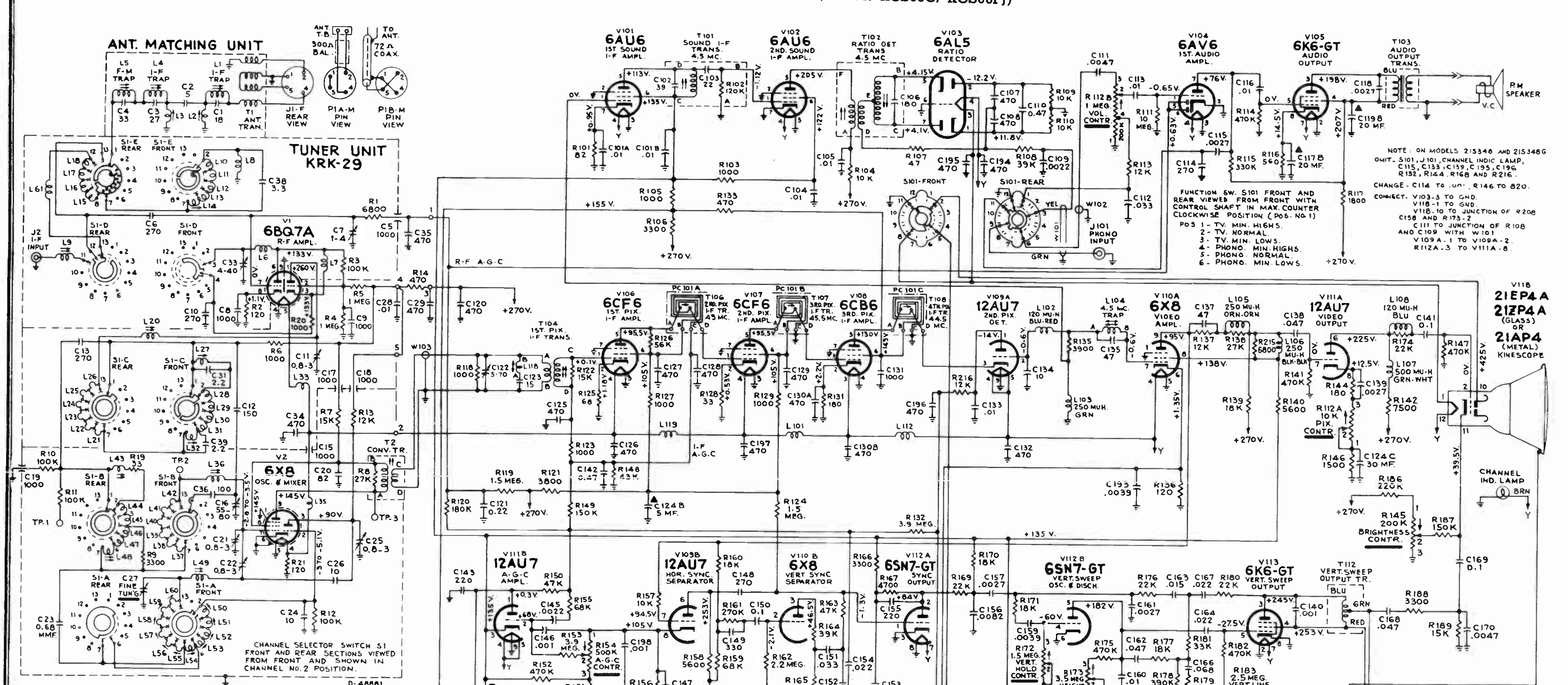
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

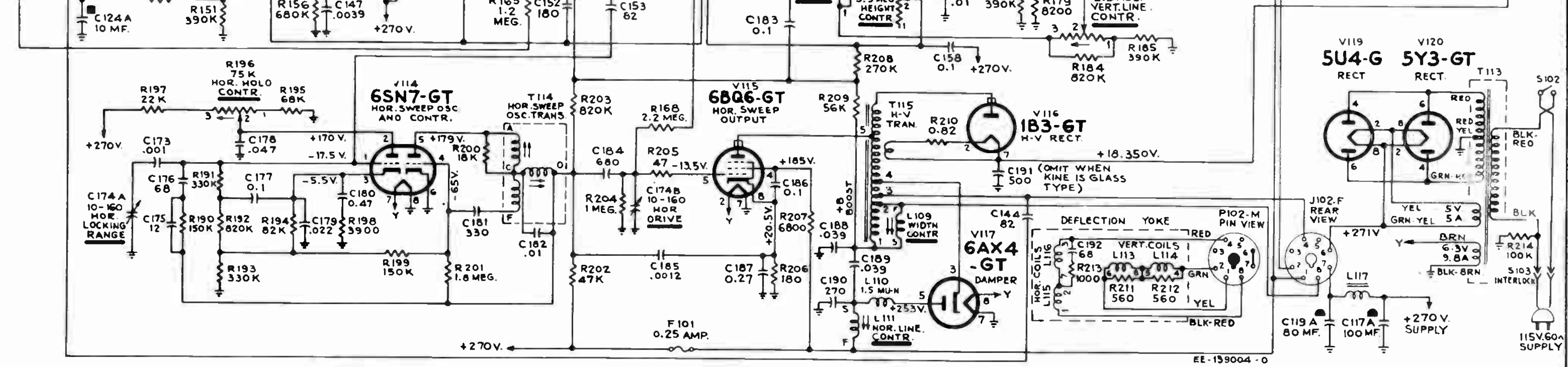
Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 30—Circuit Schematic Diagram KCS83PK, KCS83PL

CIRCUIT SCHEMATIC DIAGRAM KCS83PC (KCS83, KCS83C, KCS83PJ)





PRODUCTION CHANGES IN KCS83 SERIES CHASSIS

The schematics are shown in the latest condition. The notes below tell how early receivers differed from the schematics shown above and on pages 20 and 26.

In some receivers C7, in KRK29 and KRK29A tuners, was 0.8-3 mmf.

In some receivers C11, in KRK29 and KRK29A tuners, was 1-4 mmf.

In some receivers C20, at Pin 8 of V2, was 1000 mmf. in KRK29 and KRK29A tuners.

In some receivers a 3.3 mmf. capacitor, C32, was connected on S1B rear, in KRK29 and KRK29A tuners.

In some receivers C36 on S1B, in KRK29 and KRK29A tuners, was omitted.

In some receivers C37 on S1A, in KRK29 and KRK29A tuners, was omitted.

In some receivers C38 on S1E front, in KRK29 and KRK29A tuners, was omitted.

In some receivers C162, at pins of V112B, was .047 mfd.

In some receivers C198, .001 mfd., at pin 8 of V109B, was omitted.

In some receivers R9 was connected to terminal 2 of S1B rear in KRK29 and KRK29A tuners.

In some receivers a 39 ohm resistor R-18, was connected on S1C front from L27 to L28 in KRK29 and KRK29A tuners.

In some receivers R158, at pin 6 of V109B, was 6800 ohms.

In some receivers R185, at terminal 1 of the vertical linearity control R183, was 470,000 ohms.

In some receivers R187, at pin 11 of the Kinescope, was 270,000 ohms.

In some receivers T106, T107 and T108 were individual transformers (see page 19).

In some receivers pin 6 of V110A was connected to the junction of R162 and C152.

The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

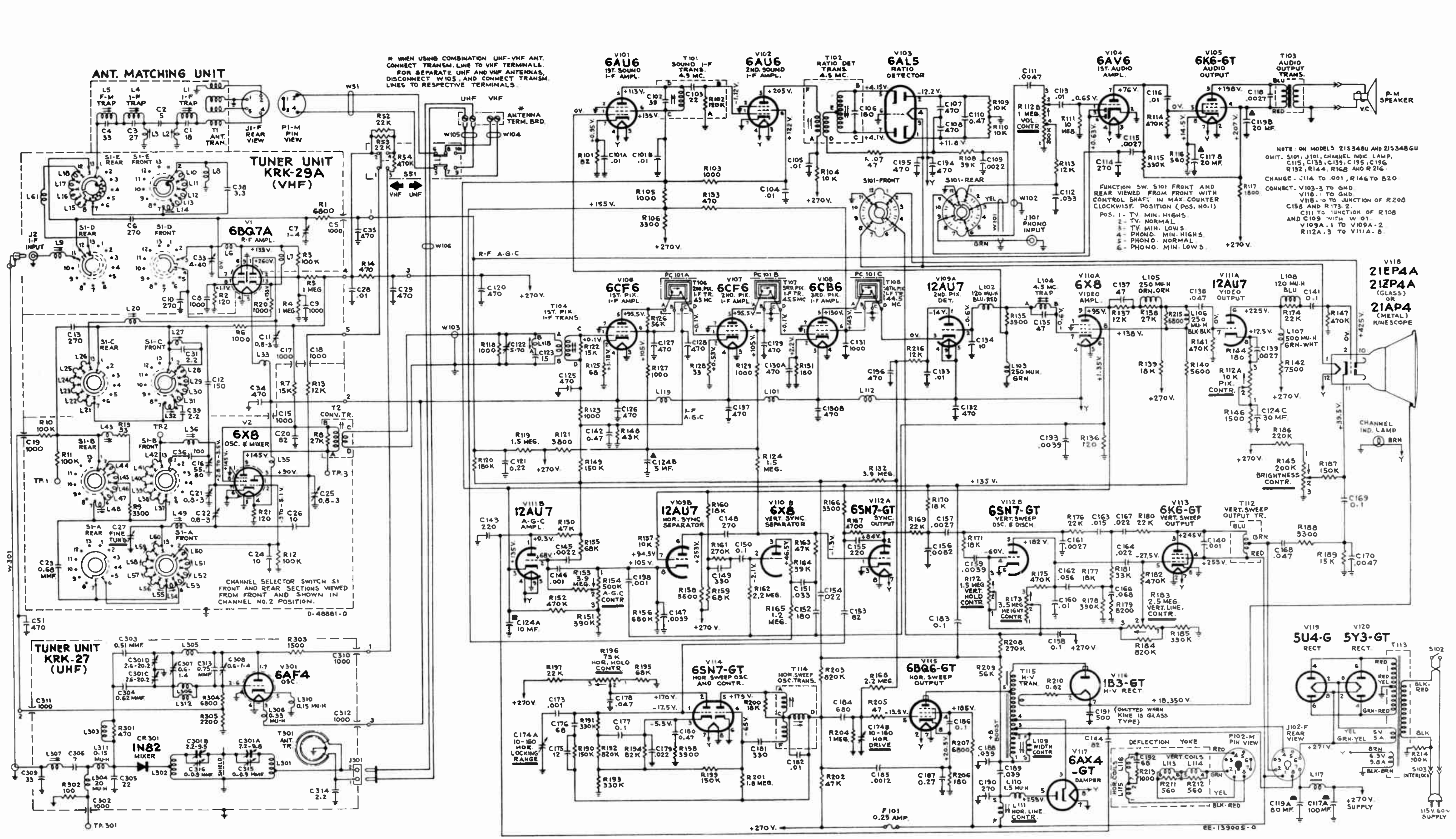
Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 31—Circuit Schematic Diagram KCS83PC (KCS83, KCS83C, KCS83PJ)

CIRCUIT SCHEMATIC DIAGRAM KCS83PD (KCS83A, KCS83D, KCS83PM)

21-S-348U to 21-S369GU incl.



PRODUCTION CHANGES IN KCS83 SERIES CHASSIS

The schematics are shown in the latest condition. The notes on pages 19 and 23 tell how early receivers differed from the schematic shown above.

The schematic is shown in the latest condition at the time of printing. All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 32—Circuit Schematic Diagram KCS83PD (KCS83A, KCS83D, KCS83PM)

ALIGNMENT DATA

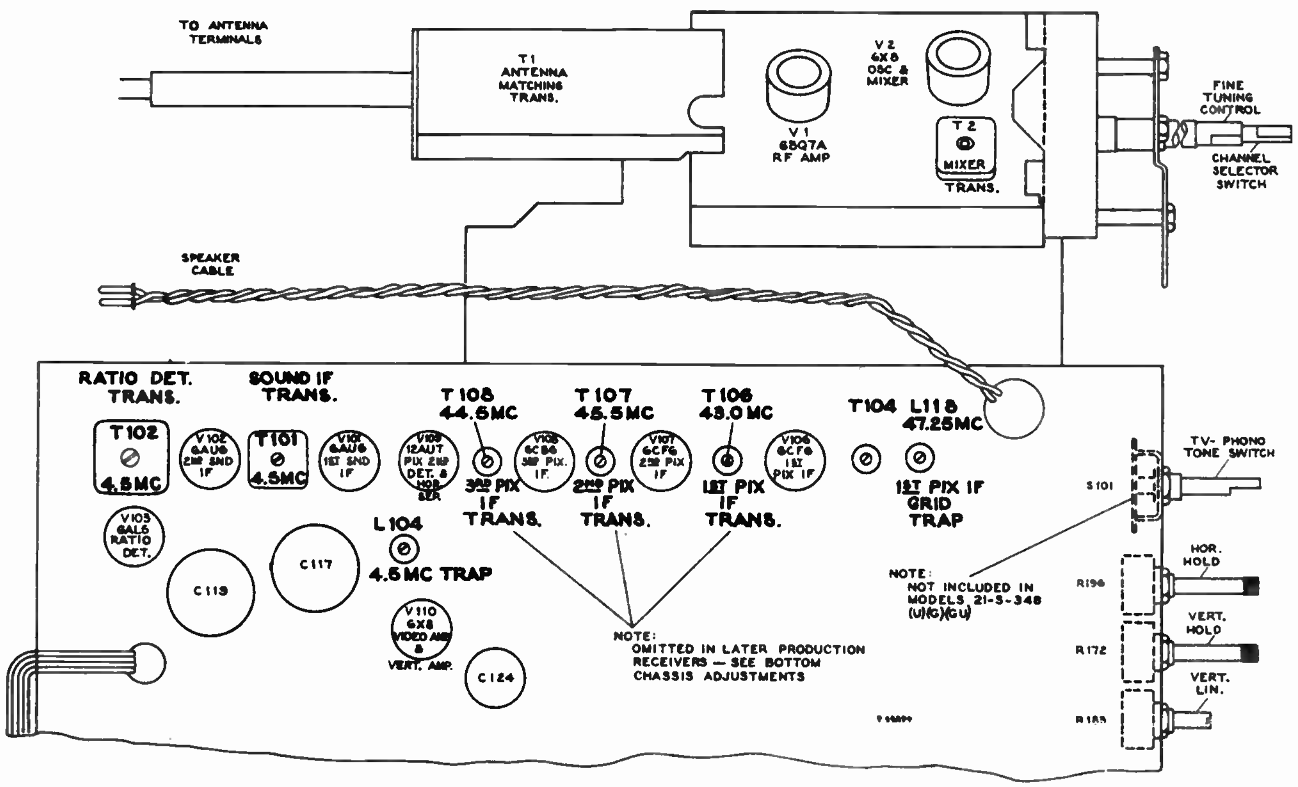


Figure 28—Top Chassis Adjustments (KRK29 Tuner Shown)

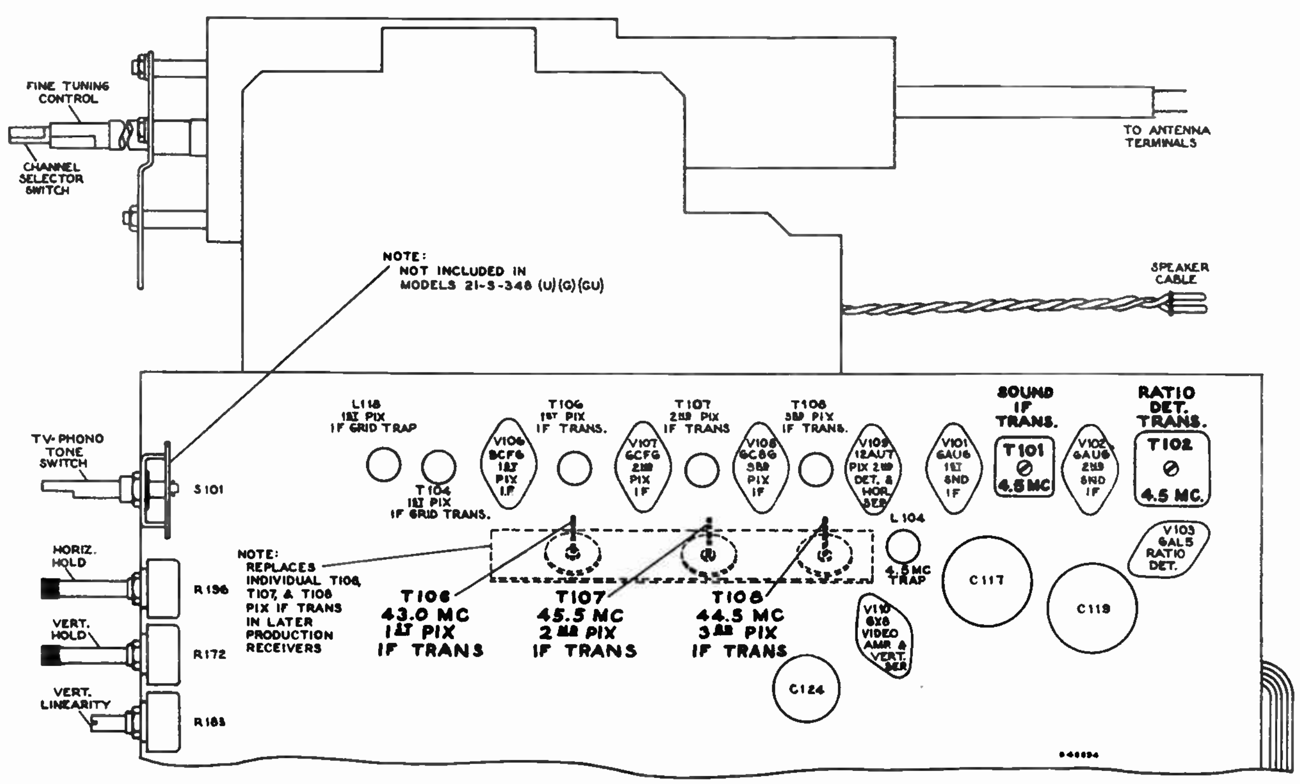


Figure 29—Bottom Chassis Adjustments (KRK29 Tuner Shown)

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
	TUNER UNIT ASSEMBLY KRK22C
77850	Bracket—Side bracket for mounting coil and stators
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C19)
	Capacitor—Adjustable, steatite:
77151	0.8-3.0 mmf. (C3, C7)
76532	1-4 mmf. (C15, C20)
	Capacitor—Ceramic—
77853	variable for fine tuning—plunger type (C2)
77084	1000 mmf., feed-thru (C11, C21, C22)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, —0%, 500 volts DC (C29, C31, C32)
77252	1000 mmf., +100%, —0%, 500 volts DC (C8, C16, C17)
73960	10,000 mmf., +100%, —0%, 500 volts DC (C28)
	Capacitor—Fixed, ceramic, insulated, High "K" disc:
75199	270 mmf., ±20%, 500 volts DC (C18)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. —0
77865	10 mmf., ±1.0 mmf., 500 volts DC (C1)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. —750
33098	10 mmf., ±1.0 mmf., 500 volts DC (C4)
	Capacitor—Mica trimmer—
76527	55-80 mmf. (C10)
77854	Clip—Mounting clip for fine tuning core
77206	Coil—Filament choke coil (L52)
79067	Coil—Heater choke coil (L50, L51)
76562	Coil—R.F. amplifier coupling coil (L47)
78466	Coil—R.F. choke coil (L48)
77860	Connector—Grounding strap connector
77859	Connector—RF grid switch return connector (L49)
76460	Contact—Test point contact
77852	Core—Adjustable core for fine tuning capacitor
78803	Detent—Detent mechanism with steel shaft
77861	Guide—Bakelite guide for fine tuning lever
78270	Lever—Fine tuning lever
	Resistor—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R11)
504147	470 ohms, ±20%, ½ watt (R14)
504268	6800 ohms, ±20%, ½ watt (R12)
523312	12,000 ohms, ±10%, 2 watts (R2)
523315	15,000 ohms, ±10%, 2 watts (R3)
504410	100,000 ohms, ±20%, ½ watt (R1, R13)
503510	1.0 megohm, ±10%, ½ watt (R9, R10)
14343	Retainer—Fine tuning shaft retainer ring
77849	Retainer—Retainer for fine tuning spring
78232	Shaft—Fine tuning shaft and cam
78236	Shield—Front shield
76534	Shield—Tube shield
77851	Shield—"U" shape shield for underside of unit
76336	Socket—Tube socket, 9 pin miniature, saddle mounted
77856	Spring—Fine tuning core spring
78241	Spring—formed for stabilizing fine tuning lever
78800	Stator—Mixer stator complete with rotor, coils, capacitors and resistors (S2, C6, C9, C13, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L43, L44, R5, R6, R7)
77911	Stator—Oscillator stator complete with rotor, coils and trimmer (S1, C5, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L42)
78801	Stator—R.F. plate stator complete with rotor, coils, capacitors and resistors (S3, C14, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L45, L46, R8)
78802	Stator—RF grid stator complete with rotor and coils (S4, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41)
78396	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
78399	Transformer—Converter transformer (T1)

STOCK No.	DESCRIPTION
	TUNER UNIT ASSEMBLIES KRK29
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78235	Board—Terminal board, 5 contact and ground
78233	Bracket—Side bracket for mounting coil and stators
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:
77151	0.8-3.0 mmf. (C11, C21, C25)
77913	0.8-3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:
77084	Feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0:
77865	10 mmf., ± 1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, —0%, 500 volts (C29, C34, C35)
77252	1000 mmf., +100%, —0%, 500 volts (C8, C9, C14)
73960	10,000 mmf., +100%, —0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K":
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0:
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750:
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, ceramic, Temp coef.—N1400:
78603	82 mmf., ±10%, 500 volts (C20)
	Capacitor—Fixed, headed-lead:
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31, C39)
71503	3.3 mmf., ±20%, 500 volts (C38)
	Capacitor—Mica trimmer:
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73458	Coil—Channel #6 r.f. grid coil (L14)
73460	Coil—Channel #6 r.f. plate coil (L32)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r.f. plate coil (L20)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
78583	Coil—Mixer I.F. Coil (L43)
78584	Coil—R.F. plate I.F. coil (L27)
76562	Coil—R.F. amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
77860	Connector—Grounding strap connector
77859	Connector—RF grid switch return connector (L8)
78237	Connector—Single contact female connector for UHF connection (J2)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
76460	Contact—Test point contact
77852	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for F.M. trap
77918	Core ¼-20 x ½" adjusting core for L14, L32, L48
77914	Core—#8-32 x 27/64" adjustable core for L20, L30, L49

REPLACEMENT PARTS (Continued)

STOCK No.	DESCRIPTION
78582	Core—#10-32 x ½" adjusting core for L27, L43
78231	Detent—Detent mechanism and fibre shaft
77917	Form—Channel #6 coil form complete with core
77912	Form—Channel #13 coil form complete with core
78581	Form—Coil form complete with adjustable core for I.F. coils L27, L43
77861	Guide—Bakelite guide for fine tuning lever
78270	Lever—Fine tuning lever
76728	Nut—Speednut for capacitors 76532, 77151
78234	Plate—Mounting plate for shafts (front)
	Resistor—Fixed, composition
503033	33 ohms, ±10%, ½ watt (R19)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
14343	Retainer—Fine tuning shaft retainer ring
77849	Retainer—Retainer for fine tuning spring
76549	Screw—#4-40 x ⅜" adjusting screw for L50, L51, L52, L53
75176	Screw—#4-40 x 7/16" adjusting screw for L54
76547	Screw—#4-40 x ¼" adjusting screw for L55, L56, L57, L58, L59, L60
78232	Shaft—Fine tuning shaft and cam
78236	Shield—Front shield
76534	Shield—Tube shield
77851	Shield—"U" shape shield for under-side of unit
76336	Socket—Tube socket, 9 pin, miniature saddle-mounted
77856	Spring—Fine tuning spring
78241	Spring—Formed spring for fine tuning lever
78277	Stator—Input selector switching stator complete with rotor and capacitor (S4, C10)
78272	Stator—Mixer stator complete with rotor (S2, C13, C23, C32, C36, L36, L37, L38, L39, L40, L41, L42, L43, L44, L45, L46, L47, L48, R9, R10, R11, R19)
77911	Stator—Oscillator coil and stator complete with rotor, coils and trimmer (S1, C22, C37, L49, L50, L51, L52, L53, L54, L55, L56, L57, L58, L59, L60)
78398	Stator—RF grid stator complete with rotor and coils (S5, C38, L10, L11, L12, L13, L14, L15, L16, L17, L18)
78274	Stator—RF plate stator complete with rotor, coils, capacitors and resistors (S3, C12, C31, C39, L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L32, R6)
76740	Stud—#6-32 x 1" adjusting stud for capacitor 77913
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Converter transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—IF trap
76542	Trap—IF trap (41.25 mc) complete with core (L1)
76541	Trap—IF trap (45.75 mc) complete with core (L4)
75190	Washer—Insulating washer (neoprene) for capacitor
	TUNER UNIT ASSEMBLIES KRK29A
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78467	Board—Terminal board—6 contact
78233	Bracket—Side bracket for mounting coil and stators
78430	Cam—Actuating cam for antenna slide switch
78417	Cam—Fine tuning cam for VHF
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:
77151	0.8-3.0 mmf. (C11, C21, C25)
77913	0.8-3.0 mmf. (C22)

STOCK No.	DESCRIPTION
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:
77853	Variable, for fine tuning capacitor—plunger type (C27)
77084	Feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, −0%, 500 volts (C29, C34, C35, C51)
77252	1000 mmf., +100%, −0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., +100%, −0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K":
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, noninsulated, Temp. coef. = 0:
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = −750:
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, ceramic, Temp. coef.—N1400
78603	82 mmf., ±10%, 500 volts (C20)
	Capacitor—Fixed, headed-lead:
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31)
71503	3.3 mmf., ±20%, 500 volts (C32)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
78401	Coil—Channel #6 antenna coil (L61)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
77919	Coil—Channel #13 mixer coil (L36)
77915	Coil—Channel #13 oscillator coil (L49)
77921	Coil—Channel #13 r.f. plate coil (L20)
78224	Coil—Choke coil (.47 muh) (L27)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
76562	Coil—R.F. amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
39153	Connector—4 contact male connector (P51)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
77860	Connector—Grounding strap connector
77859	Connector—RF grid switch return connector (L8)
78237	Connector—Single contact female connector for UHF connector (J2)
76460	Contact—Test point contact
77852	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for FM trap
77918	Core—¼-20 x ½" adjusting core for L32, L48
77914	Core 8-32 x 27/64" adjustable core for L20, L36, L49
78231	Detent—Detent mechanism and fibre shaft
77917	Form—Channel #6 coil form complete with core
77912	Form—Channel #13 coil form complete with core
77861	Guide—Bakelite guide for fine tuning lever
78431	Insulator—Insulator for antenna slide switch
78270	Lever—Fine tuning lever
76728	Nut—Speednut for capacitors 76532, 77151
78421	Pin—Clutch mechanism operating pin
78234	Plate—Mounting plate for shafts (front)
78423	Pulley—UHF channel marker escutcheon pulley
78420	Pulley UHF tuner drive pulley
	Resistor—Fixed, composition
503015	15 ohms, ±10%, ½ watt (R19)
503039	39 ohms, ±10%, ½watt (R18)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14, R54)

STOCK No.	DESCRIPTION
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
523322	22,000 ohms, ±10%, 2 watts (R52)
523327	27,000 ohms, ±10%, 2 watts (R53)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
14343	Retainer—Fine tuning shaft retainer ring
77849	Retainer—Retainer for fine tuning spring
78419	Ring—Retaining ring for UHF channel marker escutcheon pulley
76547	Screw—#4-40 x ¼" adjusting screw for L55, L56, L57, L58, L59, L60
76549	Screw—#4-40 x ⅜" adjusting screw for L50, L51, L52, L53
75176	Screw—#4-40 x 7/16" adjusting screw for L54
78418	Shaft—VHF channel selector knob shaft and clutch disc
78236	Shield—Front shield
76534	Shield—Tube shield
77851	Shield—"U" shape shield for underside of unit
76336	Socket—Tube socket, 9 pin, miniature saddle-mounted
78427	Spring—Clutch mechanism operating pin coil spring
77856	Spring—Fine tuning spring
78241	Spring—Formed spring for fine tuning lever
78422	Spring—Formed spring for actuating clutch disc
78428	Spring—UHF channel marker escutcheon pulley coil spring
78277	Stator—Input selector switching stator complete with rotor and capacitor (S4, C10)
78272	Stator—Mixer stator complete with rotor (S2, C13, C23, C36, L36, L37, L38, L39, L40, L41, L42, L43, L44, L45, L46, L47, L48, R9, R10, R11, R19)
77911	Stator—Oscillator coil and stator complete with rotor, coils and trimmer (S1, C22, C37, L49, L50, L51, L52, L53, L54, L55, L56, L57, L58, L59, L60)
78398	Stator—RF grid stator complete with rotor and coils (S5, L10, L11, L12, L13, L14, L15, L16, L17, L18)
78274	Stator—RF plate stator complete with rotor, coils, capacitors and resistors (S3, C12, C31, L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L32, R6, R18)
76740	Stud—#6-32 x 1" adjusting stud for capacitor 77913
78429	Switch—Antenna slide switch (S51)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Converter transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—I.F. trap (L6)
76542	Trap—I.F. trap (41.25 mc) complete with core (L1)
76541	Trap—I.F. trap (45.75 mc) complete with core (L4)
78426	Washer—"C" washer for clutch mechanism
75190	Washer—Insulating washer (neoprene) for capacitor
78424	Washer—Retaining washer for knob shaft spring
78425	Washer—Spring washer for clutch mechanism
	TUNER UNIT ASSEMBLIES KRK27
76522	Bracket—Vertical bracket for oscillator tube shield
76961	Spring—Retaining spring for oscillator tube shield and vertical bracket
	Capacitor—Adjustable, steatite:
78259	0.6-1.4 mmf. complete with adjustable core (C7, C8)
	Capacitor—Fixed, ceramic:
77084	1000 mmf., feed-thru (C2, C10, C11, C12)

STOCK No.	DESCRIPTION
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0:
78262	7 mmf., ±0.5 mmf., 500 volts DC (C6)
78261	22 mmf., ±5%, 500 volts DC (C5)
70596	33 mmf., ±5%, 500 volts DC (C9)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = −750:
78263	0.75 mmf. ±0.25 mmf., 500 volts DC (C13)
	Capacitor—Fixed, headed-lead:
78137	0.51 mmf., ±10%, 500 volts DC (C3)
78260	0.62 mmf., ±10%, 500 volts DC (C4)
71502	2.2 mmf., ±10%, 500 volts DC (C14)
78257	Capacitor—Variable tuning capacitor (C1A, C1B, C1C, C1D, C15, C16, L1, L2)
78258	Coil—I.F. coil complete with adjustable core (L7)
78264	Coil—Peaking coil (L3, R1)
72618	Coil—Peaking coil (20 muh) (L4)
78267	Coil—RF choke coil (0.15 muh) (L10, L11)
77279	Coil—RF choke coil (0.33 muh) (L8, L9)
78269	Connector—Single contact male connector for I.F. output cable
78255	Connector—2 contact female connector for UHF antenna (J1)
78256	Holder—Crystal holder
77489	Rectifier—Crystal rectifier IN82 (CR1)
	Resistor—Fixed, composition:
503110	100 ohms, ±10%, ½ watt (R2)
503215	1500 ohms, ±10%, ½ watt (R3)
503222	2200 ohms, ±10%, ½ watt (R5)
503268	6800 ohms, ±10%, ½ watt (R4)
78252	Shield—Oscillator shield
78253	Shield—RF shield
78254	Shield—Shield for crystal rectifier
76967	Shield—Tube shield
77274	Socket—Tube socket, miniature, 7 pin, ceramic, saddle-mounted
78265	Strip—Inductance strip (L5)
78266	Strip—Inductance strip and plate (L6)
78268	Transformer—Antenna input transformer (T1)
	CHASSIS ASSEMBLIES KCS83 (VHF-KRK29), KCS83A (VHF/UHF-KRK29A/27), KCS83C (VHF-KRK29), KCS83D (VHF-KRK29), KCS83PC (VHF-KRK29), KCS83PD (UHF/VHF-KRK29A/27), KCS83PJ (VHF-KRK29), KCS83PK (VHF-KRK22C), KCS83PL (VHF-KRK22C), KCS83PM (UHF/VHF-KRK29A/27)
78402	Board—Antenna terminal board for KCS83A, KCS83D, KCS83PD, KCS83PM
	Capacitor—Adjustable, mica:
78220	5-70 mmf. (C122)
	Capacitor—Fixed, ceramic:
78225	82 mmf., ±10%, 3500 volts (C144)
76488	500 mmf., 25,000 volts for KCS63, KCS83A only
	Capacitor—Fixed, ceramic, High "K" disc:
	470 mmf., ±20%, 500 volts (C127, C129)
77293	470 mmf., +100%, −0%, 500 volts (C120, C125, C126, C128, C132, C194, C195, C196, C197)
77672	Dual 470 mmf., +100%, −0%, 500 volts (C130A, C130B)
78623	1000 mmf., ±20%, 500 volts (C131)
73960	10,000 mmf., +100%, −0%, 500 volts (C104, C105, C133)
76991	Dual 10,000 mmf., +100%, −0%, 500 volts (C101A, C101B)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = −750:
33098	10 mmf., ±1 mmf., 500 volts (C134)
33380	12 mmf., ±10%, 500 volts (C175)
39044	15 mmf., ±5%, 500 volts (C123)
39042	47 mmf., ±5%, 500 volts (C137)
71922	180 mmf., ±10%, 500 volts (C152)
47617	270 mmf., ±10%, 500 volts (C114)—except KCS83PJ, KCS83PL, KCS83PM
	Capacitor—Fixed, mica:
76475	68 mmf., ±5%, 1000 volts (C176)
76474	82 mmf., ±5%, 1000 volts (C153)

STOCK No.	DESCRIPTION
39636	220 mmf., ±10%, 500 volts (C155)
75248	220 mmf., ±10%, 1000 volts (C143)
76579	270 mmf., ±10%, 1000 volts (C148, C190)
39640	330 mmf., ±10%, 500 volts (C149)
76476	330 mmf., ±5%, 1000 volts (C181)
39644	470 mmf., ±5%, 500 volts (C107, C108)
	Capacitor—Mica trimmer:
75217	Dual 10-160 mmf. (C174A, C174B)
	Capacitor—Electrolytic:
78213	Comprising: 1 section of 10 mfd., 350 volts 1 section of 5 mfd., 350 volts and 1 section of 30 mfd., 50 volts (C124A, C124B, C124C)
77644	Comprising: 1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C119A, C119B)
78212	Comprising: 1 section of 100 mfd., 400 volts and 1 section of 20 mfd., 50 volts (C117A, C117B)
	Capacitor—Fixed, paper, oil impregnated:
75643	.001 mfd., 1000 volts (C140, C146, C173, C198) C114 in KCS83PJ, KCS83PL, KCS83PM only
73595	.002 mfd., 600 volts (C109, C145)
73599	.0027 mfd., 600 volts (C115, C139, C157, C161)
73818	.0027 mfd., 1600 volts (C118)
73796	.0039 mfd., 600 volts (C147, C193)
73920	.0047 mfd., 600 volts (C111, C170)
73808	.0082 mfd., 1000 volts (C156)
73561	.01 mfd., 400 volts (C113, C116)
73551	.01 mfd., 400 volts (C150, C158, C169, C177)
73565	.01 mfd., 1000 volts (C160)
73797	.015 mfd., 600 volts (C163)
73562	.022 mfd., 400 volts (C179)
73798	.022 mfd., 600 volts (C164, C167)
73810	.022 mfd., 1000 volts (C154)
73552	.033 mfd., 400 volts (C112, C151)
73813	.039 mfd., 1000 volts (C188, C189)
73553	.047 mfd., 400 volts (C178)
73592	.047 mfd., 600 volts (C138, C162, C168)
73792	.068 mfd., 400 volts (C166)
73557	.1 mfd., 600 volts (C141, C183, C186)
73794	.22 mfd., 400 volts (C121)
73786	.27 mfd., 200 volts (C187)
73787	.47 mfd., 200 volts (C110, C142, C180)
	Capacitor—Fixed, moulded paper, mineral oil impregnated:
76479	.00068 mfd., 600 volts (C184)
76995	.0012 mfd., 600 volts (C185)
78221	.0039 mfd., 600 volts (C159)
73594	.01 mfd., 600 volts (C182)
77676	Choke—Filter choke (L117)
73477	Coil—Filament choke coil (L101, L112, L119)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
75253	Coil—Peaking coil (120 muh) (L102)
71529	Coil—Peaking coil (120 muh) (L108, R174)
71526	Coil—Peaking coil (250 muh) (L103)
77674	Coil—Peaking coil (250 muh) (L105, R138)
78222	Coil—Peaking coil (250 muh) (L106, R215)
75252	Coil—Peaking coil (500 muh) (L107)
76640	Coil—RF choke coil (1.5 muh) (L110)
78205	Coil—Width coil complete with adjustable core (L109)
74594	Connector—2 contact male connector for power cord
78306	Connector—2 contact male connector for antenna cable W106 for KCS83A, KCS83D
50367	Connector—6 contact female connector for yoke leads (J102)
78244	Connector—Anode connector for KCS83C, KCS83D
35787	Connector—Phono input connector (J101)—except KCS83PJ, KCS83PL, KCS83PM
75474	Connector—Single contact male connector for speaker leads
76975	Control—AGC control (R154)
78209	Control—Brightness control (R145)—except KCS83PJ, KCS83PL, KCS83PM

STOCK No.	DESCRIPTION
79088	Control—Brightness control—for KCS83PJ, KCS83PL, KCS83PM
78206	Control—Height control (R173)
77639	Control—Horizontal hold control (R196)
78208	Control—Picture control, volume control and power switch (R112A, R112B, S102)
78210	Control—Vertical hold control (R172)
78207	Control—Vertical linearity control (R183)
72953	Cord—Tuner drive cord (approx. 25" overall) for KCS83A, KCS83D
72953	Cord—UHF channel marker escutcheon drive cord (approx. 16" overall) for KCS83A, KCS83D
78199	Cover—Hi-voltage compartment cover
78214	Fuse—.3 amps., 250 volts (F101)
78406	Gear—Tuner drive gear—for KCS83A, KCS83D
76459	Grommet—Rubber grommet for 2nd anode lead connector
78218	Holder—Fuse holder
78215	Insulator—Polystyrene insulator for hi-voltage socket
78226	Lead—Anode lead complete with eyelet for KCS83, KCS83A
78743	Printed Circuit—I.F. transformer circuit (T106, T107, T108)—for KCS83PC, KCS83PD, KCS83PJ, KCS83PK, KCS83PL, KCS83PM
78404	Pulley—Tuner driven pulley (2½" dia.) complete with bushing for KCS83A, KCS83D)
78405	Pulley—UHF channel marker escutcheon drive pulley for KCS83A, KCS83D
	Resistor—Fixed, wire wound:
76382	0.82 ohms, 1/3 watts (R210)
76639	180 ohms, 2 watts (R206)
77670	3300 ohms, 7 watts (R106)
77671	3800 ohms, 7 watts (R121)
	Resistor—Fixed, composition:
502033	33 ohms, ±5%, ½ watt (R128)
503047	47 ohms, ±10%, ½ watt (R107, R205)
502068	68 ohms, ±5%, ½ watt (R125)
503082	82 ohms, ±10%, ½ watt (R101)
503112	120 ohms, ±10%, ½ watt (R136)
502118	180 ohms, ±5%, ½ watt (R131)
503118	180 ohms, ±10%, ½ watt (R144)
503147	470 ohms, ±10%, ½ watt (R133)
513156	560 ohms, ±10%, 1 watt (R116)
503182	820 ohms, ±10%, ½ watt (R146)—for KCS83PJ, KCS83PL, KCS83PM only
503210	1000 ohms, ±10%, ½ watt (R103, R118, R123, R127, R129)
513210	1000 ohms, ±10%, 1 watt (R105)
503215	1500 ohms, ±10%, ½ watt (R146)—except KCS83PJ, KCS83PL, KCS83PM
523218	1800 ohms, ±10%, 2 watts (R117)
30733	3300 ohms, ±5%, ½ watt (R166)
503233	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R135)
503239	3900 ohms, ±10%, ½ watt (R198)
503247	4700 ohms, ±10%, ½ watt (R167)
503256	5600 ohms, ±10%, ½ watt (R140, R158)
523268	6800 ohms, ±10%, 2 watts (R207)
512275	7500 ohms, ±5%, 1 watt (R142)
503282	8200 ohms, ±10%, ½ watt (R179)
502310	10,000 ohms, ±5%, ½ watt (R109, R110)
503310	10,000 ohms, ±10%, ½ watt (R157)
523310	10,000 ohms, ±10%, 2 watts (R104)
503312	12,000 ohms, ±10%, ½ watt (R113, R137, R216)
503315	15,000 ohms, ±10%, ½ watt (R122, R189)
502318	18,000 ohms, ±5%, ½ watt (R177)
503318	18,000 ohms, ±10%, ½ watt (R160, R170, R171, R200)
523318	18,000 ohms, ±10%, 2 watts (R139)
502322	22,000 ohms, ±5%, ½ watt (R180)
503322	22,000 ohms, ±10%, ½ watt (R169, R176, R197)
502333	33,000 ohms, ±5%, ½ watt (R181)
503339	39,000 ohms, ±10%, ½ watt (R108, R164)
502343	43,000 ohms, ±5%, ½ watt (R148)
503347	47,000 ohms, ±10%, ½ watt (R134, R163)
512347	47,000 ohms, ±5%, 1 watt (R202)
513347	47,000 ohms, ±10%, 1 watt (R150)

STOCK No.	DESCRIPTION
502356	56,000 ohms, ±5%, ½ watt (R126, R130)
503356	56,000 ohms, ±10%, ½ watt (R209)
503368	68,000 ohms, ±10%, ½ watt (R155, R159, R195)
503382	82,000 ohms, ±10%, ½ watt (R194)
503410	100,000 ohms, ±10%, ½ watt (R214)
502415	150,000 ohms, ±5%, ½ watt (R149)
503415	150,000, ±10%, ½ watt (R187, R190)
512415	150,000 ohms, ±5%, 1 watt (R199)
502418	180,000 ohms, ±5%, ½ watt (R120)
503422	220,000 ohms, ±10%, ½ watt (R186)
503427	270,000 ohms, ±10%, ½ watt (R161, R208)
503433	330,000 ohms, ±10%, ½ watt (R115, R191, R193)
503439	390,000 ohms, ±10%, ½ watt (R151, R178)
502447	470,000 ohms, ±5%, ½ watt (R185)
503447	470,000 ohms, ±10%, ½ watt (R114, R141, R147, R152, R175, R182)
503468	680,000 ohms, ±10%, ½ watt (R156)
502482	820,000 ohms, ±5%, ½ watt (R184)
503482	820,000 ohms, ±10%, ½ watt (R192, R203)
503510	1 megohm, ±10%, ½ watt (R204)
503512	1.2 megohm, ±10%, ½ watt (R165)
502515	1.5 megohm, ±5%, ½ watt (R119, R124)
512518	1.8 megohm, ±5%, 1 watt (R201)
503522	2.2 megohm, ±10%, ½ watt (R162, R168)
503539	3.3 megohm, ±10%, ½ watt (R132, R153)
503610	10 megohm, ±10%, ½ watt (R111)
78408	Screw—#6-32 x ¼" square head cup point set screw for pulleys and drive gear for KCS83A, KCS83D
78407	Shaft—Tuner connecting shaft for KCS83A, KCS83D
78198	Shield—Shield for hi-voltage compartment
73584	Shield—Tube shield for V101, V102, V103, V108
76972	Shield—Tube shield for V109
75718	Socket—Channel indicator lamp socket
74834	Socket—Kinescope socket
78216	Socket—Tube socket, 6 pin, wafer complete with shield for V116
50367	Socket—Tube socket, 6 pin, moulded saddle-mounted for V117
73117	Socket—Tube socket, 7 pin, miniature wafer for V101, V102, V103, V104, V106, V107, V108
31251	Socket—Tube socket, octal, wafer for V105, V112, V115, V119, V120
50367	Socket—Tube socket, octal, moulded saddle-mounted for V113
77645	Socket—Tube socket, octal, wafer for V114
76971	Socket—Tube socket, 9 pin, miniature wafer for V109, V119, V111
78409	Spring—Tuner drive cord tension spring for KCS83A, KCS83D
78410	Spring—UHF channel marker escutcheon drive cord tension spring for KCS83A, KCS83D
78403	Stop—Metal stop for connecting shaft for KCS83A, KCS83D
78243	Strap—Polystyrene strap (8½") for 2nd. anode lead for KCS83C, KCS83D
78217	Support—Support to hold RF unit on side of chassis—except KCS83PJ, KCS83PK, KCS83PL
78211	Switch—TV—phono-tone switch (S101)—except KCS83PJ, KCS83PL, KCS83PM
78201	Transformer—Hi-voltage transformer (T115)
76440	Transformer—Horizontal. oscillator transformer complete with adjustable core (T114)
76997	Transformer—Output transformer (T103)
78200	Transformer—Power transformer, 117 volts, 60 cycle (T113)
77112	Transformer—Ratio detector transformer complete with adjustable core (T102, C106)
76981	Transformer—Sound I.F. transformer complete with adjustable core (T101, C102, C103, R102)
78202	Transformer—Vertical output transformer (T112)
78203	Transformer—1st I.F. pix transformer complete with adjustable core (T104)
76433	Transformer—2nd, 3rd, 4th, I.F. transformer (T106, T107, T108)—except KCS83PC, KCS83PD, KCS83PJ, KCS83PK, KCS83PL, KCS83PM

STOCK No.	DESCRIPTION
78204	Trap—1st I.F. grid trap complete with adjustable core (L118)
76983	Trap—4.5 MC trap (L104, C135)
78219	Washer, Vellutex washer for tube socket and shield
	YOKE & MAGNET ASSEMBLIES
76863	Connector—Anode connector complete with contact and terminal for Models 21S362M, 21S362MU
75542	Connector—6 contact male connector for deflection yoke (P102)
78309	Cushion—Round rubber cushion for deflection yoke
74956	Cushion—Rubber cushion for deflection yoke hood
78308	Hood—Deflection yoke hood less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
76633	Magnet—Pin cushion correction magnet complete with support arm for either glass kinescope
78307	Plate—Metal plate for deflection yoke
78817	Plate—Deflection yoke hood plate—(all chassis with printed circuit IF)
78445	Spring—Grounding spring (coil) for deflection yoke
78310	Strap—Ground strap (formed) for deflection yoke hood for Models with glass kinescopes
76636	Stud—Adjusting stud complete with guard for focus magnet
76616	Yoke—Deflection yoke complete with 6 contact male connector (L113, L114, L115, L116, P102, C192, R211, R212, R213)
77697	Yoke—Deflection yoke complete with 6 contact male connector (L113, L114, L115, L116, C192, R211, R212, R213) for all chassis with printed circuit IF
	SPEAKER ASSEMBLIES 971636-1W RL101C5 RMA274 (For Models 21S348, 21S348U, 21S348G, 21S348GU, 21S353, 21S353U, 21S354, 21S354U, 21S354G, 21S354GU)
77000	Speaker—5" PM speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971490-3W 971490-3R RL105E6 RMA-274 RMA-285 (For Models 21S362M, 21S362MU)
75024	Cone—Cone and voice coil for speakers stamped 971490-3W
77129	Cone—Cone and voice coil for speakers stamped 971490-3W 971490-3R
75022	Speaker—8" PM speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971490-4W RL105E11 RMA-274 (For Models 21S362G, 21S367G, 21S369G, 21S362GU, 21S367GU, 21S369GU)
75024	Cone—Cone and voice coil (3.2 ohms)
77872	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instruments, number stamped on speaker and full description of part required.

Models
17-S-350, 17-S-350U
"Brent"
Metal-Brown
Maroon, Blonde

Models
17-S-351, 17-S-351U
"Bristol"
Metal-Mahogany Grain

Models
17-S-360, 17-S-360U
"Denham"
Antique Dark Red

GENERAL DESCRIPTION

Models 17-S-350, 17-S-350U, 17-S-351, 17-S-351U, 17-S-360 and 17-S-360U are "17 inch" television receivers. Models 17-S-350, 17-S-351 and 17-S-360 are identical except for kinescopes, cabinets, and speakers. Models 17-S-350U, 17-S-351U and 17-S-360U are identical except for kinescopes, cabinets, and speakers. Models 17-S-350, 17-S-351 and 17-S-360 feature full 12 channel VHF coverage. Models 17-S-350U, 17-S-351U and 17-S-360U feature full 12 channel VHF coverage plus any UHF channels desired.

All models include intercarrier FM sound system; ratio detector; improved picture brilliance; pulsed picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; noise saturation circuits; improved sync separator (3.5 mc. band width for picture channel); and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE
...146 sq. ins. on a 17CP4 or a 17QP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 17-S-350, 17-S-351 & 17-S-360

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 17-S-350U, 17-S-351U & 17-S-360U

Any of 70 UHF channels .... 470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency .... 45.75 mc.
Sound I-F Carrier Frequency .... 41.25 mc.

POWER RATING .... 215 watts
AUDIO POWER OUTPUT RATING .... 4 watts max.
VIDEO RESPONSE .... To 3.5 mc.
SWEEP DEFLECTION .... Magnetic
FOCUS .... Magnetic

ANTENNA INPUT IMPEDANCE

Models 17-S-350, 17-S-351 & 17-S-360

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 17-S-350U, 17-S-351U & 17-S-360U

UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29 (17-S-350, 17-S-351 & 17-S-360)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29A/27 (17-S-350U, 17-S-351U & 17-S-360U)	
(1) RCA 6AF4	UHF Oscillator
(2) RCA 6BQ7A	VHF R-F Amplifier UHF I-F Amplifier
(3) 6X8	VHF R-F Oscillator and Mixer UHF I-F Amplifier

A 1N82 crystal is used as the UHF mixer.

Tube Used	Function
All Models	
(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Detector and Vert. Sync. Sep.
(5) RCA 6CL6	Video Amplifier
(6) RCA 6AU6	1st Sound I-F Amplifier
(7) RCA 6AU6	2nd Sound I-F Amplifier
(8) RCA 6AL5	Ratio Detector
(9) RCA 6AV6	1st Audio Amplifier
(10) RCA 6K6GT	Audio Output
(11) RCA 12AU7	Horiz. Sync. Sep. & AGC
(12) RCA 6SN7GT	Vertical Osc. & Sync. Output
(13) RCA 6K6GT	Vertical Sweep Output
(14) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(15) RCA 6BQ6GT	Horizontal Sweep Output
(16) RCA 6W4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
(18) RCA 17CP4 (17-S-350, 350U)	Kinescope
RCA 17QP4 (17-S-351, 351U, 360 & 360U)	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

CHASSIS DESIGNATIONS

KCS78F .... Models 17-S-350, 17-S-351 and 17-S-360 employing a KRK29 Tuner.
KCS78H .... Models 17-S-350U, 17-S-351U and 17-S-360U employing a KRK29A/27 Tuner.

WEIGHT & DIMENSIONS

Model		Shipping Weight	Width Inches	Height Inches	Depth Inches
17-S-350	83 lbs.	100 lbs.	22½	22	22
17-S-351	91 lbs.	115 lbs.	21½	34¾	22
17-S-360	94 lbs.	118 lbs.	24½	35½	22½
17-S-350U	88 lbs.	105 lbs.	22½	22	22
17-S-351U	96 lbs.	120 lbs.	21½	34¾	22
17-S-360U	99 lbs.	123 lbs.	24½	35½	22½

LOUDSPEAKERS

Models 17-S-350, 350U (971636-1) 5" PM Dynm., 3.2 ohms
Models 17-S-351, 351U (971636-1) 5" PM Dynm., 3.2 ohms
Models 17-S-360, 360U (971490-3) 8" PM Dynm., 3.2 ohms

SCANNING .... Interlaced, 525 line

HORIZONTAL SCANNING FREQUENCY ..... 15,750 cps

VERTICAL SCANNING FREQUENCY .... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) 30 cps

OPERATING CONTROLS (front)

Models 17-S-350, 351 & 360

Channel Selector / Fine Tuning .... Dual Control Knobs

Models 17-S-350U, 351U & 360U

VHF Channel Selector and UHF Changeover Switch / VHF Fine Tuning and UHF Tuning .... Dual Control Knobs
Picture / Sound Volume and On-Off Switch .... Dual Control Knobs
Picture Horizontal Hold .... Single Control (Knurled)
Picture Vertical Hold .... Single Control (Knurled)
Brightness .... Single Control Knob

NON-OPERATING CONTROLS

Horizontal Centering .... top chassis adjustment
Vertical Centering .... top chassis adjustment
AGC .... rear chassis adjustment
Height .... front panel screwdriver adjustment
Horizontal Locking ..... rear chassis screwdriver adjustment
Vertical Linearity .... front panel screwdriver adjustment
Horizontal Drive .... rear chassis screwdriver adjustment
Horizontal Oscillator Frequency .... rear chassis adjustment
Horizontal Oscillator Waveform .. bottom chassis adjustment
Width Link .... H.V. compartment adjustment
Focus .... top chassis adjustment
Ion Trap Magnet .... top chassis adjustment
Deflection Coil .... top chassis adjustment
Focus Magnet .... top chassis adjustment

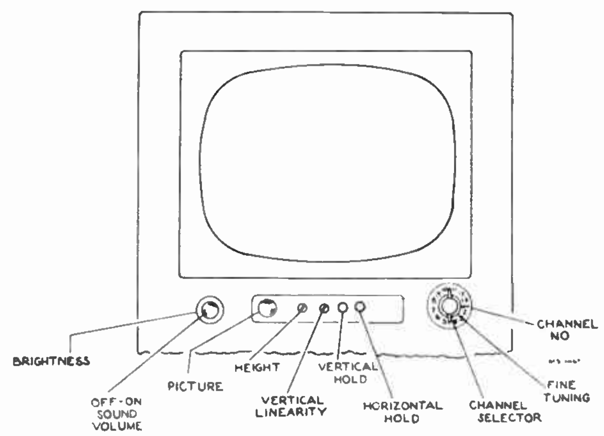


Figure 1—Receiver Operating Controls (VHF Models)

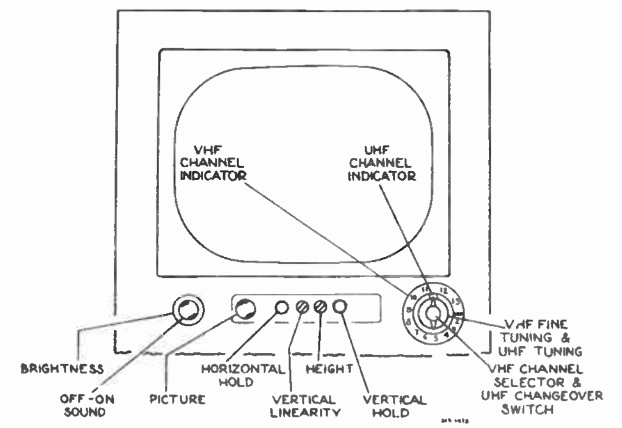


Figure 2—Receiver Operating Controls (UHF-VHF Models)

CHASSIS TOP VIEW

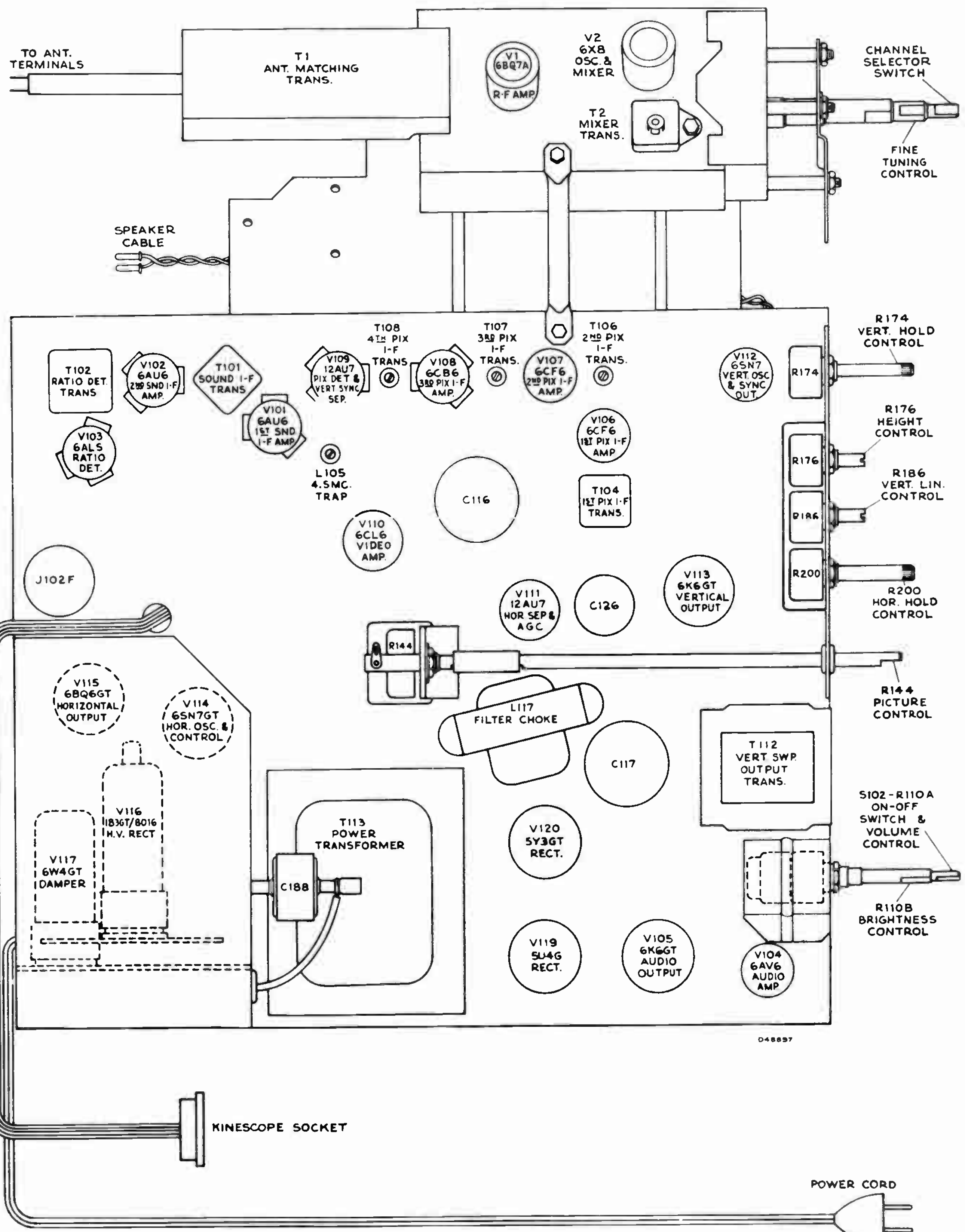


Figure 7—Chassis Top View (shown with KRK29 Tuner)

CHASSIS BOTTOM VIEW

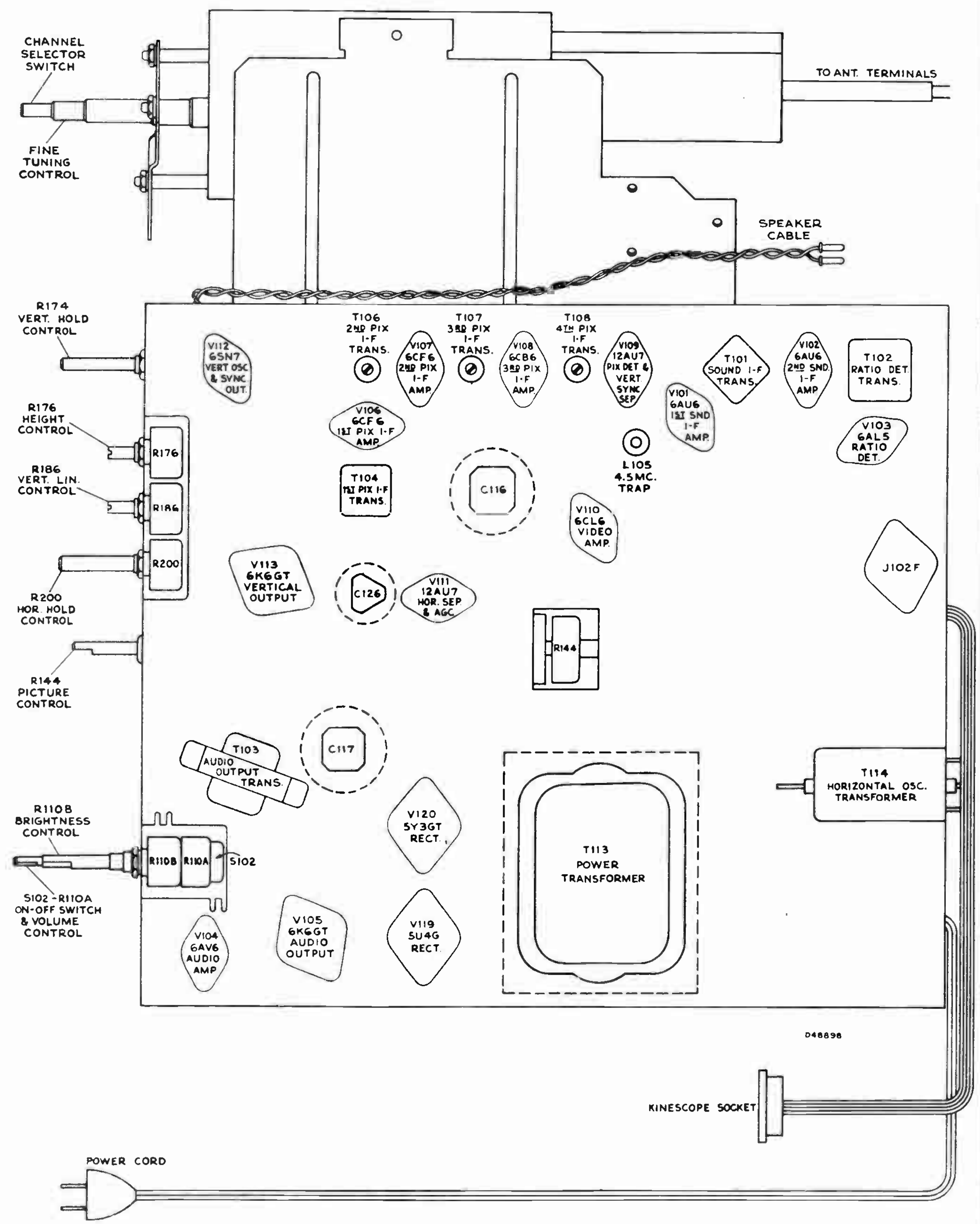


Figure 8—Chassis Bottom View (shown with KRK29 Tuner)

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
  35 to 90 mc., 1 mc. to 12 mc. sweep width
  170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
  4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

KRK29 or KRK29A ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R127 and R148. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R127 and R148.

Connect an oscilloscope to pin 2, V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 19 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in Figure 20. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 17-S-350, 17-S-351 & 17-S-360

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R147 and R148 and to ground.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction of R147 and R148.

Set the bias to produce approximately —5.0 volt of bias at the junction of R147 and R148.

Connect the "VoltOhmyst" to the juncture of R138 and L105 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst" During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138, L105 with minus 5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R138, L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	T104 top core

Models 17-S-350U, 17-S-351U & 17-S-360U

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R147 and R148 and to ground.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction of R147 and R148. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst".

Connect the "VoltOhmyst" to the junction of R138 and L105 and to ground.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138, L105 with —5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R138, L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	T104 top core

SWEEP ALIGNMENT OF PIX I-F.—

Models 17-S-350, 17-S-351 & 17-S-360

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C119 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (bottom) for maximum gain and with 45.75 mc. at 70% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C119 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 23.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R138 and L105.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 24.

Models 17-S-350U, 17-S-351U & 17-S-360U

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C119 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (bottom) for maximum gain and with 45.75 mc. at 70% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C119 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 12.

ALIGNMENT PROCEDURE

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R138 and L105.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 13.

To align the I-F amplifier circuit of the KRK29A/27, connect the VHF sweep generator to the rear terminal of the 1N82 crystal holder in series with 1000 ohms and a 1500 mmf ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Set the UHF changeover switch to the UHF position, and the UHF tuning to channel 47 at 670 mc.

Connect a 180 ohm composition resistor and a 1500 mmf capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground. Connect the oscilloscope diode probe to the junction between the resistor and capacitor.

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the KRK29A tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.3 volts or less peak-to-peak on the oscilloscope.

Adjust L307, on the KRK27 section, and L9, on the KRK29A section of the tuner, for maximum gain with picture and sound carrier markers as shown in Figure 14.

Remove the resistor, capacitor and diode probe from TP3. Connect the oscilloscope to the junction of R138 and L105. Use 3v. peak-to-peak on the oscilloscope. Retouch L307 and L9 slightly, if necessary to produce the curve shown in Figure 14.

Do not retouch T2, T104, T106, T107 or T108.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at —3.0 volts and the I-F bias at —5.0 volts. Couple the signal generator loosely to the grid of the first picture I-F amplifier, Pin 1 of V106. Switch through all VHF Channels and check for proper curve shape as in Figure 13. Retouch T107 and T108 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape, as shown in Figure 13, retouching T107 and T108 if necessary to correct any overall tilt.

Remove the sweep and marker generators and the bias supplies.

KRK29 TUNER ALIGNMENT

Models 17-S-350, 17-S-351 & 17-S-360

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in Figure 19 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in Figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK29A/27 TUNER ALIGNMENT

Models 17-S-350U, 17-S-351U & 17-S-360U

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in Figure 19 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

ALIGNMENT PROCEDURE

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in Figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT.—Ground the I-F transformer by inserting a clip lead through the aperture provided in the top of the tuner. Ground the other end of the clip lead to the tuner case.

Connect the oscilloscope to the test point TP301, using the preamplifier if needed with the oscilloscope used.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 9° and 168° should be marked on the test dial. The 0° reference point is located with the capacitor plates fully meshed. By placing a 1/16" shim between the stop pin on the tuner and the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 168°, channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the rear terminal of the crystal holder and insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust trimmer capacitors C315 and C316 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in Figure 11(A).

Adjust the oscillator trimmer capacitor C307 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in Figure 11(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 9°, channel 14, position.

Adjust L1 and L2 for a maximum amplitude overcoupled curve centered at 473.5 mc. as shown in Figure 11(B). Adjust the oscillator trimmer C308 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates may be knifed through the two holes provided on the left side of the tuner. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" to test point TP301. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .05 and .4 volts should be obtained. Voltages outside these limits are an indication of low +B voltage, low or high crystal impedance or an oscillator tube outside allowable limits.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to Figure 9). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L104 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst". Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R106 and C108.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst".

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R106 and C108. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst".

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1,000 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volts.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 6 of V110.

Adjust the core of L105 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L105 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L105 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture can not be synchronized with the horizontal hold control R200, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 25. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

ALIGNMENT DATA

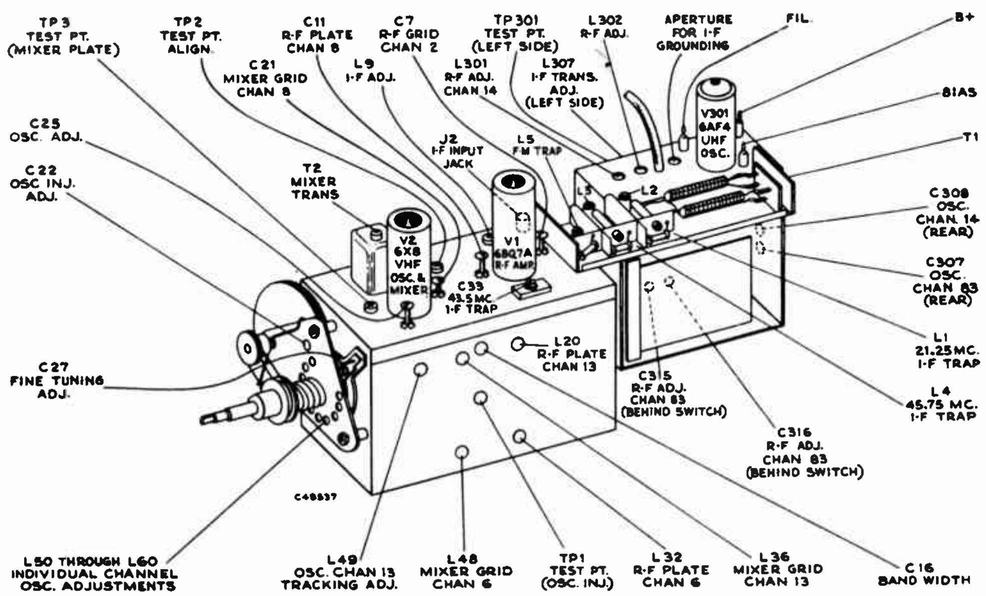


Figure 9—KRK29A/27 Tuner Adjustments

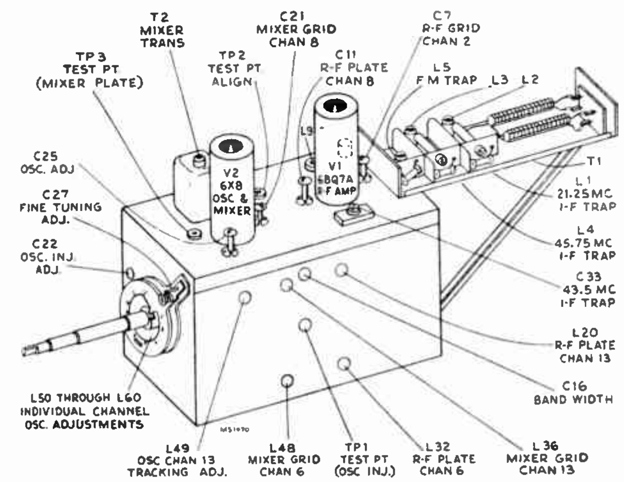


Figure 16—KRK29 Tuner Adjustments

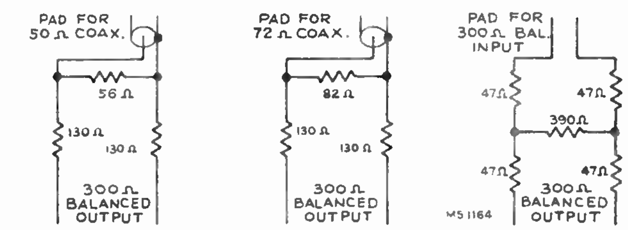


Figure 19—Sweep Attenuator Pads

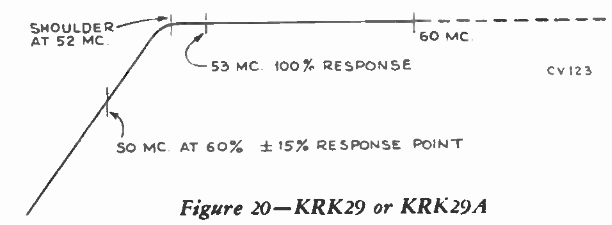


Figure 20—KRK29 or KRK29A Antenna Matching Unit Response

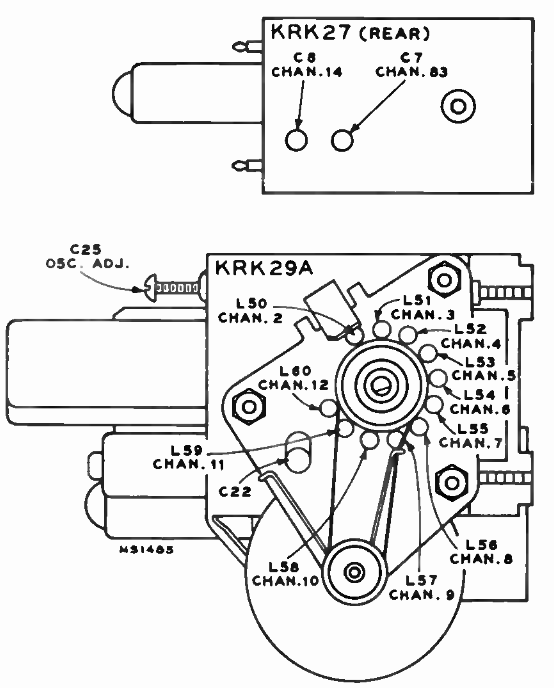


Figure 10—KRK29A/27 Oscillator Adjustments

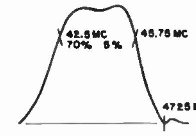


Figure 12—KRK29A/27-T2 and T104 Response

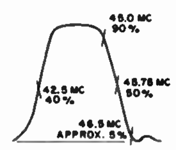


Figure 13—Overall I-F Response with KRK29A/27

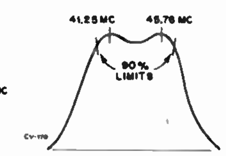


Figure 14—KRK29A/27 L9 and L307 I-F Response

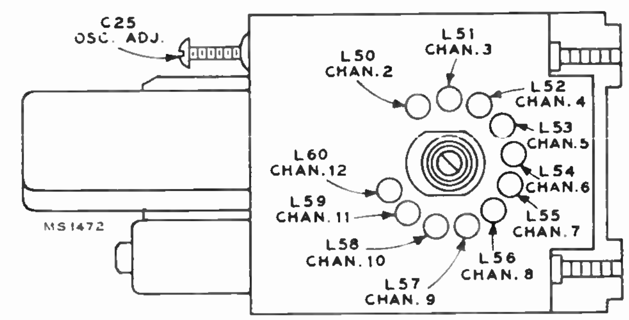


Figure 17—KRK29 R-F Oscillator Adjustments

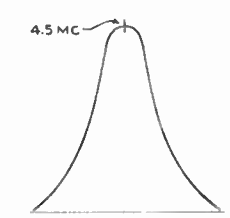


Figure 21—Sound I-F Response

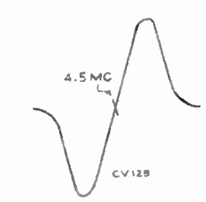


Figure 22—Ratio Det. Response

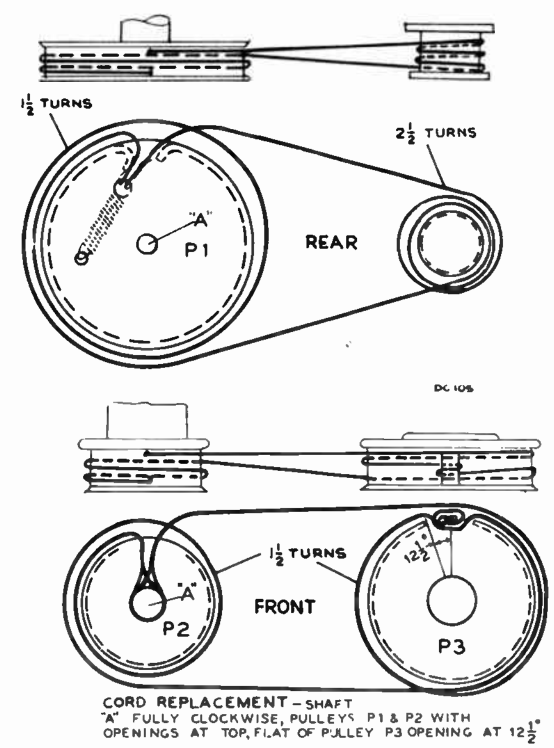


Figure 15—KRK29A/27 Dial Cords

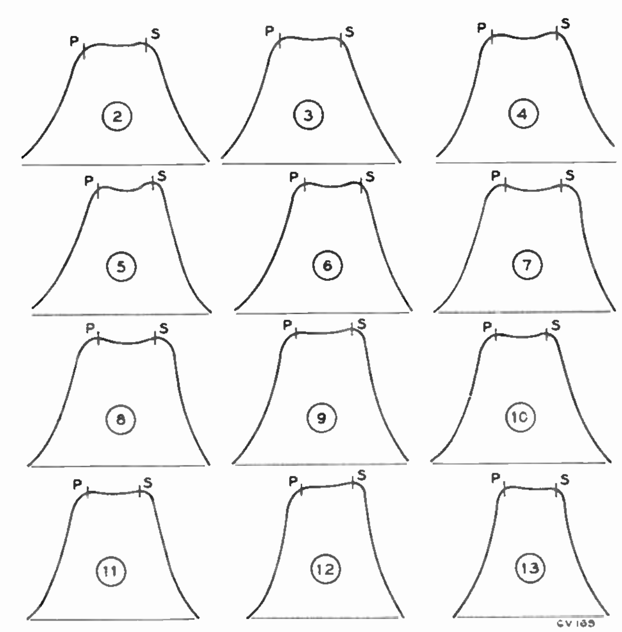


Figure 18—KRK29 or KRK29A R-F Response

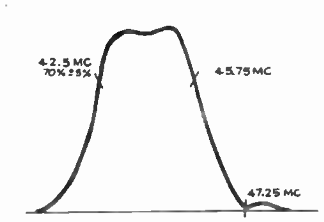


Figure 23—KRK29 T2 and T104 Response

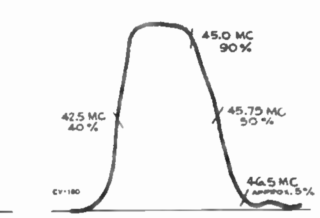


Figure 24—Overall I-F Response with KRK29

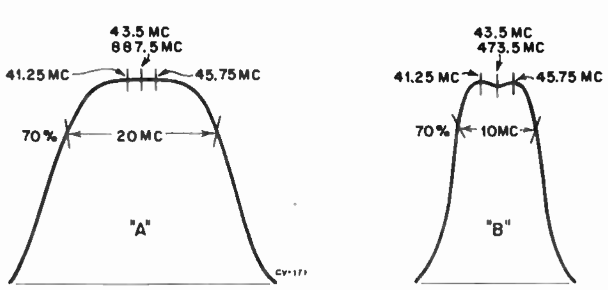


Figure 11—KRK27 R-F Response

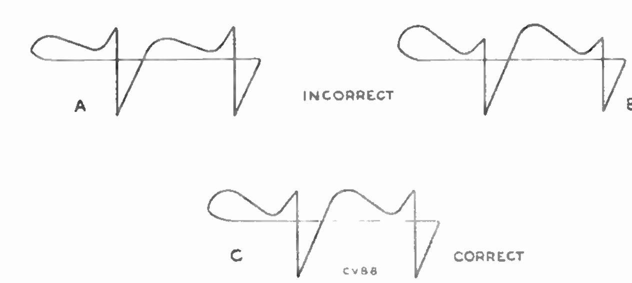


Figure 25—Horizontal Oscillator Wave Forms

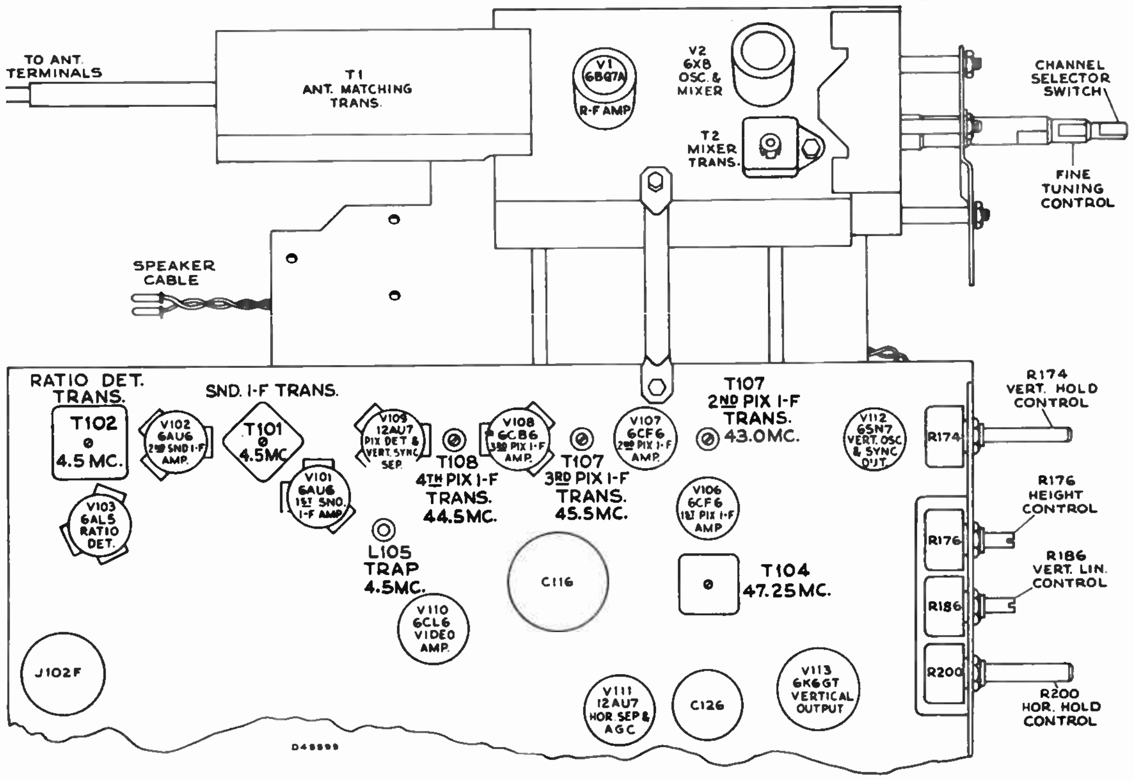


Figure 26—Top Chassis Adjustments (KRK11B Tuner Shown)

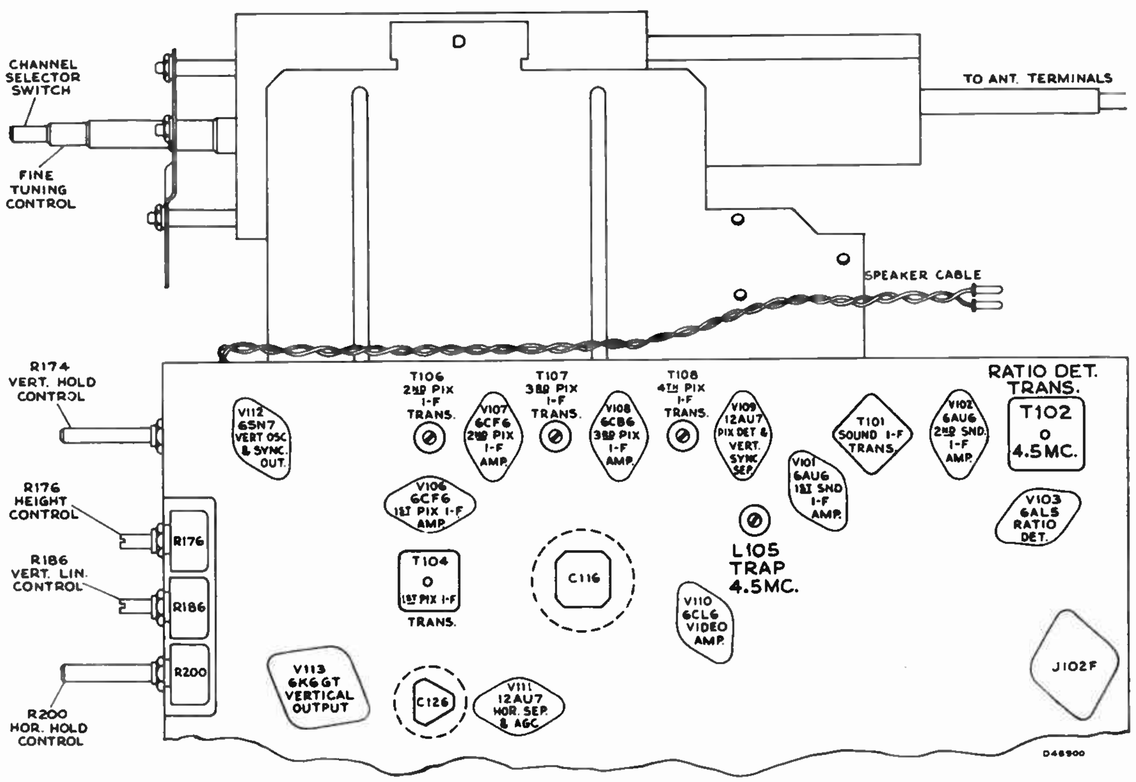
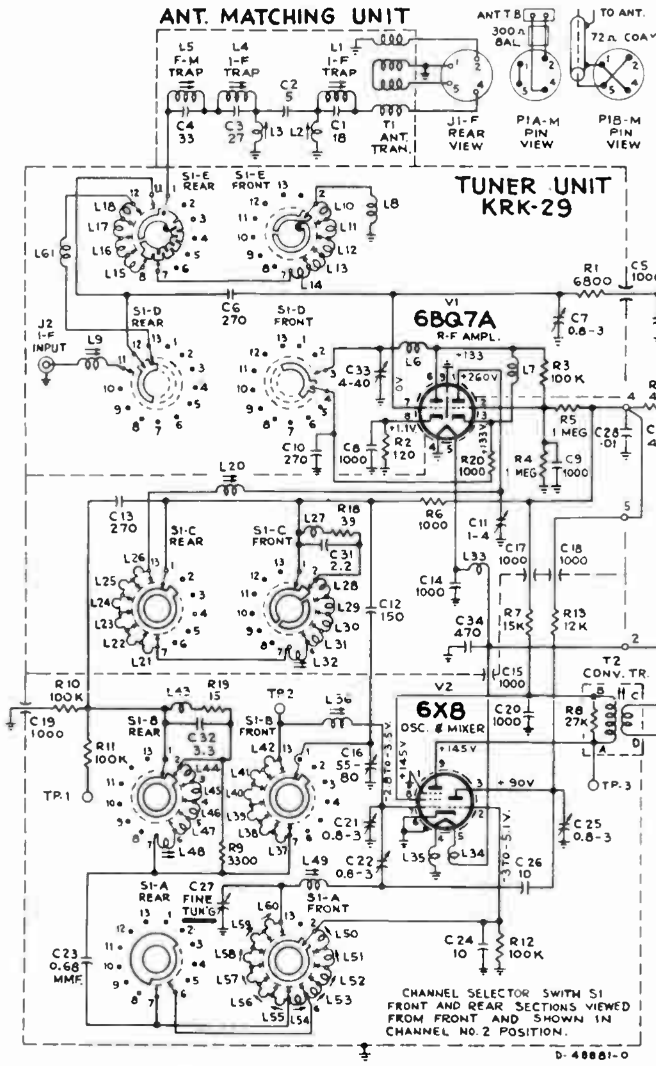
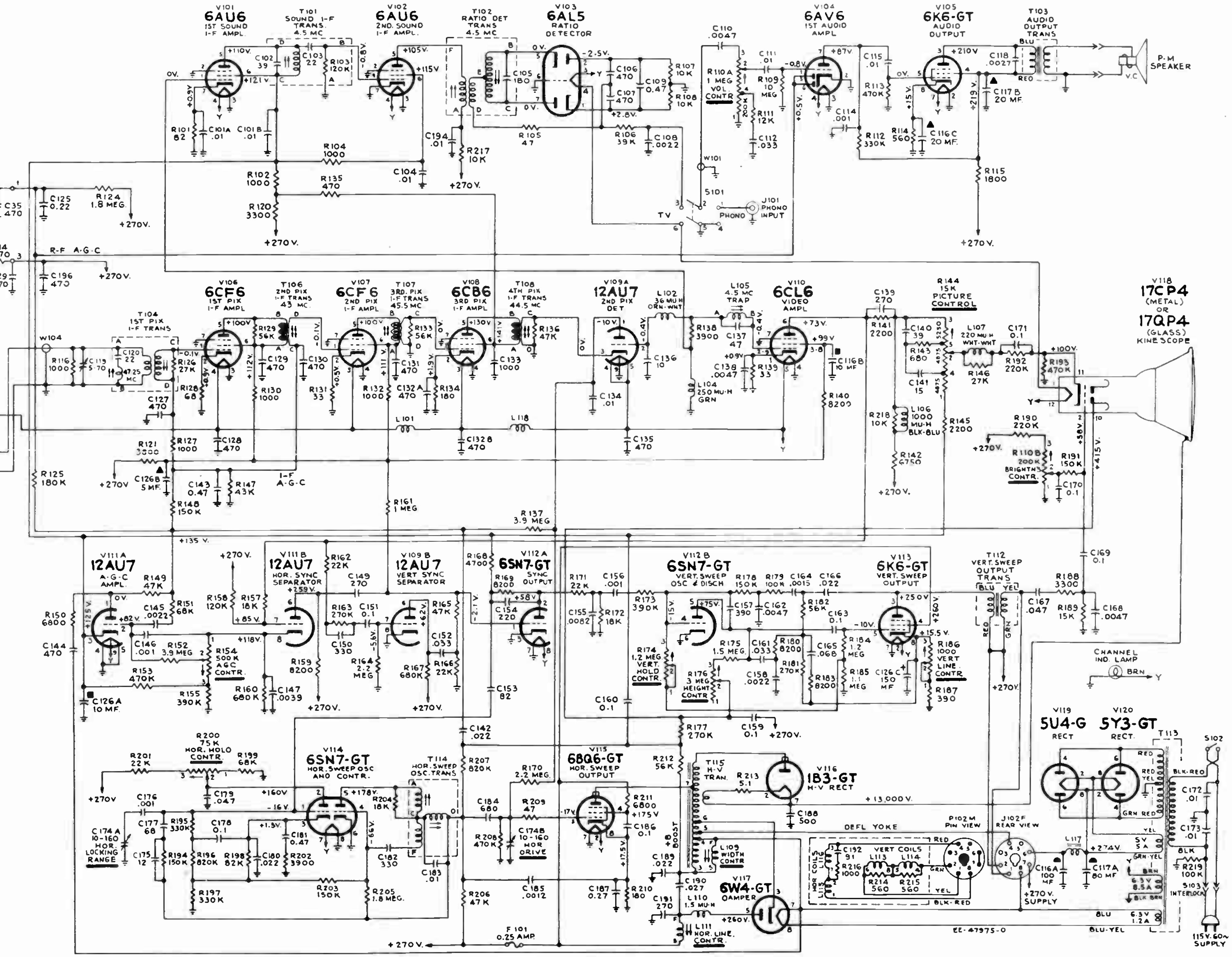


Figure 27—Bottom Chassis Adjustments (KRK11B Tuner Shown)

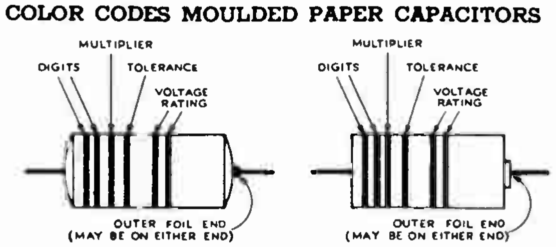
VOLTAGE CHART

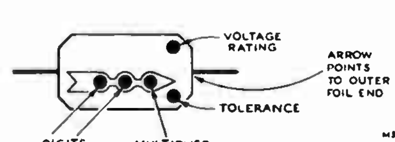
The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
KRK29			No Signal	6	133	—	—	8	1.1	7	0	
or KRK29A		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	
KRK29			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	
or KRK29A		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	127	6	140	7	1.0	1	0	
			No Signal	5	110	6	121	7	9	1	0	
V102	6AU6	2d Sound I-F Amp.	15000 Mu. V. Signal	5	125	6	136	7	0	1	—13	
			No Signal	5	105	6	115	7	0	1	*—0.8	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	0.3	—	—	1	7.2	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	0	—	—	1	*2.8	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	89	—	—	2	0	1	—0.8	At min. volume
			No Signal	7	87	—	—	2	0	1	—0.8	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	217	4	225	8	15.2	5	0	At min. volume
			No Signal	3	210	4	219	8	15.0	5	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	202	6	225	2	<0.1	1	—7.5	
			No Signal	5	100	6	112	2	0.9	1	*—0.1	*Unreliable measuring point. Make measurement at T104-B.
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	205	6	225	2	<0.1	1	—7.5	
			No Signal	5	100	6	111	2	0.5	1	—0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	140	6	155	2	2.1	1	0	
			No Signal	5	130	6	141	2	1.9	1	0	
V109A	12AU7	Picture 2d Det.	15000 Mu. V. Signal	1	—21	—	—	3	0	2	—3.8	
			No Signal	1	—10	—	—	3	0	2	—0.4	
V109B	12AU7	Vert. Sync Separator	15000 Mu. V. Signal	6	68	—	—	8	0	7	—58	
			No Signal	6	62	—	—	8	0	7	—5.6	

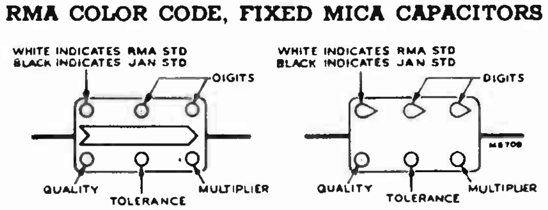



COLOR CODES MOULDED PAPER CAPACITORS





RMA COLOR CODE, FIXED MICA CAPACITORS



All resistance values in ohms. K = 1000.

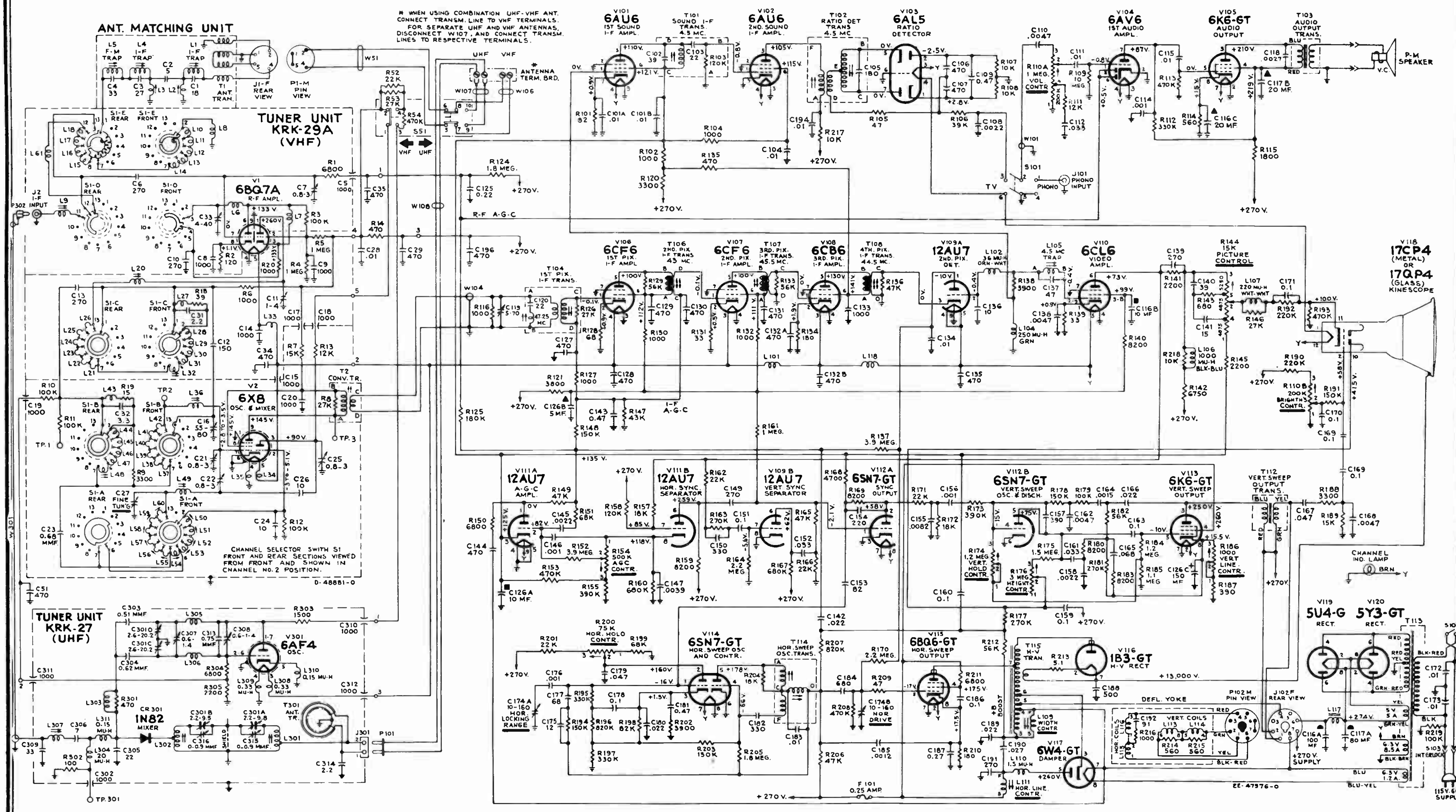
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 28—Circuit Schematic Diagram KCS78F

CIRCUIT SCHEMATIC DIAGRAM KCS78H



The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Direction of arrows at controls indicates clockwise rotation.

Figure 29—Circuit Schematic Diagram, KCS78H

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V110	6CL6	Video Amplifier	15000 Mu. V. Signal	6	82	3-8	180	1	1.1	2-9	—3.4	AGC control set for normal operation
			No Signal	6	73	3-8	99	1	0.9	2-9	—0.4	
V111A	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	42	—	—	3	148	2	115	
			No Signal	1	0	—	—	3	125	2	82	
V111B	12AU7	Hor. Sync Separator	15000 Mu. V. Signal	6	267	—	—	8	171	7	101	
			No Signal	6	259	—	—	8	118	7	85	
V112A	6SN7GT	Sync Output	15000 Mu. V. Signal	2	60	—	—	3	0	2	—2.7	
			No Signal	2	58	—	—	3	0	2	—2.1	
V112B	6SN7GT	Vertical Oscillator	15000 Mu. V. Signal	5	76	—	—	6	0	7	—16	Depends on setting of Vert. hold control
			No Signal	5	75	—	—	6	0	7	—15	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	260	4	270	8	15.9	5	—11	
			No Signal	3	250	4	260	8	15.5	5	—10	
V114A	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	172	—	—	3	—2.2	1	—25	
			No Signal	2	160	—	—	3	1.5	1	—16	
V114B	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	180	—	—	6	0	4	—74	
			No Signal	5	178	—	—	6	0	4	—66	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	180	8	18	5	—17.5	*High Voltage Pulse Present
			No Signal	Cap	*	4	175	8	17.5	5	—17	*High Voltage Pulse Present
V116	1B3GT 8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	14,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	13,000	—	—	*High Voltage Pulse Present
V117	6W4GT	Damper	15000 Mu. V. Signal	5	270	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	260	—	—	3	*	—	—	*High Voltage Pulse Present
V118	17CP4 or 17QP4	Kinescope	15000 Mu. V. Signal	Cap	14,000	10	430	11	120	2	78	At average Brightness
			No Signal	Cap	13,000	10	415	11	100	2	58	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	285	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	274	—	—	

STOCK No.	DESCRIPTION
	RF UNIT ASSEMBLIES KRK29
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78235	Board—Terminal board, 5 contact and ground
78233	Bracket—Side bracket for mounting coil and stators
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:—
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:—
77151	0.8—3.0 mmf. (C11, C21, C25)
77913	0.8—3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:—
77084	feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:—
77293	470 mmf., ±100%, —0%, 500 volts (C29, C34, C35)
77252	1000 mmf., ±100%, —0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., ±100%, —0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K"
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, headed-lead:—
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31)
71503	3.3 mmf., ±20%, 500 volts (C32)
	Capacitor—Mica trimmer:—
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r.f. plate coil (L20)
78224	Coil—Choke coil (.47 muh) (L27)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
76562	Coil—R.F. amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
77860	Connector—Grounding strap connector
77859	Connector—RF grid switch return connector (L8)
78237	Connector—Single contact female connector for UHF connection (J2)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
76460	Contact—Test point contact
77852	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for F.M. trap
77916	Core—¼-20 x ½" adjusting core for L48
77914	Core—#8-32 x 27/64" adjustable core for L20, L36, L49
78231	Detent—Detent mechanism and fibre shaft
77917	Form—Channel #6 coil form complete with core
77912	Form—Channel #13 coil form complete with core
77861	Guide—Bakelite guide for fine tuning lever
78270	Lever—Fine tuning lever
76728	Nut—Speednut for capacitors 76532, 77151
78234	Plate—Mounting plate for shafts (front)
	Resistor—Fixed, composition:—
503015	15 ohms, ±10%, ½ watt (R19)
503039	39 ohms, ±10%, ½ watt (R18)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
14343	Retainer—Fine tuning shaft retainer ring
77849	Retainer—Retainer for fine tuning spring
76549	Screw—#4-40 x ⅜" adjusting screw for L50, L51, L52, L53
75176	Screw—#4-40 x 7/16" adjusting screw for L54
76547	Screw—#4-40 x ¼" adjusting screw for L55, L56, L57, L58, L59, L60
78232	Shaft—Fine tuning shaft and cam
78236	Shield—Front shield
76534	Shield—Tube shield
77851	Shield—"U" shape shield for under-side of unit
76336	Socket—Tube socket, 9 pin, miniature saddle-mounted
77856	Spring—Fine tuning spring
78241	Spring—Formed spring for fine tuning lever
78277	Stator—Input selector switching stator complete with rotor and capacitor (S4, C10)
78272	Stator—Mixer stator complete with rotor (S2, C13, C23, C32, C36, L36, L37, L38, L39, L40, L41, L42, L43, L44, L45, L46, L47, L48, R9, R10, R11, R19)
77911	Stator—Oscillator coil and stator complete with rotor, coils and trimmer (S1, C22, C37, L49, L50, L51, L52, L53, L54, L55, L56, L57, L58, L59, L60)
78398	Stator—RF grid stator complete with rotor and coils (S5, L10, L11, L12, L13, L14, L15, L16, L17, L18)
78274	Stator—RF plate stator complete with rotor, coils, capacitors and resistors (S3, C12, C31, L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L32, R6, R18)
76740	Stud—#6-32 x 1" adjusting stud for capacitor 77913
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Convertor transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—IF trap
76542	Trap—IF trap (41.25 mc) complete with core (L1)
76541	Trap—IF trap (45.75 mc) complete with core (L4)
75190	Washer—Insulating washer (neoprene) for capacitor
	RF UNIT ASSEMBLIES KRK29A
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78467	Board—Terminal board—6 contact
78233	Bracket—Side bracket for mounting coil and stators
78430	Cam—Actuating cam for antenna slide switch
78417	Cam—Fine tuning cam for VHF
	Capacitor—Adjustable, mica:—
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:—
77151	0.8—3.0 mmf. (C11, C21, C25)
77913	0.8—3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:—
77853	Variable, for fine tuning capacitor—plunger type (C27)
77084	Feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, High "K" disc:—
77293	470 mmf., ±100%, —0%, 500 volts (C29, C34, C35, C51)
77252	1000 mmf., ±100%, —0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., ±100%, —0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K":—
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, headed-lead:—
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31)
71503	3.3 mmf., ±20%, 500 volts (C32)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
78401	Coil—Channel #6 antenna coil (L61)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
77919	Coil—Channel #13 mixer coil (L36)
77915	Coil—Channel #13 oscillator coil (L49)
77921	Coil—Channel #13 r.f. plate coil (L20)
78224	Coil—Choke coil (.47 muh) (L27)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
76562	Coil—RF amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
39153	Connector—4 contact male connector (P51)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
77860	Connector—Grounding strap connector
77859	Connector—RF grid switch return connector (L8)
78237	Connector—Single contact female connector for UHF connection (J2)
76460	Contact—Test point contact
77852	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for FM trap

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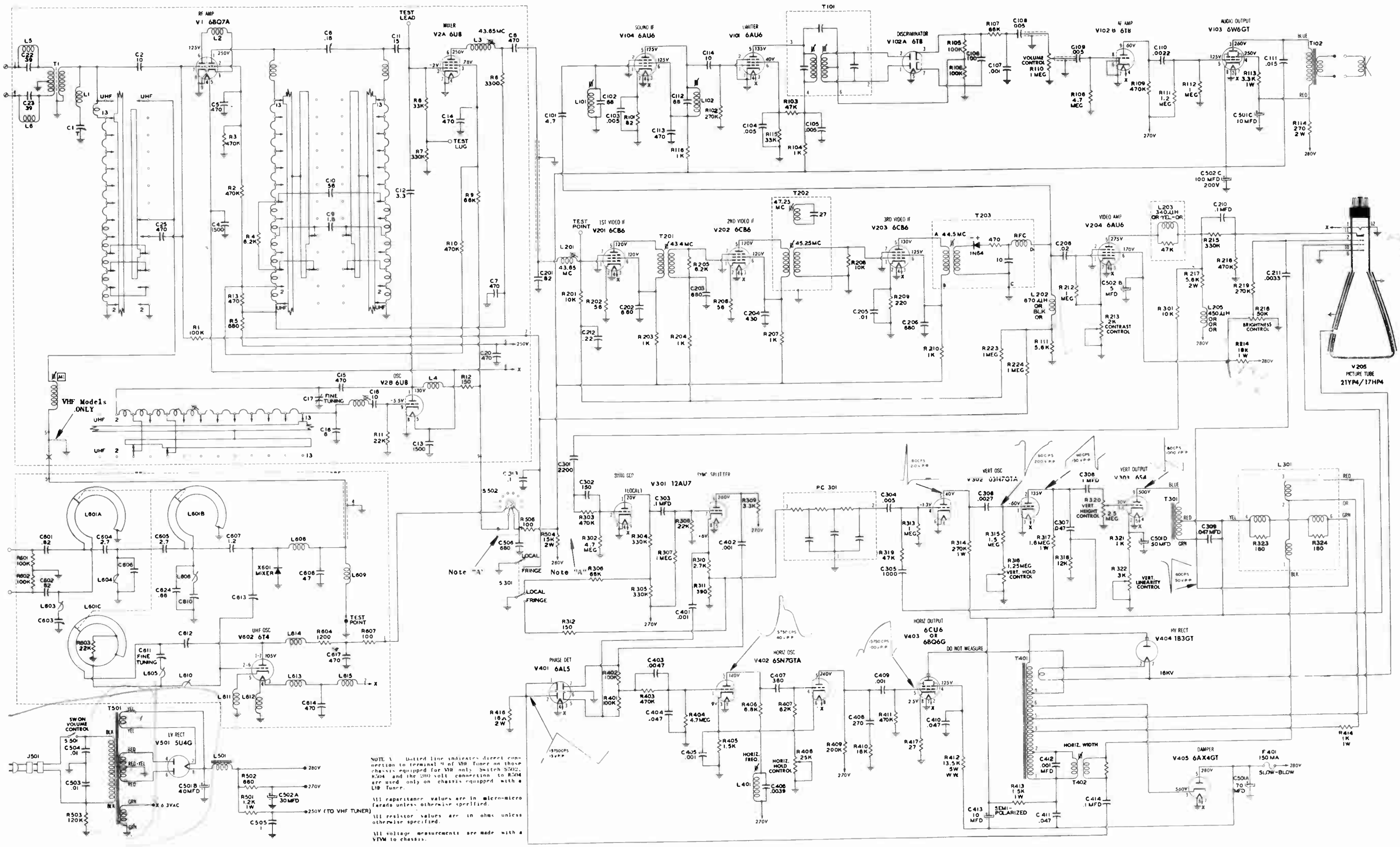
STOCK No.	DESCRIPTION
	Resistor—Fixed, composition:—
503015	15 ohms, ±10%, ½ watt (R19)
503039	39 ohms, ±10%, ½ watt (R18)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14, R54)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
523322	22,000 ohms, ±10%, 2 watts (R52)
523327	27,000 ohms, ±10%, 2 watts (R53)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Converter transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—I.F. Trap (L6)
76542	Trap—I.F. trap (41.25 mc) complete with core (L1)
76541	Trap—I.F. trap (45.75 mc) complete with core (L4)
78426	Washer—"C" washer for clutch mechanism
75190	Washer—Insulating washer (neoprene) for capacitor
78424	Washer—Retaining washer for knob shaft spring
78425	Washer—Spring washer for clutch mechanism
	RF UNIT ASSEMBLIES KRK27
	Capacitor—Adjustable, steatite:—
78259	0.6—1.4 mmf. complete with adjustable core (C7, C8)
	Capacitor—Fixed, ceramic:—
77084	1000 mmf., feed-thru (C2, C10, C11, C12)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
78262	7 mmf., ±0.5 mmf., 500 volts DC (C6)
78261	22 mmf., ±5%, 500 volts DC (C5)
70596	33 mmf., ±5%, 500 volts DC (C9)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
78263	0.75 mmf., ±0.25 mmf., 500 volts DC (C13)
	Capacitor—Fixed, headed-lead:—
78137	0.51 mmf., ±10%, 500 volts DC (C3)
78260	0.62 mmf., ±10%, 500 volts DC (C4)
71502	2.2 mmf., ±10%, 500 volts DC (C14)
78257	Capacitor—Variable tuning capacitor (C1A, C1B, C1C, C1D, C15, C16, L1, L2)
78258	Coil—I.F. coil complete with adjustable core (L7)
78264	Coil—Peaking coil (L3, R1)
72618	Coil—Peaking coil (20 muh) (L4)
78267	Coil—RF choke coil (0.15 muh) (L10, L11)
77279	Coil—RF choke coil (0.33 muh) (L8, L9)
78269	Connector—Single contact male connector for I.F. output cable
78255	Connector—2 contact female connector for UHF antenna (J1)
78256	Holder—Crystal holder
77489	Rectifier—Crystal rectifier IN82 (CR1)
	Resistor—Fixed, composition:—
503110	100 ohms, ±10%, ½ watt (R2)
503215	1500 ohms, ±10%, ½ watt (R3)
503222	2200 ohms, ±10%, ½ watt (R5)
503268	6800 ohms, ±10%, ½ watt (R4)
78268	Transformer—Antenna input transformer (T1)
	CHASSIS ASSEMBLIES KCS 78F—VHF Chassis KCS 78H—UHF/VHF Chassis
78402	Board—Antenna terminal board for KCS78H
76490	Bracket—Mounting bracket complete with insulator for picture control
	Capacitor—Ceramic:—
76461	500 mmf., 20,000 volts (C168)
	Capacitor—Fixed, ceramic, High "K" disc:—
77293	470 mmf., ±100%, —0%, 500 volts DC (C127, C128, C129, C130, C131, C135, C196)
77672	Dual 470 mmf., ±100%, —0%, 500 volts DC (C132A, C132B)
77252	1000 mmf., ±100%, —0%, 500 volts DC (C133)
73960	10,000 mmf., ±100%, —0%, 500 volts DC (C104, C134, C194)
76991	Dual 10,000 mmf., ±100%, —0%, 500 volts DC (C101A, C101B)
	Capacitor—Fixed, ceramic, insulated:—
77673	470 mmf., ±10%, 1500 volts DC (C144)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
33098	10 mmf., ±1.0 mmf., 500 volts DC (C136)
33380	12 mmf., ±10%, 500 volts DC (C175)
39044	15 mmf., ±10%, 500 volts DC (C141)
73664	39 mmf., ±10%, 500 volts DC (C140)
	Capacitor—Fixed, mica:—
76475	68 mmf., 1000 volts (C177)
76474	82 mmf., 1000 volts DC (C153)
39636	220 mmf., 500 volts DC (C154)
39638	270 mmf., 500 volts DC (C139)
76579	270 mmf., 1000 volts DC (C149, C191)
39640	330 mmf., 500 volts DC (C150)
76476	330 mmf., 1000 volts (C182)

STOCK No.	DESCRIPTION
73551	0.1 mfd., 400 volts (C151, C159, C169, C170, C178)
73557	0.1 mfd., 600 volts (C160, C163, C186)
73794	0.22 mfd., 400 volts (C125)
73786	0.27 mfd., 200 volts (C187)
73787	0.47 mfd., 200 volts (C109, C143, C181)
	Capacitor—Fixed, tubular, moulded, oil impregnated:—
76479	.00068 mfd., 600 volts (C184)
76995	.0012 mfd., 600 volts (C185)
77123	.0015 mfd., 1000 volts (C164)
73594	.01 mfd., 600 volts (C172, C173, C183)
77676	Choke—Filter choke (L117)
73477	Coil—Choke coil (L101, L118)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
76011	Coil—Peaking coil (36 muh) (L102)
77825	Coil—Peaking coil (220 muh) (L107, R146)
77124	Coil—Peaking coil (1000 muh) (L106, R218)
76640	Coil—RF choke coil (1.5 muh) (L110)
76441	Coil—Width coil complete with adjustable core (L109)
76975	Control—AGC control (R154)
77641	Control—Brightness control, volume control and power switch (R110A, R110B, S102)
77924	Control—Height control (R176)
77639	Control—Horizontal hold control (R200)
76445	Control—Picture control (R144)
77642	Control—Vertical hold control (R174)
77643	Control—Vertical linearity control (R186)
73094	390 mmf., 1000 volts DC (C157)
39644	470 mmf., 500 volts DC (C106, C107)
	Capacitor—Mica trimmer:—
71496	5-70 mmf. (C119)
75217	Dual 10-160 mmf. (C174A, C174B)
	Capacitor—Electrolytic:—
75218	Comprising:—1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C126A, C126B, C126C)
77644	Comprising:—1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C117A, C117B)
76970	Comprising:—1 section of 100 mfd., 400 volts, 1 section of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C116A, C116B, C116C)
	Capacitor—Fixed, tubular, paper, oil impregnated:—
75643	.001 mfd., 1000 volts (C114, C146, C156, C176)
73595	.0022 mfd., 600 volts (C108, C145, C158)
73818	.0027 mfd., 1600 volts (C118)
73796	.0039 mfd., 600 volts (C147)
73920	.0047 mfd., 600 volts (C110, C138, C162, C168)
73808	.0082 mfd., 1000 volts (C155)
73561	.01 mfd., 400 volts (C111, C115)
73562	.022 mfd., 400 volts (C180)
73798	.022 mfd., 600 volts (C166)
73810	.022 mfd., 1000 volts (C142, C189)
73811	.027 mfd., 1000 volts (C190)
73552	.033 mfd., 400 volts (C112, C152)
73596	.033 mfd., 1000 volts (C161)
73553	.047 mfd., 400 volts (C179)
73592	.047 mfd., 600 volts (C167)
73792	.068 mfd., 400 volts (C165)
73784	0.1 mfd., 200 volts (C171)
	Resistor—Wire wound:—
76796	5.1 ohms, ⅓ watt (R213)
76639	180 ohms, 2 watts (R210)
77670	3300 ohms, 7 watts (R120)
77671	3800 ohms, 7 watts (R121)
76642	6750 ohms, 10 watts (R142)
	Resistor—Fixed, composition:—
30789	33 ohms, ±5%, ½ watt (R131)
503033	33 ohms, ±10%, ½ watt (R139)
503047	47 ohms, ±10%, ½ watt (R105, R209)
34763	68 ohms, ±5%, ½ watt (R128)
503082	82 ohms, ±10%, ½ watt (R101)
502118	180 ohms, ±5%, ½ watt (R134)
503139	390 ohms, ±10%, ½ watt (R187)
503147	470 ohms, ±10%, ½ watt (R135)
513156	560 ohms, ±10%, 1 watt (R114)
503168	680 ohms, ±10%, ½ watt (R143)
503210	1000 ohms, ±10%, ½ watt (R104, R116, R127, R130, R132)
513210	1000 ohms, ±10%, 1 watt (R102)
523218	1800 ohms, ±10%, 2 watts (R115)
503222	2200 ohms, ±10%, ½ watt (R145)
523222	2200 ohms, ±10%, 2 watts (R141)
503233	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R138)

STOCK No.	DESCRIPTION
503239	3900 ohms, ±10%, ½ watt (R202)
502247	4700 ohms, ±5%, ½ watt (R168)
513268	6800 ohms, ±10%, 1 watt (R150)
523268	6800 ohms, ±10%, 2 watts (R211)
503282	8200 ohms, ±10%, ½ watt (R159, R169, R180, R183)
523282	8200 ohms, ±10%, 2 watts (R140)
502310	10,000 ohms, ±5%, ½ watt (R107, R108)
513310	10,000 ohms, ±10%, 1 watt (R217)
503312	12,000 ohms, ±10%, ½ watt (R111)
503315	15,000 ohms, ±10%, ½ watt (R189)
503318	18,000 ohms, ±10%, ½ watt (R157, R172, R204)
503322.	22,000 ohms, ±10%, ½ watt (R162, R166, R171, R201)
503339	39,000 ohms, ±10%, ½ watt (R106)
70351	43,000 ohms, ±5%, ½ watt (R147)
503347	47,000 ohms, ±10%, ½ watt (R136, R149, R165)
512347	47,000 ohms, ±5%, 1 watt (R206)
502356	56,000 ohms, ±5%, ½ watt (R129, R133)
503356	56,000 ohms, ±10%, ½ watt (R212)
512356	56,000 ohms, ±5%, 1 watt (R182)
503368	68,000 ohms, ±10%, ½ watt (R151, R199)
503382	82,000 ohms, ±10%, ½ watt (R198)
513410	100,000 ohms, ±10%, 1 watt (R179, R219)
503412	120,000 ohms, ±10%, ½ watt (R158)
502415	150,000 ohms, ±5%, ½ watt (R148)
503415	150,000 ohms, ±10%, ½ watt (R178, R191, R194)
512415	150,000 ohms, ±5%, 1 watt (R203)
502418	180,000 ohms, ±5%, ½ watt (R125)
503422	220,000 ohms, ±10%, ½ watt (R190, R192)
502427	270,000 ohms, ±5%, ½ watt (R181)
503427	270,000 ohms, ±10%, ½ watt (R163, R177)
503433	330,000 ohms, ±10%, ½ watt (R12, R195, R197)
503439	390,000 ohms, ±10%, ½ watt (R155, R173)
503447	470,000 ohms, ±10%, ½ watt (R113, R153, R193, R208)
503468	680,000 ohms, ±10%, ½ watt (R160, R167)
503482	820,000 ohms, ±10%, ½ watt (R196, R207)
503510	1 megohm, ±10%, ½ watt (R161)
502511	1.1 megohm, ±5%, ½ watt (R185)
503512	1.2 megohm, ±10%, ½ watt (R184)
503515	1.5 megohm, ±10%, ½ watt (R175)
11769	1.8 megohm, ±5%, ½ watt (R124, R205)
503522	2.2 megohm, ±10%, ½ watt (R164, R170)
503539	3.9 megohm, ±10%, ½ watt (R137, R152)
503610	10 megohm, ±10%, ½ watt (R109)
76795	Transformer—Hi-voltage transformer (T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable core (T114)
76982	Transformer—Output transformer (T103)
77635	Transformer—Power transformer, 117 volts, 60 cycle (T113)
77112	Transformer—Ratio detector transformer (T102, C105)
76981	Transformer—Sound I.F. transformer complete with adjustable core (T101, C102, C103, R103)
77636	Transformer—Vertical output transformer (T112)
77637	Transformer—1st pix I.F. transformer complete with adjustable cores (T104, C120, R126)
77638	Transformer—2nd pix I.F. transformer complete with adjustable core (T106)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
76983	Trap—4.5 MC trap (L105, C137)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)
	SPEAKER ASSEMBLIES 971636-1W RL101C5 RMA-274
	(For Models 17S350, 17S350U, 17S351, 17S351U)
77000	Speaker—5" PM speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971490-3W RL105E6 RMA-274 / 971490-3R RMA-285
	(For Models 17S360, 17S360U)
75024	Cone—Cone and voice coil (3.2 ohms) for speaker stamped 971490-3W
77129	Cone—Cone and voice coil (3.2 ohms) for speaker stamped 971490-3R
75022	Speaker—8" PM speaker complete with cone and voice coil (3.2 ohms)
	Note:—If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instruments, number stamped on speaker and full description of part required.



NOTE "A" Dotted line indicates direct connection to terminal 4 of VHF Tuner on those chassis equipped for VHF only. Switch S502, R504 and the 280 volt connection to R504 are used only on chassis equipped with a UHF Tuner.

All capacitance values are in micro-micro farads unless otherwise specified.

All resistor values are in ohms unless otherwise specified.

All voltage measurements are made with a VTVM to chassis.

SCHEMATIC DIAGRAM

PARTS LIST AND DESCRIPTIONS

SYMBOL	DESCRIPTION	PART NO.
	COILS & TRANSFORMERS	
T1	Antenna input transformer	360490-2
T101	Discriminator transformer	360512-1
T102	Audio output transformer	320068-2
T201	1st IF coil	360581-1
T202	2nd IF and trap coil	360582-1
T203	3rd IF and detector coil	360607-1
T301	Vertical output transformer	320067-2
T401	H. V. transformer	360606-1
T501	Power transformer	300077-1
L1	R. F. choke	360601-8
L3	IF output coil	360603-1
L4	R. F. choke	360601-9
L101	Sound take-off coil	360584-1
L102	Sound take-off coil	360584-1
L201	1st IF input coil	360540-1
L202	Peaking, orange, black, orange	360443-37
L203	Peaking, orange, yellow, orange	360443-39
L205	Peaking, orange, orange, orange	360443-28
L301	Deflection coil	360587-3
L401	Horizontal oscillator coil	360579-1
L402	Horizontal width coil	360585-2
L501	Filter reactor	320058-2
L603	Coil, part of C603	250188-8
L604	Coil, R. F. coupling	360415-44
L606	Coil, part of C606	250188-8
L608	Coil, IF coupling	360574-12
L609	Coil, Xtal return	360574-14
L611	Choke, cathode	360522-7
L612	Choke, filament	360574-8
L613	Choke, filament	360574-8
L614	Choke, oscillator plate	360574-8
L615	Choke, filament	360574-8
A41	IF input coil	360602-1
	CAPACITORS	
C1	Trimmer	250188-6
C2	Molded, 10 mmf, 500 V.	250221-127
C4	Ceramic, .0015 mfd, 500 V.	250175-10
C5	Ceramic, 470 mmf, 500 V.	250175-8
C6	Molded, .18 mmf, 500 V. (with gimmick)	250216-4
C7	Ceramic, 470 mmf, 500 V.	250175-8
C8	Ceramic, 470 mmf, 500 V.	250175-8
C9	Molded, 1.8 mmf, 500 V.	250221-117
C10	Molded, .56 mmf, 500 V.	250221-111
C11	Ceramic, 15 mmf, 500 V.	250207-5
C12	Molded, 3.3 mmf, 500 V.	250221-121
C13	Ceramic, .0015 mfd, 500 V.	250175-10
C14	Ceramic, 470 mmf, 500 V.	250175-8
C15	Ceramic, 470 mmf, 500 V.	250175-8
C16	Ceramic, 6 mmf, 500 V.	250088-137
C17	Trimmer plate & insulator	635111-1
C18	Ceramic, 10 mmf, 500 V.	250088-136
C20	Ceramic, 470 mmf, 500 V.	250175-8
C22	Ceramic, 39 mmf, 500 V.	250175-20
C23	Ceramic, 39 mmf, 500 V.	250175-20
C25	Ceramic 470 mmf, 500 V.	250175-8
C101	Molded, 4.7 mmf, 500 V.	250221-123

SYMBOL	DESCRIPTION	PART NO.
C102	Ceramic disc, 68 mmf, 500 V.	250218-7
C103	Ceramic disc, .005 mfd, 500 V.	250175-1
C104	Ceramic disc, .005 mfd, 500 V.	250175-1
C105	Ceramic disc, .005 mfd, 500 V.	250175-1
C106	Ceramic, 100 mmf, 500 V.	250207-46
C107	Ceramic disc, 1000 mmf, 500 V.	250218-8
C108	Ceramic disc, .005 mfd, 500 V.	250175-1
C109	Ceramic disc, .005 mfd, 500 V.	250175-1
C110	Paper, .0022 mfd, 400 V.	250211-3
C111	Paper, .015 mfd, 600 V.	250201-8
C112	Ceramic disc, 68 mmf, 500 V.	250218-7
C113	Ceramic disc, 470 mmf, 500 V.	250218-6
C114	Ceramic, 10 mmf, 500 V.	250207-3
C201	Silver mica, 82 mmf, 500 V.	250159-2045
C202	Ceramic disc, 680 mmf, 500 V.	250218-10
C203	Ceramic disc, 680 mmf, 500 V.	250218-4
C204	Ceramic disc, 430 mmf, 500 V.	250218-11
C205	Ceramic disc, 680 mmf, 500 V.	250218-4
C206	Ceramic disc, 680 mmf, 500 V.	250218-4
C208	Ceramic disc, .02 mfd, 450 V.	250175-7
C209	Ceramic disc, .005 mfd, 500 V.	250175-1
C210	Paper, .1 mfd, 200 V.	250202-13
C211	Paper, .0033 mfd, 600 V.	250201-4
C212	Paper, .22 mfd, 200 V.	250202-15
C213	Paper, .1 mfd, 200 V.	250202-13
C301	Paper, .0022 mfd, 400 V.	250211-3
C302	Mica, 150 mmf, 500 V.	250159-99
C303	Paper, .1 mfd, 400 V.	250211-13
C304	Ceramic disc, 5000 mmf, 500 V.	250218-13
C305	Ceramic disc, 1000 mmf, 500 V.	250218-8
C306	Mica, 2700 mmf, 500 V.	250160-1069
C307	Paper, .047 mfd, 400 V.	250212-7
C308	Paper, .1 mfd, 400 V.	250211-13
C309	Paper, .047 mfd, 400 V.	250211-11
C401	Ceramic disc, 1000 mmf, 500 V.	250218-8
C402	Ceramic disc, 1000 mmf, 500 V.	250218-8
C403	Paper, .0047 mfd, 400 V.	250212-4
C404	Paper, .047 mfd, 200 V.	250212-5
C405	Ceramic disc, 1000 mmf, 500 V.	250218-8
C406	Silver mica, 3900 mmf, 500 V.	250161-5041
C407	Silver mica, 360 mmf, 500 V.	250159-5060
C408	Silver mica, 270 mmf, 500 V.	250159-5057
C409	Paper, .001 mfd, 400 V.	250211-1
C410	Paper, .047 mfd, 400 V.	250211-11
C411	Paper, .047 mfd, 400 V.	250211-11
C412	Ceramic disc, .001 mfd, 1000 V.	250218-12
C413	Electrolytic, 10 mfd, 350 V.	270027-23
C414	Paper, .1 mfd, 600 V.	250201-13
C501	Electrolytic, 70-40-10/350 V, 50/50 V.	270021-52
C502	Electrolytic, 30-5/350 V, 100/200 V.	270021-55
C503	Ceramic disc, .01 mfd, 1000 V.	250219-2
C504	Ceramic disc, .01 mfd, 1000 V.	250219-2
C601	Molded, .82 mmf	250221-113
C602	Molded, .82 mmf	250221-113
C603	Ceramic, variable	250188-8
C604	Molded, 2.7 mmf	250221-119
C605	Molded, 2.7 mmf	250221-119
C606	Ceramic, variable	250188-7
C607	Molded, 1.2 mmf	250221-115
C608	Ceramic disc, 47 mmf	250175-21
C610	Ceramic, variable	250188-8
C611	Fine tuning	260121-1

SYMBOL	DESCRIPTION	PART NO.
C612	Ceramic, 2.3-4.0 mmf	250220-2
C614	Ceramic disc, 470 mmf	250175-8
C617	Ceramic disc, 470 mmf	250175-8
C624	Molded, .68 mmf	250221-112
	RESISTORS	
R1	100,000 ohm, ½ W.	230104-86
R2	470,000 ohm, ½ W.	230104-94
R3	470,000 ohm, ½ W.	230104-94
R4	8200 ohm, ½ W.	230104-73
R5	680 ohm, ½ W.	230104-60
R6	3300 ohm, ½ W.	230104-68
R7	330,000 ohm, ½ W.	230104-92
R8	33,000 ohm, ½ W.	230104-80
R9	68,000 ohm, ½ W.	230104-84
R10	470,000 ohm, ½ W.	230104-94
R11	22,000 ohm, ½ W.	230104-78
R12	150 ohm, ½ W.	230104-52
R101	82 ohm, ½ W.	230104-49
R102	270,000 ohm, ½ W.	230104-91
R103	47,000 ohm, ½ W.	230104-82
R104	1000 ohm, ½ W.	230104-62
R105	100,000 ohm, ½ W.	230104-86
R106	100,000 ohm, ½ W.	230104-86
R107	68,000 ohm, ½ W.	230104-84
R108	4.7 megohm, ½ W.	230104-106
R109	470,000 ohm, ½ W.	230104-94
R111	1.2 megohm, ±5%, ½ W.	230094-233
R112	1 megohm, ±5%, ½ W.	230094-231
R113	3300 ohm, 1 W.	230105-68
R114	1000 ohm, ½ W.	230104-62
R115	33,000 ohm, ½ W.	230104-80
R116	270 ohm, 2 W.	230106-55
R201	10,000 ohm, ±5%, ½ W.	230094-183
R202	56 ohm, ½ W.	230104-47
R203	1000 ohm, ½ W.	230104-62
R204	1000 ohm, ½ W.	230104-62
R205	8200 ohm, ±5%, ½ W.	230094-181
R206	56 ohm, ½ W.	230104-47
R207	1000 ohm, ½ W.	230104-62
R208	10,000 ohm, ±5%, ½ W.	230094-183
R209	220 ohm, ½ W.	230104-54
R210	1000 ohm, ½ W.	230104-62
R211	5600 ohm, ±5%, ½ W.	230094-177
R212	1 megohm, ½ W.	230104-98
R214	18,000 ohm, 1 W.	230105-77
R215	330,000 ohm, ½ W.	230104-92
R216	470,000 ohm, ½ W.	230104-94
R217	5600 ohm, 2 W.	230106-71
R219	270,000 ohm, ½ W.	230104-91
R223	1 megohm, ½ W.	230104-98
R224	1 megohm, ½ W.	230104-98
R301	10,000 ohm, ½ W.	230104-74
R302	4.7 megohm, ½ W.	230104-106
R303	470,000 ohm, ½ W.	230104-94
R304	330,000 ohm, ½ W.	230104-92
R305	330,000 ohm, ½ W.	230104-92
R306	68,000 ohm, ½ W.	230104-84
R307	1 megohm, ½ W.	230104-98
R308	22,000 ohm, ½ W.	230104-78
R309	3300 ohm, ½ W.	230104-68

SYMBOL	DESCRIPTION	PART NO.
R310	2700 ohm, ½ W.	230104-67
R311	390 ohm, ½ W.	230104-57
R312	150 ohm, ½ W.	230104-52
R313	1 megohm, ½ W.	230104-98
R314	270,000 ohm, 1 W.	230105-91
R315	1.5 megohm, ½ W.	230104-100
R317	1.8 megohm, 1 W.	230105-101
R318	12,000 ohm, ½ W.	230104-75
R319	47,000 ohm, ½ W.	230104-82
R321	1000 ohm, ½ W.	230104-62
R323	180 ohm, ½ W.	230104-53
R324	180 ohm, ½ W.	230104-53
R401	100,000 ohm, ½ W.	230104-86
R402	100,000 ohm, ½ W.	230104-86
R403	470,000 ohm, ½ W.	230104-94
R404	4.7 megohm, ½ W.	230104-106
R405	1500 ohm, ±5%, ½ W.	230094-163
R406	6800 ohm, ±5%, ½ W.	230094-179
R407	82,000 ohm, ½ W.	230104-85
R409	200,000 ohm, ±5%, ½ W.	230094-214
R410	18,000 ohm, ½ W.	230104-77
R411	470,000 ohm, ½ W.	230104-94
R412	13,500 ohm, 5 W.	240071-7
R413	1500 ohm, 1 W.	230105-64
R414	1000 ohm, 1 W.	230105-62
R415	4700 ohm, 2 W.	230106-70
R416	18 ohm, 2 W.	230106-41
R417	27 ohm, ½ W.	230104-43
R501	1200 ohm, 1 W.	230105-63
R502	680 ohm, ½ W.	230104-60
R503	120,000 ohm, ½ W.	230110-1
R504	15,000 ohm, 2 W.	230106-76
R505	15,000 ohm, 2 W.	230106-76
R601	100,000 ohm, ½ W.	230104-86
R602	100,000 ohm, ½ W.	230104-86
R603	22,000 ohm, ½ W.	230104-78
R604	1200 ohm, 1 W.	230145-63
R607	100 ohm, ½ W.	230104-50
	CONTROLS	
R110	Volume, 1 megohm, with ON-OFF switch	220126-44
R213	Contrast, 2000 ohm	220126-43
R218	Brightness, 50,000 ohm	220129-7
R316	Vertical hold, 1.25 megohm	220129-9
R320	Vertical height, 2.5 megohm	220146-2
R322	Vertical linearity, 3000 ohm	220120-3
R408	Horizontal hold, 25,000 ohm	220129-8
	MISCELLANEOUS	
PC301	Printed Circuit	250186-1
S301	Switch, fringe-local	160169-3
S501	Switch, ON-OFF (on VOL. control)	
S502	Switch, UHF-VHF	160247-1
F401	Fuse, 150 MA, slow-blow	180157-24
X601	Crystal diode	530036-1
	VHF tuner	700458-1
	UHF tuner	700459-1
	Receptacle, AC	180547-1
	Terminal board, antenna	209601-2
	Ion trap	360492-7

DESCRIPTION AND SPECIFICATIONS

The Magnavox Model 700426 UHF tuner is a two-tube, continuously tuning unit which incorporates a 24 position detent action for simplicity of operation. It is mounted at the front left of the television receiver and consists primarily of a preselector, oscillator, crystal mixer and cascode I. F. amplifier. It covers all 70 UHF television channels and has a 41 mc. I. F. output which is coupled to the TV chassis through a UHF-VHF switch.

It has a bandpass of at least three channel widths which allows the UHF range to be covered in steps of three channels for each position of the selector detent. Stations in a particular area can be quickly and accurately tuned by this method because the FCC normally allocates UHF stations at least six channels apart and only one station will be present on every other detent position. The tuner is inoperative during VHF reception.

ALIGNMENT

The following alignment makes use of the I. F. amplifiers and video detector of the TV receiver for I. F. alignment of the tuner so it is extremely important that their alignment be correct. If I.F. alignment of the receiver is necessary, see the Service Bulletin on that instrument for instructions.

The R. F. and oscillator alignment necessitates the use of a UHF sweep generator and a signal generator which will deliver frequencies of 500 mc. to 910 mc.

If UHF equipment is not available, harmonics of VHF instruments may be used. See Magnavox pamphlet "Servicing The Magnavox 700426 UHF Tuner Using VHF Test Equipment".

PRESELECTOR

As no tubes are included in the preselector, alignment should be completed with the receiver turned off. Refer to Fig. 1 for instrument connections and alignment points.

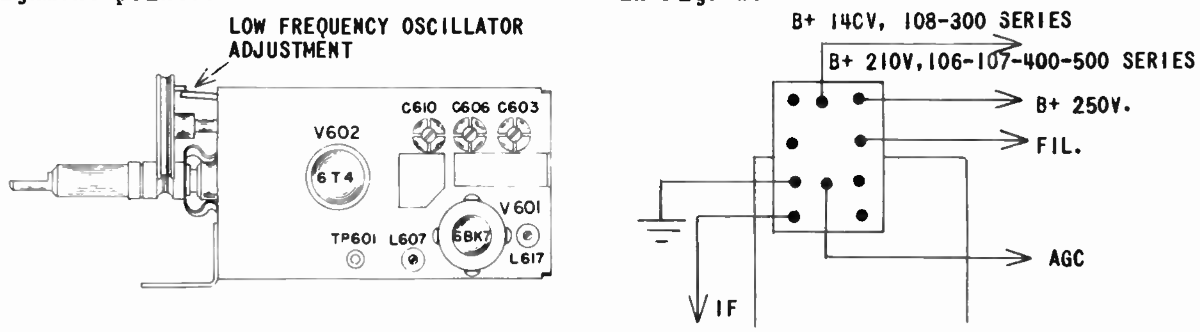


FIG.1
TOP & REAR VIEW OF TUNER

Connect oscilloscope to TP601. Connect 300 ohm output of UHF sweep generator to the UHF antenna terminals on UHF tuner. Loosely couple the signal generator to the preselector to provide markers.

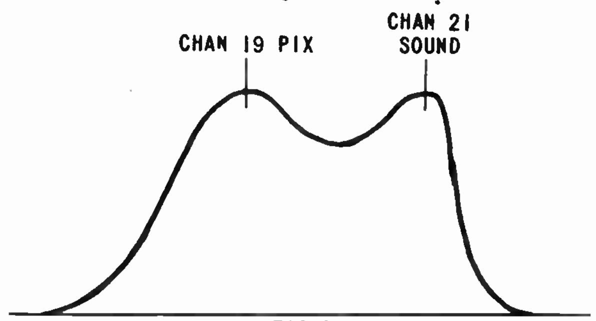


FIG.2
LOW FREQUENCY RF CURVE

Set the channel selector on channel 20, and turn the sweep generator center frequency to 509.5 mc. Insert marker frequencies of 501.25 (channel 19 pix.) and 517.75 (channel 21 sound). Adjust C603 and C610 trimmers for response curve as in Fig. 2.

Turn the channel selector to channel 77. Set the sweep generator to 851.5 mc. and adjust the marker generator to 843.25 mc. (channel 76 pix.) and 859.75 mc. (channel 78 sound). Adjust C603 and C610 trimmer lead inductances L603 and L606 by bending leads for a curve as shown in Fig. 3.

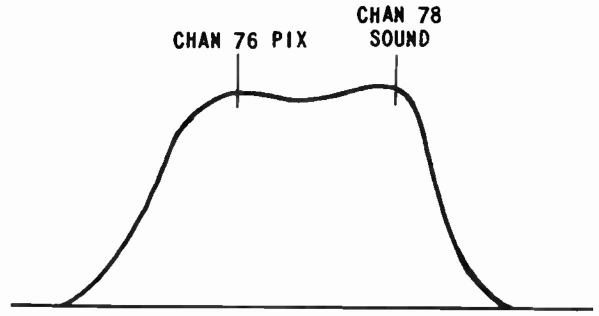


FIG.3
HIGH FREQUENCY RF CURVE

Because of interaction between high end and low end adjustments, recheck the curve on channel 20. A 30% tilt is allowable on both channels 20 and 77.

To check for tracking, turn channel selector to channel 50. Set sweep generator center frequency to 689.5 mc. and insert marker signals of 681.25 mc. (channel 49 pix.) and 697.75 mc. (channel 51 sound). A 50% tilt is allowable between the markers.

OSCILLATOR

Turn on the receiver and turn UHF-VHF switch to UHF. Connect oscilloscope to TP601, 300 ohm sweep cable to UHF antenna terminals and loosely couple signal generator to the preselector as in R. F. alignment.

Set the sweep generator center frequency to 553 mc. Turn channel selector to channel 20. Set marker signal to 565 mc, turn fine tuner fully clockwise and adjust C612 to place oscillator marker at 565 mc. Set marker signal to 541 mc., turn fine tuner fully counter-clockwise and bend the fine tuner stop to place oscillator marker at 541 mc.

Set the sweep generator to 895 mc., turn channel selector to channel 77 and fine tuner fully clockwise. Set marker signal to 907 mc., and adjust L610 inductance lead on oscillator grid by bending lead to center the oscillator marker at 907 mc. Set marker signal to 883 mc., turn fine tuner fully counter-clockwise and carefully adjust L605, inductance lead on the glass fine tuner, to center the marker at 883 mc.

Because of interaction between high end and low end oscillator adjustments, recheck the low frequency setting.

Set the channel selector to channel 50 and sweep generator frequency to 733 mc. Set marker signal to 743 mc. and turn fine tuner fully clockwise. Oscillator marker must be at 743 mc. or above. Set marker signal to 723 mc. then turn fine tuner fully counter-clockwise. Oscillator marker must be at 723 mc. or below.

IF AMPLIFIER

Turn UHF-VHF switch to UHF. Connect I.F. sweep generator to high side of the crystal mixer thru a 1000 ohm resistor and loosely couple a VHF signal generator to provide markers. Connect oscilloscope across the video detector load resistor in the TV chassis and connect bias battery to I. F. and R. F. AGC circuits (see I. F. alignment in Service Bulletin for that instrument).

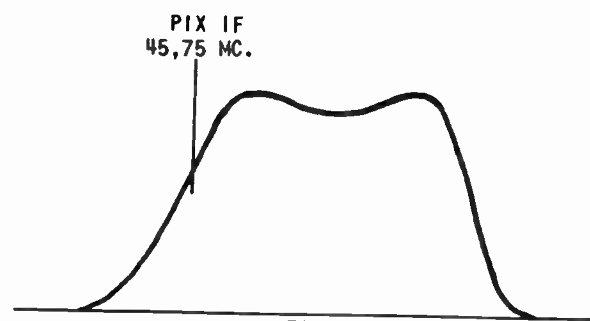
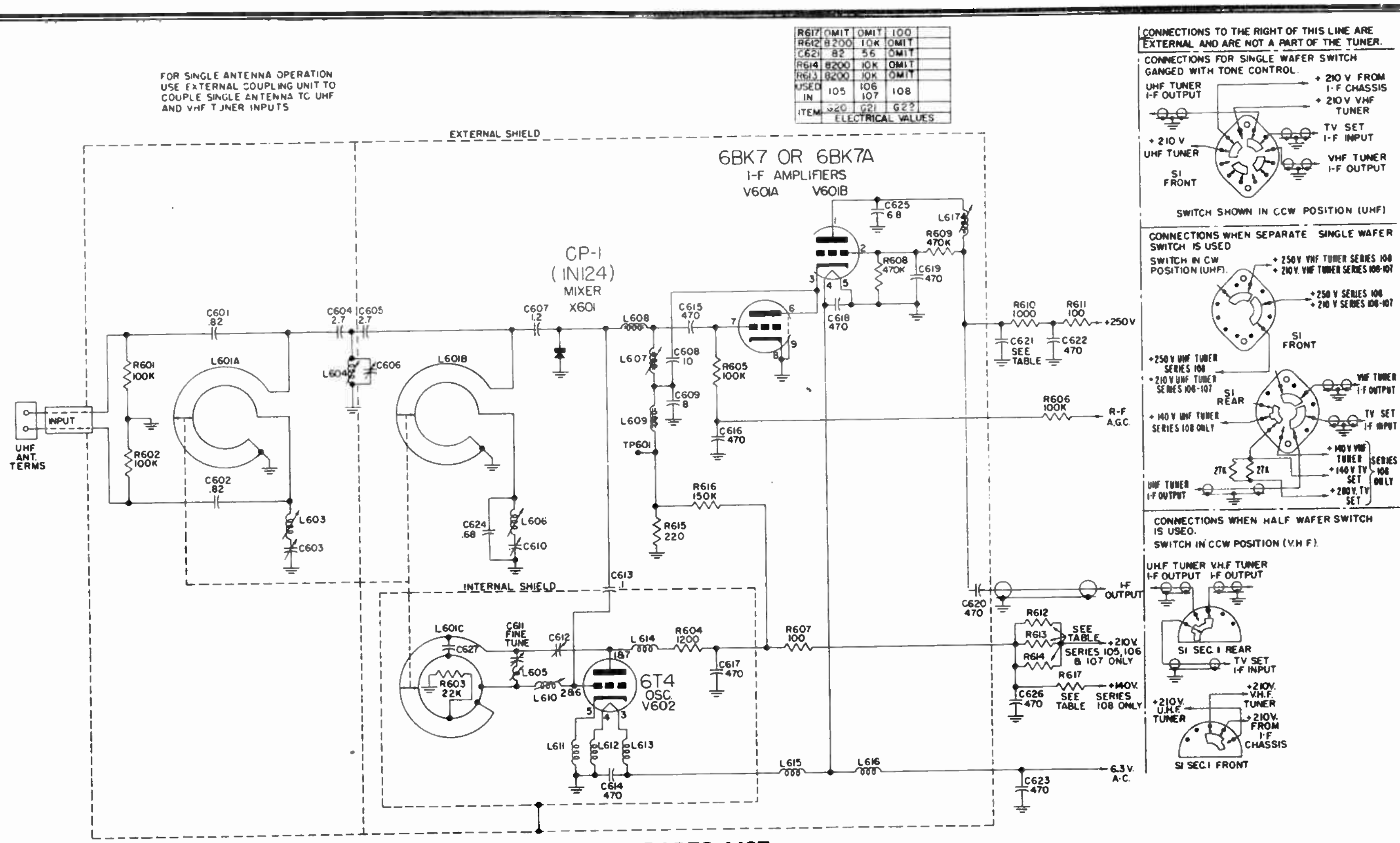


FIG.4
IF CURVE

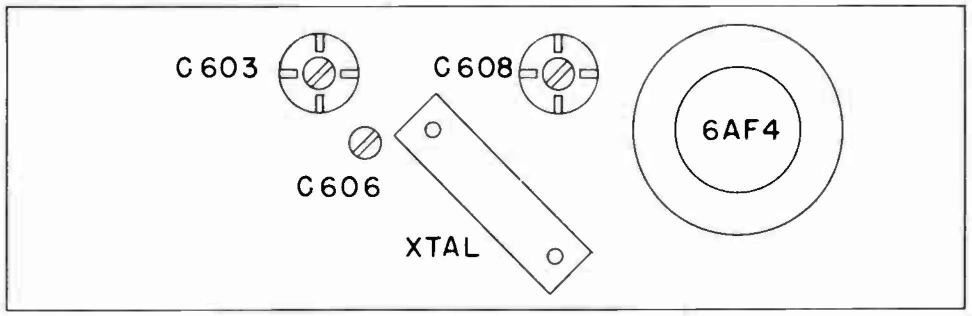
Remove UHF tuner shield cover and adjust L617 (using insulated screwdriver in slot in bottom of iron core) for maximum curve height with 45.75 mc. marker near 50% (see Fig. 4). If necessary adjust L607 (using short aligning tool) for proper tilt (not over 10%) allowing slight reduction in curve height.



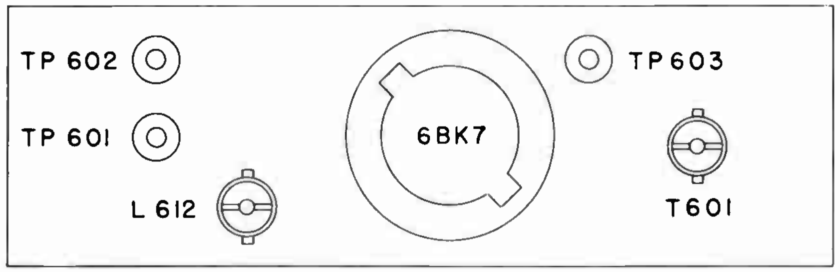
PARTS LIST

SYMBOL	DESCRIPTION	PART NO.
	COILS & TRANSFORMERS	
L604	RF coupling	360415-44
L607	Input IF	360571-1
L608	IF coupling choke	360522-6
L609	Crystal return choke	360522-5
L611	Osc. plate choke	360522-7
L612	Osc. fil. choke	360574-8
L613	Osc. fil. choke	360574-8
L614	Osc. cathode choke	360574-8
L615	Fil. choke	360574-8
L616	Fil. choke	360574-10
L617	Output IF	360572-1
	CAPACITORS	
C601	Molded, .82 mmf.	250221-113
C602	Molded, .82 mmf.	250221-113
C603	Trimmer	250188-8
C604	Molded, 2.7 mmf.	250221-119
C605	Molded, 2.7 mmf.	250221-119
C606	Trimmer	250188-7
C607	Molded, 1.2 mmf.	250221-115
C608	Ceramic, 10 mmf.	250207-3
C609	Ceramic disc, 8 mmf.	250175-11
C610	Trimmer	250188-8
C611	Fine tuning trimmer	260120-1
C612	Trimmer	250220-2
C613	Molded, .1 mmf.	250221-101
C614	Ceramic disc, 470 mmf.	250175-8
C615	Ceramic disc, 470 mmf.	250175-8
C616	Ceramic disc, 470 mmf.	250175-8
C617	Ceramic disc, 470 mmf.	250175-8
C618	Ceramic disc, 470 mmf.	250175-8
C619	Ceramic, 470 mmf.	250207-50
C620	Ceramic disc, 470 mmf.	250175-8
C621	Ceramic, 82 mmf. (105 Series)	250207-80
C621	Ceramic, 56 mmf. (400-500 Series)	250207-81
C622	Ceramic disc, 470 mmf.	250175-8
C623	Ceramic disc, 470 mmf.	250175-8
C624	Molded, .68 mmf.	250221-112
C625	Molded, 6.8 mmf.	250221-125
C626	Ceramic disc, 470 mmf.	250175-8

	RESISTORS	
R601	100,000 ohms, ½ W.	230104-86
R602	100,000 ohms, ½ W.	230104-86
R603	22,000 ohms, ½ W.	230104-78
R604	1200 ohms, 1 W.	230105-63
R605	100,000 ohms, ½ W.	230104-86
R606	100,000 ohms, ½ W.	230104-86
R607	100 ohms, ½ W.	230104-50
R608	470,000 ohms, ½ W.	230104-94
R609	470,000 ohms, ½ W.	230104-94
R610	1000 ohms, ½ W.	230104-62
R611	100 ohms, ½ W.	230104-50
R612	8200 ohms, 1 W. (105 Series)	230105-73
R612	10,000 ohms, 1 W. (400-500 Series)	230105-74
R613	8200 ohms, 1 W. (105 Series)	230105-73
R613	10,000 ohms, 1 W. (400-500 Series)	230105-74
R614	8200 ohms, 1 W. (105 Series)	230105-73
R614	10,000 ohms, 1 W. (400-500 Series)	230105-74
R615	220 ohms, ½ W.	230104-54
R616	150,000 ohms, ½ W.	230104-88
R617	100 ohms, ½ W. (300 Series)	230104-50
	CRYSTAL	
X601	1N124	530036-1



RF Deck Figure 2



IF Deck Figure 3

ALIGNMENT AND SERVICING

Alignment and servicing of the 700359 tuner converter is a simple procedure since its bandpass is essentially predetermined by the fixed characteristics of original component design, physical layout and associated circuitry. Except as stated elsewhere in this bulletin, band-pass is not subject to serious change during alignment; however, replacement of any component within the RF or IF circuits may disturb the band-pass characteristics of the instrument. Accordingly, whenever parts within these circuits are replaced, electrical and physical specifications of the original components must be duplicated by using original parts. A parts list for the 700359 tuner converter is included in this manual. Wires, parts and other accessories must be replaced in their exact former positions.

TUBE NO.	TUBE TYPE	FUNCTION	PLATE		CATHODE		GRID	
			PIN NO.	VOLTS	PIN NO.	VOLTS	PIN NO.	VOLTS
V601	6AF4 OR 6T4	OSCILLATOR	1&7	107	5	0	2&6	-5TO-8
V602	6BK7	IF AMP	6	126	8	1.5	7	0
			1	240	3	126	2	125

Voltage Chart Figure 4

Test Equipment Required

It is recommended that the following test instruments be obtained for UHF alignment, in addition to that used on VHF, because it is evident that this new band of frequencies will become more popular as more station licenses are granted, and that the work can be performed quicker and more efficiently with equipment designed specifically for UHF. It is equally evident that the use of present VHF channels will also expand, so any VHF equipment on hand will become even more useful.

In the event that the following recommended UHF gear is not on hand, and until it can be obtained, the Magnavox Company has prepared a bulletin on the use of VHF test equipment for UHF alignment. Copies of that outline are being distributed along with this maintenance manual.

1. UHF sweep generator, with a range of 470 to 890 mc., with a minimum sweep width of 40 mc. at the low end of the band and 60 mc. at the high end. It should have a continuously calibrated attenuator, providing as low as 100 microvolts output.

2. UHF marker generator for locating frequencies of 378 and 828 mc.

3. VHF marker generator for locating frequencies of 77.25 and 87.75 mc.

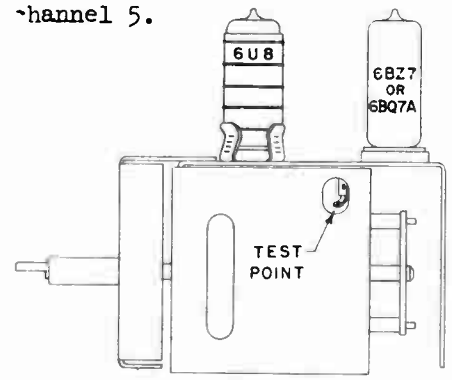
The following alignment instructions represent minimum requirements for acceptable performance of the converter. Its alignment must be performed with the unit installed in an operating television receiver.

IF Alignment on Channel 5

1. Remove the shield cover from the converter.

2. Open test point 602 and ground TP601 and TP603, see fig. 3.

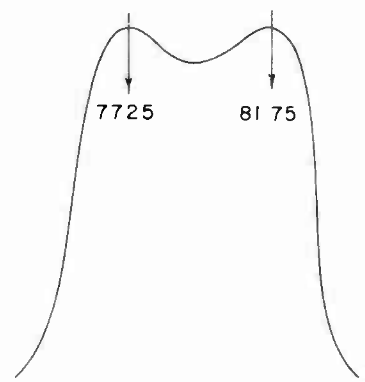
3. Connect the oscilloscope to the test point on the VHF tuner, see fig. 5. and set the tuner on channel 5.



VHF Tuner Figure 5

4. Connect the sweep generator to the converter antenna terminals, tune the converter to approximately 500 mc. (channel 19), and adjust the sweep generator for a response curve on the scope similar to fig. 6.

5. Loosely couple the VHF marker to TP602, and set it to 77.25 mc. and 81.75 mc. If the markers are not positioned as in fig. 6. spread or compress the air coil L613, located below TP601.



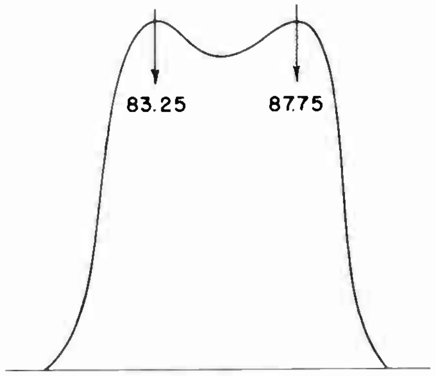
Channel 5 IF Curve - Figure 6

6. Tune the converter and sweep generator to approximately 850 mc. (channel 77) and re-adjust coil L613 if necessary, for a curve similar to that on 500 mc. Adjust L612 for maximum height at 850 mc.

   T601 may be adjusted for the best compromise.

IF Alignment on Channel 6

1. Open test points 601 and 603, and ground TP602.
2. Connect the oscilloscope to test point on the VHF tuner, and set the tuner on channel 6.
3. Tune the converter to approximately 500 mc., couple the sweep generator to the antenna terminals, and adjust it for a response curve similar to fig. 6.
4. Loosely couple the VHF marker to TP601, and set it on 83.25 mc. and 87.75 mc. If the markers are not positioned as in fig. 7. align T601 (for curve width) and L612 (for maximum height). Keep the marker level down so the "birdies" are about 1/8" high.



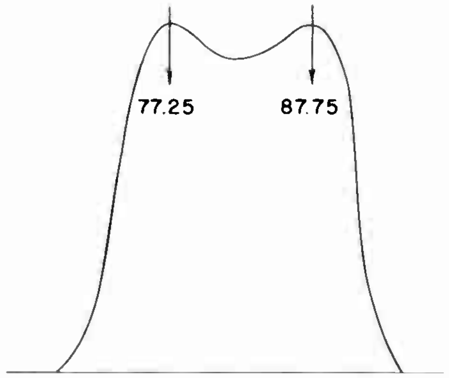
Channel 6 IF Curve - Figure 7

Oscillator Alignment

1. Remove the shield and 6BK7 tube from its socket.
2. Connect the UHF marker generator, through a .5 mmf. capacitor, to the junction of X601, L605, C611 and C612.
3. Connect the oscilloscope to test point 602, through a 10,000 ohm isolating resistor.
4. Tune the converter to its lowest frequency (extreme counter-clockwise) position.
5. Set the marker generator frequency on 378 mc. and adjust the oscillator trimmer C615 for a beat on the scope.
6. Tune the converter to its highest frequency (extreme clockwise) position.
7. Set the marker generator frequency to 828 mc. and adjust the end inductor L610 for a beat on the scope.
8. Recheck both high and low frequency positions so the beats appear without further adjustment.

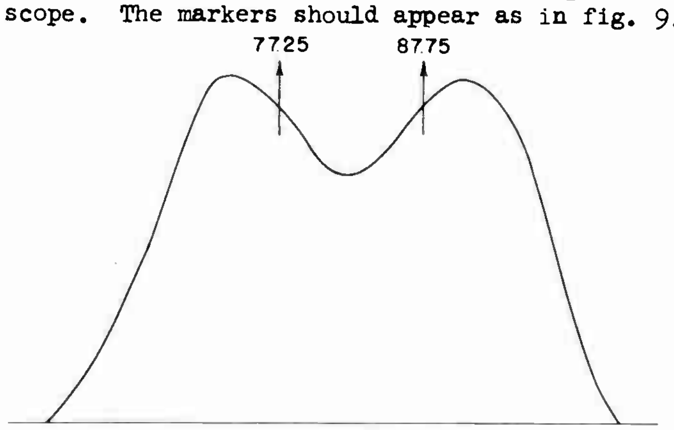
Preselector Alignment

1. Connect the properly terminated UHF sweep generator to the antenna terminals.
2. Tune the converter to approximately 500 mc. (Channel 19) and adjust the sweep generator for a flat topped response curve on the scope.
3. Loosely couple the VHF marker generator to the antenna terminals and set it on 77.25 mc. and 87.75 mc. The markers should appear on the edge of the pass-band as shown in fig. 8.



RF Curve at 500 mc. Figure 8

4. If they do not, adjust RF trimmers C603 and C608 and the coupling capacitor C606 for the proper band pass.
5. Tune the converter to approximately 850 mc. (Channel 77) and adjust the sweep generator for a response curve on the 'scope. The markers should appear as in fig. 9.

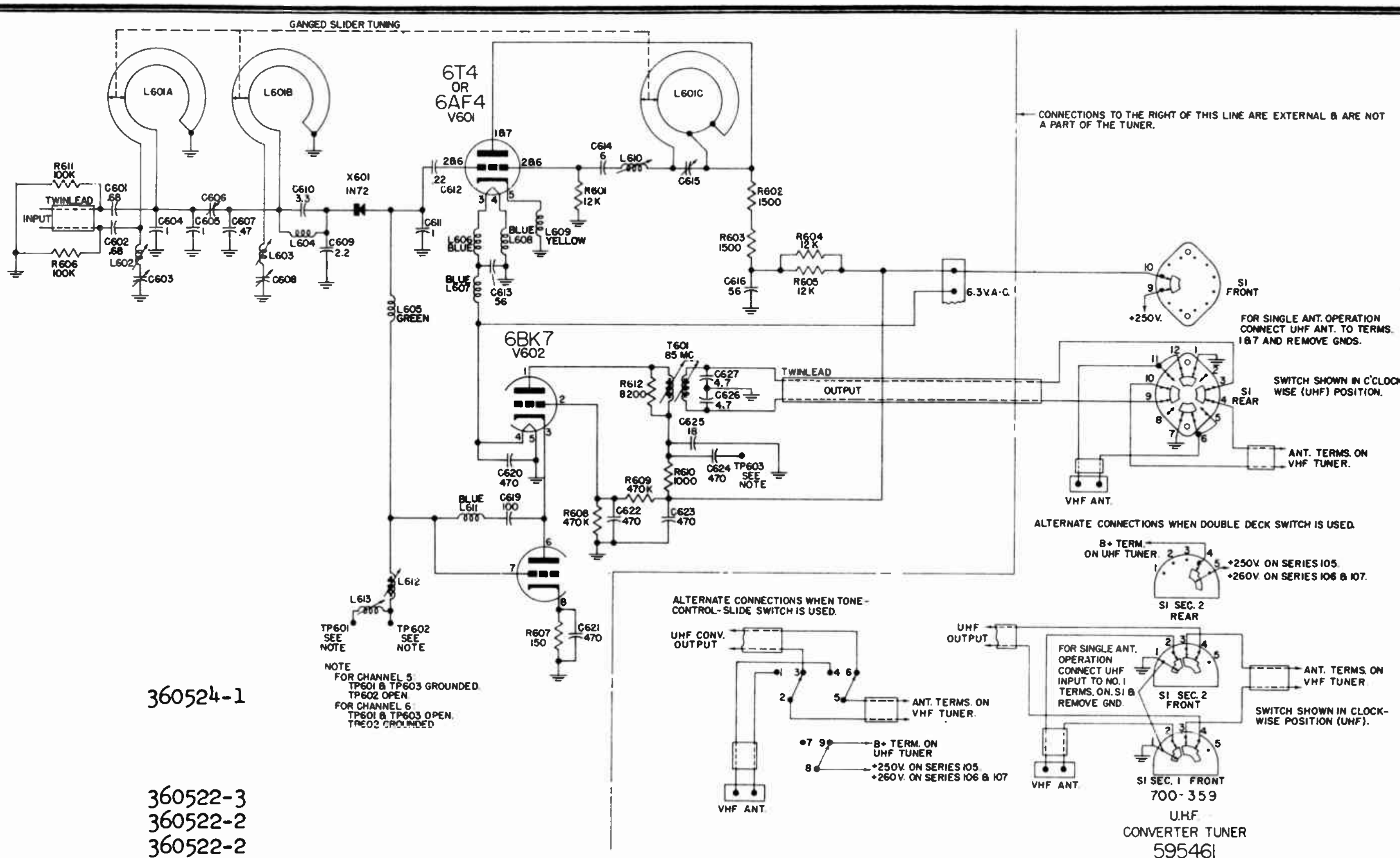


RF Curve at 850 mc. Figure 9

6. If they do not, adjust the RF end inductors L602 and L603 for the proper band pass.

   Recheck both low and high frequency positions for proper location of the markers, and repeat the foregoing adjustments if necessary.

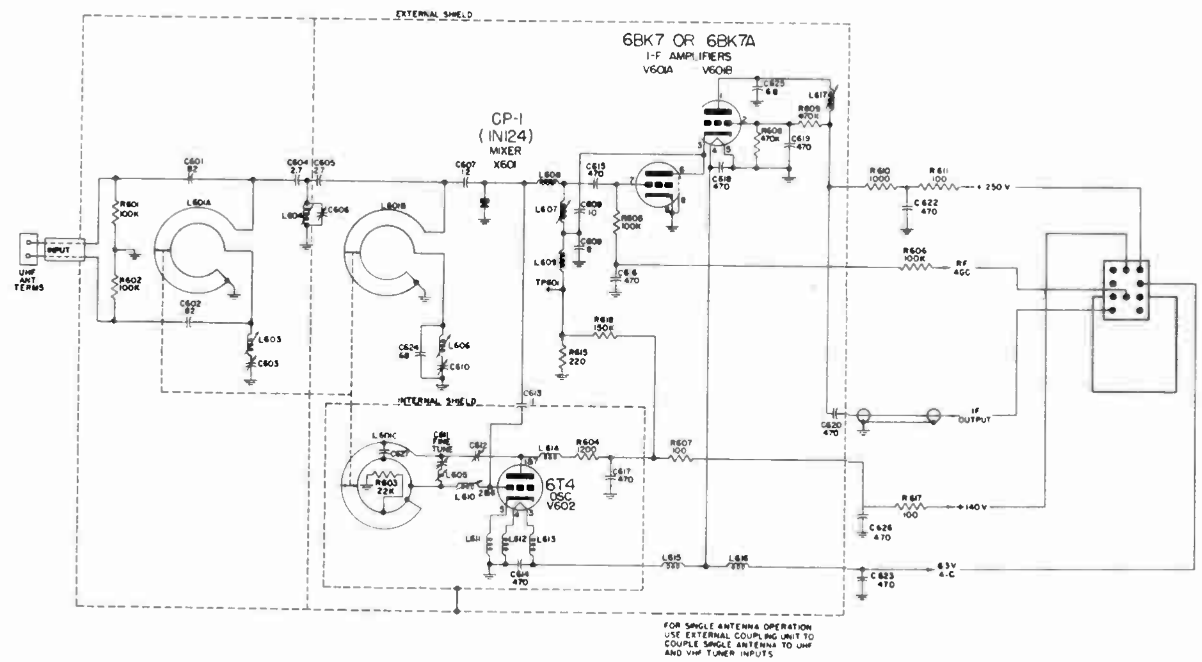
The alignment may be checked at any frequency throughout the UHF band. If the VHF markers appear within the pass-band on the 'scope, tracking is satisfactory.



PARTS LIST FOR 700359 UHF CONVERTER TUNER

T601	Transformer, output I.F.	360524-1
L602	Inductance of lead from C603	
L603	Inductance of lead from C608	
L604	Choke, wound on C610	
L605	Choke, mixer coupling (Green)	360522-3
L606	Choke, osc. & filament (blue)	360522-2
L607	Choke, osc. & filament (blue)	360522-2
L608	Choke, osc. & filament (blue)	360522-2
L609	Choke, osc. cathode (yellow)	360522-4
L610	Inductance of lead from C614	
L611	Choke, osc. & filament (blue)	360522-2
L612	Coil, input IF	360523-1
L613	Coil, input IF	360415-62
C601	Capacitor, molded, .68 mmf. ± 10%	250209-112
C602	Capacitor, molded, .68 mmf. ± 10%	250209-112
C603	Capacitor, steatite	250188-2
C604	Capacitor, molded, 1.0 mmf. ± 10%	250209-114
C605	Capacitor, molded, 1.0 mmf. ± 10%	250209-114
C606	RF coupling trimmer	
	Stator	634756-2
	Rotor	634755-2
	Connector plate	634757-2
C607	Capacitor, molded .47 mmf.	250209-109
C608	Capacitor, steatite	250188-2
C609	Capacitor, molded, 2.2 mmf.	250209-118
C610	Capacitor, choke	350049-1
C611	Capacitor, molded, 1.0 mmf. ± 10%	250209-114
C612	Capacitor, molded, .22 mmf. ± 10%	250209-105
C613	Capacitor, molded, 56 mmf. ±10%	250209-137
C614	Capacitor, ceramic	250196-1
C615	Capacitor, ceramic trimmer	250197-1
C616	Capacitor, molded, 56 mmf. ± 10%	250209-137
C619	Capacitor, ceramic, 100 mmf. ± 20%	250207-46
C620	Capacitor, ceramic disc, 470 mmf.	250175-8
C621	Capacitor, ceramic disc, 470 mmf.	250175-8
C622	Capacitor, ceramic disc, 470 mmf.	250175-8
C623	Capacitor, ceramic disc, 470 mmf.	250175-8
C624	Capacitor, ceramic disc, 470 mmf.	250175-8
C625	Capacitor, ceramic, 18 mmf. ± 10%	250207-6
C626	Capacitor, molded 4.7 mmf. ± 10%	250209-123
C627	Capacitor, molded, 4.7 mmf. ± 10%	250209-123
R601	Resistor, composition, 12,000 ohms, 1/2 W.	230104-75
R602	Resistor, composition, 1500 ohms, 1/2 W.	230104-64
R603	Resistor, composition, 1500 ohms, 1/2 W.	230104-64
R604	Resistor, composition, 12,000 ohms, 1 W.	230105-75
R605	Resistor, composition, 12,000 ohms, 1 W.	230105-75
R606	Resistor, composition, 100,000 ohms, 1/2 W.	230104-86
R607	Resistor, composition, 150 ohms, 1/2 W.	230104-52
R608	Resistor, composition, 470,000 ohms, 1/2 W.	230104-94
R609	Resistor, composition, 470,000 ohms, 1/2 W.	230104-94
R610	Resistor, composition, 1000 ohms, 1/2 W.	230104-62
R611	Resistor, composition, 100,000 ohms, 1/2 W.	230104-86
R612	Resistor, composition, 8200 ohms, 1/2 W.	230104-73
	Crystal (IN72 or IN82)	530033-1
	Screw nylon	105655-7

VIDEO IF ALIGNMENT					
Connect positive lead of tapped 4½V battery to chassis, -1½V tap to junction of R217 and C212, and -3V tap to junction of R222 and C215.					
SWEEP GEN. COUPLING	**SWEEP GEN. FREQUENCY**	**SIG. GEN. COUPLING**	**SIG. GEN. FREQUENCY**	**CONNECT SCOPE**	**ADJUSTMENTS**
1st IF grid	40mc. Adjust gain so trap suckout is visible.	Converter grid.	47.25mc modulated. Adjust gain so pip is just visible.	Across vid. det. load resistor R212	Set contrast to min. Adjust top T202 to center pip in suckout, see Fig. 1. Max. attenuation is at two core positions. Use one with slug farthest out.
"	40mc. Set gen. output for 2V P/P output at scope	"	Unmodulated 42.75 mc. 45.0 mc. 45.75 mc.	"	Check for response curve similar to Fig. 2. Adjust 3rd IF coil (T203) for max. gain. Tune 1st IF coil (T201) so 42.75 mc. marker is 60% up on curve. Tune bottom T202 so 45.75 mc. marker is 60% up on curve. Recheck 47.75 trap adjustment, top T202.
Converter grid	"	Loosely couple	Unmodulated 45.75 mc. 45.0 mc. 42.75 mc.	"	Tune channel selector to high channel. Tune converter plate coil L3 for max. with 45.75 marker 50% up on curve. Tune 1st IF grid coil L201 for max. gain and proper tilt.
VHF ant. terms. Use network in Fig. 3 if cable is not balanced	Channels 2 thru 13 R.F.	"	Unmodulated 42.75 mc. 45.0 mc. 45.75 mc.	"	Check all channels for bandwidth, slope and position of carrier.
High side of UHF crystal, junction of C607 and L608 Use 1K ohm isolation resistor.	40 mc. same gain	"	Unmodulated 45.75 mc.	"	Set UHF-VHF switch to UHF. Remove UHF tuner shield and adjust IF ampl. plate coil L617 for max. with marker 50% up on curve. Do not change T201 or L201.



NO. 700426 UHF TUNER

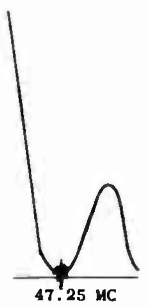


Fig. 1

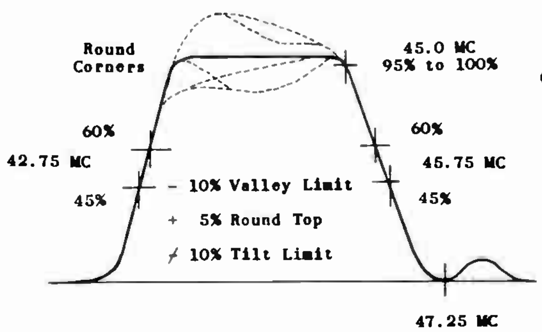
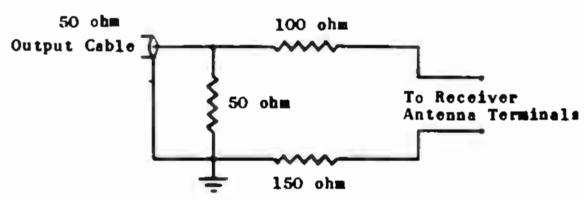
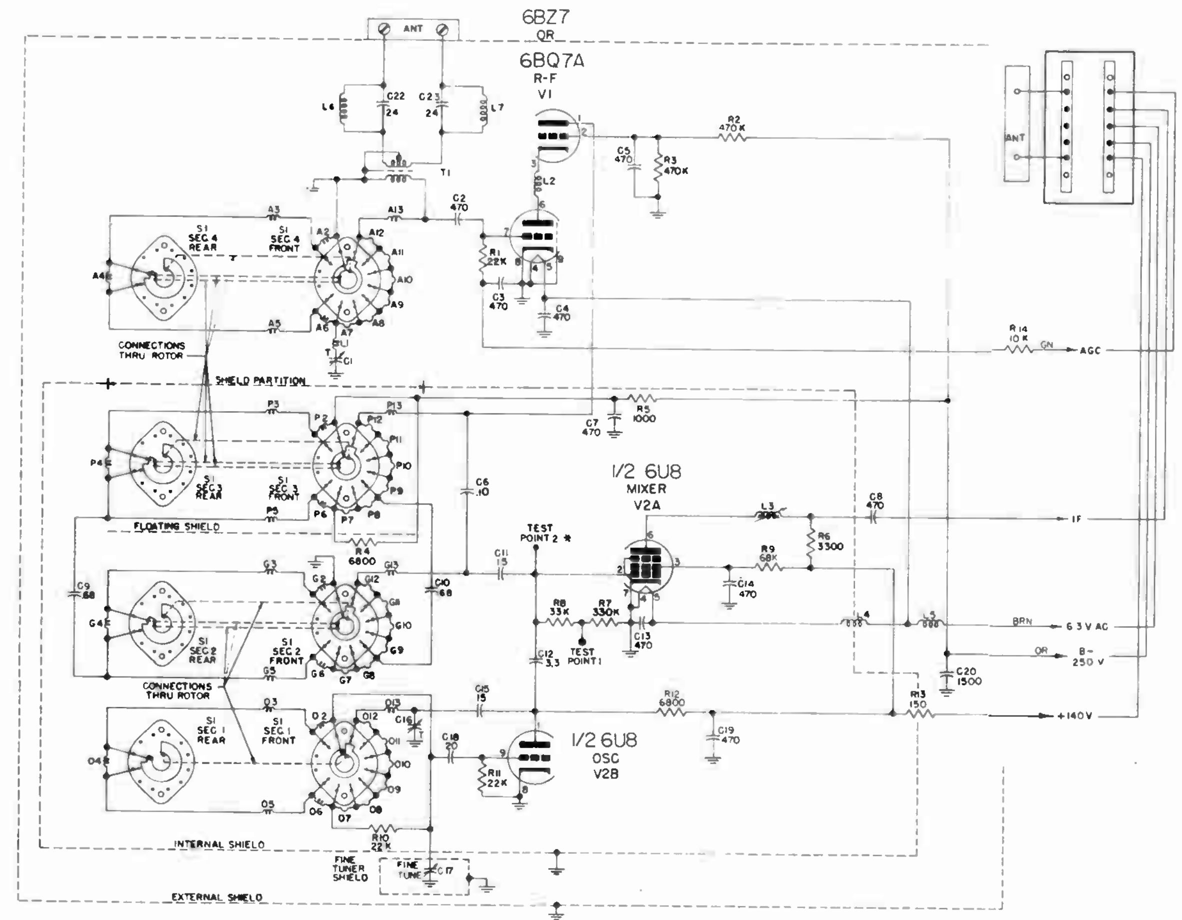


Fig. 2



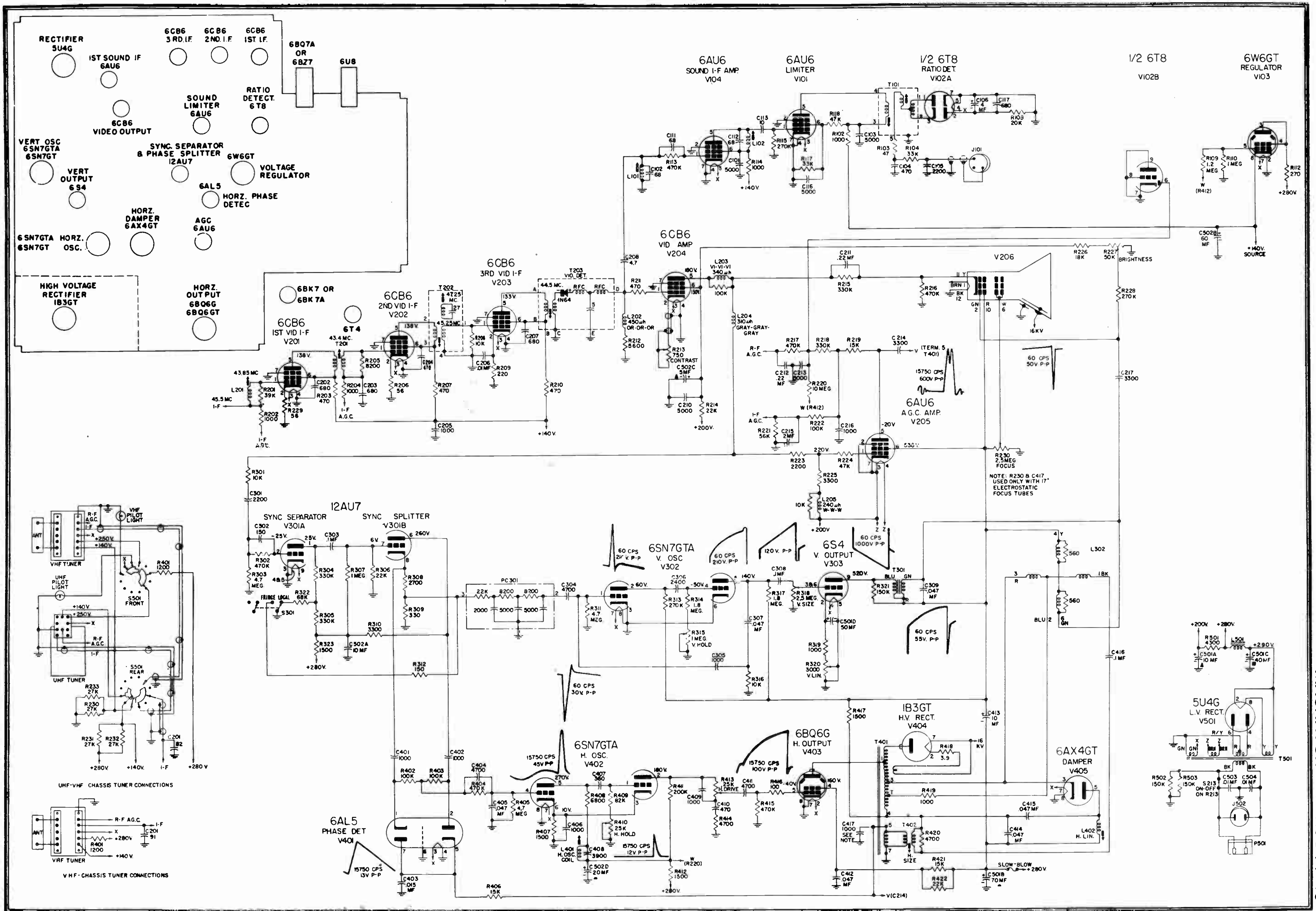
IMPEDANCE MATCHING NETWORK

Fig. 3



NO. 700379 VHF TUNER

SOUND IF ALIGNMENT			
SIG. GEN. COUPLING	**SIG. GEN. FREQUENCY**	**VTVM CONNECTION**	**ADJUSTMENTS**
Couple thru .005 mfd. capacitor to term "D" of video det. transformer	Unmodulated 4.5 mc.	Across R105, ratio det. load resistor. Use 100K resistor in series with VTVM probe.	Align sound take-off coil L101, sound IF coil L102 and ratio det. primary (bottom) for max. Keep signal low enough to obtain 6½ or 7 volts across R105.
"	"	Connect two matched 100K resistors in series across R105. Connect ground lead of VTVM to their junction and probe to junction of R103, R104 and C104. Short out limiter grid; zero meter; remove short.	Align ratio det. secondary (top) for zero. Note: The true zero point is where the meter goes positive and negative on either side of zero when the secondary is tuned through zero. If more than two turns oft of alignment, repeat peaking of primary and zeroing the secondary.


RECTIFIER 5U4G
1ST SOUND IF 6AU6
6CB6 3RD.I.F.
6CB6 2ND.I.F.
6CB6 1ST I.F.
6BQ7A OR 6BZ7
6U8
SOUND LIMITER 6AU6
RATIO DETECT. 6T8
6CB6 VIDEO OUTPUT
VERT OSC 6SN7GTA 6SN7GT
SYNC. SEPARATOR & PHASE SPLITTER 12AU7
6W6GT VOLTAGE REGULATOR
VERT OUTPUT 6S4
6AL5 HORZ. PHASE DETEC
HORZ. DAMPER 6AX4GT
AGC 6AU6
6SN7GTA 6SN7GT HORZ. OSC.
HIGH VOLTAGE RECTIFIER 1B3GT
HORZ. OUTPUT 6BQ6G 6BQ6GT
6BK7 OR 6BK7A
6T4
6AU6 SOUND I-F AMP. V104
6AU6 LIMITER V101
1/2 6T8 RATIO DET V102A
1/2 6T8 V102B
6W6GT REGULATOR V103
6CB6 VID AMP V204
V206
6CB6 3RD VID I-F V203
6CB6 2ND VID I-F V202
6CB6 1ST VID I-F V201
6AU6 A.G.C. AMP. V205
12AU7 SYNC SEPARATOR V301A SYNC SPLITTER V301B
6SN7GTA V. OSC V302
6S4 V. OUTPUT V303
1B3GT H.V. RECT. V404
6BQ6G H. OUTPUT V403
6SN7GTA H. OSC. V402
6AX4GT DAMPER V405
6AL5 PHASE DET V401
5U4G L.V. RECT. V501
VHF TUNER
UHF TUNER
UHF-VHF CHASSIS TUNER CONNECTIONS
VHF TUNER
VHF-CHASSIS TUNER CONNECTIONS
NOTE: R230 & C417 USED ONLY WITH 17" ELECTROSTATIC FOCUS TUBES
+140V. SOURCE
BRIGHTNESS
CONTRAST
FOCUS
V. HOLD
V. SIZE
V. LIN.
H. HOLD
H. DRIVE
H. SIZE
H. LIN.
SLOW-BLOW
FRINGE LOCAL S301
S501 FRONT
S501 REAR

UHF TUNER PARTS LIST

SYMBOL	DESCRIPTION	PART NO.
	COILS & TRANSFORMERS	
L604	RF coupling	360415-44
L607	Input IF	360571-1
L608	IF coupling choke	360522-6
L609	Crystal retnrn choke	360522-5
L611	Osc. plate choke	360522-7
L612	Osc. fil. choke	360574-8
L613	Osc. fil. choke	360574-8
L614	Osc. cathode choke	360574-8
L615	Fil. choke	360574-8
L616	Fil. choke	360574-10
L617	Output IF	360572-1
	CAPACITORS	
C601	Molded, .82 mmf.	250221-113
C602	Molded, .82 mmf.	250221-113
C603	Trimmer	250188-8
C604	Molded, 2.7 mmf.	250221-119
C605	Molded, 2.7 mmf.	250221-119
C606	Trimmer	250188-7
C607	Molded, 1.2 mmf.	250221-115
C608	Ceramic, 10 mmf.	250207-3
C609	Ceramic disc, 8 mmf.	250175-11
C610	Trimmer	250188-8
C611	Fine tuning trimmer	260120-1
C612	Trimmer	250220-2
C613	Molded, .1 mmf.	250221-101
C614	Ceramic disc, 470 mmf.	250175-8
C615	Ceramic disc, 470 mmf.	250175-8
C616	Ceramic disc, 470 mmf.	250175-8
C617	Ceramic disc, 470 mmf.	250175-8
C618	Ceramic disc, 470 mmf.	250175-8
C619	Ceramic, 470 mmf.	250207-50
C620	Ceramic disc, 470 mmf.	250175-8
C621	Ceramic, 82 mmf. (105 Series)	250207-80
C621	Ceramic, 56 mmf. (400-500 Series)	250207-81
C622	Ceramic disc, 470 mmf.	250175-8
C623	Ceramic disc, 470 mmf.	250175-8
C624	Molded, .68 mmf.	250221-112
C625	Molded, 6.8 mmf.	250221-125
C626	Ceramic disc, 470 mmf.	250175-8
	RESISTORS	
R601	100,000 ohms, ½ W.	230104-86
R602	100,000 ohms, ½ W.	230104-86
R603	22,000 ohms, ½ W.	230104-78
R604	1200 ohms, 1 W.	230105-63
R605	100,000 ohms, ½ W.	230104-86
R606	100,000 ohms, ½ W.	230104-86
R607	100 ohms, ½ W.	230104-50
R608	470,000 ohms, ½ W.	230104-94
R609	470,000 ohms, ½ W.	230104-94
R610	1000 ohms, ½ W.	230104-62
R611	100 ohms, ½ W.	230104-50
R612	8200 ohms, 1 W. (105 Series)	230105-73
R612	10,000 ohms, 1 W. (400-500 Series)	230105-74
R613	8200 ohms. 1 W. (105 Series)	230105-73
R613	10,000 ohms, 1 W. (400-500 Series)	230105-74
R614	8200 ohms, 1 W. (105 Series)	230105-73
R614	10,000 ohms, 1 W. (400-500 Series)	230105-74
R615	220 ohms, ½ W.	230104-54
R616	150,000 ohms, ½ W.	230104-88
R617	100 ohms, ½ W. (300 Series)	230104-50
	CRYSTAL	
X601	1N124	530036-1

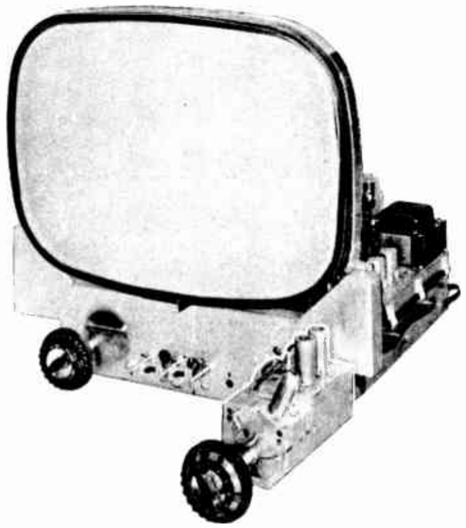
VHF TUNER PARTS LIST

SYMBOL	DESCRIPTION	PART NO.
	COILS & TRANSFORMERS	
T 1	Transformer, Antenna	360490-2
L 1	Coil, RF Choke, 3.3 uh.	360372-6

SYMBOL	DESCRIPTION	PART NO.
L 2	Coil	360415-66
L 3	Coil, Converter	360540-1
L 4	Coil, RF Choke, 47 uh.	360372-1
L 5	Coil, RF Choke, 47 uh.	360372-1
L 6	Coil, Antenna Trap	360415-64
L 7	Coil, Antenna Trap	360415-64
	CAPACITORS	
C 1	Trimmer	250188-6
C 2	Ceramic, 470 mmf, 500 V.	250207-50
C 3	Ceramic, 470 mmf, 500 V.	250207-50
C 4	Ceramic, 470 mmf, 500 V.	250207-50
C 5	Ceramic, 470 mmf, 500 V.	250207-50
C 6	Ceramic, .10 mmf, 500 V.	250216-2
C 7	Ceramic, 470 mmf, 500 V.	250207-50
C 8	Ceramic, 470 mmf, 500 V.	250207-50
C 9	Molded, .68 mmf, 500 V.	250209-112
C 10	Molded, .68 mmf, 500 V.	250209-112
C 11	Ceramic, 15 mmf, 500 V.	250207-5
C 12	Molded, 3.3 mmf, 500 V.	250209-121
C 13	Ceramic, 470 mmf, 500 V.	250207-50
C 14	Ceramic, 470 mmf, 500 V.	250207-50
C 15	Ceramic, 15 mmf, 500 V.	250088-112
C 16	Osc. Adjustment Trimmer	250188-1
C 17	Fine Tuner	634360-1
C 18	Ceramic, 20 mmf, 500 V.	250088-113
C 19	Ceramic, 470 mmf, 500 V.	250207-50
C 20	Ceramic, .0015 mfd, 500 V.	250175-3
C 22	Ceramic, 24 mmf, 500 V.	250207-83
C 23	Ceramic, 24 mmf, 500 V.	250207-83
	RESISTORS	
R 1	22,000 ohms, ½ W.	230104-78
R 2	470,000 ohms, ½ W.	230104-94
R 3	470,000 ohms, ½ W.	230104-94
R 4	6800 ohms, ½ W.	230104-72
R 5	1000 ohms, ½ W.	230104-62
R 6	3300 ohms, ½ W.	230104-68
R 7	330,000 ohms, ½ W.	230104-92
R 8	33,000 ohms, ½ W.	230104-80
R 9	68,000 ohms, ½ W.	230104-84
R 10	22,000 ohms, ½ W.	230104-78
R 11	22,000 ohms, ½ W.	230104-78
R 12	6800 ohms, 1 W.	230105-72
R 13	150 ohms, ½ W.	230104-52
R 14	10,000 ohms, ½ W.	230104-74
R 17	27,000 ohms, 1 W.	230105-79
R 18	27,000 ohms, 1 W.	230105-79

CHASSIS PARTS LIST

SYMBOL	DESCRIPTION	PART NO.
	TRANSFORMERS & COILS	
T101	Ratio Detector	360588-1
T201	1st I.F. Transformer	360581-1
T202	2nd I.F. & Trap	360582-1
T203	3rd I.F. & Det.	360583-1
T401	H.V. Transformer	360580-1
T402	Horizontal Width Coil	360585-1
T501	Power Transformer	300072-1
L101	Sound Takeoff Coil	360584-1
L102	Sound IF	360584-1
L201	Input, 1st I.F.	360540-1
L202	Peaking, Orange-Orange-Orange	360443-28
L203	Peaking, Violet-Violet-Violet	360443-31
L204	Peaking, Gray-Gray-Gray	360443-30
L205	Peaking, White-White-White	360443-29
L301	Vertical Output Transformer	320067-1
L302	Deflection Yoke	360587-1
L401	Horizontal Oscillator Coil	360579-1
L402	Horizontal Linearity Control	360586-1
L501	Filter Reactor	320058-1
	CAPACITORS	
C101	Ceramic Disc, .005 mfd, 500V.	250175-1
C102	Ceramic Disc, 68 mmf, 500V.	250218-7
C103	Ceramic Disc, .005 mfd, 500V.	250175-1
C104	Ceramic Disc, 470 mmf, 500V.	250088-117
C105	Paper, .0022 mfd, ±10%, 400V.	250212-3
C106	Electrolytic, 4 mfd, 50 V.	270027-10
C111	Ceramic Disc, 68 mmf, 500V.	250218-7
C112	Ceramic Disc, 68 mmf, 500V.	250218-7
C113	Ceramic, 10 mmf, 500V.	250207-3
C116	Ceramic Disc, .005 mfd, 500V.	250175-1
C117	Ceramic Disc, 680 mmf, 500V.	250218-4
C201	Silver Mica, 82 mmf, 500V. (CMU Version)	250159-2045
C201	Silver Mica, 91 mmf, 500V. (CT Version)	250159-46
C202	Ceramic Disc, 680 mmf, 500V.	250218-4
C203	Ceramic Disc, 680 mmf, 500V.	250218-4
C204	Ceramic Disc, 470 mmf, 500V.	250218-6
C205	Ceramic Disc, .001 mfd, 500V.	250175-14
C206	Ceramic Disc, .01 mfd, 500V.	250175-2
C207	Ceramic Disc, 680 mmf, 500V.	250218-4
C208	Molded, 4.7 mmf, 500V.	250221-123
C210	Ceramic Disc, .005 mfd, 500V.	250175-1
C211	Paper, .22 mfd, 200V.	250202-15
C212	Paper, .22 mfd, 200V.	250202-15
C213	Ceramic Disc, .005 mfd, 500V.	250175-1
C214	Paper, .0033 mfd, 600V.	250201-4
C215	Electrolytic, 2 mfd, 50V.	270027-22
C216	Ceramic Disc, .001 mfd, 500V.	250175-14
C217	Paper, .0033 mfd, 600V.	250201-4
C301	Paper, .0022 mfd, 400V.	250211-3
C302	Mica, 150 mmf, 500V.	250159-99
C303	Paper, .1 mfd, 400V.	250211-13
C304	Paper, .0047 mfd, 400V.	250211-5
C305	Paper, .001 mfd, 400V.	250212-2
C306	Silver Mica, 2400 mmf, 500V.	250160-2047
C307	Paper, .047 mfd, 400V.	250212-7
C308	Paper, .1 mfd, 400V.	250211-13
C309	Paper, .047 mfd, 400V.	250211-11
C401	Paper, .001 mfd, 400V.	250212-2
C402	Paper, .001 mfd, 400V.	250212-2
C403	Paper, .015 mfd, 200V.	250212-1
C404	Paper, .0047 mfd, 400V.	250212-4
C405	Paper, .047 mfd, 200V.	250212-5
C406	Mica, 1000 mmf, 500V.	250159-133
C407	Silver Mica, 360 mmf, ±5%, 500V	250159-5060
C408	Silver Mica, 3900 mmf, 500V.	250161-5041
C409	Paper, .001 mfd, 400V.	250211-1
C410	Silver Mica, 470 mmf, ±5%, 500V	250159-2063
C411	Paper, .0047 mfd, 400V.	250211-5
C412	Paper, .047 mfd, 400V.	250211-11
C413	Electrolytic, 10/350 Semi Polarized	270027-23
C414	Paper, .047 mfd, 400V.	250211-11
C415	Paper, .047 mfd, 400V.	250211-11
C416	Paper, .1 mfd, 600V.	250201-13
C501	Electrolytic, 70-40-10/350V, 50/50V.	270021-52
C502	Electrolytic, 20-10-5/350V, 60/200V.	270021-51
C503	Ceramic Disc, .01 mfd.	250219-2
C504	Ceramic Disc, .01 mfd.	250219-2
	CARBON RESISTORS	
R102	1000 ohms, ½ W.	230104-62
R103	47 ohms, ½ W.	230104-46
R104	33,000 ohms, ½ W.	230104-80
R105	20,000 ohms, ± 5%, ½ W.	230094-190
R109	1.2 megohm, ± 5%, ½ W.	230094-233
R110	1 megohm, ± 5%, ½ W.	230094-231
R112	270 ohms, 2 W.	230106-55
R113	470,000 ohms, ½ W.	230104-94
R114	1000 ohms, ½ W.	230104-62
R115	270,000 ohms, ½ W.	230104-91
R117	33,000 ohms, ½ W.	230104-80
R118	47,000 ohms, ½ W.	230104-82
R201	39,000 ohms, ± 5%, ½ W.	230094-197
R202	1000 ohms, ½ W.	230104-62
R203	470 ohms, ½ W.	230104-58
R204	1000 ohms, ½ W.	230104-62
R205	8200 ohms, ± 5%, ½ W.	230094-181
R206	56 ohms, ½ W.	230104-47
R207	470 ohms, ½ W.	230104-58
R208	10,000 ohms, ½ W.	230094-183
R209	220 ohms, ½ W.	230104-54
R210	470 ohms, ½ W.	230104-58
R211	470 ohms, ½ W.	230104-58
R212	5600 ohms, ± 5%, ½ W.	230094-177
R214	22,000 ohms, ½ W.	230104-78
R215	330,000 ohms, ½ W.	230104-92
R216	470,000 ohms, ½ W.	230104-94
R217	470,000 ohms, ½ W.	230104-94
R218	330,000 ohms, ± 5%, ½ W.	230094-219
R219	15,000 ohms, 2 W.	230106-76
R220	10 megohm, ± 5%, ½ W.	230094-255
R221	56,000 ohms, ± 5%, ½ W.	230094-201
R222	100,000 ohms, ± 5%, ½ W.	230094-207
R223	2200 ohms, 1 W.	230105-66
R224	47,000 ohms, ½ W.	230104-82
R225	3300 ohms, ± 5%, 1 W.	230095-171
R226	18,000 ohms, ½ W.	230104-77
R228	270,000 ohms, ½ W.	230104-91
R229	56 ohms, ½ W.	230104-47
R230	27,000 ohms, 1W. (CMU Version)	230105-79
R231	27,000 ohms, 1W. (CMU Version)	230105-79
R232	27,000 ohms, 1W. (CMU Version)	230105-79
R233	27,000 ohms, 1W. (CMU Version)	230105-79
R301	10,000 ohms, ½ W.	230104-74
R302	470,000 ohms, ½ W.	230104-94
R303	4.7 megohm, ½ W.	230104-106
R304	330,000 ohms, ½ W.	230104-92
R305	330,000 ohms, ½ W.	230104-92
R306	22,000 ohms, ½ W.	230104-78
R307	1 megohm, ½ W.	230104-98
R308	2700 ohms ±5%, ½ W.	230094-169
R309	330 ohms, ½ W.	230104-56
R310	3300 ohms, ±5%, ½ W.	230094-171
R311	1 megohm, ½ W.	230104-98
R312	150 ohms, ½ W.	230104-52
R313	270,000 ohms, 1 W.	230105-91
R314	1.8 megohm, ±5%, ½ W.	230094-237
R316	10,000 ohms, ½ W.	230104-74
R317	1.8 megohm, ½ W.	230104-101
R319	1000 ohms, ½ W.	230104-62
R321	150,000 ohms, 1 W.	230105-88
R322	68,000 ohms, ½ W.	230104-84
R323	1500 ohms, ½ W.	230104-64
R401	1200 ohms, 1 W.	230105-63
R402	100,000 ohms, ±5%, ½ W.	230094-207
R403	100,000 ohms, ±5%, ½ W.	230094-207
R404	470,000 ohms, ½ W.	230104-94
R405	4.7 megohm, ½ W.	230104-106
R406	15,000 ohms, 2 W.	230106-76
R407	1500 ohms, ±5%, ½ W.	230094-163
R408	6800 ohms, ±5%, ½ W.	230094-179
R409	82,000 ohms, ½ W.	230104-85
R411	200,000 ohms, ±5%, ½ W.	230094-214
R412	1500 ohms, ½ W.	230104-64
R414	4700 ohms, ½ W.	230104-70
R415	470,000 ohms, ½ W.	230104-94
R416	100 ohms, ½ W.	230104-50
R417	1500 ohms, 1 W.	230105-64
R418	3.9 ohms, 1 W.	230107-3
R419	1000 ohms, 2 W.	230106-62
R420	4700 ohms, 2 W.	230106-70
R421	15,000 ohms, 2 W.	230106-76
R422	22,000 ohms, 1 W.	230105-78
R501	Wire Wound, 4300 ohms, 5 W.	240071-1
R502	150,000 ohms, 2 W.	230096-26
R503	150,000 ohms, 2 W.	230096-26
	CONTROLS	
R213	Contrast, 750 ohms	220126-36
R227	Brightness, 50,000 ohms	220126-37
R315	Vertical Hold, 1 megohm	220126-39
R318	Height, 2.5 megohm	220126-40
R320	Vertical Linearity, 3,000 ohms	220120-3
R410	Horizontal Hold, 25,000 ohms	220126-38
R413	Horizontal Drive, 25,000 ohms	220126-41
	MISCELLANEOUS	
PC301	Printed Circuit	250186-1
P501	AC Receptacle	180547-1
J502	AC Socket	180476-1
S301	Switch, Fringe-Local	160229-1
S501	Switch, UHF-VHF	160238-1
F401	Fuse, 150 MA, Slow-Blow	180157-24
	RF Tuner (CT & CU models)	700379-32
	RF Tuner (CMU models)	700379-42
	UHF Tuner (CMU models)	700426-22
	Focus Unit & Centering Device	360569-1
	Ion Trap	360492-2



General Information

POWER SUPPLY—These receivers are designed to operate from a power source of 117 volts at 60 cycles A.C. It will, however, operate satisfactorily from a line whose voltage is no lower than 105 volts, or no greater than 125 volts at 60 cycles A.C. Always measure the voltage of the line with a dependable a-c voltmeter if it is suspected that the line voltage is beyond the above acceptable limits.

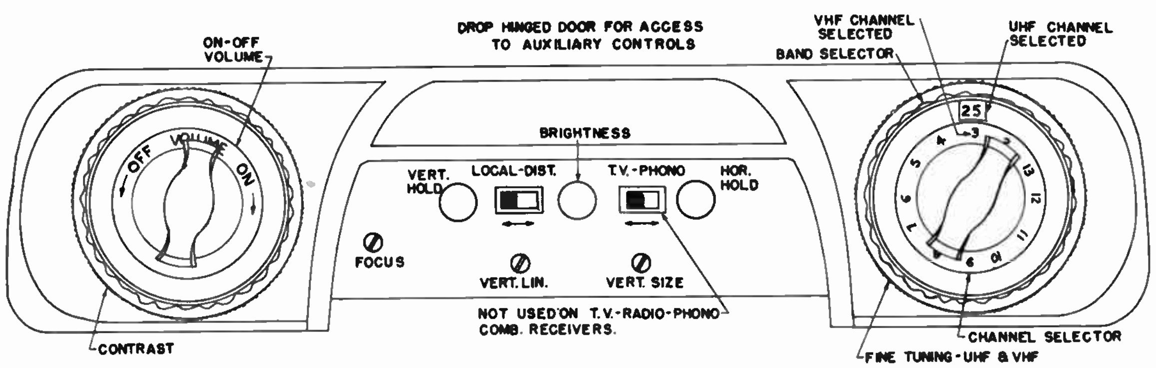


FIG. 1. FRONT PANEL ADJUSTMENTS

SERVICE ADJUSTMENTS

Below is given a description of the steps required in adjustment of the Beam Bender and Deflection Yoke and the adjustment of the Focus, Vertical Size and Linearity, and Horizontal Size, Linearity, Drive and A.F.C. controls. However, it should be remembered that these adjusments are to be made only when picture quality is such that service adjustment is warranted. Use this description as a check-list and if a particular phase of quality is good, leave it alone and go on to the next operation. Refer to figure 1 for location of front panel controls, and to figure on the schematic diagram for location of rear panel controls.

IMPORTANT—The adjustment of the Beam Bender (Ion Trap magnet) must be performed immediately after the receiver warms up. If any length of time is permitted to elapse while the receiver is on, and while the Beam Bender is misadjusted, serious damage to the internal structure of the cathode-ray gun may result.

A. PREPARATION FOR SERVICE ADJUSTMENTS

1. Remove the wood screws on the back cover and the one hex-head P.K. screw adjacent the line cord bracket, disengage the interlock, and remove the back and the line cord.
2. Drop hinged door on front panel for access to the auxiliary controls as illustrated in Fig. 1. The lower set of these controls is adjusted by means of a narrow shanked screwdriver.
3. Connect a substitute interlock line cord between receiver and suitable power outlet and turn on the receiver allowing about 30 seconds of warm-up period before proceeding. Keep the BRIGHTNESS control turned fully counter-clockwise.

B. BEAM BENDER (ION TRAP) ADJUSTMENT

1. Position the beam bender on the glass neck approximately ½" from the picture tube base.
2. Advance the BRIGHTNESS control almost fully clockwise.
3. Starting from this position, adjust the Beam Bender by moving it forward or backward, and at the same time rotating it slightly around the neck of the tube until the brightest raster appears on the screen. If two maximum brightness positions are found, the one nearest the tube base is the correct setting. This adjustment should be done quickly to avoid damaging the gun structure.
4. Adjust the BRIGHTNESS control to maximum, fully clockwise.
5. Re-adjust the Beam Bender carefully for maximum raster brilliance.
6. The Beam Bender must be adjusted at all times for maximum brightness. A misadjusted Beam Bender can damage the picture tube in a matter of seconds and it is of utmost importance to make this the first adjustment when the set is turned on and the last adjustment before the cabinet back is reinstalled.

C. DEFLECTION YOKE ADJUSTMENT

1. Loosen the wing thumb screw located at the top of the deflection yoke frame.
2. Check to see that the deflection yoke mounting bracket rubber cushions press firmly against the flare of the tube.
3. Press the yoke firmly against the flare of the tube.
4. Rotate the yoke until the lines of the raster are horizontal and squared with the picture mask, and tighten the wing screw.

D. FOCUSING ADJUSTMENTS

1. Adjust BRIGHTNESS and CONTRAST controls so that the raster brilliance corresponds to that of an average picture.
2. If a corner of the raster is shadowed, it indicates that the electron beam is striking the neck of the tube. Loosen the Focus Coil Wing Screws and rotate the coil about its horizontal and vertical axis until the entire raster is visible, approximately centered, and with no shadowed corners. The Focus Coil should be kept close to, but not necessarily touching, the rear of the deflection coil for optimum range of the focus control. A slight readjustment of the Beam Bender may now be required.
3. Adjust the focus control (see Fig. 1) so that the lines of the raster are sharp and distinct over the greatest screen area.

E. SYNC STABILITY ADJUSTMENT

1. Tune in a weak station preferably at a time when the noise level is high.
2. Turn the SYNC STABILITY control clockwise to the position of best picture stability.
3. Tune in a strong station and check the picture for twist. If excessive twist is noticed, turn the SYNC STABILITY control counterclockwise until the twist disappears.
4. The point of best SYNC STABILITY and least twist will coincide under most conditions. If two distinct positions are found, a compromise will usually be satisfactory. The noise stability will improve with clockwise rotation. In good signal areas, the control should be left in its counterclockwise position.

F. HORIZONTAL A.F.C. ADJUSTMENT

In order to check this adjustment tune in a station, preferably one that is transmitting a test pattern. If difficulty is encountered in locking the picture horizontally or if it locks-in only when the Horizontal Hold Control is at either end of its rotation, adjust the Horizontal A.F.C. control as follows:

1. Turn CONTRAST down about half way.
2. Turn HORIZONTAL HOLD CONTROL fully counter-clockwise.
3. Check that the SYNC STABILITY control is properly adjusted.
4. If the picture is not locked in, turn the HORIZONTAL A.F.C. control till it does lock-in.
5. Momentarily interrupt the signal by switching the channel selector off channel and then back. The picture should just fall out of sync. If it does not, turn the

SERVICE ADJUSTMENTS *(Continued)*

of the other. If vertical synchronization "falls-out," re-adjust the VERTICAL HOLD control. (Refer to Fig. 1)

3. Adjust the HORIZONTAL DRIVE trimmer for the elimination of drive lines in the picture as follows: While observing the raster, turn the trimmer counterclockwise until thin vertical white (drive) lines appear at the left center of the screen. Then turn the control clockwise until the lines just disappear. Do not turn the trimmer any further clockwise than necessary to eliminate the drive lines. This adjustment is extremely critical and improper adjustment may shorten the life of the horizontal output tube. Turning the trimmer clockwise (closing plates) reduces the drive to the horizontal output tube and insufficient drive may increase the plate current to excessive proportions.

4. Readjustment of the HORIZONTAL A.F.C. control may now be necessary.

5. Adjust the HORIZONTAL SIZE control slotted screw, located at the rear of the High Voltage cage at the rear of the chassis, for correction of horizontal width. The large outer arcs of the test pattern should coincide with the edge of the picture mask. (Refer to schematic diagram.)

6. Adjust the HORIZONTAL LINEARITY control slotted screw, located at the rear of the High Voltage cage, for central alignment of the inner circles of the test pattern. If no test pattern is available, the linearity can be adjusted with fair accuracy by adjusting for minimum cathode current of the horizontal output tube. As the control is rotated, a dip in cathode current will be observed.

Horizontal A.F.C. adjustment screw slightly clockwise and again momentarily interrupt the signal. Continue this procedure until the picture just falls out of sync., only when the signal is interrupted.

6. Rotate the Horizontal Hold Control clockwise until the picture falls into sync. The picture should now stay in sync. throughout most of the range of the Horizontal Hold Control.

7. If the picture cannot be made to hold sync., carefully repeat the above procedure. If difficulty is still encountered, it may be necessary to make a complete alignment on the horizontal oscillator transformer using an oscilloscope, as described on page 10 of this folder.

G. PICTURE CENTERING, SIZE AND LINEARITY

1. Horizontal or Vertical Centering is accomplished mechanically. To center the picture, loosen the Focus Coil Wing Nut sufficiently to twist the Focus Coil slightly about its horizontal or vertical axis. Make sure the corners of the raster are not shadowed. See step D.2. Note: Some receivers are equipped with a magnetic centering disc, located between the focus coil and the deflection yoke. To center the picture in the mask, rotate and slightly vary the position of the disc in its vertical plane. This adjustment should be made in conjunction with positioning of Focus Coil (described above).

2. Adjust the VERTICAL SIZE and VERTICAL LINEARITY controls until the test pattern is vertically linear and symmetrical from top to bottom, and fills the mask. Adjustment of either control may require readjustment

Alignment Instructions
Video I-F and Sound Alignment Procedure

TV VIDEO I-F ALIGNMENT

1. Set channel selector to quiet portion of VHF band.
2. Set contrast control fully counterclockwise.
3. Apply 3V. negative bias between the A.G.C. bus (at C53) and ground. (Use 2—1½ V. cells in series.)
4. Connect TV I-F Signal Generator through a 1500 mmf condenser to Test Point (A) of tuner unit: low side to ground. (See schematic diagram.)
5. Connect negative lead of V.T.V.M. or 20,000 ohm per volt meter to pin 7 of V7A 6AL5 diode TEST POINT (B) positive lead to ground. (See schematic diagram.)
6. During alignment maintain Signal Generator output below 1.5 volts peak on V.T.V.M. (Note: High Signal Generator input may cause overloading, resulting in incorrect alignment.)
7. Feed 43.8 MC (±.05 MC) from Signal Generator and adjust T5 for maximum output.
8. Adjust top tuning core of T4 to its maximum counterclockwise position (all out). This is an adjacent sound trap which is not used in most signal areas. Its use may be necessary to reduce or eliminate adjacent sound interference. When found necessary align for **minimum** output at 47.25 mc.
9. Feed 45.5 mc (±.05 mc) from Signal Generator and adjust T4 bottom core for maximum output.
10. Feed 41.25 mc (±.05 mc) from Signal Generator and adjust T3 top core for minimum output.
11. Feed 42.8 mc (±.05 mc) from Signal Generator and adjust T3 bottom core for maximum output.
12. Feed 41.0 mc (±.05 mc) from Signal Generator and adjust T2 for maximum output.
13. Feed 45.2 mc (±.05 mc) from Signal Generator and adjust T1 for maximum output (adjacent to 6U8 on top of tuner).
14. Replace the meter with the vertical input of an Oscilloscope to test point (B) through a 10K isolating resistor, low side of scope to ground.
15. Remove Signal Generator. Feed a video I.F. Sweep Generator signal (40-48 mc) through the loosely coupled shield of the 6U8 VHF converter tube, making sure the shield is not grounded. (Refer to fig. 4.)
16. Observe response curve on the Oscilloscope (refer to fig. 4). Use marker frequencies 41.25 mc, 42.5 mc, 45.0 mc, 47.25 mc and 45.75 mc. It is absolutely important to keep Sweep Generator output at the lowest usable level to prevent response distortion due to overloading.
17. If response curve does not approximate that shown in fig. 4, repeat alignment steps 7 to 12. Check bias battery potential and proper connections. A slight touch up of individual tuning cores may be necessary to approximate the recommended response curve of fig. 4.

NOTE: Top and bottom cores accessible from either end of I.F. transformers. See fig. 3 for proper alignment tool.

IMPORTANT: Keep the sweep generator and marker generator outputs at minimum to avoid curve distortion. Marker pips should be kept barely visible.

TV SOUND ALIGNMENT

NOTE: TV-phono switch if used must be in TV position.

1. Connect a 4.5 MC Signal Generator (±.01 MC) through a 1500 MMF condenser to TEST POINT (B). See schematic diagram.
2. Obtain two resistors of approximately 100,000 ohms each, whose resistances have been matched accurately with an ohmmeter. Connect them in series across the 18K resistor (R178) at the 6T8 tube socket (V11A).
3. Connect negative lead of V.T.V.M. to junction of matched resistors of step 2; positive lead to ground.
4. Feed 4.5 MC (±.01 MC) from signal generator, and adjust L22, sound take-off coil, for maximum deflection on V.T.V.M.
5. Adjust the top and bottom cores of T6 sound I.F. transformer for maximum deflection on V.T.V.M.
6. Adjust the bottom core of T7 for maximum deflection on V.T.V.M.
7. Repeat steps 4 to 6 using minimum signal input necessary for proper meter deflection.
8. Connect positive lead of V.T.V.M. to junction of C152 and R177 TEST POINT (C), leaving negative lead of V.T.V.M. Connected as in step 3. See schematic diagram.
9. Adjust top slug of T7 for zero output on V.T.V.M. between two opposite polarity peaks.

SOUND I.F. ALIGNMENT USING STATION SIGNAL
If accurate 4.5 mc. signal generator is not available, the following procedure may be used only when the video IF's and tuner are properly aligned.

1. Connect antenna to appropriate antenna terminals and tune in station signal.
2. Follow steps 2 to 9 of TV SOUND ALIGNMENT.

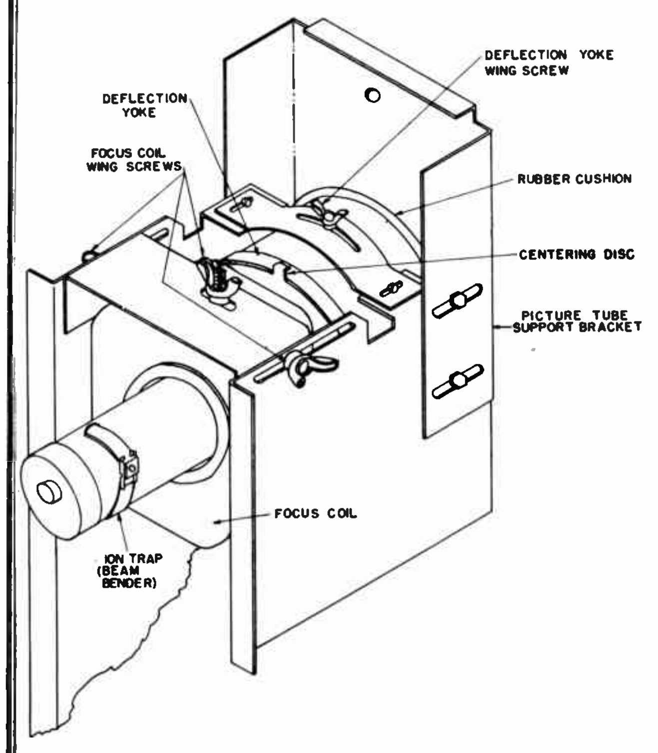
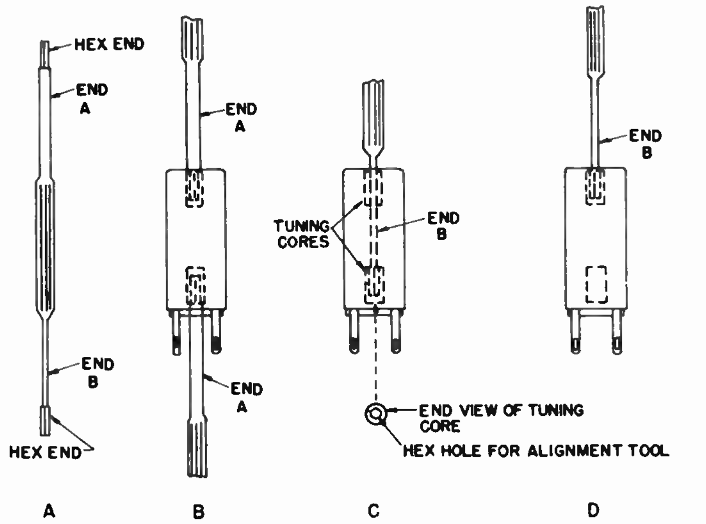


FIG. 2. DEFLECTION YOKE AND FOCUS COIL ASSEMBLY



A. Proper non-metallic tool for alignment of video I.F. transformers has two (2) hex-shaped ends.

B. End "A" can be used for tuning top or bottom core from one side of transformer at a time.

C & D. By using end "B" of alignment tool, both top and bottom cores can be rotated from either top or bottom of chassis.

FIG. 3. ALIGNMENT TOOL

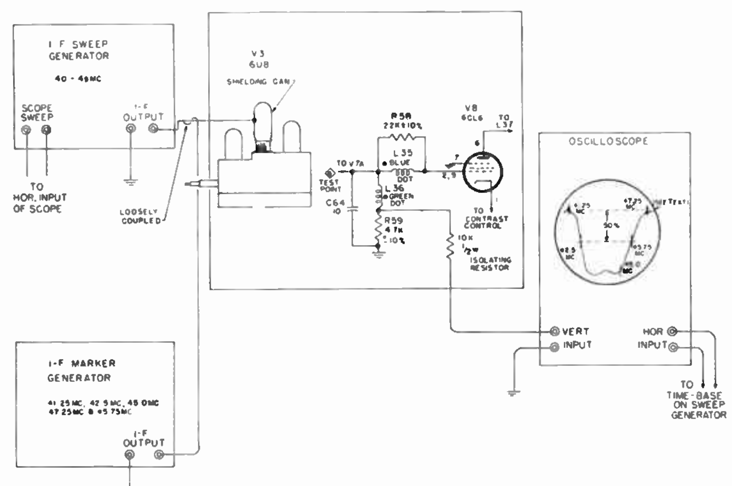


FIG. 4. IF ALIGNMENT BLOCK DIAGRAM

TABLE I RF ALIGNMENT FREQUENCIES — VHF

CHANNEL NUMBER	SWEEP GEN. CENTER FREQ. (10MC.SWEEP)	MARKER GENERATOR FREQUENCIES	
		VIDEO CARRIER	SOUND CARRIER
2	57 MC.	55.25 MC.	59.75 MC.
3	63 MC	61.25 MC.	65.75 MC.
4	69 MC.	67.25 MC.	71.75 MC.
5	79 MC.	77.25 MC.	81.75 MC.
6	85 MC.	83.25 MC.	87.75 MC.
7	177 MC.	175.25 MC.	179.75 MC.
8	183 MC.	181.25 MC.	185.75 MC.
9	189 MC.	187.25 MC.	191.75 MC.
10	195 MC.	193.25 MC.	197.75 MC.
11	201 MC.	199.25 MC.	203.75 MC.
12	207 MC	205.25 MC	209.75 MC.
13	213 MC.	211,25 MC	215.75 MC.

4.5 MC TRAP ALIGNMENT

1. Remove V6 (6CB6 3rd I-F amplifier)
2. Connect a 4.5 MC Signal Generator (±0.01 MC)* which has A.M. modulation, through a 1500 MMF condenser to the grid of V8 (pin 9 6CL6). Low side to ground.
3. Set A.M. modulation for approximately 30% modulation.
4. Set generator output to 0.1 volt.
5. Connect input of diode detector to CRT cathode. (See fig. 11 for suggested diode detector construction.)
6. Connect diode detector output to either a VTVM (D.C. (—) Volts scale) or an Oscilloscope.
7. Short out L22 (sound take-off coil) by connecting a jumper from the junction of C140 and C141 to ground.
8. Adjust L15 (4.5 MC trap) for minimum reading on VTVM or minimum pattern on Oscilloscope.

*Note: If accurate 4.5 MC generator is not available, use station signal. Short out L22 as in step 7 above. Note presence of 4.5 beat in picture. Adjust L15 for minimum beat.

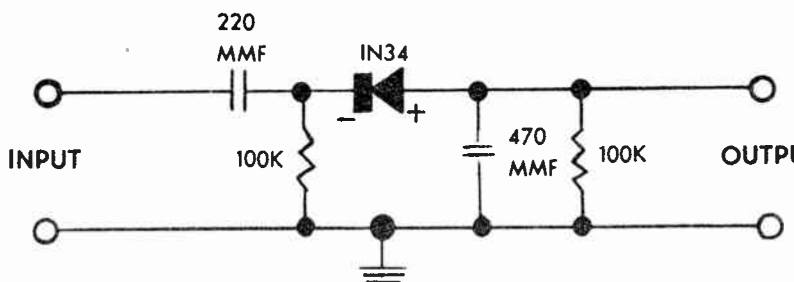
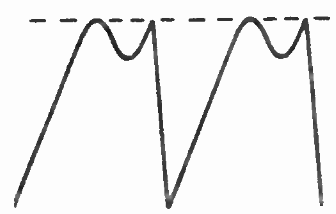


FIG. 11

HORIZONTAL OSCILLATOR TRANSFORMER ALIGNMENT

Refer to Service Adjustment "F" before proceeding with this alignment.

1. Tune in a TV station, preferably one that is transmitting a test pattern.
2. If after attempting the Horizontal A.F.C. Service Adjustment, described above, the picture cannot be made to sync. pre-set the Horizontal Stabilizing adjustment (inner slug of T11, beneath chassis) 5 turns in from its maximum out position.
3. Set the Horizontal Hold control to the center of its range and adjust the Horizontal A.F.C. adjustment until the picture is in sync.
4. Connect a low capacity probe of an oscilloscope to terminal "C" of the Horiontal oscillator transformer, T11; low side to ground. Set horizontal sweep to 7875 C.P.S. If a low capacity probe is unavailable, connect a 10K resistor in series with the vertical scope lead.
5. Adjust the Horizontal Stabilizing brass slotted screw until the broad and narrow peaks of the pattern on the oscilloscope are of equal height. (See illustration.) During Horizontal Stab. adjustment, picture must be kept in sync. by adjusting the Horizontal A.F.C. adjustment, if necessary.
6. Disconnect oscilloscope and follow Service Adjustment "F" above.



PARTS LIST—SERIES 119-120

CAPACITORS

SYMBOL	PART NO.	DESCRIPTION	TYPE
C1-C38	Part of Tuner	Unit E-36.167	
C50	B-4.115-1	5000 MMF 500V	Cer. Disc.
C51	D-4.104-70	560 MMF±10%	Mica
C52	D-4.108-12	1500 MMF 500V.	Cer.
C53	D-4.108-12	1500 MMF 500V.	Cer.
C54	B-4.242-1	680 MMF	Cer. Disc.
C56	D-4.108-12	1500 MMF 500V.	Cer.
C57	B-4.242-1	680 MMF	Cer. Disc.
C58	D-3.100-30	.25 MF 200V.	Paper Tub.
C60	D-4.108-12	1500 MMF 500V.	Cer.
C61	B-4.242-1	680 MMF	Cer. Disc.
C62	B-4.242-1	680 MMF	Cer. Disc.
C63	C-4.109-10	100 MMF	Cer.
C64	C-4.109-16	10 MMF	Cer.
*C65A	C-5.435-3	4 MF 450V.	Elect.
C66	D-4.104-38	100 MMF ± 10%	Mica
C67	D-3.105-21	.1 MF 400V.	Molded Tub.
C68	D-3.105-23	.22 MF 400V.	Molded Tub.
C69	D-3.105-23	.22 MF 400V.	Molded Tub.
C80	B-4.138	5000 MMF Heavy Duty	Cer. Disc.
C81	B-4.138	5000 MMF Heavy Duty	Cer. Disc.
*C83A	C-5.435-3	40 MF 450V.	Elect.
C84	D-4.108-12	1500 MMF 500V.	Cer.
C85	D-4.108-12	1500 MMF 500V.	Cer.
C86E	B-4.125-1	5000 MMF 450V.	Dual Cer. Disc.
*C87C	C-5.435-3	4 MF 450V.	Elect.
*C88B	C-5.435-4	40 MF 450V.	Elect.
*C89B	C-5.435-4	40 MF 450V.	Elect.
C90E	B-4.125-1	5000 MMF 450V.	Dual Cer. Disc.
*C91C	C-5.435-3	40 MF 450V.	Elect.
C92	D-3.105-21	.1 MF 400V.	Molded Tub.
*C93A	C-5.435-3	4 MF 450V.	Elect.
C94	D-3.105-19	.047 MF 400V.	Molded Tub.
C95	D-4.104-93	68 MMF ±5%	Mica
C96	D-3.105-16	.01 MF 400V.	Molded Tub.
C97	C-4.109-10	100 MMF	Cer.
C98	B-10-101	2000 MMF	Part of
C99		5000 MMF	Vert. Int.
C100		5000 MMF	Net.
C101	D-4.105-24	4700 MMF ±10%	Mica
*C102C	C-5.435-3	4 MF 450V.	Elect.
C103	D-3.105-59	.047 MF 600V. ±10%	Molded Tub.
C104	D-3.100-46	.035 MF 600V. ±10%	Paper Tub.
C105	D-3.105-23	.22 MF 400V.	Molded Tub.
*C106D	C-5.429-2	100 MF 50V.	Elect.
*C107C	C-5.435-3	40 MF 450V.	Elect.
C108	D-3.105-21	.1 MF 400V.	Molded Tub.
C109	D-3.105-34	.047 MF 600V.	Molded Tub.
C120	D-3.105-26	.0022 MF 600V.	Molded Tub.
C121	D-3.105-17	.022 MF 400V.	Molded Tub.
C122	D-3.105-19	.047 MF 400V.	Molded Tub.
C123	D-3.100-30	.25 MF 200V.	Paper Tub.
C124	D-4.104-59	330 MMF ±10%	Mica
C125	D-3.106-1	.01 MF 600V. ±10%	Molded Stab.
C126	D-4.105-9	1200 MMF ±10%	Mica
C127	C-4.109-14	47 MMF ±5%	Cer.
*C128B	C-5.435-4	8 MF 450V.	Elect.
C129	D-4.104-70	560 MMF ±10%	Mica
C130	B-4.119-2	40-370 MMF	Trimmer
C131	C-4.109-14	47 MMF ±5%	Cer.
C132	D-3.105-34	.047 MF 600V.	Molded Tub.
C133	B-4.129-6	56 MMF 2KV. ±5%	Mica (Yoke)
C134	D-3.100-30	.25 MF 200V.	Paper Tub.
C135	B-4.128	500 MMF 20KV.	Molded Cerm.
C136	B-4.129-2	39 MMF 2KV. ±10%	Cer.
C137	D-3.105-59	.047 MF 600V. ±10%	Molded Tub.
C138	D-3.100-46	.035 MF 600V. ±10%	Paper Tub.
C139	B-4.129-4	68 MMF 2KV. ±10%	Cer.
C140	C-4.111-5	3.3 MMF	Cer. Tub.
C141	D-4.104-21	39 MMF ±10%	Mica
C142	B-4.115-1	5000 MMF 450V.	Cer. Disc.
C143F	B-4.125-1	5000 MMF 450V.	Dual Cer. Disc.
C144F		5000 MMF 450V.	
C147	D-4.104-21	39 MMF ±10%	Mica
C149G	B-4.125-1	5000 MMF 450V.	Dual Cer. Disc.
C150G		5000 MMF 450V.	
C151	D-4.108-12	1500 MMF 500V.	Cer.
C152	D-4.108-12	1500 MMF 500V.	Cer.
C153	C-5.430-1	4 MF 50V.	Elect.
C154	D-3.105-19	.047 MF 400V.	Molded Tub.
C155	B-4.115-1	5000 MMF 450V.	Cer. Disc.
C158	B-10.103	.01 MF	Part of triode couplate.
C160	D-3.105-28	.0047 MF 600V.	Molded Tub.
*C161A	C-5.435-3	40 MF 450V.	Elect.
*C162D	C-5.429-2	25 MF 50V.	Elect.
C163	D-4.108-12	1500 MMF 500V.	Cer.

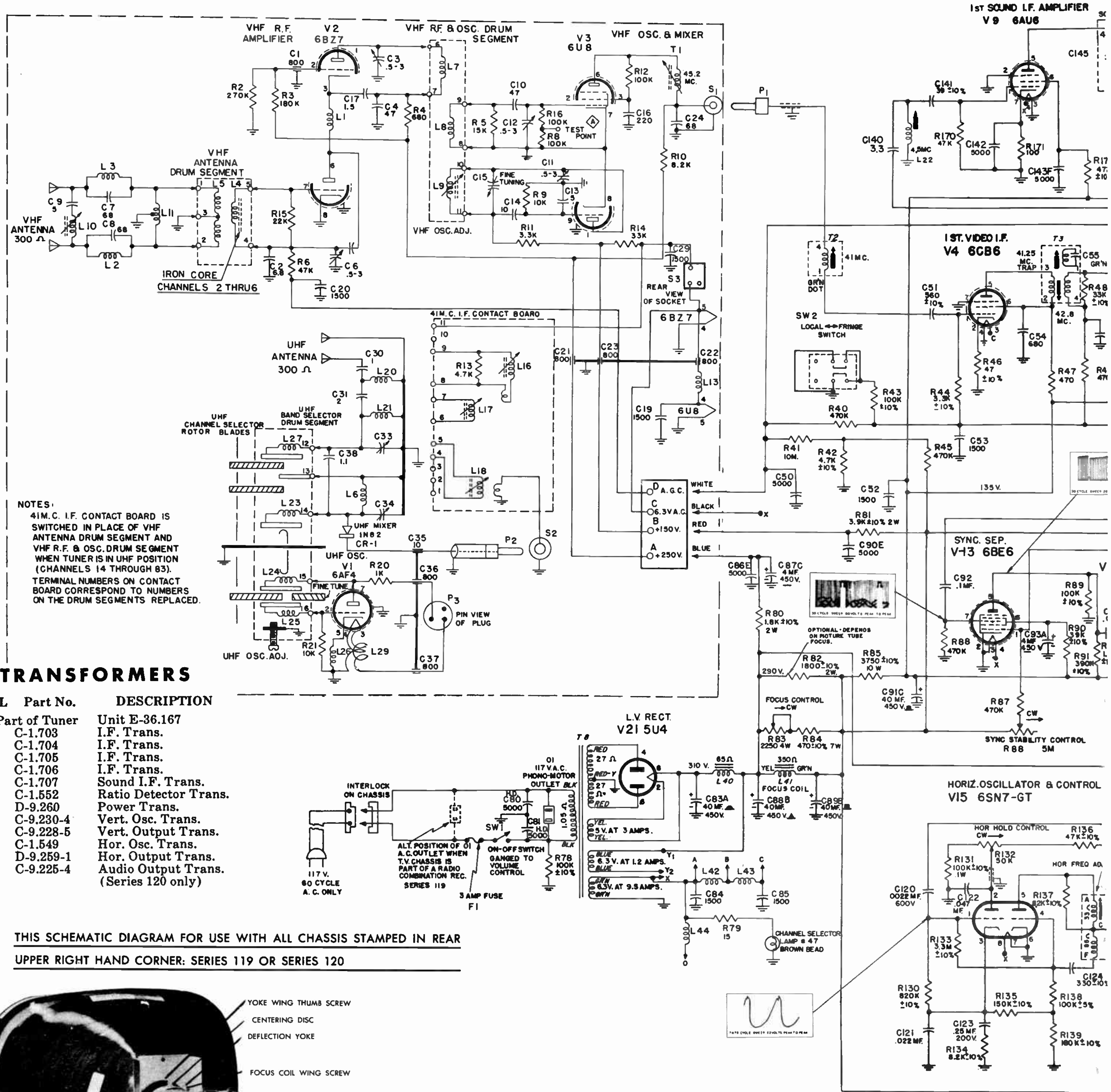
*Refer to schematic for connection of multi-sectioned electrolytic capacitors.

RESISTORS

SYMBOL	PART NO.	DESCRIPTION	TYPE
R1-R21	Part of Tuner	Unit E-36.167	
R40	D-7.101-129	470 K.	½ W. Carbon
R41	D-7.101-192	10 M.	½ W. Carbon
R42	D-7.101-44	4.7K. ±10%	½ W. Carbon
R43	D-7.101-100	100K. ±10%	½ W. Carbon
R44	D-7.101-37	3.3K. ±10%	½ W. Carbon
R45	D-7.101-129	470K.	½ W. Carbon
R46	D-7.101-250	47 ±10%	½ W. Carbon
R47	D-7.101-3	470	½ W. Carbon
R48	D-7.101-79	33K. ±10%	½ W. Carbon
R49	D-7.101-3	470	½ W. Carbon
R50	D-7.101-250	47 ±10%	½ W. Carbon
R51	D-7.101-3	470	½ W. Carbon
R52	D-7.101-79	33K. ±10%	½ W. Carbon
R53	D-7.101-217	180 ±10%	½ W. Carbon
R54	D-7.101-134	680K. ±10%	½ W. Carbon
R55	D-7.101-44	4.7K. ±10%	½ W. Carbon
R56	D-7.101-44	4.7K. ±10%	½ W. Carbon
R57	D-7.101-134	680K. ±10%	½ W. Carbon
R58	D-7.101-72	22K. ±10%	½ W. Carbon
R59	D-7.101-44	4.7K. ±10%	½ W. Carbon
R60	D-7.101-107	150K. ±10%	½ W. Carbon
R61	D-7.101-256	33 ±10%	½ W. Carbon
R62	C-8.230-3	1K. Pot. Dual (R179)	Comp.
R63	D-7.101-72	22K. ±10%	½ W. Carbon
R64	D-1.103-142	22K. ±10%	2 W. Carbon
R65	D-7.101-58	10K. ±10%	½ W. Carbon
R66	D-7.103-104	2.7K. ±10%	2 W. Carbon
R67	D-7.103-104	2.7K. ±10%	2 W. Carbon
R68	D-7.101-58	10K. ±10%	½ W. Carbon
R69	D-7.101-129	470K.	½ W. Carbon
R70	C-8.229-9	100K. Pot.	Comp.
R71	D-7.101-114	220K. ±10%	½ W. Carbon
R72	D-7.101-87	47K.	½ W. Carbon
R78	D-7.101-100	100K. ±10%	½ W. Carbon
R79	D-7.101-238	15	½ W. Carbon
R80	D-7.103-97	1.8K. ±10%	2 W. Carbon
R81	D-7.103-111	3.9K. ±10%	2 W. Carbon
R82	D-7.103-97	1.8K. ±10%	2 W. Carbon
R83	C-8.221	2250 Pot.	4 W. Wire Wound
R84	C-6.215-1	470 ±10%	7 W. Wire Wound
R85	B-6.211-5	3750 ±10%	10 W. Wire Wound
R86	D-7.101-129	470K.	½ W. Carbon
R87	D-7.101-129	470K.	½ W. Carbon
R88	C-8.219-1	5M. Pot.	Comp.
R89	D-7.101-100	100K. ±10%	½ W. Carbon
R90	D-7.101-83	39K. ±10%	½ W. Carbon
R91	D-7.101-125	390K. ±10%	½ W. Carbon
R92	D-7.101-148	1.5M. ±10%	½ W. Carbon
R93	D-7.101-37	3.3K. ±10%	½ W. Carbon
R94	D-7.101-30	2.2K. ±10%	½ W. Carbon
R95	D-7.101-142	1M.	½ W. Carbon
R96	D-7.101-115	220K.	½ W. Carbon
R97	D-7.101-100	100K. ±10%	½ W. Carbon
R98	D-7.101-66	15K.	½ W. Carbon
R99	D-7.101-80	33K.	½ W. Carbon
R100	B-10.101	22K.	Part of
R101		8.2K.	Vert. Int.
R102		8.2K.	Net.
R103	D-7.101-145	1.2M. ±10%	½ W. Carbon
R104	C-8.229-10	1.5M. Pot.	Comp.
R105	D-7.101-148	1.5M. ±10%	½ W. Carbon
R106	D-7.101-58	10K. ±10%	½ W. Carbon
R107	D-7.101-129	470K.	½ W. Carbon
R108	C-8.219-5	2.5M. Pot.	Comp.
R109	D-7.101-122	330K.	½ W. Carbon
R110	D-7.101-156	2.2M.	½ W. Carbon
R111	D-7.101-3	470	½ W. Carbon
R112	C-8.206-6	5K. Pot.	Wire Wound
R113	D-7.102-24	1K.	1 W. Carbon
R114	D-7.101-2	470 ±10%	½ W. Carbon
R130	D-7.101-138	820K. ±10%	½ W. Carbon
R131	D-7.102-108	100K. ±10%	1 W. Carbon
R132	C-8.229-7	50K. Pot.	Comp.
R133	D-7.101-171	3.3M. ±10%	½ W. Carbon
R134	D-7.101-55	8.2K. ±10%	½ W. Carbon
R135	D-7.101-107	150K. ±10%	½ W. Carbon
R136	D-7.102-94	47K. ±10%	1 W. Carbon
R137	D-7.101-55	8.2K. ±10%	½ W. Carbon
R138	D-7.101-99	100K. ±5%	½ W. Carbon
R139	D-7.101-111	180K. ±10%	½ W. Carbon
R140	D-7.102-24	1K.	1 W. Carbon
R141	D-7.102-94	47K. ±10%	1 W. Carbon
R142	D-7.101-128	470K. ±10%	½ W. Carbon
R143	D-7.101-142	1M.	½ W. Carbon
R144	D-7.101-226	100	½ W. Carbon
R145	D-7.103-118	5.6K. ±10%	2 W. Carbon
R146	C-6.212-1	3.3	½ W. Wire Wound
R147	D-7.102-214	150	1 W. Carbon
R148	D-7.102-137	470K.	1 W. Carbon
R149	D-7.101-128	470K. ±10%	½ W. Carbon
R150	D-7.101-156	2.2M.	½ W. Carbon
R170	D-7.101-87	47K.	½ W. Carbon
R171	D-7.101-226	100	½ W. Carbon
R172	D-7.101-86	47K. ±10%	½ W. Carbon
R173	D-7.101-17	1K.	½ W. Carbon
R174	D-7.101-129	470K.	½ W. Carbon
R175	D-7.101-100	100K. ±10%	½ W. Carbon
R176	D-7.101-17	1K.	½ W. Carbon
R177	D-7.101-66	15K.	½ W. Carbon
R178	D-7.101-69	18K. ±10%	½ W. Carbon
R179	C-8.230-3	1M. Pot. Dual (R62)	Comp.
R180	D-7.101-192	10 M.	½ W. Carbon
R181	B-10.103	500K.	Part of triode
R182		500K.	couplate.
R183	D-7.102-13	560 ±10%	1 W. Carbon
R184	D-7.102-10	470	1 W. Carbon

COILS AND CHOKES

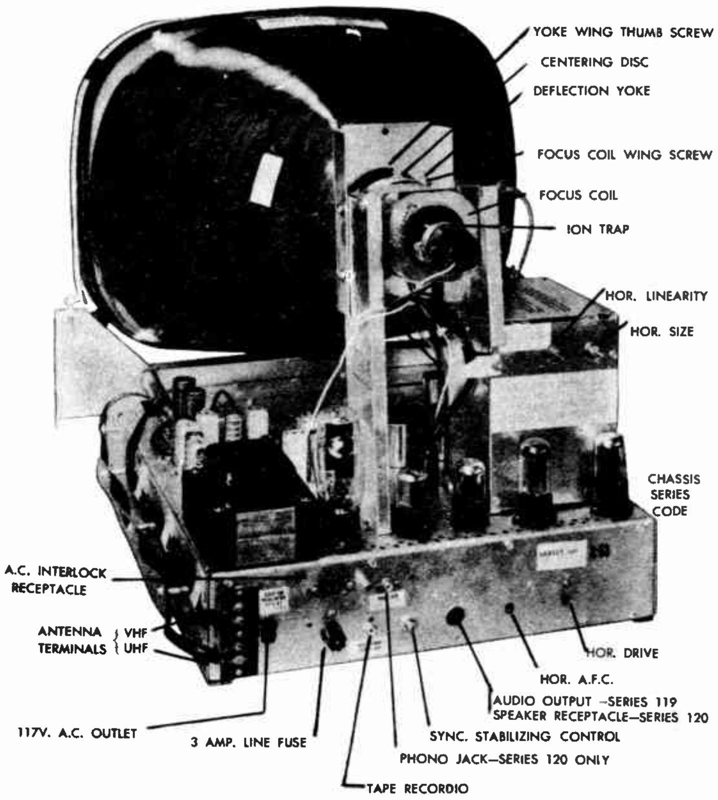
SYMBOL	PART NO.	DESCRIPTION	TYPE
L1-L29	Part of Tuner	Unit E-36.167 (Except L15 &L22)	
L15	C-1.555	Sound Trap Coil	
L22	C-1.529	Sound Take-off Coil	
L35	C-1.522-3	Video Peaking Coil	Blue Dot
L36	C-1.522-2	Video Peaking Coil	Green Dot
L37	C-1.522-4	Video Peaking Coil	Yellow Dot
L38	C-1.522-2	Video Peaking Coil	Green Dot
L40	C-9.237-3	Filter Choke	
L41	C-9.234-4	Focus Coil	
L42	B-1.501	Filament Choke	
L43	B-1.501	Filament Choke	
L44	B-1.501	Filament Choke	
L45A	C-9.254-3	Vert. Deflect Yoke	Short 70° Cosine
L45B		Hor. Deflect Yoke	
L46	B-1.533-1	Hor. Size Coil	
L47	B-1.531	Hor. Lin. Coil	



TRANSFORMERS

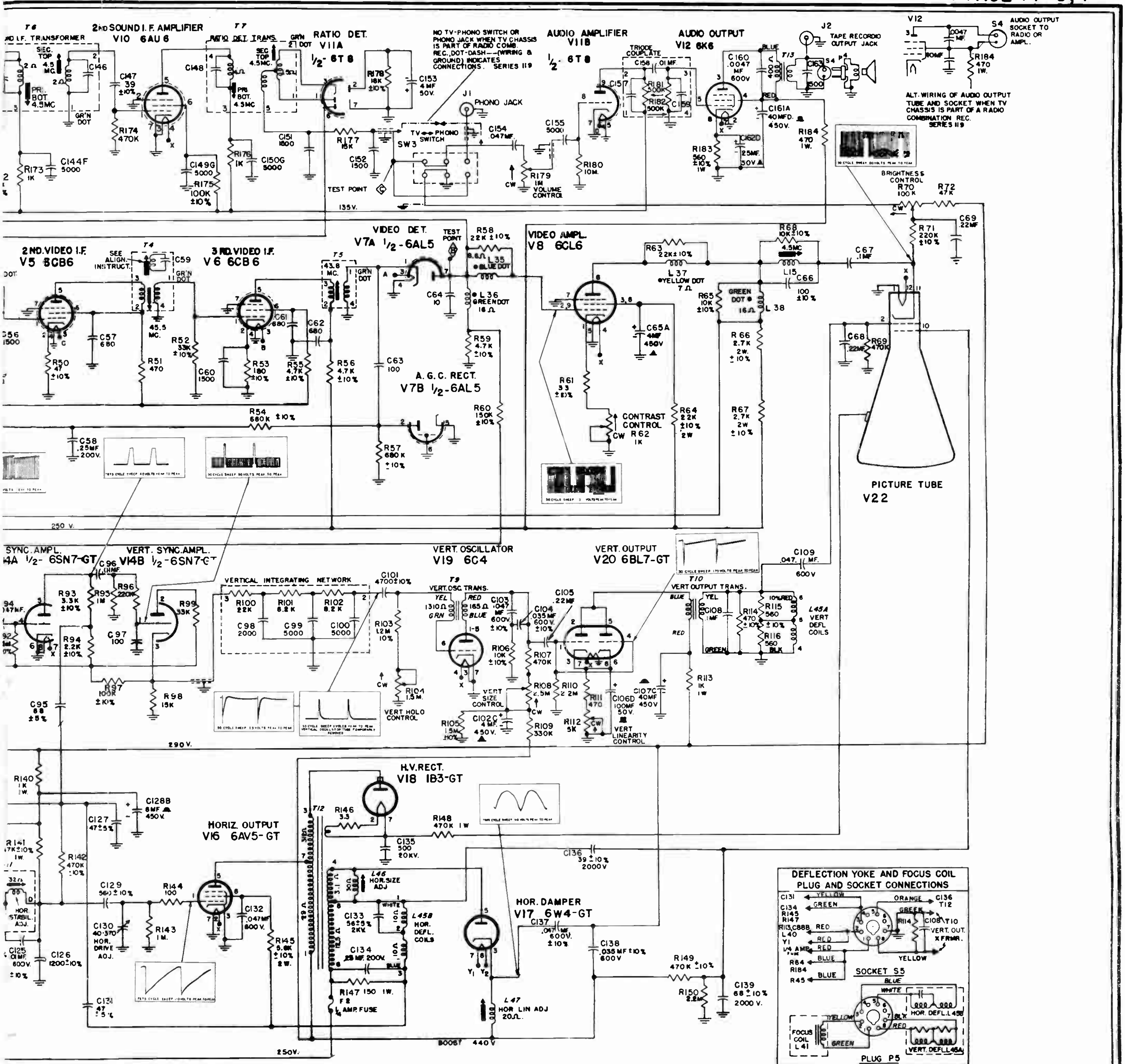
SYMBOL	Part No.	DESCRIPTION
T1	Part of Tuner	Unit E-36.167
T2	C-1.703	I.F. Trans.
T3	C-1.704	I.F. Trans.
T4	C-1.705	I.F. Trans.
T5	C-1.706	I.F. Trans.
T6	C-1.707	Sound I.F. Trans.
T7	C-1.552	Ratio Detector Trans.
T8	D-9.260	Power Trans.
T9	C-9.230-4	Vert. Osc. Trans.
T10	C-9.228-5	Vert. Output Trans.
T11	C-1.549	Hor. Osc. Trans.
T12	D-9.259-1	Hor. Output Trans.
T13	C-9.225-4	Audio Output Trans. (Series 120 only)

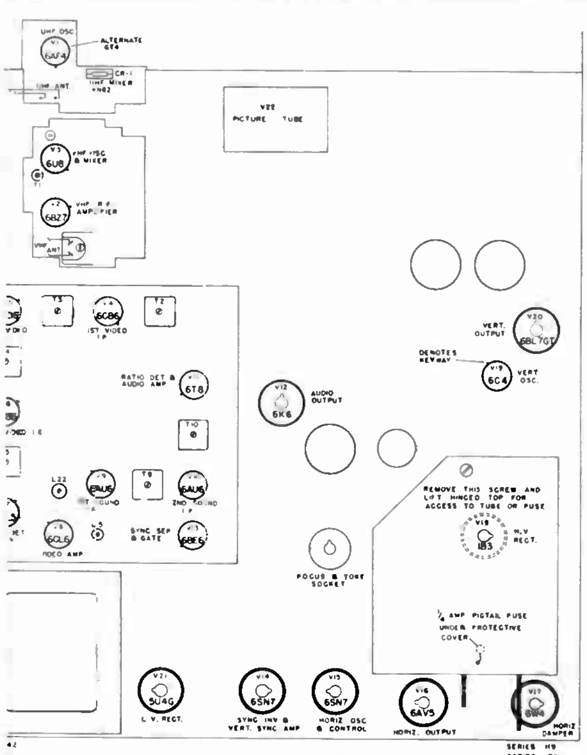
THIS SCHEMATIC DIAGRAM FOR USE WITH ALL CHASSIS STAMPED IN REAR UPPER RIGHT HAND CORNER: SERIES 119 OR SERIES 120



TUBE COMPLEMENT AND VOLTAGE CHART — SERIES 119 AND 120

Tube Type	Symbol	Function		Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	6AF4	UHF. Osc.	VHF. Pos.	20	—.2	6.3AC	0	0	—.2	20	—	—
			UHF. Pos.	60	—.18	6.3AC	0	0	—.18	60	—	—
V2	6BZ7	VHF. R.F. Amp.	VHF. Pos.	218	130	130	0	6.3AC	130	—.2	0	0
			UHF. Pos.	260	155	175	0	6.3AC	175	—3.9	0	0
V3	6U8	VHF. Osc.—Mixer	VHF. Pos.	102	—3.2	100	6.3AC	0	200	0	0	—3.5
			UHF. Pos.	—.8	—.5	64	6.3AC	0	200	0	0	—3.5
V4	6CB6	1st Video I.F.		—.7	.5	6.3AC	0	90	92	0	—	—
V5	6CB6	2nd Video I.F.		—.7	.3	6.3AC	0	94	96	0	—	—
V6	6CB6	3rd Video I.F.		0	1.5	6.3AC	0	185	90	0	—	—
V7	6AL5	Video Det.—A.G.C.		0	—.6	6.3AC	0	0	0	—.3	—	—
V8	6CL6	Video Amp.		1.1	—.3	104	6.3AC	0	110	0	104	—.3
V9	6AU6	1st Sound I F. Amp.		—.3	0	0	6.3AC	98	60	.3	—	—
V10	6AU6	2nd Sound I.F. Amp.		—.7	0	0	6.3AC	100	39	0	—	—
V11	6T8	Ratio Det.—Audio Amp.		—.3	—2.1	—1.8	6.3AC	0	—.7	0	—.6	50
V12	6K6	Audio Output		NC.	0	215	225	0	225	6.3AC	16	—
V13	6BE6	Sync Sep.—Gate		—.2	0	0	6.3AC	18	18	—.3	—	—
V14	6SN7	Sync Amp.—Vert. Sync Amp.		0	100	12	—.2	64	0	6.3AC	0	—
V15	6SN7	Hor. Osc.—Control		14	200	15	—50	190	0	0	6.3AC	—
V16	6AV5	Hor. Output		— 30	6.3AC	0	NC.	Do not measure	NC.	0	155	—
V17	6W4	Hor. Damper		230	NC.	470	NC.	230	NC.	290† / 6.3AC	290† / 6.3AC	—
V18	1B3	High Voltage Rect.		—	*15KV	—	*15KV	—	*15KV	*15KV	*15KV	—
V19	6C4	Vertical Osc.		150	0	0	6.3AC	150	—44	0	—	—
V20	6BL7	Vertical Output		0	255	17	0	255	17	6.3AC	0	—
V21	5U4	Low Voltage Rect.		NC.	**310 / 5AC	NC.	310 AC	290	310 AC	290	**310 / 5AC	—
V22	21ZP4	Picture Tube		0	0		Pins 3 to 9 NC.			Pin 10: 360	Pin 11: 35	Pin 12: 6.3AC
		Yoke Socket		230	290	230	NC.	230	NC.	0	5.5AC	—





NOTES

1. Tune receiver to unused V.H.F. channel—no signal applied unless otherwise specified.
2. All front panel controls at maximum clockwise position.
3. Screwdriver service adjustments, set for normal raster.
4. All voltages measured with V.T.V.M. at 117 volts A.C. line.
5. Values shown are D.C. voltages measured from socket to ground unless otherwise specified.
6. N.C. designates no connection.
7. A dash designates the non existence of socket connections.
8. "Local-Distance" switch in "local" position.
9. "TV-Phono" switch (if used) in TV position.

* Use high voltage insulated probe only.

† Top value is D.C. voltage to ground. Bottom value connect A.C. meter across socket connections 7 and 8.

** Top value is D.C. voltage to ground. Bottom value connect A.C. meter across socket connections 2 and 8.

PART NO.	SECTION	CAP. & W.V.	SYMBOL NO.
C-5.435-3		40MF—450V	C-83A
		40MF—450V	C-161A
		4MF—450V	C-65A
		4MF—450V	C-93A
C-5.435-4		8MF—450V	C-128B
		40MF—450V	C-89B
		40MF—450V	C-88B
C-5.435-3		40MF—450V	C-107C
		40MF—450V	C-91C
		4MF—450V	C-102C
		4MF—450V	C-87C
C-5.429-2		100MF—50V	C-106D
		25MF—50V	C-162D

KEY TO SCHEMATIC

"K"=KILOHMS "M"=MEGOHMS

Unless otherwise noted:

All capacitors are in MMF, ±20%, and rated at 400W. V.

All resistors are in ohms, ±20%, and rated at 1/2 w.

All waveshapes shown are with an input signal sufficient to develop a 3 volt peak to peak composite video signal at the video detector. Contrast set at maximum, all other controls set for normal operation.

ALL CAPACITORS WITH THE SAME SUFFIX LETTER ARE PART OF ONE MULTISECTION UNIT. SEE ALSO CHART OF ELECTROLYTIC CAPACITOR CONNECTIONS.

V.H.F. R.F. ALIGNMENT

1. Connect balanced 300 ohm sweep generator to VHF antenna terminals. (Top terminals at rear of chassis.) See fig. 8 for suitable matching pads.
2. Connect R.F. Marker Generator loosely to VHF antenna terminals.
3. Connect vertical amplifier of Oscilloscope through a 10K resistor to TEST POINT (A), fig. 4.
4. Short A.G.C. bus to ground across C53, 5000 mmf discap condenser.
5. Set TV channel selector to Channel 10.
6. Adjust Sweep Generator for Channel 10, 10 mc sweep and 193.25 mc and 197.75 mc fixed frequencies from R.F. Marker Generator.
7. Observe response curve on Oscilloscope. If necessary, adjust C3 and C12 for overcoupled pattern and C6 for maximum response in center of bandpass. Repeat C3 and C12 adjustments for flat response. See fig. 6.
8. Chcek markers on response curve of all remaining channels setting Sweep and Marker Generators at corresponding frequencies for each channel. See Table 1 for convnient tabulation of proper frequencies. If the R.F. Markers do not fall in automatically in their proper places on all channels, a compromise must be made by slight readjustments of C3, C6 and C12.

V.H.F. OSCILLATOR ALIGNMENT

1. Connect TV R.F. Sweep Generator to VHF antenna terminals.
2. Couple R.F. Marker Generator loosely to the VHF antenna terminals.
3. Connect vertical input of Oscilloscope through a 10K de-coupling resistor to pin 7 of 6AL5 diode V7A. TEST POINT (B).
4. Couple 45.75 MC video I.F. Marker Generator loosely to first I.F. grid (Pin 1 of 6CB6 V4).
5. Rotate Fine Tuning control to center of range.
6. Set channel selector to Channel 10.
7. Set Sweep Generator to Channel 10, and Marker Generator to 193.25 MC (Video carrier).
8. Observe response curve and adjust C11 oscillator adjustment, see fig. 7 for zero-beat with 45.75 MC marker. Zero beat is indicated by an unmistakable break-up of the response curve.
   NOTE: Quality of response curve does not affect accuracy of oscillator alignment, so long as a zero-beat is obtained.
9. Check for zero beat on all channels by adjusting each individual oscillator coil slug with the fine tuning control set in the mechanical center of its range and the channel selector, Sweep Generator and Marker Generator at the corresponding frequencies. See Table 1, Fig. 5.
   NOTE: Adjust oscillator slug from front end of tuner with a long non-metallic screwdriver. A clearance hole is provided through the UHF unit when the UHF drum is turned to VHF. See fig. 7.

U.H.F. R.F. ALIGNMENT

1. The UHF R.F. alignment should be made with the receiver turned off.
2. Connect unbalanced 300 ohm UHF Sweep Generator to the bottom antenna terminals, at the rear of the chassis. See fig. 8 for suitable matching pads.
3. Loosely couple Marker Generator output to the bottom antenna terminals.
4. Remove UHF I.F. plug from UHF I.F. input jack and insert 100 ohm ½ w. non-inductive resistor between center conductor and ground shield of plug. Connect vertical input of Oscilloscope across the 100 ohm resistor. Low side of scope to ground. See fig.
5. Set TV channel and band (decade) selector for Channel 69.
6. Feed 803 mc at 40 mc sweep from Sweep Generator.
7. Observe response curve on Oscilloscope and if necessary, adjust C33 and C34, see fig. 7, so that response curve falls within limits. Vary Marker Generator to check bandwidth. See Table 2 Fig. 10 for corresponding frequencies.
8. Check response curves on at least one channel in each decade setting (14-19, 20-29, etc.), and set the Sweep Generator to the corresponding frequencies. See table 2. If the response curves do not fall within the specified limits, a compromise adjustment of C33 and C34 should be made.
9. Reinsert UHF I.F. plug. The R.F. alignment is now complete for all UHF channels.

U.H.F. OSCILLATOR ALIGNMENT

1. Turn receiver on and allow a 10 minute warmup period before proceeding with adjustments.
2. Connect UHF Sweep Generator to bottom antenna terminals. See fig. 8 for suitable matching pads. (Note: matching pads for oscillator alignment is not generally required. However, to suit various input matching conditions, its use may be warranted.)
3. Couple UHF Marker Generator loosely to bottom antenna terminals.
4. Couple 45.75 mc video carrier I.F. Marker Generator loosely to first I.F. grid (Pin 1 of 6CB6 V4).
5. Connect vertical amplifier input of Oscilloscope through a 10K de-coupling resistor to TEST POINT (B) pin 7 of 6AL5 V7A diode.
6. Rotate fine tuning control to center of its range.
   NOTE: There is one oscillator adjustment for each decade of UHF channels. If local stations fall into different decades, the oscillator adjustments can be set to make each station come in at the same point of the fine tuning control. If there is more than one local station in any one decade, a compromise adjustment must be made. It will be necessary to readjust the fine tuning control when changing stations.
7. Set the TV channel and decade selector for a station in the area.
8. Set the Sweep Generator to the corresponding channel and the UHF Marker to the video carrier frequency of the channel. See table 2.
9. Adjust the UHF oscillator adjustment for zero-beat between the UHF Marker and the I.F. Marker. This zero-beat is indicated by an unmistakable breakup of the observed response curve.
   NOTE: Quality of response curve does not affect accuracy of oscillator alignment, so long as a zero-beat is obtained.
10. Check for zero-beat on all channels expected to be received in the area. See table 2.

V.H.F. R.F. and Oscillator Alignment

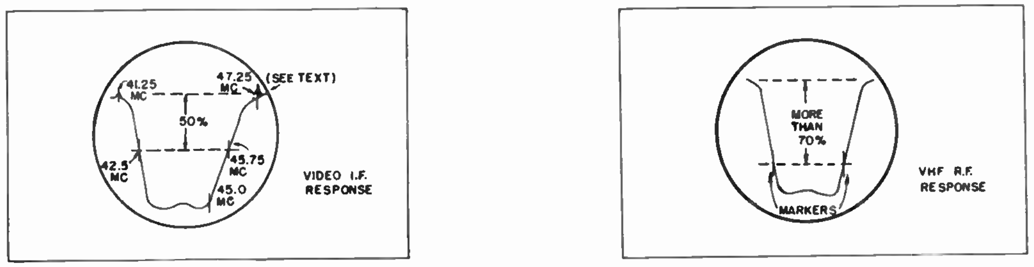


FIG. 6. RECOMMENDED RESPONSE CURVES.

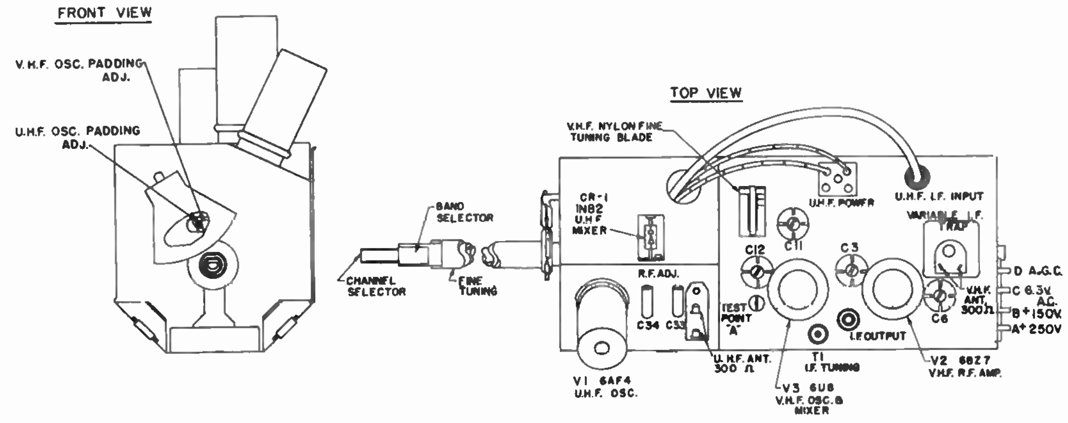


FIG. 7. R.F. TUNER ADJUSTMENT POINTS (STANDARD COIL UHF-VHF 82 CHANNEL CASCODE TUNER)

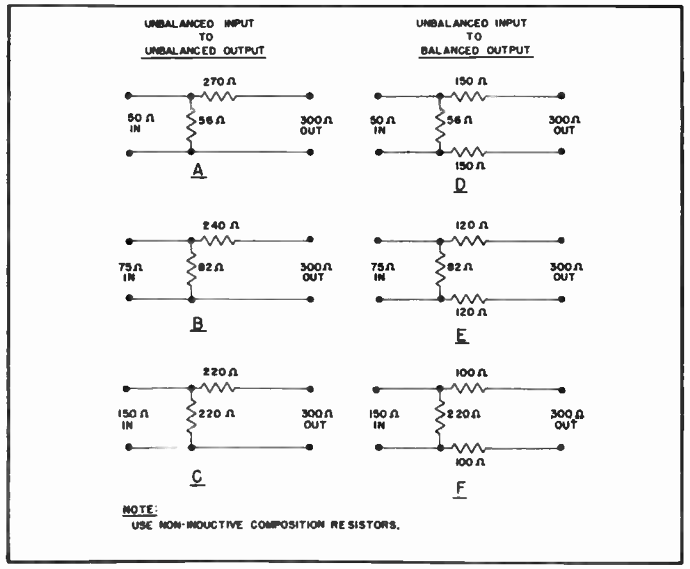


FIG. 8. MATCHING PADS

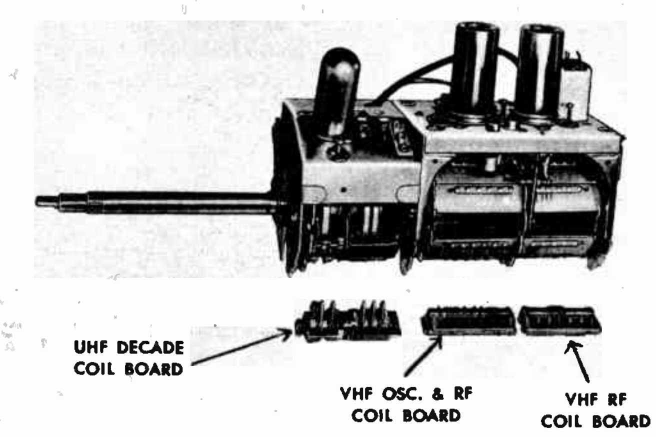


FIG. 9. TUNER WITH COVER REMOVED

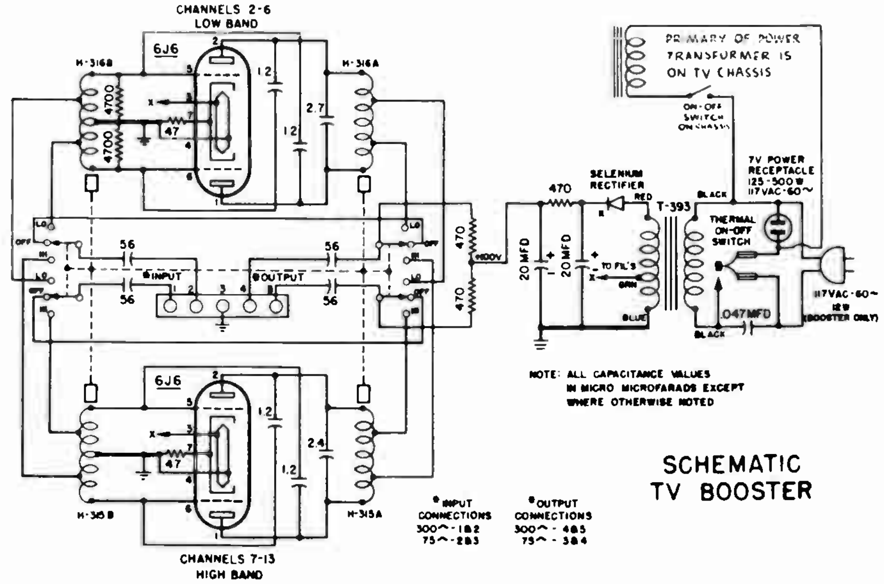
ALIGNMENT OF THE TUNER SHOULD NOT BE ATTEMPTED UNLESS IT HAS BEEN DEFINITELY DETERMINED THAT IT IS NECESSARY, AND SHOULD ONLY BE MADE WITH ADEQUATE AND PROPERLY CALIBRATED EQUIPMENT.

MATTISON TELEVISION AND RADIO CORPORATION
Alignment Procedure
MATTISON SILVER ROCKET CHASSIS

a) Use an RCA V. T. V. M. or equivalent.
b) Use RCA sweep generator or equivalent.
c) Use an RCA marker generator or equivalent.

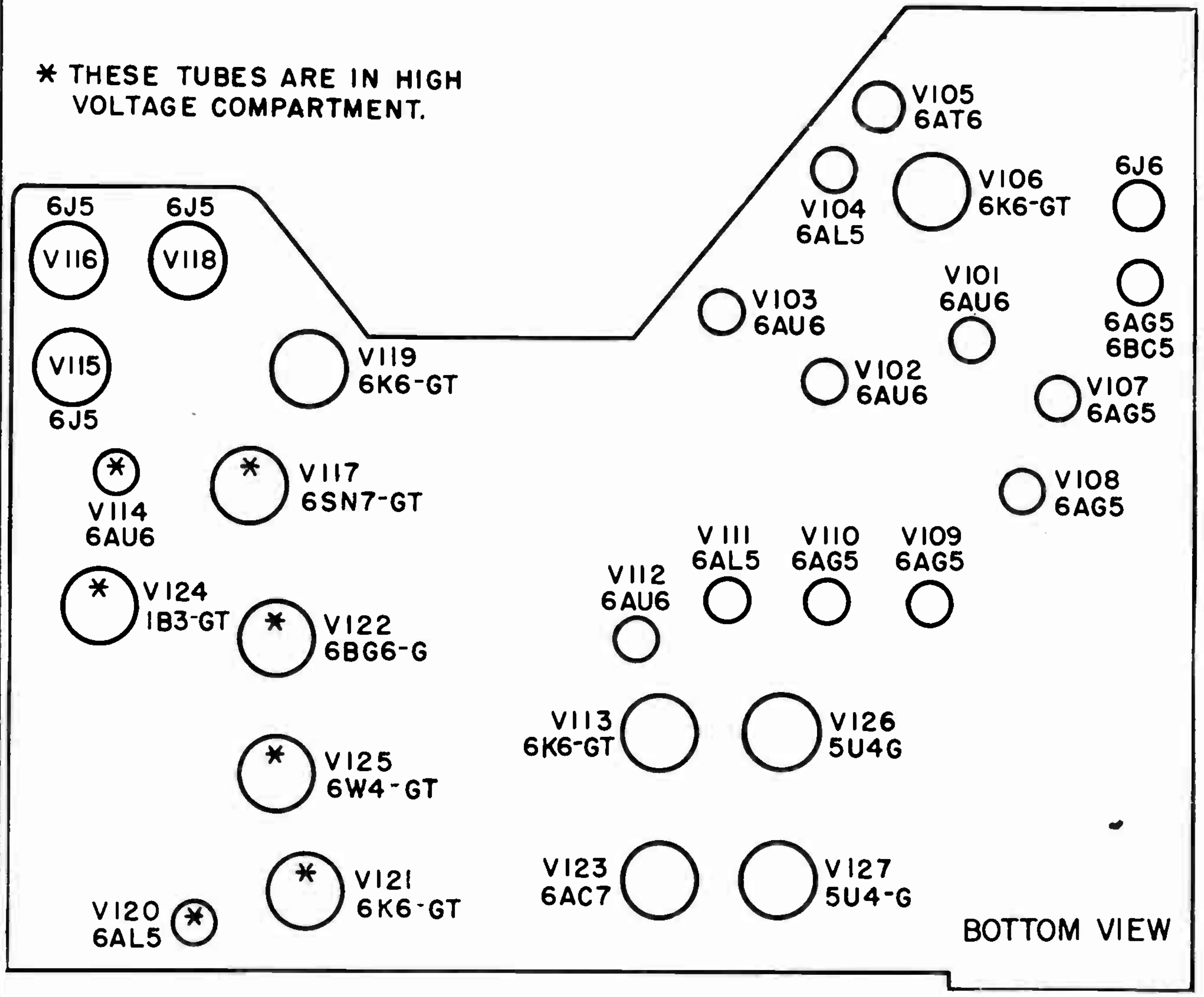
PROCEDURE:

1) Adjust fourth I. F. Coil, No. T105 to 23.9 m.c. for maximum (bottom slug).
2) Adjust marker oscillator to 21.75--adjust to minimum (top slug).
3) Adjust marker oscillator to 25.75 m.c. Adjust bottom slug on L183 for maximum reading on V. T. V. M.
4) Adjust top slug at same coul 27.75 minimum on V. T. V. M.
5) Adjust marker to 22.8 m.c. --adjust T104 for maximum (bottom slug).
6) Adjust top slug at same transformer, No. T104 for minimum.
7) Adjust T103 bottom slug for maximum 22.3 m.c. Adjust top slug for minimum.
8) Adjust converter coil on R. F. tuner to 25.7 m.c. maximum.
9) With sweep generator connected to antenna binding post and marker oscillator loosely coupled to the R. F. oscillator at the tuner, check over-all I. F. sweep response with oscilloscope. Make sure that picture carrier does not fall beyond 50% of the curve. Curve should be 4 m.c. wide from 21.75 sound carrier to 25.75 picture carrier.



SCHEMATIC
TV BOOSTER

* THESE TUBES ARE IN HIGH VOLTAGE COMPARTMENT.



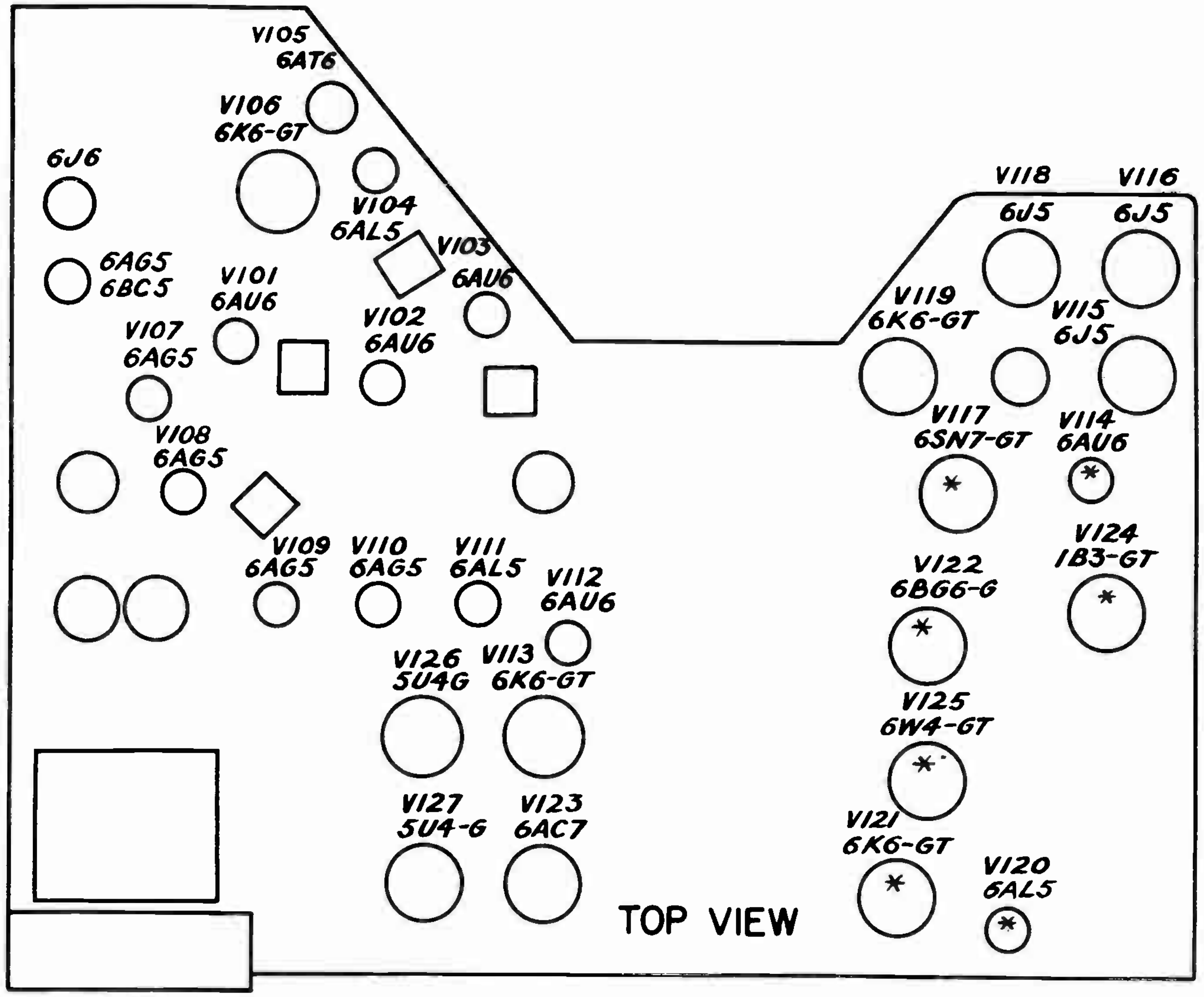


FIGURE 1

* THESE TUBES ARE IN HIGH VOLTAGE COMPARTMENT.

MATTISON SILVER ROCKET MODELS

VOLTAGE MEASUREMENT CHART

CIRCUIT SYMBOL	TUBE TYPE	PIN #1	PIN #2	PIN #3	PIN #4	PIN #5	PIN #6	PIN #7	PIN #8
V-101	6BA6	0	0	0	6 AC	100	100	0.8	-
V-102	6BA6	0	0	6.3 AC	0	100	98	0.9	-
V-103	6AU6	-0.25	0	0	6 AC	39	39	0	-
V-104	6AL5	.02	-0.46	6 AC	0	0	0	-0.5	-
V-105	6AT6	-0.84	0	6 AC	0	-0.3	-0.3	66	-
V-106	6K6GT	-14.8(TP)	6 AC	210	215	-14.5	0(TP)	0	0
V-107	6CB6	-2.7	0.38	0	6 AC	80	80	0.38	-
V-108	6CB6	-0.27	0.47	6 AC	0	84	84	0.47	-
V-109	6CB6	-0.27	0.4	6 AC	0	62	84	0.4	-
V-110	6CB6	0	1.1	6 AC	0	56	94	1.1	-
V-111	6AL5	0	0	6 AC	0	17	0	-1.2	-
V-112	6AU6	-1.2	0	0	6 AC	88	102	0	-
V-113	6K6GT	NC	0	160	135	2.1	0	6 AC	5.4
V-114	6AU6	90	98	6 AC	0	450*	245	98	-
V-115	6J5GT	0	6 AC	235	NC	82	240(TP)	0	92
V-116	6J5GT	0	6 AC	235	NC	80	250(TP)	0	90
V-117	6SN7GT	1.35	34	0	-170	-35	-140	6 AC	0
V-118	6J5	0	0	270	-125	-250	-142(TP)	6 AC	-140
V-119	6K6GT	-140(TP)	6 AC	220	220	-155	-142(TP)	0	-110
V-120	6AL5	-2	-15	0	6 AC	-2	0	-15	-
V-121	6K6GT	NC	0	165	180	-21	500(TP)	6 AC	.25
V-122	6BG6G	NC	6 AC	-135	TP	-150	NC	0	+140
V-123	6AC7	0(TP)	0	0	-2.9**	0.04	98**	6 AC	210**
V-124	1B3GT	----DANGEROUS HIGH VOLTAGE -------DO NOT MEASURE!------------------							
V-125	6W4GT	255(TP)	NC	510	250(TP)	250	255(TP)	510	510
V-126	5U4G	NC	270	NC	-140	NC	-140	NC	270
V-127	5U4G	NC	270	NC	-140	NC	-140	NC	270

* Peak to Peak, measured with oscilloscope
** These readings may be erratic due to action of V-123 with no signal input.

All readings were taken under the following conditions unless otherwise noted;

With Focus Control in center position
Without Signal Input
With Yoke and Focus Coil attached but without kinescope
All controls in maximum clockwise position

All voltages measured to ground at 115 volts line voltage with R.C.A. Voltohmyst and are positive D.C. unless preceded by a minus sign (-) or designated A.C.

NC - No Connection   TP - No tube connection - used as tie point

RESISTANCE MEASUREMENT CHART

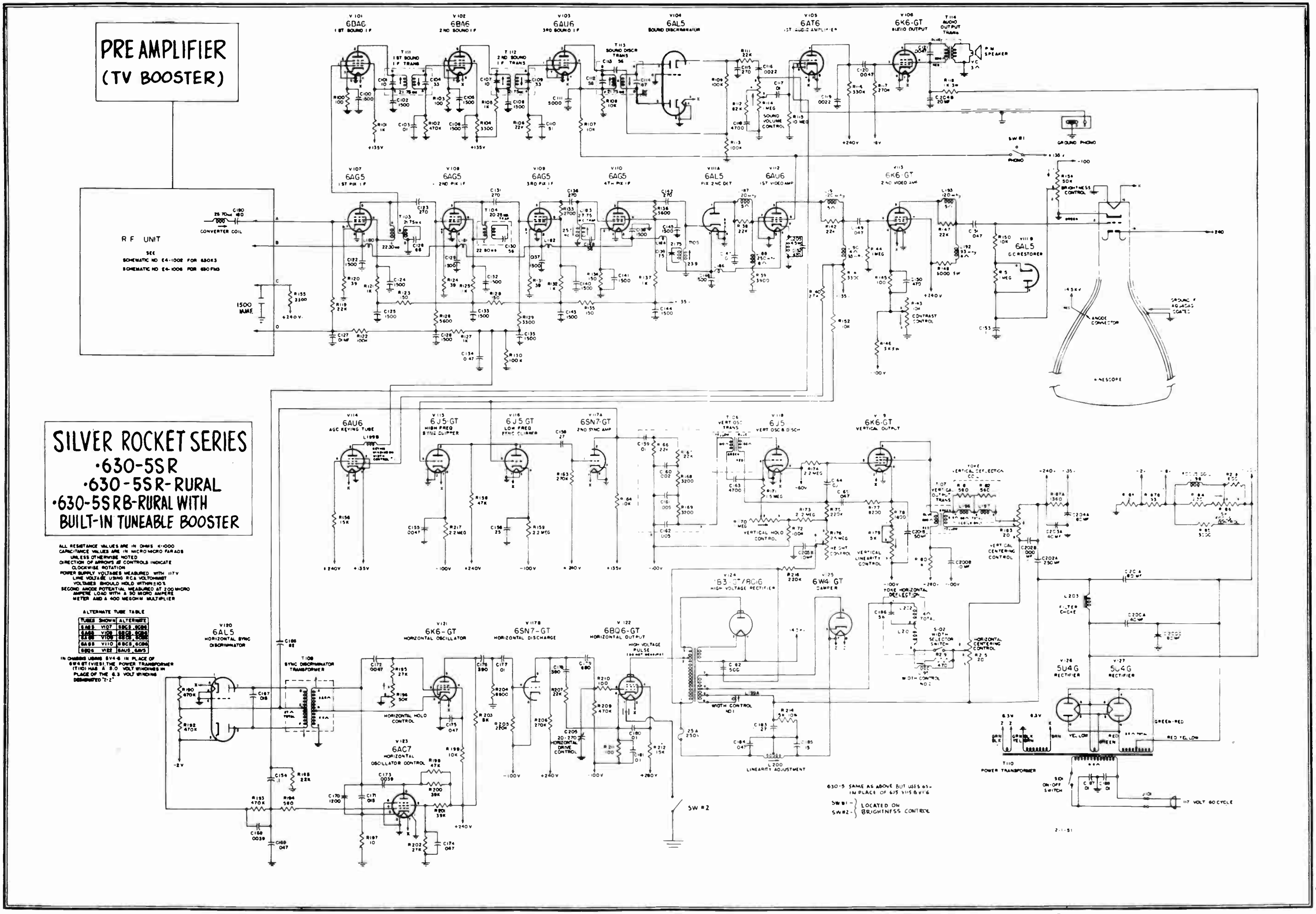
CIRCUIT SYMBOL	TUBE TYPE	PIN #1	PIN #2	PIN #3	PIN #4	PIN #5	PIN #6	PIN #7	PIN #8
V-101	6BA6	0	0	0	0	18K	18K	100	-
V-102	6BA6	600K	0	0	0	18K	20K	100	-
V-103	6AU6	22K	0	0	0	8.2K	8.2K	0	-
V-104	6AL5	190K	94K	0	0	0	0	94K	-
V-105	6AT6	12.5 meg.	0	0	0	20K	20K	430K	-
V-106	6K6GT	TP100	0	16K	16K	270K	TP330K	0	0
V-107	6CB6	230K	39	0	0	16K	16K	39	-
V-108	6CB6	96K	40	0.15	0	16K	16K	40	-
V-109	6CB6	92K	37	0.15	0	18K	15.5K	37	-
V-110	6CB6	0.4	130	0	0	21K	15.5K	130	-
V-111	6AL5	0.4	13.5	0	0	930K	0	3.9K	-
V-112	6AU6	3.9	0	0	0	18K	14K	0.3	-
V-113	6K6GT	NC	0	25K	22K	1.1 meg.	3.9K	0	6.K
V-114	6AU6	44K	14K	0	0	87K	28K	14K	-
V-115	6J5GT	0	0	62K	NC	27K	14.5K	0	2.meg.
V-116	6J5GT	0	0	62K	NC	27K	15K	0	2.2 meg.
V-117	6SN7GT	310K	24K	0	230K	275K	580	0	0
V-118	6J5	0	0	0.48meg.	86K	1.6meg.	56K	0	580
V-119	6K6GT	55K	0	16K	16K	2.2meg.	0.75K	0	2.6K
V-120	6AL5	1.4meg.	700K	0	0	12	0	700K	-
V-121	6K6GT	NC	0	20K	24K	30K	28K	0	9
V-122	6BG6	NC	0	10K	Inf.	450K	NC	0	15K
V-123	6AC7	0	0	0	1.8meg.	9	19K	0	40K
V-124	1B3GT	NC	Inf.	NC	NC	NC	NC	Inf.	-
V-125	6W4GT	TP	NC	28K	14.5K	14.5K	15K	28K	28K
V-126	5U4G	NC	15K	NC	570	NC	570	NC	15K
V-127	5U4G	NC	15K	NC	570	NC	570	NC	15K

All measurements were made with a Senior Voltohmyst VTVM. Measurements were made with the Focus Coil and Deflection Yoke connected but without a kinescope. The resistance measurements were made with no power applied to the chassis.

All readings were taken under the following conditions unless otherwise noted:

Focus Control in center position.
Brightness Control in maximum counter-clockwise position (minimum brightness) just before Phono switch clicks.
All readings are in ohms and measured to ground.
Measured with R.C.A. voltohmyst.
All controls in maximum clockwise position.

NC - No Connection
TP - No tube connection - used as a tie point


PRE AMPLIFIER
(TV BOOSTER)
SILVER ROCKET SERIES
·630-5SR
·630-5SR-RURAL
·630-5SRB-RURAL WITH
BUILT-IN TUNEABLE BOOSTER
RF UNIT
KINESCOPE
6BA6
6AU6
6AL5
6AT6
6K6-GT
6AG5
6J5-GT
6J5 GT
6SN7-GT
6J5
1B3-GT/8016
6W4-GT
6BQ6-GT
6AC7
5U4G
SW #2

SPECIFICATIONS

ELECTRICAL INPUT - - - - - - - - - - - - - - - -	117 Volts A.C., 60 cycles
RF FREQUENCY RANGE - - - - - - - - - - - - - -	Channels 2 through 13 54-88MC, 174-216 MC
INTERMEDIATE FREQUENCY - - - - - - - - - - - -	Video 26.1 MC Sound 21. 6MC Intercarrier Sound Freq. 4.5MC
ANTENNA INPUT- - - - - - - - - - - - - - - - -	300 ohms, Balanced

Re-Adjust the beam bender or ion trap if necessary.

*The chassis contains electrostatically focused picture tubes. These tubes will ordinarily have the focus electrode wired to the 140 volt B+supply. Due to line voltage variations, however, it may become necessary to raise or lower the voltage on this electrode for best focus. Any well filtered voltage from zero, or ground, to a positive 400 volts is permissable on this electrode. If satisfactory focus is not obtained within this range of voltages, re-check the width and horizontal drive adjustments. If these adjustments are found to have been correctly made, check the second anode voltage on the picture tube. For this measurement, a voltmeter which will range to at least fifteen thousand volts is necessary. The picture tube second anode voltage should range between 11.5 and 13.5K.V. positive. The picture is centered by means of a centering magnet, located just to the rear of the deflection yoke, in the position formerly occupied by the focus unit. This magnet may be rotated in any direction to correctly center the pattern. When this ring is in a vertical plane, the thumbscrew will adjust vertical centering. When the ring is in a horizontal plane, horizontal centering will be effected by adjustment of the thumbscrew. (See assembly instruction.)

Alignment Procedure

Necessary Equipment:
- Television Sweep Generator
- Marker Frequency Generator
- Vacuum Tube Voltmeter
- 4.5MC CrystallGenerator, or equivalent, Oscilloscope

Sound I.F. Alignment

1. Connect 4.5MC generator to the grid of the video amplifier tube. Low signal level is important here. Metering may be accomplished at the sound take-off point of the rationdetector (at the juncture of R-155 and C-160) with the meter ground connected to pin eight of the 6V6.

2. Adjust the slug of L-18 (sound take-off coil) for maximum negative meter indication. Attenuate the output of the generator so that not more than five volts is measured on the meter, as the alignment progresses.

3. Adjust the top slug of T-5 (ratio det. primary) for the maximum negative reading. This adjustment is on the bottom for sets employing TS-10062 for T-5.

4. Move the meter ground to the juncture of two 100K 1% resistors placed across R-156 in the sound detector circuit, and adjust the bottom (top for TS-10062) slug of T-5 (ratio det.) for zero voltage. The other meter lead remains connected as in step 1. No. 4.5MC trap adjustment is necessary. The trap consists of a coil L-17 which is self-resonant at 4.5MC.

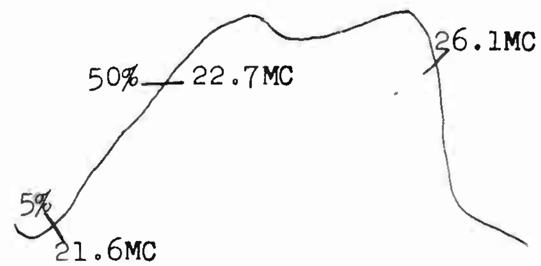
Video I.F. Alignment

The I.F. amplifier contains five tuned circuits, no traps being necessary The video carrier is passed through the I.F. at a freq. of 26.1MC, and the sound carrier at 21.6MC. Extreme care must be taken in alignment, to assure that the sound carrier is attenuated substantially below the level of the video carrier. This is necessary to assure that the slight AM modulation on the sound carrier due to picture modulation will be sufficiently low to be removed by the detector, and not produce spurious phase modulation of the sound I.F. A band width of 3.4MC (6DB down) with a stage gain of from 12 to 15 times is attained. Earlier sets employed a staggered quintuple, which resulted in a different order of stagger of the I. F. coils. (See peaking frequencies below.) These sets may be identified by the values of the grid load resistors on the last two I.F. amplifier tubes, (R-109 and R-113) 6800 ohms. In the later sets, employing a staggered double, the third I.F. grid resistor, R-109, is 10,000 ohms, while the fourth, R-113 remains 6800. Another difference which will serve to help identify the quintuple stagger, lies in the wiring of the A.G.C. to the second I.F. amplifier. In the staggered quintuple alignment, the grid return of the tube is wired directly to the .1 mfd. A.G.C. filter capacitor (C-106). In the staggered triple-staggered double alignment, a 470 ohm resistor (R-106) and a .001 mfd. capacitor (C-105) have been added as additional A.G.C. decoupling.

Peaking Frequencies

Adjust curve for band width of 3.4MC.

1st IF tuner slug to high side	25.9
2nd IF slug to middle of band	24.3
3rd IF slug to low side	23.1
4th IF slug to low side	22.9
5th IF slug to high side	25.7



Use only sufficient input to give pattern on scope with scope vertical control at maximum gain.

Should A.G.C. be developed with this decreased input apply a D.C. battery of -3V. to A.G.C. line and align as above .

An I.F. alignment signal is best introduced to the chassis by means of a suitable cup, or tube shield floated over the mixer tube to capacity couple the signal to the plate circuit. It may be necessary to disable the local oscillator* to prevent R.F. harmonics from distorting the trace on the scope screen. The oscilloscope is connected to the grid of the video amplifier, through a 100,000 ohm isolating resistor. Metering is done on the A.G.C. line, keeping the input attenuated to produce no more than a negative 1 volt reading. The resulting overall response should coincide with the curve shown below.

*A dummy 6J6 may be substituted for the mixer tube with the #1 pin removed, to facilitate alignment.

R.F. Alignment

The R.F. tuner in the receiver has to be pre-aligned by the manufacturer and adjustment in the field is not recommended. It may be necessary on occasional sets, however, to re-set the local oscillator tuning slug. This may be accomplished without test equipment, if it is possible to receive a signal of good quality, and if the I.F. and R.F. portions of the set are functioning correctly. Simply set the fine tuning in the center of its range and adjust the oscillator slug for best picture detail. The oscillator adjustment is recessed in a hole in the tuner front directly to the right of the tuner shaft. This adjustment must be checked on each channel to be received. It is important that a non-metalic alignment screwdriver be used to prevent detuning when the adjustment is completed and the screwdriver withdrawn. On sets using a wooden front panel, a small hole is proved under the flanged tuner knob which will accommodate this alignment tool, and make possible re-setting the osc. slug without removing the set from its cabinet. If a signal of sufficient strength is not available, oscillator adjustment may be made with the sweep generator connected as for I.F. alignment, and the video R.F. carrier frequency applied to the antenna terminals of the receiver from an accurately calibrated signal generator. With the hook-up outlined above, a pip, or marker indicating the video carrier for the particular channel being set will appear on the I.F. response curve. This pip will ride up and down on the curve, when the fine tuning control is moved, and the oscillator is correctly set when the pip is passing through the point on the curve marked 26.1 in Fig. 5, with the fine tuning at the center of its rotation.

NO SIGNAL VOLTAGE MEASUREMENTS

TUBE	APPLICATION	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
6AU6	1st I.F. Amp.	0-1.5	0	0	6.3AC	140	140	+.7-1.2		
6AU6	2nd I.F. Amp.	0-1.5	0	0	6.3AC	140	140	+.7-1.2		
6CB6	3rd I.F. Amp.	0	1.8	0	6.3AC	140	140	0		
6CB6	4th I.F. Amp.	0	1.9	0	6.3AC	140	140	0		
12BY7	Video Amp.	+5to3.0	-1.0to-3.0	0	6.3AC	6.3AC	0	220-290	140	
6AU6	Sound I.F.Amp.	140	140	60	60	200	45	140		
6AL5	Ratio Detector	-11	-11	6.3AC	0	0	NC	-22		
12AU7	Sync. Amp. & Clipper	+15	0	+4to+18	6.3AC	6.3AC	+120	0to-45	0	0
12AX7	Horiz. Phase Det. & 1st Audio	+100	-.5	0	6.3AC	6.3AC	+6.5to8.2	-1.0to3.3	+1.0to4.8	0
6SN7	Horiz. Osc.	-1.0to+3.3	+275	+10to-12	-7to-9	+130	+10to-12	0	6.3AC	
6BG6	Horiz.Output	+.6	0	0	+8	-19to-36	NC	6.3AC	+280	
									CAP DO NOT MEASURE	
6W4	Damper	NC	NC	+500 to +575	NC	+360	NC	+200	+200	
6SN7	Vert. Multi. Vibrator	-17to-30	+70to+150	+1.0	0	+24to-40	+1	6.3AC	-17to-30	
6SN7	Vert. Output	+.2 NC	+290 to +450	0 to +24	+.2	+290 to +450	0 to+24	6.3AC	0	
*6V6	Audio Output	NC	+60	+200	+200	-5to-15	NC	+60	0	
5U4	L.V. Rectifier	NC	+400	NC	360AC	NC	360AC	NC	+400	
1B3	H.V. Rectifier			DO NOT MEASURE						
6AU6	AGC-Keyer	+220to350	+350	+200	+200	0	+450	+350		
6V3	24" Damper	NC	NC	NC	200	200	NC	+350	+650 CAP	
6AH4	24" Vert. Output	0	0	NC	NC	300	NC	6.3AC	0to+25	
6CD6	24" Horiz. output	+8	0	0	+8	-15	NC	6.3AC	+140	

* Readings taken from Pin Socket with +140 as common negative reference.

1. Where readings may vary according to control settings, min. & max. readings are given.
2. Measurements are from socket pin to chassis, unless otherwise stated.
3. All measurements taken with line voltage maintained at 117 A.C.

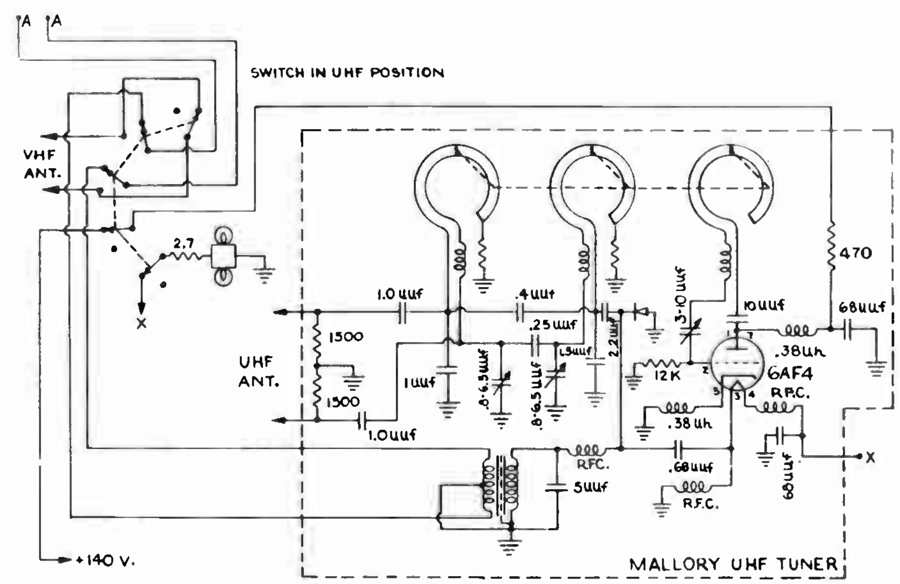
IMPORTANT NOTICE

In previous models, the filament winding on the power transformer which supplied heater voltage to the 6W4 was connected directly to the positive 140 volt supply. This was done to minimize the potential between heater and cathode of the 6W4 damper.

In these models, this heater winding is maintained at a positive 220 volts by means of a voltage divider connected between B+ and ground. The filament winding is bypassed by a .05mfd 600 volt capacitor to ground.

Below is a circuit diagram which shows the interconnections between the U.H.F. tuner unit and the V.H.F. tuner. The switch mentioned above performs the following functions:

1. Transfers the V.H.F. tuner input from the V.H.F. antenna to the output of the U.H.F. unit.
2. Shorts the V.H.F. antenna when switched to U.H.F.
3. Applies B+ to U.H.F. unit for its oscillator supply.
4. Supplies filament voltage for U.H.F. dial lights.



SCHEMATIC
MALLORY UHF TUNER
XXB-10815

CAUTION:
ION TRAP SHOULD BE MOVED CIRCULARLY AND LATERALLY ON NECK OF PICTURE TUBE FOR BRIGHTEST PICTURE WHEN BRILLIANCE CONTROL IS SET AT SLIGHTLY MORE THAN NORMAL VIEWING BRILLIANCY.

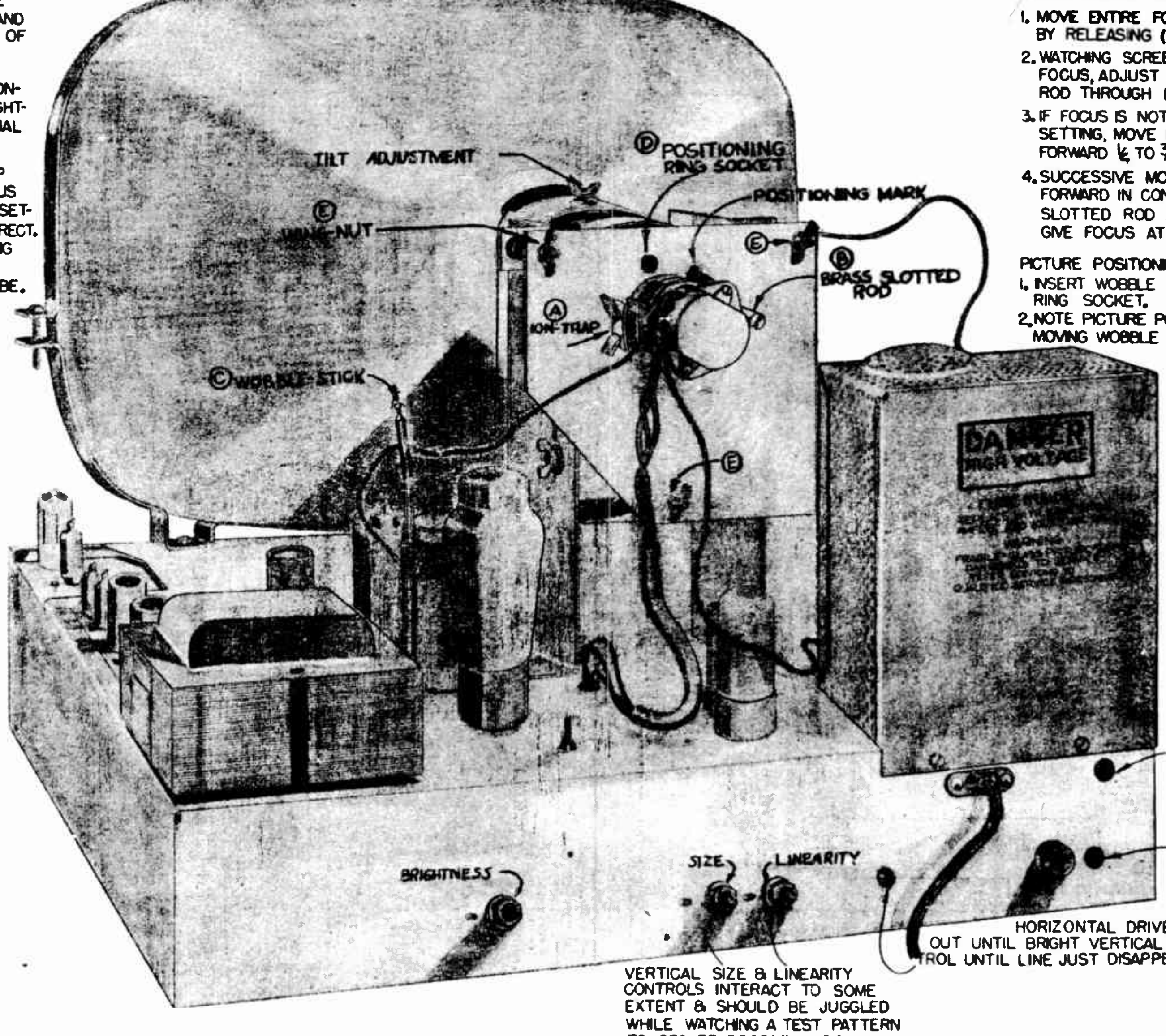
NEVER USE ION TRAP TO POSITION OR FOCUS PICTURE. ONLY ONE SETTING OF TRAP IS CORRECT. AN INCORRECT SETTING WILL PERMANENTLY DAMAGE PICTURE TUBE.

FOCUS ADJUSTMENT:

1. MOVE ENTIRE FOCUS UNIT TO REAR BY RELEASING (3) WING NUTS.
2. WATCHING SCREEN FOR SHARPEST FOCUS, ADJUST BRASS SLOTTED ROD THROUGH ENTIRE RANGE.
3. IF FOCUS IS NOT REACHED WITH THIS SETTING, MOVE ENTIRE ASSEMBLY FORWARD 1/8 TO 3/8" AND REPEAT STEP 2.
4. SUCCESSIVE MOVING OF THE UNIT FORWARD IN CONJUNCTION WITH BRASS SLOTTED ROD ADJUSTMENT, WILL GIVE FOCUS AT SOME POINT.

PICTURE POSITIONING:

1. INSERT WOBBLE STICK IN POSITIONING RING SOCKET.
2. NOTE PICTURE POSITION IN MIRROR WHILE MOVING WOBBLE STICK FOR PICTURE CENTERING.



HORIZONTAL SIZE

HORIZONTAL LINEARITY SHOULD BE ADJUSTED WHILE WATCHING A TEST PATTERN.

HORIZONTAL DRIVE CONTROL SHOULD BE TURNED OUT UNTIL BRIGHT VERTICAL LINE APPEARS. SCREW IN CONTROL UNTIL LINE JUST DISAPPEARS. THIS IS PROPER SETTING.

VERTICAL SIZE & LINEARITY CONTROLS INTERACT TO SOME EXTENT & SHOULD BE JUGGLED WHILE WATCHING A TEST PATTERN TO SECURE PROPER VERTICAL SIZE & LINEARITY.

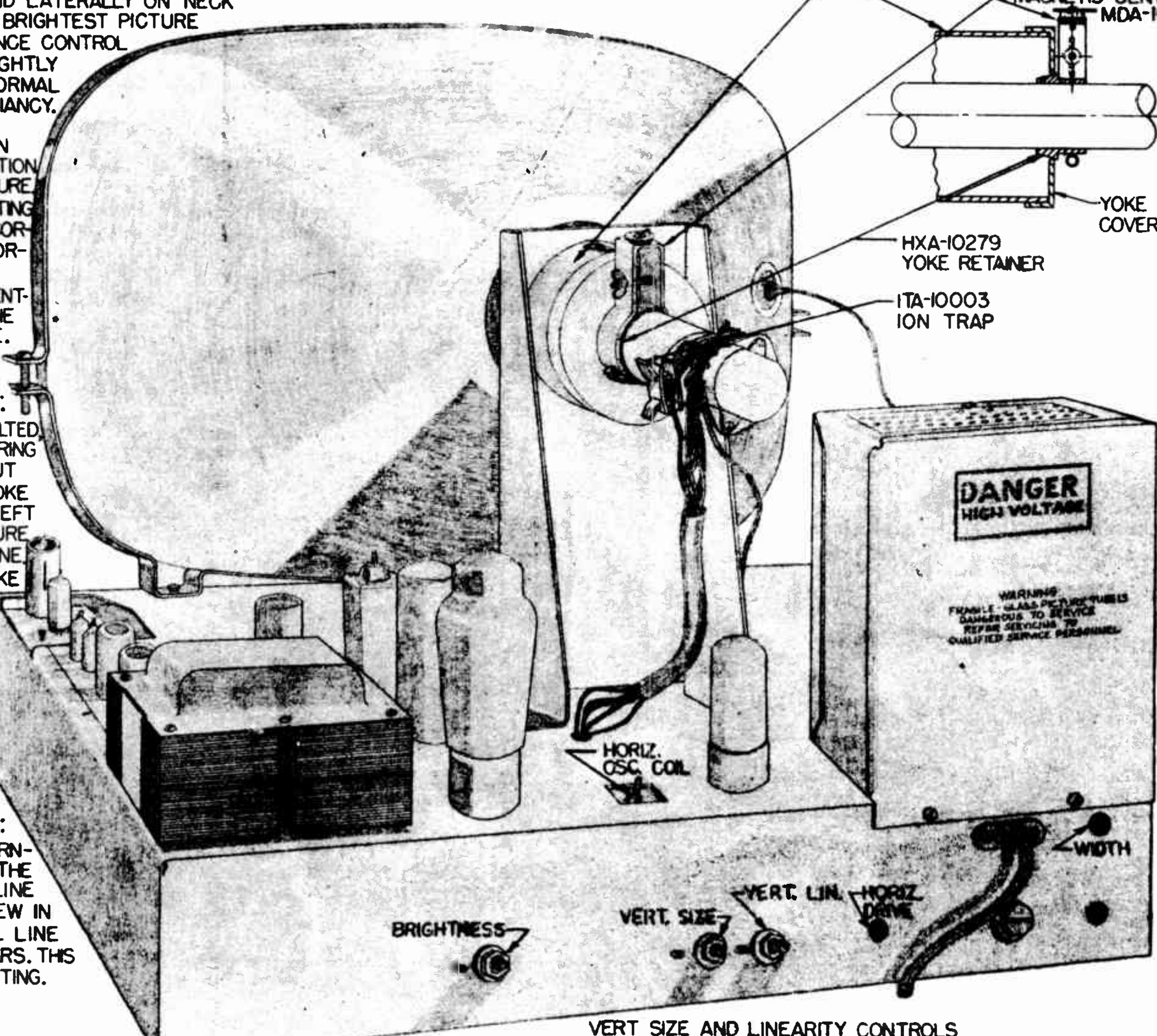
REAR VIEW OF CHASSIS
XXD-10691

CAUTION: ION TRAP SHOULD BE MOVED CIRCULARLY AND LATERALLY ON NECK OF TUBE FOR BRIGHTEST PICTURE WHEN BRILLIANCE CONTROL IS SET AT SLIGHTLY MORE THAN NORMAL VIEWING BRILLIANCY.

NEVER USE ION TRAP TO POSITION OR FOCUS PICTURE. ONLY ONE SETTING OF TRAP IS CORRECT. AN INCORRECT SETTING WILL PERMANENTLY DAMAGE THE PICTURE TUBE.

PICTURE ANGLE:
IF PICTURE IS TILTED, LOOSEN CENTERING DEVICE WING NUT AND ROTATE YOKE TO RIGHT OR LEFT TO BRING PICTURE INTO HORIZ. PLANE. BE CERTAIN YOKE REMAINS SEATED AGAINST CRT BELL. RECHECK CENTERING DEVICE & ION TRAP & TIGHTEN WING NUT.

HORIZONTAL DRIVE CONTROL:
SHOULD BE TURNED OUT UNTIL THE BRIGHT VERT. LINE APPEARS. SCREW IN CONTROL UNTIL LINE JUST DISAPPEARS. THIS IS PROPER SETTING.



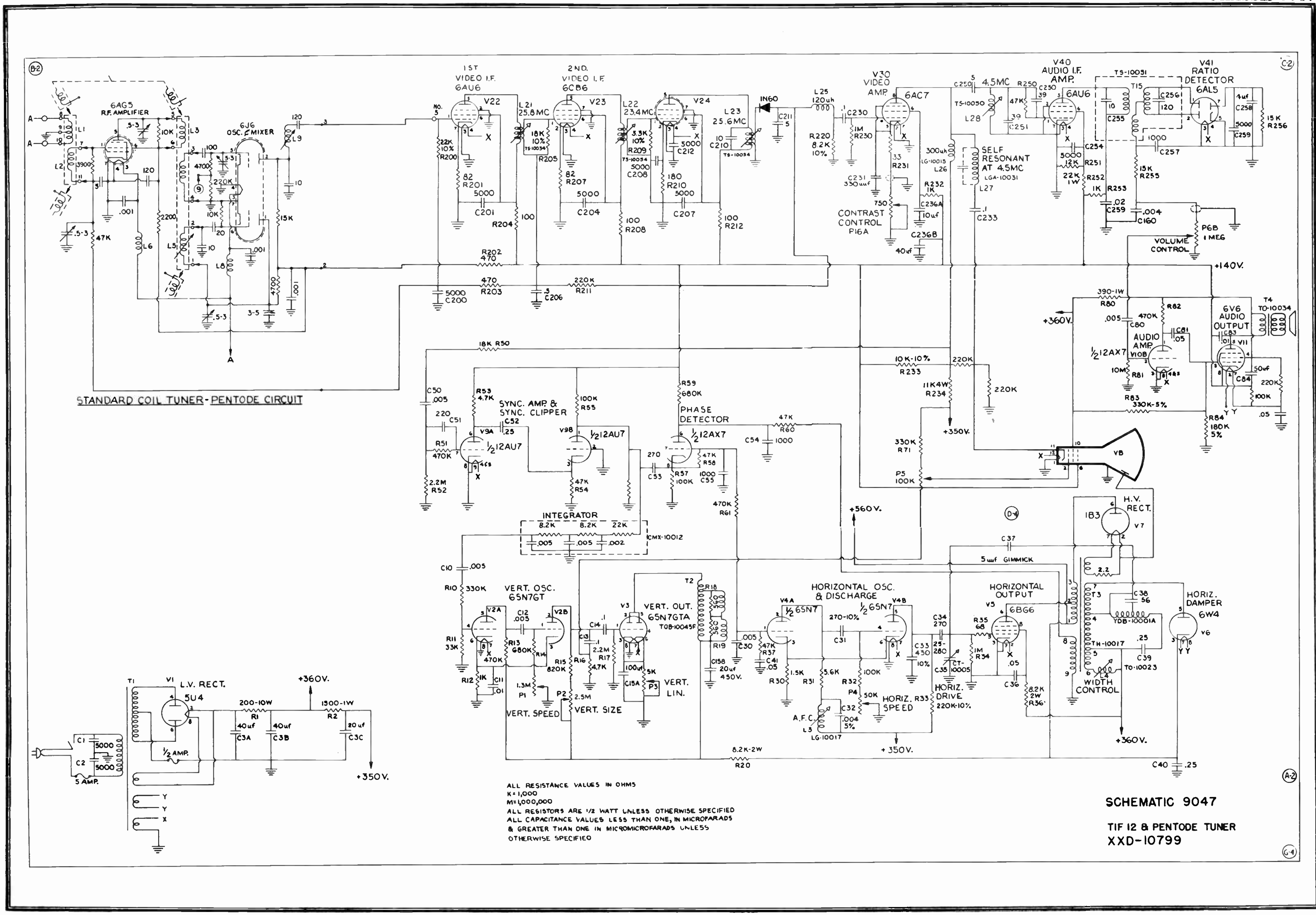
TO PROPERLY ASSEMBLE THE YOKE CENTERING DEVICE AND ION TRAP ON THE PICTURE TUBE REFER TO ILLUSTRATION. THE PURPOSE OF THE YOKE RETAINER (RUBBER SLEEVE WITH CONE SHAPED END) IS TO CENTER THE BACK OF THE YOKE ON THE PICTURE TUBE NECK AND HOLD THE YOKE AGAINST THE PICTURE TUBE.

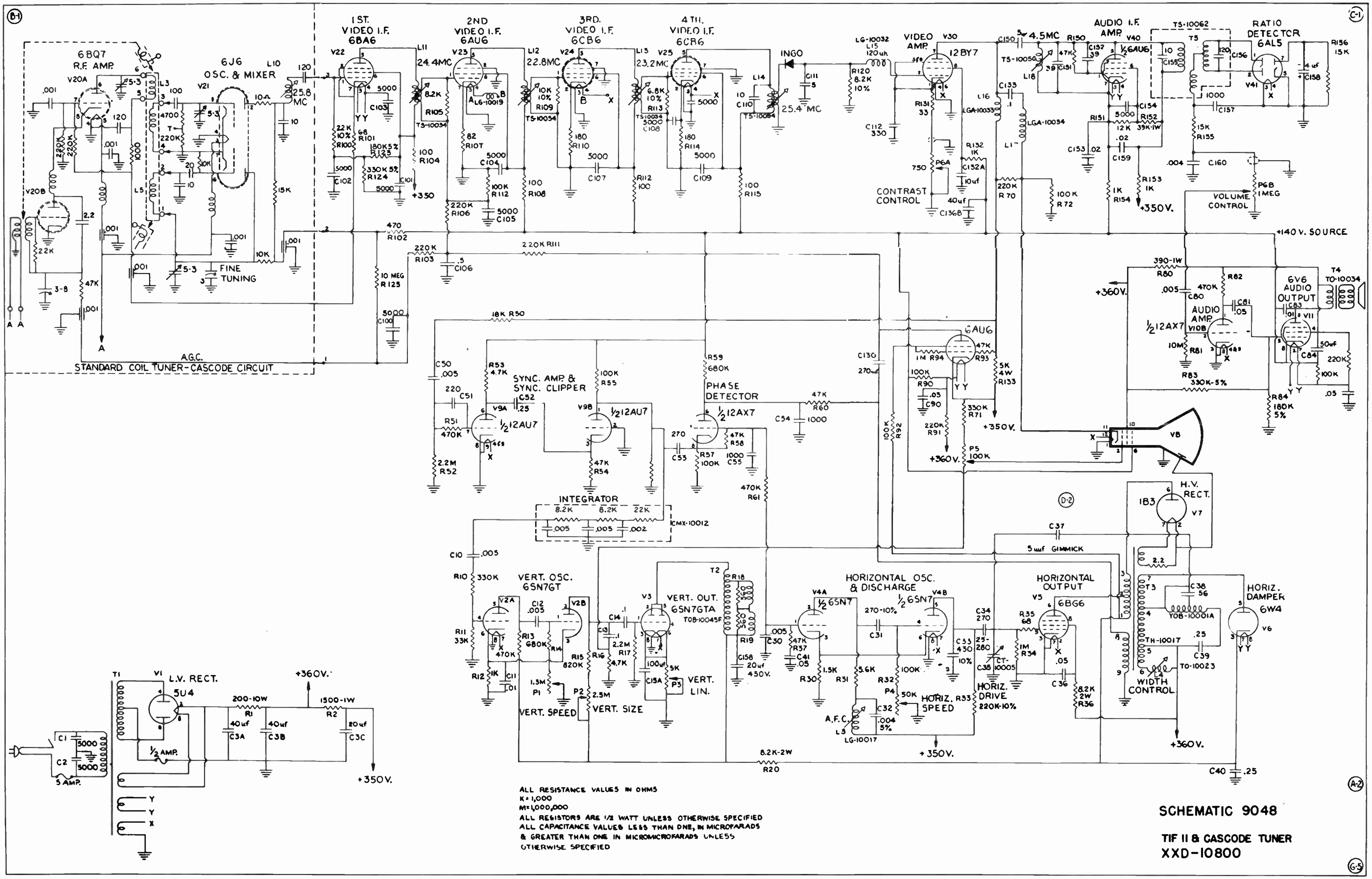
TO ASSEMBLE, HOLD THE YOKE IN POSITION AND SLIP THE PICTURE TUBE NECK THROUGH THE YOKE AND FIRMLY SEAT THE PICTURE TUBE IN ITS HARDWARE.

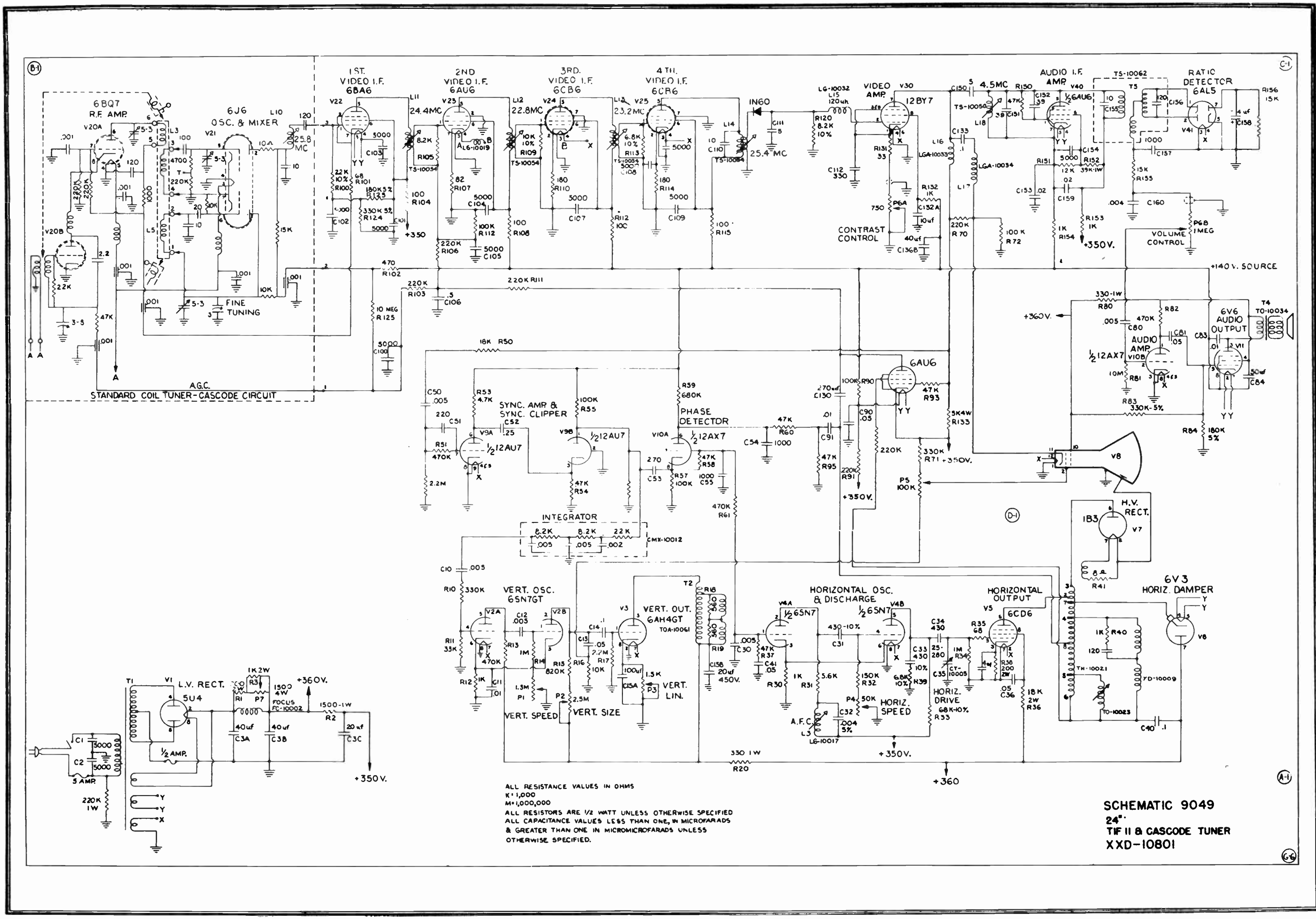
AFTER THE TUBE IS FASTENED SECURELY, CENTER THE YOKE ON TUBE NECK BY SLIDING THE YOKE RETAINER ON THE NECK WITH THE CONE PORTION TOWARD THE YOKE.
INSERT THE YOKE RETAINER IN THE REAR OF THE YOKE AND CENTER THE YOKE AT THE SAME TIME HOLDING THE YOKE AGAINST THE TUBE BELL. SLIP THE CENTERING DEVICE AROUND THE SLEEVE PORTION OF THE YOKE RETAINER WITH CLAMPING SCREW LOOSENED. INSTALL THE ION TRAP AND PICTURE TUBE SOCKET AND ADJUST THE ION TRAP. CENTER THE PICTURE BY BOTH ADJUSTING THE KNOB ON THE CENTERING DEVICE AND ROTATING THE CENTERING DEVICE AROUND THE SLEEVE PORTION OF THE YOKE RETAINER.
AFTER THE CENTERING HAS BEEN ACCOMPLISHED, TIGHTEN THE WING NUT ON THE CENTERING DEVICE TO HOLD THE YOKE IN PLACE. RECHECK THE ION TRAP ADJUSTMENT.

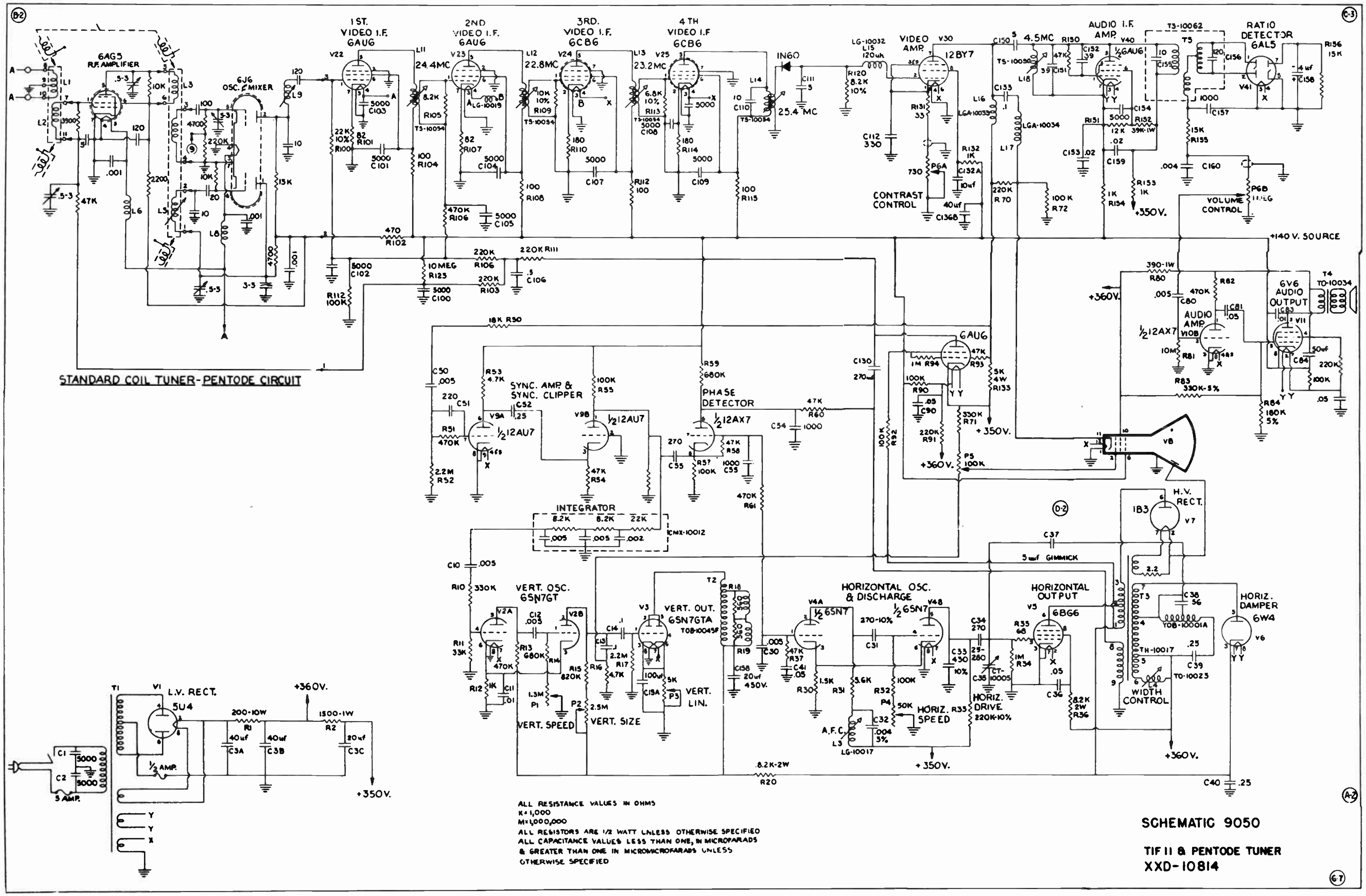
VERT SIZE AND LINEARITY CONTROLS INTERACT TO SOME EXTENT AND SHOULD BE JUGGLED WHILE WATCHING A TEST PATTERN TO SECURE PROPER SIZE & LINEARITY.

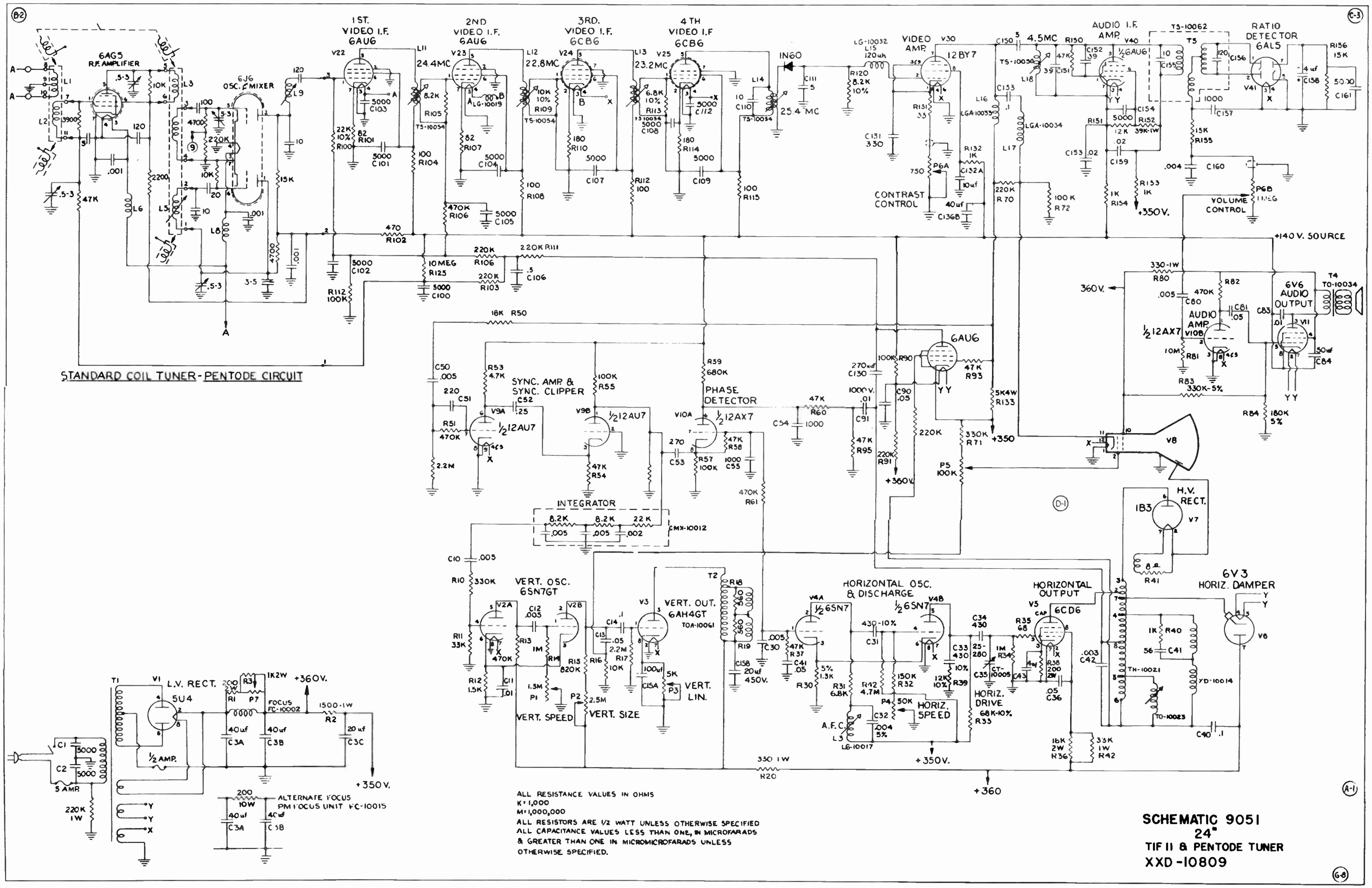
REAR VIEW OF CHASSIS
XXD-10707

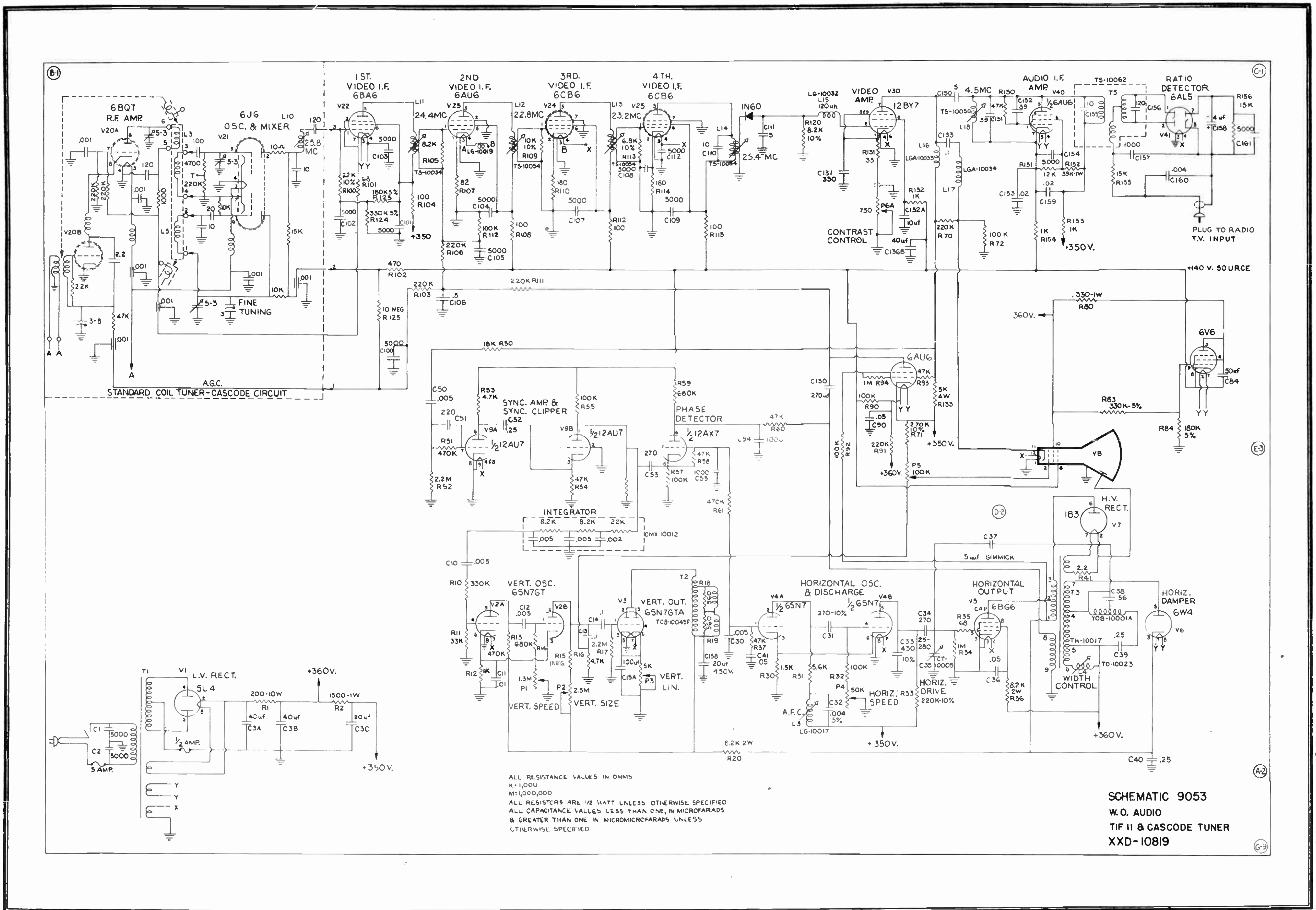

6AG5 R.F. AMPLIFIER
6J6 OSC. & MIXER
STANDARD COIL TUNER - PENTODE CIRCUIT
1ST VIDEO I.F. 6AU6 V22
2ND. VIDEO I.F. 6CB6 V23
V24
IN60
V30 VIDEO AMP. 6AC7
CONTRAST CONTROL P16A
SELF RESONANT AT 4.5MC
V40 AUDIO I.F. AMP. 6AU6
V41 RATIO DETECTOR 6AL5
VOLUME CONTROL
+140V.
+360V.
6V6 AUDIO OUTPUT V11
1/2 12AX7 AUDIO AMP. V10B
SYNC. AMP. & SYNC. CLIPPER
V9A 1/2 12AU7
V9B 1/2 12AU7
PHASE DETECTOR 1/2 12AX7
+350V.
VB
INTEGRATOR
CMX-10012
+560V.
H.V. RECT. 1B3 V7
5uuf GIMMICK
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
VERT. SPEED
VERT. SIZE
VERT. LIN.
HORIZONTAL OSC. & DISCHARGE
1/2 6SN7
A.F.C.
HORIZ. SPEED
HORIZ. DRIVE
HORIZONTAL OUTPUT 6BG6
WIDTH CONTROL
HORIZ. DAMPER 6W4
L.V. RECT. 5U4
1/2 AMP.
5 AMP.
+360V.
+350V.
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED
SCHEMATIC 9047
TIF 12 & PENTODE TUNER
XXD-10799

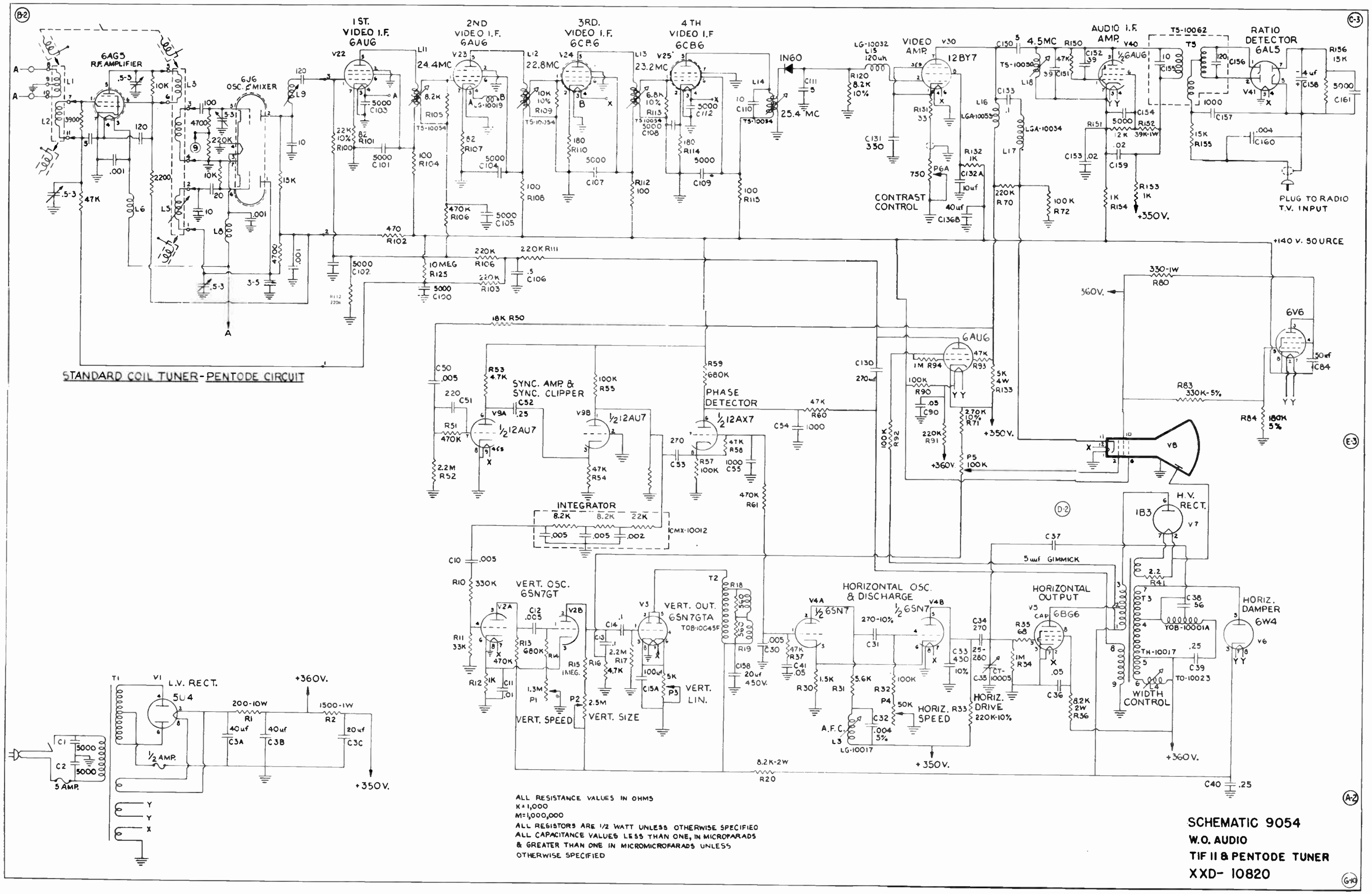

6BQ7
R.F. AMP.
6J6
OSC. & MIXER
1 ST. VIDEO I.F. 6BA6
2ND VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4 TH. VIDEO I.F. 6CB6
IN60
VIDEO AMP. 12BY7
AUDIO I.F. AMP. 1/2 6AU6
RATIO DETECTOR 6AL5
FINE TUNING
A.G.C.
STANDARD COIL TUNER-CASCODE CIRCUIT
CONTRAST CONTROL
VOLUME CONTROL
+140 V. SOURCE
6V6 AUDIO OUTPUT
AUDIO AMP. 1/2 12AX7
SYNC. AMP. & SYNC. CLIPPER
PHASE DETECTOR
INTEGRATOR
H.V. RECT. 1B3
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
HORIZONTAL OSC. & DISCHARGE
HORIZONTAL OUTPUT 6BG6
HORIZ. DAMPER 6W4
L.V. RECT. 5U4
VERT. SPEED
VERT. SIZE
VERT. LIN.
A.F.C.
HORIZ. SPEED
HORIZ. DRIVE
WIDTH CONTROL
5 uuf GIMMICK
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED
SCHEMATIC 9048
TIF II & CASCODE TUNER
XXD-10800

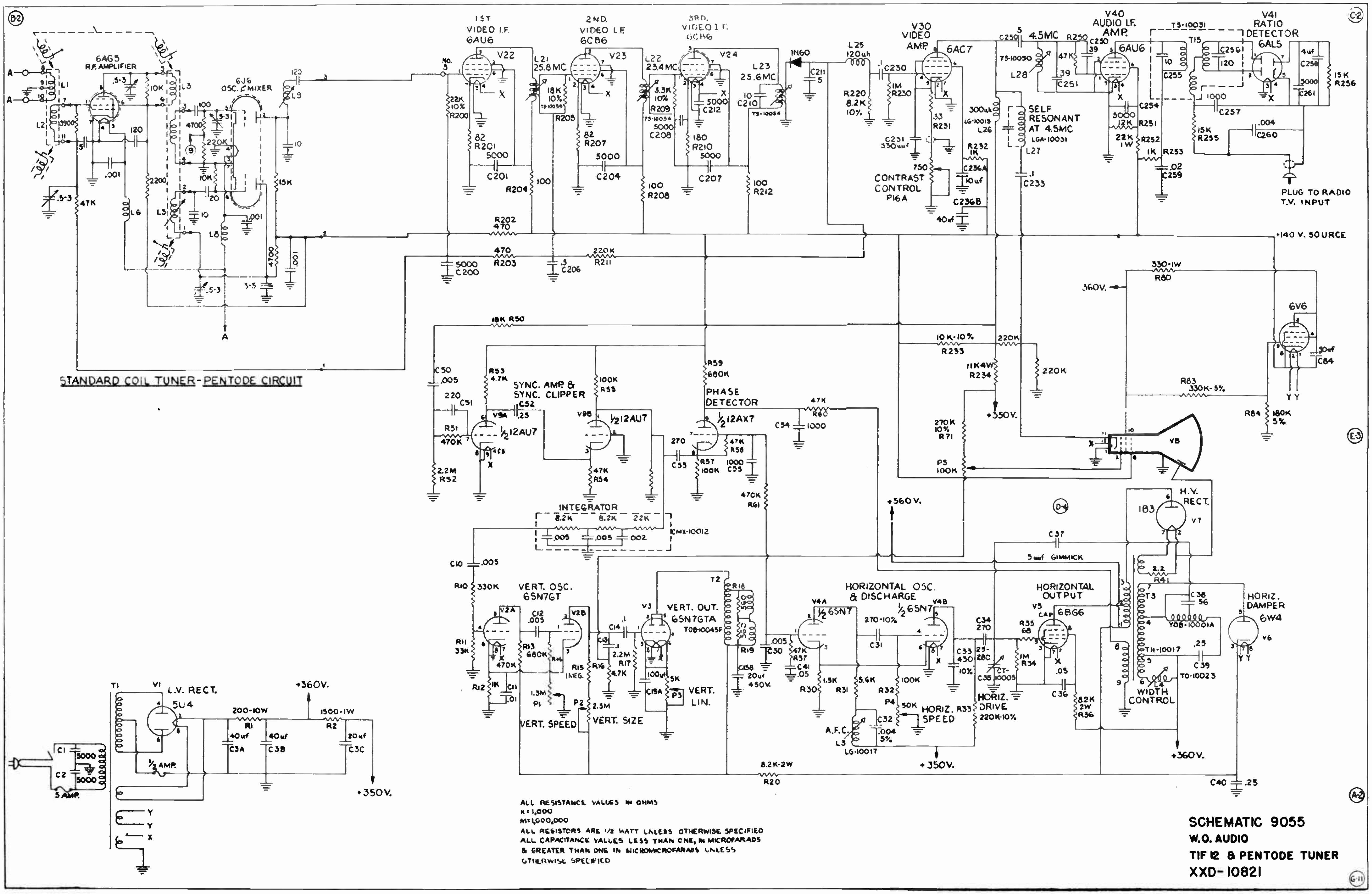

6BQ7 R.F. AMP.
6J6 OSC. & MIXER
STANDARD COIL TUNER-CASCODE CIRCUIT
FINE TUNING
A.G.C.
1ST. VIDEO I.F. 6BA6
2ND VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4TH. VIDEO I.F. 6CB6
IN60
VIDEO AMP. 12BY7
CONTRAST CONTROL
4.5MC
AUDIO I.F. AMP. 1/2 6AU6
RATIO DETECTOR 6AL5
VOLUME CONTROL
+140 V. SOURCE
6V6 AUDIO OUTPUT
AUDIO AMP. 1/2 12AX7
SYNC. AMP. & SYNC. CLIPPER 1/2 12AU7
PHASE DETECTOR 1/2 12AX7
6AU6
INTEGRATOR
H.V. RECT. 1B3
VERT. OSC. 6SN7GT
VERT. OUT. 6AH4GT
HORIZONTAL OSC. & DISCHARGE 1/2 6SN7
HORIZONTAL OUTPUT 6CD6
6V3 HORIZ. DAMPER
A.F.C.
HORIZ. SPEED
HORIZ. DRIVE
VERT. SPEED
VERT. SIZE
VERT. LIN.
L.V. RECT. 5U4
FOCUS
+360V.
+350V.
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED.
SCHEMATIC 9049
24"
TIF II & CASCODE TUNER
XXD-10801


STANDARD COIL TUNER-PENTODE CIRCUIT
6AG5
R.F. AMPLIFIER
6J6
OSC. & MIXER
1ST. VIDEO I.F. 6AU6
2ND VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4TH VIDEO I.F. 6CB6
24.4MC
22.8MC
23.2MC
25.4 MC
1N60
VIDEO AMP. 12BY7
CONTRAST CONTROL
4.5MC
AUDIO I.F. AMP. 1/2 6AU6
RATIO DETECTOR 6AL5
VOLUME CONTROL
+140 V. SOURCE
6V6 AUDIO OUTPUT
AUDIO AMP 1/2 12AX7
6AU6
SYNC. AMP. & SYNC. CLIPPER
1/2 12AU7
PHASE DETECTOR
1/2 12AX7
INTEGRATOR
H.V. RECT. 1B3
5uuf GIMMICK
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
VERT. SPEED
VERT. SIZE
VERT. LIN.
HORIZONTAL OSC. & DISCHARGE
1/2 6SN7
HORIZ. DRIVE
HORIZ. SPEED
A.F.C.
HORIZONTAL OUTPUT 6BG6
HORIZ. DAMPER 6W4
WIDTH CONTROL
L.V. RECT. 5U4
1/2 AMP.
5 AMP.
+360V.
+350V.
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED
SCHEMATIC 9050
TIF II & PENTODE TUNER
XXD-10814


1 ST. VIDEO I.F. 6AU6
2ND VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4 TH VIDEO I.F 6CB6
6AG5 R.F. AMPLIFIER
6J6 OSC. & MIXER
STANDARD COIL TUNER-PENTODE CIRCUIT
VIDEO AMP. 12BY7
AUDIO I.F. AMP. 1/2 6AU6
RATIO DETECTOR 6AL5
CONTRAST CONTROL
VOLUME CONTROL
+140 V. SOURCE
6V6 AUDIO OUTPUT
AUDIO AMP. 1/2 12AX7
SYNC. AMP & SYNC. CLIPPER 1/2 12AU7
PHASE DETECTOR 1/2 12AX7
INTEGRATOR
H.V. RECT. 1B3
VERT. OSC. 6SN7GT
VERT. OUT. 6AH4GT
VERT. LIN.
VERT. SPEED
VERT. SIZE
HORIZONTAL OSC. & DISCHARGE 1/2 6SN7
HORIZONTAL OUTPUT 6CD6
6V3 HORIZ. DAMPER
HORIZ. DRIVE
HORIZ. SPEED
A.F.C.
L.V. RECT. 5U4
FOCUS FC-10002
ALTERNATE FOCUS PM FOCUS UNIT FC-10015
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED.
SCHEMATIC 9051
24"
TIF II & PENTODE TUNER
XXD-10809


STANDARD COIL TUNER-CASCODE CIRCUIT
6BQ7 R.F. AMP.
6J6 OSC. & MIXER
FINE TUNING
A.G.C.
1ST. VIDEO I.F. 6BA6
2ND VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4 TH. VIDEO I.F. 6CB6
IN60
VIDEO AMP. 12BY7
CONTRAST CONTROL
AUDIO I.F. AMP. 1/2 6AU6
RATIO DETECTOR 6AL5
PLUG TO RADIO T.V. INPUT
+140 V. SOURCE
SYNC. AMP. & SYNC. CLIPPER 1/2 12AU7
PHASE DETECTOR 1/2 12AX7
INTEGRATOR
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
VERT. SPEED
VERT. SIZE
VERT. LIN.
HORIZONTAL OSC. & DISCHARGE 1/2 6SN7
HORIZ. SPEED
HORIZ. DRIVE
HORIZONTAL OUTPUT 6BG6
H.V. RECT. 1B3
HORIZ. DAMPER 6W4
WIDTH CONTROL
L.V. RECT. 5U4
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED
SCHEMATIC 9053
W.O. AUDIO
TIF II & CASCODE TUNER
XXD-10819


1ST. VIDEO I.F. 6AU6
2ND VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4TH VIDEO I.F. 6CB6
6AG5 R.F. AMPLIFIER
6J6 OSC. & MIXER
IN60
VIDEO AMP. 12BY7
4.5MC
AUDIO I.F. AMP. 1/2 6AU6
RATIO DETECTOR 6AL5
PLUG TO RADIO T.V. INPUT
CONTRAST CONTROL
+140 V. SOURCE
+350V.
360V.
6V6
6AU6
STANDARD COIL TUNER-PENTODE CIRCUIT
SYNC. AMP. & SYNC. CLIPPER
1/2 12AU7
PHASE DETECTOR
1/2 12AX7
INTEGRATOR
V8
H.V. RECT. 1B3
5uuf GIMMICK
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
VERT. LIN.
VERT. SPEED
VERT. SIZE
HORIZONTAL OSC. & DISCHARGE
1/2 6SN7
HORIZ. SPEED
A.F.C.
HORIZ. DRIVE
HORIZONTAL OUTPUT 6BG6
WIDTH CONTROL
HORIZ. DAMPER 6W4
L.V. RECT. 5U4
1/2 AMP.
5 AMP.
+360V.
+350V.
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED
SCHEMATIC 9054
W.O. AUDIO
TIF II & PENTODE TUNER
XXD- 10820


STANDARD COIL TUNER - PENTODE CIRCUIT
6AG5 R.F. AMPLIFIER
6J6 OSC. & MIXER
1ST VIDEO I.F. 6AU6 V22
2ND. VIDEO I.F. 6CB6 V23
3RD. VIDEO I.F. 6CB6 V24
1N60
V30 VIDEO AMP. 6AC7
V40 AUDIO I.F. AMP. 6AU6
V41 RATIO DETECTOR 6AL5
PLUG TO RADIO T.V. INPUT
+140 V. SOURCE
CONTRAST CONTROL P16A
SELF RESONANT AT 4.5MC
SYNC. AMP. & SYNC. CLIPPER
PHASE DETECTOR
INTEGRATOR
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
VERT. SPEED
VERT. SIZE
VERT. LIN.
HORIZONTAL OSC. & DISCHARGE
HORIZ. SPEED
HORIZ. DRIVE
HORIZONTAL OUTPUT 6BG6
H.V. RECT. 1B3
HORIZ. DAMPER 6W4
WIDTH CONTROL
L.V. RECT. 5U4
6V6
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS
& GREATER THAN ONE IN MICROMICROFARADS UNLESS
OTHERWISE SPECIFIED
SCHEMATIC 9055
W.O. AUDIO
TIF 12 & PENTODE TUNER
XXD-10821

PARTS LIST

PART NO.	DESCRIPTION	APPLICATION
CLC-10050	20 UF-450 V & 100 UF-25 V	Vertical Sweep
CLC-10074	40-10 UF 350-250 V	B+ Audio-Video &S.G.
CLC-10075	40-20-40 UF-450	Power
CLA-10087C	50 UF-350 V	Audio Output
CMX-10012	Intebrater Network	Vertical Sync.
CMX-10002	.005 Ceramic Disc.	Audio & Video
CPA-14402B	.004 UF 400 V 5%	LGA-10017-AFC Coil
CTA-10005	25-280 UUF Trimmer	Horizontal
CLA-10027A	4-10 UF 50 V	Audio
LGA-10017B	Horizontal AFC	Horizontal Sweep
LGA-10019A	Filament Choke	Video IF
LGA-10032	120 UH Coil	Video Amp.
LGA-10033	180 UH Coil	Video Amp.
LGA-10034	100 UH Coil	Video Amp.
THC-10017B	H.V. Transformer	High Voltage
THC-10021	H.V. Transformer	High Voltage 24"
TOB-10045H	Vertical Output Transformer	Vertical
TOA-10061	Vertical Output Transformer	Vertical 24" sets
TPC-10013E	6V Filament Tubes	Power 24" Sets
TPC-10011	Power Transformer	Power
TOA-10023C	Width Control	Horizontal
TOC-10035	Audio Transformer	Output Transformer
FCB-10010	EM Focus Unit	24" Sets
FCB-10015	PM Focus Unit	24" Sets
YDB-10014	Deflection Yoke	Horizontal & Vertical Sweep 24" Sets
YDB-1001C	Deflection Yoke	Horizontal & Vertical Sweep
TSB-10062A	Ratio Detector Coil	Sound
TSA-10054B	If Coil	I.F.
TSA-10050C	Sound Diver	Sound
TT-10014	Standard Coil Cascode tuner	Tuner
TT-10012	Standard Coil Pentode Tuner	Tuner
ITA-10003	Ion Trap	Cathode Ray Tube
VSA-10012	Picture Fidelity-Control	Video Amp
VCA-12121D	2.5 Meg. Control	Vertical Size
VCA-12120C	5K Slotted Shaft-Control	Vertical Linearity
VCA-12140	Dual 750 Tap. 250 S.W. Control	Video Amp.& Audio
VCA-12131E	50 K	Horizontal Speed
VCA-12132E	1.3 meg.	Vertical Speed
VCA-12135A	100K-Brightness	Rear Mounting
MDA-10002	Magnetic Centering Device	Cathode Ray Tube
RXA-10019	200 ohm 10 Watt Resistor	B+
1B3	Tube	High Voltage Rectifier
5U4G	Tube	Rectifier
6SN7GT	Tube	Vertical & Horizontal
6SN7GT	Tube	Vertical Output
6V6	Tube	Output
6W4	Tube	Damper
12AU7	Tube	Sync. Clipper
6BG6G	Tube	Horizontal Output
12AX7	Tube	Audio & Phase Detector

PART NO.	DESCRIPTION	APPLICATION
6CD6G	Tube	Horizontal Output 24" Sets
6AH4	Tube	Vertical Output 24" Sets
6AL5	Tube	Ratio Detector
6AU6	Tube	Video I.F. Audio I.F. Keyed A.G.C.
6CB6	Tube	Video I.F.
6V3	Tube	Damper 242 Sets
12BY7	Tube	Amplifier-Video
17HP4	Tube	Cathode Ray Tube
20HP4	Tube	Cathode Ray Tube
21FP4	Tube	Cathode Ray Tube
24CP4A	Tube	Cathode Ray Tube
DB-10000	G.E. 47 Dial Lamp	UHF
DDA-10019	Dial Drive Shaft Bushing	UHF
DDA-10020	Dial Drive Shaft	UHF
DIA-10013A	Dial Indicator	UHF
DPA-10000A	Dial Idler Pulley	UHF
MBB-10460	Dial Plate	UHF
MB-10463	Scott Name Plate	UHF
MLA-10003	Stud UHF Switch	UHF
MLA-10004	Roller-UHF Switch Stud	UHF
TPC-10012C	Power Trans.	UHF
TRFA-10034	UHF Output Transformer	UHF
TTC-10015C	UHF Tuner	UHF
VCA-12138	Dual Pot. Horiz. Vert. Control	UHF
VSA-10022	Switch	UHF
SR-10028	4" Round Speaker	
SR-10026	5" " "	

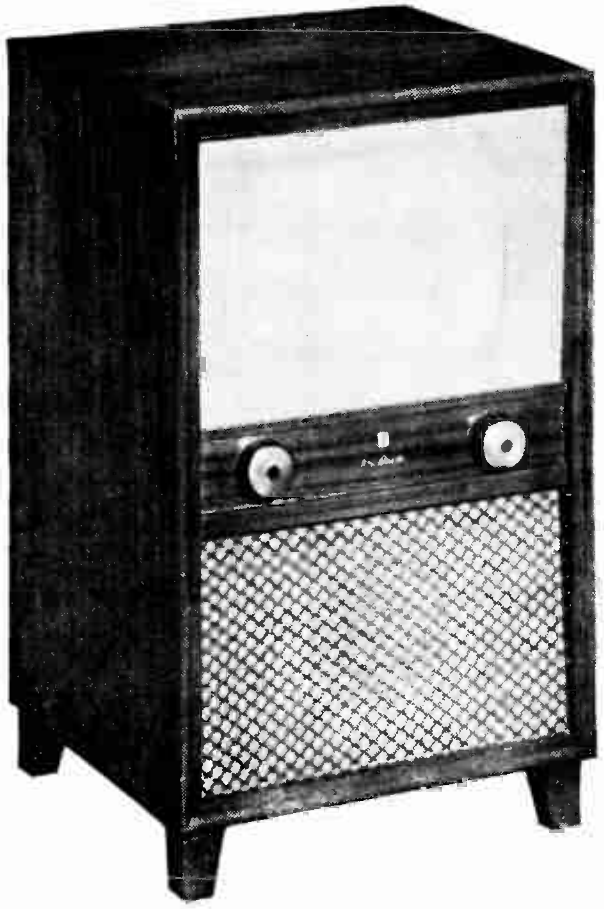
LEAD DRESS

The following lead dress is important. When such leads are properly dressed it will aid in the correction of "Audio Buzz". However, the sound alignment should be throughly checked before condeming any lead dress of the chassis.

(1) The yellow and the black twisted leads leading from the Volume control to the 15K resistor of the Ratio Detector should be dressed away from all components in the vertical circuits as much as possible. These leads should remain as close to the chassis as possible.

(2) The Blue lead from the primary of the audio output transformers to the plate of the 6V6 tube should be dressed away from the yellow and black twisted leads leading from the volume control to the grid (pin #2) of the 12AX7 tube.

(3) The green lead leading from the vertical speed control to the 1 meg resistor should be dressed away from all components as much as possible. Do not dress this lead close to the chassis.



ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	170 Watts
Power Output	2.7 Watts (Max.) 1.55 Watts (10% Distortion)
Tuning Range	12 Channel
Antenna Input Imp.	300 Ohms balanced
Intermediate Frequencies	Picture 26.4 MC Sound 21.9 MC
Intercarrier Sound System	4.5 MC
Loud Speaker	Electro-Magnetic
Voice Coil Imp.	3.2 Ohms 400 Cycles
Field Coil Resistance	90 Ohms

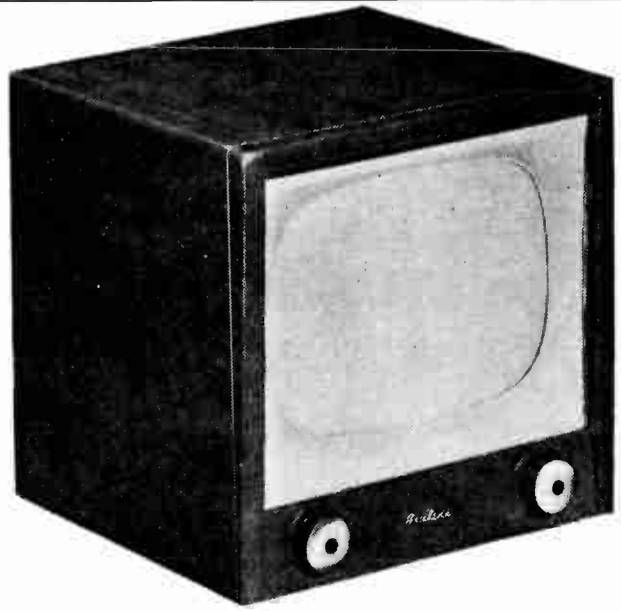
SUPPLEMENTARY MANUAL

Models GSL-3064C and GSL-3083C are identical to the issue "A" and "B" covered in Manual No. 4113A except for the following changes:

V19 (Metal Picture Tube) 17TP4 has been changed to 17HP4 (Glass Picture Tube).

Due to the difference in the mounting of the glass picture tube the necessary brackets, straps, insulating strips, etc., are incorporated in the Parts List in this supplement.

A schematic diagram together with a complete parts list are included in this manual. For test patterns, alignment procedure, wave forms and other service information refer to Manual No. 4113A.



GENERAL DESCRIPTION

These models use 19 tubes, (including picture tube and rectifier) have a crystal diode video detector, employ a intercarrier sound circuit, have safety interlock and a fuse in the low voltage power supply. Picture tube has electrostatic focus, which is automatic and permanent.

TUBE COMPLEMENT

Symbol	Type	Function
V1 Tuner	6BC5	R-F Amplifier
V2 Tuner	6J6	R-F Osc. & Mixer
V3	6CB6	1st Pix I-F Amplifier
V4	6CB6	2nd Pix I-F Amplifier
V5	6CB6	3rd Pix I-F Amplifier
V6	6AH6	Video Amp.
V7	6AU6	Sound Driver
V8	6AU6	Sync. Separator
V9	6AL5	Horizontal Phase Det.
V10 A&B	6SN7GT	Vert. Osc. & Phase Splitter
V11	6SN7GT	Horizontal Oscillator
V12 A&B	6T8	Audio Amp. & Ratio Detector
V13	6S4	Vertical Output
V14	6BQ6GT	Horizontal Output
V15	6W4-GT	Damper
V16	6Y6G	Audio Output
V17	1B3-GT	High Voltage Rectifier
V18	5U4-G	Low Voltage Rectifier
V19	17TP4	Pix Tube 17" Metal Rectangular

TUBE COMPLEMENT

Symbol	Type	Function
V1 Tuner	6BC5	R-F Amplifier
V2 Tuner	6J6	R-F Osc. & Mixer
V3	6CB6	1st Pix I-F Amplifier
V4	6CB6	2nd Pix I-F Amplifier
V5	6CB6	3rd Pix I-F Amplifier
V6	6AH6	Video Amp.
V7	6AU6	Sound Driver
V8	6AU6	Sync. Separator
V9	6AL5	Horizontal Phase Det.
V10 A&B	6SN7GT	Vert. Osc. & Phase Splitter
V11	6SN7GT	Horizontal Oscillator
V12 A&B	6T8	Audio Amp. & Ratio Detector
V13	6S4	Vertical Output
V14	6BQ6GT	Horizontal Output
V15	6W4-GT	Damper
V16	6Y6G	Audio Output
V17	1B3-GT	High Voltage Rectifier
V18	5U4-G	Low Voltage Rectifier
V19	17HP4	Pix Tube 17" Glass Rectangular

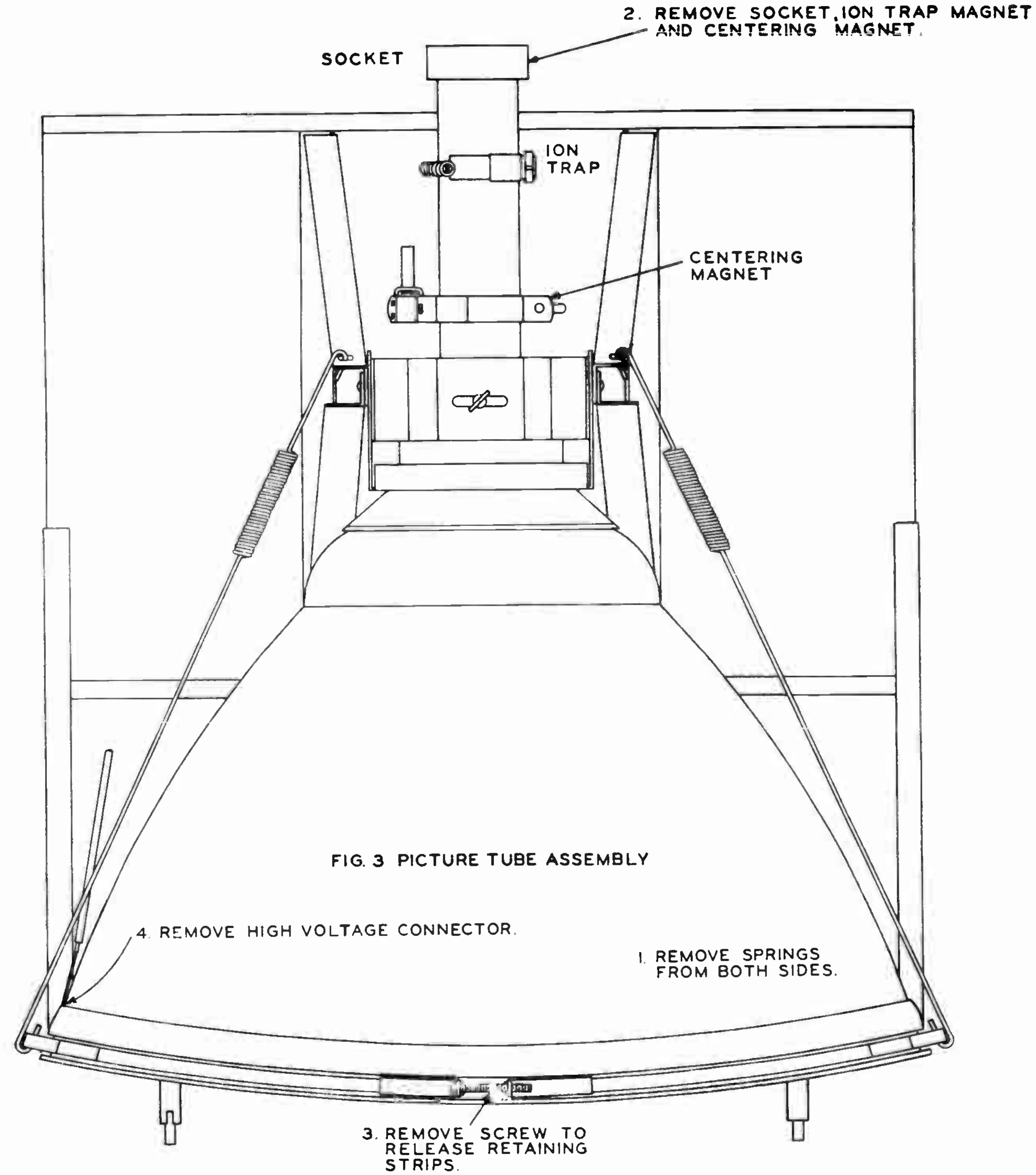


FIG. 3 PICTURE TUBE ASSEMBLY

PICTURE TUBE REPLACEMENT: To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back. Remove antenna terminal board from cabinet back. You will not that the interlocked line cord disconnects the power when the cabinet back is removed.
3. Disconnect speaker plug from chassis, remove the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

WARNING: Before handling the picture tube, it will be necessary to remove the static charge. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

ALIGNMENT PROCEDURE

TEST EQUIPMENT: To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:

18 to 30 mc, 10 mc sweep width

40 to 90 mc, 10 mc sweep width

170 to 225 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled. Electronic Voltmeter and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

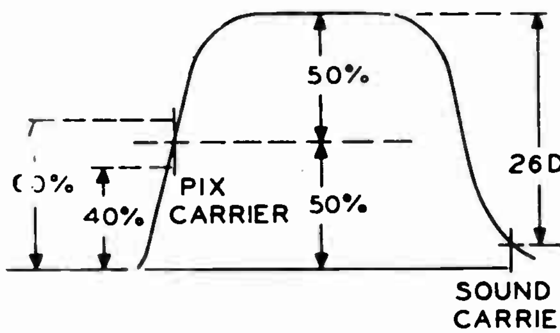


FIG.7 - OVERALL RESPONSE CURVE

SIGNAL GENERATOR to provide the following frequencies; (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.

26.1 Plate coil tuner

24.4 1st Pix I.F. Coil

24.0 2nd Pix I.F. Coil

4.5 mc video trap and sound I.F.

26.1 3rd Pix I.F. Coil

(b) Radio frequencies.

Channel No.	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

SERVICE PRECAUTIONS: To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect speaker plug from chassis, remove the antenna terminal board from cabinet back, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the top. The weight of the chassis will be supported against the high voltage housing.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-86.

LOCATION OF TUBES

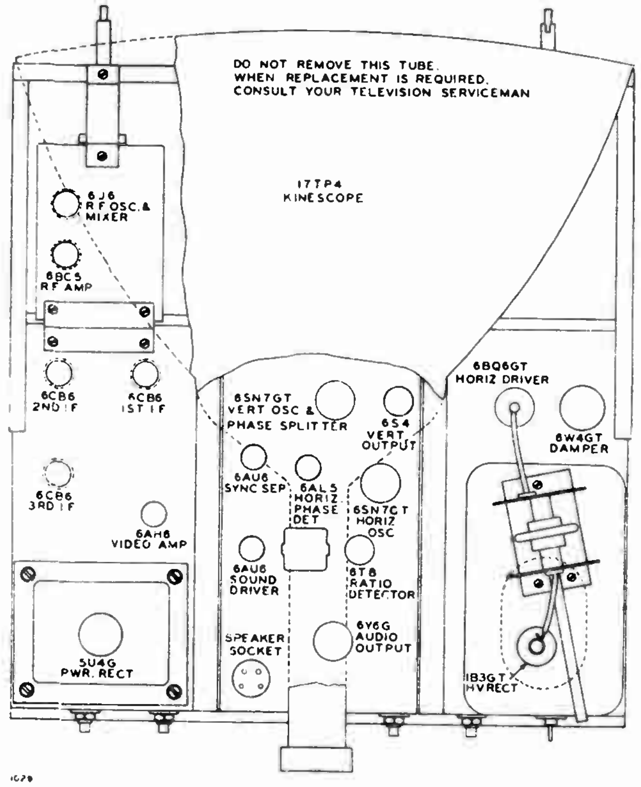


FIG 9

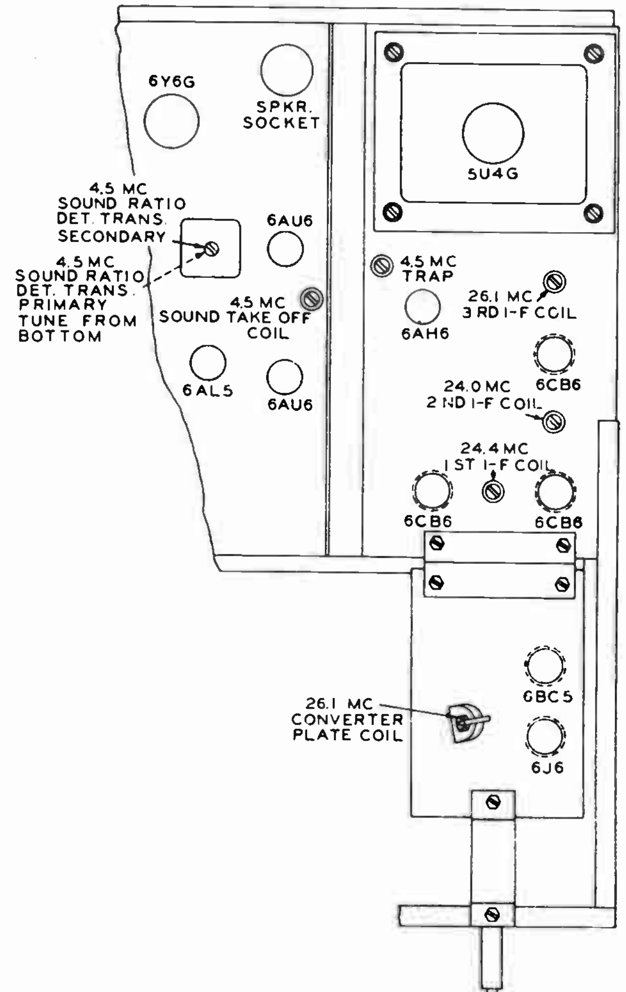


FIG. 8 TRIMMER LOCATIONS

1031

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM connected to junction picture detector load resistor, (R-21) 6800 ohms, and peaking coil (L-8). Input signal level should be such that output is less than 2 volts DC. apply — 4.5 V battery Bias on AGC line.

	Frequency	Adjust
1.	26.1 MC	Converter plate coil (on top of tuner) for maximum dc at picture detector.
2.	24.4 MC	1st picture I-F coil L-5 (above chassis) for maximum dc at picture detector.
3.	24.0 MC	2nd picture I-F coil L-6 (above chassis) for maximum dc at picture detector.
4.	26.1 MC	3rd picture I-F coil L-7 (above chassis) for maximum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base. Connect oscilloscope across R-21, 6800 Ohms (in place of VTVM). Apply — 4.5 bias (battery) to AGC line.

Tuner should be switched to a channel not being used so as not to cause interference.

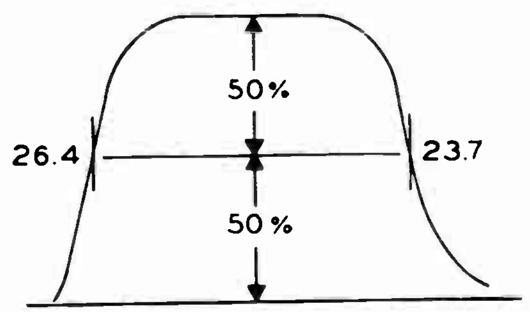


FIG. 10 OVERALL I.F. RESPONSE CURVE

1035

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should it be necessary to turn any of the picture I-F coils more than ½ turn of the slug. The following comments are suggestions only:

1. The height of the 26.4 MC marker is controlled by the (26.1 MC) converter plate coil on tuner and the (26.1 MC) 3rd P.I.F. coils.

2. The 23.7 MC marker position is controlled by the 2nd picture I-F coil (24.0 MC) and the 1st picture I-F coil (24.4 MC).

4.5 MC TRAP ALIGNMENT:

1. Tune in a station.
2. Adjust fine tuning rotar until sound bars just appear in picture.
3. Turn L-10 slug all the way out (counter clockwise).
4. Turn the slug in (clockwise) until the horizontal scanning lines are smooth and continuous.

SOUND I-F ALIGNMENT: Connect signal generator to grid of video amp. (6AH6), adjust contrast control to maximum. Set signal generator to 4.5 MC (no modulation) (setting of 4.5 MC must be accurate). Connect (2) two 50,000 ohm resistors across C-39 (resistors must match within 5%). 1. VTVM is connected across C-39. **See Fig. 12.** Adjust L-12 and T-3 (Bottom) for maximum on VTVM. This adjustment should be made with voltage on VTVM under 12 volts. 2. Connect VTVM between junction of R-39, R-40 and junction of the (2) two 50,000 ohm resistors. **See Fig. 12.** Adjust T-3 (Top) for zero on VTVM. If VTVM reads below zero, reverse leads and again adjust T-3 (Top) for zero reading. Re-check step one.

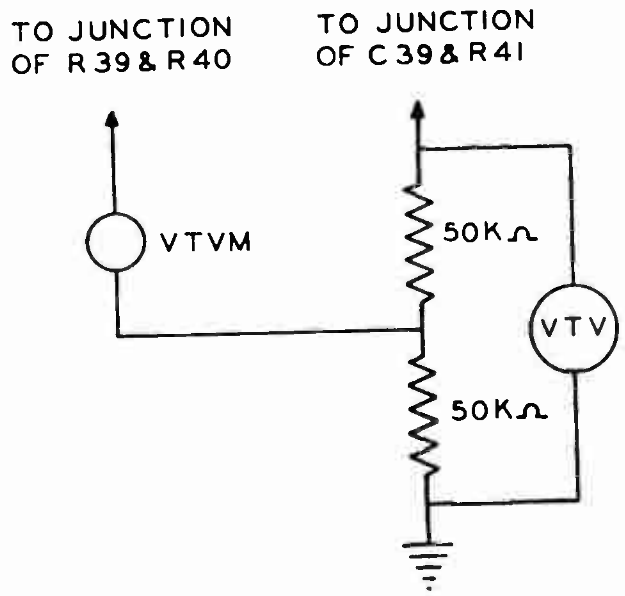
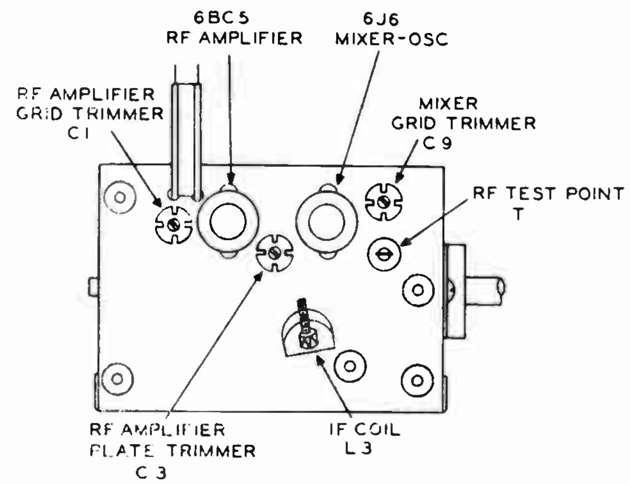


FIG. 12

1039

TUNER ALIGNMENT

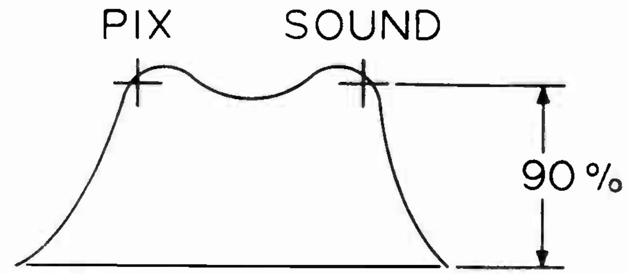
A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "Test Point" on tuner. Ground AGC line at junction of R-12 and C-17.



1043 FIG 13 TUNER ADJUSTMENTS

B. RF and converter adjustment:
1. With channel selector on channel 12, adjust C-1, C-9 and C-3 for response as in Figure 14. Picture and Sound markers at 90% maximum response.

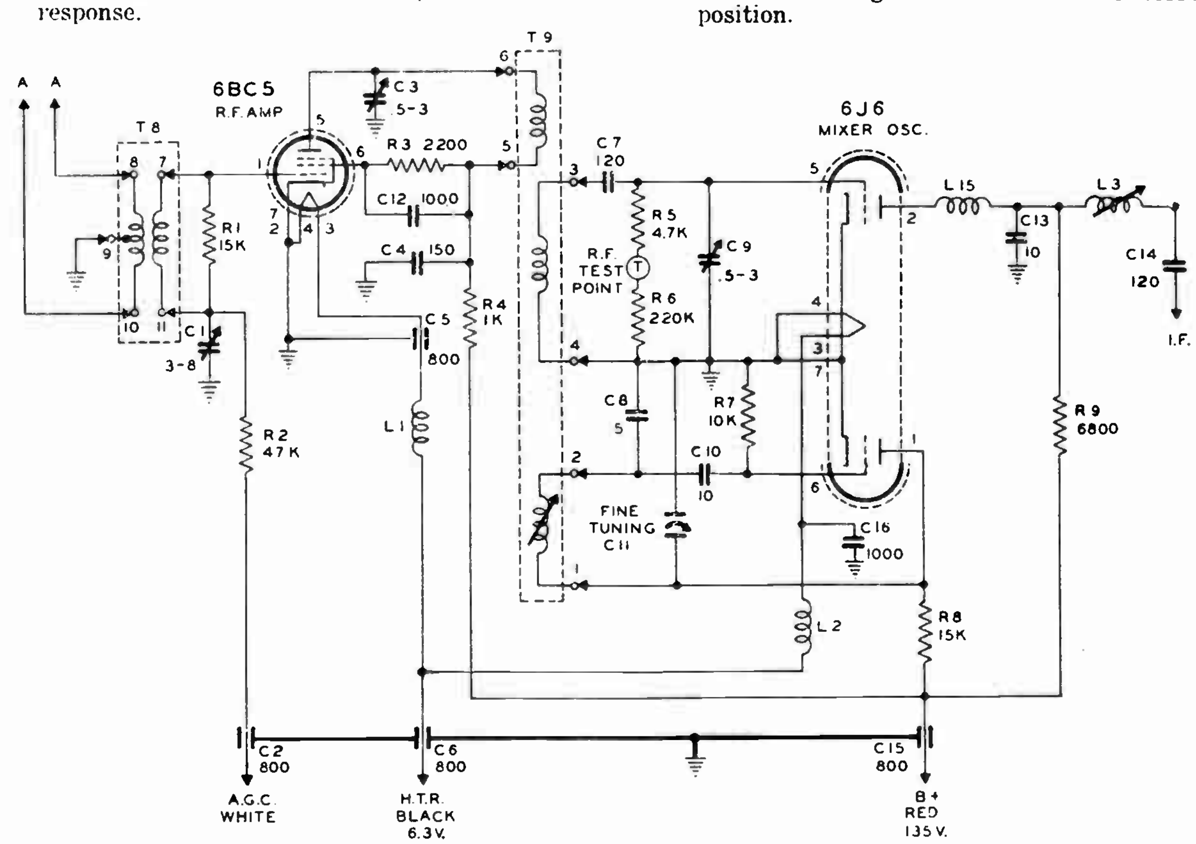
2. Check response on all channels. If markers are below 70% on any channel, readjust C-1, C-9 and C-3. Re-check all channels.



1047

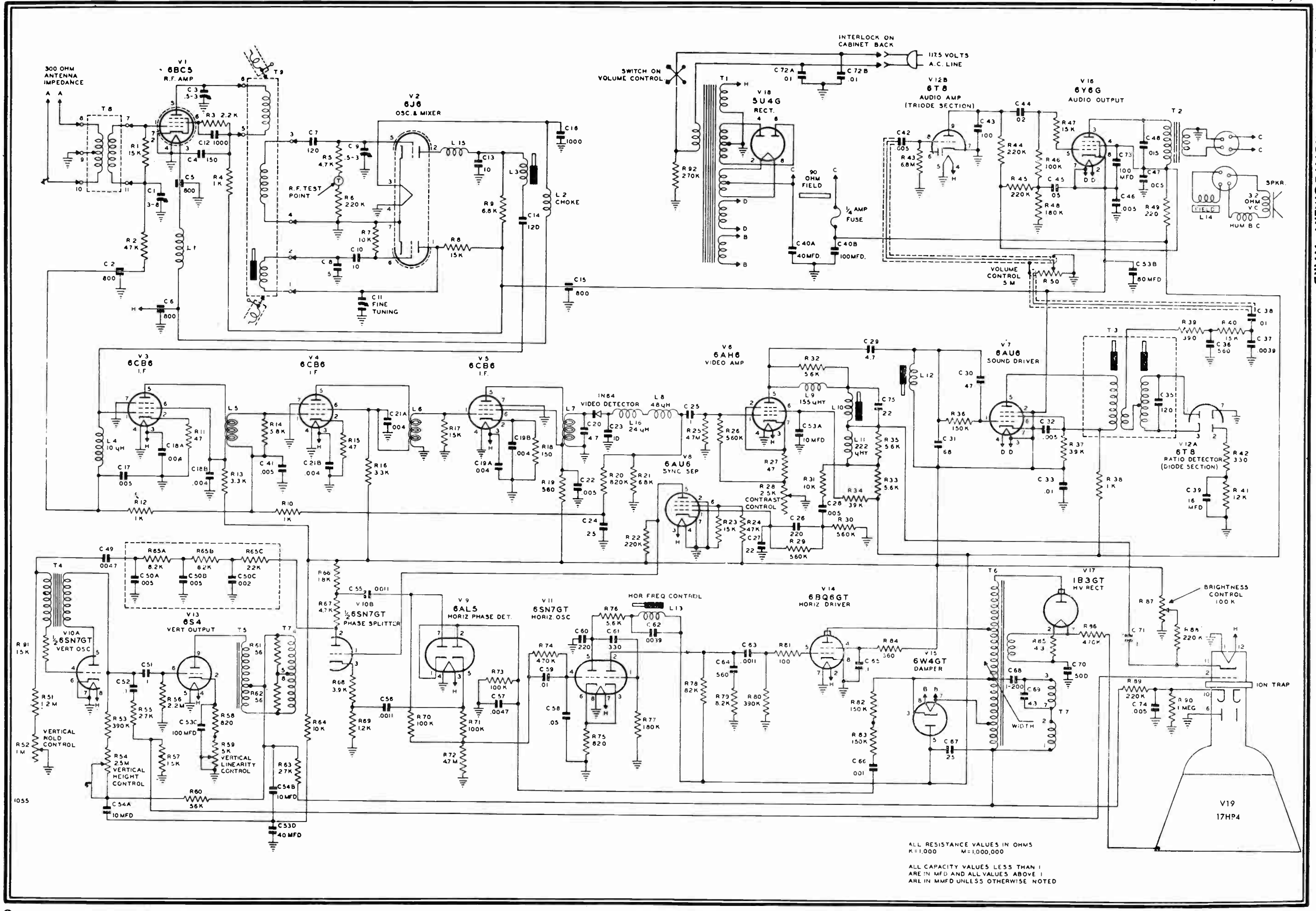
FIG. 14 – PIX AND AUDIO MARKERS

C. Oscillator adjustment:
1. Remove AGC ground. Apply — 4.5 Volts on I-F AGC line.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Picture marker should be at 50%. **See Fig. 7.**
3. If some channels are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring Picture Marker to correct position.



1. ALL CAPACITANCE VALUES STATED IN MMF.

TUNER SCHEMATIC


300 OHM ANTENNA IMPEDANCE
V1 6BC5 R.F. AMP
V2 6J6 OSC. & MIXER
R.F. TEST POINT
C11 FINE TUNING
L2 CHOKE
SWITCH ON VOLUME CONTROL
INTERLOCK ON CABINET BACK
117.5 VOLTS A.C. LINE
V18 5U4G RECT.
90 OHM FIELD
1/4 AMP FUSE
V12B 6T8 AUDIO AMP (TRIODE SECTION)
V16 6Y6G AUDIO OUTPUT
VOLUME CONTROL .5 M
SPKR.
3.2 OHM VC
HUM B C
V3 6CB6 I.F.
V4 6CB6 I.F.
V5 6CB6 I.F.
1N64 VIDEO DETECTOR
V6 6AH6 VIDEO AMP
V8 6AU6 SYNC SEP
CONTRAST CONTROL
V7 6AU6 SOUND DRIVER
V12A 6T8 RATIO DETECTOR (DIODE SECTION)
V10A 1/2 6SN7GT VERT OSC
V13 6S4 VERT OUTPUT
V10B 1/2 6SN7GT PHASE SPLITTER
V9 6AL5 HORIZ PHASE DET.
V11 6SN7GT HORIZ. OSC
HOR FREQ CONTROL
V14 6BQ6GT HORIZ DRIVER
V15 6W4GT DAMPER
V17 1B3GT HV RECT
BRIGHTNESS CONTROL 100 K
ION TRAP
WIDTH
VERTICAL HOLD CONTROL
VERTICAL HEIGHT CONTROL
VERTICAL LINEARITY CONTROL
V19 17HP4
1055
ALL RESISTANCE VALUES IN OHMS
K=1,000 M=1,000,000
ALL CAPACITY VALUES LESS THAN 1 ARE IN MFD AND ALL VALUES ABOVE 1 ARE IN MMFD UNLESS OTHERWISE NOTED

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

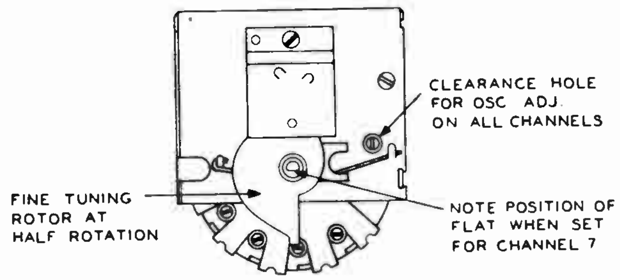
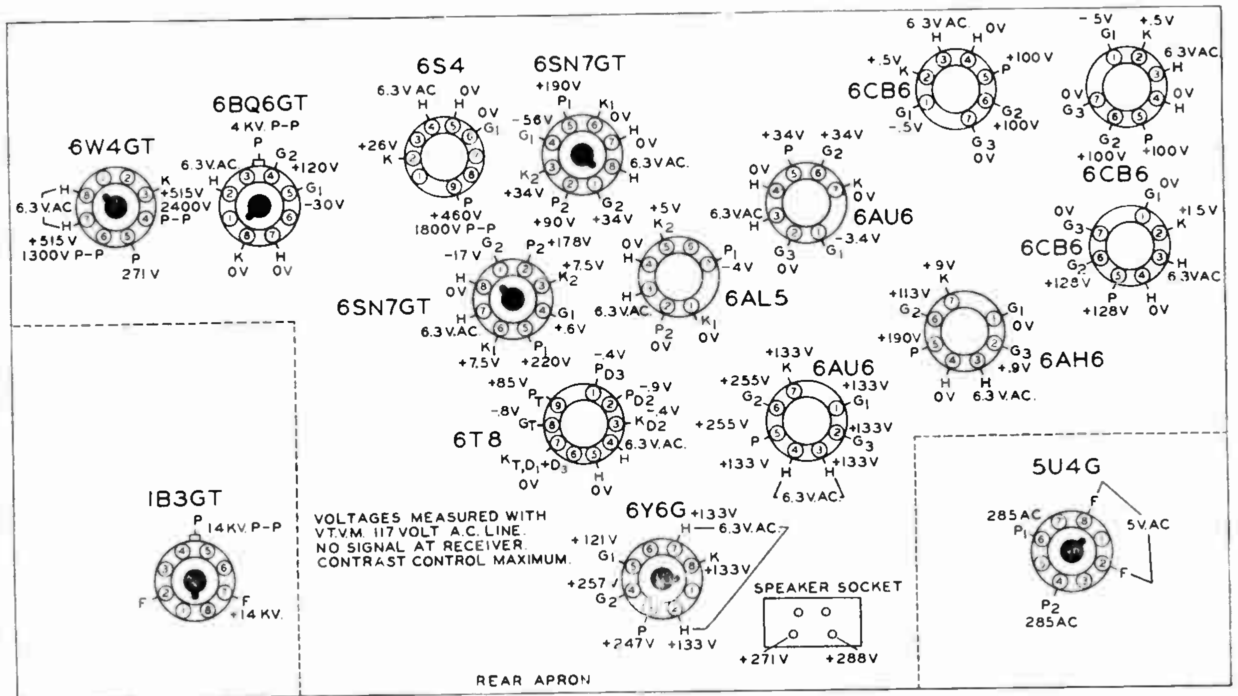
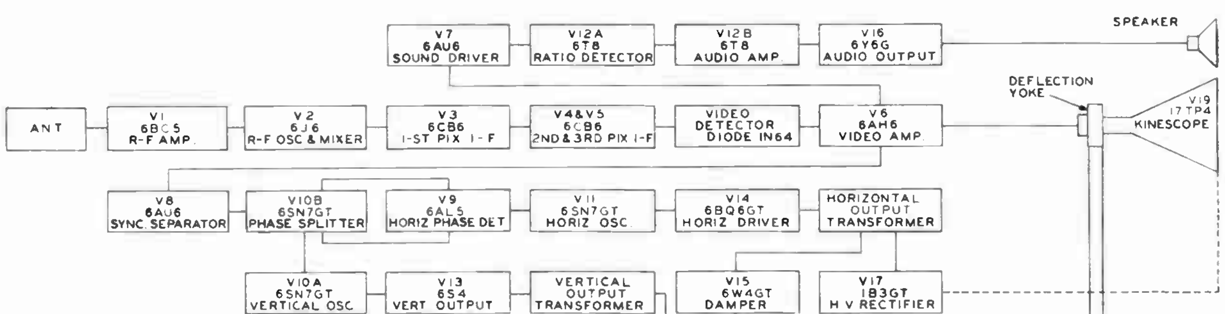


FIG 4 - TURRET TYPE TUNER
1036



BOTTOM SOCKET VOLTAGES
FIG 5
044



033

FIG 6 BLOCK DIAGRAM OF RECEIVER

TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Price Each
R1	N-6424	15,000	½	$0.14
R2	N-7124	47,000	½	.14
R3	N-5090	2,200	½	.14
R4	N-4987	1,000	½	.14
R5	N-5350	4,700	½	.14
R6	N-4899	220,000	½	.14
R7	N-4578	10,000	½	.14
R8	N-6424	15,000	½	.14
R9	N-4630	6,800	½	.14

CONDENSERS

Ref. No.	Part No.	Description	Price Each
C1	N-9395	Amplifier Grid Trimmer 3-8 MMFD.	$0.60
C2, 5, 6, C15	N-9409	800 MMFD. Minimum (Feed thru Capacitors)	.32
C3	N-9396	Amplifier Plate Trimmer .5-3 MMFD.	.60
C4	N-9410	150 MMFD. Ceramic	.28
C7, C14	N-9411	120 MMFD. Ceramic	.24
C8	N-9412	5 MMFD. Ceramic	.24
C9	N-9397	Mixer Grid Trimmer .5-3 MMFD.	.60
C10, C13	N-9413	10 MMFD. Ceramic	.20
C11	N-9394	Fine Tuning Rotor	.38
C12, C16	N-9414	1000 MMFD. Ceramic	.20

COILS & TRANSFORMERS

Ref. No.	Part No.	Coil Strip	Channel	
T8	N-9152	Antenna	2	$1.00
	N-9153	Antenna	3	1.00
	N-9154	Antenna	4	1.00
	N-9155	Antenna	5	1.00
	N-9156	Antenna	6	1.00
	N-9157	Antenna	7	.84
	N-9158	Antenna	8	.84
	N-9159	Antenna	9	.84
	N-9160	Antenna	10	.84
	N-9161	Antenna	11	.84
	N-9162	Antenna	12	.84
	N-9163	Antenna	13	.84
T9	N-9164	Osc. & Mixer	2	1.32
	N-9165	Osc. & Mixer	3	1.32
	N-9166	Osc. & Mixer	4	1.32
	N-9167	Osc. & Mixer	5	1.32
	N-9168	Osc. & Mixer	6	1.32
	N-9169	Osc. & Mixer	7	1.24
	N-9170	Osc. & Mixer	8	1.24
	N-9171	Osc. & Mixer	9	1.24
	N-9172	Osc. & Mixer	10	1.24
	N-9173	Osc. & Mixer	11	1.24
	N-9174	Osc. & Mixer	12	1.24
	N-9175	Osc. & Mixer	13	1.24
L1	N-9415	Heater Choke RF Amp.		.14
L2	N-9416	Heater Choke Osc. & Mixer		.14
L3	N-9408	IF Coil (Mix. Plate Coil)		.50
L15	N-9417	Plate Choke (Mixer Plate Choke)		.60

MECHANICAL PARTS

Ref. No.	Part No.	Description	Price Each
5	N-9384	Shield, Side	$0.16
6	N-9385	Shield, Bottom Cover	1.20
7	N-9386	Roller, Detent	.16
8	N-9387	Spring, Detent	.16
9	N-9388	Spring, Shaft Retaining Front	.16
10	N-9389	Spring, Shaft Retaining Rear	.16
11	N-9390	Spring, Fine Tuner Ground	.16
12	N-9391	Plate, Fine Tuner Ground	.20
13	N-9392	Strap, Fine Tuner Mtg.	.20
14	N-9393	Washer, Fiber	.14
15	N-9394	Fine Tuner Hot Plate & Lead	.38
16	N-9395	Trimmer, Ceramic & Lead-Ant. (C1 Schematic)	.60
17	N-9396	Trimmer, Ceramic & Lead-RF. (C3 Schematic)	.60
18	N-9397	Trimmer, Ceramic & Lead-Osc. (C9 Schematic)	.60
19	N-9398	Nut, Trimmer Spring	.14
20	N-9399	Screw, Trimmer	.14
21	N-9400	Contact Bracket Assembly	3.00
22	N-9401	Shield, Center Assembly	2.80
25	N-9402	Slug, Oscillator Tuning	.14
26	N-9403	Spring, Slug Retaining	.14
28	N-9404	Fine Tuner Shaft & Blade	.52
29	N-9405	Drum Assembly without coils	3.40
38	N-9407	Core, IF. Tuning	.16
40	N-9408	IF. Coil & Core Assembly (L3 Schematic)	.50
41 Thru 52	See Coils and Transformers for part numbers.	Antenna Coil Strips (T8 Schematic)	
53 Thru 64		Osc. & Mixer Strips (T9 Schematic)	

MAIN CHASSIS

RESISTORS

Ref. No.	Part No.	Description	Price Each
R85	N-8125	4.3 Ohms 0.5 W. 10%	$0.14
R11, R15, R27	N-6237	47 Ohms 0.5 W. 10%	.14
R61, R62	N-8023	56 Ohms 0.5 W. 10%	.14
R81	N-1349	100 Ohms 0.5 W. 20%	.14
R19	N-3663	150 Ohms 0.5 W. 10%	.14
R42	N-4420	330 Ohms 0.5 W. 10%	.14
R39	N-5159	390 Ohms 0.5 W. 10%	.14
R19, R84	N-4280	560 Ohms 0.5 W. 10%	.14
R75	N-4279	820 Ohms 0.5 W. 10%	.14
R10, R12, R38	N-3341	1000 Ohms 0.5 W. 10%	.14
R69	N-6793	1200 Ohms 0.5 W. 10%	.14
R57	N-7398	1500 Ohms 0.5 W. 10%	.14
R66	N-4281	1,800 Ohms 0.5 W. 10%	.14
R55	N-8103	2,700 Ohms 0.5 W. 10%	.14
R68	N-7399	3,900 Ohms 0.5 W. 10%	.14
R67	N-7000	4,700 Ohms 0.5 W. 20%	.14
R14	N-7400	5,600 Ohms 0.5 W. 10%	.14
R21	N-4630	6,800 Ohms 0.5 W. 10%	.14
R79	N-4897	8,200 Ohms 0.5 W. 10%	.14
R31, R64	N-4895	10,000 Ohms 0.5 W. 10%	.14
R41	N-5690	12,000 Ohms 0.5 W. 10%	.14
R17, R23, R40, 47, R91	N-6424	15,000 Ohms 0.5 W. 10%	.14
R24	N-7124	47,000 Ohms 0.5 W. 10%	.14
R60	N-4823	56,000 Ohms 0.5 W. 10%	.14
R78	N-9015	82,000 Ohms 0.5 W. 10%	.14
R46, R70, 71, 73	N-2973	100,000 Ohms 0.5 W. 10%	.14
R36	N-4468	150,000 Ohms 0.5 W. 10%	.14
R48	N-7401	180,000 Ohms 0.5 W. 5%	.14
R77	N-7003	180,000 Ohms 0.5 W. 10%	.14
R22, 44, 88, 89	N-4809	220,000 Ohms 0.5 W. 10%	.14
R45	N-9041	220,000 Ohms 0.5 W. 5%	.14
R92	N-7004	270,000 Ohms 0.5 W. 10%	.14
R53, R80	N-8026	390,000 Ohms 0.5 W. 10%	.14
R74	N-5694	470,000 Ohms 0.5 W. 10%	.14
R26, R29, R30	N-7790	560,000 Ohms 0.5 W. 10%	.14
R20	N-4469	820,000 Ohms 0.5 W. 10%	.14
R90	N-2976	1.0 Megohms 0.5 W. 10%	.14
R51	N-4470	1.2 Megohms 0.5 W. 10%	.14
R56	N-4420	2.2 Megohms 0.5 W. 10%	.14
R25, R72	N-4061	4.7 Megohms 0.5 W. 20%	.14
R43	N-4028	6.8 Megohms 0.5 W. 20%	.14
R58	N-9016	820 Ohms 1.0 W. 10%	.14
R13, R16	N-7793	3,300 Ohms 1.0 W. 10%	.14
R76	N-7406	5,600 Ohms 1.0 W. 10%	.14
R34, R37	N-7013	39,000 Ohms 1.0 W. 10%	.14
R82, R83	N-9017	150,000 Ohms 1.0 W. 10%	.14
R86	N-8029	470,000 Ohms 1.0 W. 10%	.14
R49	N-9040	220 Ohms 2.0 W. 10%	.18
R63	N-7126	2,700 Ohms 2.0 W. 10%	.18
R33	N-8491	5,600 Ohms 2.0 W. 10%	.18
R28, R50	N-8942	Contrast & On-Off Vol. Variable	1.84
R52	N-8943	1.0 Megohms, Vertical Hold, Variable	.60

RESISTORS

Ref. No.	Part No.	Description	Price Each
R87	N-8944	100,000 Ohms Brightness, Variable	$0.56
R54	N-8971	2.5 Megohms Vertical Height — Variable	.60
R59	N-8945	5,000 Ohms Vertical Linearity — Variable	.60

CAPACITORS

Ref. No.	Part No.	Description	Price Each
C18, C21, C19	N-7774	.004 MFD. Dual Ceramic 500 V.	$0.28
C72	N-9045	.01 MFD. Dual Ceramic 500 V.	.32
C20, C29	N-9047	4.7 MMFD. Ceramic 500 V. 5%	.60
C23	N-9048	10 MMFD. Ceramic 500 V. 10%	.14
C27, C75	N-9049	22 MMFD. Ceramic 500 V. 10%	.14
C69	N-9052	43 MMFD. Ceramic 2000 V. 5%	.38
C30	N-9050	47 MMFD. Ceramic 500 V. 10%	.14
C31	N-9051	68 MMFD. Ceramic 500 V. 10%	.24
C43	N-9053	100 MMFD. Ceramic 500 V. 20%	.14
C26	N-9055	220 MMFD. Ceramic 500 V. 10%	.16
C37	N-9059	3,900 MMFD. Ceramic 500 V. 20%	.18
C17, 22, 28, 32, C41, 42, 46, 47, C74	N-6272	.005 MFD. Ceramic 500 V. (GMV)	.18
C33, C38	N-9062	.01 MFD. Ceramic 400 V. (GMV)	.18
C60	N-9054	220 MMFD. Silver Mica 500 V. 5%	.26
C61	N-9056	330 MMFD. Silver Mica 500 V. 5%	.30
C64	N-9057	560 MMFD. Mica 500 V. 5%	.28
C36	N-7780	560 MMFD. Mica 500 V. 10%	.22
C66	N-9058	1000 MMFD. Mica 1,000 V. 10%	.62
C55, C56, C63	N-7783	1,100 MMFD. Mica 500 V. 10%	.26
C49	N-6893	4,700 MMFD. Mica 600 V. 10%	.50
C59	N-1344	.01 MFD. Paper 400 V.	.16
C48	N-9046	.015 MFD. Paper 600 V.	.16
C44	N-1376	.02 MFD. Paper 400 V.	.18
C45, C58	N-1345	.05 MFD. Paper 200 V.	.16
C25, C65, C68	N-1351	.1 MFD. Paper 200 V.	.20
C51, C52, C71	N-1623	.1 MFD. Paper 400 V.	.20
C24	N-1479	.25 MFD. Paper 200 V.	.28
C67	N-2579	.25 MFD. Paper 400 V.	.30
C62	N-9060	3,900 MMFD. Stab. Paper 600 V. 5%	.54
C57	N-9061	4,700 MMFD. Stab. Paper 600 V. 10%	.40
C73	N-8970	100 MFD. Electrolytic 200 V.	2.26
C40B, C40A	N-8969	100-40 MFD. Electrolytic 400 V.	3.46
C54A, C54B	N-8039	10-10 MFD. Electrolytic 450 V.	1.68
C53A, C53B, 53D, C53C	N-8967	10 MFD. Electrolytic 400 V. 80-40 MFD. Electrolytic 200 V. 100 MFD. Electrolytic 50 V.	2.72
C39	N-6912	16 MFD. Electrolytic 50 V.	.84
C70	N-8041	500 MMFD. High Volt. 20,000 V.	1.60

CHOKES, COILS, TRANSFORMERS

Ref. No.	Part No.	Description	Price Each
T3	N-8928	Coil, ratio detector includes C35	$2.32
L5, L6, L7	N-8929	Coil, I.F.	.52
L10	N-9011	Coil, 4.5 MC Sound Trap	.74
L12	N-7746	Coil, Sound Take-off	.80
T7	N-8930	Coil, Deflection Yoke	7.20
L13	N-8931	Coil, Horiz. Freq. Control	.98
L8	N-8932	Coil, Video Peaking — Detector	.34
L9	N-8933	Coil, Video Peaking — Series Includes No. R-32	.36
L11	N-8934	Coil, Video Peaking — Shunt Includes No. R-35	.40
L4	N-7321	Choke, R.F.	.26
L16	N-9250	Choke, Coil	.40
T1	N-8935	Transformer, Power	13.90
T6	N-8936	Transformer, Horiz. Output	7.86
T5	N-8937	Transformer, Vertical Output	3.12
T4	N-9002	Transformer, Vertical Osc.	2.12
T2	N-8938	Audio Output Transformer	2.08
L14		Filter Choke (Part of N-8926 or N-9184) (See Miscellaneous)	

MISCELLANEOUS

Part No.	Description	Price Each
No. 407	Cabinet — Consolette	**$87.12
N-8926	Speaker, 8" Electro-Magnetic (With cable & plug)	6.54
N-8042	Multiple Resistor Capacitor Assembly (R65 & C50)	.80
N-8915	Channel, Kinescope Support	2.56
N-8916	Support, Kinescope — Front	.16
N-8917	Bracket, Yoke	1.58
N-8918	Bracket, Tuner Mtg. (Front)	.14
N-8919	Bracket, Tuner Mtg. (Rear)	.14
N-8728	Bracket, Cabinet Back, Mtg.	.40
N-9234	Bracket, Tuner Stabilizing	.20
N-8920	Strap, Yoke Mounting	.30
N-8921	Support, Yoke Bracket	.40
N-8922	Enclosure, High Voltage	1.02
N-8924	Strap, Kinescope Retaining (Tapped)	.60
N-8925	Strap, Kinescope Retaining (Untapped)	.60
N-6402	Plate, Bakelite Electrolytic Mtg.	.14
N-9012	Ion trap	.60

IMPORTANT — All prices in this literature are subject to change without notice and are subject to an additional charge to cover any applicable sales tax, use, occupation, or other tax affecting our purchase or sale of merchandise.

MISCELLANEOUS

Part No.	Description	Price Each
N-8939	Centering Magnet	$1.00
N-8940	Socket, Kinescope — with leads	.72
N-7333	Tube Socket, (6CB6 & 6AH6)	.14
N-7334	Tube Socket (6AU6 Sound Driver)	.14
N-7336	Tube Socket (6AU6 & 6AL5)	.14
N-7335	Tube Socket (6T8)	.14
N-9034	Tube Socket (6S4)	.20
N-7515	Tube Socket (6SN7, 6Y6, 6BQ6)	.14
N-7733	Tube Socket (6W4)	.22
N-8100	Tube Socket (1B3)	.44
N-2227	Socket, Speaker plug	.14
N-6265	Socket, Inter-lock A.C.	.26
N-9087	H. V. Connector & Cable	.40
N-7355	Fuse 1/4 Amp.	.16
N-9018	Knob, Fine Tuning	.30
N-9260	Knob, Tuner	.84
N-9261	Knob, Volume	.64
N-9020	Knob, Contrast	.30
N-9462	Glass, front panel	6.16
N-9023	Mask, Picture tube	4.20
N-9024	Grille Cloth	1.70
N-9006	Strips, rubber, yoke bumper	.14
N-9008	Anode lead support	.14
N-9009	Spring, H. V. Cover retaining	.20
N-8948	Ring, Kinescope Front Insulating	3.60
N-8499	Grommet, Kinescope Support	.36
N-8947	Cabinet Back	1.48
N-8950	Line Cord	.76
N-8949	Springs, Tension — Kinescope Mtg.	.14
N-8020	Shield, Miniature Tube	.14
N-7731	Antenna Terminal Strip	.14
N-8135	Base, Tube Shield	.14
N-9007	Fuse Holder	.22
*N-435	Cabinet Table Model Leatherette	**31.98
*N-9184	Speaker 5" Electro-Magnetic (With Cable & Plug)	6.16
*N-9463	Glass, Front Panel	6.30
*N-9179	Mask, Picture Tube	4.20
*N-9254	Grille Cloth	.40
*N-9182	Cabinet Back	1.44

*Used on Table Model No. 3064A Only

**Excise Tax Included.

MODEL
WG-3180 (MAH.)

MODEL
WG-3190 (OAK)

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	Television—210 Watts Radio—35 Watts Phonograph—55 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Ranges	VHF—Channels 2 thru 13 UHF—Channels 14 thru 83 AM-540-1600 KC
Intermediate Freq. (Tel.)	Picture—26.20 MC Sound—21.70 MC
I-F (UHF Position Only)	Picture 121.75 MC Sound 126.25 MC
Intermediate Freq. (Radio)	455 KC
Selectivity (Radio)	45 KC Broad at 1,000 Times Signal, measured at 1,000 KC
Sensitivity (Radio)	(For .5 Watt Output) 10 Microvolts Average
Tel. Antenna Input Imp.	300 Ohms Balanced
Intercarrier Sound System	4.5 MC
Loud Speaker	8" PM Dynamic
Voice Coil Impedance	3.2 Ohms 400 Cycles
Record Changer	See Manual 5096A (VM-950)
Cartridge	Shure P77V (60H17)
Needles—78 RPM —33⅓ & 45 RPM	Shure 85-16 (61H2) —Shure 85-18 (61H13)

TUBE COMPLEMENT
TELEVISION

Symbol	Type	Function
VHF Tuner	6J6	R-F Osc. and Mixer
*VHF Tuner	6BQ7	R-F Amplifier
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20 & V-22	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

TUBE COMPLEMENT
RADIO CHASSIS

1	6BA6	R-F Amplifier
1	6BE6	AM Converter
1	6BA6	I-F Amplifier
1	6AV6	Det. & 1st Audio Amplifier
1	6AQ5	Audio Output
1	6X4	Rectifier
2	No. 47	Dial Lamps

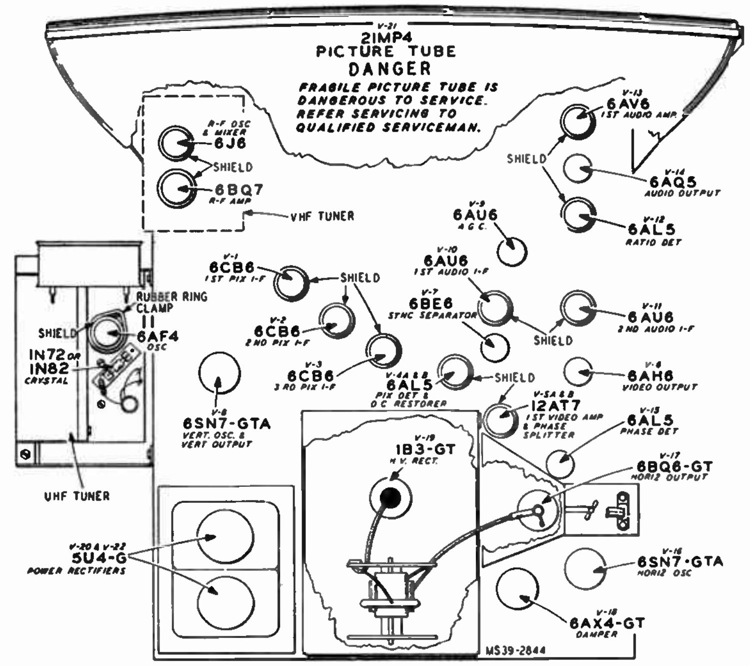


Fig. 1—Tube Layout.

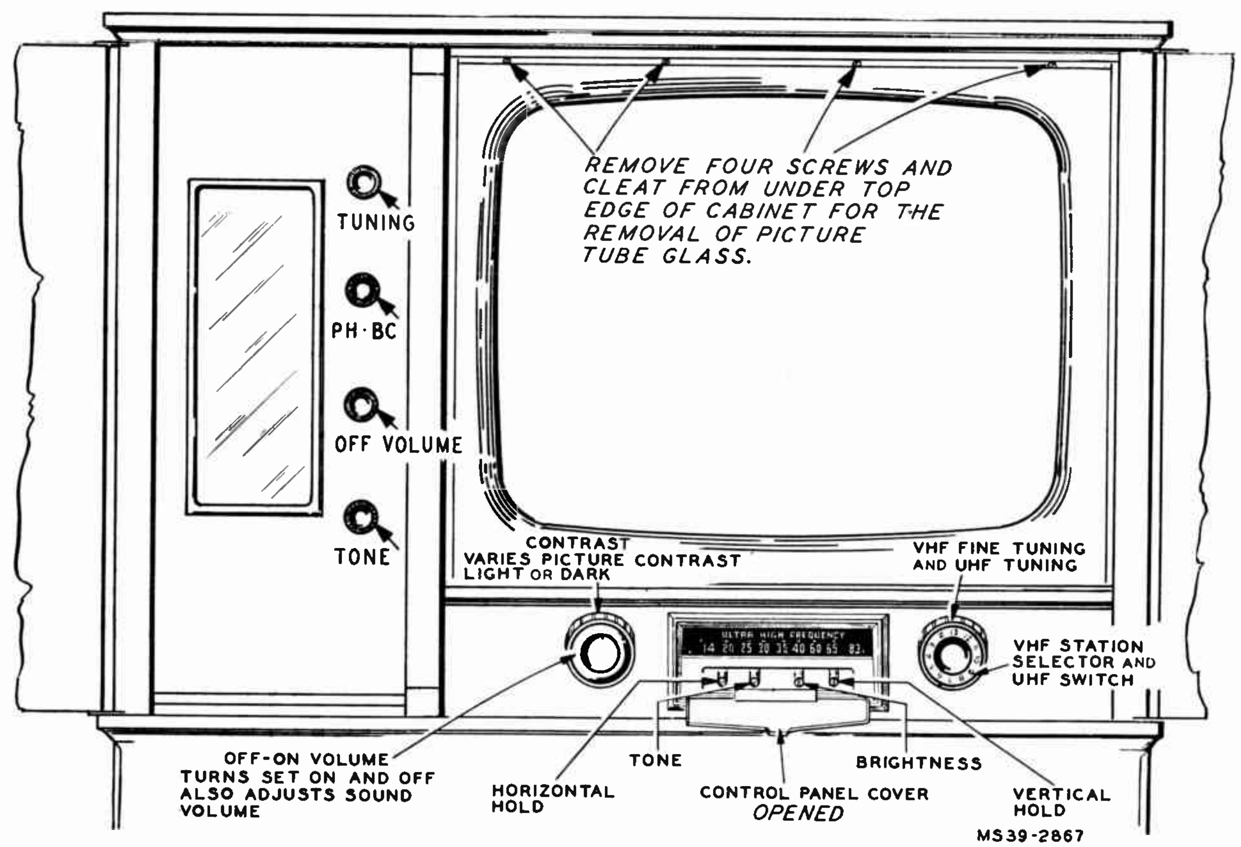


Fig. 2—Front Panel Controls

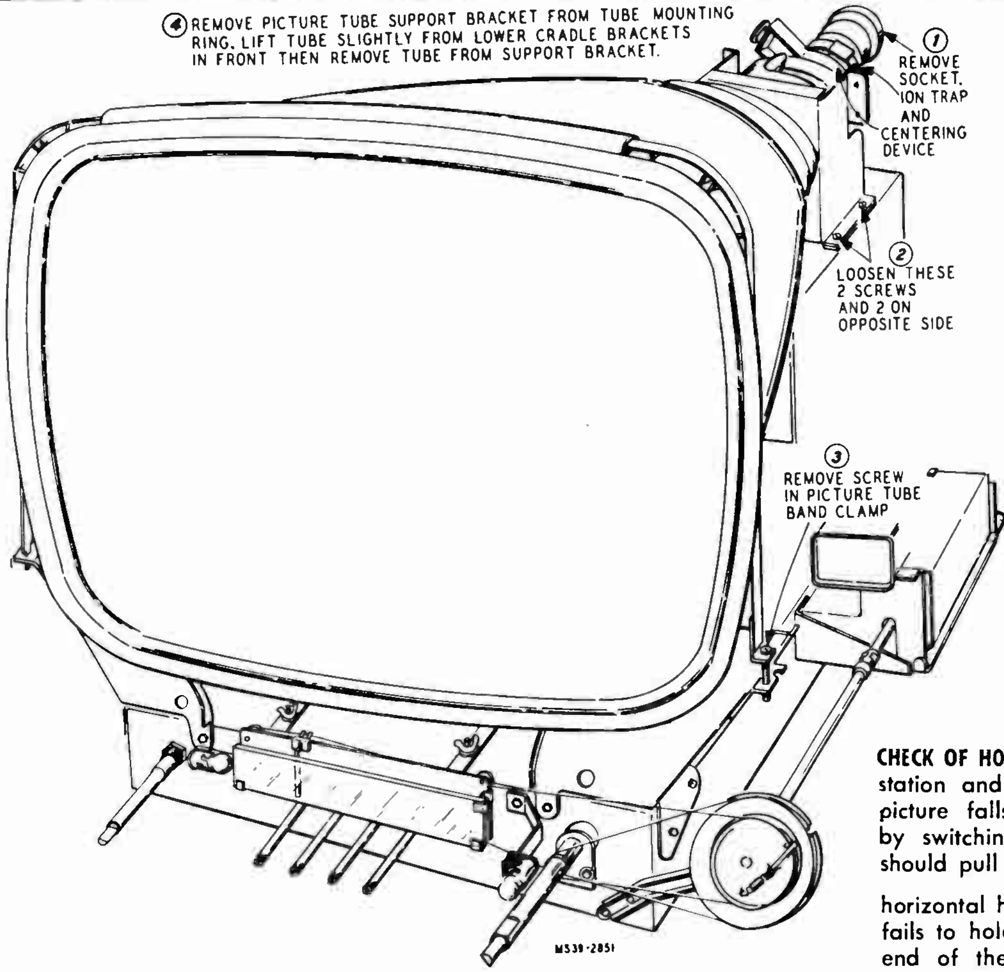


Fig. 3—Removal of Picture Tube

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver will be used. While observing the picture and listen-ceiver to the strongest station in the area in which the re-ing to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.
When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

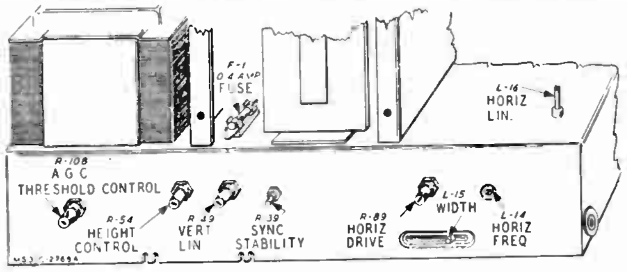


Fig. 4—Adjustments Rear of Chassis

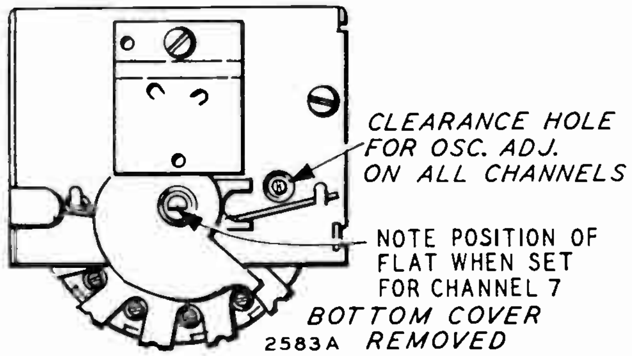


Fig. 5—Tuner Oscillator Adjustments

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

CAUTION—These adjustments are intended only for VHF Channels. For information regarding UHF alignment, see paragraph "Tuner Alignment" on page 11.

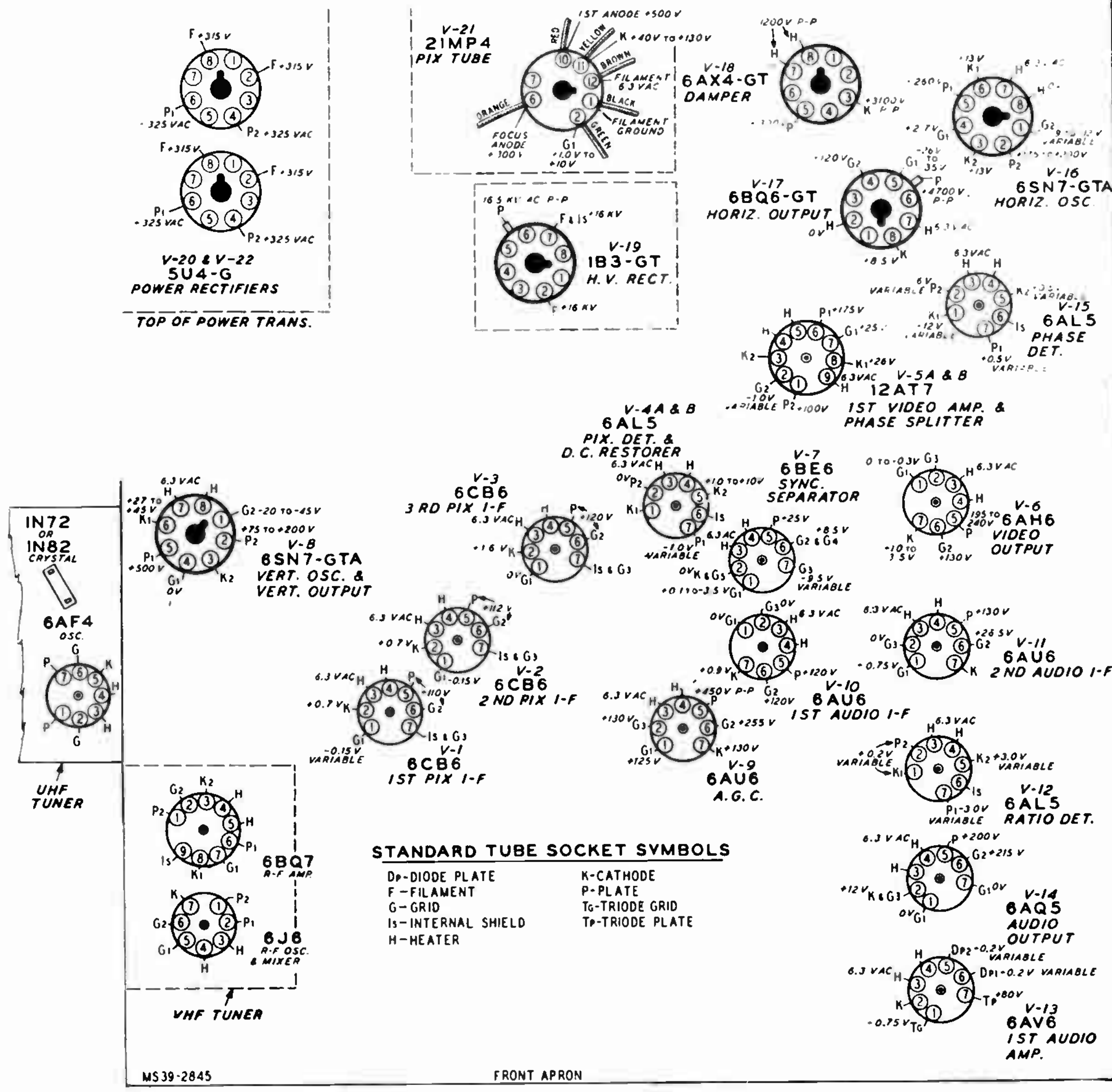


Fig. 6—Bottom Socket Voltages

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.
1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
 (A) Horizontal output tube V-17 (6BQ6-GT)
 (B) Check damper tube V-18 (6AX4-GT).
 (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
 (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
 (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-105 and C-75 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:
1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.
1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-47B, C-70 or C-71 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-68, or open or incorrect value of resistors R-90 & R-92.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-67 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:
1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-77, C-78, C-79 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:
1: Defective yoke due to C-76 or R-106 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:
1: Low +B or line voltage. Check V-20 & V-22 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:
1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:
1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:
1: Vertical integrating network capacitors C-53A, B & C, and resistors R-68A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY
1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:
1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-36. If the capacitor is not found to be defective, check the following:
 1: Check all potentials in video circuits.
 2: Check picture tube grid circuit for poor or dirty contact.
 3: Check and realign, if necessary, the picture I-F and R-F circuits.

SERVICE SUGGESTIONS—(continued)

PICTURE SMEAR:
1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)
1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING
1: Check sync stability control adjustment.
2: Check capacitors C-47A and C-49A.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND
1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND
This condition can be caused by,
1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3
2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.
4: UHF—VHF switch defective.

POOR FOCUS
1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:
1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND IN UHF POSITION
If this condition is encountered
1: Check to see whether or not a UHF station is operating in the vicinity.
2: The 6AF4 oscillator tube or the IN72 (or IN82) crystal may be defective.
3: Pre-selector in UHF tuner defective.
4: Low pass filter defective.
5: The UHF antenna and oscillator strips in the VHF tuner defective.
6: Defective switch on UHF tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
 18 to 30 mc, 10 mc sweep width
 40 to 90 mc, 10 mc sweep width
 120 to 130 mc, 10 mc sweep width
 170 to 225 mc, 10 mc sweep width
 470 to 890 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
 23.1 mc first picture I-F coil.
 24.1 mc third picture I-F coil.
 25.9 mc second picture I-F coil.
 21.7 mc sound trap.
 4.5 mc video trap & sound I-F.
 25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, the radio chassis, remove the antenna terminal boards at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-105.

ALIGNMENT PROCEDURE
PIX I-F

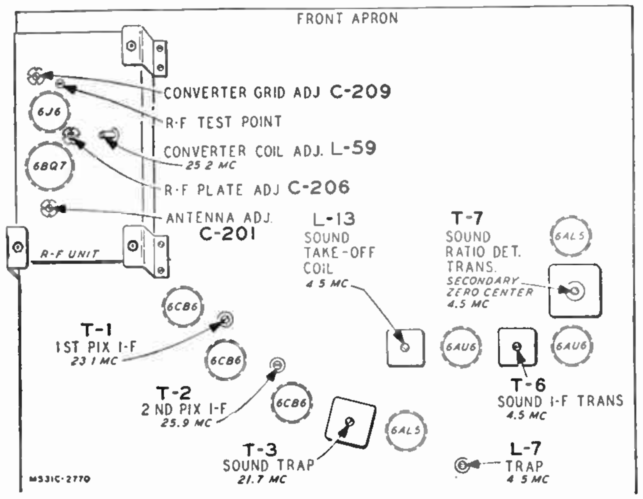


Fig. 8—Top Chassis Video and Audio I-F Adjustments

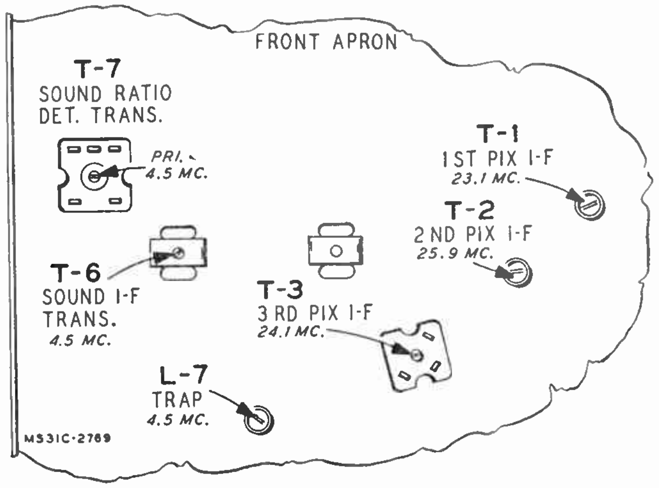


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-37) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

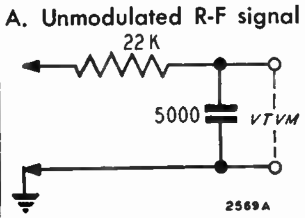


Fig. 10—VTVM Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-37 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

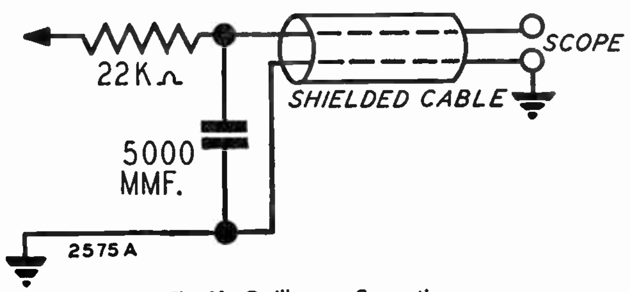


Fig. 11—Oscilloscope Connections

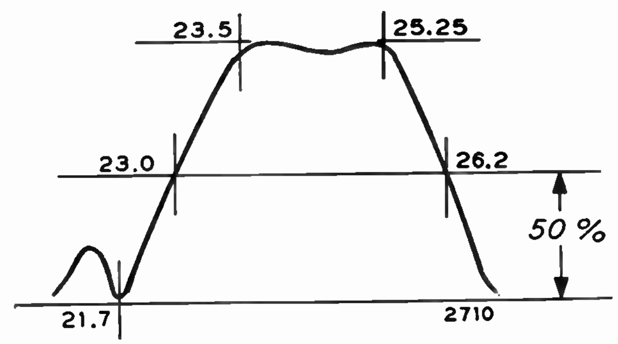


Fig. 12—Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

ALIGNMENT PROCEDURE (Continued)

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-13 and C-14, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-17, R-20 and C-18, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-34 and C-29 on the receiver.

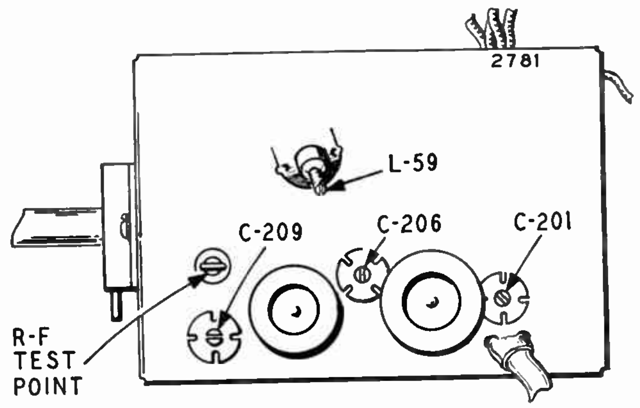


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

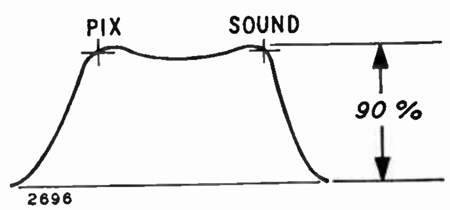


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-30A.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. To adjust oscillator on UHF position, feed the sweep generator with center frequency of 124 MC and markers at 121.75 and 126.25 into the input of the low pass filter (output of UHF tuner). Adjust oscillator slug in the VHF tuner so that the 121.75 pix carrier marker is at 50% and that 126.25 marker marker is in the sound notch. If a sweep generator is not available, a single frequency generator set to 126.25 MC and VTVM may be used. Connect VTVM to the pix detector load resistor R-37. Feed generator into the low pass filter. Adjust oscillator slug in the VHF tuner so that the 126.25 marker is in the sound notch of the I-F curve.
5. If the 6AF4 oscillator tube in the UHF tuner is replaced, it may be necessary to adjust the oscillator trimmer C-309 on the UHF tuner located underneath the chassis. (See Figure 15). Adjust this trimmer until the tuner will cover a range of below 470 MC to above 890 MC.

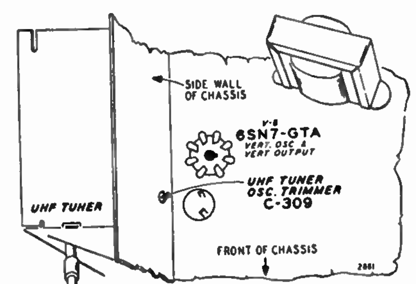


Fig. 15—UHF Tuner Adjustment.

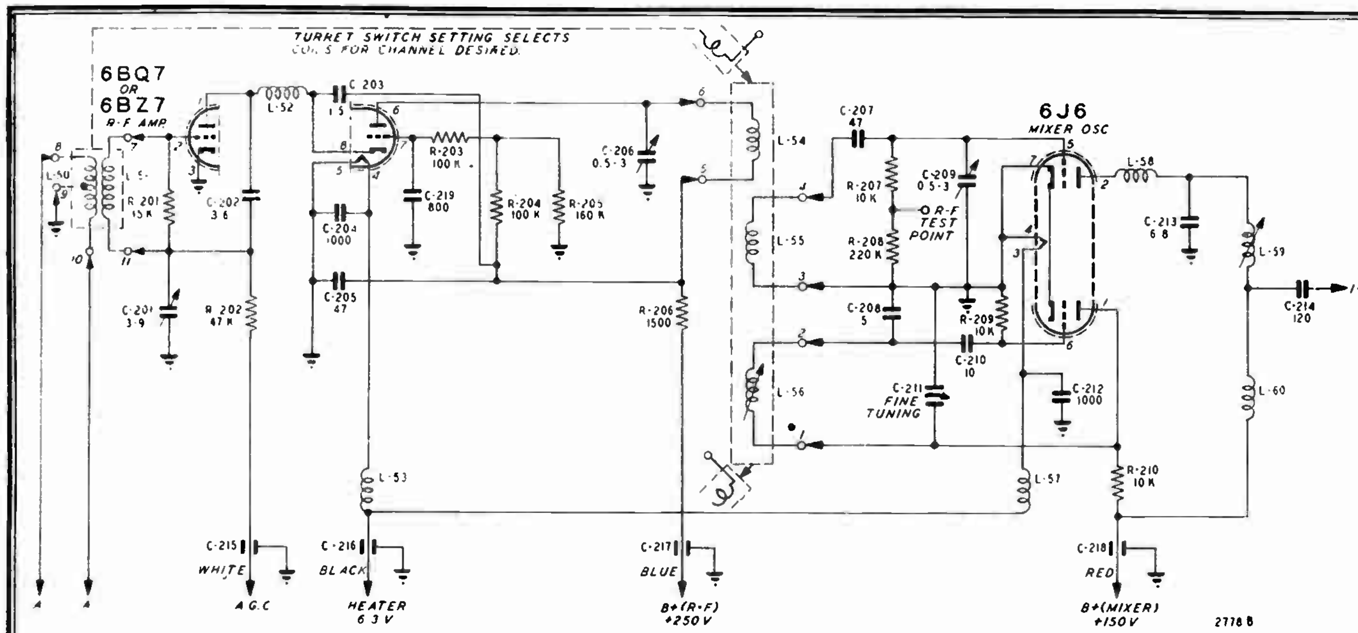


Fig. 17—Tuner Schematic Diagram.

ALIGNMENT PROCEDURE

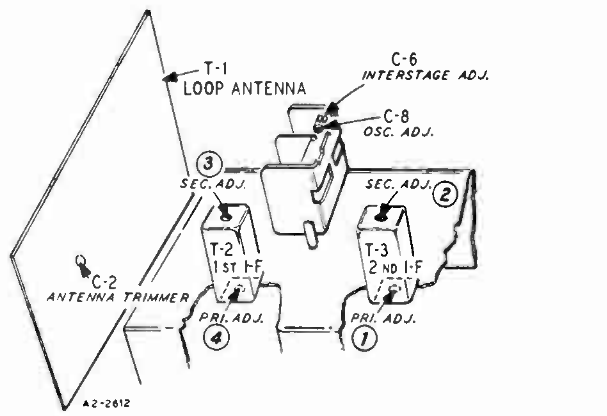
RADIO

The following is required for aligning:
An All Wave Signal Generator Which Will Provide an Accurately Calibrated Signal at the Test Frequencies as Listed.
Output Indicating Meter, Non-Metallic Screwdriver, Dummy Antennas — .1 mf, and 50 mmf.

Volume Control Maximum all Adjustments.
Connect Chassis to Ground Post of Signal Generator with a Short Heavy Lead.
Allow Chassis and Signal Generator to "Heat Up" for Several Minutes.

SIGNAL GENERATOR						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid I-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (4) and Sec. (3)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid R-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-8	Maximum Output
1400 KC	Control Grid R-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Interstage C-6 See Note B	Maximum Output
1400 KC	External Antenna Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2 See Note B	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.
NOTE B—Turn the rotor back and forth and adjust the trimmer until the peak of greatest intensity is obtained.



DRIVE CORD REPLACEMENT

DIAL POINTER CORD

Use a new S-10X77 drive cord assembly or a new length of cord 48 inches long for the installation. Install the cord as shown in the illustration, winding three turns counterclockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.

REPLACEMENT PARTS LIST

RADIO AND RECORD CHANGER

Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CAPACITORS

Ref. No.	Part No.	DESCRIPTION	Selling Price
C-1A, C-1B, C-1C	14A213	Gang Condenser Assembly	2.16
C-2	17A235	2-24 mmf Trimmer	.22
C-3, C-5, C-9, C-10, C-14	RCP10W2503M	.05 mf 200 V Tubular	.14
C-4, C-13	RCP10W2203M	.02 mf 200 V Tubular	.12
C-6, C-8		Part of Gang Condenser Assembly	
C-7	47X612	33 mmf Ceramic	.16
C-11A, C-11B		Part of 76X1 Assembly (See Miscellaneous)	
C-12	47X471	68 mmf Ceramic	.18
C-15	RCP10W4502M	.005 mf 400 V Tubular	.12
C-16A, C-16B		Part of 76X5 Assembly (See Miscellaneous)	
C-17	RCP10W6102M	.001 mf 600 V Tubular	.12
C-18A, C-18B, C-18C	45X381	20 mf 25 V, 40 mf 150 V, 40 mf 200 V Dry Electrolytic	1.34
C-19	RCP10W2104M	.1 mf 200 V Tubular	.16
C-20	RCP10W2103M	.01 mf 200 V Tubular	.12
C-21	47X508	500 mmf 500 V Ceramic	.16

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-1	B84101	100	0.5	Carbon	.08
R-2	B85104	100 K	0.5	Carbon	.06
R-3	B84563	56 K	0.5	Carbon	.08
R-4	B85470	47	0.5	Carbon	.06
R-5	B85223	22 K	0.5	Carbon	.06
R-6	B84102	1 K	0.5	Carbon	.08
R-7	B84331	330	0.5	Carbon	.08
R-8	B85225	2.2 Meg.	0.5	Carbon	.06
R-9		Part of 76X1 Assembly (See Miscellaneous)			
R-10	B84274	270 K	0.5	Carbon	.08
R-11	B84153	15 K	0.5	Carbon	.08
R-12	C85182	1.8 K	1.0	Carbon	.08
R-13	36X372	.5 Meg.		Volume Control	.74
R-14	B85106	10 Meg.	0.5	Carbon	.06
R-15A, R-15B		Part of 76X5 Assembly (See Miscellaneous)			
R-16	40X310	500 K		Tone Control	.48
R-17	B85473	47 K	0.5	Carbon	.06
R-18	B84271	270	0.5	Carbon	.08
R-19	D84821	820	2.0	Carbon	.16
R-20	B84103	10 K	0.5	Carbon	.08

TRANSFORMERS AND COILS

Ref. No.	Part No.	DESCRIPTION	Selling Price
L-1	9A2289	R. F. Interstage Coil	.48
L-2	9A2113	Oscillator Coil	.30
T-1	9A2114	"B" Range Loop Antenna	1.30
T-2	9A2112	1st I. F. Transformer	.94
T-3	9A2063	2nd I. F. Transformer	.94
T-4	51X134	Output Transformer	1.56
T-5	53X291	Power Transformer	5.52

DIAL AND DRIVE ASSEMBLY

Part No.	DESCRIPTION	Selling Price
S-10X77	Drive Cord Assembly	.12
15X251	Pointer	.10
25X1616	Dial Bracket	.90
58X771	Dial Glass	.58
26X524	Drive Shaft	.52
28X113	Drive Cord Spring	.02
7A199	Pilot Light Socket Assembly (Radio Dial)	.28
7A103	No. 47 Pilot Light Bulb (Radio Dial)	.16
19X192	"C" Washer (Mtg. Drive Shaft)	.02

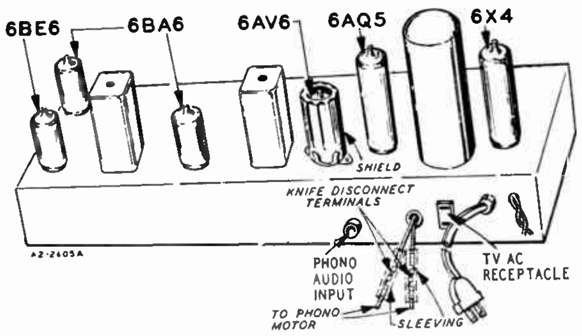
MISCELLANEOUS

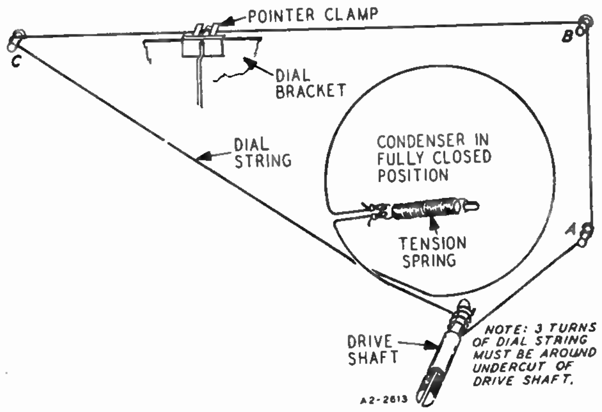
Part No.	DESCRIPTION	Selling Price
12A513	8" P.M. Speaker	5.88
13X839-1	Line Cord and Plug Assembly	.52
10A759	Knobs, (Mah.)	.16
10A766	Knobs (Blonde)	.14
4X1162	Escutcheon	.94
2A431	Band Switch	.60
3A426	Tube Socket	.12
3A458	Tube Socket	.12
32X403	Tube Shield	.06
6A307	TV-AC Receptacle	.16
30X560	Line Cord Clamp	.06
3A305	Phono Socket	.06
76X1	Capacitor-Resistor Combination	.24
76X5	Capacitor-Resistor Combination	.40
7A249	Pilot Light Socket Assembly (Radio Cabinet Base)	.36
7A32	No. 51 Pilot Light Bulb (Radio Cabinet Base)	.10
7A230	Jewel, Pilot Light, Red (Radio Cabinet Base)	.14
7A250	Phono Light Socket Assembly (Phono Comp.)	.28
7A244	Phono Light Bulb 10 W. (Phono Comp.)	.30
7A251	Dual Pilot Light Socket Assembly (Radio Phono Indicators)	.40
7A32	No. 51 Pilot Bulb (Radio Phono Indicators)	.10
7A248-1	Jewel, Pilot Light, Green (Radio Phono Indicators)	.18
7A248-2	Jewel, Pilot Light, Amber (Radio Phono Indicators)	.18

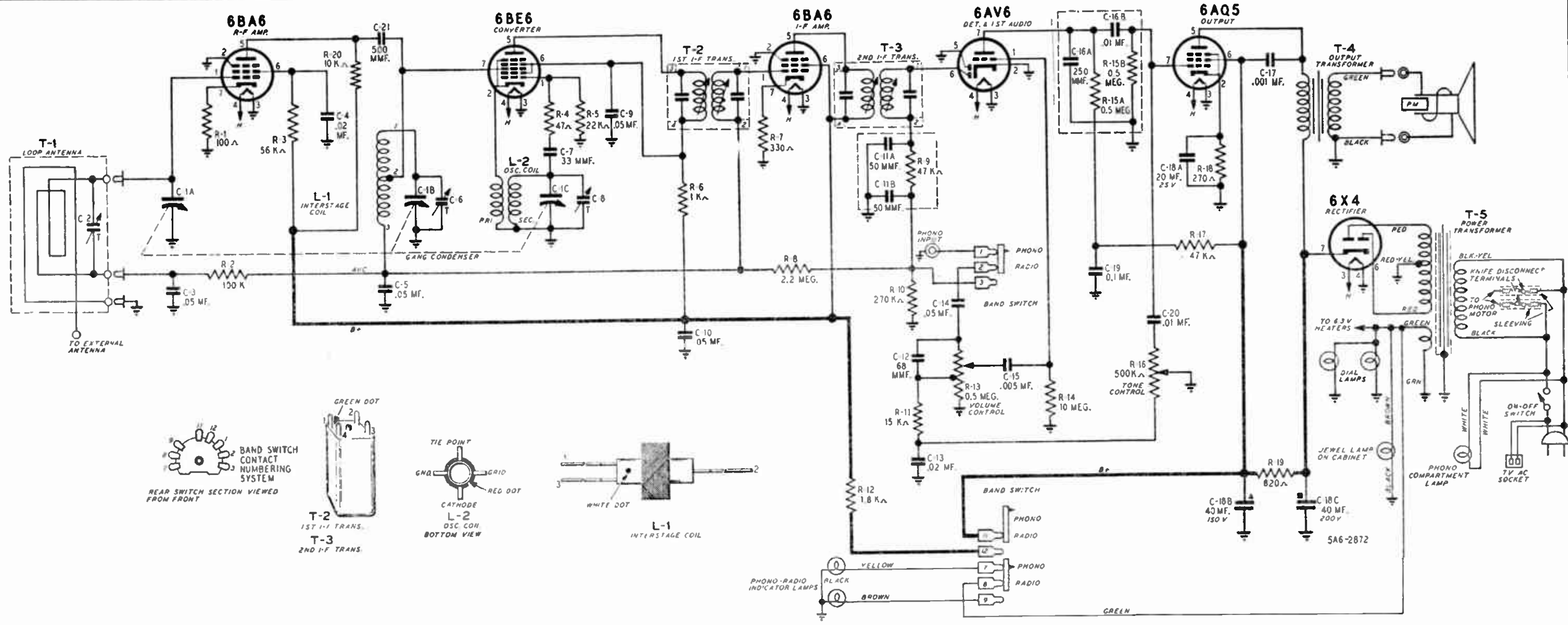
TYPE V-28A189 RECORD CHANGER PARTS

Part No.	DESCRIPTION	Qty.	Selling Price
See Note	Motor Assembly, 60 cycles 105-125 Volts AC	1	
V-2503B	Pickup Arm	1	1.20
P-77V	Crystal Cartridge & Needles (Use 60H17)	1	8.50
85-16	Needle, Regular (Use 61H2)	1	.98
85-18	Needle, Micragroove, Red (Use 61H13)	1	1.50

NOTE — Specify part number stamped on motor assembly.







UHF TUNER INFORMATION

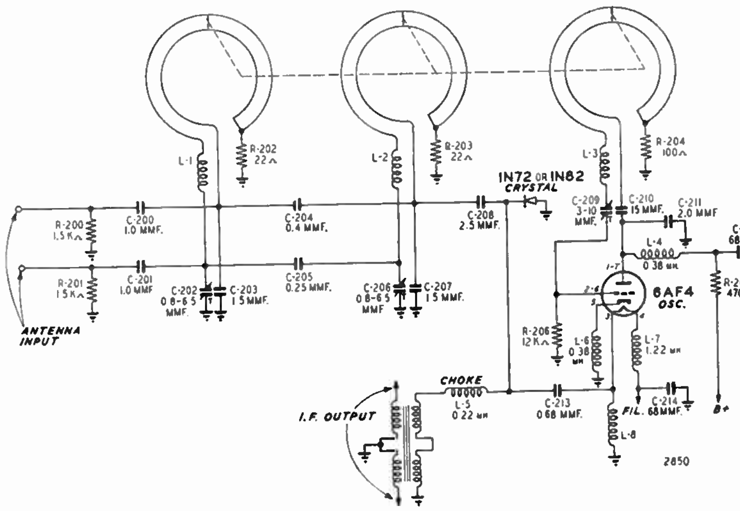
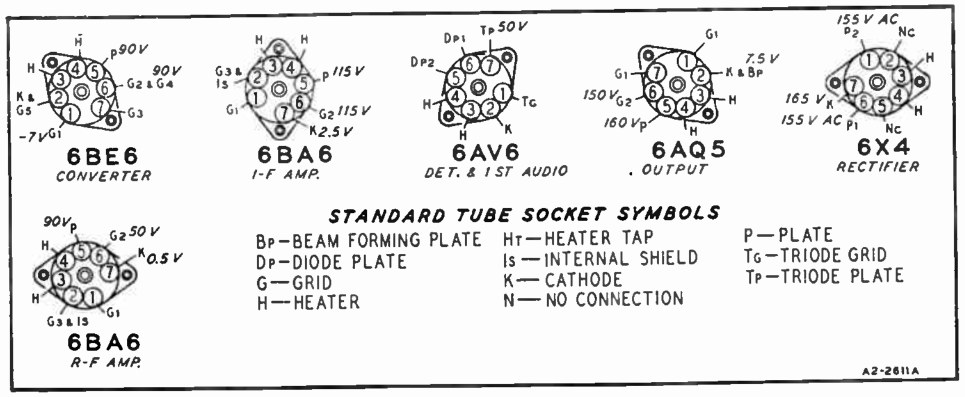


Fig. 18—UHF Tuner Schematic Diagram.

Due to the complexity of the UHF tuner, neither servicing nor aligning is encouraged in the field because replacement of any component within the R-F circuit may disturb the band-pass characteristics of the tuner. However, the 6AF4 tube or the 1N72 (or 1N82) crystal may be replaced in the field if found to be defective. A schematic diagram of this tuner is shown only for the purpose of outlining the circuit used.

If the UHF tuner does not operate satisfactorily after the tube or crystal replacement, disconnect the tuner and return it to the factory for repair.



DRIVE CORD REPLACEMENT

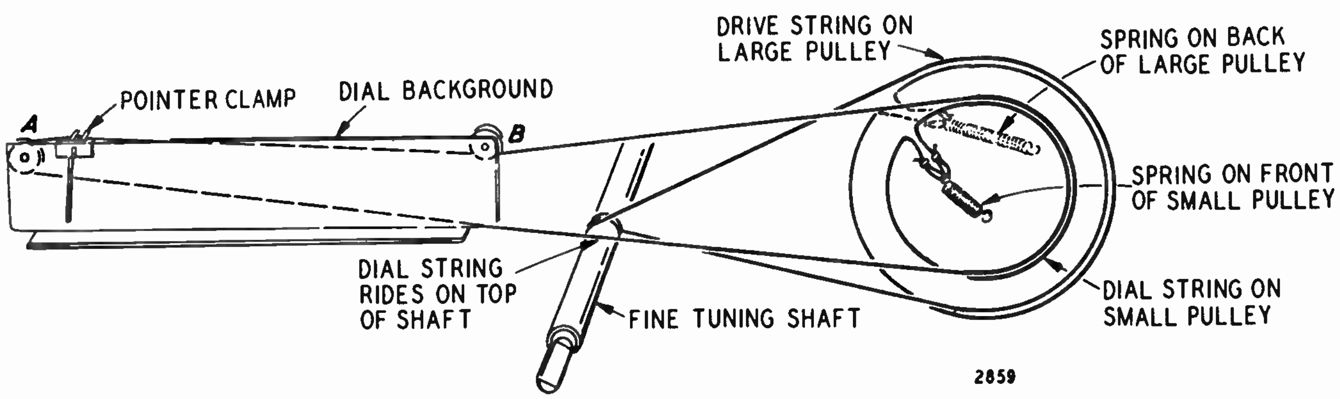


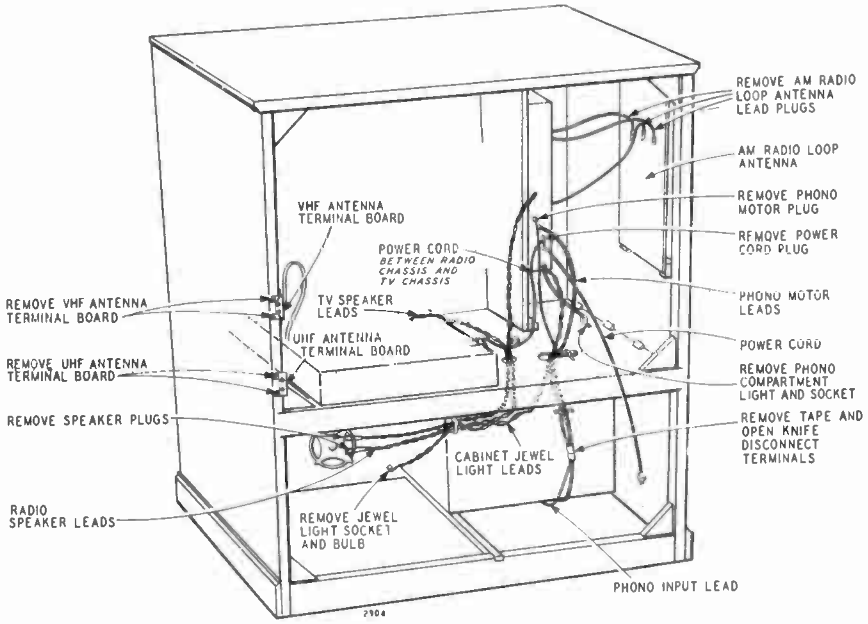
Fig. 19—Drive Cord Stringing.

TUBE SOCKET VOLTAGES

Socket voltages are shown on the Bottom Socket diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter. Conditions of measurement are:

Line voltage ....117 Volts AC
Signal Input ....None
A Variation of ±10% is usually permissible.

You will note that there are two cords used for the pointer drive system on this receiver. Part number 10X88 Drive Cord assembly and part number 28X603 Spring are used on the tuning shaft and large pulley, while part number 10X89 Drive Cord and a part number 28X603 Spring are used on the small pulley system and the pointer. Install the cords as shown in the illustration. After completing the installation rotate the fine tuning shaft a few turns to take up the slack in the cord.



NOTE—UHF Antenna Terminal board used only on UHF-VHF combinations.

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

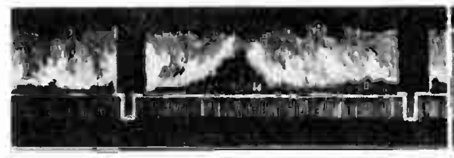
CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 4. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

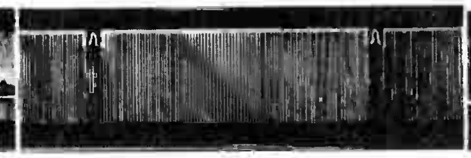
OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

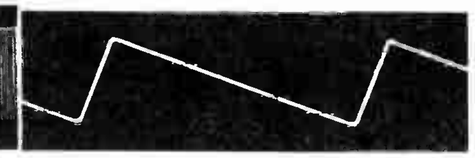
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.



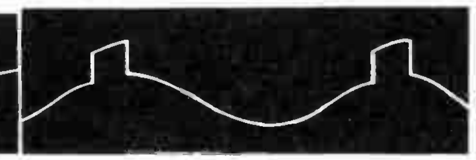
No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.



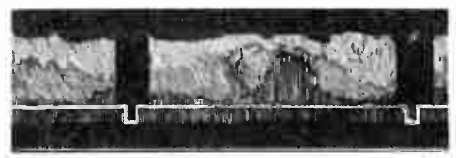
No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.

No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.

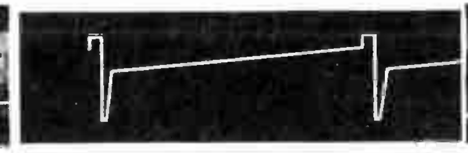
No. 8—6SN7-GTA—Vert. Osc. Plate
125V P-P 60 C.P.S.



No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.



No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.

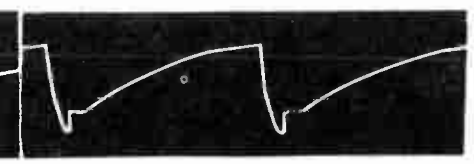


No. 9—6SN7-GTA Vert. Osc. Grid
170V P-P 60 C.P.S.

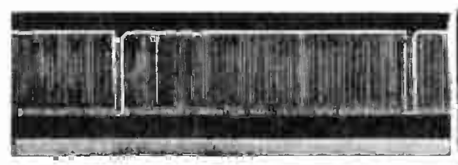
No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.

No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.

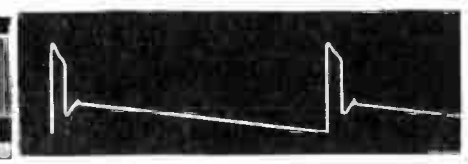
No. 10—6SN7-GTA Vert. Output Grid
150V P-P 60 C.P.S.



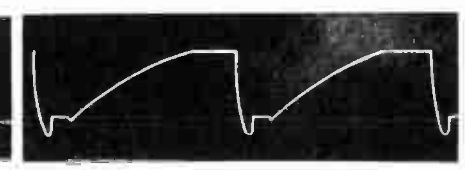
No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.



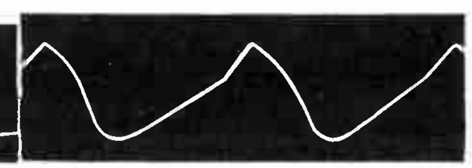
No. 11—Vert. Def. Coil
100V P-P 60 C.P.S.



No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.

No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.

No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4—GT Damper Plate
120V P-P 15,750 C.P.S.

VHF TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R-207, R 209, R-210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	A9A2297-2	Antenna Coil	2-Q
	A9A2297-3	Antenna Coil	3-Q
	A9A2297-4	Antenna Coil	4-Q
	A9A2297-5	Antenna Coil	5-Q
	A9A2297-6	Antenna Coil	6-Q
	A9A2297-7	Antenna Coil	7-Q
	A9A2297-8	Antenna Coil	8-Q
	A9A2297-9	Antenna Coil	9-Q
	A9A2297-10	Antenna Coil	10-Q
	A9A2297-11	Antenna Coil	11-Q
	A9A2297-12	Antenna Coil	12-Q
	A9A2297-13	Antenna Coil	13-Q

COILS AND CHOKES (Continued)

Ref. No.	Part No.	Description	Channel & Code No.
	A9A2297-91	Antenna Coil	UHF Position
	A9A2298-2	Oscillator Coil	2-Q
	A9A2298-3	Oscillator Coil	3-Q
	A9A2298-4	Oscillator Coil	4-Q
	A9A2298-5	Oscillator Coil	5-Q
	A9A2298-6	Oscillator Coil	6-Q
	A9A2298-7	Oscillator Coil	7-Q
	A9A2298-8	Oscillator Coil	8-Q
	A9A2298-9	Oscillator Coil	9-Q
	A9A2298-10	Oscillator Coil	10-Q
	A9A2298-11	Oscillator Coil	11-Q
	A9A2298-12	Oscillator Coil	12-Q
	A9A2298-13	Oscillator Coil	13-Q
	A9A2298-91	Oscillator Coil	UHF Position
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding
M-109	16S-006	Shield, Tube (6J6)
M-110	16S-004	Shield, Tube (6BQ7)
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil)
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD)
M-114	10E-401	Nut, Locking Spring (for trimmers)
M-115	9A-410-7	Screw, Trimmer
M-116	9A-629-3	Screw, Bracket Mounting (6/32" by ¼")
M-117	31B-029	Osc. Slug Trimmer
M-121	31B-016	Roller, Detent (⅜" dia., 3/32" dia. bearing)
M-122	31B-005	Spring, Detent (2-5/16" long)
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½")
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.)
M-126	31B-103	Shield, Bottom Cover
	31B-655-3	Fine Tuning Shaft (Sharp Tuning) used with 25A1104

TELEVISION PARTS LIST

21" METAL RECTANGULAR PIX TUBE

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

NOTICE: There is a model number label on the chassis. This label identifies the receiver as to chassis and issue letter. When ordering parts or writing, give complete model number.

CAPACITORS

Ref. No.	Part No.	Description			Selling Price
C-1, C-3, C-4, C-5, C-18, C-32, C-35, C-42, C-43, C-44, C-45, C-50, C-55, C-58, C-74	80X1	1000 mmf		Ceramic	.12
C-2A, C-2B, C-30A, C-30 B	80X3	1000 mmf		Dual Ceramic	.18
C-6	47X603	47 mmf	500 V	Ceramic	.12
C-7	Part of T-3				
C-8	47X562	5 mmf	500 V	Ceramic	.48
C-9	47X584	1.5 mmf		Composition	.06
C-10	Part of L-13				
C-11, C-12	Part of T-6				
C-13, C-15, C-17	47X507	5000 mmf		Ceramic	.18
C-14, C-66	47X604	100 mmf	500 V	Ceramic	.12
C-16, C-41	Part of T-7				
C-19, C-72	45X378	5 mf	25W.V.	Dry Electrolytic	.58
C-20	47X525	470 mmf	500 V.	Molded Mica	.16
C-21, C-62	RCP10M2473M	.047 mf	200 V	Tubular	.18
C-22, C-24, C-56, C-81	RCP10M4472M	.0047 mf	400 V	Tubular	.16
C-23, C-52, C-57	RCP10M4103M	.01 mf	400 V	Tubular	.16
C-25, C-36, C-51, C-73, C-79	RCP10M4473M	.047 mf	400 V	Tubular	.18
C-26	Part of 76X5 (See Miscellaneous)				
C-27A, C-27 B, C-27C	45X392	40 mf 10 mf 20 mf	50 V 400 V 400 V	Dry Electrolytic	1.50
C-28	RCP10M6472M	.0047 mf	600 V	Tubular	.16
C-29, C-31, C-61	RCP10M2224M	.22 mf	200 V	Tubular	.28
C-33	45X361	4 mf	100 W.V.	Dry Electrolytic	.60
C-34	47X568	360 mmf	500 V	Molded Mica	.12
C-37	RCP10M2104M	.1 mf	200 V	Tubular	.18
C-38, C-77, C-80, C-85	RCP10M4104M	.1 mf	400 V	Tubular	.22
C-39	RCP10M6153M	.015 mf	600 V	Tubular	.18
C-40, C-68	RCP10M6473M	.047 mf	600 V	Tubular	.22
C-46, C-82	47X615	.01 mf		Ceramic	.26
C-47A, C-47 B	45X391	80 mf 100 mf	400 V 50 V	Dry Electrolytic	2.22

CAPACITORS—Continued

Ref. No.	Part No.	Description			Selling Price
C-48, C-71	45X393	30 mf	400 V	Dry Electrolytic	1.06
C-49A, C-49 B	45X390	80 mf 60 mf	400 V 400 V	Dry Electrolytic	2.68
C-53A, C-53B, C-53C	Part of 76X7 (See Miscellaneous)				
C-54, C-60	47X543	4700 mmf	500 V	Molded Mica	.52
C-59	RCM20A271K	270 mmf	500 V	Molded Mica	.16
C-63	RCM20B431K	430 mmf	500 V	Molded Mica	.18
C-64	47X570	330 mmf	500 V	Molded Mica	.14
C-65	RCM20A201K	200 mmf	500 V	Molded Mica	.16
C-67, C-70	RCP10M6104M	.1 mf	600 V	Tubular	.30
C-69	RCP10M6103M	.01 mf	600 V	Tubular	.18
C-75	47X560	500 mmf	20 K.V.	Ceramic	1.20
C-76	47X598	56 mmf	1500 V	Ceramic	.20
C-78	RCP10M4154M	.15 mf	400 V	Tubular	.24

RESISTORS

Ref. No.	Part No.	Ohms	Watts		Selling Price
R-1	B83822	8.2 K	0.5	Carbon	.10
R-2, R-5	B83470	47	0.5	Carbon	.10
R-3, R-6, R-12, R-16, R-30	B85102	1 K	0.5	Carbon	.06
R-4, R-7	B83223	22 K	0.5	Carbon	.10
R-8	B84181	180	0.5	Carbon	.08
R-9, R-42	B84152	1.5 K	0.5	Carbon	.08
R-10	Part of L-5				
R-11, R-44	B84101	100	0.5	Carbon	.08
R-13	B84563	56 K	0.5	Carbon	.08
R-14, R-41, R-80	B84333	33 K	0.5	Carbon	.08
R-15, R-24, R-36, R-74	B84104	100 K	0.5	Carbon	.08
R-17	B84271	270	0.5	Carbon	.08
R-18, R-19, R-86	B84223	22 K	0.5	Carbon	.08
R-20, R-21, R-65	B84683	68 K	0.5	Carbon	.08
R-22, R-71	78X12	1.5 K 1.0 meg.		Contrast and Volume Control	1.62
R-23	B85106	10.0 meg	0.5	Carbon	.06
R-25	40X333	500 K		Brightness Control	.52
R-26A, R-26B	Part of 76X5 (See Miscellaneous)				
R-27, R-53	B85473	47 K	0.5	Carbon	.06
R-28	C84331	330	1.0	Carbon	.10
R-29	D84102	1 K	2.0	Carbon	.16
R-31, R-32	B85151	150	0.5	Carbon	.06
R-33	B84275	2.7 meg.	0.5	Carbon	.08
R-34, R-100	B84474	470 K	0.5	Carbon	.08
R-35	B83334	330 K	0.5	Carbon	.10
R-37	B83472	4.7 K	0.5	Carbon	.10
R-38, R-63, R-103	B84473	47 K	0.5	Carbon	.08

REPLACEMENT PARTS LIST—Continued

21" METAL RECTANGULAR PIX TUBE

RESISTORS—Continued

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-39	40X363	7.5 meg.		Sync Stability Control	.48
R-40	Part of L-9				
R-43, R-50	B84105	1.0 meg.	0.5	Carbon......	.12
R-46	Part of L-10				
R-47	C83472	4.7 K	1.0	Carbon......	.12
R-49	40X368	4 K		Vertical Linearity Control	.42
R-51	40X334	1.5 meg.		Vertical Hold Control	.52
R-52, R-84	B85104	100 K	0.5	Carbon......	.06
R-54	40X364	2.5 meg.		Height Control	.42
R-55	B84222	2.2 K	0.5	Carbon......	.08
R-56	B85274	270 K	0.5	Carbon......	.06
R-57	43X273	330	10.0	Wirewound...	.48
R-58	43X275	1.5 K	15.0	Wirewound...	.58
R-59	43X272	10 K	5.0	Wirewound...	.50
R-60	C84562	5.6 K	1.0	Carbon......	.10
R-61	B84274	270 K	0.5	Carbon......	.08
R-62	B84155	1.5 meg.	0.5	Carbon......	.08
R-64, R-92	B84103	10 K	0.5	Carbon......	.08
R-66	B84824	820 K	0.5	Carbon......	.08
R-67, R-70, R-96	B83222	2.2 K	0.5	Carbon......	.10
R-68A, R-68B, R-68C	Part of 76X7 (See Miscellaneous)				
R-69	B84332	3.3 K	0.5	Carbon......	.08
R-72	40X334	1.5 meg.		Tone Control..	.52
R-73	B85475	4.7 meg.	0.5	Carbon......	.06
R-75, R-83	B85474	470 K	0.5	Carbon......	.06
R-76	B84273	27 K	0.5	Carbon......	.08
R-77, R-78	C84682	6.8 K	0.5	Carbon......	.10
R-79	C83562	5.6 K	1.0	Carbon......	.12
R-81	B83224	220 K	0.5	Carbon......	.10
R-82, R-90	B84185	1.8 meg.	0.5	Carbon......	.08
R-85	B84821	820	0.5	Carbon......	.08
R-87, R-93	B84225	2.2 meg.	0.5	Carbon......	.08
R-88	B84184	180 K	0.5	Carbon......	.08
R-89	40X331	150 K		Horizontal Drive Control	.44
R-91	C84102	1 K	1.0	Carbon......	.10
R-94	40X361	50 K		Horizontal Hold Control	.52
R-95	D84682	6.8 K	2.0	Carbon......	.16
R-97	B83154	150 K	0.5	Carbon......	.10
R-98, R-107	B84561	560	0.5	Carbon......	.08
R-99	B84562	5.6 K	0.5	Carbon......	.08
R-101	D84101	100	2.0	Carbon......	.16
R-102	43X276	12 K	5.0	Wirewound...	.62
R-104	43X239	5.1	0.5	Wirewound...	.24
R-105	C85105	1.0 meg.	1.0	Carbon......	.08
R-106	B85102	1 K	0.5	Carbon......	.06
R-108	40X364	2.5 meg.		A.G.C. Control	.42
R-109	D85104	100 K	2.0	Carbon......	.12
R-110	43X279	8 K	5.0	Wirewound...	.48
R-111	D84123	12 K	2.0	Carbon......	.16

MISCELLANEOUS

Part No.	Description	Selling Price
76X5	Multiple Resistor Capacitor Assembly	.40
2A426	Centering Device	.70
76X7	Multiple Resistor Capacitor Assembly..........	.54
9A2274	Deflection Yoke Assembly	7.12
2A407	Ion Trap Magnet	.50
4A408	Antenna Terminal Strip	.24
3A427	Tube Socket Miniature	.16
3A458	Tube Socket 6CB6-6AU6-6AL5	.12
3A463	Tube Socket, 12AT7	.24
3A464	Tube Socket 6BQ6-6SN7	.10
3A445	Tube Socket, 6AX4	.16
3A466	Tube Socket, 1B3	.36
3A470	Tube Socket, Octal	.10
13X817	Pix Tube Socket	.58

MISCELLANEOUS—Continued

Part No.	Description		Selling Price
32X403	Tube Shield (3A458 Socket)		.06
32X405	Tube Shield (3A463 Socket)		.12
S-6A1	Anode Connector & Lead Assembly		.30
25X1828	Bracket, Pix Tube Rear Mtg.		1.14
8X227	Collar Pix Tube Rear Mtg.		.34
S-34X19	Tube Cover and Power Cord Assembly		1.36
6X73	Rubber Grommet (6BQ6 Plate Lead)		.04
25X1815	Bracket, Tube Front Support (R.H.)		.64
25X1816	Bracket, Tube Front Support (L.H.)		.64
16X146	Fuse Holder		.16
16X147-3	Fuse 4/10 Amp. 125-250 V		.22
S-14X72	Cabinet Back Assembly		2.70
S-25X85	Tube Mtg. Strap Assembly		.52
7A247	Pilot Light Socket Assembly (Channel Selector) ...		.16
7A32	Pilot Light Bulb		.10
4X1157	Pix Tube Mtg. Ring		3.58
20X1772	Compression Ring (For Fine Tuning Knob) ..doz.		.22
2110-15	Caster, Rubber Wheel		.46
17X174	Pix Crystal	Models 3180-3190	6.48
4X1220-16	Pix Mask	Models 3180-3190	3.20
S-4X28-1	Escutcheon Control (Panel Assembly)	Model 3180	2.10
10A820-1	Knob (Maroon) (Fine Tuning)	Model 3180	.90
10A821-1	Knob (") (Contrast)	Model 3180	.70
10A822-1	Knob (") (Channel Selector) .	Model 3180	.64
10A799	Knob (") (Volume)	Model 3180	.88
S-4X28-2	Escutcheon Control (Panel Assembly)	Model 3190	2.10
10A820-2	Knob (Beige) (Fine Tuning)	Model 3190	.34
10A821-3	Knob (Beige) (Contrast)	Model 3190	.48
10A822-3	Knob (Beige) (Channel Selector) ..	Model 3190	.76
10A812-4	Knob (Beige) (Volume)	Model 3190	.76
25A1105	UHF Tuner R.F. (Mallory)		
25A1104	VHF Tuner R.F. (Standard Coil)		
26X528	Shaft & Pulley Assembly		.64
S-37X4	Shaft Coupling Assembly		.48
S-37X3	Switch Cover Assembly		.48
2A430	Switch Assembly (VHF-UHF)		1.74
11X163	Switch Assembly Cover		.06
25X1887	Dial Bracket		.34
19X108	Flat Washer ....doz.		.06
10XB8	UHF Tuner Drive Cord Assembly		.18
10XB9	Dial Drive Cord Assembly		.22
28X603	Drive Cord Tension Springs		.04
58X768	Dial Glass		.34
15X277	Pointer		.18
52X92	Filter, Low Pass		2.92
28X564	Spring Clips		.10
28X604	Spring Washer ....doz.		.22
7A246	Pilot Light Socket Assembly (UHF Dial)		.16
4X1210-1	Escutcheon Plate		1.86

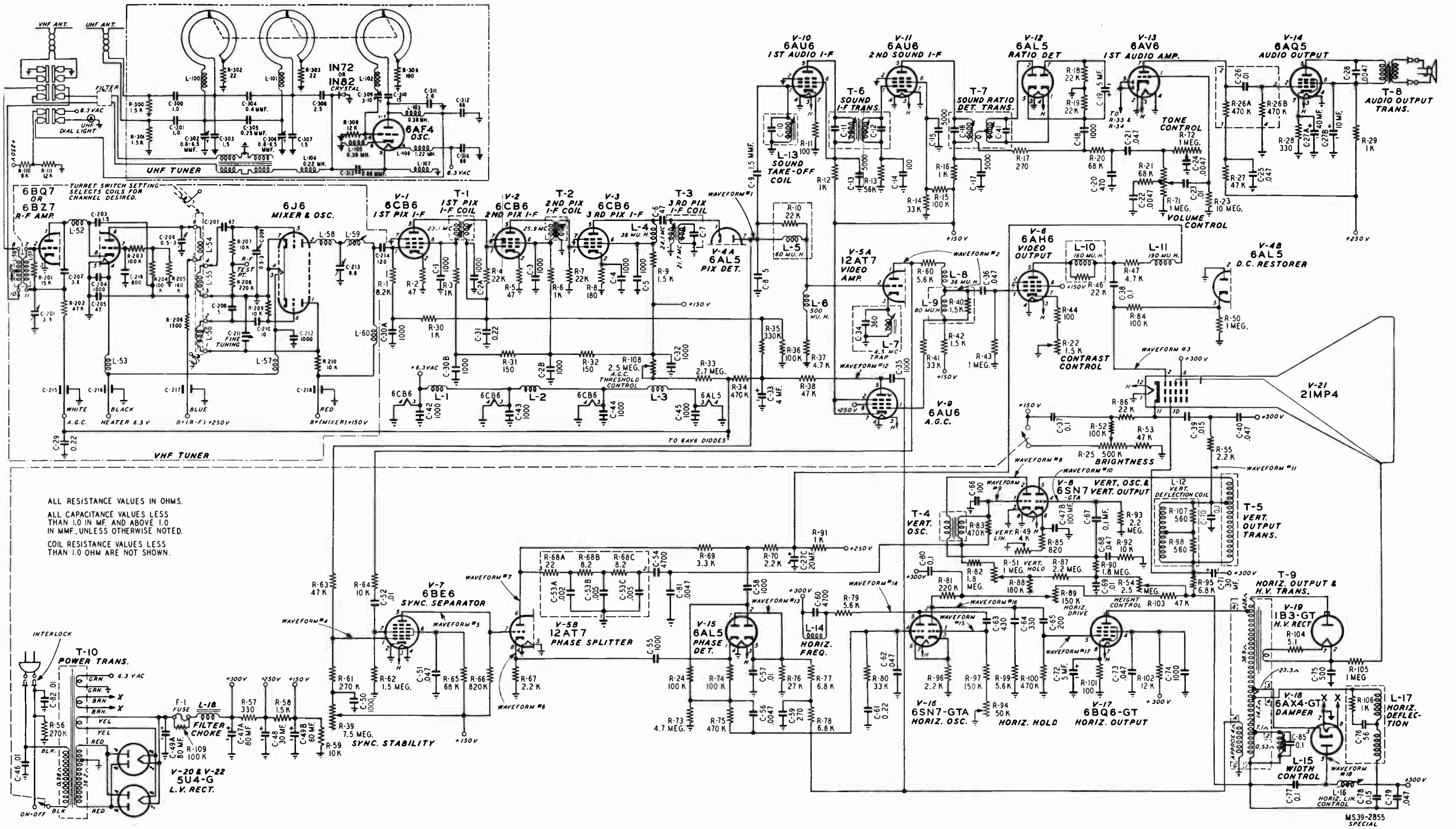
TRANSFORMERS AND COILS

Ref. No.	Part No.	Description	Selling Price
L-1, L-2, L-3	9A2033	R.F. Heater Choke	.12
L-4, L-8	9A1979	Peaking Coil (36 uh)	.30
L-5	36A10	Peaking Coil (60 uh)	.24
L-6	36A11	Peaking Coil (500 uh)	.28
L-7	9A2074	4.5 MC Trap	.36
L-9	36A16	Peaking Coil (80 uh)	.28
L-10	36A12	Peaking Coil (160 uh)	.24
L-11	36A2	Peaking Coil (190 uh)	.30
L-12, L-17	Part of Deflection Coils		
L-13	9A2168	Sound Take Off Coil	.66
L-14	9A2096	Horizontal Frequency Control	.66
L-15	9A2183	Width Control	.96
L-16	9A2262	Horizontal Linearity Control.........	.46
L-18	52X91	Filter Choke	2.22
T-1, T-2	9A2230	1st and 2nd P.I.F. Transformer	.44
T-3	9A2226	3rd P.I.F. Transformer	1.06
T-4	54X8	Vertical Osc. Transformer	1.42
T-5	51X156	Vertical Output Transformer	3.04
T-6	9A2170	Sound I.F. Transformer	.94
T-7	9A2269	Sound Ratio Det. Transformer	1.66
T-8	51X150	Audio Output Transformer	1.64
T-9	53X330	Horizontal Output Transformer	7.20
T-10	53X333	Power Transformer	16.56

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc
2	54-60	55.25	59.75	43	644-650	645.25	649.75
3	60-66	61.25	65.75	44	650-656	651.25	655.75
4	66-72	67.25	71.75	45	656-662	657.25	661.75
5	76-82	77.25	81.75	46	662-668	663.25	667.75
6	82-88	83.25	87.75	47	668-674	669.25	673.75
7	174-180	175.25	179.75	48	674-680	675.25	679.75
8	180-186	181.25	185.75	49	680-686	681.25	685.75
9	186-192	187.25	191.75	50	686-692	687.25	691.75
10	192-198	193.25	197.75	51	692-698	693.25	697.75
11	198-204	199.25	203.75	52	698-704	699.25	703.75
12	204-210	205.25	209.75	53	704-710	705.25	709.75
13	210-216	211.25	215.75	54	710-716	711.25	715.75
14	470-476	471.25	475.75	55	716-722	717.25	721.75
15	476-482	477.25	481.75	56	722-728	723.25	727.75
16	482-488	483.25	487.75	57	728-734	729.25	733.75
17	488-494	489.25	493.75	58	734-740	735.25	739.75
18	494-500	495.25	499.75	59	740-746	741.25	745.75
19	500-506	501.25	505.75	60	746-752	747.25	751.75
20	506-512	507.25	511.75	61	752-758	753.25	757.75
21	512-518	513.25	517.75	62	758-764	759.25	763.75
22	518-524	519.25	523.75	63	764-770	765.25	769.75
23	524-530	525.25	529.75	64	770-776	771.25	775.75
24	530-536	531.25	535.75	65	776-782	777.25	781.75
25	536-542	537.25	541.75	66	782-788	783.25	787.75
26	542-548	543.25	547.75	67	788-794	789.25	793.75
27	548-554	549.25	553.75	68	794-800	795.25	799.75
28	554-560	555.25	559.75	69	800-806	801.25	805.75
29	560-566	561.25	565.75	70	806-812	807.25	811.75
30	566-572	567.25	571.75	71	812-818	813.25	817.75
31	572-578	573.25	577.75	72	818-824	819.25	823.75
32	578-584	579.25	583.75	73	824-830	825.25	829.75
33	584-590	585.25	589.75	74	830-836	831.25	835.75
34	590-596	591.25	595.75	75	836-842	837.25	841.75
35	596-602	597.25	601.75	76	842-848	843.25	847.75
36	602-608	603.25	607.75	77	848-854	849.25	853.75
37	608-614	609.25	613.75	78	854-860	855.25	859.75
38	614-620	615.25	619.75	79	860-866	861.25	865.75
39	620-626	621.25	625.75	80	866-872	867.25	871.75
40	626-632	627.25	631.75	81	872-878	873.25	877.75
41	632-638	633.25	637.75	82	878-884	879.25	883.75
42	638-644	639.25	643.75	83	884-890	885.25	889.75

21" UHF-VHF TELEVISION RECEIVER



ALL RESISTANCE VALUES IN OHMS.
ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF., UNLESS OTHERWISE NOTED.
COIL RESISTANCE VALUES LESS THAN 1.0 OHM ARE NOT SHOWN.

PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-18 becomes 47X570 330 mmf molded mica condenser

R-15 becomes B84333 33K ohms 0.5 W carbon resistor

R-18, R-19 become B83103 10K ohm 0.5 W carbon resistors

In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphabetical identification (A, B, C etc.)

ELECTRICAL SPECIFICATIONS

Power Supply	117 Volts AC 60 Cycles Only
Power Consumption	210 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Range	VHF—Channels 2 thru 13
Intermediate Freq. (Tel.)	Picture—26.20 MC Sound—21.70 MC
Tel. Antenna Input Imp.	300 Ohms Balanced
Intercarrier Sound System	4.5 MC
Loud Speaker	See Parts List
Voice Coil Impedance	3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	12BY7	Video Output
V-7	6CS6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	21ZP4B	Picture Tube 21" Glass Rectangular (Magnetic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

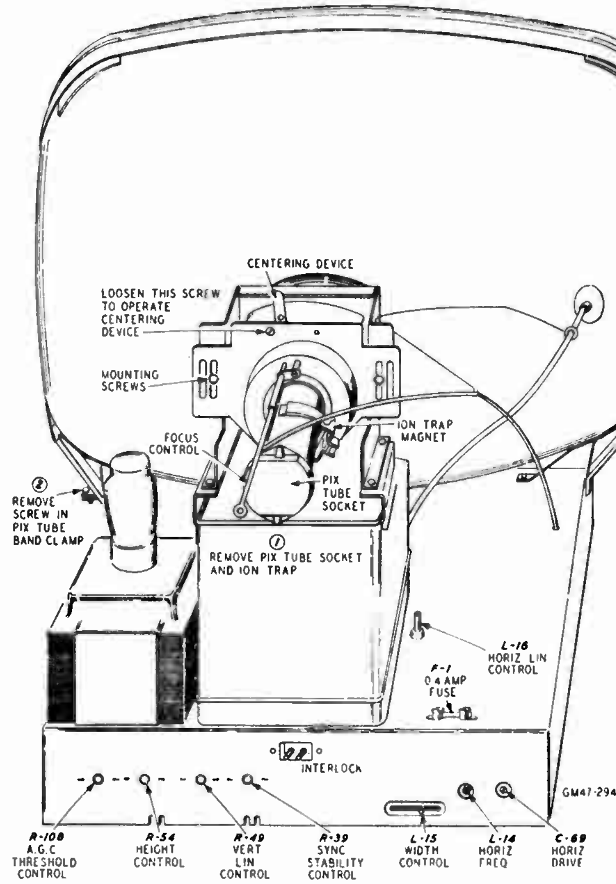


Fig. 3—Removal of Picture Tube and Rear Chassis Controls

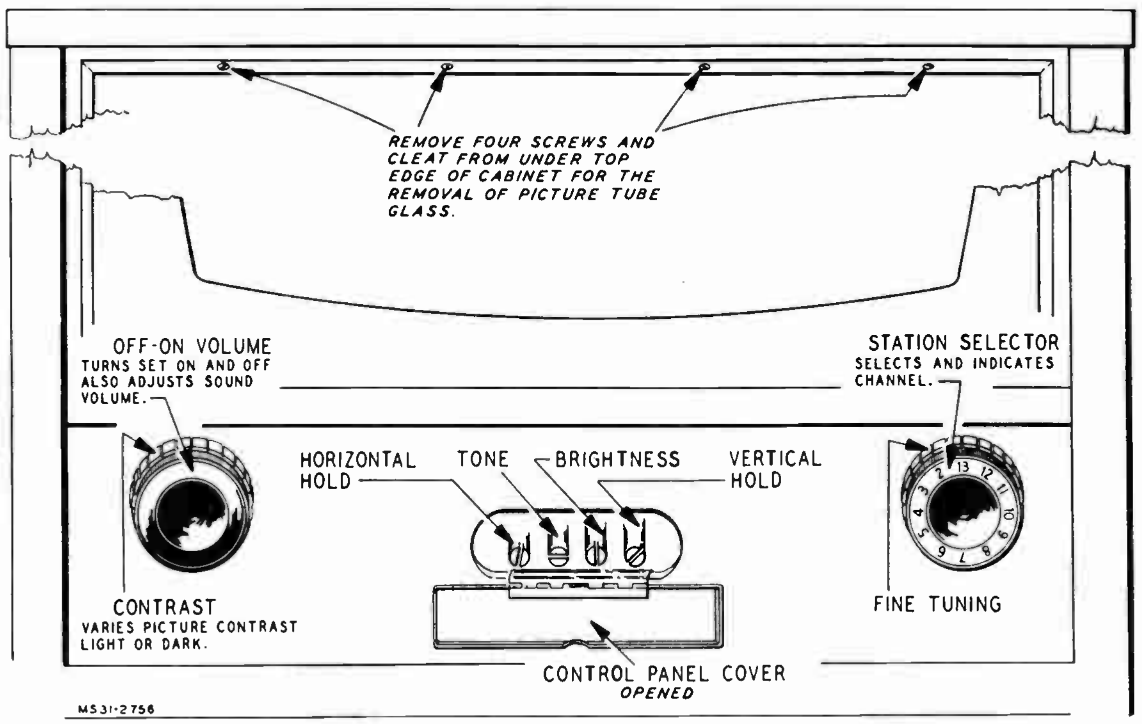


Fig. 2—Front Panel Controls

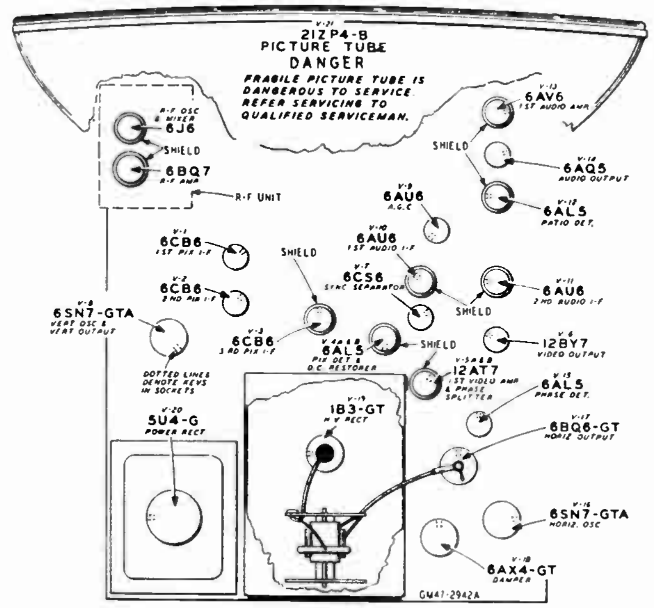


Fig. 1—Tube Layout.

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 1000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned. When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

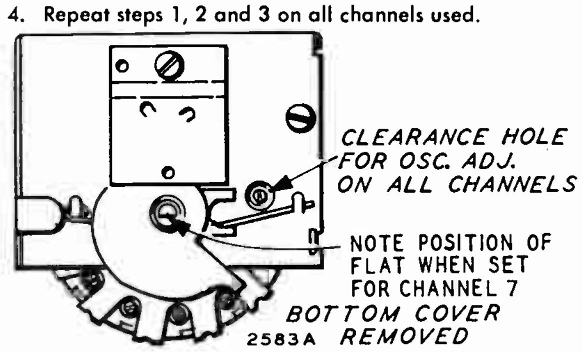


Fig. 4—Tuner Oscillator Adjustments

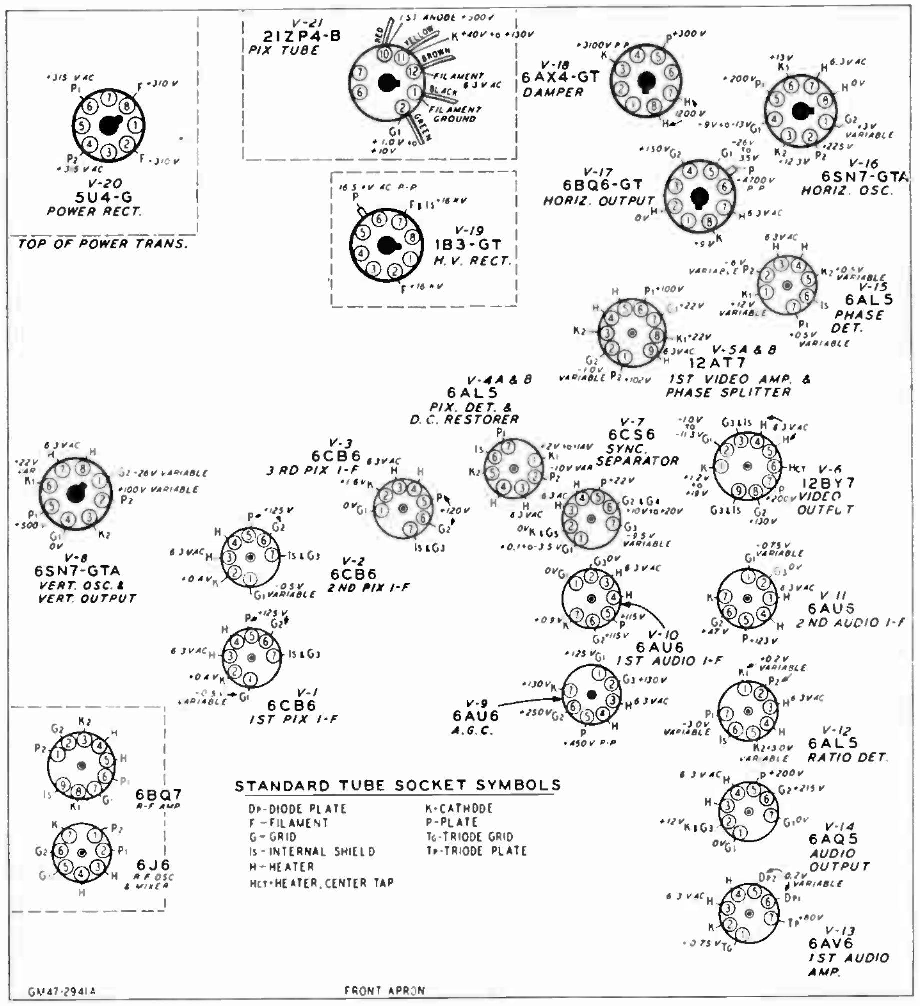


Fig. 5—Bottom Socket Voltages

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-105 and C-75 defective, or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-47B or C-71 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitors C-68 & C-70 or open or incorrect value of resistors R-90 & R-92.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-67 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-77, C-78, C-79 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:

1: Defective yoke.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:

1: Low +B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control C-69.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND— This condition can be caused by:

1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (12BY7) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:

1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6), AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:

1: Vertical integrating network capacitors C-53A, B & C, and resistors R-68A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (12BY7).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (12BY7) grid capacitor C-36. If the capacitor is not found to be defective, check the following:
   1: Check all potentials in video circuits.
   2: Check picture tube grid circuit for poor or dirty contact.
   3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (12BY7), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING

1: Check sync stability control adjustment.
2: Check capacitors C-47A and C-49A.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6CS6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND

This condition can be caused by,

1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3
2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3: Detective R-F Amplifier or oscillator mixer tubes in the tuner.

POOR FOCUS

1: Improper setting or defective focus magnet.
2: Defective picture tube.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6CS6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
18 to 30 mc, 10 mc sweep width
40 to 90 mc, 10 mc sweep width
170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
23.1 mc first picture I-F coil.
24.1 mc third picture I-F coil.
25.9 mc second picture I-F coil.
21.7 mc sound trap.
4.5 mc video trap & sound I-F.
25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-105.

ALIGNMENT PROCEDURE
PIX I-F

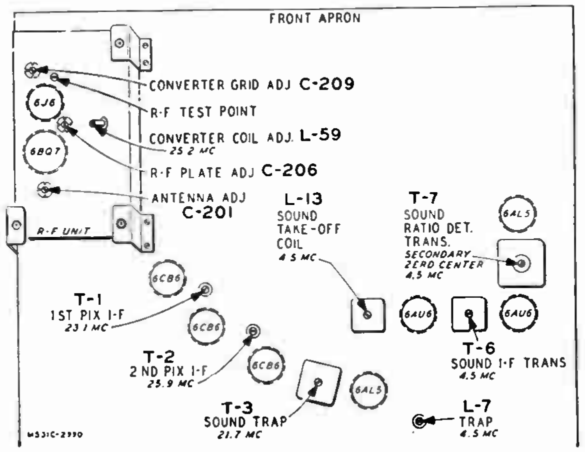


Fig. 7—Top Chassis Video and Audio I-F Adjustments

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-37) 4700 ohms, in series with peaking coil (L-6) from Pin 2 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line. (Junction of R-35 & R-36).

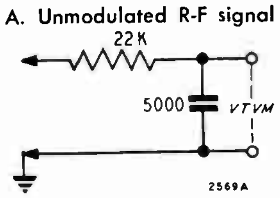


Fig. 9—VTVM Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

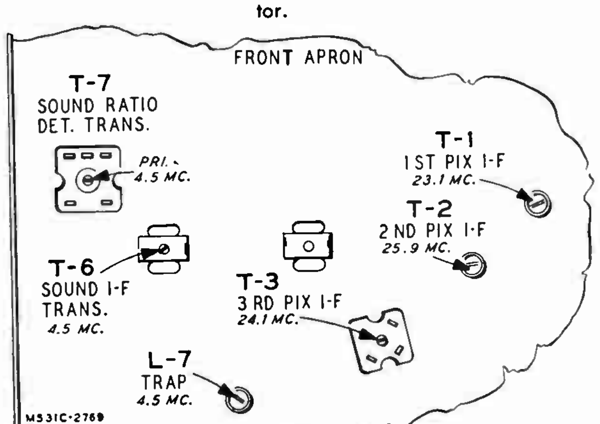


Fig. 8—Bottom Chassis Video and Audio I-F Adjustments

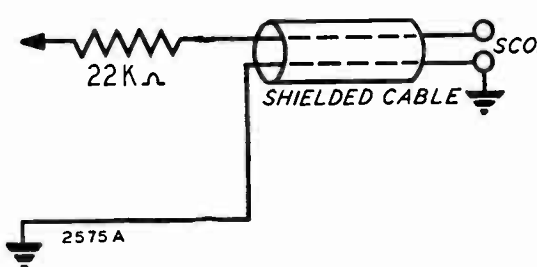


Fig. 10—Oscilloscope Connections

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-37 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

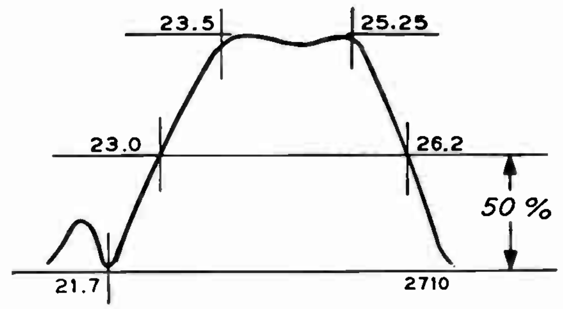


Fig. 11—Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 2-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-13 and C-14, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-17, R-20 and C-18, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" Figure 12) on tuner. Connect 1½ V bias to AGC line at junction of R-34 and C-29 on the receiver.

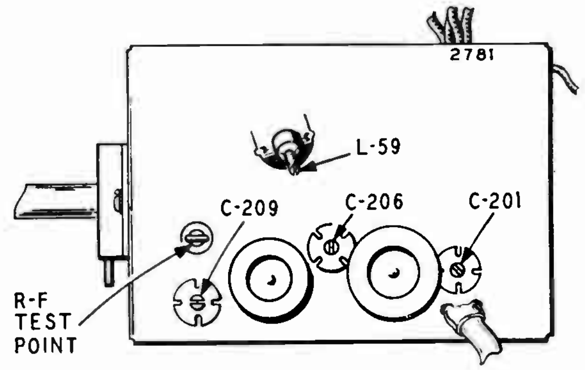


Fig. 12—Top Tuner Adjustments.

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 13. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

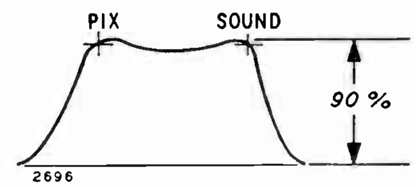


Fig. 13—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-30.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 11).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

VHF TUNER ASSEMBLY INFORMATION

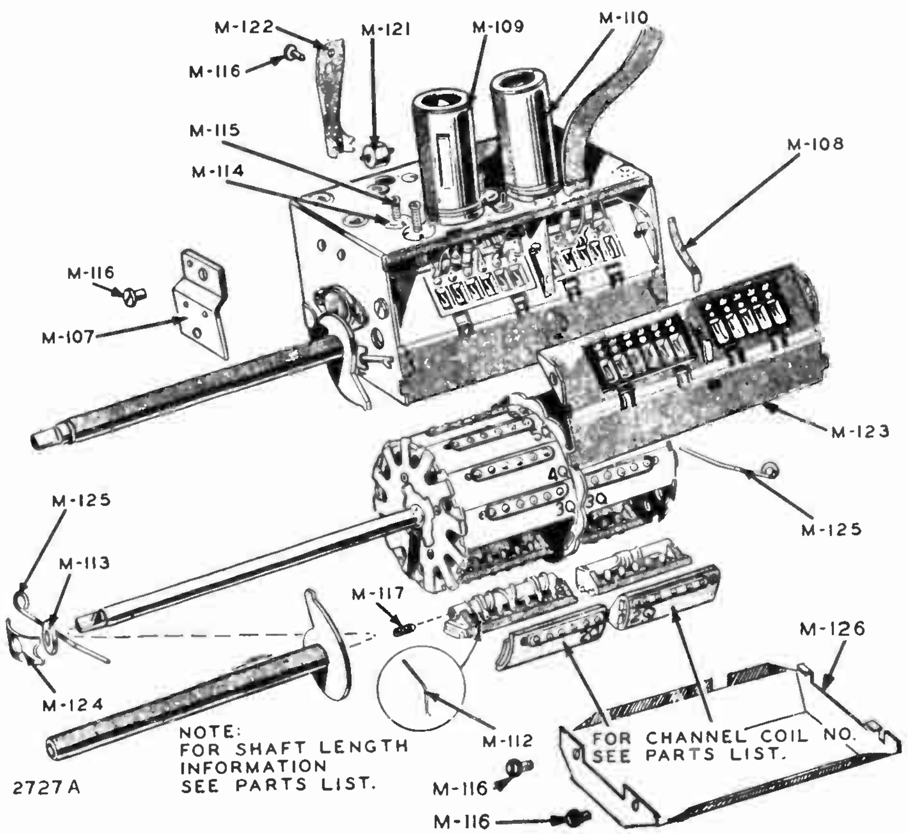


Fig. 14—"Q" Tuner Pictorial.

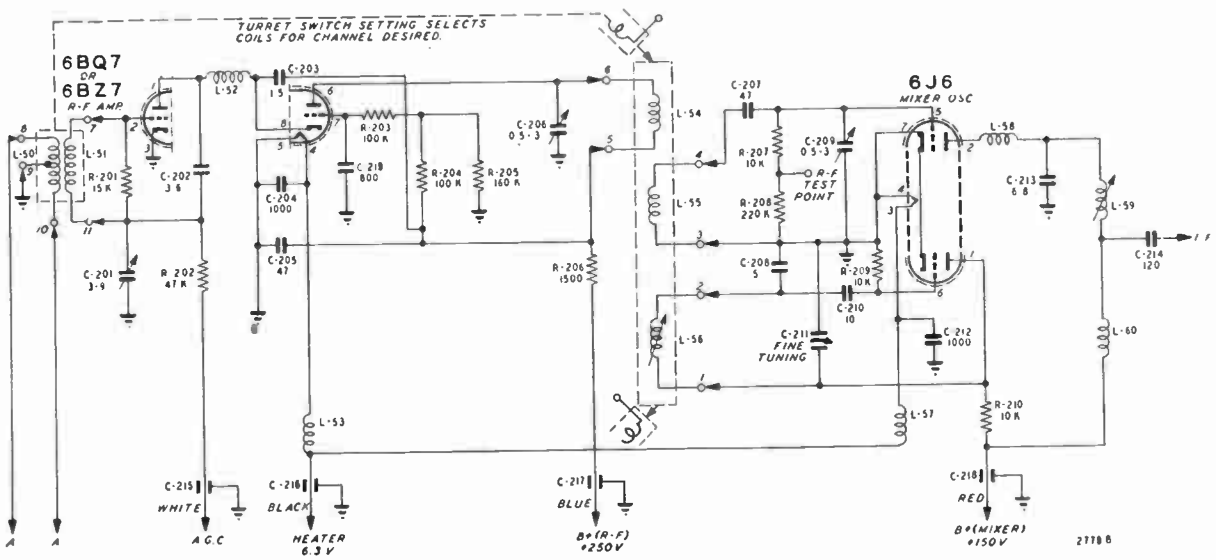


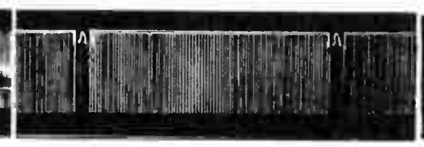
Fig. 15—Tuner Schematic Diagram.

OSCILLOSCOPE WAVEFORM PATTERNS

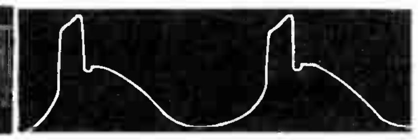
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicate the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.

No. 1—6AL5 Pix Det. Plate
2.8V P-P 60 C.P.S.
No. 4—6CS6 Sync Sep.
Grid No. 1 .26V P-P 60 C.P.S.



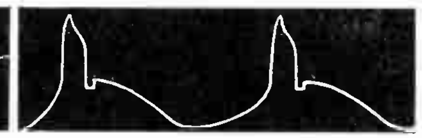
No. 7—12AT7 Phase Splitter Plate
30V P-P 60 C.P.S.



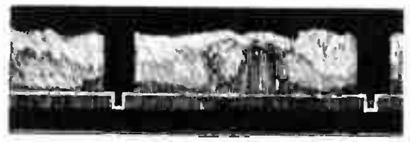
No. 14—6SN7-GTA—Hor. Osc. Plate
47V P-P 15,750 C.P.S.

No. 2—12AT7 Plate
44V P-P 60 C.P.S.
No. 2—12BY7 Grid
9.5V P-P 60 C.P.S.

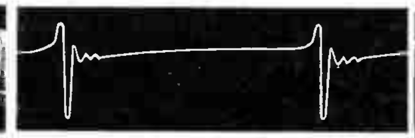
No. 8—6SN7-GTA—Vert. Osc. Plate
70V P-P 60 C.P.S.
No. 10—6SN7-GTA Vert. Output Grid
70V P-P 60 C.P.S.



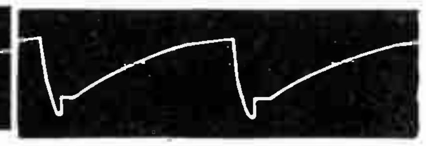
No. 15—6SN7-GTA Hor. Osc. Grid
42V P-P 15,750 C.P.S.



No. 3—Pix Tube Grid
23-150V P-P 60 C.P.S.



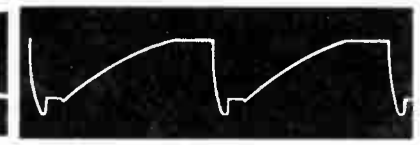
No. 9—6SN7-GTA Vert. Osc. Grid
160V P-P 60 C.P.S.



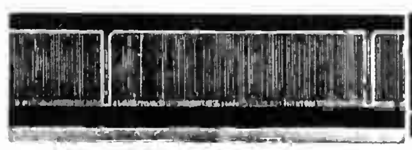
No. 16—6SN7-GTA Hor. Osc. Plate
190V P-P 15,750 C.P.S.

No. 5—6CS6 Sync Sep. Plate
36V P-P 60 C.P.S.

No. 11—Vert. Def. Coil
65V P-P 60 C.P.S.

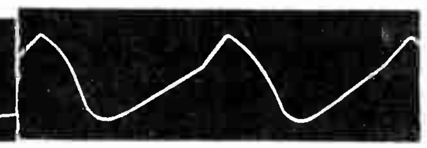


No. 17—6BQ6 Grid
150V P-P 15,750 C.P.S.



No. 6 12AT7 Phase Splitter Cathode
33V P-P 60 C.P.S.

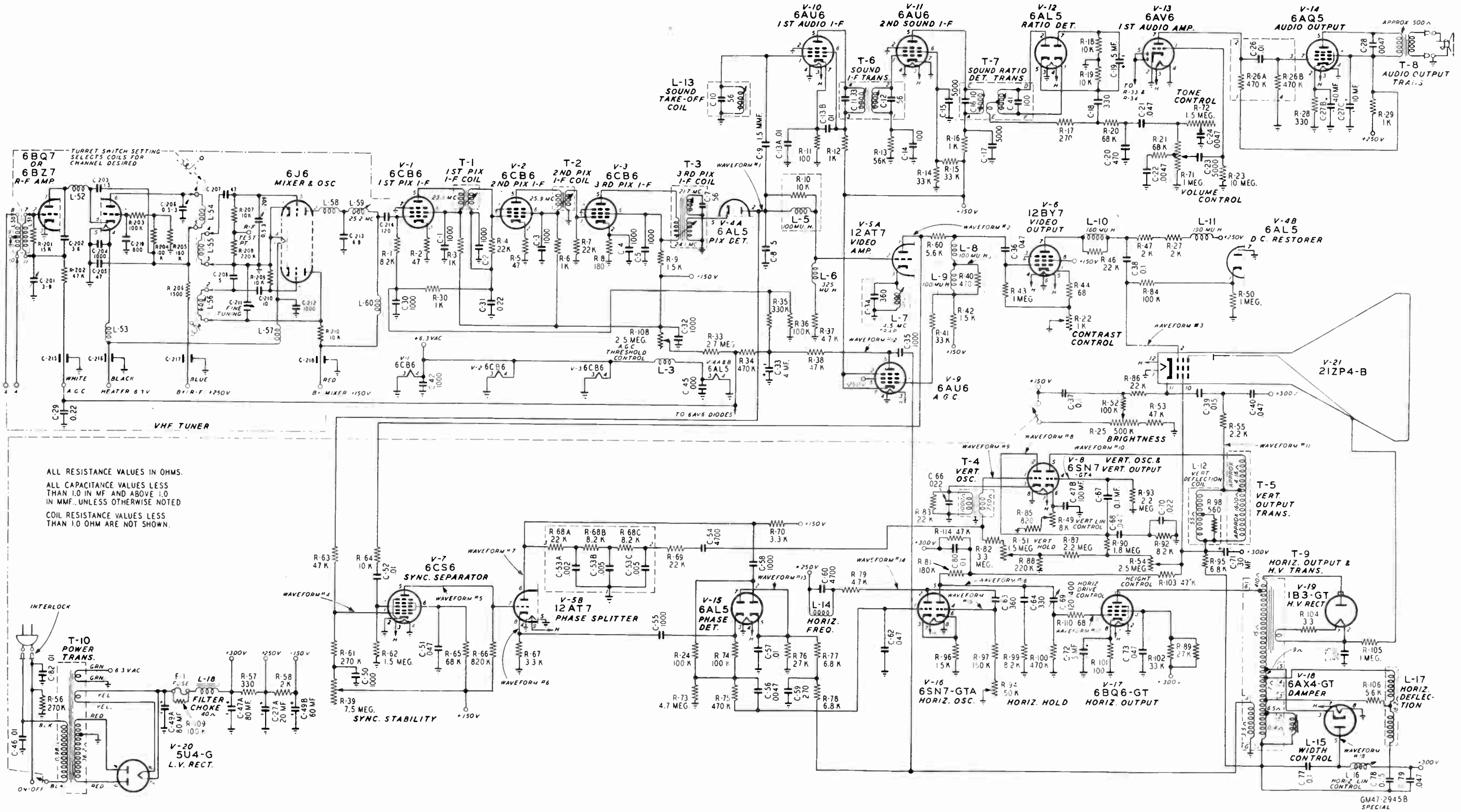
No. 12—6AU6 A.G.C.
510V P-P 15,750 C.P.S.



No. 18—6AX4-GT Damper Plate
115V P-P 15,750 C.P.S.

No. 6—12AT7 Phase Splitter Cathode
33V P-P 15,750 C.P.S.

No. 13—6AL5 Phase Det
18V P-P 15,750 C.P.S.



In earlier production R-79 was 5.6K, R-81 was 220K, R-96 was 1.8K, R-99 was 5.6K, R-103 was 47K 1/2W and R-114 was not used.

TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2278-1	Antenna Coil	2-Q
	9A2278-2	Antenna Coil	3-Q
	9A2278-3	Antenna Coil	4-Q
	9A2278-4	Antenna Coil	5-Q
	9A2278-5	Antenna Coil	6-Q
	9A2278-6	Antenna Coil	7-Q
	9A2278-7	Antenna Coil	8-Q
	9A2278-8	Antenna Coil	9-Q
	9A2278-9	Antenna Coil	10-Q
	9A2278-10	Antenna Coil	11-Q
	9A2278-11	Antenna Coil	12-Q
	9A2278-12	Antenna Coil	13-Q
	9A2279-1	Oscillator Coil	2-Q
	9A2279-2	Oscillator Coil	3-Q
	9A2279-3	Oscillator Coil	4-Q
	9A2279-4	Oscillator Cil	5-Q
	9A2279-5	Oscillator Coil	6-Q
	9A2279-6	Oscillator Coil	7-Q
	9A2279-7	Oscillator Coil	8-Q
	9A2279-8	Oscillator Coil	9-Q
	9A2279-9	Oscillator Coil	10-Q
	9A2279-10	Oscillator Coil	11-Q
	9A2279-11	Oscillator Coil	12-Q
	9A2279-12	Oscillator Coil	13-Q
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

PARTS LIST

Use only genuine factory tested parts (for the part numbers listed) to insure service jobs you can depend on and to obtain original set performance.

Use universal parts where no part numbers or prices are listed.

IMPORTANT — All prices in this literature are subject to change without notice and subject to an additional charge to cover any applicable sales tax, use, occupation, or other tax affecting our purchase or sale of merchandise.

CAPACITORS

Ref. No.	Part No.	Description			Selling Price
C-1, C-2, C-3, C-4, C-5, C-30, C-32, C-35, C-42, C-45, C-50, C-55, C-58		1000 mmf		Ceramic	
C-7	Part of T-3				
C-8	47X562	5 mmf	500 V	Ceramic	.48
C-9		1.5 mmf		Composition	
C-10	Part of L-13				
C-11, C-12	Part of T-6				
C-13A, C-13B	80X6	.01 mf	500 V	Dual Ceramic	.26
C-15, C-17, C-23		5000 mmf		Ceramic	
C-14		100 mmf	500 V	Ceramic	.12
C-16, C-41	Part of T-7				
C-18, C-64	47X570	330 mmf	500 V	Molded Mica	.14
C-19, C-72		5 mf	25 WV	Dry Electrolytic	
C-20	47X525	470 mmf	500 V	Molded Mica	.16
C-21, C-62		.047 mf	200 V	Tubular	
C-22, C-24, C-56		.0047 mf	400 V	Tubular	
C-36, C-51, C-73, C-79		.047 mf	400 V	Tubular	
C-26	Part of 76X5 (See Miscellaneous)				
C-27A, C-27B, C-27C	45X392	40 mf 10 mf 20 mf	50 V 400 V 400 V	Dry Electrolytic	1.50
C-28		.0047 mf	600 V	Tubular	
C-29, C-31	RCP10M2224M	.22 mf	200 V	Tubular	.28
C-33	45X361	4 mf	100 WV	Dry Electrolytic	.60
C-34, C-63	47X568	360 mmf	500 V	Molded Mica	.12
C-37		.1 mf	200 V	Tubular	
C-38, C-77, C-80		.1 mf	400 V	Tubular	
C-39	RCP10M6153M	.015 mf	600 V	Tubular	.18
C-40, C-68		.047 mf	600 V	Tubular	
C-46, C-82		.01 mf		Ceramic	
C-47A, C-47B	45X391	80 mf 100 mf	400 V 50 V	Dry Electrolytic	2.22
C-49A, C-49B	45X390	80 mf 60 mf	400 V 400 V	Dry Electrolytic	2.68
C-52, C-57		.01 mf	400 V	Tubular	
C-53A, C-53B, C-53C	Part of 76X7 (See Miscellaneous)				
C-54, C-60	47X543	4700 mmf	500 V	Molded Mica	.52
C-59		270 mmf	500 V	Molded Mica	
C-69	17A269	120-400		Horiz. Drive	.30
C-66, C-70		.022 mf	200 V	Tubular	
C-67		.1 mf	600 V	Tubular	
C-71		30 mf	400 V	Dry Electrolytic	
C-75	47X560	500 mmf	20 KV	Ceramic	1.20
C-78	RCP10M4154M	.15 mf	400 V	Tubular	.24

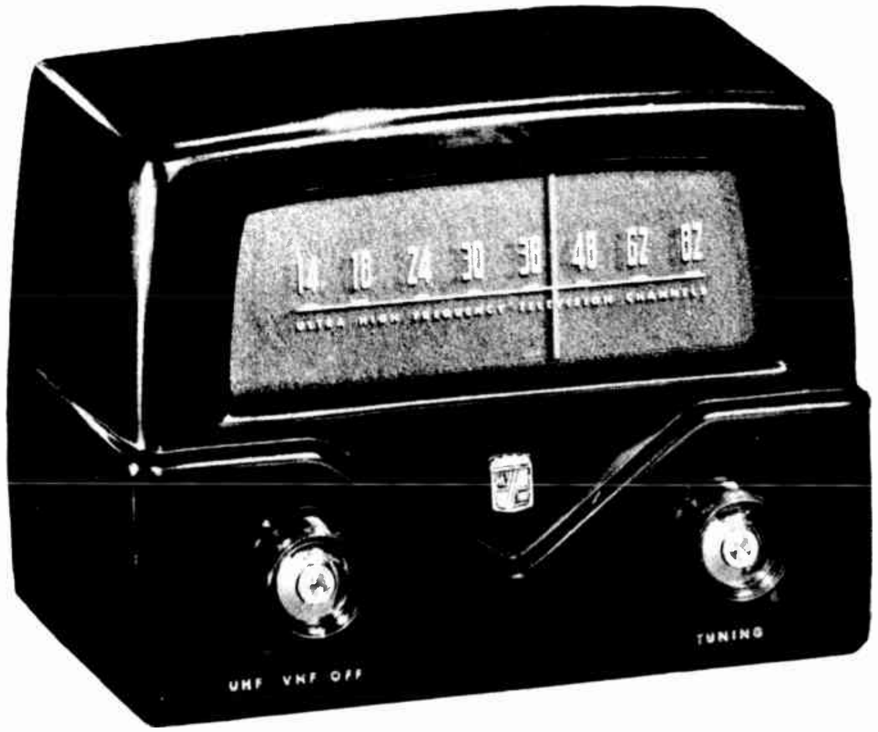
RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-1		8.2 K	0.5	Carbon	
R-2, R-5		47	0.5	Carbon	
R-3, R-6, R-12, R-16, R-30		1 K	0.5	Carbon	
R-4, R-7		22 K	0.5	Carbon	
R-8		180	0.5	Carbon	
R-9, R-42		1.5 K	0.5	Carbon	
R-10	Part of L-5				
R-11		100	0.5	Carbon	
R-13		56 K	0.5	Carbon	
R-14, R-15, R-41		33 K	0.5	Carbon	
R-17		270	0.5	Carbon	
R-18, R-19		10 K	0.5	Carbon	
R-20, R-21, R-65		68 K	0.5	Carbon	
R-22, R-71	78X19	1 K 1.0 meg.		Contrast and Volume Control	1.50
R-23		10.0 meg.	0.5	Carbon	
R-24, R-36, R-74, R-84		100 K	0.5	Carbon	
R-25	40X333	500 K		Brightness Control	.52
R-26A, R-26B	Part of 76X5 (See Miscellaneous)				
R-27, R-47	D83202	2 K	2.0	Carbon	.16
R-28		330	1.0	Carbon	
R-29		1 K	2.0	Carbon	
R-33		2.7 meg.	0.5	Carbon	
R-34, R-100		470 K	0.5	Carbon	
R-35		330 K	0.5	Carbon	
R-37, R-79		4.7 K	0.5	Carbon	
R-38, R-63, R-114		47 K	0.5	Carbon	
R-39	40X370	7.5 meg.		Sync Stability Control	.48
R-40	Part of L-9				
R-43, R-50		1.0 meg.	0.5	Carbon	
R-44		68	0.5	Carbon	
R-46	Part of L-10				
R-49	40X375	8 K		Vertical Linearity Control	.38
R-51	40X334	1.5 meg.		Vertical Hold Control	.52
R-52		100 K	0.5	Carbon	
R-53		47 K	0.5	Carbon	
R-54	40X369	2.5 meg.		Height Control	.42
R-55		2.2 K	0.5	Carbon	
R-56		270 K	0.5	Carbon	
R-57	43X273	330	10.0	Wirewound	.48
R-58	43X285	2 K	10.0	Wirewound	.48
R-60		5.6 K	1.0	Carbon	
R-61		270 K	0.5	Carbon	
R-62		1.5 meg.	0.5	Carbon	
R-64		10 K	0.5	Carbon	
R-66		820 K	0.5	Carbon	
R-67, R-70		3.3 K	0.5	Carbon	
R-68A, R-68B, R-68C	Part of 76X7 (See Miscellaneous)				
R-69, R-83, R-86		22 K	0.5	Carbon	
R-72	40X334	1.5 meg.		Tone Control	.52
R-73		4.7 meg.	0.5	Carbon	
R-75		470 K	0.5	Carbon	
R-76		27 K	0.5	Carbon	
R-77, R-78		6.8 K	1.0	Carbon	
R-81		180 K	0.5	Carbon	
R-82		3.3 meg.	0.5	Carbon	
R-85		820	0.5	Carbon	
R-87, R-93		2.2 meg.	0.5	Carbon	
R-88		220 K	0.5	Carbon	
R-89		27 K	2.0	Carbon	
R-90		1.8 meg.	0.5	Carbon	
R-92, R-99		8.2 K	0.5	Carbon	
R-94	40X361	50 K		Horizontal Hold Control	.52
R-95		6.8 K	2.0	Carbon	
R-96		1.5 K	0.5	Carbon	
R-97		150 K	0.5	Carbon	
R-98	Part of Deflection Yoke Ass'y.				
R-101		100	2.0	Carbon	
R-102		33 K	2.0	Carbon	
R-103		47 K	1.0	Carbon	
R-104	43X238	3.3	0.5	Wirewound	.24
R-105		1.0 meg.	1.0	Carbon	
R-106		5.6 K	0.5	Carbon	
R-108	40X369	2.5 meg.		A.G.C. Control	.42
R-109		100 K	2.0	Carbon	
R-110		68	0.5	Carbon	

TRANSFORMERS AND COILS

Ref. No.	Part No.	Description	Selling Price
L-3	9A2033	R.F. Heater Choke	.12
L-5	36A25	Peaking Coil (100 uh)	.24
L-6	36A27	Peaking Coil (325 uh)	.24
L-7	9A2074	4.5 Mc Trap	.36
L-8	36A1	Peaking Coil (100 uh)	.26
L-9	36A23	Peaking Coil (100 uh)	.24
L-10	36A12	Peaking Coil (160 uh)	.24
L-11	36A2	Peaking Coil (190 uh)	.30
L-12, L-17	Part of Deflection Yoke Ass'y.		
L-13	9A2201	Sound Take Off Coil	.66
L-14	9A2096	Horizontal Frequency Control	.66
L-15	9A2183	Width Control	.96
L-16	9A2262	Horizontal Linearity Control	.46
L-18	52X95	Filter Choke	1.48
T-1, T-2	9A2230	1st and 2nd P.I.F. Transformer	.44
T-3	9A2333	3rd P.I.F. Transformer	1.08
T-4	54X10	Vertical Osc. Transformer	1.18
T-5	51X168	Vertical Output Transformer	2.56
T-6	9A2323	Sound I.F. Transformer	.76
T-7	9A2295	Sound Ratio Det. Transformer	1.80
T-8	51X166	Audio Output Transformer	1.26
T-9	53X330	Horizontal Output Transformer	7.20
T-10	53X339	Power Transformer	13.36
76X5		Multiple Resistor Capacitor Assembly	.40
2A438-2		Focus Magnet Assembly	4.96
76X7		Multiple Resistor Capacitor Assembly	.54
9A2334-1		Deflection Yoke Assembly	5.56
2A421		Ion Trap Magnet	.48
12A519		Speaker 10" PM	7.00

WARDS *Airline* U.H.F. CONVERTER



GENERAL DESCRIPTION

The Airline U.H.F. Converter (Model 3309A) provides complete U.H.F. television coverage of channels 14 through 83 (470 mc. to 890 mc.). It may be attached to any standard television receiver that is capable of receiving channel 5 or channel 6. The Converter is complete with own self-contained power supply. The only connection required to the V.H.F. television receiver is made to the antenna terminals.

The power cord from the television receiver may be connected to the power receptacle on the rear of the Converter, and the television receiver power switch will then be left in the "On" position. Power to both the receiver and the Converter may then be controlled by means of the single switch on the Converter. The external V.H.F. antenna, when connected to the Converter, will be connected directly to the television receiver when the Converter selector switch is set to the V.H.F. position; and will be disconnected when the Converter selector switch is set to the U.H.F. position. The Converter is turned on when the switch is in the U.H.F. position, and standby when in the V.H.F. position.

SPECIFICATIONS

ANTENNA....................Built-in U.H.F. or external
INPUT AND OUTPUT IMPEDANCE 300 ohms
FREQUENCY COVERAGE........Channels 14 through 83 (470 mc to 890 mc)
TUBES, EARLY MODEL..........3 tubes including 1 rectifier; 1 crystal diode
TUBES, LATE MODEL...........2 tubes, 1 selenium rectifier and crystal diode
POWER INPUT.................117 volts, 50 to 60 cycles AC

DIFFERENCES BETWEEN EARLY AND LATE MODELS

The major differences between the early and late models of the 3309A UHF Converter are summarized in the table below. In addition, there are numerous differences in detail. A separate schematic diagram and parts list has been included for each version of this Converter.

	EARLY MODEL	LATE MODEL
I-F AMPLIFIER	CASCODE CIRCUIT TUBE 6BQ7 OR 6BK7	PENTODE CIRCUIT TUBE TYPE 6CB6
RECTIFIER	TUBE TYPE 6X4	SELENIUM RECTIFIER 35 MA.

REPLACEMENT OF CRYSTAL DIODES

In both the early and late models of the 3309A Converter either of two types of crystal diodes may be found. A type 1N72 or type 1N82 crystal diode unit is mounted on the top of the chassis by means of a clip-in crystal holder. These crystal types are usually not interchangeable in this application unless the circuit is realigned. It is therefore recommended that the crystal unit be replaced with the same type as the original found in the set.

Polarity should be observed when replacing the crystal. The circuit will operate if the crystal is inserted backwards, but the noise level will increase. Be sure that the replacement crystal is inserted with the corresponding ends in the same position as the original unit.

ELECTRICAL DESCRIPTION

The signal from the UHF antenna is coupled to a band pass preselector network that is tuned by means of two ganged variable inductors. A third section of the variable inductance gang varies the frequency of the local oscillator in the range of 378 mc to 828 mc. The signal voltage from the preselector network and the output voltage from the local oscillator are coupled to a crystal diode mixer circuit. The useful output from the mixer will then become the intermediate frequency of the Converter. The center i-f frequency will in all cases be 82 mc. The i-f amplifier follows the mixer stage to provide effective amplification of the signal. The output from the i-f amplifier is coupled to the VHF antenna terminals of the television receiver. The VHF tuner will readily accept the 82 mc signal when tuned to either channel 5 (76 to 82 mc) or channel 6 (82 to 88 mc).

ALIGNMENT

Complicated or specially-designed test equipment is not required for practical alignment of the 3309A. Instruments used in most TV service shops for testing VHF sets usually are satisfactory for aligning the Converter. In addition to these tools, the following instruments are needed: a VHF signal generator with AM output and a sweep modulation of at least 12 megacycles; an oscilloscope or vacuum tube volt-ohmmeter for measurement of the relative signal; and an operating VHF television set. The latter is suggested as a practical amplifier for raising the output signal of the Converter to a level which permits convenient observation.

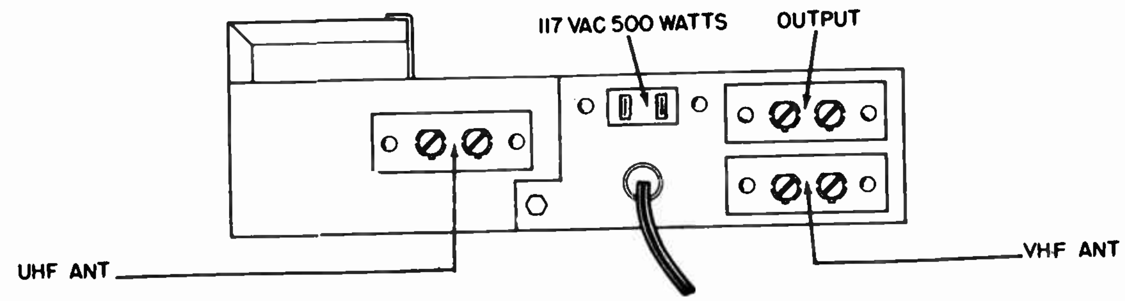


Fig. 1. Antenna and Output Connections

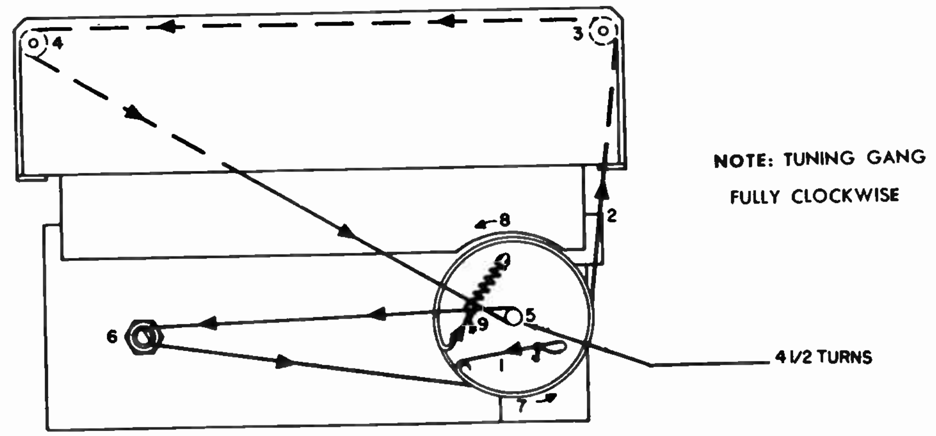


Fig. 2. Dial Stringing Detail

VOLTAGE MEASUREMENTS

NOTE: Voltage measurements made by means of an electronic voltmeter (VTVM) should be taken between tube socket terminals and the chassis. Measurements within 20 percent of the specified value usually will assure satisfactory performance of the Converter.

EARLY CASCODE I-F AMP. MODEL

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6x4	Rect.	170VAC	NC	0	6.3VAC	NC	170VAC	190VDC	—	—
6BK7 or 6BQ7	I-F AMP	120VDC	0	.85VDC	6.3VAC	0	125VDC	0	1VDC	0
6AF4	OSC.	85VDC*	5.7VDC*	0	6.3VAC	0	5.7VDC*	85VDC*	—	—

LATE PENTODE I-F AMP. MODELS

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6CB6	I-F AMP	0	1.3VDC	6.3VAC	0	98VDC	98VDC	1.3VDC	—	—
6AF4	OSC.	85VDC*	5.7VDC* (neg. 3VDC min.)	0	6.3VAC	0	5.7VDC* (neg. 3VDC min.)	85VDC*	—	—

Selenium Rectifier "K" Terminal 125VDC
*Measurement made with 15K isolating resistor in series with voltmeter probe.

RESISTANCE MEASUREMENTS

NOTE: Resistance measurements, made by means of an electronic ohmmeter (VTVM), should be taken between tube socket terminals and the chassis. Measurements within 20 percent of the specified value usually will assure satisfactory performance of the Converter. When taking these measurements, the Converter switch must be turned to the "UHF" position and the line cord detached from the power line.

EARLY CASCODE I-F AMP. MODEL

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6x4	Rect.	130	NC	0	.3	NC	130	50K or More	—	—
6BK7 or 6BQ7	I-F AMP	50K or More	0	56	.3	0	50K or More	0	56	0
6AF4	OSC.	50K or More	12K	0	.3	0	12K	50K or More	—	—

LATE PENTODE I-F AMP. MODEL

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6CB6	I-F AMP	0	150	0.6	0	50K or More	50K or More	150	—	—
6AF4	OSC.	50K or More	12K	0	0.3	0	12K	50K or More	—	—

Selenium Rectifier to "K" Terminal to Chassis 50K or More.

ALIGNMENT

The 3309A UHF Converter to be aligned should be connected to the VHF television antenna terminals. The oscilloscope or VTVM should then be connected to the TV set at a point which permits satisfactory observation of the relative intensity and character of the AM (or sweep-modulated) signal introduced into the Converter (video detector load resistor). The procedure for alignment consists of the following steps in the suggested sequence shown: (1) alignment of the I-F stage; (2) positioning of the oscillator for proper band coverage; and (3) alignment of R-F circuits for maximum effectiveness.

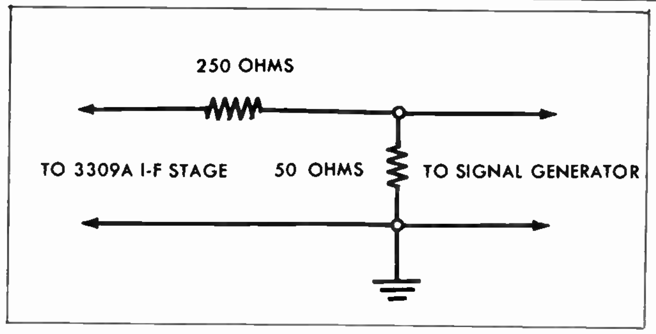


Fig. 3.

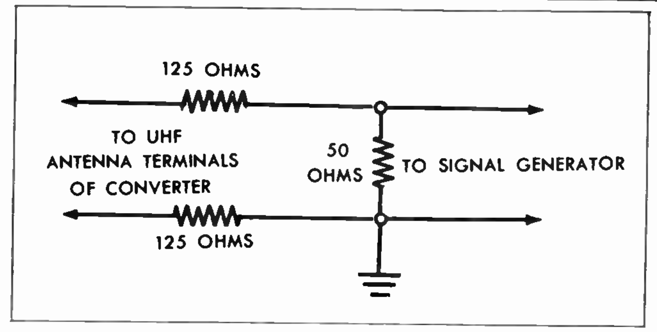


Fig. 4.

I-F ALIGNMENT

EARLY CASCODE AMP. MODEL

1. Connect the VHF signal generator, through a suitable resistor-matching network (Fig. 1) to the crystal mixer of the Converter at the junction of X1, C9, L4, and C12 (Fig. 9). Apply an AM signal centered at 82 megacycles.

2. Align input and output I-F transformers, T2 and T3, to obtain the maximum signal. Location of I-F alignment points is shown in Figs. 5 and 7.

3. Replace AM signal with a sweep of at least 12 megacycles centered at 82 megacycles. If a sweep generator with 82 megacycle center frequency is not available, switch from channel 5 to 6 to see skirts of curve.

4. Readjust slugs of double-tuned I-F output transformer, T3, for equal signal response at VHF channels 5 and 6. **The I-F amplifier must be aligned for a minimum 12-megacycle band-width, and the maximum gain possible with this band-width.**

LATE PENTODE AMP. MODEL

1. Connect the VHF signal generator, through a suitable resistor-matching network (Fig. 3), to the crystal mixer of the Converter at the junction of C9, C10, L1 and X1 (Fig. 10). Apply an AM signal centered at 82 megacycles.

2. Align input and output I-F transformers, T2 and T3, to obtain the maximum signal. Location of I-F alignment points is shown in Figs. 6 and 8.

3. Replace AM signal with a sweep of at least 12 megacycles centered at 82 megacycles.

4. Readjust slugs of double-tuned I-F transformer, T3, for equal signal response at VHF channels 5 or 6. **The I-F amplifier must be aligned for a minimum 12-megacycle band-width, and the maximum gain possible with this band-width.**

OSCILLATOR ADJUSTMENT

EARLY CASCODE AMP. MODEL

1. Adjust 3309A tuning control so that indicating pointer is positioned at extreme left-hand edge of dial.

2. Feed a 465-megacycle AM signal into Converter antenna terminals through a matching network described in Fig. 4. Adjust oscillator trimmer, C10, for maximum signal. (Use non-metallic alignment tool.) **When using a VHF signal generator, a fundamental of 93 megacycles may be employed to produce the 5th harmonic energy of 465 megacycles.**

3. Adjust 3309A tuning control so that indicator is positioned at extreme right-hand edge of dial.

4. Set signal generator for 900-megacycle output (5th harmonic of 180 megacycles). Carefully spread or pinch together the legs of the oscillator end-inductor (Fig. 5) for maximum signal.

5. Repeat above steps until no further improvement in signal is apparent. **The oscillator alignment figures of 465 and 900 megacycles are approximate only, and may not fall precisely at the maximum and minimum dial settings; however, in every case, the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the dial.**

LATE PENTODE AMP. MODEL

1. Adjust 3309A tuning control so that indicating point is positioned at extreme left-hand edge of dial.

2. Feed a 465-megacycle AM signal into the converter antenna terminals through a matching network (described in Fig. 2). Adjust oscillator trimmer, C11, for maximum signal. **When using a VHF signal generator, a fundamental of 93 megacycles may be employed to produce the 5th harmonic energy of 465 megacycles.**

3. Adjust 3309A tuning control so that indicator is positioned at extreme right-hand edge of dial.

4. Set signal generator for 900-megacycle output (5th harmonic of 180 megacycles). Carefully spread or pinch together the legs of the oscillator end-inductor (Fig. 6) for maximum signal.

5. Repeat above steps until no further improvement in signal is apparent. **The oscillator alignment figures of 465 and 900 megacycles are approximate only, and may not fall precisely at the maximum and minimum dial settings; however, in every case, the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the dial.**

R-F ALIGNMENT

EARLY CASCODE I-F AMP. MODEL

1. Adjust tuning control so that indicator is positioned at extreme left-hand edge of dial.
2. Feed a 465-megacycle signal into the Converter antenna terminals (as indicated above for oscillator alignment).
3. Adjust R-F trimmers, C6 and C3, for maximum signal.
4. Readjust tuning control so that indicator rests at extreme right-hand edge of dial.
5. Set signal generator for 900 megacycles output.
6. Adjust R-F end-inductors (Fig. 5) for maximum signal.
7. Repeat above steps until no f rther improvement in signal is apparent.
8. Readjust tuning control so that indicator is positioned at extreme left-hand edge of dial.
9. Adjust coupling trimmer, B1, for maximum signal.

LATE PENTODE I-F AMP. MODEL

1. Adjust tuning control so that indicator is positioned at extreme left-hand edge of dial.
2. Feed a 465-megacycle signal into the Converter antenna terminals (as indicated above for oscillator alignment).
3. Adjust R-F trimmers, C3 and C7, for maximum signal. Physical location of R-F alignment points is shown in Fig. 8.
4. Readjust tuning control so that indicator rests at extreme right-hand edge of dial.
5. Set signal generator for 900-megacycle output.
6. Adjust R-F end-inductors (Fig. 6) for maximum signal.
7. Repeat above steps until no further improvement in signal is apparent.

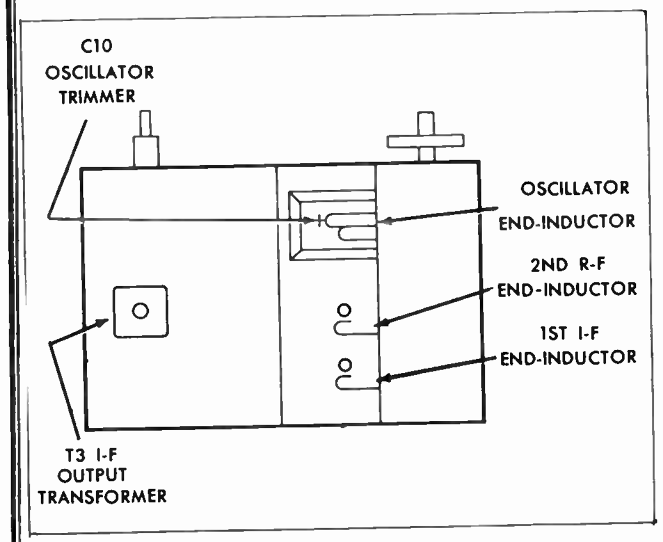


Fig. 5. Early Bottom View

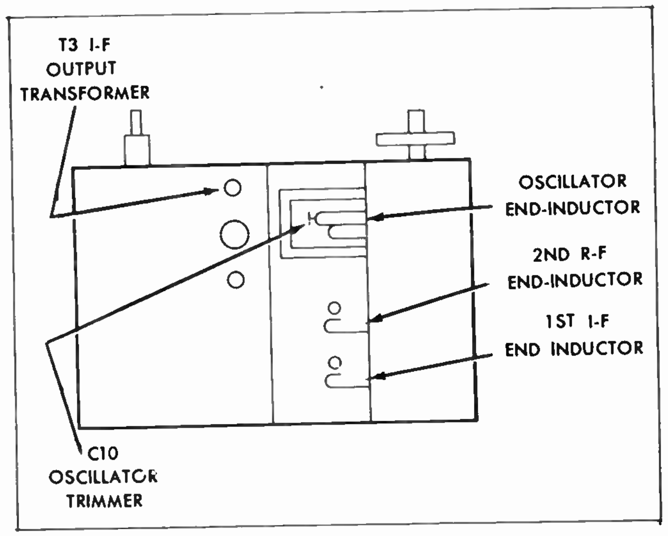


Fig. 6. Late Bottom View

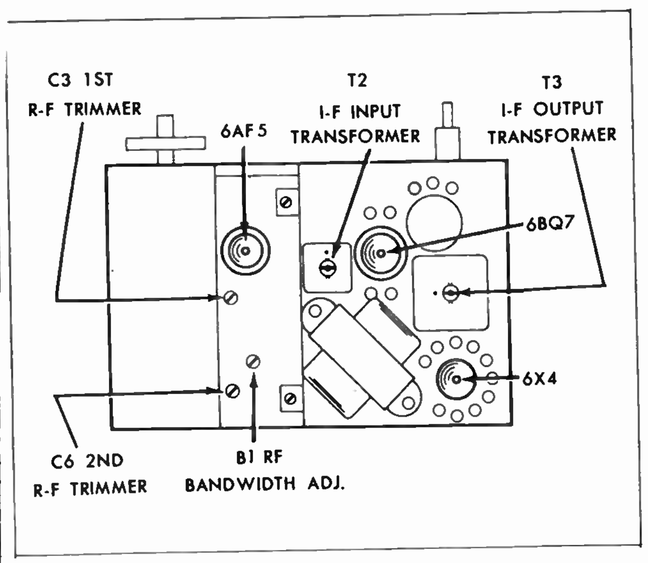


Fig. 7. Early Top View

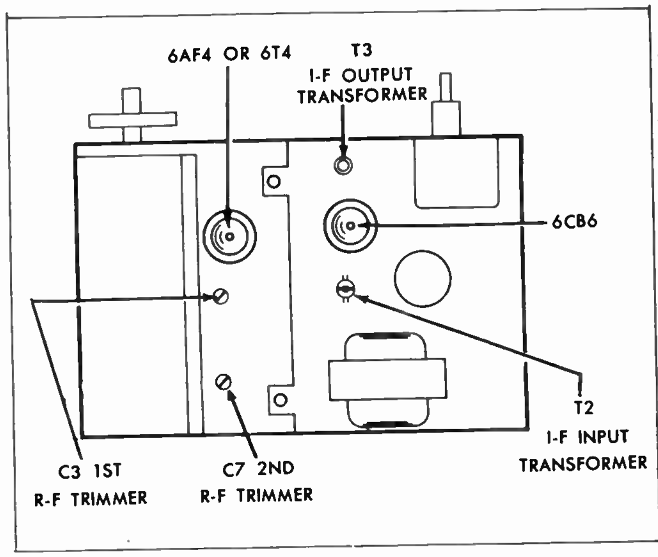


Fig. 8. Late Top View

REPAIR PARTS

LATE PENTODE MODEL

REF. NO.	PART NO.	DESCRIPTION	PRICE EACH
		CONDENSERS	
C3, C7	A-600220-1	Condenser, .8-6.5 uuf	$ .50
C4		Condenser, 1.0 uuf	
C5	A-600389-2	Condenser, 0.4 uuf ±10%	.08
C6		Condenser, 0.25 uuf ±10%	
C8		Condenser, 1.5 uuf ±10%	
C10		Condenser, .68 uuf ±10%	
C11	A-600282-3	Condenser, 3-10 uuf	.36
C12		Condenser, 10 uuf	
C13A, C13B	103035	Condenser, Filter 30-30/150V	.90
C14, C16		Condenser, 68 uuf	
C15, C17			
C18, C19		Condenser, 1000 uuf	
C20			
C21, C22, C23, C24—Part of T3 Output I-F Transformer			
		RESISTORS	
R1, R2		Resistors, 1500 ohms—½W	
R3		Resistor, 12K ohms —½W	
R4		Resistor, 470 ohms—½W	
R5		Resistor, 1200 ohms—2W	
R6		Resistor, 150 ohms—½W	
R7, R8—Part of Inductuner L7A, B and C.			
		TRANSFORMERS AND COILS	
T1	B-630124-1	Transformer, Power	2.52
T2	B-630130-1	Transformer, I-F Input	.50
T3	B-630131-1	Transformer, I-F Output	1.70
L1	A-600407	Choke	.08
L2, L3	A-600240-1	Choke, 38 uh	.50
L4, L5	A-600383-1	Choke	.07
L6	A-600384-1	Choke	.10
L7A			
L7B	A-600286-1	Tuner, UHF	13.50
L7C			
		MISCELLANEOUS	
A1	B-630094-1	Antenna	1.80
S01	A-600214-1	Power Outlet, A. C.	.28
SR1	A-600474-1	Selenium Rectifier	1.44
SW1A			
SW1B	B-630069-1	Switch	1.66
SW1C			

EARLY CASCODE MODEL

REF. NO.	PART NO.	DESCRIPTION	PRICE EACH
		CONDENSERS	
C1, C2, C12		Condenser, 68 uuf ±10%	
C3, C6	A-600220-1	Condenser, .8-6.5 uuf	$ .50
C4, C7, C9		Condenser, 1.0 uuf	
C5	A-600025-15	Condenser, 1.2 uuf	.08
C8		Condenser, 2.2 uuf	
C10	A-600282-3	Condenser, 3-10 uuf	.36
C11			
C13		Condenser, 68 uuf	
C15			
C14A			
C14B C14C	FP 318.5	Condenser, 20-20-20/200-175-150	.90
C16, C17			
C18, C19		Condenser, 1000 uuf	
C20, C21 ,C22		Condenser, 10 uuf	
		RESISTORS	
R2		Resistor, 3300 ohm—2W	
R3, R4		Resistor, 680 ohm—2W	
R5, R6		Resistor, 56 ohm ±10%—½W	
R7, R8		Resistor, 470 ohm—½W	
R9, R10		(Part of Inductuner)	
		TRANSFORMERS AND COILS	
T1	B-630052	Power Transformer	
T2	B-630070-1	Transformer, Input	2.50
T3	B-630121-1	Transformer, Output	4.60
L1, L2			
L7, L8, L9	A-600033-2	Choke	.08
L3, L4	6000285	Choke	.08
L10	A-600240	Choke	.50
L11	A-600240-2	Choke	.50
L12A			
L12B , L12C	A-600286-1	Tuner, UHF	13.50
		MISCELLANEOUS	
A1	B-630094-1	Antenna	1.80
B1	A-600219	Nylon Adjustment Screw	
S01	A-600214-1	Power Outlet, A. C.	.28
SW1A			
SW1B	B-630069-1	Switch	1.66
SW1C			

PARTS — BOTH MODELS

PART NO.	NAME OF PART	PRICE EACH
B-630065-1	Cabinet	$ 5.50
A-600376-1	Cable Clamp	.08
C-646052-1	Chassis, I-F	.28
C-646056-1	Chassis, R. F.	.33
A-600387-1	Chassis, End	.10
B-630049-3	Cord, A. C.	.82
A-600413-1	Crystal	2.90
A-600378-1	Crystal Board	.20
B-630062-1	Dial Glass	.80
A-13972-16	Eyelet	.01
A-11514-29	Hex Nut	.01
A-600023-7	Insulator	.01
C-646070-1	Knob (Function)	1.00
C-646070-2	Knob (Tuning)	.80
A-600256-1	Knob, Spring	.02

PART NO.	NAME OF PART	PRICE EACH
A-600296-1	Osc. Plate Bracket	$ .04
B-630129-1	Osc. Shield	.20
A-600298-1	Osc. Shield Lid	.08
A-600280-1	Osc. Trimmer Bracket	.04
A-600034-1	Socket (I. F.)	.18
A-6000215-1	Socket (Osc.)	.20
A-11511-62	Screw 6-32 (Trimmer)	.01
A-15717-12	Screw 6-32 (Trimmer Osc.)	.01
A-600035-1	Shield, 7 Pin Tube (Osc.)	.14
A-600035-3	Shield, 7 Pin Tube (I-F)	.08
A-600217-1	Terminal Board	.14
A-600277-1	Trimount Stud	.01
A-600222-1	Transmission Line	.10
B-630070-1	Transformer, Input	2.50
B-630121-1	Transformer, Output	4.60

IMPORTANT — All prices in this literature are subject to change without notice and are subject to an additional charge to cover any applicable sales tax, use, occupation, or other tax affecting our purchase or sale of merchandise.

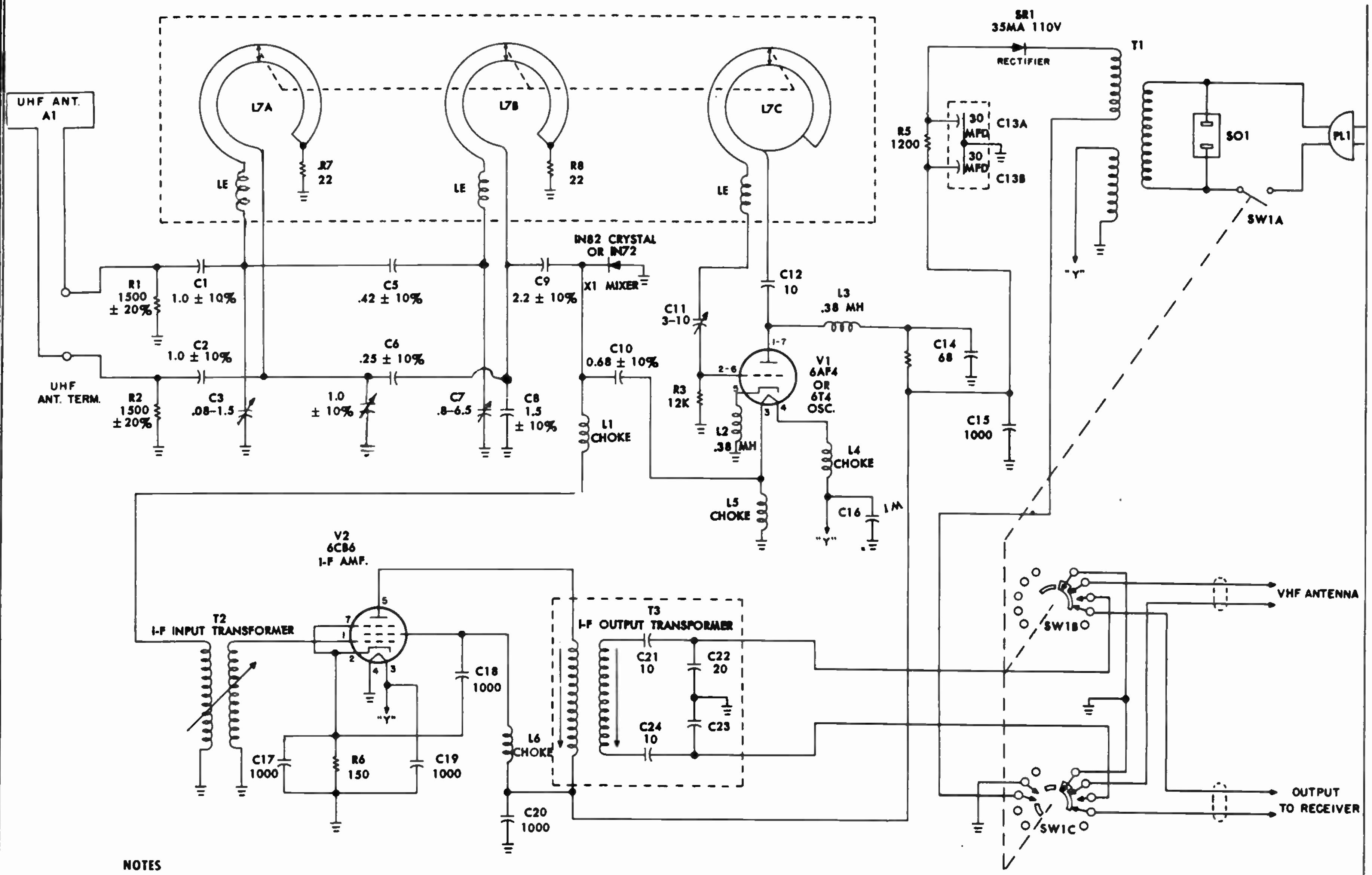


Fig. 10. Late 3309A Pentode Amplifier Model.

NOTES

1. Resistor values are in ohms unless otherwise specified.
2. Capacitor values are in mmf unless otherwise specified.
3. Resistors rating are ½ watt unless otherwise specified.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

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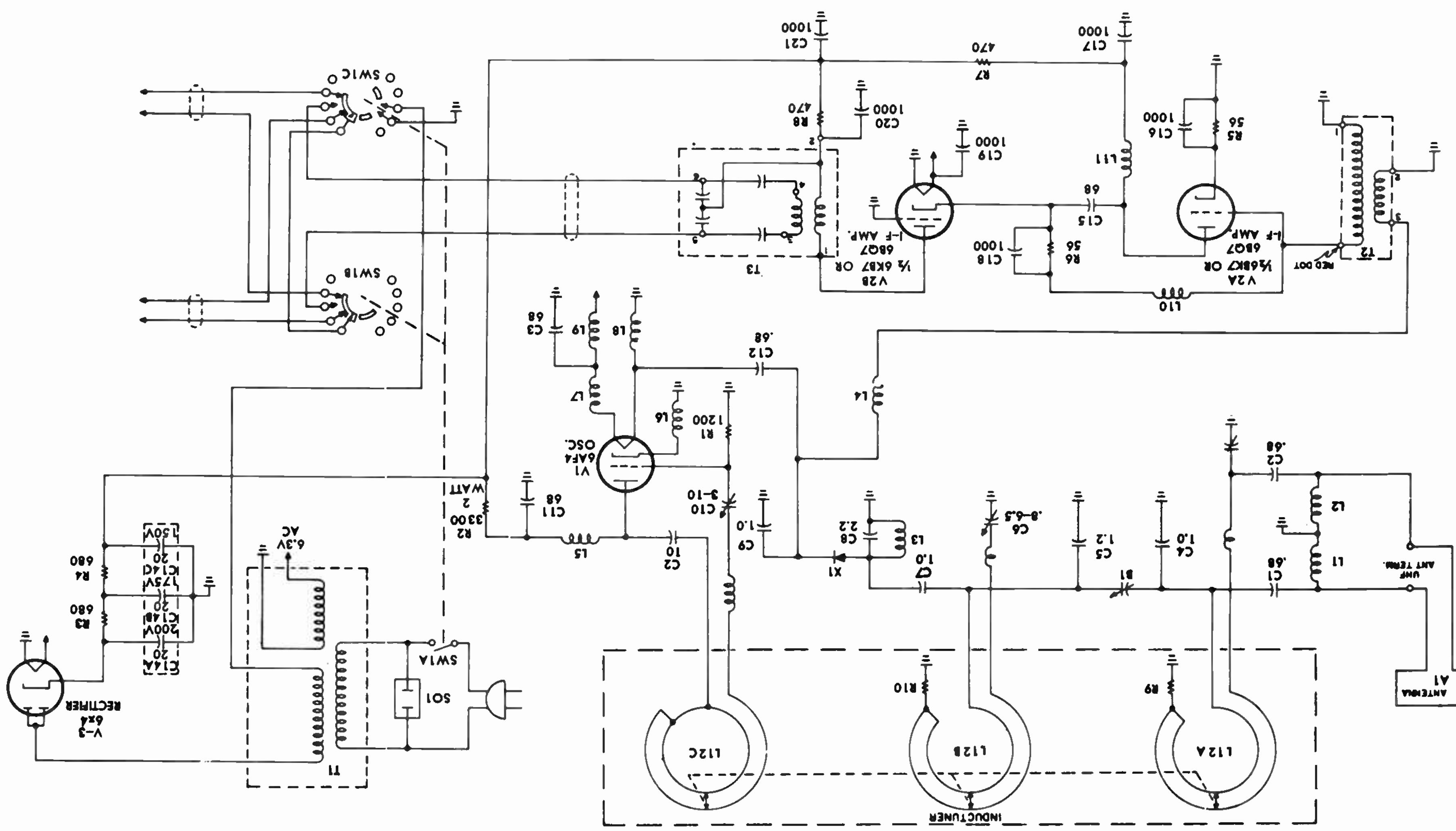
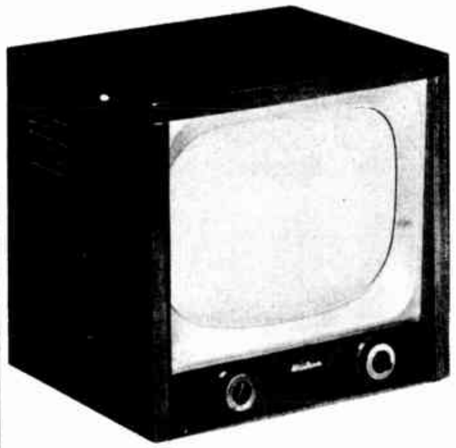
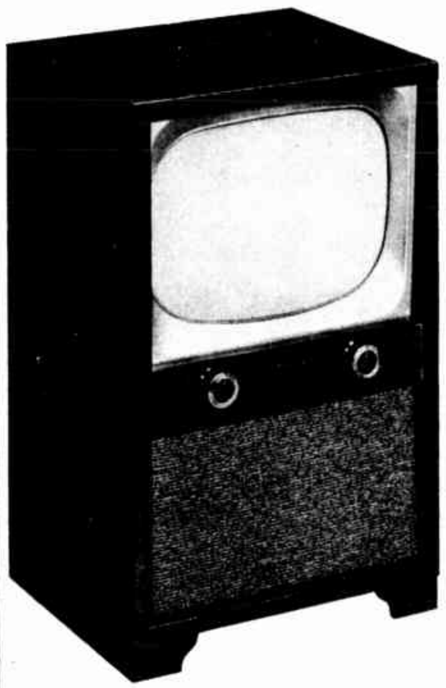


Fig. 9. Early 3309A Cascode Amplifier Model.



35GSE-3076A MAHOGANY
35GSE-3078A BLONDE



35GSE-3095A MAHOGANY
35GSE-3097A BLONDE

TUBE COMPLEMENT

6BQ7 or 6BZ7	R.F. Amplifier
6J6	Oscillator, Modulator
6CB6	Video I.F. Amplifier
6CL6	Video Amplifier
6AU6	Sound I.F. Amplifier
6AL5	Sound Detector
6SN7GT	A.F. Amplifier, Horizontal AFC Control
6W6GT	Audio Amplifier
6SN7GT	Sync Separator, Phase Splitter
6SN7GT	Horizontal Oscillator
1B3GT	H.V. Rectifier
6BQ6GT	Horizontal Output
6W4GT	Horizontal Damper
12BH7	Vertical Oscillator, Vertical Amplifier
5U4G	Power Rectifier
21YP4A	21" Picture Tube Electrostatic Focus
1N60	Video Detector Germanium Crystal

ELECTRICAL SPECIFICATIONS

Power Supply	110 to 120 Volts 60 Cycle AC
Power Consumption	225 Watts
Power Output	Undistorted 2.2 Watts Maximum 4.0 Watts
Antenna Input Imp.	300 Ohms Balanced
Tuning Range	12 Channel
Loud Speaker	6" PM 35GSE-3076A 6" PM 35GSE-3078A 8" PM 35GSE-3095A 8" PM 35GSE-3097A
Voice Coil Impedance	3.2 Ohm at 400 Cycles
I.F. CIRCUIT	Inter-Carrier Sound
R.F. STAGE	One
I.F. STAGES	Three "Combined Picture and Sound" and one "Sound" 41.25 M.C. Sound Carrier 45.75 M.C. Video Carrier 4.5 M.C. Inter-Carrier Sound

GENERAL INSTALLATION INSTRUCTIONS

While each receiver is correctly aligned at the factory rough handling in transit, ageing, drift, etc., may throw the receiver off, so we suggest that the proper oscillator trimmers, ratio detector, and rear panel controls (see pages 4 and 5) be checked for correct adjustment with a transmitted television pattern, in the customer's home at the time of installation. Be sure to have the receiver operating for one-half hour before making these adjustments. Listed below is the correct procedure to follow in making these adjustments.

(A) Check all operating channels, using FINE TUNING CONTROL for best picture detail. (See paragraph PEAKING THE INDIVIDUAL OSCILLATOR TRIMMERS.)

(B) Check LOCALITY ADJUSTER CONTROL located on back of chassis for proper setting.

NOTE: The signal strength (too strong or too weak) will be affected by location and distance from the station, type of antenna used, terrain obstructions such as tall buildings, electrical disturbances.

PEAKING THE INDIVIDUAL OSCILLATOR TRIMMERS

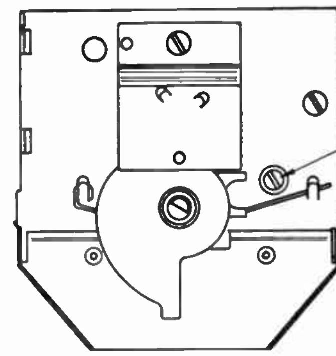
(A) Set channel selector knob to the desired channel.

(B) Set the FINE TUNING CONTROL to the center position.

(C) Remove the channel and fine tuning knobs. This will expose the individual channel adjustment screw opening just to right of the channel shaft. See Fig. 1.

(D) Use a non-metallic screwdriver such as polystyrene or nylon.

Adjust the individual oscillator screw for best picture detail. A slight adjustment in either direction is all that is necessary. CAUTION: DO NOT ADJUST INDISCRIMINATELY, this may cause the adjustment screw to fall from its locking position.



THE PROPER ADJ. SCREW FOR THE CHANNEL TUNED TO WILL APPEAR HERE

FIG. 1

ADJUSTMENT FOR STATION BUZZ

If station buzz is excessive and is NOT DUE to "contrast control" being advanced too far in a clockwise direction or the locality adjuster control in the incorrect position, adjust the ratio detector secondary adjustment screw located on top of the ratio detector for minimum buzz. MAKE SURE THAT THIS POSITION IS BETWEEN the two MAXIMUM buzz peaks that will be noticed when adjustment screw is turned to the right or left of the minimum buzz position.

HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life or may result in serious burns. Never operate or service the receiver outside of the cabinet or with the high voltage shield cover removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE

HANDLING PRECAUTION

Shatterproof goggles and heavy gloves must be worn by individuals while handling or installing the picture tube into the receiver. The picture tube encloses a high vacuum and is subjected to excessive air pressure. HANDLE WITH EXTREME CARE—do not strike or scratch the tube nor subject it to more than moderate pressure when inserting into or removing from its socket. Breakage and the resulting implosion may result in damage to property or injury to an individual.

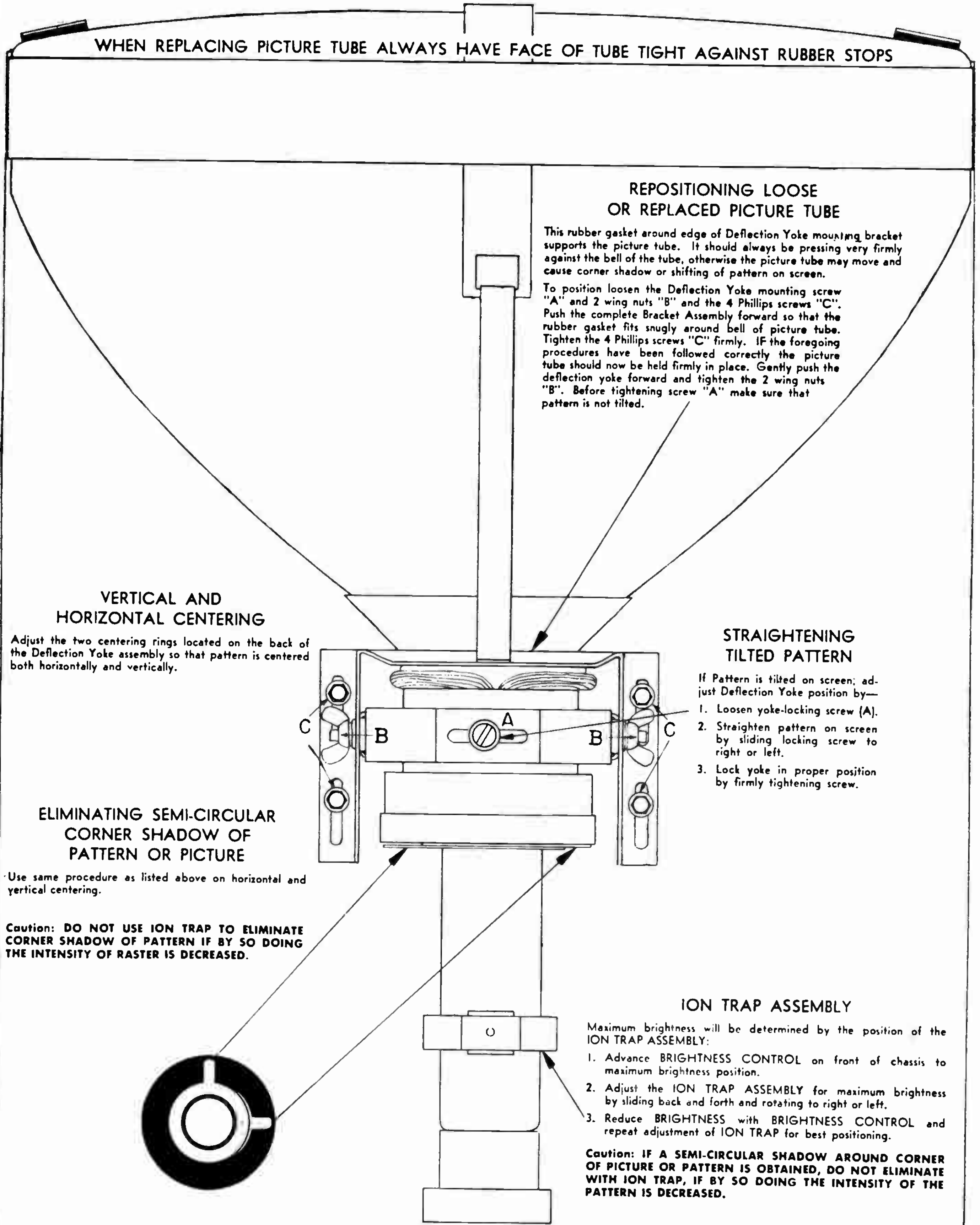
CHASSIS REMOVAL INSTRUCTIONS

To remove chassis from cabinet correctly:

1. Remove back from cabinet.
2. Disconnect speaker leads from jack mounted on chassis. (Remove speaker from table model cabinet).
3. Remove the 4 pushon type knobs.
4. Remove the 4 chassis mounting screws.

When reinstalling chassis make sure inside of safety glass is clean and face of picture tube is free of finger marks, lint, etc. Any commercial glass cleaner may be used.

ADJUSTMENT PROCEDURE FOR ELECTROSTATIC FOCUS PICTURE TUBES, DEFLECTION YOKE, ION TRAP, HORIZONTAL AND VERTICAL CENTERING, CORNER SHADOW, AND PICTURE TUBE ALIGNMENT.



REPOSITIONING LOOSE OR REPLACED PICTURE TUBE

This rubber gasket around edge of Deflection Yoke mounting bracket supports the picture tube. It should always be pressing very firmly against the bell of the tube, otherwise the picture tube may move and cause corner shadow or shifting of pattern on screen.

To position loosen the Deflection Yoke mounting screw "A" and 2 wing nuts "B" and the 4 Phillips screws "C". Push the complete Bracket Assembly forward so that the rubber gasket fits snugly around bell of picture tube. Tighten the 4 Phillips screws "C" firmly. If the foregoing procedures have been followed correctly the picture tube should now be held firmly in place. Gently push the deflection yoke forward and tighten the 2 wing nuts "B". Before tightening screw "A" make sure that pattern is not tilted.

VERTICAL AND HORIZONTAL CENTERING

Adjust the two centering rings located on the back of the Deflection Yoke assembly so that pattern is centered both horizontally and vertically.

STRAIGHTENING TILTED PATTERN

If Pattern is tilted on screen; adjust Deflection Yoke position by—

1. Loosen yoke-locking screw (A).
2. Straighten pattern on screen by sliding locking screw to right or left.
3. Lock yoke in proper position by firmly tightening screw.

ELIMINATING SEMI-CIRCULAR CORNER SHADOW OF PATTERN OR PICTURE

Use same procedure as listed above on horizontal and vertical centering.

Caution: DO NOT USE ION TRAP TO ELIMINATE CORNER SHADOW OF PATTERN IF BY SO DOING THE INTENSITY OF RASTER IS DECREASED.

ION TRAP ASSEMBLY

Maximum brightness will be determined by the position of the ION TRAP ASSEMBLY:

1. Advance BRIGHTNESS CONTROL on front of chassis to maximum brightness position.
2. Adjust the ION TRAP ASSEMBLY for maximum brightness by sliding back and forth and rotating to right or left.
3. Reduce BRIGHTNESS with BRIGHTNESS CONTROL and repeat adjustment of ION TRAP for best positioning.

Caution: IF A SEMI-CIRCULAR SHADOW AROUND CORNER OF PICTURE OR PATTERN IS OBTAINED, DO NOT ELIMINATE WITH ION TRAP, IF BY SO DOING THE INTENSITY OF THE PATTERN IS DECREASED.

SM-1002

REAR PANEL CONTROL ADJUSTMENTS

DON'T DISTURB THESE PANEL CONTROLS UNNECESSARILY—IF THE PICTURE IS GOOD, LEAVE THEM ALONE.

Normally, after the receiver has been properly installed, only the two dual operating controls on front of cabinet need be adjusted by the owner.

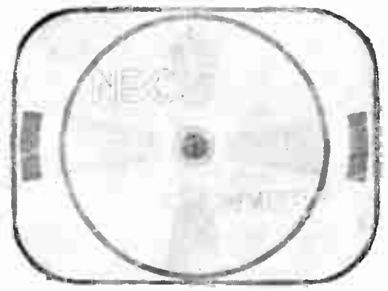
ONLY when the picture does not stay locked in the center of the screen, or is egg-shaped or very fuzzy, will it be necessary to adjust one of the rear panel controls.

If you experience a poor quality television picture, do not immediately assume that the difficulty is in your receiver. The cause may be due to temporary station transmitter difficulties.

Before adjusting any of the panel controls, study the picture you are receiving and compare it with one of the illustrative patterns below having similar characteristics. ADJUST ONLY THE CONTROL INDICATED AS THE ONE TO BE USED to correct that particular type of mis-adjustment.

By having someone hold a mirror in front of screen it is possible to adjust the required control and still look at the screen while making the adjustment. Turn the proper control slowly to the right or left until the picture stops rolling, becomes clear, etc.

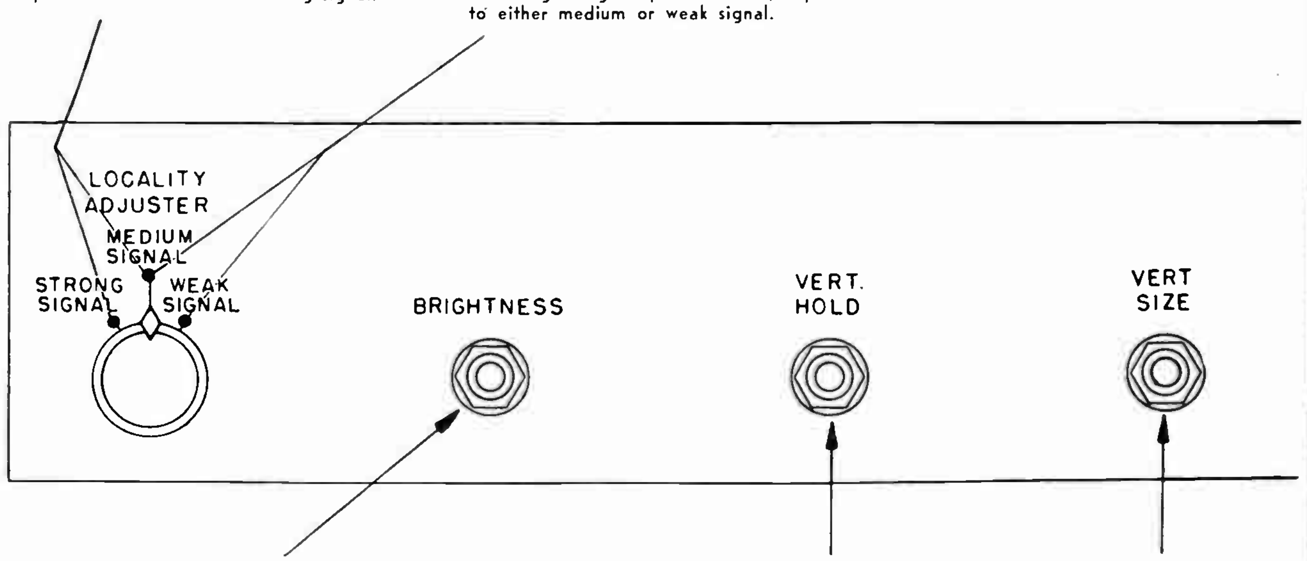
If picture is too strong and the CONTRAST CONTROL is not set too high, adjust to either medium or strong signal.

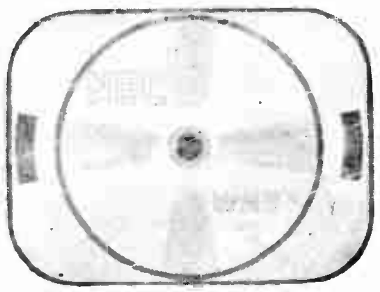


If the picture is weak and an adjustment of the FINE TUNING CONTROL does not bring out good picture detail, adjust to either medium or weak signal.

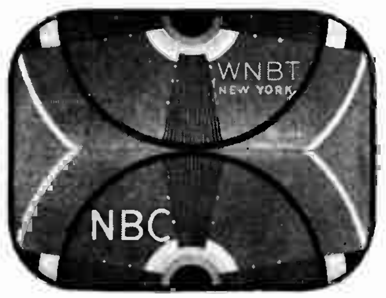
VERTICAL AND HORIZONTAL CENTERING

TO BE ADJUSTED BY A QUALIFIED TELEVISION TECHNICIAN ONLY. Adjust the 2 centering rings mounted on the back of the deflection yoke assembly for proper centered picture.

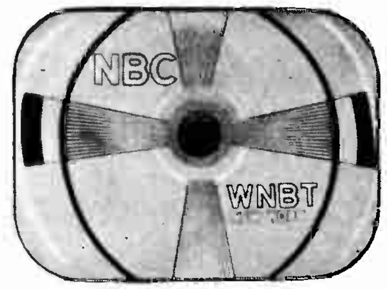




BRIGHTNESS CONTROL: This control is used in adjusting for brilliance or light intensity of the screen. When picture is too light as shown adjust Brightness Control.



IF PATTERN continuously rolls across screen in vertical direction (up or down) ADJUST VERTICAL HOLD CONTROL so that pattern stops rolling and remains stationary on screen.



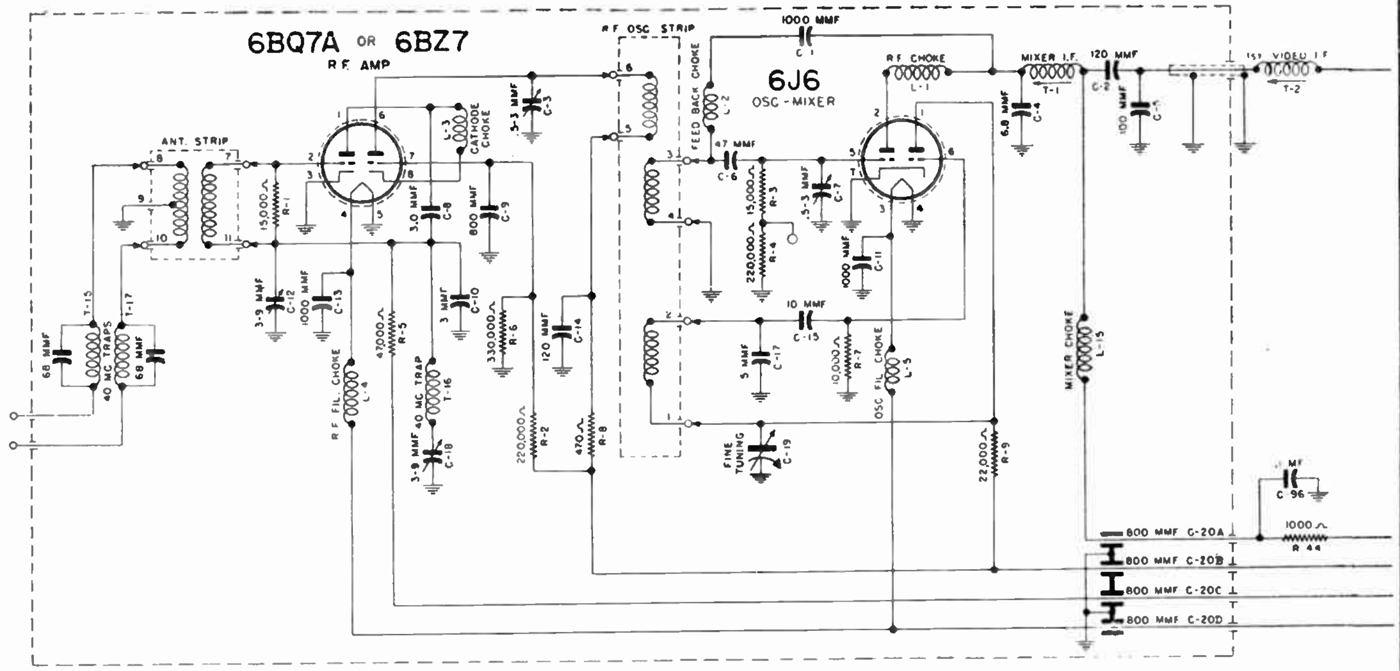
IF PATTERN extends over top and bottom of screen (too large) or is too small, in a vertical direction, adjust VERTICAL SIZE to make circle fit on screen.

NOTE: If, after this adjustment, circle is not uniformly round, a slight adjustment of the VERTICAL LINEARITY CONTROL may be necessary.

INTERFERENCE

Electrical interference, reflections and refractions, all of which will affect the quality of the picture, are problems that **cannot** be eliminated by any adjustment of the receiver controls. These sources of disturbance must be considered when the television antenna is installed.

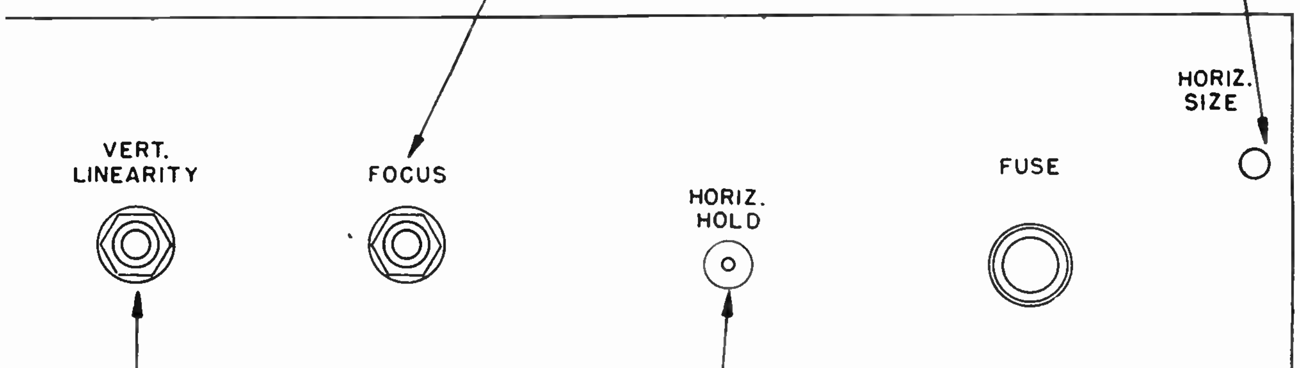
This means that both the type of antenna and its installation are of the greatest importance, and is one of the reasons why we recommend that only a trained television technician install the antenna.

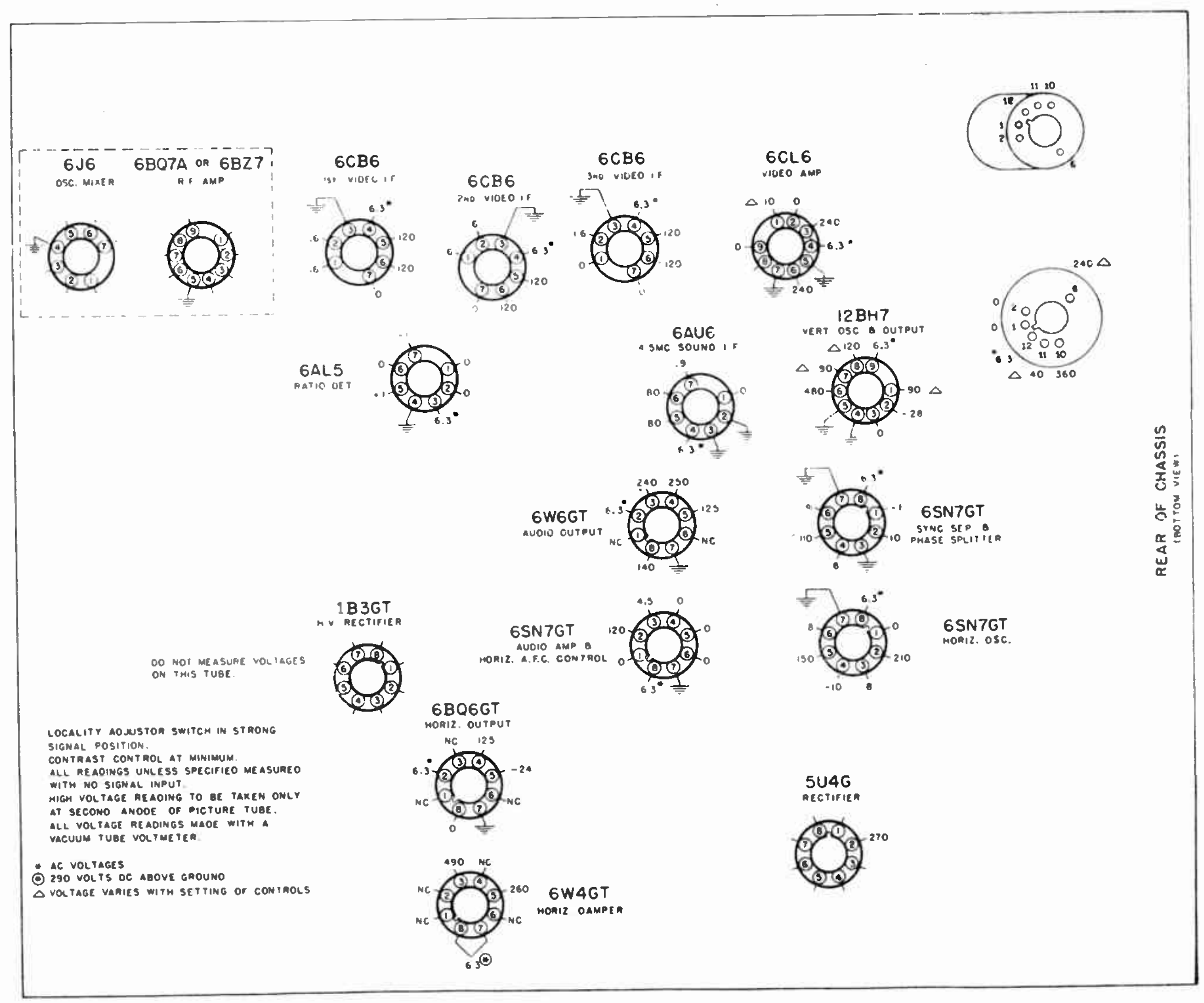


IF PATTERN IS FUZZY, ADJUST FOCUS CONTROL for sharpest definition.

NOTE: Have "Brightness" and "Contrast" controls properly adjusted before adjusting Focus Control.

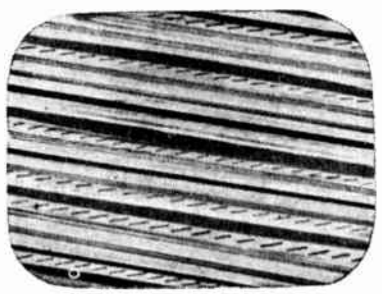
IF PATTERN IS TOO LARGE OR TOO SMALL, adjust HORIZONTAL SIZE CONTROL to make circle fit screen.





IF PATTERN is egg-shaped in vertical direction (flat on top), adjust VERTICAL LINEARITY CONTROL to make pattern round.

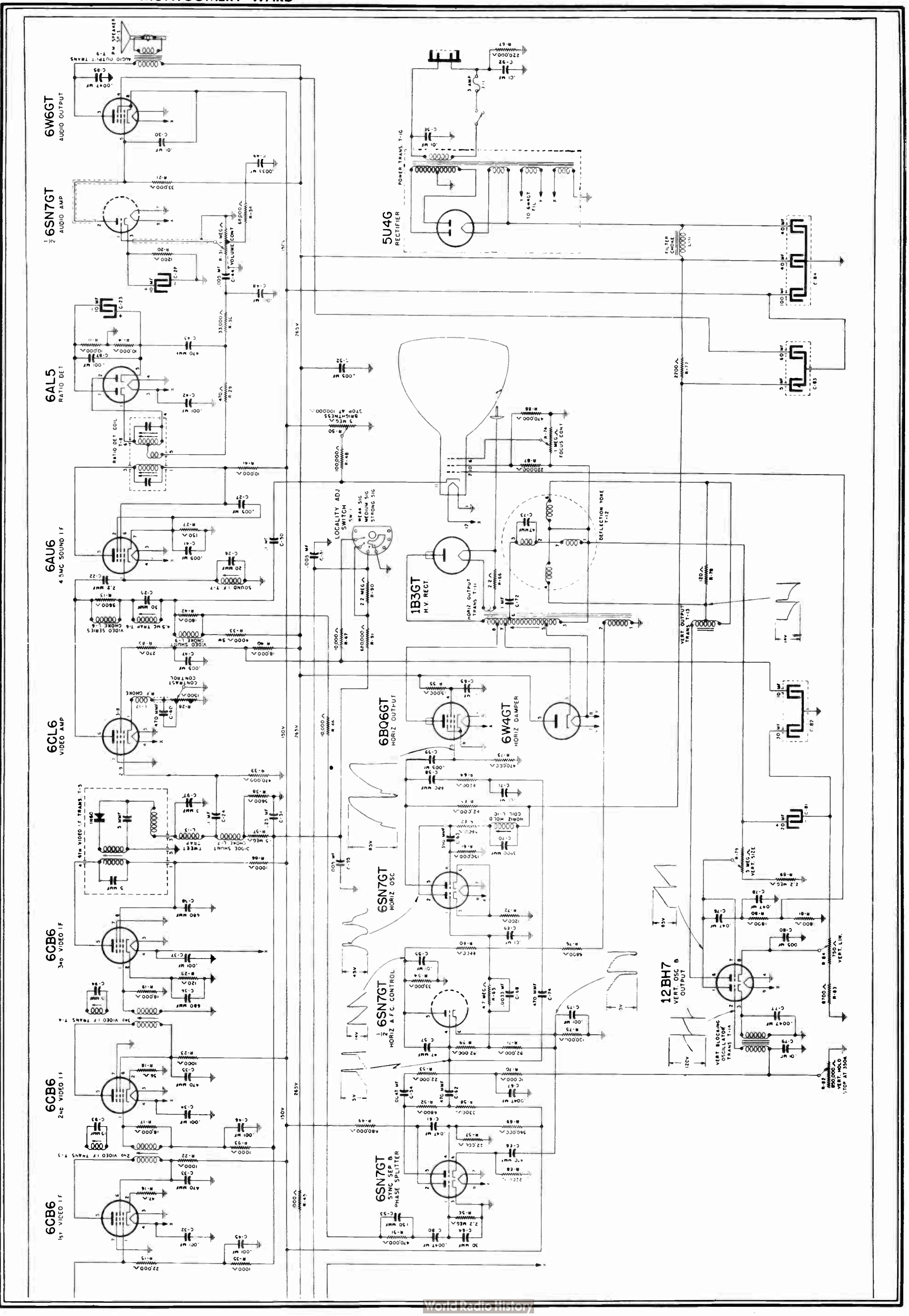
NOTE: If, after this adjustment, circle is round but is too small or too large, a slight adjustment of the VERTICAL SIZE will be necessary to make circle fit on screen properly.



IF PATTERN continuously breaks up in horizontal direction (LEFT TO RIGHT) ACROSS SCREEN, adjust HORIZONTAL HOLD CONTROL to bring pattern to stationary position on screen.

Photos by courtesy of "RCA Service Company, Inc. a Radio Corporation of America subsidiary, Camden, N. J."

MODELS 35GSE-3076A, -3078A, -3095A, -3097A



ALIGNMENT DATA

ALIGNMENT PROCEDURE

All circuits are very stable and will seldom require adjustment. Only when major parts of the tuner or the video I-F strip have been replaced or tampered with will it be necessary to realign the receiver.

Generally under normal conditions only the INDIVIDUAL CHANNEL TRIMMERS in the tuner unit may require adjustment by the service technician.

RATIO DETECTOR AND SOUND I-F ALIGNMENT

In most cases only the secondary of the ratio detector coil will require adjustment. This can be done simply by adjusting the top adjustment screw of the ratio detector for minimum buzz with the sound carrier of a TV station. For complete alignment use steps 1, 2, and 3 in the alignment table.

PICTURE I-F ALIGNMENT

Receiver should be run for at least ½ hour before proceeding with alignment.

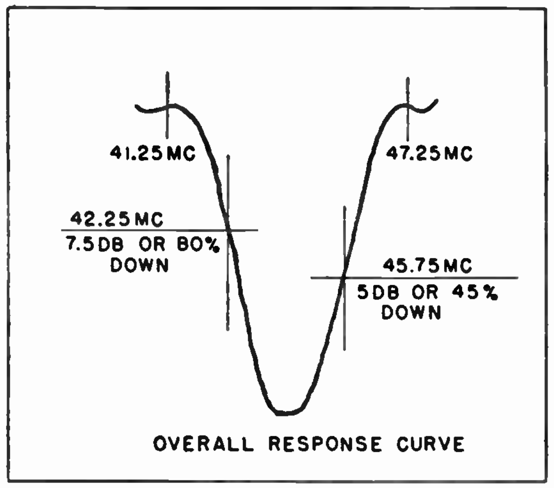


FIG. 2

EQUIPMENT REQUIRED

VACUUM TUBE VOLTMETER
For video IF alignment maintain readings in middle of low volt scale.

SIGNAL GENERATOR supplying a 4.5 MC. (within .25% 40 to 216 MC. (within 1%) signal. With output adjustable to at least .1 volt maximum.

CATHODE-RAY OSCILLOSCOPE. Must have good frequency and phase response from 10 cycles to at least 2 MC.

SWEEP GENERATOR. Capable of covering 40 to 270 MC. with a 10 MC. sweep with output adjustable to at least .1 volt maximum.

3 VOLT "A" BATTERY to provide fixed bias during video I-F and R-F alignment.

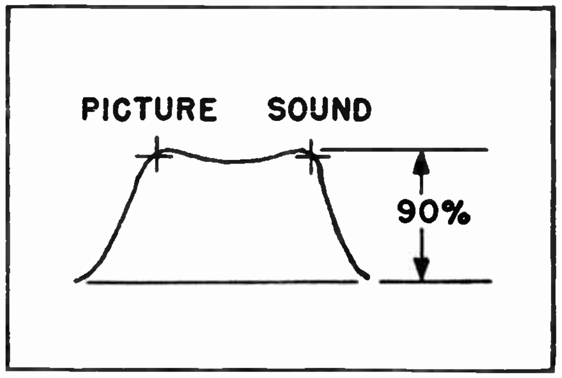


FIG. 3

ALIGNMENT TABLE

RATIO DETECTOR AND SOUND ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
1	In series with .001 Mfd. Cond. to junction of C-97 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC.	In series with 47,000 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-7 (top) and T-8 (bottom) for max. reading. See fig. 4 & 5
2	In series with .001 Mfd. Cond. to junction of C-97 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC.	In series with 47,000 ohm res. to junction of R-30 and C-44. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-8 (top) for zero reading. See fig. 4
3	In series with .001 Mfd. Cond. to cathode of picture tube yellow lead. See fig. 5	4.5 MC.	In series with 47,000 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on low volt scale. Remove 3rd video IF tube 6CB6.	T-6 (top) for minimum reading. See fig. 4

NOTE 1: For **minimum buzz** always adjust T-8 (top) with the sound carrier of a TV station.
NOTE 2: Alternate 4.5 MC. trap alignment: Adjust T-6 (top) for minimum 4.5 MC. beat on picture with a strong station signal.

PICTURE I-F ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
4	Ungrounded converter tube (6J6) shield.	44.0 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-5 (top) for maximum reading. See fig. 4
5	Ungrounded converter tube (6J6) shield.	43.0 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-4 (top) for maximum reading. See fig. 4
6	Ungrounded converter tube (6J6) shield.	41.25 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 Repeat Steps 5 & 6	T-4 (bottom) for minimum reading. See fig. 5
7	Ungrounded converter tube (6J6) shield.	45.4 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5.	T-3 (top) for maximum reading. See fig. 4
8	Ungrounded converter tube (6J6) shield.	47.25 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 Repeat Steps 7 & 8	T-3 (bottom) for minimum reading. See fig. 5
9	Ungrounded converter tube (6J6) shield.	44.6 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 **NOTE:** Detune T-2 by turning slug out as far as possible.	T-1 (top) for maximum reading. See fig. 4
10	Ungrounded converter tube (6J6) shield.	45.75MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-2 (top) for maximum reading. See fig. 4

NOTE 3: For visual check of IF response curve (see fig. 2) connect signal and sweep generator to ungrounded converter tube shield (6J6). Connect oscilloscope in series with 47,000 ohm resistor to junction of R-37 and L-7.

TUNER R.F. ALIGNMENT

NOTE 4: NEVER ADJUST C-3, C-7 and C-12 UNLESS ABSOLUTELY NECESSARY. THEY ARE FACTORY PRESET BY SPECIAL EQUIPMENT.

Step No.	Connect Marker Generator to	Marker Gen. Freq.	Connect Sweep Gen. to	Sweep Gen. Chan.	Connect Oscilloscope to	Miscellaneous Connections	Adjust
11	Loosely couple to sweep gen. leads.	205.25 MC. and 209.75 MC.	300 ohm antenna terminals.	12	Lead extending from top of tuner. See fig. 4	Tuner on channel 12 3 volt bias to junction of C-51 locality switch in strong position.	C-3, C-7 and C-12 for max. response having linear peaks with picture and sound markers at 90% maximum response. See fig. 3
12	OBSERVE RESPONSE CURVE FOR ALL CHANNELS USING CORRECT FREQUENCIES AND CHANNELS. A SLIGHT COMPROMISE SHOULD BE MADE WITH C-3, C-7 and C-12 IF MARKERS ARE BELOW 70%.						

NOTE 5: FOR RF OSCILLATOR ALIGNMENT. SET FINE TUNING CONTROL IN CENTER POSITION. ADJUST INDIVIDUAL CHANNEL TRIMMERS FOR BEST PICTURE DETAIL WITH THE PATTERNS OF A TV STATION. NOTE: USE A NON-METALLIC SCREW-DRIVER.

NOTE 6: C-1• (See fig. 4) part of a 40 MC. tuned trap need only be adjusted when local interferences from 40 thru 45 MC. affect the picture. Adjust C-18 for minimum 40 MC. beat on picture with a station signal.

TRIMMER LOCATION AND ALIGNMENT CONNECTION POINTS

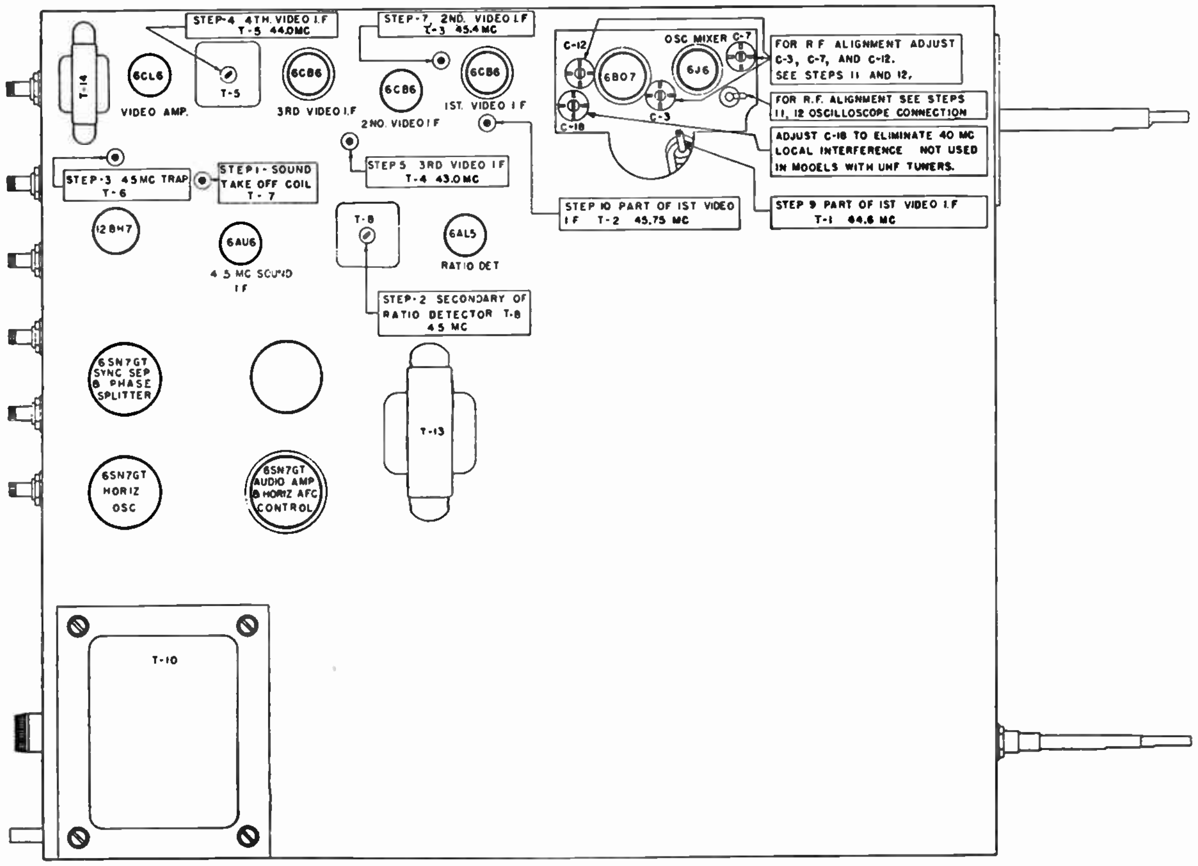


FIG. 4

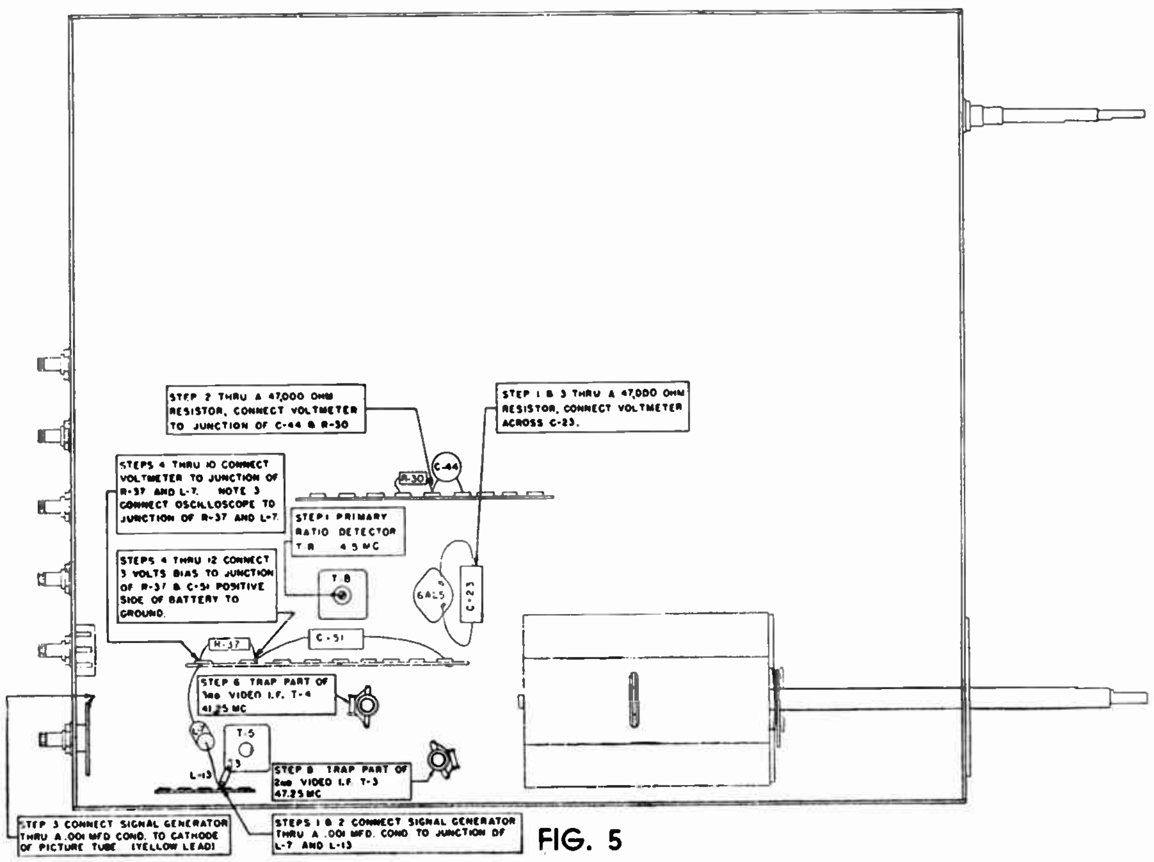


FIG. 5

PARTS LIST

R.F. TUNER UNIT

When Ordering Parts Give The Complete Part Number, Model Number and Description

TUNER UNIT CAPACITORS

Ref. No.	Part No.	Description	Price
C-1	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	$ .24
C-2	13L8D121K	Fixed Ceramic, 120 MMF ± 10% N750	.28
C-3	31B-206	Trimmer R.F., .5-3 MMF	.66
C-4	13L8C6R8C	Fixed Ceramic, 6.8 MMF ± .25 MMF NPO	.72
C-5	13XR1-30U101J	Fixed Ceramic, 100 MMF ± 5% N750	
C-6	CD8Q-470K	47 MMF ± 10% N1400	.24
C-7	31B-206	Trimmer R.F., .5-3 MMF	.66
C-8	CD8C-030C	Fixed Ceramic, 3 MMF ± .25 MMF NPO	.24
C-9	31B-611	Feed Thru Condenser 800 MMF GMV (Part of Center Shield Assembly)	.32
C-10	CD8C-030C	Fixed Ceramic, 3 MMF ± .25 MMF NPO	.24
C-11	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	.24
C-12	31B-167	Trimmer Antenna 3-9 MMF	.66
C-13	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	.24
C-14	CD8D-121K	Fixed Ceramic, 120 MMF ± 10%	.28
C-15	CD10C-100K	Fixed Ceramic, 10 MMF ± 10% NPO	.22
		68 MMF Part of 40 MC Trap T-15	
		68 MMF Part of 40 MC Trap T-17	
C-17	CD8UA-050C	Fixed Ceramic, 5 MMF ± .25 MMF N900	.24
C-18	31B-167	Trimmer Antenna 3-9 MMF	.66
C-19	31B-252	Ceramic Bushing and Lead Assembly, Fine Tuning	.40
C-20A	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.32
C-20B	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.32
C-20C	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.32
C-20D	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.32

TUNER UNIT RESISTORS

Ref. No.	Part No.	Description	Price
R-1	27E153-2	Carbon, 15,000 Ohm 1/2 W. ± 10%	.08
R-2	27E1009-6	Carbon, 220,000 Ohm 1/2 W. ± 10%	.08
R-3	27E153-2	Carbon, 15,000 Ohm 1/2 W. ± 10%	.08
R-4	27E224-2	Carbon, 220,000 Ohm 1/2 W. ± 10%	.06
R-5	27E473-2	Carbon, 47,000 Ohm 1/2 W. ± 10%	.06
R-6	27E1009-24	Carbon, 330,000 Ohm 1/2 W. ± 10%	.14
R-7	27E103-2	Carbon, 10,000 Ohm 1/2 W. ± 10%	.10
R-8	27E471-2	Carbon, 470 Ohm 1/2 W. ± 10%	.08
R-9	27E223-3	Carbon, 22,000 Ohm 1 W. ± 10%	.10

CHOKES AND COILS

Ref. No.	Part No.	Description	Price
L-1	31B-638-1	R.F. Choke	.72
L-2	31B-230	Feed Back Choke	.30
L-3	31B-629	Cathode Choke	.24
L-4	34A-546	R.F. Filament Choke	.08
L-5	34A-575	Osc. Filament Choke	.08
L-15	34A-680	Mixer Choke	.72
T-1	31B-682	Mixer I.F.	.72
T-15	31B-649	40 MC Trap (Code White)	1.68
T-16	31B-289	40 MC Trap	
T-17	31B-601	40 MC Trap (Code Black)	1.68
	31M-012-2R	Antenna Coil Assembly Channel 2, Code R	1.20
	31M-012-3R	Antenna Coil Assembly Channel 3, Code R	1.20

CHOKES AND COILS—(Cont.)

Part No.	Description	Price
31M-012-4R	Antenna Coil Assembly Channel 4, Code R	1.20
31M-012-5R	Antenna Coil Assembly Channel 5, Code R	1.20
31M-012-6R	Antenna Coil Assembly Channel 6, Code R	1.20
31M-012-7R	Antenna Coil Assembly Channel 7, Code R	1.00
31M-012-8R	Antenna Coil Assembly Channel 8, Code R	1.00
31M-012-9R	Antenna Coil Assembly Channel 9, Code R	1.00
31M-012-10R	Antenna Coil Assembly Channel 10, Code R	1.00
31M-012-11R	Antenna Coil Assembly Channel 11, Code R	1.00
31M-012-12R	Antenna Coil Assembly Channel 12, Code R	1.00
31M-012-13R	Antenna Coil Assembly Channel 13, Code R	1.00
31M-112-2R	R.F. and Oscillator Coil Assembly, Channel 2, Code R	1.60
31M-112-3R	R.F. and Oscillator Coil Assembly, Channel 3, Code R	1.60
31M-112-4R	R.F. and Oscillator Coil Assembly, Channel 4, Code R	1.60
31M-112-5R	R.F. and Oscillator Coil Assembly, Channel 5, Code R	1.60
31M-112-6R	R.F. and Oscillator Coil Assembly, Channel 6, Code R	1.60
31M-112-7R	R.F. and Oscillator Coil Assembly, Channel 7, Code R	1.50
31M-112-8R	R.F. and Oscillator Coil Assembly, Channel 8, Code R	1.50
31M-112-9R	R.F. and Oscillator Coil Assembly, Channel 9, Code R	1.50
31M-112-10R	R.F. and Oscillator Coil Assembly, Channel 10, Code R	1.50
31M-112-11R	R.F. and Oscillator Coil Assembly, Channel 11, Code R	1.50
31M-112-12R	R.F. and Oscillator Coil Assembly, Channel 12, Code R	1.50
31M-112-13R	R.F. and Oscillator Coil Assembly, Channel 13, Code R	1.50

MISCELLANEOUS TUNER PARTS

Part No.	Description	Price
31B-613-113	Fine Tuning Assembly	
31B-203-113	Drum & Shaft Assembly, Less Coils	4.08
31B-016	Roller Detent	.16
31B-005	Spring Detent	.16
31B-124	Ground Plate, Fine Tuning	.20
31B-008	Ground Spring, Fine Tuning	.16
31B-021	Mounting Strap, Ceramic Bushing	.16
11D-022	Fiber Washer	.08
31B-030	Spring, Shaft Retaining	.16
31B-278	Stator Contact Bracket Assembly	3.00
16S-004	Shield for 6BQ7	.16
16S-006	Shield for 6J6	.16
31B-103	Shield (Bottom Cover)	1.20
31B-143	Shield (Side)	1.00

Kits containing the necessary strips to convert to any UHF channel are available. When ordering please be sure to: Give required UHF channel number, model number, and code letter "R."

MAIN CHASSIS

CAPACITORS

Ref. No.	Part No.	Description	Price
C-22	23E21	Fixed Ceramic, 2.2 MMF 500 V.	.76
C-23	25E66	Dry Electrolytic, 10 MFD 50 V.	1.02
C-24	23E3216	Molded Tubular, .1 MFD 200 V.	.30
C-25	23E23	Fixed Ceramic, 30 MMF 500 V.	.24
C-26	23E22	Fixed Ceramic, 20 MMF 500 V.	.24
C-27	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-28	25E66	Dry Electrolytic, 10 MFD 50 V.	1.02
C-30	23E3410	Molded Tubular, .01 MFD 400 V.	.26
C-31	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-32	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.20
C-33	23E2027-14	Fixed Ceramic, 470 MMF 500 V.	.18
C-34	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.20
C-35	23E2027-14	Fixed Ceramic, 470 MMF 500 V.	.18
C-36	23E2027-11	Fixed Ceramic, 680 MMF 500 V.	.26
C-37	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.20
C-38	23E2027-11	Fixed Ceramic, 680 MMF 500 V.	.26
C-40	23E2027-14	Fixed Ceramic, 470 MMF 500 V.	.18
C-41	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-42	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.20
C-43	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.30
C-44	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-45	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.20
C-46	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.20
C-47	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-48	23E2027-9	Fixed Ceramic, .001 MFD 500 V. (Tubular)	.20
C-49	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-50	23E3416	Molded Tubular, .1 MFD 400 V.	.34
C-51	23E122	Fixed Paper, .25 MFD 100 V.	.40
C-52	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-53	23E2027-10	Fixed Ceramic, 150 MMF 500 V.	.18
C-54	23E3408	Molded Tubular, .0047 MFD 400 V.	.24
C-55	23E3410	Molded Tubular, .01 MFD 400 V.	.26
C-56	23E3610	Molded Tubular, .01 MFD 600 V.	.30
C-57	23E2030-15	Fixed Ceramic, 47 MMF 500 V.	.24
C-58	23E3500-85	Fixed Mica, 680 MMF 500 V. ± 5%	.38
C-59	23E2025	Fixed Ceramic, .005 MFD 500 V.	.30
C-60	23E3608	Molded Tubular, .0047 MFD 600 V.	.26
C-61	23E3414	Molded Tubular, .047 MFD 400 V.	.36
C-62	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.30
C-63	23E3500-39	Fixed Mica, 390 MMF 500 V. ± 10%	.26
C-64	23E23	Fixed Ceramic, 30 MMF 500 V.	.24
C-65	23E3416	Molded Tubular, .1 MFD 400 V.	.34
C-66	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.30
C-67	23E3408	Molded Tubular, .0047 MFD 400 V.	.24
C-68	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-69	23E3410	Molded Tubular, .01 MFD 400 V.	.26
C-70	23E2033-4	Silver Mica, 3900 MMF 500 V ± 5%	1.20
C-71	23E3410	Molded Tubular, .01 MFD 400 V.	.26
C-72	23E3616	Molded Tubular, .1 MFD 600 V.	.46
C-73	23E2025-5	Fixed Ceramic, 47 MFD 2000 V. (Disc)	.30
C-74	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.30
C-75	23E3404	Molded Tubular, .001 MFD 400 V.	.24
C-76	23E3414	Molded Tubular, .047 MFD 400 V.	.36
C-77	23E3408	Molded Tubular, .0047 MFD. 400 V.	.24
C-78	23E3414	Molded Tubular, .047 MFD 400 V.	.36
C-79	23E3424	Molded Tubular, .01 MFD 400 V. ± 10%	.30
C-80	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-81	25E64	Dry Electrolytic, 20 MFD 450 V.	1.64
C-82	25E63	Dry Electrolytic, 30 MFD 200 V., 10 MFD 350 V.	1.84
C-83	25E62	Dry Electrolytic, 5-60 MFD 250 V.	1.94
C-84	25E65	Dry Electrolytic, 100 MFD 200 V. 40-40 MFD 350 V.	4.20
C-85	23E3608	Molded Tubular, .0047 MFD 600 V.	.26
C-87	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.20
C-92	23E3610	Molded Tubular, .01 MFD 600 V.	.30
C-93		Fixed Ceramic, 15 MMF 500 V. Part of 2nd IF Transformer	
C-94		Fixed Ceramic, 15 MMF 500 V. Part of 3rd IF Transformer	
C-95	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.30
C-96	23E3216	Molded Tubular, .1 MFD 200 V.	.30
C-97	23E20	Fixed Ceramic, 3 MMF 500 V.	.24

RESISTORS

Ref. No.	Part No.	Description	Price
R-11	27E1009-35	Carbon, 10,000 OHM ½ W. ± 5%	.16
R-13	27E1009-8	Carbon, 5,600 OHM ½ W. ± 5%	.10
R-14	27E1009-35	Carbon, 10,000 OHM ½ W. ± 5%	.16
R-15	27E223-2	Carbon, 22,000 OHM ½ W. ± 10%	.10
R-16	27E470-2	Carbon, 47 OHM ½ W. ± 10%	.06
R-17	27E183-2	Carbon, 18,000 OHM ½ W. ± 10%	.08
R-18	27E560-2	Carbon, 56 OHM ½ W. ± 10%	.08
R-19	27E183-2	Carbon, 18,000 OHM ½ W. ± 10%	.08
R-20	27E122-2	Carbon, 1,200 OHM ½ W. ± 10%	.06
R-21	27E333-3	Carbon, 33,000 OHM 1 W. ± 10%	.10
R-22	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.06
R-23	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.06
R-25	27E121-2	Carbon, 120 OHM ½ W. ± 10%	.08
R-27	27E151-2	Carbon, 150 OHM ½ W. ± 10%	.06
R-28	28E99	Contrast Control, 1500 OHM (Dual See R-31)	2.60
R-29	27E471-2	Carbon, 470 OHM ½ W. ± 10%	.08
R-30	27E333-2	Carbon, 33,000 OHM ½ W. ± 10%	.06
R-31	28E99	Off-On-Volume Control, 1 Megohm (Dual See R-28)	2.60
R-33	27E1022	Wirewound, 4,000 OHM 5 W.	1.14
R-34	27E683-2	Carbon, 68,000 OHM ½ W. ± 10%	.08
R-35	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.06
R-37	27E155-2	Carbon, 1.5 Megohm ½ W. ± 20%	.08
R-38	27E1009-8	Carbon, 5,600 OHM ½ W. ± 5%	.10
R-39	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.06
R-40	27E183-5	Carbon, 18,000 OHM 2 W. ± 10%	.22
R-41	27E103-2	Carbon, 10,000 OHM ½ W. ± 10%	.08
R-42	27E182-2	Carbon, 1,800 OHM ½ W. ± 10%	.08
R-44	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.06
R-45	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.06
R-46	27E103-2	Carbon, 10,000 OHM ½ W. ± 10%	.08
R-47	27E103-3	Carbon, 10,000 OHM 1 W. ± 10%	.10
R-48	27E1009-10	Carbon, 100,000 OHM ½ W. ± 10%	.08
R-49	27E684-2	Carbon, 680,000 OHM ½ W. ± 20%	.08
R-50	28E87	Brightness Control, 5 Megohm	.82
R-51	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.06
R-52	27E682-2	Carbon, 6,800 OHM ½ W. ± 10%	.06
R-53	27E223-2	Carbon, 22,000 OHM ½ W. ± 10%	.10
R-54	27E333-2	Carbon, 33,000 OHM ½ W. ± 10%	.06
R-55	27E1016-13	Wirewound, 15,000 OHM 5 W.	.75
R-56	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.06
R-57	27E223-2	Carbon, 22,000 OHM ½ W. ± 10%	.10
R-58	27E332-2	Carbon, 3,300 OHM ½ W. ± 10%	.08
R-59	27E823-2	Carbon, 82,000 OHM ½ W. ± 10%	.08
R-60	27E682-3	Carbon, 6,800 OHM 1 W. ± 10%	.06
R-61	27E1009-46	Carbon, 150,000 OHM ½ W. ± 10%	.08
R-62	27E1009-8	Carbon, 5,600 OHM ½ W. ± 5%	.10
R-63	27E823-2	Carbon, 82,000 OHM ½ W. ± 10%	.08
R-64	27E1009-22	Carbon, 8,200 OHM ½ W. ± 5%	.14
R-65	27E475-2	Carbon, 4.7 Megohm ½ W. ± 20%	.06
R-66	23E1015-2	Wirewound, 2.2 OHM ½ W. ± 5%	.18
R-67	27E224-2	Carbon, 220,000 OHM ½ W. ± 20%	.06
R-68	27E222-2	Carbon, 2,200 OHM ½ W. ± 10%	.08
R-69	27E1009-11	Carbon, 560,000 OHM ½ W. ± 10%	.08
R-70	27E103-2	Carbon, 10,000 OHM ½ W. ± 10%	.08
R-71	27E823-2	Carbon, 82,000 OHM ½ W. ± 10%	.08
R-72	27E122-2	Carbon, 1,200 OHM ½ W. ± 10%	.06
R-73	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.06
R-74	28E89	Focus Control, 1 Megohm	.70
R-75	27E1009-10	Carbon, 100,000 OHM ½ W. ± 10%	.08
R-76	27E682-3	Carbon, 6,800 OHM 1 W. ± 10%	.10
R-77	27E222-2	Carbon, 2,200 OHM ½ W. ± 10%	.08
R-78	27E121-2	Carbon, 120 OHM ½ W. ± 10%	.08
R-79	28E88	Vertical Size Control, 5 Megohm	.80
R-80	27E182-2	Carbon, 1,800 OHM ½ W. ± 10%	.08
R-81	27E182-2	Carbon, 1,800 OHM ½ W. ± 10%	.08
R-82	28E90	Vertical Hold Control, 850,000 OHM	.80
R-83	27E1016-20	Wirewound, 8,700 OHM 5 W.	.46
R-84	28E86	Vertical Linearity Control, 750 OHM	.70
R-85	27E271-2	Carbon, 270 OHM ½ W. ± 10%	.08
R-86	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.06
R-87	27E224-2	Carbon, 220,000 OHM ½ W. ± 20%	.06
R-88	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.06

MAIN CHASSIS—(Cont.)

RESISTORS—(Cont.)

Ref. No.	Part No.	Description	Price
R-89	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.06
R-90	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.06
R-91	27E684-2	Carbon, 680,000 OHM ½ W. ± 20%	.08
R-93	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.06

CHOKES AND COILS

Ref. No.	Part No.	Description	Price
L-6	20E363-25	Video Series Choke	.70
L-7	20E363-19	Diode Shunt Choke	.70
L-9	20E363-26	Video Shunt Choke	.70
L-10	20E831	Horizontal Hold	1.74
L-11	22E73	Filter Choke	2.72
L-12	2E92	R.F. Choke	.36
L-13	20E883	Tweet Trap	.18
T-2	20E857	Transformer, 1st Video IF	.76
T-3	20E858	Transformer, 2nd Video IF	1.74
T-4	20E859	Transformer, 3rd Video IF	1.72
T-5	20E860	Transformer, 4th Video IF	2.94
T-6	20E785	Transformer, 4.5 MC Trap	1.12
T-7	20E785	Transformer, Sound IF	1.12
T-8	20E783	Transformer, Ratio Detector	3.32
T-9	22E71	Transformer, Audio Output	1.74
T-10	22E74	Transformer, Power	21.12
T-11	22E75	Transformer, Horizontal Output	12.34
T-12	20E788-2	Transformer, Deflection Yoke	12.14
T-13	22E72	Transformer, Vertical Output	3.42
T-14	22E70	Transformer, Vertical Blocking Osc.	1.92

MISCELLANEOUS

Ref. No.	Part No.	Description	Price
	29E30	Switch, Locality Adjuster	.94
	40E8-10	Fuse, 3 Ampere (Slo-Blo) Line	.26
	95E1	Crystal Diode IN60	1.00
	55E57	Fuse Holder with Cap	.70
	41E16	Line Cord with Female Plug	1.15
	17E32	Receptacle AC 2 Contact Male	.26
	17E1-17	Socket 9 Pin Miniature	.26

MISCELLANEOUS—(Cont.)

Part No.	Description	Price
17E1-18	Socket, Octal	.14
17E1-27	Socket, Octal Mica Filled	.44
17E1-36	Socket, Miniature 7 Pin	.14
17E1-39	Socket, Miniature 9 Pin (Noval Mica)	.22
18E25	Terminal, Antenna	
20E419-4	Connector, 2nd Anode Picture Tube	.48
20E617-12	Socket Assembly Picture Tube	1.02
15E174-4 OR	Ion Trap	.84
15E174-6	Ion Trap	.76
20E891	Antenna, Built-In	1.46

MISCELLANEOUS CABINET PARTS

Part No.	Description	Price
9E45	Safety Glass	11.28
20E774-9	Cabinet Back Assembly with Line Cord	4.30
36E93-2	Mask for Picture Tube	5.00
33E85	Rubber Gasket for Mask 58"	.58
*20E544-13	Knob Assembly (Channel Selector)	1.74
**20E544-14	Knob Assembly (Channel Selector)	1.74
*20E545-9	Knob Assembly (Off-On-Volume)	1.74
**20E545-10	Knob Assembly (Off-On-Volume)	1.74
**37E59	Knob Only (Channel Selector)	.22
*37E59-5	Knob Only (Off-On-Volume)	.30
*37E59-6	Knob Only (Channel Selector)	.22
**37E59-11	Knob Only (Off-On-Volume)	.32
*37E71-7	Knob, Fine Tuning	.34
*37E71-8	Knob, Contrast	.34
**37E71-11	Knob, Fine Tuning	.54
**37E71-12	Knob, Contrast	.54
36E90	Plate Only (Channel Selector)	1.30
36E91	Plate Only (Off-On-Volume)	1.30

*For mahogany cabinets only.

**For blonde cabinets only.

IMPORTANT—All prices in this literature are subject to change without notice and are subject to an additional charge to cover any applicable sales tax, use, occupations, or other tax affecting our purchase or sale of merchandise.

MODEL
35WG-3080 (MAH.)

MODEL
35WG-3090 (OAK)

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	Television—210 Watts Radio—35 Watts Phonograph—55 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Ranges	TV Channels 2 thru 13 AM—540-1600 KC
Intermediate Freq. (Tel.)	Picture—26.20 MC Sound—21.70 MC
Intermediate Freq. (Radio)	455 KC
Selectivity (Radio)	45 KC Broad at 1,000 Times Signal, measured at 1,000 KC
Sensitivity (Radio)	(For .5 Watt Output) 10 Microvolts Average
Tel. Antenna Input Imp.	300 Ohms Balanced
Intercarrier Sound System	4.5 MC
Loud Speaker	8" PM Dynamic
Voice Coil Impedance	3.2 Ohms 400 Cycles
Record Changer	See Manual 5096A (VM-950)
Cartridge	Shure P77V (60H17)
Needles—78 RPM —33⅓ & 45 RPM	Shure 85-16 (61H2) —Shure 85-18 (61H13)

TUBE COMPLEMENT
TELEVISION

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

TUBE COMPLEMENT
RADIO CHASSIS

1	6BA6	R-F Amplifier
1	6BE6	AM Converter
1	6BA6	I-F Amplifier
1	6AV6	Det. & 1st Audio Amplifier
1	6AQ5	Audio Output
1	6X4	Rectifier
2	No. 47	Dial Lamps

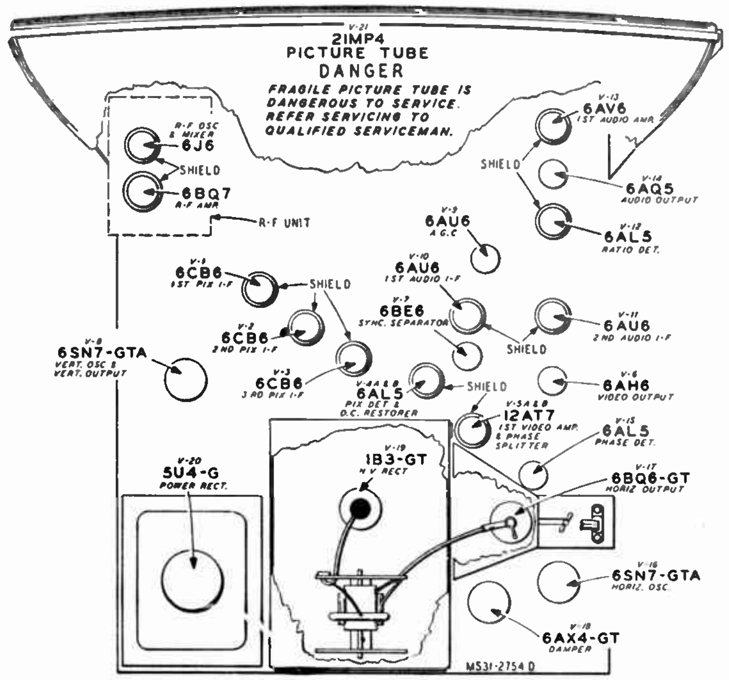


Fig. 1—Tube Layout.

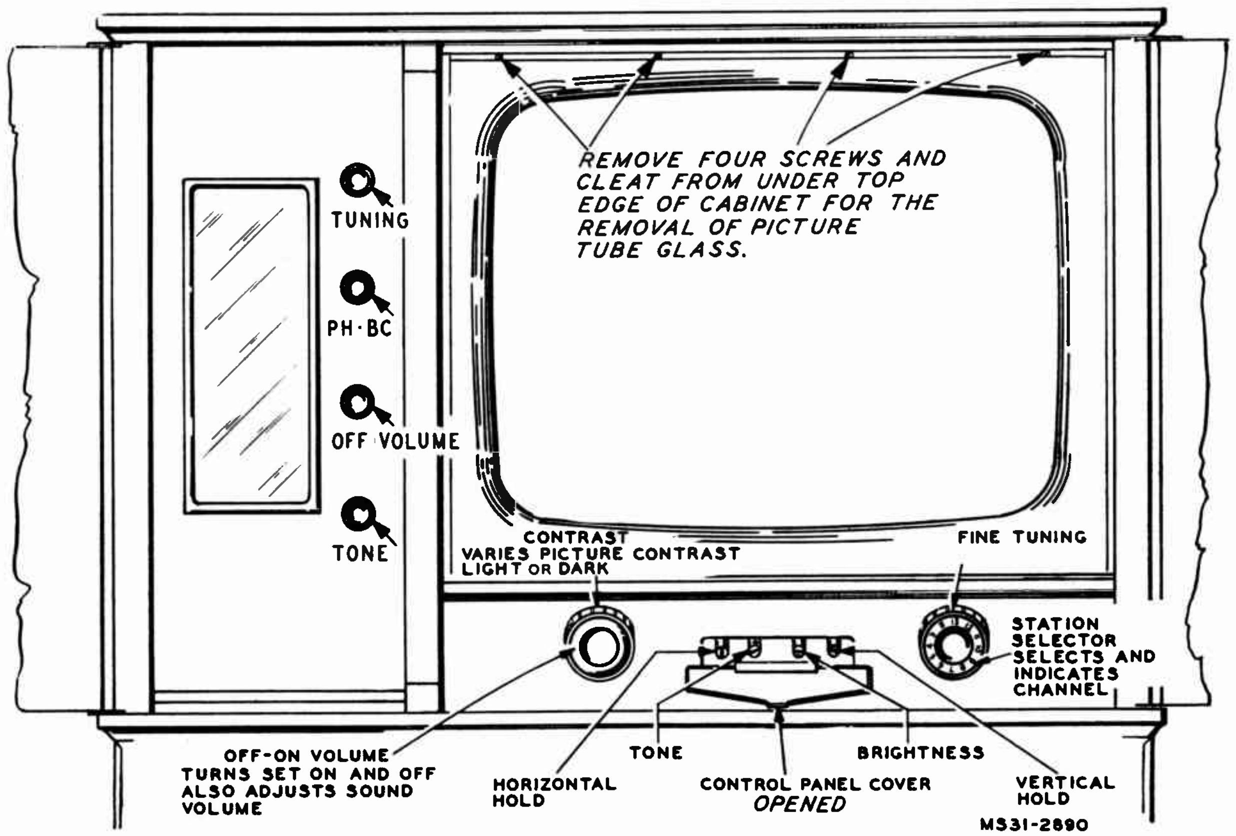


Fig. 2—Front Panel Controls

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are four controls at the front of the chassis which are accessible when the hinged control panel is pulled downward. See illustration Figure 2. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT — Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

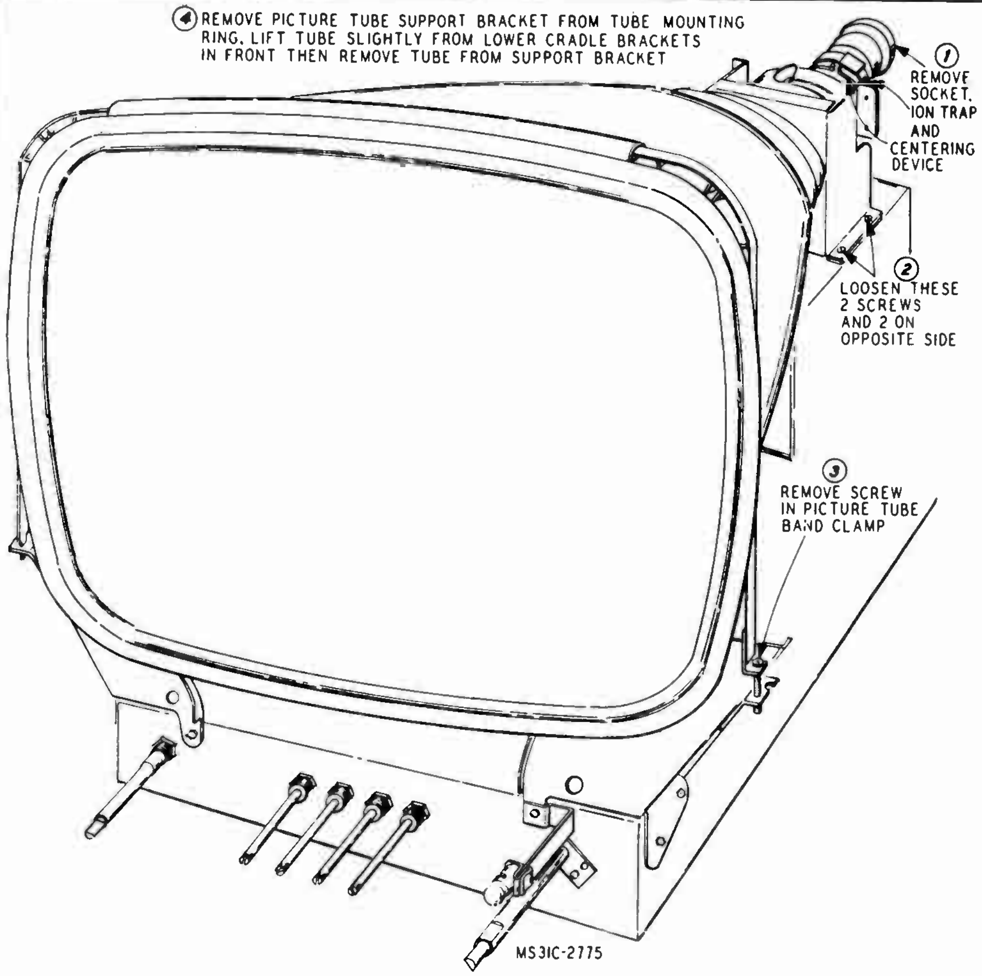


Fig. 3—Removal of Picture Tube

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, the radio chassis, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

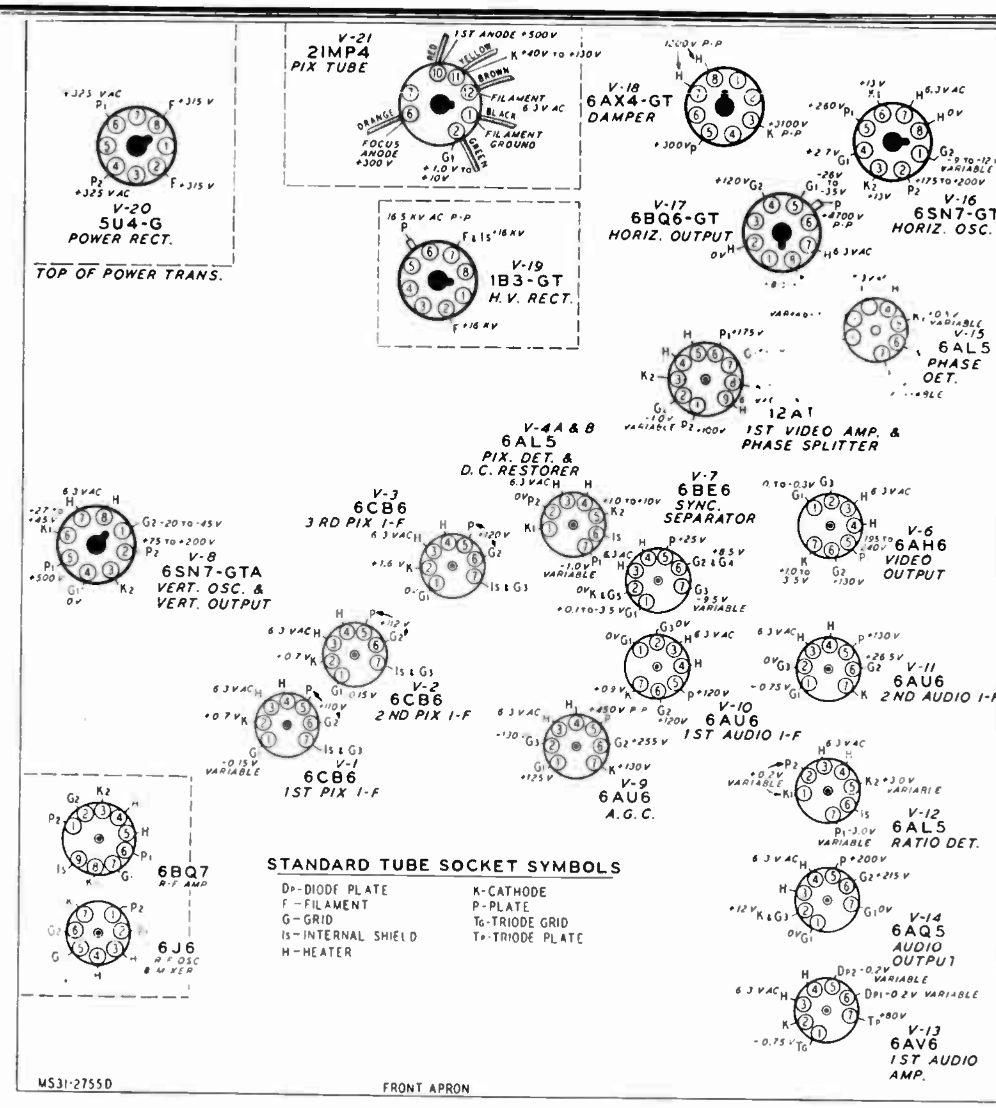


Fig. 6—Bottom Socket Voltages

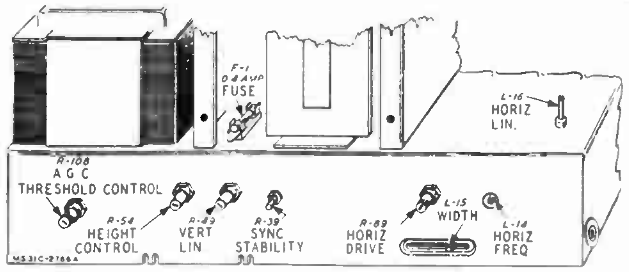


Fig. 4—Adjustments Rear of Chassis

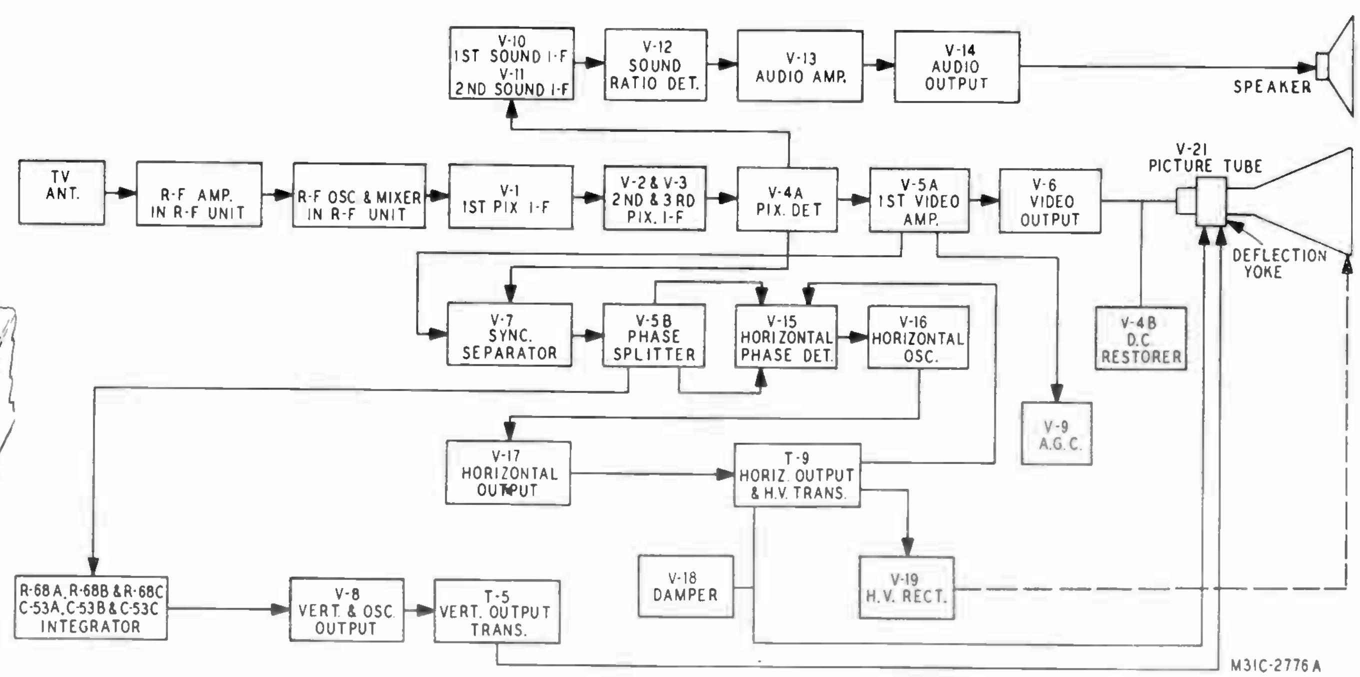


Fig. 7—Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-105 and C-75 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-47B, C-70 or C-71 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-68, or open or incorrect value of resistors R-90 & R-92.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-67 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-77, C-78, C-79 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:

1: Defective yoke due to C-76 or R-106 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:

1: Low +B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:

1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:

1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:

1: Vertical integrating network capacitors C-53A, B & C, and resistors R-68A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-36. If the capacitor is not found to be defective, check the following:
   1: Check all potentials in video circuits.
   2: Check picture tube grid circuit for poor or dirty contact.
   3: Check and realign, if necessary, the picture I-F and R-F circuits.

SERVICE SUGGESTIONS—(continued)

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING

1: Check sync stability control adjustment.
2: Check capacitors C-47A and C-49A.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND

This condition can be caused by,

1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3
2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.

POOR FOCUS

1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:
   18 to 30 mc, 10 mc sweep width
   40 to 90 mc, 10 mc sweep width
   170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.
   23.1 mc first picture I-F coil.
   24.1 mc third picture I-F coil.
   25.9 mc second picture I-F coil.
   21.7 mc sound trap.
   4.5 mc video trap & sound I-F.
   25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, the radio chassis, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-105.

ALIGNMENT PROCEDURE
PIX I-F

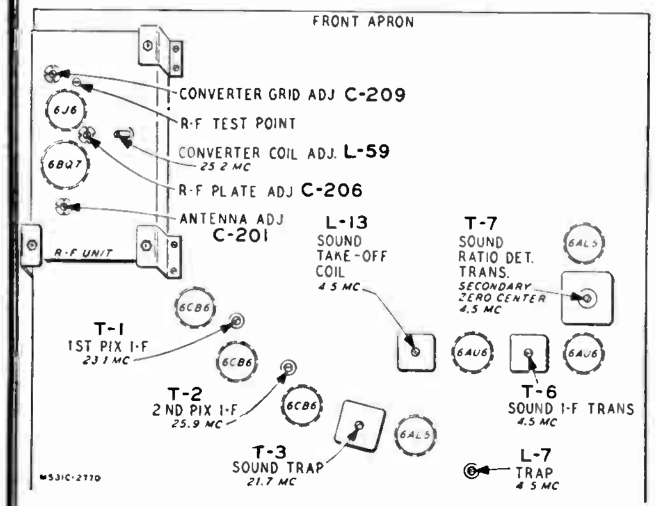


Fig. 8—Top Chassis Video and Audio I-F Adjustments

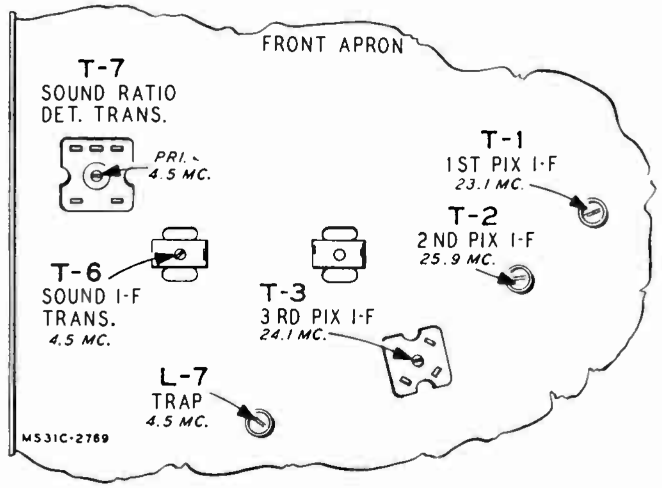


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-37) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

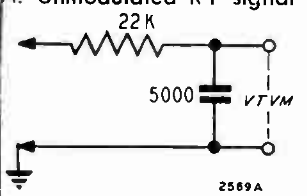


Fig 10—VTVM Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-37 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

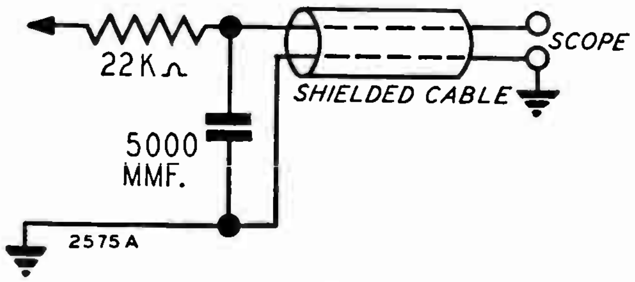


Fig. 11—Oscilloscope Connections

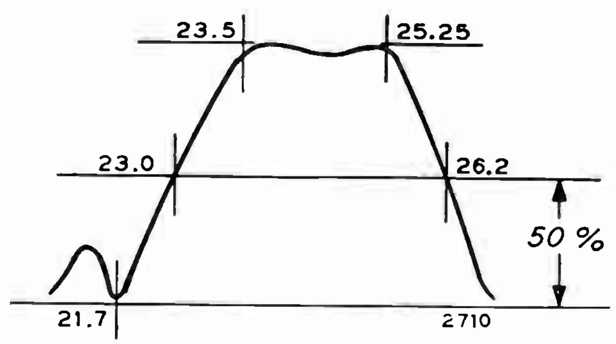


Fig. 12—Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

ALIGNMENT PROCEDURE (Continued)

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled by the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-13 and C-14, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-17, R-20 and C-18, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-34 and C-29 on the receiver.

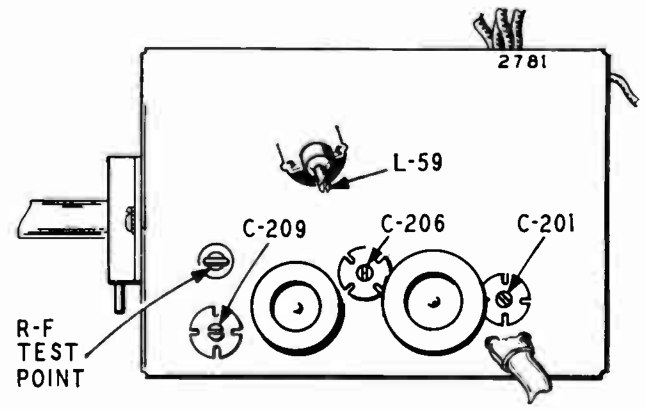


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.

2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

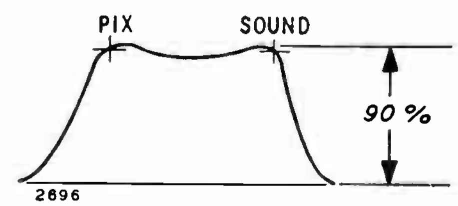


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-30A.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

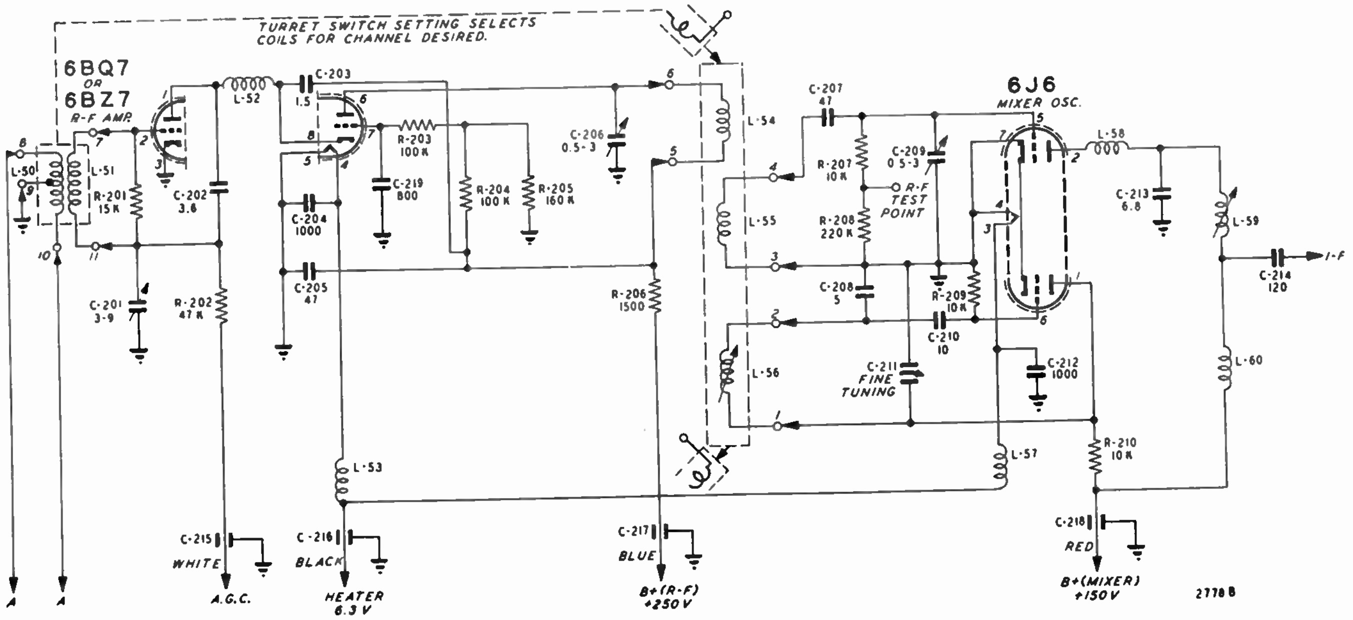


Fig. 16—"Q" Tuner Schematic Diagram.

ALIGNMENT PROCEDURE
RADIO

The following is required for aligning:
An All Wave Signal Generator Which Will Provide an Accurately Calibrated Signal at the Test Frequencies as Listed.
Output Indicating Meter, Non-Metallic Screwdriver, Dummy Antennas — .1 mf, and 50 mmf.

Volume Control Maximum all Adjustments.
Connect Chassis to Ground Post of Signal Generator with a Short Heavy Lead.
Allow Chassis and Signal Generator to "Heat Up" for Several Minutes.

SIGNAL GENERATOR						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid I-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (4) and Sec. (3)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid R-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-8	Maximum Output
1400 KC	Control Grid R-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Interstage C-6 See Note B	Maximum Output
1400 KC	External Antenna Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2 See Note B	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.
NOTE B—Turn the rotor back and forth and adjust the trimmer until the peak of greatest intensity is obtained.

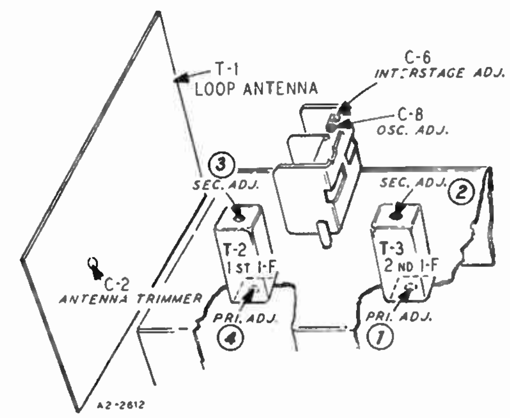
REPLACEMENT PARTS LIST
RADIO AND RECORD CHANGER

Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

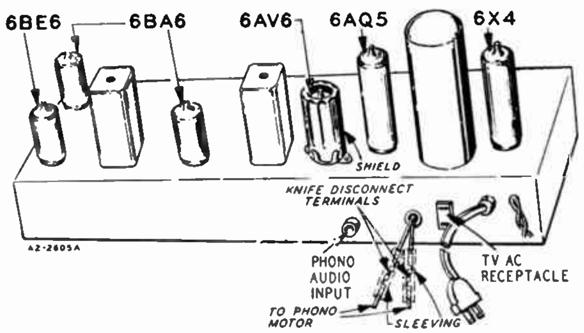
Ref. No.	Part No.	DESCRIPTION	Selling Price
		CAPACITORS	
C-1A, C-1B, C-1C	14A213	Gang Condenser Assembly	2.16
C-2	17A235	2-24 mmf Trimmer	.22
C-3, C-5, C-9, C-10, C-14	RCP10W2503M	.05 mf 200 V Tubular	.14
C-4, C-13	RCP10W2203M	.02 mf 200 V Tubular	.12
C-6, C-8		Part of Gang Condenser Assembly	
C-7	47X612	33 mmf Ceramic	.16
C-11A, C-11B		Part of 76X1 Assembly (See Miscellaneous)	
C-12	47X471	68 mmf Ceramic	.18
C-15	RCP10W4502M	.005 mf 400 V Tubular	.12
C-16A, C-16B		Part of 76X5 Assembly (See Miscellaneous)	
C-17	RCP10W6102M	.001 mf 600 V Tubular	.12
C-18A, C-18B, C-18C	45X381	20 mf 25 V, 40 mf 150 V, 40 mf 200 V Dry Electrolytic	1.34
C-19	RCP10W2104M	.1 mf 200 V Tubular	.16
C-20	RCP10W2103M	.01 mf 200 V Tubular	.12
C-21	47X508	500 mmf 500 V Ceramic	.16
		RESISTORS (Ohms / Watts)	
R-1	B84101	100 0.5 Carbon	.08
R-2	B85104	100 K 0.5 Carbon	.06
R-3	B84563	56 K 0.5 Carbon	.08
R-4	B85470	47 0.5 Carbon	.06
R-5	B85223	22 K 0.5 Carbon	.06
R-6	B84102	1 K 0.5 Carbon	.08
R-7	B84331	330 0.5 Carbon	.08
R-8	B85225	2.2 Meg. 0.5 Carbon	.06
R-9		Part of 76X1 Assembly (See Miscellaneous)	
R-10	B84274	270 K 0.5 Carbon	.08
R-11	B84153	15 K 0.5 Carbon	.08
R-12	C85182	1.8 K 1.0 Carbon	.08
R-13	36X372	.5 Meg. Volume Control	.74
R-14	B85106	10 Meg. 0.5 Carbon	.06
R-15A, R-15B		Part of 76X5 Assembly (See Miscellaneous)	
R-16	40X310	500 K Tone Control	.48
R-17	B85473	47 K 0.5 Carbon	.06
R-18	B84271	270 0.5 Carbon	.08
R-19	D84821	820 2.0 Carbon	.16
R-20	B84103	10 K 0.5 Carbon	.08

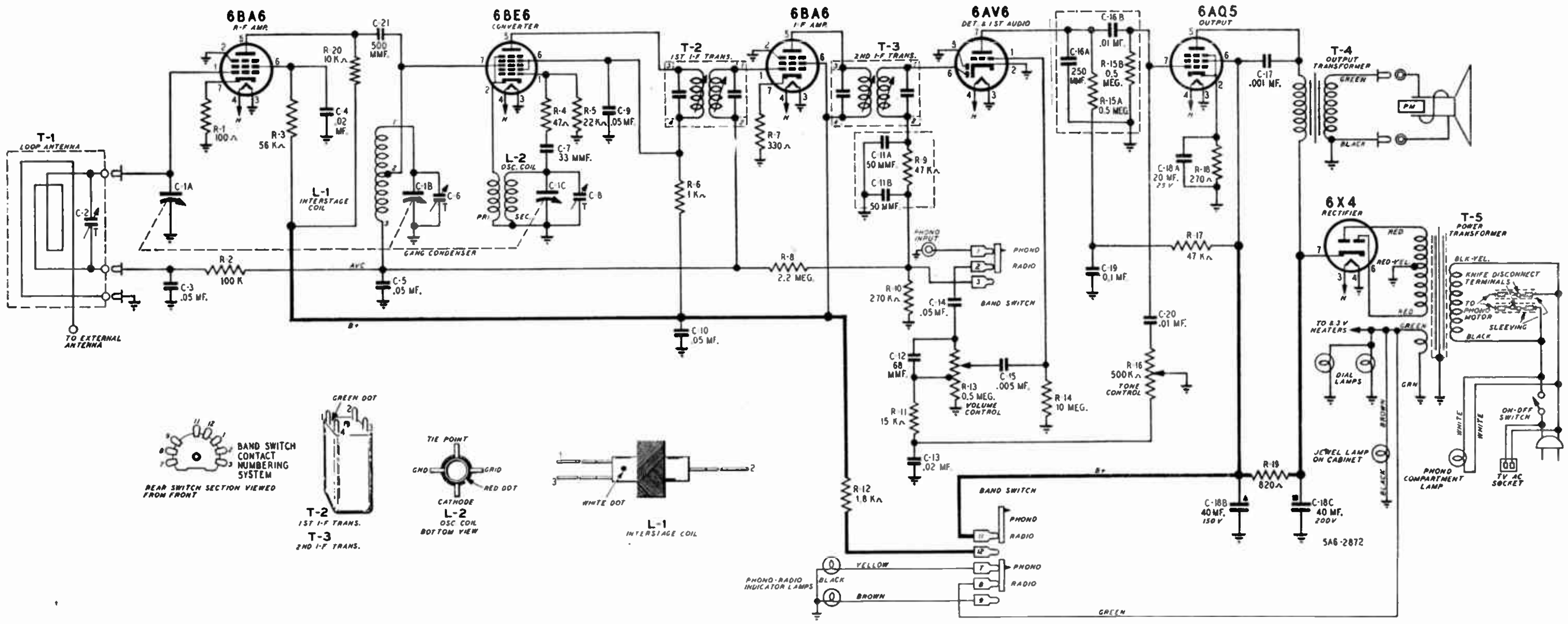
Ref. No.	Part No.	DESCRIPTION	Selling Price
		TRANSFORMERS AND COILS	
L-1	9A2289	R. F. Interstage Coil	.48
L-2	9A2113	Oscillator Coil	.30
T-1	9A2114	"B" Range Loop Antenna	1.30
T-2	9A2112	1st I. F. Transformer	.94
T-3	9A2063	2nd I. F. Transformer	.94
T-4	51X134	Output Transformer	1.56
T-5	53X291	Power Transformer	5.52
		MISCELLANEOUS	
	12A513	8" P.M. Speaker	5.88

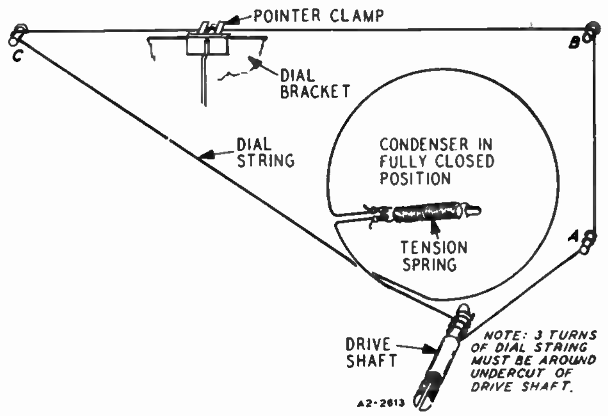


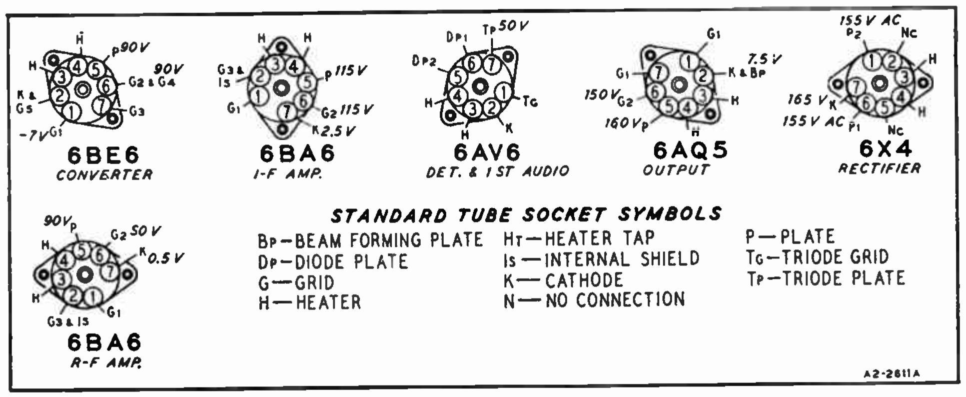
DRIVE CORD REPLACEMENT
DIAL POINTER CORD

Use a new S-10X77 drive cord assembly or a new length of cord 48 inches long for the installation. Install the cord as shown in the illustration, winding three turns counterclockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.





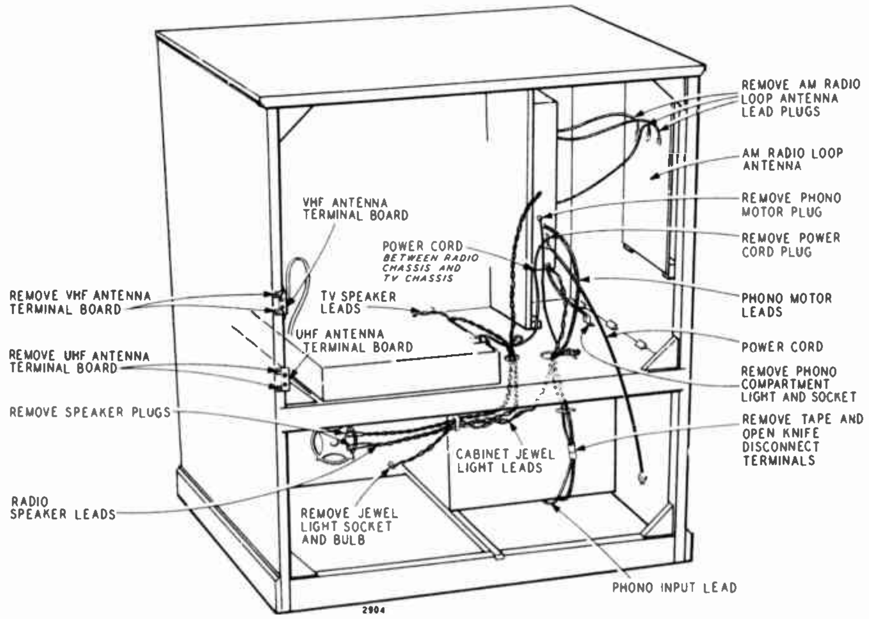




TUBE SOCKET VOLTAGES

Socket voltages are shown on the Bottom Socket diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter. Conditions of measurement are:

Line voltage ....117 Volts AC
Signal Input ....None
A Variation of ±10% is usually permissible.



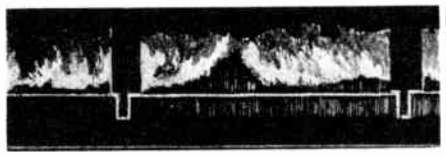
NOTE—UHF Antenna Terminal board used only on UHF-VHF combinations.

TUNING PROCEDURE

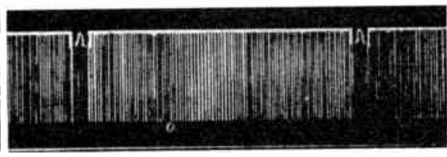
1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn only the OFF-ON VOLUME control counterclockwise until a click is heard.
6. TONE CONTROL — When this Control is turned clockwise, the high notes will predominate and when turned counterclockwise, a deep bass effect will result.

OSCILLOSCOPE WAVEFORM PATTERNS

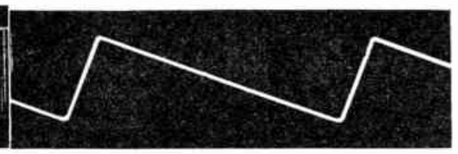
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.

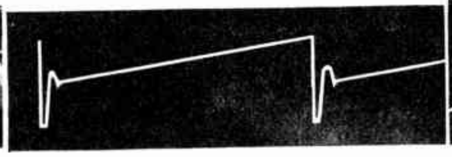


No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.

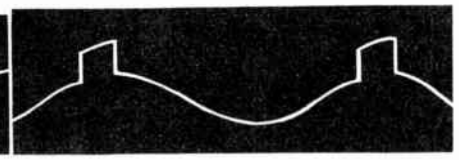


No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.

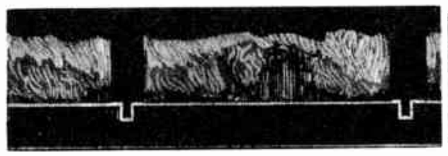
No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.



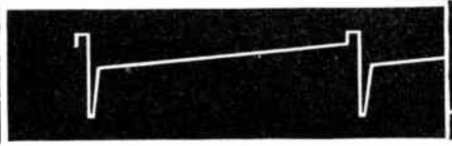
No. 8—6SN7-GTA—Vert. Osc. Plate
125V P-P 60 C.P.S.



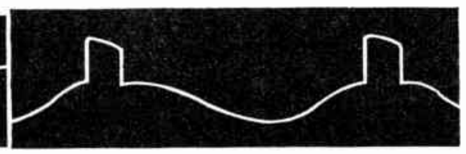
No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.



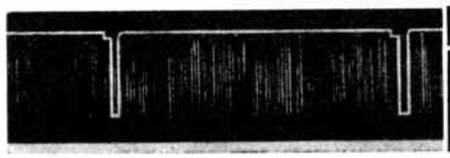
No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.



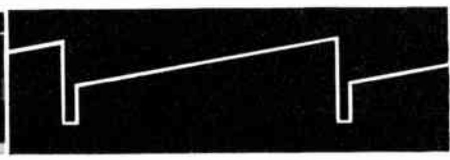
No. 9—6SN7-GTA Vert. Osc. Grid
170V P-P 60 C.P.S.



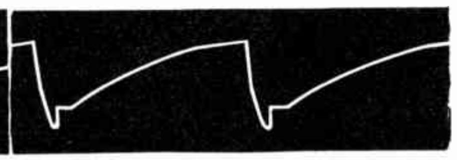
No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.



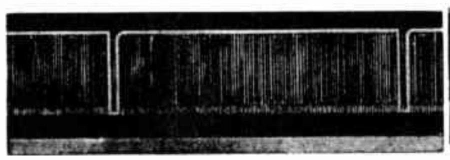
No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.



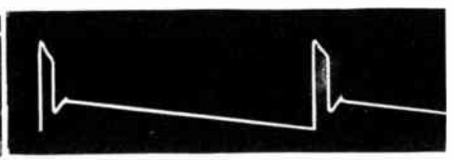
No. 10—6SN7-GTA Vert. Output Grid
150V P-P 60 C.P.S.



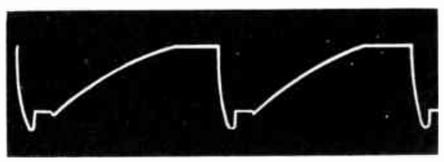
No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



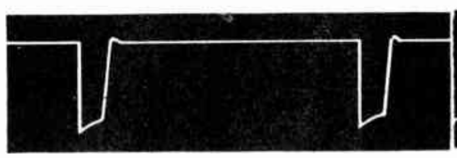
No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.



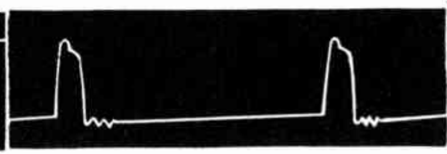
No. 11—Vert. Def. Coil
100V P-P 60 C.P.S.



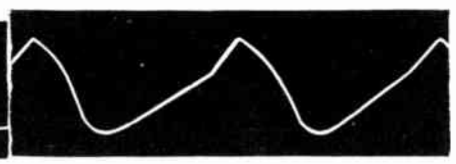
No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.



No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4—GT Damper Plate
120V P-P 15,750 C.P.S.

VHF TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R-207, R-209, R 210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2278-1	Antenna Coil	2-Q
	9A2278-2	Antenna Coil	3-Q
	9A2278-3	Antenna Coil	4-Q
	9A2278-4	Antenna Coil	5-Q
	9A2278-5	Antenna Coil	6-Q
	9A2278-6	Antenna Coil	7-Q
	9A2278-7	Antenna Coil	8-Q
	9A2278-8	Antenna Coil	9-Q
	9A2278-9	Antenna Coil	10-Q
	9A2278-10	Antenna Coil	11-Q
	9A2278-11	Antenna Coil	12-Q

COILS AND CHOKES (Continued)

Ref. No.	Part No.	Description	Channel & Code No.
	9A2278-12	Antenna Coil	13-Q
	9A2279-1	Oscillator Coil	2-Q
	9A2279-2	Oscillator Coil	3-Q
	9A2279-3	Oscillator Coil	4-Q
	9A2279-4	Oscillator Cil	5-Q
	9A2279-5	Oscillator Coil	6-Q
	9A2279-6	Oscillator Coil	7-Q
	9A2279-7	Oscillator Coil	8-Q
	9A2279-8	Oscillator Coil	9-Q
	9A2279-9	Oscillator Coil	10-Q
	9A2279-10	Oscillator Coil	11-Q
	9A2279-11	Oscillator Coil	12-Q
	9A2279-12	Oscillator Coil	13-Q
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding
M-109	16S-006	Shield, Tube (6J6)
M-110	16S-004	Shield, Tube (6BQ7)
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil)
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD)
M-114	10E-401	Nut, Locking Spring (for trimmers)
M-115	9A-410-7	Screw, Trimmer
M-116	9A-629-3	Screw, Bracket Mounting (6/32" by ¼")
M-117	31B-029	Osc. Slug Trimmer
M-121	31B-016	Roller, Detent (⅜" dia., 3/32" dia. bearing)
M-122	31B-005	Spring, Detent (2-5/16" long)
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½")
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.)
M-126	31B-103	Shield, Bottom Cover
	31B-066-26	Fine Tuning Shaft (Sharp Tuning) used with 25A1095

TELEVISION PARTS LIST

21" METAL RECTANGULAR PIX TUBE

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

NOTICE: There is a model number label on the chassis. This label identifies the receiver as to chassis and issue letter. When ordering parts or writing, give complete model number.

CAPACITORS

Ref. No.	Part No.	Description	Selling Price
C-1, C-3, C-4, C-5, C-18, C-32, C-35, C-42, C-43, C-44, C-45, C-50, C-55, C-58, C-74	80X1	1000 mmf Ceramic	.12
C-2A, C-2B, C-30A, C-30B	80X3	1000 mmf Dual Ceramic	.18
C-6	47X603	47 mmf 500 V Ceramic	.12
C-7	Part of T-3		
C-8	47X562	5 mmf 500 V Ceramic	.48
C-9	47X584	1.5 mmf Composition	.06
C-10	Part of L-13		
C-11, C-12	Part of T-6		
C-13, C-15, C-17	47X507	5000 mmf Ceramic	.18
C-14, C-66	47X604	100 mmf 500 V Ceramic	.12
C-16, C-41	Part of T-7		
C-19, C-72	45X378	5 mf 25W.V. Dry Electrolytic	.58
C-20	47X525	470 mmf 500 V. Molded Mica	.16
C-21, C-62	RCP10M2473M	.047 mf 200 V Tubular	.18
C-22, C-24, C-56, C-81	RCP10M4472M	.0047 mf 400 V Tubular	.16
C-23, C-52, C-57	RCP10M4103M	.01 mf 400 V Tubular	.16
C-25, C-36, C-51, C-73, C-79	RCP10M4473M	.047 mf 400 V Tubular	.18
C-26	Part of 76X5 (See Miscellaneous)		
C-27A, C-27B, C-27C	45X392	40 mf 50 V / 10 mf 400 V / 20 mf 400 V Dry Electrolytic	1.50
C-28	RCP10M6472M	.0047 mf 600 V Tubular	.16
C-29, C-31, C-61	RCP10M2224M	.22 mf 200 V Tubular	.28
C-33	45X361	4 mf 100 W.V. Dry Electrolytic	.60
C-34	47X568	360 mmf 500 V Molded Mica	.12
C-37	RCP10M2104M	.1 mf 200 V Tubular	.18
C-38, C-77, C-80, C-85	RCP10M4104M	.1 mf 400 V Tubular	.22
C-39	RCP10M6153M	.015 mf 600 V Tubular	.18
C-40, C-68	RCP10M6473M	.047 mf 600 V Tubular	.22
C-46, C-82	47X615	.01 mf Ceramic	.26
C-47A, C-47B	45X391	80 mf 400 V / 100 mf 50 V Dry Electrolytic	2.22

CAPACITORS—Continued

Ref. No.	Part No.	Description	Selling Price
C-48, C-71	45X393	30 mf 400 V Dry Electrolytic	1.06
C-49A, C-49B	45X390	80 mf 400 V / 60 mf 400 V Dry Electrolytic	2.68
C-53A, C-53B, C-53C	Part of 76X7 (See Miscellaneous)		
C-54, C-60	47X543	4700 mmf 500 V Molded Mica	.52
C-59	RCM20A271K	270 mmf 500 V Malded Mica	.16
C-63	RCM20B431K	430 mmf 500 V Molded Mica	.18
C-64	47X570	330 mmf 500 V Molded Mica	.14
C-65	RCM20A201K	200 mmf 500 V Molded Mica	.16
C-67, C-70	RCP10M6104M	.1 mf 600 V Tubular	.30
C-69	RCP10M6103M	.01 mf 600 V Tubular	.18
C-75	47X560	500 mmf 20 K.V. Ceramic	1.20
C-76	47X598	56 mmf 1500 V Ceramic	.20
C-78	RCP10M4154M	.15 mf 400 V Tubular	.24

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-1	B83822	8.2 K	0.5	Carbon	.10
R-2, R-5	B83470	47	0.5	Carbon	.10
R-3, R-6, R-12, R-16, R-30	B85102	1 K	0.5	Carbon	.06
R-4, R-7	B83223	22 K	0.5	Carbon	.10
R-8	B84181	180	0.5	Carbon	.08
R-9, R-42	B84152	1.5 K	0.5	Carbon	.08
R-10	Part of L-5				
R-11, R-44	B84101	100	0.5	Carbon	.08
R-13	B84563	56 K	0.5	Carbon	.08
R-14, R-41, R-80	B84333	33 K	0.5	Carbon	.08
R-15, R-24, R-36, R-74	B84104	100 K	0.5	Carbon	.08
R-17	B84271	270	0.5	Carbon	.08
R-18, R-19, R-86	B84223	22 K	0.5	Carbon	.08
R-20, R-21, R-65	B84683	68 K	0.5	Carbon	.08
R-22, R-71	78X12	1.5 K / 1.0 meg.		Contrast and Volume Control	1.62
R-23	B85106	10.0 meg	0.5	Carbon	.06
R-25	40X333	500 K		Brightness Control	.52
R-26A, R-26B	Part of 76X5 (See Miscellaneous)				
R-27, R-53	B85473	47 K	0.5	Carbon	.06
R-28	C84331	330	1.0	Carbon	.10
R-29	D84102	1 K	2.0	Carbon	.16
R-31, R-32	B85151	150	0.5	Carbon	.06
R-33	B84275	2.7 meg.	0.5	Carbon	.08
R-34, R-100	B84474	470 K	0.5	Carbon	.08
R-35	B83334	330 K	0.5	Carbon	.10
R-37	B83472	4.7 K	0.5	Carbon	.10
R-38, R-63, R-103	B84473	47 K	0.5	Carbon	.08

REPLACEMENT PARTS LIST—Continued

21" METAL RECTANGULAR PIX TUBE

RESISTORS—Continued

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-39	40X363	7.5 meg.		Sync Stability Control	.48
R-40	Part of L-9				
R-43, R-50	B84105	1.0 meg.	0.5	Carbon	.12
R-46	Part of L-10				
R-47	C83472	4.7 K	1.0	Carbon	.12
R-49	40X368	4 K		Vertical Linearity Control	.42
R-51	40X334	1.5 meg.		Vertical Hold Control	.52
R-52, R-84	B85104	100 K	0.5	Carbon	.06
R-54	40X364	2.5 meg.		Height Control	.42
R-55	B84222	2.2 K	0.5	Carbon	.08
R-56	B85274	270 K	0.5	Carbon	.06
R-57	43X273	330	10.0	Wirewound	.48
R-58	43X277	2 K	15.0	Wirewound	.60
R-59	43X272	10 K	5.0	Wirewound	.50
R-60	C84562	5.6 K	1.0	Carbon	.10
R-61	B84274	270 K	0.5	Carbon	.08
R-62	B84155	1.5 meg.	0.5	Carbon	.08
R-64, R-92	B84103	10 K	0.5	Carbon	.08
R-66	B84824	820 K	0.5	Carbon	.08
R-67, R-70, R-96	B83222	2.2 K	0.5	Carbon	.10
R-68A, R-68B, R-68C	Part of 76X7 (See Miscellaneous)				
R-69	B84332	3.3 K	0.5	Carbon	.08
R-72	40X334	1.5 meg.		Tone Control	.52
R-73	B85475	4.7 meg.	0.5	Carbon	.06
R-75, R-83	B85474	470 K	0.5	Carbon	.06
R-76	B84273	27 K	0.5	Carbon	.08
R-77, R-78	C84682	6.8 K	0.5	Carbon	.10
R-79	C83562	5.6 K	1.0	Carbon	.12
R-81	B83224	220 K	0.5	Carbon	.10
R-82, R-90	B84185	1.8 meg.	0.5	Carbon	.08
R-85	B84821	820	0.5	Carbon	.08
R-87, R-93	B84225	2.2 meg.	0.5	Carbon	.08
R-88	B84184	180 K	0.5	Carbon	.08
R-89	40X331	150 K		Horizontal Drive Control	.44
R-91	C84102	1 K	1.0	Carbon	.10
R-94	40X361	50 K		Horizontal Hold Control	.52
R-95	D84682	6.8 K	2.0	Carbon	.16
R-97	B83154	150 K	0.5	Carbon	.10
R-98, R-107	B84561	560	0.5	Carbon	.08
R-99	B84562	5.6 K	0.5	Carbon	.08
R-101	D84101	100	2.0	Carbon	.16
R-102	43X276	12 K	5.0	Wirewound	.62
R-104	43X239	5.1	0.5	Wirewound	.24
R-105	C85105	1.0 meg.	1.0	Carbon	.08
R-106	B85102	1 K	0.5	Carbon	.06
R-108	40X364	2.5 meg.		A.G.C. Control	.42
R-109	D85104	100 K	2.0	Carbon	.12

MISCELLANEOUS

Part No.	Description	Selling Price
76X5	Multiple Resistor Capacitor Assembly	.40
2A426	Centering Device	.70
76X7	Multiple Resistor Capacitor Assembly	.54
9A2274	Deflection Yoke Assembly	7.12
2A407	Ion Trap Magnet	.50
4A408	Antenna Terminal Strip	.24

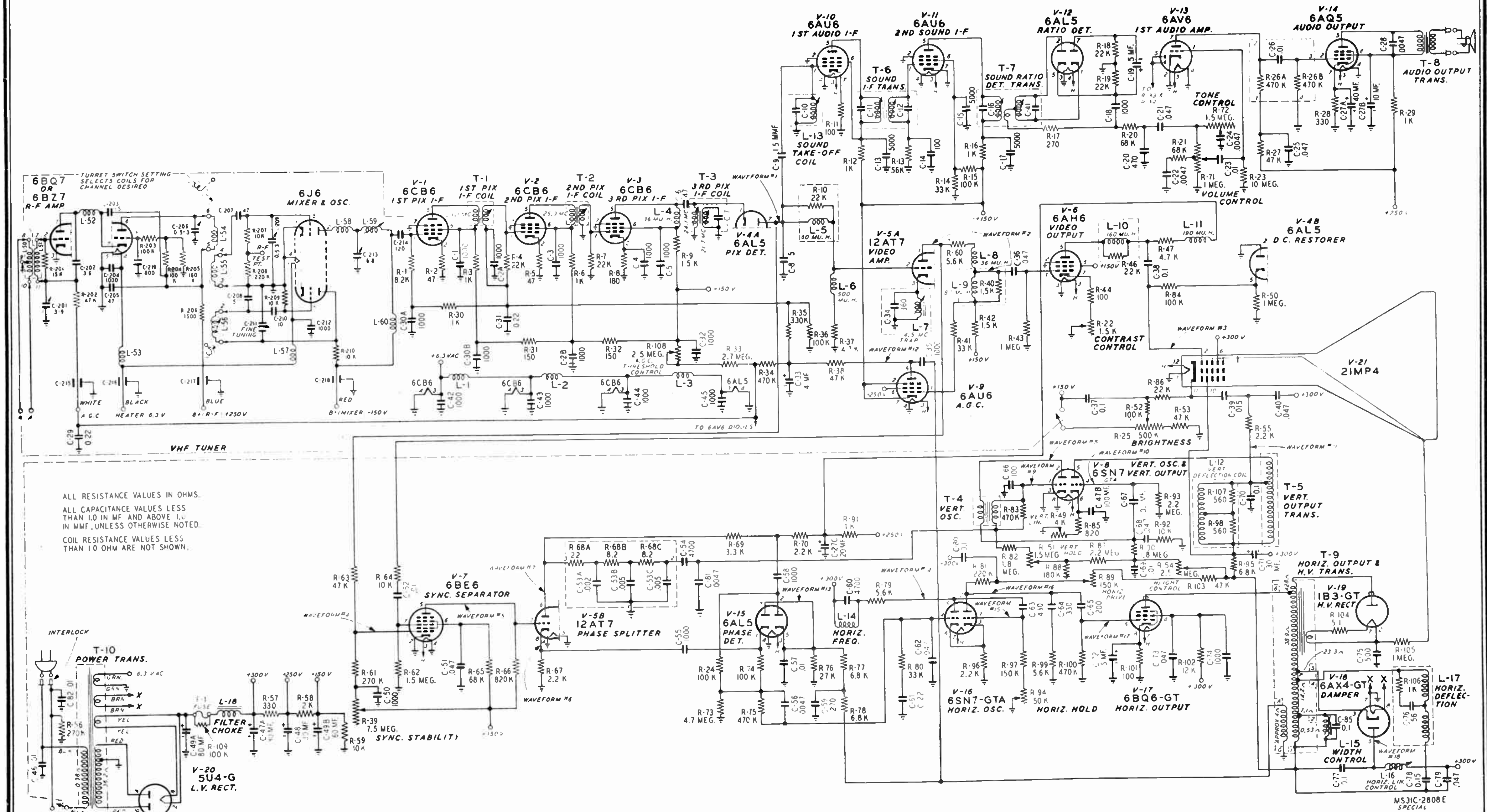
MISCELLANEOUS—Continued

Part No.	Description	Selling Price
3A427	Tube Socket Miniature	.16
3A458	Tube Socket 6CB6-6AU6-6AL5	.12
3A463	Tube Socket, 12AT7	.24
3A464	Tube Socket 6BQ6-6SN7	.10
3A445	Tube Socket, 6AX4	.16
3A466	Tube Socket, 1B3	.36
3A470	Tube Socket, Octal	.10
13X817	Pix Tube Socket	.58
32X403	Tube Shield (3A458 Socket)	.06
32X405	Tube Shield (3A463 Socket)	.12
S-6A1	Anode Connector & Lead Assembly	.30
25X1828	Bracket, Pix Tube Rear Mtg.	1.14
8X227	Collar Pix Tube Rear Mtg.	.34
S-34X19	Tube Cover and Power Cord Assembly	1.36
6X73	Rubber Grommet (6BQ6 Plate Lead)	.04
25X1815	Bracket, Tube Front Support (R.H.)	.64
25X1816	Bracket, Tube Front Support (L.H.)	.64
16X146	Fuse Holder	.16
16X147-3	Fuse 4/10 Amp. 125-250 V	.22
S-14X67	Cabinet Back Assembly	2.50
S-25X85	Tube Mtg. Strap Assembly	.52
7A240	Pilot Light Socket Assembly (Channel Selector)	.12
7A32	Pilot Light Bulb	.10
4X1157	Pix Tube Mtg. Ring	3.58
20X1772	Compression Ring (For Fine Tuning Knob) ..doz.	.22
2110-15	Caster, Rubber Wheel	.46
17X174	Pix Crystal — Models 3080-3090	6.48
4X1220-16	Pix Mask — Models 3080-3090	3.20
S-4X28-1	Escutcheon Control (Panel Assembly) — Model 3080A	2.10
10A820-1	Knob (Maroon) (Fine Tuning) — Model 3080A	.90
10A821-1	Knob (") (Contrast) — Model 3080A	.70
10A812-1	Knob (") (Channel Selector) — Model 3080A	.72
10A779	Knob (") (Volume) — Model 3080A	.88
S-4X28-2	Escutcheon Control (Panel Assembly) — Model 3090A	2.10
10A820-2	Knob (Beige) (Fine Tuning) — Model 3090A	.34
10A821-3	Knob (Beige) (Contrast) — Model 3090A	.48
10A812-3	Knob (Beige) (Channel Selector) — Model 3090A	.84
10A812-4	Knob (Beige) (Volume) — Model 3090A	.76

TRANSFORMERS AND COILS

Ref. No.	Part No.	Description	Selling Price
L-1, L-2, L-3	9A2033	R.F. Heater Choke	.12
L-4, L-8	9A1979	Peaking Coil (36 uh)	.30
L-5	36A10	Peaking Coil (60 uh)	.24
L-6	36A11	Peaking Coil (500 uh)	.28
L-7	9A2074	4.5 MC Trap	.36
L-9	36A16	Peaking Coil (80 uh)	.28
L-10	36A12	Peaking Coil (160 uh)	.24
L-11	36A2	Peaking Coil (190 uh)	.30
L-12, L-17	Part of Deflection Coils		
L-13	9A2168	Sound Take Off Coil	.66
L-14	9A2096	Horizontal Frequency Control	.66
L-15	9A2183	Width Control	.96
L-16	9A2262	Horizontal Linearity Control	.46
L-18	52X91	Filter Choke	2.22
T-1, T-2	9A2230	1st and 2nd P.I.F. Transformer	.44
T-3	9A2226	3rd P.I.F. Transformer	1.06
T-4	54X8	Vertical Osc. Transformer	1.42
T-5	51X156	Vertical Output Transformer	3.04
T-6	9A2170	Sound I.F. Transformer	.94
T-7	9A2269	Sound Ratio Det. Transformer	1.66
T-8	51X150	Audio Output Transformer	1.64
T-9	53X330	Horizontal Output Transformer	7.20
T-10	53X331	Power Transformer	15.46

21" TELEVISION RECEIVER



PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

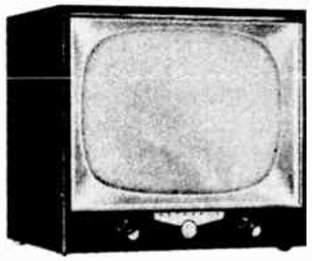
C-18 becomes 47X570 330 mmf molded mica condenser

R-15 becomes B84333 33K ohms 0.5 W carbon resistor

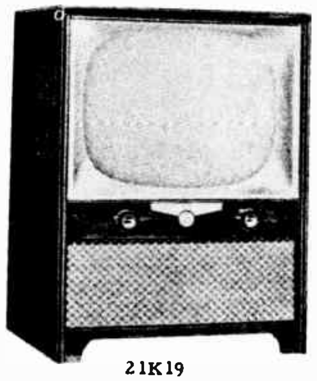
R-18, R-19 become B83103 10K ohm 0.5 W carbon resistors

In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphabetical identification (A, B, C etc.)

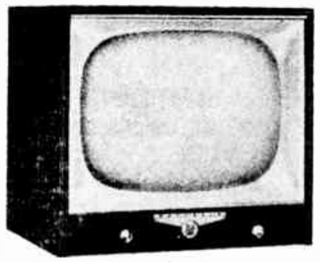
MODEL 21T15



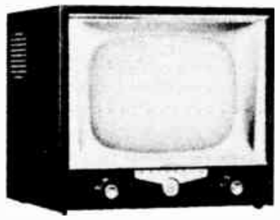
21T16



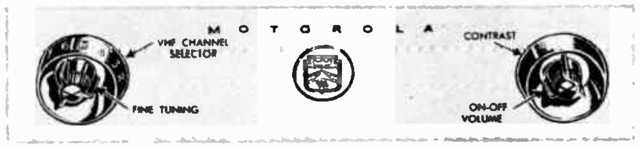
21K19



21T17



17T20



VHF Receiver Controls

VHF-UHF Receiver Controls

FIGURE 1. OPERATING CONTROLS

TUBE COMPLEMENT

Ref. No.	Tube	Function
V-1	6CB6	RF Amplifier
V-2	6U8	Mixer-Oscillator
V-3	6CB6	1st IF Amplifier
V-4	6CB6	2nd IF Amplifier
V-5	6CB6	3rd IF Amplifier
V-6	12BY7	Video Amplifier
V-8	6AU6	FM Driver-Limiter
V-9	6AL5	Ratio Detector
V-10A	1/2 6SN7GT	1st Audio Amplifier
V-10B	1/2 6SN7GT	Phase Detector
V-11	25L6GT	Audio Output
V-12	12SN7GT	1st & 2nd Clippers
V-13A	1/2 12BH7	Vertical Blocking Oscillator
V-13B	1/2 12BH7	Vertical Output
V-14	6SN7GT	Horizontal Oscillator
V-15	25BQ6GT	Horizontal Output & High Voltage Generator
V-16	12AX4GT	Damping Diode
V-17	1B3GT	High Voltage Rectifier
V-18	21YP4	Picture Tube: rectangular; glass; spherical face; electrostatic focus

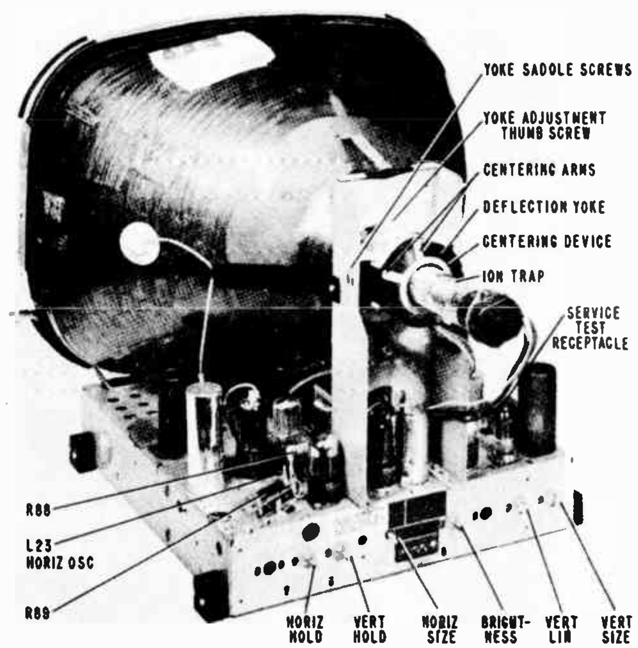


FIGURE 2. REAR VIEW OF CHASSIS

GENERAL INFORMATION

RECEIVER MODEL BREAKDOWN CHART

Model	Description	TV Chassis
21T15	Table, maroon	WTS-518
Y21T15	Table, maroon	WTS-518Y

TV CHASSIS - Chassis WTS-518 contains 16 circuit tubes plus a 21YP4 21" glass, rectangular, spherical face, electrostatically focused picture tube. The picture, sound, and scanning circuits, together with a selenium rectifier half-wave doubler "B" supply, are contained on a single chassis. A series heater circuit is used. The 300 ohm input impedance is matched to the 75 ohm TT-69 tuner impedance by use of a balun line. Field installation of UHF convertor in this chassis is not recommended.

TS-418 - Same as WTS-518 except uses a 17HP4B aluminized picture tube. The picture tube mounting parts are changed to accommodate smaller tube.

VTS-418 - Same as TS-418 except uses a 17HP4 non-aluminized picture tube.

VTS-518 - Same as WTS-518 except for 21YP4A aluminized picture tube.

The suffix "Y" indicates that the TV chassis has a built-in VTT-50MA UHF tuner and uses a WTT-24AY VHF tuner.

TV CHASSIS DIFFERENCES

Chassis	VHF Tuner	UHF Tuner
WTS-518	TT-69	-
WTS-518Y	WTT-24AY	VTT-50MA

Chassis	Picture Tube	VHF Tuner	UHF Tuner
TS-418	17HP4B	TT-69	-
TS-418Y	17HP4B	WTT-24AY	VTT-50MA
VTS-418	17HP4	TT-69	-
VTS-418Y	17HP4	WTT-24AY	VTT-50MA
VTS-518	21YP4A	TT-69	-
VTS-518Y	21YP4A	WTT-24AY	VTT-50MA

UHF TUNER - Refer to separate service manual for complete service information.

TUNING RANGE - VHF Tuner: channels 2 through 13; switch type
UHF Tuner: channels 14 through 83; continuous tuning type

TV IF FREQUENCY - Sound: 21.9 Mc & 4.5 Mc
Picture: 26.4 Mc

TV ANTENNA INPUT IMPEDANCE - 300 ohms

FUSE - B+ and initial surge; 7.5 ohm special resistor. This fuse is of the plug-in type and is accessible by removing the cabinet back. See Figure 2 for location.

POWER SUPPLY - 117 volts, 60 cycle AC only

POWER CONSUMPTION - VHF TV Chassis 155 watts
VHF-UHF TV Chassis 160 watts

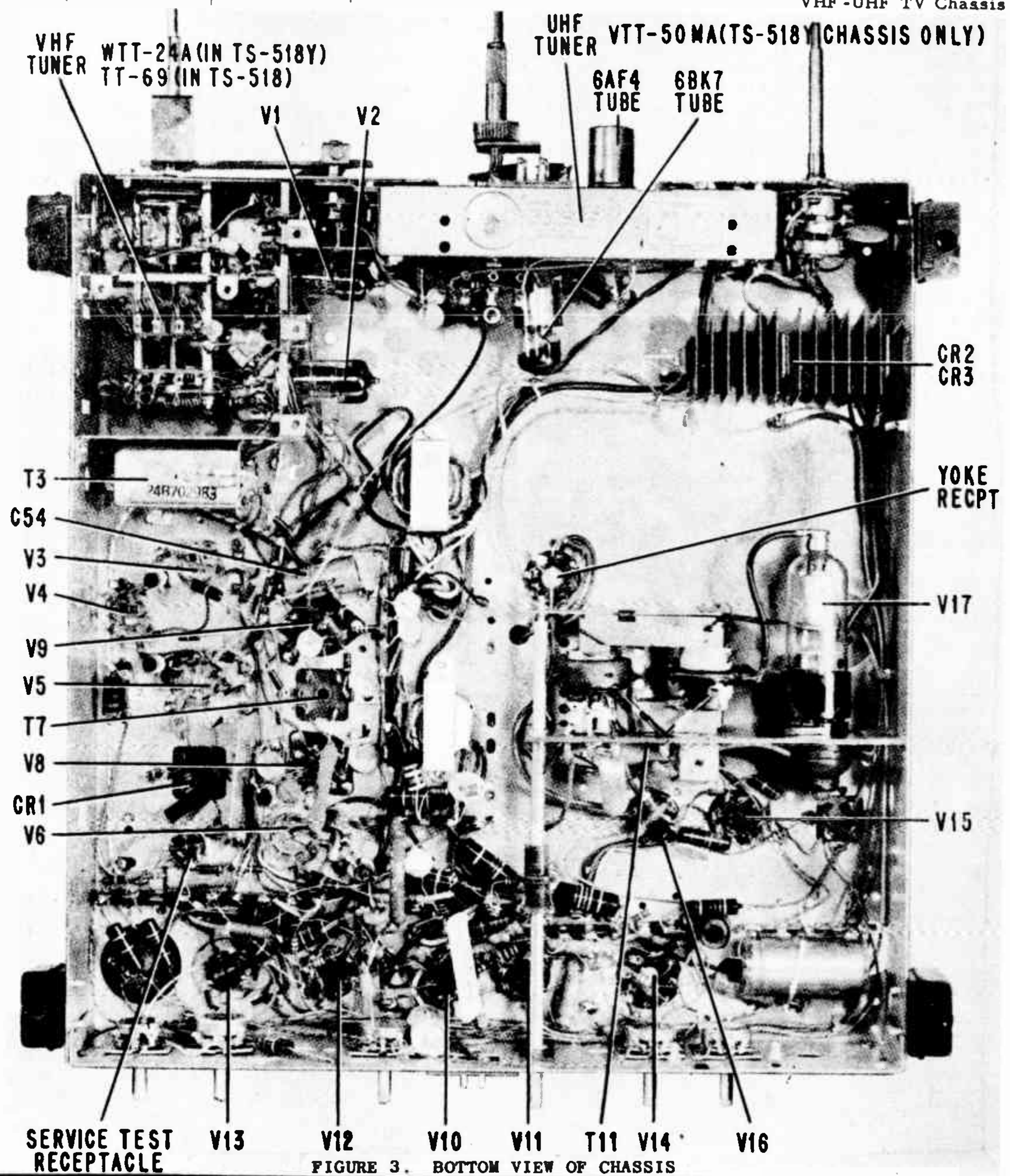


FIGURE 3. BOTTOM VIEW OF CHASSIS

DEFLECTION YOKE ADJUSTMENT

If the deflection yoke shifts, the picture will be tilted. To correct, loosen the thumbscrew on top of the deflection yoke, and rotate yoke until the picture is straight. Before tightening the thumbscrew, make certain that the deflection yoke is as far forward as possible.

If the yoke support and the picture tube have shifted in transit or, if for any reason, these parts have been removed and replaced, it is best to do a complete job of reposition-ing. See Figure 2. The picture tube should be mounted so that the front of the tube rests against the bracket on the front of the chassis. The clamp around the front of the tube should then be tightened. The picture tube rear sup-port bracket mounting screws should be loose enough to permit sliding the bracket forward until it fits snugly against the flare of the tube. Loosen the yoke adjustment thumb-screw and yoke saddle screws and push the yoke against the flare of the tube.

SERVICE NOTES

SERVICE TEST RECEPTACLE

A SERVICE TEST RECEPTACLE, accessible from the top of the chassis (see Figure 2), provides the following test points:

Pin	Connection To
1	IF AGC
2	B+
3	Video detector output
4	No connection
5	B++

CHANGING OF TUBES

1. The power should be turned off when changing tubes.
2. Indiscriminate changing or interchanging of tubes should be avoided for the following reasons:

a. A change of IF or RF tubes can cause loss of sensi-tivity or poor picture quality. Check alignment and sensi-tivity.

b. A change of limiter or ratio detector tubes can cause distorted audio, buzz, or loss of audio sensitivity. Check audio alignment and sensitivity.

c. Changing horizontal oscillator tube can result in poor noise rejection or cause the horizontal hold control to be out of range. This may necessitate readjustment of the horizontal oscillator coil.

REMOVAL OF CABINET SAFETY GLASS

1. Remove the screws and molding strip located along top edge of glass.

2. Safety glass will move outward from cabinet allowing its removal by lifting out of lower retaining channel.

3. When replacing, position rubber on glass with low side of channel facing inside of cabinet.

4. Replace molding and screws.

ALIGNMENT

GENERAL INFORMATION

Equipment Required:

A. Sweep generator: 18 to 220 Mc, 12 Mc sweep width, linear, and capable of .1 volt output. Accurately calibrated, adjustable marker genera-tor and/or AM signal generator.
B. Cathode ray oscilloscope: preferably with calibrated attenuator.
C. Variac: if line voltage is not 117 volts

NOTES: IMPORTANT

NEVER GROUND THE RECEIVER CHASSIS DUR-ING TESTING OPERATIONS OR INSTALLATION UNLESS AN ISOLATION TRANSFORMER IS USED.

At all times, keep the marker generator output low enough to prevent the marker from distorting the response curve.

Some coils resonate at two settings of the core, the correct setting is at the outer end of the winding.

For complete receiver alignment, use the following procedure in sequence. Line voltage must be 117 volts AC; if not, adjust with variac.

IF AND MIXER ALIGNMENT

1. Remove horizontal output tube (V-15) to eliminate RF interference. Complete filament circuit with a 25BQ6 tube or other type with similar filament characteristics and base connections, with all pins clipped off except heaters.
2. Remove antenna and make following connections: (See Figure 4).

a. Connect a 3 volt battery to pin 1 (AGC bus) of serv-ice test receptacle.

b. Disable tuner oscillator by grounding pin 9 of V-2 (6U8).

c. Connect sweep generator to IF test receptacle, and oscilloscope to video detector load.

3. Center sweep generator frequency at 24.6 Mc with a sweep width of 10 Mc and adjust generator output below point of receiver limiting (approximately 3 volts peak-to-peak at video detector load).

4.

Adjust	At Marker Freq	
L-12	21.9 Mc	min output (See IF response curve -Figure 4)
T-4	26.6 Mc	26.6 Mc marker (See IF re-sponse curve - Figure 4)
T-6	at top of curve	flat response (See IF re-sponse curve -Figure 4)
T-5	22.9 Mc	22.9 Mc marker (See IF re-sponse curve -Figure 4)
T-6	at top of curve	flat response (See IF re-sponse -Figure 4)

As some adjustments interact, repeat as necessary to ob-tain proper curve. (Move generator to mixer test recep-tacle and short across R-11 (4700 ohms).

T-3A & B	26.4 & 22.9 Mc	See mixer response curve -Figure 4. As adjustments interact, adjust simul-taneously.

NOTE: If desired response cannot be obtained, recheck tuning of 21.9 Mc trap (L-12). Accuracy of this adjustment is important.

Bandwidth may be determined by noting the frequencies at which the markers fall at the 50% points. Mixer and IF bandwidth over 3.5 Mc may cause loss of picture quality, and less than 3.2 Mc, a loss of audio.

5. Remove AGC bias battery, BANDWIDTH SHOULD NOT CHANGE OVER .2 Mc.

6. Decrease generator signal until there is a marked de-crease in the oscilloscope waveform. Unwanted regenera-tion will be indicated by sharp peaks on the overall response curve.

AUDIO ALIGNMENT

This alignment may be made by injecting an accurate 4.5 Mc signal at the video amplifier grid; however, the station alignment method is much more accurate and should be used whenever possible. Station alignment method fol-lows:

1. With receiver in good operating condition, tune in sta-tion.

2. Connect VTVM from positive terminal of C-54, elec-trolytic capacitor to ground.

3. Maintain 5 volts, or less, at VTVM by adjustment of fine tuning and contrast control (or by removal of antenna, if necessary) while peaking L-20 and T-7 primary (top) for maximum output.

4. Move VTVM connection to junction of C-2 (1000 mmf) and R-45 (33K). Set fine tuning for normal picture.

5. Adjust T-7 secondary (bottom) for zero reading on VTVM.

6. Recheck as in steps 2 and 3 and, if necessary, readjust primary of T-7.

4.5 MC TRAP ADJUSTMENT

Tune receiver to a local station and adjust 4.5 Mc trap (L-17) for minimum beat interference in picture by locating the two points of adjustment at which the beat is first no-ticeable, and rotating core to the center of these two points. Use the minimum amount of inductance (core out of coil) that will result in no apparent beat interference.

If a station signal is not present, use the following meth-od, which requires proper alignment of the audio system.

1. Tune the receiver to a low noise, unused channel.

2. Connect AM signal generator to picture tube cathode lead (yellow) thru a 5000 mmf capacitor. Connect ground lead to chassis.

3. Set generator to 4.5 Mc.

4. Move VTVM to positive terminal of C-54 capacitor, with ground lead to chassis.

5. Adjust 4.5 Mc trap (L-17) for minimum VTVM reading. (Generator output should be adjusted for 5 volts at VTVM.)

TUNER ALIGNMENT

GENERAL INFORMATION

It is very unlikely that the Motorola Tuner will need alignment unless it has been damaged, is being replaced, or has had components replaced in the tuned circuits. (Tubes may be changed in most cases without re-alignment, but care must be used in selection or re-alignment may be re-quired.) The tuner operates by shorting out an antenna, RF and oscillator coil section consecutively for each higher channel. When switched to the lowest channel, all coils of any one section will be series connected. Therefore, align-ment must start at the highest channel and each adjustment properly completed before the next lower channel adjust-ment is attempted. Low-band channels (6-2) may be indi-vidually adjusted by stretching or compressing coil turns, while high band channel inductances (7-13) are formed by a stamped metal plate and adjustable as a unit by L-6 and C-11 (RF) and L-8 (oscillator).

CAUTION: A small change in coil length (low channels) makes a rather large change in frequency.

In alignment, the antenna coils must be tuned to video side of bandpass, and the RF coils to the sound side of bandpass.

NOTE: Antenna, RF and oscillator coils for any one channel are in the same relative position (in line) from front to rear of the tuner.

ANTENNA AND RF ALIGNMENT

1. Remove battery used in IF alignment and ground pin 1 (AGC bus) of service test receptacle. Connect sweep gen-erator to antenna input terminal strip and adjust for 10 Mc minimum sweep width. Connect oscilloscope through a 47K resistor to mixer test receptacle.

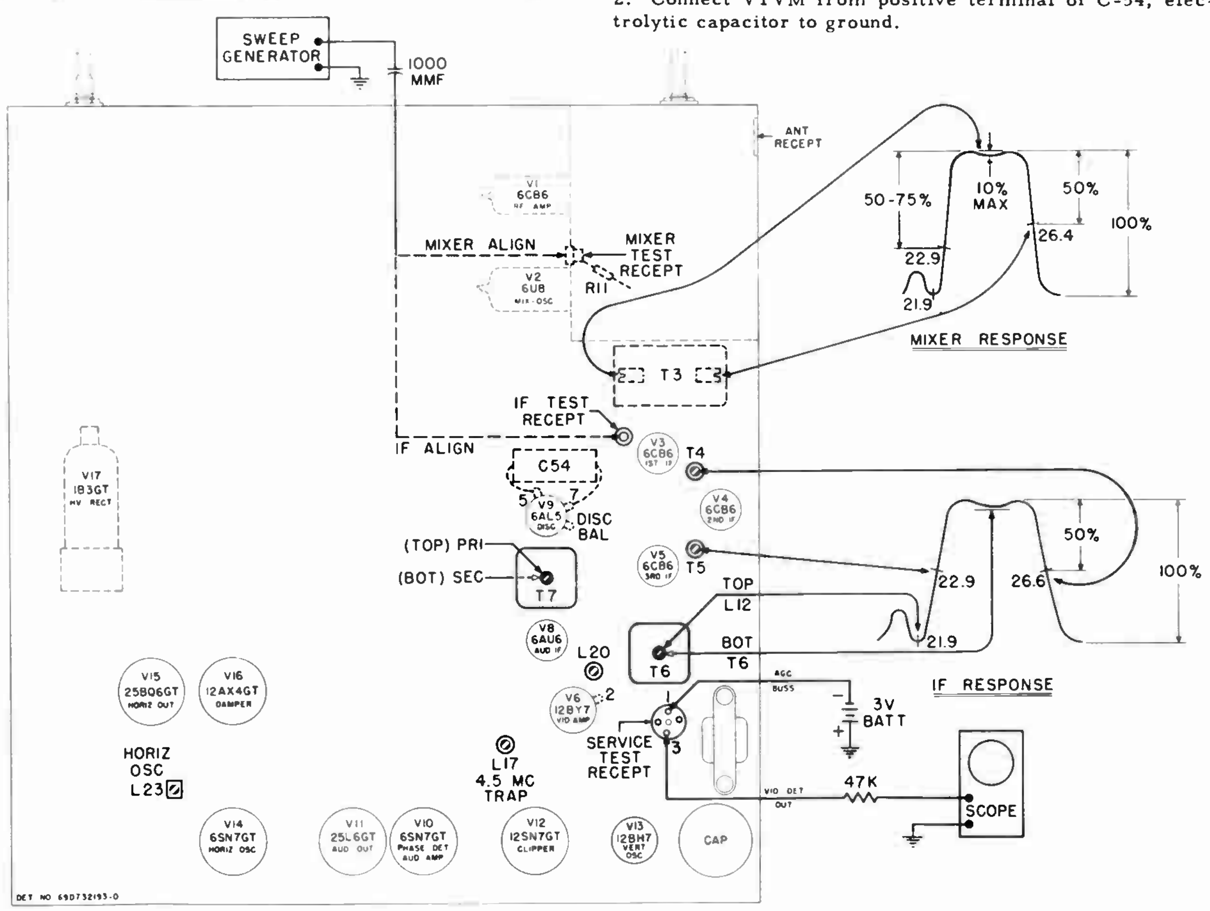


FIGURE 4. TUBE LOCATIONS & IF ALIGNMENT DETAIL

2. Set tuner to channel 7 and sweep generator to 177 Mc (center frequency). Set video marker to 175.25 Mc and sound marker to 179.75 Mc. Adjust C-11 for high channel response curve shown in Figure 5.

3. Set tuner to channel 13, and sweep generator to 213 Mc. Set video marker to 211.25 Mc and sound marker to 215.75 Mc. Adjust L-6 for high channel response curve shown in Figure 5.

4. Repeat step 2.

5. Switch tuner and generator through channels 13 to 7 and check each for correct response curve. (See chart for markers and sweep frequencies.) Coil L-1F will adjust response curve width (approximate position is 1/8" from metal shield). The amount of coil end wire extending through shield varies bandwidth, and position of markers. If this coil is moved, all previous steps must be repeated.

6. Align low channel antenna and RF coils (channels 6 thru 2) for proper markers as shown on low channel response curve (Figure 5). See alignment chart for marker and sweep frequencies.

OSCILLATOR ALIGNMENT

Preliminary Instructions:

Oscillator adjustments are made, using sound frequencies as reference, to place sound marker slightly higher than the 21.9 Mc trap dip. Sound markers must move into trap dip (within fine tuner rotation tolerances) when tuner cover is replaced.

Tuner and sweep generator must be set to channel being aligned.

The marker generator is set to the sound frequency of channel being aligned. Use at least a 10 Mc sweep width, or more if possible.

Waveform obtained should be similar to mixer waveform.

Consistent tilting of the curve when sound marker is in the trap indicates misalignment of the IF or mixer.

Procedure:

1. Remove ground added during previous procedures to pin 9 of V-2 (6U8 oscillator).

2. Connect the oscilloscope (through a 47K ohm resistor) across the video load resistor R-27 (5600) at the service test receptacle. See IF alignment, Figure 4.

3. Set fine tuner for mid-capacity position (capacity increasing in the counterclockwise direction.)

High Band Alignment

4. Adjust oscillator trimmer (C-15) on channel 10, using channel 10 sound marker and placing it just above trap null. See Figure 4 and preliminary instructions

5. Check channels 7 through 13 for correct marker positions (use fine tuner if necessary). A fine tuner rotation of over plus or minus 30 degrees from mid-point, to move marker into trap dip, requires:

a. Adjustment of coil L-8, on channel 13, for compensation of channels 10 through 13.

b. Readjustment of trimmer C-15, on channel 10, for compensation of channels 7 through 10. Repeat step 5.

Low Band Alignment

6. Reduce the capacity of fine tuner by rotating 15 degrees clockwise from mid-capacity position.

7. Adjust channel 6 oscillator coil, using channel 6 sound marker. Refer to Figure 4 and preliminary instructions. Accuracy of alignment on this channel is extremely important to alignment of following coils.

8. Adjust channel 5 through 2 oscillator coils in descending order, using proper markers.

NOTE: WHEN TUNER COVER IS REPLACED, ALL SOUND MARKERS MUST MOVE INTO TRAP DIP WITHIN FINE TUNER ROTATION LIMITS. LIMITS ARE FROM MID-POSITION TO 30 DEGREES CLOCKWISE, ON LOW CHANNELS, AND PLUS OR MINUS 30 DEGREES FROM MID-POINT ON HIGH CHANNELS.

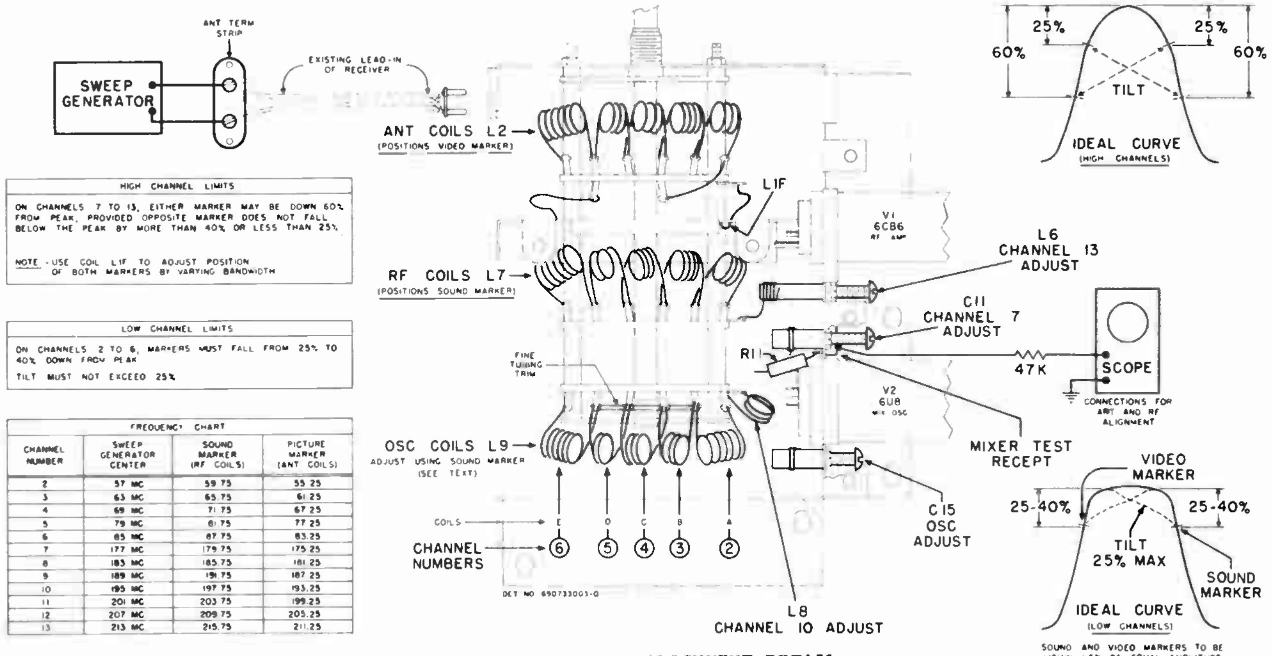
TESTS OF RECEIVER SENSITIVITY

1. Make sure AGC system is operating.

2. Short out resistor R-11 (4700 ohms) in tuner.

3. Calibrate oscilloscope by connecting the input to a 6.3 volt AC source. (This will equal approximately 18 volts peak-to-peak.) Connect scope to picture tube cathode (yellow lead).

4. Set contrast control at maximum.



HIGH CHANNEL LIMITS
ON CHANNELS 7 TO 13, EITHER MARKER MAY BE DOWN 60% FROM PEAK, PROVIDED OPPOSITE MARKER DOES NOT FALL BELOW THE PEAK BY MORE THAN 40% OR LESS THAN 25%.
NOTE - USE COIL L1F TO ADJUST POSITION OF BOTH MARKERS BY VARYING BANDWIDTH

LOW CHANNEL LIMITS
ON CHANNELS 2 TO 6, MARKERS MUST FALL FROM 25% TO 40% DOWN FROM PEAK
TILT MUST NOT EXCEED 25%

FREQUENCY CHART

CHANNEL NUMBER	SWEEP GENERATOR CENTER	SOUND MARKER (RF COILS)	PICTURE MARKER (ANT COILS)
2	57 MC	59 75	55 25
3	63 MC	65.75	61 25
4	69 MC	71 75	67 25
5	79 MC	81.75	77 25
6	85 MC	87 75	83.25
7	177 MC	179 75	175 25
8	183 MC	185.75	181 25
9	189 MC	191.75	187 25
10	195 MC	197 75	193.25
11	201 MC	203 75	199.25
12	207 MC	209 75	205.25
13	213 MC	215.75	211.25

FIGURE 5. TUNER ALIGNMENT DETAIL

IF Sensitivity Tests

5. Stop osoillator as in IF alignment.

6. Inject 23 Mc AM signal, with 30% modulation, into IF test receptacle through a 1000 mmf capacitor. Less than 500 microvolts should be required to produce 18 volts peak-to-peak at the picture tube cathode.

7. Inject the generator into mixer test receptacle. Less than 100 microvolts should be required to produce 18 volts peak-to-peak at the picture tube cathode.

Overall Sensitivity Test

8. Remove short on R-11 and oscillator and inject generator into antenna input (use resistor matching network, if necessary). Tune generator to center frequency of channel being checked, and rotate receiver fine tuner for strongest signal. 18 volts peak-to-peak should be produced at the picture tube cathode with generator outputs of less than 15 microvolts on channels 2 through 6 and less than 30 microvolts on channels 7 through 13.

Audio Sensitivity Test

9. Connect signal generator (no modulation) to video amplifier grid (pin 2) through a 5000 mmf capacitor and set to 4.5 Mc. Set contrast control to maximum.

10. Connect VTVM (DC scale) to the positive terminal of electrolytic capacitor C-54, and connect ground lead to chassis.

11. A 10,000 microvolt signal should produce approximately 10 volts.

TV CHASSIS CODING

The following chassis coding system was devised to enable the serviceman to keep abreast of circuit revisions.

The first production chassis number carries the suffix "A-00" (i.e., WTS-518A-00). With the first minor electrical revision, the suffix becomes "A-01" and with each subsequent minor change "A-02", "A-03", etc. The first major revision changes the suffix to "B-00" and, as before, each following minor change is labeled "B-01", etc.

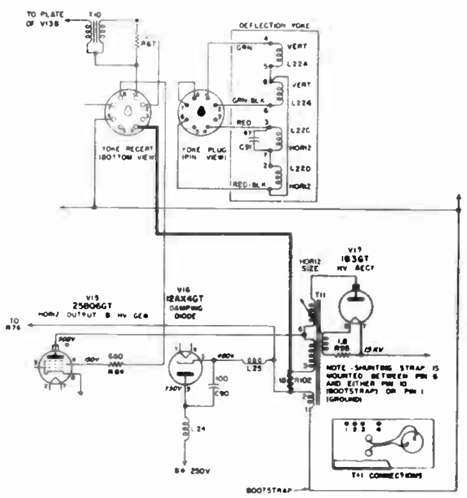
Mechanical differences between chassis are indicated by the addition of a prefix to the basic chassis (i.e., VTS-518A-00, etc.). These prefixes may be assigned in random sequence but will be confined to the end of the alphabet to avoid confusion with the A, B, C, etc., electrical change suffixes.

A "Y" suffix added to basic chassis (i.e. WTS-518YA-00, etc.,) indicates that the chassis contains a factory-installed UHF tuner.

PRODUCTION CHANGES

Chassis Coding	Changes
A-01	To improve brightness and to prevent filament breakdown on the picture tube, a new shunting strap is connected between pin 6 (focus grid) and either pin 1 (heater-a potential ground point) or pin 10 (screen grid). 5,000 mmf 2000V capacitor added between pin 1 of the picture tube and ground.
A-02	To increase sensitivity and to assure a more secure control knob fitting, VHF tuners change to WTT-24C & WTT-24CY (longer shafts). R-31 (volume-contrast) changes to Part No. 18B733977 (longer shaft). C-1 (220 mmf) changes to 470 mmf. R-7 (22,000) removed. New low frequency antenna coil (L-1) is used. Part numbers on low frequency antenna coil and VHF tuners do not change.
B-00	Area selector switch added. (See B-00 schematic.)
B-01	To increase the range of the horiz hold control, a 47,000 ohm resistor was added in parallel with the horiz osc coil L-23.

To eliminate picture tube neck shadows on some chassis, the fixed electrical horizontal centering circuit shown below was used; final centering is still performed with the magnetic centering device.



ELECTRICAL CENTERING CIRCUIT USED IN CHASSIS HAVING PICTURE TUBE NECK SHADOW PROBLEM

PARTS LIST

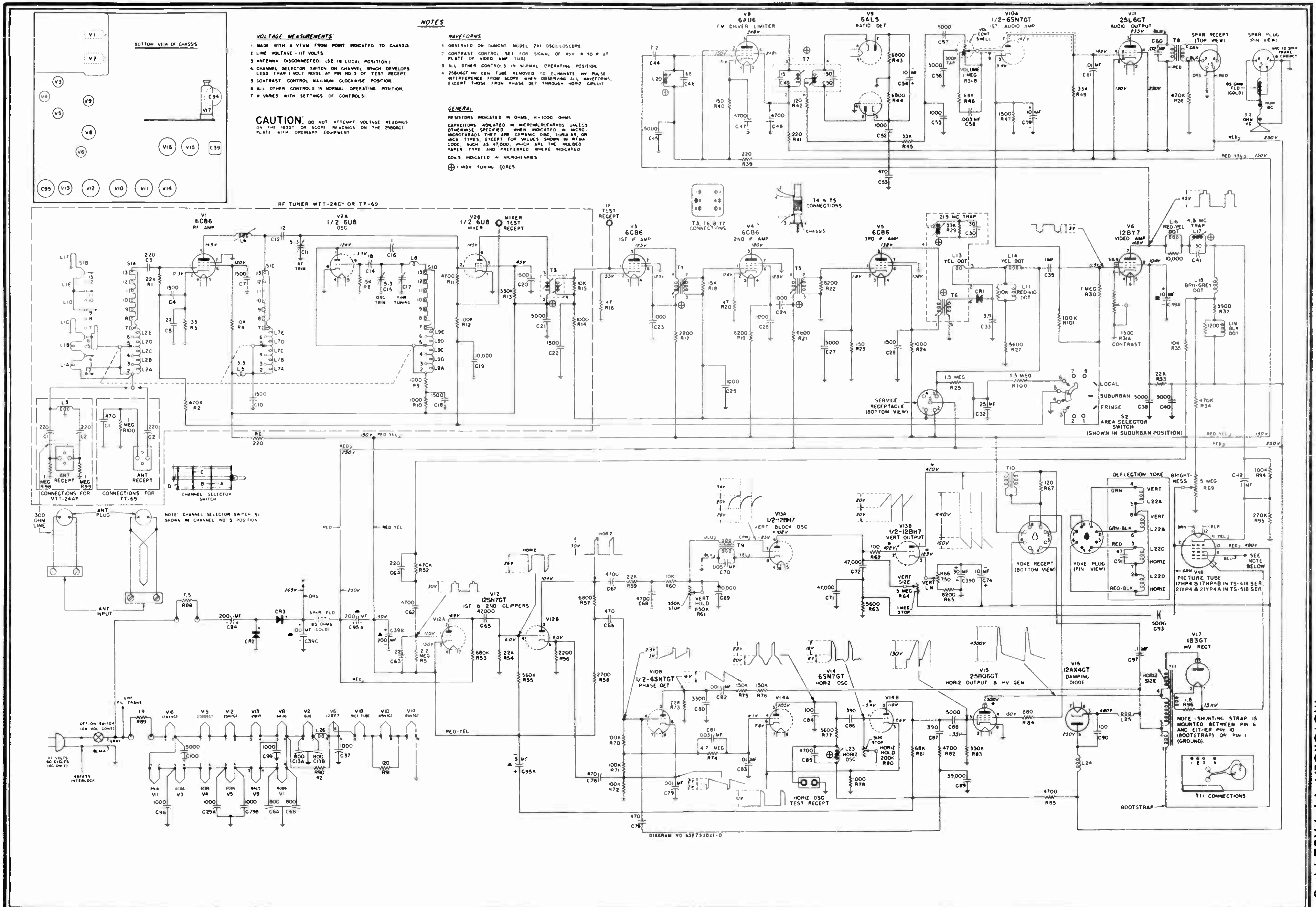
Ref. No.	Part Number	Description	List Price
ELECTRICAL PARTS			
Capacitors (Cer=Ceramic; Tub=Tubular; Mld=Molded)			
C-1	21R115905	Cer Tub: 220 mmf 1000V.....	.25
or	21R121478	Cer Disc: 470 mmf 2000V....	.20
C-2	21R115905	Cer Tub: 220 mmf 1000V.....	.25
C-3	21R115854	Cer Tub: 220 mmf 500V......	.20
C-4	21R120100	Cer Disc: 1500 mmf 500V....	.20
C-5	21R400492	Cer Tub: 22 mmf 500V.......	.25
C-6	21R400943	Cer Disc: dual 800 mmf 500V	.40
C-7	21R120100	Cer Disc: 1500 mmf 500V....	.20
C-10	21R120100	Cer Disc: 1500 mmf 500V....	.20
C-11	21K710943	Trimmer: cer; .5-3 mmf; with screw and mtg nut.....	.20
C-12	21R114073	Cer Tub: 12 mmf 500V.......	.25
C-13	21R400943	Cer Disc: dual 800 mmf 500V	.40
C-14	21R115640	Cer Tub: 18 mmf 500V.......	.25
C-15	21K710943	Trimmer: cer; .5-3 mmf; with screw and mtg nut.....	.20
C-16	21R114071	Cer Tub: 1 mmf 500V........	.30
C-17		Trimmer: fine tuning; part of channel selector switch.	
C-18	21R120100	Cer Disc: 1500 mmf 500V....	.20
C-19	21R482726	Cer Disc: 10,000 mmf 500V..	.30
C-20	21R120100	Cer Disc: 1500 mmf 500V....	.20
C-21	21R115312	Cer Disc: 5000 mmf 500V....	.25
C-22	21R120100	Cer Disc: 1500 mmf 500V....	.20
C-23	21R115386	Cer Disc: 1000 mmf 500V....	.25
C-24	21R115386	Cer Disc: 1000 mmf 500V....	.25
C-25	21R115386	Cer Disc: 1000 mmf 500V....	.25
C-26	21R115386	Cer Disc: 1000 mmf 500V....	.25
C-27	21R115312	Cer Disc: 5000 mmf 500V....	.25
C-28	21R120100	Cer Disc: 1500 mmf 500V....	.25
C-29	21R400937	Cer Disc: dual 1000 mmf 500V	.40
C-30	21R470329	Cer Tub: 30 mmf 500V.......	.30
C-32	8R9810	Paper Tub: .25 mf 400V.....	.35
C-33	21R115953	Mld Phenolic: 3.9 mmf 500V.	.10
C-35	8R9814	Paper Tub: .1 mf 100V......	.25
C-37	21R115386	Cer Disc: 1000 mmf 500V....	.25

Ref. No.	Part Number	Description	List Price
C-38	21R115312	Cer Disc: 5000 mmf 500V	.25
C-39	23B712068	Electrolytic: 4-section; A, 10 mf-300V; B, 200 mf-150V; C, 100 mf-300V; D, 30 mf-50V	5.00
C-40	21R115312	Cer Disc: 5000 mmf 500V	.25
C-41	21R470329	Tub Cer: 30 mmf 500V	.30
C-42	8R121006	Paper: .1 mf 400V	.35
C-44	21R115949	Mld Phenolic: 2.2 mmf 500V	.10
C-45	21R115312	Cer Disc: 5000 mmf 500V	.25
C-46	21R400928	Cer Tub: 68 mmf 500V	.25
C-47	21R121489	Cer Disc: 4700 mmf 500V	.30
C-48	21R121489	Cer Disc: 4700 mmf 500V	.30
C-49	21K790439	Mica: 15 mmf 500V	.20
C-50	21R121740	Cer Tub: 150 mmf 500V (in T-7 shield)	.20
C-52	8R121678	Cer Disc: 1000 mmf 500V	.25
C-53	21R115856	Cer Tub: 470 mmf 500V	.20
C-54	23A90205	Electrolytic: 10 mf-50V	.90
C-55	8R121678	Cer Tub: 1000 mmf 500V	.25
C-56	21R115312	Cer Disc: 5000 mmf 500V	.25
C-57	21R115312	Cer Disc: 5000 mmf 500V	.25
C-58	8R121569	Paper: .003 mf 600V	.20
C-59	23A90205	Electrolytic: 10 mf-50V	.90
C-60	8R9871	Paper: .02 mf 600V	.25
C-61	8R121002	Paper Tub: .01 mf 400V	.20
C-62	8K490222	Mld Paper: 4700 mmf 400V	.25
C-63	21R400942	Cer Tub: 22 mmf 500V	.25
C-64	21R115905	Cer Tub: 220 mmf 1000V	.25
C-65	8K490232	Mld Paper: 47,000 mmf 400V	.30
C-66	21R115856	Cer Tub: 470 mmf 500V	.20
C-67	8K490222	Mld Paper: 4700 mmf 400V	.25
C-68	8R490222	Mld Paper: 4700 mmf 400V	.25
C-69	8K490226	Mld Paper: 10,000 mmf 400V	.25
C-70	21R115312	Paper: .005 mf 600V	.25
C-71	8K490232	Mld Tub: 47,000 mmf 400V	.30
C-72	8K490232	Mld Tub: 47,000 mmf 400V	.30
C-74	23A702450	Electrolytic: 10 mf-450V	1.40
C-76	21R115856	Cer Tub: 470 mmf 500V	.20
C-78	21R115856	Cer Tub: 470 mmf 500V	.20
C-79	8R9866	Paper: .001 mf 600V	.20
C-80	8K490247	Mld Paper: 3300 mmf 600V	.25
C-81	8R121569	Paper: .003 mf 600V	.20
C-82	8K490268	Mld Tub: 1000 mmf 1000V	.35
C-83	8R121002	Tub: .01 mf 400V	.20
C-84	21R115900	Cer Tub: 100 mmf 500V	.25
C-85	8K490222	Mld Paper: 4700 mmf 400V	.25
C-86	21K114740	Mica: 390 mmf 500V	.50
C-87	21K114740	Mica: 390 mmf 500V	.50
C-88	21R115312	Cer Disc: 500 mmf 450V	.25
C-89	8K490231	Mld Tub: 39,000 mmf 400V	.30
C-90	21R121424	Cer Disc: 100 mmf 3000V	.30
C-91	21K710903	Cer Disc: 47 mmf 1500V	.35
or	21R120224	Cer Disc: 51 mmf 1500V	.25
C-93	21R120093	Cer Disc: 5000 mmf 2000V	.25
C-94	23B484097	Electrolytic: 200 mf-150V	2.20
C-95	23B710941	Electrolytic: 2-section; A, 200 mf-150V; B, 5 mf-150V	3.10
C-96	21R115386	Cer Disc: 1000 mmf 500V	.15
C-97	8R9854	Paper: .1 mf 200V	.25
C-99	21R115386	Cer Disc: 1000 mmf 500V	.15
C-100	21R120093	Cer Disc: 5000 mmf 2000V	.25
CR-1	48C711052		
or	48K711077		
or	48K712198		
or	48K712199		
or	48K712200		
or	48K722720		
or	48K733158		
or	48K733204	Crystal, diode: germanium	1.50
CR-2,3	48B700555		
or	48B720023	Rectifier, selenium	2.90
L-1A, B,C	24K703079	Coil, antenna primary: low frequency	.15
L-1D, E,F	24K703078	Coil, antenna primary: high frequency	.15
L-2	24K703002	Coil, antenna: channels 2 thru 6; includes L-2A thru L-2E (high channel coils are part of switch)	.25
L-3	24A790033	Coil, antenna: impedance matching	.80
L-5	24K792577	Choke, RF	.20
L-6	24C703076	Coil, RF: channel 13	.15
L-7	24K703002	Coil, RF: channels 2 thru 6; includes L-7A thru L-7E (high channel coils are part of switch)	.25
L-8	24K703097	Coil, oscillator: channel 13	.35
L-9	24C703001	Coil, oscillator: channels 2 thru 6; includes L-9A thru L-9E (high channel coils are part of switch)	.30
L-11	21R119854	Coil, compensating: red and violet dots; wound on 10,000 ohm resistor	.20
L-12	-	21.9 Mc Trap (part of T-6)	-
L-13	24B711413	Choke, RF: yellow dot	.35
L-14	24B711413	Choke, RF: yellow dot	.35
L-16	24R120984	Coil, compensating: wound on 10,000 ohm resistor; red and yellow dots	.20
L-17	24B792735	4.5 Mc Trap: with core & mtg clip	.50
L-18	24R119850	Coil, compensating: brown and gray dots	.15
L-19	24K721271		.45
or	24K721912	Coil, compensating: black dot; wound on 1200 resistor	.45
L-20	1V790341	Coil, sound take off: with core & mtg nut	.90
L-22	24K732710		
or	24K732711	Yoke, deflection: 70°; complete less cover & centering device; includes octal plug	9.65
L-23	24K701558		
or	24K721064	Coil, horizontal oscillator: with core & clip	1.65
L-24	24A733225	Choke, RF	.10
L-25	24A733225	Choke, RF	.10
L-26	24K733210	Choke, filament	.10

Resistors-Note: All resistors are insulated carbon type unless otherwise specified

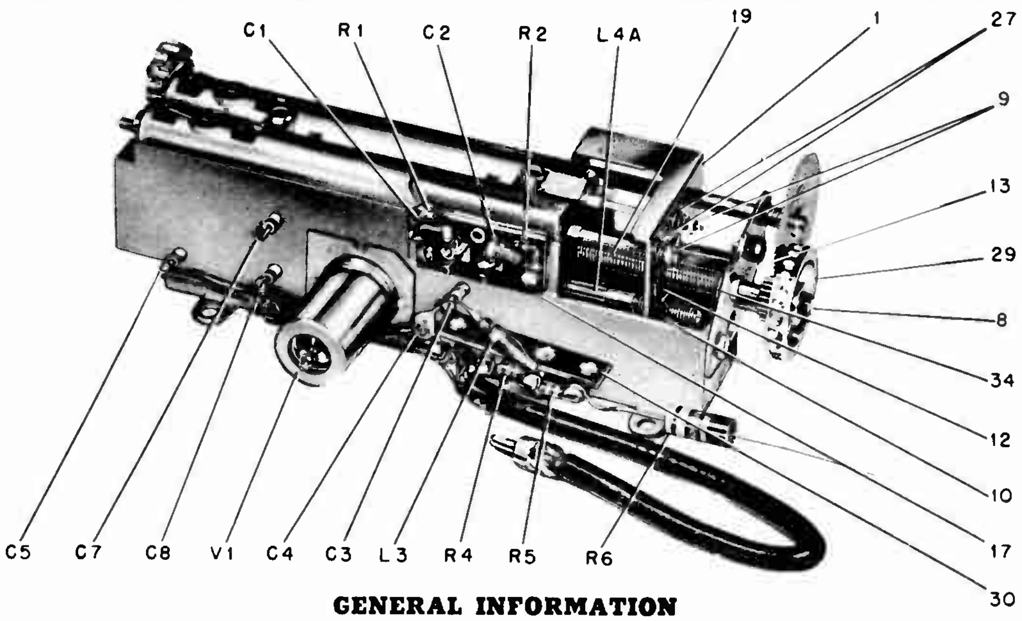
Ref. No.	Part Number	Description	List Price
R-1	6R6397	22,000 10% 1/2W doz	1.20
R-2	6R6032	470,000 20% 1/2W doz	1.20
R-3	6R2036	33 10% 1/2W doz	1.20
R-4	6R6054	10,000 20% 1/2W doz	1.20
R-6	6R3933	220 20% 1/2W doz	1.20
R-7	6R6397	22,000 10% 1/2W doz	1.20
R-8	6R2119	15,000 20% 1/2W doz	1.20
R-9	6R6301	1000 20% 1/2W doz	1.20
R-10	6R6301	1000 20% 1/2W doz	1.20
R-11	6R6039	4700 20% 1/2W doz	1.20
R-12	6R6075	100,000 20% 1/2W doz	1.20
R-13	6R6014	330,000 20% 1/2W doz	1.20
R-14	6R6301	1000 20% 1/2W doz	1.20
R-15	6R6320	10,000 10% 1/2W doz	1.20
R-16	6R5550	47 10% 1/2W doz	1.20
R-17	6R6409	2200 10% 1W	.20
R-18	6R6477	15,000 10% 1/2W doz	1.20
R-19	6R2004	8200 10% 1/2W doz	1.20
R-20	6R5550	47 10% 1/2W doz	1.20
R-21	6R490349	6800 20% 2W	.25
R-22	6R2004	8200 10% 1/2W doz	1.20
R-23	6R6373	150 10% 1/2W doz	1.20
R-24	6R6301	1000 20% 1/2W doz	1.20
R-25	6R6460	1.5 meg 10% 1/2W doz	1.20
R-26	6K121579	470,000 20% 2W	.25
R-27	6R6117	5600 10% 1/2W doz	1.20
R-29	6R6410	33,000 10% 1/2W doz	1.20
R-30	6R6046	1 meg 10% 1/2W doz	1.20
R-31	18B722190	Volume & Contrast Control: dual; 1 meg tapped at 300K; 1500 ohm; with power switch	2.40
or	18B733221	Volume & Contrast Control: dual; 1 meg tapped at 300K; 1500 ohm; with power switch (A-03 & later)	2.35
R-33	6R2098	22K 10% 2W	.25
R-34	6R2096	470,000 10% 1/2W doz	1.20
R-35	6R6054	10,000 20% 1/2W doz	1.20
R-37	17R120400	Wire Wound: 3900 10% 5W	.75
R-39	6R3933	220 20% 1/2W doz	1.20
R-40	6R3992	150 20% 1/2W doz	1.20
R-41	6R3933	220 20% 1/2W doz	1.20
R-42	6R5551	120 10% 1/2W doz	1.20
R-43	6R6428	6800 10% 1/2W doz	1.20
R-44	6R6428	6800 10% 1/2W doz	1.20
R-45	6R6012	33,000 20% 1/2W doz	1.20
R-46	6R6074	68,000 20% 1/2W doz	1.20
R-47	6R6038	1500 10% 1/2W doz	1.20
R-49	6R6400	33,000 10% 1W	.20
R-51	6R3927	2.2 meg 20% 1/2W doz	1.20
R-52	6R6032	470,000 20% 1/2W doz	1.20
R-53	6R6475	680,000 10% 1/2W doz	1.20
R-54	6R6397	22,000 10% 1/2W doz	1.20
R-55	6R5697	560,000 10% 1/2W doz	1.20
R-56	6R6069	2200 10% 1/2W doz	1.20
R-57	6R6428	6800 10% 1/2W doz	1.20
R-58	6R5577	2700 10% 1/2W doz	1.20
R-59	6R6028	22,000 10% 1/2W doz	1.20
R-60	6R6054	10,000 20% 1/2W doz	1.20
R-61	18A733170	Vertical Hold Control: 850,000 ohms, 350K stop; metal shaft; nut mtg type	.80
or	18K733417	Vertical Hold Control: 850,000 ohms, 350K stop; plastic shaft; twist lug mtg type	.70
R-62	6R6018	100 20% 1/2W doz	1.20
R-63	6R6117	5600 10% 1/2W doz	1.20
R-64	18A702443	Vertical Size Control: 5 meg, 1 meg stop; metal shaft; nut mtg type	.80
or	18B733413	Vertical Size Control: 5 meg, 1 meg stop; plastic shaft; twist lug mtg type	.70
R-65	6K120579	Wire Wound: 8200 10% 2W	.25
R-66	18A702475	Vertical Linearity Control: 750 ohms; metal shaft; nut mtg type	.70
or	18K733414	Vertical Linearity Control: 750 ohms; plastic shaft; twist lug mtg type	.80
R-67	6R5551	120 10% 1/2W doz	1.20
R-69	18A733179	Brightness Control: 5 meg; metal shaft; nut mtg type	.75
or	18K733415	Brightness Control: 5 meg; plastic shaft; twist lug mtg type	.60
R-70	6R6031	100,000 10% 1/2W doz	1.20
R-71	6R6031	100,000 10% 1/2W doz	1.20
R-72	6R6031	100,000 10% 1/2W doz	1.20
R-73	6R6397	22,000 10% 1/2W doz	1.20
R-74	6R2122	4.7 meg 20% 1/2W doz	1.20
R-75	6R410053	150,000 20% 1W	.20
R-76	6R410053	150,000 20% 1W	.20
R-77	6R6117	5600 10% 1/2W doz	1.20
R-78	6R6229	1000 10% 1/2W doz	1.20
R-80	18A733160	Horizontal Hold Control: 200,000 ohms, 50K stop; metal shaft; nut mtg type	.80
or	18K733416	Horizontal Hold Control: 200,000 ohms, 50K stop; plastic shaft; twist lug mtg type	.80
R-81	6R6074	68,000 10% 1/2W doz	1.20
R-82	6R6080	4700 10% 1/2W doz	1.20
R-83	6R2096	330,000 10% 1/2W doz	1.20
R-84	6R5594	680 10% 1W	.20
R-85	6R6080	4700 10% 1/2W doz	1.20
R-88	17A711500		
or	17A711027	Special, wire wound: 7.5 ohm 10% 5W; plug in type	.70
R-89	6A720662	Special: 19 hot; 230 cold; 7W	1.00
R-90	17K712039	Wire Wound: 42 10% 5W	.30
R-91	17K712038	Wire Wound: 120 10% 10W	.35
R-92	6K119932	10,000 10% 1/2W doz	1.20
R-94	6R6031	100,000 10% 1/2W doz	1.20
R-95	6R6407	220,000 10% 1/2W doz	1.20
R-96	17K710702	Wire Wound: 1.8 20% 1/2W doz	1.20
R-98	6R6004	1 meg 20% 1/2W doz	1.20
R-99	6R6004	1 meg 20% 1/2W doz	1.20
R-100	6R3966	1.5 meg 20% 1/2W doz	1.20
R-101	6R6075	100,000 20% 1/2W doz	1.20
R-102	6R2031	18 10% 1/2W doz	1.20
	6R6048	47,000 10% 1/2W doz	1.20
T-3	24B702983	Mixer IF: complete; shielded	1.60
T-4	1V712105	1st IF: complete	.90
T-5	1V712106	2nd IF: complete	.90
T-6	24K712104	3rd IF: complete	3.80
T-7	24B702543	Ratio Detector Transformer: complete; shielded	3.20
T-8	25K720128		
or	25B710925	Audio Output Transformer	1.80
T-9	25K702429		1.90
or	25K710730	Vertical Blocking Osc Transformer	1.55
T-10	25B731015		
or	25K721027	Vertical Output Transformer	3.40
T-11	24K733106	Horizontal Output Transformer: complete with V-17	13.00

Part Number	Description	List Price
VHF TUNERS		
1U733180	TT-69 VHF Tuner Unit	
or 1U733180	TT-69A VHF Tuner Unit	
or 1U733180	TT-69B VHF Tuner Unit (WTS-518 chassis only)	26.40* exch 19.80
1U722431	WTT-24AY VHF Tuner Unit	
or 1U722431	WTT-24CY VHF Tuner Unit (WTS-518Y chassis only)	27.50* exch 21.15
21T15 & Y21T15		
50C732758		
or 50C732997		
or 50C732998		
or 50C733259	Speaker, electrodynamic: 5-1/4"; 85 ohm field (cold) 3.2 ohm VC	5.20* exch 3.90
MODELS 17T20,B,E,M & Y17T20,B,E,M		
50C732758		
or 50C732997		
or 50C732998		
or 50C733259	Speaker, EM: 5-1/4"; 85 ohm fld (cold); 3.2 ohm VC	5.20* exch 3.90
MODELS 21K19,B & Y21K19,B		
50K733122		
or 50K733142		
or 50K733242		
or 50K733241	Speaker, EM: 8"; 85 ohm fld (cold); 3.2 ohm VC	7.50* exch 5.65
MODELS 21T16,B,E & Y21T16,B,E		
50C732758		
or 50C732997		
or 50C732998		
or 50C733259	Speaker, EM: 5-1/4"; 85 ohm fld (cold); 3.2 ohm VC	5.20* exch 3.90



MOTOROLA TV PAGE 14-5

CHASSIS TS-418, Y, VTS-418, Y, 518, Y, WTS-518, Y



GENERAL INFORMATION

Tuner TT-37 is a continuously-tuned type UHF tuner designed to convert the UHF television channels in the 470 to 890 mc range to an intermediate frequency band of 40 to 46 mc. This tuner is designed for installation in Motorola VHF TV receivers using the TS-402, TS-502 and TS-602 series chassis. This unit may be installed in the field, in above chassis (through use of suitable kit), or may be factory-installed ("Y" series TV chassis).

This tuner is driven by means of a bead chain operated by a sprocket on the rear of VHF tuner fine tuning shaft. A sprocket on front end of UHF tuner, in turn, operates the UHF dial through another bead chain. The UHF dial scale is located behind the VHF channel selector knob, and is visible through a window only when VHF channel selector dial is set to UHF position. In this position, the VHF tuner is converted to a 2-stage 40 mc IF amplifier, which amplifies the output of the TT-37 UHF tuner.

CIRCUIT DESCRIPTION

The TT-37 is a continuously-tuned, single superheterodyne type of tuner, designed to convert the television channels in the 470 to 890 mc range to an intermediate frequency band of 40 to 46 mc. It employs a germanium or silicon crystal type of mixer (CR-1) and a 6AF4 type tube (V-1) for local oscillator. The oscillator frequency is above the signal frequency in order to remain compatible with present VHF practice. The 300 ohm balanced type of antenna, for which this tuner is designed, is coupled to the crystal mixer by means of a double-tuned transformer, the selectivity of which is sufficient to provide an image ratio of the order of 40 db. The output signal of the tuner (40-46 mc) is developed across a total capacity of 28 mmf (10 mmf, C-3, plus 18 mmf of 13-inch section of 93 ohm coaxial cable). There is no tuning provided in this unit for the IF, the tuning and impedance matching being provided in the VHF tuner of the TV receiver.

The antenna is coupled to the input tuning element of the double-tuned transformer by means of a small rectangular coil (L-1), center-tapped and balanced to ground. The tuning elements consist of two shorted quarter wave length transmission lines modified by end capacity loading such that the frequency versus length of the inner conductor provides a straight line relationship. The end capacity loading is so constructed that a total of three adjustments are available for antenna tracking. The two tuning elements are coupled together by means of a small printed circuit coupling loop (L-2). This coupling loop is made up of two elements or sections. The large section provides the forward coupling and the small section is so connected to the large that it provides a bucking action that is somewhat frequency selective because of physical location. The coupling loop maintains the coupling between the two tuning elements at approximately critical coupling throughout the tuning range.

The mixer crystal (CR-1) in this unit is of the plug-in type. The crystal is coupled to the double-tuned transformer by means of a tap on the center conductor of the output tuning element. The other end of the crystal returns to ground through a 56 ohm resistor (R-3) and a 10 mmf feed-thru type capacitor (C-3), connected in series. The 93 ohm IF output cable is connected across the 10 mmf feed-thru capacitor (C-3) through a 470 mmf coupling capacitor (C-4).

A positive bias is obtained by means of a voltage divider, consisting of a 56K ohm resistor (R-5) and a 220 ohm resistor (R-4) to ground, and is DC coupled to the crystal through a 1 microhenry RF choke (L-3) connected from the 220 ohm resistor to the 10 mmf feed-thru capacitor. This provides the crystal with a DC return path and a positive bias of approximately 0.25 volts.

The local oscillator for this tuner is a modified Colpitts type using a 6AF4 tube (V-1). Straight-line frequency versus travel tuning of the oscillator is attained by a series LC type of printed circuit (L-4) on a glass cylinder. All moving elements of the circuit are capacity-coupled to stationary elements to avoid wiping contacts. The variable capacitor portion of the tuning element is connected in the grid circuit and incorporates a small disc type 27 mmf NTC series capacitor (C-6) for drift compensation. The variable inductance portion of the tuning element is connected in the plate circuit of the tube and is so arranged as

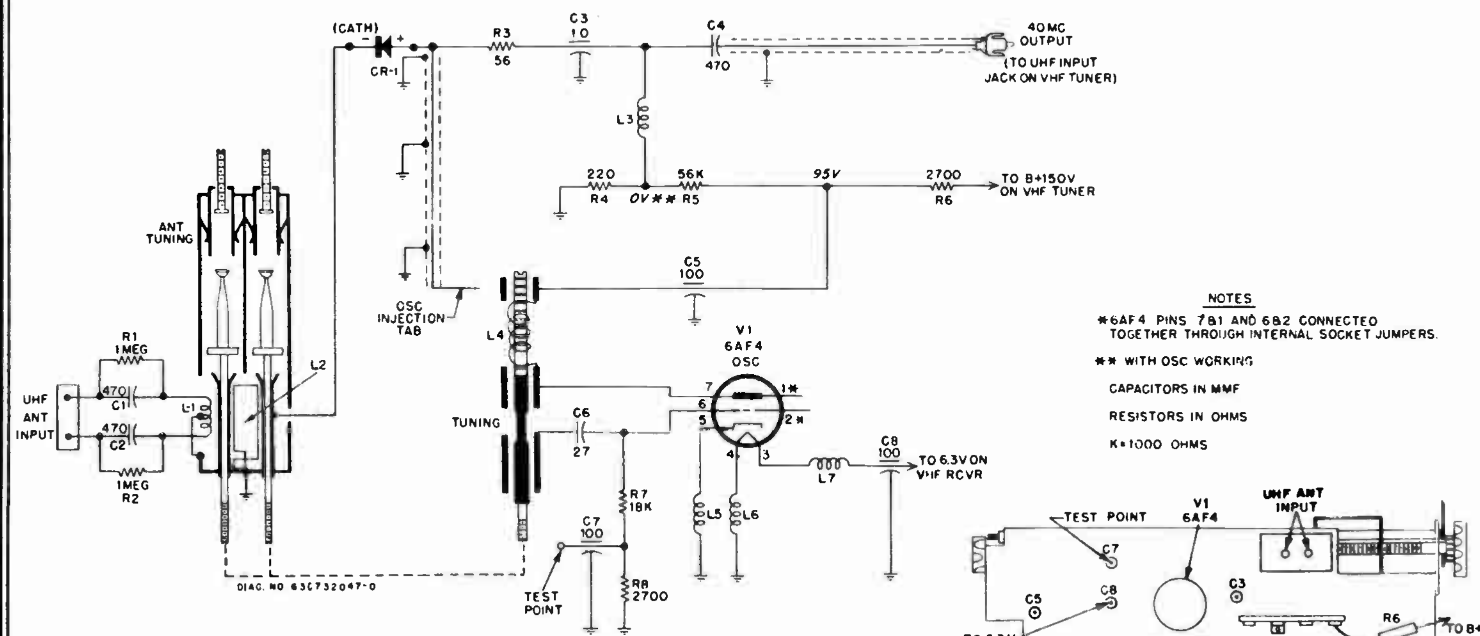


FIGURE 1. SCHEMATIC DIAGRAM

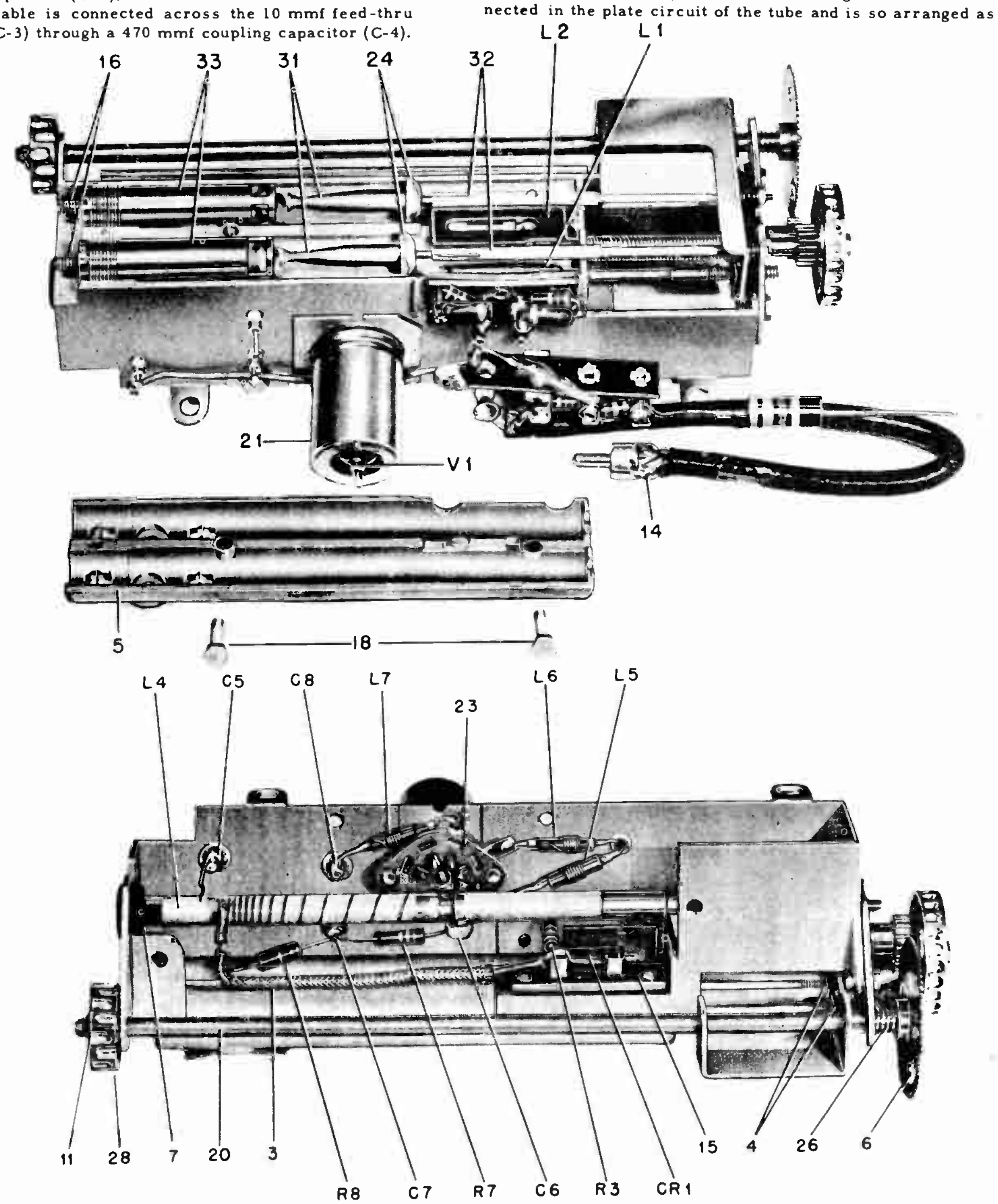


FIGURE 2. PARTS LOCATIONS

to provide its own DC path from plate to ground for B+ feed. The moving element of the oscillator circuit consists of a core whose function is to provide a variable capacitor and a variable tap on the inductance portion of the circuit and at the same time provide an electrical connection between the variable capacitor and the variable inductance. There is only one adjustment of this core.

In order to maintain a feed-back path as nearly as possible determined by the internal capacities of the oscillator tube itself, the cathode and filaments of the tube are maintained off ground to RF potential by means of small RF chokes (L-5, 6, & 7) whose resonances are held at a frequency somewhat below the UHF band.

The oscillator is coupled to the crystal mixer circuit by means of a small section of braid shielded wire serving as a high loss type of transmission line. The length of line is approximately a quarter wave length at the high end of the band. One end of the line is capacity-coupled to the low impedance end of the oscillator-tuned circuit by means of a small unshielded but insulated section of the inner conductor. Moving this wire, with respect to the oscillator coil, provides some degree of variation in the coupling to oscillator signal. The shield of the line is grounded at several points along its length. The injection current in this tuner varies from approximately 0.7 ma to 2 ma.

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	List Price
TUNER UNIT - ELECTRICAL PARTS			
Capacitors			
C-1	21R115856	Ceramic tubular: 470 mmf 500V	.20
C-2	21R115856	Ceramic tubular: 470 mmf 500V	.20
C-3	21R120805	Ceramic feed-thru: 10 mmf 500V	.35
C-4	21R114554	Ceramic disc: 470 mmf 450V..	.20
C-5	21R120806	Ceramic feed-thru: 100 mmf 500V........................	.30
C-6	21A731037	Ceramic, temperature compensating: 27 mmf 10% N5200PPM..................	.40
C-7	21R120806	Ceramic feed-thru: 100 mmf 500V........................	.30
C-8	21R120806	Ceramic feed-thru: 100 mmf 500V........................	.30
Crystal			
CR-1	48K731312 or 48K731313 or 48K731314	Crystal, UHF mixer..........	
Coils			
L-1	1V730900	Antenna Coupling RF Coil Assembly: includes C-1, C-2, R-1, R-2 & strip...........	1.25
L-2	84B730674	Coupling loop...............	.50
L-3	24K712103	Compensating coil...........	.45
L-4	24B730126	Oscillator coil (less tuning core L-4A listed below)....	2.45
L-4A	1B730885	Core Assembly, oscillator coil........................	
L-5	24K721430	Cathode choke coil..........	.45
L-6	24K712254	RF choke....................	.45
L-7	24K712254	RF choke....................	.45
Resistors			
		Note: All resistors are insulated carbon type.	
R-1	6R6004	1 meg 20% 1/2W.........doz	1.20
R-2	6R6004	1 meg 20% 1/2W.........doz	1.20
R-3	6R5614	56 10% 1/2W...........doz	1.20
R-4	6R6270	220 10% 1/2W..........doz	1.20
R-5	6R6378	56,000 10% 1/2W........doz	1.20
R-6	6R5764	2700 10% 2W...............	.25
R-7	6R5591	18,000 10% 1/2W........doz	1.20
R-8	6R5577	2700 10% 1/2W..........doz	1.20

Ref. No.	Part Number	Description	List Price
TUNER UNIT - MECHANICAL PARTS			
1	7C730308	Bracket, core slide.........	
2	1V730976	Cable Assembly, output: includes plug................	.10
3	30A731342	Cable, shielded (osc injection lead).................	
4	42A70184	Clip, core adjustment....doz	.20
5	1V730920	Cover & Spring Assembly.....	.55
6	44B730303	Gear, dial drive............	.20
7	5K792031	Grommet, rubber..........doz	.30
8	3S2286	Lockscrew: 4-40 x 3/16 slotted hex head........doz	.15
9	2S7041	Nut, hex: 2-56 x 3/16 x 1/16.....................doz	.20
10	2S7982	Nut, speed: 6-32.........doz	.20
11	2S7990	Nut, speed: round; 3/16".doz	.20
12	2A730299	Nut, tension drive..........	.05
13	1V730901	Plate, Stud & Idler Gear Assembly.....................	
14	28K731154	Plug, insulated.............	.10
15	9A731297	Receptacle, crystal.........	
16	3A711428	Screw, adjustment...........	
17	3S1579	Screw, machine: 4-40 x 1/4 slotted fillister head ....per/c	.50
18	3S2991	Screw, machine: 6-32 x 1/2 plain hex head..........doz	.15
19	47A730300	Shaft, core drive..........	.30
20	47A730294	Shaft, dial drive..........	.25
21	26K722163	Shield, tube...............	.10
22	26C730886	Shield, UHF radiation......	
23	9B730232	Socket, tube: miniature; 7-prong; with shorting straps between pins 1 & 7 and 2 & 6; with mounting studs....	1.20
24	43A711513	Spacer, rod & sleeve assembly......................	.15
25	41A711420	Spring, compression (adjustment screw 3A711428 tension)	.05
26	41A730293	Spring, dial drive.........	.05
27	41A472134	Spring, tension.......per/c	.50
28	44A730296	Sprocket, dial drive.......	.30
29	44B730306	Sprocket, drive gear.......	.30
30	31R115711	Strip, terminal: 3 insulated lugs, #2 grd..............	.10

UHF TELEVISION TUNER ADAPTOR
TK-35, 36 & 38 SERIES

GENERAL INFORMATION

The UHF tuner is mounted adjacent to the standard VHF tuner, and secured to the receiver chassis with three Phillips head screws.

UHF tuning is accomplished by a drive pulley and coupling, to the rear of the VHF fine tuning shaft. Rotation of the VHF fine tuning knob thus tunes UHF stations. Some models require a bead-chain drive (from the fine tuning shaft to the UHF tuner) and others a belt-drive. Refer to Motorola UHF Adaptor Listing (Part No. 68P732128) for selection of correct adaptor.

All chassis models utilize a front bead-chain coupling from the UHF tuner to the UHF dial scale (channel indicator). The UHF channel indicator is mounted to a shaft that rotates on the VHF tuner shaft. Insulated sleeving on both sides of the dial indicator sprocket protects the shaft from becoming "hot" should the metal bead-chain become disengaged from the sprocket.

Electrical connections required are: the UHF antenna lead-in (plug-in), the UHF tuner output to the VHF tuner (plug-in), and filament and B plus voltages as obtained from the receiver power supply. B plus connections must be made as illustrated so that plate voltage will be removed from UHF tuner when it is not in use.

Refer to illustration that is similar to receiver into which adaptor is to be installed. Position of front bead-chain sprocket, and tuner size will aid in locating the correct drawing. In the case of a belt-driven UHF tuner, use the appropriate drawing insert.

INSTALLATION INSTRUCTIONS

1. Remove VHF chassis from cabinet and support on service brackets so bottom is accessible.

2. Temporarily remove dial light assembly and light shield (not on all models) from TV chassis.

NOTE: The UHF channel indicator shaft and sprocket are factory installed on some VHF tuners, therefore these parts are not included with all adaptors. When required, they are furnished and must be installed as follows:

A. Place the "U" ring clamp in the lower groove of the VHF channel selector shaft and compress it with a pair of pliers.

B. Place the plastic rear insulator over the shaft.

C. Place the UHF channel indicator shaft and sprocket on the VHF channel selector shaft. Make sure there is a plastic front insulator on the indicator shaft.

D. Place the other "U" ring clamp in the upper groove and compress it to retain shaft. Make sure that the "U" ring clamp does not extend above shaft, as difficulty will be experienced with knob installation.

3. Mount UHF tuner on TV chassis (use appropriate drawing) using the three Phillips head screws provided. Do not tighten screws as yet.

4. Remove the fine tuning shaft bearing bracket from rear of VHF tuner.

5. Assemble spring washer and drive pulley, or sprocket, onto fine tuning shaft. The "C" washer furnished is used to retain assembly.

6. Install the short bead-chain across front sprockets of the UHF and VHF tuners (all models). NOTE: On the TS-602 series chassis, temporarily remove the fibre support bracket before installing bead-chain.

Models Using Bead-Chain Drive

7. Place long bead-chain over rear sprocket. Assemble fine tuning shaft bearing bracket, double anti-backlash spring and screws as illustrated.

8. Place other end of long bead-chain over UHF tuner sprocket.

9. Adjust position of UHF tuner so that rear anti-backlash spring exerts tension on bead-chain, but yet the chain is not stretched straight; the front chain is adjusted so it is stretched straight. While holding the UHF tuner in this position, tighten the three Phillips head mounting screws.

CAUTION! CHECK FOR BINDING IN THE DRIVE MECHANISM BY GENTLY TURNING UHF TUNING SHAFT. IF EXCESSIVE FORCE IS REQUIRED, LOCATE CAUSE OF BINDING, OTHERWISE THE BAKELITE COUPLING USED IN THE MIDDLE OF THE VHF FINE TUNING AND UHF TUNING SHAFT OF SOME MODELS MAY BE SNAPPED.

10. Adjust rear anti-backlash spring so that its flat portion contacts as many beads as possible on the long chain. This is necessary for a smooth drive action.

11. Liberally lubricate bead-chains with grease provided.

Models Using the Belt-Drive

12. Place belting over rear drive wheel.

13. Replace fine tuning shaft bearing bracket and screws.

14. Adjust position of UHF tuner so that front bead-chain is stretched straight, and rear belt-drive has sufficient tension to pull tuner. Hold the UHF tuner in this position and tighten the three Phillips head mounting screws.

15. Calibration of the UHF Dial Scale (All Models)

A. Place the UHF dial and VHF channel selector knob (furnished with adaptor) on the UHF channel indicator and VHF channel selector shafts, respectively.

B. Turn VHF channel selector knob so its window is toward top of chassis. This places the receiver in the UHF position, and exposes the UHF dial.

C. Turn UHF tuning shaft clockwise until UHF tuner cores reach their extreme inward travel stop. Grasp dial drive shaft of UHF tuner, and move it forward to disengage gears. Rotate until channel 14 is centered in VHF channel selector knob window. Release shaft to engage gears in this position.

16. Replace dial light assembly and light shield on models containing dial light. NOTE: If a light shield is furnished with adaptor, use it to replace original shield which does not have opening large enough to clear UHF channel indicator shaft.

17. Electrical Connections (All Models)

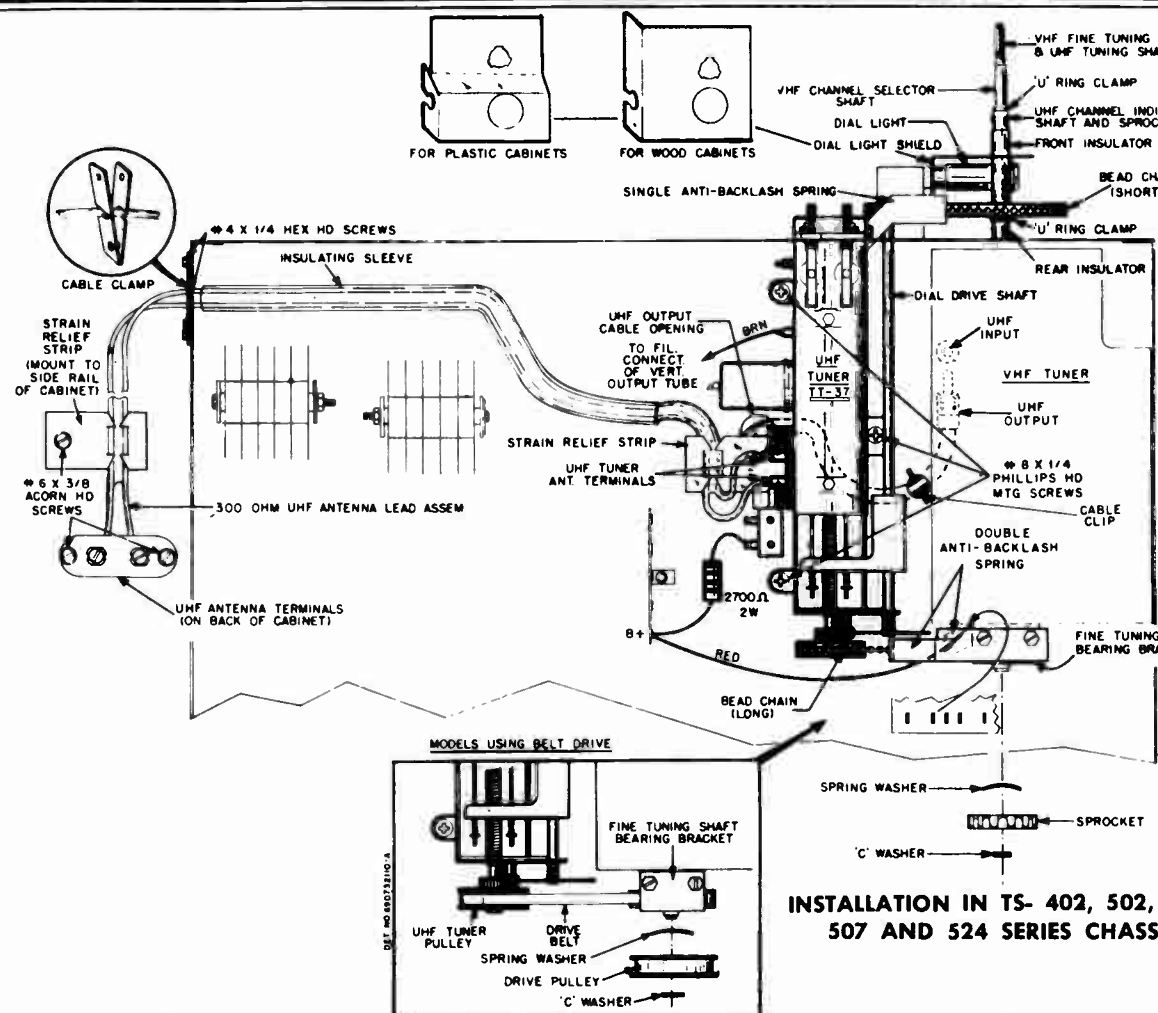
Solder the loose end of the 2700 ohm 2 watt resistor (on the UHF tuner) to the terminal strip shown. This is the B+ connection. NOTE: The red lead between the terminal strip and VHF tuner must be added to some chassis.

18. Solder brown filament lead (UHF tuner) to point shown on diagram.

19. Plug UHF output lead into UHF input receptacle on top of VHF tuner.

20. Make sure insulating sleeve is on UHF antenna lead-in and insert lead-in through chassis opening. Insert lead-in through openings of strain relief strip as illustrated and plug the 300 ohm UHF antenna lead-in assembly into UHF tuner antenna terminals. Secure to chassis with the cable clamp. Dress lead-in as shown on drawing. Ground lead-in (from UHF tuner output to VHF tuner input) to chassis by use of clip spring provided. Clip spring snaps into any convenient chassis hole.

21. Check adjustment of the UHF dial calibration. Connect speaker to TV chassis. Connect the TV set through an



INSTALLATION IN TS- 402, 502, 505, 507 AND 524 SERIES CHASSIS

ISOLATION TRANSFORMER to power line. Check dial illumination on models having a dial light. Make adjustments if necessary.

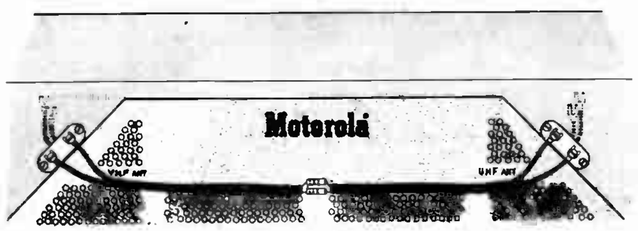
22. Remove knobs and service brackets from chassis and replace chassis in cabinet.

23. Secure UHF antenna lead-in assembly to side rail of cabinet with strain relief strip.

24. Mount antenna terminal strip to back of cabinet.

25. Reassemble balance of receiver and check operation.

USE JUMPER AS SHOWN WHEN ONLY ONE ANTENNA IS USED FOR BOTH VHF AND UHF. (SEE INSTRUCTIONS)



The Motorola BUILT-IN VHF-UHF ANTENNA will give satisfactory reception in "good signal" areas but, if you are located in a "fringe" or weak signal area, it is suggested that an outdoor antenna be used.

When the outside antenna is to be connected, be sure to disconnect the BUILT-IN ANTENNA leads first and leave them disconnected. then connect the outside antenna.

In some areas, on outdoor VHF antenna or a combination VHF-UHF single lead-in antenna will be satisfactory for both UHF and VHF reception. If you are in such an area, a special jumper connection must be made between the VHF and UHF antenna terminals on the rear of your receiver. This jumper connection (furnished with the adaptor) consists of a length of 300 ohm line, with a 150 ohm resistor in each lead. See Figure 3.

If the outdoor antenna and antenna jumper connections are used for both VHF and UHF reception, the following precautions must be taken:

1. If the receiver is located in an area where the UHF signal is stronger than the VHF signal, connect the antenna to the VHF antenna terminals on the TV receiver.

2. If the receiver is located in an area where the VHF signal is stronger than the UHF signal, connect the antenna to the UHF antenna terminals on the TV receiver instead of on the VHF side of the antenna jumper.

The above instructions will make it possible to use a single antenna for both UHF and VHF reception, but extreme caution must be taken when the antenna jumper is used, as this connector does result in a loss of signal. This signal loss cannot be tolerated if there is a very weak VHF signal as there might be too great a deterioration of the picture or, possibly, a complete loss of picture. In this case, use separate outdoor antennas for UHF and VHF reception.

Discard the antenna jumper connection and connect each antenna to the proper input terminals when two outdoor antennas are being used.

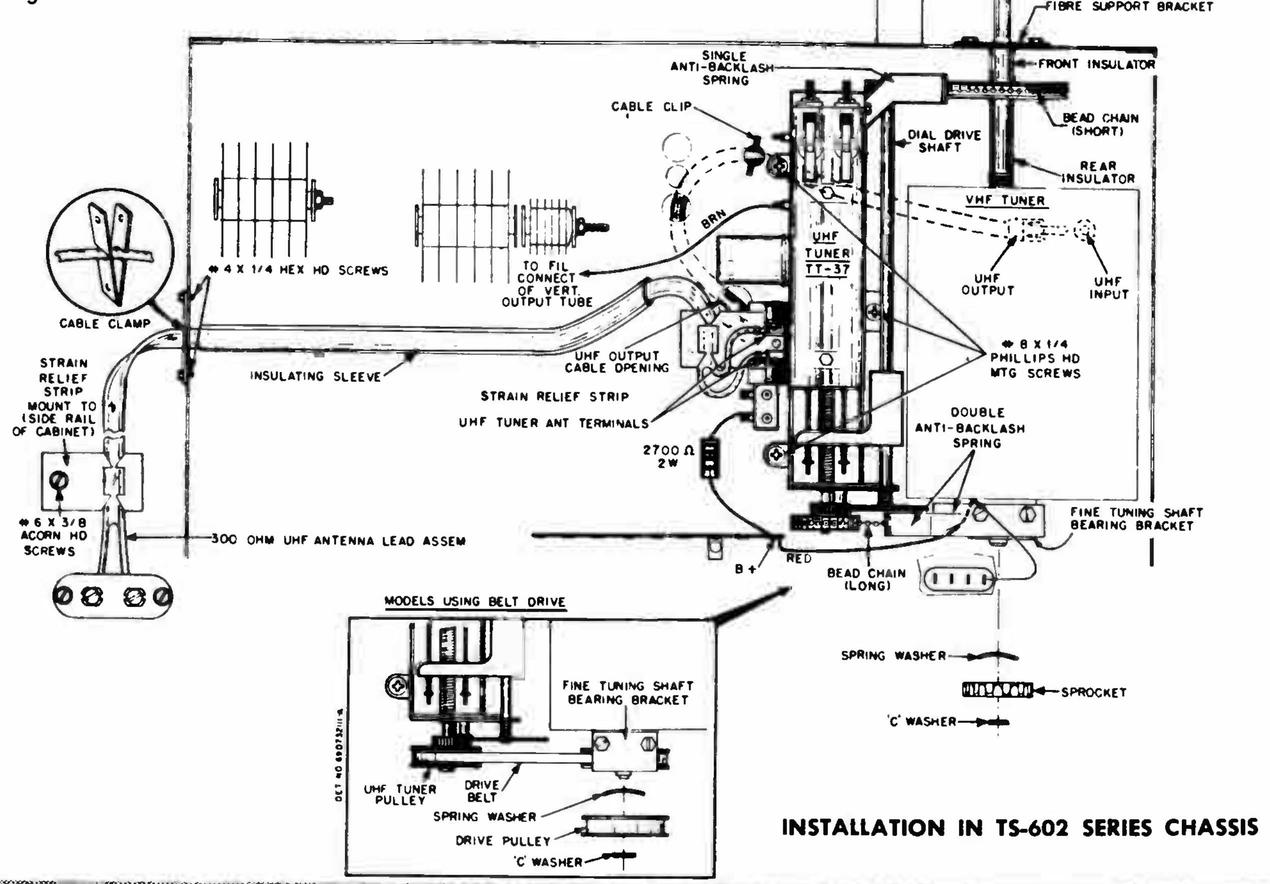
In some areas where the VHF antenna and the jumper are used, it may be necessary to experiment with the length of the leads on the antenna jumper to get the best results.

The installation procedure for the outdoor UHF antenna will, in general, be the same as for the VHF antenna. The lead-in, however, should be the tubular, unshielded 300 ohm line instead of the ribbon type, as the latter attenuates UHF frequencies when damp. As the UHF antenna is more critical in setting up than the VHF, more care should be taken in properly positioning the antenna. Setting the UHF antenna toward the station will not necessarily give the best results, so check the area in order to deliver the maximum signal to the receiver.

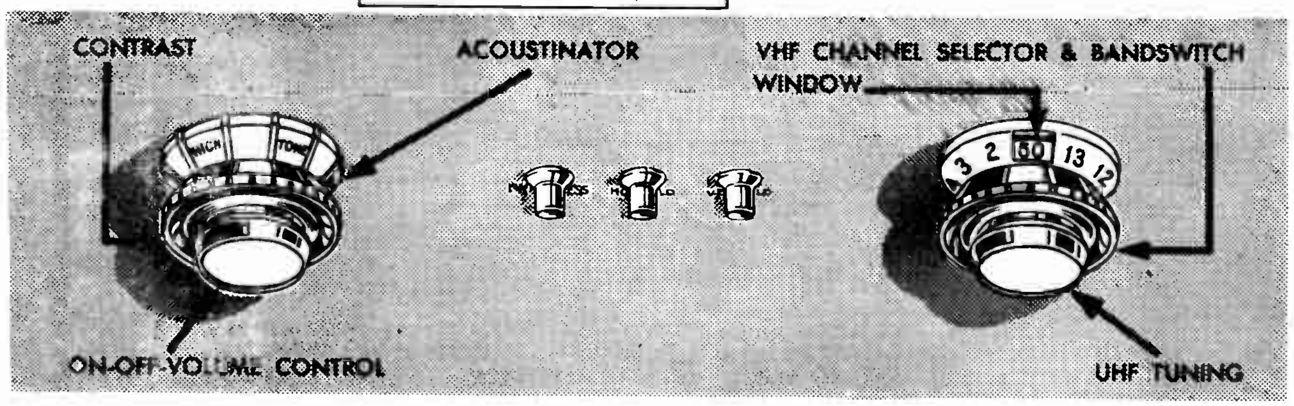
When using the tubular lead, it is good practice to form a drainage loop before the lead enters the house, then punch a hole in the polyethylene at the low point. Unless this is done, the condensation formed inside the 300 ohm tubular line, may create a pool of water behind the television set.

When using an outdoor antenna, always ground the antenna mast and use an Underwriters approved lightning arrestor at the point where the lead-in enters the house.

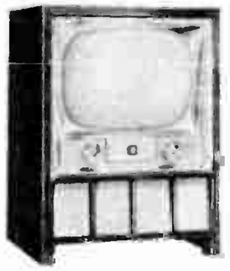
Consult your local Motorola dealer or distributor as to choice of antenna or antennas best suited for your location.



INSTALLATION IN TS-602 SERIES CHASSIS



OPERATING CONTROLS



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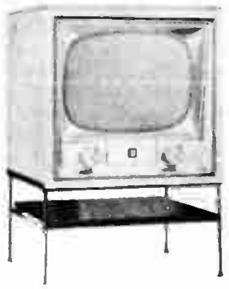

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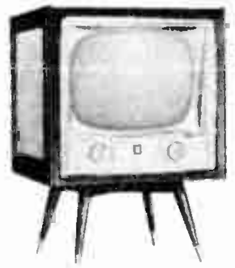

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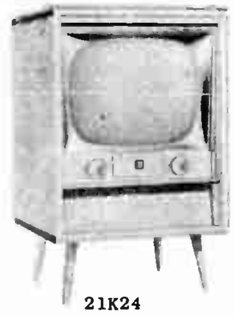

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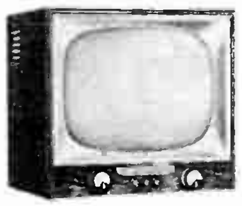

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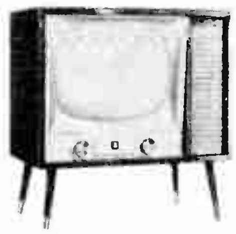

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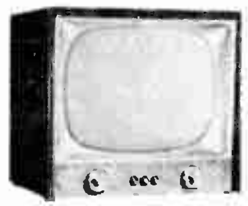

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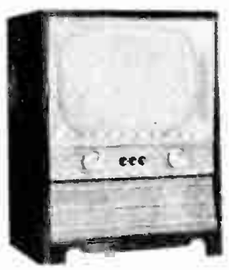

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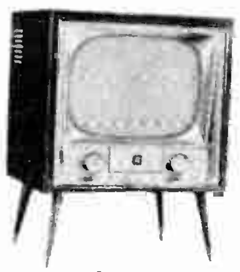
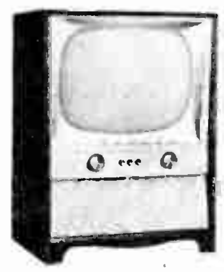


21C3



24K4

ELECTRICAL SPECIFICATIONS

POWER RATING - Source: 105-125 volts, 60 cycle AC
TS-525 series 155 watts
TS-525Y series 165 watts
TS-528 & 603 series 185 watts
TS-528Y & 603Y series 195 watts

NUMBER OF TUBES - 18 plus germanium diode, 2 selenium rectifiers and picture tube.

INTERMEDIATE FREQUENCIES - Video 45.75 Mc
Sound 41.25 Mc & 4.5 Mc

FREQUENCY RANGE - TS-525, 528 & 603 series
Channels 2 through 13
TS-525Y, 528Y & 603Y series
Channels 2 through 83

ANTENNA INPUT IMPEDANCE - VHF & UHF
balanced 300 ohm

FUSES - Filament: 1" #26 copper wire, located under chassis at right rear.
Power: Special 7.5 ohm plug-in resistor located at right rear top of chassis.

TUBE COMPLEMENT

Ref. No.	RTS-525 WTS-525 Tube Type	TS-528 TS-603 Tube Type	Function
V-1	6BZ7	6BZ7	RF Amp
V-2	6U8	6U8	Mixer-Osc
V-3	6CB6	6CB6	1st IF Amp
V-4	6CB6	6CB6	2nd IF Amp
V-5	6CB6	6CB6	3rd IF Amp
V-6	12BY7	12BY7	Video Amp
V-7	6AU6	6AU6	FM Driver
V-8	6AU6	6AU6	FM Limiter
V-9	6AL5	6AL5	Ratio Detector
V-10A	1/2 6SN7GT	1/2 6SN7GT	1st Audio Amp
V-10B	1/2 6SN7GT	1/2 6SN7GT	Phase Detector
V-11	6W6GT	6W6GT	Audio Output
V-12	6AU6	6AU6	AGC
V-13	6SN7GT	6SN7GT	1st & 2nd Clipper
V-14A	1/2 12BH7	1/2 6BL7GT	Vert Blocking Osc
V-14B	1/2 12BH7	1/2 6BL7GT	Vertical Output
V-15	6SN7GT	6SN7GT	Horizontal Osc
V-16	6BQ6GT	6CD6G	Horiz Output & High Voltage
V-17	6AX4GT	6AU4GT	Damping Diode
V-18	1B3GT	1B3GT	High Voltage Rect
V-19	21YP4A		Picture Tube: 21"-rect-glass-spher face-alum-electrostatic focus-70°
V-19		21ALP4A (TS-528)	Picture Tube: 21"-rect-glass-spher face-alum-electrostatic focus-90°
V-19		24DP4A (TS-603)	Picture Tube: 24"-rect-glass-spher face-alum-electrostatic focus-90°

CHASSIS BREAKDOWN CHART

Chassis	Picture Tube	VHF Tuner	UHF Tuner	UHF Conversion Kit
RTS-525	21YP4A	TT-70Y		WTK-35
RTS-525Y	21YP4A	TT-70Y	WTT-37	
WTS-525	21YP4A	TT-70		WTK-35
WTS-525Y	21YP4A	TT-70Y	WTT-37	
TS-528	21ALP4A	TT-70		WTK-35

Chassis	Picture Tube	VHF Tuner	UHF Tuner	UHF Conversion Kit
TS-528Y	21ALP4A	TT-70Y	WTT-37	
TS-603	24DP4A	TT-70		WTK-35
TS-603Y	24DP4A	TT-70Y	WTT-37	

NOTE: For UHF Tuner Service Information refer to separate UHF tuner service manual.

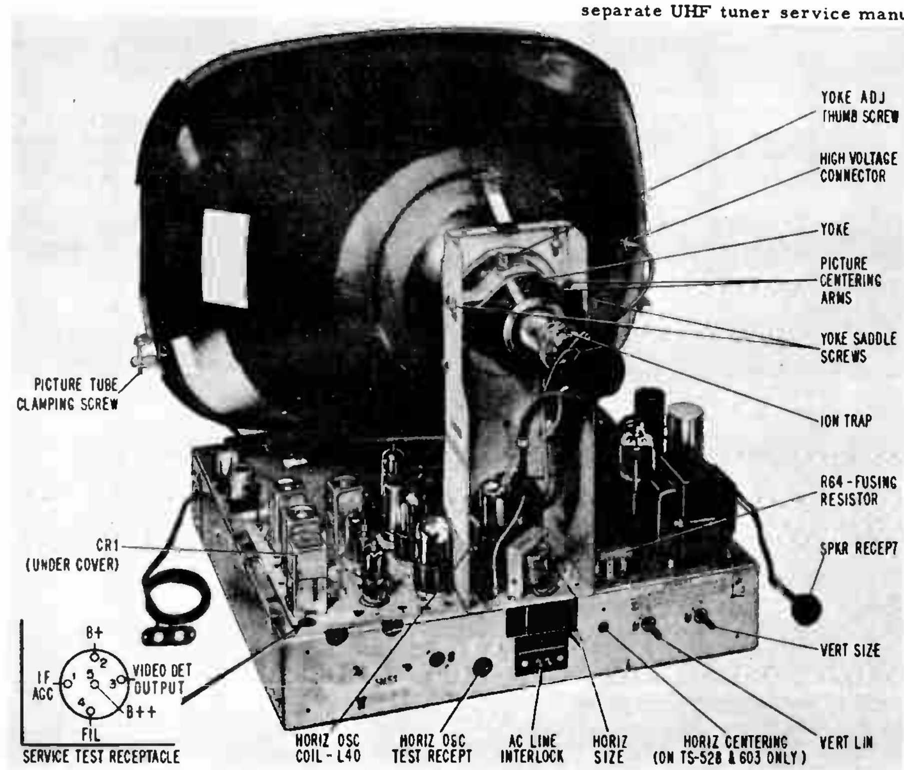


FIGURE 2. REAR VIEW OF CHASSIS

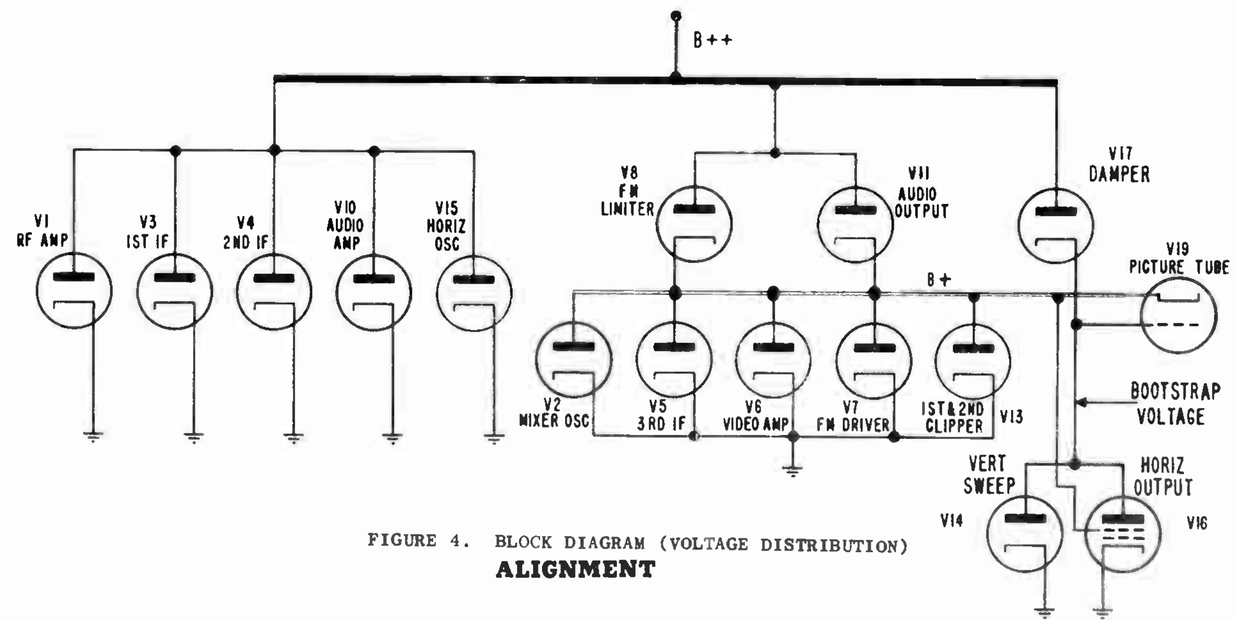


FIGURE 4. BLOCK DIAGRAM (VOLTAGE DISTRIBUTION)

ALIGNMENT

GENERAL INFORMATION

Equipment Required:

A. Sweep Generator: 18 to 220 Mc, 12 Mc sweep width, linear, and capable of .1 volt output
Accurately calibrated, adjustable marker generator and/or AM signal generator.

B. Cathode ray oscilloscope: preferably with calibrated attenuator.

C. Variac: if line voltage is not 117 volts

NOTES: IMPORTANT

NEVER GROUND THE RECEIVER CHASSIS DURING TESTING OPERATIONS OR INSTALLATION UNLESS AN ISOLATION TRANSFORMER IS USED.

Keep the marker generator output low enough, at all times, to prevent the marker from distorting the response curve.

Some coils resonate at two settings of the core, the correct setting is at the outer end of the winding.

For complete receiver alignment, use the following procedure in sequence: Line voltage must be 117 volts: if not, adjust to 117 volts with variac.

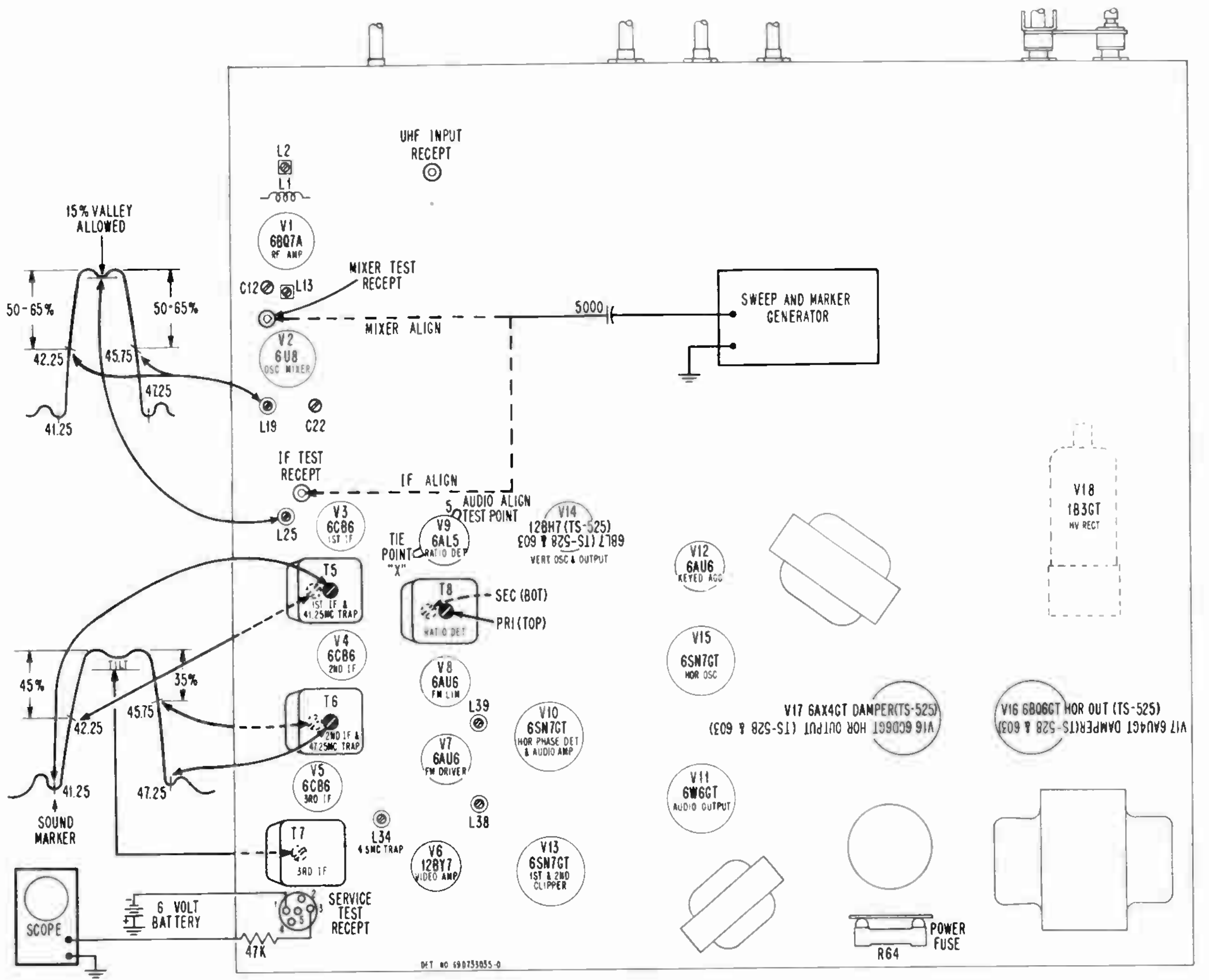


FIGURE 8. TUBE LOCATIONS & IF ALIGNMENT DETAIL

IF AND MIXER ALIGNMENT

1. Remove horizontal output tube (V-16) to eliminate RF interference. Connect a 2500 ohm 10 watt resistor from chassis ground to B++ (250V bus) to normalize voltages.

2. Remove antenna and make following connections: (See Figure 8).

a. Connect a 6 volt battery between pin 1 (IF AGC bus) of service test receptacle and ground. Positive side of battery goes to ground.

b. Disable tuner oscillator by grounding pin 9 of V-2 (6U8) and turn channel selector to channel 13.

c. Connect sweep generator to IF test receptacle and oscilloscope to detector load resistor (pin 3 of service test receptacle).

3. Center sweep frequency at 44 Mc with a sweep width of 10 Mc and adjust generator output below point of receiver limiting (approximately 3 volts peak-to-peak at detector load).

4.

Adjust	At Marker Freq.	For
T-5 top	41.25 Mc	Minimum, See Figure 8
T-6 top	47.25 Mc	Minimum, See Figure 8
T-5 bot	42.25 Mc	Marker at proper point, See Figure 8
T-6 bot	45.75 Mc	Marker at proper point, See Figure 8
T-7 bot	top of curve	Flat top, See Figure 8

As some adjustments interact, repeat as necessary to obtain proper curve.

5. Move generator to mixer test receptacle and short across R-10 (4.7K ohms). See Figure 9 for R-10 location.

L-19 & L-25	42.25 - 45.75 Mc	Proper curve, See Figure 8. If desired overall response cannot be obtained, check dressing of bypass capacitors, especially the screen bypassing of the 1st & 2nd IF tubes. These lead lengths are critical and should be kept short and dressed to obtain proper response.

CHECKS

Bandwidth may be determined by noting the frequencies at which the markers fall at the 50% points. Mixer and IF bandwidth over 3.7 Mc may cause sound bars or burble in the picture; if less than 3 Mc, a loss of resolution or fine detail in the picture may be noticed.

6. Decrease generator signal until there is a marked decrease in the oscilloscope waveform. Unwanted regeneration will be indicated by sharp peaks on the overall response curve. If regeneration is present, check IF cathode resistors, screen bypass capacitors, and lead dress. Improper alignment may also cause regeneration.

AUDIO ALIGNMENT

This alignment may be made by injecting an accurate 4.5 Mc signal in at the video amplifier grid. However, the station alignment method which follows is much more accurate and should be used whenever possible.

1. With receiver in operating condition, tune in station.

2. Connect VTVM from positive terminal of electrolytic capacitor C-50B to ground.

3. Maintain 5 volts, or less, at VTVM by adjustment of fine tuning and contrast control (or by removal of antenna, if necessary) while peaking T-8 primary (top) and L-38 & L-39 for maximum output. (See Figure 8.)

4. Tune for normal picture and carefully note voltage developed at the positive terminal of C-50B.

5. Move meter to junction of R-54 & R-56 (dummy pin on V-9 socket, marked "X" in Figure 8).

6. Adjust T-8 secondary (bottom) to give a reading on the VTVM of exactly one-half of reading in step 4.

4.5 MC TRAP ADJUSTMENT

Tune receiver to a local station and adjust 4.5 Mc trap L-34 for minimum beat interference in the picture by locating the two points of adjustment at which the beat is just noticeable. Rotate the core toward the center of these two points. Use the minimum amount of inductance (core out of coil) that will result in no apparent beat interference.

TUNER ALIGNMENT

GENERAL INFORMATION

It is very unlikely that the Motorola Tuner will need alignment unless it has been damaged, is being replaced, or has had components replaced in the tuned circuits. Tubes may be changed in most cases without realignment, but care must be used in selection or realignment may be required.

The tuner operates by shorting out an antenna, RF and oscillator coil section consecutively for each higher channel. When switched to the lowest channel, all coils of any one section will be series connected. Therefore, alignment must start at the highest channel and each adjustment properly completed before the next lower channel adjustment is attempted. Low-band channels (6-2) may be individually adjusted by stretching or compressing coil turns, while high-band channel inductances (7-13) are formed by a stamped metal plate and are adjustable as a unit by L-13 and C-12 (RF) and L-17 and C-22 (oscillator). The antenna coils are very broad in tuning and generally do not require adjustment.

All alignment procedures in receivers with built-in UHF tuners are made with the UHF tuner input plug in place during alignment. In some models without UHF tuners, a shorting link is installed in the UHF input receptacle. Be certain this plug is in place during alignment. In receivers without the shorting link installed, short UHF input receptacle with a short piece of wire during alignment and leave shorting wire in place upon completion of alignment unless UHF tuner is to be installed.

ANTENNA & RF ALIGNMENT

1. Remove battery used in IF alignment and ground RF AGC bus (white lead or white lead with color tracer on rear of VHF tuner). Connect sweep generator to antenna input socket (with leads as short as possible) and adjust for 10 Mc sweep width. Connect oscilloscope through a 47K resistor to mixer test receptacle (see Figure 9).

2. Set tuner to channel 7 and sweep generator to 177 Mc center frequency. Set video marker to 175.25 and sound marker to 179.75. Adjust C-12 for response shown in Figure 9 (high channel response curve).

3. Set tuner to channel 13 and sweep generator to 213 Mc. Set video marker to 211.25 Mc and sound marker to 215.75 Mc. Adjust L-13 and L-9D for maximum amplitude and response shown in Figure 9 (high channel response curve).

4. Repeat step 2 and 3 as necessary for correct response.

5. Check response curve on channels 13 through 7, setting tuner on proper channel and generator at proper frequencies. (See chart for marker and sweep frequencies.)

6. Turn channel selector, sweep and marker to channel 7 and turn slug out of UHF input coil L-3 until it affects curve. Turn slug back into coil until its effect is completely out of the response curve. This is the proper point of tuning for this coil and no further tuning should be done.

7. Align low channel RF coils (channels 6 through 2) for proper markers as shown on low channel response curve (Figure 9), using proper sweep and marker frequencies. CAUTION: A small change in RF or oscillator coil length on low channels makes a rather large change in frequency. When required, antenna coil L-6 (channels 5 & 6), coil L-8B (channels 3 & 4) and coil L-8A (channel 2) may be adjusted for improved low channel response. While on channel 6, adjust FM trap coil L-1 so that it just starts to affect the curve on the sound side of the response. Be sure that the UHF coil L-3 is not affecting the channel 6 response. While on channel 2, set sweep and marker to 45 Mc and adjust IF trap coil L-2 for minimum response.

8. With station selector switch on channel 6 and RF sweep and marker on channel 7, adjust C-5 for minimum response.

9. With channel selector on UHF position and the sweep generator connected to UHF input receptacle and set at 44 Mc, adjust L-20 for symmetrical response and maximum amplitude. (Make certain shorting link is in UHF jack. See General Information.)

OSCILLATOR ALIGNMENT

PRELIMINARY INSTRUCTIONS

The oscillator is adjusted on each channel using the RF sound frequency of this channel for the marker. The marker must be placed slightly higher, in frequency, on the scope curve than the 41.25 Mc trap dip. This is to compensate for the change of oscillator frequency due to the tuner cover being removed. When cover is replaced, sound marker should move into trap dip within fine tuner rotation tolerances.

Tuner and sweep generator must be set to channel being aligned.

The marker generator is set to the sound frequency of channel being aligned. Use at least a 10 Mc sweep width, or more, if possible.

Waveform to be obtained is similar to that of mixer.

Consistent tilting of the curve, when sound marker is in the trap, indicates misalignment of the IF or mixer section.

PROCEDURE

1. Remove the ground added during IF procedure to pin 9 of 6U8 (oscillator).

2. Connect the oscilloscope (through a 47K ohm resistor) across the video load resistor R-37 (4.7K ohm) at the service test receptacle (pin 3). See IF alignment, Figure 8.

3. Set fine tuner for mid-capacity position (increasing capacity in the counterclockwise direction).

HIGH-BAND ALIGNMENT

4. Adjust oscillator trimmer C-22 on channel 10, using channel 10 sound marker and placing it just above trap null. See Figure 8 and preliminary instructions.

5. Check channels 7 through 13 for correct marker positions (use proper markers and fine tuner, if necessary). A fine tuner rotation of over plus or minus 30 degrees from midpoint, to move marker into trap dip, requires:

a. Adjustment of coil L-17 on channel 13, for compensation of channels 10 through 13.

b. Readjustment of trimmer C-22 on channel 10, for compensation of channels 7 through 10. Recheck marker positions on channels 7 through 13.

LOW-BAND ALIGNMENT

6. Reduce the capacity of fine tuner by rotating 15 degrees clockwise from mid-capacity position.

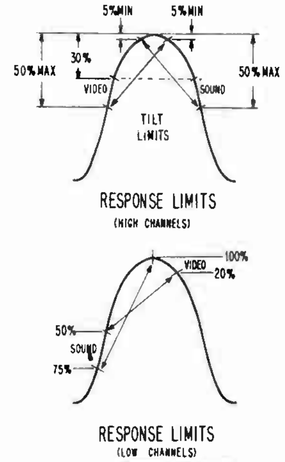
7. Adjust channel 6 oscillator coil, using channel 6 sound marker. Refer to Figure 8 and preliminary instructions. Accuracy of alignment on this channel is extremely important in the alignment of the remaining low-band coils.

8. Adjust oscillator coils of channels 5 through 2 in descending order, using proper markers.

FREQUENCY CHART			
CHANNEL NUMBER	SWEEP GENERATOR CENTER	SOUND MARKER (RF COILS)	PICTURE MARKER ANT COILS
2	57MC	59.75	55.25
3	63MC	65.75	61.25
4	69MC	71.75	67.25
5	79MC	81.75	77.25
6	85MC	87.75	83.25
7	177MC	179.75	175.25
8	183MC	185.75	181.25
9	189MC	191.75	187.25
10	195MC	197.75	193.25
11	201MC	203.75	199.25
12	207MC	209.75	205.25
13	213MC	215.75	211.25

HIGH CHANNEL LIMITS
ON CHANNELS 7 TO 13, EITHER MARKER MAY BE DOWN 50% FROM PEAK, PROVIDED OPPOSITE MARKER DOES NOT FALL BELOW THE PEAK BY MORE THAN 30% OR LESS THAN 5%

LOW CHANNEL LIMITS
ON CHANNELS 2 TO 6, THE SOUND MARKER MAY BE DOWN NO LESS THAN 50% OR NO MORE THAN 75% FROM PEAK AND THE VIDEO MARKER MAY BE DOWN NO MORE THAN 20% FROM PEAK.



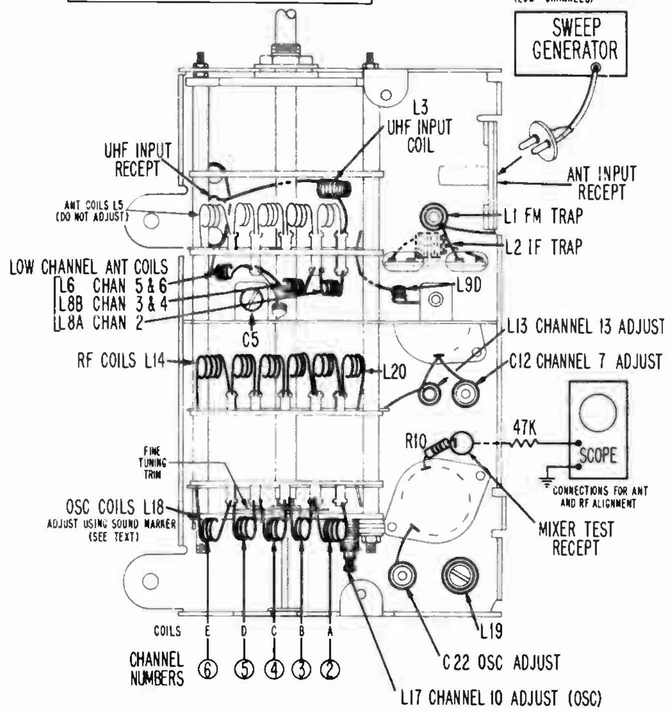


FIGURE 9. TUNER ALIGNMENT DETAIL

NOTE: WHEN TUNER COVER IS REPLACED, ALL SOUND MARKERS MUST MOVE INTO TRAP DIP WITHIN FINE TUNER ROTATION LIMITS. LIMITS ARE ±15° FROM MID-POSITION ON LOW CHANNELS AND ±30° FROM MID-POSITION ON HIGH CHANNELS.

RECEIVER SENSITIVITY TESTS

IF Sensitivity Tests

1. Set contrast control at minimum, disable horizontal sweep by removing horizontal output tube and normalize voltages by connecting a 2500 ohm 10 watt resistor from B++ to ground.

2. Stop oscillator by shorting pin 9 V-2, to ground.

3. Short IF AGC bus to ground (pin 1 of service test receptacle).

4. Set channel selector to channel 13.

5. Connect high side of VTVM to pin 3 of service test receptacle and other lead to chassis ground.

6. Inject a 45 Mc signal, with no modulation into IF test receptacle through a 1000 mmf capacitor. Less than 600 microvolts should be required to produce a one volt DC rise above noise at the detector load (pin 3 of service test receptacle).

7. Short out R-10 (4700 ohm) at V-2 (mixer) grid.

8. Inject the generator into mixer test receptacle. Less than 75 microvolts should be required to produce a one volt DC rise above noise at the detector load.

Overall Sensitivity Test

9. Remove short on R-10 and oscillator and inject generator signal into antenna input (use resistor matching network when necessary). Set generator to the center frequency of channel being checked with 30% modulation. Set fine tuning and contrast for maximum output. A peak-to-peak reading of 18 volts AC should be produced at the picture tube cathode with generator outputs of less than 15 microvolts on channels 2 through 6 and less than 25 microvolts on channels 7 through 13. This voltage may be read with a calibrated oscilloscope. To calibrate scope, connect the vertical deflection plates to a source of 6.3 volts (filament supply). This will equal approximately 18 volts peak-to-peak (6.3 x 2.4).

Sound Sensitivity Tests

10. Connect signal generator through a 5000 mmf capacitor into the video detector load (pin 3 of service test receptacle). Inject a 4.5 Mc unmodulated signal at this point.

11. Connect VTVM (DC scale) to the positive terminal of electrolytic capacitor C-50B and connect ground lead to chassis.

12. A 5000 microvolt signal should produce approximately 10 volts.

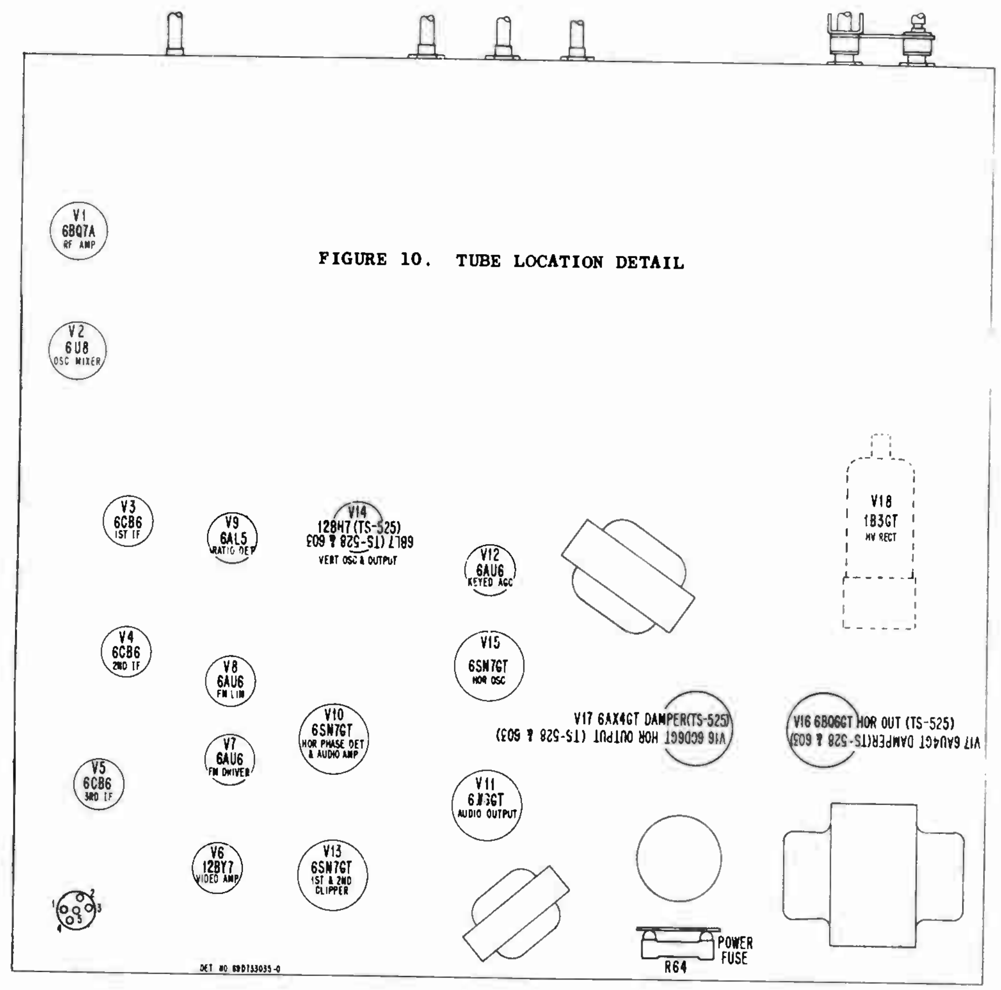


FIGURE 10. TUBE LOCATION DETAIL

SERVICE NOTES

PICTURE TUBE REPLACEMENT

To replace picture tube:

1. Remove second anode connector and short the picture tube anode to ground with a well insulated piece of wire.

2. Carefully remove picture tube socket and ion trap magnet.

3. Remove screws holding picture tube clamping band and remove band.

4. Carefully remove picture tube using caution not to damage yoke with neck of tube and not to exert any undue pressure on the tube itself.

5. Insert new tube carefully into yoke and position tube tightly against the front support bracket lugs. If at this time the rear tube support does not bear against the flare of the tube or, if it requires pressure to insert tube behind the mounting lugs, loosen rear tube support bracket mounting screws and slide forward or backward to fit against tube without forcing. If the bracket is too tight, it will cause mispositioning of the yoke. Tighten rear support bracket screws.

6. Reinstall picture tube clamping band and tighten screws securely.

7. Replace ion trap magnet, picture tube socket, and second anode connector. Loosen yoke adjustment thumbscrew and yoke saddle screws and push the yoke up against the flare of the tube. Tighten all screws.

8. Readjust yoke, ion trap and centering device.

REMOVAL OF CABINET SAFETY GLASS

1. Remove the screws and molding strip located along top edge of glass.

2. Safety glass will move outward from cabinet allowing its removal by lifting out of lower retaining channel.

3. When replacing, position rubber on glass with low side of channel facing inside of cabinet.

4. Replace molding and screws.

TONE CONTROL LINKAGE

To replace or adjust tone control linkage:

1. Set control maximum counterclockwise and install linkage with arms on top and rotated fully counterclockwise. Tighten screw.

2. With chassis in cabinet, install knob with lettering to the top.

CHANGING OF TUBES (Refer to Figure 10)

INDISCRIMINATE CHANGING OR INTERCHANGING OF TUBES MUST BE AVOIDED.

a. A change of IF or RF tubes may affect alignment. Always check alignment and sensitivity after these changes.

b. A change of audio circuit tubes may cause buzz, loss of sensitivity, and distortion. Check audio alignment and sensitivity.

c. Changing horizontal oscillator tube may cause horizontal control to be out of range and poor noise rejection. This may require readjustment of horizontal oscillator coil.

FUSE REPLACEMENT

B+ and initial surge: 7.5 ohm special resistor
Filament: fusing wire; 1" of #26 copper wire

B+ and initial surge fuse (special 7.5 ohm resistor R-64)
This fuse is of the plug-in type and is accessible by removing the cabinet back. See Figure 2 for location.

Filament fuse F-1 (1" #26 copper wire)
To replace the filament fuse, the chassis must be removed from the cabinet. See Figure 11 for location. Use a piece of #26 copper wire 1" long, soldered between the two lugs.

SERVICE TEST RECEPTACLE

A SERVICE TEST RECEPTACLE, accessible from the top of the chassis (see Figure 2) provides the following test points:

Pin	Connection To
1	IF AGC
2	B+
3	Video detector output
4	Filament
5	B++

These test points are available to the technician merely by removal of the receiver cabinet back and provide rapid checking of the power supply voltages -- giving the approximate condition of the selenium rectifiers and the line voltage. The filament connection checks the filament fuse as well as the voltage output of the filament transformer. Operation of the receiver from the antenna to the detector may be checked by the use of pin #3 (detector output). Pin #1 allows rapid checking of the IF AGC voltage. It is suggested that this voltage be checked and recorded at the first opportunity by the service technician using a receiver in normal operating condition. Such IF AGC voltage information may be invaluable when checking sets in which the AGC action is doubtful. This voltage varies according to the signal strength and may range from a very low value to about 8 volts minus.

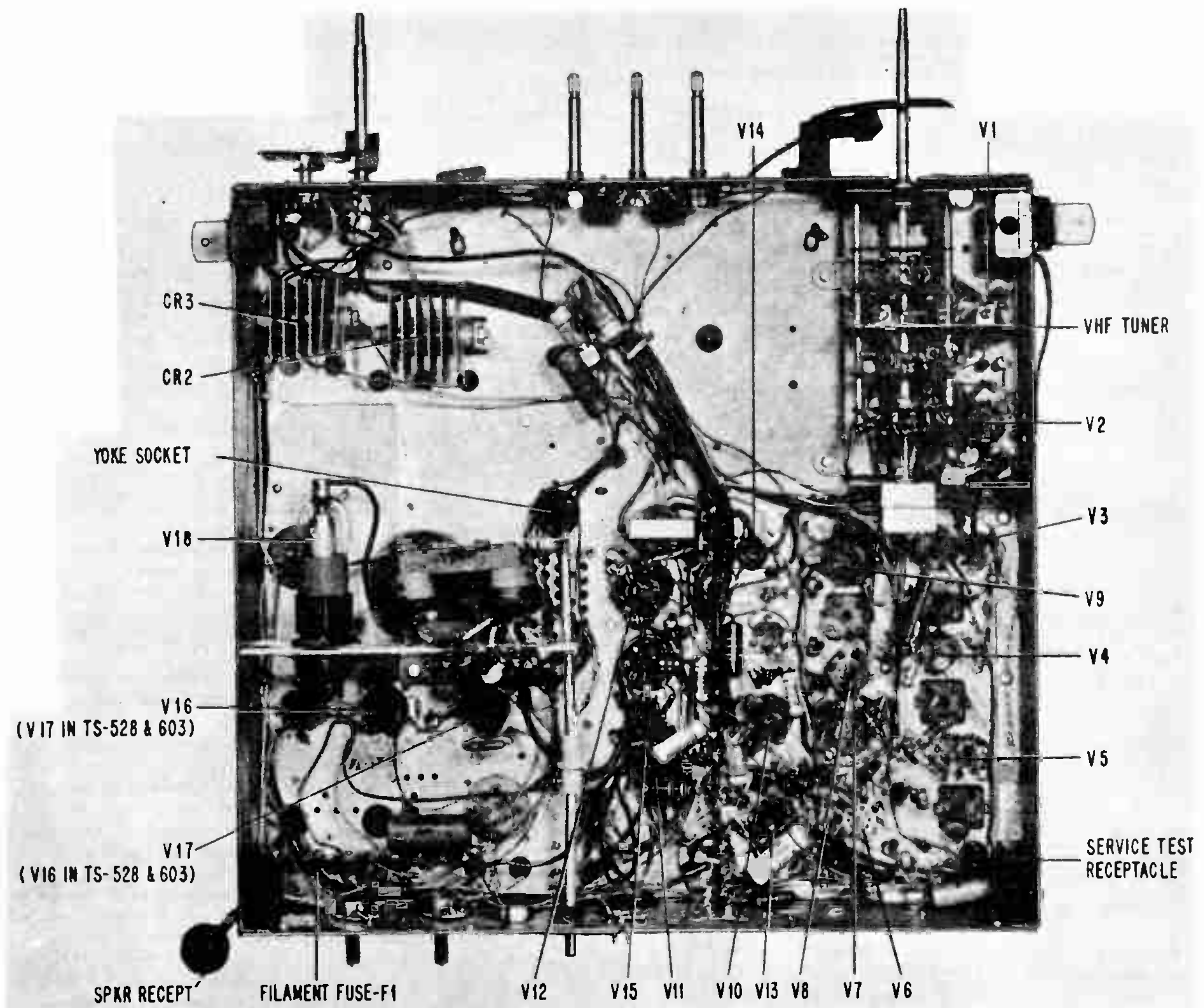


FIGURE 11. BOTTOM VIEW OF CHASSIS

SERVICE AID CHART

The following chart is designed as an aid to the technician as well as a guide to Motorola dealers, salesmen and non-technical people who may be called upon to correct some of the more simple troubles in television receivers. This chart is planned so that the more readily corrected difficulties are in the first column, the more complicated problems in the second column, etc.

In general, the information given in the MISCELLANEOUS CHECKS column should only be attempted by a trained technician.

Be certain that all applicable remedies in each section are attempted before continuing to the next column.

The television screen supplies an abundance of visible information, therefore, examine the screen very carefully, determine possible source of trouble and then proceed to make the adjustments and repairs as described in the chart.

If moving the adjustments or controls does not rectify the troubles, return them to their original position.

Turn the set to the "OFF" position when replacing tubes and replace only one tube at a time.

Before removing the picture tube, acquaint yourself with the PICTURE TUBE HANDLING PRECAUTIONS.

The following should be used in conjunction with the chart: Figure 1 (Operating Controls), Figure 2 (Rear View of Chassis) and Figure 10 (Tube Location).

This chart, if used wisely, may be of assistance even in problems not listed in this chart as in the case of a set having multiple troubles. Handling these troubles as individual problems regardless of accompanying symptoms may simplify the repairs.

TROUBLE CHART

SYMPTOM	CONTROLS	CHECK OR ADJUST	TUBES	MISCELLANEOUS CHECKS
SET DEAD (tubes not lighting)	Off-On volume	Is set plugged in? Is back cover on? Is AC line voltage available at outlet? (Check with lamp)		Filament fuse F-1
(tubes are lit)		Power fuse, R-64. Is speaker plugged in? Replace any tubes that do not light.	V-11	
NORMAL RASTER NO PICTURE NO SOUND	Channel selector (on station?)	Antenna connections. Is station on air?	V-1, 2, 3, 4, 5, 11 & 12	B+ voltage. Video detector, CR-1. AGC voltage. RF, IF or mixer stages.
WEAK PICTURE (insufficient contrast)	Contrast. Fine tuning. Channel selector on correct channel?	Antenna connections	V-1, 2, 3, 4, 5, 6 & 12	AGC voltage. Contrast control. RF, IF, mixer & AGC stages
LOW BRIGHTNESS OR NO RASTER	Brightness.	Ion trap magnet	V-15, 16, 17, 18, 19 & 11	High voltage at picture tube anode. Drive voltage, pin 5 V-16. Bootstrap voltage. B+, B++ and CRT voltages. Solder connections, base of CRT. Voltages & waveforms in V-15 & V-16 circuits. Horizontal output transformer & deflection yoke.
POOR VERTICAL LINEARITY AND/OR SIZE. HORIZ. WHITE LINE. (no vert. sweep)	Vertical size. Vert lin. Reduce brightness & return to normal when trouble is cleared.		V-14	Bootstrap voltage. Voltages in V-14 circuit. Electrolytics, C-99 & C-74C. Vertical output transformer & deflection yoke.
VERTICAL INSTABILITY, PICTURE ROLLS	Vertical hold		V-13, 14	AGC voltage. Voltages in V-13 & V-14A circuit. Interference. Sync clipping at video amplifier. Refer to tests under WEAK PICTURE. Abnormal power supply ripple. Insufficient bootstrap filtering. Video detector.

LOSS OF VERTICAL AND HORIZ. HOLD	Horiz. hold. Vert. hold.	Weak signal. Antenna and lead-in	V-13	B+ voltage. AGC voltage. Refer to test under VERTICAL INSTABILITY & NO HORIZ. HOLD.
NO HORIZ. HOLD OR CRITICAL HORIZ. HOLD	Horiz. hold	Horiz. osc. coil	V-10, 13, & 15	Refer to special "SERVICE HINTS". Waveforms in V-10B & V-15 circuits. Refer to tests under WEAK PICTURE.
INSUFFICIENT HORIZ. SIZE	Horiz. size	Center picture	V-15, 16 & 17	Bootstrap voltage. Drive voltage, pin 5, V-16. Deflection yoke and horiz. output transformer.
PICTURE NORMAL, NO SOUND OR WEAK SOUND	Fine tuning volume		V-7, 8, 9, 10 & 11	Speaker & speaker plug. Output transformer. Voltages of V-10, V-11. Sound alignment.
BUZZ IN SOUND	Fine tuning contrast	Excessive signal	V-7, 8, 9, 10 & 11	Ratio det. alignment. Sync clipping in video section. Improper AGC action. Power supply filter & sweep circuit bypass capacitors. Heater-cathode shorts in sound tubes.
VHF - NO UHF	UHF tuning UHF switch	Antenna connections	UHF Osc 6AF4	
MICROPHONICS VISUAL & AUDIBLE		Binding knobs & control shafts		Tap tubes -look & listen for microphonics.
INSUFFICIENT PICTURE SIZE HORIZ. & VERT.		Check AC line voltage		Power supply voltages Selenium rectifiers.
EXCESSIVE CONTRAST, NEGATIVE PICTURE	Contrast		V-1, 2, 3, 4, 5, 6 & 12	AGC voltage and AGC circuit. Video det. Video det. load resistor. Leakage between prim. & sec. in video IF coils. Proper pulse from horiz. output to AGC tube. Pulse coupling capacitor to AGC tube C-107 RF AGC delay resistors R-21, R-22
WIDE HORIZ. BAR OR GRADUATION IN SHADING VERTICALLY (Set may have poor vert. sync)			V-1, 2, 3, 4, 5, & 6	Heater-cathode short in any video circuit. Excessive power supply ripple (may have hum in audio). Selenium rectifiers. Heater-cathode short in V-10A (loud hum in audio). Picture tube.
INTERFERENCE IN PICTURE	Fine tuning	Ant. location Lead-in location Ant. type	V-16	Improper adjustment of 41.25 Mc and 4.5 Mc traps. Improper alignment. Open screen & decoupling bypass capacitors. Poor filter capacitors. High voltage arcs - corona. Other receivers in immediate vicinity. Radiation from signal sources in immediate vicinity. Improper horiz. hold coil adj.

PRODUCTION CHANGES

A-01 thru A-03 (TS-525 series only)

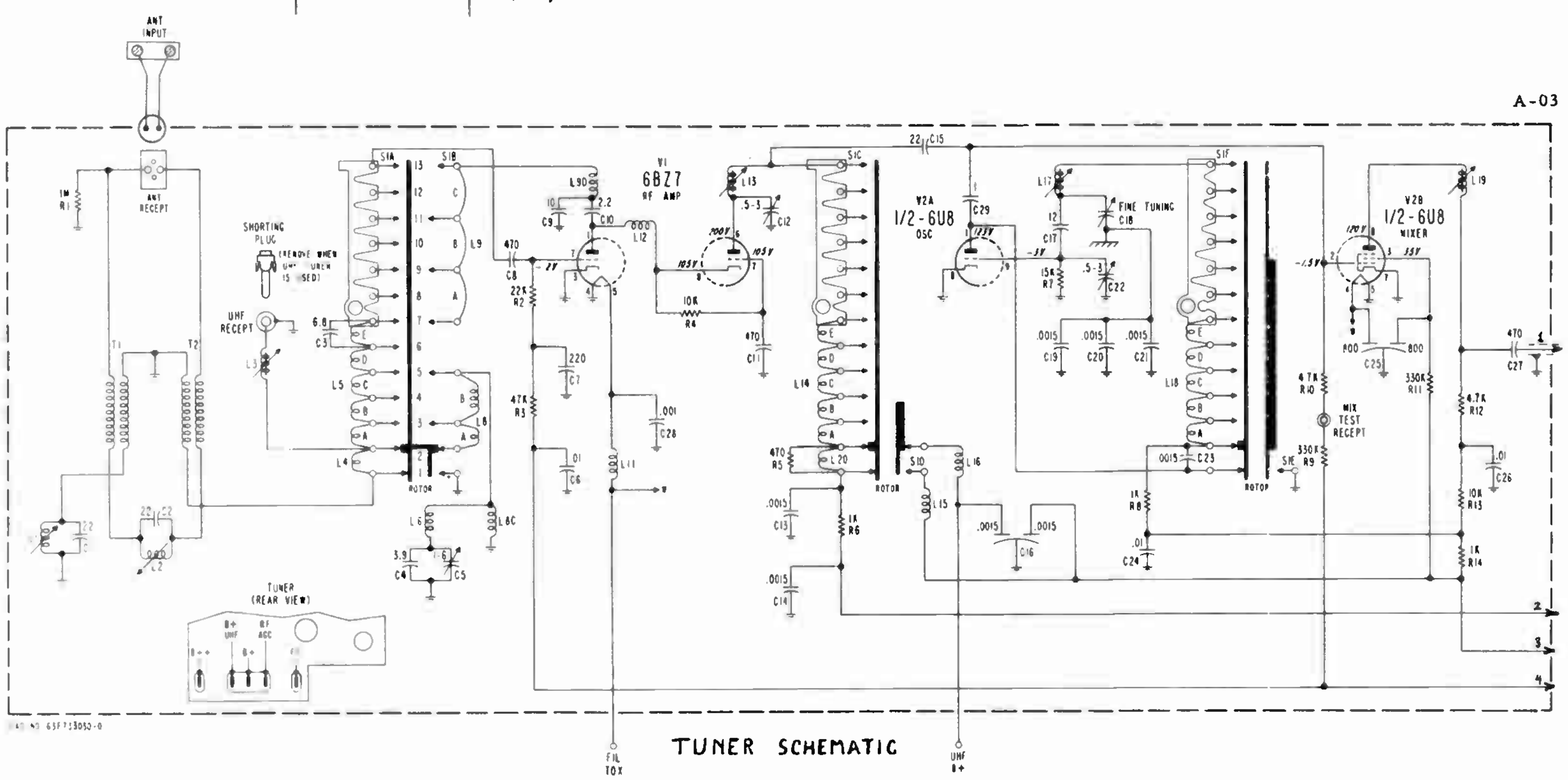
TV CHASSIS CODING

The first production chassis number carries the suffix "A-00" (i.e., TS-525A-00). With the first minor electrical revision, the suffix becomes "A-01" and with each subsequent minor change "A-02", "A-03", etc. The first major revision changes the suffix to "B-00" and, as before, each following minor change is labeled "B-01", etc.

Mechanical differences between chassis are indicated by addition of a prefix to the basic chassis (i.e., RTS-525A-00). These prefixes may be assigned in random sequence but will be confined to the end of the alphabet to avoid confusion with the A, B, C, etc., electrical change suffixes.

A "Y" suffix added to basic chassis (i.e., TS-525YA-00, etc.) indicates that the chassis contains a factory-installed UHF tuner.

Chassis Coding	Changes
(TS-525 Series Only)	
A-01	To improve the IF response C-38 (470 mmf) changed to .001 mf; C-40 (560 mmf) moved to a direct chassis ground.
A-02	To aid the magnetic centering device in horizontal centering and reduce neck shadows, a non-adjustable horizontal centering circuit is added as follows: 1. C-106 (.1 mf) replaced with linearity coil L-44 to provide a DC path through the horizontal deflection yoke. 2. Connection between lugs 4 and 5 of the horizontal output transformer (T-13) removed and an 18 ohm resistor inserted between lugs 4 and 5 to force current through yoke. 3. Leads of L-41 (RF choke) and R-83 (150K resistor) connect to lug 4 of the output transformer; the lead of L-44 connects to lug 5.
A-03	R-66 (4.7M grid to ground resistor of 1st sync separator) changed to 1.5M and ground end re-connected to cathode (pin 3) of V-13 to improve sync range at high contrast levels. NOTE: A-02 changes not incorporated into all A-03 chassis.



TUNER SCHEMATIC

CAPACITOR VALUES UNDER 1000 ARE IN MMF
ALL OTHERS IN MF UNLESS OTHERWISE SPECIFIED

⊥ = GND TO CHASSIS   = GND TO TUNER SHAFT

NOTES

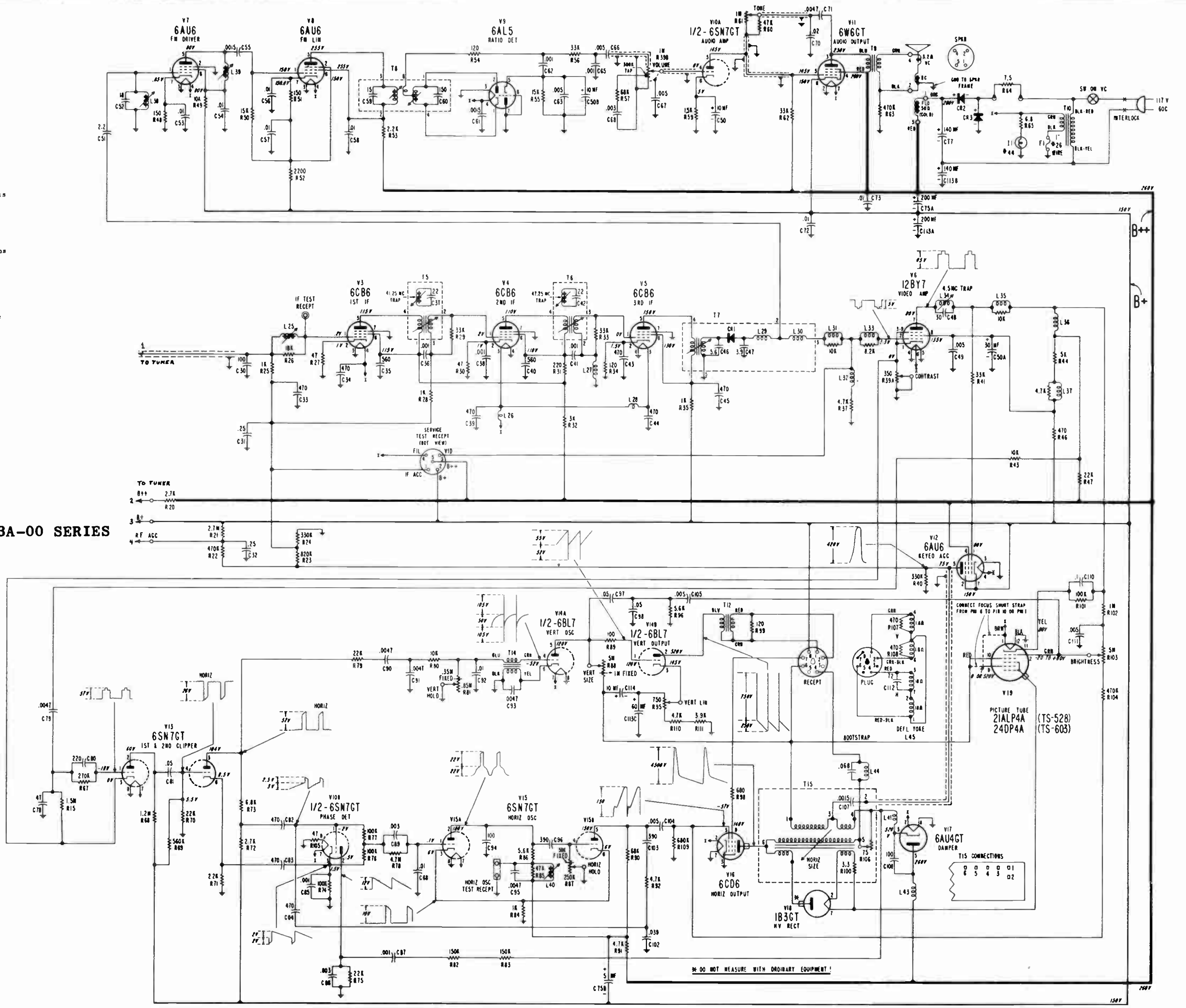
VOLTAGE MEASUREMENTS

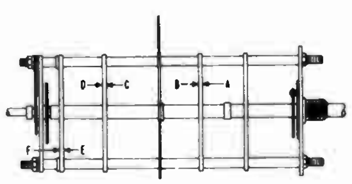
1. Made with a VTVM from point indicated to chassis
2. Line voltage - 117 volts
3. Antenna disconnected
4. Channel selector switch on channel which develops less than 1 volt noise at pin 3 of test recept
5. Contrast control maximum clockwise position
6. All other controls in normal operating position
7. Voltages associated with circuits having variable controls may vary with control settings

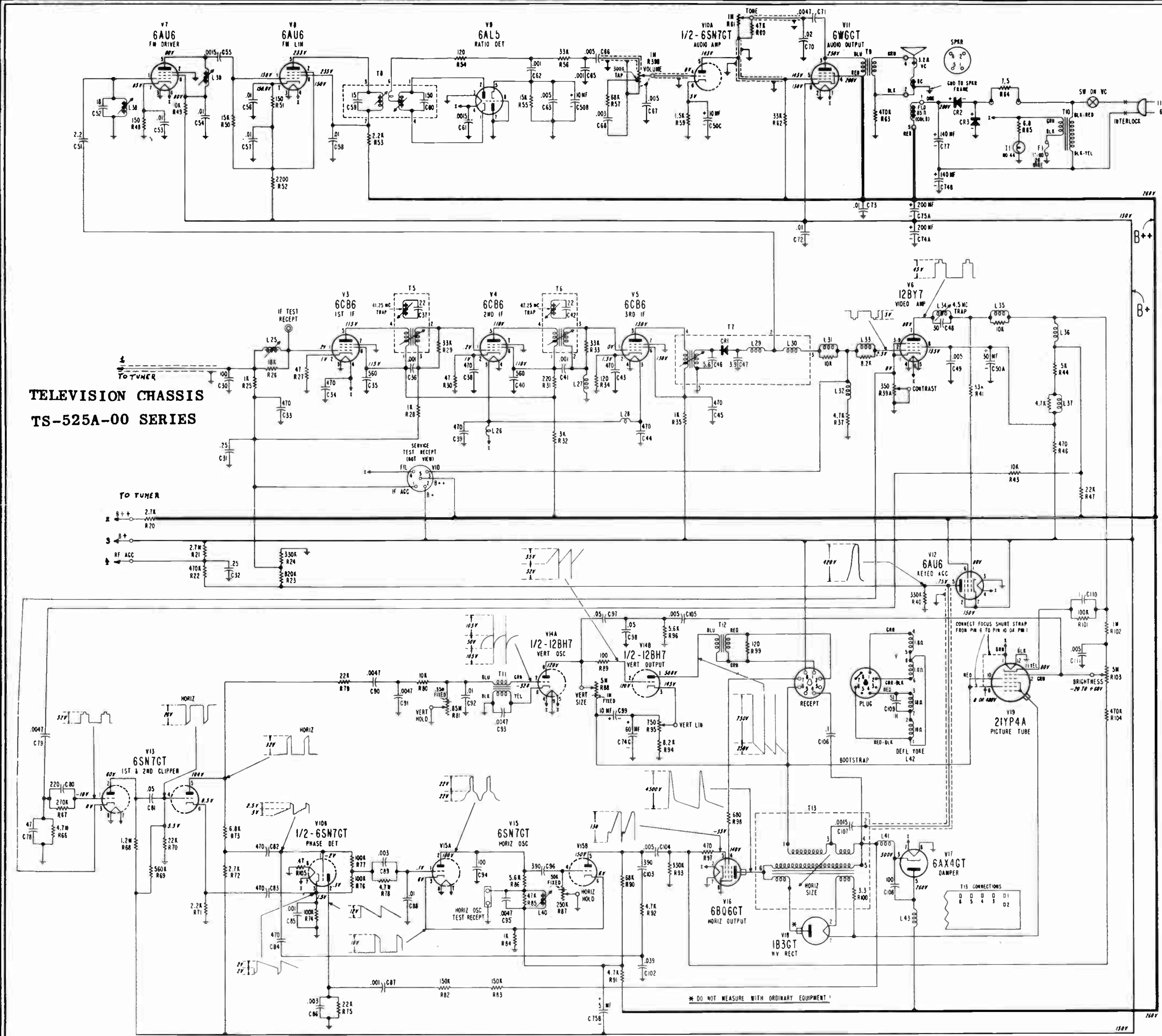
WAVEFORMS

1. Observed on Dumont Model 241 oscilloscope
2. Contrast control set for signal of 45V P to P at plate of video amp tube
3. All other controls in normal operating position
4. Horizontal output tube removed to eliminate HV pulse interference from scope when observing all waveforms, except those from phase det through horiz circuit

TELEVISION CHASSIS TS-528 & 603A-00 SERIES







TELEVISION CHASSIS
TS-525A-00 SERIES

PARTS LIST

Ref. No.	Part Number	Description	List Price
Capacitors (Cer = Ceramic; Tub = Tubular; Mld = Molded			
C-1	21R120539	Cer Disc: 22 mmf 500V......	.15
C-2	21R120539	Cer Disc: 22 mmf 500V......	.15
C-3	21R120561	Cer Tub: 6.8 mmf 500V......	.25
C-4	21R115953	Mld Phenolic: 3.9 mmf 500V.	.25
C-5	20K731175	Trimmer: 1-6 mmf...........	.25
C-6	21R482726	Cer Disc: .01 mf 500V......	.30
C-7	21R410115	Cer Disc: 220 mmf 500V.....	.25
C-8	21R115856	Cer Tub: 470 mmf 500V......	.25
C-9	21R121837	Feed Thru: 10 mmf..........	.30
C-10	21R115948	Mld Phenolic: 2.2 mmf 500V.	.25
C-11	21R121478	Cer Disc: 470 mmf 500V.....	.40
C-12	21K710943	Trimmer: .5-3 mmf..........	.25
C-13	21R120100	Cer Disc: .0015 mf 500V....	.25
C-14	21R120100	Cer Disc: .0015 mf 500V....	.25
C-15	21R119049	Cer Tub: 22 mmf 500V.......	.35
C-16	21R121406	Cer Disc: dual .0015 mf 500V......................	.25
C-17	21R121110	Cer Tub: 12 mmf 500V.......	.35
C-18	-	Trimmer, fine tuning (part of chan sel sw)............	-
C-19	21R120100	Cer Disc: .0015 mf 500V....	.25
C-20	21R120100	Cer Disc: .0015 mf 500V....	.25
C-21	21R120100	Cer Disc: .0015 mf 500V....	.25
C-22	21K710943	Trimmer: .5-3 mmf..........	.25
C-23	21R120100	Cer Disc: .0015 mf 500V....	.25
C-24	21R482726	Cer Disc: .01 mf 500V......	.30
C-25	21R400943	Cer Disc: dual 800 mmf 500V	.40
C-26	21R482726	Cer Disc: .01 mf 500V......	.30
C-27	21R121478	Cer Disc: 470 mmf 500V.....	.40
C-28	21R115386	Cer Disc: .001 mf 500V.....	.25
C-29	21R114071	Cer Mld: 1 mmf 500V........	.25
C-30	21R410036	Cer Disc: 100 mmf 500V.....	.25
C-31	8R121575	Paper Tub: .25 mf 200V.....	.35
C-32	8R121575	Paper Tub: .25 mf 200V.....	.35
C-33	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-34	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-35	21R120936	Cer Disc: 560 mmf 500V.....	.25
C-36	21R115386	Cer Disc: .01 mf 500V......	.25
C-37	21R120539	Cer Disc: 22 mmf 500V......	.15
C-38	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-39	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-40	21R120936	Cer Disc: 560 mmf 500V.....	.25
C-41	21R115386	Cer Disc: .001 mf 500V.....	.25
C-42	21R120539	Cer Disc: 22 mmf 500V......	.15
C-43	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-44	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-45	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-46	21A732738	Cer Disc: 5.6 mmf 750V.....	.35
C-47	21R115953	Mld Phenolic: 3.9 mmf 500V.	.25
C-48	21R410048	Cer Disc: 30 mmf 500V......	.25
C-49	21R115312	Cer Disc: .005 mf 500V.....	.25
C-50	23B733494	Electrolytic: 3-section; 10-10 mf/50V; 30 mf/150V...	1.85
C-51	21R115949	Mld Phenolic: 2.2 mmf 500V.	.25
C-52	21R120578	Cer Disc: 18 mmf 500V......	.25
C-53	21R482726	Cer Disc: .01 mf 500V......	.30
C-54	21R482726	Cer Disc: .01 mf 500V......	.30
C-55	21R120100	Cer Disc: .0015 mf 500V....	.25
C-56	21R482726	Cer Disc: .01 mf 500V......	.30
C-57	21R482726	Cer Disc: .01 mf 500V......	.30
C-58	21R482726	Cer Disc: .01 mf 500V......	.30
C-59	21K790439	Silver Mica: 15 mmf 500V...	.25
C-60	21A790131	Cer Tub: 150 mmf 500V......	.25
C-61	21R120100	Cer Disc: .0015 mf 500V....	.25
C-62	21A121678	Cer Disc: .001 mf 500V.....	.25
C-63	21R115312	Cer Disc: .005 mf 500V.....	.25
C-65	21A121678	Cer Disc: .001 mf 500V.....	.25
C-66	21R115312	Cer Disc: .005 mf 500V.....	.25
C-67	21R115312	Cer Disc: .005 mf 500V.....	.25
C-68	8R121569	Mld Paper Tub: .003 mf 200V	.30
C-70	8R121566	Mld Paper Tub: .02 mf 400V.	.25
C-71		Paper Tub: .0047 mf 1000V..	
C-72	21R482726	Cer Disc: .01 mf 500V......	.30
C-73	21R482726	Cer Disc: .01 mf 500V......	.30
C-74	23B733495	Electrolytic: 3-section; 60-140-200 mf/150V.........	4.35

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part Number	Description	List Price
C-75	23B710941	Electrolytic: 2-section; 5-200 mf/150V	3.10
C-77	23B484097	Electrolytic: 140 mf/150V	2.20
C-78	21R115593	Cer Disc: 47 mmf 500V	.25
C-79	8K490222	Mld Paper Tub: .0047 mf 400V	.25
C-80	21R115905	Cer Tub: 220 mmf 500V	.25
C-81	8R121567	Mld Paper Tub: .05 mf 400V	.25
C-82	21R115856	Cer Tub: 470 mmf 500V	.25
C-83	21R115856	Cer Tub: 470 mmf 500V	.25
C-84	21R115856	Cer Tub: 470 mmf 500V	.25
C-85	21R114749	Cer Tub: .001 mf 500V	.25
C-86	8R121569	Paper Tub: .003 mf 600V	.30
C-87	8K490268	Mld Paper Tub: .001 mf 1000V	.35
C-88	8R121002	Paper Tub: .01 mf 400V	.25
C-89	8R121569	Paper Tub: .003 mf 600V	.30
C-90	8K490222	Mld Paper Tub: .0047 mf 400V	.25
C-91	8K490222	Mld Paper Tub: .0047 mf 400V	.25
C-92	8K490226	Mld Paper Tub: .01 mf 400V	.25
C-93	21R120149	Cer Disc: .0047 mf 500V	.35
C-94	21R115900	Cer Tub: 100 mmf 500V	.25
C-95	8K490222	Mld Paper Tub: .0047 mf 400V	.25
C-96	21K114740	Mica: 390 mmf 500V	.50
C-97	21R121567	Paper Tub: .05 mf 400V	.25
C-98	21R121567	Paper Tub: .05 mf 400V	.25
C-99	23A702450	Electrolytic: 10 mf/450V	1.40
C-102	8K490231	Mld Paper Tub: .039 mf 400V	.35
C-103	21K114740	Mica: 390 mmf 500V	.50
C-104	21R115312	Cer Disc: .005 mf 500V	.25
C-105	21R120093	Cer Disc: .005 mf 2000V	.75
C-106	8K120875	Paper Tub: .1 mf 200V	.25
C-107	21R121863	Cer Disc: .0015 mf 2000V	.75
C-108	21R121424	Cer Disc: 100 mmf 3000V	.40
C-109	21K710903	Cer Disc: 47 mmf 1500V	.35
or	21R120224	Cer Disc: 51 mmf 1500V	.35
C-110	8K120875	Paper Tub: .1 mf 200V	.25
C-111	21R115312	Cer Disc: .005 mf 500V	.25
C-112	21R121936	Cer Disc: 72 mmf 1500V	.35
C-113	23B731523	Electrolytic: 3-section; 60 mf/200V; 140-200 mf/150V	4.35
C-114	23B731537	Electrolytic: 10 mf/500V	1.40
CR-1	48C711052		
or	48K733204		
or	48K711077		
or	48K722720		
or	48K733158		
or	48K712199	Crystal, diode	1.50
CR-2,3	48B733249	Selenium Rectifier: 325 ma.	2.90
or	48B731643	Selenium Rectifier: 350 ma.	2.90
L-1	24A734306	Coil, IF trap	.15
L-2	24A734307	Coil, FM trap	.15
L-3	24A731036	Coil, UHF input	.10
L-4	24A732652	Choke, RF	.05
L-5	24K734309	Coil, ant pri: incl L-5A thru E	.15
L-6	24K734304	Trap, low channel	.05
L-8	24C734302	Coil, low channel ant pri & channel 6 interference trap: includes L-8A thru C	.25
L-9	24K734303	Coil, high chan ant pri: incl L-9A thru C	.10
L-10	24K730391	Choke, filament	.05
L-11	24K730391	Choke, filament	.05
L-12	24B721256	Coil, neutralization	.05
L-13	24A734305	Coil, chan 13 RF	.15
L-14	24B734379	Coil, RF: incl L-14A thru E	.25
L-15	24A732652	Choke, RF	.05
L-16	24A732652	Choke, RF	.05
L-17	24A730726	Coil, chan 13 osc	.15
L-18	24K730839	Coil, osc: incl L-18A thru E	.15
L-19	24B734308	Coil, mixer pri	.95
L-20	24A734380	Coil, UHF RF	.65
L-25	24K733875	Coil, mixer sec: with core.	.25
L-26	24K730391	Choke, filament	.05
L-27	24K792577	Choke, RF	.20

Ref. No.	Part Number	Description	List Price
L-28	24K730391	Choke, filament	.05
L-29	24R119889	Coil, resonant: yel-blue code	.20
L-30	24R119889	Coil, resonant: yel-blue code	.20
L-31	24R120588	Coil, compensating: wound on 10K res; red code	.25
L-32	24R119854	Coil, compensating: red-violet code	.20
L-33	24R121728	Coil, compensating: wound on 8.2K res	
L-34	1V730808	Trap, 4.5 mc: with core; brn-yel code	.70
L-35	24R120984	Coil, compensating: wound on 10K res; red-yel code	.20
L-36	24R119850	Coil, compensating: brn-gray code	.15
L-37	24K734187	Coil, compensating: brn-brn code	.35
L-38	24K703312	Coil, audio take-off	.50
L-39	24B733873	Coil, interstage: brn-gray code	.40
L-40	1V732555	Coil, horiz osc	1.45
L-41	24A733225	Choke, RF	.10
L-42	24C733436		
or	24C733411		
or	24K732711	Yoke, defl: 70°; with plug; less centering device (TS-525 series)	10.25
L-43	24A733225	Choke, RF	.10
L-44	24A731609	Coil, linearity	1.10
L-45	24D733239	Yoke, defl: 90°; with plug; less centering device (TS-528 & 603 series)	16.25
Resistors	Note:	All resistors are insulated carbon type unless otherwise specified	
R-1	6R6004	1 meg 20% 1/2W doz	1.20
R-2	6R6397	22,000 10% 1/2W doz	1.20
R-3	6R6056	47,000 20% 1/2W doz	1.20
R-4	6R6054	10,000 20% 1/2W doz	1.20
R-5	6R6090	470 10% 1/2W doz	1.20
R-6	6R6301	1000 20% 1/2W doz	1.20
R-7	6R2119	15,000 20% 1/2W doz	1.20
R-8	6R6301	1000 20% 1/2W doz	1.20
R-9	6R6014	330,000 20% 1/2W doz	1.20
R-10	6R6039	4700 20% 1/2W doz	1.20
R-11	6R6014	330,000 20% 1/2W doz	1.20
R-12	6R6039	4700 20% 1/2W doz	1.20
R-13	6R6054	10,000 20% 1/2W doz	1.20
R-14	6R6301	1000 20% 1/2W doz	1.20
R-15	6R6460	1.5 meg 10% 1/2W doz	1.20
R-20	6R5685	2700 10% 1W	.20
R-21	6R488186	2.7 meg 5% 1/2W doz	1.75
R-22	6R400205	470,000 5% 1W	.20
R-23	6R2053	820,000 10% 1W	.20
R-24	6R2096	330,000 10% 1/2W doz	1.20
R-25	6R6301	1000 20% 1/2W doz	1.20
R-26	6R5591	18,000 10% 1/2W doz	1.20
R-27	6R5550	47 10% 1/2W doz	1.20
R-28	6R6301	1000 20% 1/2W doz	1.20
R-29	6R6410	33,000 10% 1/2W doz	1.20
R-30	6R5550	47 10% 1/2W doz	1.20
R-31	6R3933	220 20% 1/2W doz	1.20
R-32	17K733878	Wire Wound: 3000 10% 5W	.80
R-33	6R6410	33,000 10% 1/2W doz	1.20
R-34	6R5551	120 10% 1/2W doz	1.20
R-35	6R6301	1000 20% 1/2W doz	1.20
R-37	6R6080	4700 10% 1/2W doz	1.20
R-39	18B733314	Dual Control & Switch: volume - 1 meg tapped at 300K; contrast - 350	2.25
R-40	6R5717	330,000 10% 1W	.20
R-41	6R6410	33,000 10% 1/2W doz	1.20
R-43	6R6320	10,000 10% 1/2W doz	1.20
R-44	17R121123	Wire Wound: 5000 5W	.80
R-46	6R5593	470 10% 1W	.20
R-47	6R2098	22,000 10% 2W	.25
R-48	6R3992	150 20% 1/2W doz	1.20
R-49	6R6430	10,000 10% 1W	.20
R-50	6R6477	15,000 10% 1/2W doz	1.20
R-51	6R3992	150 20% 1/2W doz	1.20

Ref. No.	Part Number	Description	List Price
R-52	6R6290	2200 20% 1/2W doz	1.20
R-53	6R6290	2200 20% 1/2W doz	1.20
R-54	6R5551	120 10% 1/2W doz	1.20
R-55		15,000 20% 1W	.20
R-56	6R6012	33,000 20% 1/2W doz	1.20
R-57	6R6001	68,000 20% 1/2W doz	1.20
R-59	6R400459	1500 5% 1/2W doz	1.20
R-60	6R6048	47,000 10% 1/2W doz	1.20
R-61		Tone Control: 1 meg; nut mtg	
or	18A733887	Tone Control: 1 meg; twist lug mtg	.55
R-62	6R5758	33,000 5% 1/2W doz	1.20
R-63	6R6377	470,000 20% 2W doz	1.20
R-64	17A711500	Special, wire wound: 7.5 ohm 10% 5W; plug-in type.	.70
R-65	6K120580	6.8 10% 1W	.20
R-66	6R2122	4.7 meg 10% 1/2W doz	1.20
R-67	6R6414	270,000 10% 1/2W doz	1.20
R-68	6R5653	1.2 meg 10% 1/2W doz	1.20
R-69	6R5697	560,000 10% 1/2W doz	1.20
R-70	6R6397	22,000 10% 1/2W doz	1.20
R-71	6R6069	2200 10% 1/2W doz	1.20
R-72	6R5577	2700 10% 1/2W doz	1.20
R-73	6R6428	6800 10% 1/2W doz	1.20
R-74	6R6031	100,000 10% 1/2W doz	1.20
R-75	6R6397	22,000 10% 1/2W doz	1.20
R-76	6R6031	100,000 10% 1/2W doz	1.20
R-77	6R6031	100,000 10% 1/2W doz	1.20
R-78	6R2122	4.7 meg 20% 1/2W doz	1.20
R-79	6R6028	22,000 20% 1/2W doz	1.20
R-80	6R6048	10,000 20% 1/2W doz	1.20
R-81	18K734143	Vertical Hold: .85 meg; .35 meg fixed	.90
R-82	6R410053	150,000 20% 1W	.20
R-83	6R410053	150,000 20% 1W	.20
R-84	6R6229	1000 10% 1/2W doz	1.20
R-85	6R6048	47,000 10% 1/2W doz	1.20
R-86	6R6117	5600 10% 1/2W doz	1.20
R-87	18K734146	Horiz Hold Control: 250K; 50K fixed	.90
R-88	18A702443	Vertical Size: 5 meg; 1 meg fixed; nut mtg	.80
or	18B733413	Vertical Size: 5 meg; 1 meg fixed; twist lug mtg	.70
R-89	6R6018	100 20% 1/2W doz	1.20
R-90	6R6074	68,000 10% 1/2W doz	1.20
R-91	6R6080	4700 10% 1/2W doz	1.20
R-92	6R6080	4700 10% 1/2W doz	1.20
R-93	6R2096	330,000 10% 1/2W doz	1.20
R-94	6K120579	8200 10% 2W	.25
R-95	18A702475	Vert Lin Control: 750; nut mtg	.70
or	18K733414	Vert Lin Control: 750; twist lug mtg	.80
R-96	6R6117	5600 10% 1/2W doz	1.20
R-97	6R6090	470 10% 1/2W doz	1.20
R-98	6R118211	680 20% 1W	.20
R-99	6R5551	120 10% 1/2W doz	1.20
R-100	17K485412	3.3 10% 1/2W	.10
R-101	6R6031	100,000 10% 1/2W doz	1.20
R-102	6R6046	1 meg 10% 1/2W doz	1.20
R-103	18B734142	Brightness Control: 5 meg	.80
R-104	6R6377	470,000 10% 1/2W doz	1.20
R-105	17K488266	Wire Wound: .47 10% 1W	.15
R-106	18K721285	Horiz Centering Control: 75	.45
R-107	6R6090	470 10% 1/2W doz	1.20
R-108	6R6090	470 10% 1/2W doz	1.20
R-109	6R6377	470,000 10% 1/2W doz	1.20
R-110	6R5671	4700 10% 2W	.25
R-111	6R476042	3900 10% 2W	.25
T-1	24K730677	Transformer, ant: impedance matching	.85
T-2	24K730677	Transformer, ant: impedance matching	.85
T-5	24B733484	Transformer, 1st IF	2.10
T-6	24B733485	Transformer, 2nd IF	2.10
T-7	24B730616	Transformer, 3rd IF	4.45
T-8	24B702543	Transformer, ratio detector	3.20
T-9	25B733443	Transformer, audio output	2.05
T-10	25B733199	Transformer, filament	8.05

Ref. No.	Part Number	Description	List Price
T-11	25B730179	Transformer, vert blocking osc (TS-525 series)	1.70
T-12	25K721027		
or	25B731015	Transformer, vert output	3.40
T-13	24K733407	Transformer, horiz output & HV: incl V-18 (TS-525 series)	12.50
T-14	25K731565	Transformer, vert blocking osc (TS-528 & 603 series)	1.55
T-15	24C731610	Transformer, horiz output & HV: incl V-18 (TS-528 & 603 series)	12.50

Part Number	Description	List Price
VHF TUNERS		
1U733422	VHF Tuner TT-70	36.70* exch 27.50
1U733614	VHF Tuner TT-70Y	38.00* exch 28.50
MODELS 21K24 & Y21K24		
50K734312		
or 50K734313	Speaker, EM: 6" x 9"; 50 ohm fld (cold); 3.2 ohm VC	8.00* exch 6.00
MODELS 21T18, B, Y21T18 & B		
50C732758		
or 50C732997		
or 50C732998		
or 50C733259	Speaker, EM: 5-1/4"; 85 ohm fld (cold); 3.2 ohm VC	5.20* exch 3.90
MODELS 21T19, B, Y21T19 & B		
50C733905		
or 50K734381	Speaker, EM: 5-1/4"; 50 ohm fld (cold); 3.2 ohm VC	5.20* exch 3.90
MODELS 24K4, B, Y24K4 & B		
50K734316		
or 50K734317		
or 50K734318		
or 50K734320	Speaker, EM: 6"; 50 ohm fld (cold); 3.2 ohm VC	6.25* exch 4.70
MODELS 21K23, B, Y21K23 & B		
50C734586	Speaker, EM: 8"; 50 ohm fld (cold); 6.4 ohm VC	7.50*
MODELS 21K24 & Y21K24		
50K734319		
or 50K734206	Speaker, EM: 6"; 50 ohm fld (cold); 3.2 ohm VC	6.25* exch 4.70
MODELS 21K20, B, Y21K20 & B		
50K700850		
or 50C703337		
or 50C703098		
or 50C720156		
or 50C721294	Speaker, EM: 8"; 85 ohm fld (cold); 3.2 ohm VC	7.50* exch 5.65
MODELS 21K21, B, Y21K21 & B		
50C734373	Speaker, EM: 10"; 50 ohm fld (cold); 3.2 ohm VC	10.00* exch 7.50
MODELS 21K22 & Y21K22		
50K734416		
or 50C734373	Speaker, EM: 10"; 50 ohm fld (cold); 3.2 ohm VC	10.00* exch 7.50
MODELS 24K5, B, Y24K5 & B		
50K734314		
or 50K734315	Speaker, EM: 8"; 50 ohm fld (cold); 3.2 ohm VC	7.50* exch 5.65
50B733908		
or 50B734220		
or 50B734378	Speaker, PM: 4"; 3.2 ohm VC	3.70* exch 2.80

GENERAL INFORMATION

This booklet contains service information covering the Motorola TS-902A-03 (horizontal chassis) and the BP-902A-01 (vertical chassis). These individual chassis are interconnected in the 19-inch Motorola color television receiver series which incorporate the 19VP22 tri-color picture tube.

CHASSIS DESCRIPTION

The receiver circuits are built around 29 circuit tubes, a 19VP22 19-inch tri-color picture tube (aluminized-glass envelope, electrostatic focusing, 62 degree deflection angle) plus three germanium diodes and three selenium rectifiers. The horizontal chassis contains all signal circuits except those devoted strictly to color, the scanning circuits, filament and "B" supply. The vertical chassis contains the color section.

ELECTRICAL SPECIFICATIONS

POWER RATING - Source: 117 volts, 60 cycle AC
360 to 375 watts

NUMBER OF TUBES - 29 tubes plus 3 selenium rectifiers, 3 germanium diodes and a tri-color picture tube

INTERMEDIATE FREQUENCIES - Video: 45.75 Mc
Sound: 41.25 Mc and 4.5 Mc

FREQUENCY RANGE - Channels 2 through 13 (VHF tuner - WTT-67)
Channels 14 through 83 (UHF tuner - TT-37)

ANTENNA INPUT IMPEDANCE - VHF & UHF: Balanced 300 ohm

FUSES - Filament: 1 inch #26 copper wire, located beneath chassis near filament transformer
Power: Special 7.5 ohm plug-in resistor, located near filament transformer on top rear of horizontal chassis

POWER SUPPLY VOLTAGES (117 volts AC line voltage) - B triple plus 390 volts
B double plus 240 volts
B plus 125 volts

AUDIO OUTPUT - 1.5 watts undistorted

INSTALLATION & OPERATION

Locating the receiver

It is advisable to determine the approximately permanent position of the receiver before any attempt is made to erect an antenna or to install lead-in wires. Once the location of the receiver is determined, it is desirable to retain this location, due to the effect of stray external magnetic fields on the purity adjustments of the color fields, etc. Balancing adjustments have been incorporated into the receiver to compensate for such natural conditions; however, these controls may require re-adjustment for each change in receiver location. Such receiver movements should be avoided.

The selection of the permanent location of the receiver should be based upon the best picture visibility from the greatest number of room positions; so that all persons can view the picture comfortably. Locating the receiver near windows and corners should be avoided. The location should be chosen so that the cabinet will be subjected to a minimum amount of heat and moisture; otherwise the cabinet finish may suffer damage. Allow sufficient space behind the cabinet for proper ventilation of the chassis.

Room lighting

It is desirable to have some light in the room when viewing any type of television picture. A completely darkened room tends to create eye-strain. Light from a shaded lamp which does not fall directly on the face of the screen is usually satisfactory.

A condition of room lighting must be taken into consideration with color receivers, however, which was not important previously. That is the overall color tint of the lighting used. The room lighting color tint can accentuate or reduce certain color reproductions acutely. While the receiver may be adjusted to compensate for such lighting conditions, it is desirable to use a colorless bulb and lampshade during color program viewing.

It is also important that any receiver set-up adjustments made by the technician are performed while using the room lighting that will be available during program viewing. If different color lighting is used during set-up, it is quite possible to adjust for white screen conditions only to find that under the viewing lights, the screen may have a predominant blue, green, or red tinge.

Antenna requirements

Indoor antennas of the portable type are often satisfactory for color reception, provided the receiver is located in a strong signal area. However, an outdoor antenna will invariably give a better overall picture on all channels and is recommended whenever possible.

A color signal, as received from the transmitter, contains a number of additional signals which must reach the receiver for good color reproduction. Due to these extra requirements, many present antenna types and their lead-in wires are unsatisfactory. Color reception requires a broad-band type of antenna, a narrow-band single channel antenna can completely remove the color signals. The same is true of incorrect lead-in wires and mismatched lines. Keep in mind that it is entirely possible for an existing antenna installation to furnish satisfactory reception on a black/white receiver, but fail completely on color broadcasts. In the case of antennas for UHF reception, the above information applies with the extra care required for more critical UHF antenna set-up.

When deciding on an antenna type, remember that it is entirely possible for stations to change channels in the VHF group, and that single-channel, high-band or low-band antennas may have to be replaced to receive the new channels.

INITIAL INSTALLATION INSTRUCTIONS

After the receiver has been placed in its permanent position as determined by the viewing requirements and lead-in facilities, it is necessary to remove the cabinet back cover and shift the lever connected to the dynamic convergence coils to such position that the coils are moved flush against the neck of the picture tube (the convergence coils are moved away from the picture tube neck during shipment only). This lever is at the extreme top of the rear CRT mounting bracket and may be seen in the top view drawing of the tri-color picture tube(Fig1).

As stated previously, external magnetic fields of varying degrees and directions are encountered for each new receiver location and it is necessary to balance the receiver circuitry for the initial installation location, as well as to correct any misadjustment caused in shipment. The first receiver checks to be made, therefore, are those for correct purity, convergence and focus. Since it is almost always necessary to adjust the purity and convergence systems in an initial installation, a complete set-up procedure follows.

NOTE: To facilitate adjustments to the picture tube components and other parts, the cabinet is provided with a removable hinged top section. This top section may be moved only after the cabinet back has been removed.

Depending on the cabinet style, two different top panel locking mechanisms will be encountered. In one type, a small wooden slider, at the center underside of the top panel, will move to the rear; thus unlocking the top panel at the front end of the cabinet. The other type is fastened to the wooden side channels by thumbscrews.

HIGH VOLTAGE WARNING

Operation of this receiver with the chassis accessible involves shock hazard; therefore, no work should be done on this receiver by anyone not familiar with these hazards.

Due to the circuit used, there is always a potential difference between the chassis and ground. AN ISOLATION TRANSFORMER SHOULD BE USED WHEN SERVICING THIS RECEIVER.

Do not operate the receiver with the high voltage compartment shield removed. Make sure the ground springs between the chassis and the picture tube shield and between the yoke assembly and the picture tube shield are making contact.

PICTURE TUBE HANDLING PRECAUTIONS

Extreme care must be used in handling the picture tube as rough handling may cause it to implode due to atmospheric pressure. DO NOT NICK OR SCRATCH GLASS, OR SUBJECT IT TO ANY UNDUE PRESSURE IN INSTALLATION OR REMOVAL. Do not remove the receiver chassis, install, remove, or handle the picture tube in any manner unless shatterproof goggles and heavy gloves are worn. DISCHARGE 2nd ANODE LEAD BEFORE HANDLING.

THE TRI-COLOR PICTURE TUBE SET-UP (TS-902)

One of the first problems in setting up the picture tube is to make the apparent deflection centers of the three beams the same as that dictated by the particular picture tube design. The term "deflection centers" refers to the point inside or near the deflection yoke at which the three beams begin bending for horizontal and vertical sweeping. The forward and rear positioning of the deflection yoke on the neck of the tube locates the correct deflection centers of the beams. When the deflection center of any of the beams is incorrect, the beam will scan phosphor dots of incorrect colors.

The purity magnet mounted on the neck of the tube provides an adjustment whereby the three beams can be made to pass through their centers of deflection when the central area of the screen is being scanned.

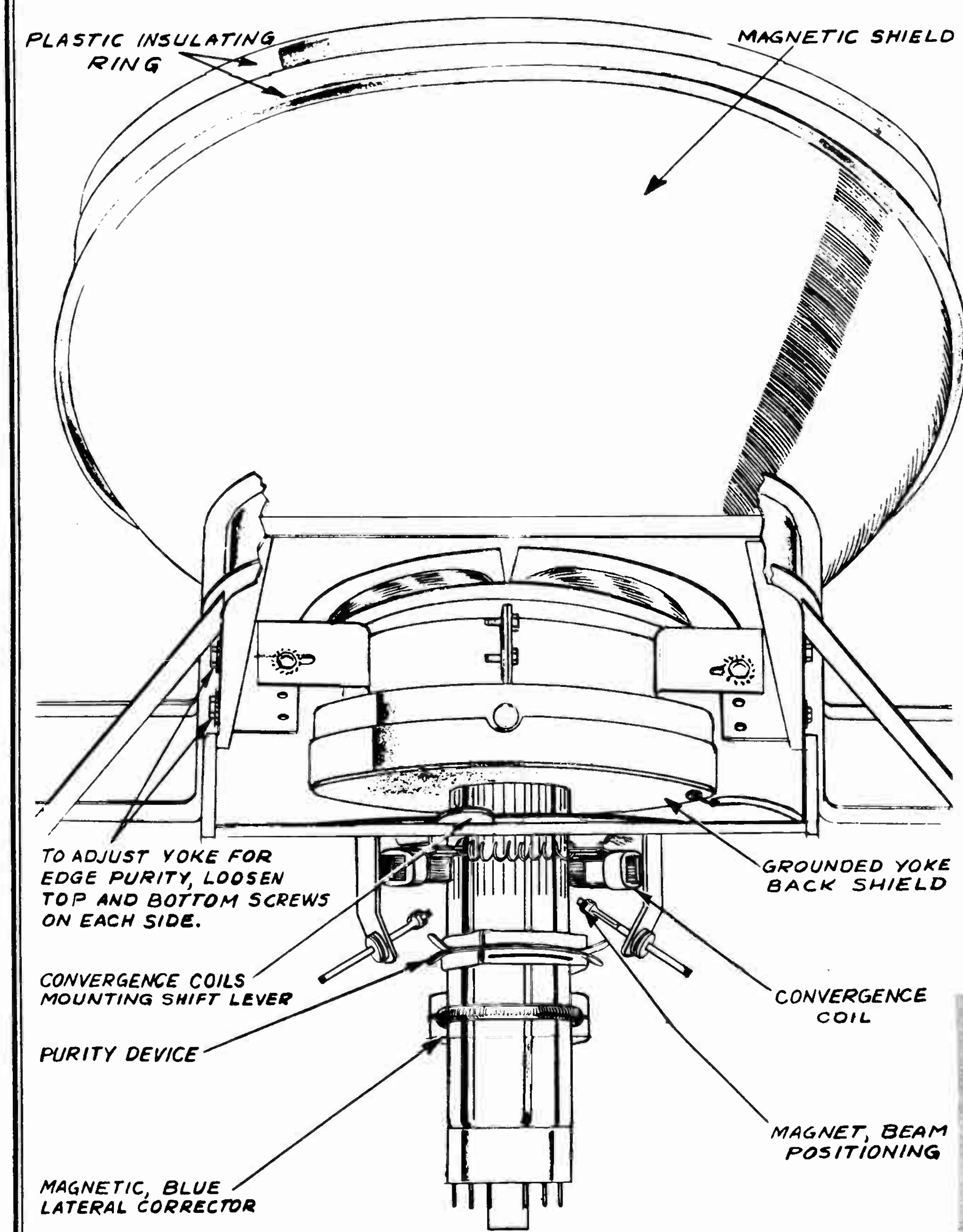


FIGURE 1. TOP VIEW OF TRICOLOR PICTURE TUBE

PURITY ADJUSTMENT

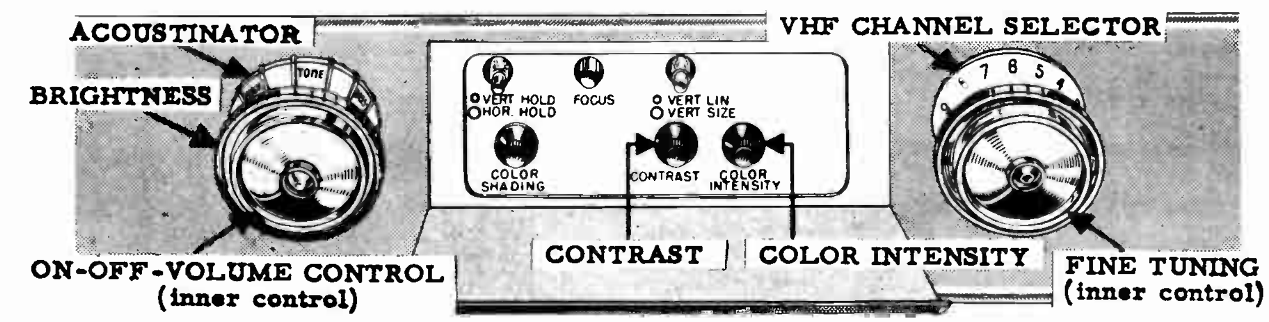
1. Inject a signal from a dot pattern generator or other appropriate source into the receiver.

2. Adjust the three beam positioning magnets and the blue lateral corrector magnet for convergence of the three beams at the center of the screen. (Fig. 1).

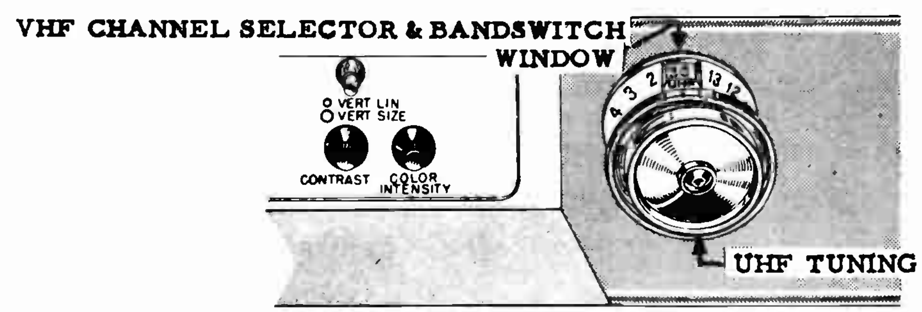
3. Remove all signal to the receiver or switch the channel selector to a vacant channel.
4. Cut off the blue and green guns by grounding their grids into the ground holes of the receptacle. (See vertical chassis, front view.) (Fig. 14).
5. Adjust the BRIGHTNESS control for high raster brightness.
6. Loosen four screws (two screws on each side of bracket) to allow backward-forward movement of yoke. If set has not been previously adjusted for purity, position yoke back as far as the mounting will allow. If set has been adjusted previously for purity, confine yoke adjustment to a minimum. Keep yoke concentric with neck of picture tube.

7. Locate the purity device, consisting of two magnetic rings mounted on the tube neck. The device is between the blue corrector magnet and the dynamic convergence coils. Position the tabs of one ring opposite the tabs of the other ring so that a minimum strength magnetic field is produced. If the correct tabs are opposite each other, rotating both rings of the device together should have no affect on the raster. If the position of the tabs is incorrect, rotate the rings to place the opposite tabs adjacent to each other.

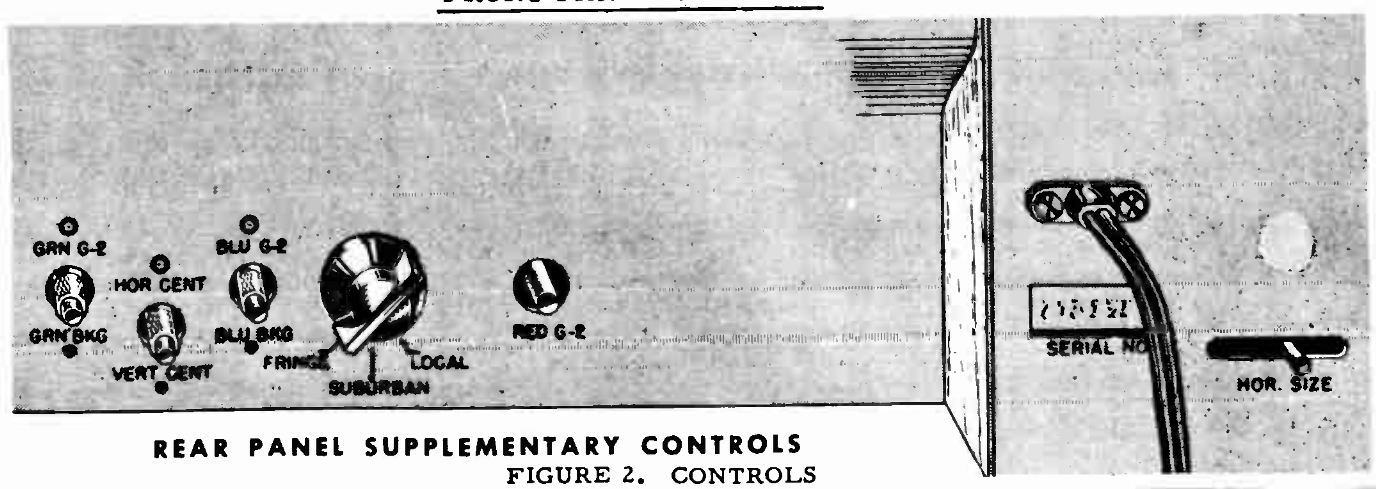
VHF OPERATION (channels 2 through 13)



(Only for sets equipped for channels 14-83)



FRONT PANEL CONTROLS



REAR PANEL SUPPLEMENTARY CONTROLS

FIGURE 2. CONTROLS

8. Check the purity at the center of the screen. If it is not satisfactory:

a. Separate the tabs by a small amount to produce a weak magnetic field.

b. Rotate the purity device to obtain better red purity in the central area of the screen.

c. Continue the process of adjusting the field strength and direction of the magnetic field until the purity in the central area of the screen has been made as large as possible.

NOTE: Use as weak a magnetic field as possible. Avoid shadow due to beam cut-off by the tube neck.

9. Move the yoke forward and backward along the neck of the tube to obtain best edge purity.

10. Re-adjust the purity device for best overall purity.

NOTE: If satisfactory edge purity cannot be obtained, it may indicate either a defective yoke or picture tube.

11. Check the purity of the green and blue fields, one at a time, by keeping the grid of the desired gun inserted into the grid receptacle and grounding the grid plugs of the other two guns. Avoid any shadows due to neck cut-off of the beams.

12. It may be necessary to compromise the setting of the purity device which resulted in best red purity in an effort to obtain best overall purity of all colors. In any compromise setting, however, the red field should always be favored strongly. Re-insert all grid plugs after purity adjustments have been completed.

DYNAMIC CONVERGENCE SYSTEM

Because the phosphor screen is not a true spherical surface, the distance the three beams travel from the center of deflection is greater at the outer areas of the phosphor screen than at the center. At the outer areas, therefore, the beams will cross-over, or converge, before they reach the shadow mask, thus causing over-convergence in these areas. The dynamic convergence coils apply electromagnetic correction to each of the three beams at a horizontal and vertical sweep rate to correct this condition. This correction causes the point of convergence to change according to the sweep rate and beam position so that it always follows the curvature of the shadow mask.

PROCEDURE

1. Turn all dynamic amplitude controls to minimum (fully counterclockwise). (Fig. 14).

2. Turn vertical tilt controls to minimum (mid-position). (Fig. 14).

3. Position shift lever so that convergence coil pole pieces are seated on the neck of the picture tube. (Fig. 1).

4. Use the signal from a dot pattern generator or other suitable source. Adjust the brightness of each beam so that each color dot can be easily observed. (Use the background and G-2 controls.) CAUTION: Maintain picture tube brightness and modulation level of signal source within limits of good focus.

5. Adjust the three beam positioning magnets and the blue lateral magnet for best convergence at center of screen.

6. Using the red field, adjust yoke and purity device for optimum purity. (Refer to purity adjustment instructions.) NOTE: If purity has been adjusted previously, yoke adjustment is unnecessary.

7. Repeat step 5 for best convergence at center of screen.

VERTICAL DYNAMIC ADJUSTMENT

1. Choose a vertical column of dots near the center of the screen. Notice that the dots, while converged at the screen center, become progressively over-converged away from the screen center toward the top and bottom of the screen.

2. Observe the position of the blue dot in each dot trio along this vertical column of dots. Adjust the red and green vertical tilt controls so that the red and green dots are converged and spaced symmetrically from the blue dot in each group (trio). This symmetrical over-convergence should be made to increase uniformly from screen center to top and screen center to bottom.

3. Adjust the blue vertical tilt control so that all blue dots in each trio along a center vertical line have the same relative position with respect to the red and green dots.

4. Adjust the beam positioning magnets for center convergence, if necessary.

5. Adjust the green vertical amplitude control to position the green dots so that they are equally spaced from the blue dots from top to bottom of the screen.

6. Adjust the green beam positioning magnet to reconverge the green dot with the blue dot at the center of the screen.

7. Repeat step 5 for the red dots.

8. Adjust the red beam positioning magnet to converge the red dot with the blue and green dots at the center of the screen.

9. Adjust the blue vertical amplitude control using the same procedure as used for the blue and green amplitude controls.

10. Adjust the blue beam magnet for convergence of the vertical row of dots.

HORIZONTAL DYNAMIC ADJUSTMENT

1. a. Peak each of the horizontal dynamic phase coils one at a time for maximum as follows:

b. Turn the blue horizontal dynamic amplitude control to maximum (fully clockwise). Set the red and green horizontal dynamic amplitude controls to minimum (fully counterclockwise). (Fig. 14).

c. Tune the blue horizontal phase coil so that, over the center portion of the screen, the blue dot is displaced a maximum amount from the other two dots. This displacement, which makes the blue dots appear to follow a parabolic path across the screen, should be such that the blue dots are moved toward a horizontal reference line at edges of the screen.

d. Turn the blue horizontal dynamic amplitude control to minimum (fully counterclockwise).

2. Repeat the foregoing procedure for the green gun only.

3. Repeat the foregoing procedure (steps 1a to 1d) for the red gun only.

4. Select a horizontal row of dots at the center of the screen.

5. Adjust the blue dynamic amplitude and phase together to obtain the same amount of misconvergence of the blue dot at the screen center and the edges of the screen. This will establish a horizontal line across the screen which can be used as reference for positioning the red and green dots.

6. Adjust the blue beam positioning magnet (not the blue lateral corrector magnet) for convergence of the dots at the center of the screen.

7. Adjust the green horizontal dynamic amplitude and phase controls so as to obtain uniform and symmetrical displacement of the green dots away from the blue dots in all horizontal dot trios.

8. Adjust the green beam positioning magnet for center convergence.

9. Adjust the red horizontal dynamic amplitude and phase controls so as to obtain uniform and symmetrical displacement of the red dots away from the blue dots in all horizontal dot trios.

10. Adjust the red beam positioning magnet for center convergence.

11. Check purity and, if necessary, adjust the three beam positioning magnets and blue lateral magnet for center convergence.

12. Make any required touch-up adjustments necessary to give best possible overall convergence of all the dots. The beam positioning magnets and the dynamic controls are used as indicated by a study of the dot pattern. NOTE: It will not be necessary to reset purity when the touch-up adjustments are made since the adjustments should be small enough so as not to upset the purity.

BALANCING THE BACKGROUND AND G-2 CONTROLS

Compensation for differences in the three phosphor efficiencies, the cut-off voltages and the emission characteristics of the three guns is provided as follows: Three G-2 controls adjust the screen voltages for each gun; two BACKGROUND (grid 1) controls adjust the static bias on the blue and green guns. Static bias on the red gun is fixed by circuitry.

Procedure for balancing BACKGROUND and G-2 controls

1. Turn channel selector to a channel transmitting a black and white picture - preferably a test pattern. (Fig. 2).

2. Set BRIGHTNESS and CONTRAST controls for normal picture. Disregard color fringing effects due to misadjustment of the convergence controls.

3. Turn GREEN G-2, BLUE G-2 and RED G-2 controls to maximum clockwise position.

4. Adjust GREEN BACKGROUND, BLUE BACKGROUND and, if necessary, RED G-2 for highlight white on the brightest picture portions.

5. Turn BRIGHTNESS control counterclockwise so that screen becomes less bright (grey). If a color begins to tint the screen as brightness is reduced: Adjust the G-2 control corresponding to this color until the bright portions of the screen are white or grey.

6. Adjust the BRIGHTNESS control for normal brightness on the screen. Re-set the BACKGROUND controls so that brightest portions of picture appear white.

7. Repeat steps 2, 4, 5 and 6 until no color tinting occurs over the usable range of the BRIGHTNESS control. (Maximum brightness setting is not considered part of the usable range.)

OPERATING CONTROLS

Front Panel Operating Controls

The large twin front panel knobs control the basic receiver functions for monochrome reception. Only two additional controls are required on the front panel for color reception. These controls are the COLOR INTENSITY and COLOR SHADING controls, located under the front panel cover. (In some models the color intensity control is labeled "chroma" and the color shading control is labeled "fine phase".) (Fig. 2).

Front Panel Controls Used For Color Reception

COLOR INTENSITY CONTROL

The COLOR INTENSITY control governs the gain of the color system and thus the intensity of the reproduced colors. Turning the COLOR INTENSITY control counterclockwise will remove all color from the picture.

When receiving a black/white picture transmission, always keep the COLOR INTENSITY control turned to the counterclockwise stop. Viewing a black/white transmission with the COLOR INTENSITY control turned up may result in color fringes outlining picture subjects. This gives the appearance of colored "snow" in the picture.

COLOR SHADING CONTROL

The purpose of the COLOR SHADING control is to allow the picture colors to be tinted as desired. The most faithful color reproduction is usually obtained by adjusting the COLOR SHADING control for natural flesh tones. Any object having a familiar color (such as sky or water) may be used for this adjustment.

Front Panel Controls Used For Monochrome (black/white) Reception

1. ON-OFF-VOLUME CONTROL

Turn the receiver on by rotating the ON-OFF-VOLUME control to the right until a click is heard. Allow the receiver to warm up for a few minutes. (NOTE: The warm-up period required for a color television receiver to produce a good picture, either in color or in monochrome, is longer than that required for a black/white receiver.) After the receiver is turned on, allow several minutes for the circuitry to stabilize. Then, advance the ON-OFF-VOLUME control temporarily to mid-position and adjust later as required.

2. COLOR INTENSITY CONTROL (Under front panel cover)

Turn off by rotating counterclockwise until stop is reached.

3. CONTRAST CONTROL (Under front panel cover)

Turn CONTRAST control to about the middle of its range.

4. BRIGHTNESS CONTROL

Turn clockwise until picture screen is lighted. Readjust later in conjunction with CONTRAST as required.

5. VHF CHANNEL SELECTOR

Turn the VHF CHANNEL SELECTOR until the desired channel number appears on top. (VHF channels are numbered 2 through 13).

6. FINE TUNING

Adjust the FINE TUNING control for best picture detail. Readjust CONTRAST and BRIGHTNESS control for most pleasing picture.

7. ACOUSTINATOR

Adjust the ACOUSTINATOR tone control for the most pleasing tone.

Tuning UHF Stations

(Only for sets equipped to receive channels 14 to 83.)

Turn VHF CHANNEL SELECTOR control so that window located between numbers 2 and 13 is at top. This switches receiver to UHF and exposes the UHF dial scale.

With the VHF CHANNEL SELECTOR control set to the UHF position, UHF stations can be tuned with the FINE TUNING control. Tune first to desired channel, then tune for best picture detail. Readjust CONTRAST and BRIGHTNESS controls for most pleasing picture.

Receiving Color Programs

1. Adjust receiver for a satisfactory monochrome picture as outlined under "Front Panel Controls Used For Monochrome (Black/White) Reception".

2. COLOR INTENSITY CONTROL (Under front panel cover)

Advance COLOR INTENSITY control to right (clockwise) until color begins to appear in picture. Adjust COLOR INTENSITY control until desired strength of color is obtained.

3. COLOR SHADING CONTROL (Under front panel cover)
Adjust the COLOR SHADING control for most natural or pleasing flesh tones, or for natural appearance of some object having familiar coloring.

4. FINE TUNING
Readjust for best picture detail and most satisfactory color reproduction. If fine tuning control is not adjusted correctly, the color may be removed from the picture.

Supplementary Controls Located Under Front Panel Cover

The small controls located under the front panel cover are provided for customer use, as required. (These controls are practically independent of critical color and monochrome circuitry.) The more-frequently used supplementary controls are provided with knobs, while those used infrequently have knurled shaft ends. This provides instantaneous recognition of the primary and secondary supplementary controls. (Fig. 2).

It is advisable to adjust these "under-cover" controls while viewing a black/white transmission, preferably a test pattern. This will reduce the possibility of error when analyzing picture defects. During the adjustment of these controls, color effects can be eliminated by turning the COLOR INTENSITY control fully counterclockwise.

HORIZONTAL HOLD

This control locks the picture horizontally. If the picture has a tendency to move across the screen horizontally or appears as a series of sloping lines or bars, this control should be adjusted. This adjustment is very broad and should be set to the center of the range in which the picture remains locked-in, or stationary.

VERTICAL HOLD

When the picture exhibits intermittent or constant vertical movement; when the picture appears to be rolling up or down, the VERTICAL HOLD control should be adjusted. The correct adjustment is in the center of the lock-in range.

VERTICAL SIZE AND VERTICAL LINEARITY

When the size of the picture, from top to bottom, is too large or too small, adjust the VERTICAL SIZE control. Stretching or squeezing of the picture at the top or bottom can be eliminated by adjusting the VERTICAL LINEARITY control. It may be necessary to adjust the VERTICAL SIZE and VERTICAL LINEARITY controls simultaneously until a picture which is balanced in shape from top to bottom (linear) fills the screen. If the picture should roll during these adjustments, reset the VERTICAL HOLD control.

FOCUS

Adjust the FOCUS control for the clearest picture.

Supplementary Controls Located At Rear of Receiver

The supplementary controls located at the rear of the receiver fall into two classifications: those that can be adjusted easily without affecting the color balancing and picture tube set-up controls and those that require careful adjustment in conjunction with one another. The more critical controls are described in the section "Balancing the Background and G-2 Controls". These controls should be adjusted by a trained technician. (These controls should be adjusted when viewing a black/white test pattern.)

HORIZONTAL CENTERING CONTROL

This control shifts the entire raster and the picture, from left to right, on the screen. Adjust this control to get a picture that is well-centered from left to right.

VERTICAL CENTERING CONTROL

This control shifts the entire raster and the picture, from top to bottom, on the screen. Adjust this control to get a picture that is well-centered from top to bottom.

HORIZONTAL DRIVE CONTROL (On models which have a drive control)

This control affects the brightness and width of the picture. Adjust this control until white vertical bars appear on the screen; then back off control to the position where bars just disappear. (NOTE: Adjust HORIZONTAL DRIVE control before making horizontal size adjustment.)

HORIZONTAL SIZE CONTROL

This control varies the width of the picture. Move the horizontal size control to the left until dark edges can be seen on each side of the picture. Then move control to the right until picture is slightly larger than the picture mask.

AREA SELECTOR SWITCH

The quality and stability of the picture is controlled by the area selector switch. Set this switch to the position in which the picture is the clearest and most stable.

SERVICE NOTES

CHANGING OF TUBES

(Refer to TS-902 horizontal chassis top view and BP-902 vertical chassis top view for tube locations.) (See Figs. 11 & 14).

The receiver should be turned off when changing tubes. Indiscriminate changing or interchanging of tubes should be avoided for the following reasons:

1. A change of IF or RF tube, or crystal detector, can cause loss of sensitivity or poor picture quality. Check alignment and sensitivity after making such changes.

2. A change of limiter or ratio detector tubes can cause distorted audio, buzz, or loss of audio sensitivity. Check alignment and sensitivity after changing these tubes.

3. Changing the horizontal oscillator tube can result in poor noise rejection or cause the horizontal hold control to be out of range. This may necessitate re-adjustment of the horizontal oscillator coil.

FUSE REPLACEMENT

B plus and initial surge fuse (special 7.5 ohm resistor R-73)

This fuse is a plug-in type located on the top rear of the horizontal chassis, behind the vertical chassis. It is possible to replace this fuse by removing the back cover. Replacement is facilitated, however, by removing the four bolts from the baseboard and shifting the receiver assembly toward the rear of the cabinet.

Filament fuse (1 inch of #26 copper wire)

This fuse is located beneath the chassis in the area below the filament transformer. The chassis must be removed from the cabinet in order to replace the filament fuse. Replace with a 1 inch length of #26 wire soldered between two lugs of the terminal strip; the connection is in series with the heavy green lead from the filament transformer.

HORIZONTAL OSCILLATOR ADJUSTMENT

The HORIZONTAL HOLD control should have a sync range of approximately 25 degrees rotation. If the control adjustment is overly critical:

1. Increase the BRIGHTNESS and reduce the HORIZONTAL SIZE until the edges of the horizontal blanking pulse (grey vertical bars) are visible on either side of the raster.

2. Shunt the HORIZONTAL OSCILLATOR coil L-43 to ground with a .25 mf 400V, capacitor, and ground the control grid of the horizontal oscillator (pin 4).

3. Adjust the HORIZONTAL HOLD control until the picture is in sync or slowly floating through sync.

4. Remove the capacitor shunting L-43 to ground and adjust the HORIZONTAL OSCILLATOR coil until the picture is again in sync or floating through sync.

5. Remove short from control grid (pin 4) of horizontal oscillator.

REMOVAL OF THE CHASSIS

The chassis and the picture tube are mounted independently to a baseboard which is bolted into the cabinet. The chassis may be removed from the cabinet independently of the picture tube by removing four bolts. When removing only the chassis: disconnect the ground lead between the high voltage cage and the picture tube: disconnect the high voltage lead; disconnect antenna lead-in and unplug speaker plug; unplug the deflection yoke plug from chassis; disconnect yoke leads extending into the high voltage case; on models using a field neutralizing coil, unplug the field neutralizing coil plug.

Both the picture tube and the chassis can be removed by removing the four bolts which hold the baseboard to the cabinet. This operation must include the removal of the antenna from the side of the cabinet, disconnecting the antenna lead-in, unplugging the speaker plug and removing the wire braid from the bezel.

TONE CONTROL LINKAGE SETTING

In the event it becomes necessary to replace the tone control linkage:

1. Turn the tone control maximum counterclockwise.

2. Place the linkage over the TONE and CONTRAST-VOLUME shafts in such a manner that the arms and link are above the shafts.

3. Move the linkage assembly counterclockwise as far as possible.

NOTE: After chassis has been replaced in the cabinet, place the TONE control knob over the CONTRAST-VOLUME shaft so that the lettering on the knob is toward the top.

REMOVAL AND REPLACEMENT OF COLOR PICTURE TUBE

Replacement of the tri-color picture tube necessitates a complete purity and convergence alignment.

To remove the color picture tube:

1. Disconnect the picture tube socket. (Refer to Fig. 1).
2. Remove the blue lateral corrector magnet.
3. Remove the PM purity device.
4. Withdraw the dynamic convergence coils from the neck of the tube by shifting the coil lever toward a vertical position.
5. Remove the fibre picture tube mounting strap.
6. Disconnect the plastic high voltage interlock.
7. Loosen connecting rods between front and rear tube supports.
8. Remove front picture tube retaining brackets. Carefully remove the picture tube out the front of the assembly. Use extreme care while pulling the neck of the picture tube through the dynamic convergence coil assembly and the yoke.
9. Remove the magnetic shield from the flare of the picture tube.
10. Remove plastic insulating sleeve from around picture tube; remove second anode connector.

To install color picture tube:

1. Before installing tube in chassis mounts, clip second anode connector on metal flange of picture tube. Make this connection at a position approximately in line with pin #12 of the picture tube.
2. Place plastic insulating sleeve around picture tube front. Sleeve fold-over should be positioned in line with pin #4 of the picture tube.
3. Place magnetic shield on flare of the tube.
4. Mount picture tube to chassis with pin #4 toward top. Replace the front tube-retaining brackets. Position tube so that plastic sleeve over picture tube face edge is flush against retaining brackets.
5. Replace fibre picture tube strap; tighten connecting rods between front and rear tube supports; connect high voltage interlock.
6. Replace the PM purity device.
7. Replace the blue lateral corrector magnet so that it is directly below the blue gun and then replace tube socket.
8. Move the dynamic convergence coils in close proximity to the tube neck by shifting the dynamic convergence coil lever toward the tuner side of chassis.
9. Proceed with a complete purity and convergence alignment and background tracking set-up.

CIRCUIT DESCRIPTION

OPERATION OF THE COLOR RECEIVER

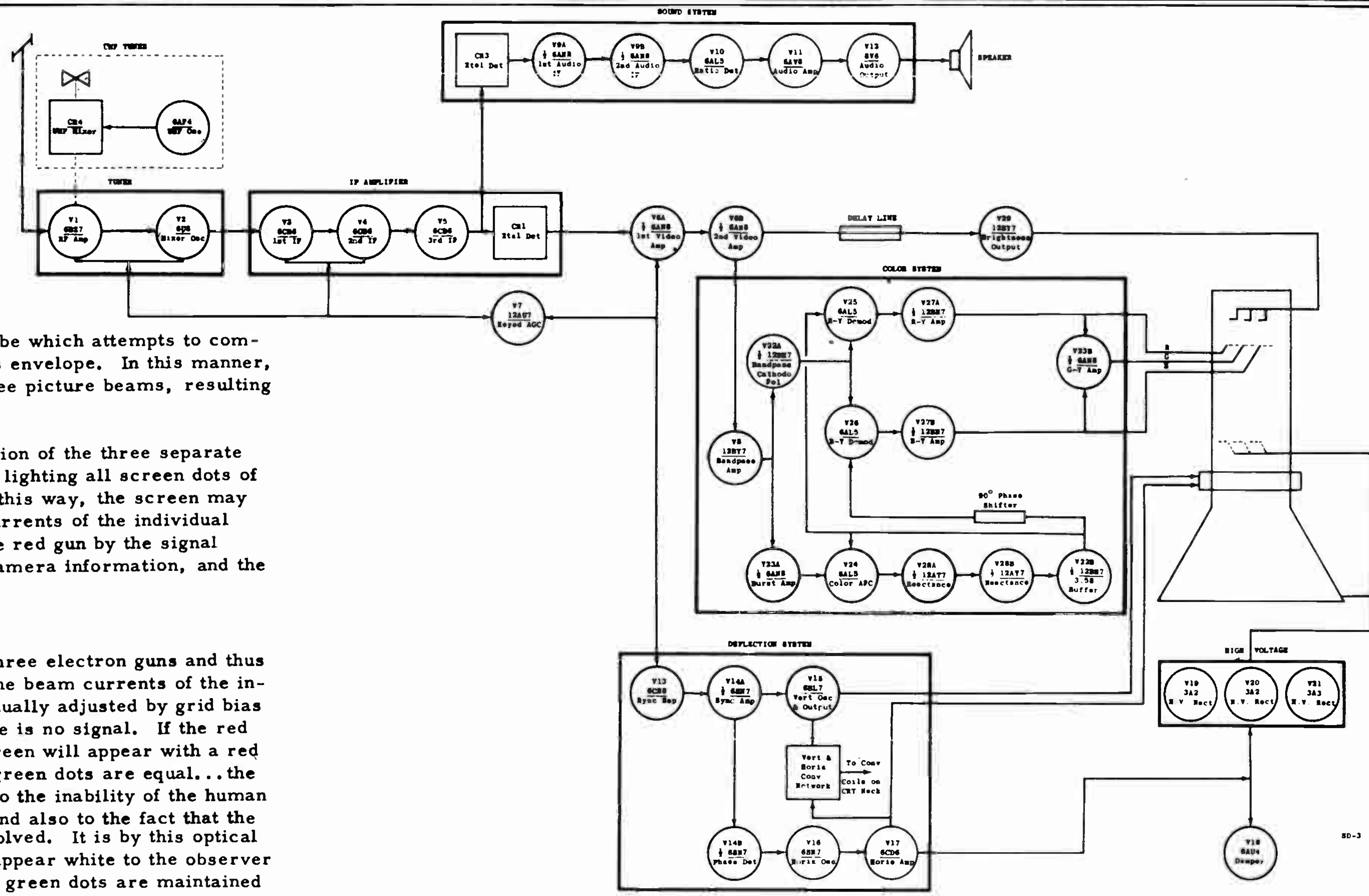
The modern color television receiver is more or less based on the original system in which three separate picture tubes were used. In this three-tube system, each picture tube had a transparent color filter of red, green and blue, respectively. Each tube could be driven with a video signal and, in this case, would show the same scene but, with the picture colored entirely red, green or blue, depending upon which tube was lighted. By a system of color sensitive mirrors and glass screens, it was possible to bring the three pictures together at one focal point in such manner that the viewer would see the three superimposed pictures (one over the other). If just the picture tube with the red filter were used, the result would be a good TV picture....but completely in red. The same would hold true for the blue and green tubes.

By the foregoing method of using three different picture tubes with color filters, it is possible to produce a color television picture provided that a method is available of breaking the picture down at the transmitter so that the red parts of the scene are sent to just the red picture tube, the blue parts of the scene to just the blue picture tube, and the green parts of the picture to just the green picture tube. This can be accomplished by having three cameras at the transmitter viewing the same scene, but with one camera having a color filter so that it can "see" only the red parts of the picture, a second camera with a filter so that it can "see" only the blue parts of the picture and the third camera that can "see" only the green parts of the picture.

If the signals from the individual cameras reach only the appropriate color picture tube, we have a method of taking the picture apart, color by color, at the transmitter and putting it back together correctly at the receiver. For any colors other than those of the color filters, a combination of two or more of the screen colors could be used and mixed to form the desired color.

The system described is possible to construct and was actually used at one time. However, the mechanical, optical and electrical problems involved make it impractical. For example, each picture tube would have to show a picture identical in height, width and linearity in order for them to superimpose perfectly. Experience with obtaining suitable linearity, etc., in just one receiver, gives an insight into the troubles encountered.

FIGURE 3. BLOCK DIAGRAM



One solution to the problem is the three-electron gun picture tube which attempts to combine the three separate picture tubes used previously into one glass envelope. In this manner, the same deflection yoke and sweep system may be used for all three picture beams, resulting in identical height, width and linearity.

The tri-color picture tube is designed to give the equivalent action of the three separate tubes by dividing its screen into extremely small color dots and by lighting all screen dots of any one basic color by a particular electron gun of three used. In this way, the screen may be made completely red, blue, or green by controlling the beam currents of the individual guns. Likewise, color may be added to a picture by controlling the red gun by the signal from the red camera at the transmitter, the blue gun by the blue camera information, and the green gun by the green camera information.

RECEIVING BLACK AND WHITE

All screen dots of any one color are lighted by just one of the three electron guns and thus the light intensity of the three-screen color may be controlled by the beam currents of the individual guns. The beam currents of the three guns may be individually adjusted by grid bias voltages in order to adjust the separate color intensities when there is no signal. If the red dots are made brighter than the blue and green dots, the entire screen will appear with a red tinge, etc. When the light intensity value of all the red, blue and green dots are equal...the entire screen will appear white to the viewer. This is due partly to the inability of the human eye to distinguish individual colors of equal light intensity values and also to the fact that the screen dots are so tiny that the individual color dots cannot be resolved. It is by this optical trick that the screen of the tri-color picture tube may be made to appear white to the observer and as long as the equal-intensity light-values of the red, blue and green dots are maintained (as determined by the gun grid bias and anode voltages).....the entire screen can be made brighter or dimmer and still appear as white or shadings of white. A standard black and white station transmission can now be used to modulate the three electron beams simultaneously and the screen will appear to follow the shadings of black and white necessary to reproduce the picture. Compatibility is thus maintained between black and white and color receivers.

The circuitry of the color receiver used to carry the black/white (brightness) signal from the second detector to the picture tube, is very similar to the standard video system used in conventional receivers. This system consists of the first and second video amplifiers, through the brightness amplifier and on to the cathodes of the three electron guns, so that the beam currents of all three are increased and decreased by the brightness (Y) signal.

ADDING THE COMPLETE COLOR SIGNAL

In the formation of an actual color telecast, three cameras are used for pick-up at the station. One camera is for the red parts of the picture, a second for the blue parts and the third for the green picture information. The outputs of these three cameras are re-combined in the correct proportions to produce a video signal practically identical to that of a conventional black and white camera. This video signal is transmitted as the "Y" signal and contains all the brightness information necessary to reproduce a picture in black and white. It corresponds closely to a standard black/white signal in bandwidth, etc., and may be reproduced on a standard black/white receiver. The "Y" signal will also produce a good definition black and white picture through the "Y" channel of a color receiver. In a sense, a color receiver reproduces a good definition black/white picture through the "Y" channel and then correctly colors this picture by information sent over a separate subcarrier and through the "chroma" channel.

The entire signal, brightness "Y" and color "chroma" is passed through the receiver from the antenna to the second video amplifier. The output of the second video amplifier divides into two paths, the brightness channel for the video signal and the chroma channel for the color signal. The brightness signal continues on through the brightness amplifier and to the cathodes of the tri-color picture tube to produce a good detail monochrome picture. The color information continues on through the bandpass amplifier, bandpass cathode follower and to the demodulators. The demodulators recover the original color signals and pass them on to the grids of the tri-color picture tube guns by way of the R-Y (red), B-Y (blue), and G-Y (green) amplifiers.

The color information from the three cameras at the transmitter is sent over a separate subcarrier of 3.58 megacycles, using a two-phase modulation, suppressed-carrier system. (NOTE: In the suppressed carrier system, the actual 3.58 megacycle carrier is not transmitted......only the upper and lower sidebands, which contain the actual picture color information, reach the receiver. However, for ease of understanding and for all practical purposes, you may assume that a conventional carrier signal and its sidebands is being received. The color subcarrier is modulated in amplitude (same as standard black and white video) as well as in phase (phase may be considered as the amount of lead or lag of one signal as compared to a fixed reference signal standard). The phase of the subcarrier determines the particular color (hue) that is to be reproduced at any particular instant of a horizontal scanning line. The amplitude of the subcarrier determines the strength of this hue in comparison to the black and white signal (brightness) and thus determines its shade or tint (saturation).

THE PHASE ANGLE OF THE SUBCARRIER DETERMINES THE COLOR (HUE)

Two demodulators are used in the receiver to recover the color information brought in by the color subcarrier. Each demodulator can detect a change in the phase of the subcarrier since they are supplied with a signal standard by the local 3.58 megacycle color oscillator (the oscillator signal also effectively re-inserts the 3.58 megacycle subcarrier). A change in phase of the subcarrier can produce a most important action through the demodulators.. it can change the polarity of the output voltage. Depending on the phase angle of the transmitted subcarrier, a positive or negative voltage may be developed at the output of either of the demodulators.

Since the polarity of the output voltage of a demodulator is dependent on the phase of the subcarrier in comparison to the phase of the local oscillator signal supplied this particular demodulator, it should be apparent that the demodulators can be designed to produce different polarity outputs from the same subcarrier merely by shifting the phase of the oscillator signal fed to one of the demodulators. This is accomplished by inserting a phase shifting network between the local oscillator and the B-Y demodulator (the network shifts the phase of the local oscillator fed to the B-Y demodulator by 90 degrees, in respect to the oscillator signal to the R-Y demodulator). In this manner, it is possible to obtain four different polarity output voltages from the two demodulators as the same subcarrier signal is shifted through 360 degrees. The demodulator output voltages may be: both positive, both negative, or one positive and one negative--or one negative and the other positive.

The output voltages of the two demodulators (R-Y & B-Y) are amplified through their respective amplifiers (R-Y and B-Y) and used to drive the control grids of the red and blue picture tube guns, respectively. If we put a positive voltage on the control grid of the blue gun, the blue phosphor dots over the entire picture screen will be more brightly lighted. If we put a negative voltage on the control grid of the green gun, the green phosphor dots over the entire picture screen will be dimmed. Thus we have the first fundamental action required to produce a particular color on the screen, since it is possible to transmit a subcarrier phase angle which will produce a positive voltage on the red electron gun lighting the red dots more brightly; at the same time producing a negative voltage on the blue electron gun reducing the brightness of the blue dots. The second requirement is to get a third negative voltage on the green gun in order to reduce the brightness of the green dots. This is accomplished by feeding some of the positive voltage of the red system and some of the negative voltage from the blue system to a third amplifier (G-Y). The two voltages subtract from each other across the G-Y resistor input system and only the remainder of the larger of the two signals will operate the tube. In this particular case, the red positive signal is the larger and the remainder is amplified and inverted through the G-Y amplifier so that a negative voltage is supplied to the control grid of the green electron gun. (NOTE: In the case of a phase angle producing positive or negative voltage outputs at both demodulators....the G-Y amplifier would add voltages.)

The preceding paragraphs explained how positive and negative voltages are produced by two separate demodulators operating on a single subcarrier and how the control grids of the three electron guns receive the correct polarities to increase or decrease the brightness of the colors. We must now take into consideration the fact that a video signal is being fed to the picture tube cathodes simultaneously with the color signals arriving at the control grids. It should be obvious that the signals at the control grids can either add to or subtract from the video brightness signals at the cathodes, resulting in an increase of brightness of a particular color or no change at all due to cancellation. Using the red signal as an example of this, as before, we find that the R-Y demodulator and amplifier will feed a positive voltage to the red CRT control grid and the B-Y demodulator and amplifier feeds a negative voltage to the blue CRT control grid. The negative B-Y signal feeds into the control grid of the blue gun and cancels the brightness signal (negative) at the cathode of the blue gun, resulting in no change in the blue beam current. The positive R-Y signal feeds into the grid of the red gun and adds to the negative brightness signal at the cathode of the red gun. Thus, the red electron gun increases its emission and colors the area red.

The green electron gun is fed by the signal from the G-Y amplifier and since the G-Y amplifier is receiving a signal from the output of both the R-Y and B-Y amplifiers, it will either add or subtract these signals. In this case, there is a positive signal at the output of the R-Y amplifier and a negative signal at the output of the B-Y amplifier, the G-Y amplifier finds the difference, inverts it, and feeds it to the green gun in the correct polarity to cancel the brightness signal at the cathode of the green gun. Thus, we find that the green gun as well as the blue gun do not change conduction, leaving only the red gun emitting heavily and coloring the area red.

Blue and green signals are formed in the same manner, the only difference being in the phase angle of the 3.58 Mc color subcarrier which, in turn, produces voltages in the demodulators of such polarities that the two unwanted color guns do not change conduction. For example, when transmitting blue, the phase angle of the subcarrier is such that the red electron gun receives a negative signal at the control grid, cancelling the negative brightness signal at the red cathode. The blue electron gun receives a positive signal at the control grid adding to the negative brightness signal at the blue gun cathode. The red and blue signals are fed to the green (G-Y) amplifier and result in a negative output to the green control grid cancelling the negative brightness signal of the cathode. Thus, we find that the red and green guns remain at the same brightness level as when no signal was applied and that the blue gun conducts heavily...coloring the particular area being scanned blue.

A similar action occurs for any green areas, with the exception that the polarities are such that the red and blue signals cancel their portion of the brightness signal, while the green signal adds to the brightness signal giving a green area.

It should be apparent that the phase angle of the color subcarrier determines the polarity output of the demodulators and thus, which signals will add and which will cancel creating the particular color required. As the phase angle of the color subcarrier is shifted, from 0 to 360 degrees, the color of the screen will not only change through the three basic colors of red, blue and green, but also through the entire color spectrum capable of being reproduced by the combinations of these three colors.

Now, let us suppose that the phase of the subcarrier is such that a red area is being produced on the screen and that the voltage of just the color signal alone is reduced. The result is that there is more brightness signal than red color signal and the red takes on a faded tint. In other words, when the amplitude of the color subcarrier is changed in respect to the brightness signal, the shade or tint of the particular color reproduced will change. The change of shade, or tint, of a color is called its saturation. Thus, we find that the amplitude of the color subcarrier in respect to the brightness signal determines the particular shade (saturation) of the basic color and that the phase angle of the subcarrier determines the particular color desired (hue).

In order for the demodulators to be able to detect a change in the phase of the color subcarrier, they must compare the subcarrier against a standard. This standard is the local 3.58 Mc color oscillator in the receiver. However, the local oscillator must have the same phase and frequency as that of the 3.58 Mc oscillator of the transmitter (before the phase of the transmitter subcarrier oscillator is changed by phase shifting). To accomplish this, a color synchronizing signal is sent at the trailing edge of the horizontal synchronizing pulse which is approximately nine cycles of 3.58 megacycles. This signal is called the "burst" signal and its purpose is to pull the receiver's local 3.58 Mc oscillator into the correct phase and frequency. During the horizontal line scanning, the local oscillator maintains its phase and frequency due to the action of the AFC control system. Oscillator stability is achieved by crystal control. Because the oscillator is held to a rigid phase relationship with the burst, a change in the phase of the color subcarrier will result in a change in amplitude or polarity of the demodulator output voltage.

THE BANDPASS AMPLIFIER AND COLOR BURST BOOST SYSTEM

The bandpass amplifier is the first tube stage of the color channel. It receives the color signal from the plate of the second video amplifier through a potentiometer mechanically ganged with the contrast control (cathode of the brightness amplifier). In this manner, the amplitude of the color signal through the chroma channel is tracked with the amplitude of the video signal through the brightness channel. An independent gain control potentiometer, located in the cathode of the bandpass amplifier, regulates the strength of the color signal only. This control is located on the front panel and is labeled "color intensity".

The synchronizing burst signal also travels through the bandpass amplifier, to reach the automatic frequency control (AFC) system of the local 3.58 megacycle oscillator.

To insure constant burst signal to the AFC system, at all settings of the color intensity control; the gain of the bandpass amplifier is automatically increased to maximum during the burst signal by injection of a positive pulse of voltage (burst boost pulse) at its control grid. This positive pulse is generated at the cathode of the damper tube during the retrace time of the horizontal sweep system and, therefore, arrives at the grid of the bandpass amplifier at approximately the time of the burst signal. (NOTE: The burst pulse is transmitted immediately following the horizontal sync pulse: the sync pulse coincides with the retrace of the horizontal system, therefore, the burst and boost pulses should arrive at the grid of the amplifier almost simultaneously.

The burst boost pulse, if of constant amplitude, would always increase the gain of the bandpass amplifier during the burst signal. However, the total amplification factor of the stage would still be dependent on the setting of the color intensity control plus the boost voltage and the burst signal would change amplitude as the setting of this control were changed. Since it is desirable to maintain the burst signal at a constant level for best AFC action in the following circuits, a clamping diode (1N60 crystal) is provided from the boost pulse input to the "hot" end of the color intensity control which varies the amplitude of the boost pulse. The clamping action of the diode is regulated by the voltage produced across the intensity control and thus the amplitude of the boost pulse is regulated by the intensity control setting. In this manner, the amplitude of the boost pulse is always such that the burst signal is amplified by the same amount (maximum gain). The constant amplitude of the burst signal, provided by this circuit, gives superior AFC control action of the 3.58 Mc crystal oscillator.

Inspection of the bandpass stage will show that a type 12BY7 sharp cut-off pentode type tube is used. However, a sharp cut-off type tube does not readily lend itself to gain-controlled circuits due to the fact that, as the bias is increased on the control grid, the tube begins acting as a clipper and the gain of the stage is not appreciably changed. A unique action is achieved in the bandpass amplifier, between the high gain of the sharp cut-off pentode and the variable gain characteristic of the remote cut-off pentode, by the use of a larger-than-normal value of screen dropping resistor (approximately 22K ohms). The screen voltage of the tube varies with the setting of the cathode bias potentiometer since the total tube current is changed in accordance with the bias. For example, as the bias is increased, the total tube current is decreased and the I x R drop, occurring across the screen resistor, is decreased resulting in a higher screen potential. As the screen voltage is increased, the tube becomes harder to cut-off due to the fact that the cut-off voltage and gain of the tube are quite dependent on the screen voltage. Thus, we find that the tube begins to act similar to a remote cut-off type of tube; also that the gain is changed, due to the characteristic curve of the tube changing with the screen voltage.

OPERATION OF THE CLAMP CIRCUIT (BURST BOOST)

Inspection of the schematic diagram shows that a positive pulse (boost signal) is coupled from the damper tube's cathode through a network (R-150, C-140, C-141 and C-142). The signal is fed to the junction of the grid resistors R-101 and R-102 and is developed across resistor R-102 (10K ohms). The resistor R-101 (3300 ohms) and peaking coil L-42 apply the voltage to the control grid. The purpose of the 1 megohm resistor returned to B++ is to counteract any negative voltage developed by the diode's conduction.

The clamping crystal CR-5 connects from the boost signal input point to the "hot" end of the color intensity control. Resistor R-103 is a conventional cathode biasing resistor, as are the cathode bypass capacitors C-105 and C-66C. Capacitor C-66C (100 mfd electrolytic) provides sufficient bypass action to prevent degeneration, with resultant loss of gain, at low frequency signals. Due to the inefficient bypass action of an electrolytic capacitor on higher frequency components, a second paper capacitor (.01 mfd - C-105) parallels the electrolytic.

The crystal CR-5 is connected in the circuit in such manner that a positive pulse voltage at the junction of the grid resistors R-101 and R-102 will cause the crystal to conduct. Considering a case in which the viewer might prefer strong color intensity signals and in which the color intensity control is set to minimum resistance (maximum stage gain), the cathode of CR-5 is at or near chassis ground potential. In this case, the forward resistance of the crystal is effectively shunted across the boost signal input R-102. CR-5 acts as a low resistance path to ground for any positive pulses appearing at this point. Thus, the boost pulse is removed or reduced, since the burst signal is receiving maximum gain and does not require a boost.

Considering the opposite case, in which the viewer might prefer weak color intensity signals, the gain of the bandpass amplifier would be decreased by increasing the resistance of the color intensity control (increased tube bias). Since it is desired to maintain the gain of the bandpass amplifier constant for the burst signal, the boost pulse now is allowed to appear at the tube input. When the resistance of the cathode potentiometer is increased (as the color intensity control is adjusted) the tube current flowing through this resistance will produce a voltage which will be positive at the cathode end, negative at the ground end. This voltage must be overcome by the boost signal before the crystal diode will conduct; therefore, a positive boost pulse will be aiding the signal at the control grid which will give maximum gain to the burst signal. The amplitude of this pulse will nearly equal the DC voltage across the cathode resistor.

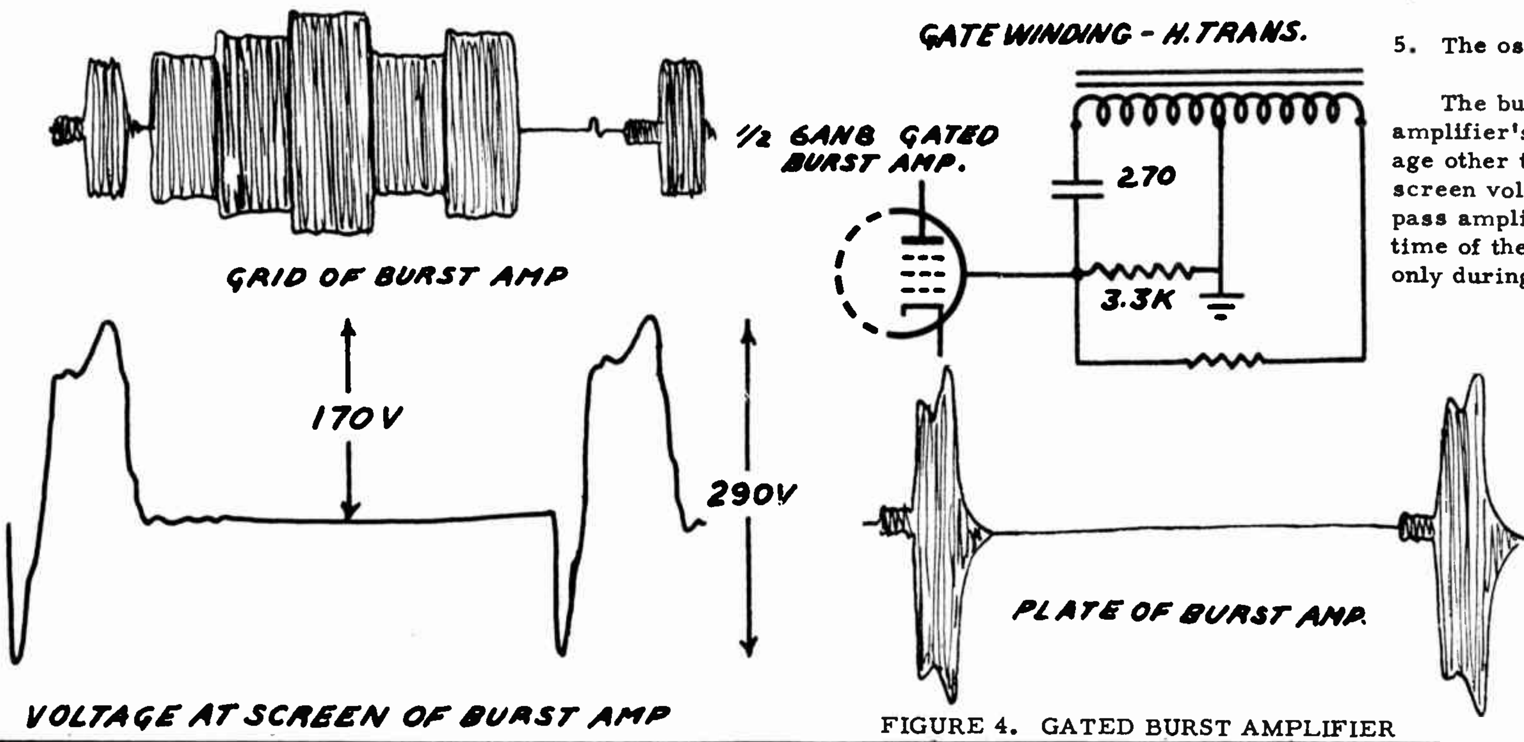
THE 3.58 MC COLOR OSCILLATOR SYSTEM

The path of the synchronizing burst signal, the AFC voltage and local 3.58 Mc oscillator signal is as follows:

From the plate of the second video amplifier to:

1. The burst amplifier
2. The color AFC phase detector
3. The reactance tube
4. The 3.58 Mc crystal oscillator
5. The oscillator buffer stage (output).

The burst amplifier receives the entire color signal, at its control grid, from the bandpass amplifier's output link coupling system. Since the screen of the burst amplifier has no B+ voltage other than that fed from a winding on the horizontal output transformer, the tube is without screen voltage except during retrace of the horizontal sweep circuit. In this manner, the bandpass amplifier is allowed to operate only during horizontal retrace, which corresponds to the time of the burst transmission. In other words, the burst amplifier tube is gated to operate only during the color burst.



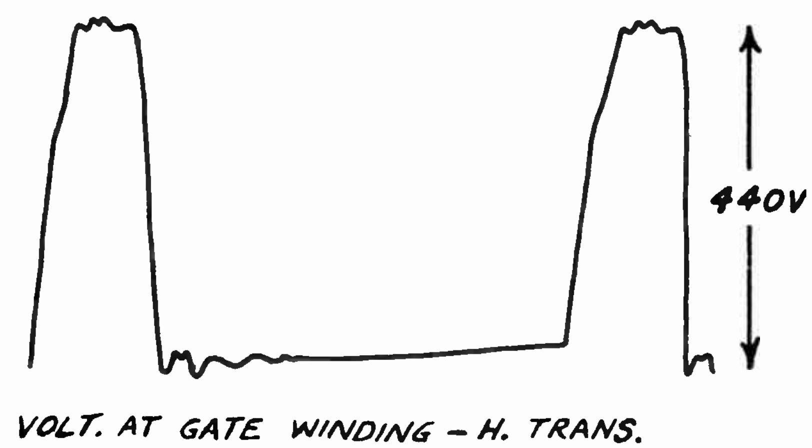


FIGURE 4. GATED BURST AMPLIFIER

The output of the burst amplifier is transformer coupled to the color AFC phase detector and, due to the keying of this stage as explained, allows only the burst to enter the phase detector. A second input to the phase detector is through transformer coupling from the output of the buffer amplifier, which in turn, is driven by the local 3.58 Mc color oscillator.

The phase detector compares the phase and frequency of the incoming burst signal, from the burst amplifier, with that of the local color oscillator. Any difference in phase or frequency results in a DC output from the center tap of the load resistors and is applied to the control grid of the reactance tube.

The reactance tube's plate current then, is under the direct control of the phase detector. Any change in the current of this stage presents varying amounts of capacitance (produced electronically by the reactance tube) to the crystal controlled oscillator and restores the phase and frequency of the oscillator.

THE BURST AMPLIFIER

The burst amplifier performs a similar function in the color system as the sync separator performs in the sync section of the conventional black and white receiver...it separates the color synchronizing burst signal (from the black and white sync as well as from the coloring information). Stated in a different manner, the burst amplifier tube allows only the color sync burst to reach the phase detector for frequency control action.

The burst amplifier is inoperative during the scanning of horizontal picture lines due to the fact that it is not supplied with screen voltage. The tube is made operative during the burst signal by a positive pulse of voltage fed to the screen from an independent gate winding located on the horizontal output transformer. The transformer and gate winding produces sizeable voltages only during the time of horizontal retrace -- during which time the burst amplifier is allowed to conduct.

The burst signal is transmitted during the blanking pedestal immediately following the horizontal sync pulse. In a receiver which is operating properly, retrace of the horizontal sweep system is initiated in close coincidence with the transmitted horizontal sync pulse. Therefore, the time of the horizontal retrace, in the receiver, occurs very close to that of the burst signal. The burst tube is keyed by the pulse fed to its screen during retrace and since the sync burst signal arrives at the grid at approximately the same time, the burst signal only is amplified and passed on to the following stages (see "Gated Burst Amp" drawing).(Fig. 14)

As stated, the burst signal is transmitted after the sync pulse and it is apparent that the keying pulse fed to the burst amplifier screen will slightly lead the burst signal at the grid ...in which case a portion of the last few burst cycles would be lost. To shift the time of the keying pulse so that it more closely coincides with the burst signal, a network (10K ohm resistor, 3300 ohm resistor and 270 mmf capacitor) is utilized to shape and delay the keying pulse.

The grid input system of the burst amplifier consists of a parallel resonant tank to ground. When tuned to 3.58 Mc, the tank will develop maximum burst voltage to the burst amplifier. Inspection of the circuit shows that the tank is adjustable capacitively as well as inductively and that the capacitor is the color shading control located on the front panel of the receiver.

It has been established that the voltage reaching the burst amplifier is that produced across the resonant tank in the grid circuit, and that this voltage represents the burst signal. When the tank is tuned to approximately 3.58 Mc, the signal produced by the tank will have the same phase as that of the incoming burst signal. On the other hand, if the tank circuit is above or below resonance (detuned), as determined by the color shading capacitor...the burst signal developed across the tank will lead or lag the actual burst signal. Since the local color oscillator is synchronized with the burst signal appearing across the burst amplifier grid tank, the local color oscillator will shift its phase to follow that of the tuned tank.

The color oscillator is being used as the standard against which the color subcarrier phase and frequency are being compared. When the phase of the subcarrier changes, the new phase angle represents a specific hue. Therefore, shifting the phase of the local oscillator, by means of the color shading capacitor, is equivalent to shifting all hues by the amount of the oscillator phase shift. This is the method used: to obtain correct, or desired tints and shades of the picture hues; to compensate for phase shift occurring through the chroma channel.

THE COLOR AFC TUBE (Phase Detector)

The purpose of the phase detector is to compare the phase and frequency of the local 3.58 Mc color oscillator against the 3.58 Mc color burst sent from the transmitter. Should a difference in phase or frequency exist between the burst and color oscillator signals, the phase detector (color AFC) will supply a DC voltage to the reactance tube which will pull the color oscillator into the desired phase and frequency with the burst signal. The polarity of this corrective voltage is dependent upon whether the color oscillator is running faster or slower (leading or lagging) than the reference burst signal; the amplitude of the DC voltage depends upon the degree of lead or lag. When both the burst signal, from the station, and the local color oscillator signal are matched in phase and frequency, the phase detector has zero output and no correction takes place.

The color AFC diodes (phase detector) may be considered as two conventional second detectors connected in such manner that one of the detectors will put out a positive rectified voltage while the other detector puts out a negative rectified voltage. Diode V-24A produces a positive rectified voltage at its cathode (junction of the .0015 mfd capacitor and 1 meg resistor). Diode V-24B produces a negative rectified voltage at its plate (junction of the .0015 mfd capacitor and 1 megohm resistor). The local color oscillator signal is fed to the phase detector at all times by the tap on coil L-210. The signal is fed equally to both diodes and both diodes will produce the same amount of rectified DC voltage across their load resistors, positive at top end of R-232 and negative at the bottom end of R-234 (see schematic). Maximum positive voltage will be found at the top end of R-232 and maximum negative voltage will be found at the bottom end of R-234....at some point between these maximum voltage values, a zero point exists. The movable rotor arm of the 250K ohm AFC balance potentiometer can locate this zero point. It should now be clear that when the oscillator signal only, is incoming to the phase detector, a zero DC voltage will be produced at the output.

As stated, the oscillator signal is injected into the phase detector at all times from coil L-210 and by itself produces a zero output voltage. During color reception, the burst signal is also injected into the phase detector; injection is from the tuned transformer T-203. The simultaneous injection of two AC signals into the phase detector create resultant voltages (added vectorially) which affect the two diodes differently. Considering the case when the phase of the burst and oscillator signals are of the required phase, the resultant of the burst and oscillator signal voltages to both diodes V-24A & B are equal and zero output results. If the phase of the oscillator signal, as compared to the burst signal, is not that required, the resultant voltage to diode V-24A would increase while the resultant voltage to diode V-24B would decrease. This would produce increased positive voltage at the cathode of V-24A, as compared to decreased negative voltage at the plate of V-24B, and result in a positive DC output from the detector. This condition results when the phase of the oscillator signal leads the phase of the burst signal. On the other hand, when the phase of the oscillator signal lags the phase of the burst signal, the resultant voltage to diode V-24B would increase and the resultant voltage to diode V-24A would decrease. This results in increased negative voltage at the plate of V-24B and decreased positive voltage at the cathode of V-24A. The phase detector would now have a negative DC output voltage.

SUMMARY: When both the phase of the oscillator and burst signals are that required by the circuitry, a zero DC output voltage is produced by the phase detector. When the phase of the oscillator signal leads the burst signal, V-24A conducts more heavily and diode V-24B conducts less heavily, producing a positive output DC voltage. When the phase of the oscillator signal lags the burst signal, diode V-24B conducts more heavily and diode V-24A conducts less heavily, producing a negative DC output voltage. This DC output voltage is supplied to the control grid of the reactance tube causing a capacitor tuning action to result which, in turn, pulls the oscillator into correct phase and frequency.

THE REACTANCE TUBE

The purpose of the reactance tube is to control the phase and frequency of the local 3.58 Mc color oscillator as dictated by the DC voltage produced by the phase detector (a DC voltage is produced in the phase detector when the phase of the local 3.58 Mc oscillator is not correct).

The reactance tube is connected across the crystal circuit of the oscillator and operates as an electronic capacitor, tuning the resonant crystal circuit to the correct frequency.

The oscillator signal voltage is fed, in reverse manner, to the plate of the reactance tube through the 100 mmf capacitor (C-236) and arrives at the grid of the reactance tube through the internal plate to grid tube capacity (in some chassis a 2 mmf capacitor is connected externally from plate to grid of the tube). The oscillator signal voltage arriving at the grid of the reactance tube leads the oscillator signal applied at the plate, due to the capacitor action. This leading voltage, at the tube's grid, produces a leading plate current through the reactance tube which makes the entire reactance tube circuit appear as a capacitor to the crystal oscillator. If the reactance tube's plate current and output signal are increased by a positive voltage on the control grid, the tube acts as a larger value capacitor and tunes the crystal to a lower frequency. If the reactance tube's plate current and output signal are decreased by a less positive (negative) voltage at its control grid, the tube acts as a smaller value capacity and tunes the crystal to a higher frequency. It should be clear that the apparent capacity presented to the crystal circuit is determined by the reactance tube's output signal and that this AC signal can be controlled by the voltage applied to the reactance tube's grid. A method is now available for controlling the frequency of the crystal oscillator by a DC voltage (as applied to the control grid of the reactance tube). The phase detector produces a DC output voltage when the phase and/or frequency of the local oscillator is not exactly that of the burst synchronizing signal sent from the transmitter. Therefore, a method of complete automatic frequency control of the local 3.58 Mc oscillator is available.

The plate current and output signal of the reactance tube determines the apparent value of capacity that is tuning the crystal to resonance. Therefore, if the reactance tube plate current is cut off by sufficient grid bias, it produces no capacity effect. It is easy to see that if minimum capacity of the tube (as produced by minimum plate current) does not tune the oscillator to the correct frequency before the reactance tube is completely cut off, the reactance tube will lose control of the oscillator. To insure sufficient range of the reactance tube's capacitor action, a tunable inductor (L-215) is incorporated in the plate circuit. This makes it possible to tune the crystal to resonance and still have the reactance tube operate over its most desirable range of voltages and currents.

THE 3.58 MC OSCILLATOR

The 3.58 Mc local color oscillator is basically a tuned plate-tuned grid type of circuit using shunt fed plate tank.

The oscillator is stabilized by a crystal in the grid circuit which replaces the usual L-C tuned tank. The crystal acts as a high "Q" tuned circuit and will operate within a few hundred cycles of the correct frequency, or not at all. The circuit is therefore operating at approximately the correct frequency.

The output of the oscillator increases as the plate L-C tank is tuned toward resonance. However, the circuit will continue to oscillate only when the tank is tuned on the high frequency side of the resonant point (the high frequency side is with the iron core out of the coil and moving into the coil) due to the phase of the feedback voltage required from the plate to grid through the tube's internal capacity. Since the circuit will not operate on the low side of resonance, it can be seen that as the tuning of the plate tank approaches resonance, the oscillator can become unstable, intermittent, or stop oscillating entirely; therefore, the correct point of the oscillator plate tank setting is always below the point of maximum output voltage (resonance) and on the high frequency side of the resonant point.

When operating, the oscillator is controlled by grid leak bias produced by capacitor C-237 (57 mmf) and R-246 (150K ohms) in the grid circuit. This negative voltage may be measured by a VTVM, as in any oscillator, and will give a good indication of the performance of the circuit.

The crystal CR-7, in the grid circuit, replaces the usual L-C tank; however, in action, it is similar to a parallel tuned circuit operating with a very high "Q". The crystal (in conjunction with the extraneous circuit capacities) will determine the frequency at which the oscillator will operate.

The 100 mmf capacitor (C-236) couples the oscillator voltage to the reactance tube V-28A which, in turn, acts as a variable electronic capacitor across the crystal, tuning it to the correct phase and frequency as dictated by the DC voltage produced in the color AFC circuit. The 100 mmf capacitor acts as a coupling from the reactance tube back to the crystal as well as from the crystal to the reactance tube.

The parallel tuned plate tank, consisting of L-216 and C-242 (180 mmf capacitor) is DC isolated from, and "RF" coupled to, the plate of the oscillator by capacitor C-241 (.01 mfd).

The plate receives DC voltage through the 150K ohm resistor R-249. Since the plate current for the oscillator does not flow through the plate L-C tank, it is called a shunt fed oscillator.

A tap on the plate tank coil feeds the oscillator signal to the buffer amplifier which acts as an output amplifier and isolation stage for the oscillator. The tap on the tank matches the impedance of the tank to the grid input impedance of the buffer stage for maximum power transfer.

THE BUFFER AMPLIFIER

The output of the local oscillator is coupled to the buffer amplifier by means of an impedance matching tap on the tuned plate tank of the oscillator. The buffer amplifier increases the oscillator signal and acts as an isolation stage between the oscillator and the demodulators, thus, keeping changes of voltages from affecting the oscillator stability. The output of the buffer amplifier is from the plate through a system of tuned coils. One tuned coil (L-210) feeds the signal to the R-Y demodulator in phase with the oscillator signal. The opposite coil (L-209) feeds the oscillator signal to the B-Y demodulator at a phase shift of 90 degrees. The output of the buffer amplifier is fed to the first tuned coil by the .01 mfd coupling capacitor. Coil L-210, in parallel with capacitors C-212 (180) and C-213 (.002) as well as other extraneous circuit capacities, constitute a parallel resonant tank. Therefore, tuning coil L-210 will result in maximum voltage developed across this circuit and maximum voltage fed to the R-Y demodulator. A portion of this voltage is tapped off by the divider circuit composed of C-212 (180 mmf) and C-213 (.002). The voltage developed across C-213 is fed to the following circuit consisting of C-211 (220), L-209 and C-214 (.01). C-214 is an RF bypass across the blue background control. C-211 and L-209 constitute a series resonant circuit and will develop maximum current through the series path when tuned to resonance. Thus, maximum voltage will be developed across coil L-209 and fed to the B-Y demodulator when properly tuned. However, since the voltage across the inductive portion of a series resonant circuit will lead the current by 90 degrees, the voltage fed to the B-Y demodulator will be 90 degrees out of phase with that fed to the R-Y demodulator. The purpose of these out-of-phase voltages, to the demodulators, is explained in the demodulator section. The oscillator signal into the demodulators is detected in the same fashion as by any peak detector and a DC voltage is developed across the load resistors proportional to peak of the oscillator signal. (This assumes absolutely no other incoming signal.)

On first thought, it would seem that the phasing of this circuit would be quite critical and require complicated and expensive equipment to tune the buffer tank coils for the correct voltage phases. However, an operational characteristic of the circuit makes the job quite easy. This characteristic is that, when the phase shifting coil L-209 is tuned to resonance, it will place maximum load on the parallel tuned tank (L-210). In other words, the voltage developed by coil L-210 will drop below its normal value as the series tank L-209 is tuned to resonance. Thus, we have the effect of the voltage fed to the R-Y demodulators dropping as the voltage to the B-Y demodulator is being increased. The voltage being referred to, is the rectified voltage developed at the junction of the 33 mmf capacitor and the 10K ohm load resistor of the demodulators. This voltage can be measured by use of a VTVM connected from this junction to ground (the hot lead of the meter connects to the junction and the ground lead of the meter connects to chassis).

The method of tuning the phase shifting coils in the output of the buffer amplifier is then to connect the meter to the load side of the R-Y demodulator and tune the first coil (L-210) for maximum voltage reading. Next, tune the phase shifting coil (L-209) for maximum voltage to the B-Y demodulator...this will result in reduced voltage to the R-Y demodulator. Retune coil L-210 for maximum voltage to the R-Y demodulator. Retune coil L-209 for maximum voltage to the B-Y demodulator and minimum voltage to the R-Y demodulator. It is necessary to work between the two coils until minimum interaction is obtained. The procedure is nothing more than tuning both tank coils to resonance and when this is accomplished, the phase shift will automatically be correct...provided there are no component part failures in the system.

THE DEMODULATORS

The function of the demodulators in the receiver's color section is similar to that of the second detector in a standard TV or radio receiver; they demodulate the color subcarrier. The demodulators continuously test the phase and amplitude of the incoming color subcarrier during horizontal picture scanning and produce an output voltage when the phase or amplitude changes. The reference phase during scanning is that of the local 3.58 Mc oscillator.

Two separate demodulators are required in the receiver to demodulate the color subcarrier signal completely. Although both demodulators operate on the same subcarrier signal, each is capable of extracting different signal information. This will be explained in the later paragraphs.

One of the demodulators is labeled the R-Y demodulator and consists of the diodes V-25A and B (see the schematic diagram). The other demodulator (B-Y) consists of the diodes V-26A and B. Considering the diode sections of tube V-25 only (the R-Y demodulator), we may regard the diode sections A and B as two conventional second detectors connected in such manner that one of the diode detectors (A) will produce a positive rectified output voltage at its cathode while the other detector (B) will produce a negative rectified output voltage at its plate. These voltages will be produced across the load resistors R-241 and R-265 (10K ohms) respectively.

The local color oscillator signal is fed to the demodulators (pins 7 and 5) continuously from the output of the buffer amplifier. Since the oscillator signal voltage is fed to both diodes equally (pins 7 and 5 are tied together), both diodes will produce the same value of rectified DC voltage (opposite polarity) across their load resistors. The load resistor voltage will be maximum positive at the top end of R-241 and maximum negative at the bottom end of R-265. The center tap of R-241 and R-265 will be at a zero voltage point since it is at the mid-point of positive and negative voltages. It should now be clear that when the oscillator signal only is incoming to the demodulator, zero output voltage is produced and no signal reaches the R-Y amplifier. An identical action occurs in the B-Y demodulator with the oscillator signal only. As stated, the oscillator signal is injected into the R-Y and B-Y demodulators continuously from the output of the buffer amplifier. During color reception, the color subcarrier is also injected into the demodulators from transformer T-202. The simultaneous injection of two alternating current signals into a demodulator produce resultant voltages that are of quite a different value than either of the injected signals alone. The phase angle between the two injected signals determines the final resultant voltage value that will be applied to each diode (A and B) of any one demodulator. For example, if the phase of the subcarrier signal lags the oscillator signal at the R-Y demodulator, a larger resultant voltage is applied to diode V-25A and a smaller resultant voltage is applied to diode V-25B. Increased conduction current through diode V-25A produces a greater positive voltage at the junction of resistor R-241 and capacitor C-207, in respect to ground. Decreased conduction current through diode V-25B produces a decreased negative voltage at the junction of resistor R-265 and capacitor C-208, in respect to ground. The load voltages are unequal and do not cancel at the center junction. The larger voltage (positive) of the two load voltages will now appear at the output of the R-Y demodulator. If the phase of the subcarrier signal leads the oscillator signal at the R-Y demodulator, the reverse action would occur and the demodulator would have a negative output voltage. The fundamental action of the R-Y demodulator, just explained, is repeated in the B-Y demodulator. The major difference between the R-Y and B-Y demodulator operation is due to a difference in the phase of the local 3.58 Mc oscillator signal fed to each.

In order to understand the action of the two demodulators (R-Y and B-Y) when operating on the same subcarrier, it is necessary to first learn some fundamental characteristics of a demodulator. The important rules are that: when the waveform of the incoming subcarrier leads or lags the oscillator signal (the oscillator is used as the standard) by a quarter of a cycle (90 degrees), the output of the demodulator is zero. When the incoming subcarrier is in phase with the demodulator: maximum positive voltage appears at the output of the demodulator. When the incoming subcarrier is of opposite polarity (180 degrees out of phase) as compared to the local oscillator, the output is maximum negative voltage.

Summary:

1. A demodulator has zero output when the two input signals are a quarter cycle (90 degrees) apart.

2. A demodulator has maximum positive output voltage when the two input signals are in phase.

3. A demodulator has maximum negative output voltage when the two input signals are in phase ...but of opposite polarity (180 degrees apart).

It should now be a simple matter to understand the action of the two demodulators on the same color subcarrier signal. The B-Y demodulator is fed a local 3.58 Mc oscillator signal which is in phase with the subcarrier reference (zero degrees) and if a subcarrier signal were received at this phase, the demodulator would produce maximum positive output voltage. The R-Y demodulator is fed with a local 3.58 Mc oscillator signal which is a quarter cycle (90 degrees) away from the reference phase (zero degrees) and, as explained previously, would have zero output when a signal at zero reference phase is injected into it. In the case just described, the B-Y demodulator would have maximum positive output voltage and the R-Y demodulator would have zero output voltage on the same signal. If the phase of the subcarrier began to shift, the output of the R-Y demodulator would increase and the output of the B-Y demodulator would decrease.... until finally the output of the B-Y demodulator would be zero and the R-Y demodulator would be maximum. This represents a shift of a quarter cycle (90 degrees) of the subcarrier.

When one of the three primary phosphor colors (red, green or blue) is transmitted, the phase angle of the subcarrier is such that it falls somewhere between maximum output voltage of one demodulator and zero output voltage of the other demodulator. In this manner, both demodulators will have some output voltage. Also, the polarity of the voltage out of either of the demodulators will be determined by the phase angle of the subcarrier in reference to the local oscillator. An example of this is the phase angle of the subcarrier for a red picture area (104 degrees leading). In this case, the subcarrier phase slightly leads the oscillator signal into the R-Y demodulator and consequently the R-Y demodulator will have a positive output voltage. The same subcarrier lags the oscillator signal [-(B-Y) 180 degree phase] into the B-Y demodulator and it will have a negative output signal. If the outputs of the demodulators were fed directly into the control grids of the picture tube, the output voltages of the demodulators, as explained, would be correct. However, the signals out of the demodulators must pass through the R-Y and B-Y amplifiers and the polarities of all voltages would be inverted. This presents no problem in the circuit since it is only necessary to interchange the connections to the demodulator diodes to produce opposite polarity outputs for the same phase of input signal.

The final result of the demodulator action is to feed a positive voltage to the red electron gun's control grid (during the scanning of red areas) and a negative voltage to the control grids of the blue and green guns. In this manner, the color signal at the electron gun of the red tube adds to that of the brightness signal at the cathode and lights the red phosphors with greater intensity. In the same way, the negative signal at the blue and green control grids cancels the brightness signal at their cathodes and the blue and green phosphors have no change in brightness. For a review, see "Operation of the Color Receiver".

PURPOSE OF THE DYNAMIC CONVERGENCE SYSTEM

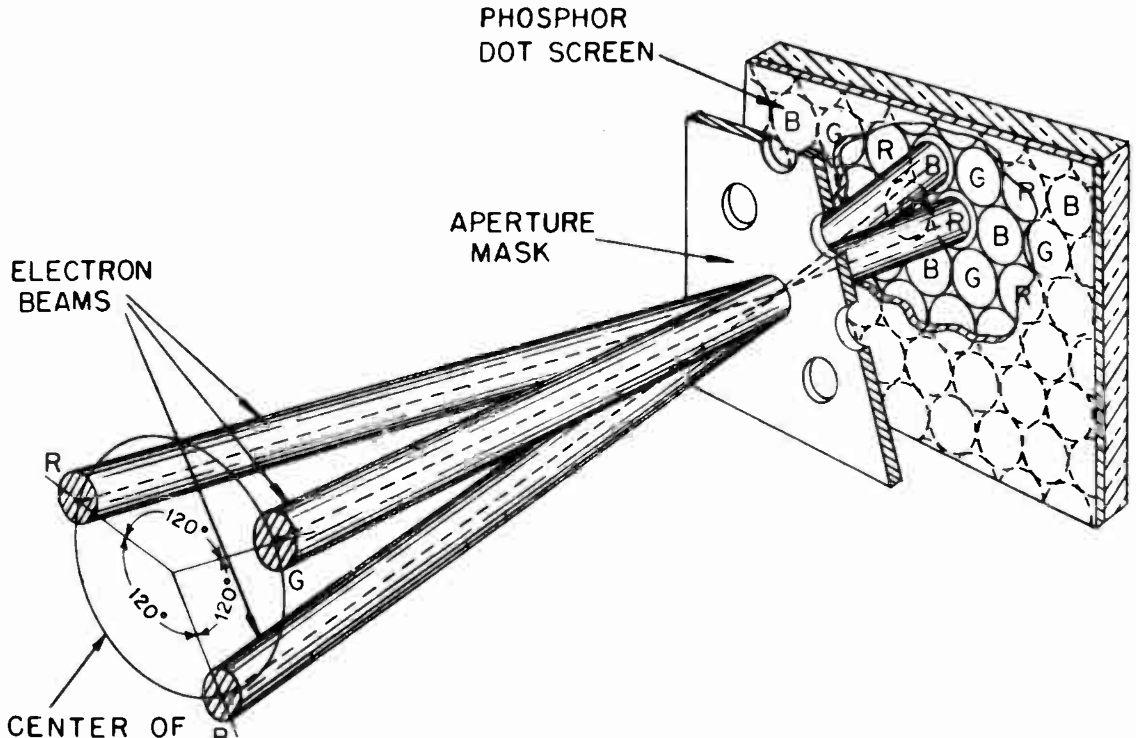
The term convergence refers to the point at which the three electron beams of the tri-color picture tube are made to cross-over before reaching the dot screen. The correct point for convergence of the three beams is at the hole in the aperture mask, which allows the beams to emerge at the correct angle for each beam to strike dots of just one color (see diagramatic illustration of the mask and screen). Convergence of the three beams is accomplished by a physical inward tilt of the electron guns as well as external, individually adjustable, beam bending magnets. This is called the static convergence system. (Fig. 5).

Exact convergence of the three beams over the entire screen cannot be accomplished by the aforementioned methods since the distance to the aperture mask is greater at the edges of the screen. In other words, the beams have to travel farther to reach the screen edges. This is due to the fact that the aperture mask and phosphor dot screen are not spherical and, therefore, do not follow the curve necessary to keep the beams converged at all points. To correct this condition, it is necessary to change the convergence point of the three beams as they are moved to either side of screen center as well as from top to bottom. Horizontal convergence is maintained by the horizontal dynamic convergence system and vertical convergence is maintained by the vertical dynamic convergence system. Since the beams are correctly converged at the center of the screen but are misconverged at the outer edges, the voltage waveform that will correct this condition will be minimum when the beams are at the screen center and maximum at the screen edges. This form of voltage curve is called a parabola.

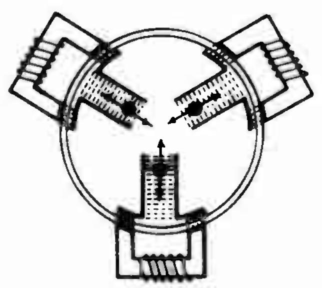
A study of the location of the electron guns in the neck of the tube and the manner in which the three beams are converged to strike dots of just one color will show that as the point of convergence is moved toward the guns (as it will be when the beams are at the edges of the screen and traveling a longer distance) that the angle of approach of the beams to the screen will be greater and that two of the beams will move below the horizontal scanning line while the third dot (blue) will move above the horizontal scan line.

To correct this condition, we must move the dots that fall below the line upward...and the dot that falls above the line downward. To accomplish this, we add a separate magnetic sweep system to each individual electron gun and feed currents into the coils of this sweep system so that they bend the beams back toward the scan line, as all three of the beams move to the screen edges.

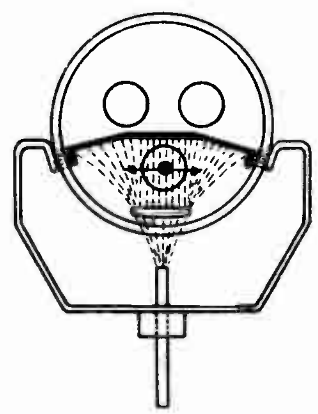
The dynamic convergence system consists of three separate coils mounted to the neck of the picture tube. Each coil has an effect on just the electron gun and beam that is directly under the coil and moves the beam by magnetic coupling. To insure that each coil has an effect on only one beam and to obtain the correct movement of the particular beam, vanes of magnetic material are placed on each side of each electron gun (see layout of dynamic convergence coils). Magnetic coupling from the coils is to the magnetic vanes which, in turn, place magnetic lines across the beam path from vane to vane. Each beam will be moved at right angles to the magnetic field produced by the coils and since these coils are spaced at equal distances around the neck of the tube (120 degrees apart) one beam (blue) will be shifted exactly up and down, while the other two beams will be shifted at an angle...in respect to the horizontal scanning lines. The coils are supplied with parabolic currents at the vertical and horizontal sweep rates, thus keeping the beams converged horizontally as well as vertically. The complete system constitutes the dynamic convergence system. (Fig. 5).



Diagramatic illustration of the mask and screen showing the convergence of the three beams at a single hole in the aperture mask. Note that the converged beams pass through the hole and strike their respective phosphor dots.

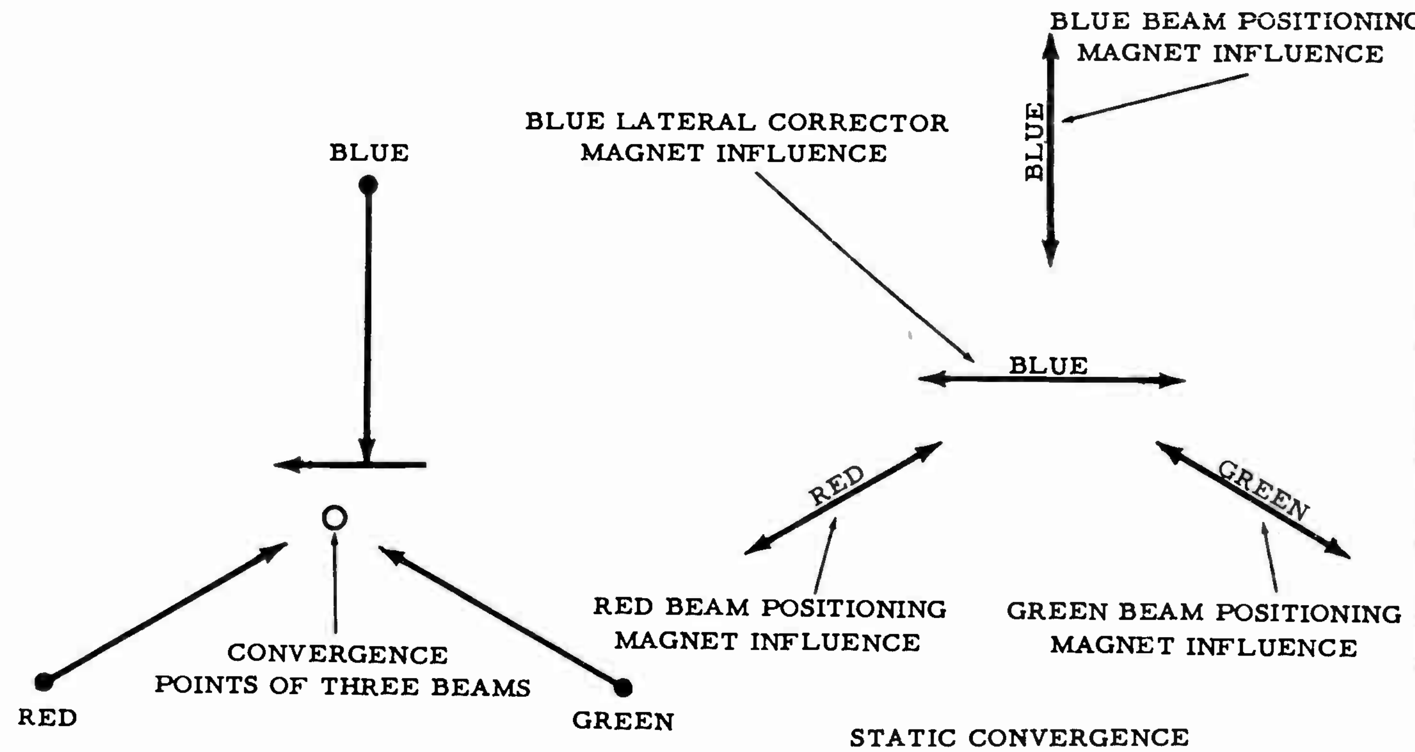


LAYOUT OF DYNAMIC CONVERGENCE COILS ARROWS SHOW DIRECTION OF BEAM MOTION



LAYOUT OF BLUE CORRECTOR POLES ARROW SHOWS DIRECTION OF BEAM MOTION

FIGURE 5.



STATIC CONVERGENCE

Direction of beam movement due to adjustment of three beam positioning magnets and blue lateral corrector magnet. (Beams shown overconverged)

SB-1

FIGURE 6. STATIC CONVERGENCE

THE BLUE CORRECTOR MAGNET OF THE STATIC CONVERGENCE SYSTEM

As stated previously, the three beams are made to converge at the center of the screen by a physical inward tilt of the electron guns as well as external, individually adjustable, beam positioning magnets. The beam positioning magnets are illustrated in the drawing of the 19-inch tri-color CRT shown in the "Installation and Operation" section. Notice that the magnets are spaced equally around the neck of the tube to lie directly above the three electron guns (120 degrees apart). The direction of each beam movement is identical to that shown by the arrows in the layout of the dynamic convergence coil drawing. The blue beam is moved in a vertical direction by movement of the blue beam positioning magnet, while the red and green beams are moved at an angle (with reference to a horizontal scanning line) by movement of the red and green beam positioning magnets. It is easy to see that the red and green dots will always have a convergence point since they can be moved toward the screen center at an angle. This is not necessarily true of the blue dot since it can only be moved vertically by the beam positioning magnet, and should it be out of convergence horizontally with the convergence point of the red and green beams...nothing could be done to correct its position. This condition is solved by an internal arrangement of magnetic material in the blue electron gun to provide a field for horizontal movement of the blue beam, provided by a fourth independent blue lateral corrector magnet (see layout of blue lateral corrector poles).

THE HORIZONTAL DYNAMIC CONVERGENCE SYSTEM

An independent secondary winding of the horizontal output transformer supplies a voltage pulse to the horizontal dynamic convergence system during each retrace of the horizontal sweep. The pulse occurs at a repetition rate of 15,750 times a second and represents a 15,750 cycle frequency.

The equivalent electrical circuit of the horizontal dynamic system is shown in the horizontal dynamics drawing (Figure 7). It consists of the 500 ohm horizontal dynamic amplitude potentiometer, a .01 mfd capacitor and the horizontal dynamic phase coil (which form a series resonant circuit) and the horizontal dynamic convergence coil. The 70, 100 and .05 mfd capacitors may be ignored in the equivalent drawing, since the reactance of these capacitors is negligible.

The amount of retrace pulse fed to the convergence circuit from the horizontal output transformer is determined by the 500 ohm horizontal dynamic amplitude potentiometer. The output of the potentiometer feeds into the series resonant circuit composed of the .01 mfd capacitor and the horizontal dynamic phase coil. For the sake of simplicity, it may be considered that the series resonant circuit is excited by the retrace pulse and will then oscillate at its resonant frequency. Since the series circuit must be tuned to 15,750 cycles (the repetition rate of the retrace pulse) it will produce a sine wave of 15,750 cycles (see Fig 7 "Across Horizontal Dynamic Phase Coil" drawing). When the series resonant circuit is tuned to this frequency by adjustment of the phase coil, maximum current will flow through the resonant circuit and maximum voltage will be produced across the phase coil. The phase coil now acts as an AC sine wave generator driving the horizontal dynamic convergence coil with a 15,750 cycle sine wave. The magnetic field produced by the convergence coil penetrates the glass neck of the picture tube and couples the flux lines through the magnetic vanes on either side of the electron beam (see "Layout of Dynamic Convergence Coils"). (Fig. 5).

The electron beam is thus forced to change its deflection angle in accordance with the 15,750 cycle sine wave and thus its convergence point with the other two beams as they move from left to right-hand sides of the screen for one horizontal scanning line. It is now possible to change the point of convergence of the beam on the left and right-hand sides of the screen as compared to the center of the screen and correct convergence of the beam may be maintained over the entire horizontal scan line.

THE VERTICAL DYNAMIC CONVERGENCE SYSTEM

The same physical coil used for the horizontal dynamic convergence system is also used for the vertical dynamic convergence system. The coil on the opposite leg of the core handles tilt voltages only and need not be considered at this time.

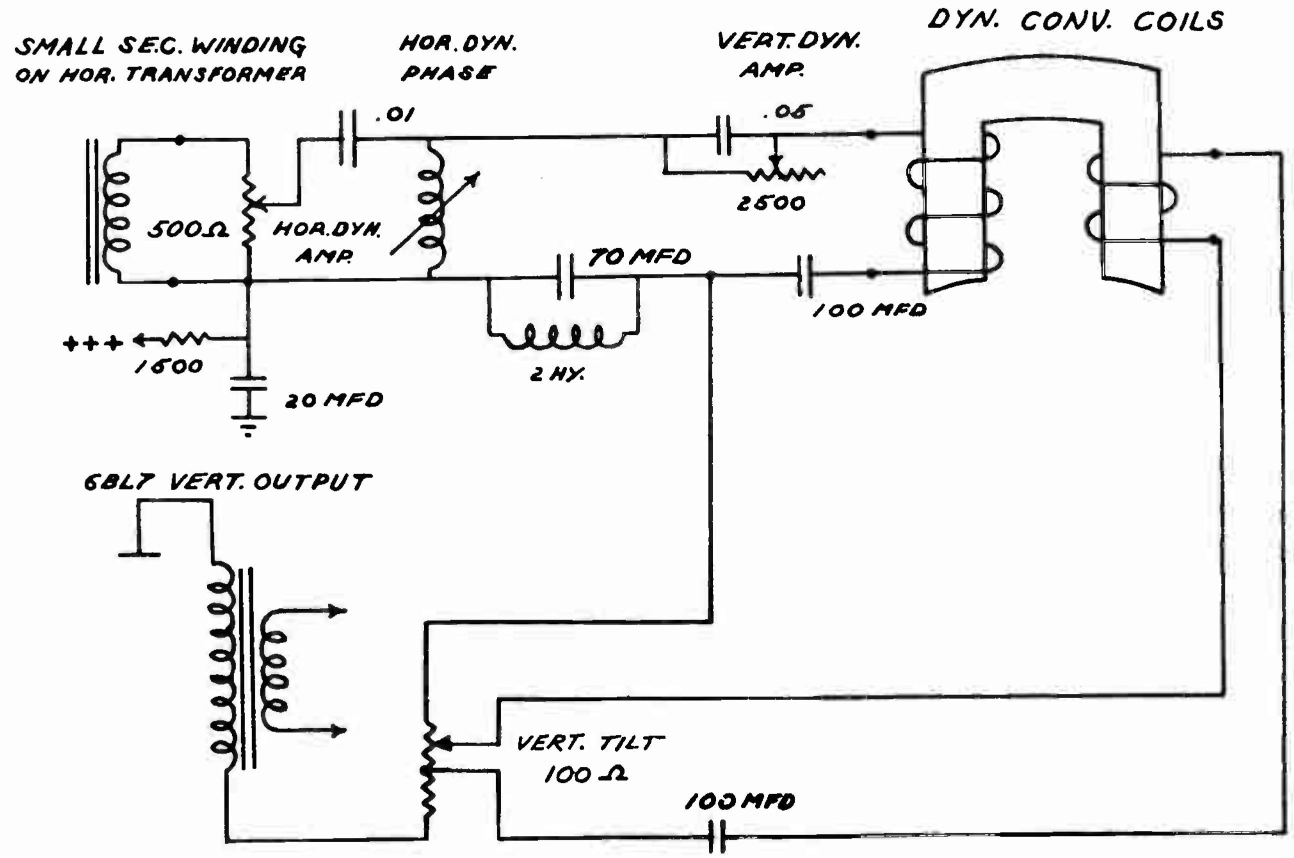
The simplified diagram (simplified convergence circuit) shows that the plate current for the vertical output tube flows through all the tilt potentiometers, through the 2 henry choke (in (Fig. 7). parallel with a 70 mfd capacitor) and finally to the B+++ by way of an 820 ohm resistor (R-164).

The formation of the dynamic parabolic voltage (vertical) is created across the parallel combination of the 70 mfd capacitor and the 2 henry choke. A combination of the charge and discharge time of the capacitor through the choke as well as the shape of the current curve through the capacitor performs the job of changing the sawtooth of current (created during the vertical sweep through the vertical output tube) into the required parabolic voltage. It may be correctly assumed from this point on that the 70 mfd capacitor and the 2 henry choke are acting as the parabolic voltage generator of the system.

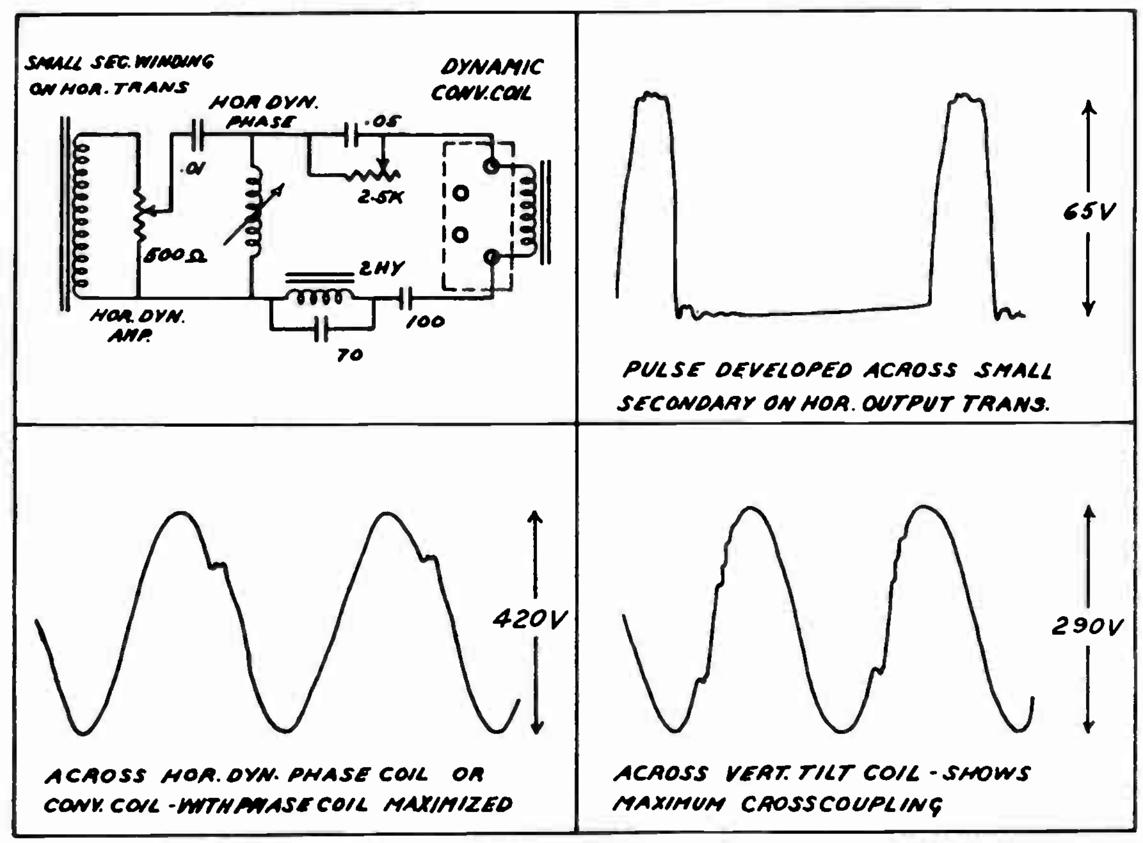
Inspection of the simplified convergence circuit shows that the 70 mfd capacitor and 2 henry choke are connected to the dynamic convergence coil through the following series paths: a 100 mfd capacitor, the horizontal dynamic phase coil and a parallel path of a .05 mfd capacitor and the 2500 ohm vertical dynamic amplitude potentiometer. This diagram may be simplified since the 100 mfd capacitor acts as a short circuit to 60 cycle current and may be replaced with a wire. The horizontal dynamic phase coil has such small reactance to 60 cycle current that it too may be replaced with a shorting wire. However, in the case of the parallel combination of the .05 mfd capacitor and the vertical amplitude potentiometer, the capacitor will not pass 60 cycle current and the 2500 ohm potentiometer is effective in the circuit.

The completely simplified circuit is shown in the drawing "Vertical Dynamics" and we find that the parallel circuit of the 70 mfd capacitor and the 2 henry choke are supplying the vertical dynamic coil with the correct parabolic voltages by way of the dynamic amplitude potentiometer and 100 mmf capacitor. (Fig. 8).

The 60 cycle parabolic voltage fed to the convergence coil creates a magnetic flux which is coupled to the beam by the magnetic vanes described previously. Keep in mind that there is a separate coil located on the tube neck for each electron gun.



SIMPLIFIED CONVERGENCE CIRCUIT



HORIZONTAL DYNAMICS

FIGURE 7.

THE VERTICAL TILT SYSTEM

The current waveform through the vertical tilt potentiometers is in the form of a sawtooth due to the action of the vertical sweep output tube. A voltage drop can occur across the rotor arm of the potentiometer and the center tap when the arm is not at the electrical center. If the arm of the potentiometer is set at the center tap junction, there would be no voltage drop and no voltage would be fed to the tilt coils. If we assume that the arm of the potentiometer is toward the top of the pot, then a sawtooth will be formed between the rotor arm and the tap. Since the point at which current flows into a resistor is the negative voltage end of the resistor; the top end of the potentiometer would have a negative polarity sawtooth. This would create a current flow through the tilt coil in a particular direction and create a sawtooth flux pattern imposed on the electron beam located under the particular coil associated with this potentiometer. Should the arm of the potentiometer be moved below the center tap, the lower end of the potentiometer would be the negative end and a sawtooth would be formed between the rotor arm and the tap... the amplitude of which would be determined by the amount of resistance between the arm and the center tap. In this case, the current through the tilt coil would be reversed and a sawtooth flux pattern would be imposed upon the electron beam of an opposite polarity. In other words, a sawtooth of variable amplitude and positive or negative polarity may be added to the electron beam. The effect of this is to add the sawtooth to the vertical dynamic parabola voltages to shape them as required for best convergence in the vertical plane.

HIGH VOLTAGE POWER SUPPLY

The operating voltages which are used to establish beam intensity and shape (focus) in the tricolor picture tube originate in the retrace (kickback) power supply section. Three high voltage rectifiers (two 3A2's and 3A3) are employed in a voltage doubler network circuit. The horizontal transformer is similar to the conventional type of auto-transformer used in high voltage circuits of black and white receivers. Extra windings are provided, however, to supply pulse voltages to the burst amplifier and the horizontal dynamic convergence system and separate filament voltages to the high voltage rectifiers.

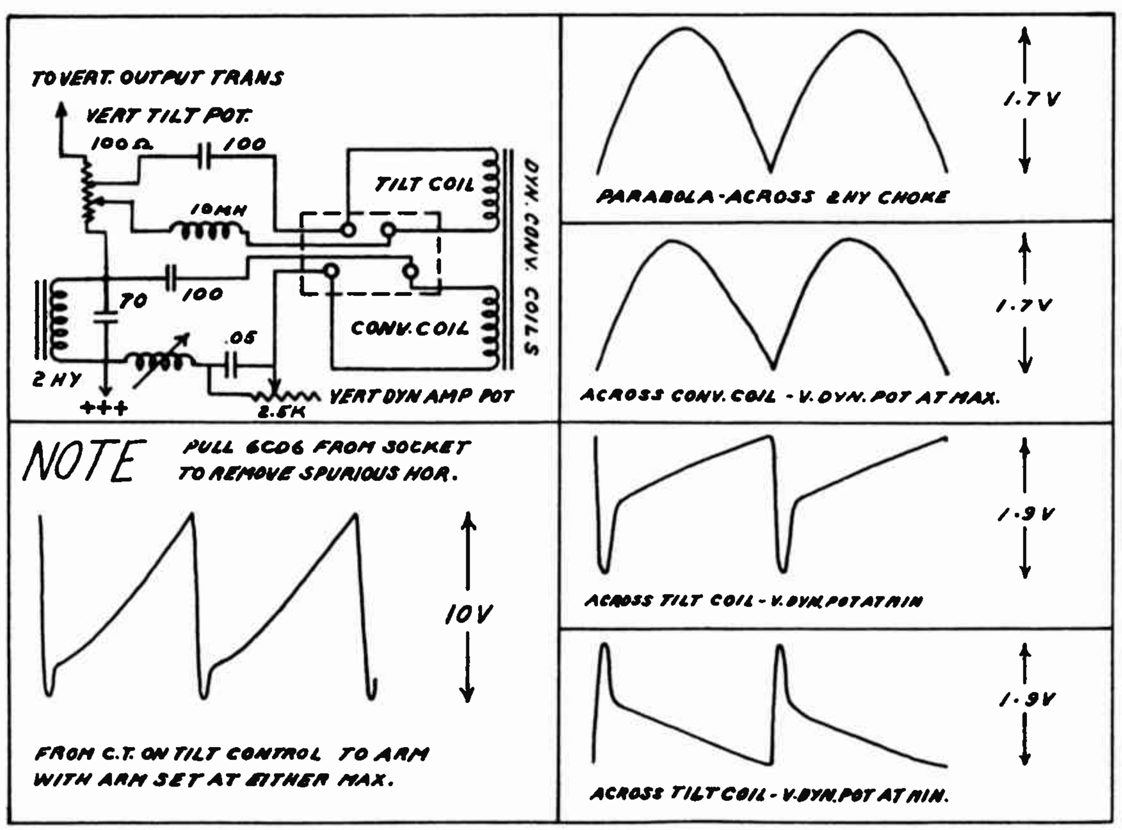


FIGURE 8. VERTICAL DYNAMICS

V-19 (3A2) and V-21 (3A3) conduct during retrace time. V-19 operates from a tap on the primary of T-13 so that the rectified output voltage at the filament of V-19 is approximately 8,000 volts. The focus circuit load drops that 8,000 volts so that approximately 6,000 volts is available at the plate of V-20. R-151 (2.5 meg) is used to adjust the voltage on the focus anode between 6,000 and 8,000 volts. The 6,000 volts at the plate of V-20 is coupled over to the plate of V-21 during the interval between pulses when V-20 conducts. This 6,000 volts plus approximately 19,000 volts, developed across the entire auto-transformer primary, appears at the plate of V-21 during retrace time. A voltage at the filament of V-21 equal to approximately 25,000 volts (developed across C-148) is available as the high voltage to the picture tube second anode.

Regulation of the 25,000 volt supply is obtained by using a regulator tube across the output circuit of the high voltage supply. Part of the output current is shunted through the regulator tube which offers a greater load to the high voltage system during the times when the high voltage tends to increase, with lessened picture tube loading (dark picture portions), and offers less load when the high voltage tends to decrease, due to increased picture tube loading (bright picture portions).

THE 19VP22 TRICOLOR PICTURE TUBE

The 19VP22 tricolor picture tube features an aluminized glass envelope, 62 degree deflection, electrostatic focusing; and is constructed for use with an electromagnetic convergence system. (Refer to diagrams of tricolor picture tube and gun assembly.)

Beam sources of the 19VP22 tricolor picture tube are supplied from a matched three-electron gun assembly. The three individual guns that make up the assembly are arranged 120 degrees apart in a triangular pattern. Each gun is tilted (approximately 1 degree) toward the common tube axis. This tilting of the guns is incorporated into the assembly with the intention of obtaining proper convergence of the beams at the center of the screen.

Aside from the yoke, which functions in the conventional manner, four external components are employed in conjunction with the tube's operation. They are: the purity device, the beam positioning magnets and convergence coils (one assembly) and the blue lateral corrector magnet. The purity device (two magnetic rings) is mounted on the neck of the tube between grid two and the focusing electrode. This device controls all beams simultaneously in an effort to provide color purity on the screen.

Three pairs of pole pieces are attached directly to the anodes of the guns (120 degrees apart). These pole pieces, or vanes, are used in conjunction with three permanent magnets (beam positioning magnets) and three electromagnetic coils (convergence coils), which are mounted directly over the pole pieces on the neck of the tube. In this manner, a means is provided for correction of center misconvergence (static adjustment) due to differences in the mechanical positions of the guns; and for correction of misconvergence at edges, top and bottom of the screen (dynamic adjustment), a natural development resulting from the particular shape of the shadow mask and phosphor-dot screen. A separate pair of pole pieces, or vanes, is attached to the focus electrode of the blue gun. This vane is used in conjunction with the blue lateral corrector magnet placed on the tube neck, directly over the vane; the action gives blue beam correction in the horizontal direction.

The tricolor phosphor-dot screen is placed directly on the inside surface of the face plate. (The opposite side of the face plate is the viewing surface of the tube.) 900,000 phosphor dots, arranged in 300,000 groups of dot trios, are located on the phosphor screen. Every dot trio includes a phosphor dot of each of the three primary colors; red, blue and green. A thin, arched shadow mask is positioned approximately 0.4 of an inch behind the phosphor screen. The shadow mask contains approximately 300,000 uniform-sized holes, precisely positioned in respect to the dot trios on the phosphor screen. Unlike the shadow masks in earlier, smaller-sized tricolor tubes, the shadow mask in the 19VP22 is unstressed, permitting expansion and contraction. High voltage requirements of the 19VP22 tricolor tube are: 25,000 volts at the anode (regulated); 6,500 to 8,000 volts at the focus electrode (adjustable).

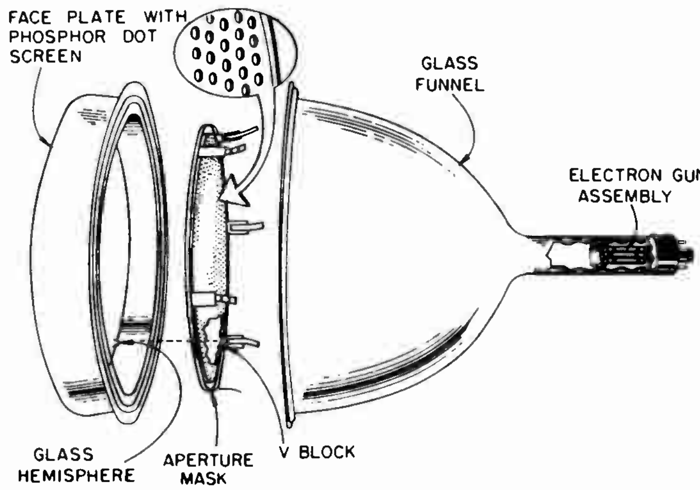
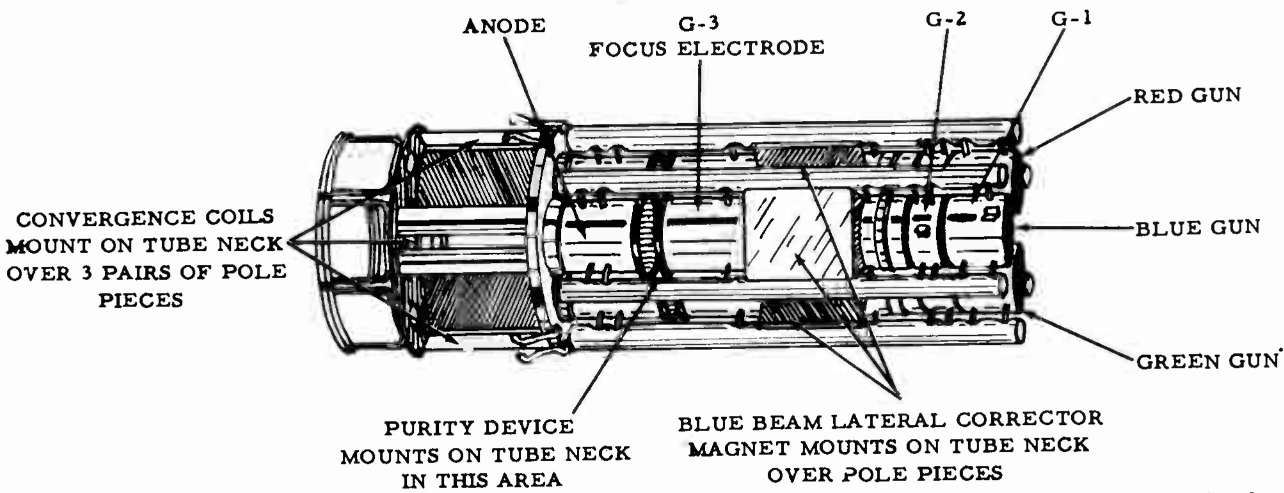
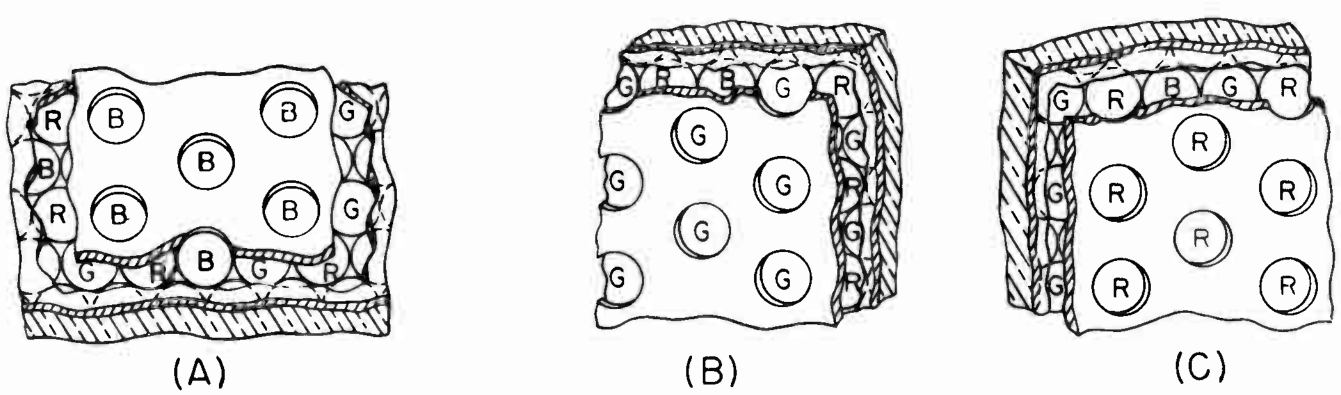


FIGURE 9. EXPLODED VIEW OF CBS COLORTRON



SB-2

ELECTRON GUN ASSEMBLY - 19VP22



Views of mask-and-screen assembly as seen from the deflection points of the three beams. (A) View from deflection point of blue gun. (B) View from deflection point of green gun. (C) View from deflection point of red gun.

FIGURE 10.

ALIGNMENT

NOTE: Circuit connections which are used during receiver alignment are symbolized TP and MTP throughout the alignment instructions. The location of these important test points can be found readily by referring to BP-902 vertical chassis, bottom view for TP number identification and TS-902 horizontal chassis, bottom view for MTP number identification.

IF ALIGNMENT
GENERAL INFORMATION

The three IF transformers of the TS-902 are aligned consecutively starting with the sweep generator at the 3rd IF and moving toward the tuner. The scope is connected across the video detector load resistor (at pin #3 of the SERVICE TEST RECEPTACLE) during the entire IF alignment procedure.

The chassis can be placed on its side, with the SERVICE TEST RECEPTACLE at the top, and positioned so that all connections and adjustments are readily accessible.

The position of the generator and the curve produced for each connection is shown on the IF alignment detail drawing in steps. Follow the steps in sequence. (See Figure 11).

EQUIPMENT REQUIRED

A. Sweep Generator: 38 to 50 Mc, 12 Mc sweep width, linear, and capable of .1 volt output.

B. Cathode-Ray Oscilloscope: preferably with calibrated attenuator

C. Variac: to adjust the line voltage if not 117 volts

NOTES: IMPORTANT

Do not ground the receiver chassis - use an isolation transformer.
Keep generator output as low as possible.
Line voltage must be 117 volts; if not, adjust with variac.
Allow sufficient warm-up time before alignment.
Some coils resonate at two core settings, use the outer end position.
Use a shielded lead for the vertical input of the scope.
Always connect ground end of signal generator, or scope leads, near point of signal input or take-off.
Use the following procedure in sequence for receiver alignment.

STEP #1 PRELIMINARY PROCEDURE

A. Remove the 6CD6 horizontal amplifier (V-17) from its socket.

B. Connect bias battery to place negative 3 volts on the IF AGC bus (MTP-12) or pin #1 of the SERVICE TEST RECEPTACLE (see bottom view of TS-902 horizontal chassis).(Fig. 12).

C. Terminate the sweep generator cable with a 56 or 75 ohm resistor, whichever is applicable. Also connect a 470 mmf capacitor in series with the hot lead of the generator to provide DC blocking.

D. Short RF secondary coils (in tuner) to ground through the hole in side of tuner shield (MTP-1).

OSCILLOSCOPE: Connects to the video detector output (MTP-6) through a 27K ohm isolation resistor or directly to pin #3 of the service test receptacle. Leave in this position for the entire IF procedure.

STEP #2

SWEEP GENERATOR: Connect to the grid of the 3rd IF. (Use the 3rd IF jack). (Refer to TS-902 horizontal chassis top view and bottom view during IF alignment.) (Fig. 11 & 12).

ADJUST

A. Top slug of 3rd IF (primary) to 41.25 Mc trap dip (minimum output).......trap.

B. Bottom slug of 3rd IF (primary) so the 45.75 Mc marker falls at knee of the response curve.

C. Bottom slug of 3rd IF (secondary) for 41.85 Mc marker at lower knee of curve.

STEP #3

SWEEP GENERATOR: Connect to the grid of the 1st IF (Use the 1st IF test receptacle.)

ADJUST

A. Top slug of 1st IF for 47.25 Mc dip (minimum)............................trap.

B. Top slug of 2nd IF for 39.75 Mc dip (minimum)............................trap.

C. Bottom slug of 1st IF for 45.75 Mc marker at the 70% point.

D. Bottom slug of 2nd IF for 41.85 Mc marker at knee (peak) of curve. If it is not possible to position the marker exactly, make certain it is not more than 10% down from the peak.

STEP #4

SWEEP GENERATOR: Connect to the grid of the mixer. (Use the mixer test receptacle.)

ADJUST

A. The mixer primary (L-26) and secondary (L-31) (both are located on top of the chassis) so that 45.75 Mc falls at the 50% point, and 41.85 Mc falls no less than 10% down from maximum.

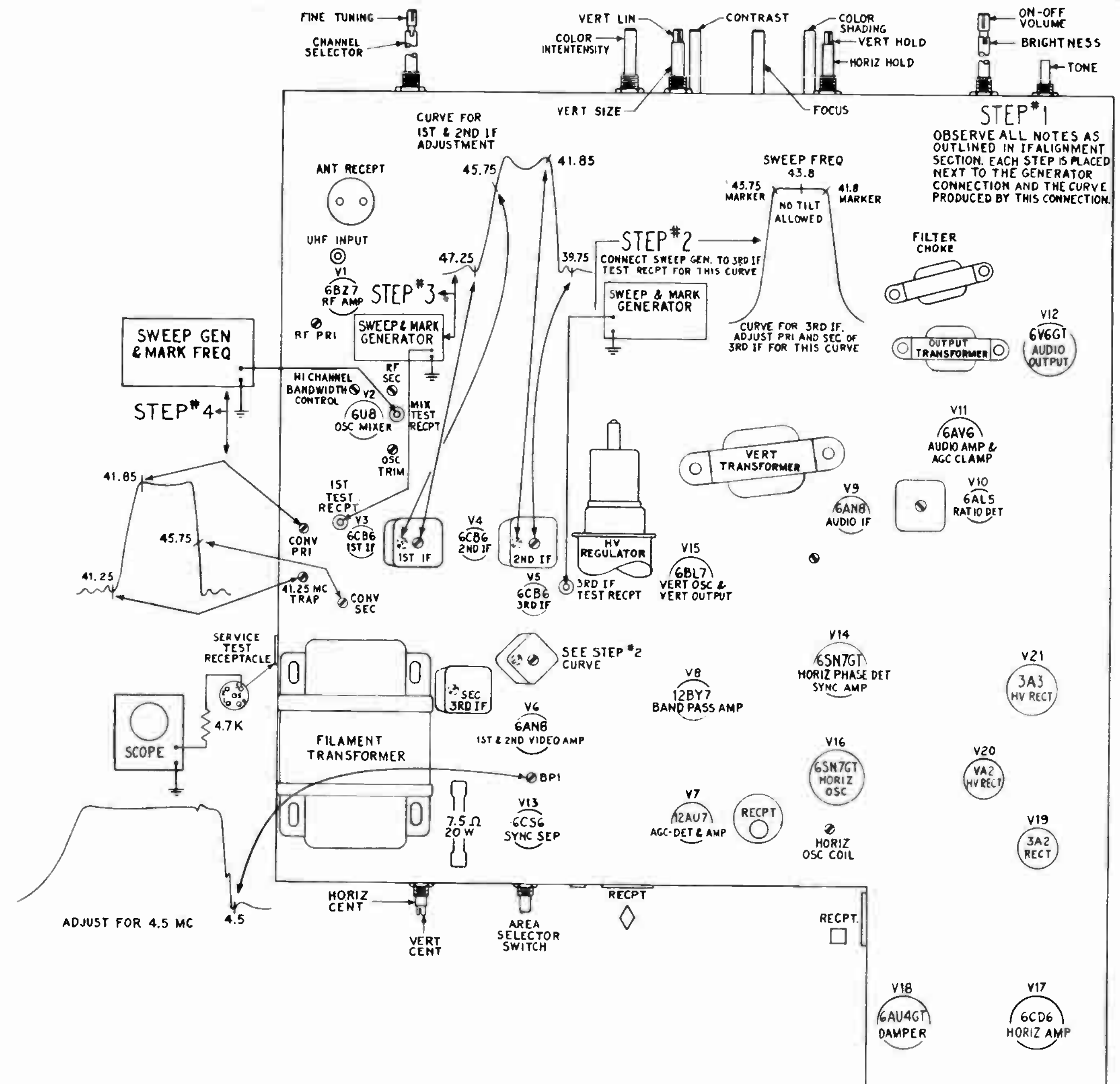


FIGURE 11. TS-902 HORIZONTAL CHASSIS (TOP VIEW)

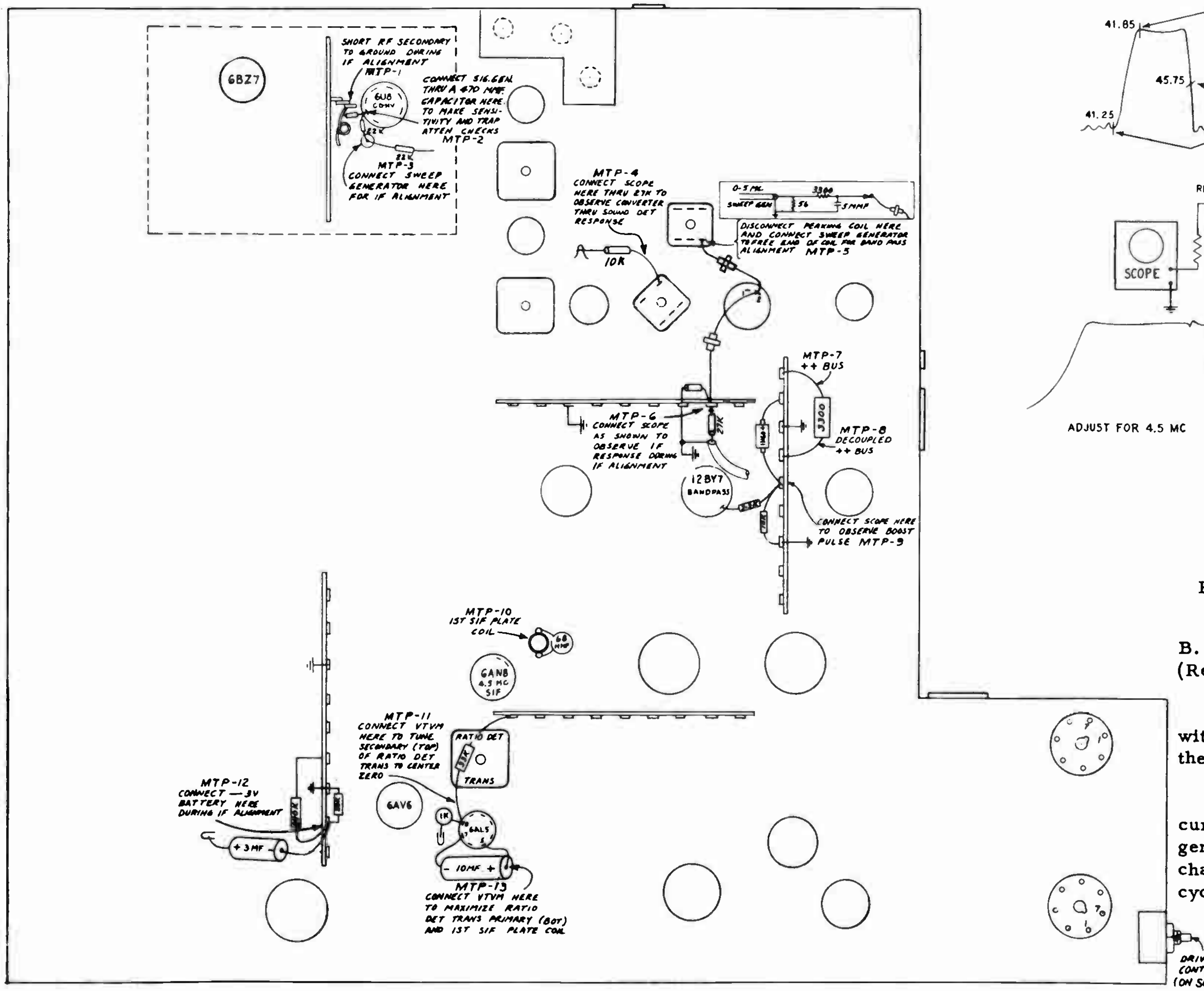


FIGURE 12. TS-902 HORIZONTAL CHASSIS (BOTTOM VIEW)

B. Trap slug in converter plate for the 41.25 Mc dip (minimum)................trap. (Refer to TS-902 horizontal chassis top view for response curve information.)

If adjustment of the converter primary and secondary coils will not put the markers within the stated limits adjust either the 1st IF plate coil or the 2nd IF plate coil to bring the response within limits.

When alignment is completed, remove the 3 volt bias from the IF AGC bus. The curve on the scope should rise appreciably in amplitude. Reduce signal level of the sweep generator to produce approximately the same height curve as obtained with bias (do not change the vertical gain of the scope). Bandwidth must not change more than 200 kilocycles (.2 Mc). There must be no signs of regeneration.

AUDIO IF ALIGNMENT

The following alignment may be made by injecting an accurate 4.5 Mc signal in at the video amplifier grid. However, using the station signal method is much more accurate and should be used whenever possible.

A conventional procedure is used in which the IF transformer, and primary of the ratio detector, are tuned for maximum reading on a VTVM connected across the ratio detector load resistor and electrolytic capacitor (MTP-13). The meter is then moved to the top "hot" end of the volume control (MTP-11) and the secondary of the ratio transformer tuned for the zero reading between the two maximum voltage points.

Refer to bottom view of the TS-902 horizontal chassis for location of the following adjustments: (Fig. 12).

1. With the receiver in good operating condition, tune in a station. Set all controls for normal operation.
2. Connect VTVM to the positive end of the 10 mf electrolytic capacitor located in the 6AL5 ratio detector (pin #5 of the 6AL5) circuit (MTP-13). The ground end of the meter connects to chassis ground.
3. Maintain 5 volts, or below limiting voltage, at the VTVM. It may be necessary to adjust the fine tuner - or to remove the antenna to attain this reading. NOTE: Adjusting the contrast control will not affect this reading.
4. Adjust the coil located in the plate of the 1st sound audio IF stage (1/2 6AN8). (See TS-902 horizontal chassis top view for location) and the primary (bottom) of the ratio detector transformer for maximum reading on the meter.
5. Move the DC lead of the VTVM to pin #8 of the ratio detector (6AL5). This is the "hot" lead of the volume control (MTP-11).
6. Tune the secondary (top) of the ratio detector transformer for the center zero reading on the meter.

TUNER ALIGNMENT

GENERAL INFORMATION

It is very unlikely that the Motorola Tuner will need alignment unless it has been damaged, has been replaced or has had components replaced in the tuner circuits. Tubes may be changed in most cases without realignment.

In the event alignment is necessary, low-band channels (6-2) may be adjusted individually by stretching or compressing coil turns, while high-band channel inductances (7-13) are formed by a stamped metal plate and are adjusted with L-8, L-13, C-10, C-28 and C-19 in the RF section and L-15 and C-21 in the oscillator section. (Fig. 13).

EQUIPMENT REQUIRED:

Sweep generator having:

1. Frequency range 40-220 Mc
2. 12 Mc sweep width
3. Adjustable linear output
4. Crystal calibrated video and sound carrier markers.

AM signal generator having:

1. Frequency range 40-220 Mc
2. Accurate frequency and attenuator calibration
3. 400 cycle modulation

Oscilloscope:

Wide-band, high gain type, preferably with a calibrated input attenuator.

PRE-ALIGNMENT PROCEDURE

1. Remove the horizontal output tube, V-17 (6CD6) to eliminate RF interference in the oscilloscope. Connect a 2500 ohm 25 watt resistor from B triple plus to ground to normalize the bus voltage.

2. Detune the oscillator by setting the fine tuner to minimum capacity.

3. Short the RF AGC bus to ground. (This is the third lug from left on rear of tuner - see main schematic.)

4. Remove the tuner cover.

5. Connect a 470 uuf capacitor from the converter plate to ground, as close as possible to the tube socket.

6. Keep the generator output as low as possible at all times to prevent overloading the receiver.

CONNECTIONS

Sweep generator - Remove the antenna lead-in from the chassis, and connect the sweep generator to the antenna receptacle. Keep the leads from the generator to the socket as short as possible.

Oscilloscope - Connect the scope lead to the mixer test receptacle. (See top view of the TS-902 horizontal chassis drawing.) (Fig. 11).

PROCEDURE

<u>Antenna and RF alignment (high channels 7-13)</u> (Refer to tuner alignment detail during following procedures.)

1. Switch the receiver channel selector to channel 8.

2. Center the sweep generator frequency at 185 Mc (center frequency of channel 8).

3. Adjust the trimmers C-10, C-28 and C-19 for the curve labeled HIGH BAND RF CURVE. (NOTE: C-10 positions the curve. C-19 acts as the jack and determines the tilt of the curve. C-28 adjusts bandwidth.) There should be no more than .05 volts peak-to-peak developed at the mixer test receptacle.

5. Center the sweep generator frequency at 213 Mc (center frequency of channel 13).

6. Adjust the channel 13 coils L-8 and L-13 by spreading or compressing the turns for symmetrical marker positions. (Use the peaks of the curve for reference.) The primary coil L-8 tends to position the curve, while the secondary coil L-13 affects the tilt of the curve.

7. Re-check channel 8 for proper response. Re-adjust trimmers C-10, C-28 and C-19 for correct curve on channel 8, if necessary.

8. Check all channels from 13 through 7 for proper curve with tuner shield on. See HIGH CHANNEL RESPONSE CURVE LIMITS. (Fig. 13).

<u>Antenna and RF alignment (low channels 6-2)</u>

1. Switch the receiver channel selector switch to channel 6.

2. Center the sweep generator frequency at 85 Mc (center frequency of channel 6).

3. Adjust the secondary coil L-12A to position the frequency of the curve and the primary L-9A for least tilt. Adjust for highest gain with least tilt and symmetrical skirts.

4. Adjust the antenna coil secondary L-4A or primary L-3C to remove tilt. Refer to LOW CHANNEL CURVE shown on TS-902 horizontal chassis top view. NOTE: It may be necessary to work between coils L-12A, L-9A, L-4A and L-3C to obtain the greatest gain with the least tilt and with symmetrical skirts.

FM trap

The FM trap L-1 may tune as low as channel 6, causing severe attenuation in part of the curve. Adjust the trap on channel 6 by spreading coil L-1 until no effect of attenuation is seen in the skirts of the response curve.

5. Adjust channel 5, 4, 3, and 2 in sequence by spreading or compressing the coil turns of the respective inductances. MAINTAIN CURVES WITHIN THE LOW CHANNEL RESPONSE LIMITS. (Fig. 13).

6. Re-examine curves on all channels for proper tracking with the tuner shield on.

Oscillator alignment

NOTE: The RF and mixer stages must be aligned before the oscillator is adjusted. Refer to tuner alignment detail during oscillator alignment.

1. Remove tuner shield and 470 uuf capacitor.

2. Set fine tuner to proper center position. (See tuner alignment detail for the fine tuner rotor position.) (Fig. 13).

3. Connect oscilloscope to pin 3 of the service test receptacle (across video load resistor). Connect sweep generator to antenna input socket and adjust for 12 Mc sweep width.

4. Set tuner to channel 8 and sweep generator to 183 Mc center frequency.

5. Adjust C-21 so that 185.75 sound marker falls into the trap dip.

6. Set tuner to channel 13 and sweep generator to 213 Mc center frequency.

7. Spread or compress L-15 so that 215.75 Mc sound marker falls into the trap dip.

8. Check channel 8 response if it was necessary to adjust channel 13.

9. Examine response on channels 13 through 7. On the high channels, a fine tuner rotation of plus or minus 30 degrees is allowable to obtain the required marker positions.

10. Set tuner to channel 6 and sweep generator to 85 Mc center frequency.

11. Spread or compress L-16A so that 87.75 Mc sound marker falls into the trap dip.

12. Adjust channel 5, 4, 3, and 2 in the same manner as channel 6. On low channels, fine tuner rotation of plus or minus 10% is allowable to obtain required marker position.

13. Replace tuner shield and check response on all channels for proper tracking.

IF trap adjustment

Set tuner to channel 2, with fine tuner adjusted properly, and sweep generator to 44 Mc center frequency (through antenna socket). Adjust L-2 for minimum response at approximately 44 Mc, with equal peaks near the video and sound marker.

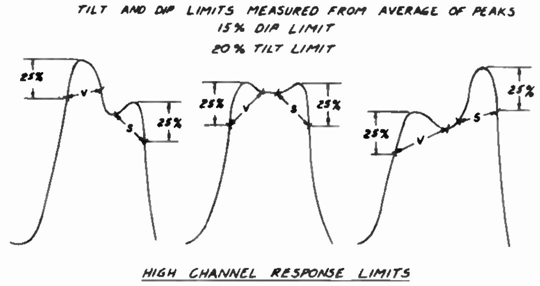
UHF alignment

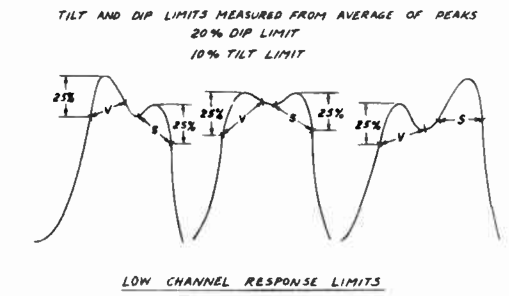
When the channel selector switch is in the UHF position, the RF and mixer stages of the VHF tuner become two additional stages of 40 Mc IF: the VHF antenna circuit is disconnected and grounded; coil L-5 (tuned to the IF range) is inserted into the grid circuit of the RF amplifier; RF primary coil L-10 and secondary coil L-11 are added to the circuit to bring it into the IF range; the oscillator is disabled and B plus is applied to the UHF tuner.

1. Remove tuner shield and connect sweep generator to UHF input receptacle across a total capacity of 33 mmf (including cable capacity). Set generator to 44 Mc center frequency with a 12 Mc sweep width.

2. Adjust L-10 and L-11 to place the 41.25 Mc sound marker and the 45.75 Mc video marker on the two peaks of the response curve. Adjust L-5 to eliminate tilt.

3. With tuner shield on, the overall curve through the IF stages should be identical to the mixer response curve.





FREQUENCY CHART

CHANNEL NUMBER	SWEEP GENERATOR CENTER	SOUND MARKER (RF COILS)	PICTURE MARKER ANT COILS
2	57MC	59.75	55.25
3	63MC	65.75	61.25
4	69MC	71.75	67.25
5	79MC	81.75	77.25
6	85MC	87.75	83.25
7	177MC	179.75	175.25
8	183MC	185.75	181.25
9	189MC	191.75	187.25
10	195MC	197.75	193.25
11	201MC	203.75	199.25
12	207MC	209.75	205.25
13	213MC	215.75	211.25

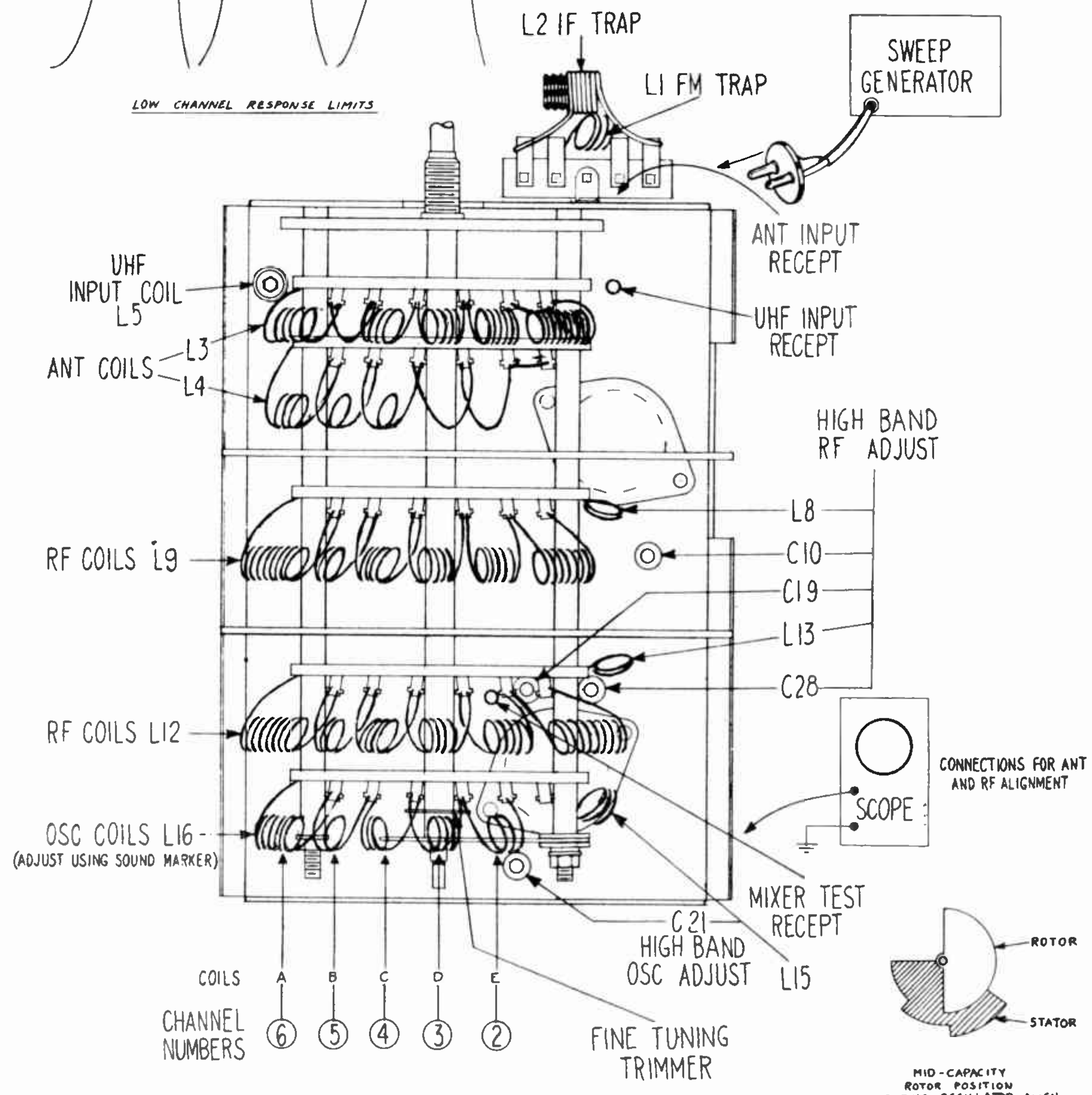


FIGURE 13. TUNER ALIGNMENT DETAIL

ALIGNMENT OF CHROMINANCE BANDPASS SYSTEM

The sections through which the signal will be passed for this alignment are: the first video amplifier, second video amplifier, bandpass amplifier, the bandpass cathode follower and the R-Y demodulator. The sweep generator is injected into 1st video amplifier by unsoldering the grid series peaking coil leading to the 3rd IF transformer and connecting the generator to the loose end. The sweep generator must be terminated with the network shown in diagram of horizontal chassis, bottom view.

The scope connects to the input side of the R-Y demodulator (junction of 33 mmf and 10K ohm resistor TP-11). Use a 100K isolation resistor in vertical input lead. (Fig. 15).

The sections tuned during this procedure are: the 1st video amp 4.5 Mc plate trap coil (L-39), the coupling transformer at the grid of the bandpass cathode follower (T-201) for 2.5 Mc on the bandpass curve and coils in the cathode of the bandpass cathode follower (T-202) for a symmetrical curve (jack action).

PROCEDURE

1. Remove 3.58 Mc color oscillator tube (V-28B, 12AT7).

2. Connect a bypass capacitor of .05 mfd 400V from junction of the 2200 ohm resistor and the delay line to ground (TP-7).

3. Set channel selector switch to channel #1 or unused channel.

4. Set contrast control for maximum (fully clockwise).

5. Set color intensity control to maximum (fully clockwise).

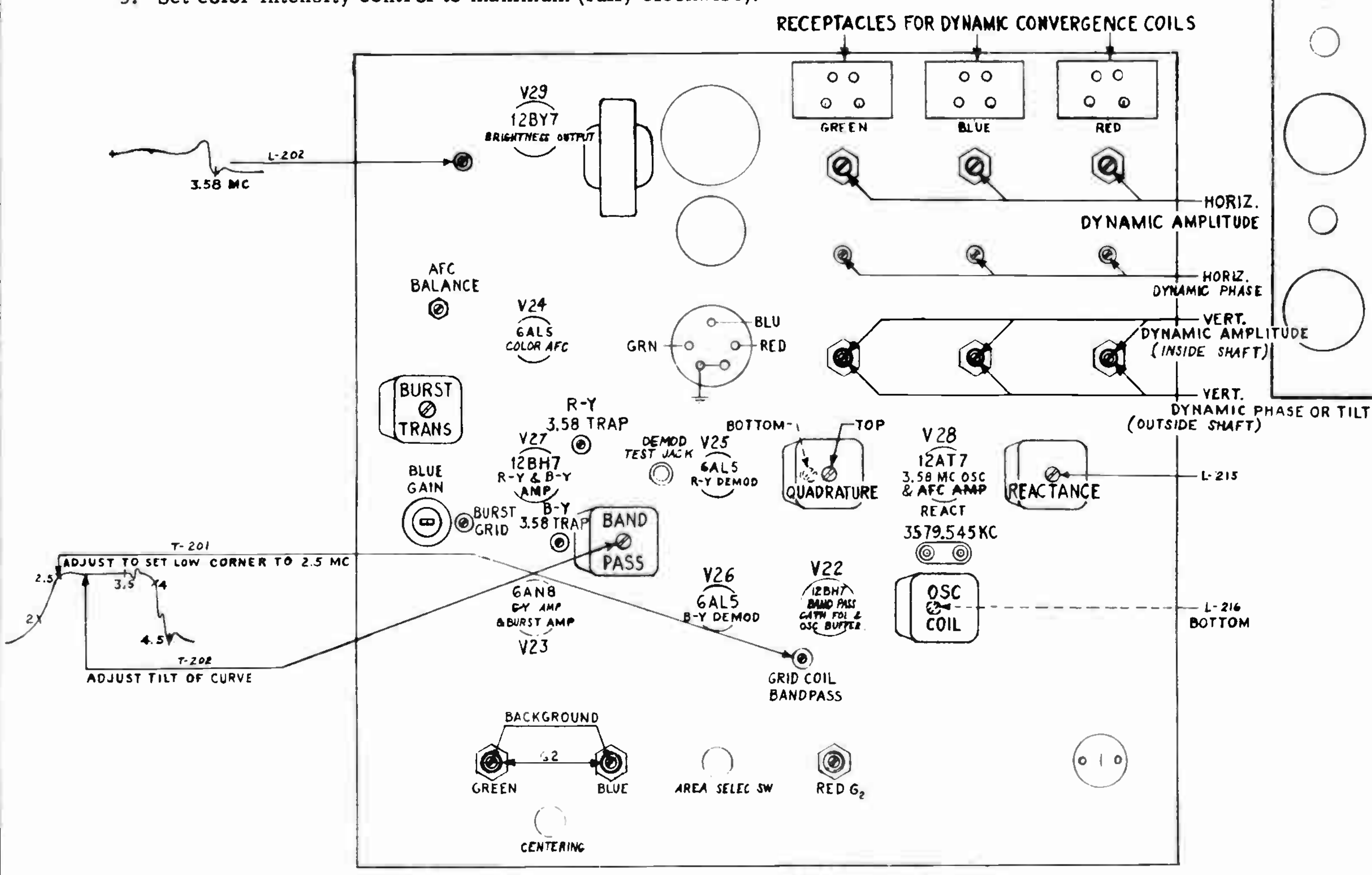


FIGURE 14. BP-902 VERTICAL CHASSIS (TOP VIEW)

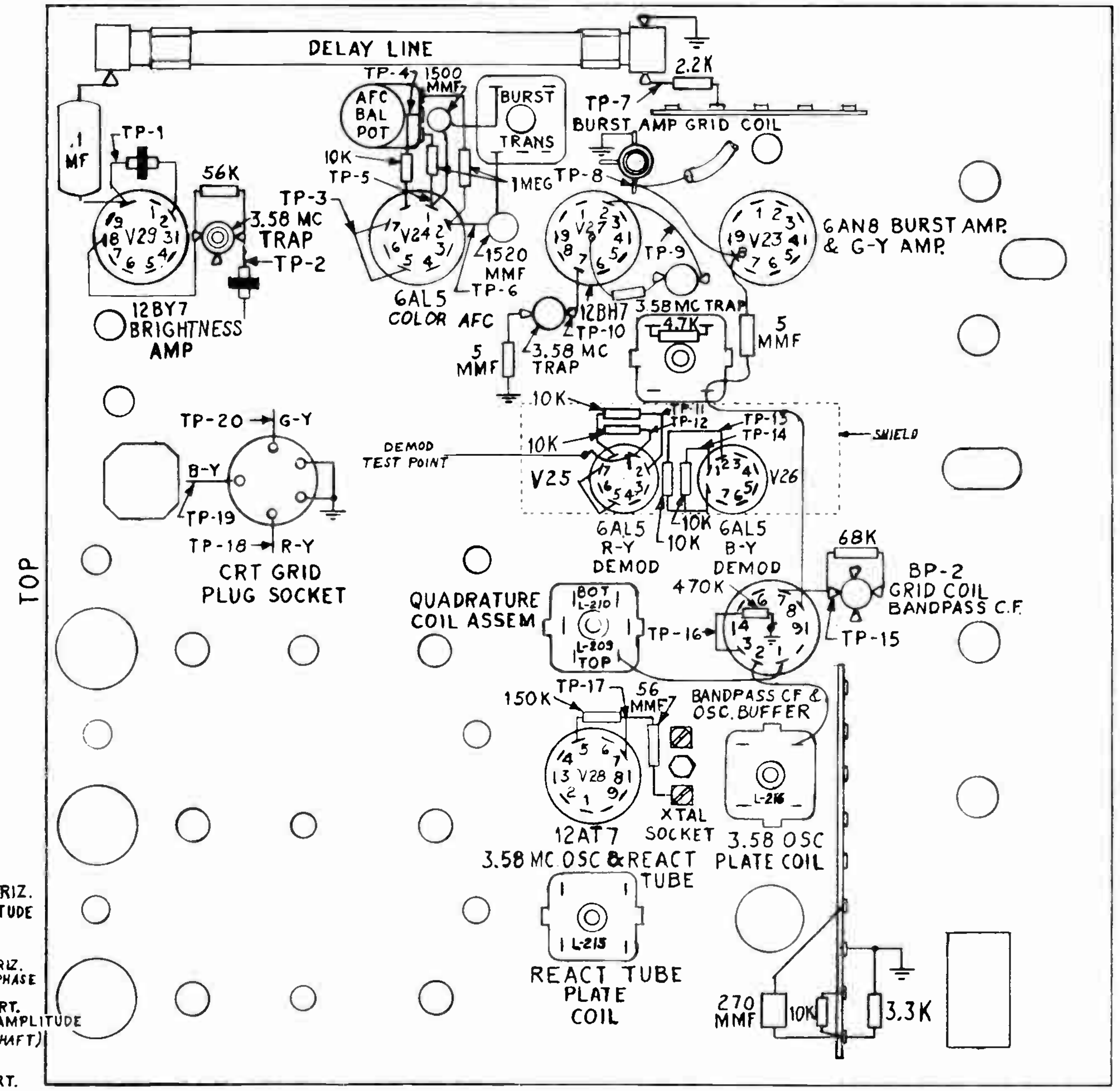


FIGURE 15. BP-902 VERTICAL CHASSIS (BOTTOM VIEW)

6. Connect scope to pin #1 of the R-Y demodulator (V-25, 6AL5) at the junction of the 10K ohm resistor and 33 mmf capacitor (TP-11) through a 100K ohm resistor.

7. Disconnect peaking coil from lug #4 of 3rd IF transformer (MTP-5). Connect sweep generator to loose end of peaking coil. Use decoupling network illustrated in diagram of horizontal chassis, bottom view.

8. Set sweep center frequency to 3 Mc and sweep width for 10 Mc.

9. Set marker generator to 4.5 Mc and adjust 4.5 Mc trap located in the plate circuit (pin #1) of the first video amplifier for the trap dip. (See TS-902 horizontal chassis top view.)(Fig. 11).

10. Set marker generator to 2.5 Mc.

11. Adjust coil in grid circuit of bandpass cathode follower (T-201) to place 2.5 Mc marker at the knee of the curve. (See BP-902 vertical chassis top view.)(Fig. 14).

12. Adjust the coil in the cathode circuit of the bandpass cathode follower (T-202) for least tilt and symmetrical response curve.

Refer to BP-902 vertical chassis top view for curve and slug locations. (Fig. 14)

ADJUSTMENT OF 3.58 MC TRAP IN BRIGHTNESS AMP PLATE

13. Remove .05 mfd capacitor at input to delay line. This is used only in bandpass alignment procedure.

14. Leave sweep generator connected to loose end of peaking coil as before. Move scope lead to cathodes of picture tube (pins #4, 5, and 13). Use crystal detector in scope input lead.

15. Set marker generator to 3.58 Mc and adjust 3.58 Mc trap (plate of the brightness amplifier) for dip.

NOTE: a. Traps must be aligned within + or - 50 Kc of specified frequency.

b. The response curve must show no sign of regenerative peaks.

c. If picture tube is not connected, curve may appear slightly different....with small peaks showing.

ALIGNMENT OF THE 3.58 MC TRAPS IN GRIDS OF THE R-Y and B-Y AMPLIFIER

The series tuned shunt traps located in the grid to ground circuits of the R-Y and B-Y amplifiers are tuned for maximum attenuation (minimum signal) using the normal leakage signal from the 3.58 Mc local color oscillator. A wide band scope must be used as the indicator and may be connected to the control grid of R-Y and B-Y amplifiers consecutively.

PROCEDURE

1. Make certain the 3.58 Mc local color oscillator is operating properly and with sufficient output.

2. Turn the color intensity control to minimum or remove the bandpass amplifier (V-8, 12BY7).

3. Connect scope (wide-band only) to grid of R-Y (TP-10) amplifier (V-27A, 12BH7).(Fig. 15)

4. Align the trap (L-207) located in the R-Y amplifier grid circuit for minimum amplitude of the 3.58 Mc signal as seen on the scope.

5. Connect scope (wide-band only) to grid of B-Y (TP-9) amplifier (V-27B, 12BH7).

6. Align the trap (L-208) located in the B-Y amplifier grid circuit for minimum amplitude of the 3.58 Mc signal as seen on the scope.

3.58 MC COLOR OSCILLATOR AND OSCILLATOR BUFFER STAGE ALIGNMENT

The 3.58 Mc color oscillator tank coil and the oscillator buffer stage coils are tuned using the frequency of the crystal. Therefore, an external signal generator is not required. The R-Y demodulator is used as the RF detector by connecting a VTVM between ground and the junction of the 10K ohm resistor and 33 mmf capacitor load circuit. The bottom slug of the quadrature coil is adjusted for maximum reading on the meter and the top slug for minimum.

3.58 Mc Osc Alignment Procedure

1. Allow set to warm up. Turn channel selector to unused VHF channel or UHF position. Turn color intensity and contrast controls to minimum.

2. Short AFC bus to ground at TP-4.

3. Connect high side of VTVM to TP-11 junction of 33 uuf capacitor and 10K resistor in R-Y demodulator circuit (a test jack is provided in some chassis).(Fig. 15).

Or, as an alternative, hook up VTVM to TP-6 junction of 1500 uuf and 1 meg resistor in AFC diode circuit. Readings made at this point will be approximately half the readings at the demodulator. Short out grid coil of gated burst amplifier TP-8, otherwise spurious incoming signals may give false injection measurement.

4. In each case when tuning coils, start with slug fully retracted from center of coil.

5. Adjust osc plate tank (L-216) for maximum response.

6. Adjust osc buffer plate coil, L-210 (bottom slug T-204) for maximum response.

7. Adjust quadrature coil, L-209 (top slug of T-204) for minimum response.

8. It may be necessary to repeat steps 5, 6 and 7 for best results.

9. Retune osc plate coil (L-216) turning screw (out) so as to retract slug from coil so that 25 volts of injection is measured at R-Y demodulator (TP-11).

or So that approximately 12 volts of injection is measured at AFC diode (TP-6).

ALIGNMENT OF THE COLOR OSCILLATOR AFC SYSTEM

The burst amplifier tube (V-23A, 1/2 6AN8) receives the entire color signal from the output of the bandpass cathode follower. Its screen voltage, however, is keyed from a winding on the horizontal output transformer; the tube operates only during the color burst. The output of the burst amplifier is fed to the color AFC phase detector and the phase and frequency of the burst reference signal is compared with that of the local 3.58 Mc color oscillator. Tuned to the 3.58 Mc burst signal are: a resonant tank in the burst amplifier grid (L-204), the coupling transformer to the AFC phase detector, the plate coil in the reactance tube circuit. An actual transmitted burst signal is used for the alignment; a VTVM is used for the output indicator. The VTVM is connected to either color AFC diode (V-24, 6AL5) at the junction of the 1 meg resistor and 1500 mmf capacitor. Connected at this point, the meter reads the rectified resultant 3.58 Mc burst voltage and the color oscillator injection voltage.

PROCEDURE

1. Allow receiver to warm up. Check the 3.58 Mc oscillator alignment and injection to insure normal operation. To check the injection, connect the VTVM to the junction of the 1500 mmf capacitor and 1 meg resistor in the color AFC phase detector circuit (TP-6). Connect the VTVM ground lead to chassis. Short the control grid of the burst amplifier (V-23A) to ground momentarily to eliminate readings from spurious incoming signals. The VTVM should read approximately 12 volts of injection.

2. Tune in a transmission supplying the standard burst of color sync. Set color intensity control for a normal color picture or near maximum CW rotation.

3. Set the fine phase trimmer (color shading control) at mid-range (on half mesh).

4. Connect a VTVM to TP-6 (jct of a 1500 mmf and 1 meg resistor) at AFC diode circuit.

5. Begin with the slugs fully retracted from the coils and tune the burst amplifier grid coil L-204 and plate transformer T-203 for maximum reading on VTVM.

6. Connect VTVM to the AFC bus at TP-4.

7. Adjust reactance tube plate coil L-215 (to bring oscillator into sync, if necessary) so that VTVM reads 0 volts on AFC bus.

8. Reduce chrominance signal so that it is just barely visible on the screen, by turning fine tuning control (front panel on RF tuner). This is done so that an extremely weak burst signal is supplied to the AFC diodes. The color oscillator may now possibly be out of sync.

9. Adjust AFC balance pot so that 3.58 Mc osc is in sync.

10. Reset RF fine tuning for normal picture so that adequate burst is supplied to the AFC diodes.

11. Connect an oscilloscope to the plate of the R-Y amplifier and retune L-204 the burst amplifier grid coil so that the burst pulse is zero volts as shown on the scope screen.

MEASUREMENTS

IF SENSITIVITY

1. Set channel selector to channel #1.

2. Short the RF secondary coils of the tuner to ground. These coils may be reached through the hole in the tuner cover.

3. No external bias is applied to the AGC line. The AGC is left wide open with normal or residual bias only.

4. Connect VTVM across the video detector load resistor (4700 ohms).

5. Feed a 44 Mc unmodulated signal through a 470 mmf capacitor into the grid of the mixer tube (pin #2 of the 6U8).

6. Less than 300 microvolts should be required for a 1 volt rise above the residual noise voltage at the video detector...as indicated on the meter.

SOUND SENSITIVITY

1. Feed an accurate 4.5 Mc signal across the 10K ohm sound detector load resistor through a 100 uuf capacitor. (Use a terminated Measurements Corp. Model 80 generator or equivalent.)

2. Connect the VTVM through a decoupling resistor to the positive side of the 10 mfd electrolytic capacitor at the ratio detector output. (The VTVM ground lead connects to chassis.)

3. Less than 3500 microvolts should be required for a 4 volt reading on the VTVM.

BANDPASS SENSITIVITY

1. Set the CONTRAST and COLOR INTENSITY controls to maximum.

2. Remove the 6CD6 horizontal amplifier tube (V-17) and the 12AT7, 3.58 Mc oscillator tube (V-28B) from their sockets.

3. Connect the high side of the VTVM through an isolation resistor of 100K ohms to junction of the 33 mmf capacitor and the 10K ohm resistor in the R-Y demodulator circuit. (Set for correct polarity.)

4. Disconnect the video peaking coil, located between lug on 3rd IF can and pin #2 of the 1st video amplifier, at the can end.

5. Connect generator through coupling network (shown on bottom view of horizontal chassis) into the loose end of the peaking coil (MTP-5) and into the first video amplifier grid. Adjust the generator for 3 Mc output. (Fig. 15).

6. Approximately a 15,000 microvolt signal should produce a rise of 1 volt on the VTVM.

VIDEO IF TRAP ATTENUATION MEASUREMENT

1. Set tuner to an unused channel or disable tuner by shorting out the RF secondary coil to ground at the junction of the RF coil and the 22 mmf capacitor.

2. Connect a terminated CW signal generator (such as Measurements Corp. Model 80) through a 470 mmf blocking capacitor directly to the grid of the mixer tube (MTP-2) pin #2 of the 6U8. (Fig. 12).

3. Apply minus 3 volts to the IF AGC bus (pin #1 of service test receptacle). (Fig. 11).

4. Connect VTVM across the video detector load resistor (4700 ohms).

5. Record the signal generator output voltage required to produce 1 volt across the video detector load resistor at the following frequencies: 39.75 Mc, 41.25 Mc, 47.25 Mc and 44 Mc.

6. Calculate the attenuation for each trap, using the following formula:

$$\frac{\text{Generator output at trap frequency}}{\text{Generator output at 44 Mc}} = \text{Attenuation}$$

7. Approximate trap attenuation should be:

At 39.75 Mc - 80
At 41.25 Mc - greater than 300
At 47.25 Mc - 65

MEASUREMENT OF THE SOUND CARRIER TO PICTURE CARRIER RATIO AT THE SOUND DETECTOR

1. Short the RF amplifier secondary coil to ground at the junction of the secondary coil and the 22 mmf capacitor (MTP-1). (Fig. 12).

2. Connect a terminated signal generator (such as Measurements Corp. Model 80) to the grid, pin #2 of the 6U8 (MTP-2).

3. Connect VTVM across the 10K ohm sound detector load resistor (MTP-4).

4. Apply minus 3 volts to the IF AGC bus at pin #1 of the service test receptacle.

5. Record the signal generator output voltage required to produce 1 volt across the sound detector load resistor at 41.25 Mc and 45.75 Mc.

6. Calculate the ratio, using the following formula:

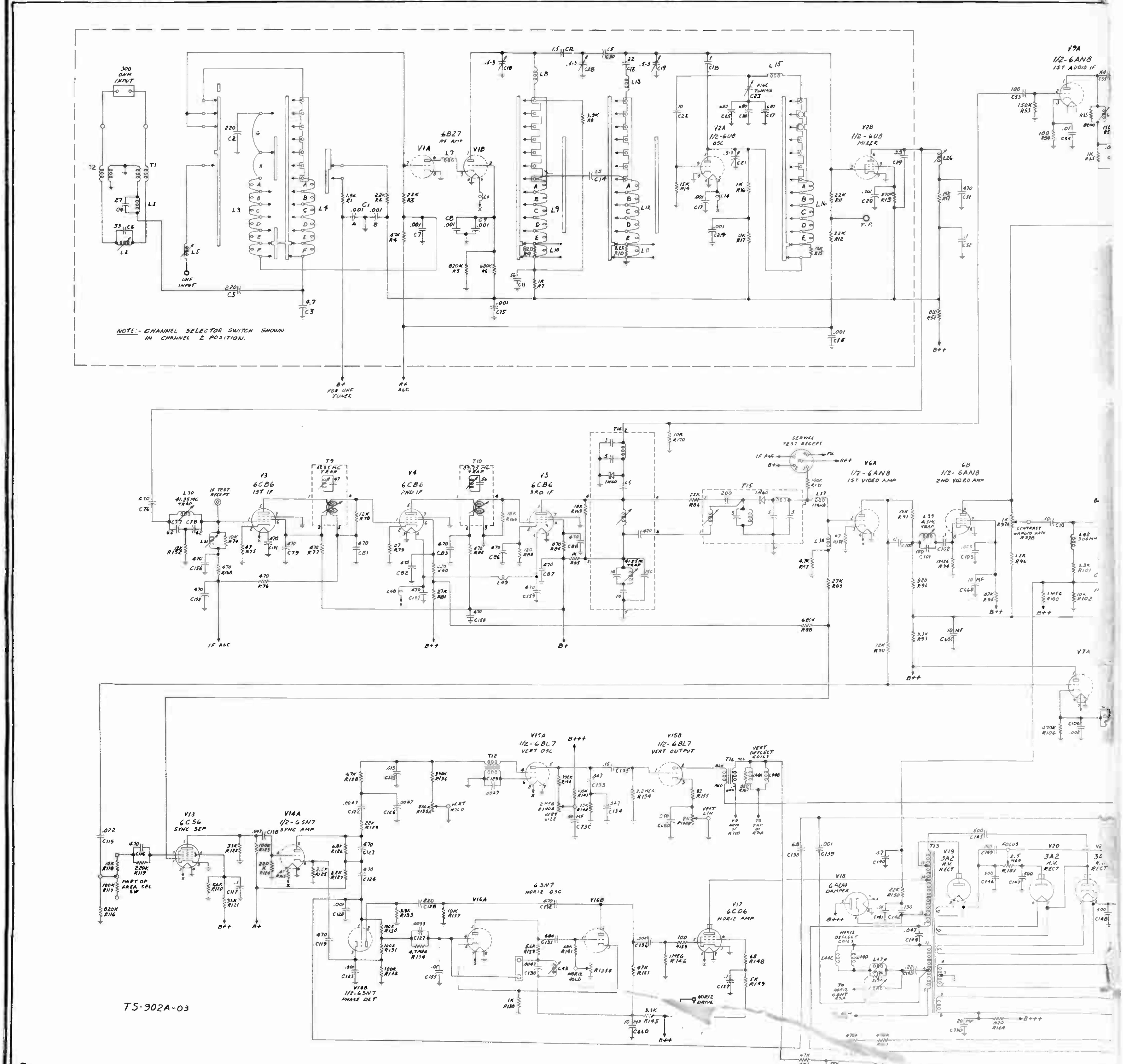
$$\frac{\text{Generator output at 41.25 Mc}}{\text{Generator output at 45.75 Mc}} = \text{Sound to picture carrier ratio}$$

7. The ratio should be no greater than 20.

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part Number	Description	List Price
ELECTRICAL PARTS			
Capacitors (Cer = Ceramic; Tub = Tubular; Mld = Molded; Lytic = Electrolytic)			
C-1	21R400937	Cer Disc: dual .001 mf 500V	.40
C-2	21R115905	Cer Tub: 220 mmf 500V......	.25
C-3	21R115955	Mld Phenolic: 4.7 mmf 500V.	.25
C-4	21R119896	Cer Disc: 27 mmf 150V......	.25
C-5	21R115905	Cer Tub: 220 mmf 500V......	.25
C-6	21R119912	Cer Disc: 33 mmf 150V......	.25
C-7	21R115386	Cer Disc: .001 mf 500V.....	.25
C-8	21R115386	Cer Disc: .001 mf 500V.....	.25
C-9	21R115386	Cer Disc: .001 mf 500V.....	.25
C-10	21K710943	Trimmer, cer: .5-3 mmf with screw & mtg nut...........	.25
C-11	21R120204	Cer Tub: 56 mmf 500V.......	.25
C-12	21R115959	Mld Phenolic: 1.5 mmf 500V.	.25
C-13	21R120203	Cer Tub: 22 mmf 500V.......	.25
C-14	21R115959	Mld Phenolic: 1.5 mmf 500V.	.25
C-15	21R115386	Cer Disc: .001 mf 500V.....	.25
C-16	21R115386	Cer Disc: .001 mf 500V.....	.25
C-17	21R115386	Cer Disc: .001 mf 500V.....	.25
C-18	21R114071	Cer Tub: 1 mmf 500V........	.25
C-19	21K710943	Trimmer, cer: .5-3 mmf with screw & mtg nut...........	.25
C-20	21R115386	Cer Disc: .001 mf 500V.....	.25
C-21	21K710943	Trimmer, cer: .5-3 mmf with screw & mtg nut...........	.25
C-22	21R400050	Cer Tub: 10 mmf 1500V......	.25
C-23	-	Trimmer, fine tuning (part of switch)................	-
C-24	21R115386	Cer Disc: .001 mf 500V.....	.25
C-25	21R410124	Cer Disc: 680 mmf 500V.....	.25
C-26	21R410124	Cer Disc: 680 mmf 500V.....	.25
C-27	21R410124	Cer Disc: 680 mmf 500V.....	.25
C-28	21K710943	Trimmer, cer: .5 to 3 mmf...	.25
C-29	21R115953	Mld Phenolic: 3.9 mmf 500V.	.25
C-30	21R115959	Mld Phenolic: 1.5 mmf 500V.	.25
C-51	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-52	8K490263	Mld Tub: .1 mf 600V........	.45
C-53	21R410036	Cer Disc: 100 mmf 500V.....	.25
C-54	21R482726	Cer Disc: .01 mf 500V......	.35
C-55	21R410036	Cer Disc: 100 mmf 500V.....	.25
C-56	21R115312	Cer Disc: .005 mf 500V.....	.25
C-57	21R482726	Cer Disc: .01 mf 500V......	.35
C-58	21R482726	Cer Disc: .01 mf 500V......	.35
C-59	21R115856	Cer Tub: 470 mmf 500V......	.25
C-60	23A90205	Lytic: 10 mf/50V...........	.90



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Part Number		Description	List Price
C-61	21R410127	Cer Disc: .001 mf 500V.....	.25
C-62	21R115867	Cer Tub: .0047 mf 500V.....	.25
C-63	21R482726	Cer Disc: .01 mf 500V......	.35
C-64	21R115867	Cer Tub: .0047 mf 500V.....	.25
C-55	21R115867	Cer Tub: .0047 mf 500V.....	.25
C-66	*23B734516	Lytic: 30-20 mf/400V; 50 mf/250V; 200 mf/150V....	2.85
C-67	21R120149	Cer Disc: .0047 mf 500V....	.25
C-68	23B721874	Lytic: 150-20 mf/300V; 10 mf/250V; 250 mf/50V.....	5.70
C-69	*23A734545	Lytic: 50-50 mf/50V........	1.25
C-70	23A732749	Lytic: 450 mf/10V..........	
C-71	23B722771	Lytic: 200 mf/150V.........	2.80
C-72	23K732636	Lytic: 500 mf/25V..........	2.40
C-73	*23B734515	Lytic: 30-20 mf/400V; 50 mf/250V; 200 mf/150V....	4.85
C-74	23B722771	Lytic: 200 mf/150V.........	2.80
C-75	23B733207	Lytic: 150-150 mf/250V.....	5.50
C-76	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-77	*21R121598	Cer Disc: 62 mmf 500V......	.25
C-78	21R121598	Cer Disc: 62 mmf 500V......	.25
C-79	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-80	21R120151	Cer Tub: 47 mmf 500V.......	.25
C-81	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-82	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-83	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-85	21R120152	Cer Tub: 56 mmf 500V.......	.25
C-86	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-87	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-88	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-100	21R121114	Cer Disc: 10 mmf 500V......	.25
C-101	21R115730	Cer Disc: 120 mmf 500V.....	.25
C-102	8K490236	Mld Tub: .1 mf 400V........	.35
C-103	21R115312	Cer Disc: .005 mf 500V.....	.25
C-104	21R121114	Cer Disc: 10 mmf 500V......	.25
C-105	21R482726	Cer Disc: .01 mf 500V......	.35
C-106	21R121106	Cer Disc: .002 mf 500V.....	.25
C-107	21R482726	Cer Disc: .01 mf 500V......	.35
C-109	21R482726	Cer Disc: .01 mf 500V......	.35
C-110	8K490236	Mld Tub: .1 mf 400V........	.35
C-111	21R482726	Cer Disc: .01 mf 500V......	.35
C-113	23A690543	Lytic: 3 mf/50V............	.90
C-114	23A690543	Lytic: 3 mf/50V............	.90
C-115	8K490228	Mld Tub: .022 mf 400V......	.40
C-116	21R115856	Cer Tub: 470 mmf 500V......	.25
C-117	8K490236	Mld Tub: .1 mf 400V........	.35
C-118	8K119350	Mld Tub: .047 mf 400V......	.25
C-119	21R115856	Cer Tub: 470 mmf 500V......	.25
C-120	21R118749	Cer Tub: .001 mf 500V......	.25
C-121	21R118749	Cer Tub: .001 mf 500V......	.25
C-122	8K490249	Mld Tub: .0047 mf 600V.....	.40
C-123	21R114554	Cer Disc: 470 mmf 500V.....	.25
C-124	21R115856	Cer Tub: 470 mmf 500V......	.25
C-125	8K119333	Mld Tub: .015 mf 200V......	.25
C-126	8K490222	Mld Tub: .0047 mf 400V.....	.25
C-127	8K490247	Mld Tub: .0033 mf 600V.....	.40
C-128	21R410115	Cer Disc: 220 mmf 500V.....	.25
C-129	21R115867	Cer Tub: .0047 mf 500V.....	.25
C-130	8K490222	Mld Tub: .0047 mf 400V.....	.25
C-131	21R114781	Mica: 680 mmf 500V.........	.25
C-132	21R6673	Mica: 470 mmf 500V.........	.25
C-133	8K119350	Mld Tub: .047 mf 400V......	.25
C-134	8K119350	Mld Tub: .047 mf 400V......	.25
C-135	8K119354	Mld Tub: .15 mf 400V.......	.35
C-136	8K490222	Mld Tub: .0047 mf 400V.....	.25
C-137	8K490236	Mld Tub: .1 mf 400V........	.35
C-138	21R120561	Cer Tub: 6.8 mmf 500V......	.25
C-139	8K490268	Mld Tub: .001 mf 1000V.....	.35
C-140	21R114207	Cer Disc: 47 mmf 500V......	.25
C-141	8K119346	Mld Tub: .01 mf 400V.......	.35
C-142	21R121252	Cer Disc: 130 mmf 5000V....	.45
C-143	8K490212	Mld Tub: .22 mf 200V.......	.40
C-144	8K490284	Mld Tub: .047 mf 1000V.....	.35
C-145	*21A733777	Cer: 500 mmf 20KV..........	1.40
C-146	*21A732365	Cer: 500 mmf 10KV; threaded on one end.................	1.30
C-147	*21A733779	Cer: 500 mmf 10KV; threaded on both ends...............	1.30
C-148	*21A732370	Cer: 500 mmf 30KV..........	3.35
C-149	21R120916	Cer Disc: .005 mf 3000V....	.45
C-150	21R482726	Cer Disc: .01 mf 500V......	.35

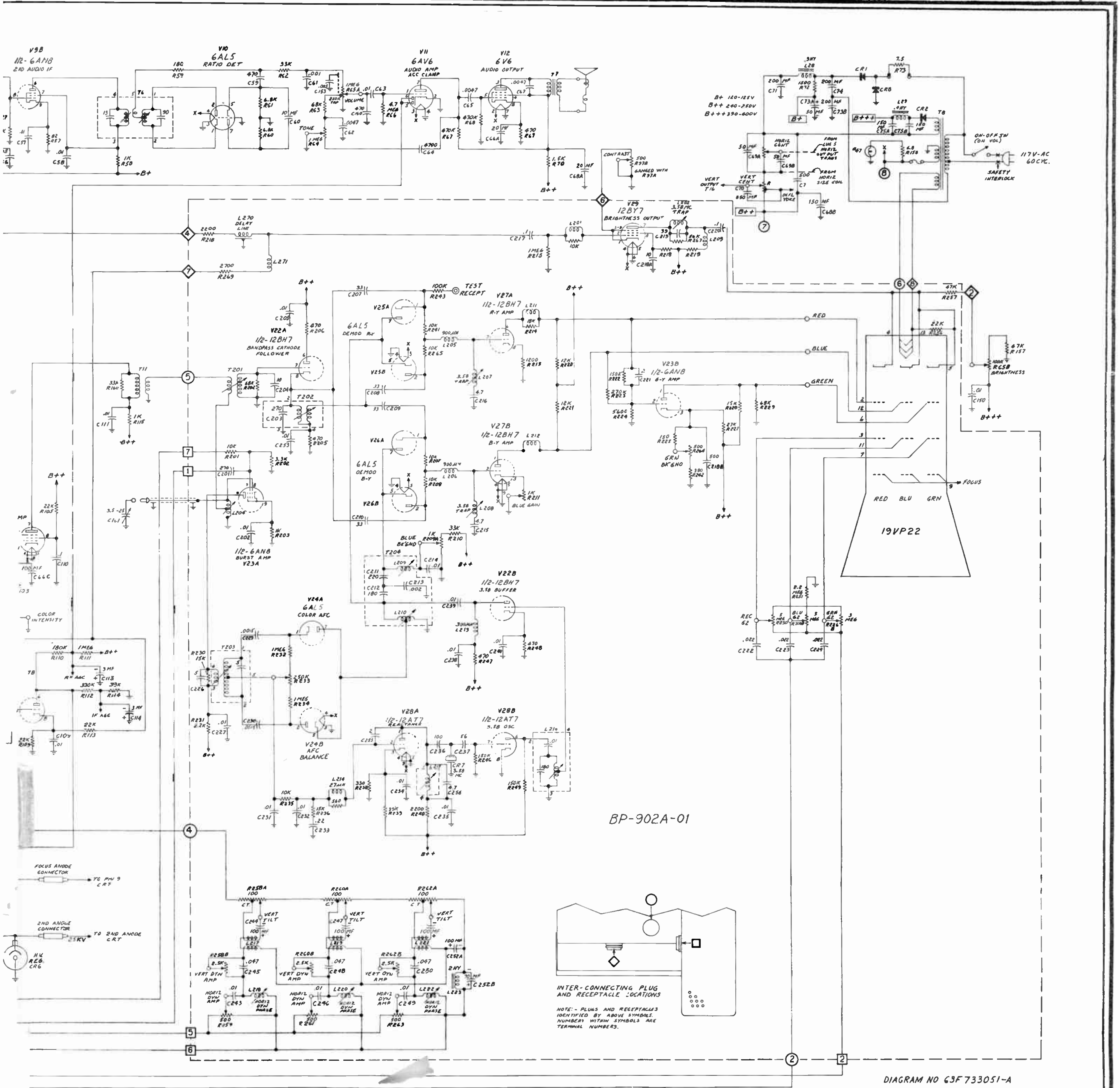
Part Number	Description	List Price
*14B733742	Insulator, control (insulates front center suppl controls from chassis)	.30
14A731524	Insulator, pic tube (on front tube support brkts)	.05
14A703228	Insulator, interlock	.10
*14A732359	Insulator, shaft (insulates shaft from chassis)...doz	.50
43A722511	Insulator, sleeving (T-1, 2)...doz	.50
14K732687	Insulator, pilot light...doz	.50
*14B733764	Insulator, pic tube (around pic tube)	6.15
61B730644	Jewel, dial light	.10
*1V734867	Magnet, beam positioning: incl magnet retaining arm	1.55
*59A733739	Magnet, blue beam (around neck of picture tube)	2.10
*59A734620	Magnet, purity control (around neck of picture tube)	2.15
2K791404	Nut, coil & core mtg (L-47)...doz	.50
*2K721967	Nut, core mtg (T-204)	.05
*2K721856	Nut, core mtg (L-215, 216, T-12)..	.05
2S7051	Nut, hex: palnut; 3/8-32 x 9/16 (control mtg)...doz	.15
2S400482	Nut, palnut (C-10, 19, 21, 28).doz	.15
*75K731897	Pad, cushion (on front pic tube support brkt)	.10
29A732247	Pin, contact (grids of pic tube)..	.10
29A5400	Pin, terminal (on spkr lead)...doz	.20
9A484098	Plate, electrolytic mtg: 3 lug (C-74, 252)	.05
64A90034	Plate, electrolytic mtg: 4 lug (C-73)	.05
*64A733762	Plate, coil mtg (T-6, 14)	.05
29K712319	Plug, line cord (interlock on chassis)	.15
28A721864	Plug, ant: 2-prong (on ant lead).	.05
28A731387	Plug, defl yoke: 4 pin	.10
29K730036	Plug, defl yoke: 1 pin	.05
*28A734765	Plug, second anode	.55
28K731154	Plug, 1 pin (L-204)	.10
28A11368	Plug, 4 pin (L-217, 219, 221)	.10
*28K732702	Plug, 8-prong (connects BP chassis to main chassis)	.35
1V732877	Pulley Assem (on rear of tuner)...	.40
9K730388	Receptacle, five pin (service test recept)	.15
9A731389	Receptacle, six pin (defl yoke)...	.15
9A730031	Receptacle, inter-chassis connecting: 1-1/2" MC	.25
9A720006	Receptacle, two pin (for L-43 adj)	.10
9A701065	Receptacle, inter-chassis connecting: 1-5/16" MC	.20
*9K734489	Receptacle, second anode	.60
9A721859	Receptacle, fusing resistor	.15
*9K732674	Receptacle, hi-voltage	.65
*9K733778	Receptacle, four pin (L-217, 219, 222 plug in)	.15
*9A6729	Receptacle, five pin (color grid test)	.20
9A722758	Receptacle, test (R-Y demodulator & IF)	.10
9A702469	Receptacle, plug in (fine phase)..	.15
*3S121890	Screw, machine: 4-40 x 1/4"; pl hex hd; stl; brass pl (convergence coil clamp retaining)...doz	.20
3S9650	Screw, machine: 6-32 x 3/4"; sl rd hd (C-10, 19, 21, 28 adj)..doz	.15
47A732384	Shaft, extension (contrast control)	.10
*47K732337	Shaft, fine tuning	.45
1A722216	Shaft & Sprocket Assem, UHF dial drive	.80
26A720284	Shield, dial light	.05
*26C734499	Shield, magnetic (around pic tube)	36.05
26K730395	Shield, tube (V-1, 2)	.10
26A522403	Shield, tube (V-3, 4, 5, 24, 25)..	.05
9R119872	Socket, tube: miniature; 7-prong; 1" MC; wafer type	.15

PRICES SUBJECT TO CHANGE WITHOUT NOTICE
*New Item, Appears in any List for First Time
**Plus Federal Excise Tax at Current Rate
***Prices Furnished Upon Request

Part Number	Description	List Price
14K733202	Insulator, chassis mtg (on sides of chassis)	.20
14K712339	Insulator, control (insulates vol, tone & rear controls from chassis)	.05
9R119873	Socket, tube: miniature; 7-prong; 1-5/16" MC; wafer type	.15
9R119881	Socket, tube: noval (V-1, 2)	.20
9B730640	Socket, pilot light & brkt assem..	.30
9R119883	Socket, tube: noval	.20
1X790307	Socket, tube: octal; cushioned type (V-13)	.40
*[illegible]A731818	Socket, crystal	.35
*9[illegible]B733794	Socket, pic tube: 14 contact - 12 leads	6.40
*41A[illegible]34508	Spring, tension (for convergence coil assem)	.05
*1V7[illegible]4239	Strap, tube retaining assem	.90
31A2[illegible]990	Strip, terminal: 2 screw (ant term)	.15
4B592[illegible]98	Washer, "C" (on contrast control shaft ext)	.05
4A11722	Washer, "C" (belt pulley ret on rear of VHF tuner)...doz	.20
4K77577	Washer, insulator (horiz size insulating)...per/c	.50
4A730195	Washer, rubber (on pic tube support rod)...doz	.35
4K730095	Washer, shoulder: fibre (control mtg)...doz	.30
VHF TUNERS		
*1U733177	VHF Tuner WTT-67	41.20** exch 30.90
*1U733178	VHF Tuner WTT-67Y	
MODELS 19CK1, B, Y19CK1 & B CABINET PARTS		
1V732596	Back Cover Assembly: incl line cord; less pic tube rear cover...	
7A722505	Bracket, window & mask retaining ...doz	.30
*7A733787	Bracket, window mtg	.05
75K734768	Bumper, rubber (on window & mask retaining brkts)...doz	.30
75K731334	Bumper, rubber (on window mtg brkt)...doz	.30
75K734651	Bumper, rubber (on suppl control door)...doz	.30
*16E733773	Cabinet, console: red-brn mahogany; less window, mask, escutcheon, case & door and ornamental trim (19CK1 & Y)	***
*16K733774	Cabinet, console: limed oak; less window, mask, escutcheon, case & door and ornamental trim (19CK1B & Y)	***
*15K733736	Case, suppl control	1.60
55K730706	Caster: with 55K712373 gripneck..	.85
30K712361	Cord, line: with plug & interlock recept	.80
15K732800	Cover, pic tube rear	1.15
15C733529	Door, suppl control	1.75
*13K733798	Escutcheon, decorative (on front of cabinet)	4.95
*32A734658	Gasket, pic tube	.15
36K733398	Knob, channel selector (19CK1 & B)	1.25
36B733397	Knob, VHF channel selector (Y19CK1 & B)	1.35
*36A734769	Knob, control: with insert spring (fine phase control)	.15
36B712294	Knob, control: with insert spring (area sel switch)	.25
36C733399	Knob, brightness	.80
*36A734772	Knob, contrast & chroma	.10
36B733395	Knob, fine tuning & off volume....	.80
*36C734253	Knob, medallion (on suppl control door)	1.75
36C730167	Knob, tone	.45
*13B734622	Logotype, color TV	1.00
13F733733	Mask, pic tube	20.45
13C733531	Overlay, decorative (on suppl control door)	1.35
*13K734254	Plate, background (on suppl control door)	1.00
5K791856	Rivet, shoulder (line cord mtg)...	.05

Part Number	Description	List Price
3K120849	Screw, machine: 8-32 x 1"; decorative ins hd; cop oxd (spkr mtg)	.05
3S114993	Screw, machine: 1/4-20 x 1-3/4"; pl hex hd; cad pl (chassis mtg) ...doz	.50
3S120612	Screw, sheet metal: #4 x 5/16"; Phillips flat hd; stl; brass pl (door knob mtg)...doz	.35
*50C734275 or 50C734759	Speaker, PM: 10"; 3.2 ohm VC; with recept	9.50** exch 7.15
*50B734220	Speaker, PM: 4"; 3.2 ohm VC; with lead & plugs	3.70** exch 2.80
41A733811	Spring, suppl control door.....doz	.30
13K731773	Trim, ornamental: right-hand; 35-5/16" long	6.90
13K731771	Trim, ornamental: left-hand; 35-5/16" long	6.90
*61K733730	Window, pic tube: clear	13.45
MODELS 19CK2, B, Y19CK2 & B CABINET PARTS		
1V732597	Back Cover Assembly: incl line cord; less pic tube rear cover...	
7A722505	Bracket, window & mask retaining ...doz	.30
*7K733789	Bracket, window mtg	.05
75K734768	Bumper, rubber (on window & mask retaining brkts)...doz	.30
75K731334	Bumper, rubber (on suppl control door)...doz	.30
*16E734159	Cabinet, table model: red-brn mahogany; less window, mask, escutcheon, case & door and ornamental trim (19CK2 & Y)	***
*16K734161	Cabinet, table model: limed oak; less window, mask, escutcheon, case & door and ornamental trim (19CK2B & Y)	***
*15K733736	Case, suppl control	1.60
30K712361	Cord, line: with plug & interlock recept	.80
15K732800	Cover, pic tube rear	1.15
15C733529	Door, suppl control	1.75
*13K733785	Escutcheon, decorative (on front of cabinet)	2.85
*32A734658	Gasket, pic tube	.15
36K733398	Knob, channel selector (19CK2 & B)	1.25
36B733397	Knob, VHF channel selector (Y19CK2 & B)	1.35
*36A734769	Knob, control: with insert spring (fine phase control)	.15
36B712294	Knob, control: with insert spring (area sel switch)	.25
36C733399	Knob, brightness	.80
*36A734772	Knob, contrast & chroma	.10
36B733395	Knob, fine tuning & off volume....	.80
*36C734253	Knob, medallion (on suppl control door)	1.75
36C730167	Knob, tone	.45
*13B734622	Logotype, color TV	1.00
13F733733	Mask, pic tube	20.45
13C733531	Overlay, decorative (on suppl control door)	1.35
*13K734254	Plate, background (on suppl control door)	1.00
5K791856	Rivet, shoulder (line cord mtg)...	.05
3K120849	Screw, machine: 8-32 x 1"; decorative ins hd; cop oxd (spkr mtg)	.25
3S114993	Screw, machine: 1/4-20 x 1-3/4"; pl hex hd; cad pl (chassis mtg) ...doz	.50
3S120612	Screw, sheet metal: #4 x 5/16"; Phillips flat hd; stl; brass pl (door pull mtg)...doz	.35
*50C734531 or 50C734532	Speaker, PM: 5 x 7"; 6.4 ohm VC; with leads & plugs	5.50** exch 4.15
*50C734533 or 50C734760	Speaker, PM: 5 x 7"; 6.4 ohm VC; with recept	5.50** exch 4.15

Part Number	Description	List Price
41A733811	Spring, suppl control door.....doz	.30
*13K733783	Trim, ornamental: right-hand; 25-5/16" long	4.65
*13D733781	Trim, ornamental: left-hand; 25-5/16" long	4.65
*61K733730	Window, pic tube: clear	13.45
MODELS 19CT1, B, Y19CT1 & B CABINET PARTS		
*1V732595	Back Cover Assembly: incl line cord; less pic tube rear cover...	
7A722505	Bracket, window & mask retaining ...doz	.30
*7K733789	Bracket, window mtg	.05
*75K734768	Bumper, rubber (on window & mask retaining bracket)...doz	.30
75K731334	Bumper, rubber (on suppl control door)...doz	.30
35A790097	Bumper, rubber (cabinet feet)	.15
*16E733795	Cabinet, table model: red-brn mahogany; less window, mask, escutcheon, case & door and ornamental trim (19CT1 & Y)	***
*16K733796	Cabinet, table model: limed oak; less window, mask, escutcheon, case & door and ornamental trim (19CT1B & Y)	***
*15K733736	Case, suppl control	1.60
30K712361	Cord, line: with plug & interlock recept	.80
15K732800	Cover, pic tube rear	1.15
15C733529	Door, suppl control	1.75
*13K733785	Escutcheon, decorative (on front of cabinet)	2.80
*32A734658	Gasket, pic tube	.15
36K733398	Knob, channel selector (19CT1 & B)	1.25
36B733397	Knob, VHF channel selector (Y19CT1 & B)	1.35
36C733399	Knob, brightness	.80
*36A734769	Knob, control: with insert spring (fine phase control)	.15
36B712294	Knob, control: with insert spring (area sel switch)	.25
*36A734772	Knob, contrast & chroma	.10
36B733395	Knob, fine tuning & off volume....	.80
*36C734253	Knob, medallion (on suppl control door)	1.75
36C730167	Knob, tone	.45
*16D734734	Leg, cabinet: red-brn mahogany (when used as floor model)	***
*16K734735	Leg, cabinet: limed oak (when used as floor model)	***
*13B734622	Logotype, color TV	1.00
13F733733	Mask, pic tube	20.45
13C733531	Overlay, decorative (on suppl control door)	1.35
*13K734254	Plate, background (on suppl control door)	1.00
5K791856	Rivet, shoulder (line cord mtg)...	.05
3K120849	Screw, machine: 8-32 x 1"; decorative ins hd; cop oxd (spkr mtg)	.25
3S114993	Screw, machine: 1/4-20 x 1-3/4"; pl hex hd; cad pl (chassis mtg) ...doz	.50
3S120612	Screw, sheet metal: #4 x 5/16"; Phillips flat hd; stl; brass pl (door pull mtg)...doz	.35
41A733811	Spring, suppl control door.....doz	.30
50C734443 or 50C734659	Speaker, PM: 6"; 6.4 ohm VC; with leads & plugs	6.00** exch 4.50
50C734444 or 50C734660	Speaker, PM: 6"; 6.4 ohm VC; with recept	6.00** exch 4.50
*13K733783	Trim, ornamental: right-hand; 25-7/16" long	4.65
*13D733781	Trim, ornamental: left-hand; 25-7/16" long	4.65
4K733232	Washer, leg mtg	.35
*61K733730	Window, pic tube: clear	13.45



Part No.	Description	List Price
21R114554	Cer Disc: 470 mmf 500V.....	.25
21R114554	Cer Disc: 470 mmf 500V.....	.25
21R115312	Cer Disc: .005 mf 500V.....	.25
21R120916	Mld Tub: .01 mf 600V.......	.45
8K490253	Mld Tub: .01 mf 600V.......	.30
21R114554	Cer Disc: 470 mmf 500V.....	.25
21R114554	Cer Disc: 470 mmf 500V.....	.25
21R114554	Cer Disc: 470 mmf 500V.....	.25
21R114554	Cer Disc: 470 mmf 500V.....	.25
21R115856	Cer Tub: 470 mmf 500V......	.25
*20A734484	Color Shading Control (fine phase): 3.5 to 25 mmf.....	3.10
21R6624	Mica: 270 mmf 500V.........	.25
21R482726	Cer Disc: .01 mf 500V......	.35
21R121481	Cer Disc: 270 mmf 500V.....	.25
21R121114	Cer Disc: 10 mmf 500V......	.25
21R482726	Cer Disc: .01 mf 500V......	.35
21R121548	Cer Disc: 33 mmf 500V......	.25
21R121548	Cer Disc: 33 mmf 500V......	.25
21R121548	Cer Disc: 33 mmf 500V......	.25
21K121548	Cer Disc: 33 mmf 500V......	.25
21K121698	Cer Disc: 220 mmf 500V.....	.25
21R121251	Cer Disc: 180 mmf 500V.....	.25
21K'21836	Cer Disc: .002 mf 500V.....	.25
21R482726	Cer Disc: .01 mf 500V......	.35
21R115955	Phenolic: 4.7 mmf 500V.....	.25
21R115955	Phenolic: 4.7 mmf 500V.....	.25

Ref. No.	Part Number	Description	List Price
C-217	8K490236	Mld Tub: .1 mf 400V........	.35
C-218	*23B734486	Lytic: 10 mf/300V; 500 mf/15V................	3.75
C-219	21R121468	Cer Disc: 39 mmf 500V......	.25
C-220	8K490236	Mld Tub: .1 mf 400V........	.35
C-221	21R115948	Mld Phenolic: 2.2 mmf 500V.	.25
C-222	8K490255	Mld Tub: .022 mf 600V......	.40
C-223	8K490255	Mld Tub: .022 mf 600V......	.40
C-224	8K490255	Mld Tub: .022 mf 600V......	.40
C-225	21R120916	Mld Tub: .01 mf 600V.......	.45
C-226	21R115955	Phenolic: 4.7 mmf 500V......	.25
C-227	21R482726	Cer Disc: .01 mf 500V......	.35
C-229	21R120100	Cer Disc: .0015 mf 500V....	.25
C-230	21R120100	Cer Disc: .0015 mf 500V....	.25
C-231	21R482726	Cer Disc: .01 mf 500V......	.35
C-232	8K490226	Mld Tub: .01 mf 400V.......	.25
C-233	8K490212	Mld Tub: .22 mf 200V.......	.40
C-234	21R482726	Cer Disc: .01 mf 500V......	.35
C-235	21R482726	Cer Disc: .01 mf 500V......	.35
C-236	21R115900	Cer Tub: 100 mmf 500V......	.25
C-237	21R115641	Cer Tub: 56 mmf 500V.......	.25
C-238	21R482726	Cer Disc: .01 mf 500V......	.35
C-239	21R482726	Cer Disc: .01 mf 500V......	.35
C-240	21R482726	Cer Disc: .01 mf 500V......	.35
C-241	21R482726	Cer Disc: .01 mf 500V......	.35
C-242	21R121251	Cer Disc: 180 mmf 500V.....	.25
C-243	8K490226	Mld Tub: .01 mf 400V.......	.25
C-244	*23K734273	Lytic: 100 mf/15V........	1.45

Ref. No.	Part Number	Description	List Price
C-245	8K490206	Mld Tub: .047 mf 200V......	.25
C-246	8K490226	Mld Tub: .01 mf 400V.......	.25
C-247	23K734273	Lytic: 100 mf/15V..........	1.45
C-248	8K490206	Mld Tub: .047 mf 200V......	.25
C-249	8K490226	Mld Tub: .01 mf 400V.......	.25
C-250	8K490206	Mld Tub: .047 mf 200V......	.25
C-251	23K734273	Lytic: 100 mf/15V..........	1.45
C-252	*23B734496	Lytic: 100-70 mf/25V.......	1.80
C-253	21R482726	Cer Disc: .01 mf 500V......	.35
C-254	21R120916	Cer Disc: .01 mf 500V......	.45
C-255	21R115948	Phenolic: 2.2 mmf 500V.....	.25
C-256	21R115955	Phenolic: 4.7 mmf 500V.....	.25
CR-1	*48B733746	Rectifier, selenium: 600 ma	3.80
CR-2	*48B733961	Rectifier, selenium: 250 ma	2.65
CR-3	48C711052		
or	48K711077	Crystal, diode (1N60).......	1.00
CR-4	48C711052		
or	48K711077	Crystal, diode (1N60).......	1.00
CR-5	48C711052		
or	48K711077	Crystal, diode (1N60).......	1.00
CR-6	*80B733741	Regulator, voltage..........	18.00
CR-7	*48B732230	Crystal, 3.58 Mc...........	7.70
CR-8	*48B733746	Rectifier, selenium: 600 ma	3.80
L-1	24A721862	Coil, FM trap..............	.10
L-2	24A731357	Coil, IF trap: 40 Mc.......	.10
L-3	24K722232	Coil, ant pri: incl L-3A thru L-3H.................	.10

Ref. No.	Part Number	Description	List Price
	24K722265	Coil, ant sec: incl L-4A thru L-4F	.20
[illegible]	24A730748	Coil, UHF input matching	.10
[illegible]	24A721274	Choke, RF	.10
L-7	24C722228	Coil, neutralization	.10
L-8	24K722231	Coil, RF pri	.10
L-9	24C722262	Coil, RF pri: chan 2 thru 6	.25
L-10	24K722229	Coil, RF pri (UHF position).	.10
L-11	24A721855	Coil, RF sec (UHF position).	.10
L-12	24K722263	Coil, RF sec: chan 2 thru 6	.25
L-13	24A730100	Coil, RF sec: chan 13	.10
L-14	24A721274	Choke, RF	.10
L-15	24K722233	Coil, osc: chan 13	.05
L-16	24K722264	Coil, osc: chan 2 thru 6	.25
L-26	*24K732820	Coil, conv pri: with core	.70
L-27	*1V733254	Coil, interstage: with core	.40
L-28	*25B734495	Choke, filter	3.85
L-29	*25B734908	Choke, filter	1.60
L-30	*24K731893	Coil, 41.25 Mc trap	
L-31	24K732820	Coil, conv sec: with core	.70
L-37	*24R119847	Coil, comp: blk-org code	.55
L-38	*24R119855	Coil, comp: org-blk code	.70
L-39	*24B731883	Coil, 4.5 Mc trap: with core	.75
L-42	24R119855	Coil, comp; org-blk code	.70
L-43	*24K721065	Coil, horiz osc	.55
L-44	*24D734997	Yoke, defl: yel code	46.95
L-47	*24B733751	Coil, horiz size & shunt: incl R-156	1.80
L-48	24A721274	Choke, RF ~~filter~~	.10
L-49	24A721274	Choke, RF ~~filter~~	.10
L-201	*24R121805	Coil, comp: wound on 10K res; red-wht code	.55
L-202	*1V732586	Coil, 3.58 Mc trap: with core; red code	.80
L-203	*24R119856	Coil, comp: org-org code	.60
L-204	*24B734843	Coil, burst take off: grn code	.75
L-205	*24B732672	Coil, comp: wht-blk code	.90
L-206	24B732672	Coil, comp: wht-blk code	.90
L-207	*1V732207	Coil, 3.58 Mc trap: with core; blue code	.85
L-208	1V732207	Coil, 3.58 Mc trap: with core; blue code	.85
L-211	24K733200	Coil, comp: wht-blk code	.70
L-212	24K733200	Coil, comp: wht-blk code	.70
L-213	24R119855	Coil, comp: org-blk code	.70
L-214	*24R121453	Coil, comp: wound on 560 res; red-vio code	.50
L-215	*24B732205	Coil, reactance	1.50
L-216	*1V734277	Coil, 3.58 Mc osc: incl C-241 & 242	1.90
L-217	*24B734745	Coil, convergence	4.35
L-218	*24K733734	Coil, horiz dyn phase	1.30
L-219	*24B734745	Coil, convergence	4.35
L-220	24K733734	Coil, horiz dyn phase	1.30
L-221	24B734745	Coil, convergence	4.35
L-222	24K733734	Coil, horiz dyn phase	1.30
L-223	*25B734494	Choke, filter: 2 hy	1.75
Resistors - Note:		All resistors are insulated carbon type unless specified	
R-1	6R3[illegible]4	1800 10% 2W	.25
R-2	6R5687	2200 10% 2W	.25
R-3	6R6397	22,000 10% 1/2W doz	1.20
R-4	6R6056	47,000 20% 1/2W doz	1.20
R-5	6R6429	820,000 10% 1/2W doz	1.20
R-6	6R6475	680,000 10% 1/2W doz	1.20
R-7	6R6229	1000 10% 1/2W doz	1.20
R-8	6R5659	3900 10% 1/2W doz	1.20
R-9	6R6269	820 10% 1/2W doz	1.20
R-10	6R6393	1200 10% 1/2W doz	1.20
R-11	6R6028	22,000 20% 1/2W doz	1.20
R-12	6R6028	22,000 20% 1/2W doz	1.20
R-13	6R6414	270,000 10% 1/2W doz	1.20
R-14	6R6477	15,000 10% 1/2W doz	1.20
R-15	6R6054	10,000 20% 1/2W doz	1.20
R-16	6R6229	1000 10% 1/2W doz	1.20
R-17	6R5766	12,000 10% 2W	.25
R-51	6R6477	15,000 10% 1/2W doz	1.20
R-52	*6K121897	820 10% 2W	.25
R-53	6R6398	150,000 10% 1/2W doz	1.20
R-54	6R6326	100 10% 1/2W doz	1.20
R-55	6R2004	8200 10% 1/2W doz	1.20

Ref. No.	Part Number	Description	List Price
R-56	6R6229	1000 10% 1/2W doz	1.20
R-57	6R2035	82 10% 1/2W doz	1.20
R-58	6R6398	150,000 10% 1/2W doz	1.20
R-59	6R5660	180 10% 1/2W doz	1.20
R-60	6R6428	6800 10% 1/2W doz	1.20
R-61	6R6428	6800 10% 1/2W doz	1.20
R-62	6R6410	33,000 10% 1/2W doz	1.20
R-63	6R6074	68,000 10% 1/2W doz	1.20
R-64	18A733887	Tone Control: 1 meg	.55
R-65	*18B732228	Dual Control & Switch: vol - 1 meg tapped at 250K & brightness - 100K	1.35
R-66	6R2122	4.7 meg 20% 1/2W doz	1.20
R-67	6R6032	470,000 20% 1/2W doz	1.20
R-68	6R6032	470,000 20% 1/2W doz	1.20
R-69	6R6090	470 10% 1/2W doz	1.20
R-70	*6K121896	1500 10% 2W	.25
R-71	*18B731827	Dual Control: horiz centering - 20 ohms; vert centering - 20 ohms	4.00
R-72	*17K731896	Wire Wound: 1500 10% 5W	.45
R-73	*17A732655	Special, wire wound: 7.5 ohm (CAUTION - use only special fusing res as replacement.)	1.00
R-74	6R6320	10,000 10% 1/2W doz	1.20
R-75	6R5550	47 10% 1/2W doz	1.20
R-76	6R3949	470 20% 1/2W doz	1.20
R-77	6R3949	470 20% 1/2W doz	1.20
R-78	6R6394	12,000 10% 1/2W doz	1.20
R-79	6R5550	47 10% 1/2W doz	1.20
R-80	6R3949	470 20% 1/2W doz	1.20
R-81	*6K121901	27,000 10% 1W	.20
R-82	6R3949	470 20% 1/2W doz	1.20
R-83	6R5551	120 10% 1/2W doz	1.20
R-84	6R3949	470 20% 1/2W doz	1.20
R-85	6R6229	1000 10% 1/2W doz	1.20
R-86	6R6397	22,000 10% 1/2W doz	1.20
R-87	6R6080	4700 10% 1/2W doz	1.20
R-88	6R6475	680,000 10% 1/2W doz	1.20
R-89	6R6434	27,000 10% 1/2W doz	1.20
R-90	6R6394	12,000 10% 1/2W doz	1.20
R-91	*6K121895	15,000 10% 1W	.20
R-92	6R6269	820 10% 1/2W doz	1.20
R-93	*6K121899	3300 10% 2W	.25
R-94	6R6046	1 meg 10% 1/2W doz	1.20
R-95	6R6048	47,000 10% 1/2W doz	1.20
R-96	6R6393	1200 10% 1/2W doz	1.20
R-97	*18B731886	Contrast Control: dual; front 500, rear 1K	1.90
R-100	6R6046	1 meg 10% 1/2W doz	1.20
R-101	6R5581	3300 10% 1/2W doz	1.20
R-102	6R6320	10K 10% 1/2W doz	1.20
R-10[illegible]	6R2035	82 10% 1/2W doz	1.20
R-1[illegible]	[illegible]B732223	Color Intensity Control (chroma): 10K	.85
R-[illegible]	6K120474	22,000 10% 2W	.25
R-[illegible]	6R6032	470,000 20% 1/2W doz	1.20
R-107	6R6031	100,000 10% 1/2W doz	1.20
R-109	6K121894	22,000 10% 1W	.20
R-110	6R2061	180,000 5% 1/2W doz	1.75
R-111	6R5587	1 meg 5% 1/2W doz	1.75
R-112	6R400067	330,000 5% 1/2W doz	1.75
R-113	*6K121894	22,000 10% 1W	.20
R-114	6R400076	39,000 5% 1/2W doz	1.75
R-115	6R6229	1000 10% 1/2W doz	1.20
R-116	6R6429	820,000 10% 1/2W doz	1.20
R-117	6R6031	100,000 10% 1/2W doz	1.20
R-118	6R6320	10,000 10% 1/2W doz	1.20
R-119	6R6407	220,000 10% 1/2W doz	1.20
R-120	6R6428	5600 10% 1/2W doz	1.20
R-121	6R5768	33,000 10% 2W	.25
R-122	6R6410	33,000 10% 1/2W doz	1.20
R-123	6R6031	100,000 10% 1/2W doz	1.20
R-124	6R6407	220,000 10% 1/2W doz	1.20
R-125	6R6069	2200 10% 1/2W doz	1.20
R-126	6R6428	6800 10% 1/2W doz	1.20
R-127	6R6069	2200 10% 1/2W doz	1.20
R-128	6R6397	22,000 10% 1/2W doz	1.20
R-129	6R6080	4700 10% 1/2W doz	1.20
R-130	6R6031	100,000 10% 1/2W doz	1.20
R-131	6R6031	100,000 10% 1/2W doz	1.20

Ref. No.	Part Number	Description	List Price
R-132	6R6031	100,000 10% 1/2W doz	1.20
R-133	6R5659	3900 10% 1/2W doz	1.20
R-134	6R2122	4.7 meg 20% 1/2W doz	1.20
R-135	*18B733738	Dual Control: vert hold - 200K; horiz hold - 100K	1.70
R-136	6R5646	390,000 10% 1/2W doz	1.20
R-137	6R6320	10,000 10% 1/2W doz	1.20
R-138	6R6229	1000 10% 1/2W doz	1.20
R-139	6R6117	5600 10% 1/2W doz	1.20
R-140	*18B731880	Dual Control: vert lin - 2K; vert size - 2 meg	1.70
R-141	6R6074	68,000 10% 1/2W doz	1.20
R-142	6R5646	390,000 10% 1/2W doz	1.20
R-143	6R6031	100,000 10% 1/2W doz	1.20
R-144	6R6320	10,000 10% 1/2W doz	1.20
R-145	6R5581	3300 10% 1/2W doz	1.20
R-146	6R6046	1 meg 10% 1/2W doz	1.20
R-147	*18K734928	Horiz Drive Control: 5000	1.65
R-148	6R6007	68 20% 1/2W doz	1.20
R-149	17R121123	5000 10% 5W	.80
R-150	6R6397	22,000 10% 1/2W doz	1.20
R-151	*18K733743	Focus Control: 2.5 meg	3.95
R-152	6R6394	12,000 10% 1/2W doz	1.20
R-153	6R6048	47,000 10% 1/2W doz	1.20
R-154	6R6433	2.2 meg 10% 1/2W doz	1.20
R-155	6R2035	82 10% 1/2W doz	1.20
R-156	6R476012	3900 10% 2W	.25
R-157	6R6048	47,000 10% 1/2W doz	1.20
R-158	6K120580	Wire Wound: 6.8 10% 1W	.20
R-159	6R6326	100 10% 1/2W doz	1.20
R-160	6R6410	33,000 10% 1/2W doz	1.20
R-161	6K121900	47,000 10% 1W	.20
R-162	6K121893	470,000 10% 1W	.20
R-163	6K121893	470,000 10% 1W	.20
R-164	6R2046	820 10% 2W	.25
R-165	17K488266	Wire Wound: .47 10% 1/2W.	.15
R-166	6R5591	18,000 10% 1/2W doz	1.20
R-167	6R5701	820 10% 1W	.20
R-168	6R3949	470 20% 1/2W doz	1.20
R-169	6R5591	18,000 10% 1/2W doz	1.20
R-170	6R6320	10,000 10% 1/2W doz	1.20
R-171	6R6075	100,000 20% 1/2W doz	1.20
R-172	6R5550	47 10% 1/2W doz	1.20
R-201	6R6430	10,000 10% 1W	.20
R-202	6R6074	68,000 10% 1/2W doz	1.20
R-203	6R6229	1000 10% 1/2W doz	1.20
R-205	6R3949	470 20% 1/2W doz	1.20
R-206	6R3949	470 20% 1/2W doz	1.20
R-207	6R5556	10,000 5% 1/2W doz	1.20
R-208	6R5556	10,000 5% 1/2W doz	1.20
R-209	*18B731834	Dual Control: blue G-2 - 3 meg; blue bkgd - 100	1.70
R-210	*6A733145	Special: 33,000 10% 4W; with heat dissapating band.	.50
R-211	*18K732740	Blue Gain Control: 1000 ohms	.40
R-213	6R6393	1200 10% 1/2W doz	1.20
R-214	6R5591	18,000 10% 1/2W doz	1.20
R-215	6R6046	1 meg 10% 1/2W doz	1.20
R-218	6R476014	18,000 10% 2W	.25
R-219	17R121123	5000 10% 5W	.80
R-220	6K121488	12,000 10% 2W	.25
R-221	6K121488	12,000 10% 2W	.25
R-222	6R6398	150,000 10% 1/2W doz	1.20
R-223	6R6414	270,000 10% 1/2W doz	1.20
R-224	6R6117	5600 10% 1/2W doz	1.20
R-225	6R6373	150 10% 1/2W doz	1.20
R-226	*18B731833	Dual Control: green G-2 - 3 meg; green bkgd - 500	1.70
R-227	*6K733772	Special: 27,000 10% 4W; with heat dissapating band.	.50
R-228	6R5732	15,000 10% 2W	.25
R-229	6R6236	68,000 10% 1W	.20
R-230	6R6477	15,000 10% 1/2W doz	1.20
R-231	6R6069	2200 10% 1/2W doz	1.20
R-232	6R6046	1 meg 10% 1/2W doz	1.20
R-233	*18A734485	AFC Control: 250K	.75
R-234	6R6046	1 meg 10% 1/2W doz	1.20
R-235	6R6320	10,000 10% 1/2W doz	1.20
R-236	6R6477	15,000 10% 1/2W doz	1.20
R-238	6R6022	330 10% 1/2W doz	1.20
R-239	6R5731	39,000 10% 2W	.25
R-240	6R6409	2200 10% 1W	.20
R-241	6R5556	10,000 5% 1/2W doz	1.20

Ref. No.	Part Number	Description	List Price
R-242	6R5554	390 10% 1/2W doz	1.20
R-243	6R6075	100,000 20% 1/2W doz	1.20
R-246	6R6398	150,000 10% 1/2W doz	1.20
R-247	6R3949	470 20% 1/2W doz	1.20
R-248	6R3949	470 20% 1/2W doz	1.20
R-249	6R5721	150,000 10% 1W	.20
R-250	*18A734621	Red G-2 Control: 3 meg	.85
R-251	6R2011	2.2 meg 10% 1W	.20
R-254	*6K121893	470,000 10% 1W	.20
R-255	*6K121893	470,000 10% 1W	.20
R-256	6R6397	22,000 10% 1/2W doz	1.20
R-257	6R6048	47,000 10% 1/2W doz	1.20
R-258	*18B733740	Dual Control: vert dyn tilt 100, vert dyn amp 2.5K	1.75
R-259	*18K734497	Horiz Dyn Conv Control: 500	.75
R-260	*18B733740	Dual Control: vert dyn tilt 100, vert dyn amp 2.5K	1.75
R-261	18K734497	Horiz Dyn Conv Control: 500	.75
R-262	18B733740	Dual Control: vert dyn tilt 100, vert dyn amp 2.5K	1.75
R-263	18K734497	Horiz Dyn Conv Control: 500	.75
R-265	*6R5556	10,000 5% 1/2W doz	1.20
R-267	6R5718	3300 10% 1W	.20
R-268	6R6069	2200 10% 1/2W doz	1.20
R-269	6R5577	2700 10% 1/2W doz	1.20
T-1	24K730677	Trans, ant: imp matching	.85
T-2	24K730677	Trans, ant: imp matching	.85
T-6	*24C734459	Trans, ratio det	2.10
T-7	*25K733208	Trans, audio output	2.20
T-8	*25B733226	Trans, filament	18.60
T-9	24B721953	Trans, 1st IF	2.20
T-10	*24B732201	Trans, 2nd IF	2.05
T-11	*24K734252	Trans, bandpass plate	1.00
T-12	*25K734747	Trans, vert blocking osc	
T-13	*24D734487	Trans, hi-voltage & horiz output	22.95
T-14	*24C734522	Trans, 3rd IF (sound det)	6.05
T-15	*24C734521	Trans, 3rd IF (video det)	5.50
T-16	*25B734976	Trans, vert output	
T-201	*24B734844	Trans, bandpass cathode follower grid	1.20
T-202	*24B733747	Trans, bandpass cathode follower cathode	1.60
T-203	*24C734483	Trans, burst amp	1.70
T-204	*24B733760	Trans, quadrature: incl L-209, 210, C-211, 212 & 213	2.60

MECHANICAL PARTS

Part Number	Description	List Price
1V733441	Arms & Link Assem, tone control	.25
7B732855	Bracket, bearing (holds fine tuning - UHF shaft)	.10
42A732663	Belt, UHF drive	.25
*75K731898	Bumper, rubber (on pic tube tilt brkt)	.25
43A732660	Bushing, pulley: phenolic (on rear of fine tuning shaft)	.20
43A735148	Bushing, sleeve: nylon (on rear of fine tuning shaft)	
*14A734482	Cap, plate insulating (V-20 mtg)	
42A720008	Cap, plate: with lead (V-17)	.20
*42K471194	Clip, electrolytic mtg (C-66, 75).	.05
*42K734748	Clip, electrolytic mtg (C-69)	.05
*42A734655	Clip, grid & lead (V-19)	.35
42A730642	Clip, spring (dial light jewel ret)	.05
41A732715	Clip, spring (fine tuning rotor grounding)	.05
42K731600	Clip, tube shield (V-3, 4, 5, 25, 26)	.05
*76K733748	Core, iron (L-47)	.30
46A711360	Core, iron (L-2, 3)	.10
46A780344	Core, iron & screw (L-43, 218)	.45
46K722164	Core, iron & screw (T-9, 10, L-26, 30, 31)	.10
*46K732255	Core, iron & screw (T-204)	.15
46B790943	Core, iron & screw (L-39, 201, 202, 204, 208, 215, 216, T-12, 204)	.15
58A702714	Coupling, shaft (couples contrast shaft & ext)	.10
*1B734488	Hi-Voltage Socket Assembly (V-21).	
*1V734197	Hi-Voltage Socket Assembly (V-19).	
*1V734198	Hi-Voltage Socket Assembly (V-20).	
14A733464	Insulator, core rod (L-47)	.30

These models are nineteen tube direct viewing television receivers differing only in type of cabinet, size of speaker and their use in conjunction with a radio receiver and automatic record changer in the combination models. A 17" electrostatically focused rectangular tube (17HP4) is used in the 17" models and a 21" magnetically focused and rectangular tube {21ZP4B / 21ZP4A} is used in the 21" models. Replacement, in all cases, must be of the identical size and type.

Service information for radio chassis in combination models will be found in the Operating and Service Instructions, which are furnished with each set along with operating instructions for the automatic record changer.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

TUBE COMPLEMENT	REF. NO.	FUNCTION
R-S — 6BC5 / U — 6BQ7	V1	RF Amplifier
6J6	V2	RF Oscillator and Converter
6AU6	V3	2nd Sound IF Amplifier
6AL5	V4	Ratio Detector
6AV6	V5	Audio Amplifier
6W6/GT	V6	Audio Output
6AU6	V7	Ist Video IF Amplifier
6AU6	V8	2nd Video IF Amplifier
6CB6	V9	3rd Video IF Amplifier
12BY7	V10	Video Amplifier
12AX7	V11A	Sync. Separator
12AX7	V11B	Sync. Amplifier
12AU7	V12A	Sync Clipper
12AU7	V12B	Vertical Oscillator
6V6GT	V13	Vertical Output
6SN7/GT	V14	Horizontal Oscillator & AFC
6BQ6/GT	V15	Horizontal Output
1B3/GT OR 1X2B	V16	High Voltage Rectifier
6W4/GT	V17	Damper
5U4/G	V18	Power Rectifier
17HP4 / 21ZP4A / 21ZP4B	V19	Picture Tube — R Chassis / Picture Tube — S-U Chassis

Power Supply	105-125 Volts 60 Cycle AC only
Power Consumption	185 Watts R — 200 Watts S-U
Speaker:	
17TR10, 17TR19, 17CR20 / 21TS11, 21CS12, 21TS17 / 21CS18, 21TU14	5" PM
21CU15	8" PM
21CU16, 21KS22	10" PM
Voice Coil Impedance	3.2 Ohms at 400 Cycles
Antenna Input Impedance	300 Ohms

OPERATING CONTROLS (SEE FIG. 1)

Front Panel — Exposed

Channel Selector / Fine Tuning	Dual Control
Power Switch and Volume / Contrast (Picture) Control	Dual Control

Front Panel — Concealed

Horizontal Hold	Single Control
Vertical Hold	Single Control
Brightness	Single Control

NON OPERATING CONTROLS (SEE FIGS. 1 AND 6)

Width Control	Top Chassis Screwdriver Adjustment
Horizontal Drive	Rear Screwdriver Adjustment
Horizontal Oscillator	Top Chassis Screwdriver Adjustment
Horizontal Phasing	Top Chassis Screwdriver Adjustment
Height	Front Panel Screwdriver Adjustment (Concealed)
Vertical Linearity	Front Panel Screwdriver Adjustment (Concealed)
Centering	Centering Magnet on Neck of Pix Tube
Focus	REAR — Projects from cup on cabinet back, S-U Models Only

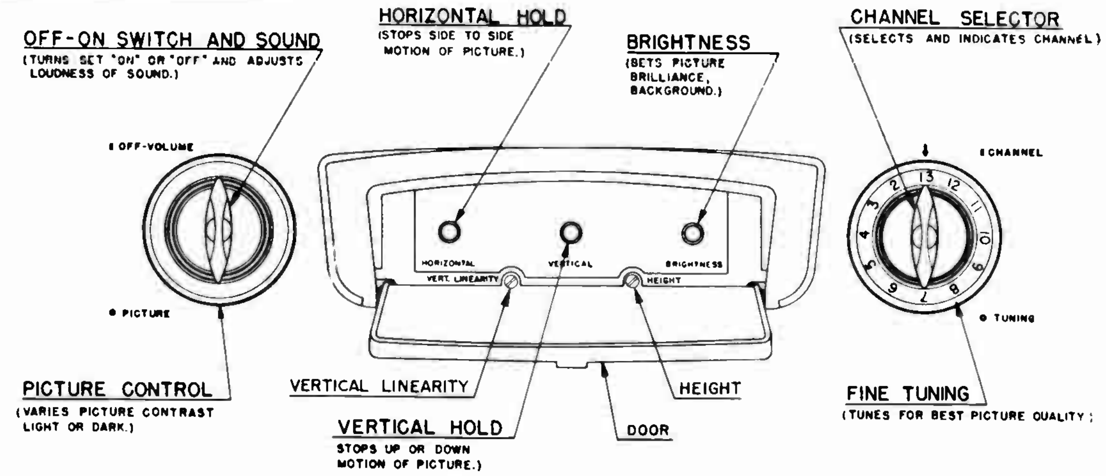


FIG. 1

CIRCUIT DESCRIPTION

GENERAL

The Olympic receivers covered by this manual use the Intercarrier type of Video and Sound IF System. Both Picture and Sound signals are received by the tuner, converted to an IF frequency and then fed, together, through three stages of video IF amplification. At the Video Amplifier stage the two signals are separated. The sound signal is fed into a Sound IF Amplifier and then through a Ratio Detector, an Audio amplifier, an Audio Output stage and ultimately to the speaker. The Video signal with its accompanying Sync pulses are fed through a Video Amplifier after which the Sync pulses are diverted into three Sync Separating and Clipping Stages and from there to the Vertical and Horizontal Sweep Oscillators. The Video information is fed from the Video amplifier to the Cathode of the Cathode Ray (Picture) Tube.

TUNER U CHASSIS

These receivers include the Olympic "Rocket" Tuner which is of the new cascode type. The principal advantages of the Rocket tuner are; greater sensitivity, improved Signal-to-noise ratio, and low radiation. Most of these properties are accomplished through the use of a dual triode (6BQ7 — V1) in which the two sections of the tube are separated by a grounded shield. The first triode is used as grounded cathode amplifier and the AGC voltage, generated later in the Video Detector and AGC Stage, is applied to the grid. The second Triode section of the tube is a Grounded Grid Amplifier and is directly coupled to the first section. The first section is neutralized by a factory adjusted coil to resonate with the grid-cathode capacity of the second section. The overall gain of the two stages is only slightly higher than that of a single pentode but through the use of triodes, which have a smaller amount of tube noise, the signal to noise ratio is greatly improved.

TUNER R-S CHASSIS

These chassis incorporate a Pentode tuner which uses a {6BC5 / 6CB6} tube as an RF Amplifier.

The Oscillator and Mixer stages are essentially the same as earlier Olympic turret type tuners with the addition of a complete shield covering the entire underside of the tuner, internal shielding, and added decoupling, all to minimize radiation.

PICTURE IF SYSTEM

These receivers have three stages of Video IF Amplification. The first IF coil (L301) is located on the tuner and functions as the output coupling of the tuner. The second IF coil (L-5) is followed by the Adjacent Sound Trap (L-6). The adjacent sound trap eliminates interference in the picture which might be caused by the sound signal of the next lowest channel when the lower channel is used in the same area. The Third Picture IF (L7) is followed by an accompanying Sound Trap (L9) but the Fourth Picture IF transformer (L8) has no trap. All coils and traps are adjusted from the top of the chassis. The IF coils are "stagger-tuned" to four frequencies described later in this manual under "RF-IF Alignment Procedure."
Note: Adjacent sound trap is used in "U" only.

VIDEO DETECTOR AND AGC

Both video detection and the development of the AGC voltage are accomplished in the IN64 Germanium diode.

The sound portion of the composite signal is picked off the output of the Video Amplifier by the2nd Sound IF Amplifier. This stage utilizes the 6AU6 tube (V3).

VIDEO AMPLIFIER

The Video information and the Sync and Blanking pulses are amplified at the 12BY7 (V10) Video Amplifier Tube. The Sync is picked off through an "RC" network consisting of R33 and C33 in the Plate circuit and fed to the Sync Separator (V11A) and Clipper stages (V 12A). The Video information goes to the cathode of the Kinescope (V19 — Pin 11) after passing through a 4.5 Mc trap (L1) to eliminate any sound interference in the picture.

SYNC SEPARATOR AND CLIPPERS

The sync system of these receivers employs three stages. Two dual triodes, a 12AX7 & a 12AU7 (VII & V12). The first triode of the first (V11A) is the sync separator stage. This in turn feeds into the second half of the same tube (V11B), the sync amplifier. The sync amplifier supplies pulses to the Horizontal AFC and oscillator (V14) and simultaneously to the Vertical Blocking oscillator (V12B) (through the Vertical Intergrating network). The first half of the second tube (V12A) is the sync clipper and the second half of the second tube (V12B) is the vertical oscillator.

SWEEP SYSTEM — VERTICAL — 6V6GT

The output of the oscillator stage is amplified in the 6V6GT tube (V13) and then fed through the Vertical Output Transformer to the vertical windings of the Deflection Yoke.

SWEEP SYSTEM — HORIZONTAL

The Horizontal Oscillator is essentially of the blocking oscillator type. The operation of the A.F.C. system depends upon a correcting voltage developed in the control section of the Horizontal Oscillator and AFC tube (V14) where the oscillator output and the incoming pulses differ in either phase or frequency. The control tube, (first section V14) is maintained at cut-off until such time as the sync pulse is either ahead or behind the Oscillator sawtooth peak. When either case occurs the control tube develops a voltage which is applied as a bias to the oscillator grid and alters the oscillator frequency to coincide with the frequency of the incoming pulses. The Horizontal Oscillator transformer (L16) has an adjustable core which is a coarse adjustment of the oscillator frequency and the front panel Horizontal Hold Control is a fine adjustment in the same sense.

Note: Many of the components in the horizontal circuits are of critical value and therefore should only be replaced by the exact replacement part. Care should also be taken in dressing leads and locating parts when replacing. This can be accomplished by carefully noting positions of parts and leads before removal.

SOUND SYSTEM

The sound carrier is taken off the plate (Pin 7) of the Video Amplifier tube (V10) and fed into the grid of the 2nd Sound IF Amplifier (V3 — Pin 1) and from there through the Ratio Detector (V4), the Audio Amplifier (V5), the Audio Output tube (V6) and then to the speaker.

HIGH VOLTAGE POWER SUPPLY

The Energy stored in the horizontal windings of the deflection yoke during the forward sweep produces high voltage surges during retrace. This is multiplied by the "Auto Transformer" (primary) winding of the Horizontal Output Transformer (TR 2771) and is then rectified by 1X2B or 1B3/GT (V16) to provide approximately 15 Kilovolts for the picture tube anode (V19).

"B" VOLTAGE POWER SUPPLY

The "B" voltage in these chassis is provided by a standard transformer-rectifier circuit. The secondary of the Power Transformer provides, in addition to a center-tapped "B" voltage winding, a five-volt filament winding for the 5U4G Power Rectifier (V18), and two six-volt windings. One six-volt source is used for the filaments of the Damper Tube (V17) only, and the other for the filaments of all other tubes. A "B" voltage of +140 volts is derived from the cathode of the 6W6/GT Audio Output Tube (V 6). This voltage is utilized primarily in the IF circuits and removal of the 6W6 from its socket will therefore make the entire IF strip inoperative.

ADJUSTMENTS

ION TRAP MAGNET ADJUSTMENT

Turn the brightness control fully clockwise and the contrast control fully counterclockwise. Adjust the ion trap magnet by moving it forward or backward and at the same time rotating it slightly around the neck of the kinescope until the raster on the screen is brightest. Of two possible positions, use the one nearest the tube base. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust focus control until the line structure of the raster is clearly visible (sharp). Readjust the ion trap magnet again for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained. Never correct for a shadowed raster with the ion trap.

DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask. Loosen the deflection yoke adjustment screw and rotate the deflection yoke until this condition is obtained, and retighten the yoke adjustment screw. If neck shadow is evident or the corners of the raster are dark, the deflection yoke must be moved forward as far as possible and the wing screw re-tightened.

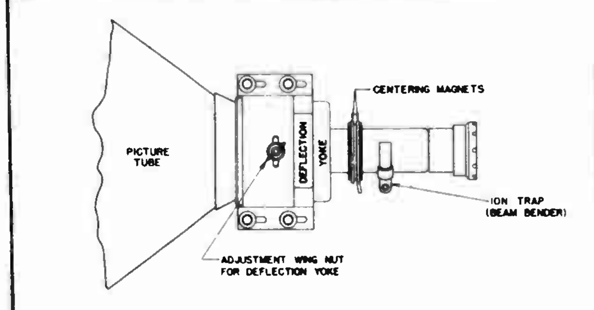


FIG. 2-"R" ONLY

CENTERING MAGNET ADJUSTMENT (17"—"R" ONLY)

The 21" receivers are electromagnetically focused and centering is accomplished by adjusting an arm which extends vertically from the front of the focus coil. This arm may be rotated, for a limited distance, around the neck of the tube and may also be moved up and down. The physical setting of the focus coil itself in relation to the neck of the tube will also affect picture position. Before the adjustment arm is used, it should be ascertained that (1) the focus coil is at right angles to the

CENTERING ADJUSTMENT (21" — S-U — ONLY)

The 21" receivers are magnetically focused and centering is accomplished by adjusting an arm which extends vertically from the front of the focus magnet. This arm may be rotated for a limited distance, around the neck of the tube and may also be moved up and down. The physical setting of the focus coil itself in relation to the neck of the tube will also affect picture position. Before the adjustment arm is used, it should be ascertained that (1) the focus magnet is at right angles to the neck of the tube (by setting the two nuts which tighten the tube support rods) and (2) that the neck of the tube is directly centered in the focus magnet (by loosening the two mounting screws on either side of the focus coil and sliding up or down).

Note: Remove corrugated shipping clip from around neck of pix tube before attempting any adjustments.

ADJUSTMENT OF HORIZONTAL OSCILLATOR

(1) Allow set to warm up to operating temperature. Select station operating normally.

(2) Short out horizontal Phasing Coil (L 17) Terminals C and D.

(3) Set horizontal hold control at maximum clock-wise rotation.

(4) Adjust horizontal frequency screw (L 16) until picture falls into sync. Turning the horizontal frequency screw (L 16) clockwise lowers the frequency, (bars sloping downward to left). Turning the screw counter-clockwise increases frequency (bars sloping downward to right).

(5) Connect vertical input lead of oscilloscope with 5 MMF isolating condenser in series to terminal "C" of horizontal oscillator transformer and ground oscilloscope to chassis. Set frequency of scope to approximately 5 KC.

(6) Remove short from terminals of the horizontal phasing coil (L 17) and adjust screw (L 17) until wave shape as observed on scope is like that shown in sketch. (See Fig. 3.)

(7) Some further adjustment of horizontal frequency screw (L 16) may be necessary to keep picture in sync after adjusting L 17 for proper wave shape.

(8) Remove scope from terminal "C" and retouch L 16, as per "9" below.

(9) Turn horizontal hold control through entire range. Picture should fall out of sync at either end of rotation. At full clockwise rotation blanking bar or jitter should be evident. At full counter-clockwise position picture should fall out to 4½ to 5 bars sloping downward to the left. (If picture stays in sync the tuner switch should be rotated to interrupt signal momentarily)

Caution: It is important that the picture be centered in the mask properly with the horizontal hold control in the mid-position, otherwise the set user may attempt to center the picture by means of the hold control. Under this condition the control may be on "edge" and impulse noise or change of camera will cause the picture to fall out of synchronization. It should also be noted that some manufacturers types of 6SN7GT may perform better than others in the horizontal oscillator socket and excessive drift of the horizontal oscillator circuit may be caused by a weak or defective 6SN7GT tube.

ADJUST FOR EQUAL PEAKS


FIG. 3

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS

For best results it is preferable that these adjustments be made on a transmitted test pattern; although satisfactory results can be obtained from an active picture.

Both controls will affect the height AND linearity of the picture and therefore must be adjusted simultaneously. It will be found that the Height Control has a tendency to affect the bottom of the picture more than the top and the linearity control just the reverse.

Note: It is advisable that both height and width of the picture be adjusted to a size slightly larger than the mask opening, so that during periods of low line voltage adequate picture size is maintained.

HORIZONTAL WIDTH & DRIVE ADJUSTMENT

The Horizontal Drive Trimmer should be screwed tight (clockwise) and then backed off (counter-clockwise) until Horizontal Drive bars appear. Then turn Drive Trimmer in again (clockwise) until drive bars, just disappear. (Note: In some sets no horizontal drive bars will appear regardless of Drive Trimmer adjustment. In these sets the trimmer should be set for proper width.

Important: The horizontal oscillator frequency must be checked for proper range of horizontal control after any adjustment of horizontal drive (C67). Any adjustment of C67 will usually require resetting of the horizontal frequency adjustment coil (L-16).

BUILT-IN ANTENNA

All models are equipped with a built-in antenna which provide satisfactory reception in many locations. In areas of weak reception an outside antenna will substantially improve the performance of the receiver. Antenna binding posts are provided at the rear of chassis and are accessible through the opening in the masonite back to permit the connection of an outside aerial. The built-in antenna is normally connected to the antenna posts and must be disconnected when attaching the outside aerial. To prevent the lead-in wires of the built-in antenna from contacting chassis parts and tubes, it is recommended that the lead-in wire be folded and held in place by tape or a rubber band. In some cases reception can be improved by changing the location of the receiver in the room when set is operating with built-in antenna.

RF-IF ALIGNMENT PROCEDURE

EQUIPMENT REQUIRED

(1) RF signal generator to provide the following accurate frequencies:

(a) 4.5 Mc (Video Amplifier Trap, Sound IF and Ratio Detector)

(b) IF Frequencies

21.75	MC	Accompanying Sound Trap (L9)
27.75	MC	Adjacent Sound Trap (L6) U only
22.5	MC	First Pix IF Transformer (L301)
25.75	MC	Second Pix IF Transformer (L5)
23.5	MC	Third Pix IF Transformer (L7)
25.25	MC	Fourth Pix IF Coil (L8)
21.75	MC	Sound Carrier Marker
26.25	MC	Picture Carrier Marker
23.0	MC	Marker

(c) RF Frequencies

CHANNEL NUMBER	PICTURE CARRIER FREQ. MC	SOUND CARRIER FREQ. MC
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

(d) Output on these ranges should be adjustable and capable of providing at least .1 volt.

If the accuracy of the generator frequencies is not known, some type of crystal calibrator should be utilized to check the correct settings of the RF generator for each particular frequency.

(2) Electronic Voltmeter

(3) Cathode Ray Oscilloscope, 3" minimum screen.

(4) RF Sweep Generator, meeting the following requirements:

(a) Frequency Ranges:

18 to 30 MC }
40 to 90 MC } 10 MC sweep width
170 to 225 MC }

(b) Output adjustable to .1 volt.

TO REMOVE CHASSIS FROM CABINET

Remove: (1) Line cord from power outlet
(2) Masonite back.
(3) Antenna Lead-in from terminal posts.
(4) Speaker plug from rear of chassis.
(5) Knobs from front of cabinet.
(6) Four mounting screws and washers from bottom of cabinet.

In sliding chassis out of cabinet, be careful that the kinescope tube does not strike against speaker or any other obstruction.

Before proceding it will be necessary to use an extra line (or "cheater") cord to supply AC current to the chassis as the set's line cord is attached to the masonite back of the cabinet.

ORDER OF ALIGNMENT

When complete receiver alignment is necessary, it should be performed in the following sequence:

(1) Accompanying Sound Trap
(2) Adjacent Sound Trap
(3) Pix IF Coils
(4) 4.5 MC Trap
(5) 4.5 MC Sound IF and Ratio Detector
(6) Tuner

After removing chassis from cabinet re-connect power and speaker plugs.

If a local station is not operating on Channel 9 set the tuner to this channel, turn on power switch and proceed as follows: (If 9 is a local station, use Channel 8 or 10.)

ACCOMPANYING AND ADJACENT SOUND TRAPS

Insert a 100,000 ohm 1/2 watt resistor in series with the "Hot Lead" of the electronic voltmeter and connect to the junction of L12 and C25. Meter switch should be set to the lowest negative scale. Ground lead of meter should be connected to chassis.

Remove the shield of the RF Oscillator and Mixer tube (V2) from ground clips leaving shield resting on tube and connect hot lead of the RF Signal Generator to it. This will couple generator output to mixer plate.

Set the generator frequency accurately to 21.75 MC, and adjust (L9) sound trap (See Fig. 6 Tube and Trimmer Layout) for **minimum** reading on voltmeter.

Set the generator frequency accurately to 27.75 MC and adjust (L6) Adjacent Sound Trap for **minimum** reading on voltmeter.

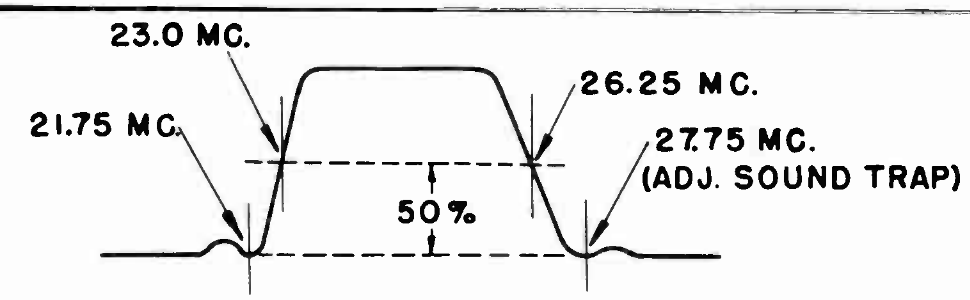


FIG. 4 STANDARD RESPONSE CURVE

PIX IF COIL ADJUSTMENT

Adjust the following slugs for maximum output at frequencies and sequence indicated with meter and generator connected as above: (See Sound Traps above).

L301	22.5 MC
L5	25.75 MC
L7	23.5 MC
L8	25.25 MC

Note: After setting L5 **DO NOT** readjust to improve wave shape.

If oscillation occurs during alignment, temporarily raise frequency of L8 by turning screw counter-clockwise until screw projects approximately 3/4". Oscillation is evidenced by high reading on voltmeter (—5V to —20V) with signal generator OFF and no signal coming in through the antenna terminals. After properly adjusting L301, L5 and L7 reset L8 to proper frequency, if it had been necessary to detune.

Connect hot lead of sweep generator through a 330 uuf condenser to test point on tuner and connect ground lead to chassis.

Connect vertical input terminal of oscilloscope to junction of peaking coil L12 and C25 and connect ground lead of scope to chassis.

Connect 1.5 V flashlight battery with positive terminal to chassis and negative terminal to junction of R13 and C21. This point is AGC bias voltage. Set tuner to Channel 9 unless local station is operating on this frequency, in which case an adjacent channel should be used.

Set Sweep Generator frequency to IF sweep on the 20 to 30 MC range.

Adjust sweep generator output to produce a curve on the scope which is approximately 2/3 of the screen diameter.

Loosely couple output of RF signal generator by using shield on V2 and set frequency of RF signal generator to 26.25 MC (marker).

Curve shown on scope should be similar to the response curve shown in Figure 4. For proper setting of the pix carrier the 26.25 MC marker should appear on the curve at a point approximately 50% of the vertical height of the curve.

To obtain this setting retouch L8.

Reset RF signal generator frequency to 23.O MC and retouch L301 and L7 for correct positioning of marker on curve.

Recheck setting of 26.25 MC marker to make sure that position has not shifted on curve.

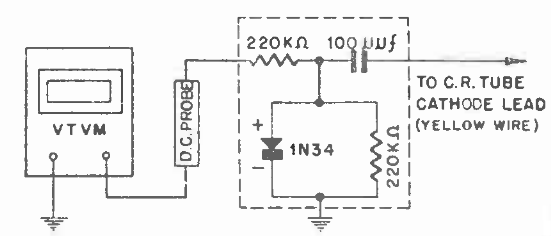
Disconnect bias battery.

Note: If the curve cannot be made to appear as above due to a local station or other interference, or if multiple markers appear, remove (V1 — 6BZ7 or 6BQ7) RF tube from tuner.

TRAP ALIGNMENT

Connect voltmeter lead to Diode crystal rectifier as shown in Fig. 5. Connect Diode crystal rectifier between C.R. Tube Cathode lead (yellow wire) and chassis ground. Signal generator is connected at junction of L12 and C33. Set contrast control at maximum and voltmeter to 3 volt scale (negative). Remove 6CB6 (V9) from socket. Use maximum output of generator at 4.5 MC. Adjust L1, top of TR-3386 for **minimum** reading on meter.

When it is necessary to retouch this trap in the field, proper adjustment can be made by using the local station signal and turning the Fine Tuning Control to bring fine herringbone sound beat into the picture. The 4.5 MC trap (L1) should then be adjusted to minimize this beat interference.



VOLTMETER AND CRYSTAL DIODE CONNECTIONS

FIG. 5

SOUND IF TRANSFORMER, (4.5 MC) AND RATIO DETECTOR ADJUSTMENT

In view of the fact that the transmitted sound signal from a TV station is probably the most accurate available, as far as frequency is concerned, it is recommended that a working signal be used for sound alignment. The set should be connected to an antenna, turned on, allowed to warm up for about 5 to 10 minutes and then tuned for the best picture. A vacuum tube voltmeter should be connected to Pin 2-V4 and the meter set to the minus 30 volt scale. The bottom of the 4.5 MC Sound IF Transformer (L2) and the primary of the Ratio Detector (L4 — bottom of the chassis) should be tuned for maximum deflection of the meter. The vacuum tube voltmeter should then be connected to the junction of R7 and C6 and one side of the volume control and the secondary of the Ratio Detector (L3 — top adjustment) should be adjusted for a zero reading with the meter set to the 3 volt scale. The secondary can also be adjusted by ear tuning L3 for the elimination of buzz in the sound.

TUNER ALIGNMENT FOR MODELS USING TUNER PART CL-2755-2

Note: Before making a complete tuner adjustment it is essential that all the IF, Trap, Sound and Discriminator circuits be aligned to their proper frequencies as described above. WHEN CHANGING THE CONVERTER TUBE IT IS NECESSARY TO REALIGN THE OSCILLATOR ADJUSTMENT ON ALL CHANNELS WITH THE V2 TUBE SHIELD IN PLACE.

A. RF and Converter Alignment

(1) Set Channel Selector switch to #12.

(2) Connect oscilloscope through 10,000 ohms to test point on tuner (bare tinned copper loop wire located between V1 and V2).

(3) Set fine tuning control at approximately midpoint of its tuning range. Temporarily connect jumper wire from Test Point "D" to chassis.

(4) Feed sweep generator into antenna terminals, sweeping channel 12.

(5) Adjust C301, C302 and C304 for flat top response curve. Check picture and sound carrier markers corresponding to frequencies shown in Service Data Section.

(6) Remove jumper from Test Point "D" to chassis.

B. Oscillator Alignment

Note: Oscillator adjustments (which are accessible through the hole in the front of the tuner) are provided for each channel. See "Tube and Trimmer Layout". Any oscillator coil slug can be adjusted without interaction on any other channel since individual coils are used for each of the 12 channels. This adjustment may be made on the station or with sweep generator and signal generator as follows:

(1) Set fine tuning control to midpoint of range. Do not touch during alignment.

(2) Connect sweep generator and marker (signal) generator to antenna terminals.

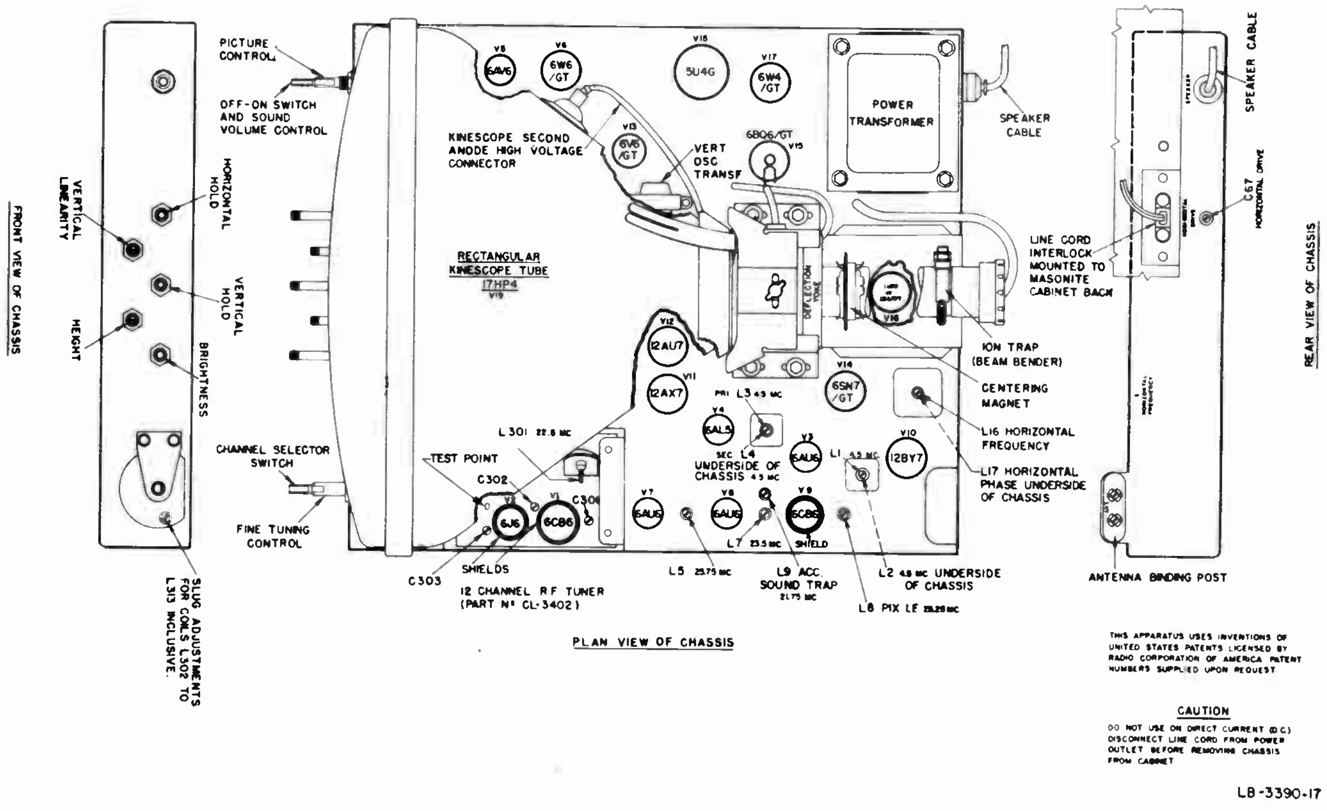
(3) Connect vertical input lead of scope with 50K resistor in series to test point A.

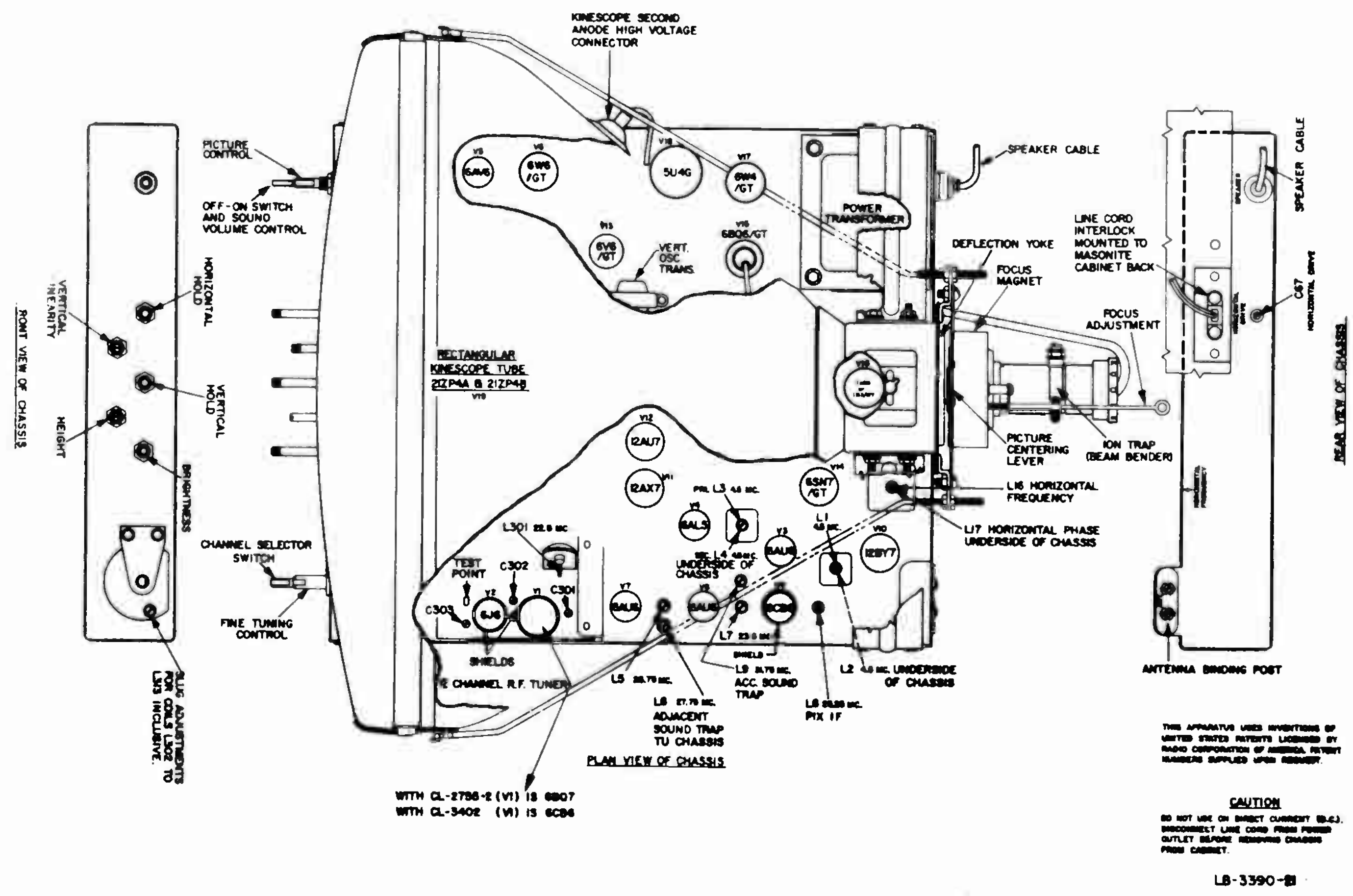
(4) Refer to following table for frequencies and adjustments.

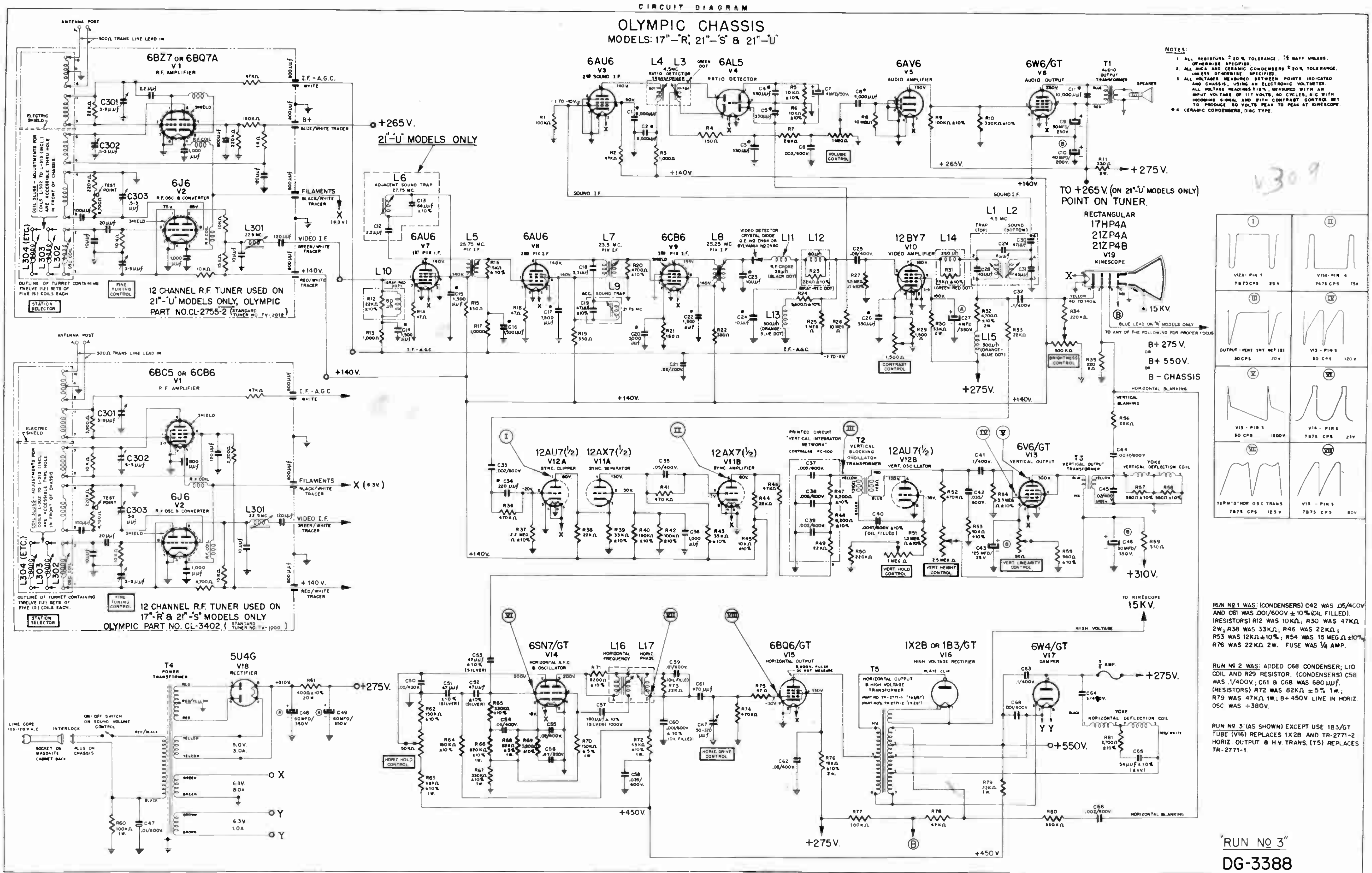
Couple marker and Sweep Generator as in Section "B", Step 2

Connect Scope Through 10K Isolating Resistor to Test Point "A" and Low Side to Chassis

Step	SIGNAL GENERATOR INPUT Sweep Gen.	Marker Gen.	Channel	Adjust	Procedure
1	207.0 MC.	209.75 MC.	12	L-312	Adjust for placement of 21.25 MC. marker as per response curve Fig. 4.
2	207.0 MC.	209.75 MC.	12	C-301 C-302 C-304	Adjust shape of response curve Fig. 4 for maximum amplitude and bandwidth.
3	213.0 MC.	215.75 MC.	13	L-313	Adjust as in Step 1.
4	201.0 MC.	203.75 MC.	11	L-311	Adjust as in Step 1.
5	195.0 MC.	197.75 MC.	10	L-310	Adjust as in Step 1.
6	189.0 MC.	191.75 MC.	9	L-309	Adjust as in Step 1.
7	183.0 MC.	185.75 MC.	8	L-308	Adjust as in Step 1.
8	177.0 MC.	179.75 MC.	7	L-307	Adjust as in Step 1.
9	85.0 MC.	87.75 MC.	6	L-306	Adjust as in Step 1.
10	79.0 MC.	81.75 MC.	5	L-305	Adjust as in Step 1.
11	69.0 MC.	71.75 MC.	4	L-304	Adjust as in Step 1.
12	63.0 MC.	65.75 MC.	3	L-303	Adjust as in Step 1.
13	57.0 MC.	59.75 MC.	2	L-302	Adjust as in Step 1.







OLYMPIC TV PAGE 14-5

CHASSIS R, S, U

PART LIST

COILS AND TRANSFORMERS

SCHEMATIC NO.	DESCRIPTION	PART NO.
L-1, L-2	Sound Trap-4.5 mc	TR3386
L-3, L-4	Transformer-Ratio Detector	TR2630
L-5, L-7, L-8	Transformer-Pix-IF-Bifilar	CL2309
L-6	Adjacent Sound Trap-"U" only	CL2973
L-9	Accompanying Sound Trap	CL2972
L-10, L-12	Peaking Coil-80uh-10%-Grey & Red Dot	CL3401
L-11	Peaking Coil-36uh-Black Dot	CL1535
L-13, L-15	Peaking Coil-300uh-10%-Orange & Blue Dot	CL3403
L-14	Peaking Coil-250uh-10%-Green & Red Dot	CL3398
L-16, L-17	Transformer-Horiz. Oscillator	TR2990
T-1	Transformer-Audio Output-3/8 x 3/8	TR2766-1
T-2	Transformer-Vert. Oscillator	TR1473
T-3	Transformer-Vert. Output	TR3385
T-4	Transformer-Power	TR2770
T-5	Transformer-Flyback (Used with 1B3)	TR2771-1
T-5	Transformer-Flyback (Used with 1X2)	TR2771-2
	Deflection Yoke	CL2753
	Tuner-Cascode-"U" only	CL2755-2
	Tuner-Pentode-"R", "S" only	CL3402

CONDENSERS

SCHEMATIC NO.	DESCRIPTION	PART NO.
C-1, C-2, C-8, C-20	Condenser-5,000 mmf-Disc Ceramic	CCD 502X
C-3, C-4, C-5, C-26	Condenser-Disc-330 mmf-20%-1,000v	CCD 331M
C-6, C-33, C-66	Condenser-Paper-.002/600v	CO-H-6202
C-7	Condenser-Electrolytic-4 mfd-50v	CO2756
C-9	Condenser-Electrolytic-50 mfd-250v	CO2068
C-10, C-43, C-46	Condenser-Electrolytic-30/350v x 40/200v x 125/25V	CO3381
C-11	Condenser-10,000 mmf-Disc Ceramic	CCD-103X
C-12	Condenser-2.2 mmf-"U" only	CO1112
C-14, C-15, C-16, C-17, C-22	Condenser-Ceramic-Dual-1,500 mmf	CC2D-152X
C-18	Condenser-Moulded-3.3 mmf	CO3468
C-19, C-30, C-51, C-52, C-53	Condenser-Mica-47 mmf-10%	RCM-20C-470K
C-21	Condenser-Paper-.22/200v	CO-H-2224
C-23, C-24	Condenser-Disc-10 mmf-20%-NPO	CCD-C100M
C-25, C-35, C-50, C-54, C-62	Condenser-Paper-.047/400v	CO-H-4473
C-27, C-48, C-49	Condenser-Electrolytic-60/350v x 60/350v x 4/350v	CO3380
C-32, C-41, C-58, C-63, C-64	Condenser-Paper-.1/400v	CO-H-4104
C-34	Condenser-Disc-220 mmf-20%-1,000v	CCD-221M
C-36	Condenser-1,000 mmf-Disc Ceramic	CCD-102K
C-37, C-38, C-39	Vertical Int. Network	PC2435
C-40	Condenser-Paper-.0047/600v-Oil	CO-O-6472K
C-42	Condenser-Paper-.035/400v	CO-O-4353K
C-44	Condenser-Paper-.0047/600v	CO-H-6472
C-45, C-55	Condenser-Paper-.02/400v	CO-H-4203
C-47, C-59	Condenser-Moulded-.01/600v-Oil	CO-B-6103
C-56	Condenser-Paper-.47/200v	CO-H-2474
C-57	Condenser-Mica-180 mmf-10%-1,000v Silver	SCM-40C-181K
C-60	Condenser-Paper-.001/600v-Oil	CO-O-6102K
C-61	Condenser-Mica-680 mmf	RCM-30A-681M
C-65	Condenser-Ceramic-56 mmf-10%-2KV(N750)	CCD-560K
C-67	Condenser-Trimmer-50-370-mmf	CT2757

CONTROLS

DESCRIPTION	PART NO.
Control-Horiz. Hold-50,000 Ohms	PT2268-1
Control-Vert. Hold-1 meg	PT2269-1
Control-Brightness-1/2 meg	PT2270-1
Control-Vert. Linearity-5,000 ohms	PT2271-1
Control-Height-2.5 meg	PT2272-1
Control-Dual-Contrast (1,000 ohms) & Volume (1 meg)	PT2774-1

RESISTORS

SCHEMATIC NO.	DESCRIPTION	PART NO.
R-1, R-77	Resistor-100K-20%-1/2w	REB104M
R-2, R-46, R-78	Resistor-47K-20%-1/2w	REB473M
R-3, R-13, R-17	Resistor-1,000 ohms-20%-1/2w	REB102M
R-4, R-21	Resistor-150 ohms-20%-1/2w	REB151M
R-5, R-6, R-45, R-53	Resistor-10K-10%-1/2w	REB103K
R-7, R-33, R-38, R-44, R-49, R-56, R-73	Resistor-22K-20%-1/2w	REB223M
R-8, R-26	Resistor-10 meg-20%-1/2w	REB106M
R-9, R-42	Resistor-100K-10%-1/2w	REB104K
R-10, R-65	Resistor-330K-10%-1/2w	REB334K-A
R-11	Resistor-330 ohm-20%-2w	RED331M
R-14, R-18, R-75	Resistor-47 ohm-20%-1/2w	REB470M
R-15, R-19, R-22, R-59	Resistor-330 ohms-20%-1/2w	REB331M
R-16	Resistor-15K-10%-1/2w	REB153K
R-20	Resistor-4,700 ohms-10%-1/2w	REB472K
R-24	Resistor-5,600 ohms-10%-1/2w	REB562K
R-25	Resistor-1 meg-20%-1/2w	REB105M
R-27, R-51	Resistor-1.5 meg-10%-1/2w	REB155K
R-28, R-36, R-41, R-52, R-74	Resistor-470K-20%-1/2w	REB474M
R-29	Resistor-1,500 ohm-20%-1/2w	REB152M
R-30	Resistor-33K ohm-20%-2w	RED333M
R-32	Resistor-4,700 ohms-10%-2w	RED472K
R-34, R-35, R-50	Resistor-220K-20%-1/2w	REB224M
R-37	Resistor-2.2 meg-10%-1/2w	REB255K
R-39, R-43	Resistor-33K-10%-1/2w	REB333K
R-40, R-64	Resistor-180K-10%-1/2w	REB184K-A
R-47, R-48, R-71	Resistor-8,200 ohm-10%-1/2w	REB822K
R-54	Resistor-3.3 meg-10%-1/2w	REB335K
R-55, R-57, R-58	Resistor-560 ohm-10%-1/2w	REB561K
R-60	Resistor-100K-20%-1w	REC104M
R-61	Resistor-400 ohm-10%-20w	RE3469
R-62	Resistor-150K-10%-1/2w	REB154K-A
R-63	Resistor-68K-10%-1w	REC683K-A
R-66	Resistor-820K-10%-1w	REC824K-A
R-67	Resistor-330K-5%-1w	REC334J-A
R-68, R-72	Resistor-82K-5%-1w	REC823J-A
R-69	Resistor-3,900 ohm-10%-1/2w	REB392K
R-70	Resistor-150K-5%-1w	REC154J-A
R-76	Resistor-18K-10%-2w	RED183K
R-79	Resistor-47K-20%-1w	REC473M
R-80	Resistor-330K-20%-1/2w	REB334M
R-81	Resistor-2,700 ohm-10%-1/2w	REB272K

MISCELLANEOUS

DESCRIPTION	PART NO.
Ant. Binding Post	BP1700
Fuse-1/4 Amp.	FU1683
Crystal Diode	IN64 or IN60
Line Cord	LC1523
Loop Antenna	LP2353
Moulded Rubber Pad-"R" only	MP2780
Rubber Channel-"S"-"U" only	MP2956
Rubber Channel-"R" only	MP2982
Rubber Channel-"S"-"U" only	MP2982-21
Insulating Cup	MP3400
Speaker Plug-2 Prong	PL637
Interlock-Pin Plug	PL1524
Ion Trap (Single) 45 Gauss (Red Dot) "S"-"U" only	PP2248
Ion Trap (Single) 35 Gauss (Green Dot) "R" only	PP2623
Centering Magnet-"R" only	PP2763
Hi-Voltage Lead-"R" only	PP2772
Hi-Voltage Lead-"S"-"U" only	PP2896
Focus Magnet-"S"-"U" only	PP3379
CRT Socket-"R" only	SO2621
CRT Socket-"S"-"U" only	SO3125-1

CABINETS & ACCESSORIES

DESCRIPTION	PART NO.
Cabinet for 21TS11	CA3246-1
Cabinet for 21TU14	CA3246-2
Cabinet for 21TS17	CA3246-3
Cabinet for 17TR10	CA3248-1
Cabinet for 17TR19	CA3248-2
Cabinet for 21CS12	CA3296-1
Cabinet for 21CU15	CA3296-2
Cabinet for 21CS18	CA3296-3
Cabinet for 21CU16	CA3326
Cabinet for 17CR20	CA3485
Cabinet for 21KS22	CA3519
Caster Wheels for 21CU16	HW2658
Knob, Mahogany-Channel Selector	KN2295-1
Knob, Mahogany-Fine Tuning	KN2296
Knob, Mahogany-Volume Control	KN2297-1
Knob, Mahogany-Contrast Control	KN2298
Knob, Tan-Channel Selector	KN2545
Knob, Tan-Tuning Fine	KN2546
Knob, Tan-Volume Control	KN2547
Knob, Tan-Contrast Control	KN2548
Moulded Cup-17" Sets	MP2666
Moulded Cup-21" Sets	MP3391
Moulded T.V. Door	MP2775
Moulded T.V. Escutcheon	MP2776-1
Extruded Channel-17TR10, 17TR19	MP2991-17
Safety Glass-17TR10, 17TR19	PP2937
Safety Glass-21KS22	PP2938
Safety Glass-"S" & "U" Sets	PP3393
Safety Glass-17CR20	PP3487
Mask-17TR10-17TR19	PP2939
Mask-all "S" sets except 21KS22	PP2940
Mask-all "U" sets	PP2940-2
Mask-21KS22	PP2940-3X
Mask-17CR20	PP3488
Decorative Control Panel-21CU16	PP3329
Decorative Control Panel-17TR19	PP3480
Speaker-5" PM-all except 21CU15 & 21CU16	SK1788-2
Speaker-10" PM-21CU16-21KS22	SK1789-1
Speaker-8" PM-21CU15	SK1906-2
Spring for KN2296, KN2546	SP1512
Spring for KN2297-1, KN2547	SP1513
Spring for KN2295-1, KN2298, KN2545, KN2548	SP1534

Fig. 1. Model 2041/2141

Fig. 2. Model 2042/2142

Fig. 3. Model 2043/2143

Fig. 4. Model 2044/2144

DESCRIPTION OF MODELS:

The Packard-Bell television receivers described in this manual incorporate either chassis type 1840 or 2040. The circuits are much the same, the main difference being that the 1840 uses two crystals in place of the 6AL5 ratio detector and also eliminates one of the low voltage rectifier tubes. For minor differences, see notes under schematics, Figs 15 and 16. The receiver may be equipped with either VHF or VHF/UHF (all-channel) tuning. The following table indicates the different features of the various models.

	VHF Tuner (10534B)	VHF/UHF Tuner (10535C)	Chassis Type	Picture Tube Size	Description	Illustrated in
Model	1841	1941	1840	21 in.	Table Model	Similar to Fig. 1
Model	1842	1942	1840	21 in.	Standard Console	Similar to Fig. 2
Model	2041	2141	2040	21 in.	Table Model	Fig. 1
Model	2042	2142	2040	21 in.	Standard Console	Fig. 2
Model	2043	2143	2040	21 in.	De Luxe Console	Fig. 3
Model	2044	2144	2040	17 in.	Table Model	Fig. 4

CABINET DIMENSIONS, OVERALL (not including tube shield):

	1841/1941	1842/1942	2041/2141	2042/2142	2043/2143	2044/2144
Height	23 in.	37 in.	22½ in.	34 in.	34 in.	19½ in.
Width	24 in.	24 in.	23 in.	24 in.	24½ in.	20½ in.
Depth	22 in.	22 in.	22 in.	23 in.	23½ in.	20 in.
Shipping Wt.	105 lb.	140 lb.	105 lb.	140 lb.	150 lb.	80 lb.

SPECIFICATIONS:

CHASSIS DIMENSIONS:

Chassis 1840 and 2040 are the same size and are designed for horizontal mounting in the cabinet. Dimensions are 17¾ in. square by 4 in. high.

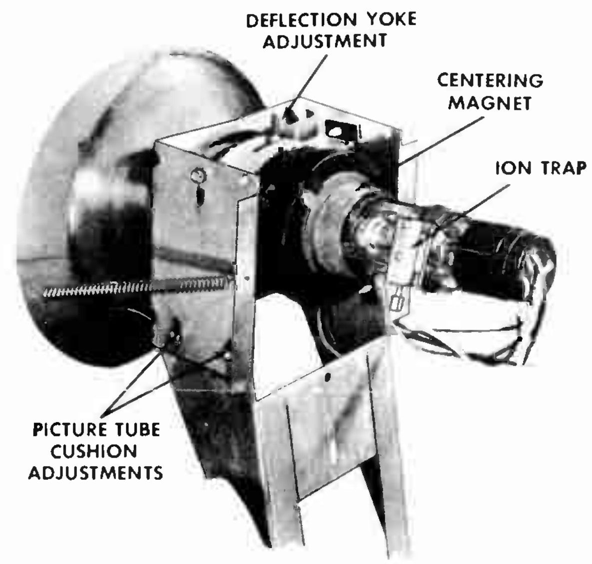


Fig. 5. Picture Tube Yoke Assembly

TELEVISION TUNING FREQUENCY RANGE:

Models using the VHF tuner receive all twelve VHF channels, 2 through 13, and coil strips are available for UHF channels 14 through 83.

All TV channels, 2 through 83, may be received on models using the VHF/UHF tuner. This tuner is available through Packard-Bell service departments for field installation in VHF models if desired.

INTERMEDIATE FREQUENCIES:

Picture Carrier: 45.75 Mc.
Sound Carrier: 41.25 Mc.
Intercarrier Sound: 4.5 Mc.

ELECTRICAL RATINGS:

Line voltage: 110-120 volts, 60 cycles.
Power consumption:
Models 1841/1941 & 1842/1942: 160 watts.
Models 2041/2141, 2042/2142, 2043/2143, and 2044/2144: 210 watts.

SPEAKER DATA:

Type: Permanent magnet dynamic.
Voice coil impedance: 3.2 ohms at 400 cycles.
Cone diameter (all models): 6 inches.

FOCUS:

Electrostatic.

SWEEP DEFLECTION:

Electromagnetic, 70 degree.

TUBE COMPLEMENT, 2040 CHASSIS:

Reference Symbol	Tube	Function
V-1	6AU6	Sound I-F
V-2	6AL5	Ratio Detector
V-3	6AV6	1st Audio & A.G.C.
V-4	6K6	Audio Output
V-5	6CB6	1st Pix I-F
V-6	6CB6	2nd Pix I-F
V-7	6CB6	3rd Pix I-F
V-8	12AU7	Video Amplifier and Output
V-9	12AU7	Sync Separator and Inverter
V-10	6AL5	A.F.C. and Discriminator
V-11	6SN7	Horizontal Oscillator
V-12	6BQ6	Horizontal Output
V-13	1B3	H. V. Rectifier
V-14	12BH7	Vertical Oscillator and Vertical Output
V-15	6AX4	Damper
V-16	5Y3	L. V. Rectifier
V-17	5U4	L. V. Rectifier
V-18	21YP4	Picture Tube

Picture tube is 17HP4 or 17RP4 on 2044/2144 chassis.

See section on "Radio Frequency Tuner," for remaining tubes.

TUBE COMPLEMENT, 1840 CHASSIS:

The tube complement on the 1840 chassis is identical to that on the 2040 chassis except that V-2 and V-16 are deleted.

PICTURE TUBE ADJUSTMENTS:

The following picture tube adjustments are to be made upon installation or whenever the receiver is serviced. (See Fig. 5, Picture Tube Yoke Assembly.)

1. DEFLECTION YOKE. Loosen deflection yoke adjustment screw and rotate yoke so that raster is square with picture tube frame. Make certain yoke is positioned firmly against cone of tube.
2. ION TRAP. Turn contrast control to minimum. Set brightness control at approximately 90% clockwise. Position ion trap over second opening from tube base, then rotate trap, at the same time turning adjusting screw, to obtain maximum brightness with sharpest focus.
   Reset brightness control to just light tube. Turn contrast control clockwise to 90% of maximum and readjust ion trap for peak brightness and focus.
3. CENTERING. The centering magnet is a dual ring magnet. The centering of the picture is dependent upon the relation of the rings to each other and the relation of both to the tube. To adjust, position the magnet almost against the deflection yoke, then rotate the two sections in relation to each other, and as a whole, until proper centering is obtained. This adjustment is quite stable and will need little attention unless its position is disturbed.

NOTE: If centering magnet is adjusted, repeat adjustment 2 above.

REMOVING PICTURE TUBE:

CAUTION

WEAR GOGGLES OR A MASK AND USE GLOVES WHEN HANDLING TUBE. DO NOT STRIKE OR SCRATCH THE TUBE OR SUBJECT IT TO MORE THAN MODERATE PRESSURE.

The uncoated bulb surface of the picture tube should be kept clean and free from dust or fingerprints. This is to prevent electrical leakage from the high voltage connection.

It is not necessary to remove the picture tube to clean the tube face. Simply remove the three screws in the rail above the tube and remove the safety glass. Clean glass and face of tube with window cleaning fluid on a soft cloth.

The chassis must be removed from the cabinet in order to remove the picture tube. The procedure is as follows:

1. Disconnect power plug and antenna.
2. Remove back and pull out speaker plug.
3. Remove control knobs on front panel.
4. Remove four bolts located under the shelf that the chassis rests on.
5. Take chassis out of cabinet.
6. Remove picture tube socket.
7. Remove ion trap and centering magnet.
8. Disconnect high voltage lead from picture tube.
9. Remove spring harness and unfasten band over top of picture tube.
10. Pull tube forward and out of yoke.

NON-OPERATING CONTROLS:

GENERAL:

The non-operating controls are located in two places. Five of them are under the nameplate escutcheon on the front of the set. They are:

Focus
Height
Vertical Hold
Vertical Linearity
Brightness

To reach these controls open the spring door on the escutcheon.

There are two non-operating controls at the rear of the chassis. They are:

Width
Horizontal Hold

Also at the rear of the chassis there is a "Local/Dist." switch.

All controls are marked. Read the following instructions before making any adjustments.

ADJUSTMENT OF NON-OPERATING CONTROLS:

The following adjustments should be made while observing a station test pattern. Allow receiver to warm up for ten minutes.

The BRIGHTNESS control should be adjusted in conjunction with the CONTRAST control so that each step (usually five) from black to white in the shading blocks is separate and distinct.

The FOCUS control should be adjusted so that the separate lines in the vertical resolution wedge are distinct as far as possible in to the narrow end of the vertical wedge.

Adjust HEIGHT and WIDTH controls in conjunction with VERTICAL LINEARITY control so that the large circles in the test pattern are as round as possible, and so that the test pattern is slightly larger than the mask opening.

The VERTICAL HOLD is adjusted so that the picture does not move up or down.

The HORIZONTAL HOLD control is set about halfway between the points where the picture tears.

LOCAL/DISTANCE SWITCH:

For areas in which there is no difficulty in reception, operate the receiver with this switch on "LOCAL." For fringe area reception, turn the switch to "DIST." This cuts out the auxiliary AGC, increases plate limiting in 1st video, and gives maximum sensitivity.

ALIGNMENT PROCEDURE

GENERAL:

It is important that the service technician read and adhere to the alignment instructions in this section. This point cannot be stressed too strongly, especially in the case of the picture I-F alignment.

Many service technicians have been accustomed to aligning the picture I-F response curve on the oscilloscope alone. This procedure is not recommended because it is actually quite possible to get what appears to be an acceptable curve and still be lacking in horizontal resolution.

It will be noted that in the following procedure the sweep generator is fed in through the antenna terminals. This being the case, the output impedance of the generator must be matched to the 300 ohm input impedance of the set. A matching network to accomplish this is shown in Fig. 6. The values in the illustration are for a generator of 75 ohms output impedance. If the sweep generator has a 50 ohm impedance use 56 ohms for the shunt resistor and 130 ohms for each of the series resistors.

In step 2 of the procedure below it is directed that the generator be loosely coupled to the converter tube. This is done by disconnecting the tube shield from the ground and connecting the generator between the shield and the ground.

Test point locations are shown on the schematic diagrams, Figs. 13, 15 and 16, and on the chassis illustrations, Figs 8, 9, and 12.

Allow set to warm up for ten minutes before alignment.

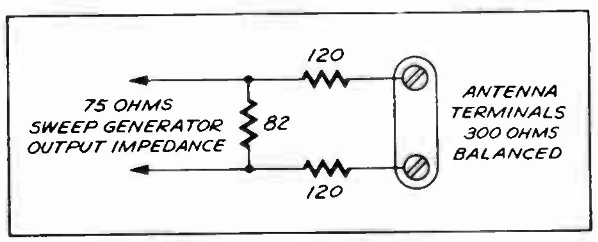


Fig. 6. Matching Network

PICTURE I-F ALIGNMENT:

1. Connect a vacuum tube voltmeter between point "A" and ground.
2. Loosely couple signal generator to mixer tube (6J6) in tuner*, keeping leads short. (See general instructions above.) Set output at maximum.

Step	Sig. Gen. Frequency	Adjust	For
3.	45.50 Mc.	S-15 (Mixer I-F in tuner)	MAXIMUM
4.	45.50 Mc.	S-6	MAXIMUM
5.	41.80 Mc.	S-5	MAXIMUM
6.	43.30 Mc.	S-8	MAXIMUM
7.	44.50 Mc.	S-10	MAXIMUM
8.	39.75 Mc.	S-4 and S-9	Minimum

S-9 later deleted; see production modification 14.

Step	Sig. Gen. Frequency	Adjust	For
9.	47.25 Mc.	S-3 and S-7	Minimum

REPEAT STEPS 3 THROUGH 9

10. Connect oscilloscope to point "B," using a 22,000 ohm isolating resistor in series with the scope probe. Connect an electrolytic capacitor, 5 mfd, 50 volts, between point "A" and ground, the negative lead going to point "A."
11. Connect sweep generator to antenna terminals through an impedance matching network. (See general instructions above.)
12. Rotate tuner to channel 3, and set sweep generator to center frequency of channel, (63 Mc.). With a sweep width of 10 Mc., adjust generator output to develop approximately 2 volts of AGC.
13. With signal generator loosely coupled to converter tube, adjust output to provide the markers shown on the response curve, Fig. 7. Check the position of the markers one at a time.

*In 82-channel tuner, mixer tube is a 6U8.

14. Observe the wave form obtained on the oscilloscope and compare it with the waveform shown in Fig. 7. If the spot frequency alignment has been carefully done, the comparison will be favorable. However, slight retouching of the I-F adjustments may be required. It should not be necessary to change any adjustment appreciably. The markers should be located as follows:

The 47.25 Mc. and the 39.75 Mc. at minimum response. (These markers will be at too low a level to show on scope.)

The 45.75 Mc. marker at 50% response.

The 43.30 Mc. marker at 95% response.

The 45.00 Mc. marker at 97% response.

The 41.25 Mc. marker at a maximum of 12% response.

IMPORTANT: The 45.00 Mc. marker must not exceed 97% response on channel 3 or picture may smear on higher channels.

ALIGNMENT OF 4.5 Mc. TRAP:

1. Connect signal generator between point "B" and ground through a .001 mfd isolating capacitor.
2. Turn contrast control to maximum.
3. Connect a R-F vacuum tube voltmeter to point "C." If an R-F VTVM is not available, connect a germanium diode crystal in series with the positive probe of a conventional VTVM.
4. Set signal generator to 4.50 Mc., exactly, with the output at one volt or more.
5. Adjust trap, S-11, for minimum VTVM reading.

NOTE: If signal generator is not capable of one volt output, it will be necessary to adjust the trap by visual means. To do this, observe the picture and adjust the trap to eliminate the 4.5 Mc. beat.

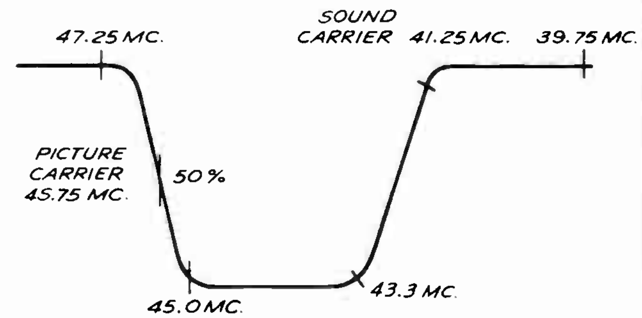


Fig. 7. I-F Response Curve

SOUND I-F AND RATIO DETECTOR ALIGNMENT:

1. Connect signal generator between point "B" and ground through a .001 mfd isolating capacitor.
2. Connect VTVM between point "D" and ground.
3. With generator frequency at 4.50 Mc., adjust S-12 and S-1 for MAXIMUM output.
4. Connect VTVM between points "E" and "F."
5. Adjust Ratio Detector secondary, S-2, for zero between positive and negative peaks.

RADIO FREQUENCY TUNER:

The VHF tuner number 10534B contains two tubes, the R-F amplifier, a 6BZ7 or 6BQ7A, and an oscillator and mixer tube, a 6J6. The 6BZ7 is interchangeable with the 6BQ7A.

Oscillator coil tuning slugs are reached through hole in front of tuner chassis, see Fig. 12. Tuner adjustment other than tuning slug and I-F adjustment (S-15) is not recommended.

UHF OPERATION:

UHF coil strips for the VHF tuner are available at Packard-Bell Factory Service Departments. No tuner adjustment is needed after strip installation except normal slug adjustment.

NOTE: TUBE LOCATIONS, TEST POINTS, AND ADJUSTMENTS ON THE 2040 AND 1840 CHASSIS ARE IDENTICAL EXCEPT THAT THE 1840 DOES NOT USE TUBES V-2 AND V-16.

LIST OF ADJUSTMENTS:

REFERENCE SYMBOL	DESCRIPTION
S-1	Ratio detector primary
S-2	Ratio detector secondary

PRODUCTION MODIFICATIONS, CHASSIS 2040:

The following modifications were made after production of the receivers had begun and are listed to point out variations in early sets from the schematics shown in this manual. The reason for the change is given in each case.

1. Capacitor C-35, now .1 mfd, was .01 mfd. (To improve horizontal linearity.)
2. Resistor R-32, 1200 ohms, is now 12 watts instead of 10 watts. (To prevent overheating of resistor.)

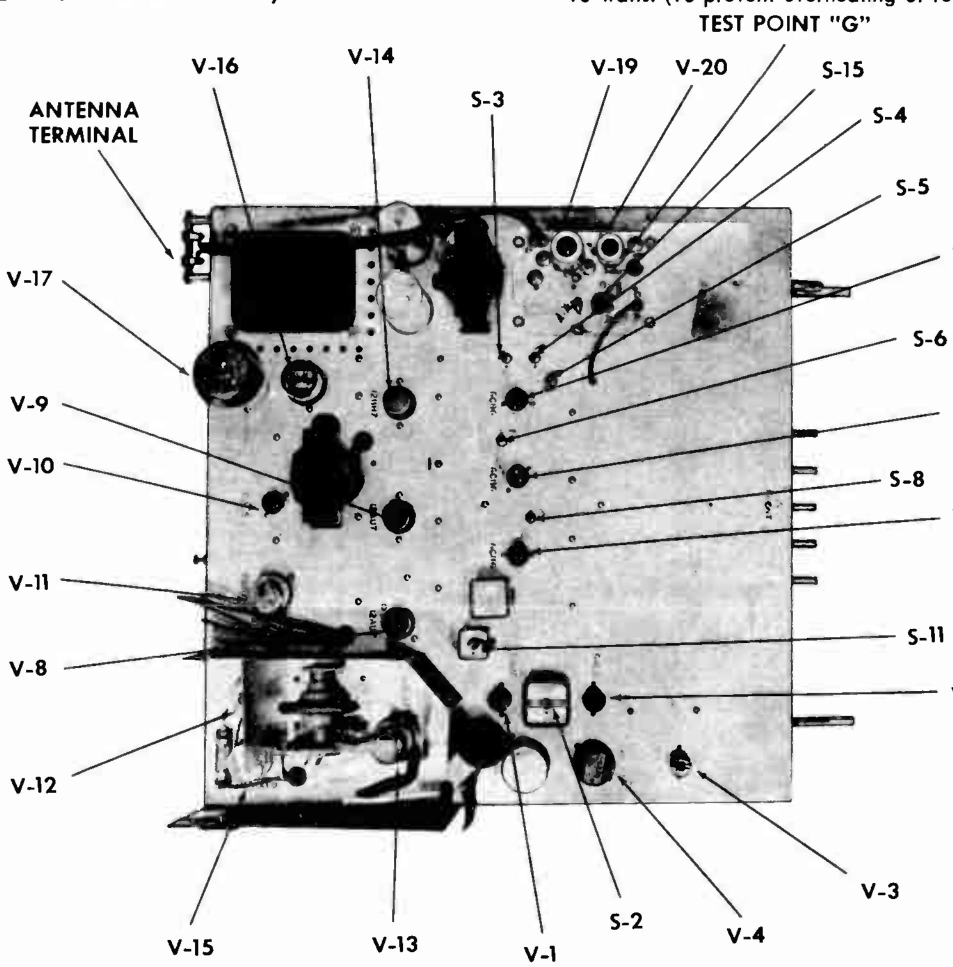


Fig. 8. Chassis 2040, Top View

S-3	Trap, 47.25 Mc.
S-4	Trap, 39.75 Mc.
S-5	1st picture I-F, 41.8 Mc.
S-6	2nd picture I-F, 45.5 Mc.
S-7	Trap, 47.25 Mc.
S-8	3rd picture I-F, 43.3 Mc.
S-9	Trap, 39.75 Mc.
S-10	Detector assembly
S-11	Primary, sound I-F transformer
S-12	Secondary, sound I-F transformer
S-13	Horizontal hold
S-14	Width
S-15	I-F output
S-16	R-F plate trimmer
S-17	Mixer grid trimmer — On R-F tuner 10534
S-18	Antenna trimmer
S-19	Trap

3. Capacitor C-51 added to circuit. (To preclude misalignment of picture I-F due to part variations.)
4. Resistor R-76 added to circuit. This resistor had a value of 1000 ohms originally but now is 10,000 ohms, 2 watts. In the 1840 chassis it has a different value. (To stabilize variations due to part differences.)
5. Resistor R-12 was changed from 1 to 2 watts. (To prevent overheating of resistor.)
6. Capacitor C-33 was changed from 1500 mmf to .01 mfd. (To increase drive on horizintal output tube and increase width.)
7. Resistor R-54 was changed from 18,000 ohms to 15,000 ohms. (To increase drive on horizontal output tube and increase width.)
8. The two triode sections of V-14 were transposed so that terminals 1, 2, and 3 are those of the output triode. Socket was reversed. (To prevent breakdown of socket.)
9. Capacitor C-38, .001 mfd, was removed from the circuit. This originally was connected to secondary of T-3. (To stabilize vertical oscillator.)
10. Resistor R-9, 2.2 megohms, was removed from the circuit. This was connected to pin 6 of V-3. (To increase AGC voltage.)

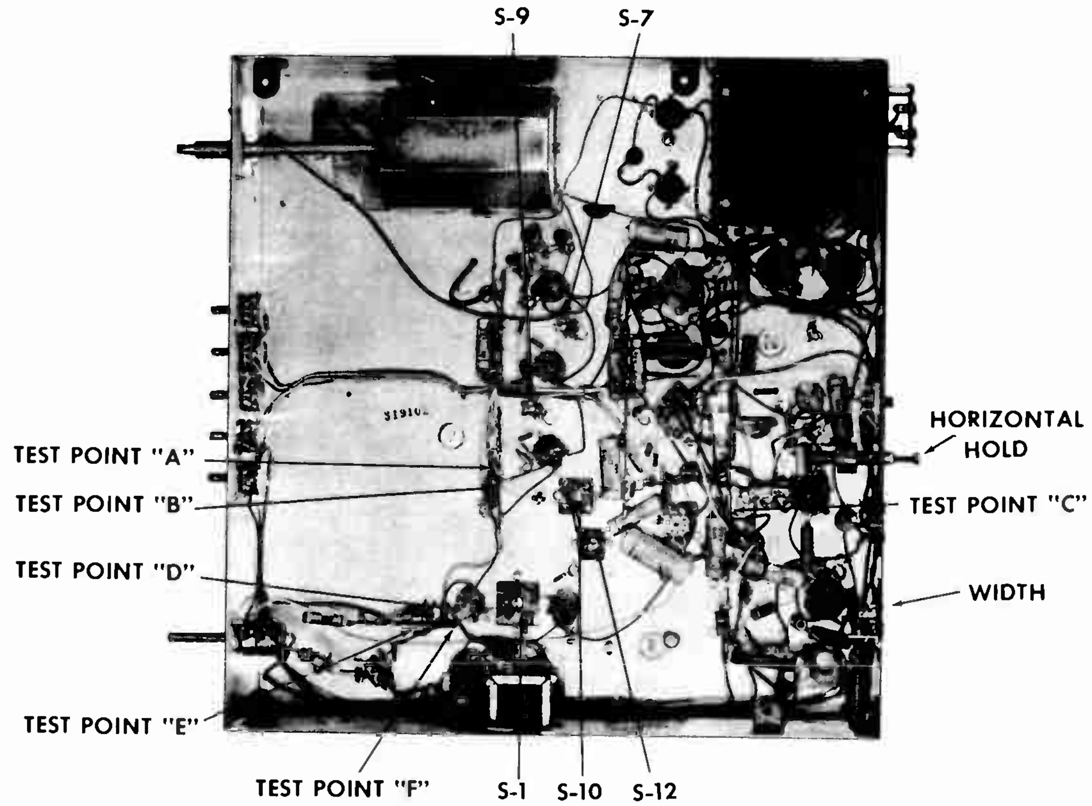


Fig. 9. Chassis 2040, Bottom View

11. Resistor R-77 added to circuit. (To help prevent overloading of 12AU7.)
12. Fuse changed from ¼ amp 250 volts to 3/16 amp 125 volts. (To prevent fuse blowing from possible arc in damper tube.)
13. Resistor R-79 added to circuit. (To prevent high voltage breakdown in areas with high altitude.)
14. Capacitor (no reference symbol) removed from trap L-6B. (S-9), and trap slug backed out. (To increase audio gain in fringe areas.)
15. Capacitor C-52, 56 mmf, 3500 volt (same as C-47) added in parallel with capacitor C-47. Compare production modification 2, in 1840 chassis. (To provide sufficient width at low line voltage.)

PRODUCTION MODIFICATIONS, CHASSIS 1840:

1. Resistor R-30, 100,000 ohms, was removed from the circuit. This was connected to the grid of the second video (pin 7, V-8). (To prevent overload due to variation in 12AU7 tubes.)
2. Capacitor C-47, normally 56 mmf, 3500 volts, was changed to 120 mmf, 2000 volts IF A THERMADOR POWER TRANSFORMER IS USED. If a TRIAD transformer is used, the value remains at 56 mmf, 3500 volts. Compare production modification 15, in 2040 chassis. (To provide sufficient width at low line voltage.)

SOCKET VOLTAGES:

The socket voltages shown were measured on a typical chassis under the following conditions.

1. No signal.
2. Line voltage, 117 volts.
3. Volume and contrast controls set at minimum, other controls at normal operating position.
4. DC voltage measured with a vacuum tube voltmeter.
5. AC voltages measured with a 1000 ohms-per-volt meter.

NOTE: Some voltages depend upon the setting of related controls. Thus the voltages on the vertical oscillator tube V-14 depend on the setting of the vertical hold control and the height control.

The figures below indicate the approximate magnitude of the reading to be expected, rather than the exact voltage.

Tube location is shown in Fig. 11, which is a BOTTOM VIEW of the chassis.

(VOLTAGES FOR CHASSIS 2040 AND CHASSIS 1840 LISTED IN SEPARATE COLUMNS.)

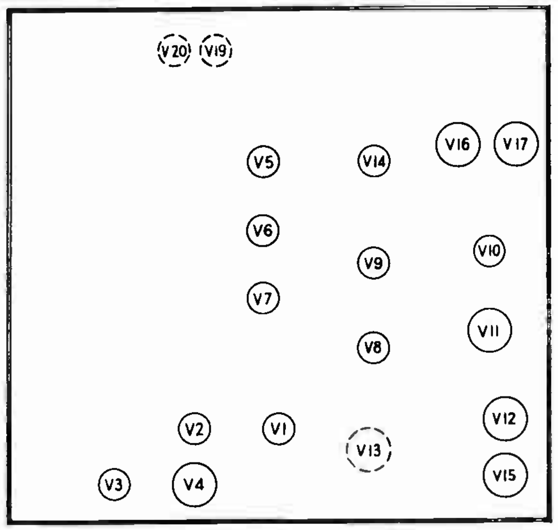


Fig. 11. Tube Location Chart, Chassis 2040, Bottom View

Omit V-2 and V-16 in chassis 1840.

V-1, 6AU6, Sound I-F

Pin	Element	Voltage 2040 chassis	1840
1	Grid 1	0	0
2	Grid 3	0	0
3	Heater	0	0
4	Heater	6.3 AC	6.3
5	Plate	98	95
6	Grid 2	98	95
7	Cathode	6	1

V-2, 6AL5, Ratio Detector

Pin	Element	Voltage 2040 chassis	1840
1	Cathode 1	0.5	
2	Plate 2	0	Tube
3	Heater	0	
4	Heater	6.3 AC	not
5	Cathode 2	0.2	
6	Shield	0	used
7	Plate 1	0.2	

V-3, 6AV6, 1st Audio

Pin	Element	Voltage 2040 chassis	1840
1	Grid	–0.7	–0.7
2	Cathode	0	0
3	Heater	0	0
4	Heater	6.3 AC	6.3
5	Diode plate, not used		
6	Diode plate	–0.9	–0.9
7	Plate	98	90

V-4, 6K6, Audio Output

Pin	Element	Voltage 2040 chassis	1840
1	No connection		
2	Heater	0	0
3	Plate	260	190
4	Grid 2	270	200
5	Grid 1	0	0
6	No connection		
7	Heater	6.3 AC	6.3
8	Cathode, grid 3	19	14

V-5, 6CB6, 1st Pix I-F

Pin	Element	Voltage 2040 chassis	1840
1	Grid 1	–0.4	–0.4
2	Cathode	1.3	1.3
3	Heater	0	0
4	Heater	6.3 AC	6.3
5	Plate	158	105
6	Grid 2	158	105
7	Grid 3	0	0

V-6, 6CB6, 2nd Pix I-F

Pin	Element	Voltage 2040 chassis	1840
1	Grid 1	–0.4	–0.4
2	Cathode	1.3	1.3
3	Heater	0	0
4	Heater	6.3 AC	6.3
5	Plate	167	110
6	Grid 2	167	110
7	Grid 3	0	0

V-7, 6CB6, 3rd Pix I-F

Pin	Element	Voltage 2040 chassis	1840
1	Grid 1	–0.35	–0.35
2	Cathode	1.6	1.6
3	Heater	0	0
4	Heater	6.3 AC	6.3
5	Plate	173	120
6	Grid 2	173	120
7	Grid 3	0	0

V-8, 12AU7, 1st & 2nd Video Amplifier

Pin	Element	Voltage 2040 chassis	1840
1	Plate 2	110	90
2	Grid 2	0	0
3	Cathode 2	1	0.7
4	Heater	6.3 AC	6.3
5	Heater	6.3 AC	6.3
6	Plate 1	230	180
7	Grid 1	0	0
8	Cathode 1	7.2	3
9	Heater Tap	0	0

V-9, 12AU7, Sync. Separator and Inverter

Pin	Element	Voltage 2040 chassis	1840
1	Plate 2	8	5
2	Grid 2	0	–0.6
3	Cathode 2	0	0
4	Heater	6.3 AC	6.3
5	Heater	6.3 AC	6.3
6	Plate 1	150	105
7	Grid 1	8	5
8	Cathode 1	14	8.5
9	Heater Tap	0	0

V-10, 6AL5, A.F.C., Discriminator

Pin	Element	Voltage 2040 chassis	1840
1	Cathode 1	0	0
2	Plate 2	0	0
3	Heater	0	0
4	Heater	6.3 AC	6.3
5	Cathode 2	3.8	3.2
6	Shield	0	0
7	Plate 1	–3.7	–3.6

V-11, 6SN7-GT, Horizontal Oscillator

Pin	Element	Voltage 2040 chassis	1840
1	Grid 2	0	0
2	Plate 2	229	175
3	Cathode 2	9	7
4	Grid 1	0	0
5	Plate 1	156	115
6	Cathode 1	9	7
7	Heater	6.3 AC	6.3
8	Heater	0	0

V-12, 6BQ6-GT, Horizontal Output

Pin	Element	Voltage 2040 chassis	1840
1	No connection		
2	Heater	6.3 AC	6.3
3	No connection		
4	Grid 2	167	135
5	Grid 1	–35	–31
6	No connection		
7	Heater	0	0
8	Cathode, grid 3	0	0
Cap	Plate	Do not measure	

V-13, 1B3-GT, H. V. Rectifier

High voltage, do not measure

V-14, 12BH7, Vertical Oscillator and Output

Pin	Element	Voltage 2040 chassis	1840
1	Plate 1	385	322
2	Grid 1	0	0
3	Cathode 1	19	15
4	Heater	6.3 AC	6.3
5	Heater	6.3 AC	6.3
6	Plate 2	75	65
7	Grid 2	–19	–20
8	Cathode 2	0	0
9	Heater Tap	0	0

V-15, 6AX4, Damper

Pin	Element	Voltage 2040 chassis	1840
1	No connection		
2	No connection		
3	Cathode	Do not measure	
4	No connection		
5	Plate	270	200
6	No connection		
7	Heater	6.3 AC	6.3
8	Heater	0	0

V-16, 5Y3-GT, L. V. Rectifier

Pin	Element	Voltage 2040 chassis	1840
1	No connection		
2	Filament	282	Tube
3	No connection		
4	Plate 1	280 AC	not
5	No connection		
6	Plate 2	280 AC	used
7	No connection		
8	Filament	282	

V-17, 5U4-G, L. V. Rectifier

Pin	Element	Voltage 2040 chassis	1840
1	No connection		
2	Filament	282	210
3	No connection		
4	Plate	280 AC	300
5	No connection		
6	Plate	280 AC	300
7	No connection		
8	Filament	282	210

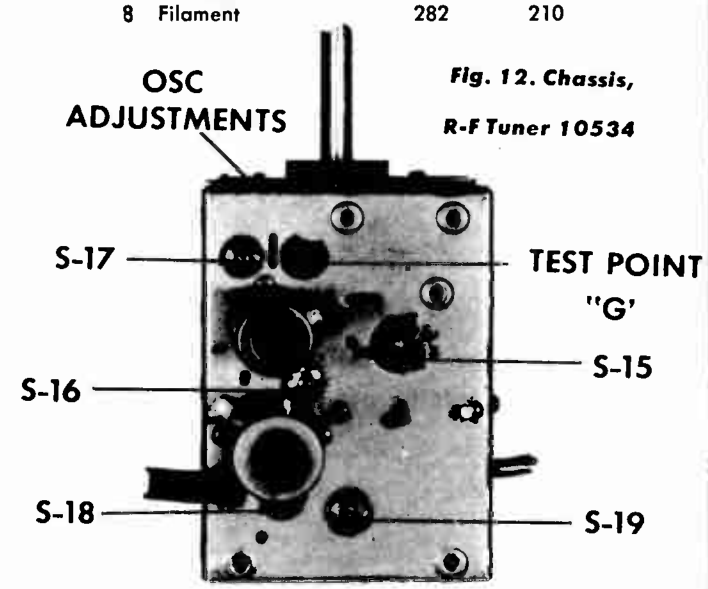


Fig. 12. Chassis, R-F Tuner 10534

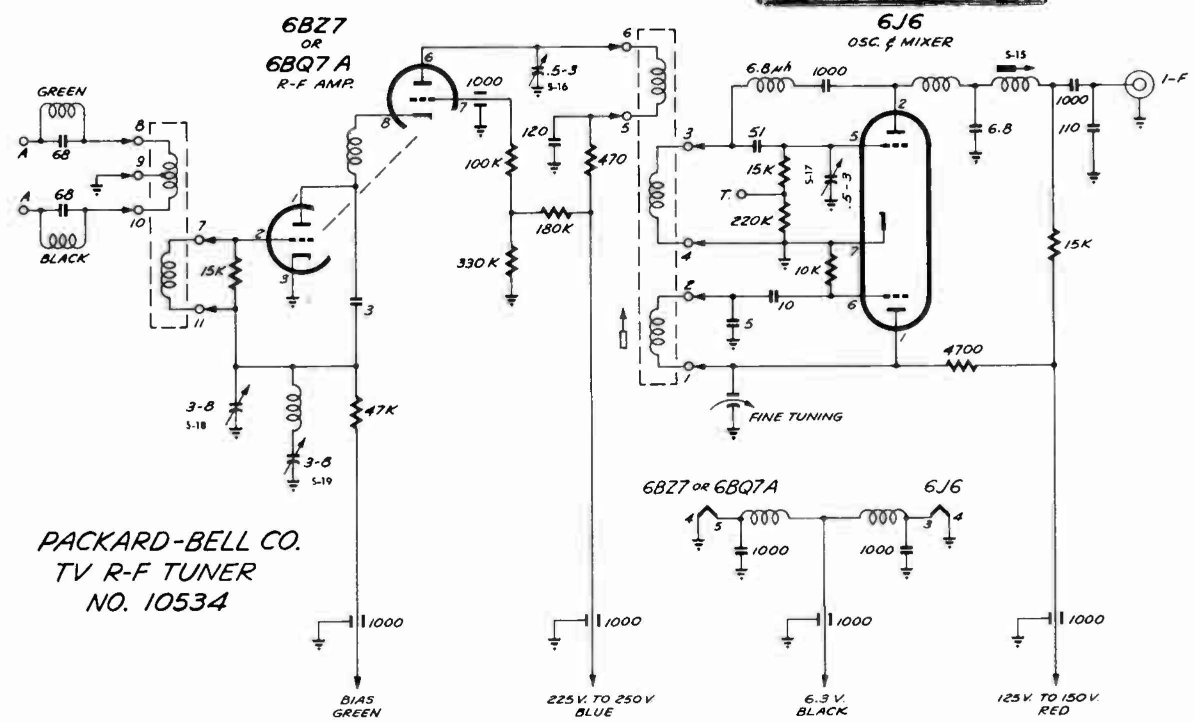
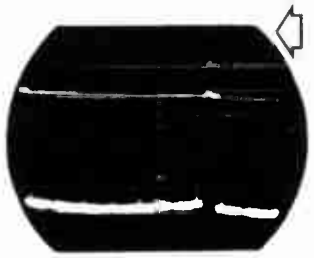
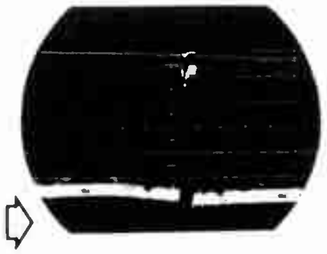


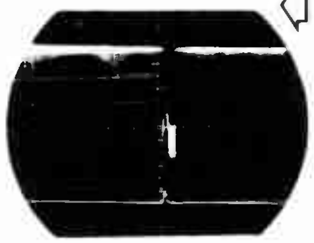
Fig. 13. Schematic Diagram, R-F Tuner 10534



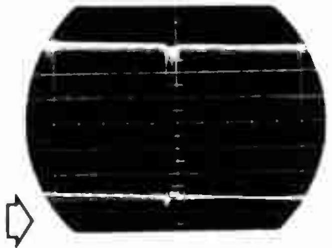
1. V-8, 12AU7, Video Amplifier, (Pin 1), Plate; 60 C.P.S., 13 V.P.P.



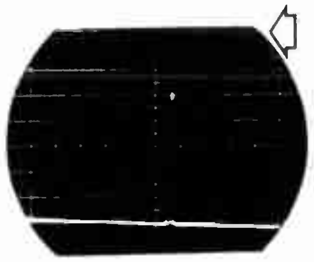
2. V-9, 12AU7, Sync Phase Inverter, (Pin 2), Grid; 60 C.P.S., 10 V.P.P.



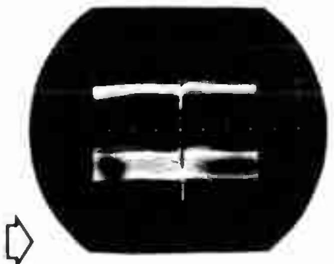
3. V-9, 12AU7, Sync Phase Inverter, (Pin 7), Grid; 60 C.P.S., 32 V.P.P.



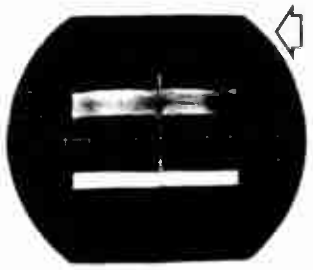
4. V-9, 12AU7, Sync Phase Inverter, (Pin 8), Cathode; 60 C.P.S., 24 V.P.P.



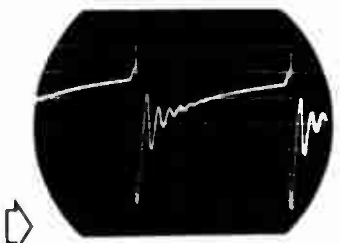
5. V-9, 12AU7, Sync Phase Inverter, (Pin 6), Plate; 60 C.P.S., 53 V.P.P.



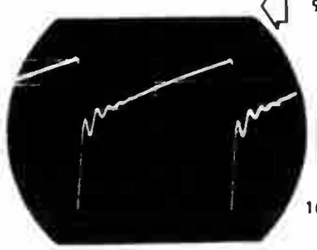
6. V-10, 6AL5, AFC Discriminator, (Pin 7), Plate; 60 C.P.S., 24 V.P.P.



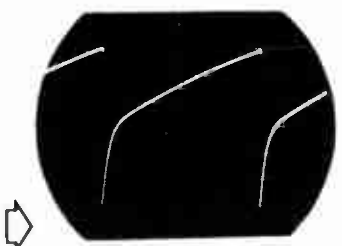
7. V-10, 6AL5, AFC Discriminator, (Pin 5), Cathode; 60 C.P.S., 28 V.P.P.



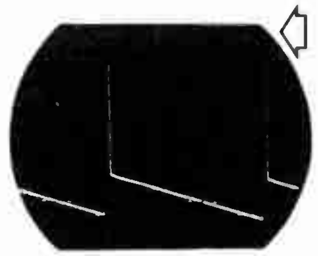
8. V-14, 12BH7, Vertical Oscillator, (Pin 2), Grid: 60 C.P.S., 85 V.P.P.



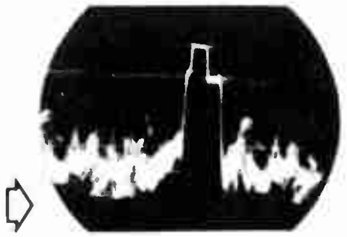
9. V-14, 12BH7, Vertical Oscillator, (Pin 1), Plate: 60 C.P.S., 75 V.P.P.



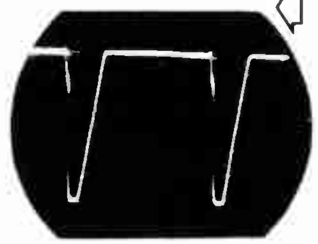
10. V-14, 12BH7, Vertical Oscillator, (Pin 7), Grid: 60 C.P.S., 60 V.P.P.



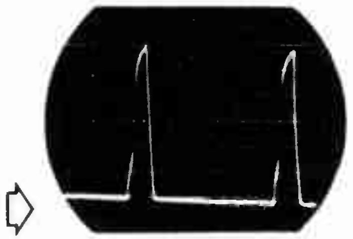
11. V-14, 12BH7, Vertical Oscillator, (Pin 6), Plate; 60 C.P.S., 1200 V.P.P.



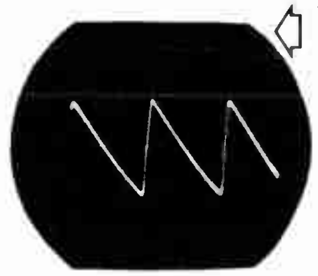
12. V-9, 12AU7, Sync Phase Inverter, (Pin 2), Grid; 15,750 C.P.S., 13 V.P.P.



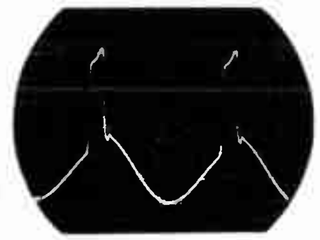
13. V-9, 12AU7, Sync Phase Inverter, (Pin 7), Grid; 15,750 C.P.S., 32 V.P.P.



14. V-9, 12AU7 Sync Phase Inverter, (Pin 6), Plate; 15,750 C.P.S., 53 V.P.P.

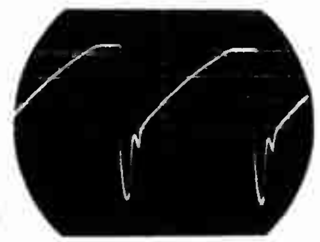


15. V-10, 6AL5, AFC Discriminator, (Pins 1 & 2), Horizontal Sweep Phasing Pulse; 15,750 C.P.S., 10 V.P.P.



16. V-11, 6SN7-GT, Horizontal Oscillator, (Pin 2), Plate; 15,750 C.P.S., 50 V.P.P.

17. V-11, 6SN7-GT, Horizontal Oscillator, (Pin 4), Grid; 15,750 C.P.S., 55 V.P.P.



18. V-11, 6SN7-GT, Horizontal Oscillator, (Pin 5), Plate; 15,750 C.P.S., 130 V.P.P.

Fig. 14. Waveforms

CONDITIONS: Contrast control set to 50% of maximum; signal developed 3 volts of AGC.

OSCILLOSCOPE: Tektronix type 514D.

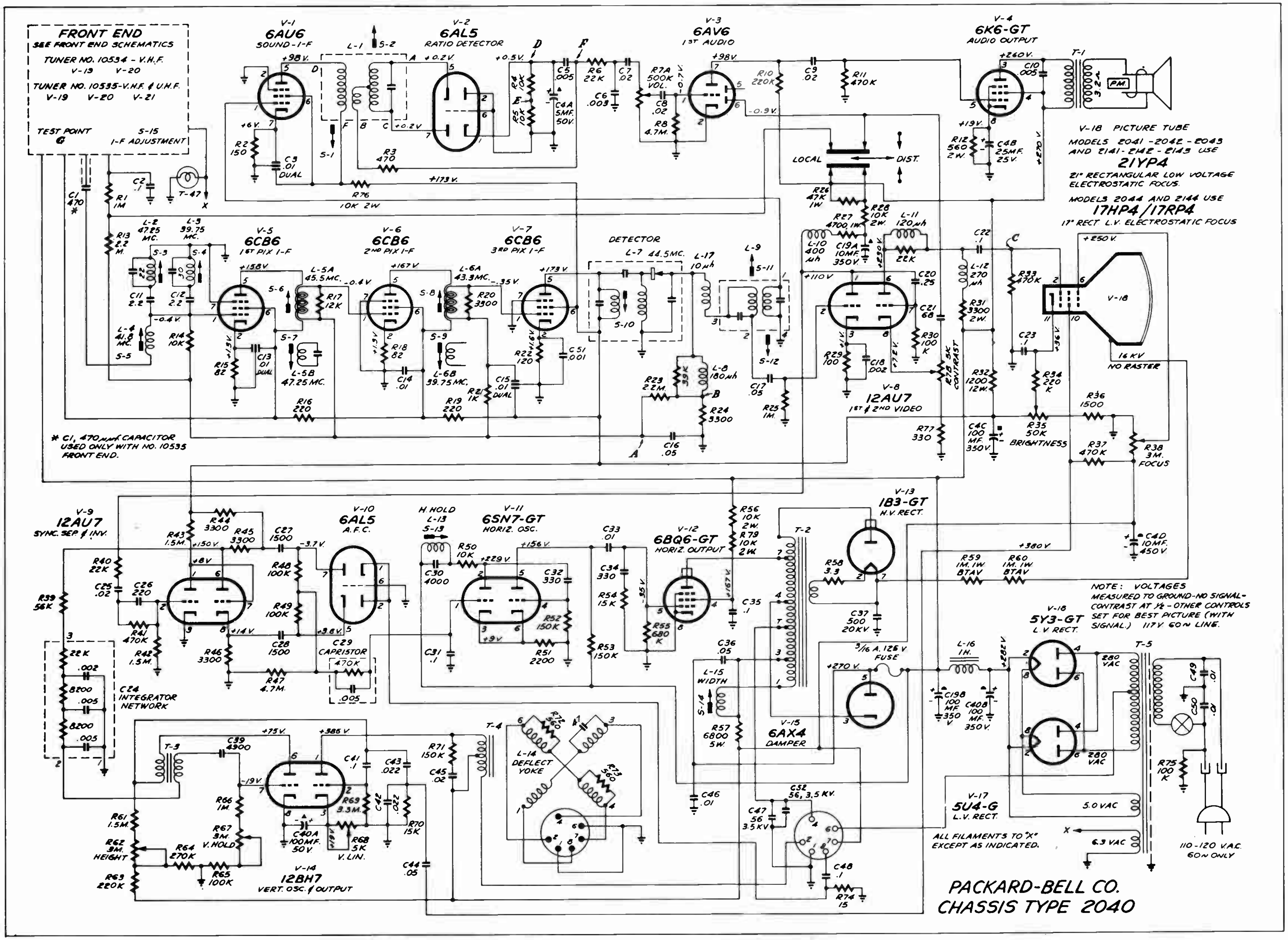


Fig. 15. Schematic Diagram, Chassis 2040

NOTE: TUBE LOCATIONS, TEST POINTS, AND ADJUSTMENTS ON THE 2040 AND 1840 CHASSIS ARE IDENTICAL EXCEPT THAT THE 1840 DOES NOT USE TUBES V-2 AND V-16.

NOTES:
R-9 deleted, see production modification 10
R-30 used in 2040, not in 1840 chassis.
R-56 not the same value on 1840 & 2040 chassis.
R-76 not the same value on 1840 & 2040 chassis.
R-77 used on both chassis, but not in same place.
R-78 used in 1840, not in 2040 chassis.
R-79 used in 2040, not in 1840 chassis.
R-80 used in 1840, not in 2040 chassis.

C-1 used only in sets with UHF-VHF tuner.
C-38 deleted, see production modification 9
C-52 used on 2040, not on 1840 chassis, see production modification 15
C-47, see production modification 15.
V-2 and V-16 used on 2040, not on 1840 chassis.
X-1 and X-2 used on 1840, not on 2040 chassis.

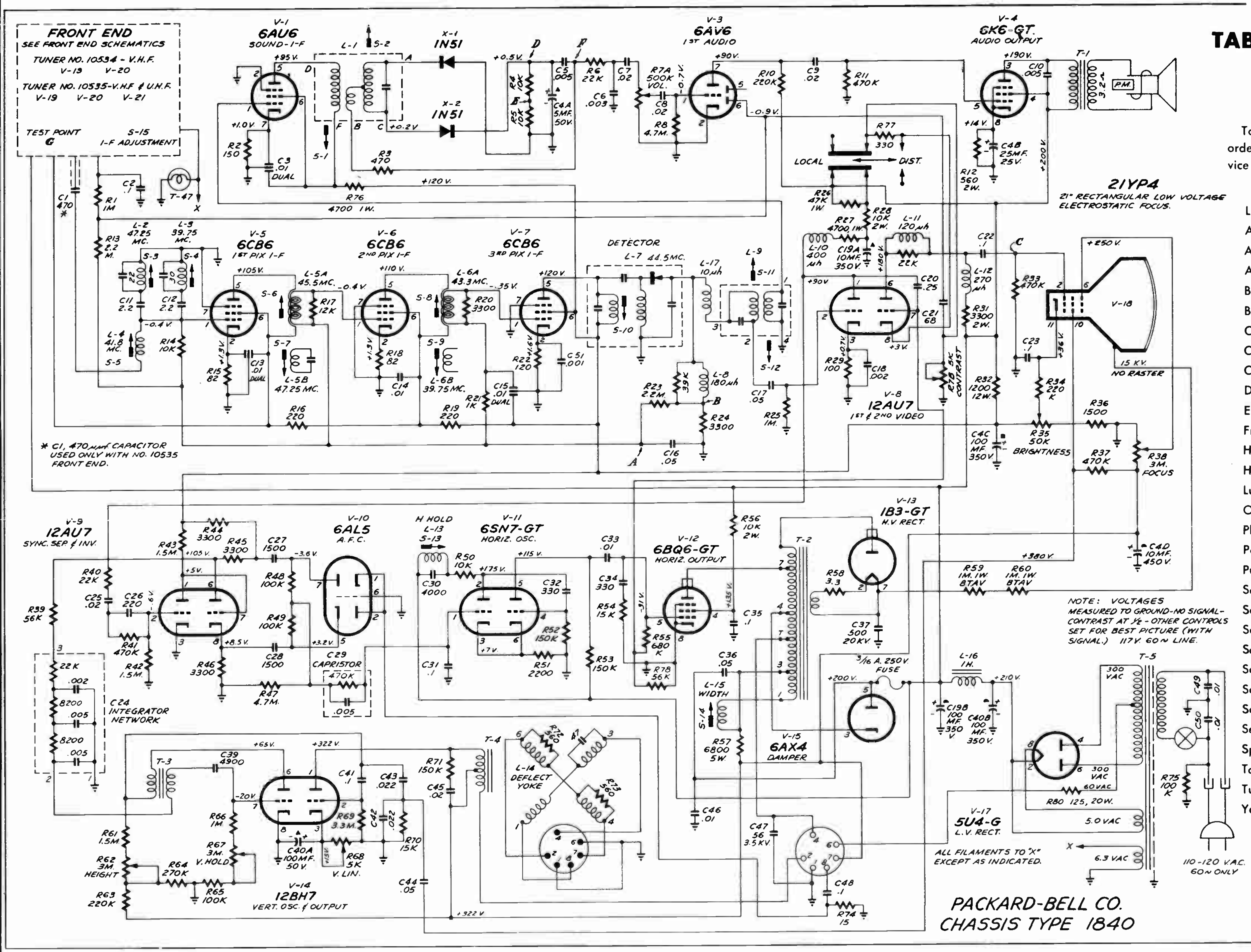


Fig. 16. Schematic Diagram, Chassis 1840

TABLE OF REPLACEABLE PARTS

CHASSIS 1840 & 2040

To be assured of genuine Packard-Bell replacement parts, order by part number from your nearest Packard-Bell Service Department. Addresses are listed below.

City	Address
Los Angeles (home office)	1101 So. Hope St.
Albuquerque, N. M.	4601 Lomas Blvd., N. E.
Alhambra, Calif.	2221 W. Valley Blvd.
Amarillo, Texas	703 No. Fillmore St.
Boise, Idaho	3001 Crescent Rim Drive
Burbank, Calif.	3007 Magnolia Blvd.
Colton, Calif.	295 So. 8th
Compton, Calif.	14912 So. Atlantic Blvd.
Culver City, Calif.	2405 So. La Cienega Blvd.
Denver, Colo.	1441 Ogden St.
El Paso, Texas	1109 Wyoming St.
Fresno, Calif.	531 "P" St.
Hollywood, Calif.	6620 Melrose Ave.
Honolulu, Hawaii	1923 Kalakaua Ave.
Lubbock, Texas	1810 Fourth St.
Oakland, Calif.	1009 Cypress St.
Phoenix, Ariz.	228 E. Roosevelt St.
Portland, Ore.	326 N. W. 21st Ave.
Pueblo, Colo.	119 W. 13th St.
Sacramento, Calif.	1617 Eighteenth St.
Salem, Ore.	2890 Silverton Road
Salt Lake City, Utah	624 So. State St.
Santa Ana, Calif.	406 N. Sullivan St.
San Diego, Calif.	3536 Adams Ave.
San Francisco, Calif.	1157 Post St.
San Mateo, Calif.	1037 N. Bayshore Blvd
Seattle, Wash.	2310 Fourth Ave.
Spokane, Wash.	West 38 Third Ave.
Tacoma, Wash.	2329 So. Tacoma Ave.
Tucson, Ariz.	745 No. Fourth Ave.
Yakima, Wash.	803 Summitview Ave.

NOTE: TUBE LOCATIONS, TEST POINTS, AND ADJUSTMENTS ON THE 2040 AND 1840 CHASSIS ARE IDENTICAL EXCEPT THAT THE 1840 DOES NOT USE TUBES V-2 AND V-16.

NOTES:
R-9 deleted, see production modification 10
R-30 used in 2040, not in 1840 chassis.
R-56 not the same value on 1840 & 2040 chassis.
R-76 not the same value on 1840 & 2040 chassis.
R-77 used on both chassis, but not in same place.
R-78 used in 1840, not in 2040 chassis.
R-79 used in 2040, not in 1840 chassis.
R-80 used in 1840, not in 2040 chassis.

C-1 used only in sets with UHF-VHF tuner.
C-38 deleted, see production modification 9
C-52 used on 2040, not on 1840 chassis, see production modification 15
C 47, see production modification 15
V-2 and V-16 used on 2040, not on 1840 chassis.
X-1 and X-2 used on 1840, not on 2040 chassis.

CAPACITORS

Notes: (1) "GMV" means capacities listed are Guaranteed Minimum Values over a range of from plus 10 degrees C. to plus 65 degrees C."
(2) Unless otherwise specified, tolerances are:
Paper capacitors, +30%, −10%
Electrolytic capacitors, +50%, −10%
(3) "NPO" denotes zero temperature coefficient.

SYMBOL	DESCRIPTION	PART NUMBER
C-1	Ceramic, 470 mmf. 20%, 350 volt. Note: C-1 used only in sets with 82-channel tuner 10535	23916
C-2	Paper, .1 mfd 200 volt	23019
C-3	Ceramic, dual .01 mfd GMV, 500 volt, disc	23962
C-4A	Electrolytic, 5 mfd 50 volt (quadruple)	24074A
C-4B	Electrolytic, 25 mfd, 25 volt (quadruple)	24074A
C-4C	Electrolytic, 100 mfd, 350 volt (quadruple)	24074A
C-4D	Electrolytic, 10 mfd, 450 volt (quadruple)	24074A
C-5	Ceramic, 5000 mmf GMV, 500 volt, disc	23931
C-6	Paper, .003 mfd 600 volt	23016
C-7	Paper, .02 mfd 600 volt	23007
C-8	Same as C-7	
C-9	Same as C-7	
C-10	Paper, .005 mfd 600 volt	23004
C-11	Ceramic, 2.2 mmf ± .25 mmf, 500 volt, NPO	23969
C-12	Same as C-11	
C-13	Same as C-3	
C-14	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-15	Same as C-3	
C-16	Paper, .05 mfd 200 volt	23017
C-17	Paper, .05 mfd 600 volt	23010
C-18	Ceramic, 2000 mmf, 20%, 500 volt, disc	23974
C-19A	Electrolytic, 10 mfd 350 volt (double)	24075
C-19B	Electrolytic, 100 mfd 350 volt (double)	24075
C-20	Paper, .25 mfd 600 volt	23014
C-21	Ceramic, 68 mmf, 20%, 500 volt	23913
C-22	Paper, .1 mfd 600 volt	23012
C-23	Same as C-22	
C-24	Integrator Network (see schematic diagram for components)	23980
	alternate	23951
C-25	Ceramic, .02 mfd, 20%, 500 volt, disc	23972
C-26	Ceramic, 220 mmf, 20%, 350 volt	23915
C-27	Ceramic, 1500 mmf, 20%, 500 volt	23936
C-28	Same as C-27	
C-29	Capristor (5000 mmf in parallel with 470,000 ohms)	23960
C-30	Mica, 4000 mmf, 10%, 500 volt	23208
C-31	Same as C-2	
C-32	Mica, 330 mmf, 10%, 500 volt	23221
C-33	Paper, .01 mfd 600 volt	23006
C-34	Ceramic, 330 mmf, 20%, 500 volt	23944
C-35	Same as C-22	
C-36	Same as C-17	
C-37	Ceramic, 500 mmf, +50%, −20%, 20,000 volt	23959
C-38	Deleted, see production modifications	
C-39	Mica, 4900 mmf, 5%, 500 volt	23207
C-40A	Electrolytic, 100 mfd, 50 volt (double)	24076
C-40B	Electrolytic, 100 mfd, 350 volt (double)	24076
C-41	Same as C-22	
C-42	Paper, .022 mfd 600 volt	23042
C-43	Same as C-42	
C-44	Same as C-17	
C-45	Same as C-7	
C-46	Same as C-33	
C-47	Ceramic, 56 mmf, 10%, 3500 volt (Might be 120 mmf, see production modification 2, chassis 1840)	23977
C-48	Same as C-22	
C-49	Bakelite enclosed tubular, .01 mfd 125 volts AC	23932
C-50	Same as C-49	
C-51	Ceramic, 1000 mmf, 20%, 500 volt	23965
C-52	Ceramic, 56 mmf, 10%, 3500 volt (C-52 used on 2040 but not on 1840 chassis; see production modification 15, chassis 2040)	23977

RESISTORS

Notes (1) Resistors are ½ watt unless otherwise specified.
(2) Tolerance is 10% unless otherwise specified.

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NUMBER
R-1	Composition, 1 megohm, 20%	73161
R-2	Composition, 15 ohms	73015
R-3	Composition, 470 ohms	73021
R-4	Composition, 10,000 ohms	73037
R-5	Same as R-4	
R-6	Composition, 22,000 ohms	73041
R-7	See "CONTROLS"	
R-8	Composition, 4.7 megohms, 20%	73169
R-9	Deleted, see production modifications	
R-10	Composition, 220,000 ohms, 20%	73153
R-11	Composition, 470,000 ohms, 20%	73157
R-12	Composition, 560 ohms, 2 watt	73422
R-13	Composition, 2.2 megohms, 20%	73165
R-14	Same as R-4	
R-15	Composition, 82 ohms	73012
R-16	Composition, 220 ohms	73017
R-17	Composition, 12,000 ohms	73038
R-18	Same as R-15	
R-19	Same as R-16	
R-20	Composition, 3300 ohms	73031
R-21	Composition, 1000 ohms	73025
R-22	Composition, 120 ohms	73014
R-23	Same as R-13	
R-24	Same as R-20	
R-25	Same as R-1	
R-26	Composition, 47,000 ohms, 1 watt	73245
R-27	Composition, 4700 ohms, 1 watt	73233
R-28	Composition, 10,000 ohms, 2 watt	73437
R-29	Composition, 100 ohms	73013
R-30	Composition, 100,000 ohms, 20% (R-30 not used on chassis 1840)	73149
R-31	Composition, 3300 ohms, 2 watt	73431
R-32	Wire Wound, 1200 ohms, 12 watt	73624
R-33	Same as R-11	
R-34	Same as R-10	
R-35	See "CONTROLS"	
R-36	Composition, 1500 ohms	73027
R-37	Same as R-11	
R-38	See "CONTROLS"	
R-39	Composition, 56,000 ohms	73046
R-40	Same as R-6	
R-41	Same as R-11	
R-42	Composition, 1.5 megohms, 20%	73163
R-43	Same as R-42	
R-44	Same as R-20	
R-45	Same as R-20	
R-46	Same as R-20	
R-47	Same as R-8	
R-48	Composition, 100,000 ohms	73049
R-49	Same as R-48	
R-50	Same as R-4	
R-51	Composition, 2200 ohms	73029
R-52	Composition, 150,000 ohms	73051
R-53	Same as R-52	
R-54	Composition, 15,000 ohms	73039
R-55	Composition, 680,000 ohms, 20%	73159
R-56	Chassis 1840, 4700 ohms 2 watts	73433
	Chassis 2040, 10,000 ohms 2 watt	73437
R-57	Wire Wound, 6800 ohms, 5 watt	73653
R-58	Composition, 3.3 ohm	73291
R-59	Composition, 1 megohm, 20%, 1 watt, type BTAV	73398
R-60	Same as R-59	
R-61	Same as R-42	
R-62	See "CONTROLS"	
R-63	Same as R-10	
R-64	Composition, 270,000 ohms	73054
R-65	Same as R-30	
R-66	Same as R-1	
R-67	See "CONTROLS"	
R-68	See "CONTROLS"	
R-69	Composition, 3.3 megohms, 20%	73167
R-70	Same as R-54	
R-71	Same as R-52	
R-72	Composition, 560 ohms	73022
R-73	Same as R-72	
R-74	Composition, 15 ohms	73003
R-75	Same as R-30	
R-76	Chassis 1840: 4700 ohms, 1 watt	73233
	Chassis 2040: 10,000 ohms, 2 watt	73437
R-77	Composition, 330 ohms (R-77 used in both 1840 & 2040 chassis but not in the same place in circuit)	73019
R-78	Composition, 56,000 ohms (R-78 used on chassis 1840 but not on chassis 2040)	73046
R-79	Composition, 10,000 ohms, 2 watt (R-79 used on chassis 2040 but not on chassis 1840)	73437
R-80	Wire wound, 125 ohms, 20 watt (R-80 used on chassis 1840 but not on chassis 2040)	73669

COILS

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NUMBER
L-1	Ratio Detector	29054
L-2	Trap, 47.25 Mc.	29564
L-3	Trap, 39.75 Mc.	29565
L-4	1st Pix I-F	29559
L-5A	2nd Pix I-F	29560
L-5B	Trap, 47.25 Mc.	29560
L-6A	3rd Pix I-F	29574
L-6B	Trap, 39.75 Mc.	29574
L-7	Pix Detector Assembly	29573A
L-8	Peaking Coil, 180 uh on 39,000 ohms	29508
L-9	Sound I-F Transformer	29563
L-10	Peaking Coil, 400 uh	29558
L-11	Peaking Coil, 120 uh on 22,000 ohms	29506
L-12	Peaking Coil, 270 uh	29557
L-13	Horizontal Oscillator	29527
L-14	Deflection Coils (Yoke)	29556
L-15	Width Coil	29555B
L-16	Filter Choke, 1 henry at 320 ma	27005
L-17	R-F Choke, 10 uh	29566

CONTROLS

REFERENCE SYMBOL	DESCRIPTION		PACKARD-BELL PART NUMBER
R-7A	Volume, 500,000 ohms	dual	25835A
R-7B	Contrast, 5000 ohms	dual	25835A
R-35	Brightness, 50,000 ohms		25856
R-38	Focus, 3 megohm		25854
R-62	Height, same as R-38		
R-67	Vertical Hold, same as R-38		
R-68	Vertical Linearity, 5000 ohms		25855

CRYSTALS

X-1, X-2 — 1N51 (in 1840 chassis only)
These must be ratio balanced crystals. For replacement obtain crystals from Packard-Bell Service Department.

TRANSFORMERS

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NUMBER
T-1	Audio Output	89427A
T-2	Horizontal Output	89440
T-3	Vertical Oscillator	89046
T-4	Vertical Output	89441
T-5	Power	89045

Primary: 117 volts
Secondary: 542 volts, 280 ma
6 volts, 8.15 amp
5 volts, 5 amp

MISCELLANEOUS PARTS

Cabinet, order by model number and specify finish	
Cord, AC power, 6 ft.	32021
Fuse, 3/16 amp. 125 volt	45006
Ion Trap	28106A
Knobs, for models with 12 channel tuner:	
Fine Tuning	52085-CX (G)
Fine Tuning, for mahogany finish	52085-AB (G)
Volume	52086-AN (D)
Volume, for mahogany finish	52086-AB (D)
Channel Selector	52089-AN (D)
Channel Selector, for mahogany	52089-AB (D)
Contrast	52087-CX
Contrast, for mahogany finish	52087-AB
Knobs, for models with 82 channel tuner:	
UHF Tuning	52108B
VHF Tuning	52106
Fine Tuning	52097
Volume	52098
Contrast	52087-CX
Contrast, for mahogany finish	52087-AB
Lamp, T-47	54002
Magnet, centering	28075
Shield, heat	78113A
Speaker	83305
Switch, local-distance	86709
Tuner, 12 channel	10534B
Tuner, 82 channel	10535C

CIRCUIT DESCRIPTION

Philco "B" line, Code 147 Television Receivers use two chassis—r-f chassis R-191, containing the r-f, video, audio and sync circuits, and deflection chassis D-197, containing the power and deflection circuits. Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

CAUTION: See A-C LINE ISOLATION

A separate subchassis contains the r-f amplifier, the oscillator, and the mixer. The r-f amplifier uses a type 6BZ7 tube, V1. The oscillator and the mixer use a type 6X8 tube, V2, the pentode section of the tube being used for the mixer, and the triode section for the oscillator. The output of the mixer is fed to a three-stage, stagger-tuned, i-f amplifier system employing three type 6CB6 tubes, V3, V4, and V5. A type 1N64 crystal diode, CD200, is used for the video detector, the output of which is amplified by a two-stage video amplifier utilizing a type 6AU6 tube, V6, and a type 6AQ5 output tube, V7. The connections at the detector are such as to produce a composite video signal with negative-going sync pulses. The signal, which is subjected to a 360-degree phase shift through the video amplifier, is applied to the grid of the picture tube, V19; therefore the sync pulses at this point are negative-going. A positive-going blanking pulse, taken from the vertical-output stage, is applied to the cathode of the picture tube for suppression of the vertical retrace.

Sound i.f. (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75-mc. video carrier and the 41.25-mc. sound carrier are mixed in the video detector. The 4.5-mc. beat frequency is the difference between 45.75 mc. and 41.25 mc., and contains the FM sound signal. This 4.5-mc. signal contains only a negligible amount of video amplitude modulation, provided that the amplitude of the 41.25-mc. signal is considerably lower than that of the 45.75-mc. signal. The proper relationship between the two carriers is established during the alignment of the receiver. There is sound output only when both the video and sound carriers are present.

The oscillator is tuned primarily to obtain the best picture, since the 4.5-mc. relationship always exists between the two carriers. The 4.5-mc. sound i.f. (intercarrier), which is taken from the plate circuit of the video amplifier, is passed through a 4.5-mc. sound i-f stage using a 6AU6 tube, V8, and is then applied to the FM detector, which utilizes two diode sections of a 6T8 tube, V9A. The triode section of the 6T8, V9B, is used as the first audio amplifier. The power amplifier uses a type 6V6GT tube, V10.

A portion of the video signal appearing at the output of the first video amplifier is applied to grid 3 (pin 7) of the 6CS6 sync separator, V11. Since grid-leak bias is used on grid 3, the tips of the sync pulses are clamped to zero, and the video components swing in a negative direction from zero. Because of the cut-off characteristics of grid 3, the video components are eliminated, and only negative-going sync pulses appear in the plate circuit of the sync separator. At the same time, however, a signal is taken from the video detector and applied to grid 1 (pin 1) of the 6CS6 tube. This grid is returned to B plus, and the bias is maintained close to zero, because of a small grid-current flow. Since the signal applied to grid 1 is composite video with negative-going sync, any noise modulation present in the signal appears in the form of sharp spikes, driving in a negative direction. The circuit constants are chosen to allow grid 1 to cut off plate current whenever the signal goes more negative than the sync pulses. A series grid-limiting resistor, R608, is also incorporated to prevent the video components from appearing in the plate circuit of the sync separator. A-G-C voltage is also developed in the sync separator circuit in the following manner: On tips of the sync pulses, grid 3 (pin 7) of the 6CS6 tube draws current which flows downward through the network R602, R603, R604, R211, and L214, causing capacitors C605, C602, and C603, to assume negative charges proportional to the amount of peak signal applied to grid 3. The tuner a-g-c voltage is delayed by means of a resistor divider network which applies a small positive voltage to the tuner a-g-c circuit. This positive voltage prevents a-g-c action from lowering the tuner gain on weak signals. To prevent the delay voltage from driving the tuner a-g-c voltage positive on weak signals, a diode clamp (part of V9B) is connected across C602.

The negative-going sync pulses appearing in the plate circuit of the sync separator are fed to one half of a 12AU7 tube, V12A, connected as a phase-splitter circuit; positive sync pulses appear in the plate circuit, and negative sync pulses are taken from the cathode.

Proper triggering of the vertical oscillator requires positive synchronizing pulses. The vertical sync signal is separated from the horizontal sync signal by the vertical integrator circuit, and is fed to the grid circuit of the vertical blocking oscillator, one half of a 12AU7 tube (V12B). The output of the vertical oscillator is amplified by a type 12B4 tube, V13, which is employed as the vertical-output amplifier. The output of the amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

The horizontal-sweep circuits require both positive and negative sync pulses. The phase-comparer circuit uses a 6AL5 tube, V14. Positive sync pulses are applied to the plate of V14A, and negative sync pulses are applied to the cathode of V14B. A saw-tooth voltage, taken from the horizontal-output circuit, is fed to the plate of V14B and to the cathode of V14A, for comparison of the sync and horizontal sweep voltages. When the saw-tooth and sync signals are exactly in phase, no voltage is developed across R800, but when the two signals are out of phase, either a positive or a negative voltage is developed, depending upon whether the horizontal-oscillator frequency is lower or higher than the sync-pulse frequency. The grid circuit of the horizontal oscillator, a type 12AU7 tube, V15, operating as a cathode-coupled multivibrator, is connected to R800 through a filter network. When the voltage at this point goes in a positive direction, the frequency of the horizontal oscillator is increased; when the voltage swings negative, the frequency of the oscillator is decreased. In this manner the frequency of the horizontal oscillator is controlled over the lock-in range of the circuit. The horizontal hold control, R811, adjusts the horizontal-oscillator frequency so that it is within the control range of the phase comparer. The output of the horizontal oscillator is fed to the horizontal output amplifier, which makes use of a type 6BQ6GT tube, V16. The screen voltage for the horizontal amplifier is supplied from a voltage-divider network. The network includes R818, R816 (the WIDTH control), R817, R315 (the BRIGHTNESS control), and R316. R816 varies the voltage applied to the screen, thus adjusting for proper picture width. Adjusting R315 for brightness varies the bias on the picture tube. The change in bias causes a change in beam current, and would tend to result in a change in picture width and a variation in the second-anode voltage. However, when the control arm of the BRIGHTNESS control, R315, is moved toward ground, a smaller part of the control is shunted by the 22,000-ohm resistor, R316, and the total resistance of the voltage divider is increased. This increase in resistance results in a decrease in the current through the divider, and the screen voltage on the horizontal amplifier is increased proportionally, thus compensating automatically for the increase in beam current in the picture tube. The horizontal amplifier feeds the deflection coils through the horizontal-output transformer. A 6AX4GT tube, V17, is used as the horizontal damper.

The second-anode voltage for the picture tube is supplied by one 1B3GT high-voltage rectifier tube, V18. The B plus voltage for the receiver is supplied by two selenium rectifiers, CR100 and CR101 in a full-wave, voltage-doubler circuit, operating directly from the power line. Bias voltage is obtained from across a filter choke, which is in series with the negative side of the B plus supply. The B plus boost voltage, derived from the horizontal damper circuit, supplies higher B plus voltage to the vertical oscillator, first audio stage, and the first anode of the picture tube. Filament voltage for all the tubes except the high-voltage rectifier is supplied by a step-down transformer. Filament voltage for the high-voltage rectifier is supplied by a winding of the horizontal-output transformer.

The circuit description, schematic diagram, base layout, and service information for r-f chassis R-191 is given in PR-2507. When this chassis is used with deflection chassis D-197, the filter choke is not mounted on the speaker, and a plain p-m speaker is used. The filter choke is mounted on the D-197 chassis.

IMPORTANT
A-C LINE ISOLATION

CAUTION: One side of the a-c line is connected to the chassis through C101 and L100. The other side of the a-c line is connected to the chassis through F100, R100, CR100, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment it is desirable that an a-c line isolation transformer capable of handling at least 225 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment or receiver, or both.

SPECIFICATIONS

VHF TUNING ....Twelve channel, 12-position incremental tuner, covering VHF Television Channels 2 through 13; fine tuning of local oscillator

UHF TUNING (if provided).......Continuous tuning, covering UHF Television Channels 14 through 83; fine and coarse tuning

INTERMEDIATE FREQUENCIES
Video Carrier ....45.75 mc.
Sound (intercarrier) ....4.75 mc.

TRANSMISSION LINE ....300-ohm, twin-wire lead

OPERATING VOLTAGE ....110 to 120 volts, 60 cycles, a. c.

POWER CONSUMPTION
Without UHF, 205 watts; with UHF, 210 watts.

TUBE COMPLEMENT

R-F CHASSIS R-191

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
V1	6BZ7 miniature	R-F Amplifier
V2	6X8 miniature	Oscillator-Mixer
V3, V4, V5	6CB6 miniature	Video I-F Amplifiers
V6	6AU6 miniature	Video Amplifier
V7	6AQ5 miniature	Video Output Amplifier
V8	6AU6 miniature	Sound I-F Amplifier
V9	6T8 miniature	Ratio Detector, First Audio, and Tuner A-G-C Clamp
V10	6V6GT octal	Audio Output
V11	6CS6 miniature	Sync Separator
V19	17YP4 or 21ZP4A	Picture Tube

DEFLECTION CHASSIS D-197

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
V12	12AU7—miniature	Phase splitter, vertical oscillator
V13	6BQ6GT—octal	Vertical output
V14	6AL5—miniature	Phase comparer
V15	12AU7—miniature	Horizontal oscillator
V16	6CD6G—octal	Horizontal output
V17	6V3A—miniature	Damper
V18	1B3GT—octal	High-voltage rectifier
V19	24VP4	Picture tube

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. AD2248-19.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture until approximately 1 inch of blank screen appears at the right-hand and left-hand sides of the picture.

2. Increase the BRIGHTNESS control setting until the blanking becomes visible. This will appear as a dark vertical bar on each side of the picture.

3. Connect a .1 μf. condenser from the test point, adjacent to TC800, to ground. (The plate side of the horizontal ringing coil, L800, is connected to the test point.)

4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.

5. Adjust the HORIZ HOLD CENTERING control until equal portions of the blanking bar appear on both sides of the picture.

6. Remove the .1-μf. condenser from the test point.

7. Adjust the horizontal ringing coil, L800, until equal portions of the blanking bar again appear on both sides of the picture.

8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync on both sides, readjust the HORIZ HOLD CENTERING control.

9. Rotate the HORIZONTAL HOLD control through its range, and observe the number of diagonal blanking bars that appear just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO PEAKING-COIL ADJUSTMENT

The video peaking coil, L303, is adjusted at the factory for proper transient response of the video circuits. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of L303 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If L303 is replaced in servicing, adjustment will be required.

Before adjusting L303, check the tuner alignment and i-f alignment. (Never adjust L303 until the alignment of the receiver is correct.) Then tune in a station and adjust L303 until there are no trailing whites or smear in the picture. Turning TC301 clockwise reduces trailing whites and overshoot; turning TC301 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of TC301 applies to a particular station exhibiting smear or overshoot. After TC301 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

TELEVISION ALIGNMENT

GENERAL

The alignment procedure follows the general pattern of first checking the tuner response with an FM sweep generator and oscilloscope, comparing the response curve with that given in the manual, and aligning the tuner if necessary. After it is established that the tuner is in correct alignment, the video i-f channel is aligned by tuning each coil to its assigned pole frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and retouching the i-f adjustments to obtain the desired pass band. Finally, the sound channel is aligned, using an AM signal, by tuning the sound take-off coil and the i-f and ratio-detector transformers.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the i-f stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chassis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.

2. Do not disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.

3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.

4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method for calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745 (J) entitled "Television Service in the Home."

TEST EQUIPMENT REQUIRED

The following test equipment is recommended for aligning the receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.

2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.

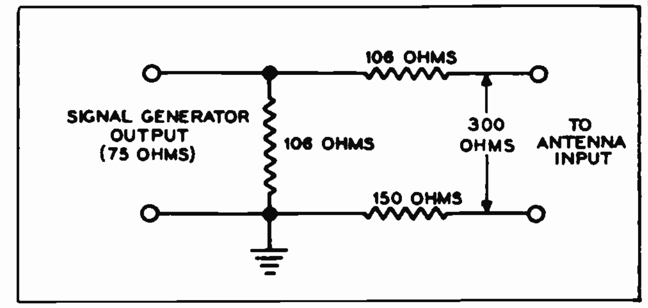


Figure 1. Antenna-Input Matching Network

3. R-F Probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

JIGS AND ADAPTERS REQUIRED

Mixer Jig

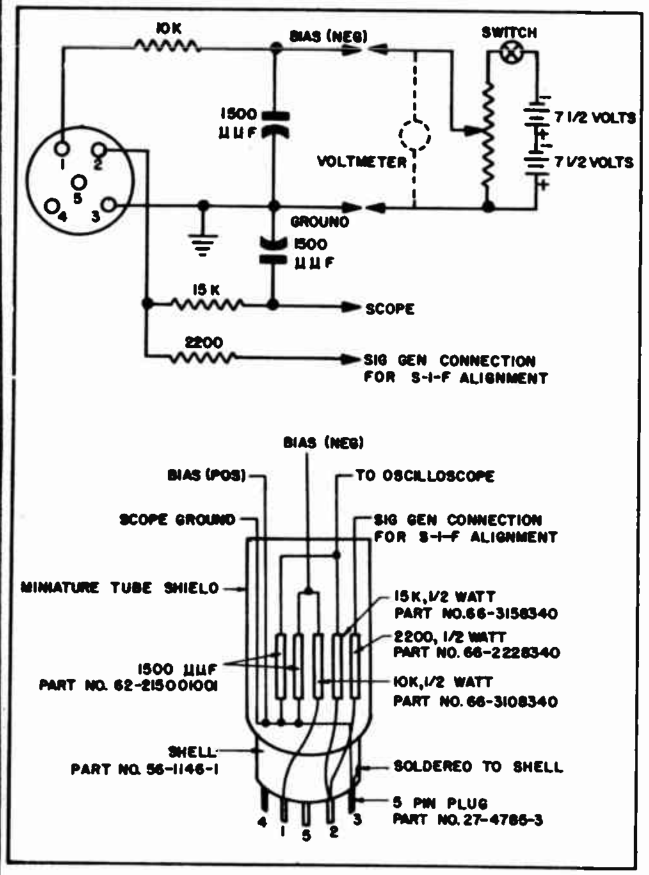
Connections to the grid of the mixer tube may be made through the alignment jack provided for that purpose. To connect the generator to this point, a mixer jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

Antenna-Input Matching Network

Figure 1 shows an impedance-matching network for coupling the signal generator to the antenna-input terminals of the receiver. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms, is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group to obtain values within 10% of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig
(Video Test Jack Adapter)

The alignment jig shown in figure 2 should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This jig consists of a 5-prong plug, a 10,000-ohm potentiometer, two isolating resistors (one 10,000-ohm and one 15,000-ohm), two 1500-



TP3-988

Figure 2. Video I-F Alignment Jig

micromicrofarad capacitors, two 7½-volt batteries and switch. A suggested method of fabricating the jig is also shown. It is suggested that the bias batteries and potentiometer be mounted in a metal box of convenient size.

The potentiometer and switch are connected across the two 7½-volt batteries. The switch is used to disconnect the potentiometer, to prevent the discharge of the battery while not in use.

Sound I-F Alignment Jig

Figure 3 shows the jig that should be used to connect the voltmeter and oscilloscope to the VOLUME CONTROL socket, J400.

TELEVISION TUNER ALIGNMENT

After the tuner is serviced, or if an i-f alignment is required, the tuner alignment should be checked by observing the tuner response curve, as given under Bandpass Alignment. If the response curve does not fall within the limits shown in figure 5, the tuner should be realigned. If realignment is necessary, use the procedure given below.

Since the frequency of the local oscillator affects the tuner response, the local-oscillator alignment should be made first.

Oscillator Alignment

General

Tuning cores are provided in the oscillator coils at channels 13, 11, 9, 7, 6, and 4. By adjusting these tuning cores, all channels may be placed on frequency. This procedure should be carried out with the highest-frequency channel first, since the alignment of each channel affects the alignment of all the channels below it in frequency. The channel adjustments are so arranged that, with one exception, each adjustment corrects the tuning of more than one channel. The coverage of the various adjustments is as follows:

CHANNEL ADJUSTMENT	CHANNELS CORRECTED BY ADJUSTMENT
13	13 and 12
11	11 and 10
9	9 and 8
7	7 only
6	6 and 5
4	4, 3, and 2

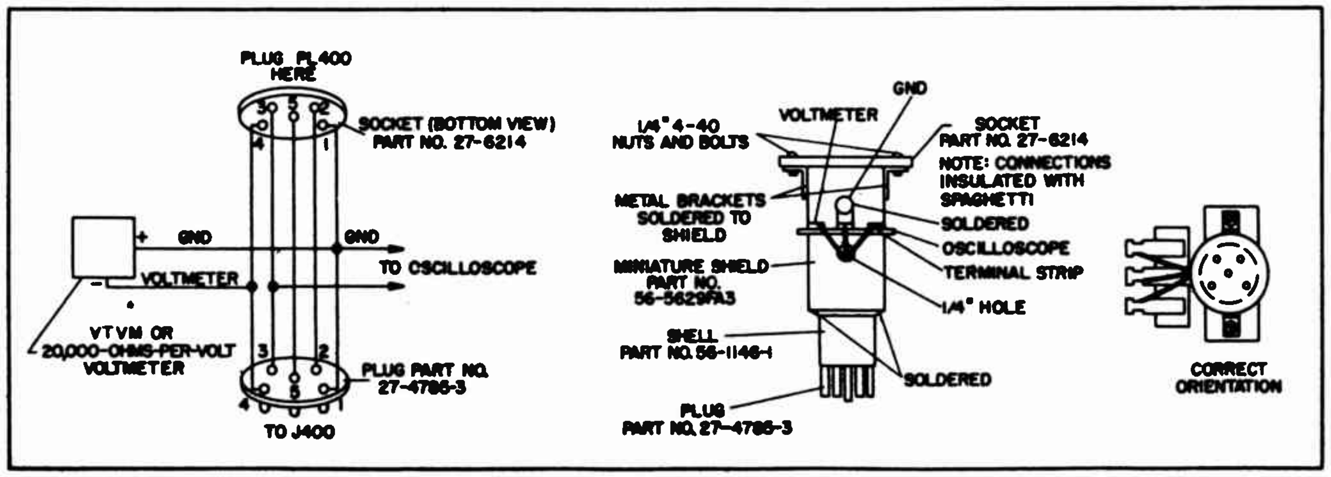


Figure 3. Sound I-F Alignment Jig

TP2-2200

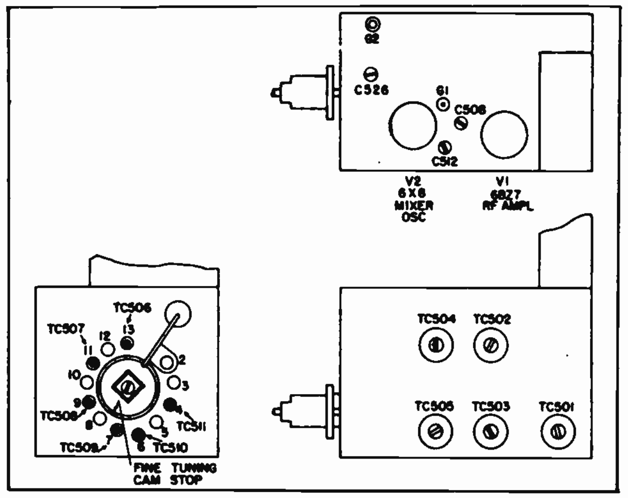


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Figure 4. Television Tuner, Showing Locations of Adjustments

The FINE TUNING cam should be preset for all adjustments by placing the stop on the FINE TUNING cam between the Channel 7 and 8 holes on the front plate of the tuner. See figure 4.

Procedure Using Signal Generator

An r-f signal (unmodulated), at the oscillator frequency, is fed into the antenna input from an AM signal generator, and the oscillator tuning cores are adjusted for zero beat. The r-f signal frequency should be accurately determined. It is preferable that the signal be taken from a crystal-controlled source; if this is not available, the signal generator may be calibrated against the television station.

1. Connect the hot lead of the oscilloscope to the mixer plate test point, G2, through a 1000-ohm resistor, and connect the ground lead of the oscilloscope to the chassis, near the test point. (High oscilloscope gain may be necessary to obtain a visual beat. In this instance, base-line hum may be ignored.)

2. Connect the AM (marker) generator to the 300-ohm antenna-input terminals. For this purpose the antenna-input matching network is not required.

3. Disconnect the white lead from the tuner, and connect it to the negative terminal of a 1½-volt battery. Ground the positive terminal. If regeneration is observed, the bias may be increased to 4 or 5 volts, to reduce the regeneration.

4. Mechanically preset the fine-tuning cam stop as shown in figure 4.

5. Feed in an r-f signal (unmodulated), at the oscillator frequency for Channel 13, with the CHANNEL SELECTOR set for Channel 13.

6. Adjust the tuning core for Channel 13 (see figure 4).

7. Reset the signal-generator frequency and the CHANNEL SELECTOR, and adjust the tuning cores for Channels 11 and 9, respectively.

8. Repeat steps 5, 6, and 7 until Channels 13, 11, and 9 are within plus or minus 500 kc. of the correct frequency.

9. Feed in r-f (unmodulated) signals, at the oscillator frequencies for Channels 7, 6, and 4, consecutively (see NOTE below), and adjust the respective tuning cores (see figure 4).

> NOTE: The exact position of the FINE TUNING cam should be marked when Channel 4 is correctly aligned. This position is to be used in step 4 of the i-f alignment procedure.

Procedure Using Station Signal

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available:

1. Mechanically preset the FINE TUNING cam to the center of its range (see figure 4).

2. Tune in the highest-frequency channel to be received.

3. Adjust the tuning core for that channel, or the next higher channel, for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound disappears. Repeat for each channel received in the area.

Bandpass Alignment

General

The bandpass alignment consists of aligning the tuner at Channels 13 and 6, and then making it track down to Channels 7 and 2, respectively.

During the alignment, a fixed bias of 1½ volts is applied to the r-f amplifier tube.

An FM (sweep) signal is applied to the antenna-input circuit, and an oscilloscope is connected to the mixer plate circuit. The oscilloscope gain should be as high as possible, consistent with hum level and "bounce" conditions. Hum conditions will cause distortion of the time base and response. Bounce conditions, which are caused by poor line regulation, will cause the response and time base to jump up and down. The use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a gain necessitates increasing the generator output to a point where the tuner may be overloaded. Overload may be checked by changing the generator output while observing the shape of the response curve; any change in the shape of the curve indicates overload, in which case a lower generator output and higher oscilloscope gain must be used. The tuner coupling link should be disconnected from the

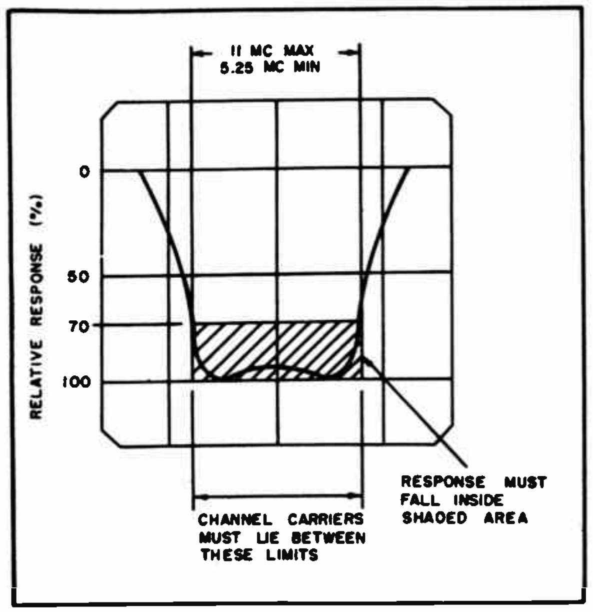


Figure 5. Television Tuner Response Curve, Showing Bandpass

i-f section by removing the plug, PL500, and a 40- to 70-ohm carbon resistor should be connected across the open end of the plug. This is done to eliminate the absorption effect of the tuner link coil, L200, on the response curve.

Procedure

1. Disconnect the white (a-g-c) lead, from the tuner, and connect it to the negative terminal of a 1½-volt battery. Ground the positive terminal.
2. Disconnect the tuner plug, PL500, at terminal board B13 (see figure 33), and connect a 40- to 70-ohm carbon resistor across the plug.
3. Connect a 1000-ohm resistor in series with the hot lead of the oscilloscope. Connect the other end of the resistor to the mixer plate test point, G2, and connect the ground lead of the oscilloscope to the chassis, near the test point.
4. Connect the FM (sweep) generator to the 300-ohm antenna-input terminals through an antenna-input matching network. See figure 1.
5. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 13 (213 mc.). Adjust the generator for sufficient sweep to show the complete response curve.
6. Establish the channel limits (see figure 5) by using the marker (AM r-f) signal generator to produce marker pips on the response curve. (Set the marker generator first to 210 mc., then to 216 mc.) The curve should be reasonably flat between the limits shown in figure 5.
7. Adjust TC502 and TC504 (figure 4) for a symmetrical, approximately centered pass band.
8. Set the CHANNEL SELECTOR and FM generator to Channel 7 (177 mc.).
9. Establish the channel limits by using the marker generator to produce marker pips on the response curve. (Set the generator first to 174 mc., then to 180 mc.) The curve should be reasonably flat between the limits.
10. On Channel 7, note the response curve, with respect to tilt and center frequency. The curve should be centered in the pass band, and should be symmetrical.
11. If the curve is not symmetrical, and appears unbalanced, as shown in figure 6, leave the generator and tuner set to Channel 7, and adjust C508 and C512 (see figure 4) to obtain a response curve which is the mirror image (tilt in the opposite direction) of the original. This is a form of overcompensation, to allow for the effect of Channel 13 adjustment on Channel 7. For example, if the Channel 7 response appears as in figure 6A, then the trimmer should be adjusted to obtain the response shown in figure 6B.
12. Reset the CHANNEL SELECTOR and generators to Channel 13. Readjust TC502 and TC504 for a symmetrical and centered band pass. See step 4.
13. Set the CHANNEL SELECTOR and generators to Channel 7, and check the response for center frequency and symmetry. Repeat steps 8 and 9 as many times as is necessary to obtain the most symmetrical, centered response curves on Channels 13 and 7. Channels 7 through 13 are now correctly aligned.
14. Set the CHANNEL SELECTOR and sweep generator to Channel 6 (85 mc.).
15. Establish the channel limits, using the marker generator to produce marker pips on the response curve. (Set the generator first to 82 mc., then to 88 mc.)
16. Adjust TC503 and TC505 for a symmetrical, approximately centered pass band. Set the marker generator to 85 mc. Detune TC505 counterclockwise until a single peak appears.

   CAUTION: Do not turn the core of TC505 excessively, or it will fall out of the coil.

   Adjust TC503 until the peak falls on the 85-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC501 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for Channels 2 through 6. To prevent overloading, the output of the generator should be reduced after this adjustment is completed.
17. Readjust TC503 and TC505 for a symmetrical response, centered about 85 mc.

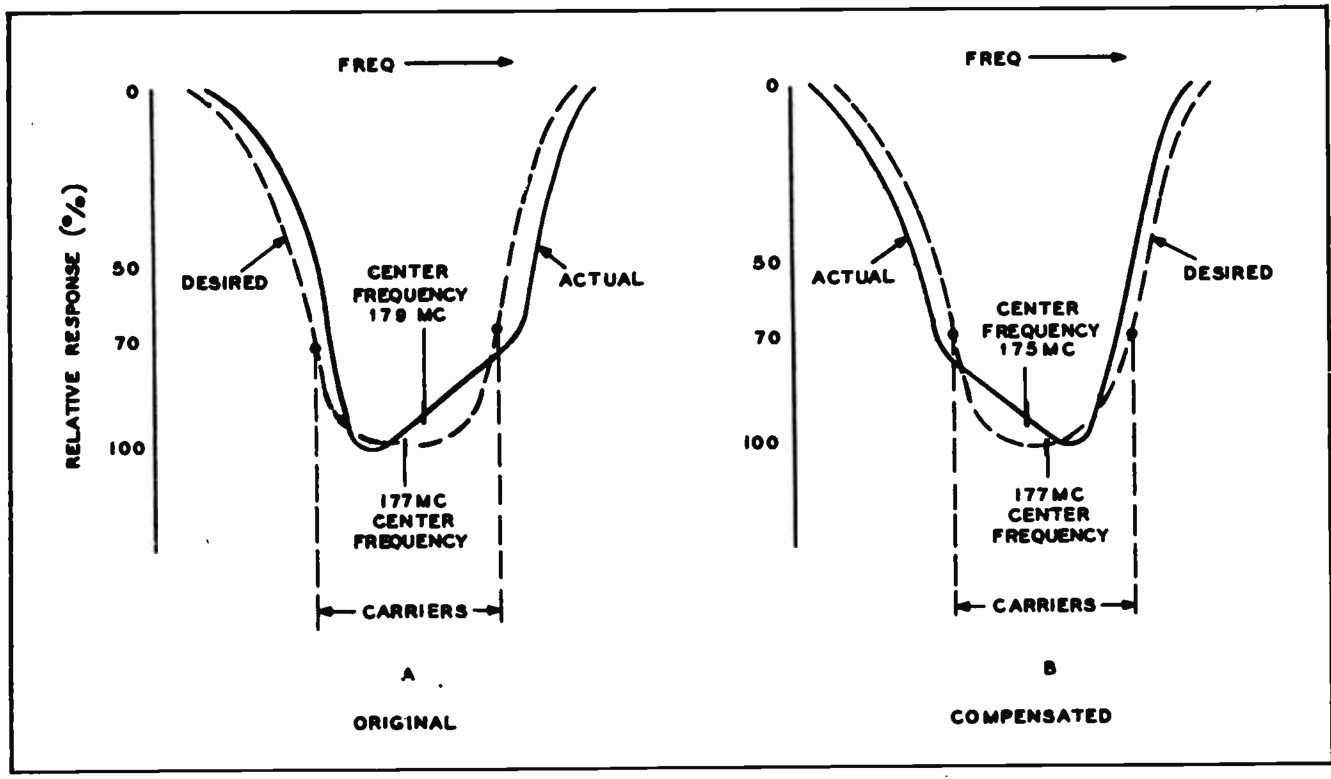


Figure 6. Television Tuner Response Curve, Showing Tracking Compensation

VIDEO I-F ALIGNMENT

Preliminary

Before proceeding with the i-f alignment or making an alignment check, observe the following preliminary instructions:

1. Preset the CONTRAST and BRIGHTNESS controls to the maximum counterclockwise position.
2. Preset the CHANNEL SELECTOR to Channel 4.
3. Insert the video i-f alignment jig (figure 2) into J200.
4. Connect the oscilloscope to the 15,000-ohm resistor from the video i-f alignment jig. Connect the ground lead of the oscilloscope to the ground lead from the adapter.
5. With a voltmeter connected across the points shown in figure 2, set the potentiometer to furnish −6 volts of bias.
6. Connect the AM generator to the mixer test point, G1, through a mixer jig (described in step 4 of procedure given below), and adjust the generator for approximately 30 percent modulation with 400 cycles. Adjust the output of the generator during the alignment to keep the output at the second detector below .6 volt, peak to peak.

   NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

Procedure

1. Preset condenser C526 for minimum capacitance (turn screw counterclockwise).
2. Tune the AM generator to 47.25 mc., and adjust C200 for minimum output, as observed on the oscilloscope. See figure 7.

   NOTE: It is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.
3. Tune the AM generator to the frequencies indicated below, and adjust the trimmers for maximum output, as observed on the oscilloscope.
   a. 45.7 mc.—adjust C526
   b. 42.6 mc.—adjust C202
   c. 45.0 mc.—adjust C206
   d. 43.2 mc.—adjust C210
   e. 44.3 mc.—adjust C212
4. Connect the sweep generator and r-f marker generator to the antenna terminals through a matching jig. (If a separate oscilloscope is used, connect the sweep output of the generator to the horizontal input of the oscilloscope.) Set the CHANNEL SELECTOR to Channel 4, and tune the sweep generator for output on Channel 4. Tune the r-f marker generator to the video carrier frequency of Channel 4 (67.25 mc.),

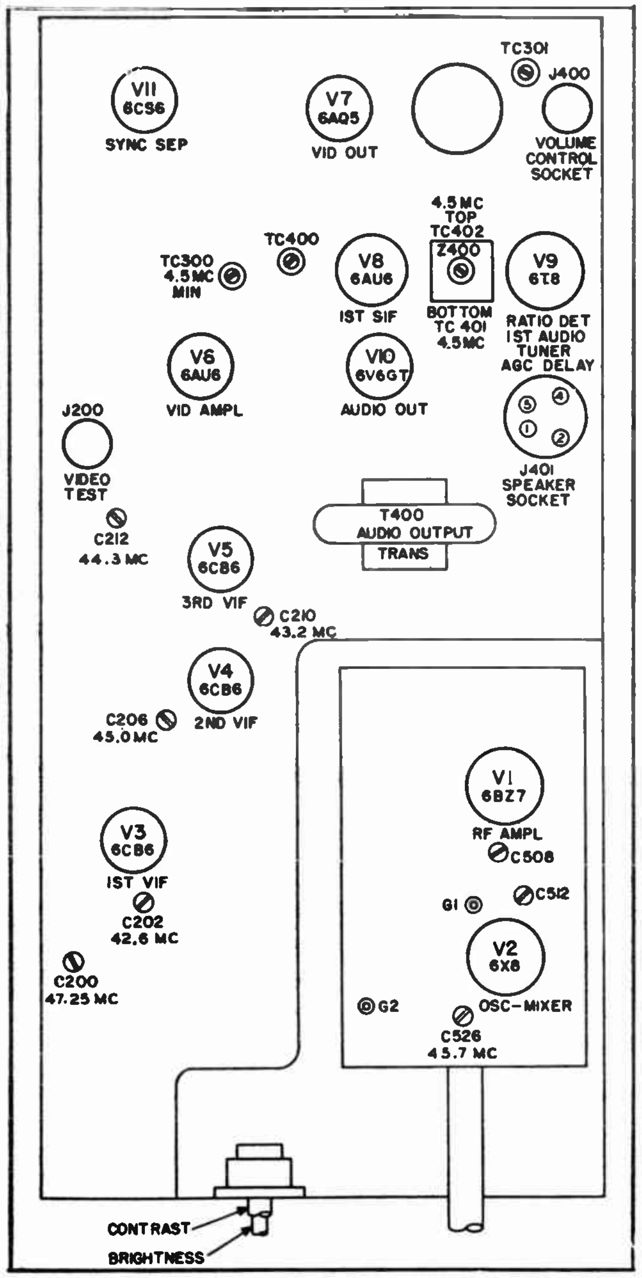


Figure 7. R-F Chassis R-191, Top View, Showing Locations of Adjustments

and tune the i-f marker generator (capacitively coupled to the mixer grid) to 45.75 mc. Note two marker generators are used for this procedure. The r-f marker generator is connected to the antenna terminals, while the i-f marker generator is coupled capacitively to the mixer grid test point, G1. A jig constructed from a piece of fiber tubing, with $\frac{3}{16}$-inch inside diameter, and a brass machine screw which fits tightly into the tubing, is used to couple the generator capacitively to the test point. The screw is adjusted so that its tip clears the test point by approximately $\frac{1}{64}$ inch. The output cable of the marker generator is connected to the head of the brass screw in the jig and to the chassis near the mixer tube. Both marker generators should be adjusted for the minimum output required to make the markers barely visible. Failure to observe this precaution, or the use of excessive output from the sweep generator, will cause misleading results. After the equipment is properly connected, adjust the FINE TUNING control for zero beat of the two markers, as observed on the oscilloscope. When zero beat is obtained, remove the i-f marker.

5. If the response curve does not fall within the limits shown in figure 8, the adjustment of the trimmers may be touched up slightly, while observing the response curve. Do not retouch the setting of C202 at this point. To adjust the curve, first adjust C206 and C212, alternately, until maximum improvement has been obtained. C212 affects the tilt of the curve, and C206 affects the dip of the curve. After C212 and C206 have been adjusted, adjust C210 for proper slope at the 42.5-mc. side of the curve, then adjust C526 for proper level at the video carrier frequency (45.75 mc.). After these adjustments have been made, if the response curve still does not fall within the limits shown in figure 8, a slight readjustment of C202 is permissible.

CAUTION: Do not turn any of the trimmers excessively. To retouch, turn the trimmers only slightly.

SOUND I-F ALIGNMENT

1. Remove the 1st v-i-f tube, and connect a v.t.v.m. or a 20,000-ohms-per-volt voltmeter to the sound i-f alignment jig (figure 3). Adjust the VOLUME control for moderate speaker output.

2. Feed in an accurately calibrated 4.5-mc. AM signal, through the 2200-ohm resistor in the video i-f alignment jig, to pin 2 of J200.

3. Tune TC400, TC401, and TC402 for maximum indications on the meter. The point of maximum meter indication for TC402 should also be the point of minimum speaker output.

4. Tune TC402 for minimum speaker output.

5. Connect an r-f probe or crystal detector to the grid (pin 2) of the picture tube. See NOTE below.

6. Tune TC300 for minimum indication on oscilloscope. (If a crystal detector is not available, TC300 may be adjusted for minimum beat pattern, as observed on the picture tube, with a station picture present.)

7. Replace the 1st v-i-f tube. Tune in a station, using the speaker output as an indication of correct tuning.

8. Turn the FINE TUNING control clockwise to obtain a slightly fuzzy picture.

9. Tune TC402 for minimum AM (noise) output.

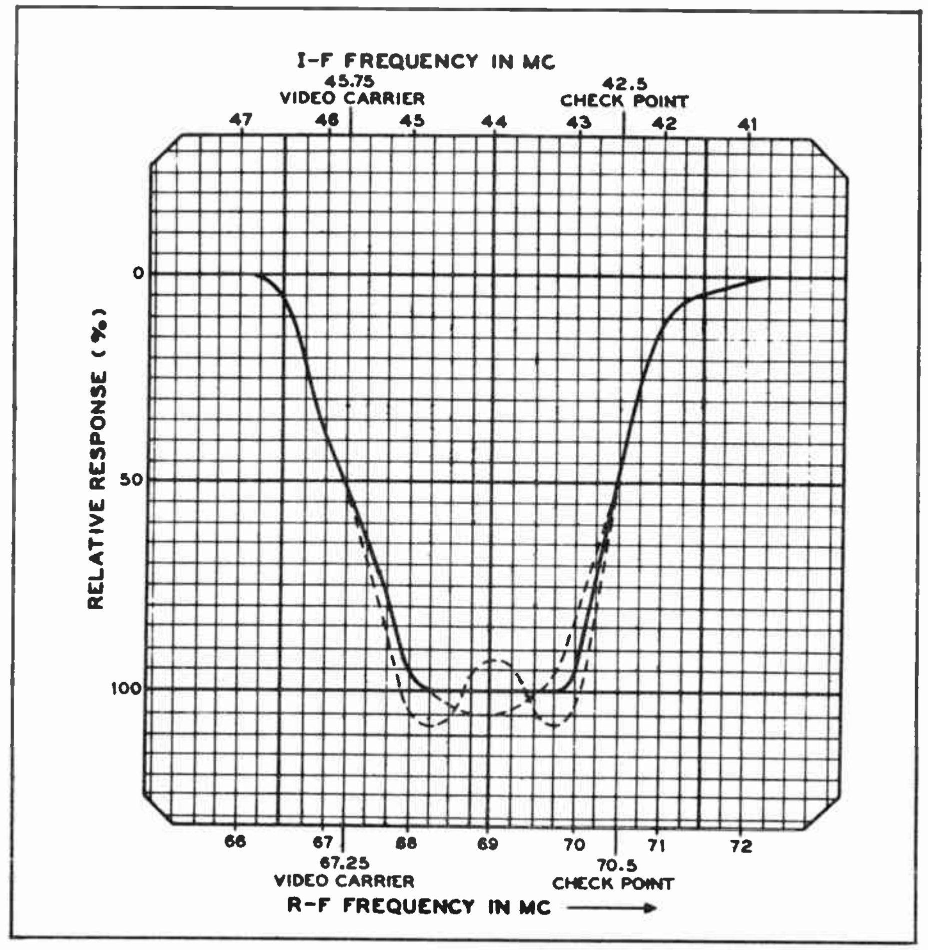


Figure 8. Over-All, R-F, I-F Response Curve, Showing Tolerance Limits

NOTE: The R-F Probe, Part No. 76-3595, is used as a detector of the 4.5-mc. signal, and the oscilloscope is used as an indicating device. An alternate crystal detector may be made up as shown in figure 9.

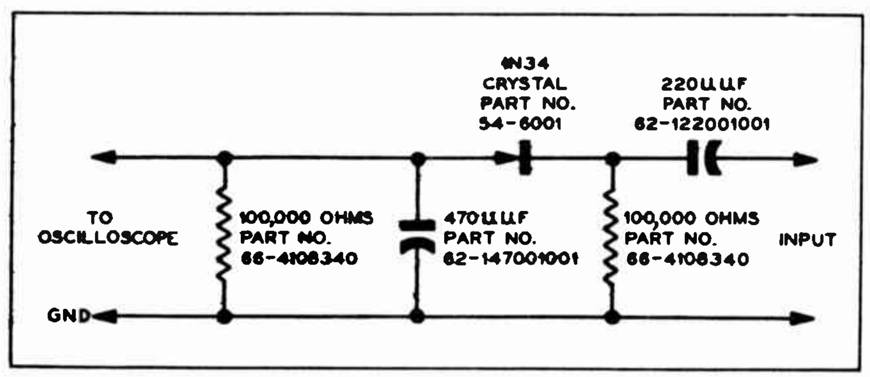
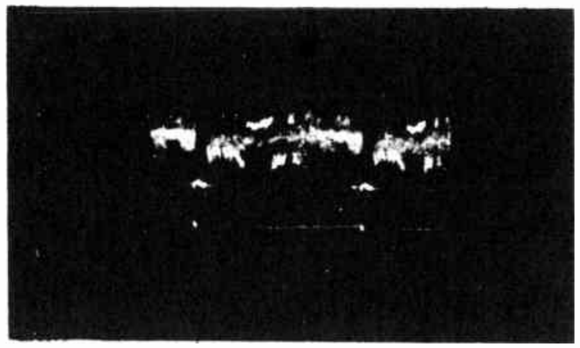
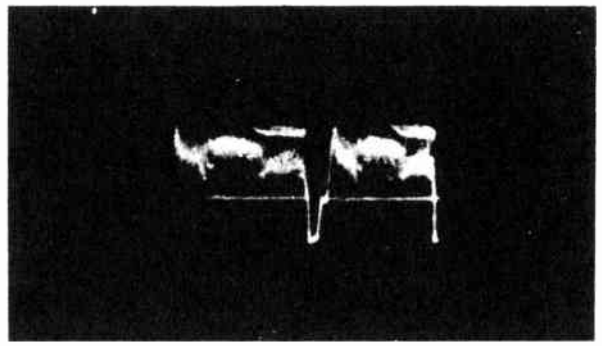


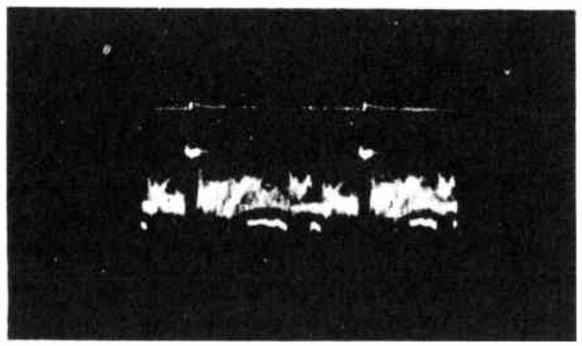
Figure 9. Wiring Diagram of Crystal Detector

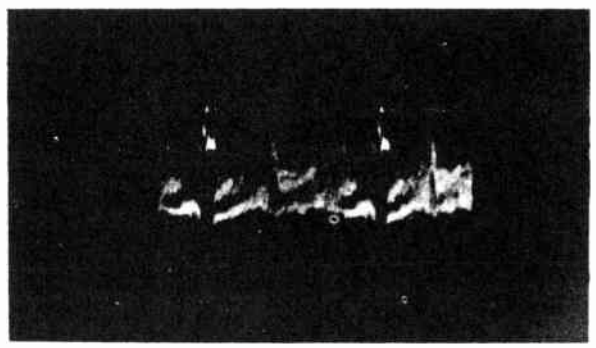
OSCILLOSCOPE WAVEFORM PATTERNS

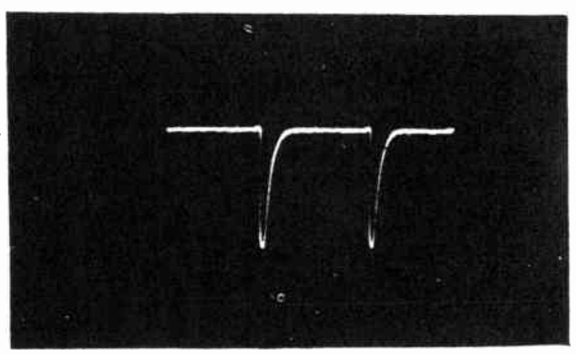
These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.

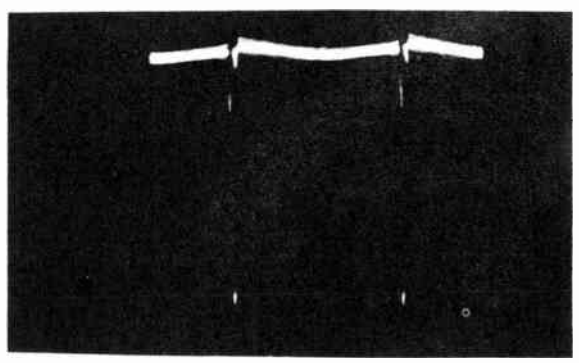

TP2-787
Figure 10. Video Detector Output, Pin 2 of J200
2 volts, 60 c.p.s.

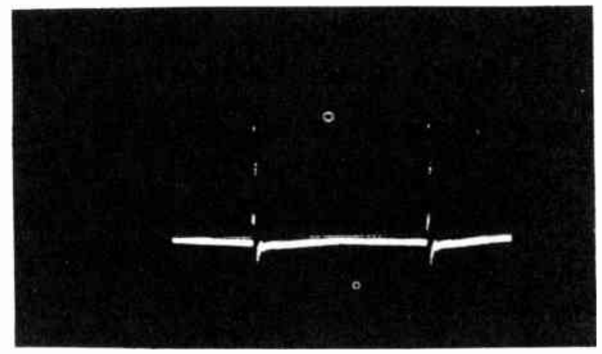

TP2-786
Figure 11. Video Detector Output, Pin 2 of J200
2 volts, 15,750 c.p.s.

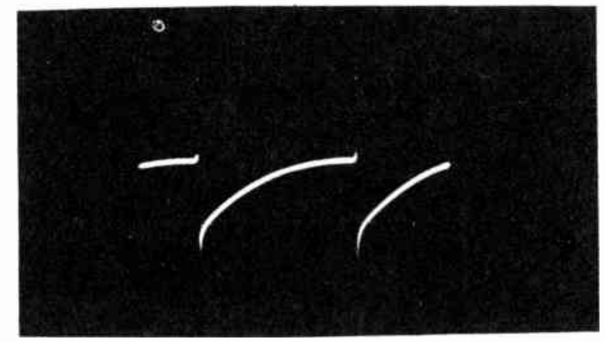

TP2-788
Figure 12. Video Amplifier Plate, Pin 5
50 volts, 60 c.p.s.

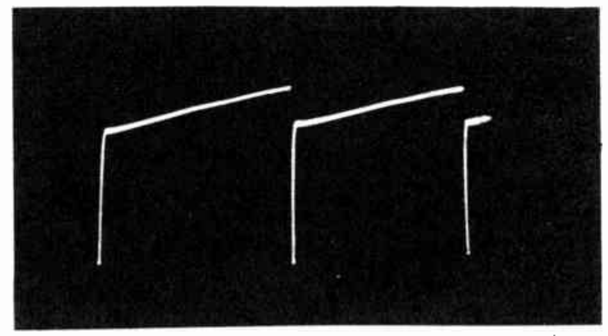

TP2-790
Figure 13. Sync Separator Grid, Pin 7
40 volts, 60 c.p.s.

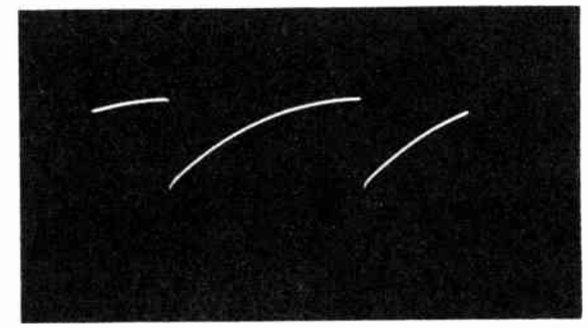

TP2-792
Figure 14. Sync Separator Plate, Pin 5
26 volts, 15,750 c.p.s.

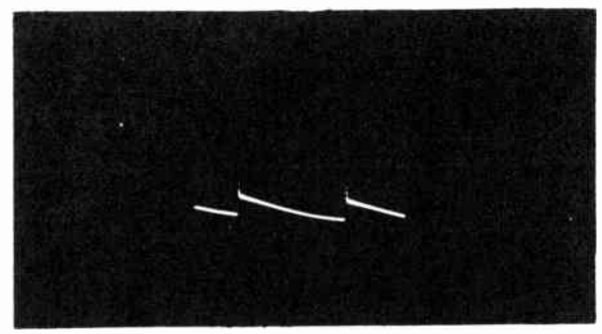

TP2-639
Figure 15 Phase-Splitter Grid, Pin 2
21 volts, 60 c.p.s.

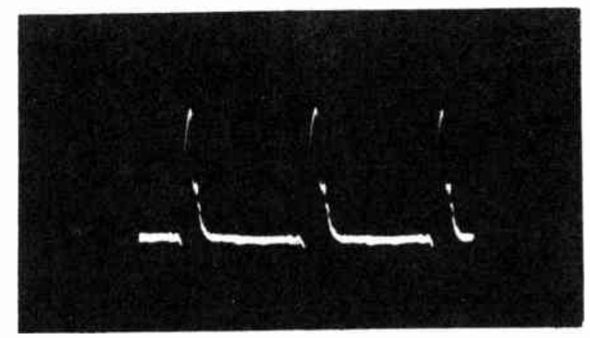

TP2-640
Figure 16. Phase-Splitter Plate, Pin 1
34 volts, 60 c.p.s.

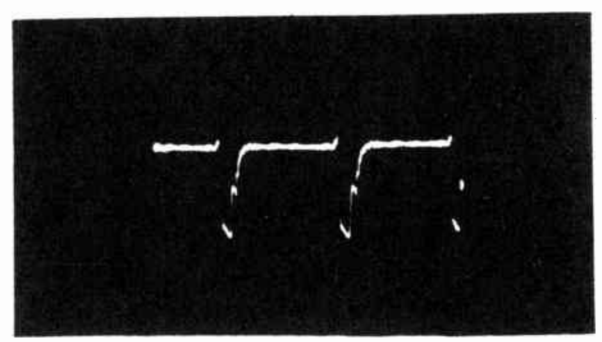

TP2-643
Figure 17. Vertical-Oscillator Grid, Pin 7
85 volts, 60 c.p.s.

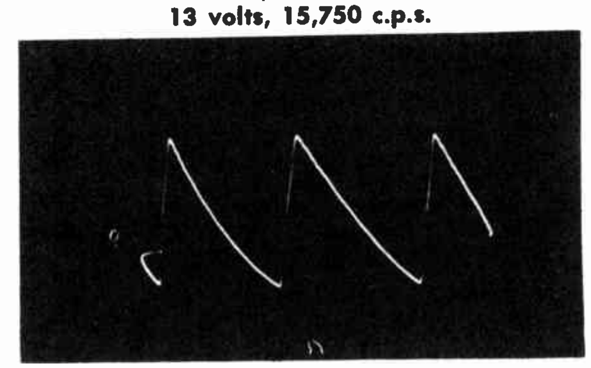

TP2-697
Figure 18. Vertical-Oscillator Plate, Pin 6
50 volts, 60 c.p.s.

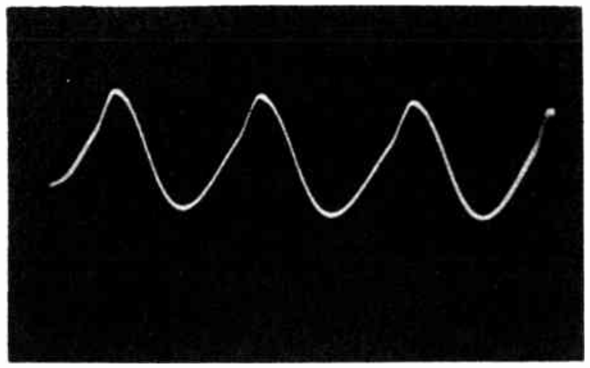

TP3-2472
Figure 19. Vertical-Output Grid, Pin 5
24 volts, 60 c.p.s.


TP2-645
Figure 20. Vertical-Output Plate, Plate Cap
1200 volts, 60 c.p.s.


TP2-641
Figure 21. Phase-Splitter Plate, Junction of R614, R615, and C800
13 volts, 15,750 c.p.s.

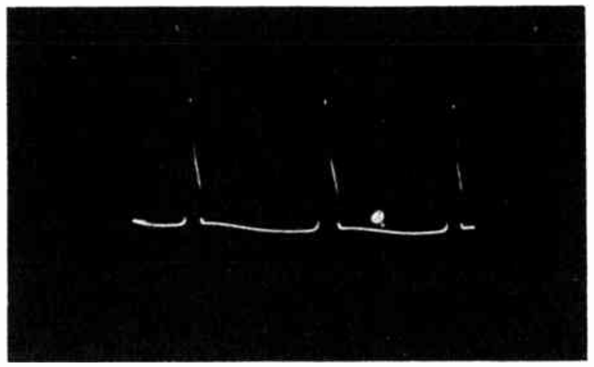

TP2-642
Figure 22. Phase-Splitter Cathode, Pin 3
11 volts, 15,750 c.p.s.


TP2-652
Figure 23. Phase Comparer, Pins 1 and 2
6 volts, 15,750 c.p.s.



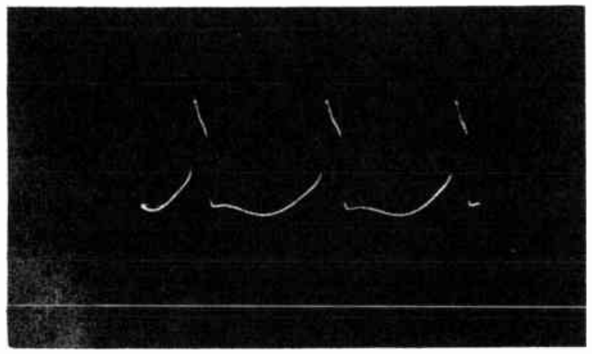
TP2-2852

Figure 24. Horizontal Oscillator, Junction G800 Test Point
26 volts, 15,750 c.p.s.



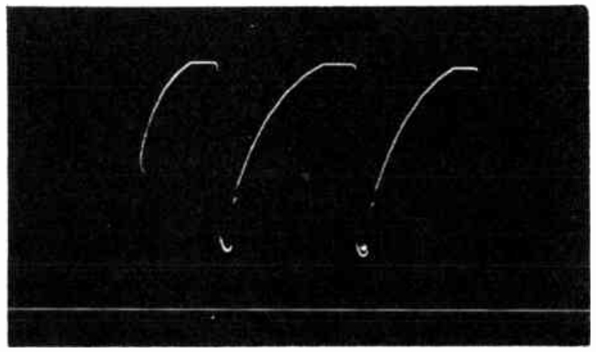
TP2-647

Figure 25. Horizontal-Oscillator Cathode, Pins 3 and 8
16 volts, 15,750 c.p.s.



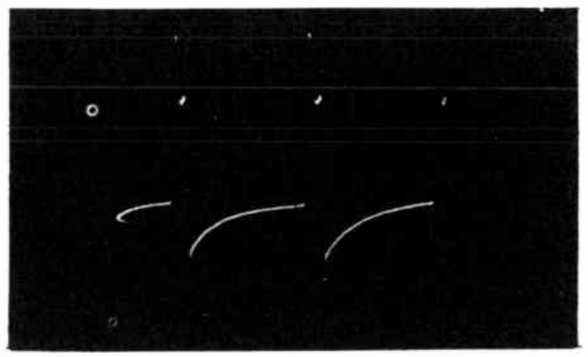
TP2-648

Figure 26. Horizontal-Oscillator Grid, Pin 2
45 volts, 15,750 c.p.s.



TP2-649

Figure 27. Horizontal-Output Grid, Pin 5
120 volts, 15,750 c.p.s.



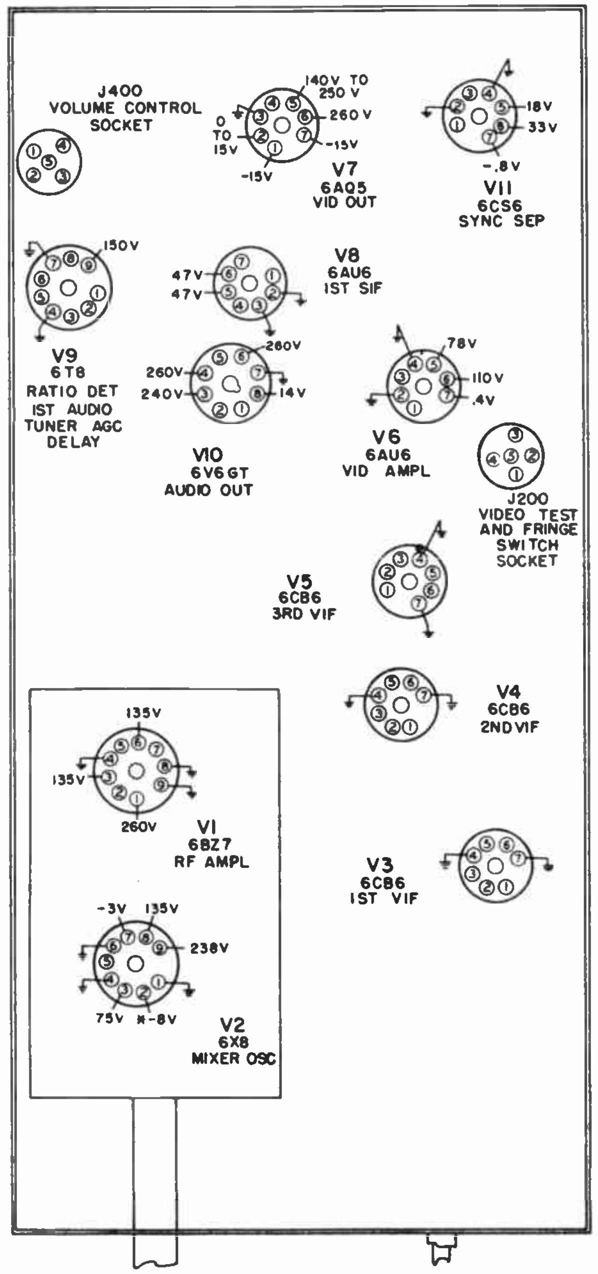
TP2-650

Figure 28. Horizontal-Deflection Yoke, Pin 5 of J800
4100 volts, 15,750 c.p.s.
*** See CAUTION.**

*** CAUTION:** High-voltage pulses are present in the horizontal-output circuit. The waveform in figure 28 was taken with the alligator clip of the oscilloscope lead clipped over the insulation of the lead connected to pin 7 of J800. (To prevent puncture of the insulation of the lead, file off the teeth of the alligator clip, and wrap friction tape around the clip.) Connection to other points in the horizontal-output circuit is dangerous, because of the high voltages present. The peak-to-peak voltage shown for figure 28 is the actual voltage present; however, the amplitude of the scope presentation depends upon the degree of coupling.

VOLTAGE MEASUREMENTS

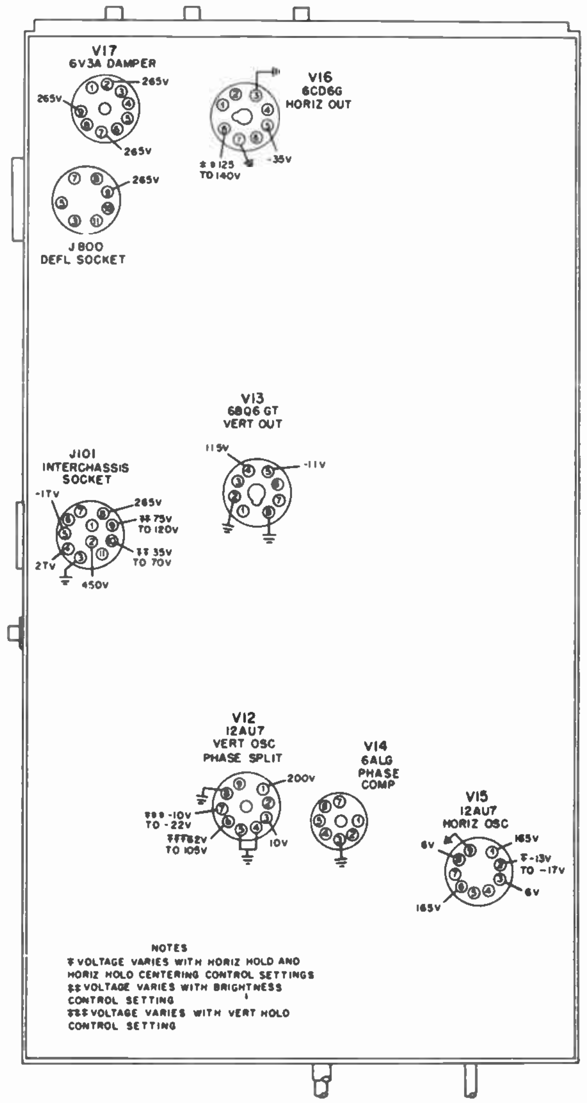
The voltages given here and on the schematics were taken with a 20,000-ohms-per-volt voltmeter, with a line voltage of 117 volts, and no signal input to the receiver. Since voltage readings taken in the video i-f stages vary widely with different test equipment setups, voltage measurements for these stages are omitted from the diagrams.



* VOLTAGE MEASURED WITH 47,000 OHM ISOLATING RESISTOR IN SERIES WITH METER PROBE

TP3-906

Figure 29. R-F Chassis R-191, Bottom View, Showing Voltages at Socket Pins



‡‡ VOLTAGE VARIES WITH HORIZ HOLD CONTROL SETTING
‡‡‡ VOLTAGE VARIES WITH VERT HOLD CONTROL SETTING

TP3-1885

Figure 30. Deflection Chassis D-197, Showing Voltages at Socket Pins

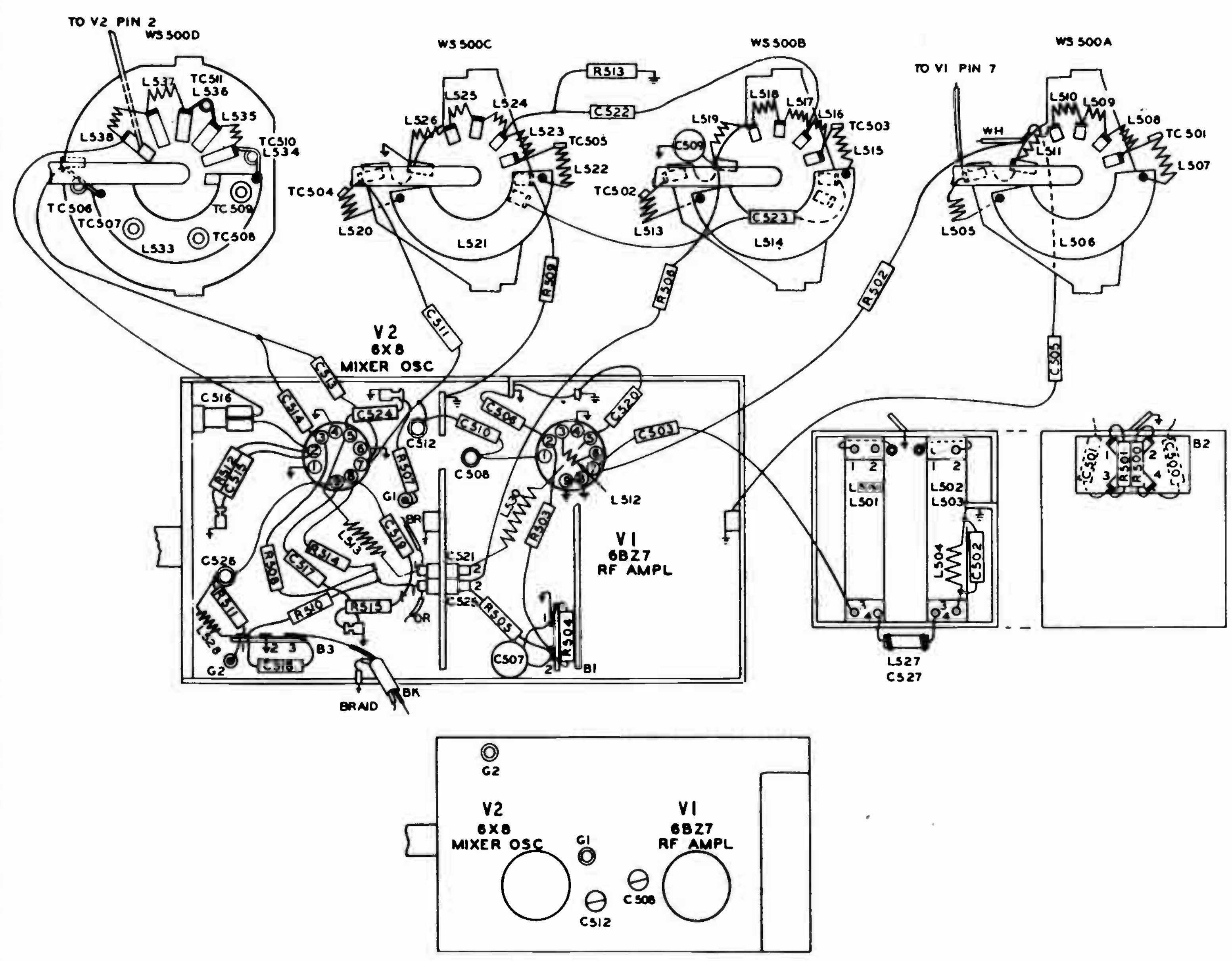


Figure 31. Television (VHF) Tuner, Part No. 76-8400, Base Layout

TP3-908

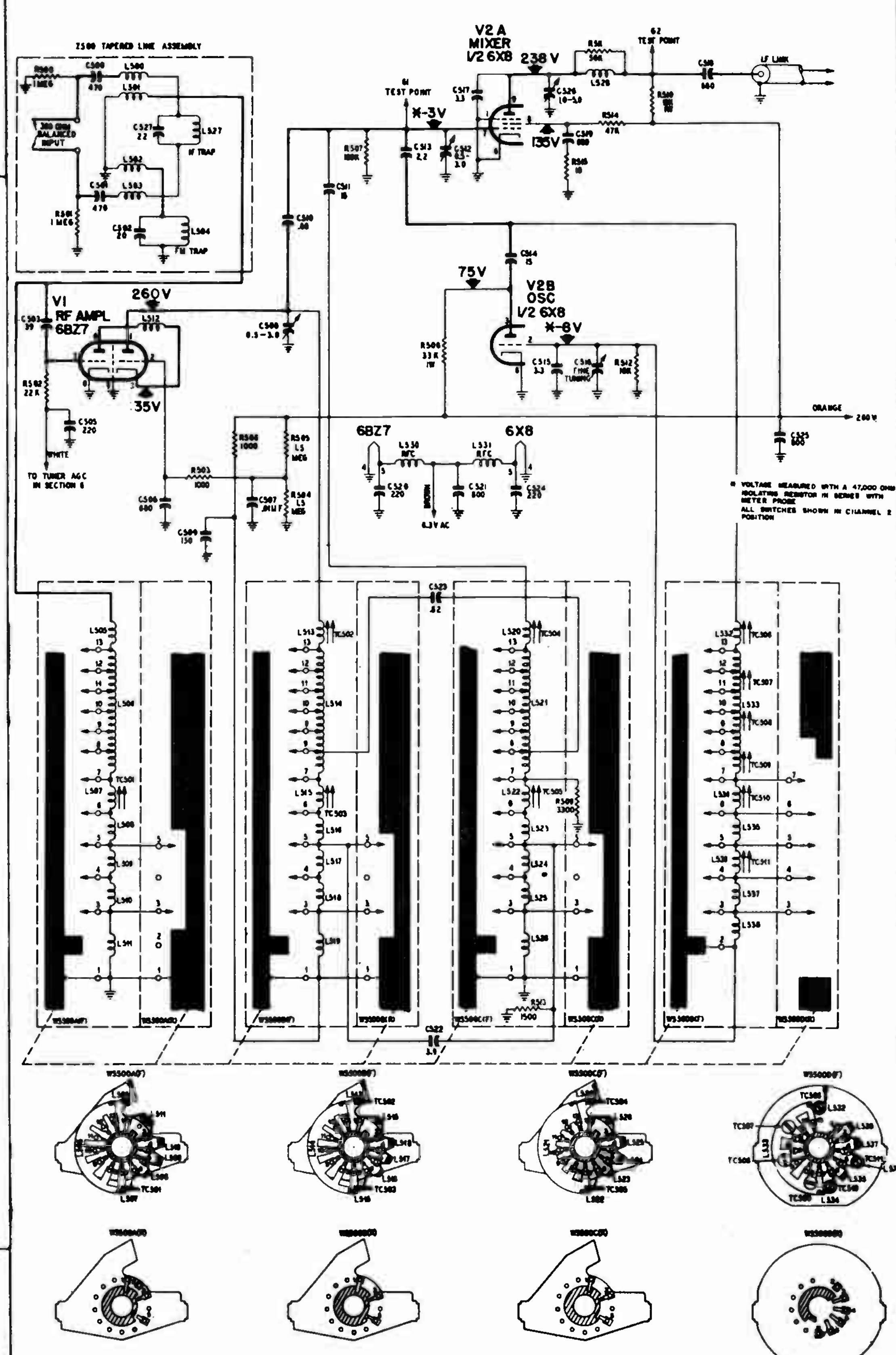
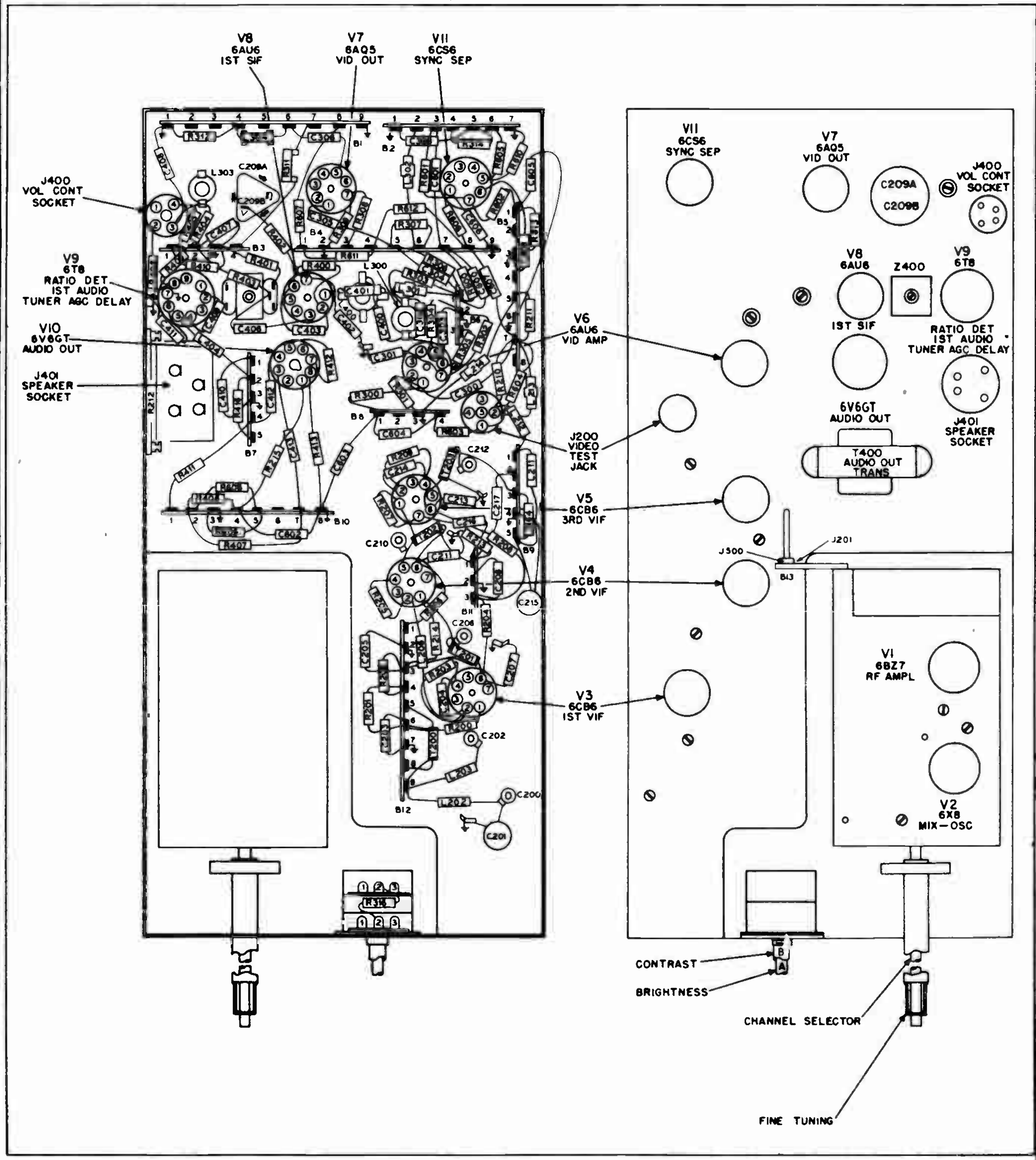


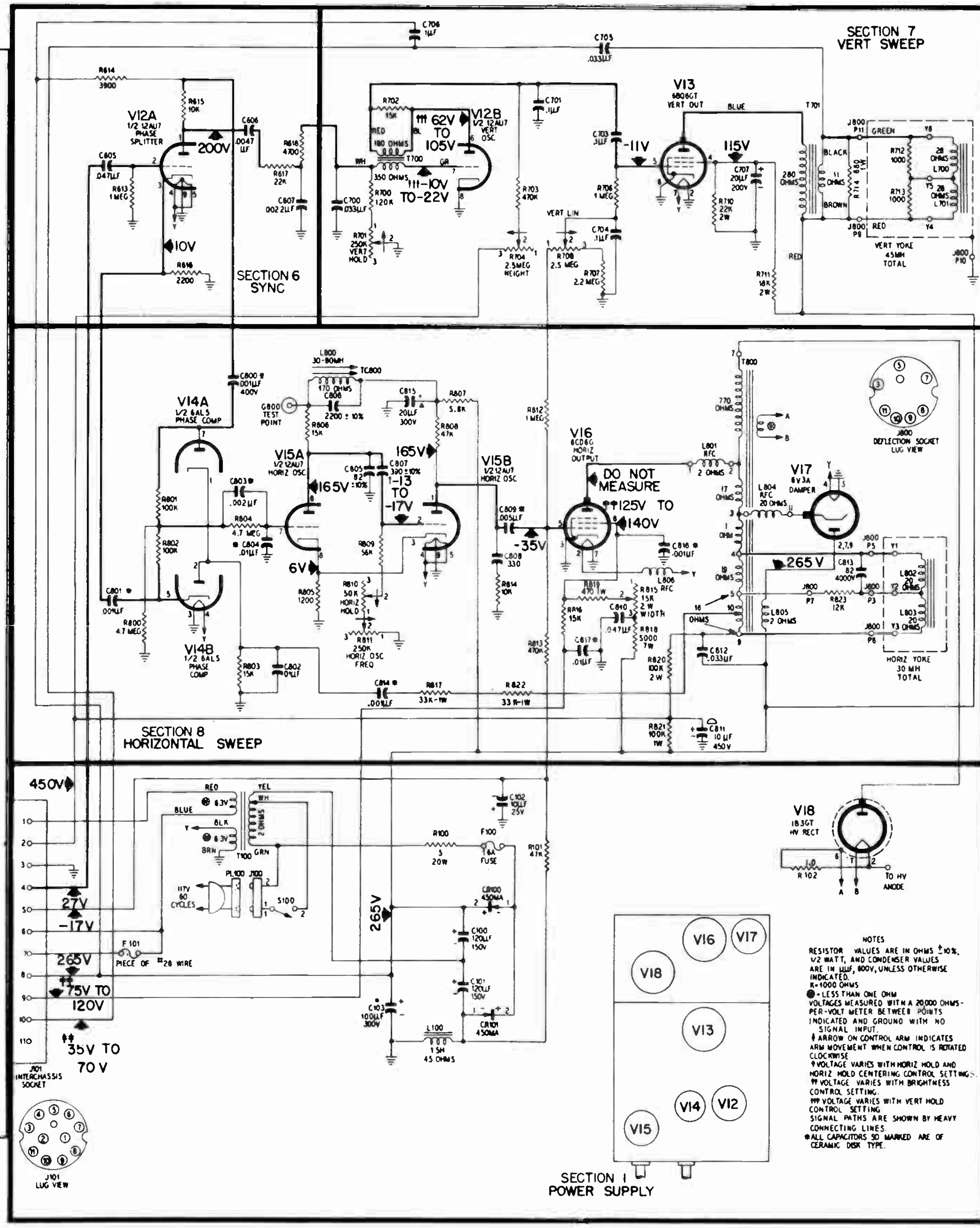
Figure 32. Television (VHF) Tuner, Part No. 76-8400, Schematic Diagram

TP3-909



TP3-910

Figure 33. R-F Chassis R-191, Base Layout



TP3-1886

Figure 35. Deflection Chassis D-197, Schematic Diagram

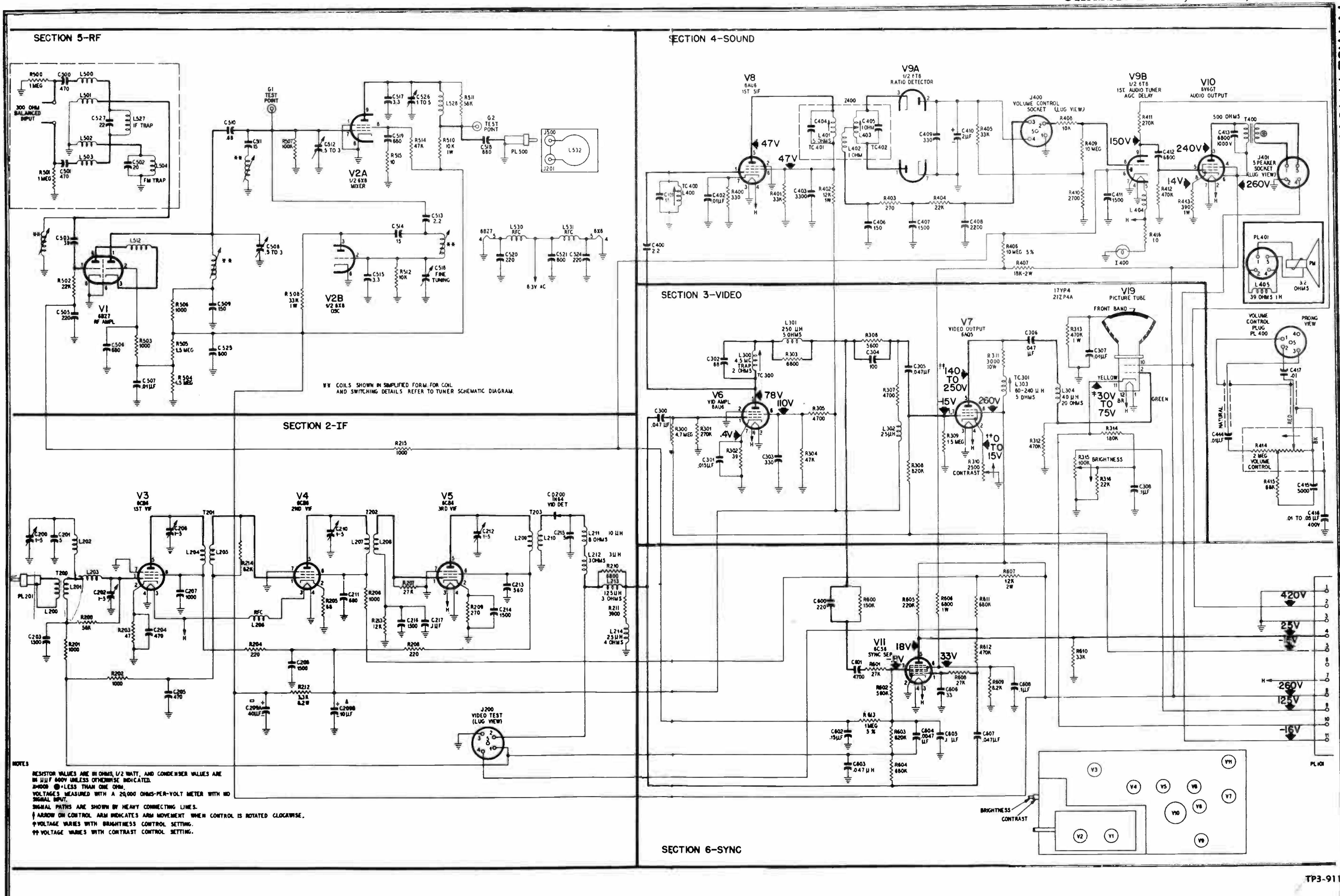


Figure 34. R-F Chassis R-191, Schematic Diagram

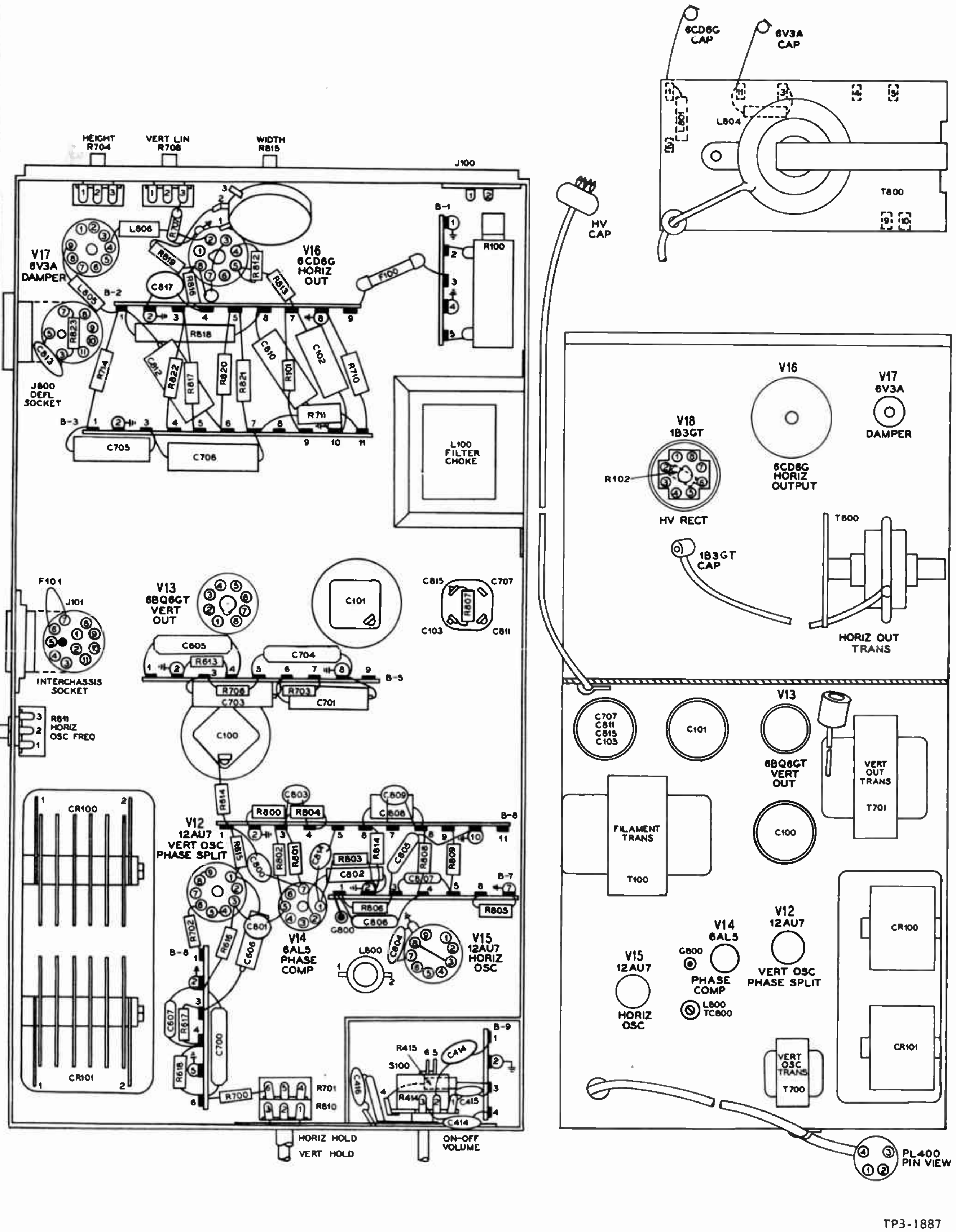


Figure 36. Deflection Chassis D-197, Base Layout

UHF TUNER-ADAPTER UT22, PART NO. 43-6703, FOR RECEIVERS USING R-F CHASSIS R-191

UHF Tuner-Adapter UT22, Part No. 43-6703, will provide for the reception of UHF Channels 14 through 83. It is designed for installation in Philco B line television receivers, and is installed on all BU models. These receivers use r-f chassis R-191.

The Tuner-Adapter consists of a UHF tuner, a change-over switch, adapter cables and plugs, a planetary tuner driving assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The incoming UHF signal is coupled through the antenna input line to blocking condensers C1 and C2, leakage resistors R8 and R9, an i-f trap, C5-L1, C6-L2, and a 150-ohm transmission line, to the antenna tank of the tuner. See figure 37. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the correct frequency; this is accomplished by tuning condensers C3A, C3B, C3C, and C3D. These condensers, plus C3E and C3F, located in the oscillator tank circuit, form the manual tuning gang.

The signal is then fed to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and its associated circuit. The frequency of oscillation is maintained at 45.75 mc. above the signal frequency in the antenna and mixer tank, in order to effect a 45.75-mc. video carrier intermediate frequency when the two signals are subsequently mixed in the crystal mixer tank.

The output signal from this local oscillator is introduced into the crystal mixer circuit through a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. These four printed inductances, in addition to C7, form the mixer board assembly. The signal is fed into a 6BQ7 preamplifier stage, then to the video i-f circuits, and through the UHF change-over switch, by means of a coaxial connection. On VHF operation, a 150,000-ohm resistor is placed in series with the UHF oscillator plate, rendering this oscillator inoperative.

The two tanks of the UHF tuner, the antenna tank and the mixer tank, are used to prevent the i-f signal from feeding back to the antenna and interfering with other receivers. These two tanks pass incoming signals very readily, but do not pass the i-f signal.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the Channel Selector of the VHF tuner is turned to the UHF position, the change-over switch makes proper connection for UHF operation. In this position, the switch places a 150,000-ohm resistor in series with the VHF B-plus lead, which drops the B-plus voltage applied to the VHF tuner. The antenna is connected to the UHF tuner, the VHF pilot light is turned off, and the UHF pilot lights are turned on; the output of the UHF tuner is connected to the video i-f input circuit.

When the VHF Channel Selector is turned to any VHF position, the change-over switch places a 150,000-ohm resistor in series with the UHF local-oscillator plate circuit, which drops the voltage applied to the plate, and disables the oscillator. The switch also connects the antenna to the VHF tuner, turns off the UHF pilot lights, and turns on the VHF pilot light.

ADAPTER CABLES AND PLUGS

The adapter plugs shown in the schematic diagram are not used in factory-installed units; the cables are wired directly into the chassis at the proper places. The plugs are used only in field-installed units. (Refer to the installation instructions for the proper method of inserting and connecting all plugs and cables.)

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is constructed so that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three steel balls, which form a planetary drive that produces a slow rotation for fine tuning. See figure 38. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direction of the rotation. The dial pointer

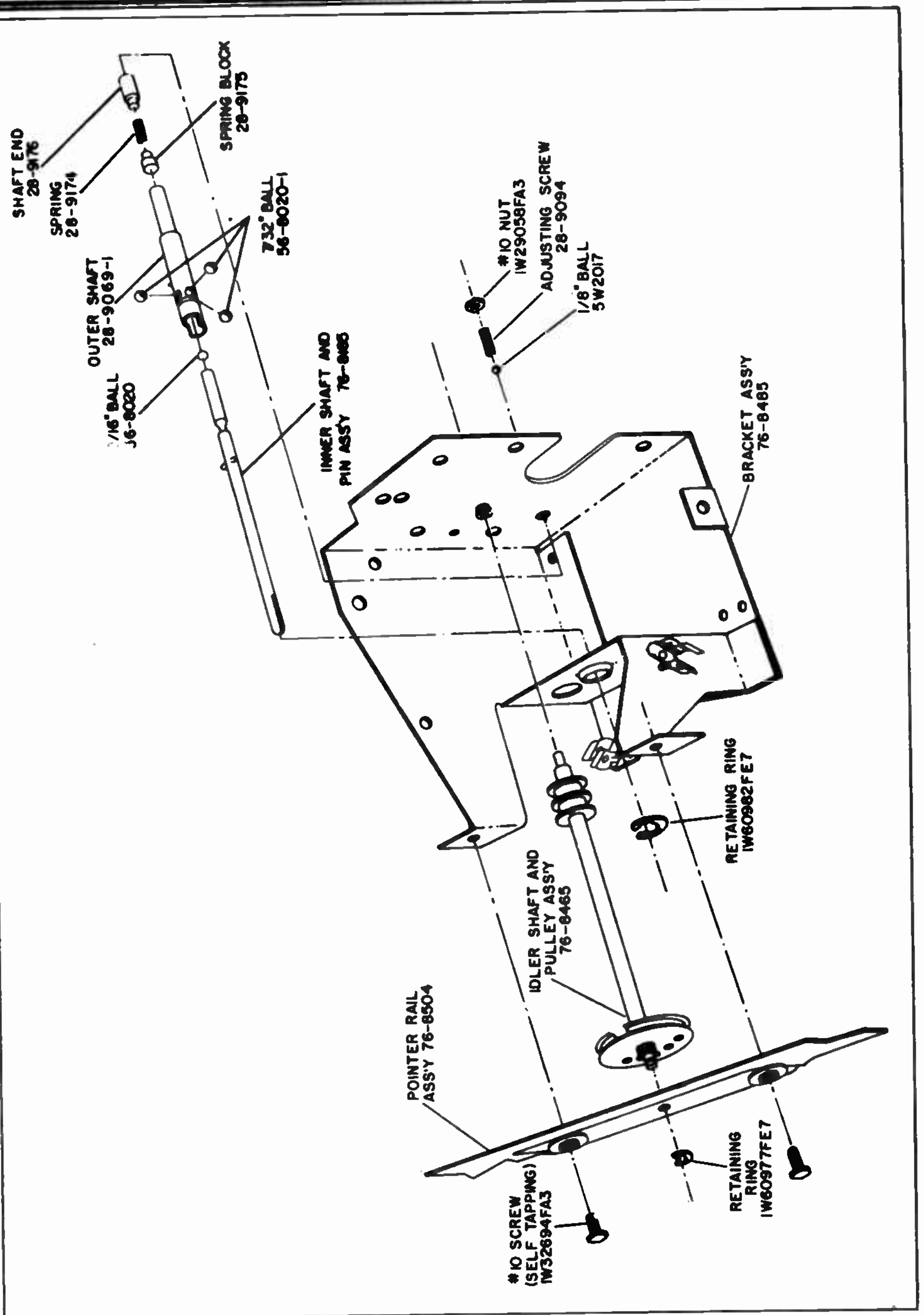


Figure 38. Planetary Assembly, Exploded View, Showing Mechanical Layout

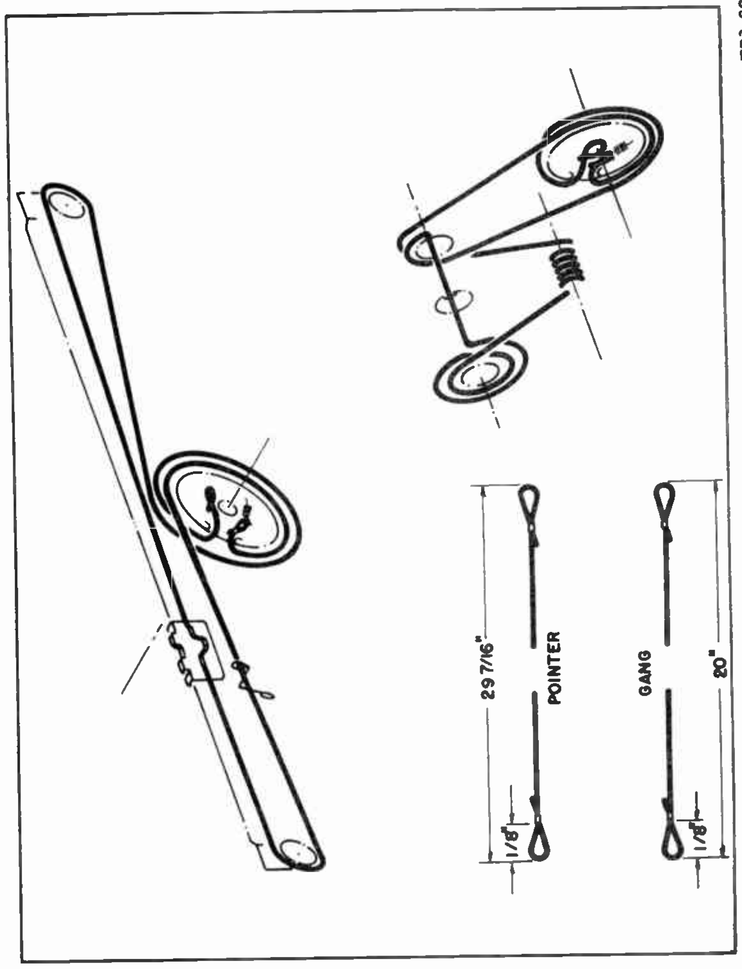


Figure 39. Drive-Cord Stringing Arrangement

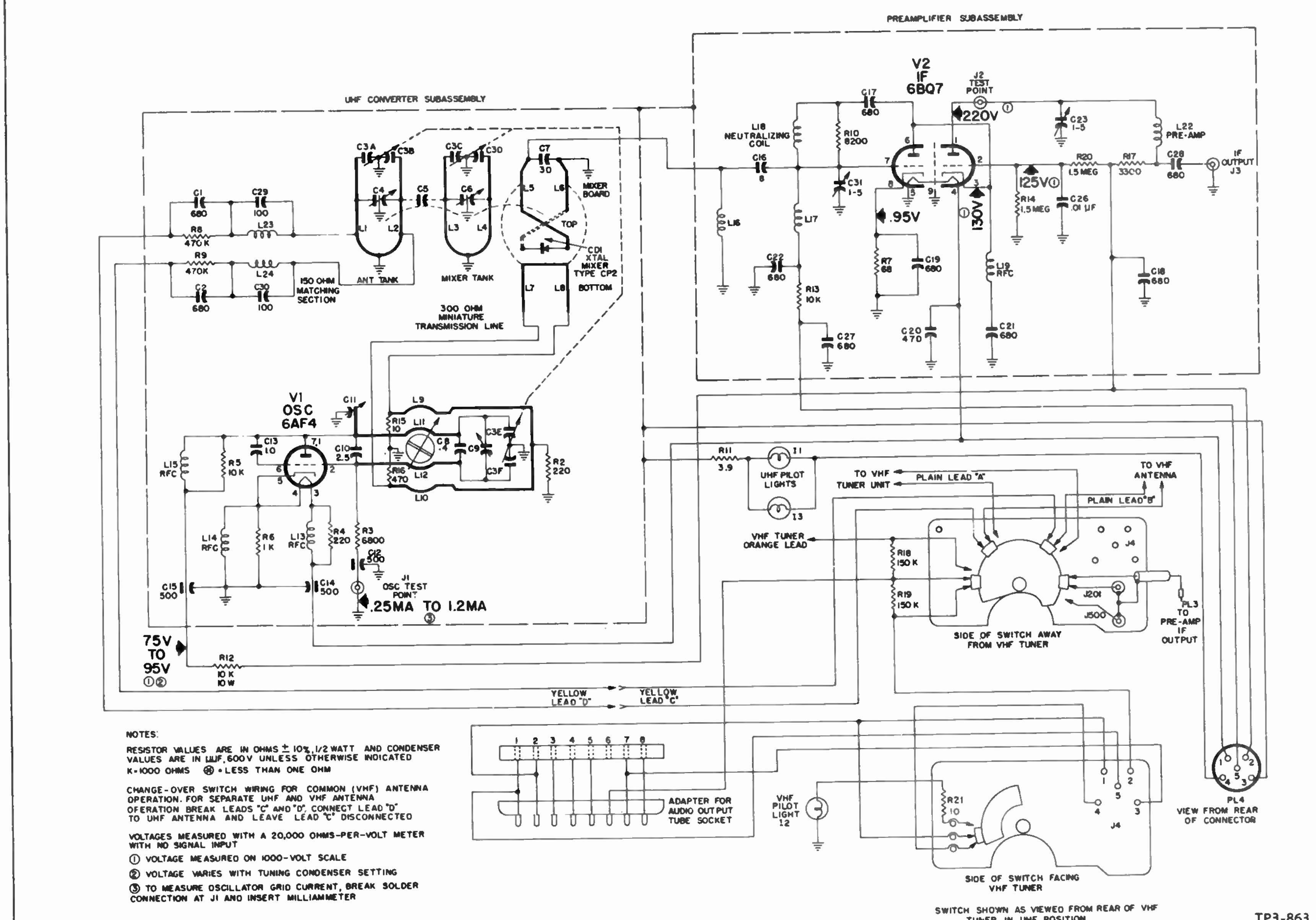
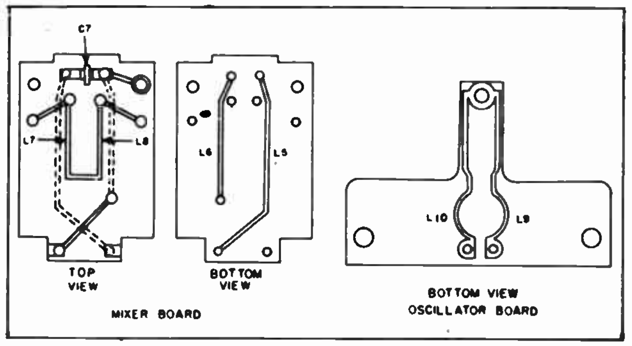
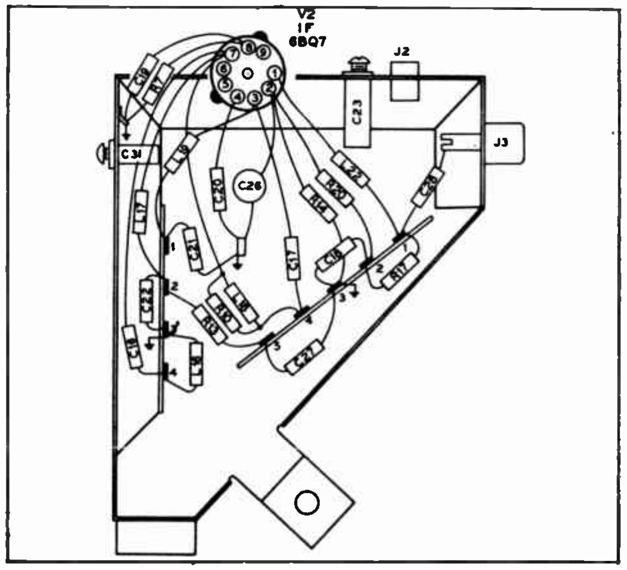


Figure 37. Philco UHF Tuner-Adapter UT22, Part No. 43-6703, Schematic Diagram



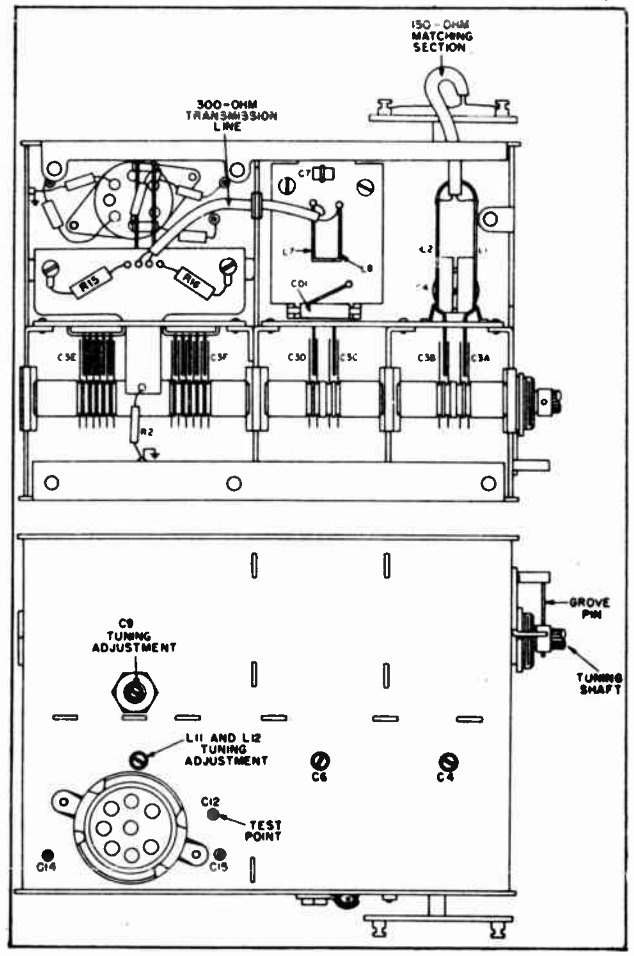
TP2-3175

Figure 40. Oscillator and Mixer Board Layouts



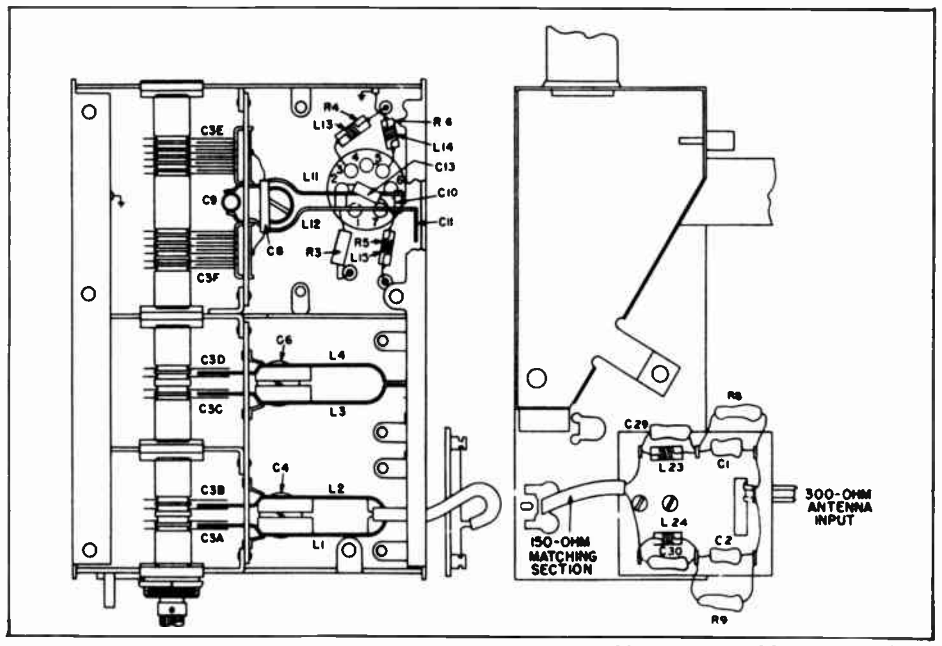
TP3-883

Figure 41. Base View of Preamplifier Assembly of UHF Tuner-Adapter UT22, Part No. 43-6703



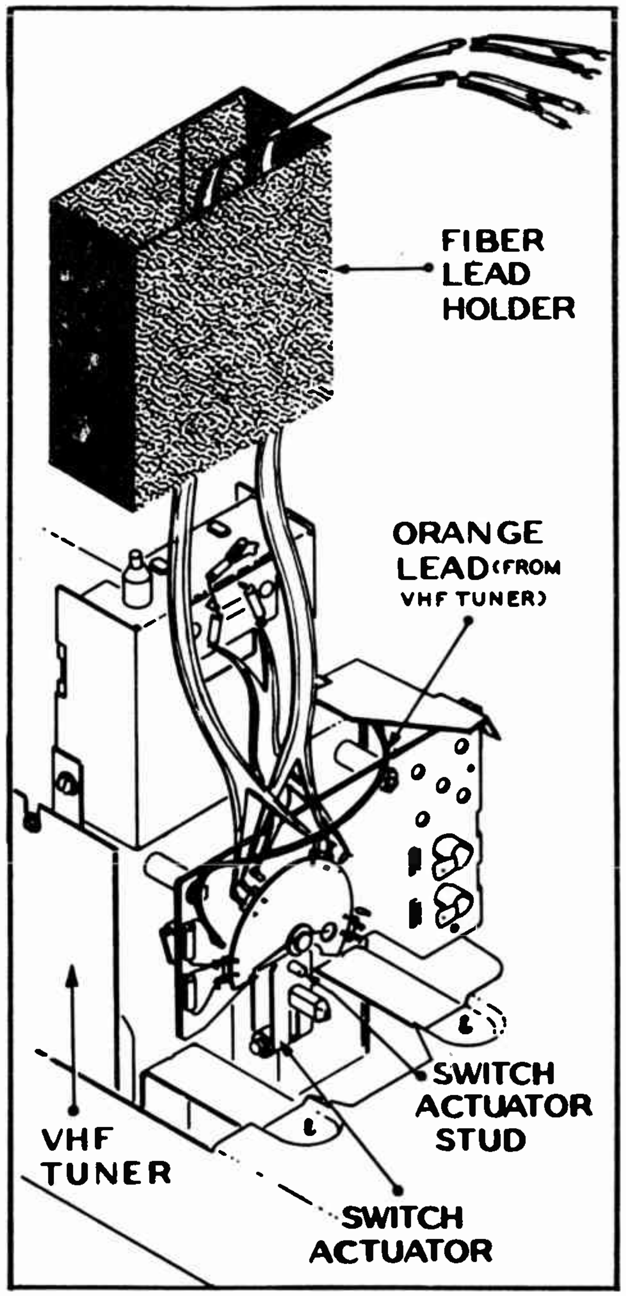
TP3-895

Figure 43. Top View and Base View of UHF Tuner-Adapter UT22, Part No. 43-6703, With Board Assemblies



TP3-896

Figure 42. Side View and Base View of UHF Tuner-Adapter UT22, Part No. 43-6703, Without Board Assemblies



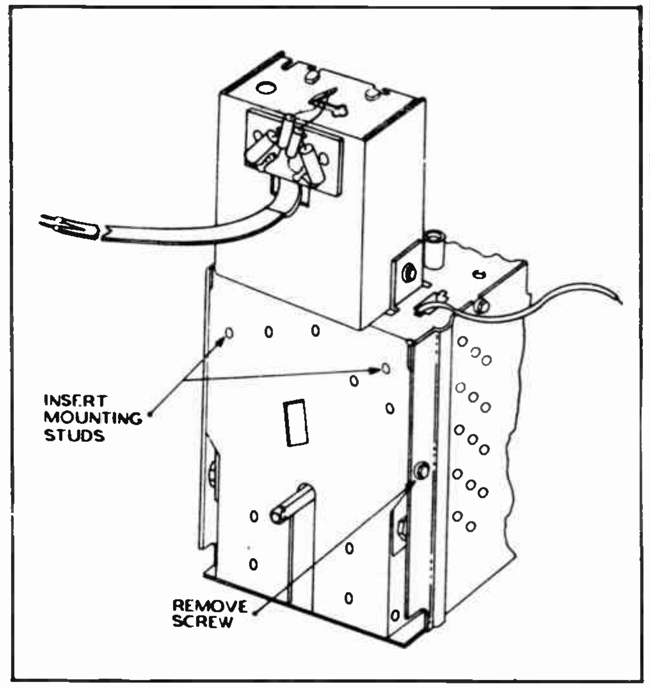
TP3-760

Figure 44. Change-Over Switch, Switch Actuator, and Lead-Dress Details

is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The



TP3-793

Figure 45. Rear View of VHF Tuner

Tuner-Adapter should be returned to the factory for alignment or major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is not to remove the cover of the Tuner-Adapter, unless so equipped.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, try a number of tubes until one is found that will provide the most satisfactory performance.

INSTALLATION INSTRUCTIONS

To install the UHF Tuner-Adapter on the r-f chassis, proceed as follows:

1. Remove the cabinet back and r-f chassis from the cabinet; then remove the nameplate on the control panel by pushing it out from inside the cabinet.
2. Insert the dial scale and bezel assembly into the hole provided in the cabinet. Fasten the assembly in place with the two nuts provided.
3. Remove the UHF tuner assembly from the mounting board with which it was shipped. Keep the three screws for mounting the tuner in the cabinet.
4. Remove the coaxial cables from the two sockets at the side of the VHF tuner. Remove the bracket and socket assembly (J500 and J201) from the back of the VHF tuner, and discard them.
5. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner so that the switch-actuator stud points away from the tuner. See figure 44. Place the spacers on the mounting studs

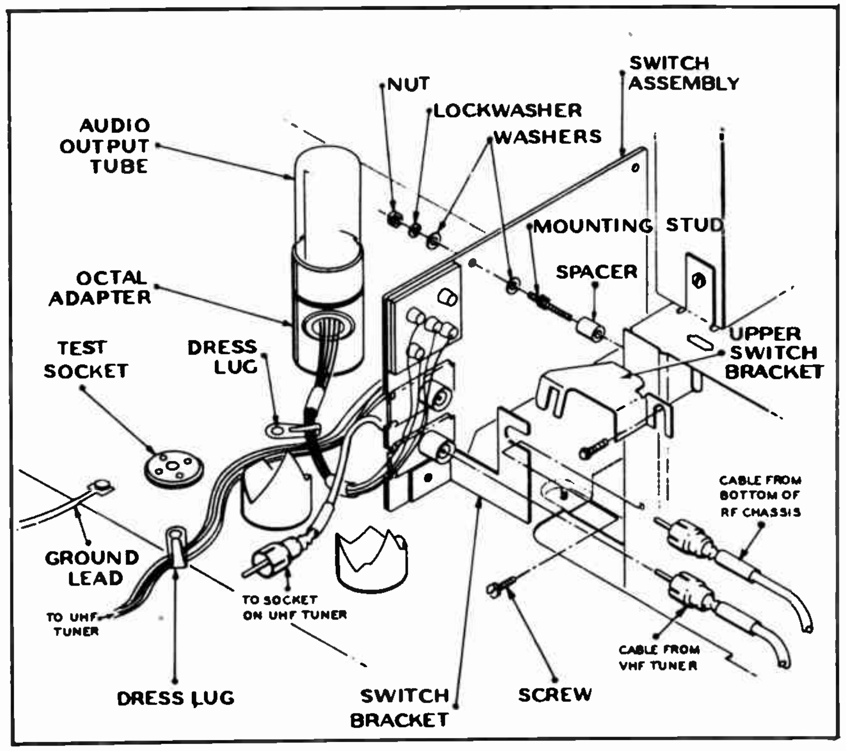


Figure 46. Change-Over Switch Mounting Details and Lead-Dress Details

and attach to the rear of the VHF tuner on the r-f chassis. See figure 45.

6. Remove the screw on the side of the VHF tuner, as shown in figure 41. Place the switch assembly on the two mounting studs, and fasten it in place with the flat washers, lock washers, and nuts provided. See figure 46. Fasten the upper switch bracket in place as shown in figure 46.

7. Put the VHF Channel Selector in the Channel 2 position. Rotate the switch actuator clockwise (as viewed from the rear of the VHF tuner) on the tuner shaft until the actuator touches the fiber cam on the change-over switch. Fasten the switch actuator in this position. Rotate the Channel Selector to the UHF position. Check the switch operation to make sure that the switch is thrown properly. Rotate the Channel Selector to Channel 13 position and check the switch operation to make sure that the switch is not thrown in this position. Fasten the lower switch bracket to the side of the VHF tuner with the screw removed in step 6. Lubricate the switch-actuator stud and switch cam with cup grease.

8. Remove the audio-output tube from its socket, and insert the adapter plug into the socket. Insert the tube into the adapter. See figure 46.

9. Insert the coaxial cable from the VHF tuner into the bottom socket on the change-over switch. Insert the coaxial cable from the r-f chassis into the top socket on the switch. See figure 46.

10. Pull the orange lead from the VHF tuner up out of the r-f chassis, and cut it off at the point where it comes through the chassis. Skin the orange lead attached to the VHF tuner, and solder it to the lug on the change-over switch, as shown in figure 44.

CAUTION: The orange lead supplies B plus to the VHF tuner. Tape the loose end to prevent shorting to the chassis.

11. Remove the pilot lamp from the r-f chassis pilot-light socket. Cut the pilot-light lead from the r-f chassis where it passes through the chassis, and discard the socket and lead. Tape up the lead to prevent the possibility of a short circuit. Mount the new pilot-light socket from the change-over switch with the drive screw provided, as shown in figure 47. Insert the pilot light in the socket, and install the shield provided over it.

12. Remove the antenna lead from the VHF tuner, and solder the short lead from the UHF-VHF change-over switch to the VHF tuner terminals from which the antenna lead was removed. Slide the folded fiber lead holder over the tapered-line coil assembly on the VHF tuner, and dress the twin-wire antenna leads through the holder. See figure 44. The fiber holder will prevent the twin-wire leads from touching the tubes on the r-f chassis.

13. Place the UHF tuner in the cabinet between the r-f and deflection chassis, and fasten the UHF

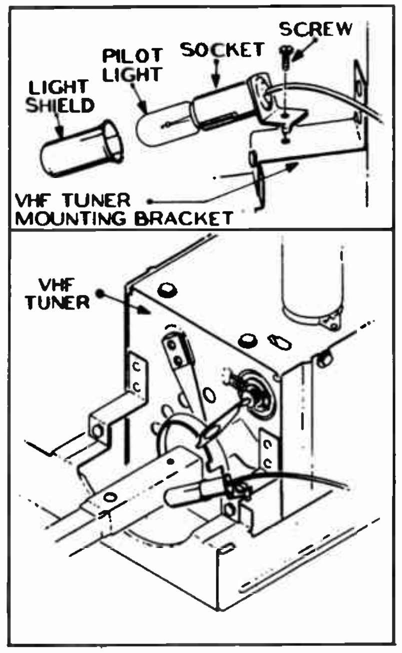


Figure 47. Pilot Light Mounting Details

tuner to the chassis shelf with the three screws removed in step 3. It is important that these screws be tightened securely, so as to hold the UHF tuner in place on the chassis shelf. Turn the UHF tuning shaft to its extreme counterclockwise position, and check the pointer position on the scale. The pointer should be positioned just below the Channel 14 mark on the scale. If the pointer is not properly positioned, loosen the three mounting bolts and move the UHF tuner

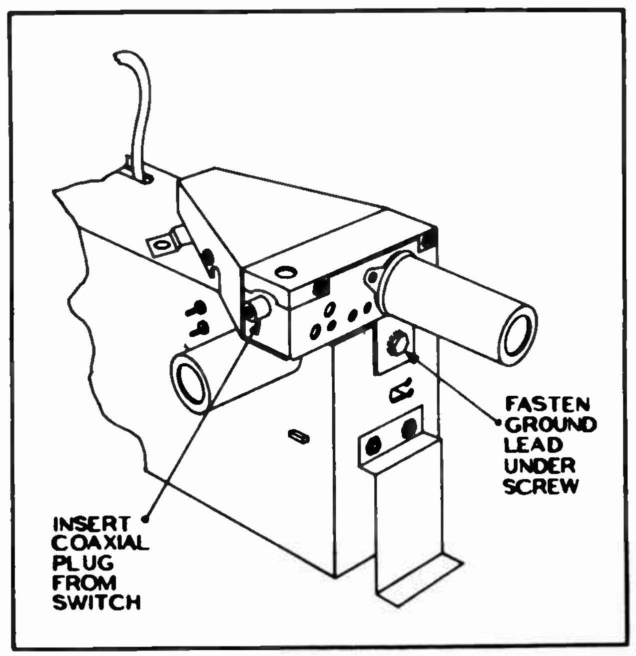


Figure 48. UHF Tuner, Showing Location of Ground Lead and Coaxial Socket

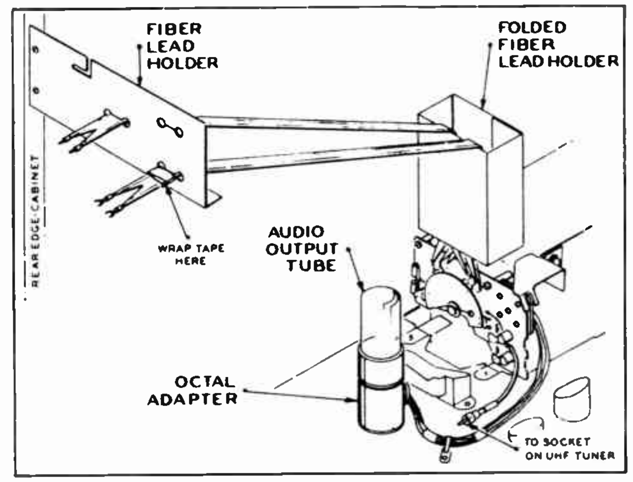


Figure 49. Rear View of VHF Tuner, Showing Lead Dress

assembly to properly position the pointer; then fasten the assembly with the three mounting screws.

14. Fasten the ground lead and the dress lugs to the r-f chassis with drive screws. See figure 46. Install the chassis in the cabinet, and fasten the ground strap under the screw on the UHF tuner as shown in figure 48. Fasten the r-f chassis with the original mounting bolts. Place the original knobs on their shafts, and the felt washer and knob supplied on the UHF tuning shaft.

15. Insert the coaxial plug from the change-over switch into the socket on the UHF tuner. See figure 48. Insert the 5-pin plug from the UHF tuner into the socket on the bracket at the rear of the VHF tuner. Dress the leads under the dress lug as shown in figure 46.

16. Replace the fiber antenna-lead holder with the new holder provided. Fasten the new holder with the nails provided (or screws for metal cabinets), and then pass the twin-wire leads through the holes as shown in figures 49 and 50. Pull the leads through

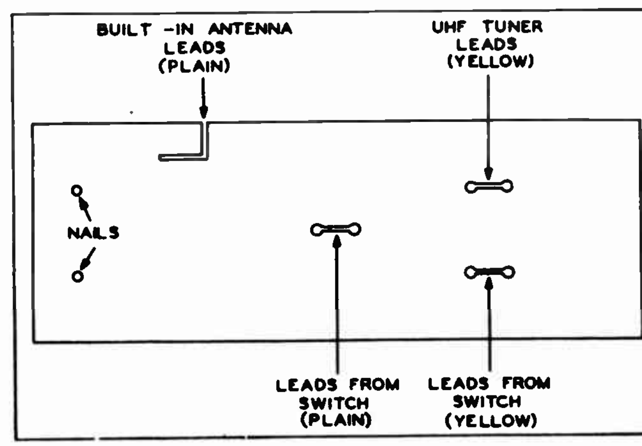
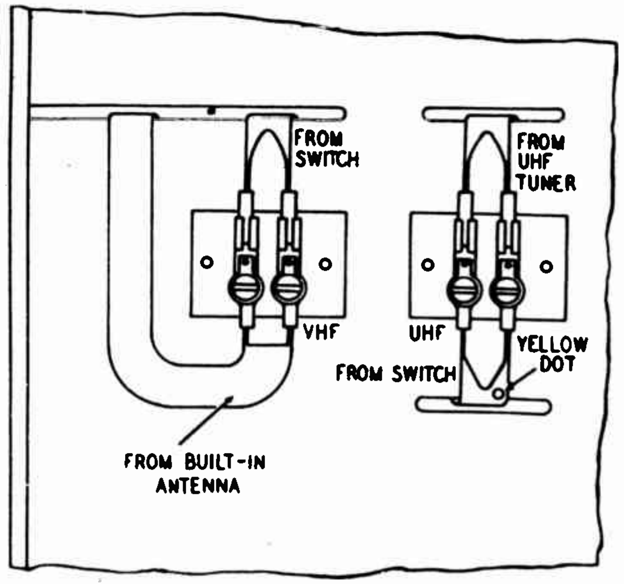


Figure 50. Antenna-Lead Holder



TP2-3170-1

Figure 51. Antenna-Lead Connections, Common Built-In Antenna

the holder until they are tight, making certain that the leads do not contact the tubes or the chassis. Wrap tape around the yellow-marked twin-wire leads with the spade-lug ends, to prevent the leads from passing back through the fiber holder..

17. Fasten the antenna terminal board provided as shown in the illustrations above (figures 51 to 55). Replace the cabinet back, and make the connections as illustrated, according to the type of antenna installation being used.

18. Paste the label provided over the outside-antenna instructions on the cabinet back.

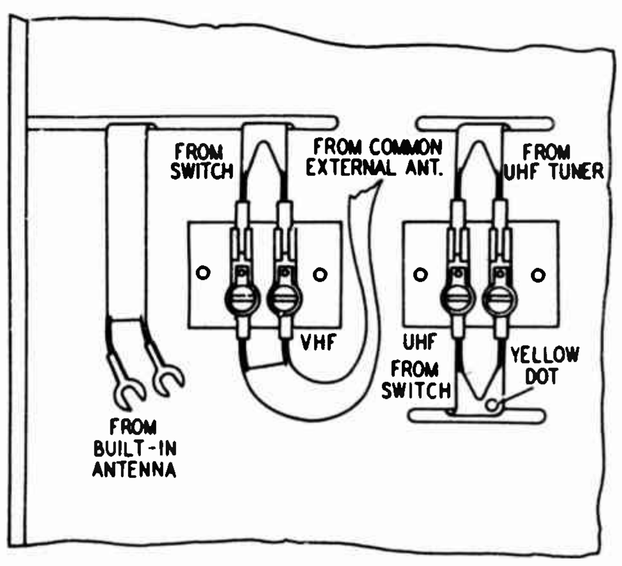


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Figure 52. Antenna-Lead Connections, Common External Antenna

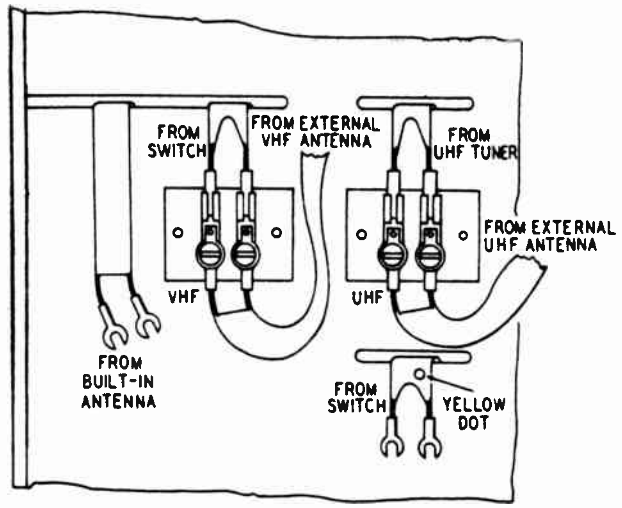

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Figure 53. Antenna-Lead Connections, Separate External Antennas

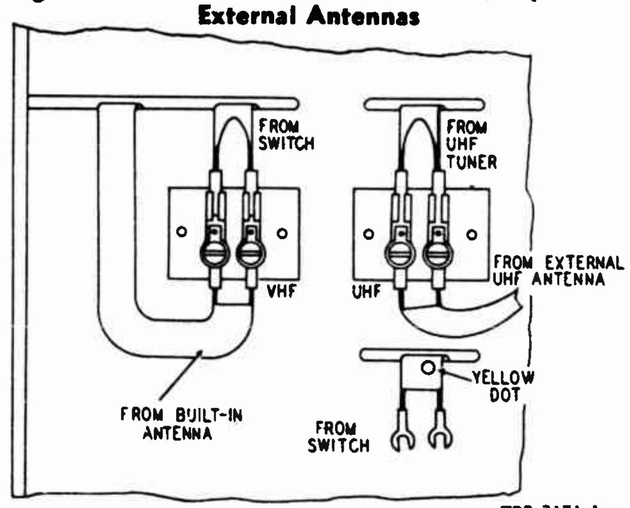

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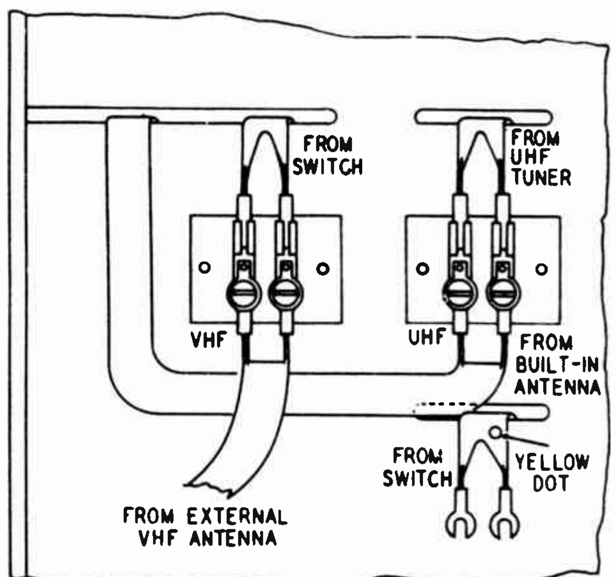
Figure 54. Antenna-Lead Connections, VHF Built-In and UHF External Antennas



TP2-3173-1

Figure 55. Antenna-Lead Connections, VHF External and UHF Built-In Antennas

PARTS LIST

IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are ½ watt, unless otherwise indicated. Parts are listed according to chassis type, and should be ordered in this way rather than by model number. A list of miscellaneous parts is given at the end of the parts list for each chassis type. All parts are symbolized in the schematic diagram and base layout, for identification purposes.

NOTE: Part numbers identified by an asterisk (*) are gèneral replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation will be unchanged. When ordering replacements, use only the "Service Part No."

DEFLECTION CHASSIS D-197

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condensers, filter, electrolytic, 120 μf., 150v	30-2568-61
C102	Condenser, filter, electrolytic, 10 μf., 25v	45-3035-6
C103	Condenser, filter, electrolytic, 100 μf., 300v	30-2584-7
CR100 and CR101	Rectifiers, selenium, 450 ma. ..	34-8003-8
F100	Fuse, line, 1.6 amperes	AD2248-19
F101	Fuse, filament	Piece of #26 wire
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis, connecting ...	27-6274-1
L100	Choke, filter	32-8600-1
PL100	Plug, a-c line	Part of a-c line cord ass'y. (see Misc. "A")
PL101	Plug and cable ass'y., chassis connecting	(See Misc. "B" in PR-2507)
R100	Resistor, current limiting, 5 ohms, 20 watts	33-3448-18
S100	Switch-off-on	Part of VOLUME control
T100	Transformer, filament	32-8643

SECTION 4—SOUND

Reference Symbol	Description	Service Part No.
R414	Potentiometer, VOLUME control, 2 megohms	33-5564-16

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
C707	Condenser, screen filter, 20 μf., 200v	Part of C103
L700 and L701	Coils, vertical deflection	Part of deflection yoke ass'y. (see Misc. "A")
R701	Potentiometer, VERT. HOLD control, 250,000 ohms	Part of R810
R704	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32

SECTION 7—VERTICAL SWEEP (Cont.)

Reference Symbol	Description	Service Part No.
R708	Potentiometer, VERT. LIN. control, 2.5 megohms	33-5565-32
R710	Resistor, screen divider, 22,000 ohms, 2 watts	66-3225340
R711	Resistor, screen divider, 18,000 ohms, 2 watts	66-3185340
R714	Resistor, vertical damping, 680 ohms, 1 watt	66-1684340
T700	Transformer, vertical oscillator	32-8431-2
T701	Transformer, vertical output..	32-8637

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C805	Condenser, by-pass, 82 μμf. ...	60-00825437
C806	Condenser, ringing, .0022 μf., ±10%	60-20225434
C807	Condenser, d-c blocking, 390 μμf.	60-10395437
C808	Condenser, charging, 330 μμf. .	60-10335417
C811	Condenser, decoupling, 10 μf., 450v	Part of C103
C813	Condenser, anti-ringing, 82 μμf., 4000v	30-1246-4
C815	Condenser, electrolytic, 20 μf., 300v	Part of C103
J800	Socket, deflection	27-6274-8
J801	Socket, gate pulse	27-6273
L800	Coil, stabilizing, 30—80 mh. ..	32-4557
L801	Coil, r-f choke, horizontal-output plate	Part of T800
L802 and L803	Coils, horizontal deflection ...	Part of deflection yoke ass'y. (see Misc. "A")
L804	Coil, r-f choke, damper cathode	Part of T800
L805	Coil, r-f choke, damper plate..	32-4112-24
L806	Coil, r-f choke, horiz.-output heater	32-4112-18
PL800	Plug, deflection	Part of cable ass'y. (see Misc. "A")

SECTION 8—HORIZONTAL SWEEP (Cont.)

Reference Symbol	Description	Service Part No.
PL801	Plug, gate pulse	Part of cable ass'y. (see Misc. "B")
R810	Potentiometer, HORIZ. HOLD control, 50,000 ohms	33-5563-57
R811	Potentiometer, HORIZ. OSC. FREQ., 250,000 ohms	33-5565-17
R815	Potentiometer, WIDTH control, 15,000 ohms, 2 watts	33-5546-56
R817 and R822	Resistors, feedback, 33,000 ohms, 1 watt	66-3334340
R818	Resistor, voltage divider, 5000 ohms, 7 watts	33-1335-118
R819	Resistor, horiz.-output screen, 470 ohms, 1 watt	66-1474340
R820	Resistor, boost voltage divider, 100,000 ohms, 2 watts	66-4105340
R821	Resistor, boost voltage divider, 100,000 ohms, 1 watt	66-4104340
T800	Transformer, horizontal output	32-8642-1

MISCELLANEOUS "A"

Arm and magnet ass'y., picture tube (1 used)	76-8474-1
Arm and magnet ass'y., picture tube (2 used)	76-8897
Beam bender	76-6077-4
Cable assembly, high voltage	AD2631
Cable and plug assembly, deflection	41-4146-9
Cable and plug assembly, Volume control	41-4136-5
Clip, tube retaining (6CD6GT)	56-4125FA3
Cord, line	41-3865
Deflection yoke	32-9663-1
Focus assembly	76-8087
Frame assembly	318-3489
Insulator, rear control panel (2 used)	54-8814
Insulator, front controls	54-8813
Plate cap and lead (1B3GT)	76-8166
Shield, corona	56-9684
Socket, high-voltage rectifier	27-6290-2
Socket, miniature, 7-pin	27-6203-12
Socket, miniature, 9-pin	27-6203-6
Socket, octal	27-6174
Socket, horiz. osc. tube (V18)	76-6115-1
Socket, vertical-output tube (V16)	76-6119
Spring, anode lead	28-9137-1

R-F CHASSIS R-191

SECTION 2—VIDEO I.F.

Reference Symbol	Description	Service Part No.
C200	Condenser, trimmer, 1—5 $\mu\mu$f.	31-6520-9
C201	Condenser, trap, 5 $\mu\mu$f.	30-1224-28
C202	Condenser, 1st i-f tuning, 1—5 $\mu\mu$f.	31-6520-9
C204	Condenser, cathode by-pass, 470 $\mu\mu$f.	30-1225-18
C205	Condenser, a-g-c decoupling, 470 $\mu\mu$f.	30-1225-18
C206	Condenser, 1st i-f plate tuning, 1—5 $\mu\mu$f.	31-6520-9
C209	Condenser, electrolytic	30-2584-33
C209A	Condenser, filter, 40 μf., 300v	Part of C209
C209B	Condenser, decoupling, filter, 10 μf., 300v	Part of C209
C210	Condenser, 2nd i-f plate tuning, 1—5 $\mu\mu$f.	31-6520-9
C211	Condenser, screen by-pass, 680 $\mu\mu$f.	62-168001001
C212	Condenser, 3rd i-f plate tuning, 1—5 $\mu\mu$f.	31-6520-9
C213	Condenser, screen by-pass, 560 $\mu\mu$f.	62-156001011
C215	Condenser, detector by-pass, 5 $\mu\mu$f.	30-1224-28
CD200	Crystal, video detector 1N64	34-8022
J200	Socket, video test	27-6273
J201	Socket, tuner to i-f coupling	Part of connector ass'y. (see Misc. "C")
L200 and L201	Coils, tuner coupling	Part of T200
L202	Coil, trap	32-4597-2
L203	Coil, 1st i-f grid	32-4548-12
L204 and L205	Coils, coupling	Part of T201
L206	Coil, filament choke	32-4112-15
L207 and L208	Coils, coupling	Part of T202
L209 and L210	Coils, coupling	Part of T203
L211	Coil, series peaking, 10 μh.	32-4422-27
L212	Coil, series peaking, 3 μh.	
L213	Coil, series peaking, 125 μh.	32-4480-8
L214	Coil, video peaking, 250 μh.	32-4480-4
PL201	Plug, tuner link	Part of cable and plug ass'y. (see Misc. "B")
R212	Resistor, voltage dropping, 3300 ohms, 6.2 watts	33-3446-11
T200	Transformer, video i-f input	32-4599-1
T201	Transformer, 1st video i-f plate	32-4598-4
T202	Transformer, 2nd video i-f plate	32-4598
T203	Transformer, 3rd video i-f plate	32-4598-2

SECTION 3—VIDEO

Reference Symbol	Description	Service Part No.
C302	Condenser, 4.5-mc. trap, 68 $\mu\mu$f.	62-068409001
C303	Condenser, screen by-pass, 330 $\mu\mu$f.	62-133001001
C304	Condenser, by-pass, 100 $\mu\mu$f.	62-110409001
L300	Coil, 4.5-mc. trap	32-4463-2
L301	Coil, series peaking, 250 μh.	32-4480-4
L302	Coil, shunt peaking, 250 μh.	32-4480-4
L303	Coil, variable video peaking, 60—240 μh.	32-4467-18
L304	Coil, series peaking, 40 μh.	
L310	Potentiometer, CONTRAST, 2500 ohms	Part of R315
R311	Resistor, plate load, 3000 ohms, 10 watts	33-1335-121
R313	Resistor, picture-tube grounding, 470,000 ohms, 1 watt	66-4474340
R315	Potentiometer, BRIGHTNESS, 100,000 ohms	33-5563-51

R-F CHASSIS R-191 (Cont.)

SECTION 4—SOUND

Reference Symbol	Description	Service Part No.
C400	Condenser, coupling, 2.2 $\mu\mu$f.	30-1221-6
C401	Condenser, fixed trimmer, 18 $\mu\mu$f.	62-018400021
C404	Condenser, fixed trimmer	Part of Z400
C405	Condenser, fixed trimmer	Part of Z400
C406	Condenser, detector balancing, 150 $\mu\mu$f.	62-115001011
C409	Condenser, r-f by-pass, 330 $\mu\mu$f.	62-133001001
C410	Condenser, filter, 2 μf.	30-2417-7
C413	Condenser, plate by-pass, 6800 $\mu\mu$f., 1000v	30-4650-91
I400	Pilot light	34-2068
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-22
L400	Coil, audio take-off	32-4463-9
L401, L402, and L403	Coils, ratio detector	Part of Z400
L404	Coils, ratio detector	32-4112-15
L405	Filter choke, 1 henry, 39 ohms	32-8617
PL400	Plug, volume control	(Part of cable and plug ass'y. (see Misc. "A")
PL401	Plug, speaker	Part of speaker cable ass'y. (see cabinet parts)
R400	Resistor, cathode bias, 390 ohms, 1 watt	66-1394340
R402	Resistor, screen dropping, 12,000 ohms, 1 watt	66-3124340*
R407	Resistor, voltage dropping, 18,000 ohms, 2 watts	66-3185340
R413	Resistor, cathode bias, 390 ohms, 1 watt	66-1394340
R414	Potentiometer, VOLUME control, 2 megohms	33-5564-14
T400	Transformer, audio output	32-8629
Z400	Transformer, ratio detector	32-4450-6A

SECTION 6—SYNC

Reference Symbol	Description	Service Part No.
C600	Condenser, by-pass, 220 $\mu\mu$f.	62-122001001
R606	Resistor, voltage divider, 6800 ohms, 1 watt	66-2684340
R607	Resistor, decoupling, 12,000 ohms, 2 watts	66-3125340
R613	Resistor, voltage divider, 1 megohm, ½ watt, ±5%	66-5108240

MISCELLANEOUS "B"

Description	Service Part No.
Cable and plug ass'y., chassis connecting	41-4146-10*
Cable and plug, i.f. to tuner	41-3754-55
Cable and socket ass'y., picture tube	41-3964-19
Cable and socket ass'y., pilot light	27-6233-6*

MISCELLANEOUS "B" (Cont.)

Description	Service Part No.
Insulator, CONTRAST and BRIGHTNESS control	54-8488
Shield, tube (6T8)	56-5629-5
Shield, tube (6CB6)	56-5629FA3
Shield, pilot light	56-9074-2FA3
Socket and base ass'y. (6CB6)	27-6203-14
Socket and base ass'y. (6T8)	27-6203-18
Socket, tube, 7-pin miniature	27-6203
Socket, tube, 7-pin miniature (6AQ5)	27-6294
Socket, tube, 9-pin miniature	27-6203-6*
Socket, tube, octal	27-6174

TV TUNER, PART No. 76-8400

Reference Symbol	Description	Service Part No.
C500 and C501	Condensers, antenna isolating, 470 $\mu\mu$f.	30-1225-18
C502	Condenser, FM trap, 20 $\mu\mu$f.	30-1251-4
C503	Condenser, grid coupling, 39 $\mu\mu$f.	62-039403011
C505	Condenser, a-g-c by-pass, 220 $\mu\mu$f.	62-122001011
C506	Condenser, grid by-pass, 680 $\mu\mu$f.	62-168001011
C507	Condenser, decoupling, .01 μf.	30-1238-6
C508	Condenser, trimmer, r-f plate, .5—3 $\mu\mu$f.	31-6520-3
C509	Condenser, by-pass, 150 $\mu\mu$f.	62-115001011
C510	Condenser, coupling, .68 $\mu\mu$f.	30-1221-11
C511	Condenser, coupling, 15 $\mu\mu$f.	62-015409011
C512	Condenser, trimmer, mixer grid, .5—3 $\mu\mu$f.	31-6520-7
C513	Condenser, oscillator coupling, 2.2 $\mu\mu$f.	30-1221-6
C514	Condenser, grid blocking, 15 $\mu\mu$f.	30-1224-113
C515	Condenser, fixed trimmer, 3.3 $\mu\mu$f.	30-1224-114
C516	Condenser, FINE TUNING, plastic tube	76-6935-1
C517	Condenser, by-pass, 3.3 $\mu\mu$f.	30-1224-58
C518	Condenser, output coupling, 680 $\mu\mu$f.	62-168001021
C519	Condenser, screen by-pass, 680 $\mu\mu$f.	62-168001011
C520	Condenser, filament by-pass, 220 $\mu\mu$f.	62-122001011
C521	Condenser, filament by-pass, 800 $\mu\mu$f.	30-1238-7
C522	Condenser, coupling, 3.9 $\mu\mu$f.	30-1221-14
C523	Condenser, coupling, .82 $\mu\mu$f.	30-1221-10
C524	Condenser, filament by-pass, 220 $\mu\mu$f.	62-122001011
C525	Condenser, by-pass, 800 $\mu\mu$f.	30-1238-7
C527	Condenser, i-f trap, 22 $\mu\mu$f.	Part of L527

TV TUNER, PART No. 76-8400 (Cont.)

Reference Symbol	Description	Service Part No.
J500	Socket, tuner link	Part of Connector ass'y., tuner to i-f (see Misc. "C")
L500, L501, L502, and L503	Coils, tapered line	32-4432-3
L504	Coil, FM trap	32-4550-3
L505 to L511 incl.	Coils, antenna tuning	Part of WS500A
L512	Coil, r-f coupling	312-5145-22
L513 to L519 incl.	Coils, r-f plate tuning	Part of WS500B
L520 to L526 incl.	Coils, mixer grid tuning	Part of WS500C
L527	Coil, i-f trap	32-4552-1
L528	Coil, mixer plate	312-5151-10
L530	Coil, filament choke	32-4550-1
L531	Coil, filament choke	32-4550-11
L532 to L538 incl.	Coils, oscillator tuning	Part of WS500D
PL500	Plug, tuner link	Part of Cable and Plug ass'y. (see Misc. "C")
R508	Resistor, oscillator feed, 33,000 ohms	66-3334340
R510	Resistor, mixer plate feed, 10,000 ohms, 1 watt	66-3104540
WS500A(F) and WS500A(R)	Switch, wafer, antenna	76-8410
WS500B(F) and WS500B(R)	Switch, wafer, r-f plate	76-8409
WS500C(F) and WS500C(R)	Switch, wafer, mixer grid	76-8408
WS500D(F) and WS500D(R)	Switch, wafer, oscillator	76-8407
Z500	Tapered line ass'y.	76-8417

MISCELLANEOUS "C"

Description	Service Part No.
Cam and shaft, fine tuning	76-6936-3
Cable and plug, tuner to i-f	41-3754-55
Connector ass'y., tuner to i-f	76-8521
Coupling, fine tuning shaft	54-4912-2
Detent, ball	56-8020
"E" Washer, detent (in back of fine tuning cam)	1W60980FA3

MISCELLANEOUS "C" (Cont.)

Description	Service Part No.
Front panel ass'y.	76-8395
Hairpin, plunger grounding	56-9858
Hairpin, plunger-pivot lever-pin	1W42704FA3
Pivot pin, lever	56-9149
Lever, plunger	56-9148
Plunger	56-8034-1
Retaining ring	1W61043
Shaft	76-6914-4
Shaft extension	56-8358
Shield, tube, 9-pin miniature	56-5629-5
Socket, tube, 9-pin miniature	27-6203-21
Spring, shaft	56-8023
Spring, plunger	56-9628
Spring, detent index	56-9158
Terminal panel, antenna	76-5504-2
Washer, detent (in back of fine tuning cam)	56-9351
Washer, fiber, fine tuning plunger	27-4109-13
Washer, spring, plunger lever	56-9157

CONNECTING CABLES, PLUGS, AND SOCKETS

Reference Symbol	Description	Service Part No.
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis connecting	27-6274-1
J200	Socket, video test	27-6273
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-2
J800	Socket, deflection-yoke connector	27-6274-8
PL100	Plug and line cord ass'y.	41-3865
PL101	Plug and cable ass'y., chassis connecting	41-4146-10
PL400	Plug and cable ass'y., volume control	41-4136-3
PL401	**Plug and cable ass'y., speaker	See cabinet parts list
PL800	Plug and cable ass'y., deflection	
	(17" picture tube)	41-4086-18
	(21" picture tube)	41-4086-25
	Cable, high voltage	AD-2631
	Cable and socket ass'y., picture tube	41-3964-19
	Cable and socket ass'y., pilot light	27-6233-103

** NOTE: The length of this cable varies with cabinet and speaker size. For Service Part No. refer to cabinet parts list.

UHF TUNER-ADAPTER UT22, PART No. 43-6703

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 $\mu\mu f$.	Part of panel filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-4
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f.	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f.	76-7472
C7	Condenser, mixer tank, 30 $\mu\mu f$.	Part of board ass'y., mixer
C8	Condenser, temperature compensating, .4 $\mu\mu f$.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 $\mu\mu f$.	Part of tank ass'y., osc.
C11	Condenser, by-pass	Part of tank ass'y., osc.
C12	Condenser, grid by-pass, 500 $\mu\mu f$.	30-1245-3
C13	Condenser, feedback, 1.0 $\mu\mu f$.	30-1238-2
C14	Condenser, heater by-pass, 500 $\mu\mu f$.	30-1245-3
C15	Condenser, plate by-pass, 500 $\mu\mu f$.	30-1245-3
C16	Condenser, input coupling, 8 $\mu\mu f$.	30-1224-46
C17	Condenser, neutralizing, 680 $\mu\mu f$.	62-168001001
C18	Condenser, decoupling, 680 $\mu\mu f$.	62-168001001
C19	Condenser, cathode by-pass, 680 $\mu\mu f$.	62-168001001
C20	Condenser, filament by-pass, 470 $\mu\mu f$.	62-147001011
C21	Condenser, cathode tuning, 680 $\mu\mu f$.	62-168001001
C22	Condenser, grid by-pass, 680 $\mu\mu f$.	62-168001001
C23	Condenser, plate tuning, 1—5 $\mu\mu f$.	31-6520-10
C26	Condenser, grid by-pass, .01 μf.	30-1238-2
C27	Condenser, decoupling, 680 $\mu\mu f$.	62-168001001
C28	Condenser, output coupling, 680 $\mu\mu f$.	62-168001001
C29 and C30	Condenser, antenna input, 100 $\mu\mu f$.	30-1225-13
C31	Condenser, grid tuning, 1—5 $\mu\mu f$.	31-6520-10
CD1	Crystal detector, mixer circuit	34-8026
I1 and I3	Lamps, pilot, UHF	34-2068
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A-Stator

UHF TUNER-ADAPTER UT22, PART No. 43-6703

Reference Symbol	Description	Service Part No.
L2	Inductor, r-f, r.h.	Part of C3B-Stator
L3	Inductor, r-f, l.h.	Part of C3C-Stator
L4	Inductor, r-f, r.h.	Part of C3D-Stator
L5 and L6	Inductors, crystal mixer	Part of board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of board ass'y., osc.
L11 and L12	Inductors, oscillator	76-7627
L13	Choke, heater decoupling	32-4556-3
L14	Choke, heater-cathoae decoupling	32-4556-4
L15	Choke, plate decoupling	32-4556-2
L16	Coil, input tuning, primary	32-4597-7
L17	Coil, input tuning, secondary	32-4597-9
L18	Coil, neutralizing	32-4597-4
L19	Choke, cathode tuning	32-4597-5
L22	Choke, plate decoupling	32-4556-2
L23 and L24	Coils, i-f trap	Part of panel filter
R2	Resistor, damping, 220 ohms	66-1228340
R3	Resistor, decoupling, 6800 ohms	66-2688340
R4	Resistor, decoupling, 220 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, cathode bias, 1000 ohms	66-2104240
R7	Resistor, cathode bias, 68 ohms	66-0688340
R8 and R9	Resistor, antenna input, 470,000 ohms	Part of panel filter
R10	Resistor, grid loading, 8200 ohms	66-2828340
R11	Resistor, pilot light, 3.9 ohms	66-9398340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, a-g-c decoupling, 10,000 ohms	66-3108340
R14	Resistor, bias divider, 1.5 megohms	66-5158340
R15	Resistor, damping, 10 ohms	66-0108340
R16	Resistor, damping, 470 ohms	66-1478340
R17	Resistor, plate load, 3300 ohms	66-2338340
R18 and R19	Resistor, tuner disabling, 150,000 ohms	66-4158340
R20	Resistor, bias divider, 1.5 megohms	66-5158340
R21	Resistor, pilot light, 10 ohms	66-0108340
	Board ass'y., mixer	76-7475-4
	Board ass'y., oscillator	76-7480
	Panel, filter	76-8078
	Tank ass'y., oscillator	76-7627

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 μμf.	Part of panel filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-4
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f.	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f.	76-7472
C7	Condenser, mixer tank, 30 μμf.	Part of board ass'y., mixer
C8	Condenser, temperature compensating, .4 μμf.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 μμf.	Part of tank ass'y., osc.
C11	Condenser, by-pass	Part of tank ass'y., osc.
C12	Condenser, grid by-pass, 500 μμf.	30-1245-3
C13	Condenser, feedback, 1.0 μμf.	30-1238-2
C14	Condenser, heater by-pass, 500 μμf.	30-1245-3
C15	Condenser, plate by-pass, 500 μμf.	30-1245-3
C16	Condenser, input coupling, 8 μμf.	30-1224-46
C17	Condenser, neutralizing, 680 μμf.	62-168001001
C18	Condenser, decoupling, 680 μμf.	62-168001001
C19	Condenser, cathode by-pass, 680 μμf.	62-168001001
C20	Condenser, filament by-pass, 470 μμf.	62-147001011
C21	Condenser, cathode tuning, 680 μμf.	62-168001001
C22	Condenser, grid by-pass, 680 μμf.	62-168001001
C23	Condenser, plate tuning, 1—5 μμf.	31-6520-10
C26	Condenser, grid by-pass, .01 μf.	30-1238-2
C27	Condenser, decoupling, 680 μμf.	62-168001001
C28	Condenser, output coupling, 680 μμf.	62-168001001
C29 and C30	Condenser, antenna input, 100 μμf.	30-1225-13
C31	Condenser, grid tuning, 1—5 μμf.	31-6520-10
CD1	Crystal detector, mixer circuit	34-8026
I1 aud I3	Lamps, pilot, UHF	34-2068
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A-Stator

Reference Symbol	Description	Service Part No.
L2	Inductor, r-f, r.h.	Part of C3B-Stator
L3	Inductor, r-f, l.h.	Part of C3C-Stator
L4	Inductor, r-f, r.h.	Part of C3D-Stator
L5 and L6	Inductors, crystal mixer	Part of board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of board ass'y., osc.
L11 and L12	Inductors, oscillator	76-7627
L13	Choke, heater decoupling	32-4556-3
L14	Choke, heater-cathoae decoupling	32-4556-4
L15	Choke, plate decoupling	32-4556-2
L16	Coil, input tuning, primary	32-4597-7
L17	Coil, input tuning, secondary	32-4597-9
L18	Coil, neutralizing	32-4597-4
L19	Choke, cathode tuning	32-4597-5
L22	Choke, plate decoupling	32-4556-2
L23 and L24	Coils, i-f trap	Part of panel filter
R2	Resistor, damping, 220 ohms	66-1228340
R3	Resistor, decoupling, 6800 ohms	66-2688340
R4	Resistor, decoupling, 220 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, cathode bias, 1000 ohms	66-2104240
R7	Resistor, cathode bias, 68 ohms	66-0688340
R8 and R9	Resistor, antenna input, 470,000 ohms	Part of panel filter
R10	Resistor, grid loading, 8200 ohms	66-2828340
R11	Resistor, pilot light, 3.9 ohms	66-9398340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, a-g-c decoupling, 10,000 ohms	66-3108340
R14	Resistor, bias divider, 1.5 megohms	66-5158340
R15	Resistor, damping, 10 ohms	66-0108340
R16	Resistor, damping, 470 ohms	66-1478340
R17	Resistor, plate load, 3300 ohms	66-2338340
R18 and R19	Resistor, tuner disabling, 150,000 ohms	66-4158340
R20	Resistor, bias divider, 1.5 megohms	66-5158340
R21	Resistor, pilot light, 10 ohms	66-0108340
	Board ass'y., mixer	76-7475-4
	Board ass'y., oscillator	76-7480
	Panel, filter	76-8078
	Tank ass'y., oscillator	76-7627

CIRCUIT DESCRIPTION

Philco B Line, Code 158, Television Receivers use two chassis—the r-f chassis, R-207, containing the r-f, video, audio, and sync circuits, and the deflection chassis, D-207 or D-208, containing the power and deflection circuits.

Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

CAUTION: See A-C Line Isolation.

The r-f amplifier, oscillator, and mixer section is built on a separate sub-chassis. The r-f amplifier uses a 6BZ7 tube, V1. The oscillator and mixer each use one half of a 12AZ7 tube, V2. The output of the mixer is fed to a four-stage i-f amplifier system employing four 6CB6 tubes, V3, V4, V5, and V6. A 1N64 crystal diode is used for the video detector. One half of a 6U8 tube, V7A, is used as the first video amplifier, which feeds into a 6AQ5 video output amplifier, V8.

Sound i-f (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75-mc. video carrier and the 41.25-mc. sound carrier are mixed in the video detector. The beat frequency, 4.5 mc., is the difference between 45.75 mc. and 41.25 mc., and contains the FM sound signal. This 4.5-mc. signal contains only a negligible amount of the video amplitude modulation, provided that the amplitude of the 41.25-mc. signal is considerably lower than that of the 45.75-mc. signal. The proper relative amplitude of the two carriers is established in the alignment of the receiver. There is sound output only when both the video and sound carriers are present.

The oscillator is tuned primarily to obtain the best picture, since the 4.5-mc. relationship always exists between the two carriers. The 4.5-mc. sound i.f. (intercarrier), which is taken from the video detector, is amplified by a 6BA6 tube, V9, and a 6AU6 tube, V10, and is fed to the FM detector, which utilizes two diode sections of a 6T8 tube, V11A. The triode section of the 6T8 tube, V11B, is used as the first audio amplifier. The power amplifier uses a 6L6GA tube, V12.

A-G-C voltage for the video i-f system and the r-f amplifier is obtained from a keyed a-g-c system which uses a 6AU6 tube, V13, as the a-g-c gate. Composite video from the video amplifier plate circuit, V7A, is fed to the grid of the a-g-c gate tube, while a gating or keying pulse, obtained from a winding on the horizontal-output transformer located on the deflection chassis, is applied to the plate. The signal at the grid of V13 has positive sync polarity; therefore, the a-g-c gate can conduct in proportion to the amplitude of the sync-pulse tips if the gating or keying pulse occurs at the same time as the sync. Because the gate pulse is of constant amplitude (approximately 500 volts peak), the amplitude of the sync pulse determines the amount of conduction in the gate tube. The plate current of the keyed a-g-c gate tube flows through R220, R219, and R218, developing a voltage which is negative with respect to the chassis, and is proportional to the plate current. This negative voltage is used to control the gain of the receiver. Since conduction cannot occur in the a-g-c gate tube unless the sync pulse and gating pulse occur at the same time, noise disturbances that occur during the intervals between sync pulses cannot affect the a-g-c voltage.

Composite video for the sync circuits is taken from the plate circuit of the video amplifier, V7A. The plate load of the video amplifier consists of two sections, R304 and R305. The full output of the amplifier is fed to the grid of the noise inverter, one half of a 12AU7 tube, V14B, and to the grid of the sync separator, one half of a 6U8 tube, V7B. The output developed across R305 only is fed to the grid of the a-g-c gate, V13. The noise inverter is operated with a low value of plate voltage and with high bias (applied to the cathode by a voltage-divider network), which keeps the tube beyond cutoff. When the composite video signal is applied to the grid of the noise inverter through C601, the sync appears as positive pulses, and noise which could affect the sweep circuits also appears as positive pulses. Harmful noise pulses usually have amplitudes far greater than that of the sync pulses, and, therefore, drive the grid of the noise inverter positive sufficiently to allow conduction in the noise inverter plate circuit. To prevent the noise inverter from conducting during the sync-pulse interval, the gated leveler, using one half of a 12AU7 tube, V14A, is used to clamp the sync pulses below the conduction level of the noise inverter. The gated leveler conducts only when the sync pulses and gating pulse occur at the same time, thus leveling the noise-inverter input to the sync-pulse level.

The output of the noise inverter consists of negative-going noise pulses. It should be noted that the noise pulses which exceed the sync level have been passed and their polarity reversed by the noise inverter. The output of the noise inverter is now mixed with the composite video and fed to the grid of the sync separator. Since the composite video fed to the grid of the sync separator has positive sync polarity, the positive noise pulses carried with the composite video would be passed by the sync separator; however, the output of the noise inverter consists of these same noise pulses, but of opposite polarity. Thus, cancellation of the noise pulses is effected. The output of the sync separator contains only the sync pulses, which are fed to the deflection chassis through the connecting cable.

The phase splitter, using one half of a 12AU7 tube, V15A, inverts the sync polarity for proper triggering of the vertical oscillator. The vertical sync is separated from the horizontal sync by the integrator circuits, and is fed to the grid of the vertical blocking oscillator, which uses one half of a 12AU7 tube, V15B. The output of the vertical oscillator is amplified by the vertical-output amplifier, which uses a 6BQ6GT tube, V16. The output of this amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

In addition to the vertical-sync output, two horizontal-sync outputs are taken from the phase splitter, one from the cathode, and the other from the plate circuit. These two outputs are of opposite polarity, and are fed to the two diodes of the phase comparer, a 6AL5 tube, V17; the negative pulses are fed to the cathode of V17B, and the positive pulses, to the the plate of V17A. A portion of the horizontal sweep output voltage is taken from the horizontal-output transformer, and is fed to the plate of V17B and the cathode of V17A, for comparison of the horizontal-sync and horizontal-sweep voltages. When the sweep and sync are in phase, no voltage is developed across R800, but when the two signals are out of phase, a voltage is developed across R800. When this voltage is positive, it increases the frequency of the horizontal oscillator (a 12AU7 tube, V18); when the voltage is negative, it reduces the frequency of the oscillator. This action holds the horizontal oscillator in phase with the sync signal. The horizontal hold control, R810, adjusts the horizontal-oscillator frequency so that it may be controlled by the phase comparer. The output of the horizontal oscillator is fed to the horizontal-output amplifier, which uses a 6CD6G tube, V19. The horizontal-output tube feeds the deflection coils through the horizontal-output transformer. A 6V3A tube, V20, is used as the horizontal damper.

The second-anode voltage for the picture tube is supplied by two 1B3GT high-voltage-rectifier tubes, V21 and V22, connected in a voltage-doubler circuit. The B-plus voltage for the receiver is supplied by two selenium rectifiers, CR100 and CR101, in a full-wave voltage-doubler circuit, operating from the power line through an autotransformer which provides a step-up of the line voltage. Bias voltage is obtained from across the filter choke which is in series with the negative side of the B-plus supply. The B-plus-boost voltage derived from the horizontal-damper circuit supplies higher B-plus voltage to the first anode of the picture tube. Filament current for all the tubes except the high-voltage rectifiers is supplied by a 117-volt, 60-cycle step-down transformer. Filament current for the high-voltage rectifiers is supplied by two windings on the horizontal-output transformer.

NOTE: The D-207 and D-208 chassis incorporate a protective high-voltage shorting switch (located on the rear of the high-voltage cage), which shorts the output of the 1B3GT high-voltage doubler-rectifier (V22) to ground when the cabinet back is removed. Do not attempt to operate the receiver with the cabinet back removed without first disabling this shorting switch. The switch can be disabled temporarily for service work by removing the two self-tapping screws at the bottom edge of the rear cover of the high-voltage cage, and propping up the rear cover.

IMPORTANT

A-C LINE ISOLATION

CAUTION: One side of the a-c line is connected to the chassis through T100, C101, and L100, in series. The other side of the a-c line is connected to the chassis through R100, F100, CR100, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment, it is desirable that an a-c line isolation transformer capable of handling at least 250 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment, or receiver, or both.

SPECIFICATIONS

VHF TUNING .... Twelve-channel, 13-position wafer switch; Television Channels 2 through 13 and UHF position

UHF TUNING (if provided) ...... Continuous tuning; Channels 14 through 83

INTERMEDIATE FREQUENCIES
Video carrier .... 45.75 mc.
Sound (intercarrier) .... 4.5 mc.

TRANSMISSION LINE .... 300-ohm, twin-wire lead

OPERATING VOLTAGE .... 110 to 120 volts

POWER CONSUMPTION .... VHF only models, 250 watts; VHF and UHF models, 255 watts

TUBE COMPLEMENT

R-F CHASSIS R-207

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
V1	6BZ7—miniature	R-F amplifier
V2	12AZ7—miniature	Oscillator, mixer
V3, V4, V5, V6	6CB6—miniature	Video i-f amplifiers
V7	6U8—miniature	Video amplifier, sync separator
V8	6AQ5—miniature	Video output
V9	6BA6—miniature	First sound i-f amplifier
V10	6AU6—miniature	Second sound i-f amplifier
V11	6T8—miniature	FM detector, first audio amplifier
V12	6L6GA—octal	Audio output
V13	6AU6—miniature	A-G-C gate
V14	12AU7—miniature	Gated leveler, noise inverter
V23	27LP4 or 24VP4	Picture tube

DEFLECTION CHASSIS, D-207 OR D-208

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
V15	12AU7—miniature	Phase splitter, vertical oscillator
V16	6BQ6GT—octal	Vertical output
V17	6AL5—miniature	Phase comparer
V18	12AU7—miniature	Horizontal oscillator
V19	6CD6G—octal	Horizontal output
V20	6V3A—miniature	Damper
V21, V22	1B3GT—octal	High-voltage rectifiers

REMOVING, REPLACING 27LP4 PICTURE TUBE

GENERAL

The Philco 27LP4 picture tube is designed for a maximum of safety. Moreover, when properly mounted in the frame assembly, the picture tube is supported in such a manner as to provide a maximum of protection against breakage. Therefore, it is important that the tube be properly installed in its supporting frame. It is suggested that the service technician protect his eyes and the exposed parts of his body when handling all picture tubes. The removal and installation of the 27LP4 picture tube is quite safe if the procedure given below is followed.

CAUTION: Because of the bulkiness and increased weight of the 27LP4 tube, as compared with that of the smaller picture tubes, replacement of the 27LP4 requires two men. These tubes are not delicate when handled in the proper manner; however, care must be taken not to mar the glass in any way, as surface scratches and chips weaken a glass structure considerably. Also, because of its weight, do not attempt to handle this tube by the neck.

PROCEDURE FOR REMOVING 27LP4 TUBE

1. Remove both the deflection chassis and the r-f chassis from the cabinet.

2. Lay the cabinet face-down on the floor, taking precautions against marring the cabinet.

3. Remove the four nuts and washers that secure the mounting feet of the picture-tube assembly to the front of the cabinet.

4. Remove the two wood screws that secure the rear supporting struts of the tube assembly to the cabinet.

5. Remove the tube assembly (one man on each side of the cabinet).

6. Place the tube assembly face-down on a soft, protective cloth or mat, and slip the beam-bender magnet off the rear end of the tube. Referring to figure 1, loosen clamp ring (A) by means of clamp screw (B), unhook the four clips securing the web straps to the mounting feet, and lift the deflection-yoke housing and strap assembly (containing the deflection yoke and focus assembly) off the neck of the tube.

7. Mark the positions of the four mounting feet on the front band with a pencil or scriber (this is necessary because the mounting feet are free to slide, once the front band is loosened).

8. Loosen the two Allen head clamping screws (C) and (D) with a 5/16-inch Allen wrench, and remove the front band assembly.

PROCEDURE FOR INSTALLING 27LP4 TUBE

1. Place the picture tube face-down on a soft, protective cloth or mat, and position the front band assembly over the tube so that the lateral indentation in the band coincides with the welded seam around the outer edge of the tube's face plate.

Take up slack in the band, tightening both clamping screws (C) and (D) by hand.

NOTE: If the front band is positioned correctly, the distance from the bottom edge of each mounting foot to the surface on which the tube is resting will be 1⅞ inches, as shown in figure 1.

2. Position the mounting feet, on the front band, to coincide with the marks previously made on the front band.

3. Tighten both clamping screws (C) and (D) alternately, using a 5/16-inch Allen wrench.

NOTE: Take up on clamping screw (C) and (D) as tightly as possible. As can be seen from figure 1, the separation between the ends of the bands must be less than ⅛ inch, when tightened.

4. Slip the deflection-yoke housing and strap assembly (containing the deflection yoke and focus assembly) over the neck of the tube, and position it so that clamp screw (B) on clamp ring (A) is on the side of the tube opposite the anode button.

5. Place the clips (on the web straps) over the hooks on the four mounting feet, and tighten clamp ring (A) by means of clamp screw (B).

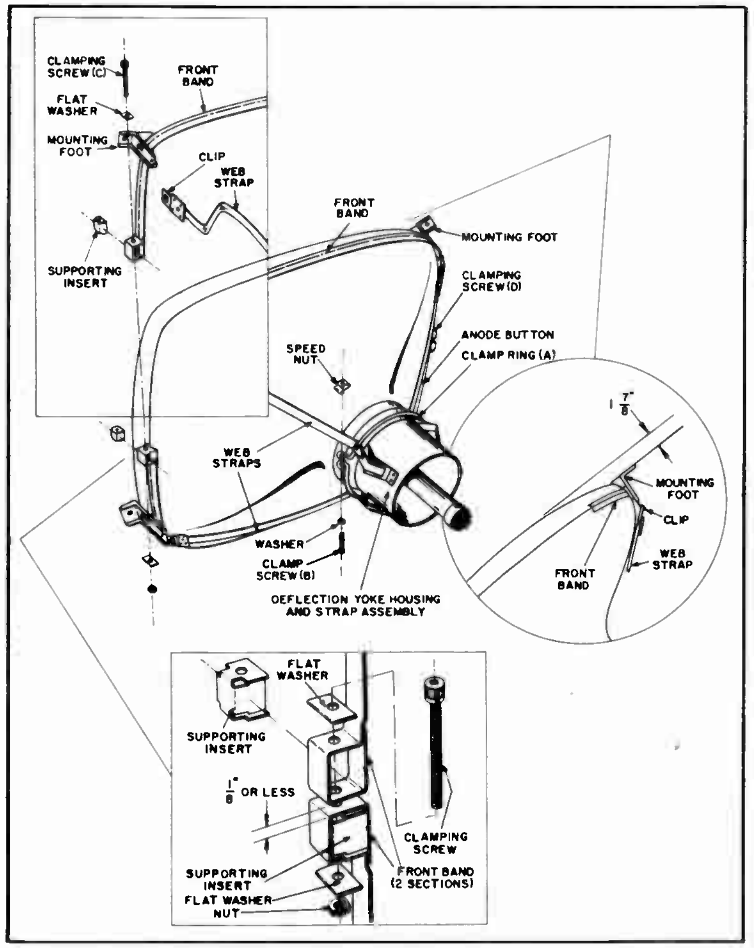
6. With the cabinet face-down on the floor, place the tube assembly in the cabinet (one man on each side of cabinet), and replace the four nuts and washers that secure the mounting feet to the front of the cabinet.

7. Replace the two wood screws that secure the rear supporting struts of the tube assembly to the cabinet.

8. Stand the cabinet upright, and install the r-f chassis, deflection chassis, and beam-bender magnet.

ADJUSTING 27LP4 PICTURE-TUBE ASSEMBLY

1. Mechanically center the focus assembly, over the neck of the tube, by adjusting the centering plate. It is important that the focus assembly and yoke be concentric with the tube neck for best focus and shadow clearance.



TP2-3264

Figure 1. 27LP4 Picture-Tube Assembly

2. Set the HORIZ. CENTERING control (R824) to its extreme counterclockwise position, and set the BRIGHTNESS control for maximum brightness of the picture.

3. Adjust the beam bender for maximum brightness of the picture.

4. If necessary, loosen the wing nuts and rotate the deflection yoke, to correct for picture tilt. Make certain that the deflection yoke is as far forward as possible, and tighten the wing nuts.

5. Adjust the centering plate so that neck shadow is just eliminated on the right-hand side of the screen, at the same time keeping the picture centered vertically. Do not attempt to center the picture horizontally by means of the centering plate.

6. Adjust the FOCUS control (on focus assembly). Set the CONTRAST control for the proper level, and readjust the FOCUS control for the best over-all focus.

7. Repeat steps 3 and 5, if necessary.

8. Adjust the HORIZ. CENTERING control (R824) for proper horizontal centering of the picture.

9. Turn the BRIGHTNESS control slowly toward the minimum position, checking that shadow does not appear at any brightness level. If shadow does appear, repeat steps 5 and 8, and recheck.

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. 45-2656-23.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture so that approximately one inch of blank screen appears at the right-hand and left-hand sides of the picture.

2. Increase the BRIGHTNESS control setting so that the blanking time becomes visible. This appears as a dark vertical bar at the right-hand and left-hand sides of the picture.

3. Connect a .1-μf. condenser from Test Point G800 to ground.

4. Set the HORIZ. HOLD control to the center of its mechanical rotation.

5. Adjust the HORIZ. HOLD CENTERING control to bring the picture into the center of the blanking bars. When the picture is centered in the blanking bars, the bars at the left-hand and right-hand sides of the picture will be of equal width.

6. Remove the .1-μf. condenser from the Test Point. (See step 3.)

7. Adjust the horizontal ringing coil, L800, until the picture is again centered in the blanking bars.

8. Rotate the HORIZ. HOLD control through its range. The picture should fall out of sync to both sides of the center of rotation. If the picture does not fall out of sync to both sides, readjust the HORIZ. HOLD CENTERING control to obtain fall-out to either side of sync.

9. Rotate the HORIZ. HOLD control through its range, and observe the number of diagonal blanking bars that are visible just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO PEAKING-COIL ADJUSTMENT

The video peaking coils, L305 and L307, are adjusted at the factory for proper transient response of the video amplifiers. Ordinarily, these coils will require no further adjustment by the serviceman except in cases where they have been tampered with, or where replacement becomes necessary. Under normal circumstances, when alignment of the tuner or i-f stages is undertaken, the video peaking coils should not require adjustment.

Before adjusting L305 and L307, check both the tuner and i-f alignment. (Never adjust L305 and L307 until the alignment of the receiver is correct.) Then tune in a station and adjust the receiver to give a picture of the best obtainable quality, with medium contrast. Turn the fine tuning control clockwise until a very slight beat pattern appears in the picture. Carefully observe the appearance of the picture regarding smear or overshoot (trailing whites). A small amount of overshoot may be desirable, to produce a sharper picture. Conversely, in weak-signal areas, a small amount of smear may be desirable, to reduce the harsh appearance of "snow". The adjustments of L305 and L307, and their effects on the picture, are as follows:

1. The amount of overshoot may be reduced by turning both TC302 and TC303 counterclockwise.

2. The amount of smear may be reduced by turning both TC302 and TC303 clockwise.

Normally, the point of proper adjustment is where minimum smear and trailing whites appear in the picture; however, a compromise adjustment may be made to suit prevailing conditions. As a rule, when properly adjusted, the adjustment screws (TC302 and TC303) should protrude from the chassis by approximately ½ inch to ¾ inch.

TELEVISION ALIGNMENT

GENERAL

The alignment consists of tuning each i-f coil to a given frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and touching up the adjustments to obtain the desired pass band.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the i-f stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned. Before aligning the tuner, refer to the CAUTION given under Procedure in Tuner Bandpass Alignment Procedure.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained if the top of the workbench is metallic. The receiver chassis should be placed tuner-side-down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about two inches wide. The section of the chassis nearest the tuner should rest on the strip.

2. Do not disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.

3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.

4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If Philco Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method of calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745 (J) entitled "Television Service in the Home."

TEST EQUIPMENT REQUIRED

The following test equipment is recommended for aligning the receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.

2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.

3. R-F Probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

JIGS AND ADAPTERS REQUIRED

Mixer Jig

Connections to the grid of the mixer tube may be made through the alignment jack provided for that purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon) so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna input terminals of the receiver is shown in figure 2. This network, which is designed to have an input impedance of 75 ohms

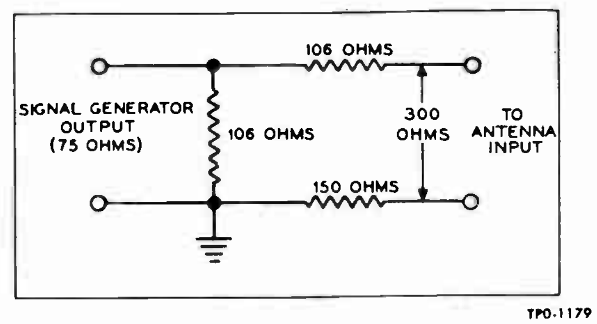


Figure 2. Antenna-Input Matching Network

and an output impedance of 300 ohms, is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group to obt in values within ten percent of those indicated. The resistors should be placed in a shield can to prevent variable effects. An antenna-matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig

(Video Test Jack Adapter No. 1)

The alignment jig, used at J200, and shown in figure 3, should be used during the i-f alignment to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This adapter consists of a five-pin plug, and two 10,000-ohm resistors and a 1500$\mu\mu$f. condenser for isolation of the bias supply. To isolate the oscilloscope from the receiver circuits, a 15,000-ohm resistor, by-passed by a 1500-$\mu\mu$f. condenser is used. A suggested method of fabricating the jig is also shown in figure 2. This jig should not be used to observe the composite video from the video detector output.

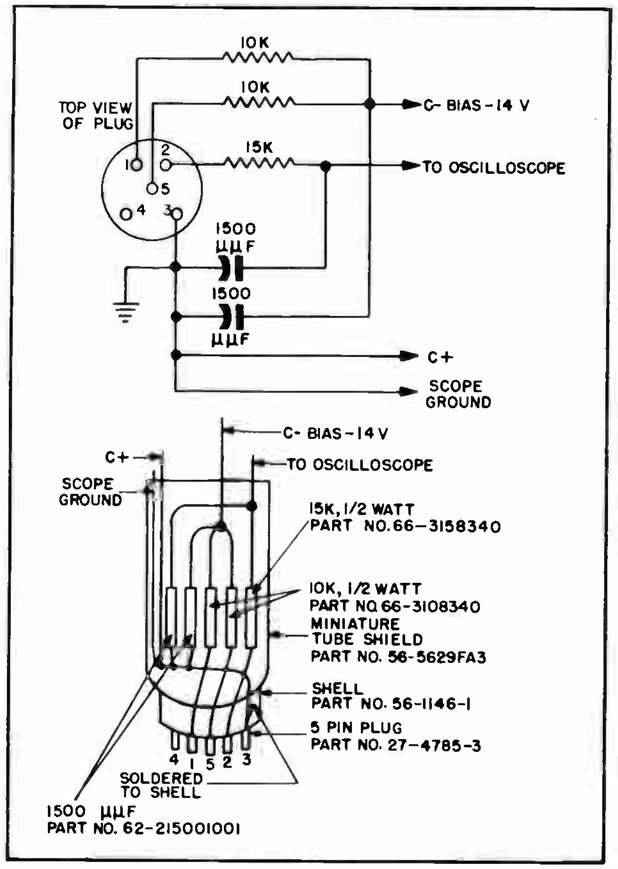


Figure 3. Video I-F Alignment Jig (Video Test Jack Adapter No. 1)

Sound I-F Alignment Jig

(Video Test Jack Adapter No. 2)

To observe the composite video at J200, a jig may be made with a five-pin plug and a 2200-ohm resistor. (See figure 4.) The 2200-ohm resistor should be connected to pin 2 of the plug. A ground lead should be connected to pin 3. To observe the composite video, connect the oscilloscope to the 2200-ohm resistor and the ground lead. This jig is also used for injection of the 4.5-mc. signal during sound i-f alignment.

Sound I-F Alignment Jig (FM Test Point and Volume Control Socket Adapter)

Figure 5 shows the adapter that should be used to connect the voltmeter to the FM detector through the volume control socket (J400) and FM test point (G400). The adapter should be inserted into the volume control socket, and the clip lead from the adapter connected to the FM test point. The volume control cable and plug (PL400) is inserted into the socket on top of the adapter.

TELEVISION TUNER ALIGNMENT

After the tuner is serviced, or if an i-f alignment is required, the tuner alignment should be checked. If realignment is necessary, use the procedure given below.

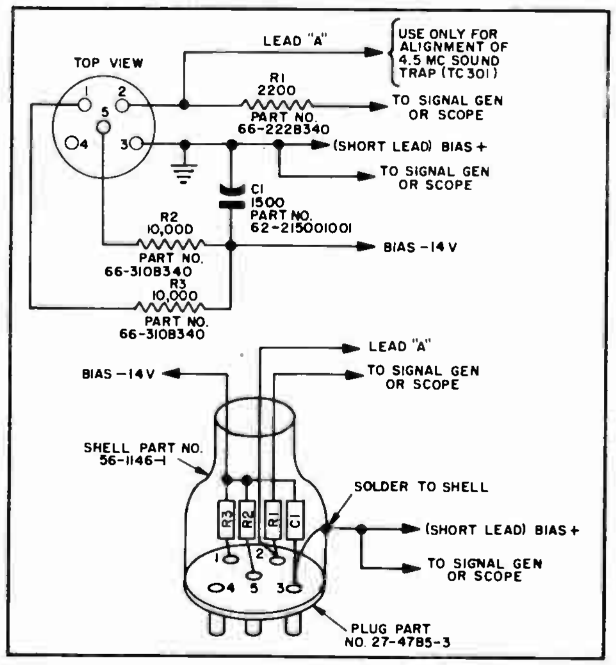


Figure 4. Sound I-F Input Alignment Jig (Video Test Jack Adapter No. 2)

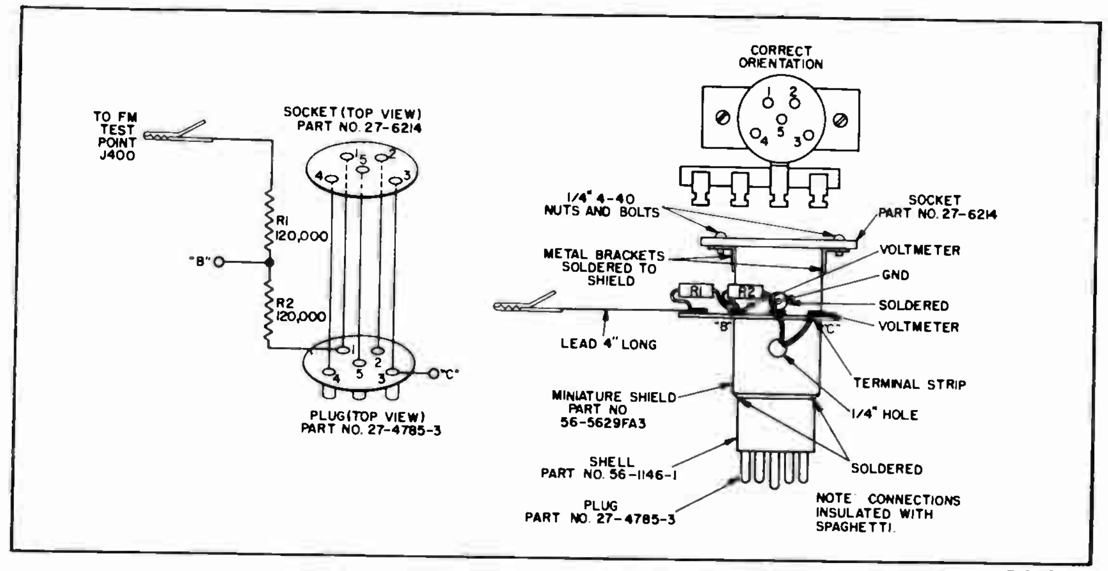


Figure 5. Sound I-F Output Alignment Jig (FM Test Point and Volume-Control Socket Adapter)

Since the frequency of the local oscillator affects the tuner response, the local-oscillator alignment should be made first.

Oscillator Alignment

General

It is possible to place each channel exactly on frequency by adjusting the tuning core of each coil. The adjustment procedure should be carried out with the highest channel (13) first, since the alignment of each channel will affect the alignment of the channels below it in frequency. The FINE TUNING control should be preset for all adjustments by placing the stop on the fine-tuning cam at Channel 8 oscillator tuning core. See figure 6.

Procedure Using Signal Generators

An r-f signal (unmodulated), at the video carrier frequency of the channel, is fed into the antenna input, and an i-f signal, at the i-f carrier frequency, is fed to the first i-f amplifier. Two AM signal generators are used to supply the above signals. An oscilloscope is connected to the video detector output. The oscillator core is then adjusted for zero beat on each channel. The two generators should be accurately calibrated, as described in Philco Lesson Series, PR-1745(J).

To align the oscillator, proceed as follows:

1. To observe the zero beat, connect the oscilloscope to the video detector output through the video i-f alignment jig. See figure 3. Bias the tuner and i-f a-g-c circuits with 1½ volts, and remove the gate-pulse plug, PL801, from the socket, J801. To apply the bias to the tuner, connect the battery to the white lead which comes off the feed-through condenser at the top of the tuner. To make certain that good connection is made to the tuner a-g-c circuit, remove the glyptol coating on this condenser terminal.

2. To feed in the i-f comparison signal, remove the shield from the first v-i-f tube, and wrap several turns of insulated copper wire around the tube. Connect the output leads of the v-i-f signal generator to the two ends of the wire loop, and set the generator for unmodulated output at 45.75 mc.

3. To feed in the signal representing the channel frequency, set the r-f signal generator at the video carrier frequency of Channel 13, and connect the output to the antenna-input terminals of the receiver, through the proper matching jig.

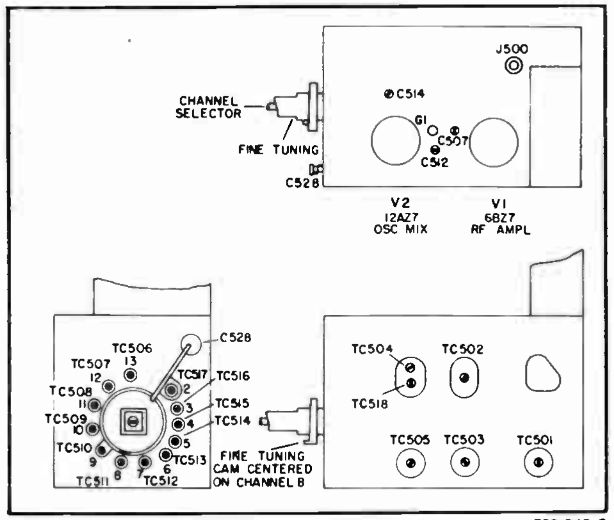
4. Mechanically preset the fine-tuning cam, as shown in figure 6, and set the CHANNEL SELECTOR to Channel 13.

5. Adjust the Channel 13 tuning core for zero beat, as indicated by the oscilloscope.

6. Retune the r-f signal generator and the CHANNEL SELECTOR for Channels 12, then 11, etc., each time adjusting the respective tuning core for zero beat. The tuning cores should be adjusted progressively from the highest-frequency channel to the lowest, because the higher channel adjustments will affect the lower channels.

Procedure Using Station Signal

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available. If this



TP3-942-C

Figure 6. Television Tuner Showing Locations of Adjustments

procedure is used in the service shop, signals from all stations which the customer can receive must be available in the service shop.

1. Mechanically preset the fine-tuning cam as shown in figure 6.

2. Tune in the highest-frequency channel to be received, and adjust the tuning core for that channel for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound in the picture just disappears.

3. Repeat step 2 for each channel received in the area, starting with the highest-frequency channel and finishing with the lowest channel.

Tuner Bandpass Alignment

General

The bandpass alignment consists of aligning the tuner at Channel 13 and 6 and then making it track properly.

During the alignment, a fixed bias of 1½ volts is applied to the r-f amplifier tube through the white a-g-c lead.

An FM (sweep) signal is applied to the antenna-input circuit through the proper matching jig, and an oscilloscope is connected to the junction of R518 and the tuner red lead. The oscilloscope gain should be as high as possible, consistent with "hum" level and "bounce" conditions. Hum conditions will cause distortion of the time base and response. Bounce conditions will cause the response and the time base to jump up and down, and are caused by poor line regulation. The use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a gain necessitates increasing the generator output to a point where the tuner may be overloaded. The scope controls should be adjusted so that the width of the presentation is double the height. Overload may then be checked by changing the generator output while observing the shape of the response curve. When the generator output is changed, the vertical gain of the oscilloscope should be readjusted to keep the scope presentation amplitude the same. Do not readjust the horizontal gain control. Any change in the shape of the curve indicates overload, in which case a lower generator output and higher oscilloscope gain must be used.

The signal-generator output circuit must be properly matched to the antenna input circuit of the tuner. The antenna-input matching network shown in figure 2, or a Philco antenna matching jig, Part No. 45-1637, may be used for this purpose. If a matching jig is not used, the result obtained will be extremely unreliable.

Regeneration or a mismatch in the test setup will also cause poor and unreliable results. To check for regeneration or mismatch move the hand along the generator cable after all equipment is connected, and observe the response curve on the oscilloscope screen. If the response curve on the oscilloscope changes as the hand is moved along the cable, regeneration or mismatch is indicated. Another check may also be made with the VOLUME control advanced until noise can be heard from the speaker. If the level of the noise changes as the hand is moved along the generator cable, regeneration or mismatch is indicated. The symptoms which indicate these conditions may also be caused by failure to use the proper matching jig, as described above.

Procedure

CAUTION: When comparing the response curves from channel to channel, maintain the 2-to-1 width-to-height relationship in the oscilloscope presentation, as described above.

1. Connect the FM (sweep) and AM marker generators to the 300-ohm antenna input terminals through an antenna-input matching jig.

2. Connect the oscilloscope to the junction of R518 (15K, 1w) and the tuner red lead.

3. Apply 1½ volts of bias to the white tuner a-g-c lead.

4. Disconnect the tuner coupling link at wiring panel B-14, terminals 1 and 4, and solder a 68-ohm, one-half watt carbon resistor to the open link coming from the tuner. See figure 9. Remove the first i-f tube from its socket.

5. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 13 (213 mc.). Adjust the generator for sufficient sweep width to show the complete response curve.

6. Establish the channel limits (see figure 7) by using the marker (AM) r-f signal generator to produce marker pips on the response curve. (Set the marker generator first to 210 mc., and then to 216 mc.) The response curve should be reasonably flat between the limits.

7. Adjust TC502 and TC504 for a symmetrical response, centered about 213 mc., and falling within the specifications, as shown in figure 7.

8. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 7 (177 mc.). Establish the channel limits by using the marker signal generator to produce marker pips on the response curve. (Set the marker generator first to 174 mc., and then to 180 mc.) The curve should be reasonably flat between the limits.

9. On Channel 7, observe the tilt, and center frequency of the response curve. The curve should be centered on the pass band, and should be symmetrical. If it is not symmetrical and appears unbalanced, as in figure 8, adjust C507 and C512 (figure 6) to obtain a response curve which is the mirror image (tilt in the opposite direction) of the original; for example, if Channel 7 response curve appears as in figure 8A, adjust C507 and C512 until the curve appears as in figure 8B. This adjustment overcompensates to make allowance for the effect of Channel 13 adjustments (to be made in step 10) upon Channel 7 response.

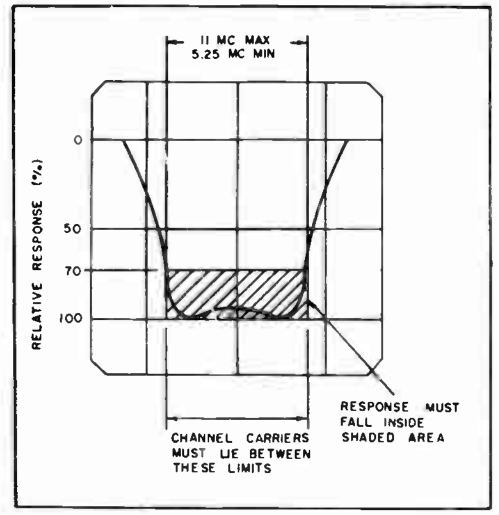
10. Reset the CHANNEL SELECTOR and generators to Channel 13, and repeat steps 8 through 10 as many times as is necessary to obtain the most symmetrical and centered response curves on Channels 13 and 7. Channels 7 through 13 are now correctly aligned.

11. Set the CHANNEL SELECTOR and sweep generator to Channel 6 (85 mc.).

12. Establish the channel limits, using the marker generator to produce marker pips on the response curve. (Set the marker generator first to 82 mc., and then to 88 mc.)

13. Adjust TC503 and TC505 for a symmetrical, approximately centered pass band. Set the marker generator to 85 mc. Detune TC505 counterclockwise until a single peak appears. Adjust TC503 until the peak falls on the 85-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC501 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for Channels 2 through 6.

14. Readjust TC503 and TC506 for a symmetrical



TP3-1213-1

Figure 7. Television Tuner Response Curve, Showing Bandpass Limits

response, centered about 85 mc., and falling within the specifications, as shown in figure 7. Channels 2 through 6 are now correctly aligned.

VIDEO I-F ALIGNMENT

Preliminary

Before proceeding with the i-f alignment or making an alignment check, observe the following preliminary instructions:

1. Preset the CONTRAST and BRIGHTNESS controls to the maximum counterclockwise position.

2. Preset the CHANNEL SELECTOR to Channel 4.

3. Insert the video i-f alignment jig into J200.

4. Connect the oscilloscope to the 15,000-ohm resistor from the video i-f alignment jig. Connect the ground lead of the oscilloscope to the ground lead from the adapter.

5. With a voltmeter connected across the points shown in figure 3, set the potentiometer to furnish 14 volts of bias.

6. Connect the AM generator to the mixer test point, G500, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during the alignment to keep the output at the second detector below .6 volt, peak to peak.

NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

Procedure

1. Tune the AM generator to 47.25 mc., and adjust C201 for minimum output, as observed on the oscilloscope.

2. Tune the AM generator to 41.25 mc., and

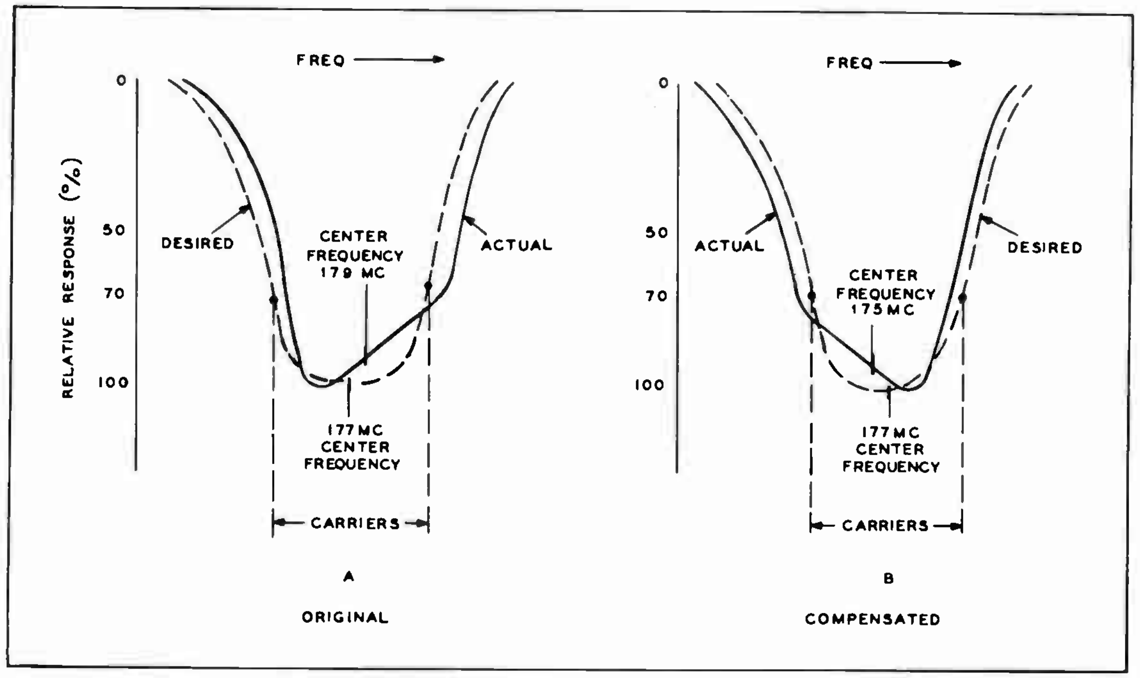


Figure 8. Television Tuner Response Curve, Showing Tracking Compensation

adjust C203 for minimum output, as observed on the oscilloscope.

NOTE: In steps 1 and 2, it is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading the receiver by excessive signal.

3. Tune the AM generator to the frequencies indicated below, and adjust the trimmers for maximum output.

a. 42.7 mc.—adjust C514
b. 44.75 mc.—adjust C204
c. 45.7 mc.—adjust C210
d. 44.4 mc.—adjust C215
e. 43.0 mc.—adjust C218
f. 42.0 mc.—adjust C206

4. Increase the bias (by means of the potentiometer) until the scope presentation of step f, above, is reduced to 50 percent of its previous amplitude, and retouch C206 for maximum indication on the oscilloscope.

5. Connect the sweep generator and r-f marker generator to the antenna terminals through a matching jig. (If a separate oscilloscope is used, feed the sweep output of the generator to the horizontal input terminals of the oscilloscope.) Set the CHANNEL SELECTOR to Channel 4, and tune the sweep generator for output on Channel 4. Tune the r-f marker generator for the video carrier frequency of Channel 4 (67.25 mc.), and tune the i-f marker generator (connected through jig to mixer grid) to 45.75 mc. Note that two marker generators are used for this procedure. The r-f marker generator is connected to the antenna terminals, while the i-f marker generator is connected capacitively to the mixer grid test point, G500. A jig constructed from a piece of fiber tubing, with 3/16-inch inside diameter, and a brass machine screw which fits tightly into the tubing, is used to connect the generator capacitively to the test point. The screw is adjusted so that it clears the test point by approximately 1/64 inch. The output cable of the marker generator is connected to the head of the brass screw in the jig and to the chassis, near the mixer tube. Both marker generators should be adjusted for the minimum output required to make the markers barely visible. Failure to observe this precaution, or the use of excessive output from the sweep generator, will cause misleading results. After the equipment is properly connected, adjust the FINE TUNING control for zero-beat of the two markers, as observed on the oscilloscope. When zero beat is obtained, remove the i-f marker.

6. If the response curve does not fall within the limits, as shown in figure 10, the adjustment of the trimmers may be touched up slightly, while observing the response curve. Do not retouch the setting of C201, C203, or C206. To adjust the curve, first adjust C215 and C218, alternately, until maximum improvement has been obtained. C215 affects the tilt of the curve, and C218 affects the dip of the curve. After C215 and C218 have been adjusted, adjust C514 for proper slope at the 42.25-mc. side of the curve, and then adjust C204 and C210 for proper level at the video carrier frequency (45.75 mc.).

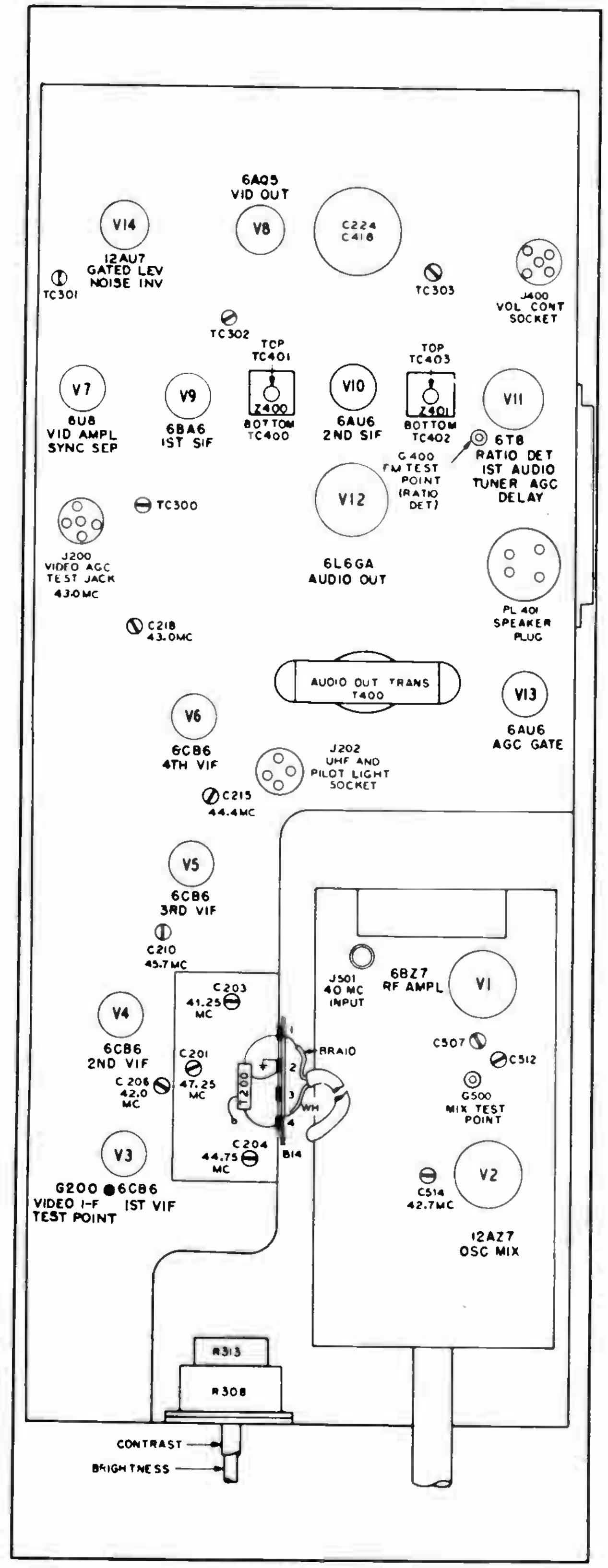


Figure 9. R-F Chassis, Top View, Showing Locations of Adjustments

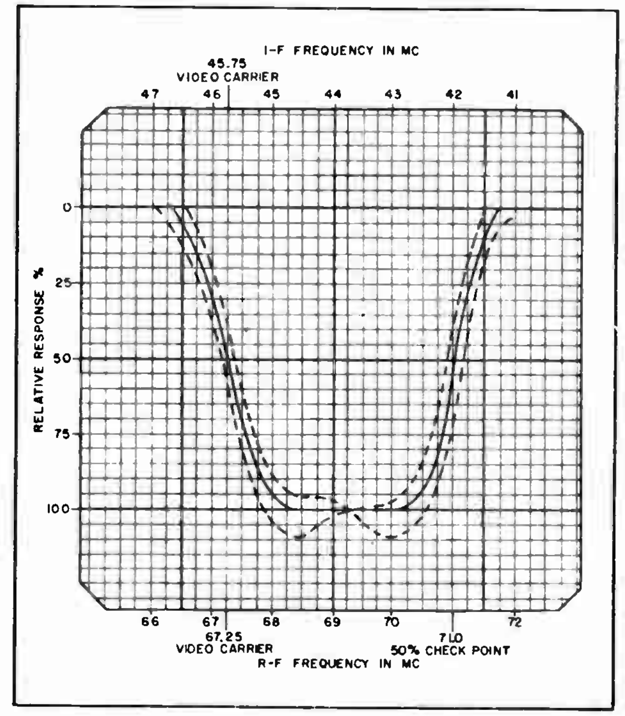


Figure 10. Over-all R-F, I-F Response Curve

CAUTION: Do not turn any of the trimmers excessively. To retouch, only turn the trimmers slightly.

SOUND I-F ALIGNMENT

The sound i-f system may be aligned by the use of a station signal or an accurately calibrated signal generator, for the signal source. If the station signal is used, tune the FINE TUNING control for the best picture, regardless of sound. It will be necessary to reduce the signal input to the receiver, so that the d-c output at the sound detector, as measured with the aid of the sound i-f output alignment jig (between point "B" and ground), is kept below 5 volts maximum, and preferably below 3 volts. To establish this level in strong-signal areas, it may be necessary to short the antenna terminals and to apply bias to the a-g-c circuit. The signal input to the receiver may be adjusted by varying the length of the shorting lead. The bias may be applied to the a-g-c circuit by means of the jig shown in figure 4. The sound i-f output alignment jig shown in figure 5 should be used for convenient connection of the meter to the sound-detector output.

When a signal generator is used, bias should be applied to the a-g-c circuit, to avoid any possibility of regeneration, using the sound i-f input alignment jig (figure 4). In addition, the first video i-f tube should be removed, to aid in the reduction of circuit noises from the i-f system.

1. Connect the generator through the 2200-ohm resistor, in the sound i-f input alignment jig, to pin 2 of J200. The generator should be adjusted for unmodulated output at 4.5 mc.

2. Insert the sound i-f output alignment jig in the volume-control socket (J400), and insert the volume-control plug (PL400) in the top of the jig. Connect the clip lead to the FM test point (G400); connect a 20,000-ohms-per-volt voltmeter between point "B" and the ground lug of the jig, with the negative lead of the meter going to point "B".

3. Adjust TC300, TC400, TC401, and TC402 for maximum output, as indicated on the meter. If the output exceeds 5 volts, reduce the signal input to the receiver.

4. Shift the positive lead of the meter to point "C" on the sound i-f output alignment jig, and adjust TC403 for zero crossover. Zero crossover is indicated by a zero indication on the meter, under the following conditions: when TC403 is turned in one direction from this zero point, the meter will swing positive; turning TC403 in the opposite direction will cause a negative swing. (To aid in reading a positive and negative swing on the meter, set the pointer, by means of its zero-adjustment screw, to a convenient calibration mark on the scale, before connecting the meter to the circuit.)

5. Replace the first video i-f tube, and then tune in a station on the receiver. Turn the FINE TUNING control to obtain a slightly fuzzy picture, and retouch TC403 for minimum AM (noise), using the speaker output as an indication.

ADJUSTMENT OF 4.5-MC. TRAP

To adjust the 4.5-mc trap in the plate circuit of the first video amplifier, proceed as follows:

1. Connect the output of the signal generator to the lead from pin 2 of the sound i-f alignment jig (see figure 3). Adjust the generator for 4.5 mc., 400-cycle modulated output. Set the output attenuator for maximum output from the generator.

2. Connect the input of an r-f probe, shown in figure 11, to the grid of the picture tube, and connect the output leads of the probe to the vertical input terminals of the oscilloscope. Adjust the vertical gain of the oscilloscope to maximum.

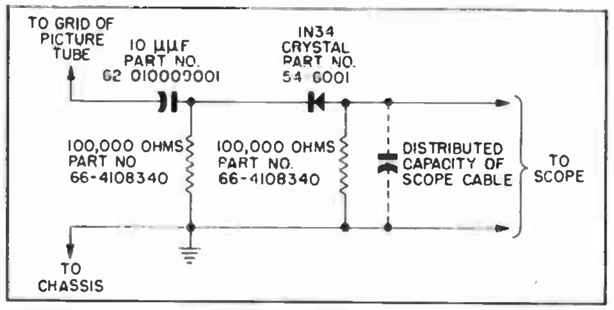
3. Adjust TC301 for minimum indication on the oscilloscope. (The normal setting for TC301 is with the screw approximately ⅝ inch out from the chassis.) An alternate method for adjustment of TC301 may be used if a 4.5-mc. generator is not available. To adjust TC301 without the generator, proceed as follows:

1. Tune in a strong station signal.

2. Turn the FINE TUNING control in a clockwise direction until a fine beat pattern appears in the picture.

3. Adjust TC301 until the beat disappears or is at a minimum. When correctly adjusted, the screw will be out from the chassis approximately ⅝ inch.

4. If more than one station is available, check the setting of TC301 on all stations.



TP2-2670-A

Figure 11. R-F Probe for Sound-Trap Adjustment

OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms shown below were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak voltages will differ from those shown.


TP1-1200-A

Figure 12. Video-Detector Output, Pin 2 of J200, 2 volts, 60 c.p.s.

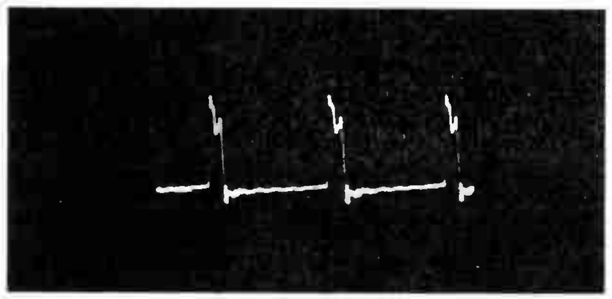

TP2-654

Figure 13. Gate-Pulse Plug, Pin 4 700 volts, 15,750 c.p.s.

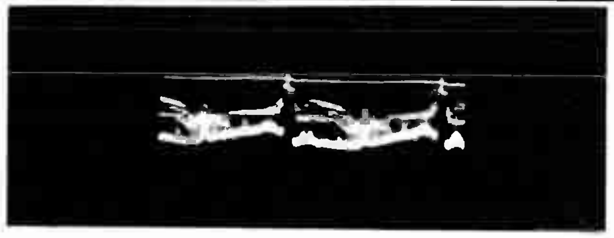

TP2-653

Figure 14. A-G-C Gate Grid, Pin 1 17 volts, 60 c.p.s.


TP2-656

Figure 15. Gate-Pulse Plug, Pin 3 10.5 volts, 15,750 c.p.s.

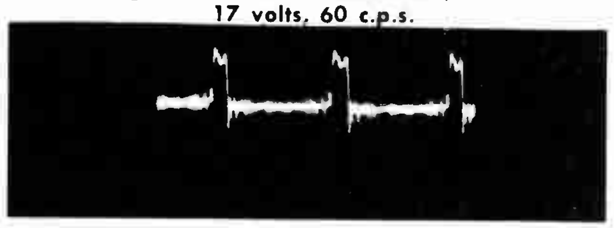

TP2-655

Figure 16. Gated-Leveler Grid, Pin 2 3 volts, 15,750 c.p.s.

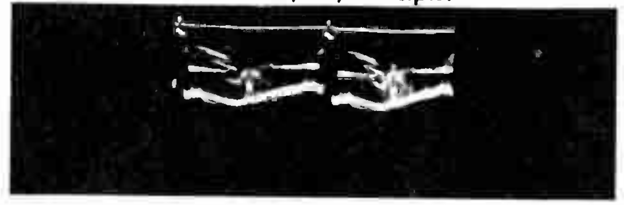

TP2-657

Figure 17. Noise-Inverter Plate, Junction of R605, C602, and C603, 23 volts, 15,750 c.p.s.

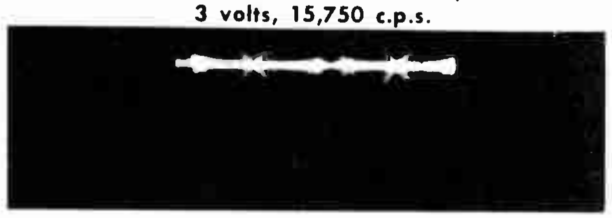

TP2-658

Figure 18. Noise-Inverter Cathode, Pin 8 (Wave shape and amplitude vary with noise)

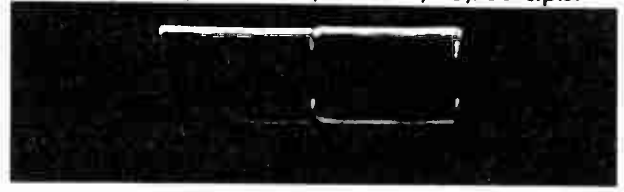

TP2-659

Figure 19. Sync-Separator Plate, Pin 1 20 volts, 60 c.p.s.

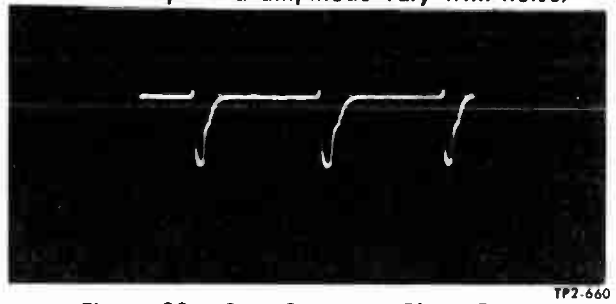

TP2-660

Figure 20. Sync-Separator Plate, Pin 1 20 volts, 15,750 c.p.s.

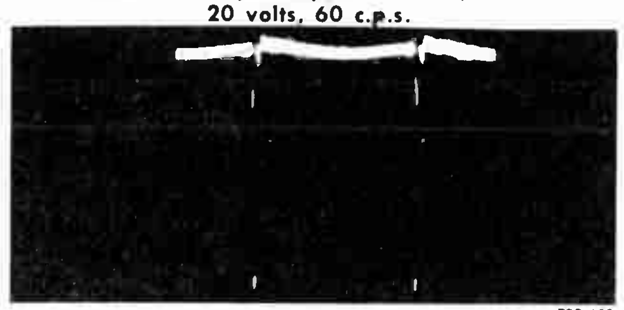

TP2-639

Figure 21. Phase-Splitter Grid, Pin 2 16 volts, 60 c.p.s.

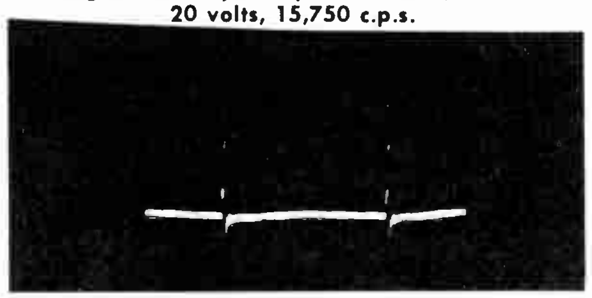

TP2-640

Figure 22. Phase-Splitter Plate, Pin 1 50 volts, 60 c.p.s.

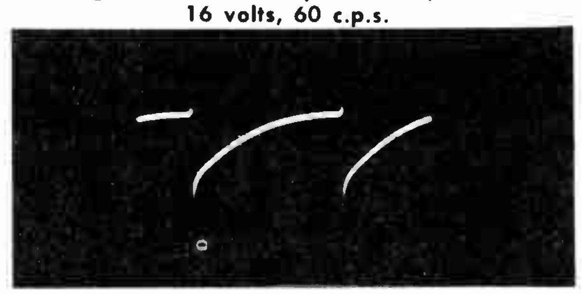

TP2-643

Figure 23. Vertical-Oscillator Grid, Pin 7 170 volts, 60 c.p.s.

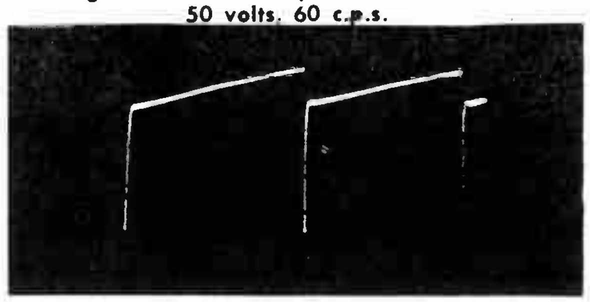
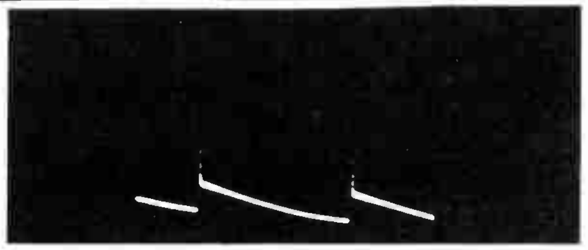

TP2-697

Figure 24. Vertical-Oscillator Plate, Pin 6 130 volts, 60 c.p.s.

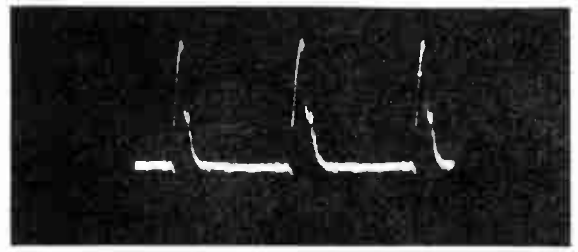

TP2-644

Figure 25. Vertical-Output Grid, Pin 5 40 volts, 60 c.p.s.



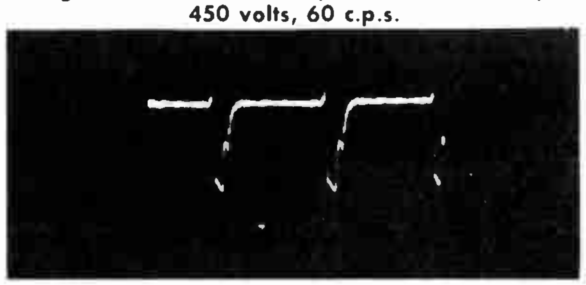
TP2-645

Figure 26. Vertical-Output Plate, Plate Cap 450 volts, 60 c.p.s.



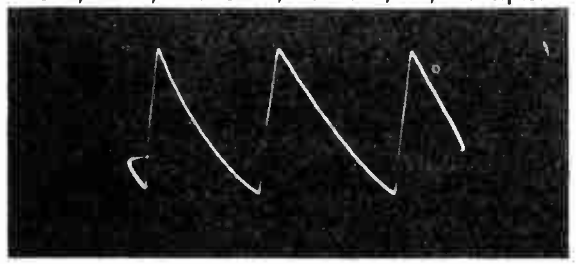
TP2-641

Figure 27. Phase-Splitter Plate, Junction of R614, R615, and C800, 13 volts, 15,750 c.p.s.



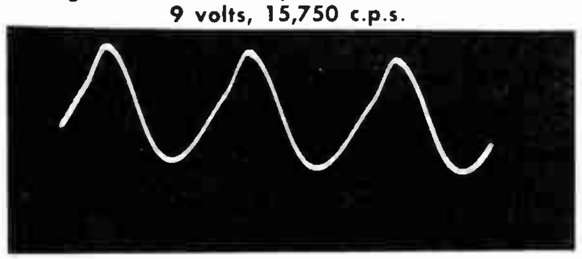
TP2-642

Figure 28. Phase-Splitter Cathode, Pin 3 9 volts, 15,750 c.p.s.



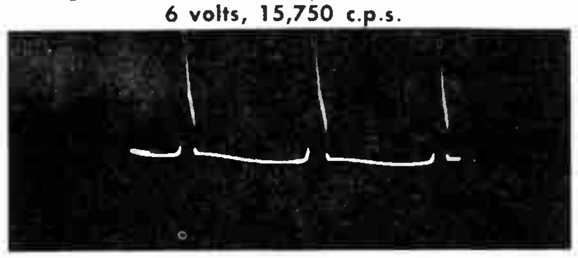
TP2-652

Figure 29. Phase Comparer, Pins 1 and 2 6 volts, 15,750 c.p.s.



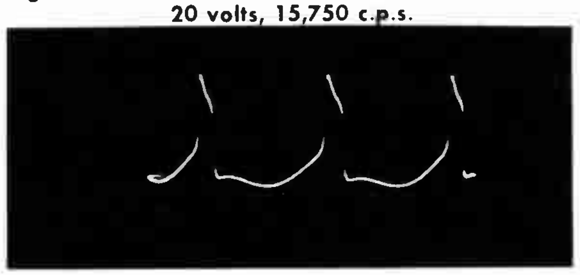
TP2-2852

Figure 30. Horizontal Oscillator, G800 Test Point 20 volts, 15,750 c.p.s.



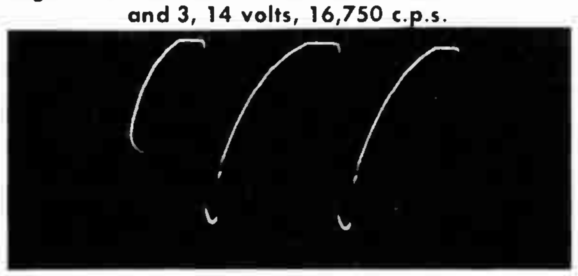
TP2-647

Figure 31. Horizontal-Oscillator Cathode, Pins 8 and 3, 14 volts, 16,750 c.p.s.



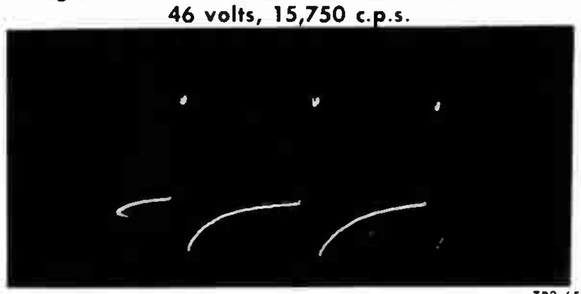
TP2-648

Figure 32. Horizontal-Oscillator Grid, Pin 2 46 volts, 15,750 c.p.s.



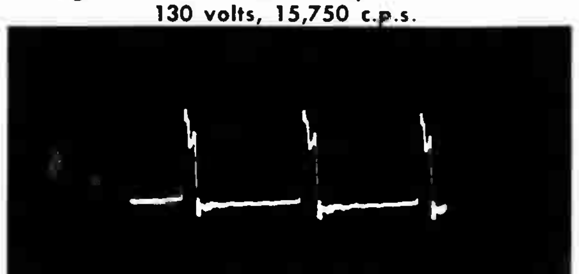
TP2-649

Figure 33. Horizontal-Output Grid, Pin 5 130 volts, 15,750 c.p.s.



TP2-650

Figure 34. Horizontal-Deflection Yoke, Pin 7 of J800 5600 volts, 15,750 c.p.s.



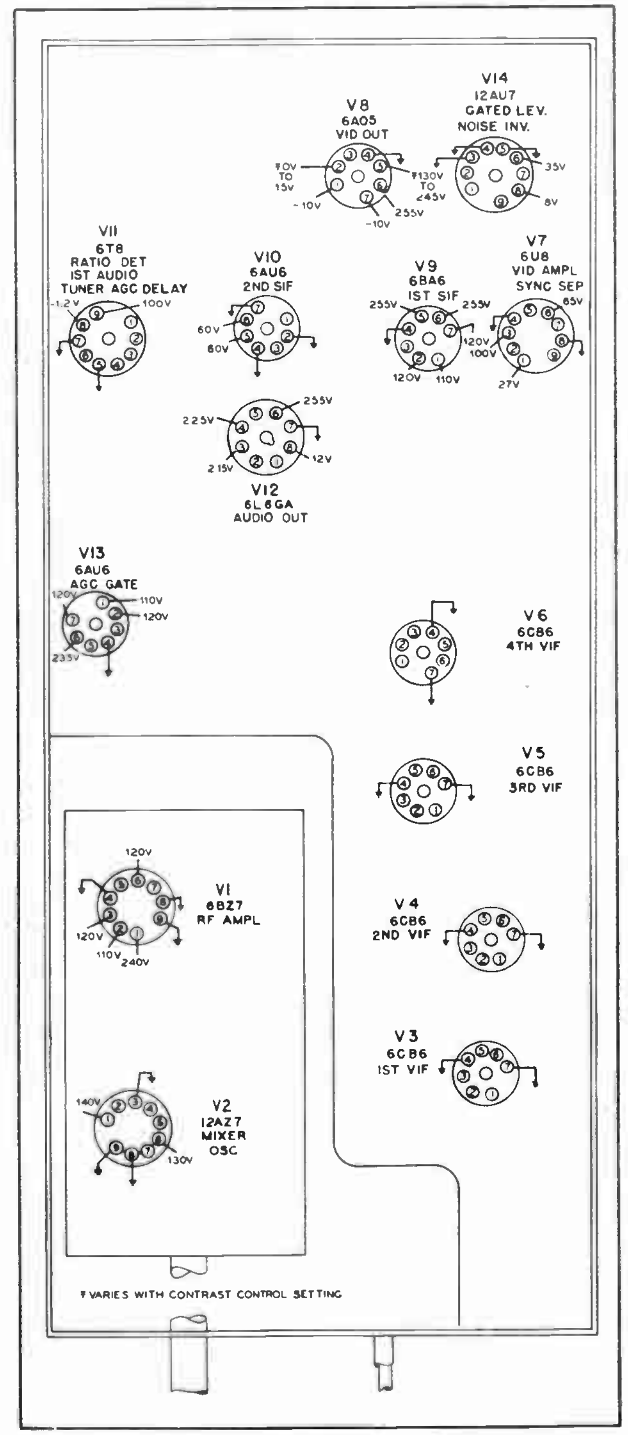
TP2-654

Figure 35. Gate-Pulse Socket, Pin 4 of J801 700 volts, 15,750 c.p.s.

*CAUTION: High-voltage pulses are present in the horizontal-output circuit. The waveform in figure 34 was taken with the alligator clip of the oscilloscope lead clipped over the insulation of the lead connected to pin 7 of J800. (To prevent puncture of the insulation of the lead, file off the teeth of the alligator clip, and wrap friction tape around the clip.) Connection to other points in the horizontal-output circuit is dangerous, due to the high voltages present. The peak-to-peak voltage shown for figure 34 is the actual voltage present; however, the amplitude of the scope presentation depends upon the degree of coupling.

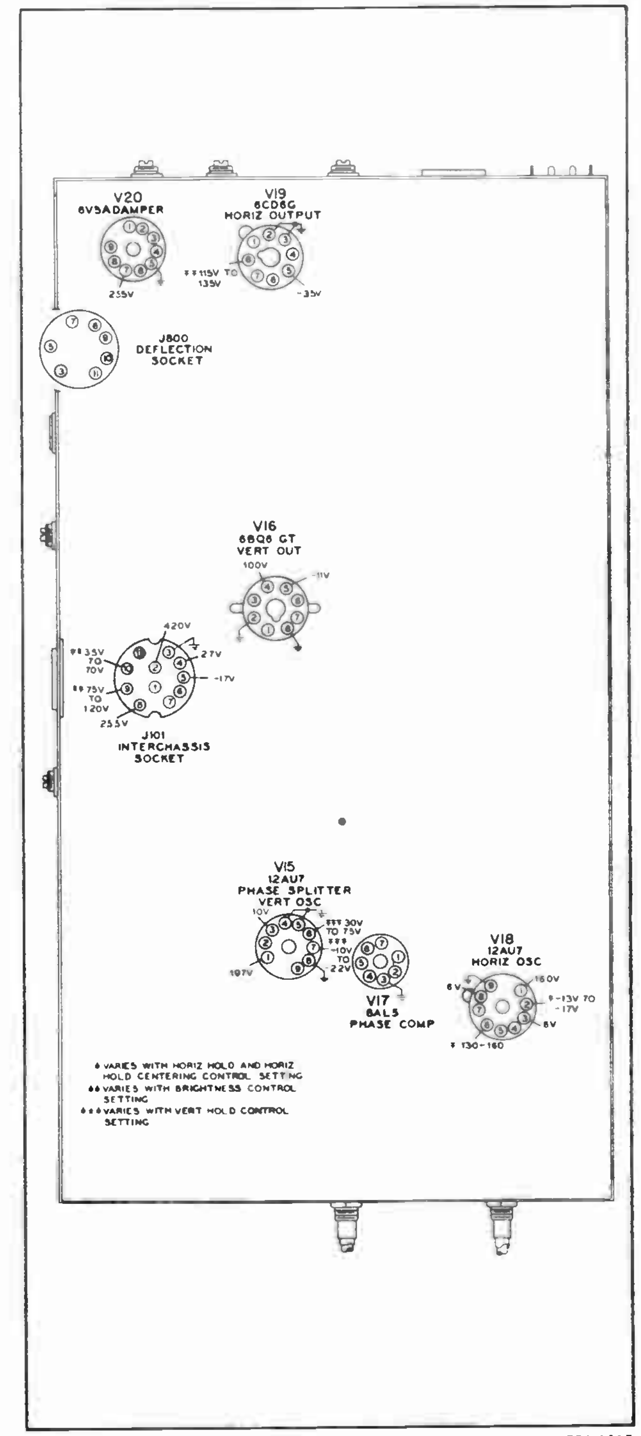
VOLTAGE MEASUREMENTS

The voltages given here and on the schematic diagrams were taken with a 20,000-ohms-per-volt voltmeter, at a line voltage of 117 volts, and with no signal input to the receiver. Since voltage readings taken in the video i-f stages vary widely with different test equipment setups, voltage measurements for these stages are omitted from the diagrams.



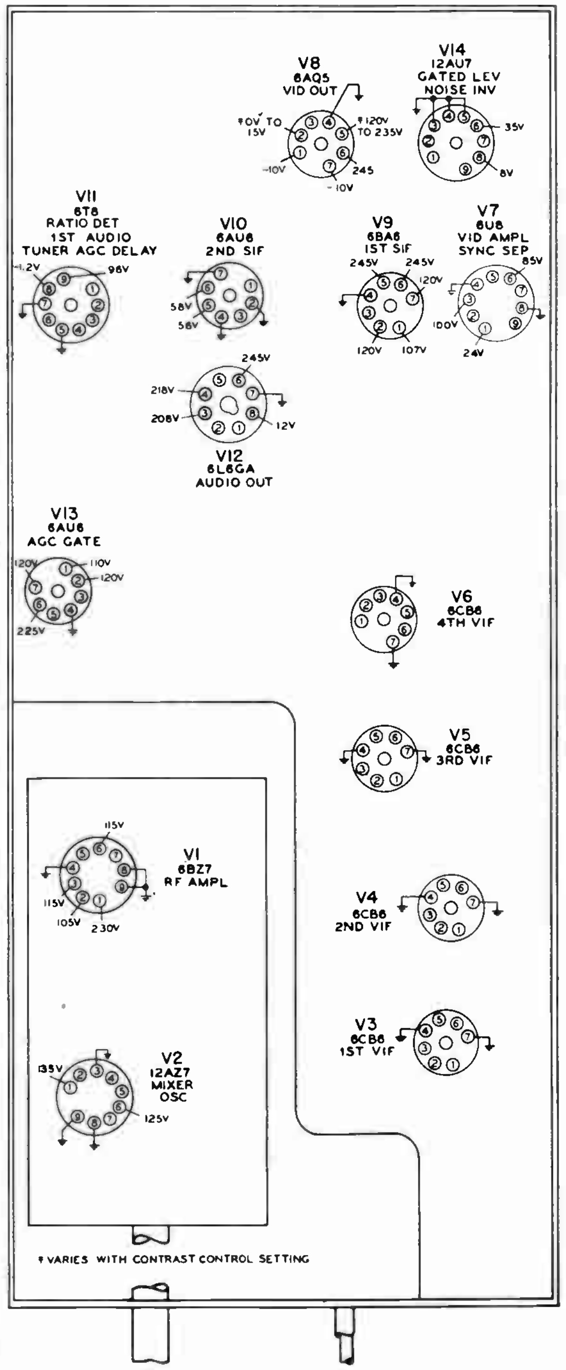
TP3-1311

Figure 36. R-F Chassis R-207, Bottom View, Showing Voltages at Socket Pins when Used with D-208 Chassis



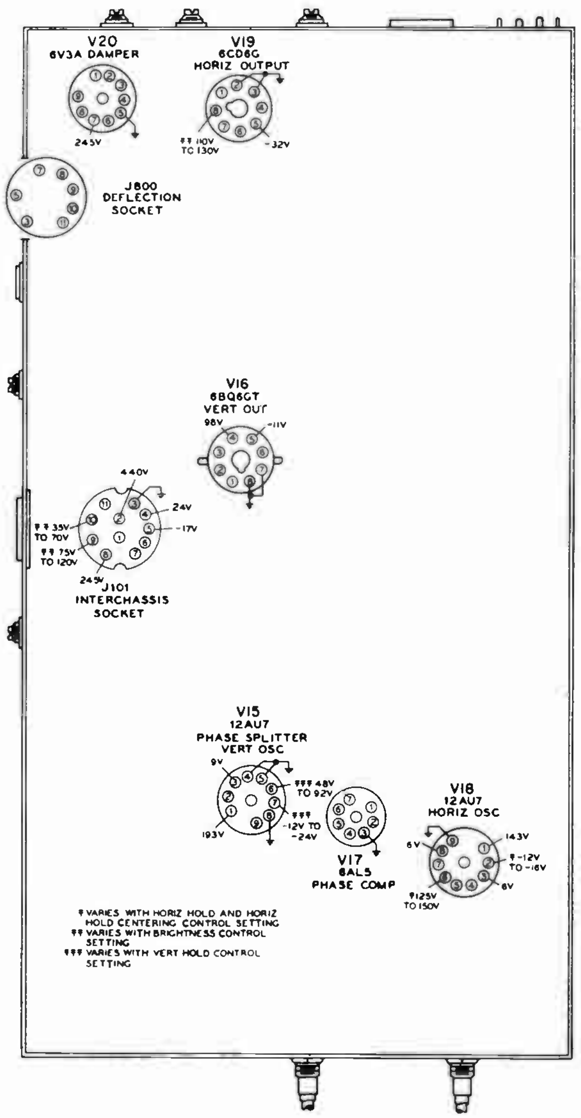
TP3-1312

Figure 37. Deflection Chassis D-208, Bottom View, Showing Voltages at Socket Pins



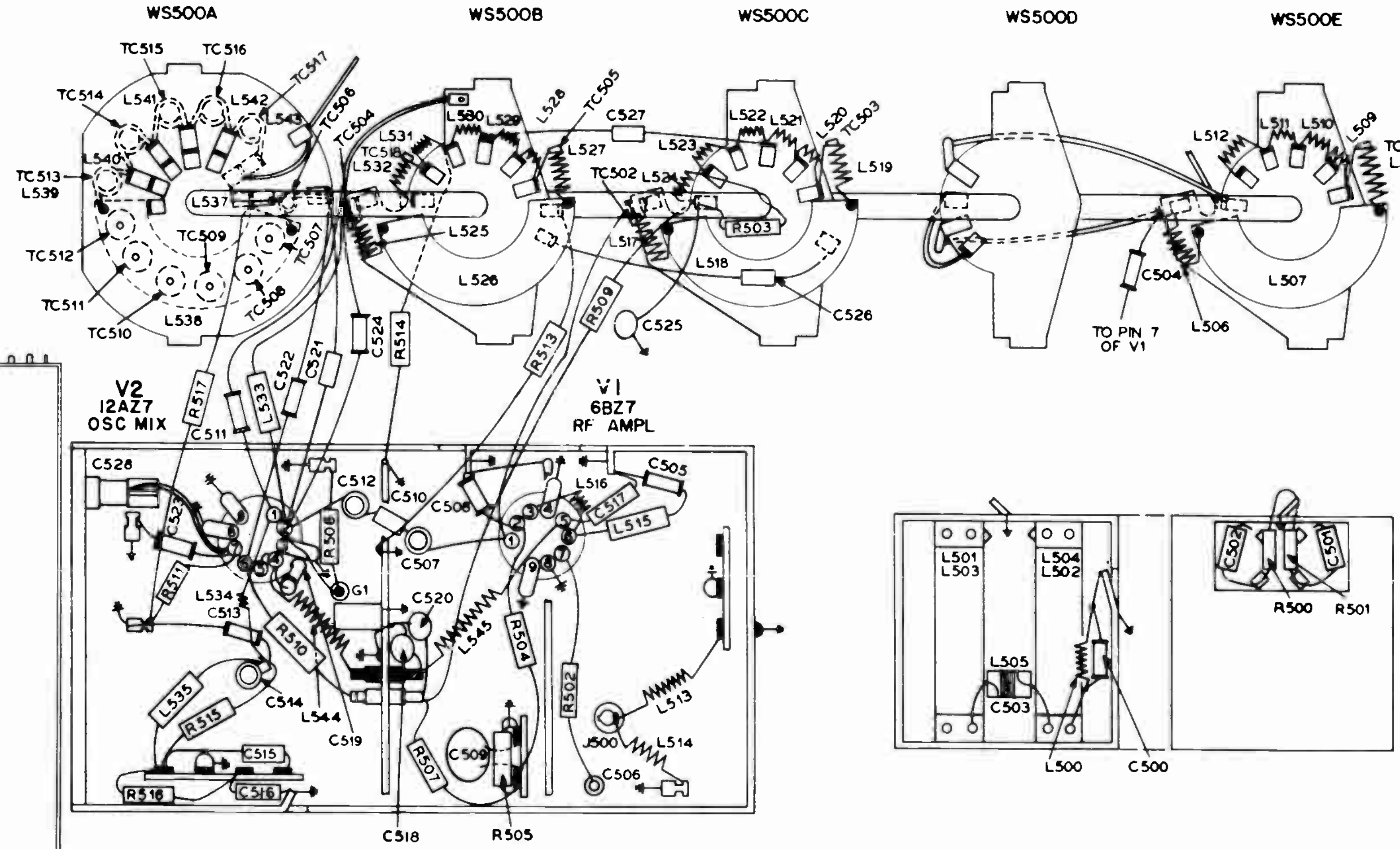
TP3-1313

Figure 38. R-F Chassis R-207, Bottom View, Showing Voltages at Socket Pins when Used with D-207 Chassis



TP3-1314

Figure 39. Deflection Chassis D-207, Bottom View, Showing Voltages at Socket Pins



TP3-947

Figure 40. Television Tuner, Part No. 76-7600-3, Base Layout

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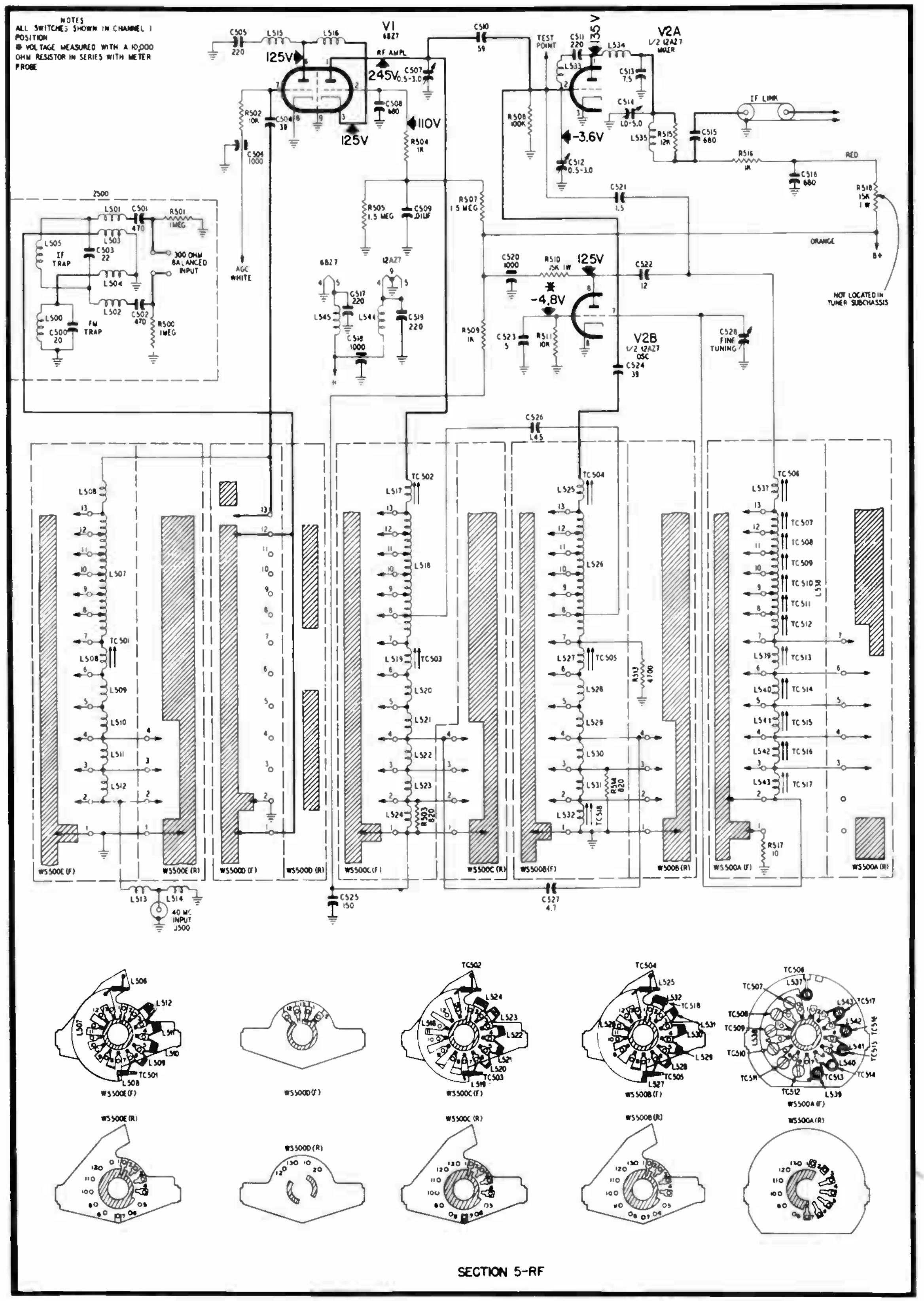
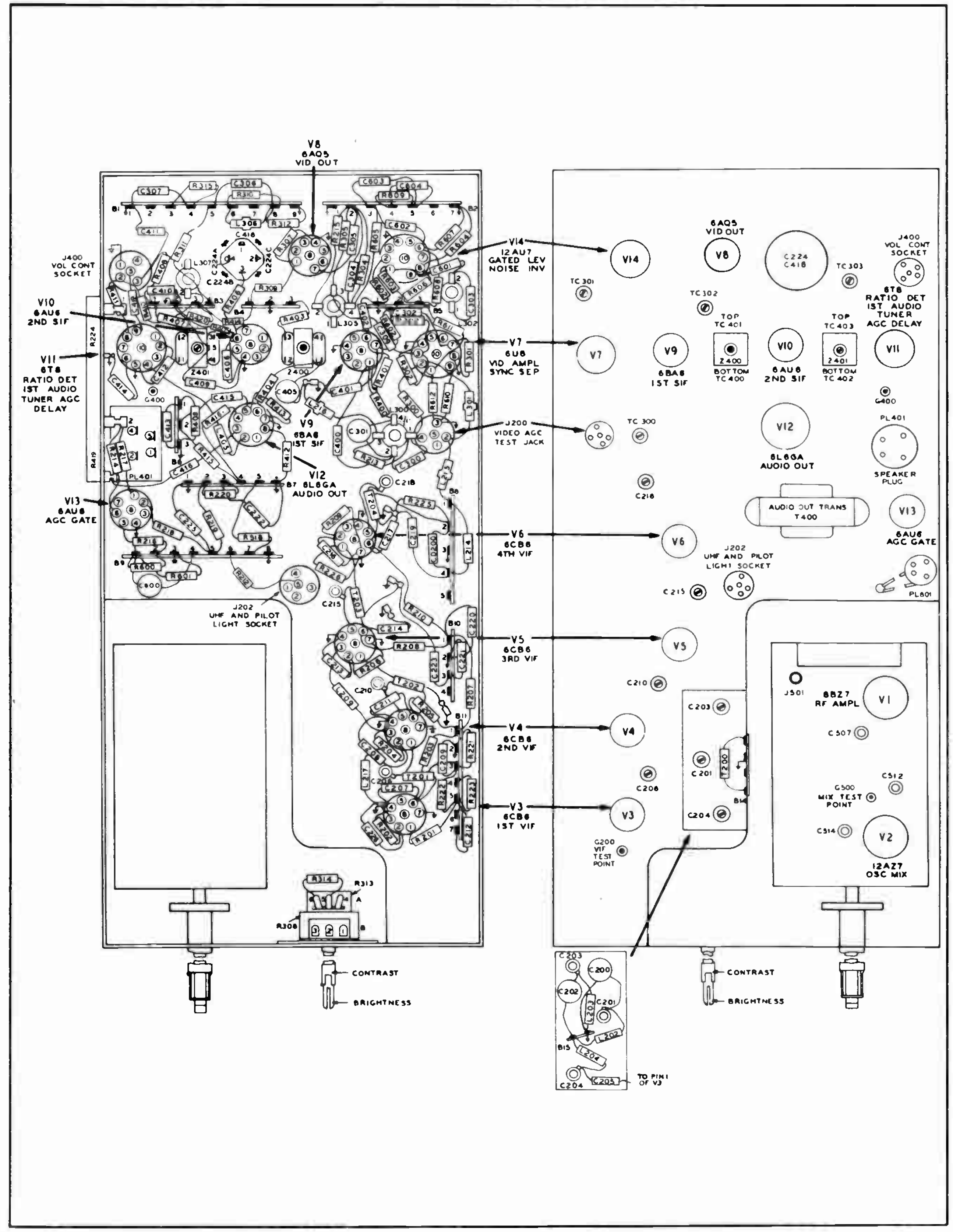


TP2-2245-A

Figure 41. Television Tuner, Part No. 76-7600-3, Schematic Diagram



TP3-1315

Figure 42. R-F Chassis R-207, Base Layout

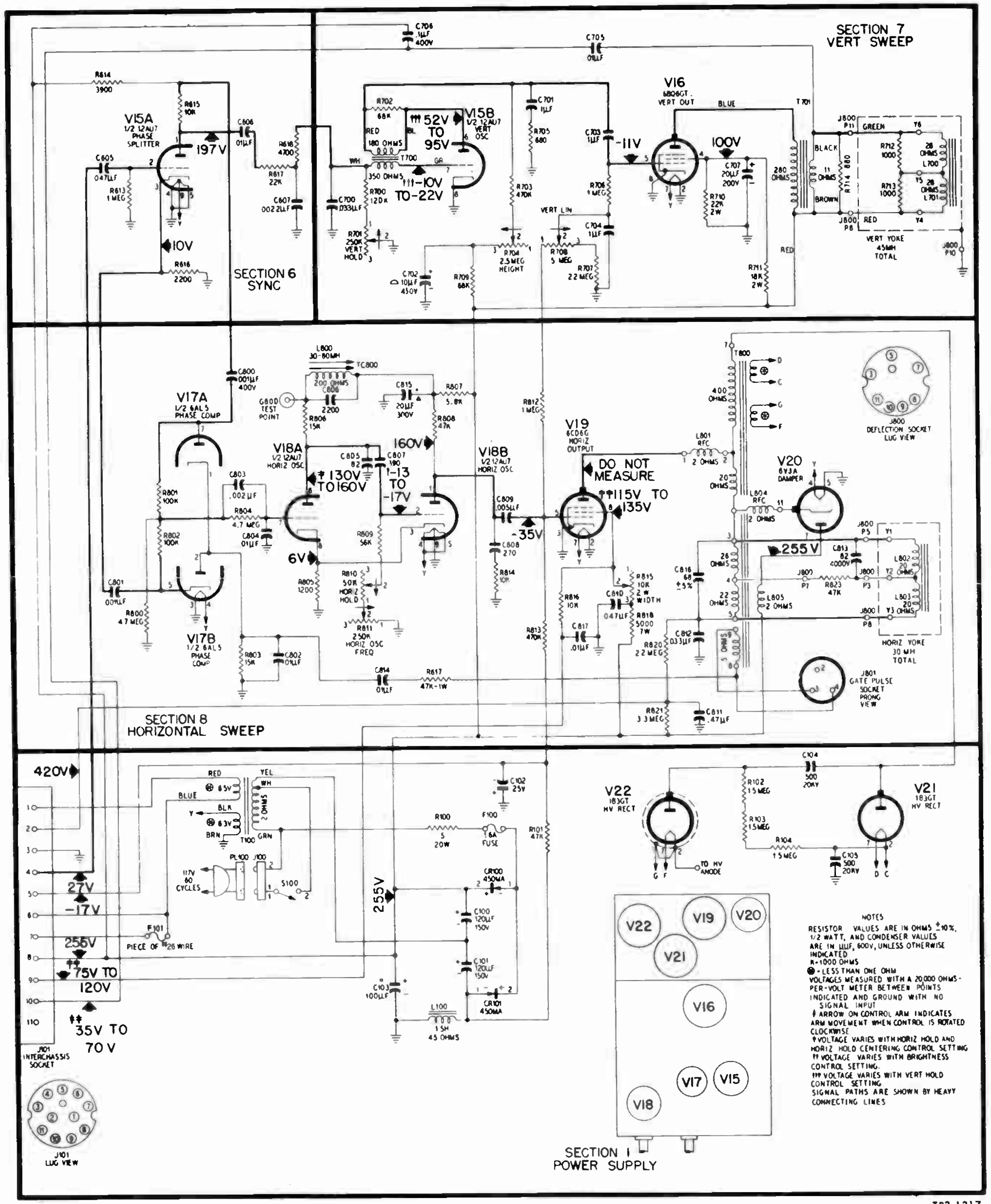


Figure 44. Deflection Chassis D-208, Schematic Diagram

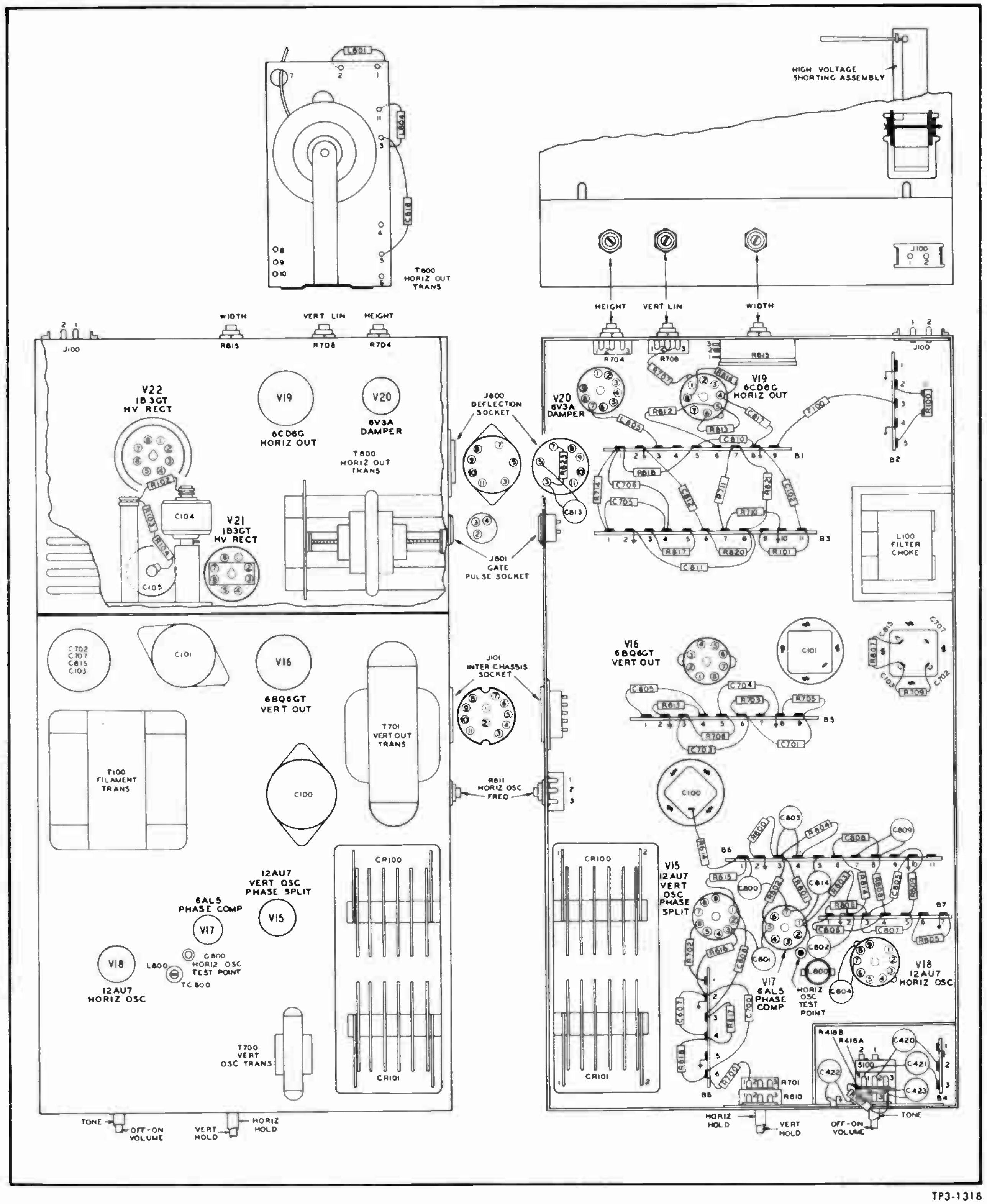


Figure 45. Deflection Chassis D-208, Base Layout

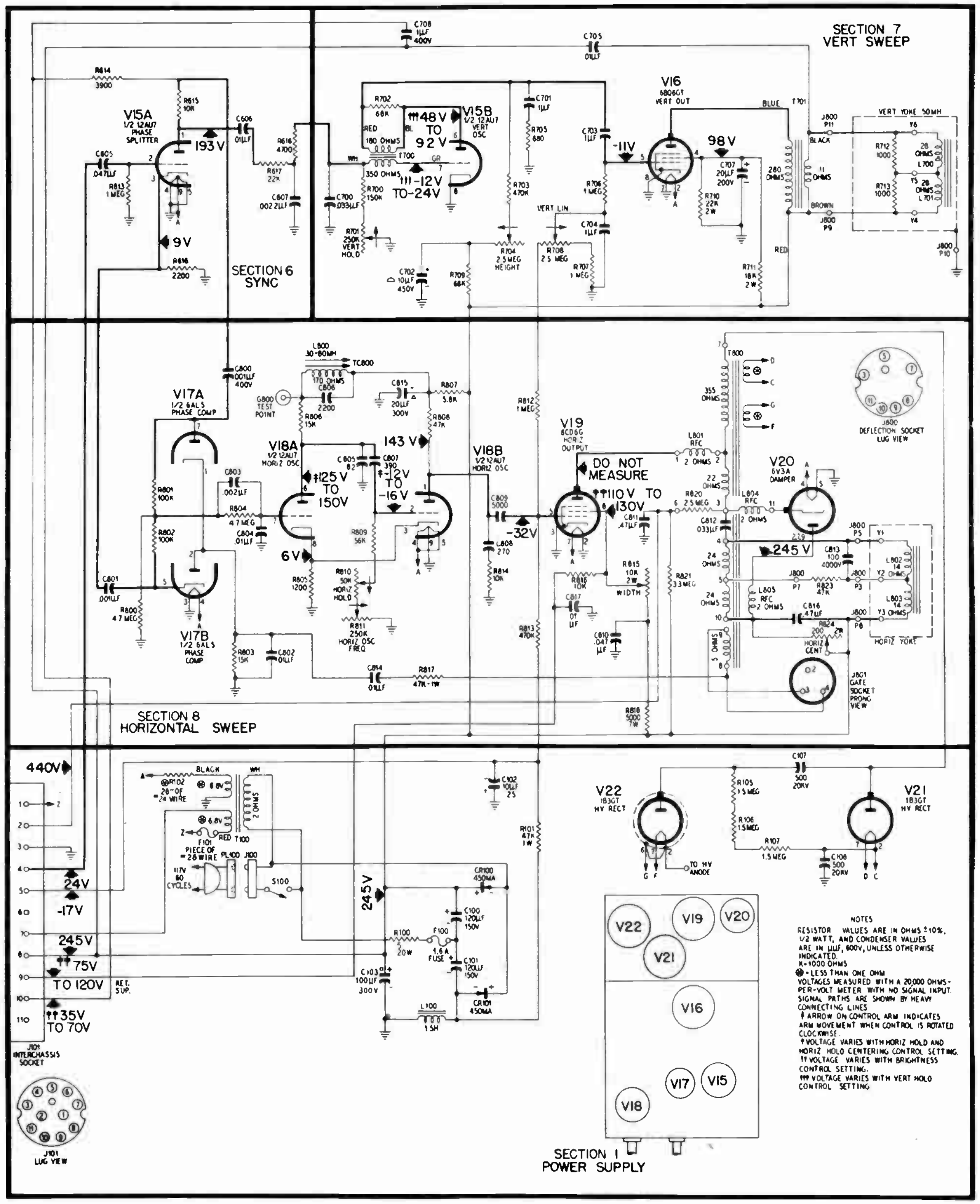


Figure 46. Deflection Chassis D-207, Schematic Diagram

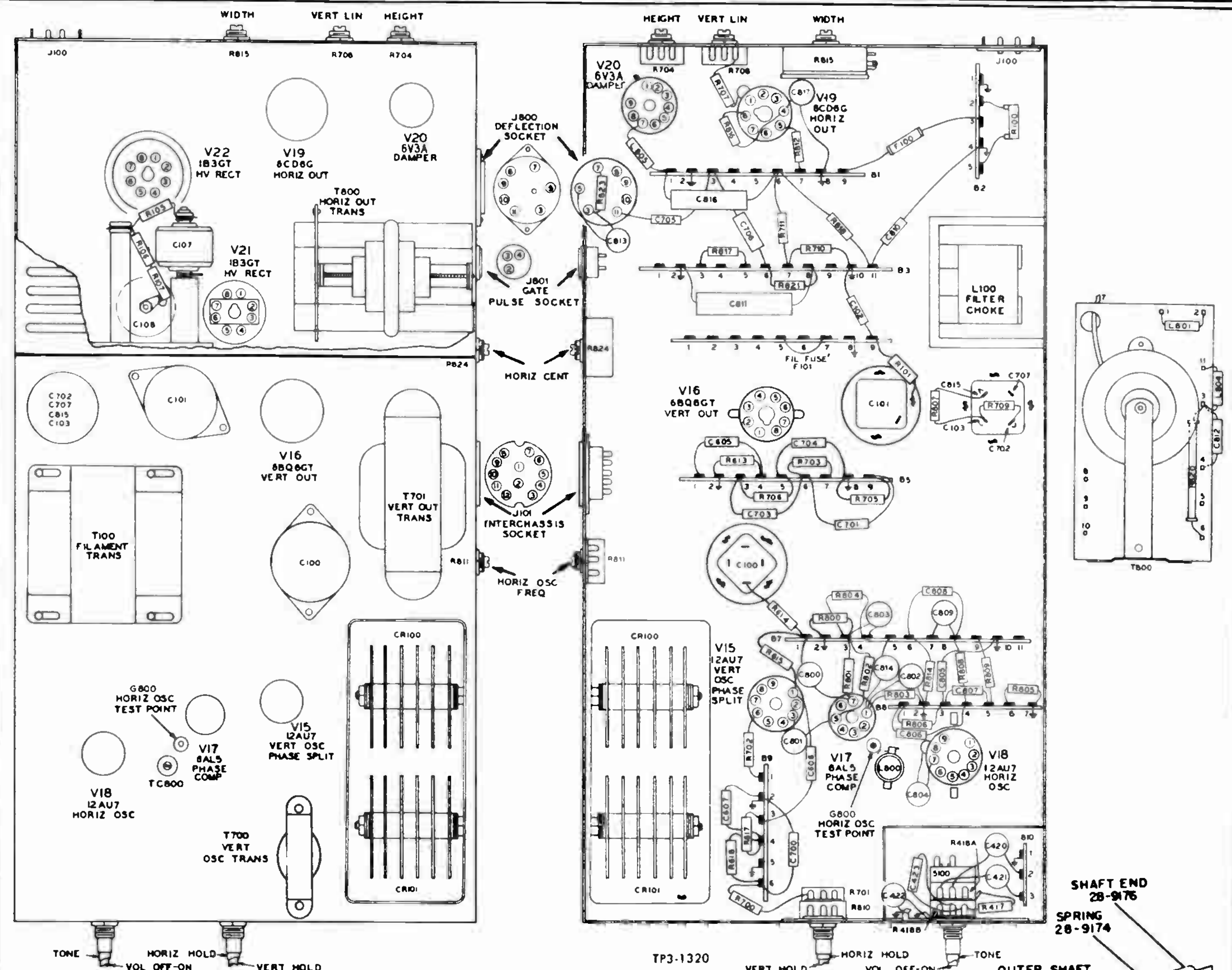


Figure 47. Deflection Chassis D-207, Base Layout

UHF TUNER-ADAPTER UT20B, PART NO. 43-6701

UHF Tuner-Adapter UT20B, Part No. 43-6701, provides for reception of UHF signals on television Channels 14 through 83. UHF Tuner-Adapter UT20B is designed for installation in Philco B line television receiver and is installed on BU models. These receivers use r-f chassis R-201.

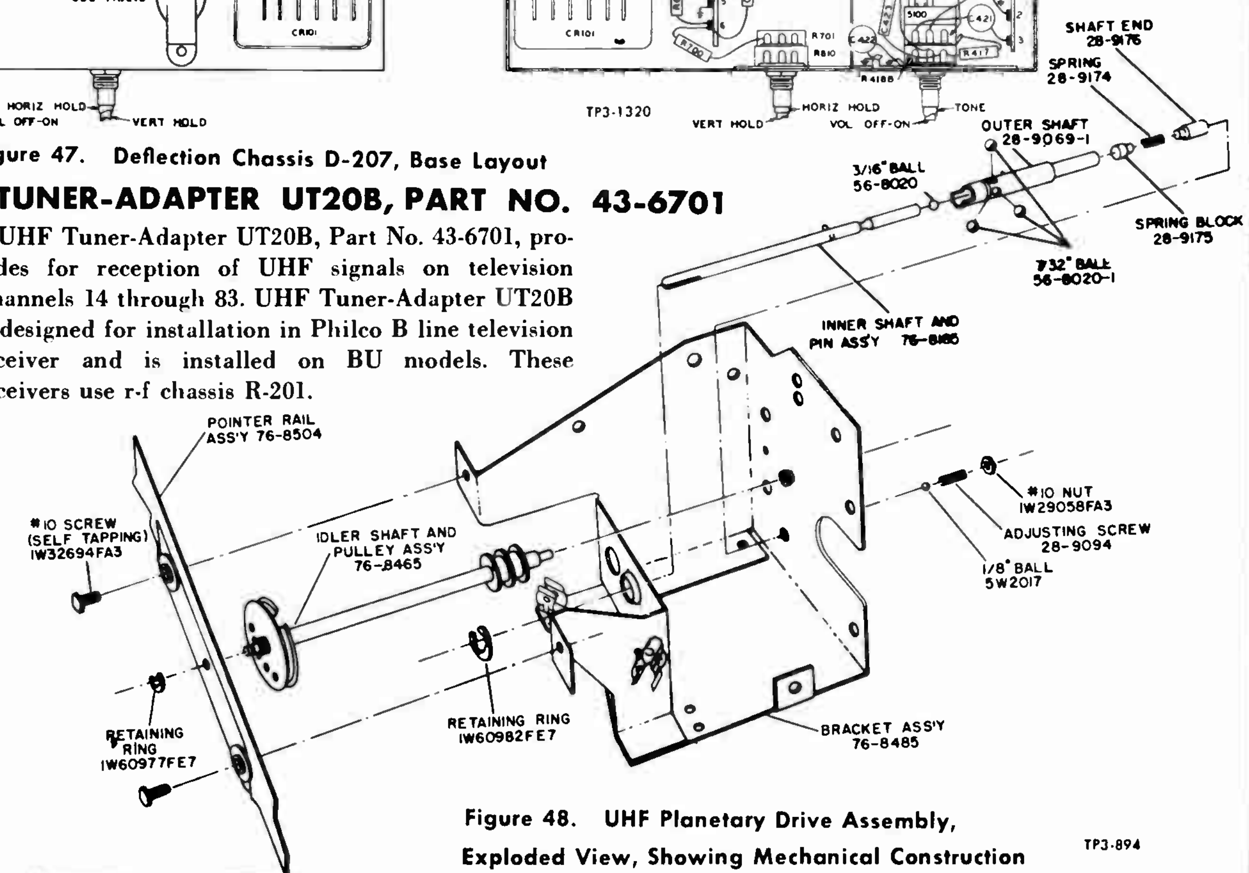
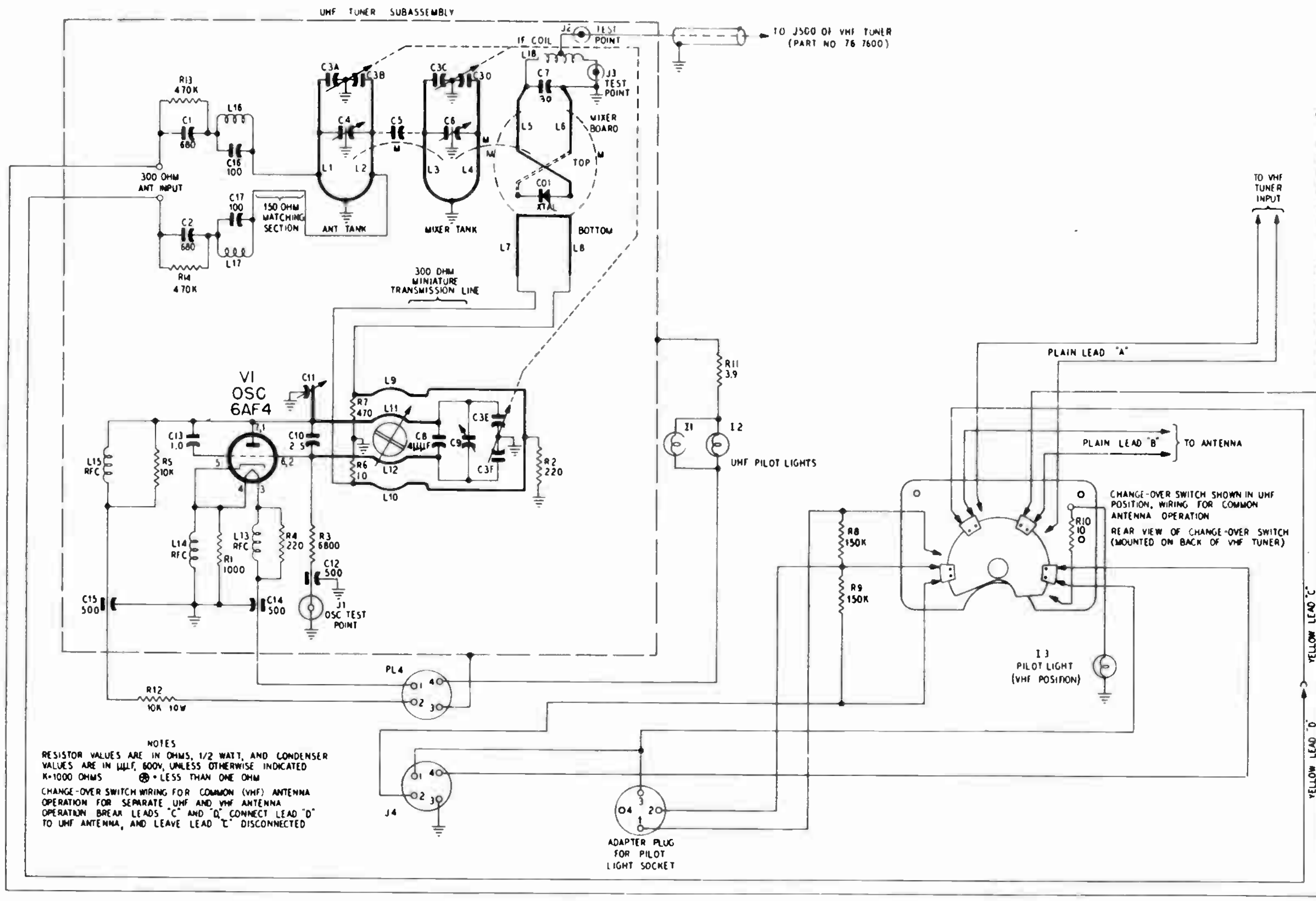
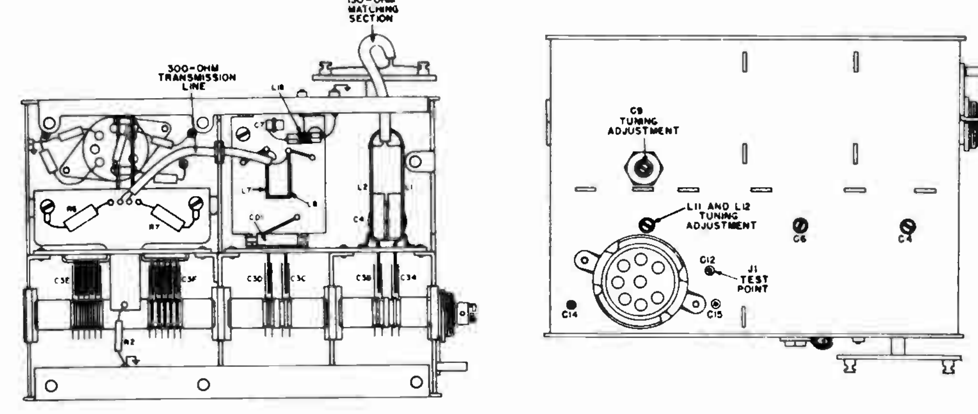


Figure 48. UHF Planetary Drive Assembly, Exploded View, Showing Mechanical Construction



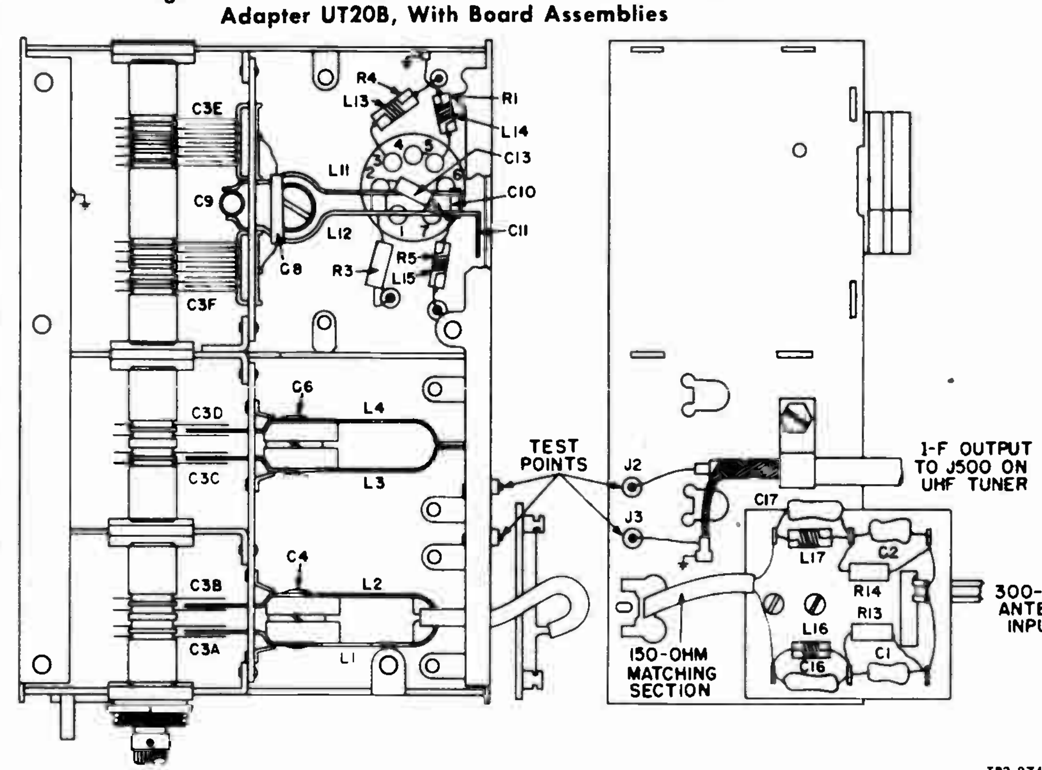
TP3-873

Figure 50. UHF Tuner-Adapter UT20B, Part No. 43-6701, Schematic Diagram



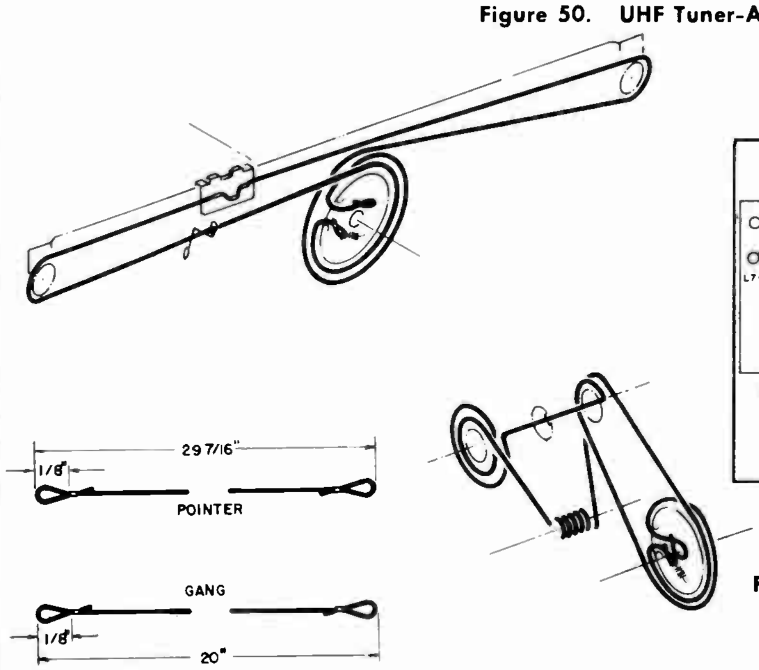
TP3-875-C

Figure 53. Side View and Base View of UHF Tuner-Adapter UT20B, With Board Assemblies



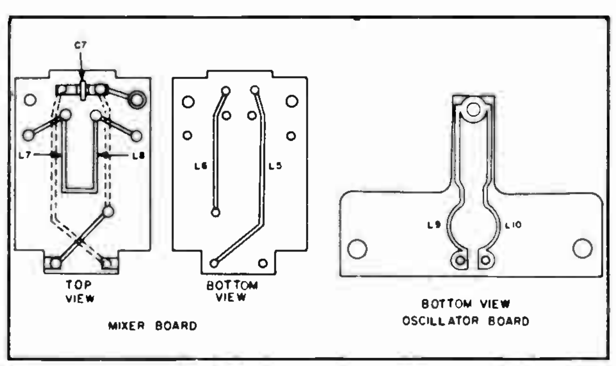
TP3-874-B

Figure 52. Top View and Base View of UHFTuner-Adapter UT20B, Without Board Assemblies



TP3-888

Figure 49. UHF Drive-Cord Stringing Arrangement



TP2-3175-A

Figure 51. Oscillator and Mixer Board Layouts, UHF Tuner

The Tuner-Adapter consists of a UHF Tuner, a VHF-UHF change-over switch, adapter cables and plugs, a planetary tuner driving assembly and mounting hardware.

CIRCUIT DESCRIPTION

The UHF tuner converts the UHF signals to the intermediate frequency of the r-f chassis.

The incoming UHF signal is coupled through the antenna input line, and through two i-f traps, two 680-$\mu\mu$f. condensers, and a 150-ohm transmission line to the antenna tank of the tuner. See figures 50 through 53. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the correct frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and the associated circuit. The oscillator circuit is coupled to the crystal mixer circuit by a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The r-f signal and the oscillator signal are mixed in the crystal mixer circuit to produce a 45.75-mc. video carrier intermediate-frequency signal. This signal is coupled to the VHF tuner through L18, a coaxial cable, and J500 on the VHF tuner. In UHF operation, the local oscillator of the VHF tuner is inoperative, and the r-f amplifier and mixer tubes of the VHF tuner operate as i-f amplifiers.

The two tanks of the UHF tuner, the antenna tank and the mixer tank, are used to prevent the i-f and oscillator signals from feeding back to the antenna and interfering with other receivers. The two tanks pass incoming signals readily, but do not pass the i-f or oscillator signal.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the Channel Selector of the VHF tuner is turned to the UHF position, the change-over switch makes proper connections for UHF operation. In this position, the switch places a 150,000-ohm resistor in series with the VHF mixer plate, which drops the voltage on the plate of the tube. (In the UHF position, the VHF Channel Selector places extra inductances in the VHF r-f and mixer circuits, permitting them to operate as i-f amplifiers, and it also shunts the VHF oscillator grid circuit with a 10-ohm resistor, putting the oscillator out of operation.) The change-over switch also turns off the VHF pilot light, turns on the UHF dial pilot lights, and connects the antenna to the UHF tuner.

When the VHF Channel Selector is turned to any VHF position, the change-over switch places a 150,000-ohm resistor in series with the UHF local oscillator plate circuit, which drops the voltage applied to the plate, and puts the oscillator out of operation. The switch also turns on the VHF pilot light, turns off the UHF dial pilot lights, and connects the antenna to the VHF tuner.

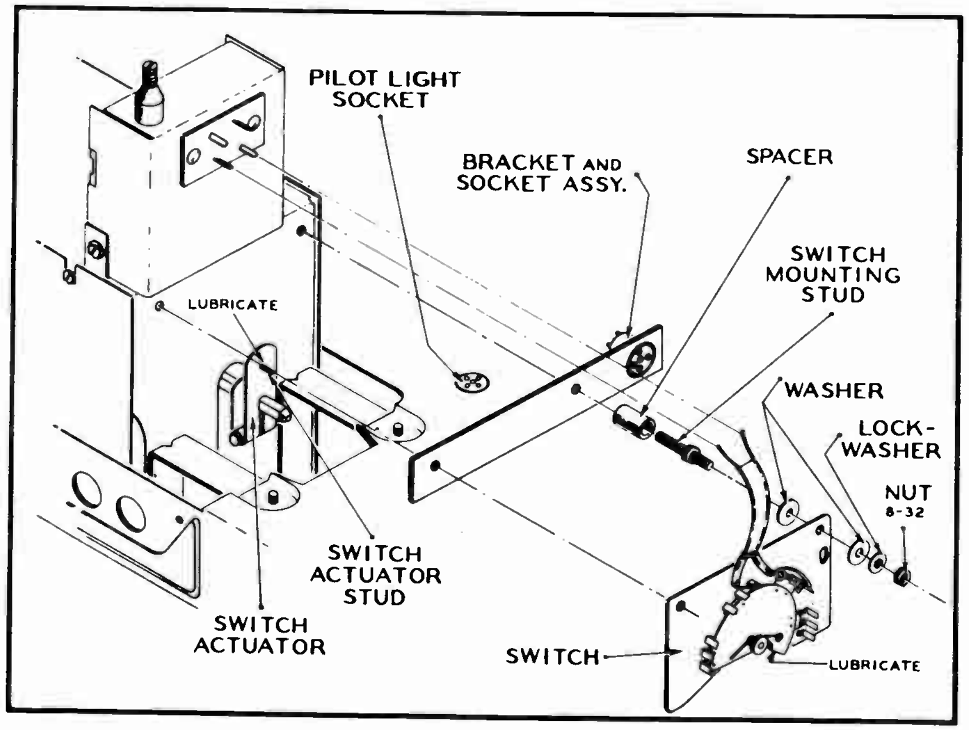
PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. See figure 48. The planetary drive is so constructed that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three balls, which form a planetary drive that produces slow rotation for fine tuning. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To reengage the planetary drive for fine tuning, it is only necessary to reverse the direction of rotation. The dial pointer is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned. See figure 49.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The Tuner-Adapter should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is not to remove the cover of the Tuner-Adapter.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, a number of tubes should be tried, until the most satisfactory substitute for the original is found.



TP3-480-A

Figure 54. VHF-UHF Change-Over Switch, Mounting Details

INSTALLATION INSTRUCTIONS FOR UHF TUNER-ADAPTER UT20B

To install the UHF tuner-adapter, proceed as follows:

1. Remove the cabinet back and r-f chassis from the cabinet; then remove the nameplate on the control panel by pushing it out from inside the cabinet.

2. Insert the dial scale and bezel assembly into the hole provided in the cabinet. Fasten the assembly in place with the two 10-32 nuts provided.

3. Remove the tuner assembly from the mounting board with which it was shipped. Keep the three screws for mounting the tuner in the cabinet.

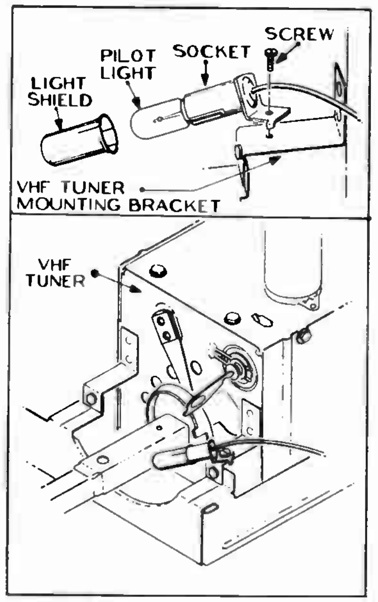
4. Place the spacers on the mounting studs and attach the bracket and socket assembly to the rear of the VHF tuner on the r-f chassis. See figure 54.

5. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner so that the switch actuator stud points away from the tuner. See figure 54.

6. Place the switch assembly on the two mounting studs, and fasten it in place with the flat washers, lock washers, and nuts provided. See figure 54.

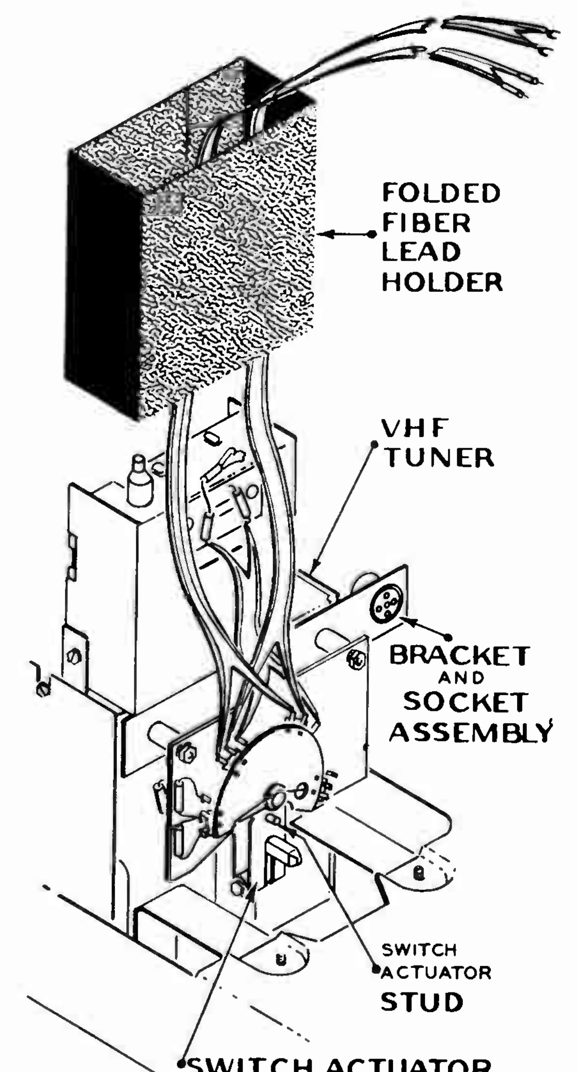
7. Put the VHF Channel Selector in the Channel 2 position. Rotate the switch actuator clockwise on the tuner shaft until the actuator touches the fiber cam on the change-over switch, and fasten the switch actuator in this position. Rotate the VHF Channel Selector to the UHF position. Check the switch operation, to make sure that the switch is thrown properly. Rotate the VHF Channel Selector to Channel 13 position, and check the switch operation, to make sure that the switch is not thrown in this position. Lubricate the switch-actuator stud and switch cam with cup grease.

8. Remove the pilot lamp from the r-f chassis pilot-light socket. Remove and discard the pilot-light socket and cable assembly from the r-f chassis. Insert the plug from the change-over switch into the socket



TP3-755-A

Figure 55. Pilot-Light Socket, Mounting Details



TP3-756-A

Figure 56. Folded Fiber Lead Holder and VHF-UHF Change-Over Switch, Mounting Details

on the r-f chassis from which the pilot-light cable was removed. Mount the new pilot-light socket from the change-over switch as shown in figure 55. Insert the pilot light in the socket, and install the shield provided over it.

9. Remove the antenna lead from the VHF tuner, and solder the short lead from the UHF-VHF change-over switch to the VHF tuner terminals from which the antenna lead was removed. Slide the folded fiber lead holder over the tapered-line coil assembly on the VHF tuner, and dress the twin-wire antenna leads through the holder. See figure 56. The fiber holder will prevent the twin-wire leads from touching the tubes on the r-f chassis.

10. Place the UHF tuner in the cabinet between the r-f and deflection chassis, and fasten the UHF tuner to the chassis shelf with the three screws removed in step 3. It is important that these screws be tightened securely, so as to hold the UHF tuner in place on the chassis shelf.

11. Fasten one end of the ground lead to the r-f chassis with the drive screw. See figure 57. Install the chassis in the cabinet, and fasten the other end of the ground lead to the UHF tuner with the 8-32 x 1/4 inch hex-head machine screw. Fasten the r-f chassis with the original mounting bolts. Place the original knobs on their shafts, and the knob provided on the UHF tuning shaft.

12. Insert the plug from the UHF tuner into the socket on the bracket installed in step 4.

13. Insert the coaxial cable into the jack on the VHF tuner. See figure 57.

14. Replace the fiber antenna-lead holder with the new holder provided. Fasten the new holder with the nails provided, and then pass the twin-wire leads through the holes as shown in figure 58. Pull the leads through the holder until they are tight, making certain that the leads do not contact the tubes or the chassis. Wrap tape around the yellow-marked twin-wire leads with the spade lug ends, to prevent the leads from passing back through the fiber holder.

15. Fasten the antenna terminal board provided as shown in figures 59 through 63. Replace the cabinet back and make the connections illustrated for the type of antenna installation being used.

16. Paste the label provided over the outside-antenna instructions on the cabinet back.

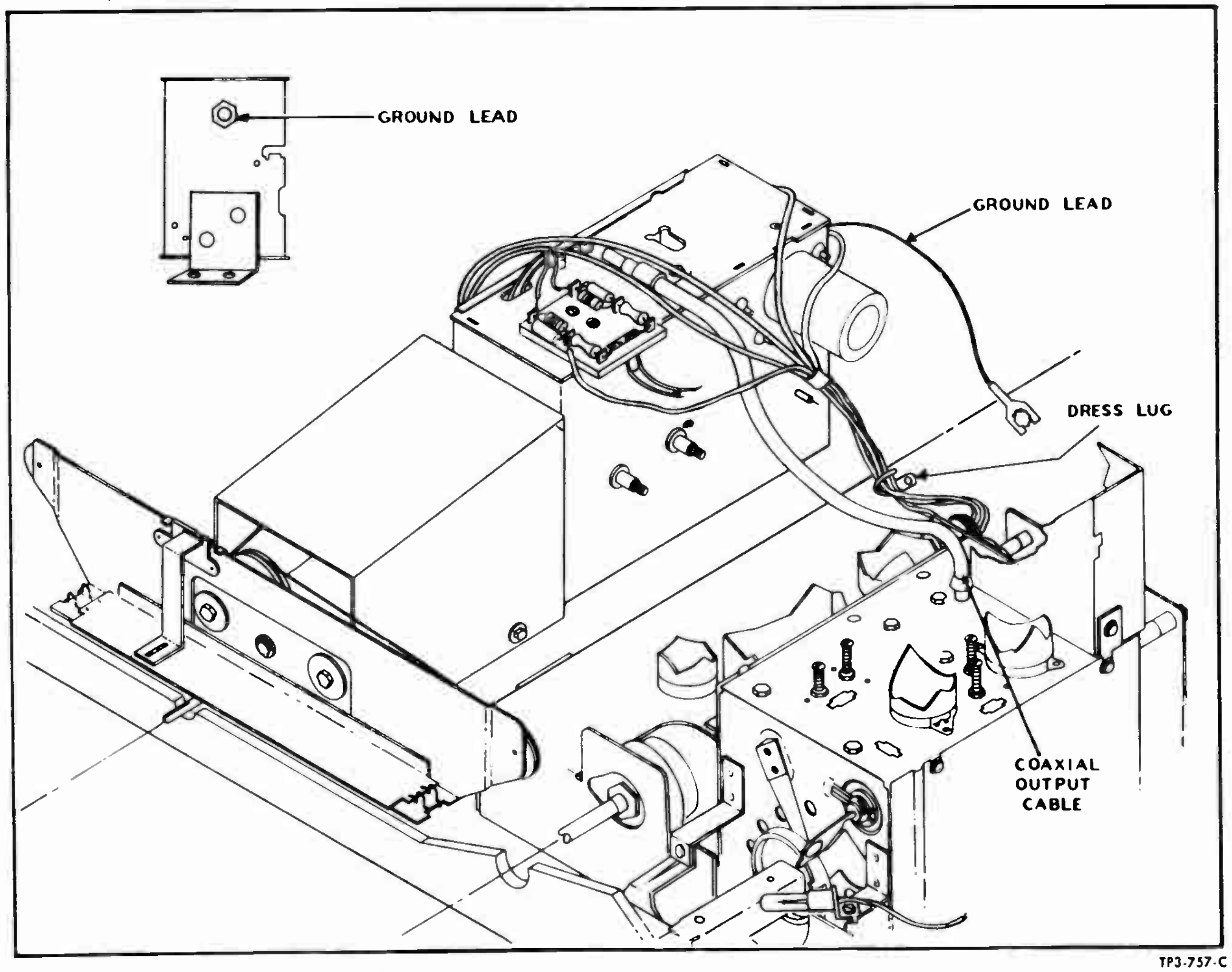


Figure 57. UHF Tuner-Adapter and R-F Chassis, with Lead Dress Details

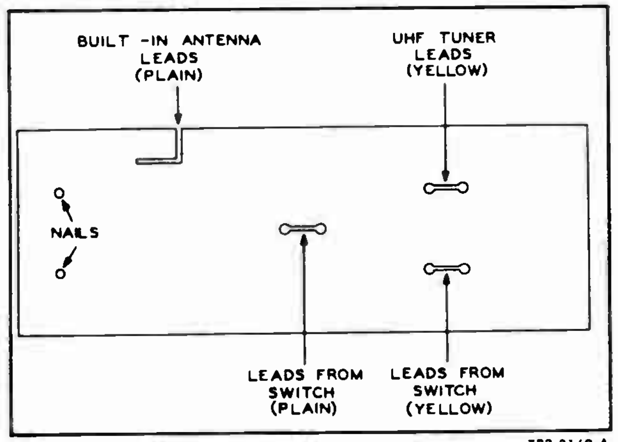


Figure 58. Fiber Lead Holder, with Lead Dress Details

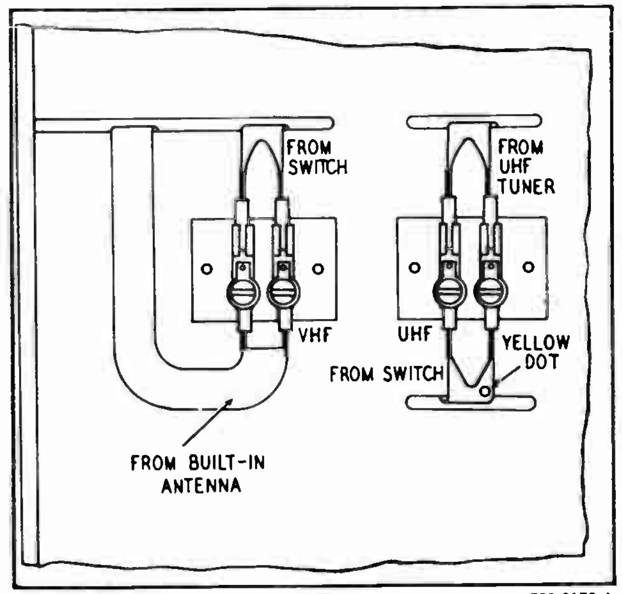


Figure 59. Antenna-Lead Connections, Common VHF and UHF Built-In Antenna

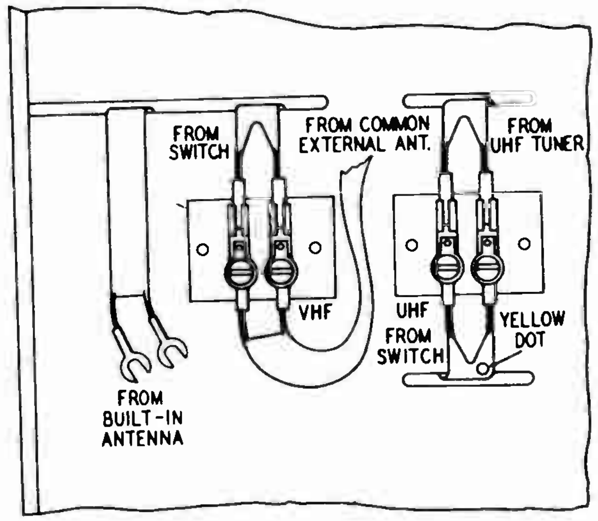


Figure 60. Antenna-Lead Connections, Common VHF and UHF External Antenna

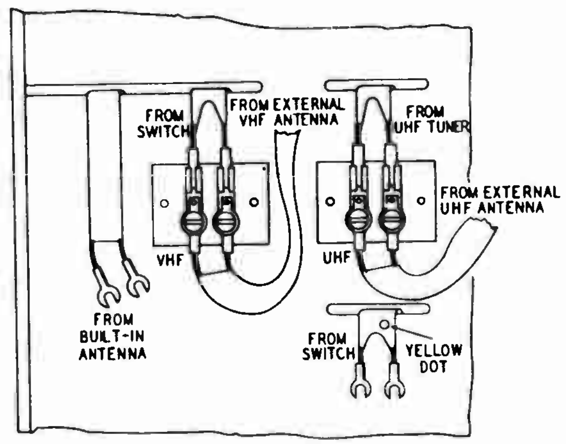


Figure 61. Antenna-Lead Connections, Separate VHF and UHF External Antennas

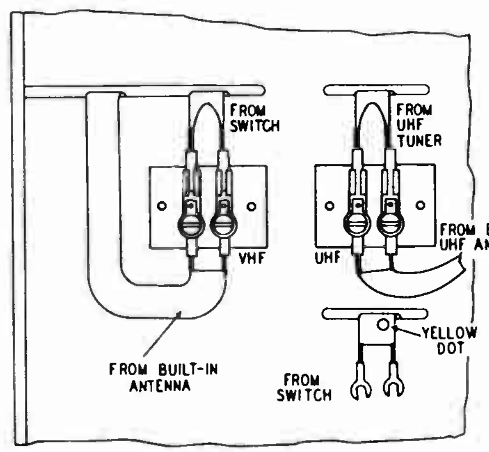


Figure 62. Antenna-Lead Connections, VHF Built-In and UHF External Antennas

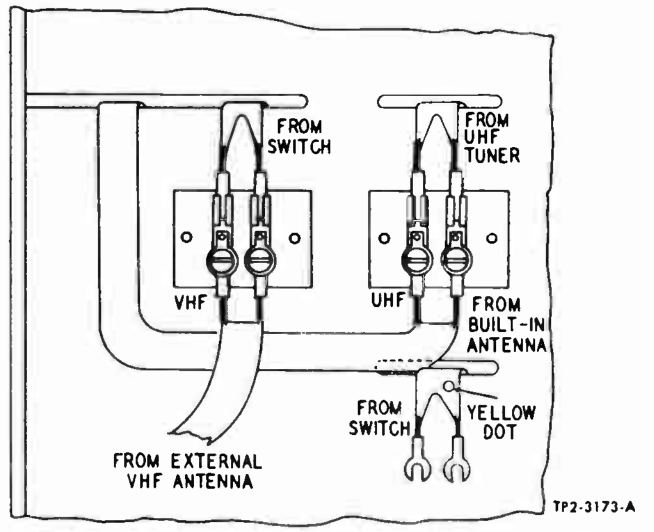


Figure 63. Antenna-Lead Connections, VHF External and UHF Built-In Antennas

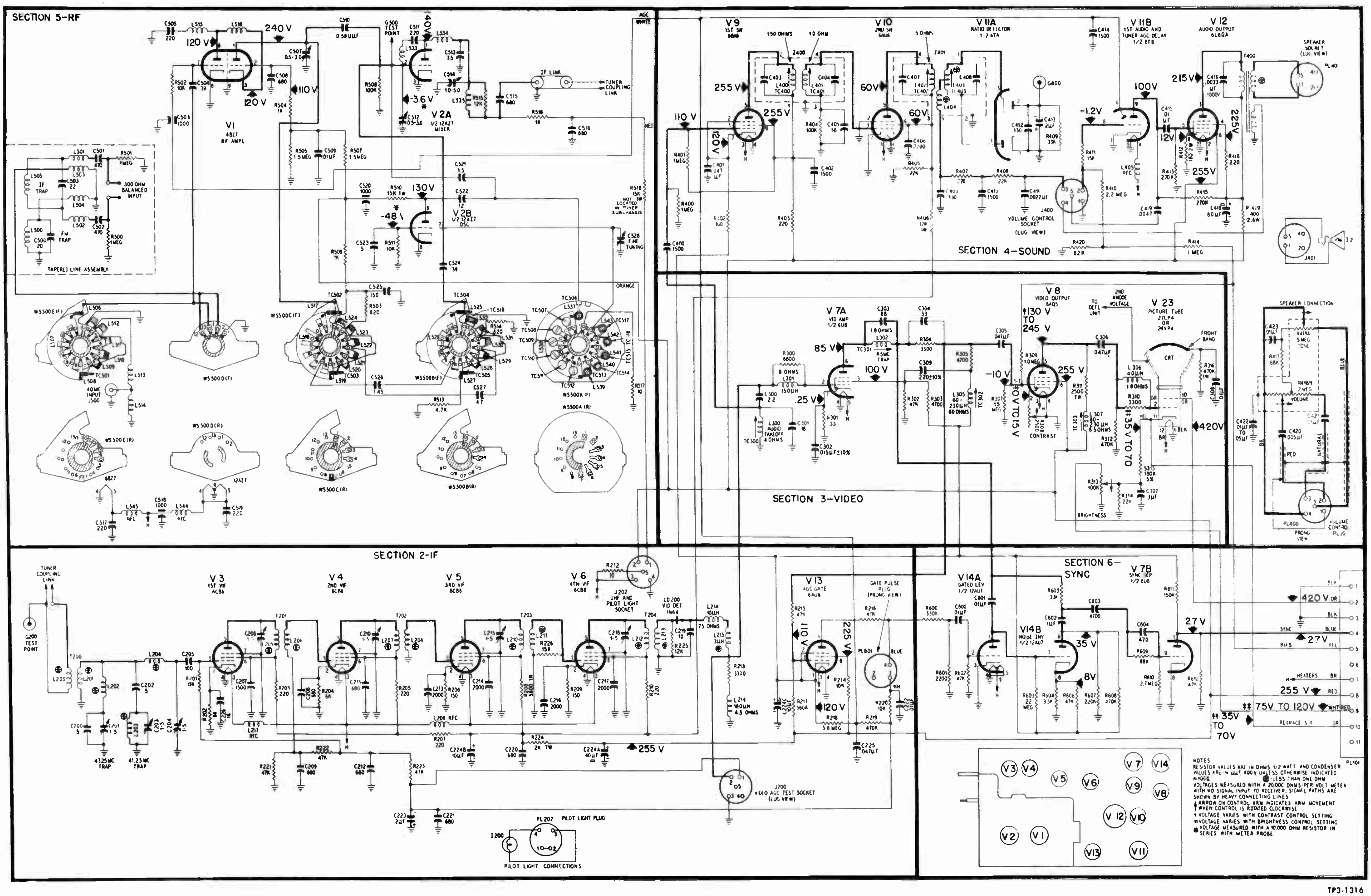


Figure 43. R-F Chassis R-207, Schematic Diagram

REPLACEMENT PARTS LIST

IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are ½ watt, ±10%, unless otherwise indicated. Parts are listed according to chassis type, and should be ordered in this way rather than by model number. A list of miscellaneous parts is given at the end of the parts list for each chassis type. All parts are symbolized in the schematic diagram and base layout, for identification purposes.

DEFLECTION CHASSIS D-207

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condensers, filter, electrolytic, 120 μf., 150v.	30-2568-61
C102	Condenser, filter, electrolytic, 10 μf., 25v.	45-3035-6
C103	Condenser, filter, electrolytic, 100 μf., 300v.	30-2584-7
C107 and C108	Condensers, high-voltage rectifier, 500 μμf., 20,000 volts	30-1229-6
CR100 and CR101	Rectifier, selenium, 450 ma.	34-8003-8
F100	Fuse, line, 1.6 amperes	AD2248-19
F101	Fuse, filament	Piece of #26 wire
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis connecting	27-6274-1
L100	Choke, filter	32-8600-1
PL100	Plug, a-c line	Part of a-c line cord ass'y. (See Misc. "A")
PL101	Plug and cable ass'y. chassis connecting	(See Misc. "B")
R100	Resistor, current limiting, 5 ohms, 20 watts	33-3448-18
R101	Resistor, filter, 47,000 ohms, 1 watt	66-3474340
R102	Resistor, filament dropping (piece of #24 wire)	41-4149-2
R105, R106, and R107	Resistor, high-voltage rectifier, 1.5 megohms	33-1352-2
S100	Switch, off-on	Part of VOLUME control
T100	Transformer, filament	32-8597

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
C702	Condenser, filter, 10 μf., 450v.	Part of C103
C707	Condenser, screen filter, 20 μf., 200v.	Part of C103
L700 and L701	Coils, vertical deflection	Part of deflection yoke ass'y. (See Misc. "A")
R701	Potentiometer, VERT. HOLD control, 250,000 ohms.	Part of R810
R704	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R708	Potentiometer, VERT. LIN. control, 2.5 megohms	33-5565-32
R710	Resistor, screen divider, 22,000 ohms, 2 watts	66-3225340
R711	Resistor, screen divider, 18,000 ohms, 2 watts	66-3185340
T700	Transformer, vertical oscillator	32-8431-9
T701	Transformer, vertical output	32-8637

SECTION 8—HORIZONTAL SWEEP

C805	Condenser, by-pass, 82 μμf.	60-00825437
C806	Condenser, ringing, .0022 μf., ±10%	60-20225434
C807	Condenser, d-c blocking, 390 μμf.	60-10395437
C808	Condenser, charging, 270 μμf.	60-10275417
C811	Condenser, decoupling, .47 μf., 600v.	30-4671-68
C813	Condenser, anti-ringing, 100 μμf., 4000v.	30-1246-2
C815	Condenser, electrolytic, 20 μf., 300v.	Part of C103
C816	Condenser, yoke blocking, .47 μf., 100v.	30-4651-16
J800	Socket, deflection	27-6274-7
J801	Socket, gate pulse	27-6273
L800	Coil, stabilizing, 30—80 mh.	32-4557
L801	Coil, r-f choke, horizontal-output plate	Part of T800
L802 and L803	Coils, horizontal deflection	Part of deflection yoke ass'y. (See Misc. "A")
L804	Coil, r-f choke, damper cathode	Part of T800
L805	Coil, r-f choke, damper plate	32-4112-24
PL800	Plug, deflection	Part of cable ass'y. (See Misc. "A")
PL801	Plug, gate pulse	Part of cable ass'y. (See Misc. "B")
R810	Potentiometer, HORIZ. HOLD control, 50,000 ohms	33-5563-57
R811	Potentiometer, HORIZ. OSC. FREQ., 250,000 ohms	33-5565-17
R815	Potentiometer, WIDTH control, 10,000 ohms, 2 watts	33-5546-18
R817	Resistor, feedback, 47,000 ohms, 1 watt	66-3474340
R818	Resistor, voltage divider, 5000 ohms, 7 watts	33-1335-95
R824	Potentiometer, HORIZ. CENTERING control, 200 ohms, 2 watts	33-5546-50
T800	Transformer, horizontal output	32-8598

DEFLECTION CHASSIS D-208

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condensers, filter, electrolytic, 120 μf., 150v.	30-2568-61
C102	Condenser, filter, electrolytic, 10 μf., 25v.	45-3035-6
C103	Condenser, filter, electrolytic, 100 μf., 300v.	30-2584-7
C104 and C105	Condensers, high-voltage rectifier, 500 μμf., 20,000 volts	30-1229-6
CR100 and CR101	Rectifier, selenium, 450 ma.	34-8003-8
F100	Fuse, line, 1.6 amperes	AD2248-19
F101	Fuse, filament	#26 wire
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis connecting	27-6274-1
L100	Choke, filter	32-8600-1
PL100	Plug, a-c line	Part of a-c line cord ass'y. (See Misc. "A")
PL101	Plug and cable ass'y. chassis connecting	(See Misc. "B")
R100	Resistor, current limiting, 5 ohms, 20 watts	33-3448-18
R101	Resistor, filter, 47,000 ohms, 1 watt	66-3474340
R102, R103, and R104	Resistors, high-voltage rectifier, 1.5 megohms	33-1352-2
S100	Switch, off-on	Part of VOLUME control
T100	Transformer, filament	32-8635

SECTION 7—VERTICAL SWEEP

C702	Condenser, filter, 10 μf., 450v.	Part of C103
C707	Condenser, screen filter, 20 μf., 200v.	Part of C103
L700 and L701	Coils, vertical deflection	Part of deflection yoke ass'y. (See Misc. "A")
R701	Potentiometer, VERT. HOLD control, 250,000 ohms	Part of R810
R704	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R708	Potentiometer, VERT. LIN. control, 2.5 megohms	33-5565-31
R710	Resistor, screen divider, 22,000 ohms, 2 watts	66-3225340
R711	Resistor, screen divider, 18,000 ohms, 2 watts	66-3185340
T700	Transformer, vertical oscillator	32-8431-9
T701	Transformer, vertical output	32-8637

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C805	Condenser, by-pass, 82 μμf.	60-00825437
C806	Condenser, ringing, .0022 μf., ±10%	60-20225434
C807	Condenser, d-c blocking, 390 μμf.	60-10395437
C808	Condenser, charging, 270 μμf.	60-10275417
C811	Condenser, yoke blocking, .47 μf., 100v.	30-4651-16
C813	Condenser, anti-ringing, 82 μμf., 4000v.	30-1246-4
C815	Condenser, by-pass, 20 μf., 300v.	Part of C103
C816	Condenser, horizontal yoke, 68 μμf.	30-1246-5
J800	Socket, deflection	27-6274-7
J801	Socket, gate pulse	27-6273
L800	Coil, stabilizing, 30—80 mh.	32-4557
L801	Coil, r-f choke, horizontal-output plate	Part of T800
L802 and L803	Coils, horizontal deflection	Part of deflection yoke (See Misc. "A")
L804	Coil, r-f choke, damper cathode	Part of T800
L805	Coil, r-f choke, damper plate	32-4112-24
PL800	Plug, deflection	Part of cable ass'y. (See Misc. "A")
PL801	Plug, gate pulse	Part of cable ass'y. (See Misc. "B")
R810	Potentiometer, HORIZ. HOLD control, 50,000 ohms.	33-5563-57
R811	Potentiometer, HORIZ. HOLD CENTERING, 250,000 ohms	33-5565-17
R815	Potentiometer, WIDTH control, 10,000 ohms, 2 watts	33-5546-18
R817	Resistor, feedback, 47,000 ohms, 1 watt	66-3474340
R818	Resistor, voltage divider, 5000 ohms, 7 watts	33-1335-95
T800	Transformer, horizontal output	32-8634

R-F CHASSIS R-207

SECTION 4—AUDIO

C405	Condenser, by-pass, 56 μμf.	30-1251-2
C409	Condenser, detector, balancing, 330 μμf.	62-133001001
C412	Condenser, r-f by-pass, 330 μμf.	62-133001001
C413	Condenser, filter, 2 μf.	45-3035
C416	Condenser, plate by-pass, .0033 μf., 1000v.	30-4650-89
C418	Condenser, filter, 60 μf.	Part of C224
J400	Socket, VOLUME control	27-6273*
L405	Coil, filament choke	32-4112-15
PL401	Plug, speaker	27-4785-22
R406	Resistor, voltage divider, 27,000 ohms, 1 watt	66-3124346
R412	Resistor, cathode bias, 180 ohms, 2 watts	66-1185340
R418	Potentiometer, dual	33-5563-56
R418A	Potentiometer, TONE control, 5 megohms	Part of R418
R418B	Potentiometer, VOLUME control, 2 megohms	Part of R418
R419	Resistor, B+ dropping, 400 ohms, 2.6 watts	Part of R224
T400	Transformer, audio output	32-8579
Z400	Transformer, 1st sound i-f	32-4497A
Z401	Transformer, FM detector	32-4450-6A
C220	Condenser, by-pass, 680 μμf.	62-168001001
C221	Condenser, by-pass, 680 μμf.	62-168001001
C223	Condenser, a-g-c filter, 2 μf.	45-3035
C224	Condenser, electrolytic	30-2584-24
C224A	Condenser, filter, 40 μf.	Part of C224
C224B	Condenser, filter, 10 μf.	Part of C224
C224C	Condenser, filter, 10 μf.	Part of C224
C226	Condenser, cathode by-pass, 18 μμf.	62-018400021
CD200	Crystal, video detector	34-8022

SECTION 2—VIDEO I.F.

Reference Symbol	Description	Service Part No.
C200	Condenser, 47.25-mc. trap, 5 μμf.	30-1224-28
C201	Condenser, 47.25-mc. trap, 1 to 5 μμf.	31-6520-9
C202	Condenser, 41.25-mc. trap, 5 μμf.	30-1224-28
C203	Condenser, 41.25-mc. trap, 1 to 5 μμf.	31-6520-9
C204	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C205	Condenser, d-c blocking, 100 μμf.	30-1224-116
C206	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C207	Condenser, screen by-pass, 1500 μμf.	62-215001011
C208	Condenser, cathode by-pass, 680 μμf.	62-168001001
C209	Condenser, a-g-c by-pass, 680 μμf.	62-168001001
C210	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C211	Condenser, screen by-pass, 680 μμf.	62-168001001
C212	Condenser, a-g-c by-pass, 680 μμf.	62-168001001
C215	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C218	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C219	Condenser, detector by-pass, 10 μμf.	62-010409001
I200	Lamp, pilot	34-2068
J200	Socket, video test	27-6273
J201	Socket, pilot light	27-6273
L200 and L201	Coils, tuner coupling	Part of T200
L202	Coil, 47.25-mc. trap	32-4597-2
L203	Coil, 41.25-mc. trap	32-4112-31
L204	Coil, 1st video i-f grid	32-4597-3
L205 and L206	Coils, coupling	Part of T201
L207 and L208	Coils, coupling	Part of T202
L209	Coil, filament choke	32-4112-15
L210 and L211	Coils, coupling	Part of T203
L212 and	Coils, coupling	Part of T204
L302	Coil, 4.5-mc. trap	32-4463-2
L305	Coil, shunt peaking, 60—230 μh.	32-4467-20
L306	Coil, picture-tube grid peaking, 40 μh.	32-4480-1
L307	Coil, shunt peaking, 60—230 μh.	32-4467-20
R308	Potentiometer, CONTRAST control, 2500 ohms	33-5563-51
R311	Resistor, plate load, 2500 ohms, 7 watts	33-1335-93
R313	Potentiometer, BRIGHTNESS control, 100,000 ohms.	Part of R308
R316	Resistor, grounding 470,000 ohms, 1 watt	66-4474340

Reference Symbol	Description	Service Part No.
L213		
L214	Coil, series peaking, 10 μh.	32-4422-27
L215	Coil, series peaking 3 μh.	32-4480-17
L216	Coil, shunt peaking, 180 μh.	32-4480-9
L217	Coil, filament choke	32-4112-15
R208	Resistor, voltage dropping, 5600 ohms, 1 watt	66-2564340
R224	Resistor, B+ dropping, 2000 ohms, 7 watts	33-3446-8
T200	Transformer, video i-f input	32-4599-2
T201	Transformer, 1st video i-f	32-4598-5
T202	Transformer, 2nd video i-f	32-4598-3
T203	Transformer, 3rd video i-f	32-4548-26
T204	Transformer, 4th video i-f	32-4548-27

SECTION 3—VIDEO

C300	Condenser, audio take-off, 2.2 μμf.	30-1221-6
C301	Condenser, by-pass, 18 μμf.	62-018400021
C303	Condenser, by-pass, 68 μμf.	62-068409011
C304	Condenser, by-pass, 33 μμf.	62-033009001
C309	Condenser, screen by-pass, 220 μμf.	60-10225417
L300	Coil, audio take-off	32-4463-9
L301	Coil, video amplifier grid, peaking, 150 μh.	32-4480-18

SECTION 6—SYNC

C604	Condenser, by-pass, 470 μμf.	30-1225-18

SECTION 5—TV TUNER, PART NO. 76-7600-3

C500	Condenser, FM trap, 20 μμf.	62-020309011
C501 and C502	Condenser, antenna isolating, 470 μμf.	30-1225-18
C503	Condenser, i-f trap, 22 μμf.	Part of L505
C504	Condenser, r-f coupling, 39 μμf.	62-039409011
C505	Condenser, neutralizing, 220 μμf.	62-122001001
C506	Condenser, a-g-c decoupling, 1000 μμf.	30-1245-1
C507	Condenser, r-f trimmer, 0.5 to 3.0 μμf.	31-6520-3
C508	Condenser, r-f by-pass, 680 μμf.	62-168001001
C509	Condenser, grid by-pass, .01 μf.	30-1238-2
C510	Condenser, coupling, .59 μμf.	311-5050-3
C511	Condenser, neutralizing, 220 μμf.	62-122001001
C512	Condenser, mixer-grid trimmer, 0.5 to 3.0 μμf.	31-6520-3
C513	Condenser, by-pass, 7.5 μμf.	30-1224-13
C514	Condenser, trimmer, 1 to 5 μμf.	31-6520-11
C515	Condenser, i-f link coupling, 680 μμf.	62-168001001
C516	Condenser, by-pass, 680 μμf.	62-168001001
C517	Condenser, filament decoupling, 220 μμf.	62-122001001
C518	Condenser, filament by-pass, 1000 μμf.	30-1245-1
C519	Condenser, filament decoupling, 220 μμf.	62-122001001
C520	Condenser, by-pass, 1000 μμf.	30-1245-1
C521	Condenser, oscillator injection	30-1221-7
522	Condenser, oscillator plate, 12 μμf.	62-012300001
523	Condenser, grid blocking, 5 μμf.	30-1224-5

Reference Symbol	Description	Service Part No.
C524	Condenser, mixer-grid blocking, 39 μμf.	62-039409011
C525	Condenser, by-pass, 150 μμf.	62-115001011
C528	Condenser, fine tuning	76-6935-1
J500	Connector, 40-mc. input	57-0590-2
L501, L502, L503, and L504	Coils, tapered-line assembly	32-4432-3
L505	Coil, r-f trap (44.75 mc.)	32-4552-1
L506 to L512 inclusive	Coils, r-f grid tuning	Part of WS500E
L513	Coil, 40-mc. channel	312-5146-16
L514	Coil, 40-mc. channel	312-5146-19
L515	Coil, r-f amplifier neutralizing	32-4548-13
L516	Coil, r-f coupling	312-5146-20
L517 to L524 inclusive	Coil, r-f plate tuning	Part of WS500C
L525 to L532 inclusive	Coil, mixer grid	Part of WS500B
L533	Coil, mixer neutralizing	32-4551-1
L534	Coil, mixer plate	312-5146-8
L535	Coil, i-f primary	312-5151-6
L537 to L543 inclusive	Coil, oscillator tuning	Part of WS500A
L544 and L545	Coils, r-f choke	32-4550-1
R518	Resistor, B+ dropping, 15,000 ohms, 1 watt	66-3154340
WS500A(F) and WS500A(R)	Switch wafer, oscillator	76-7604
WS400B(F) and WS400B(R)	Switch wafer, mixer grid	76-7606
WS500C(F) and WS500C(R)	Switch wafer, r-f plate	76-7608
WS500D(F) and WS500D(R)	Switch wafer, r-f grid	76-7612
WS500E(F) and WS500E(R)	Switch wafer, r-f grid	76-7610

UHF TUNER-ADAPTER UT20B, PART NO. 43-6701

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna coupling, 680 μμf.	Part of Panel, filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-4
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472
C7	Condenser, crystal, mixer tank, 30 μμf.	Part of Board ass'y., mixer
C8	Condenser, temperature compensating, .4 μμf.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 μμf.	Part of Tank ass'y., osc.
C11	Condenser, by-pass	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 500 μμf.	30-1245-3
C13	Condenser, temperature compensating, 1.0 μμf.	30-1224-107
C14	Condenser, filament by-pass, 500 μμf.	30-1245-3
C15	Condenser, plate by-pass, 500 μμf.	30-1245-3
C16 and C17	Condenser, 45.75-mc. i-f trap	Part of Panel, filter
CD1	Crystal detector, mixer circuit	34-8026
I1 and I2	Lamp, pilot, UHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A Stator
L2	Inductor, r-f, r.h.	Part of C3B Stator
L3	Inductor, r-f, l.h.	Part of C3C Stator
L4	Inductor, r-f, r.h.	Part of C3D Stator
L5	Inductor, crystal mixer	Part of Board ass'y., mixer
L6	Inductor, crystal mixer	Part of Board ass'y., mixer
L7	Inductor, oscillator coupling	Part of Board ass'y., mixer
L8	Inductor, oscillator coupling	Part of Board ass'y., mixer
L9	Inductor, oscillator coupling	Part of Board ass'y., osc.
L10	Inductor, oscillator coupling	Part of Board ass'y., osc.
L11	Inductor, oscillator	Part of Tank ass'y., osc.
L12	Inductor, oscillator	Part of Tank ass'y., osc.
L13	Choke, r-f, heater decoupling	32-4556-3
L14	Choke, r-f, cathode decoupling	32-4556-4
L15	Choke, r-f, plate decoupling	32-4556-2
L16 and L17	Coils, 45.75-mc. i-f trap	Part of Panel, filter
L18	Coil, i-f output	32-4558
R1	Resistor, damping, 1000 ohms	66-2108340
R2	Resistor, damping, 220 ohms	66-1228340
R3	Resistor, grid leak, 6800 ohms	66-2688340
R4	Resistor, filament decoupling, 220 ohms.	Part of L13
R5	Resistor, plate decoupling, 10,000 ohms	Part of L15
R6	Resistor, balancing, 470 ohms	66-1478340
R7	Resistor, balancing, 10 ohms	66-0108340
R8 and R9	Resistor, B+ dropping, 150,000 ohms	66-4158340
R10	Resistor, pilot-light dropping, 10 ohms	66-0108340
R11	Resistor, pilot-light dropping, 3.9 ohms	66-9138340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13 and R14	Resistor, antenna coupling, 470,000 ohms	66-4478340
	Board ass'y., mixer	76-7475-4
	Board ass'y., oscillator	76-7480
	Panel, filter, i-f trap	76-8078
	Tank ass'y., oscillator	76-7627

THE TV-300 AND TV-301 DIFFERENCE

The TV-301 is similar to the TV-300, the difference being in the picture tube used and the shorting out of one resistor in the TV-300 to make the TV-301 chassis.

The TV-300 chassis uses a 21XP4A picture tube which is an electrostatic focus tube. When this tube is used the 27 ohm resistor in the high voltage transformer is necessary for proper electrical centering of the picture.

The TV-301 chassis uses a 21WP4A picture tube which is an electromagnetic focus picture tube. When this picture tube is used the 27 ohm resistor is shorted out and the chassis is called the 301.

This is the only difference between these two chassis.

TUBE COMPLEMENT — TV-300 CHASSIS

Reference Symbol	Tube Type	Function
	6BQ7A	R.F. amplifier
	6X8	Oscillator mixer
S1	5U4G	Low Voltage rectifier
S2	6AX4G	Horizontal damper
S3	12BH7	Vertical oscillator
S4	12AU7A	Horizontal oscillator
S5	6BQ6GT or GTA	Horizontal output
S6	6CB6	1st V.I.F.
S7	6CB6	2nd V.I.F.
S8	6CB6	3rd V.I.F.
S9	6AU6	Sound I.F.
S10	6T8	Ratio detector - 1st audio
S11	6W6GT	Audio output
S12	12AZ7	Sync sep - phase comp.
S13	12BY7	Video output
S14	1B3GT	High voltage rectifier
	21XP4	
	21XP4A	Picture tube
	21WP4A	Picture tube
	21YP4A	Picture tube

SPECIFICATIONS — TV-300 CHASSIS

VHF TUNER	Twelve channel, 13 position incremental tuner, covering VHF television channels 2 through 13; fine tuning of local oscillator.
UHF TUNING	Continuous tuning, covering UHF channels 14 through 83; fine and coarse tuning.
INTERMEDIATE FREQUENCIES	
VIDEO CARRIER	45.75 Mc.
SOUND CARRIER	4.5 Mc.
TRANSMISSION LINE	300 ohm, twin wire lead
OPERATING VOLTAGE	110 to 120 volts, 60 cycles, AC
POWER CONSUMPTION	Without UHF — 170 watts With UHF — 175 watts

CIRCUIT DESCRIPTION — TV-300

The TV-300 receiver contains a 13 position incremental type VHF tuner, covering VHF channels 2 through 13 with a UHF position. Power and filament voltage for the UHF tuner-adapter are supplied through a switch built into the rear of the VHF tuner. The output of the VHF tuner is a 40 Mc., IF signal which is inductively coupled to three stagger tuned IF stages. A 1N64 crystal serves as the diode detector for the output of the IF stages.

The output of the video detector, a negative phase, composite-video detected signal, is fed through a single video amplifier to the cathode ray tube. Since a single output amplifier is employed a positive going signal is being applied to the picture tube and therefore, is fed to the picture tube cathode.

AGC voltage is developed in the output stages of the video detector and through the bias on the grid of the sync separator. A delay voltage applied to the tuner AGC is effectively clamped by the diode portion of the 6T8 first audio amplifier stage, to prevent the RF grid being driven too far positive under weak signal conditions.

The 4.5 Mc., intercarrier IF sound is taken from the output circuit of the crystal video detector. The 4.5 Mc., sound signal is the resulting difference signal from the beat between the video carrier, 45.75 Mc., and the 41.25 Mc., sound carrier when they are mixed in the video detector. In order for the 4.5 Mc., resultant signal to contain the FM sound with only a negligible amount of video modulation, the sound carrier must be considerably lower than the video. The proper ratio of the two signals is established during alignment of the receiver.

The intercarrier sound IF signal is fed through a sound IF amplifier stage to the ratio detector. A 6AU6 tube is employed in the sound IF stage. The ratio detector employs the duo-diode section of a 6T8 tube and the detected signal is fed to the triode section of the same tube as the first audio amplifier. A 6W6GT tube serves as the audio output stage which drives the speaker. B plus voltage, approximately 260 volts, is fed to the screen grid and plate circuits of the 6W6GT, while a second B plus voltage through a resistor divider network is applied to the grid. The cathode of this tube is connected through the cathode resistor and through decoupling circuits to the plates and screen grids of all of the IF stages and to the screen grids of the video output tube and the horizontal output tube. Thus, the 6W6GT tube is effectively in series with the tubes mentioned and the necessary B plus voltage for these tubes develops due to the current flow through the 6W6GT cathode circuit. The 6W6GT tube since it is in series with the IF tubes, and screen grids of the video output and horizontal output stages, from B plus to ground, forms a large voltage divider network across the power supply, and acts as a voltage regulator for these stages. The voltage drop across the 6W6GT remains approximately 120 volts.

A portion of the composite video signal is taken from the video output circuits to the grid of the sync separator, one half of a 12AZ7 duo-triode tube. The bias of this tube is such that negative going composite sync pulses appear at the plate. The vertical integrator circuit feeds the vertical sync pulses to the vertical blocking oscillator, a 12BH7 tube.

The vertical blocking oscillator requires a positive pulse for triggering purposes and the incoming sync pulse is negative. consequently, the incoming pulse is fed into the cathode lead tap of the oscillator transformer. The action of the transformer circuit causes a large positive overshoot to occur on the sync pulse at the cathode and grid. The grid pulse being larger than that at the cathode, will cause this positive overshoot to trigger the oscillator.

The second half of the 12BH7 duo-triode is used as the vertical output amplifier and the vertical signal is fed to the deflection coils through the vertical output transformer. A retrace suppression circuit from the vertical output transformer to the grid of the picture tube effectively removes vertical retrace lines.

From the plate of the sync separator the horizontal pulses are fed to the cathode circuit of the phase comparer, one-half of a 12AZ7 tube. At the same time, a pulse is taken from a winding on the horizontal output transformer, and fed to the phase comparer plate through a shaping network. The grid of the phase comparer is grounded and the circuits of this stage are such that if the incoming signal and the signal taken from the horizontal output transformer are not in phase a difference voltage results in the plate circuit which is fed to the grid of the horizontal oscillator and controls its frequency.

The horizontal oscillator is a conventional multivibrator type employing a duo-triode 12AU7A tube. The horizontal hold control is placed in the grid circuit of the second triode section of the multivibrator and provides the means of manually adjusting the frequency of the oscillator so that its frequency is within the control range of the phase comparer.

A 6BQ6GT tube is employed as the horizontal output tube. Horizontal width is adjustable by means of a variable resistor in the screen grid circuit. The horizontal output transformer contains a 27 ohm resistor inserted in the center windings to provide electrical centering of the raster. High voltage rectification is performed by a 1B3GT tube, while a 6AX4G tube serves as a damper tube.

A transformer power supply provides B plus voltage. A 5U4G tube is employed in full wave rectification of the B plus voltage. A .7 ampere slow-blow fuse is inserted in the B minus center tap lead of the transformer and is located in the high voltage cage on top of the chassis for easy access.

The picture tube employed with the TV-300 chassis is either the electrostatic fixed focus type with the focus anode returned to ground or the electromagnetic type. The electrostatic employs ring type permanent magnets for centering of the raster.

TELEVISION ALIGNMENT

General

The alignment procedure follows the general pattern of first checking the tuner response with an FM sweep generator and oscilloscope, comparing the response curve with that given in the manual, and aligning the tuner if necessary. After it is established that the tuner is in correct alignment, the video I-F channel is aligned by tuning each coil to its assigned pole frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and retouching the I-F adjustments to obtain the desired pass band. Finally, the sound channel is aligned, using an AM signal, by tuning the sound take-off coil and the I-F and ratio-detector transformers.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the I-F stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chassis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.
2. Do not disconnect the picture tube yoke, or speaker while the receiver is turned on.
3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.
4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method for calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745 (J) entitled "Television Service in the Home."

HORIZONTAL OSCILLATOR ADJUSTMENT

1. Center horizontal hold control.
2. Adjust T-1 until the picture comes into sync.

JIGS AND ADAPTERS REQUIRED

Mixer Jig

Connections to the grid of the mixer tube may be made through the alignment jack provided for this purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

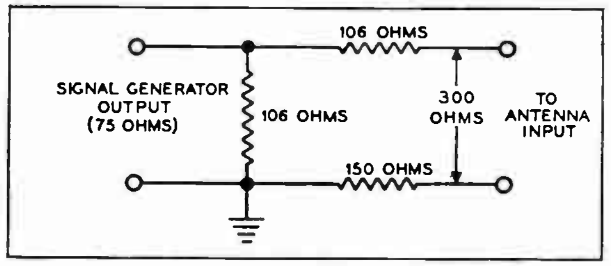


Fig. 1. Antenna-Input Matching Network.

Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna input terminals of the receiver is shown in figure 1. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group, to obtain values within ten percent of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna-matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

TUNER OSCILLATOR ALIGNMENT
TABLE 1

AM GENERATOR: Connect to the receiver antenna-input terminals. (No matching network is required.) Use in modulated R-F output.

OSCILLOSCOPE: Connect the vertical-input lead, in series with a 1000-ohm resistor, to the mixer plate test point, TP-2. Connect the scope ground lead to the chassis, near TP-4.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner AGC (white) lead from main chassis, and connect a 1.5-volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis.

STEP	AM GENERATOR DIAL SETTING	RECEIVER TUNING	ADJUST	REMARKS
1	257 mc.	channel 13	TC-506 for zero beat on scope.	a. If regeneration occurs, increase bias; bias may be increased up to 4 or 5 volts, if necessary. b. Preset fine tuning control to center of its range.
2	251 mc.	channel 12	TC-507 for zero beat on scope.	
3	245 mc.	channel 11	TC-508 for zero beat on scope.	
4	239 mc.	channel 10	TC-509 for zero beat on scope.	
5	233 mc.	channel 9	TC-510 for zero beat on scope.	a. To adjust channel 8 use channel 9 tuning core, then recheck channel 9.
6	221 mc.	channel 7	TC-511 for zero beat on scope.	a. Repeat steps 1 thru 6 and readjust if necessary until channels are within 500 kc. of proper frequency.
7	129 mc.	channel 6	TC-512 for zero beat on scope.	
8	113 mc.	channel 4	TC-513 for zero beat on scope.	
9	101 mc.	channel 2	TC-514 for zero beat on scope.	

VIDEO I-F ALIGNMENT
TABLE 2

A.M. GENERATOR: Connect to mixer test point, TP-2, through a mixer jig, and adjust the generator for approximately 30% modulation at 400 cycles. Adjust the output of the generator during alignment to keep the output at the CRT cathode below 40 volts peak to peak.

SWEEP (FM) GENERATOR: After step 5 connect to antenna-input circuit through antenna-input matching network (see figure ?)

OSCILLOSCOPE: Connect vertical-input lead to pin No. 11 at the cathode ray tube.

PRESET: Contrast control full on. Channel selector to channel position No. 1.

BIAS: Apply 5.0 volts of negative bias into TP-1 (AGC system).

NOTE: I-F shield must be in place.

STEP	AM GENERATOR DIAL SETTING	SWEEP (FM) GENERATOR		ADJUST	REMARKS
		SWEEP DIAL SETTING	MARKER DIAL SETTING		
1	45.5 mc.			TT for maximum indication on scope.	The scope level must not be permitted to exceed 40 volts peak to peak or overloading will occur.
2	43.1 mc.			VC-1 for maximum indication on scope.	
3	42.7 mc.			T-2-IF for maximum indication on scope.	
4	45.0 mc.			T6-IF for maximum indication on scope.	
5	44.4 mc.			T3-IF for maximum indication on scope.	
6		Channel 4 (69 mc. with 6 mc. sweep width).	Run marker along curve checking against curve limits given in figure 6.	If necessary retouch TT, VC1, T2-IF, T6-IF, T3-IF.	Adjust carrier level with TT and T6 level curve with T-3. Position 42.5 mc. slope with VC-1 and T-2. CAUTION: Retouch only slightly.

TUNER BANDPASS ALIGNMENT — *See Table 3 on Page Five*

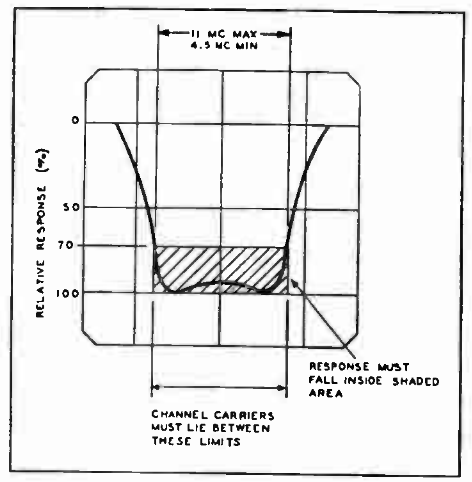


Fig. 2. Television tuner response curve, showing bandpass limits.

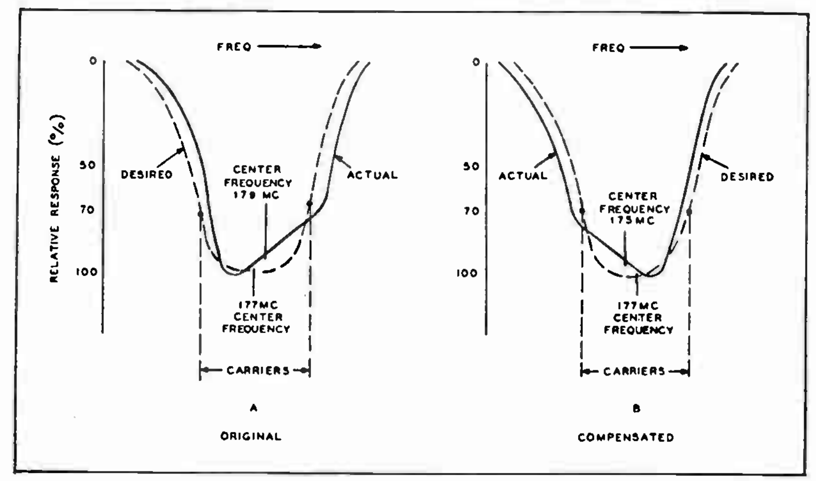


Fig. 3. Television tuner response curve, showing tracking compensation.

TUNER BANDPASS ALIGNMENT
TABLE 3

SWEEP (FM) GENERATOR: Connect to receiver antenna-input circuit through antenna-input matching network (see figure 1).

OSCILLOSCOPE: Same as in Chart 1.

RECEIVER CIRCUIT ALTERATIONS: Bias same as Chart 1. Disconnect the tuner coupling link leads and connect a 40- to 70-ohm carbon resistor across the open end of the lead from the tuner.

STEP	SWEEP (FM) GENERATOR: SWEEP DIAL SETTING	SWEEP (FM) GENERATOR: MARKER DIAL SETTING	RECEIVER TUNING	ADJUST	REMARKS
1	Channel 13 (213 mc., with 10-mc. sweep width.)	Set first to 210 mc. and not position of marker on response curve. Then set to 216 mc. and note position of marker on response curve.	Channel 13		Use oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve. Response curve should be flat between limits (see figure 2). If not, proceed with step 2.
2	Channel 13	213 mc.	Channel 13	T-8 — WS2 counter-clockwise until single peak appears.	CAUTION: Care must be taken not to un screw core far enough to make it drop out of the coil.
3	Channel 13	213 mc.	Channel 13	T-15—WS3 until peak falls on 213-mc. marker.	It may be necessary to increase sweep-generator output.
4	Channel 7 (177 mc., with 10-mc. sweep width.)	Set first to 174 mc. and note position of marker on response curve. Set to 180 mc. and note position of marker on response curve.	Channel 7		Note curve with respect to tilt and center frequency. Curve should be centered in pass band and symmetrical. If not, proceed with step 5.
5	Channel 7	174 mc. & 180 mc.	Channel 7	VC-3 and VC-2 to obtain correct tilt on top of curve.	VC3 and VC2 compensate for the tuning effect of Channel 13 adjustment upon Channel 7. (See figure 3.)
6	Channel 13	213 mc.	Channel 13	Retouch T-15 of WS3 and T-8 — WS2 for symmetrical response, centered about 213-mc. marker.	To retouch, only turn cores slightly.
7	Channel 7	117 mc.	Channel 7	Repeat step 5.	Check response curve for correct center frequency and symmetry.
8				Repeat steps 6 and 7.	Repeat Channel 13 and Channel 7 adjustments, alternately, until favorable curves are obtained on both.
9	Channel 6 (85 mc., with 10-mc. sweep width.)	Set first to 82 mc. and note position of marker on response curve. Then set to 88 mc. and note position of marker on response curve.	Channel 6		Curve should be symmetrical and centered in pass band. If not, proceed with step 10.
10	Channel 6	85 mc.	Channel 6	T-14 of WS2 counter-clockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
11	Channel 6	85 mc.	Channel 6	T-21—WS3 until peak falls on 85-mc. marker.	It may be necessary to increase sweep-generator output.
12	Channel 6	85 mc.	Channel 6	T-27 — WS5 for maximum curve height and symmetry of single peak.	After adjusting TC501, recheck as in step 9. If necessary, reduce sweep-generator output to avoid overloading.
13	Channel 6	85 mc.	Channel 6	Retouch T-21 — WS3 and T-14 — WS2 for symmetrical response, centered about 85-mc. marker.	To retouch, only turn cores slightly.

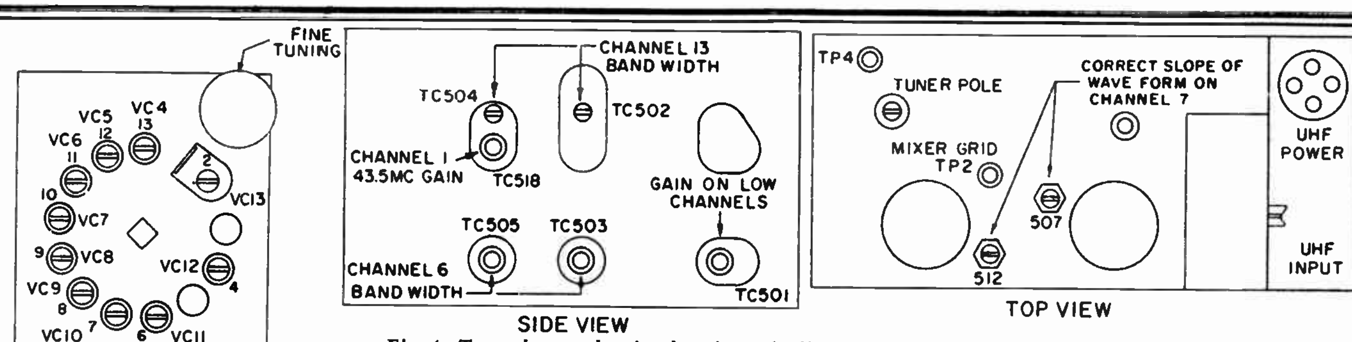


Fig. 4. Tuner layout showing locations of adjustments.

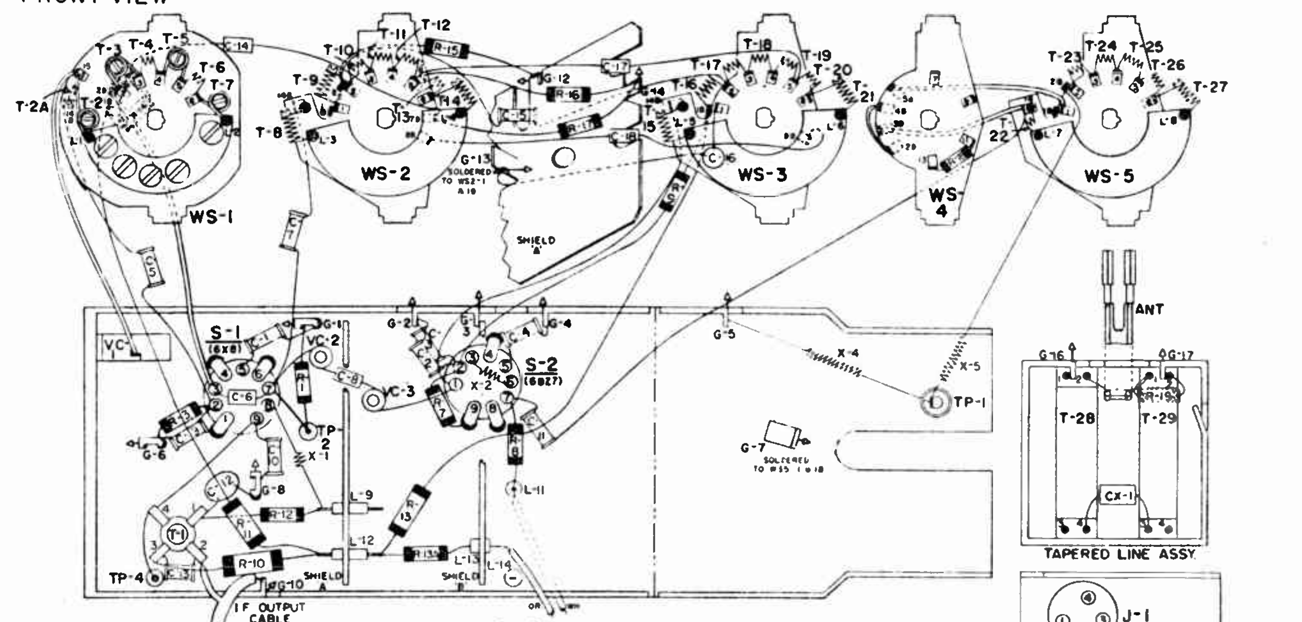


Fig. 5. Tuner Wiring Diagram.

SOUND ALIGNMENT
TABLE 4

A.M. GENERATOR: Connect the "hot" lead through a 2200 ohm resistor to the junction of C-24, X3 and the xtal det. Adjust generator for 400v. modulation at approximately 30% modulation.

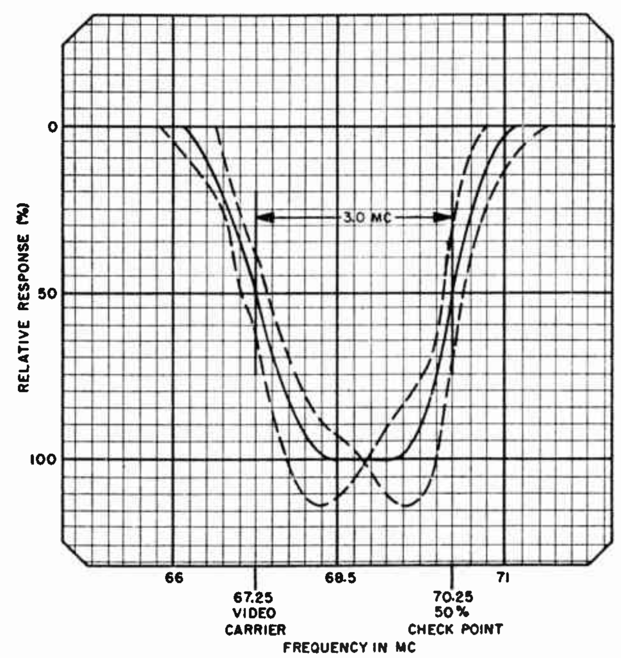


Fig. 6. Over-all R-F, I-F response curve, showing tolerance limits.

VOLTMETER: Use V.T.V.M. on 20,000-ohms-per-volt voltmeter. Connect through a crystal probe to pin No. 11 of the picture tube in step 1 and to pin No. 3 of the 6W6 audio output tube in the remainder of the steps.

STEP	AM GENERATOR DIAL SETTING	ADJUST	REMARKS
1	4.5 mc. modulated	T7-IF for minimum indication.	Voltmeter through xtal probe. Plate of video amplifier.
2	4.5 mc. modulated	T5 top for maximum indication.	a. Volume control full on. b. Voltmeter thru xtal probe to 6W6 pin No. 3. c. Keep generator level low to prevent overload.
3	4.5 mc. modulated	T5 bottom for maximum indication.	
4	4.5 mc. modulated	T4-IF for maximum indication.	

OSCILLOSCOPE WAVEFORM PATTERN — TV-300

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 6 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms — not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.

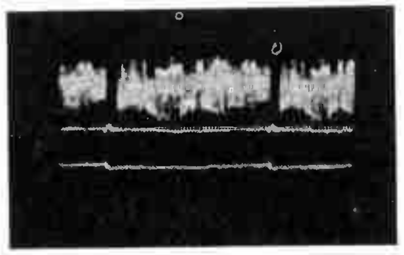


Fig. 8. Composite Signal, Pin 2 of 12BY7, 6 volts, 60 c.p.s.

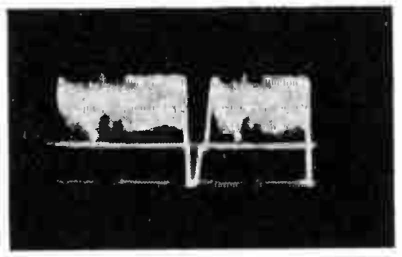


Fig. 9. Composite Signal, Pin 2 of 12BY7, 6 volts, 15,750 c.p.s.

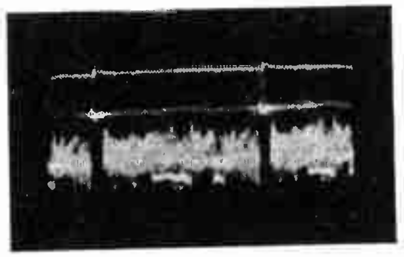


Fig. 10. Video Amplifier Plate, 83 volts, 60 c.p.s.

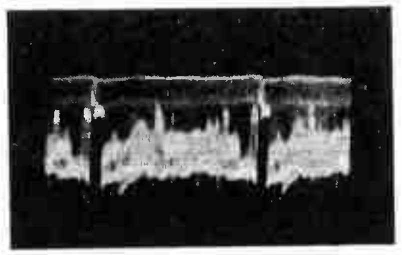


Fig. 11. Sync Separator Grid, Pin 2, 90 volts, 60 c.p.s.

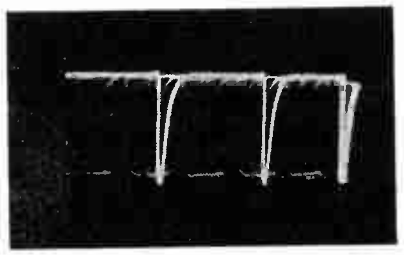


Fig. 12. Sync Separator Plate, Pin 1, 30 volts, 15,750 c.p.s.

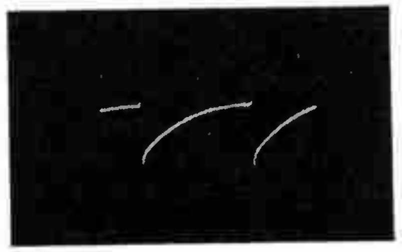


Fig. 13. Vertical-Oscillator Grid, Pin 7, 140 volts, 60 c.p.s.

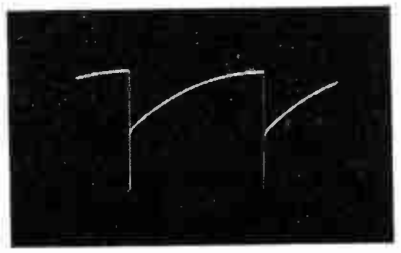


Fig. 14. Vertical-Output Grid, Pin 2, 72 volts, 60 c.p.s.

Fig. 15. Vertical-Output Plate, Pin 9, 900 volts, 60 c.p.s.

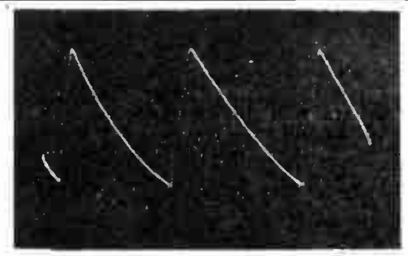


Fig. 16. Phase Comparer, Pin 6, 7 volts, 15,750 c.p.s.

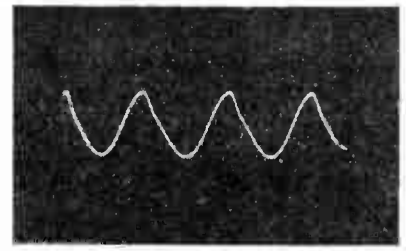


Fig. 17. Horizontal Oscillator, junction of L800 and R806, 43 volts, 15,750 c.p.s.

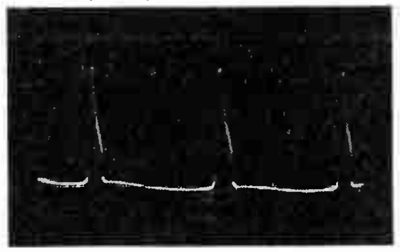


Fig. 18. Horizontal-Oscillator Cathode, Pins 3 and 8, 18 volts, 15,750 c.p.s.

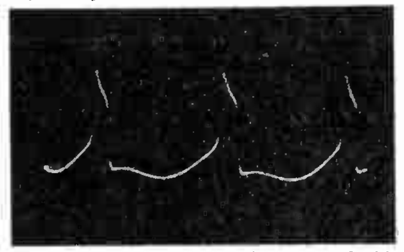


Fig. 19. Horizontal-Oscillator Grid, Pin 2, 40 volts, 15,750 c.p.s.

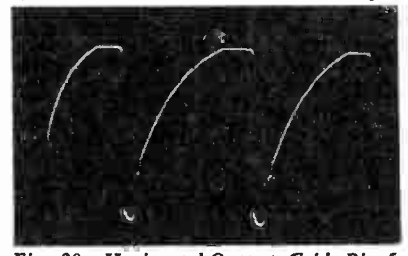


Fig. 20. Horizontal-Output Grid, Pin 5, 120 volts, 15,750 c.p.s.

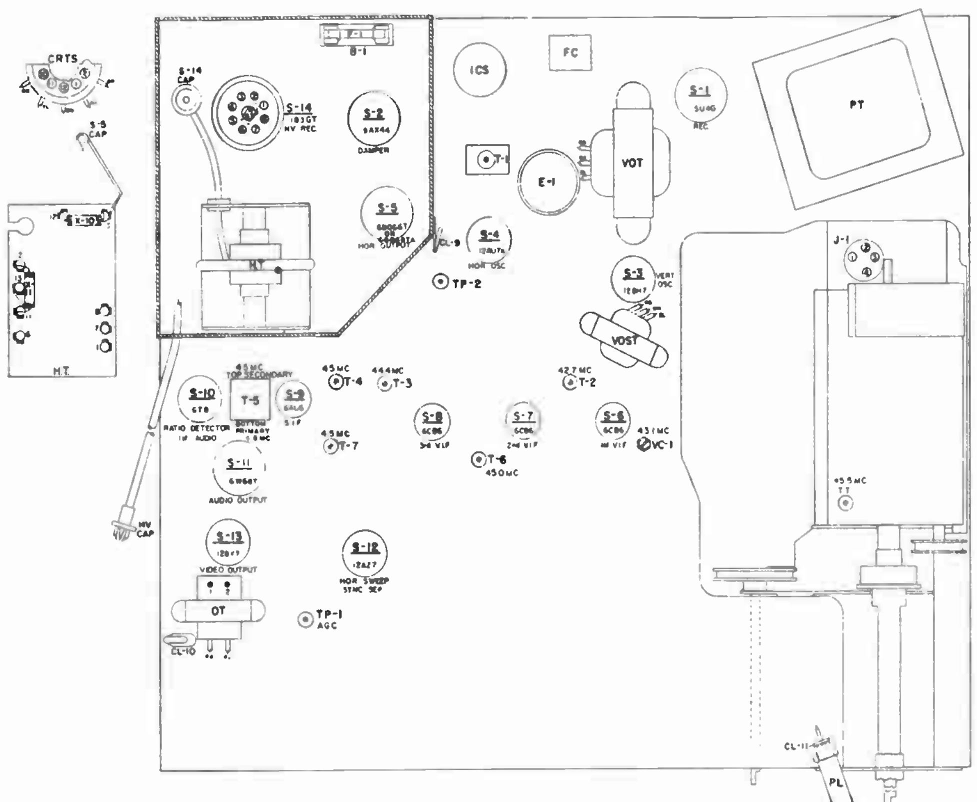


Fig. 7. Base Layout — Top View — TV-300 Chassis.

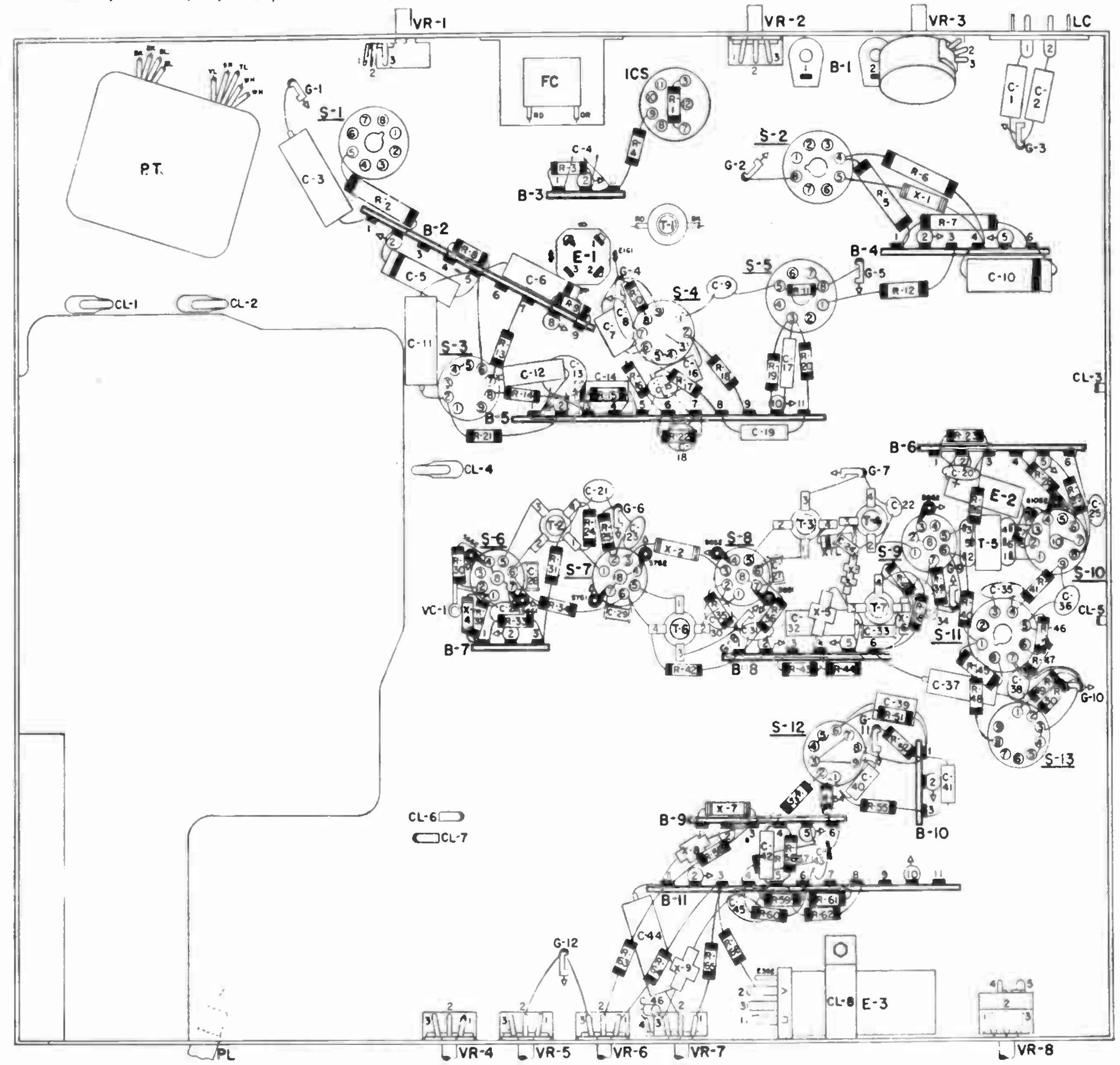
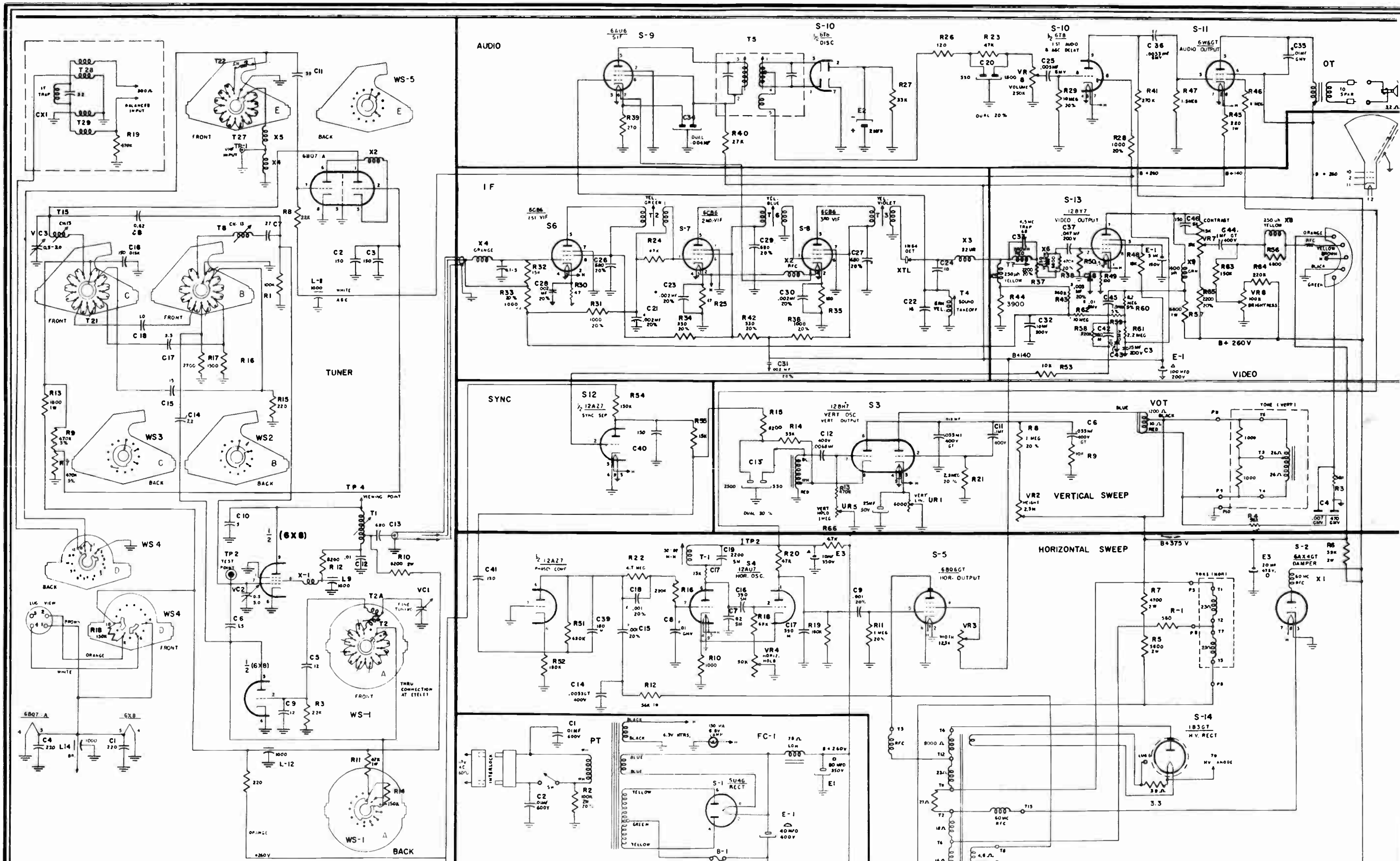


Fig. 22. Wiring Diagram, Bottom View — TV-300.



Voltage readings taken with a Philco Model No. 7001: VTVM. All capacity values in micro-microfarads unless otherwise noted. Direction of arrow through control arms indicates clockwise rotation. * All capacitors so marked are of ceramic disc type. Capacitors marked GMV have tolerance of —0% +100%. Letters on tuner switch wafers read from front to back of tuner. All resistors are ½ watt 10% unless otherwise noted. Resistance values noted for coil and transformer windings are D.C. readings. Mica and ceramic capacitors are ±10% unless otherwise noted. For sets with UHF see PR-2811, File C8 for UHF schematic.

Fig. 21. Schematic Diagram — TV-300 Chassis.

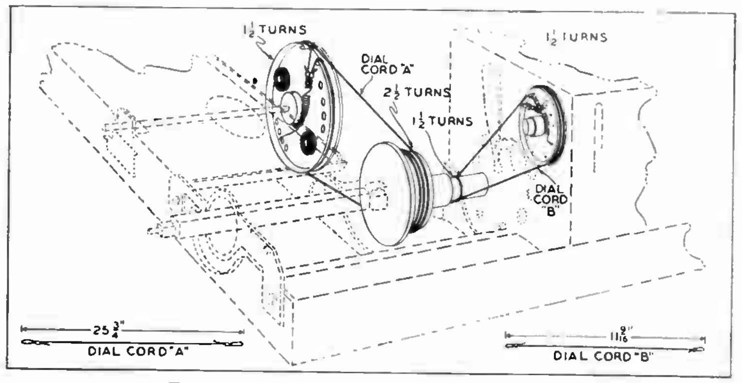


Fig. 23. Dial Cord Stringing Arrangement.

REPLACEMENT PARTS LIST

TV-300 CHASSIS

TUNER — MECHANICAL

Reference Symbol	Description	Service Part No.
	Tuner (T36A)	76-8946-1
	Tube shield	56-5629-5
	Stud	W2235-7FA9
	Connector	27-6273-11
	Antenna coil box assembly	76-9204
	Washer, switch assembly	56-9351
	Washer, switch assembly	1W60980FE5
	Retaining ring, switch assembly	1W61043
	Hairpin, switch assembly	56-9859
	Ball, detent, switch assembly	56-8020
	Spring, shaft, switch assembly	56-8023
	Pulley & shaft, switch assembly	76-9026
	Bearing, switch assembly	54-9244
	Spring, switch assembly	28-9088
	Rotor & shaft, switch assembly	76-9025
	Spring, detent, switch assembly	56-8158
	Washer, switch assembly	W2556-5
	Tube cap, switch assembly	54-9242
	Sleeve cap, switch assembly	28-10283
	Shaft assembly, switch assembly	76-6914-6
	Shaft extension, switch assembly	56-8358-7
	Coupling, shaft, switch assembly	54-4912
S1-S2	socket, tube	27-6203-21

TUNER — ELECTRICAL

Reference Symbol	Description	Service Part No.
C1	capacitor, r.f. heater; oscillator heater	62-122001001
C2	capacitor, r.f. grid by-pass	62-115001001
C3	capacitor, r.f. grid by-pass	62-115001001
C4	capacitor, r.f heater; oscillator heater	62-122001001
C5	capacitor, oscillator grid block; oscillator grid tank (12 mmf.)	30-1224-128
C6	capacitor, injection coupler	30-1224-127
C8	capacitor, interstage coupler	30-1253-1
C9	capacitor, oscillator grid block; oscillator grid tank (12 mmf.)	30-1224-28
C11	capacitor, r.f. grid coup.	62-033409011
C12	capacitor, IF by-pass	30-1238-2
C14	capacitor, mixer grid coup.	30-1224-126
CX-1	IF trap coil, antenna assembly	32-4552-1

Reference Symbol	Description	Service Part No.
L11	capacitor, feed thru, heater by-pass AGC decoupling	30-1245-6
L14	capacitor, feed thru, heater by-pass AGC decoupling	30-1245-6
R1	resistor, mixer grid (100K)	66-4108340
R3	resistor, oscillator grid leak; AGC decoupling (22K)	66-3228340
R7	resistor, r.f. grid	66-4478240
R8	resistor, oscillator grid leak; AGC decoupling (22K)	66-3228340
R9	resistor, r.f. grid section II (470K)	66-4478240
R10	resistor, mixer decoupling (8200)	66-2825340
R12	resistor, mixer screen (8200)	66-2828340
R14	resistor, damper (680)	
R19	resistor, antenna assembly (470K)	66-4478340
T1	coil, IF primary	32-4629
T28	antenna coils (ant. assy.)	32-4432-3
T29	antenna coils (ant. assy.)	32-4432-3
VC2	capacitor, var., r.f. plate; mixer grid (.5 to 3.0 mmf.)	31-6520-3
VC3	capacitor, var., r.f. plate; mixer grid (.5 to 3.0 mmf.)	31-6520-3
WS1	oscillator wiring assembly, switch assy.	76-9231
WS2	ant. wafer wiring assy., switch assy.	76-9245
WS3	grid wiring assembly, switch assy.	76-8955
WS4	RF wiring assembly, switch assy.	76-8956
WS5	auxiliary antenna wiring assy., switch assy.	76-8965
X1	coil, mixer screen	32-4623-57
X2	coil, plate-cathode	32-4623-50

CHASSIS — MECHANICAL

Reference Symbol	Description	Service Part No.
CRTS	CRT socket	41-4147-1
PL	pilot lamp	27-6233-4
	tube shield	56-5629-5
S14	socket, hi-voltage	27-6290-1

CHASSIS — ELECTRICAL

Reference Symbol	Description	Service Part No.
C1	line by-pass —2 (0.01)	30-4650-58
C2	line by-pass —2 (0.01)	30-4650-58
C3	AGC (0.15)	30-4650-48
C5	sawtooth form (0.0033)	30-4650-55
C6	vertical oscillator plate (0.01)	30-1238-2

Reference Symbol	Description	Service Part No.
C7	horizontal oscillator (82 mmf.)	60-00825347
C8	horizontal oscillator (0.01)	30-1238-2
C9	horizontal output grid (0.001)	30-1238-3
C10	boost voltage filter (0.47)	30-4650-45
C11	vertical oscillator coupling (0.01)	30-4650-47
C12	vertical oscillator grid (0.0068)	30-4650-57
C15	sawtooth coupling (0.001)	30-1238-3
C16	horizontal oscillator (390 mmf.)	60-10395437
C17	horizontal oscillator (390 mmf.)	60-10395417
C19	horizontal ringing (2200 mmf.)	60-20225434
C22	sound take off (18 mmf.)	62-018300001
C23	2nd V.I.F. (0.002)	30-1238-12
C24	detector (10 mmf.)	62-010409001
C25	1st audio grid (0.005)	30-1238-1
C26	1st V.I.F. screen by-pass (680 mmf.)	62-168001011
C27	3rd V.I.F. screen by-pass (680 mmf.)	62-168001011
C28	1st V.I.F. by-pass (0.002)	30-1238-12
C29	2nd V.I.F. screen by-pass (680 mmf.)	62-168001011
C30	3rd V.I.F. by-pass (0.002)	30-1238-12
C31	video by-pass (0.002)	30-1238-12
C32	AGC (0.1)	30-4650-47
C33	4.5 mc., trap (68 mmf.)	62-068409011
C34	SIF (0.004)	30-1239
C35	audio output plate (0.01)	30-1238-2
C36	audio coupler (0.002)	30-1238-2
C37	video coupling (0.47)	30-4650-45
C38	video output cathode by-pass	30-1238-16
C39	phase comp. cathode (180 mmf.)	60-10185417
C40	SS plate (150 mmf.)	62-115001001
C41	SS output (150 mmf.)	62-115001001
C42	SS coupling (560 mmf.)	60-10565307
C43	AGC by-pass (0.01)	30-1238-2
C44	contrast (0.1)	30-4650-47
C46	cont. tap (150 mmf.)	62-115001001
	adj., 1-5 mmf. V.I.F.	31-6520-9
E3	20 mf. @ 475V.; 10 mf. @ 350V.; 5 mf. @ 150V.	30-2584-50
E1	80 mf. @ 350V.; 40 mf. @ 400V.; 100 mf. @ 200V.; 25 mf. @ 50V.	30-2584-47
	crystal 1N64	34-8022
	pilot lamp	3463-4
F1	fuse	AD-2246-15
HT	transformer, horizontal output	32-8677
	shield corona	56-9684
	anode lead assy.	AD-2631
	pulley assy., driving	76-9037
	shaft, dial	28-10011
	spring, dial cord	28-10029
R2	line to chassis (100K.)	66-4105340
R5	boost (5600)	66-2565340
R6	boost (39K.)	66-3395340
R7	boost (4700)	66-2465340
R8	height (1 meg.)	66-5108340
R10	horizontal oscillator cathode (1000)	66-2108340
R11	horizontal output grid (1 meg.)	66-5108340
R12	sawtooth form (56K.)	66-3564340
R13	vertical oscillator grid (820K.)	66-4828340
R14	vertical integrator (33K.)	66-3338340

Reference Symbol	Description	Service Part No.
R16	horizontal oscillator grid (220K.)	66-4228340
R17	horizontal oscillator plate (15K.)	66-3158340
R18	horizontal oscillator grid (56K.)	66-3568340
R20	horizontal oscillator plate (47K.)	66-3478340
R21	vertical oscillator grid (2.2 meg.)	66-5228340
R23	de-emph (47K.)	66-3478340
R25	2nd V.I.F. cathode (47 ohms)	66-0478340
R26	discriminator (120 ohms)	66-1128340
R27	diode plate (33K.)	66-3338340
R28	AGC (1000)	66-2108340
R29	1st audio grid (10 meg.)	66-6108340
R30	1st V.I.F. cathode (47 ohms)	66-0478340
R31	1st V.I.F. —2 (1000)	66-2108340
R32	1st V.I.F. grid (15K.)	66-3158340
R33	1st V.I.F. —2 (1000)	66-2108340
R34	1st V.I.F. decoupler (330)	66-1338340
R35	3rd V.I.F. cathode (180 ohms)	66-1188340
R36	3rd V.I.F. decoupler (1000)	66-2108340
R37	video grid (2200)	66-2228340
R39	SIF cathode (270 ohms)	66-1278340
R41	vertical integrator (33K)	66-4278340
R42	3rd V.I.F. decoupler (330)	66-1338340
R43	AGC filter (680K.)	66-4688340
R44	diode load (3900)	66-2398340
R47	audio output grid (1.5 meg)	66-5158340
R48	video screen drop (18K.)	66-3188340
R49	video output cathode (100)	66-1108340
R50	video output grid (470K.)	66-4478340
R51	phase comp. grid (680K.)	66-4688340
R52	phase comp. cathode (180K.)	66-4188340
R53	SS grid (10K.)	66-3108340
R54	SS plate (150K.)	66-4158340
R57	video B+ (6800)	66-2684340
R58	SS grid (220K.)	66-4228340
R59	AGC filter (1 meg.)	66-5108340
R60	AGC filter (8.2 meg.)	66-5828340
R61	AGC filter (2.2 meg.)	66-5228340
R62	AGC filter (10 meg.)	66-6108340
R63	bright lim. (150K.)	66-4158340
R64	CRT cathode (270K.)	66-4278340
R65	cont. lim. (2200)	66-2228340
T1	horizontal ringing	32-4557-4
T2	1st V.I.F. plate	32-4486-45
T3	3rd V.I.F. plate	32-4486-47
T4	sound takeoff	32-4463-10
T5	trans. disc.	32-4631A
T6	2nd V.I.F. plate	32-4486-46
T7	4.5 mc., trap	32-4463-2
VR1	vertical lin.	67-0025
VR2	height	33-5572-1
VR3	width	33-5574
VR4	bright, horizontal hold	33-5572-16
VR5	vertical hold	33-5572-10
VR6	bright, horizontal hold	33-5572-16
VR7	contrast	33-5572-15
VR8	off-on, volume	33-5566-61
X1	damper	32-4112-50
X2	heater	32-4112-49
X3	detector series	32-4630
X4	1st V.I.F. grid	32-4597-3
X5	detector shunt	32-4480-5
X8	video output peak	32-4480-5
X9	video plate peak	32-4480-9
R66	MV filter (4700 ohms)	66-2478340
R22	S.S. coup. (4.7 meg.)	66-5478340
R56	video plate damper (4700 ohms)	66-2478340
	vertical oscillator peak (6800 ohms)	66-2688340
R9	1B3 heater	66-9393360
R15	vertical integrator (8200 ohms)	66-2828340
	SSTC (560 mmf.)	60-10565307

TUBE COMPLEMENT — TV-350 CHASSIS

Reference Symbol	Tube Type	Function
S2	6BZ7	RF Amplifier
S1	6X8	Oscillator-mixer
S10, S11	6DE6	Video I-F amplifiers
S12	6CB6	Video I-F amplifiers
S15	12BY7	Video output
S13	6AU6	Sound Amplifier
S9	6AL5	Ratio Detector
S8	6AT6	First Audio and AGC Delay
S1	6V6 GT/G	Audio Output
S14	6CS6	Sync Separator
S7	12AU7	Vertical Oscillator
S6	6S4	Vertical Output
S4	6AL5	Phase Comparer
S2	12AU7A	Horizontal Oscillator
S3	6CU6, 6BQ6GT, or 6BQ6GTA	Horizontal Output
S5	6AX4GT	Horizontal Damper
S16	1B3GT	High Voltage Rectifier
S17	5AW4, or 5U4GB	Low Voltage Rectifier
S18	21ZP4B	Picture tube

SPECIFICATIONS — TV-350 CHASSIS

VHF TUNING .... Twelve channel, 13-position incremental tuner, covering VHF Television channels 2 through 13; plus UHF position, and fine tuning of local oscillator.

UHF TUNING (if provided) .... Continuous tuning, covering UHF Television Channels 14 through 83.

INTERMEDIATE FREQUENCIES
Video Carrier .... 45.75 mc.
Sound (intercarrier) .... 4.5 mc.

TRANSMISSION LINE .... 300-ohm, twin-wire lead

OPERATING VOLTAGE .... 110 to 120 volts, 60 cycles, a.c.

POWER CONSUMPTION .... without UHF, 185 w. with UHF, 190 w.

SPECIFICATIONS — TV-354

VHF TUNING .... Twelve channel, 13-position incremental tuner, covering VHF Television channels 2 through 13; plus UHF position, and fine tuning of local oscillator.

UHF TUNING (if provided) .... Continuous tuning, covering UHF television channels 14 through 83.

INTERMEDIATE FREQUENCIES
Video Carrier .... 45.75 mc.
Sound (intercarrier) .... 4.5 mc.

TRANSMISSION LINE .... 300-ohm, twin-wire lead

OPERATING VOLTAGE ..... 110 to 120 volts, 60 cycles, a.c.

POWER CONSUMPTION without UHF, 240 w. with UHF, 245 w.

CIRCUIT DESCRIPTION OF TV-354

The TV-354 is the same as the TV-350 with the following exceptions. The vertical output tube has been changed from a 6S4 to a 6CM6. The horizontal output tube from a 6BQ6 to a 6CD6. The damper tube in the TV-350 is a 6AX4, while the damper tube in the TV-354 is a 6AU4GT. The power supply in the TV-354 contains two 5U4G rectifiers. These changes have been made in the TV-354 to accommodate the larger picture tube.

CIRCUIT DESCRIPTION — TV-350 CHASSIS

The RF amplifier, oscillator and mixer are contained in a separate tuner sub chassis. The RF amplifier uses a twin triode type 6BZ7 tube. The oscillator is ½ 6X8 and uses the triode side of the tube. The other side of the 6X8, the pentode side, is used for mixing.

The VHF tuner when placed in UHF position is tuned automatically to i-f frequency in the RF amplifier stage as well as the mixer stage. Thus, when this set is used in UHF position it has five I-F stages. The VHF oscillator is made inoperative in the UHF position.

The output of the mixer stage is inductively coupled to the i-f amplifier system. The I-F system consists of three stages, and is stagger tuned, and 40 megacycles, using two 6DE6 tubes and one 6CB6 tube. A type IN64 crystal diode is used for the video detector. The output of the video detector is amplified by a single stage video amplifier using a type 12BY7 tube. The picture tube is cathode driven due to the single video amplifier stage. The grid of the picture tube is returned to ground through a 470 K resistor R 32. A blanking pulse, taken from the vertical output stage is applied to the grid of the picture tube for suppression of the vertical retrace.

Sound I-F (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75 mc. video carrier and the 41.25 mc sound carrier are mixed in the video detector. The 4.5 mc difference signal contains the FM sound. This 4.5 mc signal contains only a negligible amount of video amplitude modulation, provided that the amplitude of the 41.75 mc. signal is considerably lower than that of the 45.75 mc. signal. The proper ratio of the two signals is established during the alignment of the receiver. Sound is present only when the video and sound carriers are transmitted.

The oscillator is tuned primarily to receive the best picture, since the 4.5 mc difference signal is established at the transmitter. The 4.5 mc sound I-F signal is taken from the plate of the video tube and is further amplified in a 4.5 mc tuned amplifier, type 6AU6. The signal is then applied to a ratio detector using a tube type 6AL5. The output of this ratio detector is applied to the triode section of a 6AT6. The output of the 6AT6 drives a 6V6GT which is the power output tube.

A portion of the video signal appearing at the output of the video amplifier is applied to grid 3 (pin 7) of the 6CS6 sync separator. Since grid leak bias is used on grid 3, the tips of the sync pulses are clamped to zero, and the video components swing in a negative direction from zero. Because of the cut-off characteristics of grid 3, the video components are eliminated, and only negative-going sync pulses appear in the plate circuit of the sync separator. At the same time, however, a signal is taken from the video detector and applied to grid 1 (pin 1) of the 6CS6 tube. This grid leak is returned to B plus, and the bias is maintained close to zero, because of a small grid-current flow. Since the signal applied to grid 1 is composite video with negative-going sync, any noise modulation present in the signal appears in the form of sharp spikes, driving in a negative direction. The circuit constants are chosen to allow grid 1 to cut off plate current whenever the signal goes more negative than the sync pulses. The series grid resistance and low grid impedance when the tube is drawing current greatly reduces the amount of video appearing at the grid and therefore the plate of the sync separator. A-G-C voltage is also developed in the sync separator circuit in the following manner: on tips of the sync pulses, grid 3 (pin 7) of the 6CS6 tube draws current which flows downward through the network R64, R62, R76 and R79, causing capacitors C50, C51, and C52, to assume negative charges proportional to the amount of peak signal applied to grid 3. The tuner a-g-c voltage is delayed by means of a resistor divider network which applies a small positive voltage to the tuner a-g-c circuit. This positive voltage prevents a-g-c action from lowering the tuner gain on weak signals. To prevent the delay voltage from driving the tuner a-g-c voltage positive on weak signals, a diode clamp (part of 6AT6) is connected across C52.

The I-F strip also has an A-G-C delay network which allows the i-f strip to operate more efficiently under conditions of weak signals. To prevent the delay voltage from driving the I-F grids positive a diode clamp (part of 6AT6) is connected across C61.

This receiver is equipped with a three position range switch. These positions are referred to as strong signal, normal signal and fringe signal. Under conditions of strong signal, G1 of the 6CS6 sync separator tube is grounded. When this grid is grounded G3 to K looks like a good diode with the result that a maximum A-G-C is developed by grid leak action at G3.

In the normal signal position a slight bias is applied to G1 of this tube and noise will not disturb the bias developed. G3 to K then looks like a rectifier of less efficiency. Under conditions of fringe signal, G1 of the 6CS6 is operating on grid leak bias and the efficiency of rectification is very poor with the result that very little, if any, grid leak bias is developed at G3.

The range switch also changes the tuner and I-F delay.

Proper triggering of the vertical oscillator requires negative synchronizing pulses. The vertical sync signal is separated from the horizontal sync signal by the integrator circuit, and is fed to the grid of the vertical oscillator, a cathode-coupled multivibrator. The output of the vertical oscillator is amplified by a type 6S4 tube which is employed as the vertical output amplifier. The output of the amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

The horizontal sweep circuits require both posiitve and negative sync pulses. The phase-comparer circuit uses a 6AL5 tube. Positive sync pulses are applied to the plate of S4, and negative sync pulses are applied to the cathode of S4. A saw-tooth voltage is fed to the plate of S4 and to the cathode of S4, for comparison of the sync and horizontal sweep voltages. When the saw-tooth and sync signals are exactly in phase, no voltage is developed across R16, but when the two signals are out of phase, either a positive or a negative voltage is developed, depending upon whether the horizontal-oscillator frequency is lower or higher than the sync-pulse frequency. The grid circuit of the horizontal oscillator, a 12AU7 (S-2) cathode-coupled multivibrator, is connected to R17 through a filter network; when the voltage at this point goes in a positive direction, the frequency of the horizontal oscillator is increased, and when the voltage swings negative, the frequency of the oscillator is decreased. In this manner the frequency of the horizontal oscillator is controlled over the lock-in range of the circuit. The horizontal oscillator hold control adjusts the horizontal-oscillator frequency so that it is within the control range of the phase comparer. The output of the horizontal oscillator is fed to the horizontal output amplifier, which makes use of a 6CU6 tube. The screen voltage for the horizontal amplifier is supplied from a voltage-divider network. The horizontal amplifier feeds the deflection coils through the horizontal output transformer. A 6AX4GT tube is used as the horizontal damper.

The second-anode voltage for the picture tube is supplied by a 1B3GT high-voltage rectifier. The B plus voltage is supplied by a power transformer and a full wave rectifier, type 5AW4. All of the filament voltage is supplied from a filament winding on the transformer with the exception of the high voltage rectifier which is supplied by a winding on the horizontal output transformer.

Bias voltage is supplied by isolating the center tap of the secondary of the power transformer away from ground by means of a 1.2 henry choke.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture until approximately 1 inch of blank screen appears at the right-hand and left-hand sides of the picture.
2. Increase the BRIGHTNESS control setting until the blanking becomes visible. This will appear as a dark vertical bar on each side of the picture.
3. Connect a .1 mf condenser from the test point to ground. (The plate side of the horizontal ringing coil, T1, is connected to the test point.)
4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.
5. Adjust the HORIZONTAL HOLD CENTERING control until equal portions of the blanking bar appear on both sides of the picture.
6. Remove the .1 mf condenser from the test point.
7. Adjust the horizontal ringing coil, T1, until equal portions of the blanking bar again appear on both sides of the picture.
8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync on both sides, readjust the HORIZONTAL HOLD CENTERING control.
9. Rotate the HORIZONTAL HOLD control through its range, and observe the number of diagonal blanking bars that appear just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO PEAKING-COIL ADJUSTMENT

The peaking coil, T6, is adjusted at the factory for proper transient response of the video circuits. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of T6 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If T6 is replaced in servicing, adjustment will be required.

Before adjusting T6, check the tuner alignment and I-F alignment. (Never adjust T6 until the alignment of a receiver is correct.) Then tune in a station and adjust T6 until there are no trailing whites or smear in the picture. Turning T6 clockwise reduces trailing whites and overshoot; turning T6 counter-clockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of T6 applies to a particular station exhibiting smear or overshoot. After T6 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

TELEVISION ALIGNMENT

General

The alignment procedure follows the general pattern of first checking the tuner response with an FM sweep generator and oscilloscope, comparing the response curve with that given in the manual, and aligning the tuner if necessary. After it is established that the tuner is in correct alignment, the video I-F channel is aligned by tuning each coil to its assigned pole frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and retouching the I-F adjustments to obtain the desired pass band. Finally, the sound channel is aligned, using an AM signal, by tuning the sound take-off coil and the I-F and ratio-detector transformers.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the I-F stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chassis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.

2. Do not disconnect the picture tube yoke, or speaker while the receiver is turned on.

3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.

4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If Philco Alignment Generator Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method for calibrating the signal generator to the sound and video i-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745 (J) entitled "Television Service in the Home."

JIGS AND ADAPTERS REQUIRED

Mixer Jig

Connections to the grid of the mixer tube may be made through the test point provided for this purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adaptor, Part No. 45-1636, with as short a ground lead as possible, may be ued to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

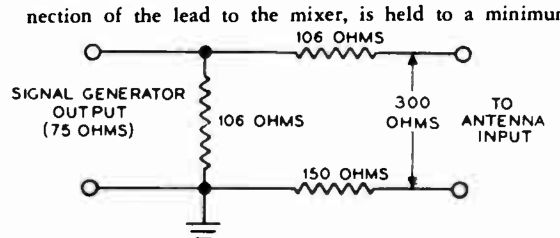


Fig. 1. Antenna-Input matching network.

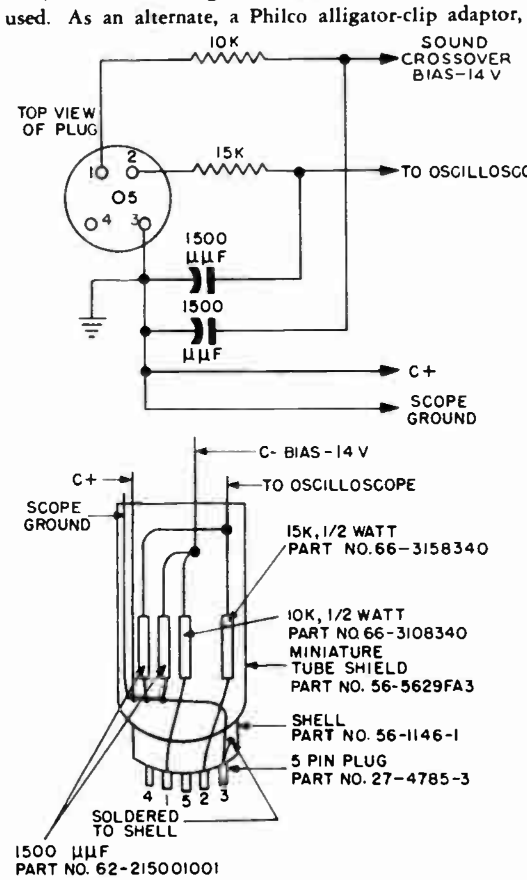


Fig. 2. Video I-F Alignment Jig (Video Test Jack Adapter No. 1).

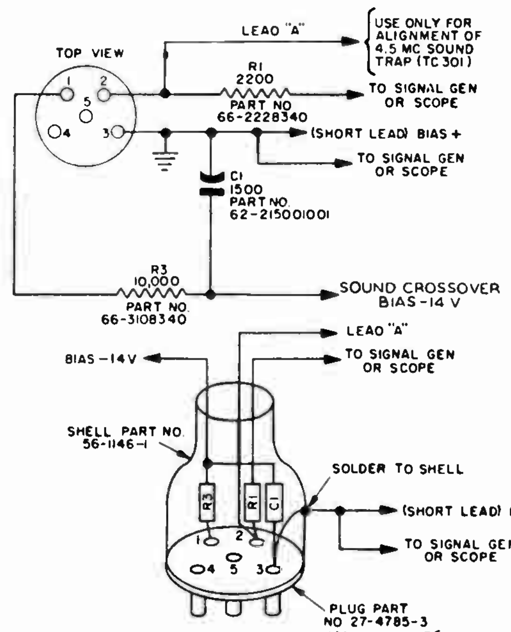


Fig. 3. Sound I-F Input Alignment Jig (Video Test Jack Adapter No. 2).

Sound I-F Input Alignment Jig

(Video Test Jack Adapter No. 2)

To observe the composite video, at TS1, a jig may be made with a five-pin plug and a 2200 ohm resistor. (See figure 3.) The 2200 ohm resistor should be connected to pin 2 of the plug. A ground lead should be connected to pin 3. To observe the composite video, connect the oscilloscope to the 2200 ohm resistor and the ground lead. This jig is also used for injection of the 4.5 mc. signal during s-i-f alignment.

Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna input terminals of the receiver is shown in figure 1. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group, to obtain values within ten percent of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna-matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig

(Video Test Jack Adapter No. 1)

The alignment jig used at TS1 and shown in figure 2, should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This adapter consists of a five-pin plug, two 10,000 ohm resistors, and a 1500 mmf condenser for isolation of the bias supply. To isolate the oscilloscope from the receiver circuits, a 15,000-ohm resistor, by-passed by a 1500 mmf. condenser, is used. A suggested method of fabricating the jig is also shown in figure 2. This jig should not be used to observe the composite video from the video detector output.

TUNER BAND PASS ALIGNMENT

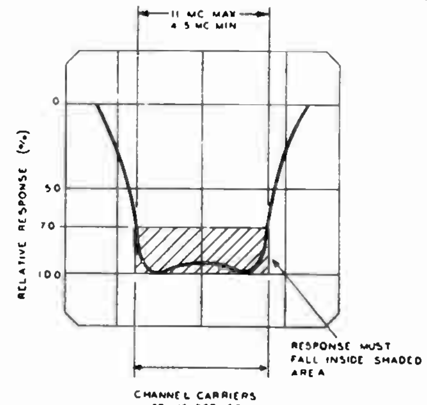


Fig. 4. Television tuner response curve, showing bandpass limits.

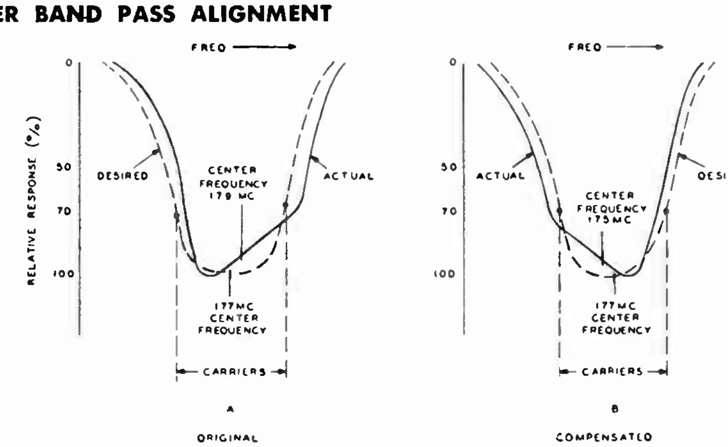


Fig. 5. Television tuner response curve, showing tracking compensation.

TUNER OSCILLATOR ALIGNMENT

AM GENERATOR: Connect to receiver antenna-input terminals. (No matching network is required.) Use unmodulated r-f output.

OSCILLOSCOPE: Connect the vertical-input lead, in series with a 1000-ohm resistor, to the mixer grid test point. Connect the scope ground lead to the chassis, near the test point.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (white) lead from main chassis, and connect a 1.5 volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis.

TABLE NO. 1

STEP	AM GENERATOR DIAL SETTING	RECEIVER TUNING	ADJUST	REMARKS
1	257 mc.	channel 13	VC4 for zero beat on scope.	a. If regeneration occurs, inject bias; bias may be increased up to 3 volts, if necessary at pin 1 video test jack — TS1. b. Preset fine tuning adjustment so that it is in the middle of its range.
2	251 mc.	channel 12	VC5 for zero beat on scope.	
3	245 mc.	channel 11	VC6 for zero beat on scope.	
4	239 mc.	channel 10	VC7 for zero beat on scope.	
5	233 mc.	channel 9	VC8 for zero beat on scope.	
6	227 mc.	channel 8	VC9 for zero beat on scope.	
7	221 mc.	channel 7	VC10 for zero beat on scope.	
8	64.5 mc.	channel 6	VC11 for zero beat on scope.	2nd harmonic gives 129 mc.
9	113 mc.	channel 4	VC12 for zero beat on scope.	
10	101 mc.	channel 2	VC13 for zero beat on scope.	

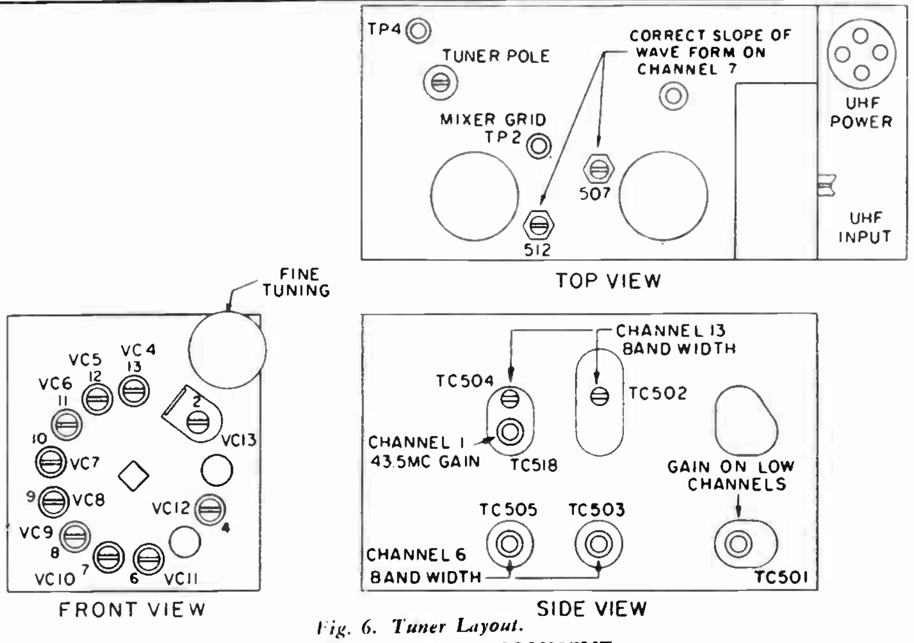


Fig. 6. Tuner Layout.

TUNER BANDPASS ALIGNMENT

SWEEP (FM) GENERATOR: Connect to antenna-input circuit through antenna-input matching network (See figure 1).

OSCILLOSCOPE: Connect the vertical-input lead, in series with a 1000-ohm resistor, to the mixer plate test point, TP4. Connect scope ground lead to the chassis, near TP4.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (white) lead from main chassis, and connect a 1.5 volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis. Disconnect tuner link from terminal board, B-9, and connect a 40 to 70-ohm carbon resistor across the link.

TABLE NO. 2

STEP	SWEEP (FM) GENERATOR		RECEIVER TUNING	ADJUST	REMARKS
	SWEEP DIAL SETTING	MARKER DIAL SETTING			
1	channel 13 (213 mc. with 10-mc. sweep width.)	Set first to 210 mc. and note position of marker on response curve. Then set to 216 mc. and note position of marker on response curve.	channel 13		Use oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve. Response curve should be flat between limits (see fig. 5). If not, proceed with step 2.
2	channel 13	213 mc.	channel 13	TC502 counterclockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
3	channel 13	213 mc.	channel 13	TC504 until peak falls on 213 mc. marker.	It may be necessary to increase sweep-generator output.
4	channel 6 (85 mc. with 10-mc. sweep width.)	Set first to 82 mc. and note position of marker on response curve. Then set to 88 mc. and note position of marker on response curve.	channel 6		Curve should be symmetrical and centered in pass band. If not, proceed with step 5.
5	channel 6	85 mc.	channel 6	TC503 counterclockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
6	channel 6	85 mc.	channel 6	TC505 until peak falls on 85 mc. marker.	It may be necessary to increase sweep-generator output.
7	channel 6	85 mc.	channel 6	TC503 for maximum curve height and symmetry of single peak.	After adjusting TC503, recheck as in step 4. If necessary, reduce sweep-generator output to avoid overloading.
8	channel 6	85 mc.	channel 6	Retouch TC503 and TC505 for symmetrical response, centered about 85 mc. marker.	To retouch, only turn cores slightly.
9	channel 1 (UHF)	44 mc.	channel 1 (UHF)	Retouch TC503 and TC505 for symmetrical response centered about 44 mc.	After this adjustment recheck channel 6 and be sure it is within limits.

NOTE: On channel 7, observe the tilt and center frequency of the response curve. The curve should be centered on the pass band and should be symmetrical. If it is not symmetrical, and appears unbalanced, as in figure 6, adjust C507 and C512 (figure 5) to obtain a response curve which is in the mirror image (tilt in the opposite direction) of the original: for example, if channel 7 response curve appears as in figure 6A, adjust C507 and C512 until the curve appears as in figure 7B. This adjustment over-compensates to make allowance for the effect of channel 13 adjustments upon channel 7 response.

VIDEO I-F ALIGNMENT

AM GENERATOR: Connect to mixer test point, TP2, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during alignment, to keep the output at the second detector below 4 volt, peak to peak.

SWEEP (FM) GENERATOR: After step 7, connect to antenna-input circuit through antenna input matching network. (See figure 1.)

OSCILLOSCOPE: Connect the vertical-input lead to the 15K resistor of the video i-f alignment jig. Connect scope ground lead to the ground lead of the jig. Plug jig into TS1.

PRESET: Contrast and Brightness controls fully counterclockwise, and channel selector to channel 4. Adjust AGC switch to normal position.

BIAS: Apply —14 volts of negative bias to pin 1 of video i-f alignment jig; ground positive side of bias supply to pin 3 of jig. (See figure 2.)

NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

TABLE NO. 3

STEP	AM GENERATOR DIAL SETTING	SWEEP (FM) GENERATOR		ADJUST	REMARKS
		SWEEP DIAL SETTING	MARKER DIAL SETTING		
1	47.25	not used	not used	VC1 for minimum indication on scope.	It is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.
2	41.25	not used	not used	VC2 for minimum indication on scope.	
3	45.4	not used	not used	TT for maximum indication on scope.	Adjust the output of the AM generator, to keep the output at the second detector below 4 volt, peak to peak. (For convenience, the oscilloscope may be calibrated for this purpose beforehand.)
4	45.4	not used	not used	T2 for maximum indication on scope.	
5	43.0	not used	not used	VC3 for maximum indication on scope.	
6	42.7	not used	not used	T3 for maximum indication on scope.	
7	44.4	not used	not used	T4 for maximum indication on scope.	
8	not used	channel 4 (69 mc., with 6-mc. sweep width)	Run marker along curve, checking against the curve limits given in fig. 7.	If necessary, retouch T1, T2, T3, & T4 as directed in REMARKS column. CAUTION: Do not touch settings of VC1 and VC2.	Set Fine Tuning Cam to reference point previously made in step 1 of Table 1. If response curve does not fall within limits shown in fig. 7, retouch T1 & T2 for proper level of curve at video carrier frequency; adjust T4 to level top of curve and T3 for proper slope of low-frequency side of curve. CAUTION: To retouch, only turn the adjustments slightly, particularly T2.

SOUND IF ALIGNMENT

AM GENERATOR: Connect "hot" lead through a 2200 ohm resistor to pin 2 of TS1, using the video i-f alignment jig. Connect ground lead of generator to ground lead of jig.

VOLTMETER: Use v.t.v.m. or 20,000 ohms-per-volt voltmeter. Connect to sound test point.

OSCILLOSCOPE: Connect through crystal probe to cathode (pin 11) of picture tube.

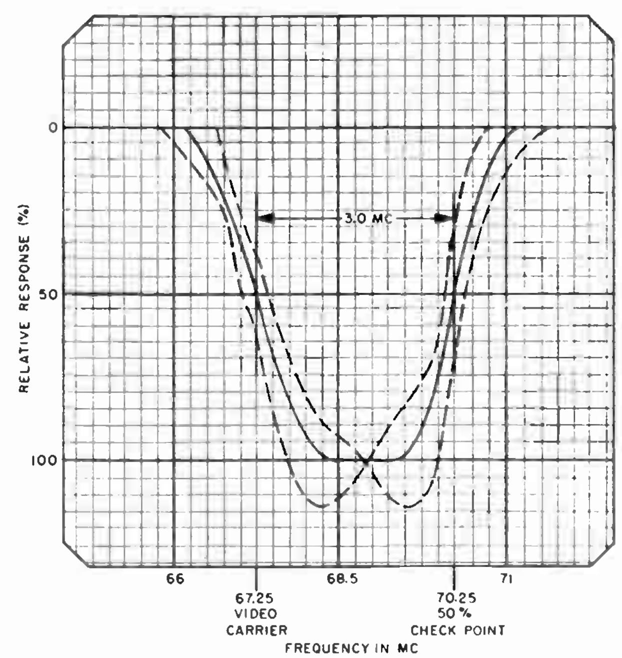


Fig. 7. Over-all R-F, I-F response curve, showing tolerance limits.

STEP	AM GENERATOR DIAL SETTING	ADJUST	REMARKS
1	4.5 mc.	T7 for maximum indication on voltmeter.	Remove 1st video i-f tube, and adjust the volume control for moderate speaker output.
2	4.5 mc.	T5 primary (bottom of T5) for maximum indication on voltmeter.	
3	4.5 mc.	T5 secondary (top of T5) for maximum indication on voltmeter and minimum speaker output.	The point of maximum meter indication for C5 should also be the point of minimum speaker output.
4	4.5 mc.	T8 for minimum indication as view on the oscilloscope.	
5	use station signal	T5 primary (bottom of T5) for minimum AM (noise or buzz), using speaker output for indication.	Replace 1st video i-f tube, and tune in a station, setting fine tuning control to obtain a crisp picture, with a small amount of beat.

OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 3.5 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms — not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.

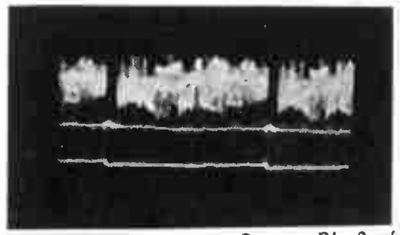


Fig. 8. Video Detector Output, Pin 2 of TS1, 3.5 volts, 60 c.p.s.

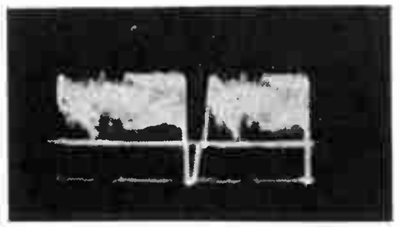


Fig. 9. Video Detector Output, Pin 2 of TS1, 3.5 volts, 15,750 c.p.s.

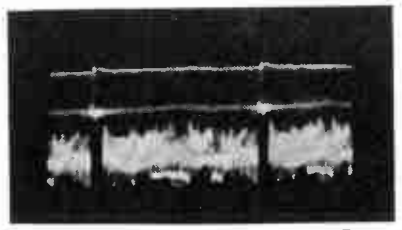


Fig. 10. Video Amplifier Plate, Pin 7, 83 volts, 60 c.p.s.

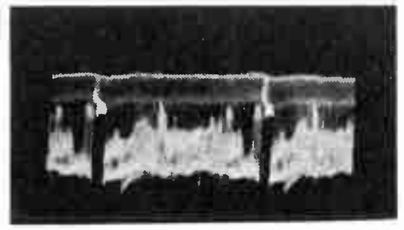


Fig. 11. Sync Separator Grid, Pin 7, 38 volts, 60 c.p.s.

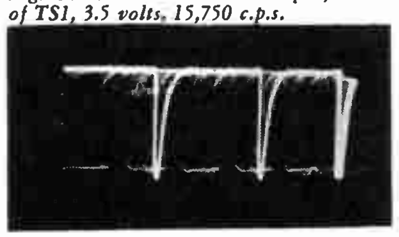


Fig. 12. Sync Separator Plate, Pin 5, 41 volts, 15,750 c.p.s.

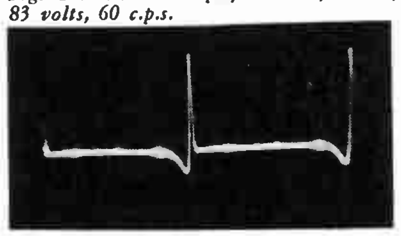


Fig. 13. Vertical-Oscillator Grid, Pin 2, .34 volts, 60 c.p.s.

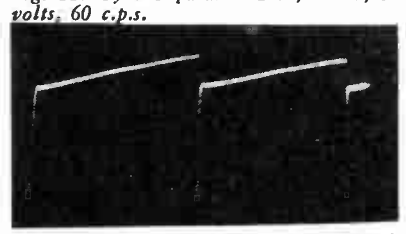


Fig. 14. Vertical-Output Grid, Pin 6, 80 volts, 60 c.p.s.

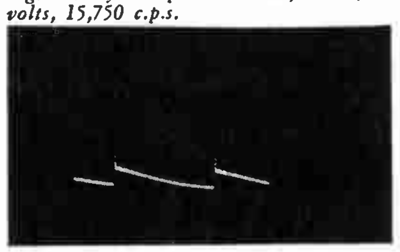


Fig. 15. Vertical Output Plate, Pin 9, 1100 volts, 60 c.p.s.

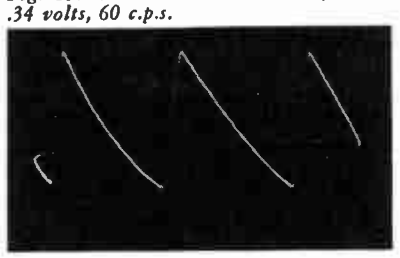


Fig. 16. Phase Comparer, Pin 2, 11 volts, 15,750 c.p.s.

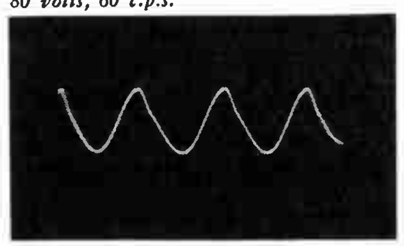


Fig. 17. Horizontal Oscillator, 43 volts, 15,750 c.p.s. test point.

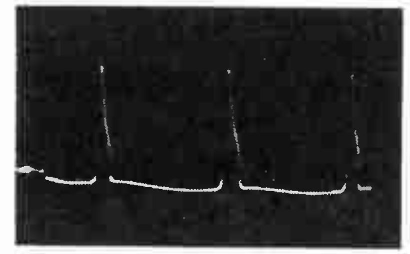


Fig. 18. Horizontal-Oscillator Cathode, Pins 3 and 8, 18 volts, 15,750 c.p.s.

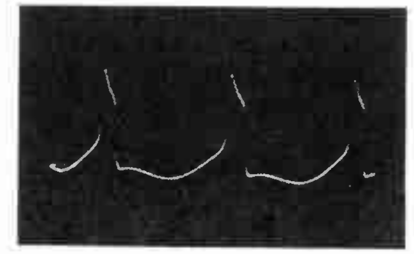


Fig. 19. Horizontal-Oscillator Grid, Pin 2, 65 volts, 15,750 c.p.s.

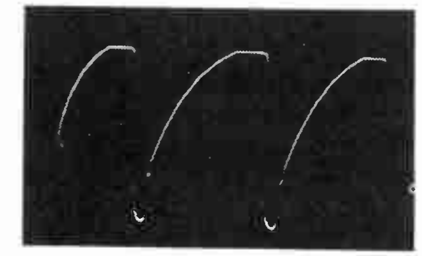


Fig. 20. Horizontal-Output Grid, Pin 5, 160 volts, 15,750 c.p.s.

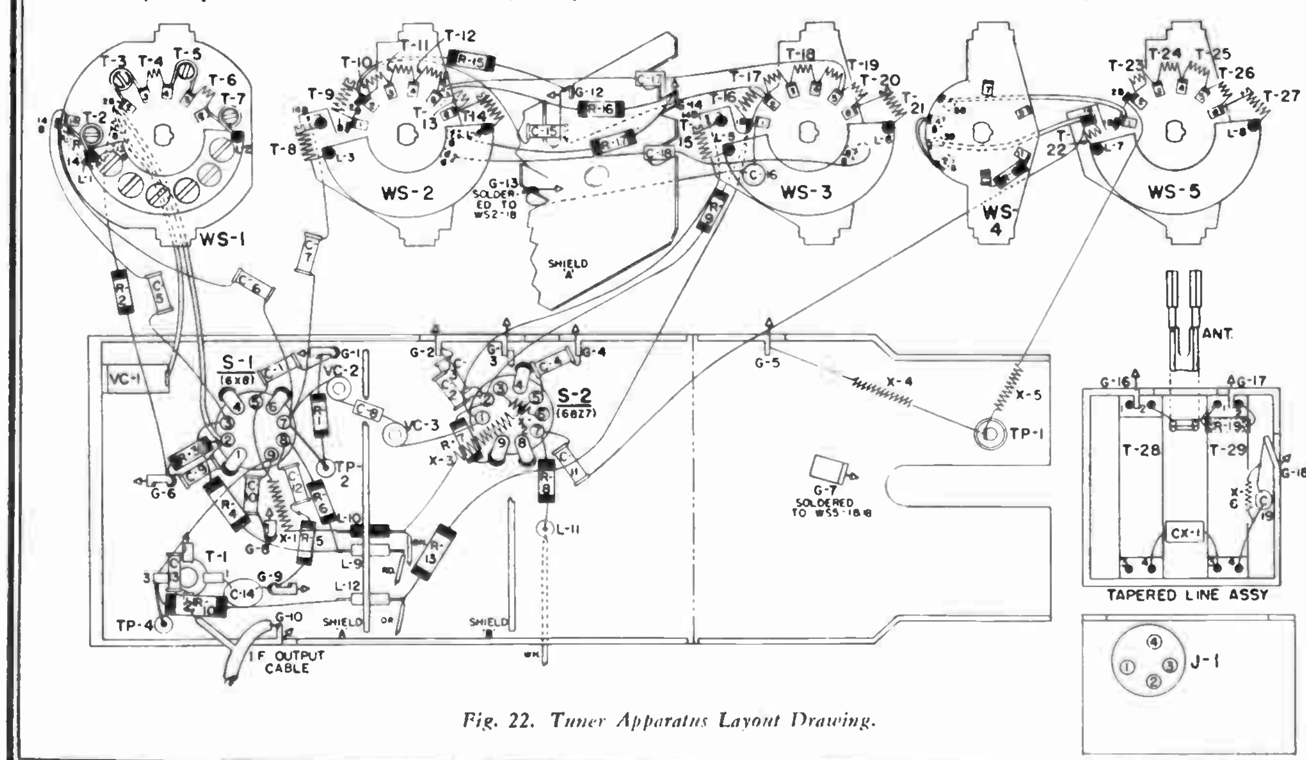


Fig. 22. Tuner Apparatus Layout Drawing.

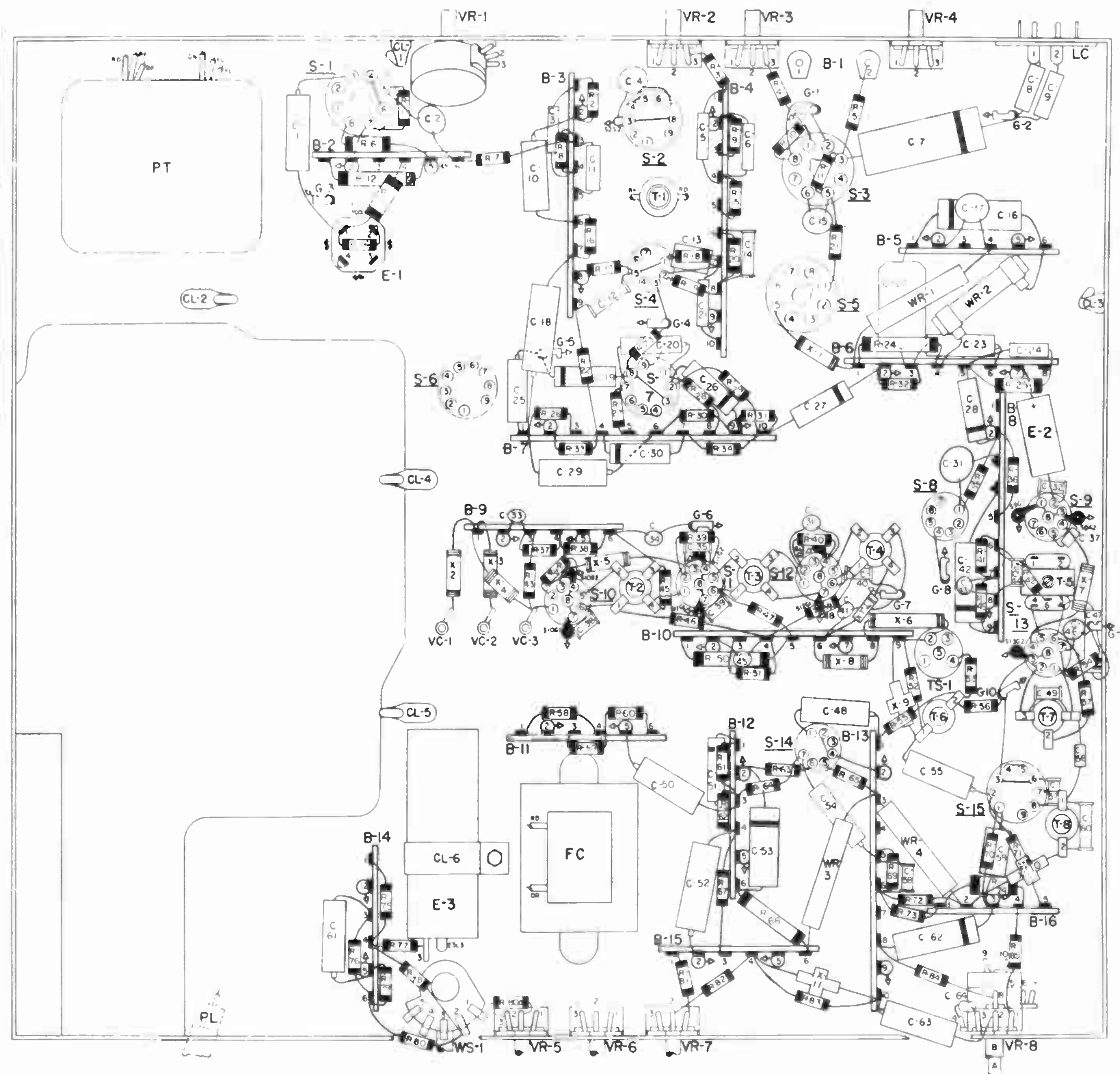


Fig. 23. Wiring diagram, bottom view — TV-350 chassis.

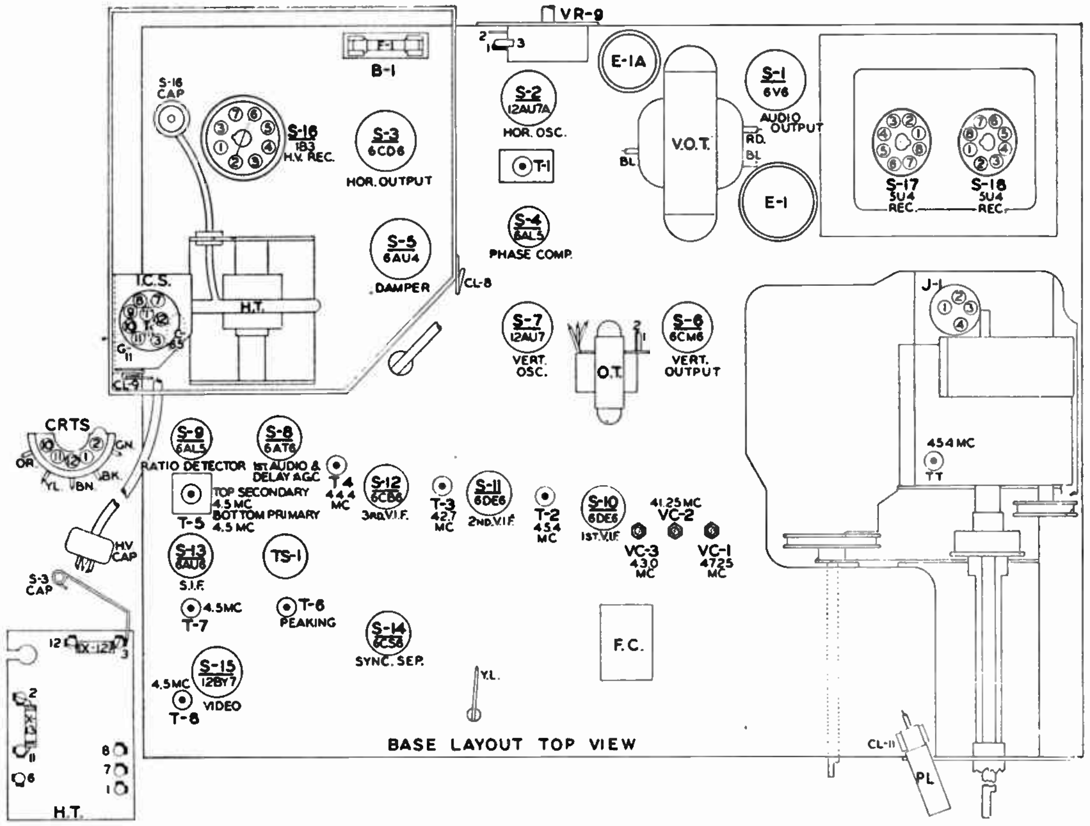


Fig. 26. Base layout, top view — TV-354.

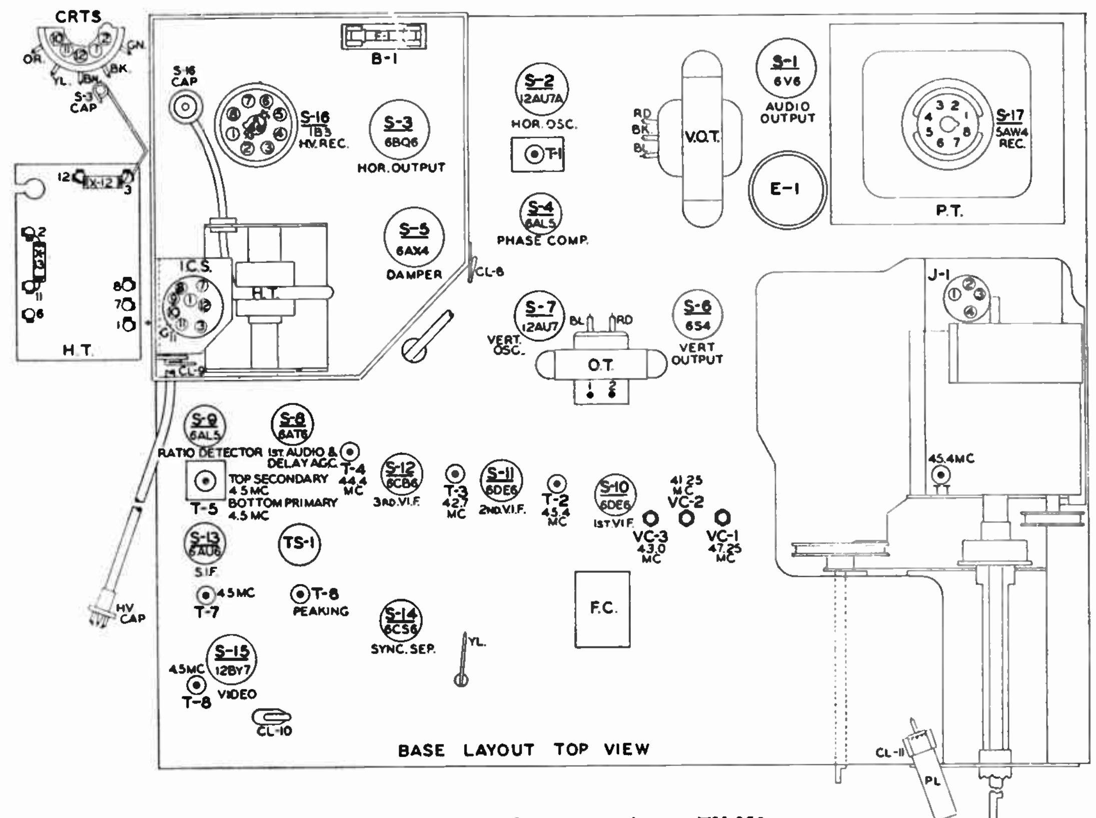


Fig. 27. Base layout, top view — TV-350.

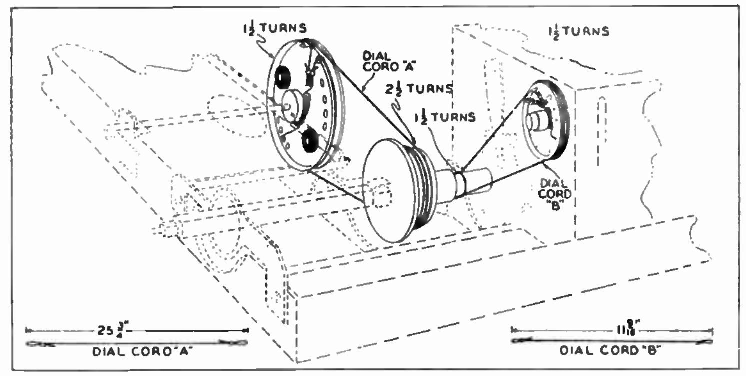
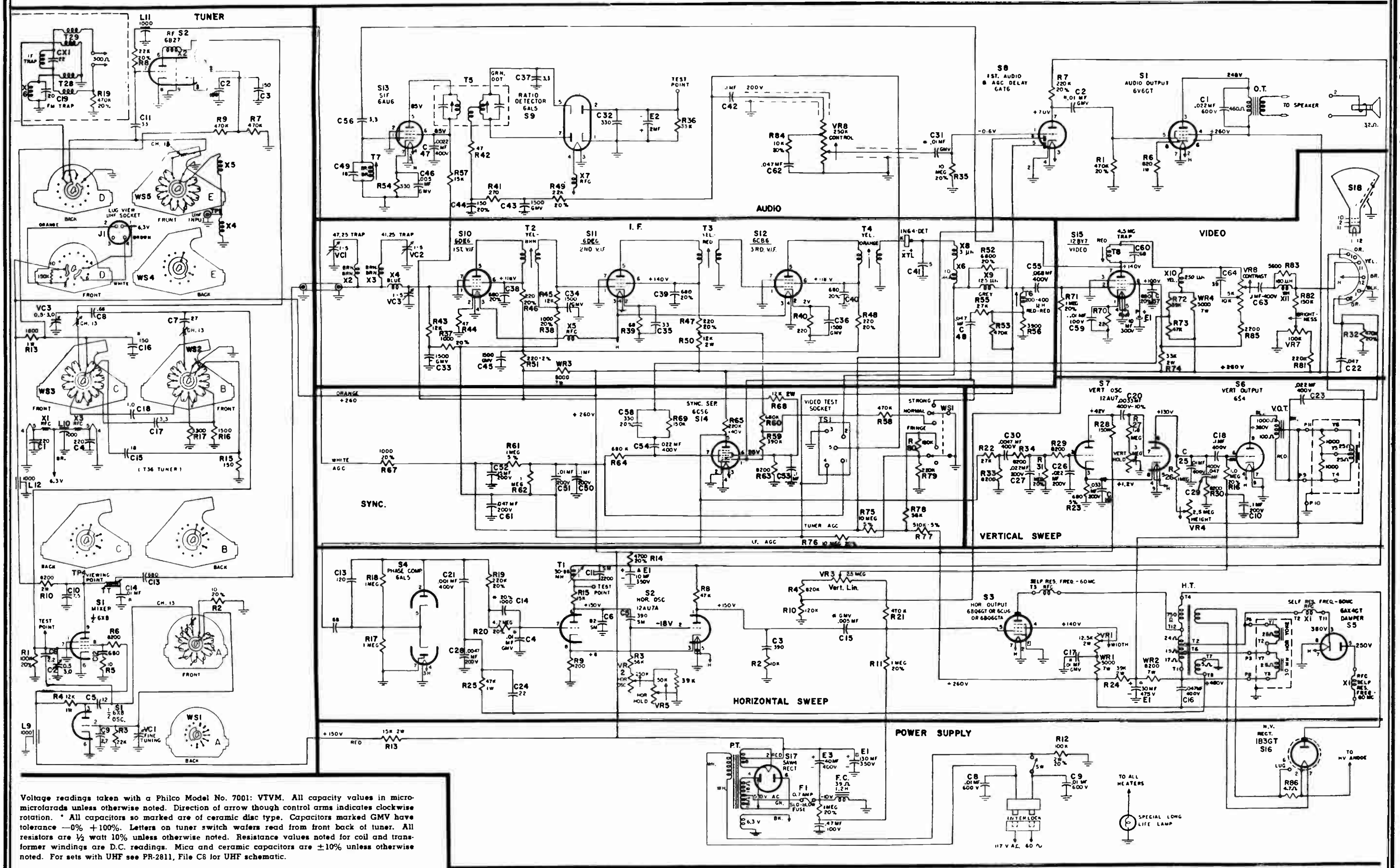


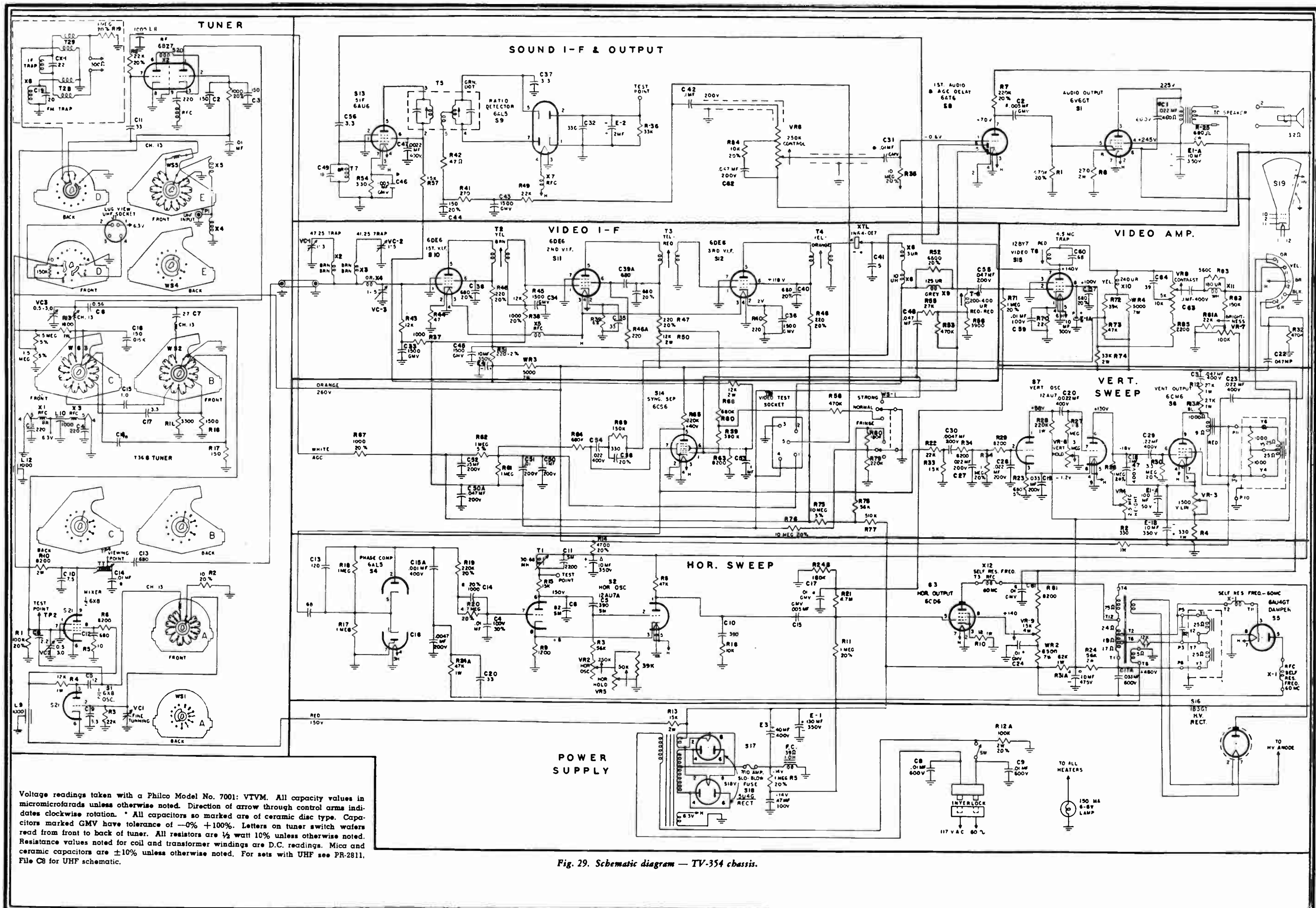
Fig. 24. Dial cord stringing arrangement (TV-350 & TV-354).

Fig. 28. Wiring Diagram, bottom view — TV-354 chassis.



Voltage readings taken with a Philco Model No. 7001: VTVM. All capacity values in micro-microfarads unless otherwise noted. Direction of arrow though control arms indicates clockwise rotation. * All capacitors so marked are of ceramic disc type. Capacitors marked GMV have tolerance —0% +100%. Letters on tuner switch wafers read from front back of tuner. All resistors are ½ watt 10% unless otherwise noted. Resistance values noted for coil and transformer windings are D.C. readings. Mica and ceramic capacitors are ±10% unless otherwise noted. For sets with UHF see PR-2811, File C8 for UHF schematic.

Fig. 25. Schematic Diagram — TV-350 Chassis.



Voltage readings taken with a Philco Model No. 7001: VTVM. All capacity values in micromicrofarads unless otherwise noted. Direction of arrow through control arms indicates clockwise rotation. * All capacitors so marked are of ceramic disc type. Capacitors marked GMV have tolerance of −0% +100%. Letters on tuner switch wafers read from front to back of tuner. All resistors are ½ watt 10% unless otherwise noted. Resistance values noted for coil and transformer windings are D.C. readings. Mica and ceramic capacitors are ±10% unless otherwise noted. For sets with UHF see PR-2811, File C8 for UHF schematic.

Fig. 29. Schematic diagram — TV-354 chassis.

REPLACEMENT PARTS LIST

TV-350

Reference Symbol	Description	Service Part No.
R1	100K mixer grid	66-4108340
R2	10 oscillator disabling	66-0108340
R3	22K oscillator grid leak	66-3228340
R4	12K oscillator plate feed	66-3124340
R5	10 parasitic suppression	66-0108340
R6	8200 mixer screen	66-2828340
R7	470K RF grid section II	66-4478240
R8	22K AGC decoupling	66-3228340
R9	470K RF grid section II	66-4478240
R10	8200 mixer decoupling	66-2825340
R19	470K discharge resistor	66-4478340
C1	220 mmf. osc. heater by-pass	62-122001001
C2	150 mmf. RF grid by-pass	62-115001011
C3	150 mmf. RF grid by-pass	62-115001011
C4	220 mmf. RF heater by-pass	62-122001001
C5	2.7 mmf. oscillator grid tank	30-1224-125
C6	2.2 mmf. injection coupling	30-1221-6
C8	.68 mmf. mixer grid coupling	30-1224-126
C9	2.7 mmf. oscillator grid blocking	30-1224-102
C10	7.5 mmf. I-F primary	30-1224-37
C11	33 mmf. RF grid coupling	62-033009001
C12	680 mmf. mixer screen	62-168001011
C13	680 mmf. interstage coupling	62-168001011
C14	.01 mf. I-F by-pass	30-1238-2
C19	20 mmf. FM trap	62-020309011
VC2	0.5 to 3.0 mmf. mixer grid	31-6520-3
VC3	0.5 to 3.0 mmf. RF plate	31-6520-3
X1	Choke, RF heater	32-4550-1
X2	Plate-cathode coil, tuner 6BZ7	312-5124-7
X3	Choke, oscillator heater	32-4550-11
T-T	Coil, IF primary	32-4359-16
L11	Capacitor, feed thru, AGC decoupling	30-1245-6
OT	Transformer, audio output	32-8656
VOT	Transformer, vertical output	32-8658
FC	Filter choke	32-8655
PT	Transformer, power	32-8657
X1 X1	Coil damper circuit	32-4112-50
X2	Coil 47.25 mc	32-4597-11
X3	Coil 39.75 mc	32-4597-11
X4	Coil 1st VIF grid	32-4597-3
X5	Coil, heater	32-4112-49
X6	Choke, detector	32-4422-27
X8	Coil, detector	32-4112-52
X9	Coil, 2nd detector peak	32-4467-22
X10	Coil, video shunt peak	32-4480-4
X11	Coil, CRT grid	32-4480-9
T-1	Coil, horizontal ringing	32-4557-3
T-2	Coil, 1st VIF plate	32-4486-41
T-3	Coil, 2nd VIF plate	32-4486-42
T-4	Coil, 3rd VIF plate	32-4486-43
T-6	Coil, detector peak	32-4480-8
T-7	Coil, 1st sound I-F grid	32-4463-10
T-8	Coil, 4.5 mc trap	32-4463-2
T-9	Transformer, discriminator	32-4450-6A
	Cable, CRT socket	41-4147-1
	Cable, pilot light	27-6233-4
VR-1	Width control	33-5574
VR-2	Horizontal hold aux. control	33-5565-17
VR-3	Vertical linearity control	33-5572-1
VR-4	Height linearity control	33-5572-1
VR-5	Horizontal hold control	33-5572-8
VR-6	Vertical hold control	33-5572-14
VR-7	Brightness control	33-5572-9
VR-8	Off-on, volume	33-5573
WS-1	Switch, fringe	42-2035
WR-1		
WR-3	Horizontal out. screen; IF b+ vid. plate load (3 used)	33-1335-95
WR-4	Boost	33-1335-119
R1	Audio output grid resistor (470K)	66-4478340
R2	Horizontal oscillator plate (10K)	66-3108340
R3	Horizontal oscillator grid (39K)	66-3395340
R4	Vertical output grid divider (820K)	66-4828340
R5	C— filter resistor (1 meg.)	66-5108340
R6	Audio output cathode (820 ohms)	66-1824340
R7	1st audio plate (220K)	66-4228340
R8	Horizontal oscillator plate (47K)	66-3478340
R9	Horizontal oscillator cathode (1200K)	66-2128340
R10	Vertical output grid divider (120K)	66-4128340
R11	Horizontal output grid (1 meg.)	66-4108340
R12	Line to chassis (100K)	66-4105340
R13	Tuner B+	66-3158340
R14	Horizontal oscillator decoupling (4700 ohms)	66-2478340
R15	Horizontal oscillator plate	66-3158340
R16	Vertical oscillator plate (1 meg.)	66-5108340
R17	Phase comp. (1 meg.)	66-5108340
R18	Phase comp. (1 meg.)	66-5108340
R19	Phase comp. out. (220K)	66-4228340
R20	Phase comp. filter (4.7 meg.)	66-5478340
R22	Vertical sync divider (27K)	66-3278340
R23	Vertical oscillator cathode (680 ohms)	66-1688240
R24	Boost (39K)	66-3395340
R26	Vertical output grid (1 meg.)	66-5108340
R27	Vertical oscillator grid (1.8 meg.)	66-5188340
R28	Vertical oscillator plate (150K)	66-4156340
R29	Vertical Int. (8200 ohms)	66-2828340
R30	Vertical peak (8200 ohms)	66-2828340
R31	Vertical oscillator grid (1 meg.)	66-5108340
R32	CRT grid (470K)	66-4478340
R33	SS plate divider (8200 ohms)	66-2828340
R34	Vertical Int. (8200 ohms)	66-2828340
R35	1st audio grid (10 meg.)	66-6108240
R36	Disc. output (33K)	66-3338340
R37	AGC (1000 ohms)	66-2108340
R38	2nd video IF AGC (1000 ohms)	66-2108340
R39	2nd video IF cathode (68 ohms)	66-0688340
R40	3rd video IF cathode (220 ohms)	66-1228340
R41	Discriminator (270K)	66-1278340
R42	Discriminator (47 ohms)	66-0478340
R43	1st video IF grid (12K)	66-3128340
R44	1st video IF cathode	66-0478340
R45	2nd video IF grid (12K)	66-3128340
R46	1st video IF plate (220 ohms)	66-1228340
R47	2nd video IF plate (220 ohms)	66-1228340
R48	3rd video IF plate (220 ohms)	66-1228340
R49	Discriminator Filter (22K)	66-3228340
R50	2nd IF plate (12K)	66-3125340
R51	B+ decoup. (220 ohms)	66-1228340
R52	Detector damper (6800 ohms)	66-2688340
R53	Fringe switch (470K)	66-4478340
R54	Sound IF cathode (330K)	66-1338340
R55	SS grid (27K)	66-3278340
R56	Detector load (3900 ohms)	66-2398340
R57	Sound IF drop (8200 ohms)	66-2828340
R58	SS grid (150K)	66-4158340
R59	SS grid (390K)	66-4398340
R60	SS grid (680K)	66-4688340
R61	AGC (1 meg.)	66-5108340
R62	AGC (1 meg.)	66-5108340
R63	SS screen (8200 ohms)	66-2828340
R64	SS grid (680K)	66-4688340
R65	SS plate (220K)	66-4228340
R67	Tuner AGC (1000 ohms)	66-2108340
R68	SS screen (12K)	66-3125340
R70	Video cathode (22 ohms)	66-0228340
R71	Video grid (1 meg.)	66-5108340
R72	Video plate divider (39K)	66-3398340
R73	Video plate divider (47K)	66-3478340
R74	Video screen 2W (33K)	66-3335340
R75	AGC tuner delay (10 meg.)	66-6108240
R76	Fringe switch (10 meg.)	66-6108340
R77	Fringe switch (510K)	66-4518240
R79	Fringe switch (220K)	66-4228340
R81	CRT cathode (220K)	66-4228340
R82	CRT cathode (150K)	66-4158340
R83	CRT grid (5600)	66-2568340
R84	Bass compression (10K)	66-3108340
R85	Cont. divider (2200 ohms)	66-2228340
R86	1B3 heater (4.7 ohms)	66-9478340
	Horizontal feed (47K)	66-3474340
C1	Audio plate (.022)	30-4650-60
C2	Audio grid (.01)	30-1238-2
C3	Horizontal charge (390 mmf.)	60-10395437
C5	Horizontal charge (390 mmf.)	60-10395437
C6	Horizontal mv. (82 mmf.)	60-00825437
C7	C— filter (.47)	30-4671-68
C8	Line by-pass (.01)	30-4650-58
C9	Line by-pass (.01)	30-4650-58
C10	Output grid (.1 mf.)	30-4650-47
C11	Horizontal ringing (2200 mmf.)	60-20225434
C12	Sync coupling (68 mmf.)	62-068409011
C13	Phase compensation (120 mmf.)	60-10125237
C14	Horizontal feed (1000 mmf.)	62-02209001
C15	Horizontal output grid (.005)	30-1238-1
C16	Horizontal boost (.047)	30-4650-45
C17	Horizontal screen (.01)	30-1238-2
C18	Vertical output grid (.1 mf.)	30-4650-47
C19	Vertical oscillator cathode (.033)	30-4650-44
C20	Vertical oscillator grid (.0033)	30-4650-55
C21	AFC filter (.001 mmf.)	62-210001011
C22	Retrace suppression (.047)	30-4650-45
C23	Retrace suppression (.022)	30-4650-43
C25	Vertical charge (.01)	30-4650-41
C26	Vertical integrator (.022)	30-4650-43
C27	Vertical integrator (.022)	30-4650-43
C28	Horizontal feed (.0047)	30-4650-56
C29	Vertical output grid (.047)	30-4650-45
C30	Vertical integrator (.0047)	30-4650-56
C31	1st audio grid (.01)	30-1238-2
C32	Discriminator (330 mmf.)	62-133001001
C33	1st video grid (1500 mmf.)	30-1238-15
C34	2nd video grid (1500 mmf.)	30-1238-15
C35	2nd video IF cathode (33 mmf.)	62-033009001
C36	3rd video IF cathode (1500 mmf.)	30-1238-15
C37	Discriminator (2 used) (3.3 mmf.)	31-1221-9
C38	1st video IF screen (680 mmf.)	30-1238-7
C39	2nd video IF screen (680 mmf.)	30-1238-7
C40	3rd video IF screen (680 mmf.)	30-1238-7
C41	Detector by-pass (5.0 mmf.)	30-1224-28
C42	Audio coupling (.1 mf.)	30-4650-47
C43	Discriminator filter (1500 mmf.)	30-1224-28
C44	Discriminator (150 mmf.)	62-115001001
C45	B+ decoupling (1500 mmf.)	30-1238-15
C46	Sound IF cathode (.005)	30-1238-1
C47	Sound IF screen (.0022)	30-4650-54
C48	SS grid (.047)	30-4650-45
C49	Sound takeoff (18 mmf.)	62-018300001
C50	AGC (.1 mf.)	30-4650-47
C51	AGC (.01)	30-4650-41
C52	AFC output (.001)	30-4650-53
C53	SS screen (.1 mf.)	30-4650-47
C54	SS grid (.022)	30-4650-43
C55	Video grid (.047)	30-4650-45
C56	Sound IF grid (3.3 mmf.)	31-1221-9
C57	Video screen (680 mmf.)	30-1238-7
C58	SS grid (330 mmf.)	62-133001001
C59	Video cathode (.01)	30-4650-41
C60	4.5 trap (68 mmf.)	62-068409011
C61	AGC (.047)	30-4650-45
C62	Bass comp. (.047)	30-4650-45
C64	Contrast control (39 mmf.)	62-039409011
	SS plate (39 mmf.)	62-039409011
VC1	Video IF	31-6520-9
VC2	Video IF	31-6520-9
VC3	Video IF	31-6520-9
E2	Electrolytic capacitor (sound discriminator)	45-3035-4
E3	Electrolytic capacitor (input)	30-2568-62
E1	Electrolytic capacitor (4 section)	30-2584-1
XTL	Crystal (1N64) (detector)	34-8022
PL	Pilot lamp	3463-4
F1	Fuse (.7 amp.)	AD-2246-15
H.T.	Transformer, horizontal output	32-8653

TV-354

Reference Symbol	Description	Service Part No.
R	100K mixer grid	66-4108540
R2	10 oscillator disabling	66-0108340
R3	22K oscillator grid leak	66-3228340
R4	12K oscillator plate feed	66-3124340
R5	10 parasitic suppression	66-0108340
R6	8200 mixer screen	66-2828340
R7	470K RF grid section 11	66-4478240
R8	22K AGC decoup.	66-3228340
R9	470K RF grid section 11	66-4478240
R10	8200 mixer decoupling	66-2825340
R19	470K discharge	66-4478540
C1	220 R.F. capacitor	62-122001001
C2	150 R.F. grid bypass capacitor	62-115001001
C3	150 R.F. grid bypass capacitor	62-115001001
C4	220 oscillator heater capacitor	62-122001001
C5	2.7 oscillator grid tank	30-1224-125
C6	2.2 injection coupling	30-1221-6
C8	0.56 interstage coupling	30-1221-11
C9	12 oscillator grid block capacitor	30-1224-102
C10	7.5 IF primary	30-1224-37
C11	33 mmf. R.F. grid coupling	62-033409011
C12	680 mixer screen	62-168001011
C19	22 FM trap	62-020309011
	27 mixer grid coupling	30-1224-126
	.01 IF bypass capacitor	30-1238-2
VC2	.05 to 3.0 mixer-grid	31-6520-3
VC3	.05 to 3.0 RF plate	31-6520-3
X1	RF heater	32-4550-1
X2	plate-cathode (6BZ7)	312-5124-7
X3	oscillator heater	32-4550-11
X4	UHF channel, gnd. side	32-4550-11
X5	UHF channel	312-5133-3
X6	FM trap	32-4550-3
L11	AGC decoupling	30-1245-6
	shield, tube tuner (2 used)	56-5629-5
	stud, trimount, tuner (5 used)	W2235-7FA9
	connector, tuner	27-6273-11
TT	IF primary	32-4359-16
T28	antenna coils	32-4432-3
T29	antenna coils	32-4432-3
CX1	IF trap	32-4552-1
	antenna coil assy.	76-8957
TS-1	test connector	27-6273-8
LC	interlock connector	27-6240-3
OT	audio output transformer	32-8684
V	vertical output transformer	32-8667
F.C.	choke, filter	32-8654
B1	fuse holder	76-4519-2
CL-11	clip, pilot lamp	56-3545-5
	fuse	AD2246-15
	transformer, horizontal output	32-8666
R1	audio output grid (470K)	66-4478340
R3	horizontal oscillator grid (56K)	66-3568340
R4	resistor, vertical output cathode (330)	66-1334340
R5	C filter (1 meg.)	66-5108340
R6	audio output cathode (270 ohms)	66-1274340
R7	1st audio plate (220K)	66-4228340
R8	horizontal oscillator plate (47K)	66-3478340
R9	horizontal oscillator cathode (1200)	66-2128340
R11	horizontal output grid (1 meg.)	66-5108340
R12	vertical damp.	66-3274340
R12A	line to chassis (100K)	66-4105340
R13	resistor, tuner B plus (15K)	66-3155340
R14	horizontal oscillator decoupling (4700)	66-2478340
R15	horizontal oscillator plate (15K)	66-3158340
R17	phase comparer (1 meg.)	66-5108340
R18	phase comparer (1 meg.)	66-5108340
R19	phase comparer output (220K)	66-4228340
R20	phase comparer filter (4.7 meg.)	66-5478340
R21	bias divider (4.7 meg.)	66-5478340
R23	vertical oscillator cathode (680)	66-1688240
R24	boost divider (47K)	66-3475340
R24A	horizontal feed (47K)	66-3474340
R24B	bias divider (180K)	66-4188340
R26	vertical oscillator plate (1 meg.)	66-5108340
R27	vertical oscillator grid (1.8 meg.)	66-5188340
R28	vertical oscillator plate (180K)	66-4184340
R29	vertical integrator (8200)	66-2828340
R30	vertical output grid (3.3 meg.)	66-5338340
R31	vertical oscillator grid (1 meg.)	66-5108340
R31A	boost divider (100K)	66-4104340
R32	CRT grid (470K)	66-4478340
R34	vertical integrator (8200)	66-2828340
R35	1st audio grid (10 meg.)	66-6108340
R36	discriminator output (33K)	66-3338340
R37	AGC (1000)	66-2108340
R38	2nd VIF AGC (1000)	66-2108340
R39	2nd VIF cathode (68)	66-0688340
R40	3rd VIF cathode (220)	66-1228340
R41	discriminator (270)	66-1278340
R42	discriminator (47)	66-0478340
R43	1st VIF grid (12K)	66-3128340
R44	1st VIF cathode (47)	66-0478340
R45	2nd VIF grid (12K)	66-3128340
R46	1st VIF plate (220)	66-1228340
R47	2nd VIF plate (220)	66-1228340
R47A	2nd video IF screen (220)	66-1228340
R48	3rd VIF plate (220)	66-1228340
R49	discriminator filter (22K)	66-3228340
R50	2nd IF plate (12K)	66-3125340
R51	B plus decoupling (220)	66-1228340
R52	detector damping (6800)	66-2688340
R54	SIF cathode (330)	66-1338340
R55	SS grid (27K)	66-3278340
R56	detector load (3900 ohms)	66-2398340
R57	SIF drop (15K)	66-3158340
R58	fringe switch (470K)	66-4478340
R59	SS grid	66-4398340
R60	SS grid (680K)	66-4688340
R61	AGC tuner delay (1 meg.)	66-5108240
R62	AGC (1 meg.)	66-5108340
R63	SS screen (8200)	66-2828340
R64	SS grid (680K)	66-4688340
R65	SS plate (220K)	66-4228340
R67	tuner AGC (1000)	66-2108340
R68	SS screen (12K)	66-3125340
R69	SS grid (150K)	66-4158340
R70	video cathode (22)	66-0228340
R71	video grid (1 meg.)	66-5108340
R72	video plate divider (39K)	66-3398340
R73	video plate divider (47K)	66-3478340
R74	video screen (33K)	66-3335340
R75	AGC tuner delay (10 meg.)	66-6108240
R76	fringe switch (10 meg.)	66-6108340
R77	fringe switch (510K)	66-4518240
R78	fringe switch (56K)	66-3568340
R79	fringe switch (220K)	66-4228340
R80	fringe switch (180K)	66-4188340
R81	brightness comp. (8200)	66-2828340
R81A	brightness comp. (22K)	66-3228340
R82	CRT cathode (150K)	66-4158340
R83	CRT cathode (5600)	66-2568340
R84	bass comp. (10K)	66-3108340
R85	cont. div. (2200)	66-2228340
	1B3 heater (1.0 ohms)	66-9108340
C1	audio plate (.022)	30-4650-60
C2	audio coupling (.005)	30-1238-1
C3	vertical damp. (.047)	30-4650-45
C4	AFC filter (.01)	30-1238-2
C5	horizontal m.v (390)	60-10395437
C6	horizontal m.v.	60-00825437
C7	C filter (.47)	30-4671-68
C8	line bypass (.01)	30-4650-58
C9	line bypass (.01)	30-4650-58
C10	horizontal charge (390)	60-10395417
C11	horizontal ringing (2200)	60-20225434
C12	sync coupling (68)	62-068409011
C13	phase comp. (120 mmf.)	60-01025237
C14	horizontal feed (1000 mf.)	62-022009001
C15	horizontal output grid (.005)	30-1236-1
C15A	AFC output (.001)	30-4650-52
C16	horizontal feed (.0047)	30-4650-56
C17	video bias filter (.01)	30-1238-2
C17A	horizontal boost (.033)	30-4650-61
C18	vertical charge (.1)	30-4650-47
C20	vertical oscillator grid (.0022)	30-4650-54
C22	retrace suppression (.047)	30-4650-45
C23	retrace suppression (.022)	30-4650-43
C26	vertical integrator (.022)	30-4650-43
C27	vertical integrator (.022)	30-4650-43
C29	vertical output grid (.22)	30-4650-49
C30	vertical integrator (.0047)	30-4650-56
C31	1st audio grid (.01)	30-1236-2
C32	discriminator	62-133001001
C33	1st VIF grid (1500 mmf.)	30-1238-15
C34	2nd VIF grid (1500 mmf.)	30-1238-15
C35	2nd VIF cathode (33)	62-033009001
C36	3rd VIF cathode (1500 mmf.)	30-1239-15
C37	discriminator (3.3)	30-1221-9
C38	1st VIF screen (680 mmf.)	62-168001011
C39	2nd VIF screen (680 mmf.)	62-168001011
C39A	2nd VIF screen (680 mmf.)	62-168001011
C40	3rd VIF screen (680 mmf.)	62-168001011
C41	detector bypass (5.0 mmf.)	30-1224-28
C43	discriminator filter (1500 mmf.)	30-1238-15
C44	discriminator (150)	62-115001001
C45	B plus decoupling (1500 mmf.)	30-1236-15
C46	SIF cathode (.005)	30-1238-1
C47	SIF screen (.0022)	30-4650-54
C48	SS grid (.047)	30-4650-45
C49	sound takeoff (18 mmf.)	62-018300001
C50	AGC (.1)	30-4750-47
C50A	AGC (.15)	30-4650-48
C52	AGC (.047)	30-4650-45
C53	SS screen (.1)	30-4650-47
C54	SS grid (.022)	30-4650-43
C55	video grid (.047)	30-4650-45
C56	sound IF grid (3.3)	30-1221-9
C57	video screen (680 mmf.)	62-168001011
C58	SS grid	62-133001001
C59	video cathode (.01)	30-4650-41
C60	4.5 trap (68)	62-068409011
C61	brightness compensator (.01)	30-1236-2
C62	bass comp. (.033)	30-4650-44
C63	CRT cathode (.1)	30-4650-47
C64	contrast cont. (390)	62-039409011
VR-2	control, horizontal hold aux.	33-5565-17
VR-3	control, vertical lin.	33-5572-13
VR-4	control, height	33-5572-1
VR-5	control, horizontal hold	33-5572-8
VR-6	control, vertical hold	33-5572-14
VR-7	control, brightness	33-5572-9
VR-8	control, off-on volume	33-5573
VR-9	control, width	33-5546-56
WS-1	switch, fringe	42-2035
T1	coil, horizontal ringing	32-4557-3
T2	coil, 1st VIF plate	32-4486-41
T3	coil, 2nd VIF plate	32-4486-42
T4	coil, 3rd VIF plate	32-4486-43
T5	transformer, discriminator	32-4450-6A
T7	coil, 1st SIF grid	32-4463-10
T8	coil, 4.5 trap	32-4463-2
X1	coil, damper	32-4112-50
X2	47.25 trap	32-4597-11
X3	41.25 trap	32-4597-11
X4	coil, 1st VIF grid	32-4597-3
X5	1st video I.F.	32-4112-49
X6	choke, detector	32-4422-27
X7	discriminator	32-4112-49
X8	coil, detector	32-4112-52
X9	coil, 2nd detector peak	32-4467-22
X10	coil, Video shunt peak	32-4480-4
X11	coil, CRT cathode	32-4480-9
WR-2	res., horizontal output screen	33-1335-125
WR-3	IF B plus	33-1335-95
WR-4	video plate load	33-1335-95
VC1	VIF (0.5 to 5.0)	31-6520-9
VC2	VIF (0.5 to 5.0)	31-6520-9
VC3	VIF (0.5 to 5.0)	31-6520-9
E-1	capacitor, 1⅜" cam	30-2584-42
E-1A	capacitor, 1" cam	30-2584-43
E-2	sound discriminator (2 mf.)	45-3035-4
E-3	input	30-2568-62
xtal	crystal 1N64	34-8022
	transformer, power	32-8661
	cable, CRT socket	41-4147-1
	cable, pilot lamp	27-6233-4
	pilot lamp	3463-4

TUBE COMPLEMENT — TV-400 CHASSIS

Reference Symbol	Tube Type	Function
S1	6AT6	first audio and tuner a-g-c delay
S2	6AL5	ratio detector
S3	6AU6	2nd sound i-f amplifier
S4	6BA6	1st sound i-f amplifier
S5	6CU6	horizontal output
S6	6V6GT	audio output
S7	6AX8	video amplifier, sync separator
S8	6AX4GT	damper
S9	6CB6	video, i-f amplifier
S10	6CB6	video, i-f amplifier
S11	12AU7	cathode follower & noise inverter
S12	6AU6	AGC gate
S13	6CB6	video i-f amplifier
S14	6AQ5	video output
S15	12AU7	vertical oscillator
S16	12B4	vertical output
S17	6BC6	video i-f amplifier
S18	6AL5	phase comparer
S19	12AU7A	horizontal oscillator
S20	1B3GT	high voltage rectifier
S21	5U4G	low voltage rectifier
S22	5U4G	low voltage rectifier
S23	6BZ7	RF amplifier
S24	6X8	oscillator-mixer
	21ZP4B	picture tube

SPECIFICATIONS — TV-400 CHASSIS

VHF TUNING .... Twelve channel, 13 position incremental tuner, covering VHF television channels 2 through 13; plus UHF position, and fine tuning of local oscillator.

UHF TUNING (if provided) Continuous tuning, covering UHF television channels 14 through 83.

INTERMEDIATE FREQUENCIES ....
- Video Carrier .... 45.75 mc.
- Sound (intercarrier) .... 4.5 mc.

OPERATING VOLTAGE .... 100 to 120 volts, 60 cycle, A.C.

POWER CONSUMPTION .... Without UHF, 240 w. With UHF, 245 w.

TRANSMISSION LINE .... 300-ohm, twin-wire lead.

CIRCUIT DESCRIPTION

The TV-400 is the deluxe receiver of the new line employing a single chassis. The VHF tuner used is a 12 channel, 13 position tuner mounted on a separate sub-chassis. The thirteenth position is used for the reception of UHF signals in conjunction with a UT-26 UHF tuner. The R.F. amplifier is a 6BZ7 tube, while the local oscillator and mixer stages use a type 6X8 tube. The pentode section of the 6X8 is used for mixing, while the triode is used as a local oscillator.

The output of the mixer, a 40-MC signal, is link coupled to four stagger tuned video I-F stages employing four 6CB6 tubes. This I-F system is an improved I-F, in that it contains additional trapping to improve the adjacent channel interference. In the grid circuit of the first I-F, we have the 47.25-MC adjacent channel sound trap and the 41.25-MC accompanying sound trap. In the grid circuit of the third Video I-F, we have an additional 47.25-MC adjacent sound trap along with a 39.75-MC adjacent channel picture trap. This 39.75-MC adjacent channel picture trap is something we have not used in quite a long period of time, and the adjustment of this trap along with the other traps is of primary importance in achieving the top performance built into our TV-400 chassis.

A 1N64 crystal diode is used as a video detector. Following the video detector is a video amplifier consisting of two stages. The first stage uses the pentode section of the 6AX8 and the output stage uses a 6AQ5 which drives the grid of the picture tube.

Sound I-F (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75-MC video carrier and the 41.25-MC sound carrier are mixed in the video detector. The beat frequency 4.5-MC is the difference between 45.75-MC and 41.25-MC and contains the FM sound signal. This 4.5-MC signal contains only a negligible amount of the video AM amplitude modulation, provided that the amplitude of the 41.25-MC signal is considerably lower than that of the 45.75-MC signal. The proper relative amplitude of the two carriers is established in the alignment of the receivers. There is sound output only when both the video and sound carriers are present.

A-G-C voltage for the video I-F system and the R-F amplifier is obtained from a keyed a-g-c system which uses a 6AU6 tube, as the a-g-c gate. Composite video from the video-amplifier plate circuit through a cathode follower, is fed to the grid of the a-g-c gate tube, while a gating or keying pulse, obtained from a winding on the horizontal-output transformer, is applied to the plate. The sync-pulse polarity applied to the grid of S12 is positive; therefore, the a-g-c gate can conduct in proportion to the amplitude of the sync-pulse tips if the gating or keying pulse occurs at the same time as the sync. Because the keying or gate pulse is a constant amplitude, approximately 500 volts peak, the amplitude of the sync pulse will determine the amount of conduction in the gate tube. The plate current of the keyed a-g-c gate tube flows through a resistor network, developing a voltage which is negative with respect to the chassis and whose amplitude is proportional to the plate current. This negative voltage is used to control the gain of the receiver. Since conduction cannot occur in the a-g-c gate tube unless the sync pulse and gating pulse occur at the same time, noise disturbances that occur between sync-pulse intervals cannot affect the a-g-c voltage.

Composite video for the sync circuits is taken from the plate of the first video amplifier. The output is fed to a cathode follower which delivers the information into the noise inverter circuit. The noise inverter is operated with a low value of plate voltage and high bias which keeps the tube beyond cut-off. When the composite video signal is applied to the grid of the noise inverter the sync appears as positive pulses: noise which could affect the sweep circuits also appears as positive pulses. Harmful noise pulses usually have amplitudes far greater than the sync pulses, and therefore, drive the grid of the noise inverter positive sufficiently to allow conduction in the noise-inverter plate circuit.

The output of the noise inverter consists of negative-going noise pulses. It should be noted that the noise pulses which exceed the sync level have been passed and their polarity reversed by the noise inverter. The output of the noise inverter is now mixed with the composite video and fed to the grid of the sync separator, the triode section of the 6AX8 tube. Since the composite video fed to the grid of the sync separator has positive sync polarity, the positive noise pulses carried with the composite video would be passed by the sync separator; however, the output of the noise inverter consists of these same noise pulses, but they are of opposite polarity; thus, the noise pulses are cancelled. The output of the sync separator contains only the sync pulses which are fed to the vertical and horizontal circuits. The vertical pulses are fed from the plate of the sync separator to the vertical oscillator through an integrator circuit. The vertical oscillator employs a 12AU7 tube as a cathode coupled multivibrator. A variable resistor in the grid circuit of the second triode adjusts the oscillator frequency and serves as the hold control. A variable resistor in the plate circuit of the same tube provides vertical height adjustment. The vertical output stage employs a 12B4 tube. A variable resistor in the cathode circuit provides adjustment of the vertical linearity. A vertical retrace suppression circuit is connected from one side of the vertical output transformer to the picture tube cathode. The vertical sync is separated from the horizontal sync by the integrator circuit, and is fed to the grid of the vertical oscillator. The output of the vertical oscillator is amplified by the vertical-output amplifier, using a 12B4 tube, and the output of the amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

Horizontal sync information is fed into the phase comparer circuit which controls the frequency of the horizontal oscillator. A 6AL5 tube is employed as the phase comparer in the horizontal circuits. The plate of one diode is grounded, the cathodes of both diodes are tied together and, from a winding on the horizontal output transformer, a pulse is fed, through a shaping network to the plate to the other diode. The horizontal sync pulses from the sync separator are fed to the cathodes. If the incoming sync pulse is not in phase with the pulse from the horizontal output transformer, a difference voltage occurs in the output of the phase comparer which is fed to the horizontal oscillator and is used to control its frequency. A cathode coupled multivibrator using a 12AU7A tube provides the horizontal oscillator signal. Two variable resistors in series to the grid of the second triode section of the oscillator are employed as the horizontal hold control and horizontal hold centering control. With these controls, the horizontal oscillator frequency is adjusted within the range of the phase comparer control voltage.

When the voltage is delivered to the horizontal oscillator grid by the phase comparers circuit is positive, it increases the frequency of the oscillator; when the voltage is negative, it reduces the frequency of the oscillator. This control voltage holds the horizontal oscillator in phase with the sync signal. The HORIZ. HOLD control, adjusts the horizontal oscillator to the proper frequency, so that it may be controlled by the phase comparer. The output of the horizontal oscillator is fed to the horizontal-output amplifier, which uses a 6CU6 tube, V19.

The second anode voltage for the picture tube is furnished by a high-voltage winding of the horizontal-output transformer, and is rectified by a 1B3GT high-voltage rectifier tube.

VIDEO PEAKING-COIL ADJUSTMENT — TV-400

The peaking coil, T5, is adjusted at the factory for proper transient response of the video circuits. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of T5 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If T5 is replaced in servicing, adjustment will be required.

Before adjusting T5, check the tuner alignment and I-F alignment. (Never adjust T5 until the alignment of a receiver is correct.) Then tune in a station and adjust T5 until there are no trailing whites or smear in the picture. Turning T5 clockwise reduces trailing whites and overshoot; turning T5 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of T5 applies to a particular station exhibiting smear or overshoot. After T5 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

TELEVISION ALIGNMENT

General

The alignment procedure follows the general pattern of first checking the tuner response with an FM sweep generator and oscilloscope, comparing the response curve with that given in the manual, and aligning the tuner if necessary. After it is established that the tuner is in correct alignment, the video I-F channel is aligned by tuning each coil to its assigned pole frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and retouching the I-F adjustments to obtain the desired pass band. Finally, the sound channel is aligned, using an AM signal, by tuning the sound take-off coil and the I-F and ratio-detector transformers.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the I-F stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chassis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.
2. Do not disconnect the picture tube yoke while the receiver is turned on.
3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.
4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method for calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745 (J) entitled "Television Service in the Home."

HORIZONTAL-OSCILLATOR ADJUSTMENT — TV-400

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Decenter the picture until blanking can be observed at the right-hand side.
2. Increase the BRIGHTNESS control setting until the blanking becomes visible. This will appear as a dark vertical bar on each side of the picture.
3. Connect a .1 mf condenser from the test point, to ground. (The plate side of the horizontal ringing coil, T6, is connected to the test point.)
4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.
5. Adjust the HORIZONTAL HOLD CENTERING control until equal portions of the blanking bar appear on both si[redacted] of the picture.

6. Remove the .1 mf condenser from the test point.

7. Adjust the horizontal ringing coil until equal portions of the blanking bar again appear on both sides of the picture.

8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync on both sides, readjust the HORIZONTAL HOLD CENTERING control.

9. Rotate the HORIZONTAL HOLD control through its range, and observe the number of diagonal blanking bars that appear just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

JIGS AND ADAPTERS REQUIRED — TV-400

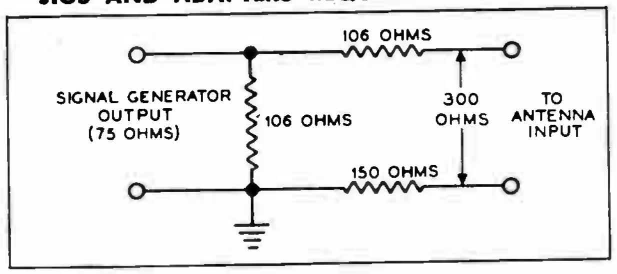


Fig. 1. Antenna-Input matching network.

Mixer Jig

Connections to the grid of the mixer tube may be made through the test point provided for this purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

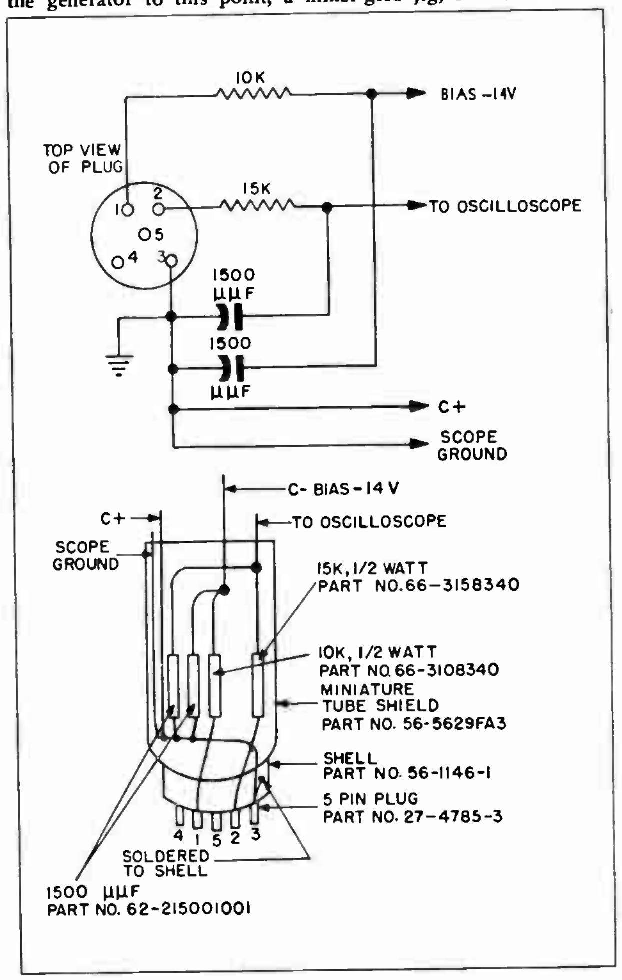


Fig. 2. Video I-F Alignment Jig (Video Test Jack Adapter No. 1).

Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna input terminals of the receiver is shown in figure 1.* This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group, to obtain values within ten percent of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna-matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig

(Video Test Jack Adapter No. 1)

The alignment jig used at TS1 and shown in figure 2, should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This adapter consists of a five-pin plug, two 10,000 ohms resistors, and a 1500 mmf condenser for isolation of the bias supply. To isolate the oscilloscope from the receiver circuits, a 15,000-ohm resistor, by-passed by a 1500 mmf. condenser, is used. A suggested method of fabricating the jig is also shown in figure 2. This jig should not be used to observe the composite video from the video detector output.

Sound I-F Input Alignment Jig

(Video Test Jack Adapter No. 2)

To observe the composite video, at TS1, a jig may be made with a five-pin plug and a 2200 ohm resistor. (See figure 3.) The 2200 ohm resistor should be connected to pin 2 of the plug. A ground lead should be connected to pin 3. To observe the composite video, connect the oscilloscope to the 2200 ohm resistor and the ground lead. This jig is also used for injection of the 4.5 mc. signal during s-i-f alignment.

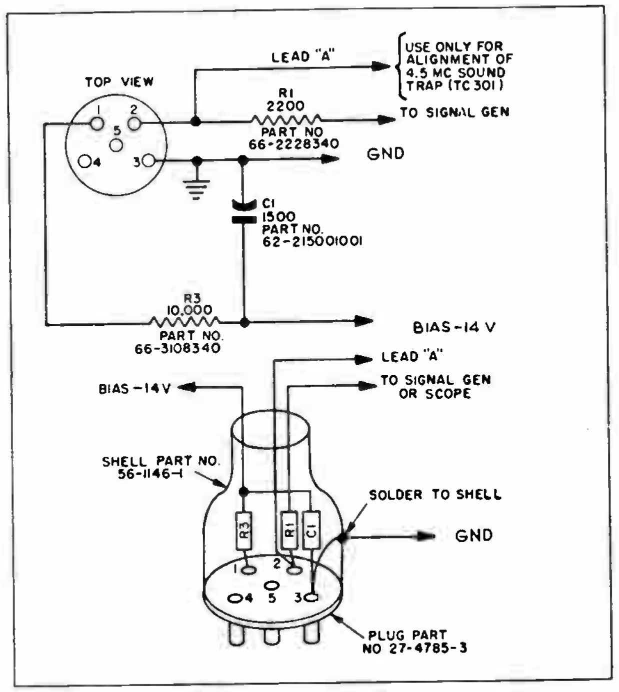


Fig. 3. Sound I-F Input Alignment Jig (Video Test Jack Adapter No. 2).

TUNER BAND PASS ALIGNMENT

(See Table No. 2

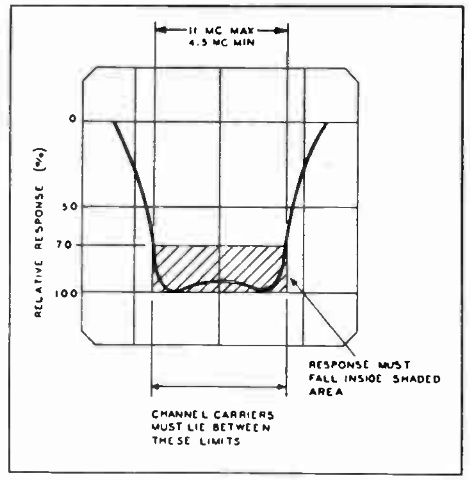


Fig. 4. Television tuner response curve, showing bandpass limits.

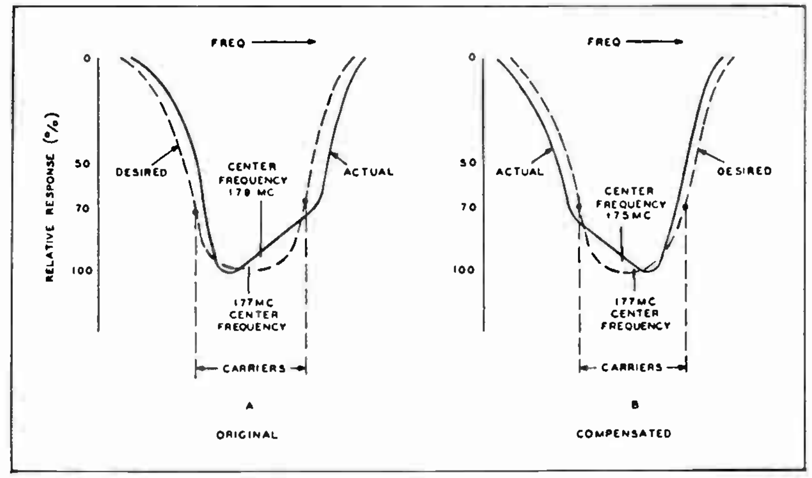


Fig. 5. Television tuner response curve, showing tracking compensation.

TUNER OSCILLATOR ALIGNMENT

TABLE NO. 1

AM GENERATOR: Connect to receiver antenna-input terminals. (No matching network is required.) Use unmodulated r-f output.

OSCILLOSCOPE: Connect the vertical-input lead, in series with a 1000-ohm resistor, to the mixer grid test point. Connect the scope ground lead to the chassis, near the test point.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (pink tracer) lead from main chassis, and connect a 1.5 volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis.

STEP	AM GENERATOR DIAL SETTING	RECEIVER TUNING	ADJUST	REMARKS
1	257 mc.	channel 13	T2 for zero beat on scope.	a. If regeneration occurs, inject bias; bias may be increased up to 3 volts, if necessary at pin 1 video test jack — TS1. b. Preset fine tuning adjustment so that it is in the middle of its range.
2	251 mc.	channel 12	VC8 for zero beat on scope.	
3	245 mc.	channel 11	VC7 for zero beat on scope.	
4	239 mc.	channel 10	VC6 for zero beat on scope.	
5	233 mc.	channel 9	VC5 for zero beat on scope.	
6	221 mc.	channel 7	VC4 for zero beat on scope.	
7	64.5 mc.	channel 6	T7 for zero beat on scope.	2nd harmonic gives 129 mc.
8	113 mc.	channel 4	T5 for zero beat on scope.	
9	101 mc.	channel 2	T3 for zero beat on scope.	

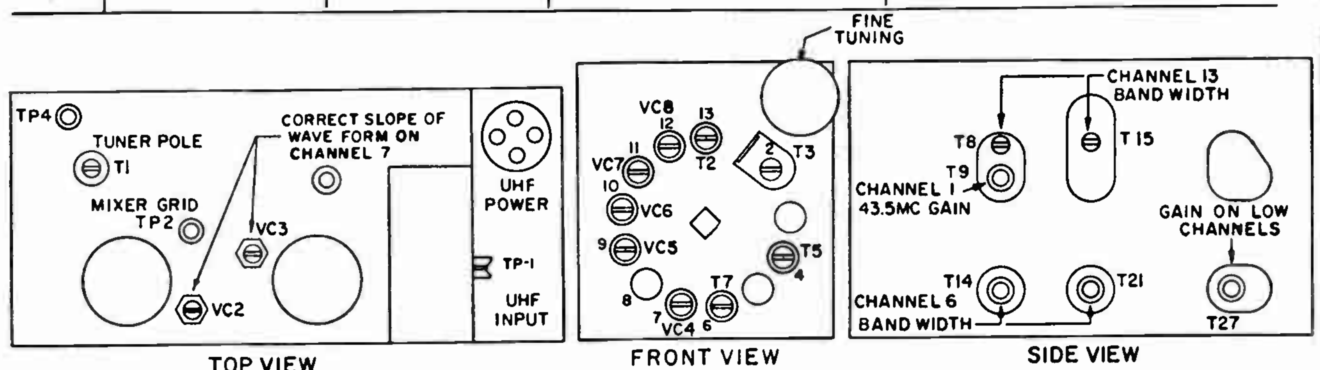


Fig. 6. Tuner Layout.

TUNER BANDPASS ALIGNMENT — TABLE 2

SWEEP (FM) GENERATOR: Connect to receiver antenna-input through Antenna-input Matching Network. (See figure 1.)
OSCILLOSCOPE: Connect the oscilloscope to the junction of R518(15K,1W) and the tuner red lead. Clip ground lead of scope to chassis.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (white) lead from main chassis and connect a 1.5-volt bias battery; negative terminal to white lead from tuner, and positive terminal to chassis. Disconnect tuner coupling link leads, and connect a 40- to 70-ohm carbon resistor across the open end of the lead, from the tuner.

STEP	SWEEP (FM) GENERATOR		RECEIVER TUNING	ADJUST	REMARKS
	Sweep Dial Setting	Marker Dial Setting			
1	Channel 13 (213 mc., with 10-mc. sweep width.)	Set first to 210 mc. and note position of marker on response curve. Set to 216 mc. and note position of marker on response curve.	Channel 13		Oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve. Response curve to be flat between limits (see figure 4). If not, proceed with step 2.
2	Channel 13	213 mc.	Channel 13	T8 counterclockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
3	Channel 13	213 mc.	Channel 13	T15 until peak falls on 213 mc. marker.	Sweep Generator output may have to be increased.
4	Channel 7 (177 mc., with 10-mc. sweep width.)	Set first to 174 mc. and note position of marker on response curve. Set to 180 mc. and note position of marker on response curve.	Channel 7		Note curve with respect to tilt and center frequency. Curve should be centered in pass-band and symmetrical. If not, proceed with step 5.
5	Channel 7	174 mc. and 180 mc.	Channel 7	VC3 and VC2 to get correct tilt on top of curve.	VC3 and VC2 compensate for the tuning effect of Channel 13 adjustment upon Channel 7. (See figure 5.)
6	Channel 13	213 mc.	Channel 13	Retouch T15 and T8 for symmetrical response centered about 213 mc. marker.	To retouch, only turn cores slightly.
7	Channel 7	117 mc.	Channel 7	Repeat step 5.	Check response curve for correct center frequency and symmetry.
8				Repeat steps 6 and 7.	Repeat Channel 13 and Channel 7 adjustments, alternately, until favorable curves are obtained on both.
9	Channel 6 (85 mc. with 10-mc. sweep width.)	Set first to 82 mc. and note position of marker on response curve. Set to 88 mc. and note position of marker on response curve.	Channel 6		Curve should be symmetrical and centered in pass-band. If not, proceed with step 10.
10	Channel 6	85 mc.	Channel 6	T14 counterclockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
11	Channel 6	85 mc.	Channel 6	T21 until peak falls on 85-mc. marker.	Sweep Generator output may have to be increased.
12	Channel 6	85 mc.	Channel 6	T27 for maximum curve height and symmetry of single peak.	After adjusting T27 recheck as in step 9. If necessary, reduce Sweep Generator output to avoid overloading.
13	Channel 6	85 mc.	Channel 6	Retouch T21 and T14 for symmetrical response centered about 85-mc. marker.	To retouch, only turn cores slightly.
14	43.5 mc. (with 10-mc. sweep width.)	Set first to 45.75 mc. and note position of marker on response curve. Set to 41.25 mc. and note position of marker on response curve.	UHF (Channel 1 position.)		Disconnect sweep (FM) generator from antenna-input terminals and connect to 40-mc. input jack TP1, using a matching network. Curve should be symmetrical and flat-topped. Markers should fall along flat-topped portion of curve. If not, proceed with step 15.
15	43.5 mc. (with 10-mc. sweep width.)	43.5 mc.	UHF (Channel 1 position.)	T9 for most symmetrical flat-topped response curve, centered about 43.5 mc. marker.	Recheck band-pass as in step 14, and repeat adjustment if necessary.

VIDEO I-F ALIGNMENT

AM GENERATOR: Connect to mixer test point, TP-2, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during alignment, to keep the output at the second detector below 4 volts peak to peak.

BIAS: Apply 10 volts of negative bias, through 10,000-ohm resistor, to pin 1 of video I-F alignment jig; ground positive side of bias supply to pin 3 of jig. (See figure 2).
NOTE: If the i-f shield has been removed fro repairs, it must be replaced before proceeding with the alignment.

PRESET: Contrast and Brightness controls fully counterclockwise, and channel selector to channel 4.
OSCILLOSCOPE: Connect the vertical-input lead to the 15,000-ohm resistor of the video i-f alignment jig. Connect scope ground lead to the ground lead of the jig. (See figure 2). Plug jig into TS-1.
SWEEP (FM) GENERATOR: After step 9, connect to antenna-input circuit through antenna-input matching network. (See figure 1).

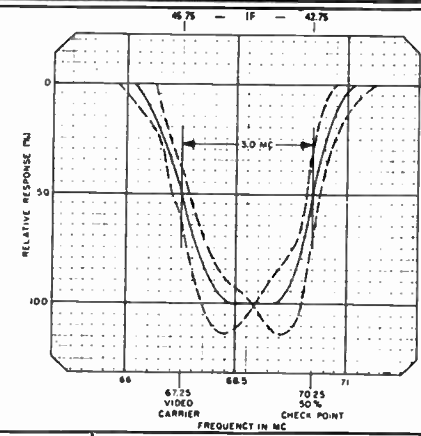


Fig. 7. Over-all R-F, I-F response curve, showing tolerance limits.

STEP	AM GENERATOR DIAL SETTING	SWEEP (FM) GENERATOR		ADJUST	REMARKS
		Sweep Dial Setting	Marker Dial Setting		
1	47.25 mc.	not used	not used	VC3 and VC8 for minimum indication on scope.	
2	41.25 mc.	not used	not used	VC9 for minimum indication on scope.	
3	39.75 mc.	not used	not used	VC4 for minimum indication on scope.	It is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.
4	42.7 mc.	not used	not used	T1 for maximum indication on scope.	T1 located on tuner. Adjust the output of the AM generator when necessary, to keep the output at the second detector below 4 volt, peak to peak. (For convenience, the oscilloscope may be calibrated for this purpose beforehand.)
5	43.1 mc.	not used	not used	VC1 for maximum indication on scope.	
6	44.4 mc.	not used	not used	VC2 for maximum indication on scope.	
7	42.0 mc.	not used	not used	VC6 for maximum indication on scope.	
8	45.0 mc.	not used	not used	VC5 for maximum indication on scope.	
9	45.7 mc.	not used	not used	VC7 for maximum indication on scope.	
10	not used	Channel 4 (69 mc., with 6 mc., width.)	Run marker along curve checking against the curve limits given in figure 8.	If necessary, retouch T1, VC6, VC7, VC5 and VC1 as directed in REMARKS column. CAUTION: Do not touch the setting 1, 2 and 3.	Set fine tuning cam to middle of range. If response curve does not fall within limits shown in figure 7, retouch VC5 and VC1 alternately. T1, VC5 and VC1 affect dip of curve and VC2 affects tilt of curve. Adjust VC6 for proper slope at 42.0 mc., side of curve, and VC7 for proper level of curve, at video carrier frequency. If curve still does not fall within the limits, a slight readjustment of VC1 is permissible. CAUTION: To retouch, only turn the adjustments slightly.

SOUND I-F ALIGNMENT
TABLE 4

AM GENERATOR: Connect "hot" lead through a 2200-ohm resistor to pin 2 of TS1, using the sound i-f alignment jig. (Figure 3.) Connect ground lead of generator to ground lead of jig.

VOLTMETER: Use v.t.v.m. or 20,000 ohms-per-volt voltmeter. Connect to sound test point and ground.
OSCILLOSCOPE: Connect through crystal probe to grid (pin 2) of picture tube.
BIAS: —15V into AGC system.

STEP	AM GENERATOR DIAL SETTING	ADJUST	REMARKS
1	4.5 mc.	T1 primary (bottom of T-1) for maximum indication on voltmeter.	Remove 1st video i-f tube, and adjust the Volume control for moderate speaker output.
2	4.5 mc.	T2 secondary (top of T2) for maximum indication on voltmeter.	
3	4.5 mc.	T2 primary (bottom) for minimum indication on voltmeter.	
4	4.5 mc.	T3 for maximum indication on voltmeter and minimum speaker output.	
5	4.5 mc.	T4 for minimum indication on oscilloscope.	If scope and crystal probe are not available, T4 may be adjusted for minimum beat pattern on picture tube, using station signal.
6	Use Station Signal	T1 top (secondary) for minimum AM (noise or buzz), using speaker output for indication.	Replace 1st video i-f tube, and tune in a station, setting fine tuning control to obtain a crisp picture, with a small amount of beat.

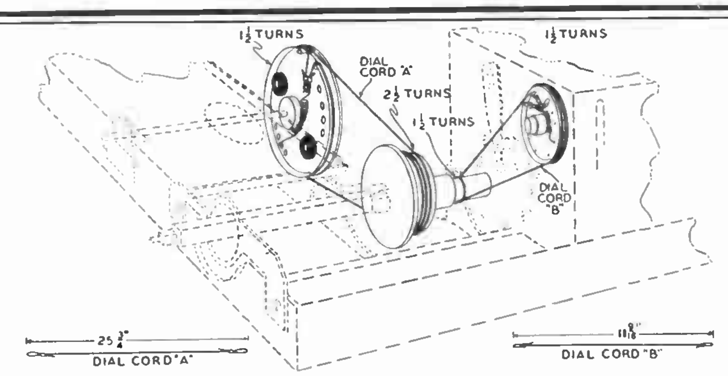


Fig. 25. Dial Cord Stringing Arrangement.

OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 3.5 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms — not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.

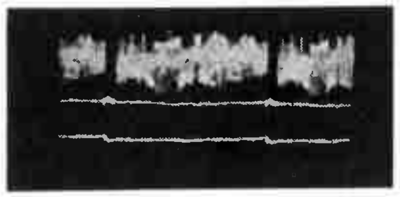


Fig. 8. Video Detector Output, Pin 2 of TS1, 3.5 volts, 60 c.p.s.

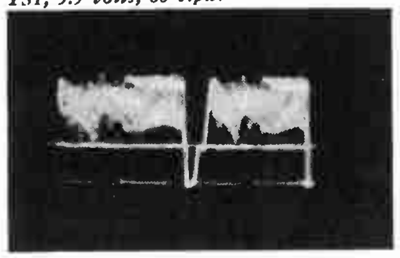


Fig. 9. Video Detector Output, Pin 2 of TS1, 3.5 volts, 15,750 c.p.s.

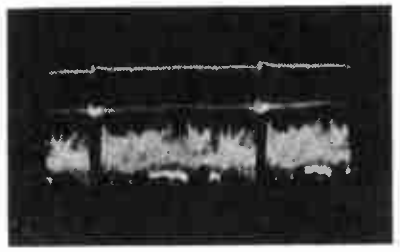


Fig. 10. Video Amplifier Plate, Pin 6, 40 volts, 60 c.p.s.

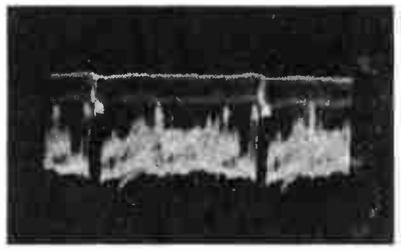


Fig. 11. Sync Separator Grid, Pin 9, 30 volts, 60 c.p.s.

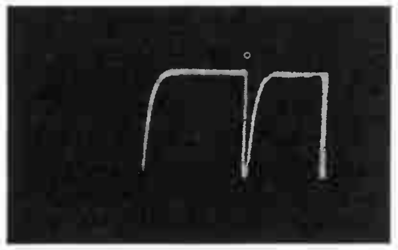


Fig. 12. Sync Separator Plate, Pin 1, 20 volts, 15,750 c.p.s.

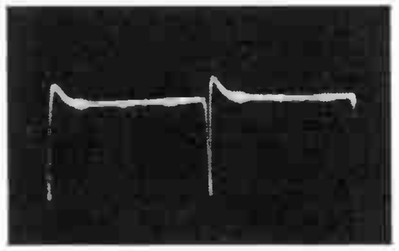


Fig. 13. Vertical-Oscillator Grid, Pin 2, 34 volts, 60 c.p.s.

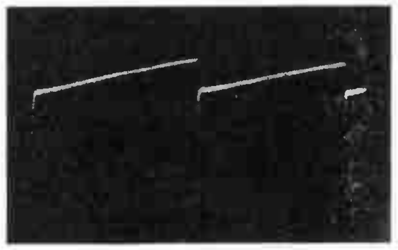


Fig. 14. Vertical-Output Grid, Pin 2, 140 volts, 60 c.p.s.

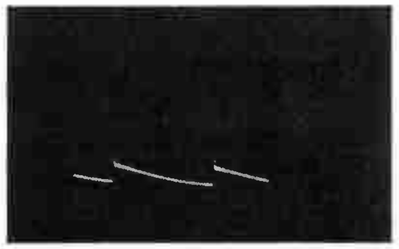


Fig. 15. Vertical-Output Plate, Pin 9, 1100 volts, 60 c.p.s.

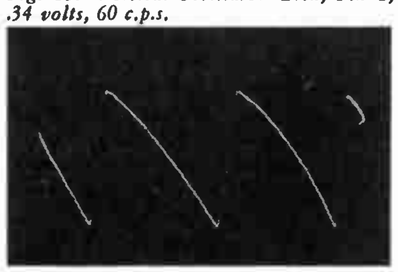


Fig. 16. Phase Comparer, Pin 2, 11 volts, 15,750 c.p.s.

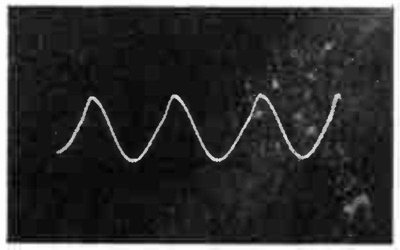


Fig. 17. Horizontal Oscillator, 40 volts, 15,750 c.p.s. test point.

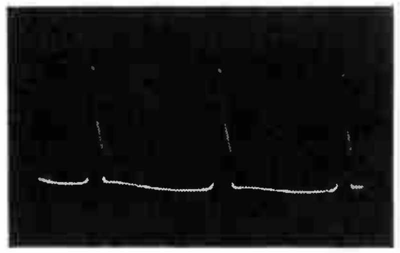


Fig. 18. Horizontal-Oscillator Cathode, Pins 3 and 8, 15 volts, 15,750 c.p.s.

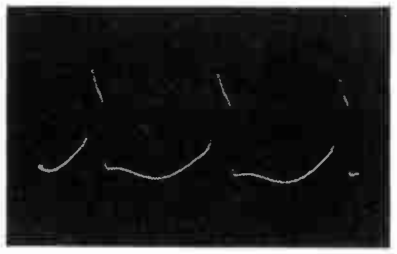


Fig. 19. Horizontal-Oscillator Grid, Pin 2, 60 volts, 15,750 c.p.s.

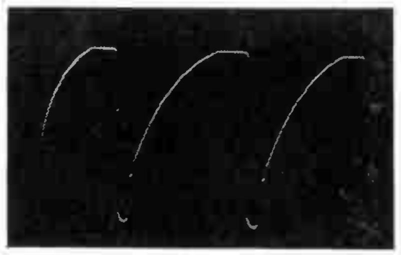


Fig. 20. Horizontal-Output Grid, Pin 5, 160 volts, 15,750 c.p.s.

Fig. 22. Wiring Diagram, Bottom view—TV-400.

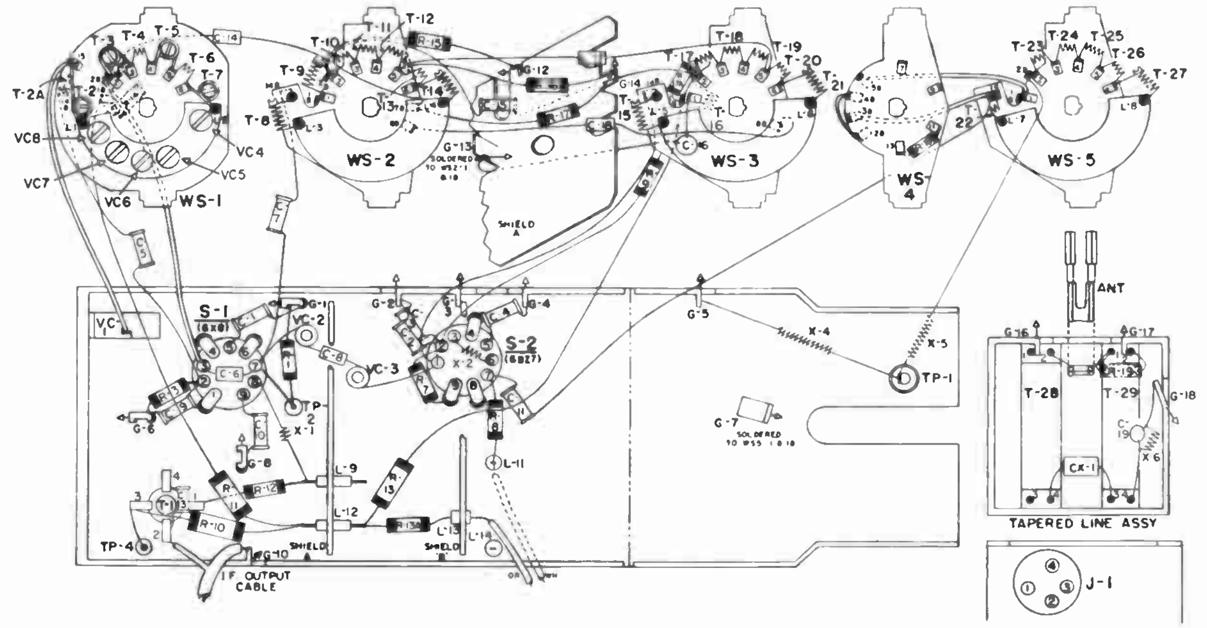
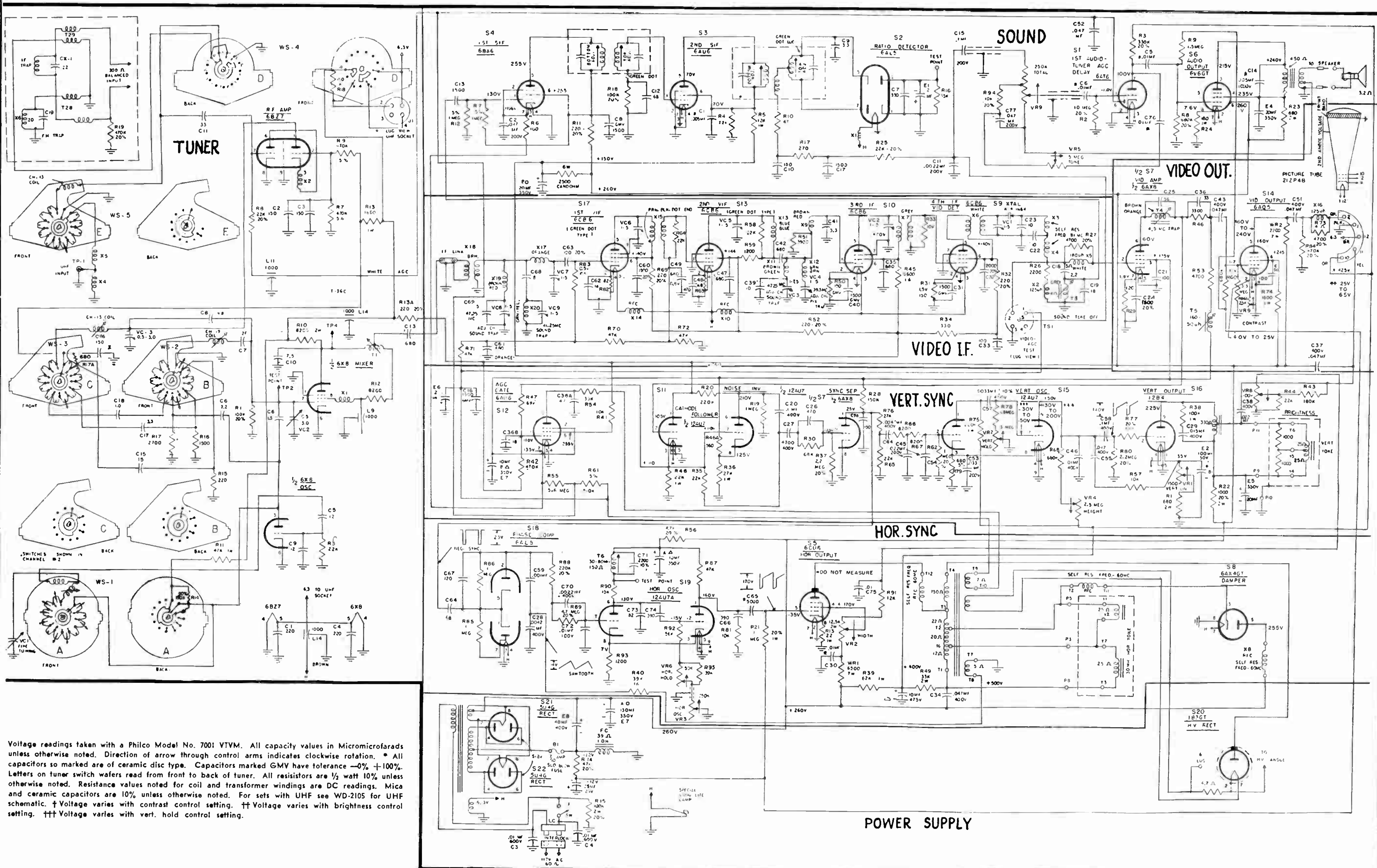


Fig. 23. Tuner Apparatus Layout Drawing.



Voltage readings taken with a Philco Model No. 7001 VTVM. All capacity values in Micromicrofarads unless otherwise noted. Direction of arrow through control arms indicates clockwise rotation. • All capacitors so marked are of ceramic disc type. Capacitors marked GMV have tolerance —0% +100%. Letters on tuner switch wafers read from front to back of tuner. All resisistors are ½ watt 10% unless otherwise noted. Resistance values noted for coil and transformer windings are DC readings. Mica and ceramic capacitors are 10% unless otherwise noted. For sets with UHF see WD-2105 for UHF schematic. † Voltage varies with contrast control setting. †† Voltage varies with brightness control setting. ††† Voltage varies with vert. hold control setting.

Fig. 24. Schematic Diagram—TV-400 Chassis.

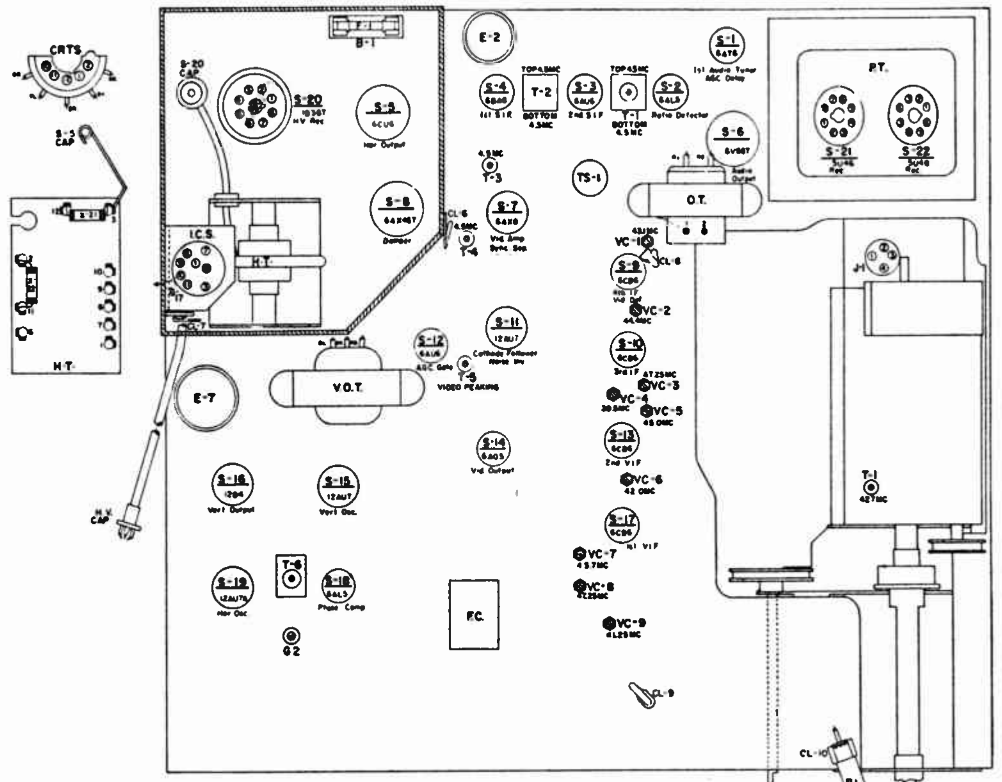


Fig. 21. Base Layout, Top view—TV-400.

PARTS LIST

CHASSIS — MECHANICAL

Reference Symbol	Description	Service Part No.
	Socket (2 used)	76-8115-1
	Socket (2 used)	27-6174
	Socket	27-6174-7
	Socket (4 used)	27-6203-12
	Socket (2 used)	27-6203
	Socket (2 used)	27-6203-14
	Socket (2 used)	27-6203-16
	Fuse	AD2246-15
	Socket, hi-voltage	27-6290-1
	Shield, corona	56-9684
	Anode Lead	AD2631
	Socket, yoke	27-6274-11
	Pulley assembly and bushing	76-9037
	Grommet	27-4099-3
	Shaft, dial	28-10011
	Dial and film assembly	76-9048
	Spring, dial cord	28-10029
	Antenna wiring assembly, tuner	76-9245
	Connector, test	27-6273-8
	Connector, interlock	27-6240-3
	Clip, pilot lamp	56-3545-5

CHASSIS — ELECTRICAL

Reference Symbol	Description	Service Part No.
	Transformer, horizontal output	32-8662
OT	Transformer, audio output	32-8685
VOT	Transformer, vertical output	32-8625
FC	Filter choke	32-8654
B1	Fuse holder	76-4519-2
PT	Transformer, power	32-8661
X1	Filter choke	
X2	Detector peak, coil	32-4480-8
X3	Detector peak, coil	32-4480-9
X4	Detector, coil	32-4112-52
X5	180MH VID peak	
X6	Coil, 4th VIF plate	32-4598-9
X7	Coil, 3rd VIF plate	32-4596-6
X8	Coil, damper	32-4112-50
X9	Coil, 3rd VIF grid	32-4548-12
X10	Coil, heater	32-4112-49
X11	Coil 47.25 trap	32-4587-15
X12	ADJ CH pix trap	
X13	2nd VIF plate	32-4112-31
X14	Coil, heater	32-4112-49
X15	Coil, 1st VIF plate	32-4598-10
X16	Coil, CRT grid	32-4480-8
X17	Coil, 1st VIF grid	32-4597-3
X18	Coil, link	32-4599-1
X19	Coil, 47.25 trap	32-4597-12
X20	Coil, 41.25 trap	32-4112-54
T1	Transformer, discriminator	32-4450-6A
T2	Transformer, SIF	32-4497A
T3	Coil, var., sound takeoff	32-4483-9
T4	Coil, var., 4.5 trap	32-4463-13
T5	Coil, var., 1st VID plate	32-4487-23
T6	Coil, hor. ringing	32-4557-3
VR-1	Control, vertical linearity	33-5546-44
VR-2	Control, width	33-5574
VR-3	Control, horizontal hold aux.	33-5565-17
VR-4	Control, height	33-5572-1
VR-5	Control, tone	33-5572-12
VR-6	Control, horizontal hold	33-5572-8
VR-7	Control, vertical hold	33-5572-14
VR-8	Control, bright	33-5572-9
VR-9	Control, off-on, volume	33-5573-1
WR-1	Resistor, horizontal out. screen	33-1335-125
WR-3	Resistor, candohm	33-3435-36
	Resistor, 1B3 heater	66-9478340
	Cable, CRT socket	41-3964-20
	Cable, pilot light	27-6233-4
	Cable, volume control	41-4202
WR-2	Resistor, 2nd VID. plate	33-1335-97
R1	Cathode, vert. output 680Ω	66-1685340
R2	1st audio grid (10 meg.)	66-6106340
R3	1st audio plate	66-4338340
R4	2nd SIF screen (22 K)	66-3228340
R5	2nd SIF plate (12 K)	66-3124340
R6	1st SIF cathode (100)	66-1106340
R7	1 Meg. (grid 6BA6)	66-5104340
R8	Audio output grid (680 K)	66-4688340
R9	Audio output grid (1.5 meg.)	66-5158340
R10	47Ω disc	66-0474340
R11	1st SIF plate (220)	66-1226340
R12	1 meg., 1st sound I-F grid	66-5104340
R13	22Ω 1w. 6CU6 K Bias	66-0224240
R14	C filter (47 K)	66-3478340
R15	Line to chassis (100 K)	66-4105340
R16	Disc. output (33 K)	66-3338340
R17	Disc., resistor (270)	66-1278340
R18	2nd SIF grid (100 K)	66-4106340
R19	Noise inv. plate (1.0 meg.)	66-5108340
R20	Cathode foll. plate (220 K)	66-4228340
R21	Horizontal output grid (1.0 meg.)	66-5106340
R22	1000Ω, 2w.	66-2105340
R23	680Ω, 2w.	66-0685340
R24	Audio output cathode (180)	66-1184340
R25	Disc. filter (22 K)	66-3228340
R26	Detect. load (2200)	66-2228340
R27	1st VID grid (4700)	66-2478340
R28	SS plate (150 K)	66-4158340
R29	120Ω, Cath. res. of 6X8	66-1124340
R30	SS grid (AGC gate)	66-3688340
R31	4th VIF cathode (150)	66-1158340
R32	4th VIF plate (220)	66-1228340
R33	4th VIF grid (10K)	66-3108340
R34	4th VIF decoupling (330)	66-1338340
R35	Noise inv. grid (22 K)	66-3228340
R36	27K., 1w.	66-3274340
R37	SS grid (2.2 meg.)	66-5228340
R38	Vertical decoupler (1000)	66-2105340
R39	Boost div. (82 K)	66-3824340
R40	Horizontal feed (39 K)	66-3394340
R41	AGC gate screen (10 K)	66-3108340
R42	AGC gate grid (470 K)	66-4478340
R43	CRT cathode (180 K)	66-4188340
R44	CRT cathode (22 K)	66-3228340
R45	3rd VIF plate (5600)	66-2564340
R46	1st VID plate (3300)	66-2338340
R47	68 K	
R48	Cathode foil (22 K)	66-3228340
R49	Boost div. (33 K)	66-3335340
R50	3rd VIF cathode (150)	66-1158340
R51	2nd VIF trap (3900)	66-2398340
R52	2nd VIF plate (220)	66-1228340
R53	1st VID plate (4700)	66-2478340
R54	AGC gate plate (33 K)	66-3338340
R55	AGC gate cathode (5.6 meg.)	66-5568340
R56	Horizontal oscillator decoupling (4700)	66-2478340
R57	Vertical peak (10 K)	66-3108340
R58	3rd VIF grid (22 K)	66-3228340
R59	2nd VIF plate (1200)	66-2128340
R60	2nd VID grid (680 K)	66-4688340
R61	AGC gate cathode (510 K)	66-4518340
R62	Vertical output grid (22 meg.)	66-5228340
R63	2nd VIF cathode (68)	66-0688340
R64	22K damping 2 VIF grid	66-3228340
R65	Vertical sync. div. (22 K)	66-3228340
R66	Vertical int. (8200)	66-2828340
R67	Vertical int. (8200)	66-2828340
R68		
R69	1st VIF plate (220)	66-1228340
R70	AGC div. (47 K)	66-3478340
R71	AGC div. (47 K)	66-3478340
R72	AGC div. (47 K)	66-3478340
R73		
R74	Vid. out. screen (1800)	66-2184340
R74A	Vid. out. grid (3.3 meg.)	66-5338340
R75	Vertical oscillator plate (220 K)	66-4224340
R76	Vertical sync. div. (27 K)	66-3278340
R77	Vertical output grid (100)	66-1108340
R78	Vertical oscillator grid (1.8 meg.)	66-5188340
R79	Vertical oscillator cathode (680)	66-1688340
R80	2.2 meg. 12B4 grid rep.	66-5228340
R81	Horizontal oscillator plate (10 K)	66-3108340
R82	1st VIF cathode (82)	66-0828340
R83	1st video grid (15 K)	66-3158340
R84	CRT grid (470 K)	66-4478340
R85	Phase comp. (1.0 meg.)	66-5108340
R86	Phase comp. (1.0 meg.)	66-5108340
R87	Horizontal oscillator plate (47 K)	66-3478340
R88	Phase comp. output (220 K)	66-4228340
R89	AFC filter (4.7 meg.)	66-5478340
R90	Horizontal oscillator plate (15 K)	66-3158340
R91	Horizontal screen div. (12 K)	66-3128340
R92	Horizontal oscillator grid (56 K)	66-3568340
R93	Horizontal oscillator cathode (1200)	66-2128340
R94	Bass comp. (10 K)	66-3106340
R95	Horizontal hold	66-3398340
	Cathode inverter (560)	66-0628340
	Vid amp. screen (27 K)	66-3274340
C1	2nd SIF screen (.005)	30-1238-1
C2	1st SIF cathode (.047)	30-4650-45
C3	Line bypass (.01)	30-4650-58
C4	Line bypass (.01)	30-4650-58
C5	Audio output grid	30-1238-2
C6	1st audio plate	30-1238-2
C7	Discriminator output (330)	62-133001001
C8	1st SIF screen (1500)	30-1238-15
C9	3.3 by-pass	
C10	SS plate disc. tert. (150)	62-115001001
C11	.0022 mf. aud. filter	
C12	2nd SIF grid	62-068409011
C13	1st SIF grid (1500)	30-1238-15
C14	Audio output plate (.005)	30-1252-1
C15	Volume cont. input (.01)	30-4650-47
C16	AGC (1500)	30-1238-15
C17	Disc. filter (1500)	30-1238-15
C18	Sound takeoff (2.2)	30-1221-6
C19	Sound takeoff (18)	62-018400021
C20	Noise inv. plate (.01)	30-4650-47
C21	1st video screen (100)	62-110001021
C22	Detect. lead (10)	62-010409001
C23	Detect. lead (10)	62-010409001
C24	.1500K. by-pass, 1st VID amp.	
C25	4.5 mc. trap (56)	62-056409001
C26	SS grid (470)	30-1225-18
C27	Noise inv. plate (.0047)	30-4650-56
C28	Horizontal feedback (.0047)	30-4650-56
C29	Vert. output damp. (.015)	30-4650-42
C30	Horizontal screen bypass (.01)	30-1238-2
C31	4th VIF cathode (1500)	30-1238-15
C32	4th VIF screen (.002)	30-1225-6
C33	4th VIF decoupler (100)	62-110001021
C35	3rd VIF screen (680)	62-168001011
C36	1st VID plate (33)	62-033009001
C36A	47mmf.	62-047009001
C36B	18 mmf.	
C37	Retrace supp. (.047)	30-4650-45
C38	Retrace supp. (.022)	30-4650-43
C39	2nd VIF trap (10)	62-010409001
C40	3rd VIF cathode (1500)	30-1238-15
C41	3.3 3rd VIF grid	
C42	680 coupling	
C43	1st VID plate (.047)	30-4650-45
C44	Vert. int. (.0047)	30-4650-56
C45	Vert. inv. (.022)	30-4650-43
C46	Vert. charge (.01)	30-4650-41
C47	2nd VIF screen (680)	62-168001011
C48	2nd VIF cathode (680)	62-168001011
C49	2nd VIF grid (680)	62-168001011
C50	VID output screen (100)	62-110001021
C51	2nd VID plate (.047)	30-4650-45
C52	AGC (.047)	30-4650-45
C53	Vertical oscillator cathode (.033)	30-4650-44
C54	Vertical inv. (.022)	30-4650-43
C55	Vertical charge (.047)	30-4650-45
C56	SS plate disc. tert. (150)	62-115001001
C57	Vert. oscillator grid (.0033)	30-4650-55
C58	Vert. output grid (0.1)	30-4650-47
C59	Phase comp. output (.001)	30-4650-52
C60	1st VIF screen (1500)	62-215001011
C61	AGC (680)	62-168001011
C62	18 mmf. K. bypass, 1st UHF	
C63	1st VIF grid (100)	62-110001021
C64	Sync coupling (68)	62-068409011
C65	Horizontal output grid (.005)	30-1238-1
C66	Horizontal charge (390)	60-10395417
C67	Phase comp. (120)	60-10125237
C68	41.25 trap (8)	30-1224-112
C69	47.25 trap (5)	30-1224-28
C70	.0022 filter, PH comp. output	30-4650-54
C71	Horizontal ringing (2200)	60-20225434
C72	AFC filter (.01)	30-1238-2
C73	Horizontal MV (82)	60-00825437
C74	Horizontal MV (390)	60-10395437
C75	Horizontal screen div. (.01)	30-1238-2
C34	Horizontal boost (.047)	30-4650-62
X15, X13 etc.	Adj. VIF — (0.5 to 5.0)	31-6520-9
	Elect., C filter	45-3035-6
E1	Sound disc.	45-3035-4
E7	AGC	45-3035-4
	Elect., input	30-2568-62
	Elect., 1⅜" can	30-2584-42
	Elect., 1" can	30-2584-43
	Crystal	34-8022
	Pilot lamp (later prod.)	3463-4

TUNER — MECHANICAL

Reference Symbol	Description	Service Part No.
	Tuner, T36C	76-8946-3
	Spring, detent, tuner	56-9158
	Washer, springgrip, tuner	W2556-5
	Tube cap, tuner	54-9242
	Sleeve cap, tuner	26-10283
	Washer, tuner	56-9351
	"E" washer, tuner (2 used)	1W60980FE5
	Retaining ring	1W61043
	Hairpin, tuner	56-9858
	Ball, detent	56-8020
	Spring, shaft (2 used)	56-8023
	Shaft	76-6914-6
	Oscillator wiring assembly	76-9231
	Shaft extension	56-8358-7
	Auxiliary antenna wiring assembly	76-8965
	Coupling insulator	54-4912
	Drive pulley and fine tuning shaft	76-9026
	Bearing	54-9244
	Spring	28-9088
	Rotor and fine tuning shaft	76-8025
	R-F wiring assembly	76-9349
	Grid wiring assembly	76-9327
	Socket, tube (2 used)	27-6203-21
	Connector, UHF input	57-0590-2
	Tube shield (2 used)	56-5629-5
	Stud, trimount (5 used)	W2235-7FA9
	Connector	27-6273-11

TUNER — ELECTRICAL

Reference Symbol	Description	Service Part No.
R1	100K mixer grid	66-4108340
R3	22K oscillator grid leak	66-3228340
R7	470K R-F grid section II	66-4478240
R8	22K AGC decoupling	66-3228240
R9	470K R-F grid section II	66-4478240
R10	8200 mixer decoupling	66-2825340
R11	12K oscillator plate feed	66-3124340
R12	8200 mixer screen	66-2828340
R13	1800 ohm, 1 watt	66-2184340
R13A	220 ohm decoupling	66-1224340
R14	150K on WS-1	66-4158340
R15	220 ohm on WS-2	66-1228340
R16	1500 ohm on WS-2	66-2158240
R17	2700 ohm on WS-2	66-2278340
R17A	680 ohm on WS-3	66-1688240
R18	150K on WS-4	66-4154240
R19	470K discharge resistor	66-4478340
C1	220 mmf. R-F heater	62-122001001
C2	150 mmf. R-F grid by-pass	62-115001001
C3	150 mmf. R-F grid by-pass	62-115001001
C4	220 mmf. oscillator heater	62-122001001
C5	12 mmf. oscillator grid tank	30-1224-128
C6	2.2 mmf. injection coupling	30-1224-127
C8	.68 mmf. mixer grid coupling	30-1224-126
C9	12.0 mmf. oscillator grid block	30-1224-128
C10	7.5 mmf. I-F primary	30-115001001
C11	33 mmf. R-F grid coupling	62-033409011
C13	680 mmf. I-F coupling	62-168001011
C19	20 mmf. FM trap	62-020309011
VC2	.5 to 5.0 mmf. mixer grid	31-6520-3
VC3	.5 to 5.0 mmf. R-F plate	31-6520-3
X2	Plate-cathode coil, tuner	32-4623-50
X4	UHF channel, ground side coil, tuner	32-4623-55
X5	UHF channel coil, tuner	32-4623-56
X6	FM trap, coil, antenna coil assembly	32-4550-3
T1	Coil, I-F primary	32-4587-14
T28	Antenna Coil	32-4432-3
T29	Antenna Coil	32-4432-3
L11	Capacitor, AGC decoupling	30-1245-6
	8200 damping I-F, resistor	66-2828340
	I-F padding, capacitor, var. tuner	31-6520-8
	Interstage coupling, capacitor	30-1253-1
	R-F heater, oscillator heater, choke	32-4550-11
X2	Cathode tuning, coil	32-4597-13
	Antenna coil assembly, tuner	318-5348
	I-F trap, coil, antenna coil assembly	32-4552-1

Alignment Procedure

NECESSARY EQUIPMENT

Television Sweep Generator
Marker Freq. Generator
Vacuum Tube Voltmeter
4.5 Mc fixed freq. Generator or equivalent

I.F. ALIGNMENT

1. Connect VTVM and the input terminal of the scopes' vertical amplifier to the juncture of 8200 ohm resistor and 410 uh choke - this is immediately following the video detector, the 8200 ohms being the resistor portion of the detector load. I.F. signal may be introduced by means of a miniature tube shield floated over the 6AG5 mixer tube.
2. With the sweep off and the marker freq. set to 23.3 mc, adjust the 1st and 3rd I.F. coils for maximum response, as indicated by VTVM. Generator should be attenuated so as not to provide more than threshold sensitivity (1 volt on VTVM at fixed freq., 1/2 volt on sweep.)
3. Re-set marker frequency to 25.6 mc and adjust 2nd and 4th I.F. transformers for maximum VTVM indication, as above.
4. With sweep turned on observe I.F. curve shape on oscilloscope - the knee of the curve should be at approximately 23.5 & 25.5 mc. If original alignment did not produce satisfactory curve, it may be modified by adjusting the I.F. tuning slightly, while observing the curve on the scope. Care must be taken that both peaks are approximately the same height and that the mid-portion of the curve is not down more than about 2 db. The sound rides at 21.6 mc and this point should be checked to make sure that it is at least 26db below the flat top. The picture frequency rides the curve at 26.1 mc and should be 6 db down on the opposite side of the curve. The curve should be about 3 mc wide at 6db down (1/2 way down).

SOUND ALIGNMENT

1. Connect 4.5 mc generator to the grid of the video amplifier tube (there again, low signal level is important, so that limiting action does not occur.) Metering may be accomplished at the sound take-off point of the ratio and detector (at the juncture of the 15,000 ohm resistor and the 3900 mmf capacitor).
2. Adjust the top and bottom slugs on the sound trans for maximum response.
3. Adjust primary of ratio detector (top slug) to maximum.
4. Connect meter ground to the juncture of the two 6800 ohm resistors off the sound detector, and adjust the bottom slug on ratio detector to Zero voltage.

R.F. ALIGNMENT

The R.F. Tuner in this receiver has been pre-aligned by the manufacturer, and it is not recommended that adjustment be made in the field, especially since the fine tuning control will move the oscillator at least 3/4 mc on the low channels and 2 mc on the high channels.

VOLTAGE MEASUREMENTS

6BG6	Screen	+255	
	Cathode	+8.6	
	Grid	-12.5	
6V6	Plate	340	
	Screen	360	
	Cathode	140	
	Grid	-12	Measured from +140

6SN7

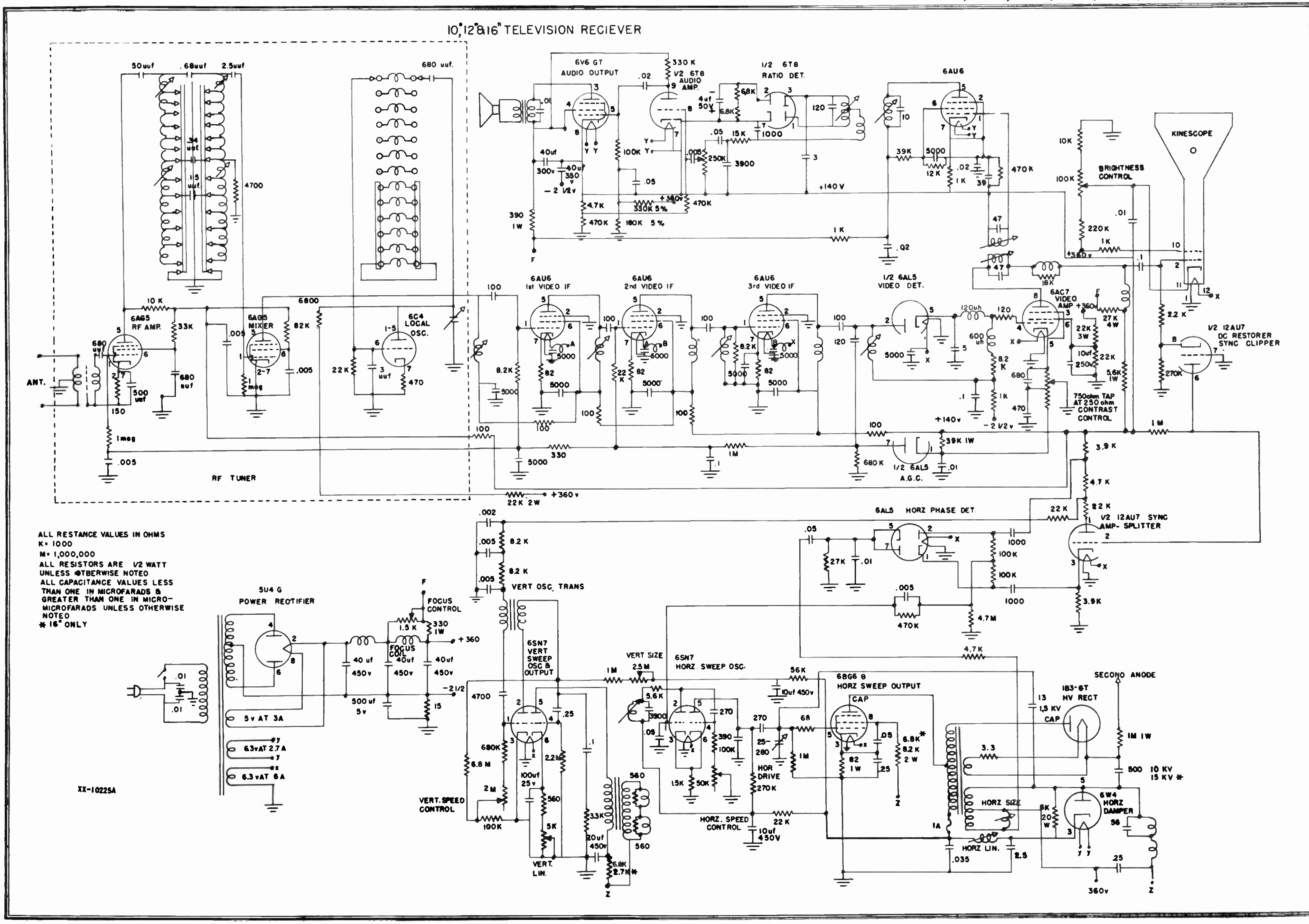
	Horizontal osc.	Vertical osc. and Output
Pin 1	+ .4	- 20 to -35
2	+240	+ 75 to +100V
3	+ 9	0
4	-6.4	0
5	+100	+300
6	+ 9	+12.6
7	HTR	HTR
8	GND	GND

6AL5 Phase Detector

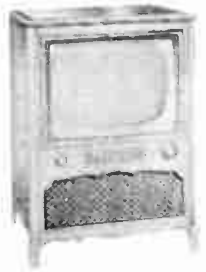
	No Signal	Signal
Pin 1	+2.5	+3.4
2	-1.2	-1.6
3	GND	
4	HTR	
5	0	
6		
7	0	

12AU7 Clipper Sync. Separator

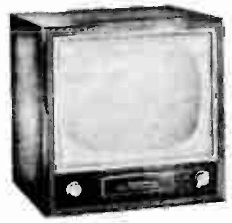
	No Signal	Signal
Pin 1	+120	
2	0	
3	+6.5	
4	HTR	
5	HTR	
6	+6.2	+3.6
7	GND	
8	+1.3	+18
9	GND	


10", 12" & 16" TELEVISION RECIEVER
RF TUNER
ANT.
6AG5 RF AMP.
6AG5 MIXER
6C4 LOCAL OSC.
6V6 GT AUDIO OUTPUT
1/2 6T8 AUDIO AMP.
1/2 6T8 RATIO DET.
6AU6
KINESCOPE
BRIGHTNESS CONTROL
6AU6 1st VIDEO IF
6AU6 2nd VIDEO IF
6AU6 3rd VIDEO IF
1/2 6AL5 VIDEO DET.
6AC7 VIDEO AMP
1/2 12AU7 DC RESTORER SYNC CLIPPER
750ohm TAP AT 250 ohm CONTRAST CONTROL
1/2 6AL5 A.G.C.
6AL5 HORZ PHASE DET.
1/2 12AU7 SYNC AMP- SPLITTER
ALL RESTANCE VALUES IN OHMS
K= 1000
M= 1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE NOTED
ALL CAPACITANCE VALUES LESS THAN ONE IN MICROFARADS & GREATER THAN ONE IN MICRO-MICROFARADS UNLESS OTHERWISE NOTED
* 16" ONLY
5U4 G POWER RECTIFIER
FOCUS CONTROL
FOCUS COIL
VERT OSC. TRANS
6SN7 VERT SWEEP OSC & OUTPUT
VERT SIZE
6SN7 HORZ. SWEEP OSC.
6BG6 G HORZ SWEEP OUTPUT
1B3-GT HV RECT
SECOND ANODE
6W4 HORZ DAMPER
VERT. SPEED CONTROL
VERT. LIN.
HORZ. SPEED CONTROL
HOR DRIVE
HORZ SIZE
HORZ LIN.
XX-10225A

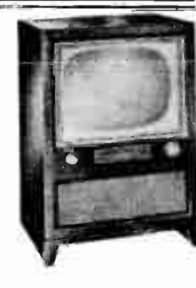
Models 21-T-314, 21-T-314G, 21-T-314U, 21-T-314GU "Prentiss" Mahogany, Oak



Models 21-T-315, 21-T-315U "Deauville" Maple



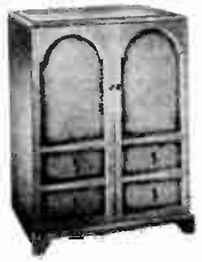
Models 21-T-303, 21-T-303U "Kirby" Antique Mahogany



Models 21-T-313, 21-T-313G, 21-T-313U, 21-T-313GU "Jeffrey" Mahogany, Blond Mahogany

Models 21-T-316, 21-T-316U "Hilton" Oak

Models 21-T-322, 21-T-322U "Dobson" Mahogany, Oak



Models 21-T-323, 21-T-323U "Lexington" Maple, Red Cherry

Models 21-T-324, 21-T-324U "Stockton" Mahogany, Walnut

GENERAL DESCRIPTION

All models are "21 inch" television receivers. Models 21-T-303, 21-T-313, 21-T-313G, 21-T-314, 21-T-314G, 21-T-315, 21-T-316, 21-T-322, 21-T-323 and 21-T-324 are identical except for cabinets and speakers. Models 21-T-313G and 21-T-314G employ a 21EP4 glass kinescope but are otherwise identical. These receivers feature full twelve channel VHF coverage.

Models 21-T-303U, 21-T-313U, 21-T-313GU, 21-T-314U, 21-T-314GU, 21-T-315U, 21-T-316U, 21-T-322U, 21-T-323U and 21-T-324U are identical except for cabinets and speakers. Models 21-T-313GU and 21-T-314GU employ a 21EP4 glass kinescope but are otherwise identical. These receivers feature full twelve channel VHF coverage plus any four UHF channels.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE 227 sq. ins. on a 21AP4 or a 21EP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 21-T-303, 313, 313G, 314, 314G, 315, 316, 322, 323 & 324
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 21-T-303U, 313U, 313GU, 314U, 314GU, 315U, 316U, 322U, 323U & 324U
Any desired combination of 16 VHF and/or UHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc., 470 mc. to 890 mc.

PICTURE CARRIER FREQUENCY .... 45.75 mc.

SOUND CARRIER FREQUENCY .... 41.25 mc.

AUDIO POWER OUTPUT RATING ...... 4.0 watts max.

VIDEO RESPONSE .... To 3.5 mc.

SWEEP DEFLECTION .... Magnetic

FOCUS .... Magnetic

POWER SUPPLY RATING

KCS82 and KCS82A chassis ...... *115 volts, 60 cycles, 215 watts*
KCS82B chassis ...... *115 volts, 60 cycles, 230 watts*

RECEIVER ANTENNA INPUT IMPEDANCE

KCS82 chassis (KRK11B Tuner)
Choice: 300 ohms balanced or 72 ohms unbalanced.

KCS82A chassis (KRK22A Tuner)
Choice: 300 ohms balanced or 72 ohms unbalanced.

KCS82B chassis (KRK12 Tuner)
UHF—Choice: 300 ohms balanced or 72 ohms unbalanced.
VHF—300 ohms balanced.

LOUDSPEAKERS

Models 21-T-303, 21-T-303U .... (971636-1) 5" PM, 3.2 ohms
Models 21-T-313, 21-T-313G, 21-T-313U, 21-T-313GU (971490-3) 8" PM, 3.2 ohms
Models 21-T-314, 21-T-314G, 21-T-314U, 21-T-314GU, 21-T-315, 21-T-315U, 21-T-316, 21-T-316U, 21-T-322, 21-T-322U (971692-1) 10" PM, 3.2 ohms
Models 21-T-323, 21-T-323U, 21-T-324, 21-T-324U (92569-12) 12" PM, 3.2 ohms

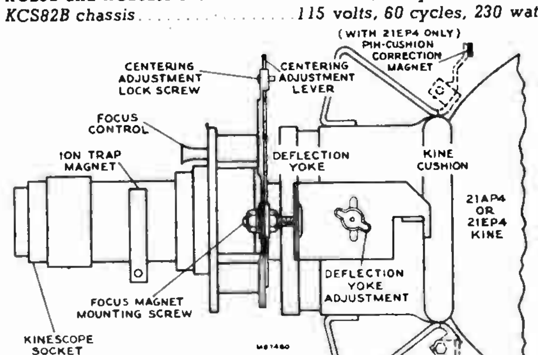


Figure 2—Yoke and Focus Magnet Adjustments

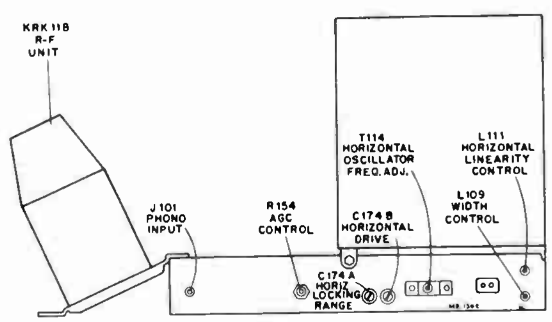


Figure 3—Rear Chassis Adjustments

ADJUSTMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over the balance of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment.—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T114 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T114 core until the bar moves out of the picture leaving it in sync.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on page 16. For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R176 under front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R186 under front control panel), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—Adjust the focus control for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the yoke thumbscrew and the focus magnet mounting screws are tight.

KRK11B R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 11. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis.

KRK22A R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 13. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 5. Adjustment for channel 13 is C3 on top of the tuner chassis.

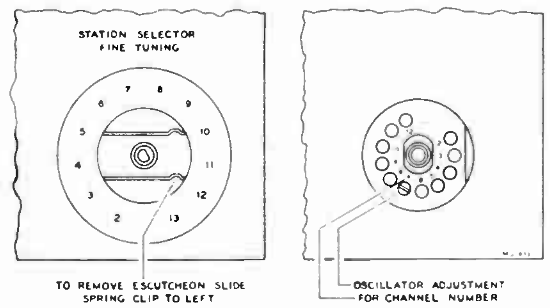


Figure 5—KRK22A R-F Oscillator Adjustments

KRK12 R-F OSCILLATOR ADJUSTMENTS.—Set the fine tuning control to the center of its range on the channel to be adjusted. Adjust the oscillator core for this channel to obtain maximum audio output without distortion. The adjustment location is the same for all channels, see figure 6. The insert in the operating position can be determined by a stamping on the insert drum. This stamping is visible through either the front or rear apertures as shown in figure 6.

AGC THRESHOLD CONTROL.—The AGC threshold control R154 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R154. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R154 should be readjusted.

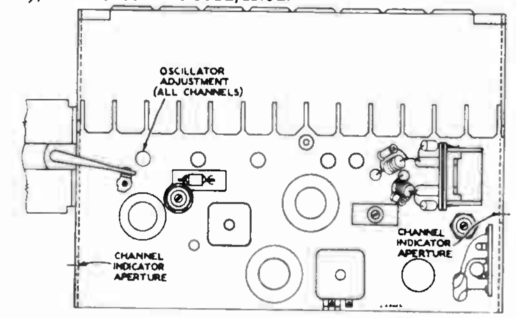


Figure 6—KRK12 Oscillator Adjustment

Turn R154 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R154 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R154 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R154 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

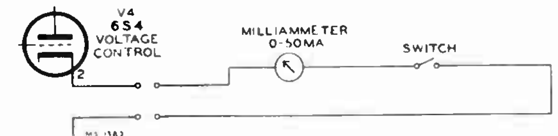


Figure 9—KRK12 Voltage Control Adapter

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is L58 on KRK11B tuners or L53 on KRK22A tuners and is located on the antenna matching transformer.

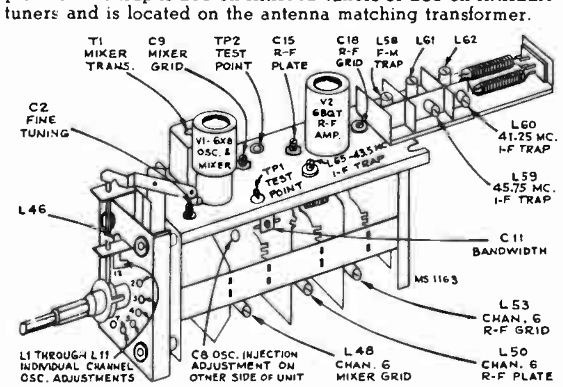


Figure 14—KRK11B Tuner Adjustments

CAUTION.—In some receivers, the FM trap L53 or L58 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L53 or L58 to make sure that it does not affect sensitivity on these two channels.

The FM trap on models using the KRK12 Tuner is fastened to the receiver antenna cable and is adjusted in the same manner as described above.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

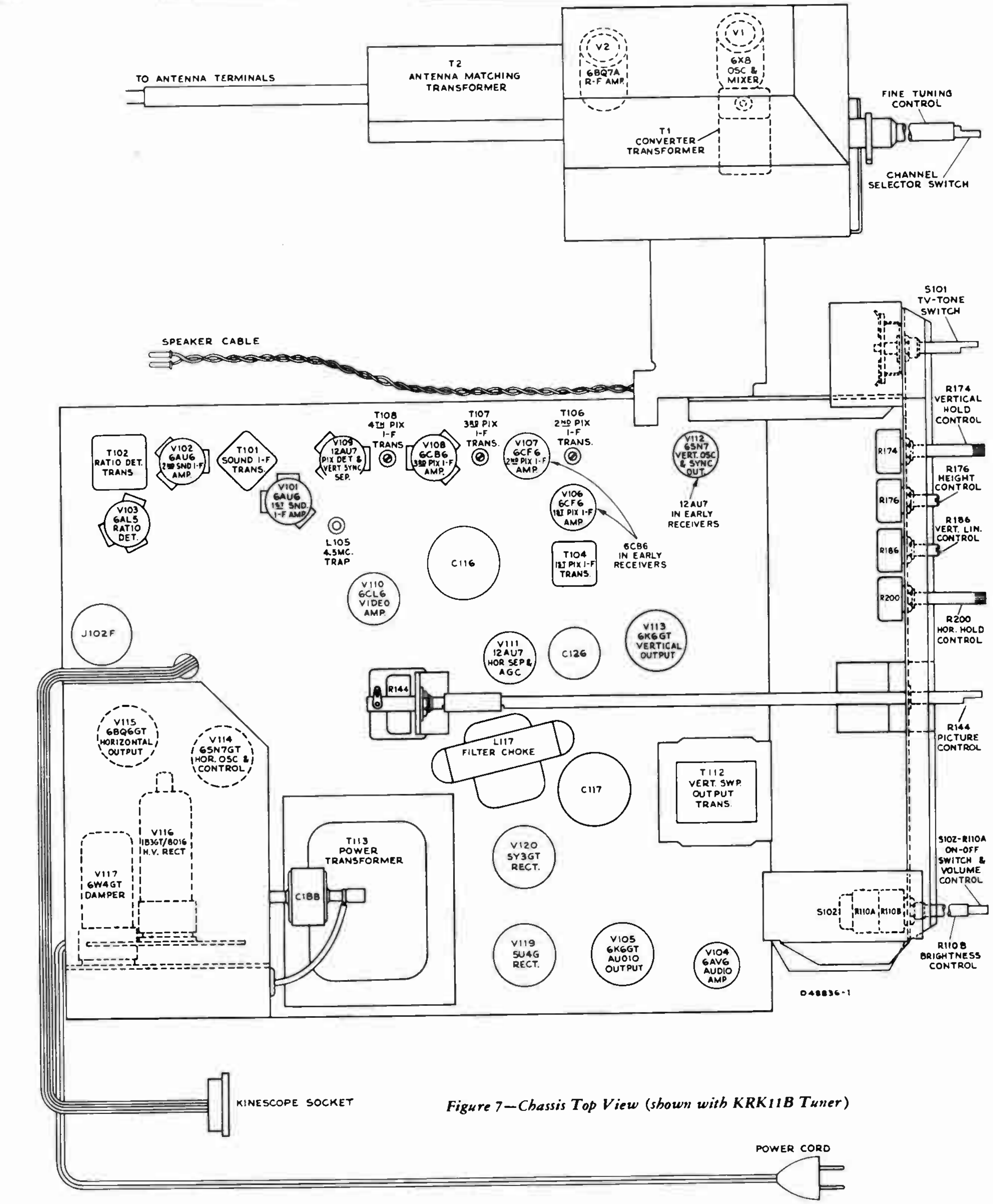


Figure 7—Chassis Top View (shown with KRK11B Tuner)

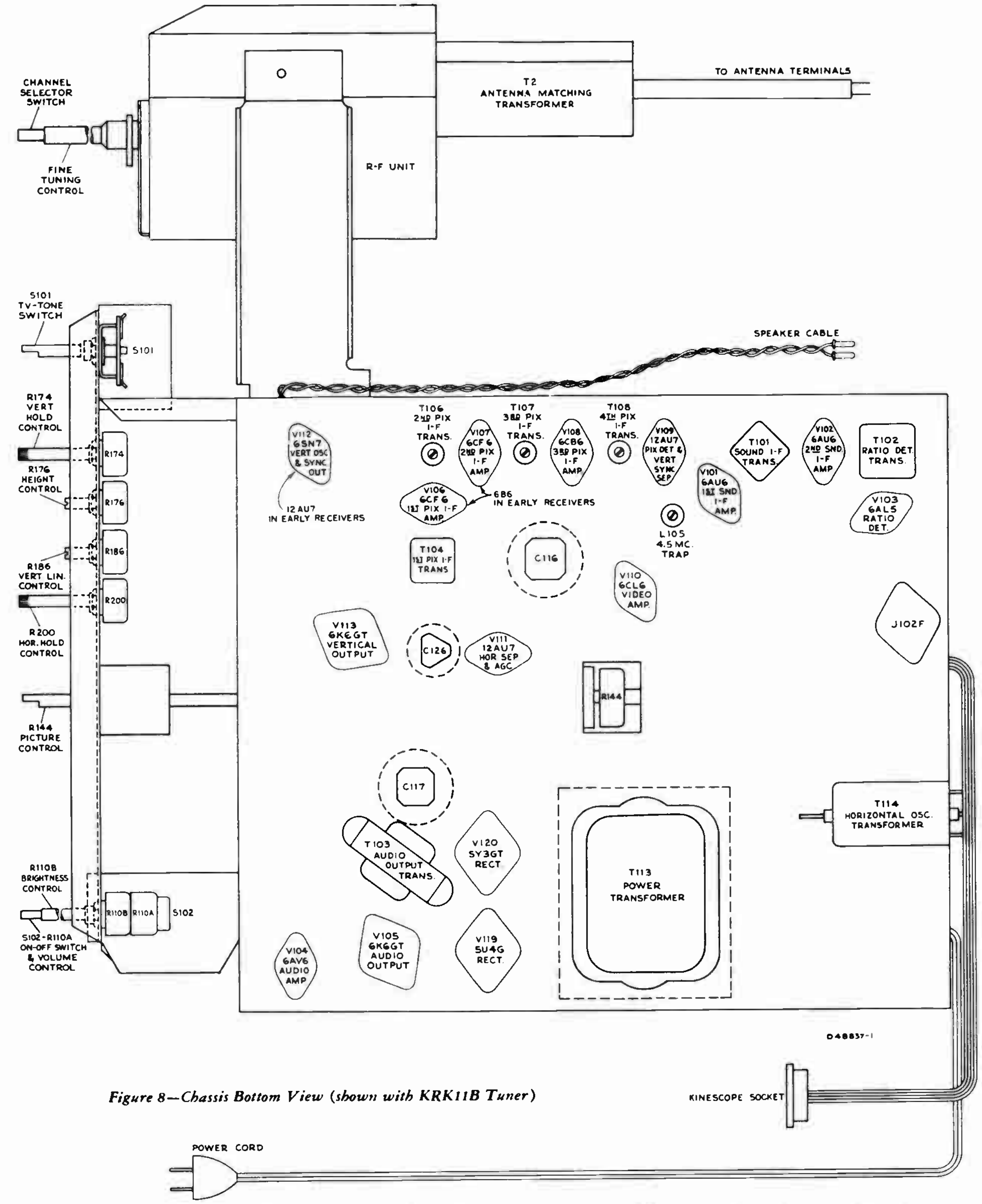


Figure 8—Chassis Bottom View (shown with KRK11B Tuner)

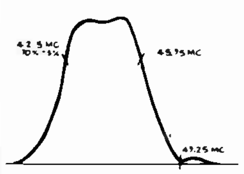


Figure 10
KRK11B or KRK22A
T1 and T104
Response

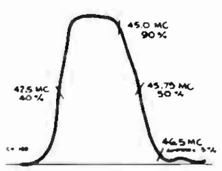


Figure 11
Over-all I-F Response
with KRK11B or
KRK22A

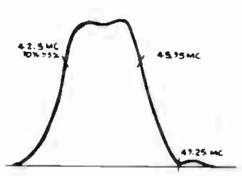


Figure 12
KRK12, T2 and T104
Response

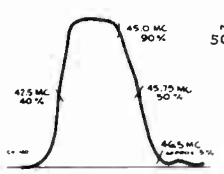


Figure 13
Over-all I-F Response
with KRK12

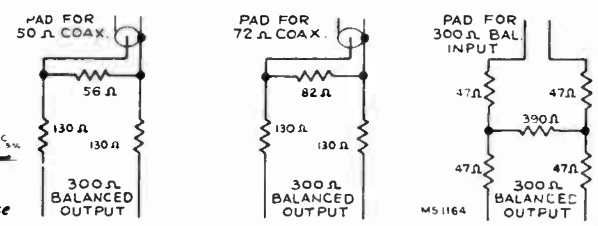


Figure 15—Sweep Attenuator Pads

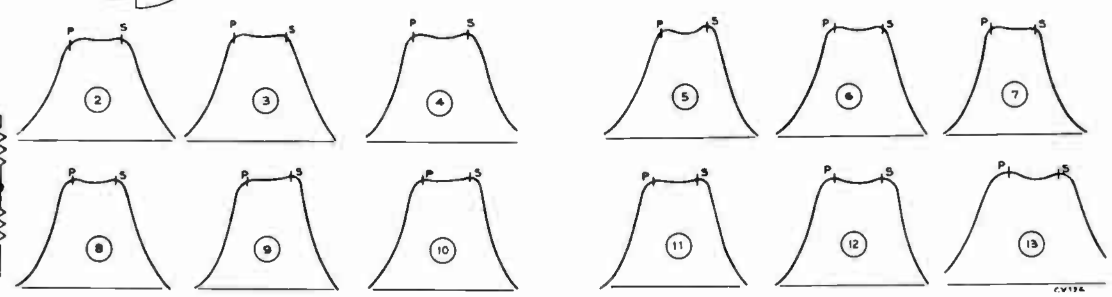


Figure 16—KRK11B R-F Response

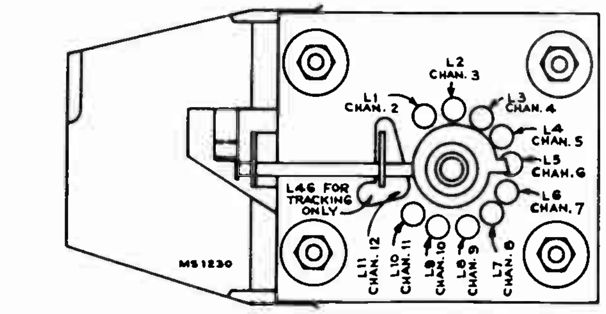


Figure 17—KRK11B Oscillator Adjustments

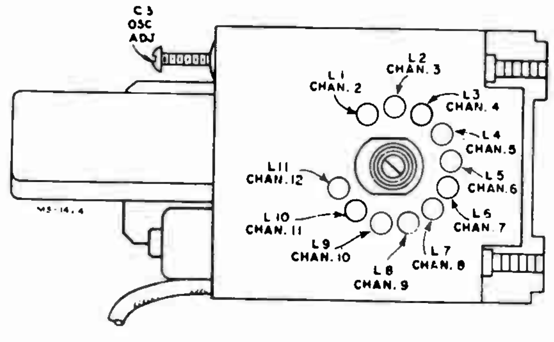


Figure 21—KRK22A Oscillator Adjustments

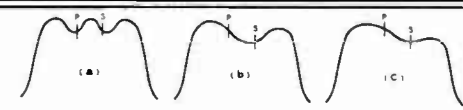


Figure 25—KRK12 UHF Insert Responses

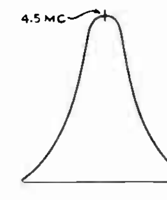


Figure 26 Sound I-F Response

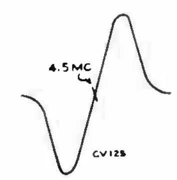


Figure 27 Ratio Det. Response

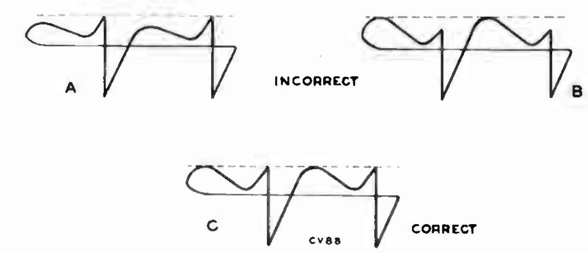


Figure 28—Horizontal Oscillator Waveforms

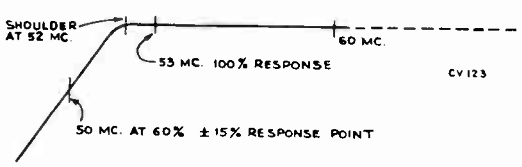


Figure 18—KRK11B Antenna Matching Unit Response

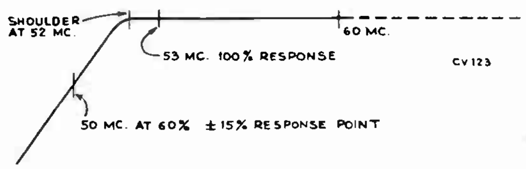


Figure 22—KRK22A Antenna Matching Unit Response

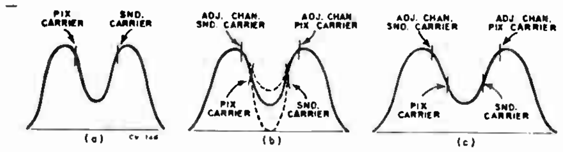


Figure 23—KRK12 VHF Insert Responses

ALIGNMENT DATA

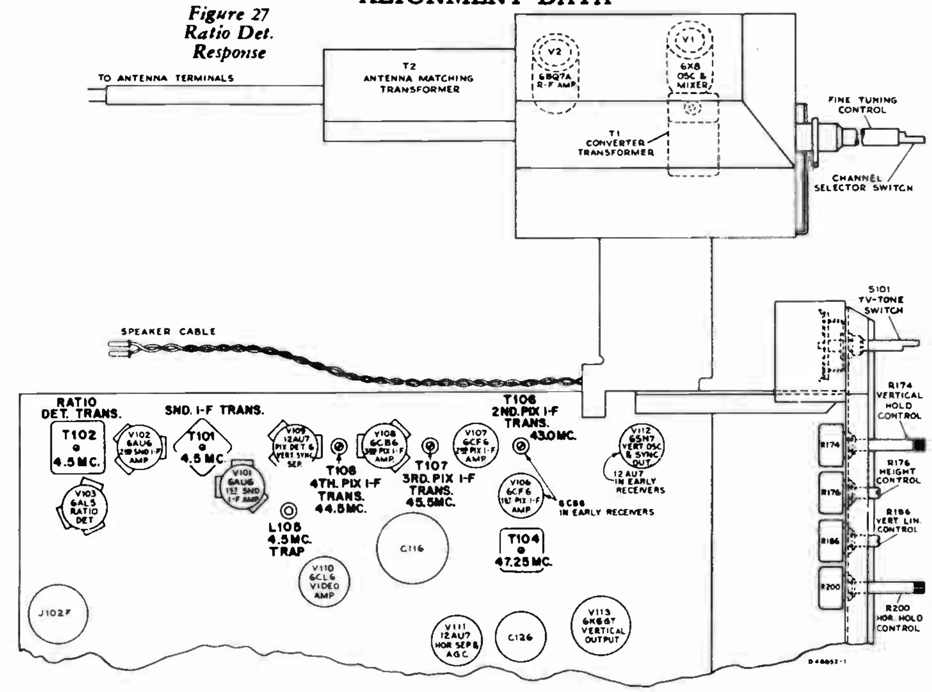


Figure 29—Top Chassis Adjustments (KRK11B Tuner Shown)

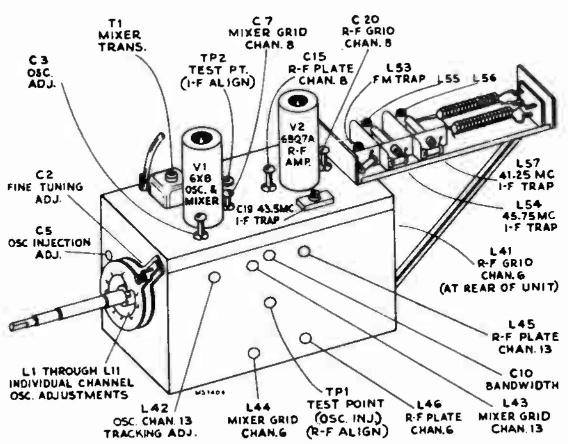


Figure 19—KRK22A Tuner Adjustments

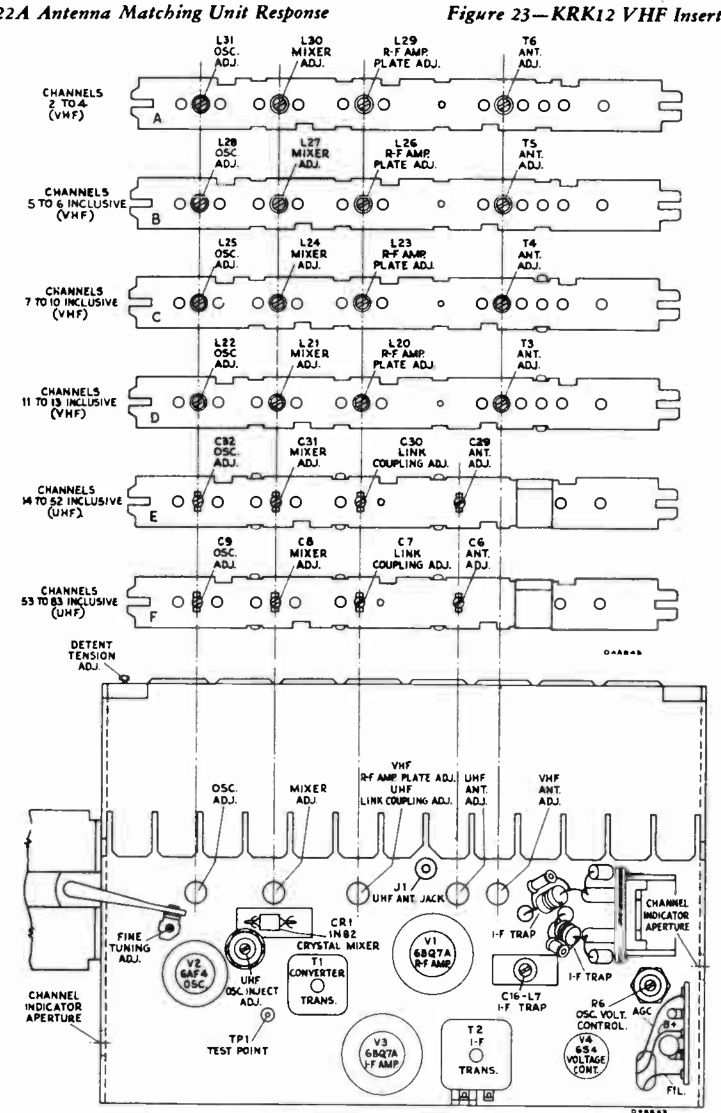


Figure 24—KRK12 Tuner Adjustments

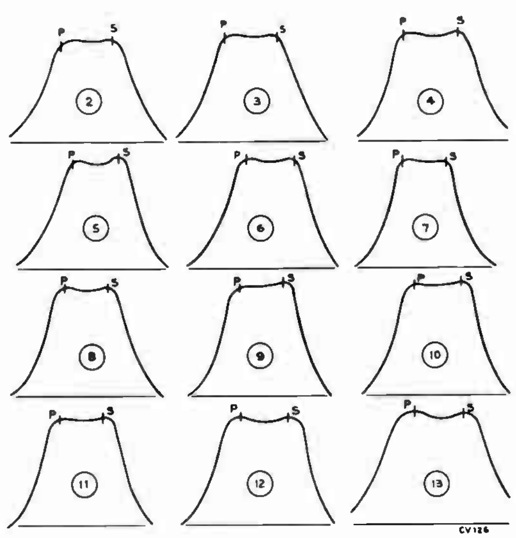


Figure 20—KRK22A R-F Response

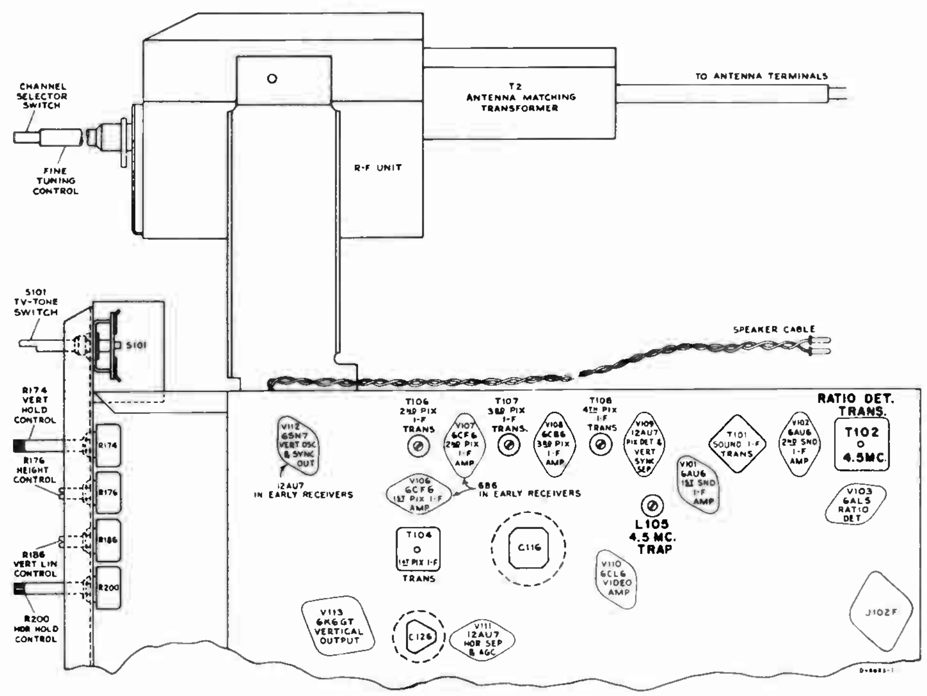


Figure 30—Bottom Chassis Adjustments (KRK11B Tuner Shown)

ALIGNMENT TABLE

Step No.	CONNECT VHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT VHF SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
35	Not used	—	Not used	—	Loosely coupled to r-f oscillator	239 mc.	TP1. Gain to maximum	Rec. on channel 10	L9 as above	Fig. 14
36	"	—	"	—	"	233 mc.	"	Rec. on channel 9	L8 as above	Fig. 14
37	"	—	"	—	"	227 mc.	"	Rec. on channel 8	L7 as above	Fig. 14
38	"	—	"	—	"	221 mc.	"	Rec. on channel 7	L6 as above	Fig. 14
39	"	—	"	—	"	129 mc.	"	Rec. on channel 6	L5 as above	Fig. 14
40	"	—	"	—	"	123 mc.	"	Rec. on channel 5	L4 as above	Fig. 14
41	"	—	"	—	"	113 mc.	"	Rec. on channel 4	L3 as above	Fig. 14
42	"	—	"	—	"	107 mc.	"	Rec. on channel 3	L2 as above	Fig. 14
43	"	—	"	—	"	101 mc.	"	Rec. on channel 2	L1 as above	Fig. 14
44	Repeat steps 31 through 43 as a check. On completion, remove 39 ohm resistor and reconnect link to terminals A and B of T104.									
	KRK11B ANTENNA MATCHING UNIT ALIGNMENT									
45	Do not adjust this unit unless fairly certain that it requires adjustment. Disconnect lead from L58 to S5. Connect output of matching unit through 1000 mmf. to pin 1 of V107. Replace cover on matching unit. Remove V106 from socket. Connect bias box to junction of R127 and R147 and set to produce −5 volts.									
46	Antenna terminals	45.75 mc. 30% mod.	Not used	—	Not used	—	Pin 2, V110 Scope gain to max.	—	L59 for min. audio on scope	Fig. 14
47	"	41.25 mc. 30% mod.	"	—	"	—	"	—	L60 for min. audio on scope	Fig. 14
48	Antenna terminals loosely	—	Antenna terminals through pad	45 to 54 mc.	"	—	Scope xtal probe from L58 to gnd.	Connect 300 ohms from L58 to gnd.	L61 and L62 to obtain response of Fig. 18	Fig. 14 Fig. 15 Fig. 18
49	Remove bias supply and 1000 mmf. capacitor. Restore connection between L58 and S5. Replace V106.									
	KRK22A TUNER ALIGNMENT									
1	If unit is completely out of adjustment, preset all adjustments to center of range with following exceptions. Set T1 and C2 fully counterclockwise. Set channel 7 to 13 oscillator slugs one turn from tight. Disconnect link from T104 and terminate with 39 ohms. Short the AGC terminal to ground. Preset C5 to read −3.0v dc. at TP1.									
2	Junction of L53 and C24 at bottom of L53	42.0 mc. 30% mod.	Not used	—	Not used	—	TP1. Gain to maximum	Set r-f unit on channel 2	C19 for min. indication on scope	Fig. 19
3	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8. Insert −3V bias at AGC terminal	C3 for beat on freq. meter. Fine tuning fully clockwise	Fig. 19
4	"	—	"	—	"	"	"	Return fine tuning to mid-range after adjustment of C2	C2 one turn clockwise past change in beat note	Fig. 19
5	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	R-F unit on channel 8. Set T1 max. counterclockwise	C7, C10, C15 and C20 for response shown in Fig. 20	Fig. 19 Fig. 20
6	Not used	—	Not used	—	Not used	—	Not used	On channel 8. Connect "VoltOhmyst" to TP1	C5 for −20 volts on meter	Fig. 19
7	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	R-F unit on channel 8	Check response. Readjust C7, C10, C15 and C20 if necessary	Fig. 19 Fig. 20
8	Not used	—	Not used	—	Loosely to r-f unit oscillator	257 mc.	Not used	Rec. on channel 13. Fine tuning fully clockwise	L42 for beat on het. freq. meter. Overshoot L42 slightly and adjust C2 for beat	Fig. 19
9	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. Gain to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	L43 and L45 for proper response and osc. injection within limits	Fig. 20
10	If C5 was readjusted in step 9, repeat step 8 and step 9 until the conditions specified in each step are fulfilled without additional adjustments.									
11	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C2 for beat on freq. meter	Fig. 19
12	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	"	Check response adjust C7, C10, C15 and C20 if necessary	Fig. 20
13	If C7 was readjusted in step 12 recheck the oscillator injection. Repeat steps 3 to 12 until all conditions are satisfied.									
14	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	R-F unit on channel 6. Fine tuning midrange	L5 for beat on het. freq. meter	Fig. 19
15	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	"	L41, L44 and L46 for response shown in Fig. 20	Fig. 19 Fig. 20
16	"	83.25 87.75	"	Channel 6	"	—	"	Rec. on channel 6. "VoltOhmyst" on TP1	Check to see that response is correct and osc. injection is within limits	Fig. 19 Fig. 20
17	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	"	Fig. 20
18	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	Fig. 20
19	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	Fig. 20
20	"	55.25 59.75	"	Channel 2	"	—	"	Rec. on channel 2	"	Fig. 20
21	If the response of any channel (steps 16 through 20) is below 80% at either marker, adjust L41, L44 and L46 as necessary to obtain proper response yet maintain correct response on channel 8.									
22	Repeat steps 14 through 20 until all adjustments are obtained.									

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 8 SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED

Step No.	CONNECT VHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT VHF SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	KRK11B TUNER ALIGNMENT									
1	If unit is completely out of adjustment, preset all adjustments to center of range with following exceptions. Set C18 so that head is ⅜" above chassis. Set C11 ¼ turn from max. clockwise. Disconnect link from T104 and terminate with 39 ohms. Connect bias supply between AGC terminal on tuner and ground. Adjust bias for −3.5V at terminal 3. Set fine tuning 30 degrees clockwise from mechanical center of its range.									
2	Grid, pin 7 of V2 through 1500 mmf.	43.5 mc. 30% mod.	Not used	—	Not used	—	TP1. Gain to maximum	Set r-f unit on channel 2	L65 for min. indication on scope	Fig. 14
3	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C2 for beat on freq. meter	Fig. 14
4	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	R-F unit on channel 8. Set T1 max. counterclockwise	C9, C11, C15 and C18 for response shown in in Fig. 16	Fig. 14 Fig. 16
5	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	R-F unit on channel 6	L5 for beat on het. freq. meter	Fig. 17
6	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	"	L48, L50 and L53 for response shown in Fig. 16	Fig. 14 Fig. 16
7	Not used	—	Not used	—	Not used	—	Not used	On channel 6. Connect "VoltOhmyst" to TP1	C8 for −3.5 volts on meter	Fig. 14
8	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	R-F unit on channel 6	Check response. Readjust L48, L50 and L53 if necessary	Fig. 14 Fig. 16
9	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C2 for beat on freq. meter	Fig. 14
10	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	"	Check response adjust C9, C11, C15 and C18 if necessary	Fig. 14
11	If C9 was readjusted in step 10, repeat step 7, step 9 and step 10 until the conditions specified in each step are fulfilled without additional adjustments.									
12	Not used	—	Not used	—	Loosely to r-f unit oscillator	257 mc.	Not used	Rec. on channel 13	L46 for beat on het. freq. meter. Overshoot L46 slightly and adjust C2 for beat	Fig. 14
13	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. Gain to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	Check to see that response is correct and −3.0 volts of osc. injection is present	Fig. 16
14	"	205.25 209.75	"	Channel 12	Not used	—	"	Rec. on channel 12	"	Fig. 16
15	"	199.25 203.75	"	Channel 11	"	—	"	Rec. on channel 11	"	Fig. 16
16	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	Fig. 16
17	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	Fig. 16
18	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	Fig. 16
19	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	"	Fig. 16
20	If the response of any channel (steps 13 through 19) is below 80% at either marker, adjust C9, C11, C15 and C18 as necessary to pull response up on the low channel yet maintain correct response on channel 8.									
21	Repeat step 9. If the oscillator is off frequency overshoot the adjustment of C2 and correct by adjusting L46.									
22	Repeat steps 12 through 21 until all adjustments are obtained.									
23	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	Rec. on channel 6	L5 for beat on het. freq. meter	Fig. 14
24	Antenna terminals loosely	55.25 59.75	Antenna terminals through pad	Channel 2	Not used	—	TP1. Gain to maximum	Rec. on channel 2	Adjust T1 core clockwise to a point at which channel 2 response does not change	Fig. 14
25	"	83.25 87.75	"	Channel 6	Not used	—	"	Rec. on channel 6. "VoltOhmyst" on TP1	Check to see that response is correct and −3.0 volts of osc. injection is present	Fig. 14 Fig. 16
26	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	"	Fig. 16
27	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	Fig. 16
28	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	Fig. 16
29	"	55.25 59.75	"	Channel 2	"	—	"	Rec. on channel 2	"	Fig. 16
30	If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt then switch to channel 6 and adjust L53 for max. amplitude of response between carrier markers.									
31	Check r-f response and oscillator injection on channels 7 through 13 steps 23 back up through step 17 stopping on channel 13 for the next step.									
32	Not used	—	Not used	—	Loosely coupled to r-f oscillator	257 mc.	TP1. Gain to maximum	Rec. on channel 13	C2 for beat on het. freq. meter	Fig. 14
33	"	—	"	—	"	251 mc.	"	Rec. on channel 12	L11 as above	Fig. 14
34	"	—	"	—	"	245 mc.	"	Rec. on channel 11	L10 as above	Fig. 14

ALIGNMENT TABLE

Step No.	CONNECT VHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT VHF SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
23	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. Gain to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	Check to see that response is correct and osc. injection within limits	Fig. 19 Fig. 20
24	"	205.25 209.75	"	Channel 12	Not used	—	"	Rec. on channel 12	"	Fig. 20
25	"	199.25 203.75	"	Channel 11	"	—	"	Rec. on channel 11	"	Fig. 20
26	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	Fig. 20
27	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	Fig. 20
28	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	Fig. 20
29	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	"	Fig. 20
30	Check r-f response and oscillator injection on channels 7 through 13, adjusting C7, C10 or C15 if necessary, stopping on channel 13 for the next step.									
31	Not used	—	Not used	—	Loosely coupled to r-f oscillator	257 mc.	TP1. Gain to maximum	Rec. on channel 13	L42 for beat on het. freq. meter	Fig. 19
32	"	—	"	—	"	251 mc.	"	Rec. on channel 12	L11 as above	Fig. 21
33	"	—	"	—	"	245 mc.	"	Rec. on channel 11	L10 as above	Fig. 21
34	"	—	"	—	"	239 mc.	"	Rec. on channel 10	L9 as above	Fig. 21
35	"	—	"	—	"	233 mc.	"	Rec. on channel 9	L8 as above	Fig. 21
36	"	—	"	—	"	227 mc.	"	Rec. on channel 8	L7 as above	Fig. 21
37	"	—	"	—	"	221 mc	"	Rec. on channel 7	L6 as above	Fig. 21
38	"	—	"	—	"	129 mc.	"	Rec. on channel 6	L5 as above	Fig. 21
39	"	—	"	—	"	123 mc.	"	Rec. on channel 5	L4 as above	Fig. 21
40	"	—	"	—	"	113 mc	"	Rec. on channel 4	L3 as above	Fig. 21
41	"	—	"	—	"	107 mc.	"	Rec. on channel 3	L2 as above	Fig. 21
42	"	—	"	—	"	101 mc	"	Rec. on channel 2	L1 as above	Fig. 21
43	Repeat steps 31 through 42 as a check. Upon completion, remove 39 ohm resistor and reconnect link to terminals A and B of T104.									
	KRK22A ANTENNNA MATCHING UNIT ALIGNMENT									
44	Do not adjust this unit unless fairly certain that it requires adjustment. Disconnect lead from L53 to S4. Connect output of matching unit through 1000 mmf. to pin 1 of V107. Replace cover on matching unit. Remove V106 from socket. Connect bias box to junction of R127 and R147 and set to produce −5 volts.									
45	Antenna terminals	45.75 mc. 30% mod.	Not used	—	Not used	—	Junction R138 and L105. Scope gain to max.	—	L54 for min. audio on scope	Fig. 19
46	"	41.25 mc 30% mod.	"	—	"	—	"	—	L57 for min. audio on scope	Fig. 19
47	Antenna terminals loosely	—	Antenna terminals through pad	45 to 54 mc.	"	—	Scope xtal probe from L53 to ground	Connect 300 ohms from L53 to gnd.	L55 and L56 to obtain response of Fig. 22	Fig. 19 Fig. 22
48	Remove bias supply and 1000 mmf. capacitor. Restore connection between L53 and S4. Replace V106.									
	KRK12 VHF TUNER ALIGNMENT									
1	Not used	—	Not used	—	Not used	—	Not used	Insert adapter and meter in 6S4 cathode circuit. Short contacts 12 and 13	R6 for 28 ma. reading on meter. (See text for alternate method)	Fig. 9 Page 14
2	Antenna terminals loosely	55.25 59.75	Antenna terminals through pad	Channel 2	"	—	TP1. Through pre-amplifier if required	Adapter switch "off". Receiver on Channel 2. Ground AGC terminal on tuner.	T6, L29 and L30 for response shown in Fig. 23(b)	Fig. 9 Fig 23 Fig. 24 Pg. 17
3	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	"
4	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	"
5	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	T5, L26 and L27 for response shown in Fig. 23(b)	"
6	"	83.25 87.75	"	Channel 6	"	—	"	Rec. on channel 6	"	"
7	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	T4, L23 and L24 for response shown in Fig. 23(b)	"
8	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	"
9	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	"
10	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	"
11	"	199.25 203.75	"	Channel 11	"	—	"	Rec. on channel 11	T3, L20 and L21 for response shown in Fig. 23(b)	"
12	"	205.25 209.75	"	Channel 12	"	—	"	Rec. on channel 12	"	"
13	"	211.25 215.75	"	Channel 13	"	—	"	Rec. on channel 13	"	"
14	Not used	—	Not used	—	Loosely coupled to rf oscillator	257 mc.	Junction of R138 and L105. Use 3 to 5V. P-P.	Adapter switch "on". AGC rf bias −3.5V. IF bias −5V at R127, R147 Rec. on channel 13	L22 for beat on het. freq. meter	Fig. 9 Fig. 24
15	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	"	"	T1 for max. gain. L21 for response shown in Fig. 13	Fig. 13 Fig. 24
16	Repeat steps 14 and 15 for all VHF channels adjusting approximate mixer slug for response shown in Figure 13.									
17	Junction C2-L2 at end opposite antenna plug	43.5 mc.	Antenna terminals through pad	Channel 6	Not used	—	Junction of R138 and L105	Rec. on channel 6	C16-L7 for min. 43.5 MC. indication on scope	Fig. 24

ALIGNMENT TABLE

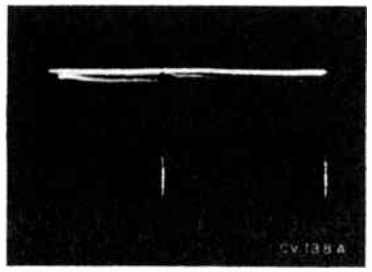
Step No.	CONNECT UHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT UHF SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT VHF SIGNAL GENERATOR TO	SIGNAL GEN FREQ MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	KRK12 UHF TUNER ALIGNMENT									
18	Antenna terminals loosely	Picture and sound carrier markers of channel to be aligned	Antenna terminals through pad	Sweeping channel being aligned. Use full sweep width	Not used	—	TP1. Through pre-amplifier if required	AGC terminal on tuner grounded. Adapter switch in OFF position	C29, C30 and C31 for channels 14 to 52 or C6, C7 and C8 for channels 53 to 83, to obtain response shown in Fig. 25 (a) (b) or (c)	Fig. 9 Fig. 24 Fig. 25
19	Repeat the above step for all UHF inserts to be used. Adjusting antenna, link coupling and mixer slugs for response shown in Fig. 25.									
20	Test point TP1	Picture carrier freq. of channel to be aligned	Antenna terminals through pad	Sweeping channel being aligned. 45.75 mc. marker placed as shown in Fig. 13. Adjust generator freq. to position marker	Test point TP1	45.75 mc.	Junction of R138 and L105. 3 to 5V. P-P on scope	Adapter switch ON. AGC r-f bias at tuner terminal −3.5V. I-f bias −5V. at junction of R127 and R147. Channel switch to channel being aligned	Oscillator C9 or C32 to bring marker to coincide on response curve with 45.75 mc. marker from VHF generator	Fig. 9 Fig. 13 Fig. 24
21	"	"	"	"	"	"	"	"	Mixer C8 or C31 for max. gain with response shown in Fig. 13	Fig. 13 Fig. 24
22	"	"	"	"	"	"	"	As above. "VoltOhmyst" to TP1. Use 1.5V. scale on meter	Oscillator injection adjustment to read .3V. or less at TP1	Fig. 24
23	Repeat steps 20 to 22 for all UHF inserts, checking oscillator frequency and injection voltage for each insert.									

PICTURE I-F AND TRAP ADJUSTMENT

Step No.	CONNECT VHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT VHF SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
1	Not used	—	Not used	—	Not used	Junction of R127 & R147	Connect bias box to junction of R127 & R147 and to ground AGC fully clockwise	Adjust potentiometer for −5.0 volts on meter	Fig. 3
2	Terminals A and B of T104	44.5	"	—	"	Junction R138 and L105 and to ground	Bias box connected as above	T108 (top) for max.	Fig. 29
3	"	45.5	"	—	"	"	"	T107 (top) for max.	Fig. 29
4	"	43.0	"	—	"	"	"	T106 (top) for max.	Fig. 29
5	"	47.25	"	—	"	"	"	T104 (top) for min.	Fig. 24
6	Connected loosely to diode probe	Various See Fig. 11 or Fig. 13	Mixer grid test point TP2 in series with 1500 mmf. for KRK11B or KRK-22A. Front term. of IN82 crystal for KRK12	40 to 48 mc.	Scope diode probe to pin 5 of V106 and to gnd. Connect a 180 ohm resistor from pin 5 of V106 to pin A of T106	"	Shunt terminals A and B of T107 and T108 with 330 ohms. Bias box connected as above. .3v p-p on scope	Set C119 to min. Adjust T1 top and T104 bot. (T1, T2 and T104 on KRK12) for max. gain with 45.75 mc. at 70%. C119 for 42.5 at 70%	Fig. 29 Fig. 30
7	Connected loosely to grid of 1st pix i-f. Adjust for small marker indication	"	"	"	Connect scope to junction of R138 and L105. Remove shunt & diode probe used above	"	Remove shunts from T107 & T108	Retouch T106, T107 and T108 to obtain response shown in Fig. 11 or Fig. 13	Fig. 11 Fig. 13 Fig. 29
	RATIO DETECTOR, SOUND I-F AND 4.5 MC TRAP ALIGNMENT								
8	Grid 1st Snd. I-F (pin 1, V101) or WR39B or C connect to grid 3rd pix I-F (pin 1, V108)	45.75 mc. mod. by 4.5 mc.	Not used	—	Not used	Pin 2 of V103	Set signal gen. to give 6V on meter	T102 top core for max. d-c on meter	Fig. 29
9	"	"	"	—	"	"	"VoltOhmyst" to junction R106 and C108. Adjust T102 bottom core for zero DC on meter. Repeat steps 8 and 9 until all conditions are satisfied.		Fig. 29 Fig. 30
10	Sig. Gen. to 1st Snd. I-F grid	4.5 mc.	"	—	"	"	Signal generator output adjusted to provide 6 v on meter	T101 top core for max. DC on meter	Fig. 29
11	Sig. Gen. in series with 1000 ohms to pin 2 of V109	4.5 mc. mod. 30% with 400 cy.	"	—	Diode probe to pin 6 of V110	Not used	Short pin 1 of V108 to ground	Adjust L105 for minimum output on oscilloscope	Fig. 29

RESPONSE AND WAVE FORM PHOTOGRAPHS

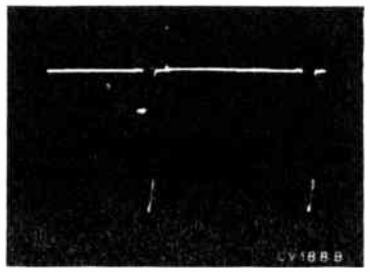
Taken from RCA WO58A Oscilloscope



Grid of Sync Output (Pin 1 of V112A) (6SN7GT) or (Pin 2 of V112A) (12AU7)

Figure 51—Vertical (40 Volts PP)

Figure 52—Horizontal (40 Volts PP)



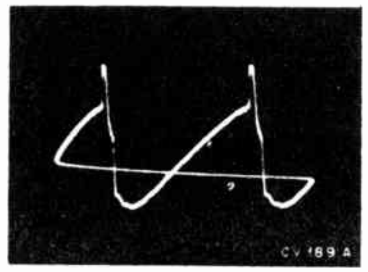
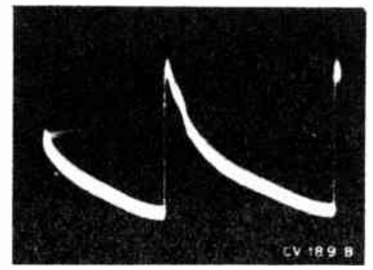


Figure 61—Grid of Horizontal Oscillator Control (Pin 1 of V114) (6SN7GT) (22.5 Volts PP)

Figure 62—Cathode of Horizontal Oscillator Control (Pin 3 of V114) (6SN7GT) (1.2 Volts PP)



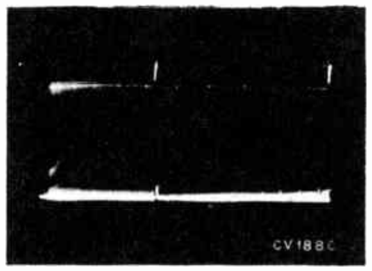
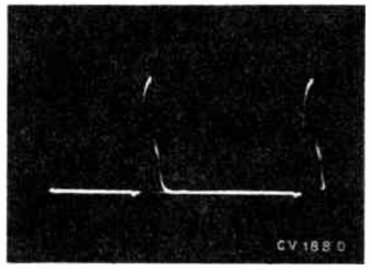


Plate of Sync Output (Pin 2 of V112A) (6SN7GT) or (Pin 1 of V112A) (12AU7)

Figure 53—Vertical (55 Volts PP)

Figure 54—Horizontal (55 Volts PP)



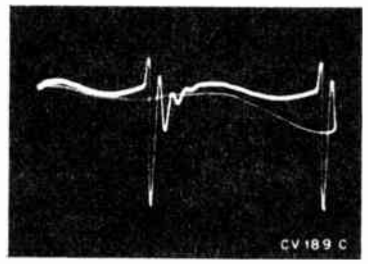
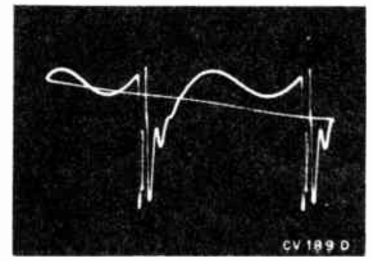


Figure 63—Grid of Horizontal Oscillator (Pin 4 of V114) (6SN7GT) (345 Volts PP)

Figure 64—Plate of Horizontal Oscillator (Pin 5 of V114) (6SN7GT) (175 Volts PP)



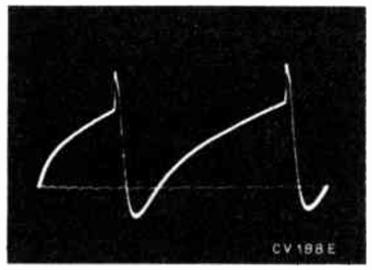
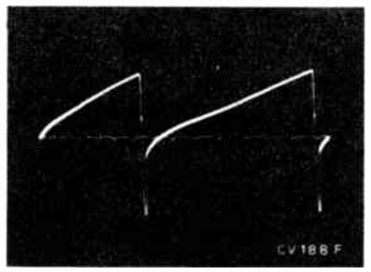


Figure 55—Grid of Vertical Sweep Osc. (Pin 4 of V112B) (6SN7GT) or (Pin 7 of V112B) (12AU7) (21 Volts PP)

Figure 56—Plate of Vertical Sweep Osc. (Pin 5 of V112B) (6SN7GT) or (Pin 6 of V112B) (12AU7) (55 Volts PP)



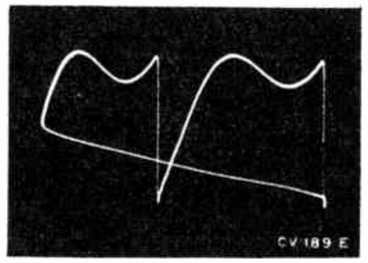
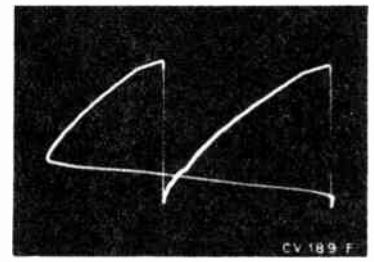


Figure 65—Terminal "C" of T114 (120 Volts PP)

Figure 66—Grid of Horizontal Sweep Output (Pin 5 of V115) (6BQ6GT) (90 Volts PP)



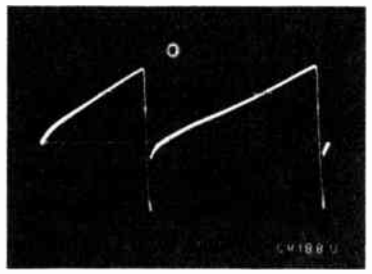
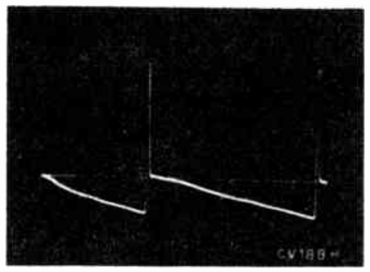


Figure 57—Grid of Vertical Sweep Output (Pin 5 of V113) (6K6GT) (55 Volts PP)

Figure 58—Plate of Vertical Sweep Output (Pin 3 of V113) (6K6GT) (715 Volts PP)



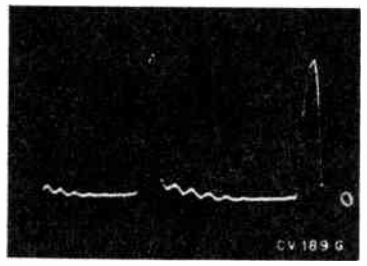
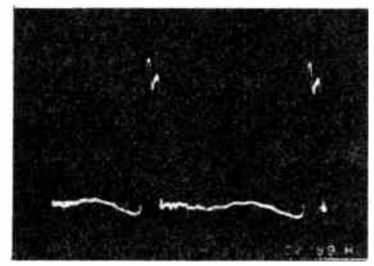
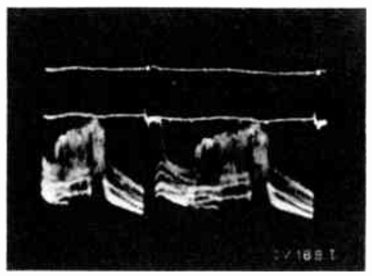


Figure 67—Plate of Horizontal Output (Approx. 4000 Volts PP) (Measured Through a Capacity Voltage Divider Connected from Top Cap of V115 to Ground)

Figure 68—Cathode of Damper (Pin 3 of V117) (6W4GT) (2350 Volts PP)



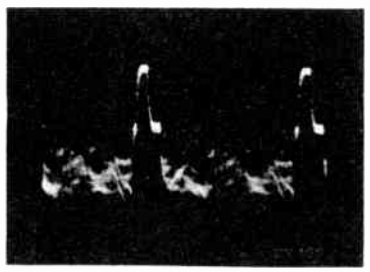


Cathode of Kinescope (Pin 11 of V118) (17CP4)

Voltage depends on picture

Figure 59—Vertical

Figure 60—Horizontal



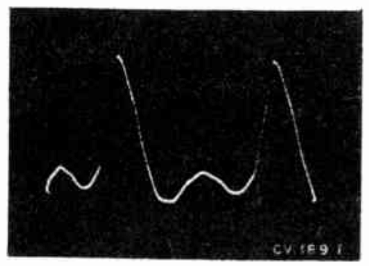
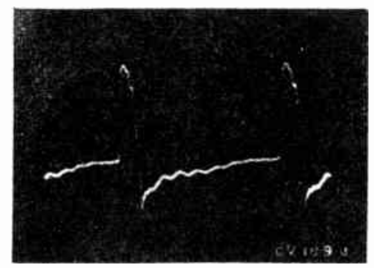


Figure 69—Plate of Damper (Pin 5 of V117) (6W4GT) (160 Volts PP)

Figure 70—Plate of AGC Amplifier (Pin 1 of V111A) (12AU7) (530 Volts PP)



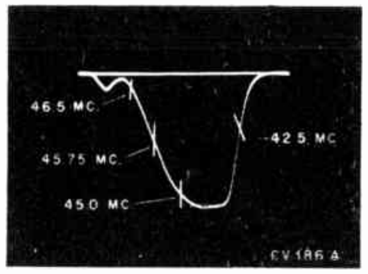
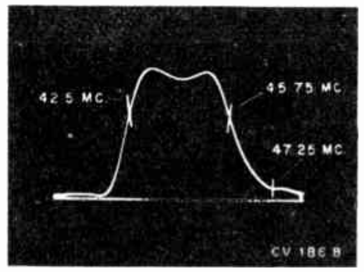


Figure 31—Over-all Pix I-F Response ◄◄◄——

Figure 32—Response of T2-T104 Pix I-F Transformers ►►►——



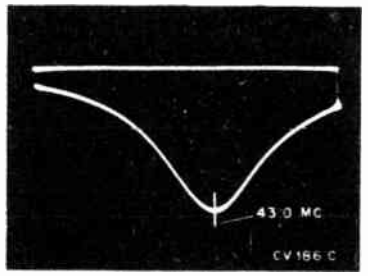
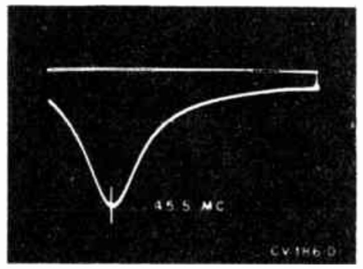


Figure 33—Response of T106 Pix I-F Transformer ◄◄◄——

Figure 34—Response of T107 Pix I-F Transformer ►►►——



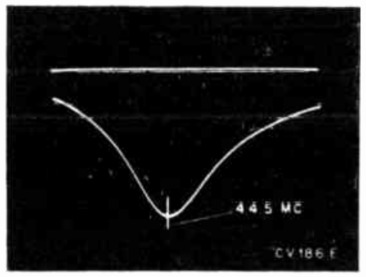
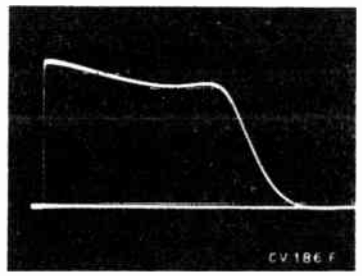
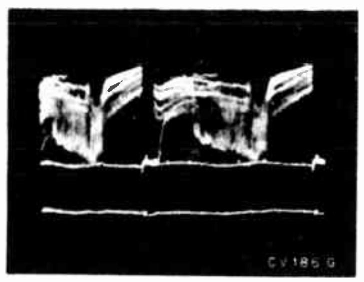


Figure 35—Response of T108 Pix I-F Transformer ◄◄◄——

Figure 36—Video Response at Average Contrast ►►►——

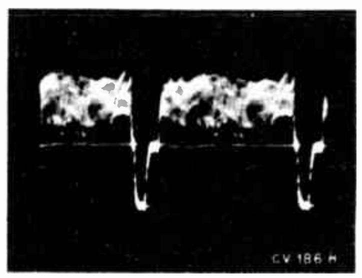




Grid of Video Amplifier (Pin 2 of V110) (6CL6) Voltage Depends on Picture

Figure 37—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (3 Volts PP) ◄◄◄——

Figure 38—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (3 Volts PP) ►►►——



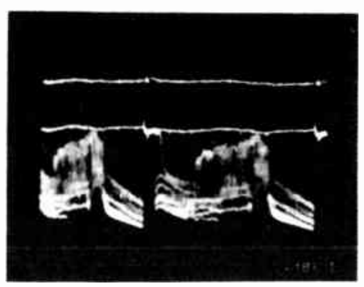
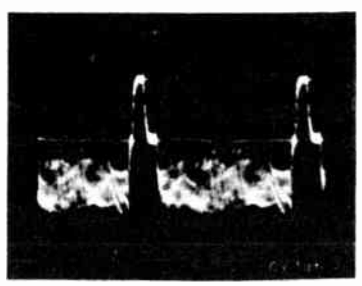


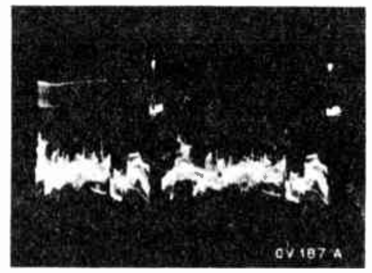
Plate of Video Amplifier (Pin 6 of V110) (6CL6)

Voltage depends on picture

Figure 39—Vertical (105 Volts PP) ◄◄◄——

Figure 40—Horizontal (105 Volts PP) ►►►——

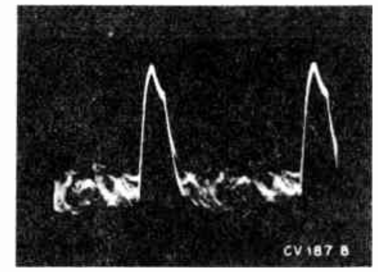


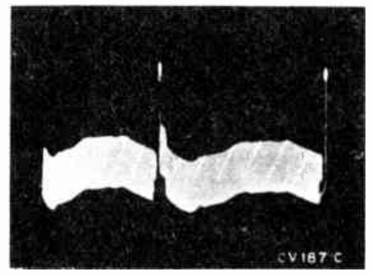


Grid of Horizontal Sync Separator (Pin 7 of V111B) (12AU7) Voltage depends on picture

Figure 41—Vertical (85 Volts PP) ◄◄◄——

Figure 42—Horizontal (85 Volts PP) ►►►——





Cathode of Horizontal Sync Sep. (Pin 8 of V111B) (12AU7)

Figure 43—Vertical (12 Volts PP) ◄◄◄——

Figure 44—Horizontal (7.5 Volts PP) ►►►——

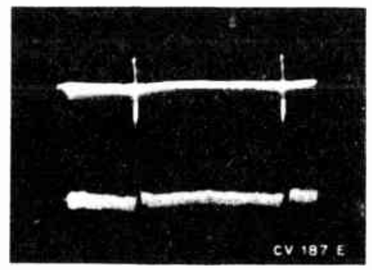
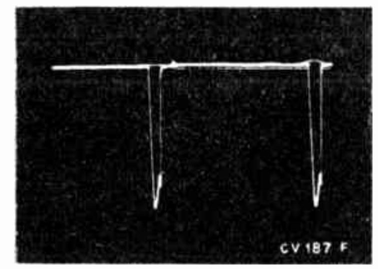
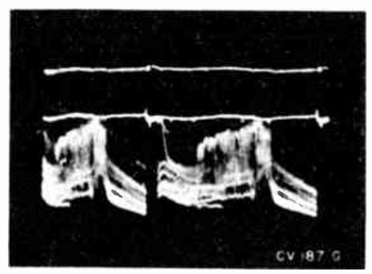


Plate of Horizontal Sync Separator (Pin 6 of V111B) (12AU7)

Figure 45—Vertical (45 Volts PP) ◄◄◄——

Figure 46—Horizontal (45 Volts PP) ►►►——





Grid of Vertical Sync Sep. (Pin 7 of V109B) (12AU7)

Figure 47—Vertical (65 Volts PP) ◄◄◄——

Figure 48—Horizontal (65 Volts PP) ►►►——

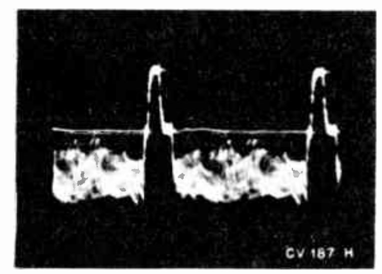
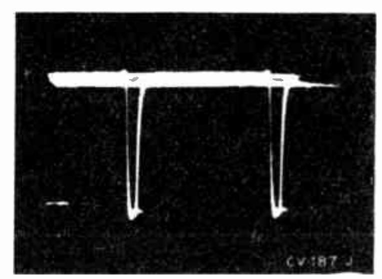


Plate of Vertical Sync Sep. (Pin 6 of V109B) (12AU7)

Figure 49—Vertical (70 Volts PP) ◄◄◄——

Figure 50—Horizontal (70 Volts PP) ►►►——



TUNER UNIT WIRING DIAGRAMS

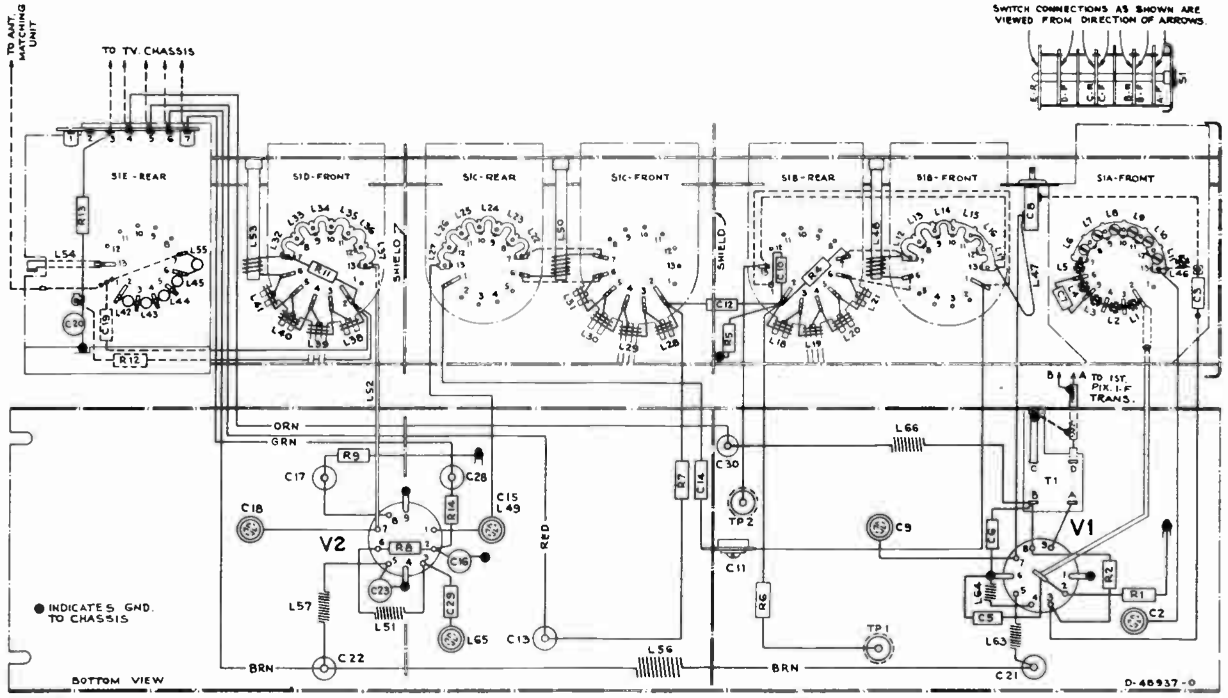


Figure 79—KRK11B Tuner Unit Wiring Diagram

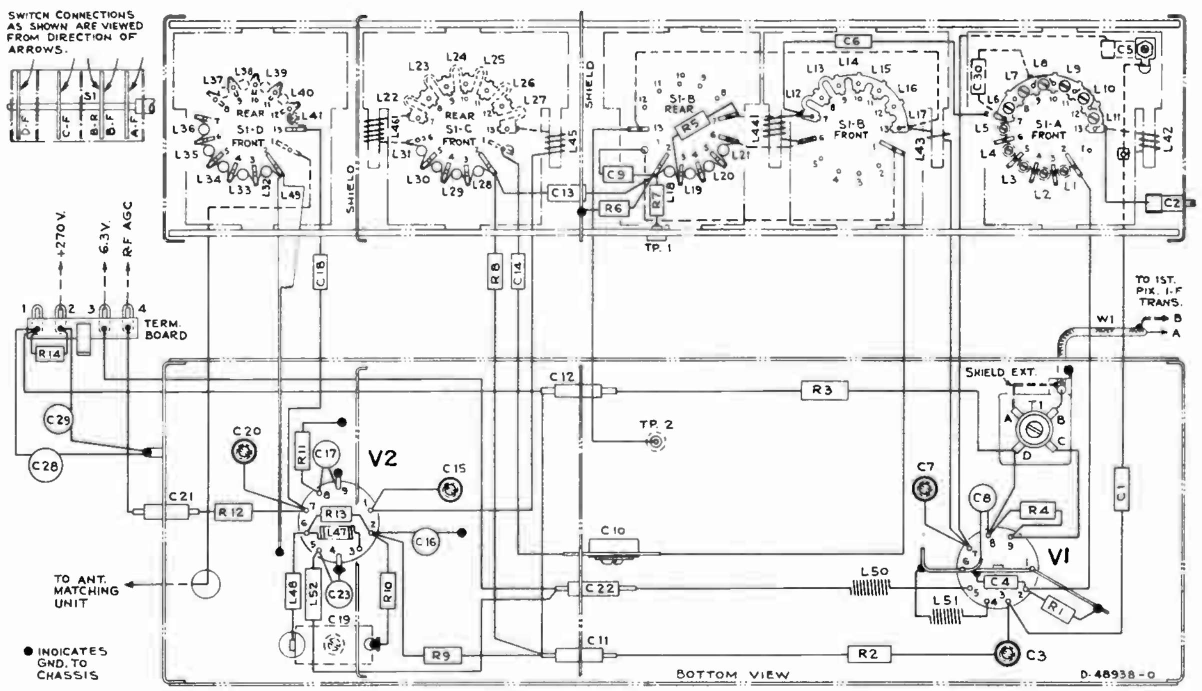


Figure 80—KRK22A Tuner Unit Wiring Diagram

TUNER UNIT WIRING DIAGRAM

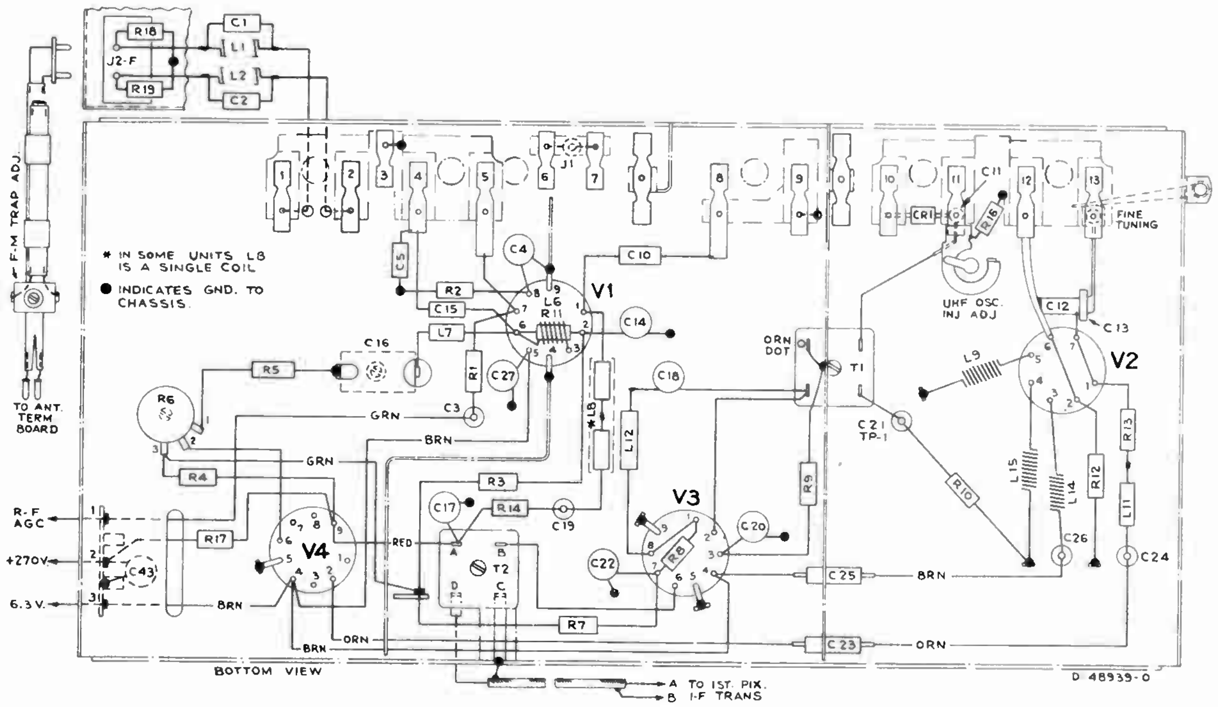


Figure 81—KRK12 Tuner Unit Wiring Diagram

CRITICAL LEAD DRESS

(1) Keep all wiring in the pix i-f, sound i-f and video circuits as short as possible.

(2) Keep the leads on C127, C128, C129, C130, C131, C132, C133 and C135 as short and direct as possible.

(3) Do not run any leads under C119 trimmer capacitor.

(4) Do not change the bus wire connection to pins 2 and 8 of V101 and V102. Sleeving is used on these wires to insure length and to prevent shorting.

(5) Dress C143 close to chassis.

(6) Keep leads on R129 as short and direct as possible.

(7) Keep C134 up and away from chassis with not more than ¼" lead at each end to terminal.

(8) Dress the lead from T106-C to terminal board close to chassis.

(9) Keep all filament leads dressed close to chassis.

(10) Keep leads on R116 as short and direct as possible.

(11) Ground the filaments of sockets V106, V107 and V108 independently of the tube shields (pin 8). Use ground lances provided near each socket.

(12) Keep leads to L105 (4.5 mc. trap) as short as possible.

(13) Do not run any leads other than the 135 v. and 270 v. bus wires under the lead from T105-B to pin 2 of V110.

(14) Dress L104 and L106 peaking coils up from chassis.

(15) Dress R157, R141, R162, R192, R142, L106, L102, L107, C139, C171 and R138 up from chassis.

(16) Do not tape lead to kinescope cathode in with other leads.

(17) Keep leads on C144 short and direct.

(18) Keep the leads on R209 as short and direct as possible.

(19) Dress C183 to provide access to adjustment of T114.

(20) Keep C167 and C169 dressed close to chassis.

(21) Dress all leads in the high voltage compartment away from each other and away from the high voltage transformer.

(22) C109 should be centered and held in place by shield.

(23) Do not change dress of the audio cable.

(24) Do not change grounding of R110A or R110B.

(25) Dress the lead from pin 1 of V111 around power transformer side nearest apron.

(26) Keep C110 and C111 dressed apart from each other.

(27) Keep AC switch leads away from tubes on top of chassis.

(28) Dress all leads away from T104 as far as possible.

(29) Keep leads to pin 1 of V114 up away from chassis.

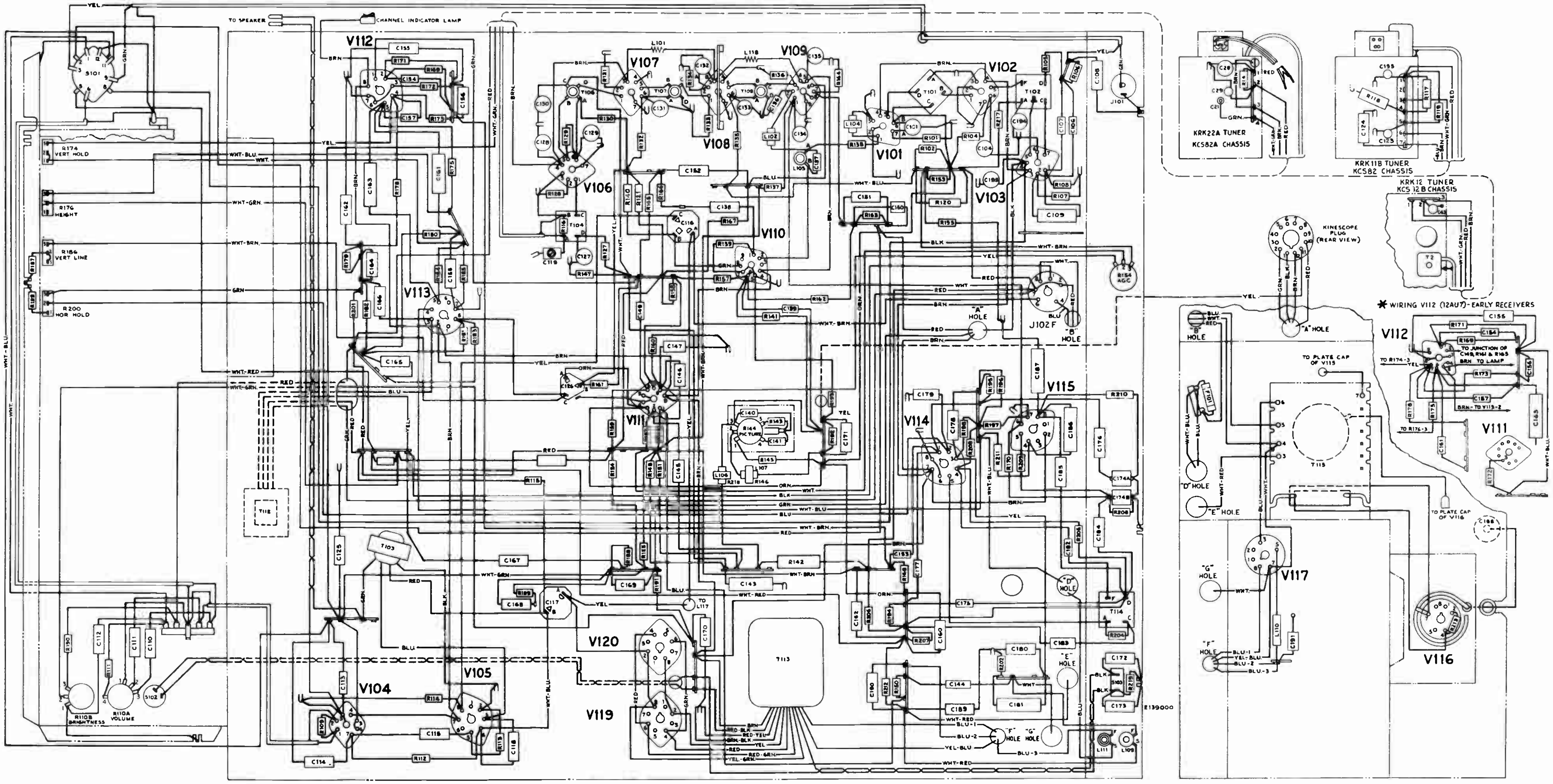


Figure 82—Chassis Wiring Diagram, KCS82, KCS82A & KCS82B

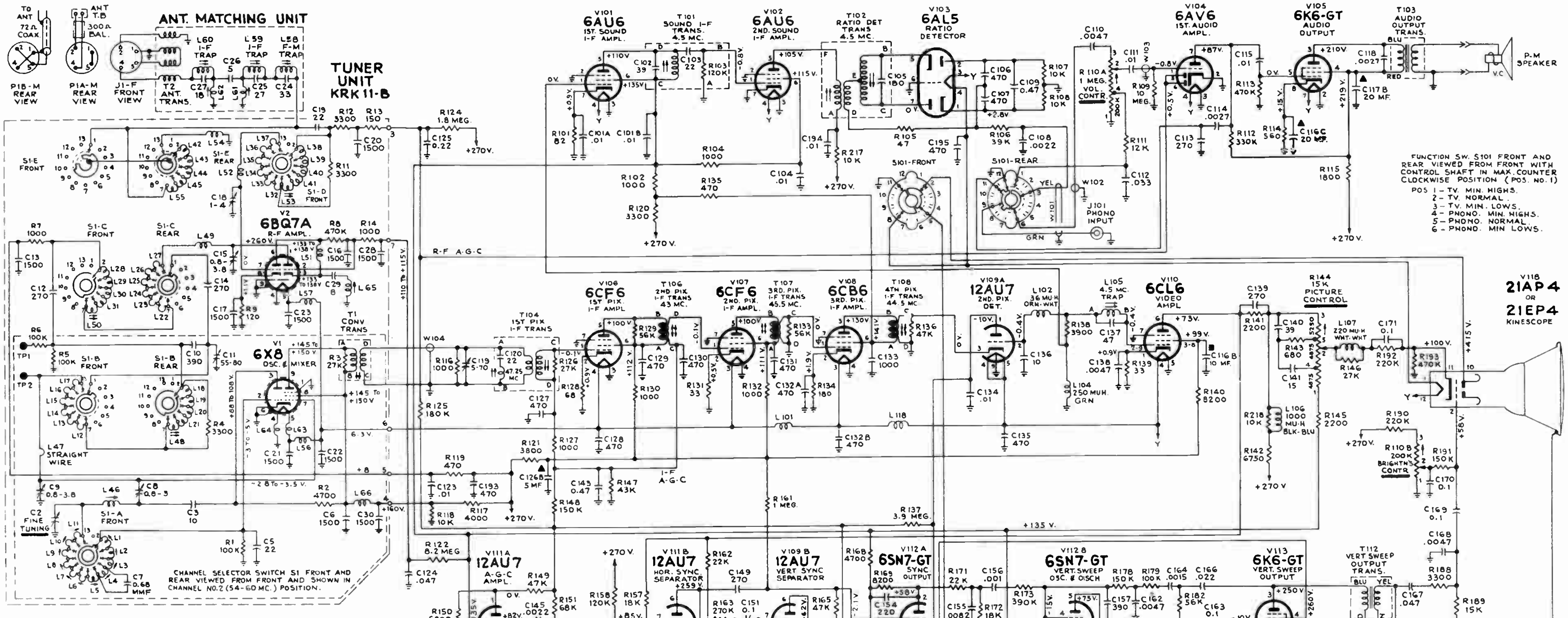
VOLTAGE CHART

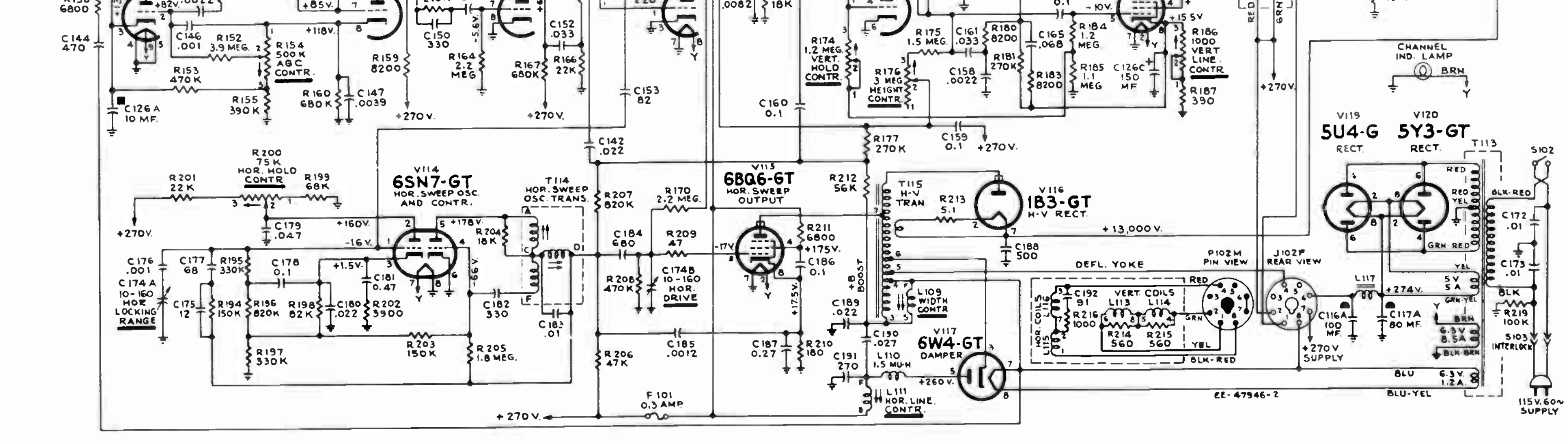
The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
KRK11B			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
KRK22A		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V2	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
KRK11B			No Signal	6	133	—	—	8	1.1	7	0	
KRK22A		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V1	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	Shelf removed from tuner box. 6S4 removed from socket to protect oscillator. AGC terminal on tuner grounded.
KRK12			No Signal	6	138	—	—	8	1.0	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	260	—	—	3	143	2	97	
			No Signal	1	250	—	—	3	137	2	97	
V2	6AF4	R-F Oscillator	15000 Mu. V. Signal	1 & 7	78	—	—	5	0	2 & 6	−8	
KRK12			No Signal	1 & 7	75	—	—	5	0	2 & 6	−6	
V3	6BQ7A	I-F Amplifier	15000 Mu. V. Signal	6	270	—	—	8	148	7	103	Shelf removed from tuner box. 6S4 removed from socket to protect oscillator. AGC terminal on tuner grounded.
			No Signal	6	260	—	—	8	142	7	99	
KRK12		I-F Amplifier	15000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	
			No Signal	1	143	—	—	3	1.2	2	0	
V4	6S4	Voltage Control	15000 Mu. V. Signal	9	270	—	—	2	94	6	*68	*Depends on adjustment of R6.
KRK12			No Signal	9	260	—	—	2	90	6	*65	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	127	6	140	7	1.0	1	0	
			No Signal	5	110	6	135	7	.9	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	125	6	136	7	0	1	−13	
			No Signal	5	105	6	115	7	0	1	*−0.8	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	0.3	—	—	1	7.2	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	0	—	—	1	*2.8	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	89	—	—	2	0	1	−0.8	At min. volume
			No Signal	7	87	—	—	2	0	1	−0.8	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	217	4	225	8	15.2	5	0	At min. volume
			No Signal	3	210	4	219	8	15.0	5	0	At min volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	202	6	225	2	<0.1	1	−7.5	
			No Signal	5	100	6	112	2	0.9	1	*−0.1	*Unreliable measuring point. Make measurement at T104-B.
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	205	6	225	2	<0.1	1	−7.5	
			No Signal	5	100	6	111	2	0.5	1	−0.1	

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	140	6	155	2	2.1	1	0	
			No Signal	5	130	6	141	2	1.9	1	0	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	−21	—	—	3	0	2	−3.8	
			No Signal	1	−10	—	—	3	0	2	−0.4	
V109B	12AU7	Vert. Sync Separator	15000 Mu. V. Signal	6	68	—	—	8	0	7	58	
			No Signal	6	62	—	—	8	0	7	−5.6	
V110	6CL6	Video Amplifier	15000 Mu. V. Signal	6	82	3-8	180	1	1.1	2-9	−3.4	AGC control set for normal operation
			No Signal	6	73	3-8	99	1	0.9	2-9	−0.4	AGC control set for normal operation
V111A	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	42	—	—	3	148	2	115	
			No Signal	1	0	—	—	3	135	2	82	
V111B	12AU7	Hor. Sync Separator	15000 Mu. V. Signal	6	267	—	—	8	171	7	101	
			No Signal	6	259	—	—	8	118	7	85	
V112A	6SN7GT	Sync Output	15000 Mu. V. Signal	2	60	—	—	3	0	1	−2.7	
			No Signal	2	58	—	—	3	0	1	−2.1	
V112B	6SN7GT	Vertical Oscillator	15000 Mu. V. Signal	5	76	—	—	6	0	4	−16	Depends on setting of Vert. hold control
			No Signal	5	75	—	—	6	0	4	−15	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	260	4	270	8	15.9	5	−11	
			No Signal	3	250	4	260	8	15.5	5	−10	
V114A	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	172	—	—	3	−2.2	1	−25	
			No Signal	2	160	—	—	3	1.5	1	−16	
V114B	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	180	—	—	6	0	4	−74	
			No Signal	5	178	—	—	6	0	4	−66	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	180	8	18	5	−17.5	*High Voltage Pulse Present
			No Signal	Cap	*	4	175	8	17.5	5	−17	*High Volatge Pulse Present
V116	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	14,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	13,000	—	—	*High Voltage Pulse Present
V117	6W4GT	Damper	15000 Mu. V. Signal	5	270	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	260	—	—	3	*	—	—	*High Voltage Pulse Present
V118	21AP4	Kinescope	15000 Mu. V. Signal	Cap	14,000	10	430	11	120	2	78	At average Brightness
			No Signal	Cap	13,000	10	415	11	100	2	58	At average Brightness
V119	5U4G	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	285	—	—	
V120	5Y3GT		No Signal	4 & 6	—	—	—	2 & 8	274	—	—	

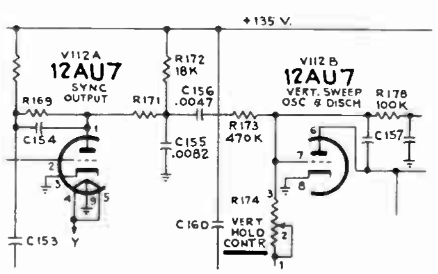




PRODUCTION CHANGES IN KCS82, KCS82A AND KCS82B

The schematics are shown in the latest condition. The note below tells how early receivers differed from the schematics shown above and on pages 38 and 40.

In early production receivers V112 was a 12AU7 and was connected as shown below.



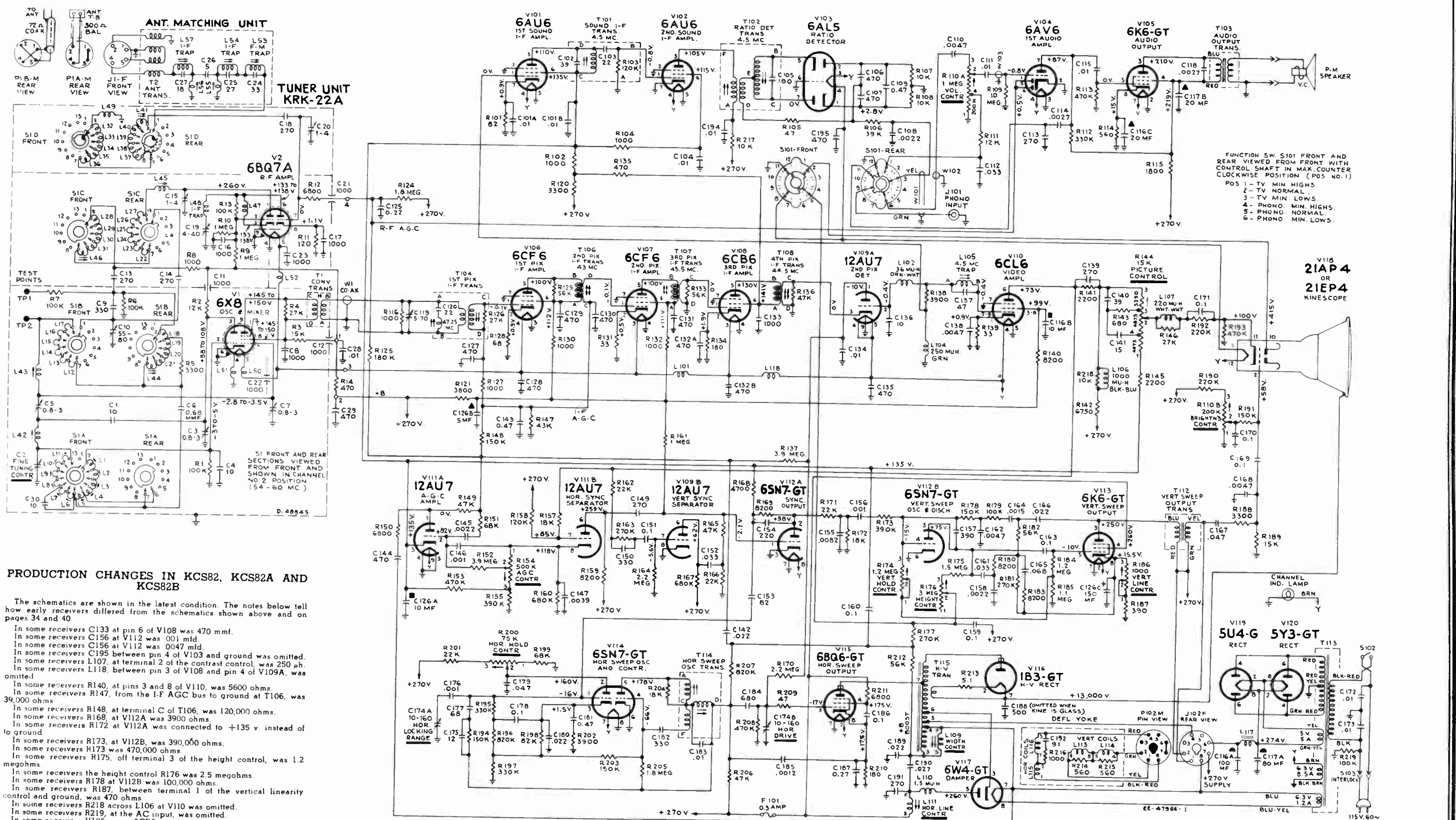
The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 83—Circuit Schematic Diagram KCS82



PRODUCTION CHANGES IN KCS82, KCS82A AND KCS82B

The schematics are shown in the latest condition. The notes below tell how early receivers differed from the schematics shown above and on pages 34 and 40.

In some receivers C133 at pin 6 of V108 was 470 mmf.
In some receivers C156 at V112 was .001 mfd.
In some receivers C156 at V112 was .0047 mfd.
In some receivers C195 between pin 4 of V103 and ground was omitted.
In some receivers L107, at terminal 2 of the contrast control, was 250 μh.
In some receivers L118, between pin 3 of V108 and pin 4 of V109A, was omitted.
In some receivers R140, at pins 3 and 8 of V110, was 5600 ohms.
In some receivers R147, from the I-F AGC bus to ground at T106, was 39,000 ohms.
In some receivers R148, at terminal C of T106, was 120,000 ohms.
In some receivers R168, at V112A was 3900 ohms.
In some receivers R172 at V112A was connected to +135 v. instead of to ground.
In some receivers R173, at V112B, was 390,000 ohms.
In some receivers R173 was 470,000 ohms.
In some receivers R175, off terminal 3 of the height control, was 1.2 megohms.
In some receivers the height control R176 was 2.5 megohms.
In some receivers R178 at V112B was 100,000 ohms.
In some receivers R187, between terminal 1 of the vertical linearity control and ground, was 470 ohms.
In some receivers R218 across L106 at V110 was omitted.
In some receivers R219, at the AC input, was omitted.
In some receivers V106 was a 6CB6.
In some receivers V107 was a 6CB6.
In Models 21-T-313G, 314G, 313GU and 314GU the kinescope V118 is a 21EP4.
In some receivers the heater terminals 2 and 7 of V105 were reversed.
In some receivers V112 was a 12AU7 (see page 33 for wiring).
In some receivers the heater terminals 2 and 7 of V115 were reversed.

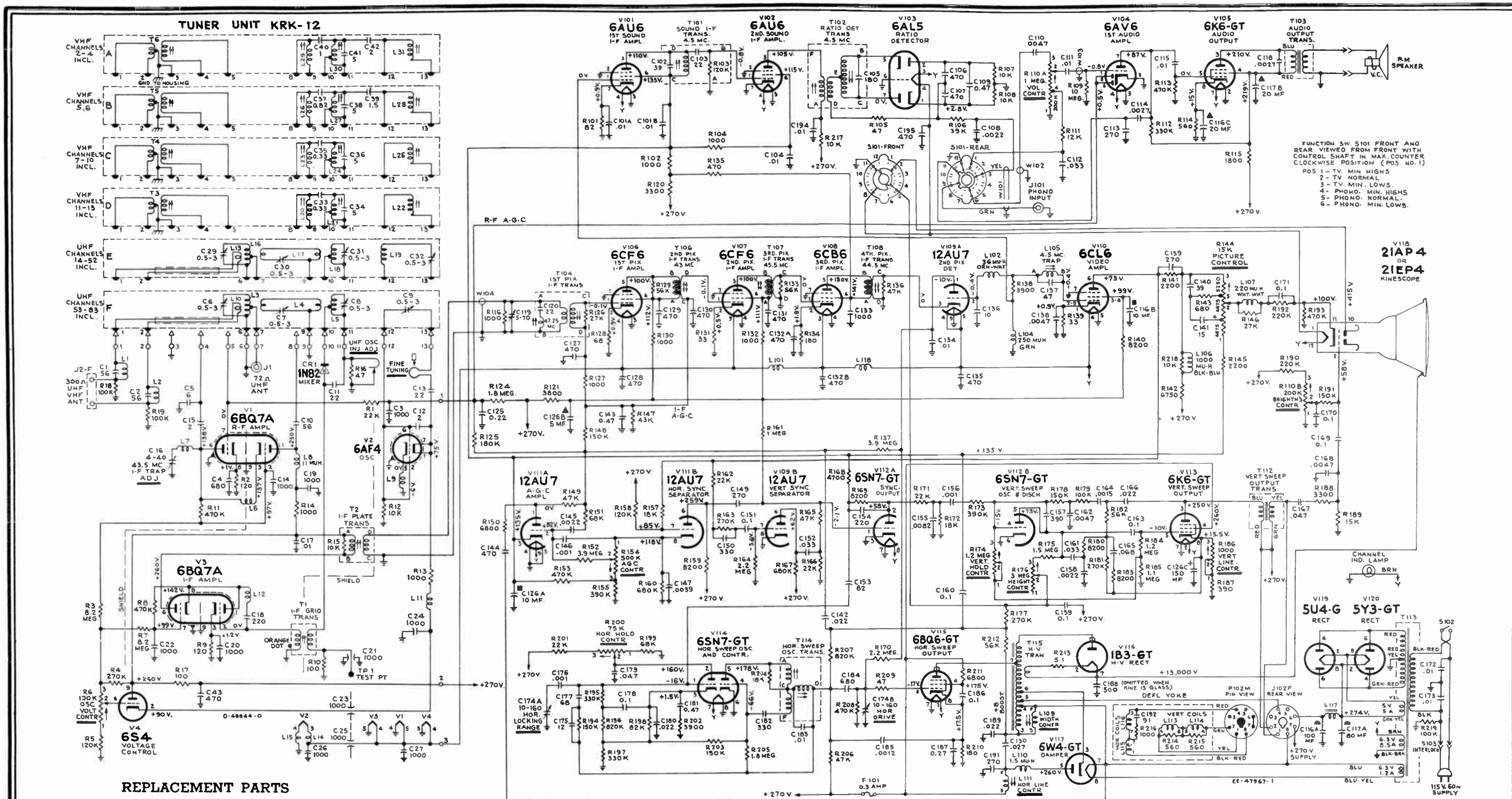
The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 84—Circuit Schematic Diagram KCS82A



REPLACEMENT PARTS

STOCK No.	DESCRIPTION
76965	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts (C7)
77151	Capacitor—Tubular, adjustable, steatite, 0.8-3 mmf. (C8)
75184	Capacitor—Ceramic, adjustable, 0.8-3.8 mmf., complete with adjusting stud (C9)
76532	Capacitor—Adjustable trimmer, steatite, 1-4 mmf. (C18)
	Capacitors—Ceramic, fixed, non-insulated:
93056	5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C26)
70597	8 mmf., ±1 mmf., 500 volts DC, Temp. coef. = 0 (C29)
• 55326	10 mmf., ±1 mmf., 500 volts DC, Temp. coef. = −80 (C3)
54207	18 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C27)
76557	22 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C19)
76558	22 mmf., ±10%, 500 volts DC, Temp. coef. = −750 Special—copper coated (C5)
70935	27 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C25)
76739	33 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C24)
76527	Capacitor—Mica trimmer, 55-80 mmf. (C11)

The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 85—Circuit Schematic Diagram KCS82B

STOCK No.	DESCRIPTION
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf., ±20%, 500 volts DC, High "K" type (C12, C14)
75641	Capacitor—Fixed, ceramic, insulated, 390 mmf., ±10%, 500 volts DC, High "K" type (C10)
75166	Capacitor—Ceramic, 1500 mmf. (stand-off) (C13, C21, C22, C28, C30)
75610	Capacitor—Fixed, ceramic, insulated, 1500 mmf., ±20%, 500 volts DC, High "K" type (C6)
73748	Capacitor—Fixed, ceramic, 1500 mmf., +100%, −0%, 500 volts DC, High "K" disc (C16, C17, C20, C23)
73591	Coil—Antenna matching coil (2 req'd)
73477	Coil—Choke coil (L57)
77206	Coil—Filament choke coil (L56)
76763	Coil—Filament choke coil (L63, L64)
76562	Coil—RF amplifier coupling coil (L51)

STOCK No.	DESCRIPTION
77153	Coil—RF choke coil (L66)
76537	Coil—Shunt coil complete with adjustable core (L61)
76538	Coil—Shunt coil complete with adjustable core (L62)
76529	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r.f. section (L49, C15)
	Resistors—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R9)
503115	150 ohms, ±10%, ½ watt (R13)
503210	1000 ohms, ±10%, ½ watt (R7, R14)
503233	3300 ohms, ±10%, ½ watt (R4, R11, R12)
503247	4700 ohms, ±10%, ½ watt (R2)
503410	100,000 ohms, ±10%, ½ watt (R1, R5, R6)
503447	470,000 ohms, ±10%, ½ watt (R8)

STOCK No.	DESCRIPTION
76536	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, L58, L59, L60, L61, L62, J1)
77663	Transformer—Convertor transformer complete with adjustable core (T1, R3)
76535	Trap—I.F. trap
76542	Trap—I.F. trap (41.25 MC) complete with core (L60)
76541	Trap—I.F. trap (45.75 MC) complete with core (L59)
76540	Trap—F.M. trap complete with adjustable core (L58)
77853	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
77913	Capacitor—Tubular, adjustable, steatite, 0.8-3.0 mmf. (C5)
71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts DC (C6)
77151	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. (C3, C7)

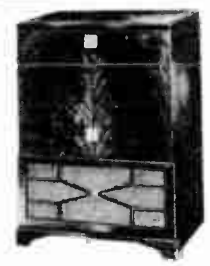
STOCK No.	DESCRIPTION
76532	Capacitor—Adjustable, steatite, 1-4 mmf. (C15, C20)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C19)
93056	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C26)
77865	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts DC, Temp. coef. = 0 (C1, C30)
78247	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts, Temp. coef. = −750 (C4)
54207	Capacitor—Fixed, ceramic, non-insulated, 18 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C27)
70935	Capacitor—Fixed, ceramic, non-insulated, 27 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C25)
76739	Capacitor—Fixed, ceramic, non-insulated, 33 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C24)
76527	Capacitor—Mica trimmer, 55-80 mmf. (C10)
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf., ±20%, 500 volts DC, High "K" type (C13, C14, C18)
76552	Capacitor—Fixed, ceramic, insulated, 330 mmf., ±10%, 500 volts DC, High "K" type (C9)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 volts DC, High "K" disc (C29)
77084	Capacitor—Ceramic, feed-thru, 1000 mmf. (C11, C12, C21, C22)
77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C8, C16, C17, C23)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C28)
77854	Clip—Mounting clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T2)
73874	Coil—Channel #6 mixer coil (L44)
73460	Coil—Channel #6 r.f. plate coil (L46)
77915	Coil—Channel #13 oscillator coil (L42)
77919	Coil—Channel #13 mixer coil (L43)
77921	Coil—Channel #13 r.f. plate coil (L45)
77206	Coil—Filament choke coil (L52)
76763	Coil—Heater choke coil (L50, L51)
76562	Coil—RF amplifier coupling coil (L47)
76537	Coil—Shunt coil complete with adjustable core (L55)
76538	Coil—Shunt coil complete with adjustable core (L56)
	Resistor—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R11)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R8)
503233	3300 ohms, ±10%, ½ watt (R5)
503268	6800 ohms, ±10%, ½ watt (R12)
523312	12,000 ohms, ±10%, 2 watts (R2)
523315	15,000 ohms, ±10%, 2 watts (R3)
502327	27,000 ohms, ±5%, ½ watt (R4)
503410	100,000 ohms, ±10%, ½ watt (R1, R6, R7, R13)
503510	1 megohm, ±10%, ½ watt (R9, R10)
77858	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
77857	Transformer—Convertor transformer (T1)
76540	Trap—FM trap complete with adjustable core (L53)
77628	Trap—I.F. trap (L48)
76542	Trap—I.F. trap (41.25 MC) complete with core (L57)
76541	Trap—I.F. trap (45.75 MC) complete with core (L54)
77691	Capacitor—Fixed, headed-lead type, 33 mmf., ±10%, 500 volts DC (C33, C35)
77689	Capacitor—Fixed, headed-lead type, .82 mmf., ±10%, 500 volts DC (C37)
77690	Capacitor—Fixed, headed-lead type, 1 mmf., ±10%, 500 volts DC (C40)
71500	Capacitor—Fixed, headed-lead type, 1.5 mmf., ±10%, 500 volts DC (C39)
78047	Capacitor—Fixed, headed-lead type, 2.0 mmf., ±10%, 500 volts DC (C42)
77210	Capacitor—Fixed, ceramic, non-insulated, 2 mmf., ±0.25 mmf., 500 volts DC, Temp. coef. = 0 (C15)
77667	Capacitor—Fixed, ceramic, insulated, comprising 1 section of 2 mmf., and 1 section of 22 mmf., Temp. coef. = −750 (C12, C13)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C16)
77688	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C34, C36, C38, C41)
74182	Capacitor—Fixed, ceramic, non-insulated, 6 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C5)
77621	Capacitor—Fixed, ceramic, crystal holder, 22 mmf., ±10%, Temp. coef. = −750 (C11)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C10)
77625	Capacitor—Fixed, ceramic, 220 mmf., +100%, −0%, 500 volts DC, High "K" disc (C18)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 volts DC, High "K" disc (C43)
77624	Capacitor—Fixed, ceramic, 680 mmf., +100%, −0%, 500 volts DC, High "K" disc (C4)
77084	Capacitor—Ceramic, feed-thru, 1000 mmf. (C21, C23, C25)
77615	Capacitor—Ceramic, stand-off, 1000 mmf. (C3, C19, C24, C26)
77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C14, C20, C22, C27)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C17)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)

STOCK No.	DESCRIPTION
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
77489	Rectifier—Germanium rectifier Type IN82 (CR1)
	Resistors—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R13, R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohms, ±10%, ½ watt (R3, R7)
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
	CHASSIS ASSEMBLIES KCS 82 (KRK11B Tuner Unit) KCS 82A (KRK22A Tuner Unit) KCS 82B (KR12 Tuner Unit)
76456	Bracket—Channel indicator lamp bracket for KCS82
76490	Bracket—Mounting bracket complete with insulator for picture control
71496	Capacitor—Mica trimmer, 5-70 mmf. (C119)
33098	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts DC, Temp. coef. = −750 (C136)
75217	Capacitor—Mica trimmer, dual 10-160 mmf. (C174A, C174B)
33380	Capacitor—Fixed, ceramic, non-insulated, 12 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C175)
39044	Capacitor—Fixed, ceramic, non-insulated, 15 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C141)
73664	Capacitor—Fixed, ceramic, non-insulated, 39 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C140)
76475	Capacitor—Fixed, mica, 68 mmf., 1000 volts (C177)
76474	Capacitor—Fixed, mica, 82 mmf., 1000 volts DC (C153)
39636	Capacitor—Fixed, mica, 220 mmf., 500 volts DC (C154)
39638	Capacitor—Fixed, mica, 270 mmf., 500 volts DC (C139)
47617	Capacitor—Fixed, ceramic, non-insulated, 270 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C113)
76579	Capacitor—Fixed, mica, 270 mmf., 1000 volts DC (C149, C191)
39640	Capacitor—Fixed, mica, 330 mmf., 500 volts DC (C150)
76476	Capacitor—Fixed, mica, 330 mmf., 1000 volts (C182)
73094	Capacitor—Fixed, mica, 390 mmf., 1000 volts DC (C157)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 volts DC, High "K" disc (C127, C128, C129, C130, C131, C135, C195, C193 for KCS82)
77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C133)
77672	Capacitor—Fixed, ceramic, dual 470 mmf., +100%, −0%, 500 volts DC, High "K" disc (C132A, C132B)
77673	Capacitor—Fixed, ceramic, insulated, 470 mmf., ±10%, 1500 volts DC, Special H.V. (C144)
39644	Capacitor—Fixed, mica, 470 mmf., 500 volts DC (C106, C107)
76461	Capacitor—Ceramic, 500 mmf., 20,000 volts (C188)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C104, C134, C194, C123 for KCS82)
76991	Capacitor—Fixed, ceramic, dual 10,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C101A, C101B)
75218	Capacitor—Electrolytic, comprising 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C126A, C126B, C126C)
77644	Capacitor—Electrolytic, comprising 1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C117A, C117B)
76970	Capacitor—Electrolytic, comprising 1 section of 100 mfd., 400 volts, 1 section of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C116A, C116B, C116C)
	Capacitors—Fixed, tubular, oil impregnated:
76479	Moulded, .00068 mfd., 600 volts (C184)
75643	Paper, .001 mfd., 1000 volts (C146, C156, C176)
76995	Moulded, .0012 mfd., 600 volts (C185)
77123	Moulded, .0015 mfd., 1000 volts (C164)
73595	Paper, .0022 mfd., 600 volts (C108, C145, C158)
73599	Paper, .0027 mfd., 600 volts (C114)
73818	Paper, .0027 mfd., 1600 volts (C118)
73796	Paper, .0039 mfd., 600 volts (C147)
73920	Paper, .0047 mfd., 600 volts (C110, C138, C162, C168)
73808	Paper, .0082 mfd., 1000 volts (C155)
73561	Paper, .01 mfd., 400 volts (C111, C115)
73594	Moulded, .01 mfd., 600 volts (C172, C173, C183)
73562	Paper, .022 mfd., 400 volts (C180)
73798	Paper, .022 mfd., 600 volts (C166)
73810	Paper, .022 mfd., 1000 volts (C142, C189)
73811	Paper, .027 mfd., 1000 volts (C190)
73552	Paper, .033 mfd., 400 volts (C112, C152)
73596	Paper, .033 mfd., 1000 volts (C161)
73553	Paper, .047 mfd., 400 volts (C124 for KCS82, C179)
73592	Paper, .047 mfd., 600 volts (C167)

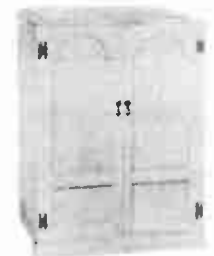
STOCK No.	DESCRIPTION
73792	Paper, .068 mfd., 400 volts (C165)
73784	Paper, 0.1 mfd., 200 volts (C171)
73551	Paper, 0.1 mfd., 400 volts (C151, C159, C169, C170, C178)
73557	Paper, 0.1 mfd., 600 volts (C160, C163, C186)
73794	Paper, 0.22 mfd., 200 volts (C125)
73786	Paper, 0.27 mfd., 200 volts (C187)
73787	Paper, 0.47 mfd., 200 volts (C109, C143, C181)
77676	Choke—Filter choke (L117)
73477	Coil—Choke coil (L101, L118)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
76011	Coil—Peaking coil (36 muh) (L102)
71526	Coil—Peaking coil (250 muh) (L104)
77925	Coil—Peaking coil (220 muh) (L107, R146)
77124	Coil—Peaking coil (1000 muh) (L106, R218)
76640	Coil—RF choke coil (1.5 muh) (L110)
76441	Coil—Width coil complete with adjustable core (L109)
76975	Control—AGC control (R154)
77655	Control—Brightness control, volume control and power switch (R110A, R110B, S102)
77924	Control—Height control (R176)
77639	Control—Horizontal hold control (R200)
76445	Control—Picture control (R144)
77642	Control—Vertical hold control (R174)
77643	Control—Vertical linearity control (R186)
77647	Coupling—Coupling (nylon) for picture control
76986	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
77935	Fuse—0.3 amp., 250 volts (F101)
76796	Resistor—Wire wound, 5.1 ohms, 1/3 watt (R213)
76639	Resistor—Wire wound, 180 ohms, 2 watts (R210)
77670	Resistor—Wire wound, 3300 ohms, 7 watts (R120)
77671	Resistor—Wire wound, 3800 ohms, 7 watts (R121)
77668	Resistor—Wire wound, 4000 ohms, 7 watts (R117 for KCS82)
76642	Resistor—Wire wound, 6750 ohms, 10 watts (R142)
77669	Resistor—Wire wound, 10,000 ohms, 5 watts (R118 for KCS82)
	Resistors—Fixed, composition:
30789	33 ohms, ±5%, ½ watt (R131)
503033	33 ohms, ±10%, ½ watt (R139)
503047	47 ohms, ±10%, ½ watt (R105, R209)
34763	68 ohms, ±5%, ½ watt (R128)
503082	82 ohms, ±10%, ½ watt (R101)
502118	180 ohms, ±5%, ½ watt (R134)
503139	390 ohms, ±10%, ½ watt (R187)
503147	470 ohms, ±10%, ½ watt (R119 for KCS82, R135)
513156	560 ohms, ±10%, 1 watt (R114)
503168	680 ohms, ±10%, ½ watt (R143)
503210	1000 ohms, ±10%, ½ watt (R104, R116, R127, R130, R132)
513210	1000 ohms, ±10%, 1 watt (R102)
523218	1800 ohms, ±10%, 2 watts (R115)
503222	2200 ohms, ±10%, ½ watt (R145)
523222	2200 ohms, ±10%, 2 watts (R141)
503223	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R138)
503239	3900 ohms, ±10%, ½ watt (R202)
502247	4700 ohms, ±5%, ½ watt (R168)
513268	6800 ohms, ±10%, 1 watt (R150)
523268	6800 ohms, ±10%, 2 watts (R211)
503282	8200 ohms, ±10%, ½ watt (R159, R169, R180, R183)
513282	8200 ohms, ±10%, 1 watt (R140)
502310	10,000 ohms, ±5%, ½ watt (R107, R108)
513310	10,000 ohms, ±10%, 1 watt (R217)
503312	12,000 ohms, ±10%, ½ watt (R111)
503315	15,000 ohms, ±10%, ½ watt (R189)
503318	18,000 ohms, ±10%, ½ watt (R157, R172, R204)
503322	22,000 ohms, ±10%, ½ watt (R162, R166, R171, R201)
503339	39,000 ohms, ±10%, ½ watt (R106)
70351	43,000 ohms, ±5%, ½ watt (R147)
503347	47,000 ohms, ±10%, ½ watt (R136, R149, R165)
512347	47,000 ohms, ±5%, 1 watt (R206)
502356	56,000 ohms, ±5%, ½ watt (R129, R133)
503356	56,000 ohms, ±10%, ½ watt (R212)
512356	56,000 ohms, ±5%, 1 watt (R182)
503368	68,000 ohms, ±10%, ½ watt (R151, R199)
503382	82,000 ohms, ±10%, ½ watt (R198)
503410	100,000 ohms, ±10%, ½ watt (R219)
513410	100,000 ohms, ±10%, 1 watt (R179)
503412	120,000 ohms, ±10%, ½ watt (R158)
502415	150,000 ohms, ±5%, ½ watt (R148)
503415	150,000 ohms, ±10%, ½ watt (R178, R191, R194)
512415	150,000 ohms, ±5%, 1 watt (R203)
502418	180,000 ohms, ±5%, ½ watt (R125)
503422	220,000 ohms, ±10%, ½ watt (R190, R192)
502427	270,000 ohms, ±5%, ½ watt (R181)
503427	270,000 ohms, ±10%, ½ watt (R163, R177)
503433	330,000 ohms, ±10%, ½ watt (R112, R195, R197)
503439	390,000 ohms, ±10%, ½ watt (R155, R173)
503447	470,000 ohms, ±10%, ½ watt (R113, R153, R193, R208)
503468	680,000 ohms, ±10%, ½ watt (R160, R167)
503482	820,000 ohms, ±10%, ½ watt (R196, R207)
503510	1 megohm, ±10%, ½ watt (R161)

STOCK No.	DESCRIPTION
502511	1.1 megohm, ±5%, ½ watt (R185)
503512	1.2 megohm, ±10%, ½ watt (R184)
503515	1.5 megohm, ±10%, ½ watt (R175)
11769	1.8 megohm, ±5%, ½ watt (R124)
39063	1.8 megohm, ±5%, 1 watt (R205)
503522	2.2 megohm, ±10%, ½ watt (R164, R170)
503539	3.9 megohm, ±10%, ½ watt (R137, R152)
503582	8.2 megohm, ±10%, ½ watt (R122)
503610	10 megohm, ±10%, ½ watt (R109)
76795	Transformer—Hi-voltage transformer (T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable core (T114)
76997	Transformer—Output transformer (T103)
77635	Transformer—Power transformer, 117 volt, 60 cycle (T113)
77112	Transformer—Ratio detector transformer (T102, C105)
76981	Transformer—Sound I.F. transformer complete with adjustable core (T101, C102, C103, R103)
77636	Transformer—Vertical output transformer (T112)
77637	Transformer—1st pix I.F. transformer complete with adjustable cores (T104, C120, R126)
77638	Transformer—2nd pix I.F. transformer complete with adjustable core (T106)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
76983	Trap—4.5 MC trap (L105, C137)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)
	YOKE AND MAGNET ASSEMBLIES
77008	Connector—Anode connector complete with contact and eyelet (except Models 21T313G, 21T313GU, 21T314G, 21T314GU
77677	Connector—Anode connector for Models 21T313G, 21T313GU, 21T314G, 21T314GU
75542	Connector—6 contact male connector—part of deflection yoke (P102)
74956	Cushion—Rubber cushion for deflection yoke hood
76654	Hood—Deflection yoke hood—less rubber cushions (except Models 21T313G, 21T313GU, 21T314G, 21T314GU)
76830	Hood—Deflection yoke hood—less rubber cushions for Models 21T313G, 21T313GU, 21T314G, 21T314GU
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
76633	Magnet—Pin cushion connection magnet complete with support arm for Models 21T313G, 21T313GU, 21T314G, 21T314GU
71456	Screw—#8-32 x 7/16" wing screw for mounting deflection yoke
76636	Stud—Adjusting stud complete with guard for focus magnet
77697	Yoke—Deflection yoke complete with male connector (L113, L114, L115, L116, C192, R214, R215, R216, P102)
	SPEAKER ASSEMBLIES 971636-1W RL101C5 RMA-274 (For Models 21T303, 21T303U)
77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971490-3W 971490-3R RL105E6 RMA-285 RMA-274 (For Models 21T313, 21T313G, 21T313U, 21T313GU)
75024	Cone—Cone and voice coil for speakers stamped 971490-3W
77129	Cone—Cone and voice coil for speakers stamped 971490-3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971692-1 (For Models 21T314, 21T314G, 21T314U, 21T314GU, 21T315, 21T315U, 21T316, 21T316U, 21T322, 21T322U)
77777	Speaker—10" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 92569-12W RL111A1 RMA-274 (For Models 21T323, 21T323U, 21T324, 21T324U)
75682	Cone—Cone and voice coil
76093	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.

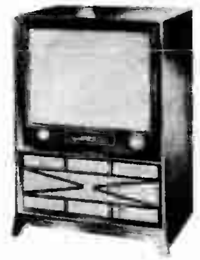


Models 21-D-326, 21-D-326 U
"Staunton"
Mahogany, Oak

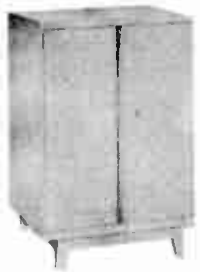


Models 21-D-327, 21-D-327 U
"Yorktown"
Natural Cherry, Red Cherry

Models 21-D-305, 21-D-305 U
"Cabot"
Mahogany, Oak

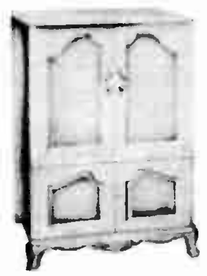


Models 21-D-317, 21-D-317 U
"Merritt"
Mahogany, Oak



Models 21-D-328, 21-D-328 U
"Kenbridge"
Oak, Natural Walnut

Models 21-D-329, 21-D-329 U
"Southbridge"
Mahogany, Walnut



Models 21-D-330, 21-D-330 U
"Claremont"
Maple, Red Cherry

GENERAL DESCRIPTION

All models are "21 inch" deluxe television receivers. Models 21-D-305, 21-D-317, 21-D-326, 21-D-327, 21-D-328, 21-D-329 and 21-D-330 are identical except for cabinets and speakers. These models feature full 12 channel VHF coverage.

Models 21-D-305U, 21-D-317U, 21-D-326U, 21-D-327U, 21-D-328U, 21-D-329U and 21-D-330U are identical except for cabinets and speakers. These models feature full 12 channel VHF coverage plus any 4 UHF channels desired. All models have an auxiliary audio input jack to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE .... 227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 21-D-305, -317, -326, -327, -328, -329, -330

Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 21-D-305U, -317U, -326U, -327U, -328U, -329U, -330U

Any desired combination of 16 VHF and/or UHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc., 470 mc. to 890 mc. may be used.

INTERMEDIATE FREQUENCIES

Picture Carrier Frequency .... 45.75 mc.

Sound Carrier Frequency .... 41.25 mc.

AUDIO POWER OUTPUT RATING .... 4.0 watts max.

VIDEO RESPONSE .... To 4 mc.

POWER SUPPLY RATING

KCS81 and KCS81A chassis .... 115 volts, 60 cycles, 295 watts

KCS 81B chassis .... 115 volts, 60 cycles, 305 watts

RECEIVER ANTENNA INPUT IMPEDANCE

KCS81 chassis (KRK11B Tuner)

Choice: 300 ohms balanced or 72 ohms unbalanced.

KCS81A chassis (KRK22A Tuner)

Choice: 300 ohms balanced or 72 ohms unbalanced.

KCS81B chassis (KRK12 Tuner)

UHF—Choice: 300 ohms balanced or 72 ohms unbalanced.

VHF—300 ohms balanced.

OPERATING CONTROLS (Front)

Channel Selector } .... Dual Control Knobs
Fine Tuning }

Picture .... Single Control under Panel

Picture Horizontal Hold .... Single Control under Panel

Picture Vertical Hold .... Single Control under Panel

Sound Volume and On-Off Switch } .... Dual Control Knobs
Brightness }

NON-OPERATING CONTROLS (under Front Panel)

Height .... screwdriver adjustment

Vertical Linearity .... screwdriver adjustment

CHASSIS DESIGNATIONS

KCS81 Models 21-D-305, -317, -326, -327, -328, -329 and -330 employing a KRK11B Tuner.

KCS81A Models 21-D-305, -317, -326, -327, -328, -329 and -330 employing a KRK22A Tuner.

KCS81B Models 21-D-305U, -317U, -326U, -327U, -328U, -329U and -330U employing a KRK12 Tuner.

SWEEP DEFLECTION .... Magnetic

FOCUS .... Magnetic

HORIZONTAL SWEEP FREQUENCY .... 15,750 cps

VERTICAL SWEEP FREQUENCY .... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) .... 30 cps

LOUDSPEAKERS

Models 21-D-305, 21-D-305U .... (971490-3) 8" PM, 3.2 ohms

All models except 21-D-305 and 21-D-305U .... (92569-12) 12" PM, 3.2 ohms

NON-OPERATING CONTROLS (not including R-F and I-F adjustments)

Picture Centering .... top chassis adjustment

Width .... rear chassis adjustment

Horizontal Drive .... rear chassis screwdriver adjustment

Horizontal Linearity .... rear chassis adjustment

Horizontal Oscillator Frequency .... rear chassis adjustment

Horizontal Oscillator Waveform .... bottom chassis adjustment

Horizontal Locking Range .... rear chassis adjustment

Focus .... top chassis adjustment

Ion Trap Magnet .... top chassis adjustment

Deflection Coil .... top chassis wing nut adjustment

AGC Control .... rear chassis adjustment

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 70 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should just begin to show a black bar in the picture on the left side.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Adjustment of Horizontal Oscillator" and proceed with "Centering Adjustment."

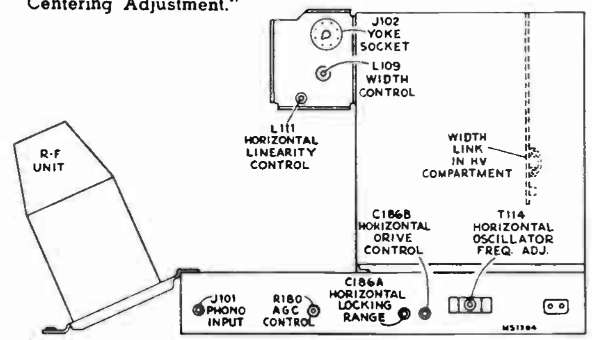


Figure 3—Rear Chassis Adjustments

ADJUSTMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

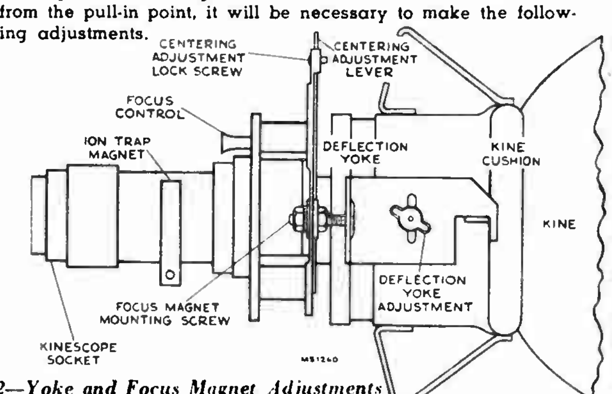


Figure 2—Yoke and Focus Magnet Adjustments

Horizontal Frequency Adjustment.—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T114 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T114 core until the bar is just visible at the extreme left side of the picture.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 2 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C186A slightly clockwise. If less than 2 bars are present, adjust C186A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure   For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENTS.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the middle.

CENTERING ADJUSTMENT.—No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plate includes a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and re-center the picture by adjustment of the focus magnet plate. In no case should the ion trap magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C186B for maximum drive (minimum capacity) consistent with a linear raster. Compression of the raster due to excessive drive can be seen as a white vertical bar or bars in the right half of the picture. Besides compression caused by excessive drive, another item to watch for is the change in linearity at the extreme left with changes of brightness control setting. By proper adjustment of the linearity coil, the changes in linearity with changes in brightness can be made negligible. In general, to achieve this condition, the linearity coil should be set slightly on the high inductance side (core slightly clockwise) of the optimum position.

Preset the following adjustments as directed:

A.—Place the width plug P103 in the minimum width position (top).

B.—Set the width control coil L109 in approximately mid position.

C.—Set the linearity control coil L111 near minimum inductance (counter-clockwise).

D.—Set the drive capacitor C186B in the maximum drive position (counter-clockwise).

If the raster is cramped or shows compression bars on the right half of the picture turn C186B clockwise until this condition is just eliminated.

Adjust the linearity control coil L111 clockwise until best linearity and maximum deflection or best compromise are obtained then turn one quarter turn clockwise from this position.

Retouch the drive trimmer C186B if necessary to obtain best linearity and maximum width.

Check the horizontal linearity at various settings of the brightness control R114A. There should be no compression of the right half and no appreciable change of linearity especially at the extreme left of the picture. If objectional change does occur, turn linearity coil L111 slightly clockwise and repeat the test.

Adjust the width control L109 to fill the mask.

If the line voltage is low and it becomes impossible to fill the mask, move the width plug P103 to the bottom position. The width coil L109 is inoperative in this position.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R190 behind front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R197 behind front control panel), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

If necessary readjust centering to align the picture with the mask.

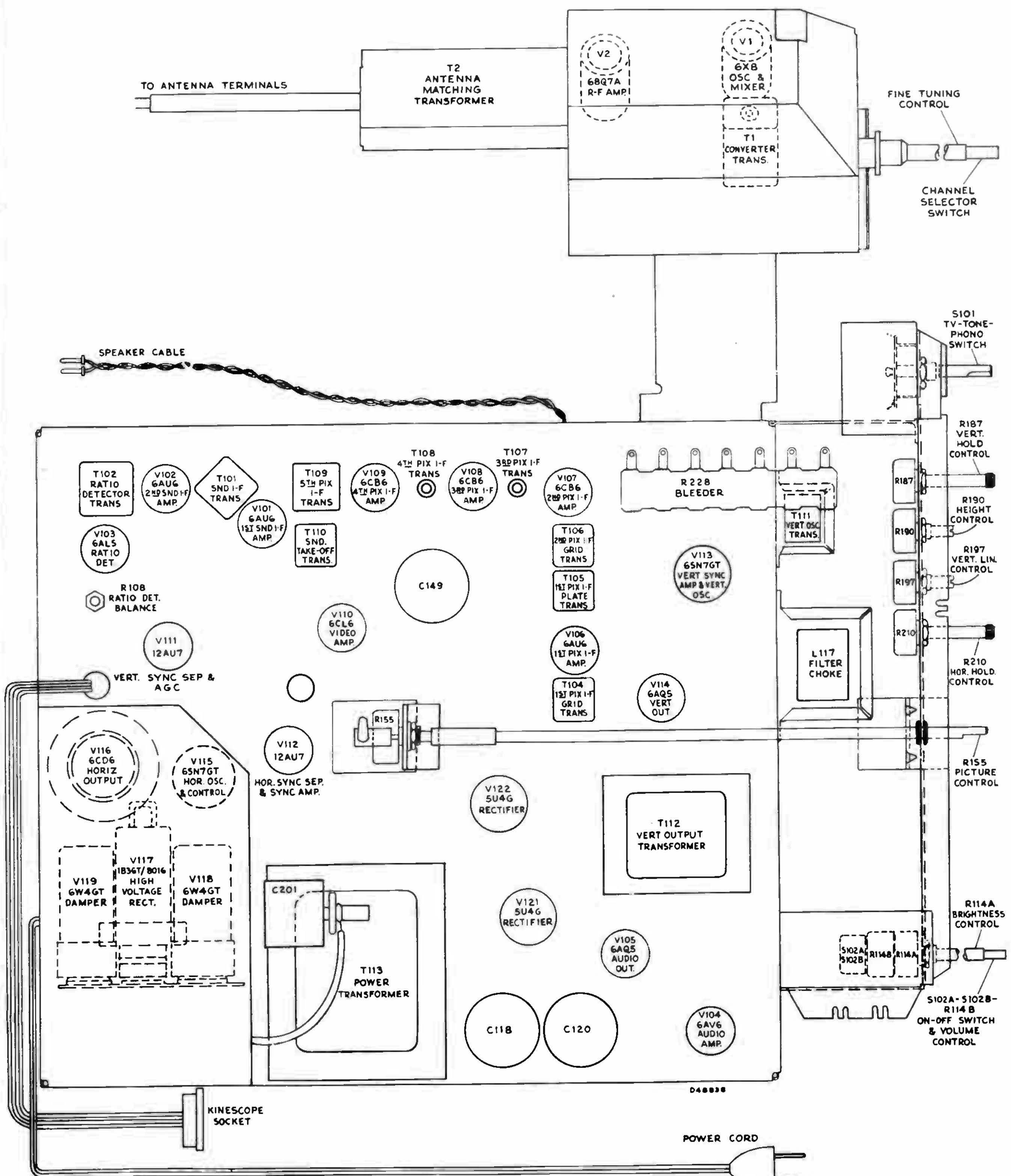


Figure 7—Chassis Top View (shown with KRK11B Tuner)

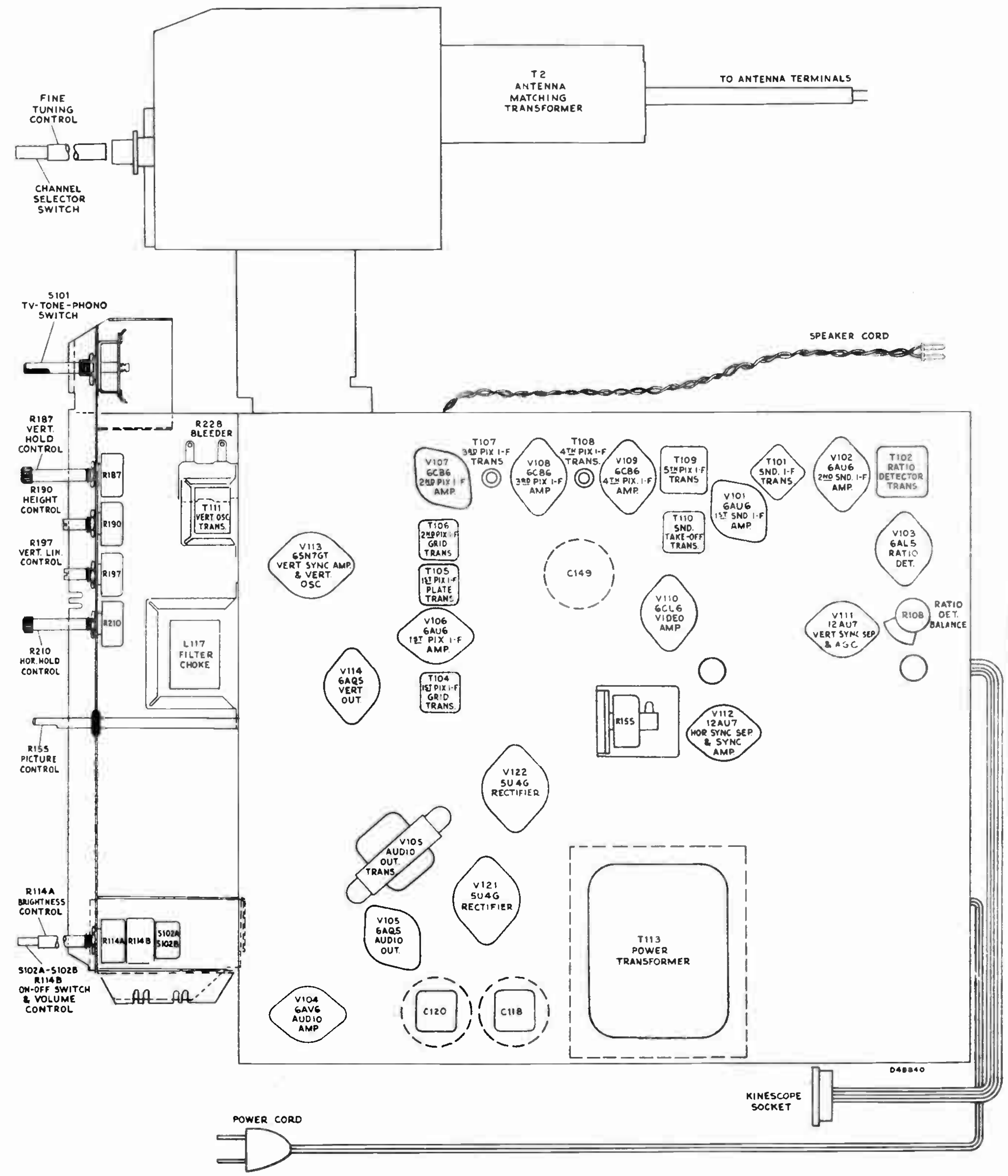


Figure 8—Chassis Bottom View (shown with KRK11B Tuner)

CHECK OF R-F OSCILLATOR ADJUSTMENTS.—

(Models 21-D-305 to 21-D-330 incl. with KRK11B Tuner.)

Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 10. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis.

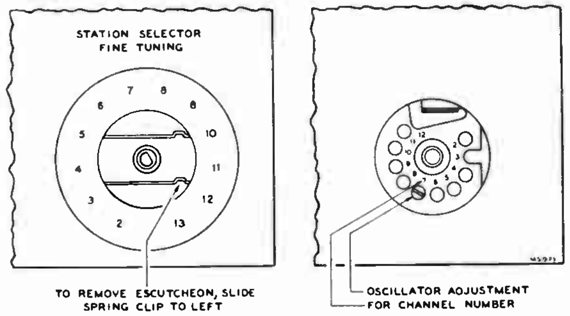


Figure 4—KRK11B R-F Oscillator Adjustments

(Models 21-D-305 to 21-D-330 incl. with KRK22A Tuner.)

Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 13. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 5. Adjustment for channel 13 is C3 on top of the tuner chassis.

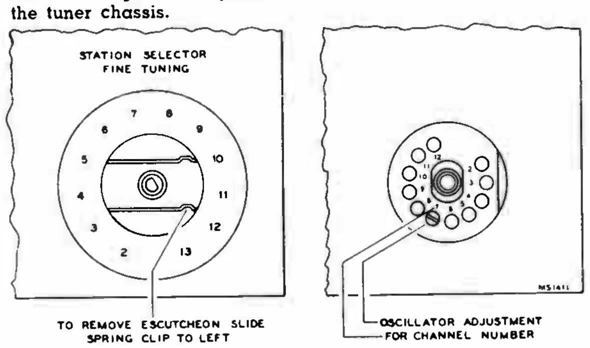


Figure 5—KRK22A R-F Oscillator Adjustments

(Models 21-D-305U to 21-D-330U incl. with KRK12 Tuner.)

Tune in all available VHF stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure

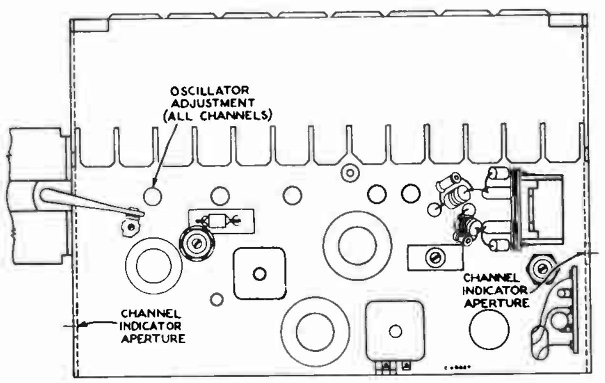


Figure 6—KRK12 Oscillator Adjustment

NOTE.—Some factory prealigned UHF inserts may require minor adjustment when installed in the tuner. This can be accomplished by using the UHF stations as a signal source.

Set the fine tuning control to the center of its range on each UHF channel to be adjusted. Adjust the oscillator core for each UHF channel to obtain maximum audio output without distortion. The adjustment location is the same for all channels, see Figure 6. The insert in the operating position can be determined by a stamping on the insert drum. This stamping is visible through either the front or rear apertures shown in Figure 6.

AGC THRESHOLD CONTROL. — The AGC Threshold Control R180 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not over-loading due to improper setting of R180. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R180 should be readjusted.

Turn R180 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R180 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R180 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R180 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT. — In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is L58 on KRK11B tuners or L53 on KRK22A tuners and is located on the antenna matching transformer.

CAUTION. — In some receivers, the FM trap L53 or L58 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L53 or L58 to make sure that it does not affect sensitivity on these channels.

The FM trap on Models 21-D-305U to 21-D-330U is attached to the receiver antenna cable and should be adjusted in the same manner as on Models 21-D-305 to 21-D-330.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

ALIGNMENT PROCEDURE

TEST EQUIPMENT. — To properly service the television **chassis of these receivers, it is recommended that the following test equipment be available:**

VHF Sweep Generator meeting the following requirements:
(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:
(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope. — An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter. — A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter. — A milliammeter with a range of 0-50 milliamperes full scale, or 0-100 milliamperes where adapter socket is not used.

Adapter Socket. — An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12 Tuner. Wiring of adapter is shown in Figure 9. For an alternate method without the use of an adapter socket refer to alignment procedure

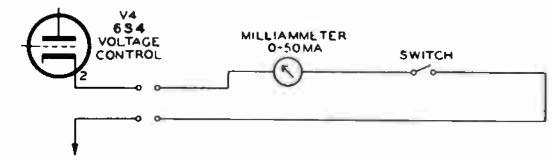


Figure 9—KRK12 Voltage Control Adapter

PICTURE I-F TRAP ADJUSTMENT. — Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R133 and C133B.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the positive terminal of one battery to chassis and the potentiometer arm to the junction of R133 and C133B.

Set the bias to produce approximately −1.0 volt of bias at the junction of R133 and C133B.

Connect the "VoltOhmyst" to pin 9 of V110, the 6CL6 video amplifier.

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS. —

Models 21-D-305 to 21-D-330 Incl.

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with −1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to −1.0 volt at the junction of R133 and C133B.

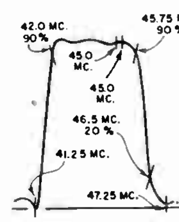


Figure 10—T105 and T106 Response

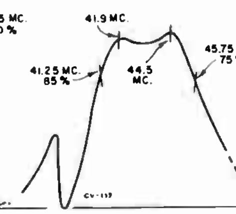


Figure 11—T1 and T104 Response with KRK11B or KRK22A

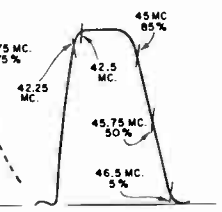


Figure 12—Over-all I-F Response with KRK11B or KRK22A

Connect the oscilloscope to pin 9 of V110.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 10. For final adjustment set the output of the sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T1 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 75% of maximum response.

Adjust C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 11.

Disconnect the diode probe, the 180 ohm and three 330 ohm resistors.

Models 21-D-305U to 21-D-330U Incl.

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with −1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to −1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110, the 6CL6 video amplifier.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 10. For final adjustment set the output of the VHF sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align the crystal mixer and T2 and T104, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1,500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 75% of maximum response.

Adjust the shunt trimmer C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 13. Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 13.

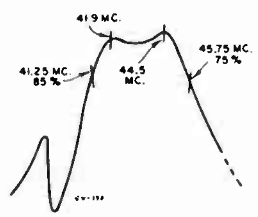


Figure 13—T2 and T104 Response with KRK12

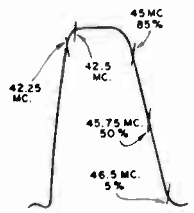


Figure 14—Over-all I-F Response with KRK12

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

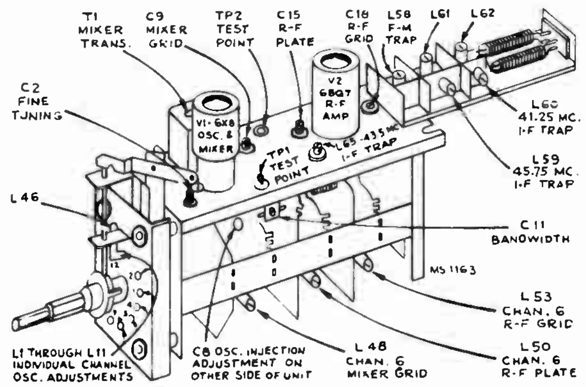


Figure 15—KRK11B R-F Tuner Adjustments

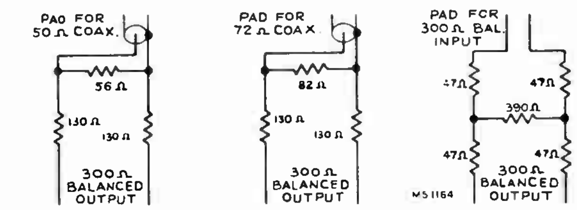


Figure 16—Sweep Attenuator Pads

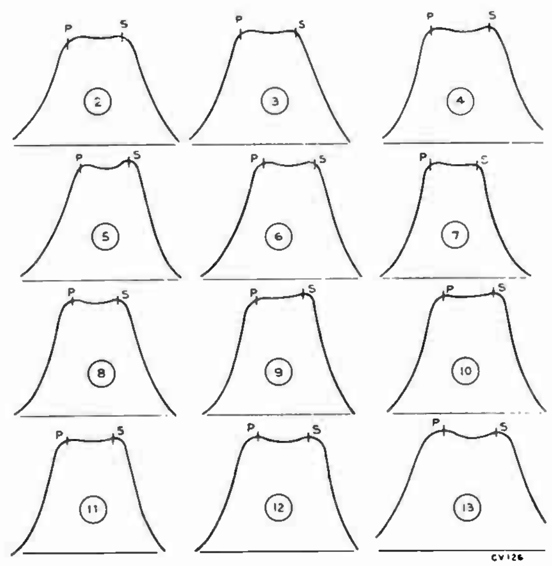


Figure 17—KRK11B R-F Response

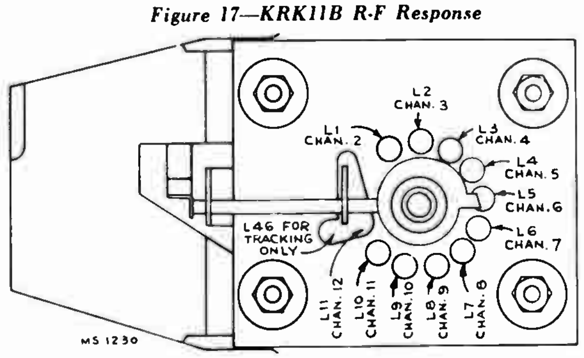


Figure 18—KRK11B R-F Oscillator Adjustments

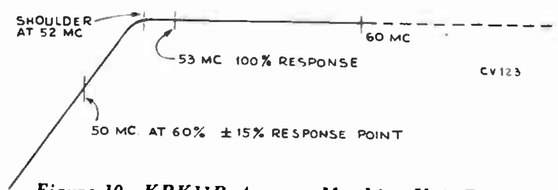


Figure 19—KRK11B Antenna Matching Unit Response

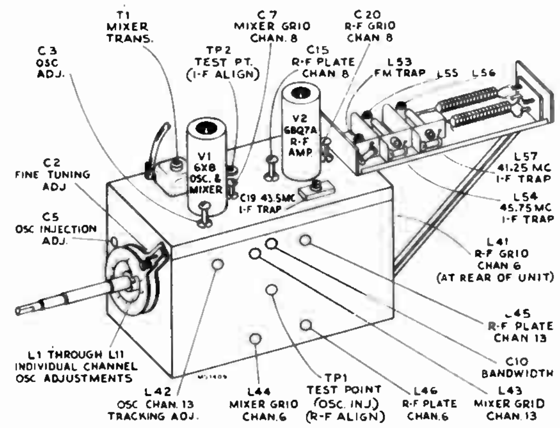


Figure 20—KRK22A Tuner Adjustments

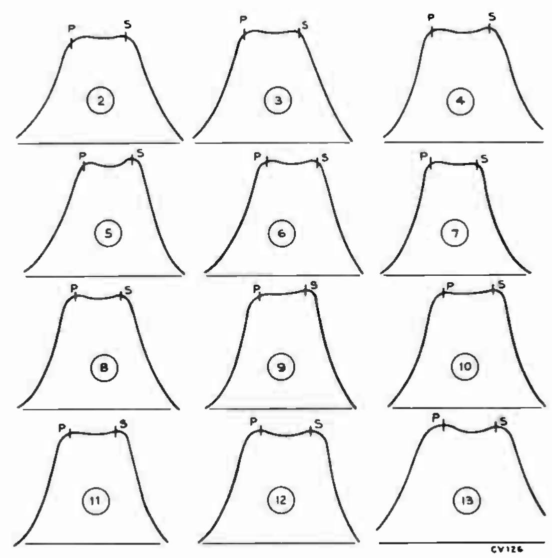


Figure 21—KRK22A R-F Response

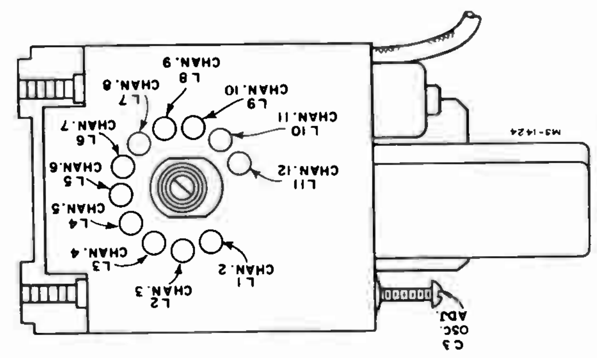


Figure 22—KRK22A R-F Oscillator Adjustments

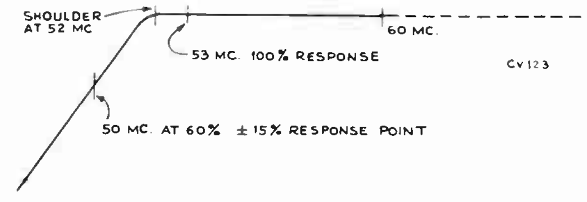


Figure 23—KRK22A Antenna Matching Unit Response

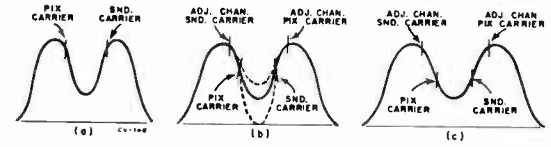


Figure 24—KRK12 VHF Insert Responses

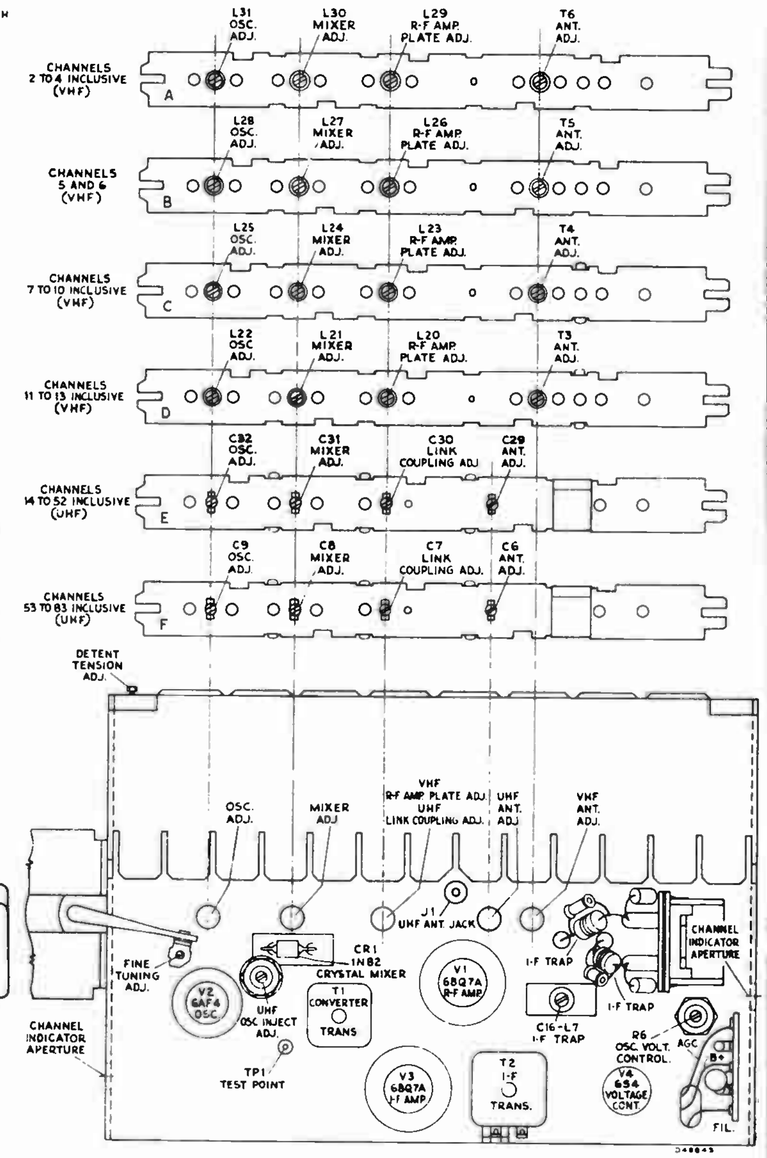


Figure 25—KRK12 Tuner Adjustments

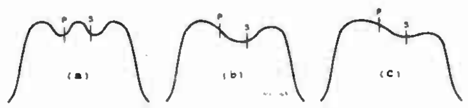


Figure 26—KRK12 UHF Insert Responses

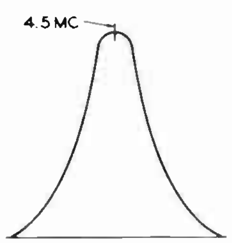


Figure 27—Sound I-F Response

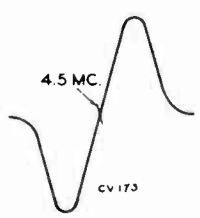


Figure 28—Ratio Det. Response

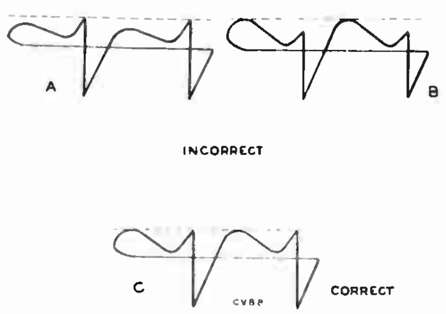


Figure 29—Horizontal Oscillator Wave Forms

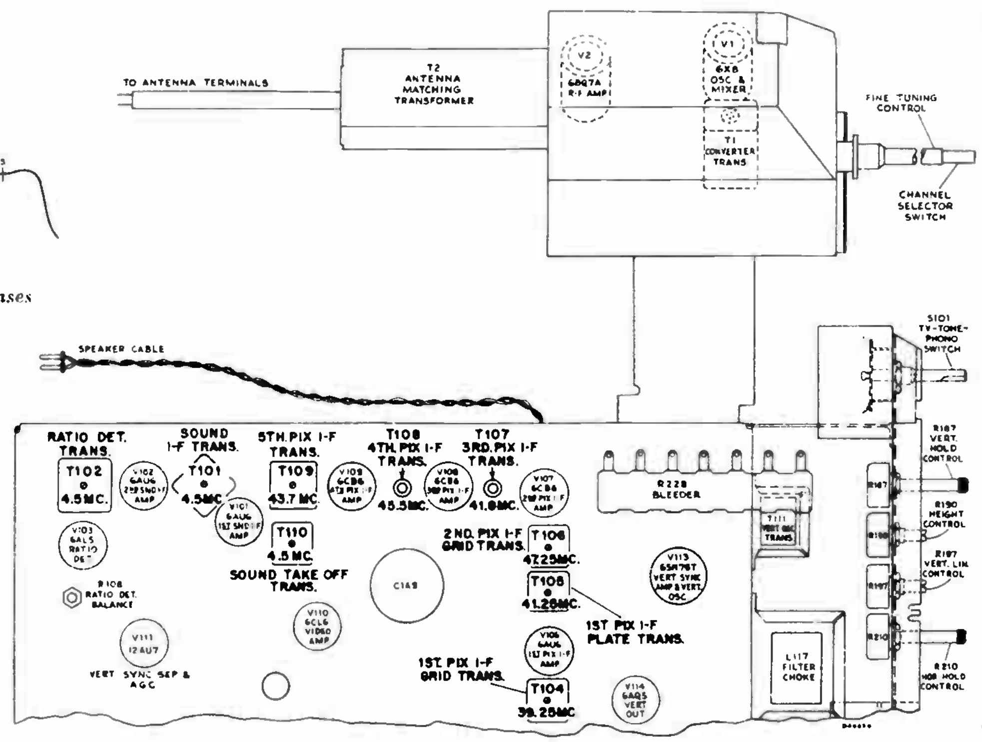


Figure 30—Top Chassis Adjustments (KRK11B Tuner Shown)

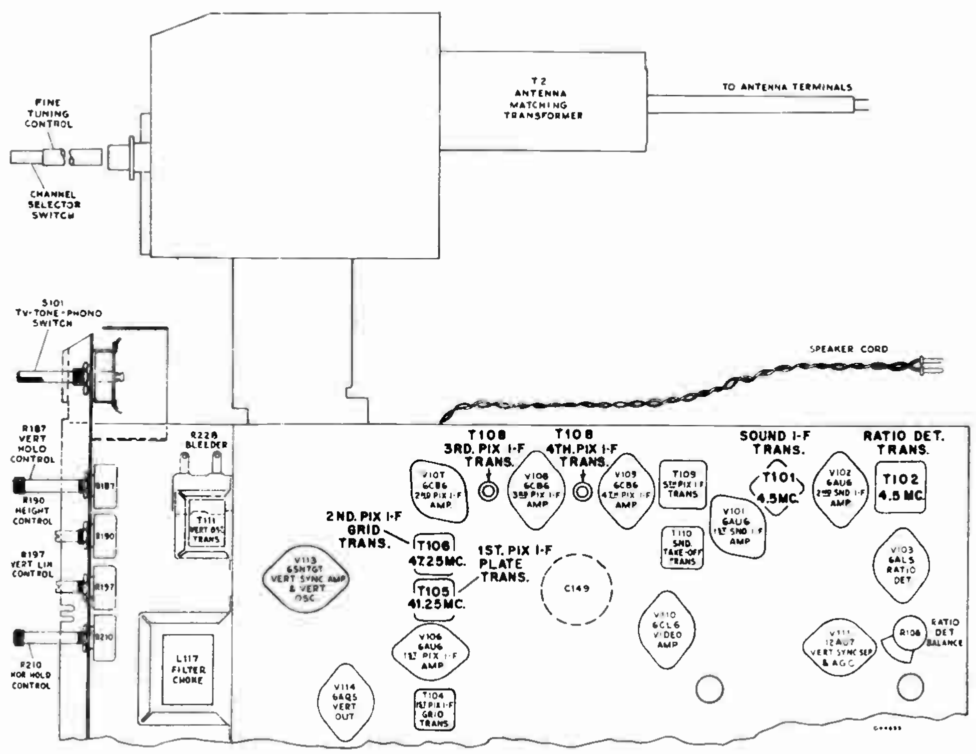


Figure 31—Bottom Chassis Adjustments (KRK11B Tuner Shown)

Following is a list of symptoms of possible failures and an indication of some of the possible faults:

NO RASTER ON KINESCOPE:

(1) Incorrect adjustment of ion trap magnet. Magnet reversed either front to back or top to bottom.

(2) V115 or V116 inoperative. Check waveforms on grids and plates.

(3) No high voltage — if horizontal deflection is operating as evidenced by the correct waveform on terminal 1 of high voltage transformer, the trouble can be isolated to the 1B3GT circuit. Either the T115 high voltage winding is open, the 1B3GT tube is defective, its filament circuit is open or C201 is shorted.

(4) V110 circuit inoperative. Refer to schematic and waveform chart.

(5) Damper tubes (V118 or V119) inoperative.

(6) Defective kinescope.

(7) R114A open.

(8) No receiver plate voltage—filter capacitor shorted—or filter choke open.

NO VERTICAL DEFLECTION:

(1) V113B or V114 inoperative. Check voltage and waveforms on grids and plates.

(2) T111 or T112 open.

(3) Vertical deflection coils open.

SMALL RASTER:

(1) Low Plus B or low line voltage.

(2) V116 defective.

POOR VERTICAL LINEARITY:

(1) If adjustments cannot correct, change V114.

(2) Vertical output transformer T112 defective.

(3) V113B defective. Check voltage and waveforms on grid and plate.

(4) C175, C176, C118D or C120B defective.

(5) Low plate voltage. Check rectifiers and capacitors in supply circuits.

(6) If height is insufficient, try changing V113.

POOR HORIZONTAL LINEARITY:

(1) If adjustments do not correct, change V116, V118 or V119.

(2) T115 or L111 defective.

(3) C203 defective.

WRINKLES ON SIDE OF RASTER:

(1) R227 defective.

(2) Defective yoke.

PICTURE OUT OF SYNC HORIZONTALLY:

(1) T114 incorrectly tuned.

(2) R209, R212 or R210 defective.

TRAPEZOIDAL OR NON-SYMMETRICAL RASTER:

(1) Improper adjustment of focus magnet or ion trap magnet.

(2) Defective yoke.

RASTER AND SIGNAL ON KINESCOPE BUT NO SOUND:

(1) T110 defective.

(2) Sound i-f, ratio detector or audio amplifier inoperative. Check V101, V102, V103 and their socket voltages.

(3) Audio system defective.

(4) Speaker defective.

SIGNAL AT KINESCOPE GRID BUT NO SYNC:

(1) AGC control R180 misadjusted.

(2) V111 inoperative. Check voltage and waveforms at its grid and plate.

SIGNAL ON KINESCOPE GRID BUT NO VERTICAL SYNC:

(1) Check V113B and associated circuit—C171, etc.

(2) Integrating network inoperative. Check.

(3) V111, V112 or V113A defective or associated circuit defective.

(4) Gas current grid emission or grid cathode leakage in V113. Replace.

SIGNAL ON KINESCOPE GRID BUT NO HORIZONTAL SYNC:

(1) T114 misadjusted. Readjust as instructed

(2) V112 inoperative. Check socket voltages and waveforms.

(3) T114 defective.

(4) C165, C186A, C188, C189, C190, C191 or C192 defective.

(5) If horizontal speed is completely off and cannot be adjusted check R209, R212, R210, R214 and R216.

SOUND AND RASTER BUT NO PICTURE OR SYNC:

(1) Picture, detector or video amplifier defective. Check CR101 and V110. Check socket voltages.

(2) Bad contact to kinescope cathode.

PICTURE STABLE BUT POOR RESOLUTION:

(1) CR101 or V110 defective.

(2) Peaking coils defective. Check resistance.

(3) Make sure that the focus control operates on both sides of proper focus.

(4) R-F and I-F circuits misaligned.

PICTURE SMEAR:

(1) R-F or I-F circuits misaligned.

(2) Open peaking coil.

(3) This trouble can originate at the transmitter. Check on another station.

PICTURE JITTER:

(1) AGC control R180 misadjusted.

(2) If regular sections at the left picture are displaced change V116.

(3) Vertical instability may be due to loose connections or noise.

(4) Horizontal instability may be due to unstable transmitted sync.

RASTER BUT NO SOUND, PICTURE OR SYNC:

(1) Defective antenna or transmission line.

(2) R-F oscillator off frequency.

(3) Tuner unit inoperative. Check V1, V2 (V1, V2, V3 or V4 in KRK12 Tuner).

DARK VERTICAL LINE ON LEFT OF PICTURE:

(1) Reduce horizontal drive and readjust width and horizontal linearity.

(2) Replace V116.

LIGHT VERTICAL LINE ON LEFT OF PICTURE:

(1) R227 defective.

(2) V118 or V119 defective.

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 8 SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED

KRK11B TUNER ALIGNMENT

Step No.	Connect VHF Signal Generator To	Signal Gen. Freq. Mc.	Connect VHF Sweep Generator To	Sweep Gen. Freq. Mc.	Connect Heterodyne Freq. Meter To	Het. Meter Freq. Mc.	Connect Oscilloscope To	Miscellaneous Connections and Instructions	Adjust	Refer To
1	If unit is completely out of adjustment, preset all adjustments to center of range with following exceptions. Set C18 so that head is 3/8" above chassis. Set C11 1/4 turn from max. clockwise. Disconnect link from T104 and terminate with 39 ohms. Connect bias supply between AGC terminal on tuner and ground. Adjust bias for —3.5V at terminal 3. Set fine tuning 30 degrees clockwise from mechanical center of its range.									
2	Grid, pin 7 of V2 through 1500 mmf.	43.5 mc. 30% mod.	Not used	—	Not used	—	TP1. Gain to maximum	Set r-f unit on channel 2	L65 for min. indication on scope	Fig. 15
3	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C2 for beat on freq. meter	Fig. 15
4	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	R-F unit on channel 8. Set T1 max. counter-clockwise	C9, C11, C15 and C18 for response shown in Fig. 17	Fig. 15 Fig. 17
5	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	R-F unit on channel 6	L5 for beat on het. freq. meter	Fig. 18
6	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	--	TP1. Gain to maximum	"	L48, L50 and L53 for response shown in Fig. 17	Fig. 15 Fig. 17
7	Not used	—	Not used	—	Not used	—	Not used	On channel 6. Connect "VoltOhmyst" to TP1	C8 for —3.5 volts on meter	Fig. 15
8	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	R-F unit on channel 6	Check response. Readjust L48, L50 and L53 if necessary	Fig. 15 Fig. 17
9	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C2 for beat on freq. meter	Fig. 15
10	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	"	Check response adjust C9, C11, C15 and C18 if necessary	Fig. 15
11	If C9 was readjusted in step 10, repeat step 7, step 9 and step 10 until the conditions specified in each step are fulfilled without additional adjustments.									
12	Not used	—	Not used	—	Loosely to r-f unit oscillator	257 mc.	Not used	Rec. on channel 13	L46 for beat on het. freq. meter. Overshoot L46 slightly and adjust C2 for beat	Fig. 15
13	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. Gain to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	Check to see that response is correct and —3.5 volts of osc. injection is present	Fig. 17
14	"	205.25 209.75	"	Channel 12	Not used	—	"	Rec. on channel 12	"	Fig. 17
15	"	199.25 203.75	"	Channel 11	"	—	"	Rec. on channel 11	"	Fig. 17
16	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	Fig. 17
17	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	Fig. 17
18	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	Fig. 17
19	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	"	Fig. 17
20	If the response of any channel (steps 13 through 19) is below 80% at either marker, adjust C9, C11, C15 and C18 as necessary to pull response up on the low channel yet maintain correct response on channel 8.									
21	Repeat step 9. If the oscillator is off frequency overshoot the adjustment of C2 and correct by adjusting L46.									
22	Repeat steps 12 through 21 until all adjustments are obtained.									
23	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	Rec. on channel 6	L5 for beat on het. freq. meter	Fig. 15
24	Antenna terminals loosely	55.25 59.75	Antenna terminals through pad	Channel 2	Not used	—	TP1. Gain to maximum	Rec. on channel 2	Adjust T1 core clockwise to a point at which channel 2 response does not change	Fig. 15
25	"	83.25 87.75	"	Channel 6	Not used	—	"	Rec. on channel 6. "VoltOhmyst" on TP1	Check to see that response is correct and —3.5 volts of osc. injection is present	Fig. 15 Fig. 17
26	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	"	Fig. 17
27	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	Fig. 17
28	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	Fig. 17
29	"	55.25 59.75	"	Channel 2	"	—	"	Rec. on channel 2	"	Fig. 17
30	If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt then switch to channel 6 and adjust L53 for max. amplitude of response between carrier markers.									
31	Check r-f response and oscillator injection on channels 7 through 13 steps 23 back up through step 17 stopping on channel 13 for the next step.									
32	Not used	—	Not used	—	Loosely coupled to r-f oscillator	257 mc.	TP1. Gain to maximum	Rec. on channel 13	C2 for beat on het. freq. meter	Fig. 15
33	"	—	"	—	"	251 mc.	"	Rec. on channel 12	L11 as above	Fig. 15
34	"	—	"	—	"	245 mc.	"	Rec. on channel 11	L10 as above	Fig. 15
35	Not used	—	Not used	—	Loosely coupled to r-f oscillator	239 mc.	TP1. Gain to maximum	Rec. on channel 10	L9 as above	Fig. 15
36	"	—	"	—	"	233 mc.	"	Rec. on channel 9	L8 as above	Fig. 15
37	"	—	"	—	"	227 mc.	"	Rec. on channel 8	L7 as above	Fig. 15
38	"	—	"	—	"	221 mc.	"	Rec. on channel 7	L6 as above	Fig. 15
39	"	—	"	—	"	129 mc.	"	Rec. on channel 6	L5 as above	Fig. 15
40	"	—	"	—	"	123 mc.	"	Rec. on channel 5	L4 as above	Fig. 15
41	"	—	"	—	"	113 mc.	"	Rec. on channel 4	L3 as above	Fig. 15
42	"	—	"	—	"	107 mc.	"	Rec. on channel 3	L2 as above	Fig. 15
43	"	—	"	—	"	101 mc.	"	Rec. on channel 2	L1 as above	Fig. 15
44	Repeat steps 31 through 43 as a check. On completion, remove 39 ohm resistor and reconnect link to terminals A and B of T104.									

KRK11B ANTENNA MATCHING UNIT ALIGNMENT

Step No.	Connect VHF Signal Generator To	Signal Gen. Freq. Mc.	Connect VHF Sweep Generator To	Sweep Gen. Freq. Mc.	Connect Heterodyne Freq. Meter To	Het. Meter Freq. Mc.	Connect Oscilloscope To	Miscellaneous Connections and Instructions	Adjust	Refer To
45	Do not adjust this unit unless fairly certain that it requires adjustment. Disconnect lead from L58 to S1. Connect output of matching unit through 1000 mmf. to pin 1 of V107. Replace cover on matching unit. Remove V106 from socket. Connect bias box to junction of R133 and C133B and set to produce —5 volts.									
46	Antenna terminals	45.75 mc. 30% mod.	Not used	—	Not used	—	Pin 9, V110 Scope gain to max.	—	L59 for min. audio on scope	Fig. 15
47	"	41.25 mc. 30% mod.	"	—	"	—	"	—	L60 for min. audio on scope	Fig. 15
48	Antenna terminals loosely	—	Antenna terminals through pad	45 to 54 mc.	"	—	Scope xtal probe from L58 to gnd.	Connect 300 ohms from L58 to gnd.	L61 and L62 to obtain response of Fig. 19	Fig. 15 Fig. 16 Fig. 19
49	Remove bias supply and 1000 mmf. capacitor. Restore connection between L58 and S1. Replace V106.									

KRK22A TUNER ALIGNMENT

Step No.	Connect VHF Signal Generator To	Signal Gen. Freq. Mc.	Connect VHF Sweep Generator To	Sweep Gen. Freq. Mc.	Connect Heterodyne Freq. Meter To	Het. Meter Freq. Mc.	Connect Oscilloscope To	Miscellaneous Connections and Instructions	Adjust	Refer To
1	If unit is completely out of adjustment, preset all adjustments to center of range with following exceptions. Set T1 and C2 fully counterclockwise. Set channel 7 to 13 oscillator slugs one turn from tight. Disconnect link from T104 and terminate with 39 ohms. Short the AGC terminal to ground. Preset C5 to read —3.0v dc. at TP1.									
2	Junction of L53 and C24 at bottom of L53	43.5 mc. 30% mod.	Not used	—	Not used	—	TP1. Gain to maximum	Set r-f unit on channel 2	C19 for min. indication on scope	Fig. 20
3	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8. Insert —3V bias at AGC terminal	C3 for beat on freq. meter. Fine tuning fully clockwise	Fig. 20
4	"	—	"	—	"	"	"	Return fine tuning to mid-range after adjustment of C2	C2 one turn clockwise past change in beat note	Fig. 20
5	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	R-F unit on channel 8. Set T1 max. counter-clockwise	C7, C10, C15 and C20 for response shown in Fig. 21	Fig. 20 Fig. 21
6	Not used	—	Not used	—	Not used	—	Not used	On channel 8 Connect "VoltOhmyst" to TP1	C5 for —20 volts on meter	Fig. 20
7	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	R-F unit on channel 8	Check response. Readjust C7, C10, C15 and C20 if necessary	Fig. 20 Fig. 21
8	Not used	—	Not used	—	Loosely to r-f unit oscillator	257 mc.	Not used	Rec. on channel 13. Fine tuning fully clockwise	L42 for beat on het. freq. meter. Overshoot L42 slightly and adjust C2 for beat	Fig. 20
9	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. Gain to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	L43 and L45 for proper response and osc. injection within limits	Fig. 21
10	If C5 was readjusted in step 9, repeat step 8 and step 9 until the conditions specified in each step are fulfilled without additional adjustments.									
11	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C2 for beat on freq. meter	Fig. 20
12	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	"	Check response adjust C7, C10, C15 and C20 if necessary	Fig. 21
13	If C7 was readjusted in step 12 recheck the oscillator injection. Repeat steps 3 to 12 until all conditions are satisfied.									
14	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	R-F unit on channel 6. Fine tuning midrange	L5 for beat on het. freq. meter	Fig. 20
15	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	"	L41, L44 and L46 for response shown in Fig. 21	Fig. 20 Fig. 21
16	"	83.25 87.75	"	Channel 6	"	—	"	Rec. on channel 6. "VoltOhmyst" on TP1	Check to see that response is correct and osc. injection is within limits	Fig. 20 Fig. 21
17	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	"	Fig. 21
18	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	Fig. 21
19	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	Fig. 21
20	"	55.25 59.75	"	Channel 2	"	—	"	Rec. on channel 2	"	Fig. 21
21	If the response of any channel (steps 16 through 20) is below 80% at either marker, adjust L41, L44 and L46 as necessary to obtain proper response yet maintain correct response on channel 8.									
22	Repeat steps 14 through 20 until all adjustments are obtained.									

Step No.	CONNECT VHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT VHF SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
23	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. G[illegible] to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	Check to see that response is correct and osc. injection within limits	Fig. 20 Fig. 21
24	"	205.25 209.75	"	Channel 12	Not used	—	"	Rec. on channel 12	"	Fig. 21
25	"	199.25 203.75	"	Channel 11	"	—	"	Rec. on channel 11	"	Fig. 21
26	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	Fig. 21
27	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	Fig. 21
28	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	Fig. 21
29	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	"	Fig. 21
30	Check r-f response and oscillator injection on channels 7 through 13, adjusting C7, C10 or C15 if necessary, stopping on channel 13 for the next step.									
31	Not used	—	Not used	—	Loosely coupled to r-f oscillator	257 mc.	TP1. Gain to maximum	Rec. on channel 13	L42 for beat on het. freq. meter	Fig. 20
32	"	—	"	—	"	251 mc.	"	Rec. on channel 12	L11 as above	Fig. 22
33	"	—	"	—	"	245 mc.	"	Rec. on channel 11	L10 as above	Fig. 22
34	"	—	"	—	"	239 mc.	"	Rec. on channel 10	L9 as above	Fig. 22
35	"	—	"	—	"	233 mc.	"	Rec. on channel 9	L8 as above	Fig. 22
36	"	—	"	—	"	227 mc.	"	Rec. on channel 8	L7 as above	Fig. 22
37	"	—	"	—	"	221 mc.	"	Rec. on channel 7	L6 as above	Fig. 22
38	"	—	"	—	"	129 mc.	"	Rec on channel 6	L5 as above	Fig. 22
39	"	—	"	—	"	123 mc.	"	Rec on channel 5	L4 as above	Fig. 22
40	"	—	"	—	"	113 mc.	"	Rec on channel 4	L3 as above	Fig. 22
41	"	—	"	—	"	107 mc.	"	Rec on channel 3	L2 as above	Fig. 22
42	"	—	"	—	"	101 mc.	"	Rec. on channel 2	L1 as above	Fig. 22
43	Repeat steps 31 through 42 as a check. Upon completion, remove 39 ohm resistor and reconnect link to terminals A and B of T104.									

KRK22A ANTENNNA MATCHING UNIT ALIGNMENT

44	Do not adjust this unit unless fairly certain that it requires adjustment. Disconnect lead from L53 to S1. Connect output of matching unit through 1000 mmf. to pin 1 of V107. Replace cover on matching unit. Remove V106 from socket. Connect bias box to junction of R133 and C133B and set to produce —5 volts.									
45	Antenna terminals	45.75 mc. 30% mod.	Not used	—	Not used	—	Pin 9, V110 Scope gain to max.	—	L54 for min. audio on scope	Fig. 20
46	"	41.25 mc. 30% mod.	"	—	"	—	"	—	L57 for min. audio on scope	Fig. 20
47	Antenna terminals loosely	—	Antenna terminals through pad	45 to 54 mc.	"	—	Scope xtal probe from L53 to ground	Connect 300 ohms from L53 to gnd.	L55 and L56 to obtain response of Fig. 23	Fig. 20 Fig. 23
48	Remove bias supply and 1000 mmf. capacitor. Restore connection between L53 and S1. Replace V106.									

KRK12 VHF TUNER ALIGNMENT

1	Not used	—	Not used	—	Not used	—	Not used	Insert adapter and meter in 6S4 cathode circuit. Short contacts 12 and 13	R6 for 28 ma. reading on meter. Refer to text for alternate method.	Fig. 9 Pg. 14
2	Antenna terminals loosely	55.25 59.75	Antenna terminals through pad	Channel 2	"	—	TP1. Through preamplifier if required	Adapter switch off. Receiver on. Channel 2 Ground AGC terminal on tuner.	T6, L29 and L30 for response shown in Fig. 24(b)	Fig. 9 Fig. 24 Fig. 25 Pg. 14
3	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	"
4	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	"
5	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	T5, L26 and L27 for response shown in Fig. 24(b)	"
6	"	83.25 87.75	"	Channel 6	"	—	"	Rec. on channel 6	"	"
7	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	T4, L23 and L24 for response shown in Fig. 24(b)	"
8	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	"
9	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	"
10	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	"
11	"	199.25 203.75	"	Channel 11	"	—	"	Rec on channel 11	T3, L20 and L21 for response shown in Fig. 24(b)	"
12	"	205.25 209.75	"	Channel 12	"	—	"	Rec. on channel 12	"	"
13	"	211.25 215.75	"	Channel 13	"	—	"	Rec. on channel 13	"	"
14	Not used	—	Not used	—	Loosely coupled to rf oscillator	257 mc.	Pin 2 of V110. Use 3 to 5V. P-P	Adapter switch on AGC rf bias —3.5V. IF bias —5V at R133, C133B Rec. on channel 13	L22 for beat on het. freq. meter	Fig. 9 Fig. 25
15	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	"	"	T1 for max. gain. L21 for response shown in Fig. 14	Fig. 14 Fig. 25
16	Repeat steps 14 and 15 for all VHF channels adjusting approximate mixer slug for response shown in Figure 14									
17	Junction C2-L2 at end opposite antenna plug	43.5 mc.	Antenna terminals through pad	Channel 6	Not used	—	Pin 2 of V110	Rec. on channel 6	C16-L7 for min. 43.5 MC. indication on scope	Fig. 25

Step No.	CONNECT UHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT UHF SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT VHF SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	KRK12 UHF TUNER ALIGNMENT									
18	Antenna terminals loosely	Picture and sound carrier markers of channel to be aligned	Antenna terminals through pad	Sweeping channel being aligned. Use full sweep width	Not used	—	TP1. Through preamplifier if required	AGC terminal on tuner grounded. Adapter switch in OFF position	C29, C30 and C31 for channels 14 to 52 or C6, C7 and C8 for channels 53 to 83, to obtain response shown in Fig. 26 (a) (b) or (c)	Fig. 9 Fig. 25 Fig. 26
19	Repeat the above step for all UHF inserts to be used. Adjusting antenna, link coupling and mixer slugs for response shown in Fig. 26.									
20	Test point TP1	Picture carrier freq. of channel to be aligned	Antenna terminals through pad	Sweeping channel being aligned. 45.75 mc placed as in Fig. 13. Adjust generator freq to position marker	Test point TP1	45.75 mc.	Junction of R138 and L105. 3 to 5V. P-P on scope	Adapter switch ON. AGC r-f bias at tuner —3.5V. I-F bias —5V. at R133 and C133B. Channel switch to proper channel	Oscillator C9 or C32 to bring marker to coincide on response curve with 45.75 mc. marker from VHF generator	Fig. 9 Fig. 14 Fig. 25
21	"	"	"		"	"	"	"	Mixer C8 or C31 for max. gain with response shown in Fig. 14	Fig. 14 Fig. 25
22	"	"	"		"	"	"	As above. "VoltOhmyst" to TP1. Use 1.5V. scale on meter	Oscillator injection adjustment to read .3V. or less at TP1	Fig. 25
23	Repeat steps 20 to 22 for all UHF inserts, checking oscillator frequency and injection voltage for each insert.									

RATIO DETECTOR, SOUND I-F AND SOUND TAKE-OFF ALIGNMENT

Step No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET METER FREQ. MC	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
1	Grid 2nd Snd. I-F (pin 1, V102) or WR39B or C connect to grid 4th pix I-F (pin 1, V109)	4.5 mc. 400 cy. mod. or 45.75 mc. mod. by 4.5 mc. and 400 cy.	Not used	—	Not used	—	Across speaker voice coil Volume control set for max. volume	"VoltOhmyst" to junction of R111 and C111. Set signal gen. to give —10 V on meter.	T102 top core for max. d-c on meter. T102 bottom core for min. audio on the oscilloscope.	Fig. 28
2	"	"	"	—	"	—	"	"VoltOhmyst" to junction R110 and C110. If the meter reads more than ±1.5 volts, adjust R108 for zero on the meter and readjust T102 (bot.) for min. output on scope. Repeat steps 1 and 2 until all conditions are satisfied.		Fig. 28 Fig. 29
3	Sig. Gen. to 1st Snd. I-F grid	4.5 mc.	1st Sound I-F grid (pin 1, V101)	4.5 mc.	"	—	In series with 10,000 ohms to terminal A, of T101	Sweep output reduced to provide 2 v p-p on scope.	T101 top and bot. cores for max. gain and symmetry at 4.5 mc.	Fig. 27 Fig. 30 Fig. 31
4	"	"	"	"	"	—	Junction of R110 and C110	Check for symmetrical response waveform (positive and negative).		Fig. 28
5	Sig. Gen. in series with 1000 ohms to T110-C or WR39 across T104 A and B	"	Not used	—	"	—		"VoltOhmyst" xtal probe to pin 6, V110. If sig. gen. is used short pin 1, V109 to ground.	Adjust T110 for minimum reading on "VoltOhmyst"	Fig 30

PICTURE I-F AND TRAP ADJUSTMENT

6	Not used	—	Not used	—	Not used	—	Not used	Connect bias box and "VoltOhmyst" to junction of R133 and C133B and to gnd. Adjust bias box to give —1.0 v on "VoltOhymst".		
7	Sig. Gen. across T104 A and B	39.25 mc.	"	—	"	—	"	"VoltOhmyst" to pin 9, V110. Gen. output to give —1.0 volt d-c.	T104 top core to give min. d-c on meter.	Fig. 30
8	"	41.25 mc.	"	—	"	—	"	"	T105 bot. for min.	Fig. 31
9	"	47.25 mc.	"	—	"	—	"	"	T106 bot. for min.	Fig. 31
10	"	43.7 mc.	"	—	"	—	"	Sig. Gen. output to give —1.0 v d-c at Pin 9, V110.	T109 for max.	Fig. 30
11	"	45.5 mc.	"	—	"	—	"	"	T108 for max.	Fig. 30
12	"	41.8 mc.	"	—	"	—	"	"	T107 for max.	Fig. 30
13	First pix i-f grid (pin 1, V106) loosely	Various See Fig. 10	First pix i-f grid pin 1, V106 through 1000 mmf.	40 to 48 mc.	"	—	To pin 9 of V110	Shunt R137, R141 and terminals A and F of T109 with 330 ohms, 0.5 v p-p on scope.	Adjust T105 and T106 top cores for max. gain and response shown in Fig. 10	Fig. 30 Fig. 10
14	Connected loosely to diode probe	Various See Fig. 11	Mixer grid test point TP2 with short lead. (Front terminal of crystal through 1500 mmf. for KRK12)	40 to 48 mc.	"	—	Scope diode probe to T105-B and to gnd.	Rec. on chan. 5. Connect 180 ohms from T105-B to junction R131 and C133A. Upon completion disconnect scope and shunting resistors.	Set C121 to min. Adjust T1 (T2) top and T104 bot. for max. gain at 43.5 mc. and 45.75 mc. at 70%. Adjust C121 until 41.25 mc. is at 80%.	Fig. 30 Fig. 11
15	Connected loosely to grid of 1st pix i-f	Various See Fig. 12	"	"	"	—	Connect scope to pin 9 of V110	"VoltOhmyst" to pin 9, V110. Set bias box for —6.0 volts on the meter. Set sweep output to produce 3.0 volts p-p on scope.	Retouch T108 and T109 to obtain response shown in Fig. 12. Do not adjust T107 unless absolutely necessary.	Fig. 12

RESPONSE PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

PICTURE I-F RESPONSE. — At times it may be desirable to observe the individual i-f stage response. This can be achieved by the following method:

For T107, T108 or T109, shunt all i-f transformers with a 330 ohm carbon resistor except the one whose response is to be observed.

Connect a wide band sweep generator to the second pix i-f grid and adjust it to sweep from 38 mc. to 48 mc.

Connect the oscilloscope to pin 9 of V110 and observe the over-all response. The response obtained will be essentially that of the unshunted stage.

To see the response of transformers T1 (T2), T104 and T105, T106, follow the instructions given

Figures 36 through 41 show the response of the various stages obtained in the above manner. The curves shown are typical although some variation between receivers can be expected. Relative stage gain is not shown.

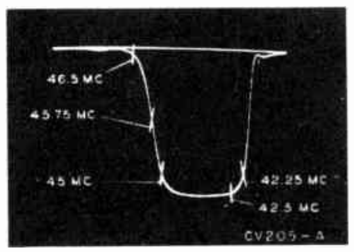


Figure 36—Over-all Pix I-F Response

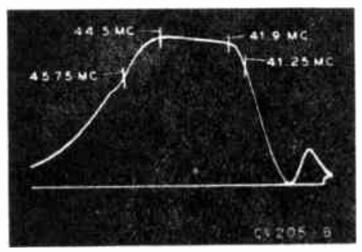


Figure 37—Response of T1 (T2)-T104 Pix I-F Transformers

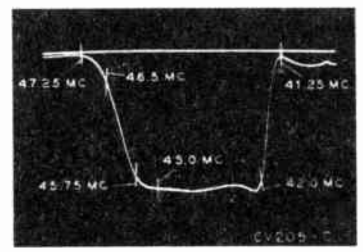


Figure 38—Response of T105-T106 Pix I-F Transformer

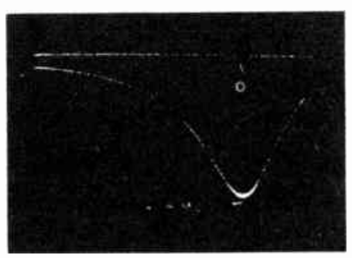
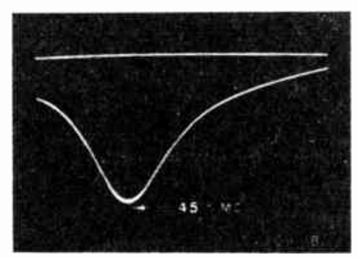


Figure 39—Response of T107 Pix I-F Transformer

Figure 40—Response of T108 Pix I-F Transformer



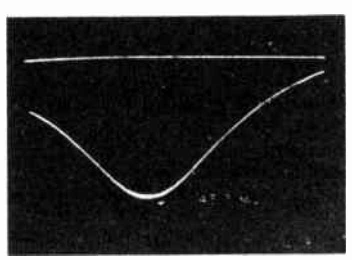
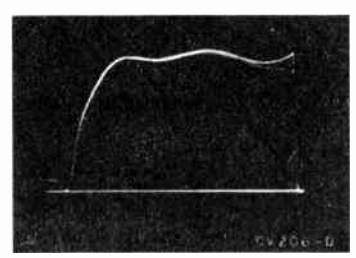
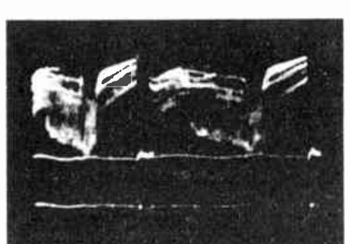


Figure 41—Response of T109 Pix I-F Transformer

Figure 42—Video Response at Average Contrast

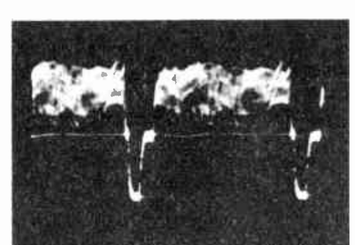




Grid of Video Amplifier (Pin 9 of V110) (6CL6)

Figure 43—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (7.5 Volts PP)

Figure 44—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (7.5 Volts PP)



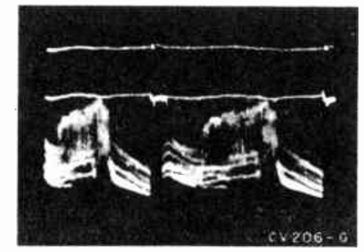
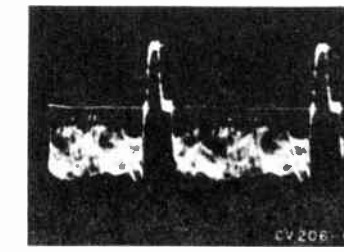


Plate of Video Amplifier (Pin 6 of V110) (6CL6)

Voltage depends on picture

Figure 45—Vertical (155 Volts PP)

Figure 46—Horizontal (155 Volts PP)



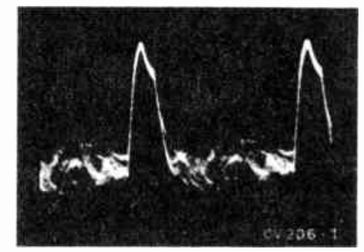
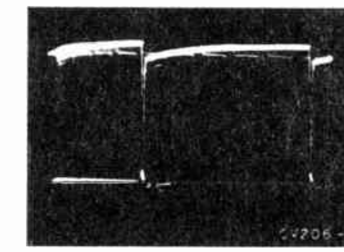
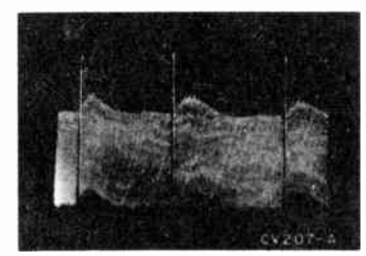


Figure 47—Grid of Vertical Sync Separator (Pin 7 of V111) (12AU7) (110 Volts PP) Voltage depends on picture

Figure 48—Plate of Vertical Sync Separator (Pin 6 of V111) (12AU7) (60 Volts PP) Voltage depends on picture

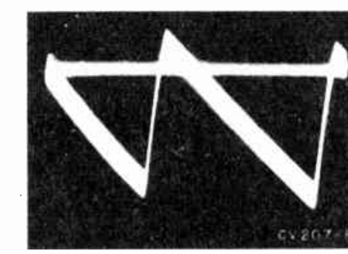


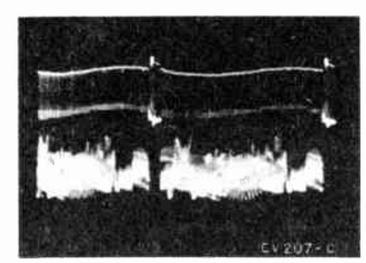


Cathode of Horizontal Sync Separator (Pin 3 of V112) (12AU7)

Figure 49—Vertical (18 Volts PP)

Figure 50—Horizontal (18 Volts PP)

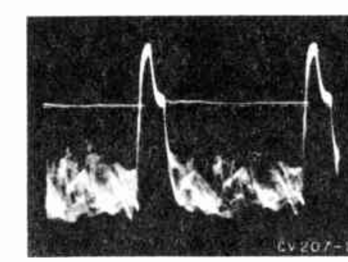




Grid of Horizontal Sync Separator (Pin 2 of V112) (12AU7)

Figure 51—Vertical (115 Volts PP)

Figure 52—Horizontal (115 Volts PP)



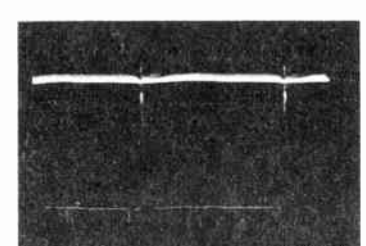
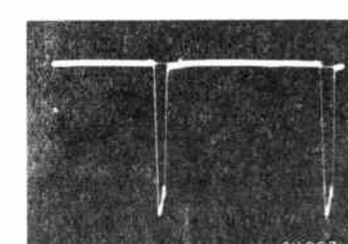
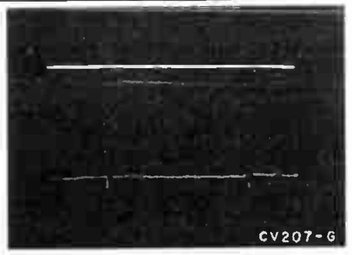


Plate of Horizontal Sync Separator (Pin 1 of V112) (12AU7)

Figure 53—Vertical (75 Volts PP)

Figure 54—Horizontal (75 Volts PP)

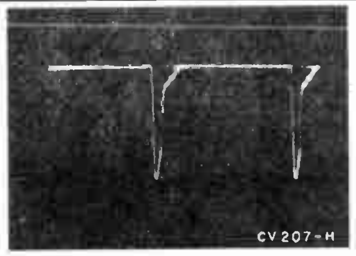




Grid of Sync Amplifier (Pin 7 of V112) (12AU7)

Figure 55—Vertical (70 Volts PP)

Figure 56—Horizontal (70 Volts PP)



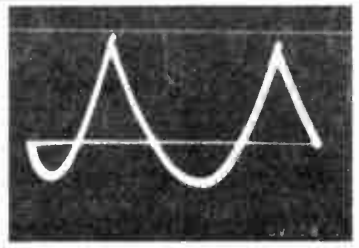
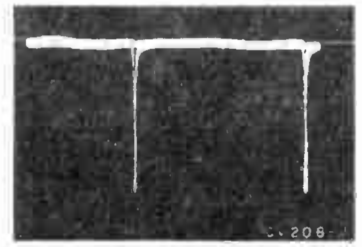


Figure 67—Cathode of Vertical Output (1.0 Volts PP) (Pin 2 of V114) (6AQ5)

Figure 68—Grid of Kinescope (Pin 2 of V120) (15 Volts PP)



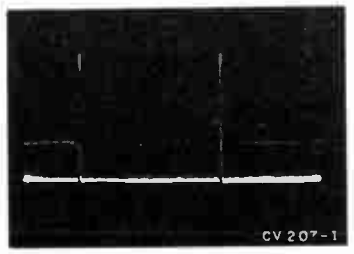
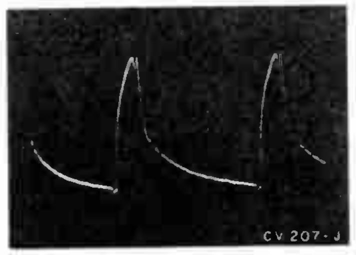


Plate of Sync Amplifier (Pin 6 of V112) (12AU7)

Figure 57—Vertical (105 Volts PP)

Figure 58—Horizontal (105 Volts PP)



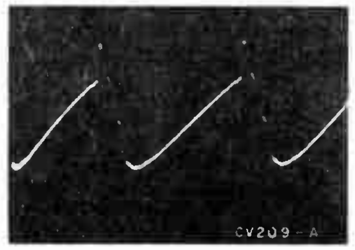
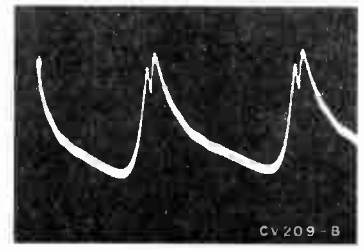


Figure 69—Grid of Horizontal Oscillator Control (30 Volts PP) (Pin 1 of V115) (6SN7GT)

Figure 70—Cathode of Horizontal Oscillator Control (2.1 Volts PP) (Pin 3 of V115) (6SN7GT)



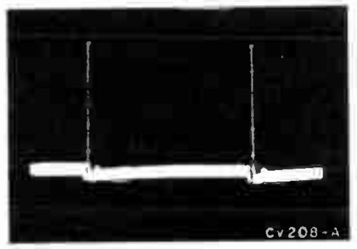
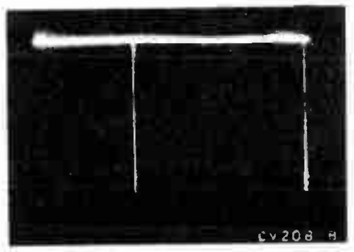


Figure 59—Grid of Vertical Sync Amplifier (Pin 1 of V113A) (6SN7) (57 Volts PP)

Figure 60—Plate of Vertical Sync Amplifier (Pin 2 of V113A) (6SN7) (95 Volts PP)



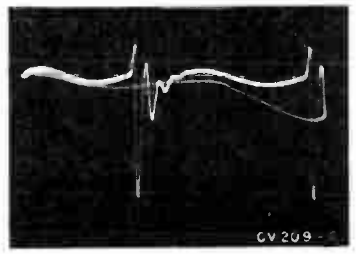
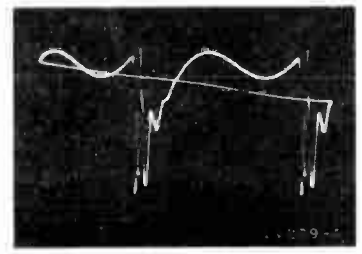


Figure 71—Grid of Horizontal Oscillator (420 Volts PP) (Pin 4 of V115) (6SN7GT)

Figure 72—Plate of Horizontal Oscillator (230 Volts PP) (Pin 5 of V115) (6SN7GT)



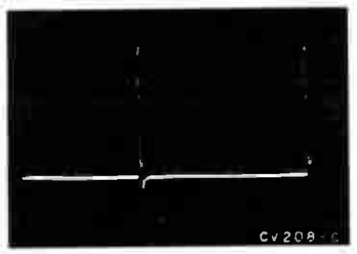
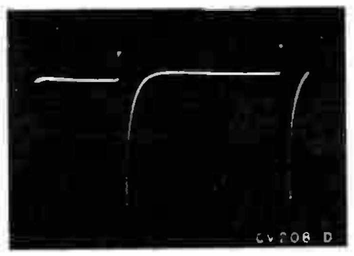


Figure 61—Cathode of Vertical Sync Amplifier (Pin 3 of V113A) (6SN7) (43 Volts PP)

Figure 62—Grid of Vertical Oscillator and Discharge (Pin 4 of V113B) (6SN7) (195 Volts PP)



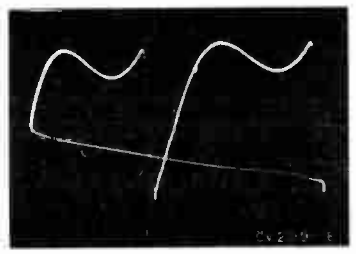
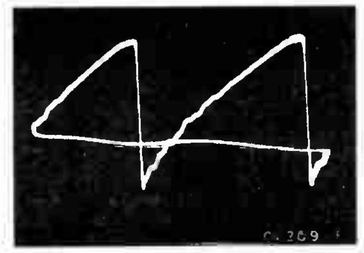


Figure 73—Terminal "C" of T114 (140 Volts PP)

Figure 74—Grid of Horizontal Output Tube (110 Volts PP) (Pin 5 of V116) (6CD6G)



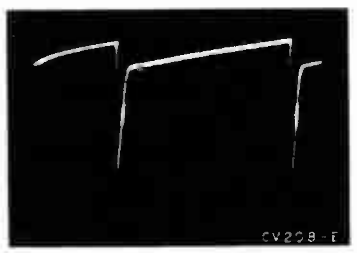
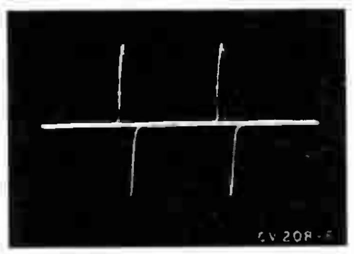


Figure 63—Plate of Vertical Oscillator and Discharge (Pin 5 of V113B) (6SN7) (170 Volts PP)

Figure 64—Cathode of Vertical Oscillator and Discharge (Pin 6 of V113B) (6SN7)



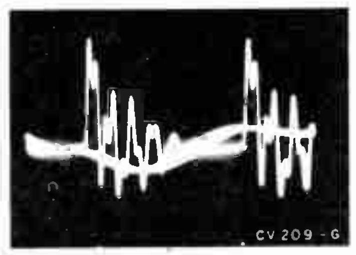
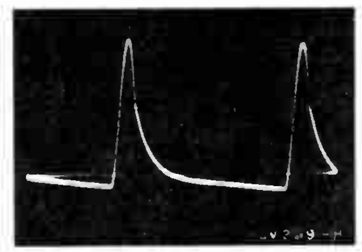


Figure 75—Plate of Horizontal Output (Approx. 5,450 Volts PP) (Measured Through a Capacity Voltage Divider Connected from Top Cap of V116 to Ground)

Figure 76—Cathodes of Dampers (2,050 Volts PP) (Pin 3 of V118/V119) (6W4GT's)



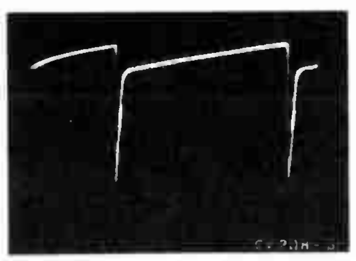
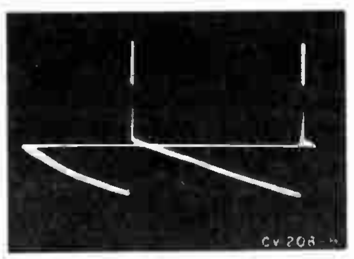


Figure 65—Grid of Vertical Output (170 Volts PP) (Pin 1 of V114) (6AQ5)

Figure 66—Plate of Vertical Output (1,325 Volts PP) (Pin 5 of V114) (6AQ5)



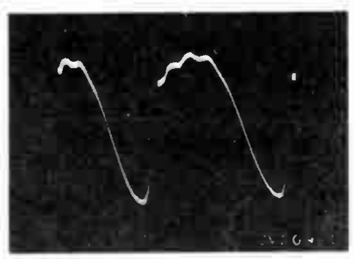
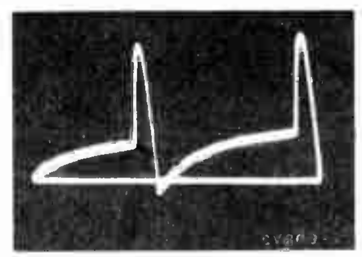


Figure 77—Plates of Dampers (85 Volts PP) (Pin 5 of V118/119) (6W4GT's)

Figure 78—Plate of AGC Amplifier (Pin 1 of V111) (12AU7) (345 Volts PP)



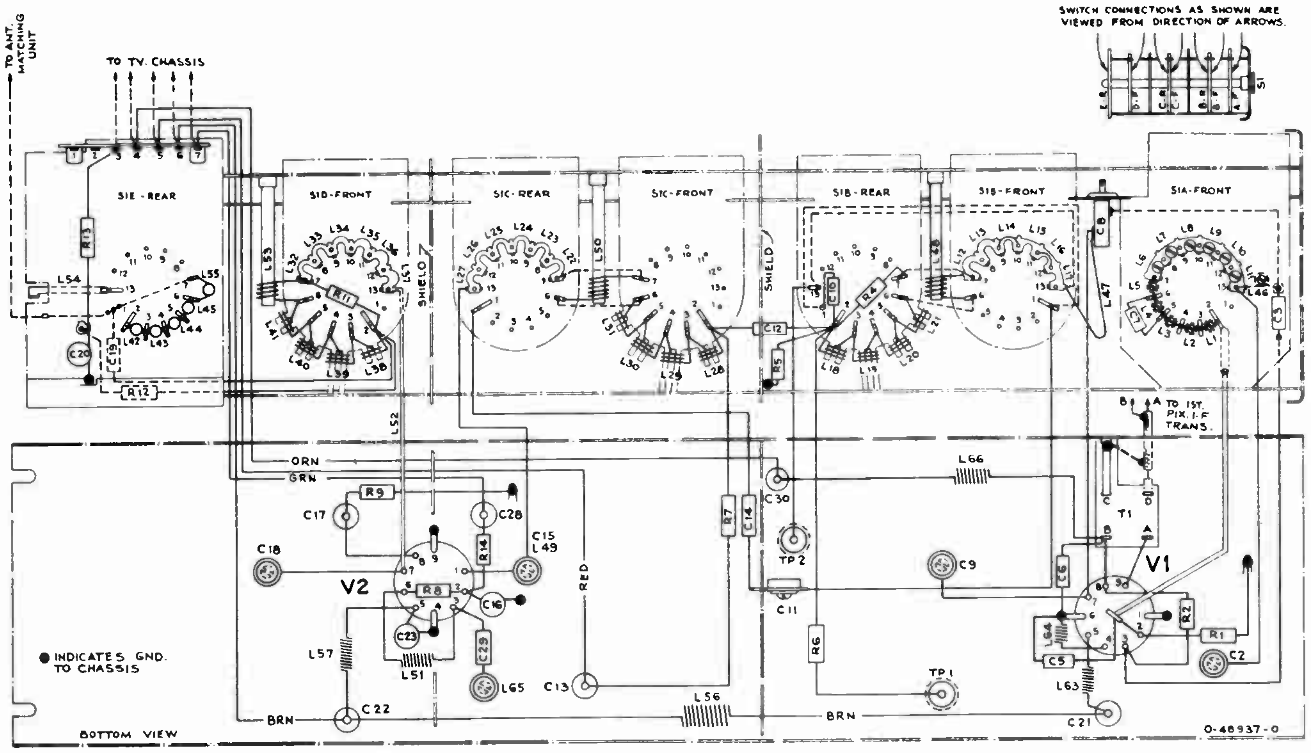


Figure 79—KRK11B Tuner Unit Wiring Diagram

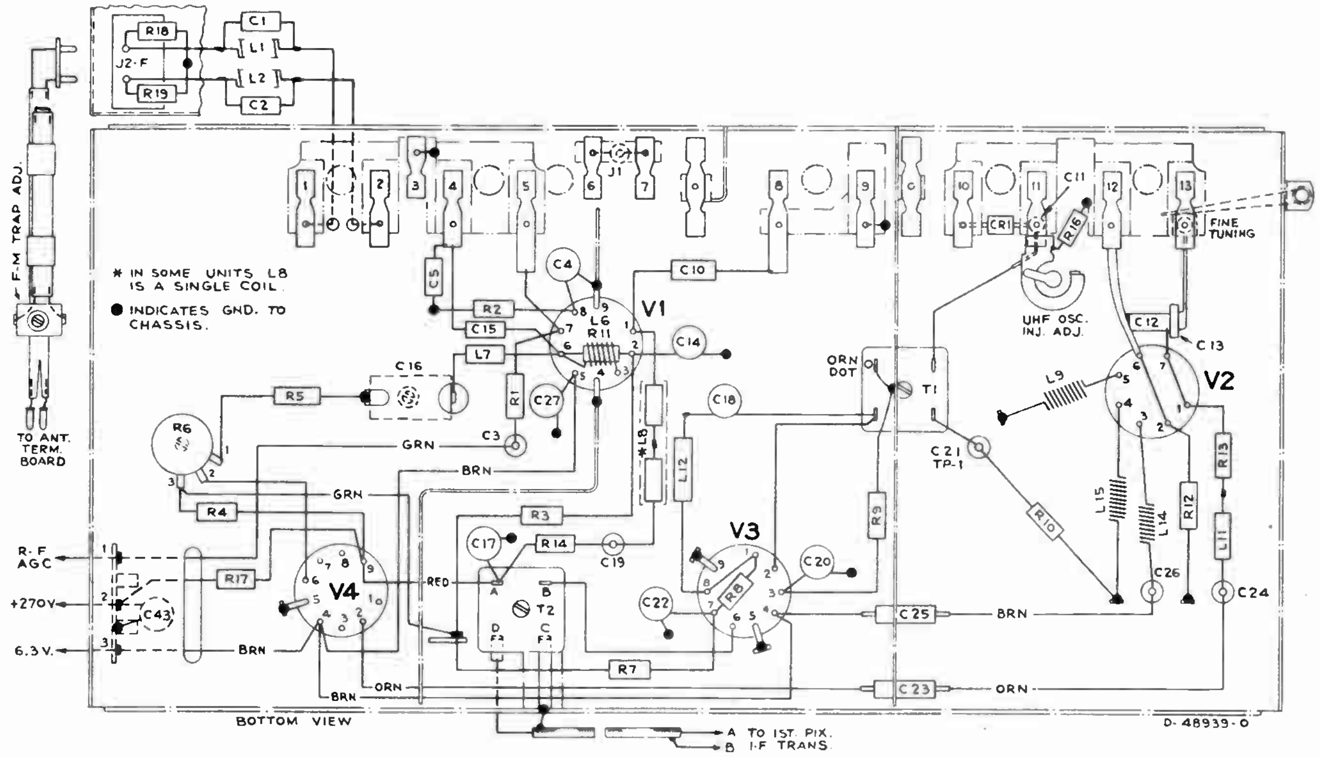


Figure 81—KRK12 Tuner Unit Wiring Diagram

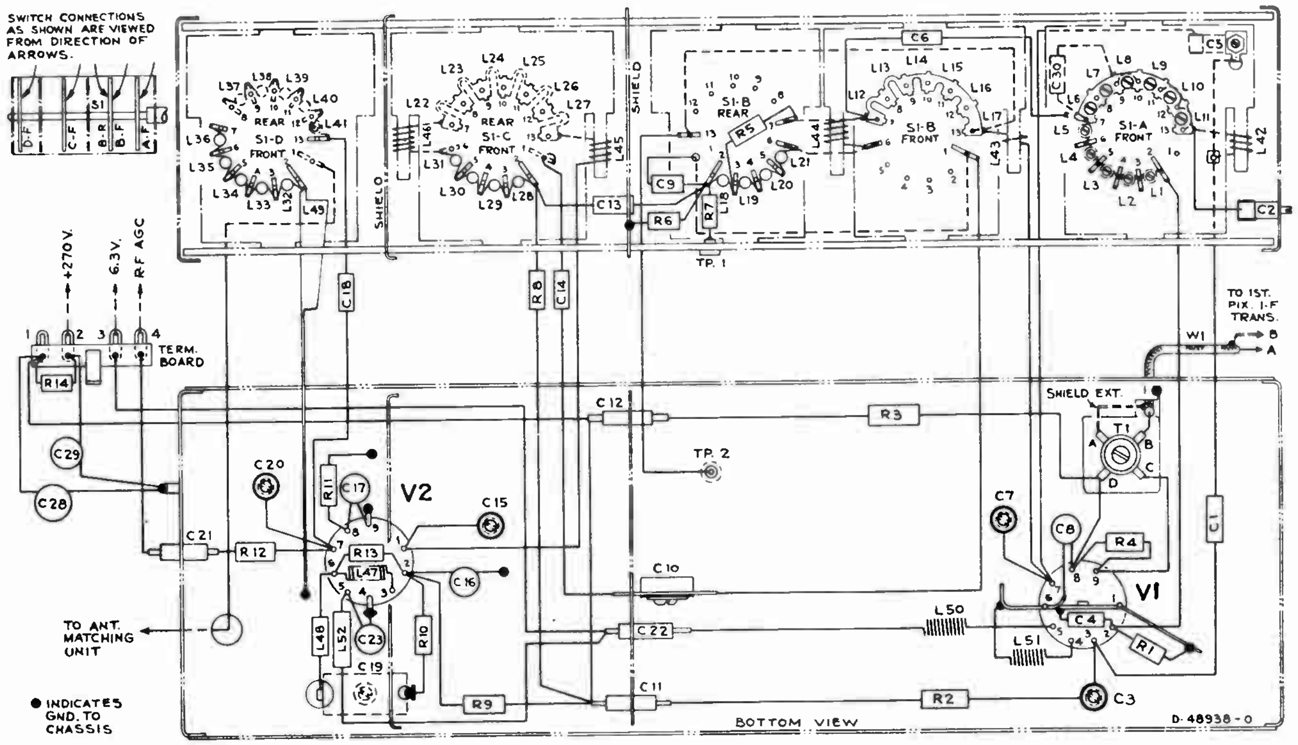


Figure 80—KRK22A Tuner Unit Wiring Diagram

CRITICAL LEAD DRESS

1. Keep all wiring in the pix i-f, sound i-f and video circuits as short as possible.
2. Keep the leads on C108, C109, C111, R107, R109, R110, R111 and R112 as short and direct as possible.
3. Do not change the bus wire connections to pin 2 of V101 and V102. Sleeving is used on these wires to insure length and to prevent shorting.
4. Do not change position of R150 and L104 at pin 9 of V110.
5. Ground R128 to pin 3 of V106 and R134 to pin 7 of V107.
6. Do not change the grounding of R137, R138 and R141.
7. Keep the bus wire from T109-A to C144 (plug-in capacitor) short and direct.
8. Ground the filaments of sockets of V107, V108 and V109 independently of tube shields (pin 8). Use ground lances provided near each socket.
9. Dress C146 straight up to act as a shield between T101-A and V110-9.
10. Dress C153 and R159 (kine cathode) up in the air above the terminal board.
11. Keep the leads connected to T114-C and T114-D (synchroguide) down so that they will not short out when the chassis is placed in the cabinet.
12. Do not reroute any wires between T104 and the terminal board alongside it. Keep all leads on the foot side of the terminal board.
13. Dress all wires routed past T104, under the large lances near T104.
14. Dress black and red leads from S102 through slot in cap of S102.
15. Dress R113 close to the chassis with leads as short as possible.
16. Dress C198, C199 and C200 up in the air and away from all other leads and components.
17. Dress all leads away from bleeder resistor R228.
18. The brown and green leads of the vertical output transformer should be routed from J102 under clamp on high voltage shield and away from all tubes.
19. Keep leads on C145 as short and direct as possible.
20. Do not dress any leads under C121 (5-70) trimmer.
21. Keep the wire from the vertical output transformer T112 away from the 5U4G rectifier tubes.
22. Dress all 2 watt resistors away from each other and all other wires and components.
23. Dress all wires away from damper tubes V118 and V119.
24. Blue wire from pin 1 V111 to terminal board should be routed between V116 and rear apron.
25. Dress all peaking coils up and away from the base.
26. Dress all shielded wires under lances provided.

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V1	6X8	Mixer	5000 Mu. V. Signal	9	160	8	160	6	0	7	-2.4 to -3.0	—	—	
KRK11B			No Signal	9	145	8	145	6	0	7	-2.8 to -3.5	—	—	
KRK22A		R-F Oscillator	5000 Mu. V. Signal	3	95	—	—	6	0	2	-3.8 to -5.5	—	—	
			No Signal	3	90	—	—	6	0	2	-3.0 to -5.1	—	—	
V2	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	170	—	—	8	0.1	7	0	—	—	
KRK11B			No Signal	6	133	—	—	8	1.1	7	0	—	—	
KRK22A		R-F Amplifier	5000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2		—	—	
V1	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	—	—	
KRK12			No Signal	6	138	—	—	8	1.0	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	260	—	—	3	143	2	97	—	—	
			No Signal	1	250	—	—	3	137	2	97	—	—	
V2	6AF4	R-F Oscillator	5000 Mu. V. Signal	1 & 7	78	—	—	5	0	2&6	−8	—	—	
			No Signal	1 & 7	75	—	—	5	0	2&6	−6	—	—	
V3	6BQ7A	I-F Amplifier	5000 Mu. V. Signal	6	270	—	—	8	148	7	103	—	—	
KRK12			No Signal	6	260	—	—	8	142	7	99	—	—	
		I-F Amplifier	5000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	—	—	
			No Signal	1	143	—	—	3	1.2	2	0	—	—	
V4	6S4	Voltage Control	5000 Mu. V. Signal	9	270	—	—	2	94	6	*68	—	—	*Depends on adjustment of R6.
			No Signal	9	260	—	—	2	90	6	*65	—	—	
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	127	6	124	7	0.7	1	−0.4	6.0	3.0	
			No Signal	5	126	6	123	7	0.5	1	−1.2	5.0	3.0	
V102	6AU6	2nd Sound I-F Amp.	5000 Mu. V. Signal	5	132	6	60	7	0	1	−10	2.8	1.2	
			No Signal	5	131	6	65	7	0	1	−5	2.0	1.0	
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	2 7	−9.2 1.0	—	—	5 1	1.0 9.2	—	—	—	—	
			No Signal	2 7	−8.0 0	—	—	5 1	0 8.0	—	—	—	—	
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	90	—	—	2	0	1	−0.7	0.65	—	At min. volume
			No Signal	7	88	—	—	2	0	1	−0.7	0.65	—	
V104	6AV6	R-F Bias Clamp	5000 Mu. V. Signal	5-6	−3.0	—	—	2	0	—	—	—	—	
			No Signal	5-6	0.3	—	—	2	0	—	—	—	—	
V105	6AQ5	Audio Output	5000 Mu. V. Signal	5	327	6	342	2	146	7	136	28	2.0	At min. Volume
			No Signal	5	323	6	338	2	143	7	133	28	2.0	
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	160	6	215	7	0.17	1	−6.6	1.4	.4	
			No Signal	5	85	6	115	7	0.98	1	0	6.5	3.3	

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	227	6	225	2	0.1	1	−6.6	1.5	.25	
			No Signal	5	209	6	115	2	0.8	1	0	10.9	3.3	
V108	6CB6	3rd Pix. I-F Amplifier	5000 Mu. V. Signal	5	138	6	132	2	1.02	1	0	11.4	3.5	
			No Signal	5	134	6	126	2	.98	1	0	10.4	3.1	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	168	6	165	2	2.32	1	0	8.85	2.2	
			No Signal	5	156	6	161	2	2.07	1	0	8.6	2.1	
V110	6CL6	Video Amplifier	5000 Mu. V. Signal	6	130	3-8	159	1	.84	2-9	*−5.0	22.5	5.5	*Depends on picture
			No Signal	6	130	3-8	80	1	0.7	2-9	*−2.0	15.0	4.0	*Depends on picture
V111A	12AU7	AGC Rectifier	5000 Mu. V. Signal	1	−30	—	—	3	142	—	—	0	—	AGC control set for normal operation
			No Signal	1	0	—	—	3	137	—	—	0	—	
V111B	12AU7	Vert. Sync. Separator	5000 Mu. V. Signal	6	110	—	—	8	0	7	−42	.25	—	
			No Signal	6	45	—	—	8	0	7	*−5	.25	—	*Depends on noise
V112A	12AU7	Hor. Sync. Separator	5000 Mu. V. Signal	1	323	—	—	3	192	2	116	.5	—	
			No Signal	1	320	—	—	3	132	2	112	.5	—	
V112B	12AU7	Sync. Amplifier	5000 Mu. V. Signal	6	78	—	—	8	0	7	−3.5	6.2	—	
			No Signal	6	78	—	—	8	0	7	−1.6	6.2	—	
V113A	6SN7GT	Vert. Sync. Amplifier	5000 Mu. V. Signal	2	140	—	—	3	19.2	1	−.35	0.1	—	
			No Signal	2	135	—	—	3	17.3	1	0	<0.1	—	
V113B	6SN7GT	Vert. Osc. & Discharge	5000 Mu. V. Signal	5	203	—	—	6	0	4	−56	.2	—	
			No Signal	5	208	—	—	6	0	4	−55	.2	—	
V114	6AQ5	Vertical Output	5000 Mu. V. Signal	5	334	6	334	2	30	1	0	17.3	1.2	
			No Signal	5	332	6	332	2	29	1	0	17.3	1.2	
V115	6SN7GT	Horizontal Osc. Control	5000 Mu. V. Signal	2	188	—	—	3	−9	1	−28	0.37	—	Hor. hold at mid-range
			No Signal	2	0	—	—	3	0	1	0	0	—	
		Horizontal Oscillator	5000 Mu. V. Signal	5	184	—	—	6	0	4	−72	2.5	—	Hor. hold at mid-range
			No Signal	5	182	—	—	6	0	4	−73	2.5	—	
V116	6CD6G	Horizontal Output	5000 Mu. V. Signal	Cap	*	8	165	3	12.5	5	−30	110	15.0	*High Voltage Pulse Present
			No Signal	Cap	*	8	165	3	12.5	5	−30	110	15.0	
V117	1B3GT/8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	16,000	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	16,400	—	—	—	—	
V118 V119	6W4GT	Dampers	5000 Mu. V. Signal	5	352	—	—	3	*	—	—	57	—	*High Voltage Pulse Present
			No Signal	5	348	—	—	3	*	—	—	57	—	
V120	21AP4	Kinescope	5000 Mu. V. Signal	Cone	16,000	10	525	11	140	2	*82	0.2	—	At average Brightness
			No Signal	Cone	16,400	10	520	11	132	2	*76	0.2	—	*0 voltage on Phono. position
V121 V122	5U4G	Rectifiers	5000 Mu. V. Signal	4 & 6	364	—	—	2 & 8	364	—	—	*145	—	*Per Tube
			No Signal	4 & 6	360	—	—	2 & 8	360	—	—	*150	—	

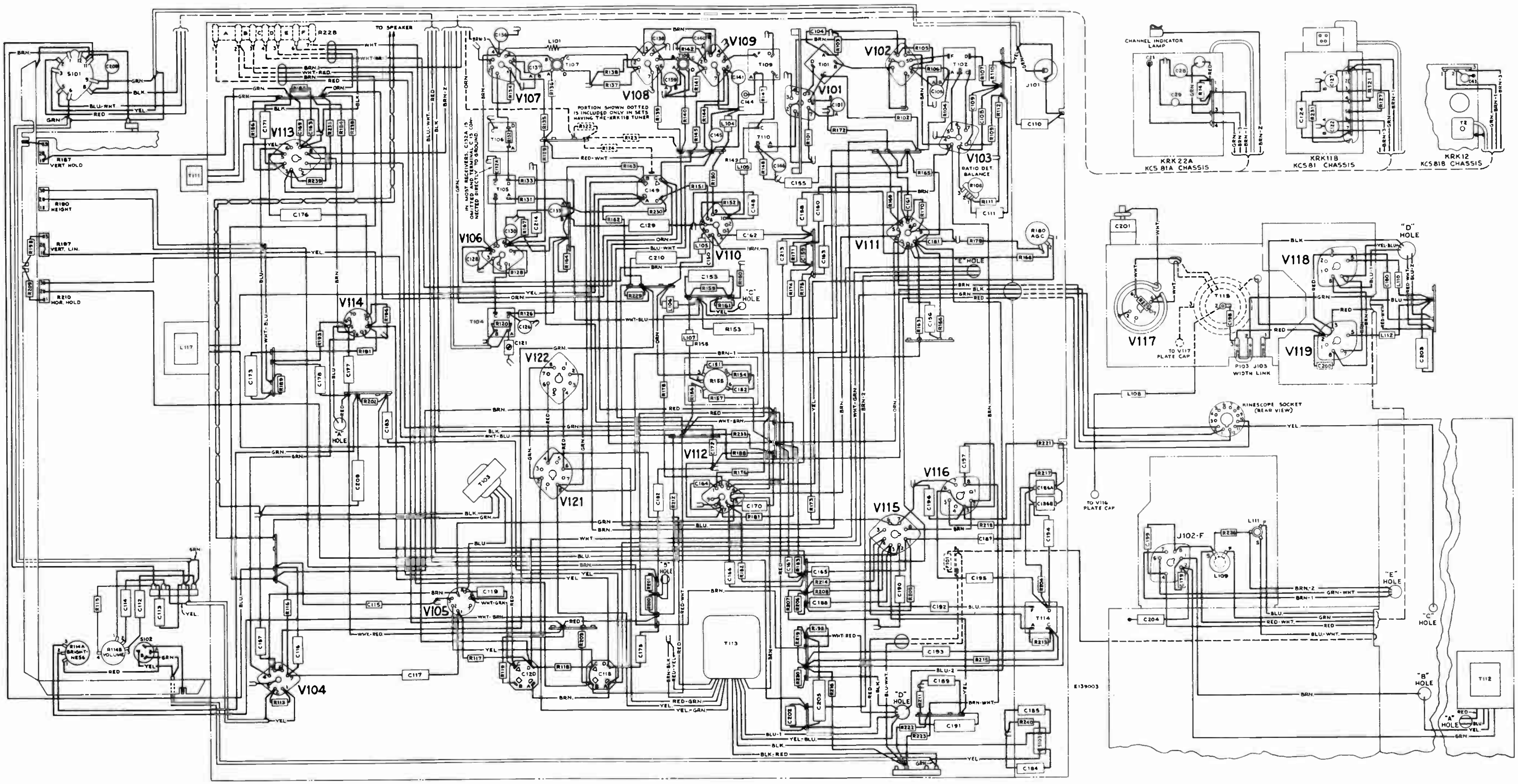
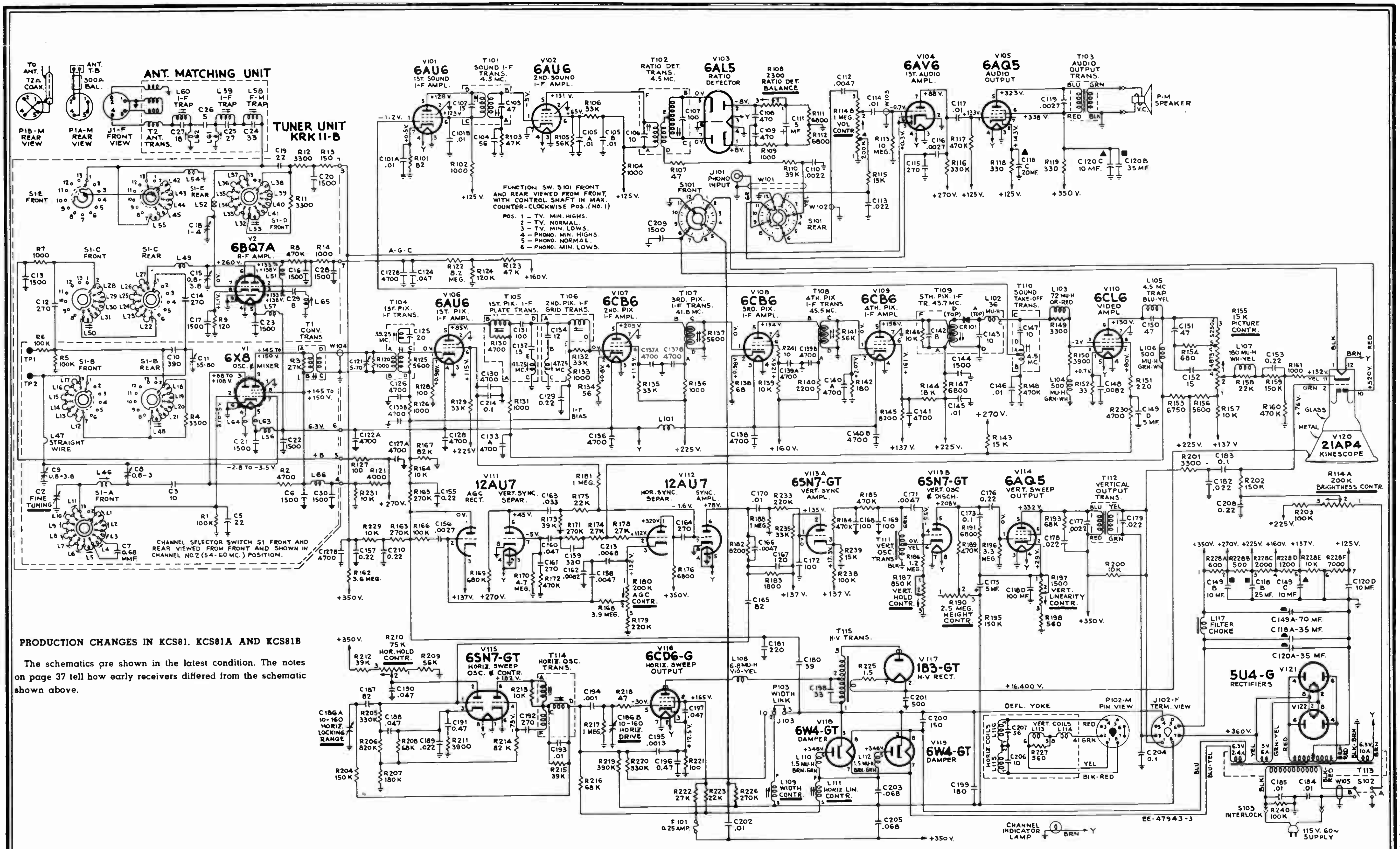


Figure 82—Chassis Wiring Diagram KCS81, KCS81A and KCS81B



PRODUCTION CHANGES IN KCS81, KCS81A AND KCS81B

The schematics are shown in the latest condition. The notes on page 37 tell how early receivers differed from the schematic shown above.

The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 83—Circuit Schematic Diagram KCS81

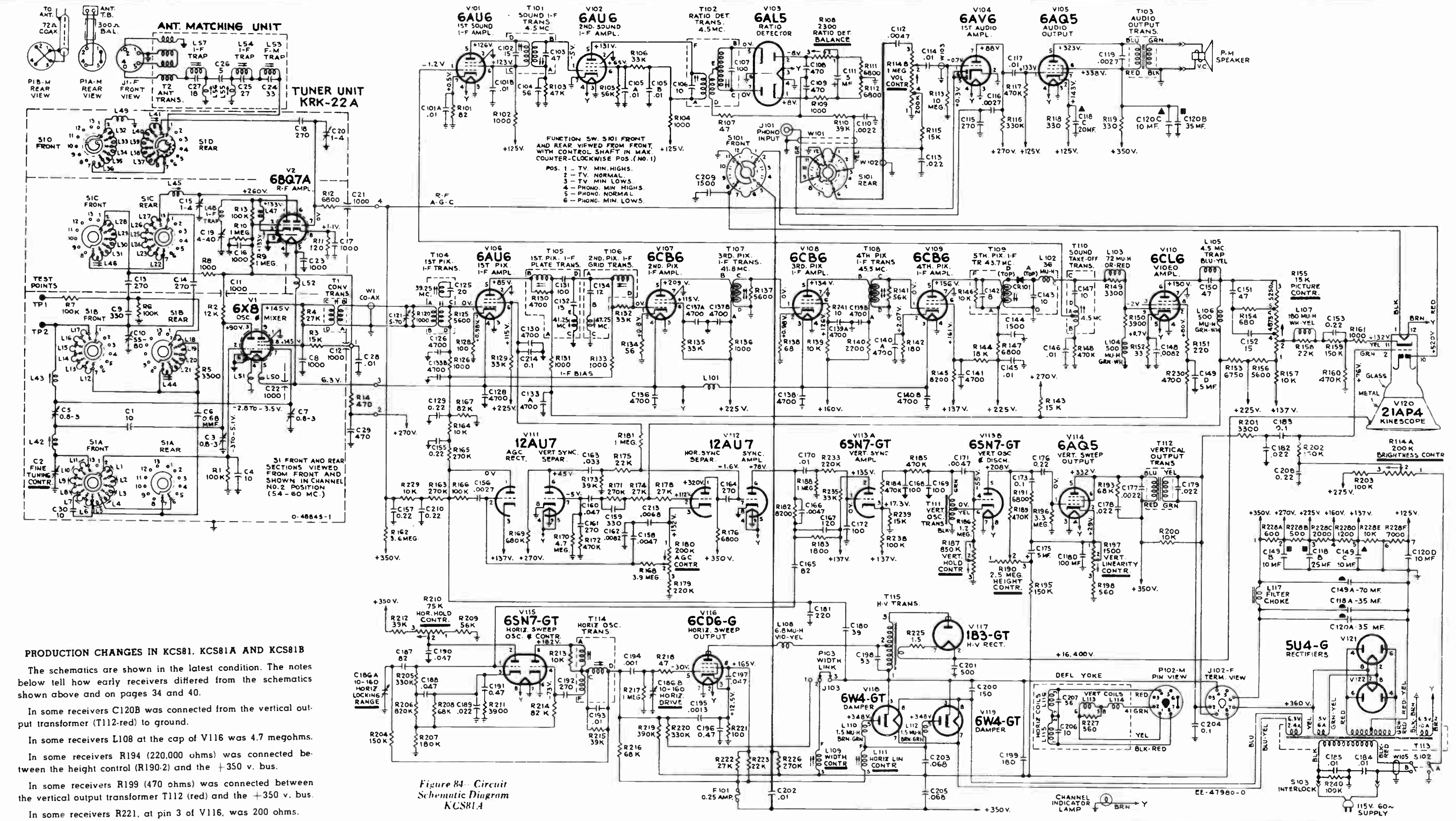


Figure 84—Circuit Schematic Diagram KCS81A

PRODUCTION CHANGES IN KCS81, KCS81A AND KCS81B

The schematics are shown in the latest condition. The notes below tell how early receivers differed from the schematics shown above and on pages 34 and 40.

In some receivers C120B was connected from the vertical output transformer (T112-red) to ground.

In some receivers L108 at the cap of V116 was 4.7 megohms.

In some receivers R194 (220,000 ohms) was connected between the height control (R190-2) and the +350 v. bus.

In some receivers R199 (470 ohms) was connected between the vertical output transformer T112 (red) and the +350 v. bus.

In some receivers R221, at pin 3 of V116, was 200 ohms.

In some receivers R241, at pin 6 of V108, was omitted.

In some receivers terminals 2 and 3 of R190 height control were reversed.

NOTE: In receivers where T105 1st Pix I-F Transformer is stamped 971363-1 (Part No. 76434) an 82 uuf. ceramic capacitor (Part No. 71514) is connected from Terminal "C" of T105 to ground. (For replacement use Part No. 77197 and omit capacitor.)

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
76965	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts (C7)
77151	Capacitor—Tubular, adjustable, steatite, 0.8-3 mmf. (C8)
75184	Capacitor—Ceramic, adjustable, 0.8-3.8 mmf., complete with adjusting stud (C9)

STOCK No.	DESCRIPTION
76532	Capacitor—Adjustable trimmer, steatite, 1-4 mmf. (C18)
	Capacitors—Ceramic, fixed, non-insulated:
93056	5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C26)
70597	8 mmf., ±1 mmf., 500 volts DC, Temp. coef. = 0 (C29)
55326	10 mmf., ±1 mmf., 500 volts DC, Temp. coef. = -80 (C3)
54207	18 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C27)
76557	22 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C19)
76558	22 mmf., ±10%, 500 volts DC, Temp. coef. = −750 Special—copper coated (C5)

STOCK No.	DESCRIPTION
70935	27 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C25)
76739	33 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C24)
76527	Capacitor—Mica trimmer, 55-80 mmf. (C11)
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf., ±20%, 500 volts DC, High "K" type (C12, C14)
75641	Capacitor—Fixed, ceramic, insulated, 390 mmf., ±10%, 500 volts DC, High "K" type (C10)
75166	Capacitor—Ceramic, 1,500 mmf. (stand-off) (C13, C21, C22, C28, C30)
75610	Capacitor—Fixed, ceramic, insulated, 1,500 mmf., ±20%, 500 volts DC, High "K" type (C6)
73748	Capacitor—Fixed, ceramic, 1,500 mmf., +100%, 0%, 500 volts DC, High "K" disc (C16, C17, C20, C23)
76143	Clip—Tubular clip for mounting stand-off capacitors
73591	Coil—Antenna matching coil (2 req'd)

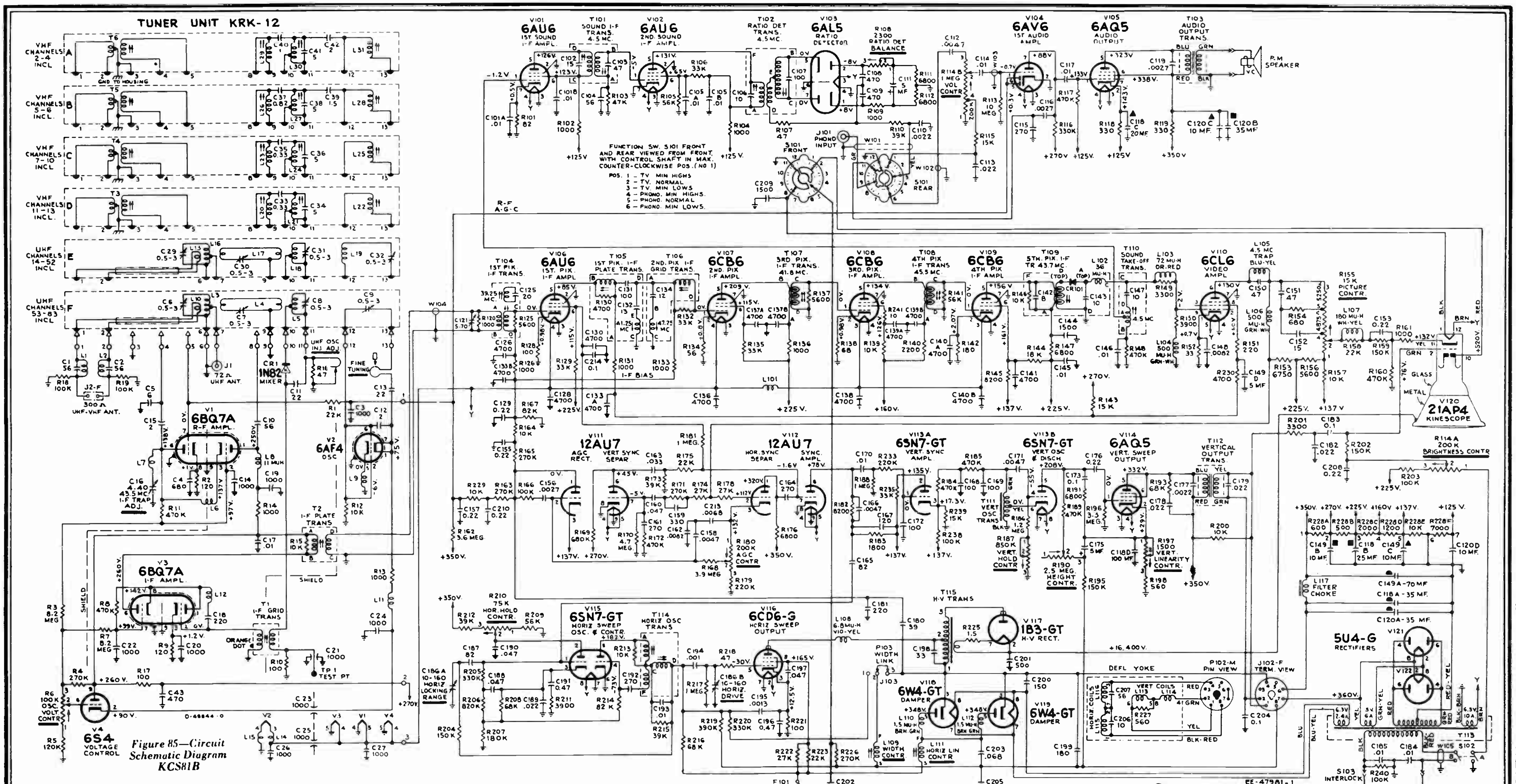


Figure 85—Circuit Schematic Diagram KCS81B

STOCK No.	DESCRIPTION
73477	Coil—Choke coil (L57)
77206	Coil—Filament choke coil (L56)
76763	Coil—Filament choke coil (L63, L64)
76562	Coil—RF amplifier coupling coil (L51)
77153	Coil—RF choke coil (L66)
76537	Coil—Shunt coil complete with adjustable core (L61)
76538	Coil—Shunt coil complete with adjustable core (L62)
76529	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r.f. section (L49, C15)
	Resistors—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R9)
503115	150 ohms, ±10%, ½ watt (R13)
503210	1,000 ohms, ±10%, ½ watt (R7, R14)
503233	3,300 ohms, ±10%, ½ watt (R4, R11, R12)
503247	4,700 ohms, ±10%, ½ watt (R2)
503410	100,000 ohms, ±10%, ½ watt (R1, R5, R6)
503447	470,000 ohms, ±10%, ½ watt (R8)

STOCK No.	DESCRIPTION
76536	Transformer—Antenna matching transformer — complete (T2, C24, C25, C26, C27, L58, L59, L60, L61, L62, J1)
77663	Transformer—Convertor transformer complete with adjustable core (T1, R3)
76535	Trap—I.F. trap
76542	Trap—I.F. trap (41.25 MC) complete with core (L60)
76541	Trap—I.F. trap (45.75 MC) complete with core (L59)
76540	Trap—F.M. trap complete with adjustable core (L58)
77853	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
77913	Capacitor—Tubular, adjustable, steatite, 0.8-3.0 mmf. (C5)
71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts DC (C6)
77151	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. (C3, C7)
76532	Capacitor—Adjustable, steatite, 1-4 mmf. (C15, C20)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C19)
93056	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C26)

STOCK No.	DESCRIPTION
77865	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts DC, Temp. coef. = 0 (C1, C30)
78247	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts, Temp. coef. = -750 (C4)
54207	Capacitor—Fixed, ceramic, non-insulated, 18 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C27)
70935	Capacitor—Fixed, ceramic, non-insulated, 27 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C25)
76739	Capacitor—Fixed, ceramic, non-insulated, 33 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C24)
76527	Capacitor—Mica trimmer, 55-80 mmf. (C10)
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf., ±20%, 500 volts DC, High "K" type (C13, C14, C18)
76552	Capacitor—Fixed, ceramic, insulated, 330 mmf., ±10%, 500 volts DC, High "K" type (C9)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, 0%, 500 volts DC, High "K" disc (C29)

STOCK No.	DESCRIPTION
77084	Capacitor—Ceramic, feed-thru, 1,000 mmf. (C11, C14, C21, C22)
77252	Capacitor—Fixed, ceramic, 1,000 mmf., +100%, -0%, 500 volts DC, High "K" disc (C8, C16, C17, C23)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, -0%, 500 volts DC, High "K" disc (C28)
77854	Clip—Mounting clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T2)
73874	Coil—Channel No. 6 mixer coil (L44)
73460	Coil—Channel No. 6 r.f. plate coil (L46)
77915	Coil—Channel No. 13 oscillator coil (L42)
77919	Coil—Channel No. 13 mixer coil (L43)
77921	Coil—Channel No. 13 r.f. plate coil (L45)
77206	Coil—Filament choke coil (L52)
76763	Coil—Heater choke coil (L50, L51)
76562	Coil—RF amplifier coupling coil (L47)
76537	Coil—Shunt coil complete with adjustable core (L55)
76538	Coil—Shunt coil complete with adjustable core (L56)

STOCK No.	DESCRIPTION
	Resistor—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R11)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1,000 ohms, ±10%, ½ watt (R8)
503233	3,300 ohms, ±10%, ½ watt (R5)
503268	6,800 ohms, ±10%, ½ watt (R12)
523312	12,000 ohms, ±10%, 2 watts (R2)
523315	15,000 ohms, ±10%, 2 watts (R3)
502327	27,000 ohms, ±5%, ½ watt (R4)
503410	100,000 ohms, ±10%, ½ watt (R1, R6, R7, R13)
503510	1 megohm, ±10%, ½ watt (R9, R10)
77858	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
77857	Transformer—Convertor transformer (T1)
76540	Trap—FM trap complete with adjustable core (L53)
77628	Trap—I.F. trap (L48)
76542	Trap—I.F. trap (41.25 MC) complete with core (L57)
76541	Trap—I.F. trap (45.75 MC) complete with core (L54)
77691	Capacitor—Fixed, headed-lead type, .33 mmf., ±10%, 500 volts DC (C33, C35)
77689	Capacitor—Fixed, headed-lead type, .82 mmf., ±10%, 500 volts DC (C37)
77690	Capacitor—Fixed, headed-lead type, 1 mmf., ±10%, 500 volts DC (C40)
71500	Capacitor—Fixed, headed-lead type, 1.5 mmf., ±10%, 500 volts DC (C39)
78047	Capacitor—Fixed, headed-lead type, 2.0 mmf., ±10%, 500 volts DC (C42)
77210	Capacitor—Fixed, ceramic, non-insulated, 2 mmf., ±0.25 mmf., 500 volts DC, Temp. coeff. = 0 (C15)
77667	Capacitor—Fixed, ceramic, insulated, comprising 1 section of 2 mmf., and 1 section of 22 mmf., Temp. coeff. = −750 (C12, C13)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C16)
77688	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±.5 mmf., 500 volts DC, Temp. coeff. = 0 (C34, C36, C38, C41)
74182	Capacitor—Fixed, ceramic, non-insulated, 6 mmf., ±0.5 mmf., 500 volts DC, Temp. coeff. = 0 (C5)
77621	Capacitor—Fixed, ceramic, crystal holder, 22 mmf., ±10%, Temp. coeff. = −750 (C11)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC, Temp. coeff. = −750 (C10)
77625	Capacitor—Fixed, ceramic, 220 mmf., +100%, −0%, 500 volts DC, High "K" disc (C18)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 volts DC, High "K" disc (C43)
77624	Capacitor—Fixed, ceramic, 680 mmf., +100%, −0%, 500 volts DC, High "K" disc (C4)
77084	Capacitor—Ceramic, feed-thru, 1,000 mmf. (C21, C23, C25)
77615	Capacitor—Ceramic, stand-off, 1,000 mmf. (C3, C19, C24, C26)
77252	Capacitor—Fixed, ceramic, 1,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C14, C20, C22, C27)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C17)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
77489	Rectifier—Germanium rectifier IN82 (CR1)
	Resistors—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1,000 ohms, ±10%, ½ watt (R13, R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)

STOCK No.	DESCRIPTION
71496	Capacitor—Mica trimmer, 5-70 mmf. (C121)
75217	Capacitor—Mica trimmer, dual 10-160 mmf. (C186A, C186B)
39044	Capacitor—Fixed, ceramic, non-insulated, 15 mmf., ±10%, 500 volts DC, Temp. coef = −750 (C152)
76577	Capacitor—Fixed, ceramic, 33 mmf., 6,000 volts (C198)
76574	Capacitor—Fixed, ceramic, 39 mmf., 3,500 volts (C180)
39042	Capacitor—Fixed, ceramic, non-insulated, 47 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C151)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C104)
76474	Capacitor—Fixed, mica, 82 mmf., 1,000 volts DC (C165, C187)
39396	Capacitor—Fixed, ceramic, non-insulated, 100 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C168, C169, C172)
71614	Capacitor—Fixed, ceramic, non-insulated, 120 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C167)
76576	Capacitor—Fixed, ceramic, 150 mmf., 2,000 volts (C200)
76575	Capacitor—Fixed, ceramic, 180 mmf., 3,500 volts (C199)
75248	Capacitor—Fixed, mica, 220 mmf., 1,000 volts (C181)
47617	Capacitor—Fixed, ceramic, non-insulated, 270 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C115, C164)
39638	Capacitor—Fixed, mica, 270 mmf., 500 volts DC (C161)
76579	Capacitor—Fixed, mica, 270 mmf., 1,000 volts DC (C192)
39640	Capacitor—Fixed, mica, 330 mmf., 500 volts DC (C159)
39644	Capacitor—Fixed, mica, 470 mmf., 500 volts DC (C108, C109)
76488	Capacitor—Ceramic, 500 mmf., 30,000 volts (C201)
75166	Capacitor—Ceramic, stand-off, 1,500 mmf. (C144)
73748	Capacitor—Fixed, ceramic, 1,500 mmf., +100%, −0%, 500 volts DC, High "K" disc (C209)
73473	Capacitor—Fixed, ceramic, 4,700 mmf., +100%, −0%, 500 volts DC, High "K" disc (C126, C128, C130, C136, C138, C141)
76470	Capacitor—Fixed, ceramic, dual 4,700 mmf., +100%, −0%, 500 volts DC, High "K" disc (C122A, C122B, C127A, C127B for KCS81) (C133A, C133B, C137A, C137B, C139A, C139B, C140A, C140B)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C145, C146)
75877	Capacitor—Fixed, ceramic, dual 10,000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C101A, C101B, C105A, C105B)
74521	Capacitor—Electrolytic, 5 mfd., 50 volts (C111)
28417	Capacitor—Electrolytic, 5 mfd., 450 volts (C175)
76485	Capacitor—Electrolytic, comprising 2 sections of 35 mfd., 450 volts, 1 section of 10 mfd., 450 volts and 1 section of 10 mfd., 200 volts (C120A, C120B, C120C, C120D)
76486	Capacitor—Electrolytic comprising 1 section of 35 mfd., 450 volts, 1 section of 25 mfd., 450 volts, 1 section of 20 mfd., 200 volts and 1 section of 100 mfd., 50 volts (C118A, C118B, C118C, C118D)
77657	Capacitor—Electrolytic comprising 1 section of 70 mfd., 450 volts, 2 sections of 10 mfd., 450 volts and 1 section of 5 mfd., 450 volts (C149A, C149B, C149C, C149D)
	Capacitors—Fixed, tubular, oil impregnated:
75643	Paper, .001 mfd., 1,000 volts (C194)
77727	Moulded paper, .0013 mfd., 600 volts (C195)
73595	Paper, .0022 mfd., 600 volts (C110)
73803	Paper, .0022 mfd., 1,000 volts (C177)
73599	Paper, .0027 mfd., 600 volts (C116, C119, C156)
73920	Moulded paper, .0047 mfd., 600 volts (C112, C158, C166, C171)
73789	Moulded paper, .0068 mfd., 400 volts (C213)
73808	Paper, .0082 mfd., 1,000 volts (C148, C162)
73561	Paper, .01 mfd., 400 volts (C114, C117, C170, C202)
73594	Moulded paper, .01 mfd., 600 volts (C184, C185, C193)
73562	Paper, .022 mfd., 400 volts (C113, C178, C179, C189)
73798	Paper, .022 mfd., 600 volts (C182)
73552	Paper, .033 mfd., 400 volts (C163)
73553	Paper, .047 mfd., 400 volts (C124 for KCS81) (C160, C188, C190)
73592	Paper, .047 mfd., 600 volts (C197)
73815	Paper, .068 mfd., 1,000 volts (C203, C205)
73551	Paper, 0.1 mfd., 400 volts (C183, C214)
73557	Paper, 0.1 mfd., 600 volts (C173, C204)
73794	Paper, 0.22 mfd., 400 volts (C129, C153, C155, C157, C208, C210)
74957	Paper, 0.22 mfd., 600 volts (C176)
73787	Paper, 0.47 mfd., 200 volts (C191, C196)
77676	Choke—Filter choke (L117)
76143	Clip—Mounting clip for stand-off capacitor
73477	Coil—Choke coil (L101)
76672	Coil—Filament winding only for hi-voltage transformer (Part of T115)

STOCK No.	DESCRIPTION
76483	Coil—Horizontal linearity coil complete with adjustable core (L111)
76646	Coil—Peaking coil (72 muh) (L103, R149)
76647	Coil—Peaking coil (180 muh) (L107, R158)
75252	Coil—Peaking coil (500 muh) (L104, L106)
76640	Coil—RF choke coil (1.5 muh) (L110, L112)
76510	Coil—RF choke coil (4.7 muh) (L108)
76484	Coil—Width coil complete with adjustable core (L109)
77654	Control—AGC control (R180)
77655	Control—Brightness control, volume control and power switch (R114A, R114B, S102A, S102B)
77640	Control—Height control (R190)
76639	Control—Horizontal hold control (R210)
76445	Control—Picture control (R155)
77199	Control—Ratio detector balance control (R108)
77652	Control—Vertical hold control (R187)
77653	Control—Vertical linearity control (R197)
76675	Rectifier—Picture detector crystal rectifier (CR101)
76468	Resistor—Wire wound, 1.5 ohms, 1/3 watt (R225)
76682	Resistor—Wire wound, 200 ohms, 5 watts (R221)
77651	Resistor—Wire wound comprising 1 section of 600 ohms, 16 watts, 1 section of 500 ohms, 6 watts, 1 section of 2,000 ohms, 5 watts, 1 section of 1,200 ohms, 1 watt, 1 section of 10,000 ohms, 5 watts and 1 section of 7,000 ohms, 5 watts (R228A, R228B, R228C, R228D, R228E, R228F)
76642	Resistor—Wire wound, 6,750 ohms, 10 watts (R153)
77668	Resistor—Wire wound, 4,000 ohms, 7 watts (R121 for KCS81)
77669	Resistor—Wire wound, 10,000 ohms, 5 watts (R231 for KCS81)
	Resistors—Fixed, composition:
503033	33 ohms, ±10%, ½ watt (R152)
503047	47 ohms, ±10%, ½ watt (R107, R218)
502056	56 ohms, ±5%, ½ watt (R134)
34763	68 ohms, ±5%, ½ watt (R138)
502082	82 ohms, ±5%, ½ watt (R101)
502110	100 ohms, ±5%, ½ watt (R128)
503110	100 ohms, ±10%, ½ watt (R127 for KCS81)
503118	180 ohms, ±10%, ½ watt (R142)
503122	220 ohms, ±10%, ½ watt (R151)
513133	330 ohms, ±10%, 1 watt (R118, R119)
503156	560 ohms, ±10%, ½ watt (R198)
503168	680 ohms, ±10%, ½ watt (R154)
503210	1,000 ohms, ±10%, ½ watt (R102, R104, R109, R120, R126, R131, R133, R136, R161)
502218	1,800 ohms, ±5%, ½ watt (R183)
503222	2,200 ohms, ±10%, ½ watt (R140)
502233	3,300 ohms, ±10%, ½ watt (R201)
502239	3,900 ohms, ±5%, ½ watt (R150)
503239	3,900 ohms, ±10%, ½ watt (R211)
503247	4,700 ohms, ±10%, ½ watt (R230)
502256	5,600 ohms, ±5%, ½ watt (R137)
513256	5,600 ohms, ±10%, 1 watt (R156)
14659	6,800 ohms, ±5%, ½ watt (R111, R112, R191)
503268	6,800 ohms, ±10%, ½ watt (R176)
513268	6,800 ohms, ±10%, 1 watt (R147)
503282	8,200 ohms, ±10%, ½ watt (R145)
513282	8,200 ohms, ±10%, 1 watt (R182)
503310	10,000 ohms, ±10%, ½ watt (R139, R164, R200, R213, R229)
513310	10,000 ohms, ±10%, 1 watt (R157)
503315	15,000 ohms, ±10%, ½ watt (R115, R239)
523315	15,000 ohms, ±10%, 2 watts (R143)
503318	18,000 ohms, ±10%, ½ watt (R144)
503322	22,000 ohms, ±10%, ½ watt (R175)
522322	22,000 ohms, ±10%, 2 watts (R223)
503327	27,000 ohms, ±10%, ½ watt (R174, R178)
523327	27,000 ohms, ±10%, 2 watts (R222)
503333	33,000 ohms, ±10%, ½ watt (R106, R129, R132, R135, R235)
503339	39,000 ohms, ±10%, ½ watt (R110, R173, R212, R215)
503347	47,000 ohms, ±10%, ½ watt (R103) (R123 for KCS81)
502356	56,000 ohms, ±5%, ½ watt (R141)
503356	56,000 ohms, ±10%, ½ watt (R105, R209)
503368	68,000 ohms, ±10%, ½ watt (R208)
512368	68,000 ohms, ±5%, 1 watt (R193)
513368	68,000 ohms, ±10%, 1 watt (R216)
8064	82,000 ohms, ±5%, ½ watt (R167)
513382	82,000 ohms, ±10%, 1 watt (R214)
503410	100,000 ohms, ±10%, ½ watt (R166, R203, R238, R240)
503412	120,000 ohms, ±10%, ½ watt (R124)
503415	150,000 ohms, ±10%, ½ watt (R159, R195, R202, R204)
503418	180,000 ohms, ±10%, ½ watt (R207)
502422	220,000 ohms, ±5%, ½ watt (R179)
503422	220,000 ohms, ±10%, ½ watt (R233)
502427	270,000 ohms, ±5%, ½ watt (R163, R165)
503427	270,000 ohms, ±10%, ½ watt (R171, R226)

STOCK No.	DESCRIPTION
503433	330,000 ohms, ±10%, ½ watt (R116, R205, R220)
503439	390,000 ohms, ±10%, ½ watt (R219)
503447	470,000 ohms, ±10%, ½ watt (R117, R148, R160, R172, R184, R185, R189)
503468	680,000 ohms, ±10%, ½ watt (R169)
503482	820,000 ohms, ±10%, ½ watt (R206)
503510	1 megohm, ±10%, ½ watt (R181, R188, R217)
503512	1.2 megohm, ±10%, ½ watt (R186)
503533	3.3 megohm, ±10%, ½ watt (R196)
512536	3.6 megohm, ±5%, 1 watt (R162)
503539	3.9 megohm, ±10%, ½ watt (R168)
503547	4.7 megohm, ±10%, ½ watt (R170)
503582	8.2 megohm, ±10%, ½ watt (R122 for KCS81)
503610	10 megohm, ±10%, ½ watt (R113)
77656	Switch—Phono-tone switch (S101)
76463	Terminal—Screw type grounding terminal
77198	Transformer—1st pix I.F. grid transformer complete with adjustable cores (T104, C125, R125)
77197	Transformer—1st pix I.F. plate transformer complete with adjustable cores (T105, C131, C132, R130)
76435	Transformer—2nd pix I.F. grid transformer complete with adjustable cores (T106, C134)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
76436	Transformer—5th pix I.F. transformer (T109, C142, C143, L102, R146, CR101)
76501	Transformer—Hi-voltage transformer (Part of T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T114)
76997	Transformer—Output transformer (T103)
77649	Transformer—Power transformer, 117 volts, 60 cycle (T113)
76439	Transformer—Ratio detector transformer complete with adjustable cores (T102, C106, C107)
76438	Transformer—Sound I.F. transformer complete with adjustable cores (T101, C102, C103)
76437	Transformer—Sound take-off transformer complete with adjustable cores (T110, C147)
77650	Transformer—Vertical oscillator transformer (T111)
76494	Transformer—Vertical output transformer (T112)
76482	Trap—4.5 MC trap (L105, C150)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)

YOKE & MAGNET ASSEMBLIES

STOCK No.	DESCRIPTION
76863	Connector—Anode connector complete with contact and eyelet
75542	Connector—6 contact male connector—part of deflection yoke (P102)
74956	Cushion—Rubber cushion for deflection yoke hood
76654	Hood—Deflection yoke hood—less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
71456	Screw—No. 8-32 x 7/16" wing screw for mounting deflection yoke
76636	Stud—Adjusting stud complete with guard for focus magnet
76653	Yoke—Deflection yoke complete with male connector (L113, L114, L115, L116, C206, C207, R227, P102)

SPEAKER ASSEMBLIES

971490-3W 971490-3R

RL 105E6 RMA 285

RMA 274

(For Table Models)

STOCK No.	DESCRIPTION
75024	Cone—Cone and voice coil for speakers stamped 971490-3W
77129	Cone—Cone and voice coil for speakers stamped 971490-3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

SPEAKER ASSEMBLIES

92569-12W

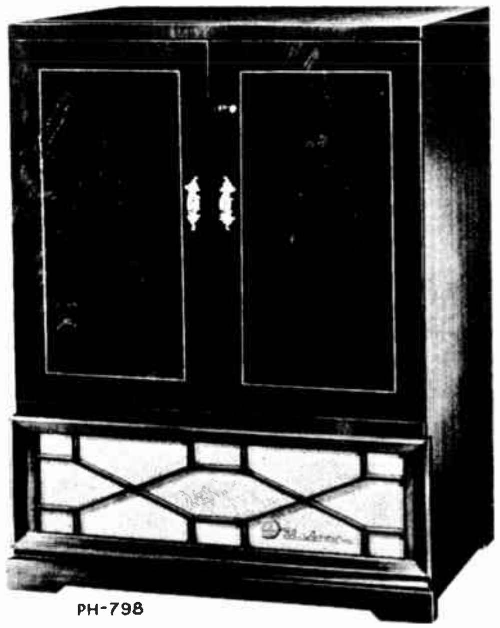
RL 111A1

RMA 274

(For Console Models)

STOCK No.	DESCRIPTION
75682	Cone—Cone and voice coil
76093	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.



Models 27-D-331, 27-D-331U
Mahogany, Oak

GENERAL DESCRIPTION

Models 27-D-331 and 27-D-331U are Deluxe "27 Inch" television receivers. Model 27-D-331 features full 12 channel VHF coverage.
Model 27-D-331U features full 12 channel VHF coverage plus any 4 UHF channels desired. These receivers have an auxiliary audio input jack to permit the use of an external record playing attachment. Both models incorporate two 8" PM speakers.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE....420 square inches on a 27MP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Model 27-D-331

All 12 VHF channels....54 mc. to 88 mc., 174 mc. to 216 mc.

Model 27-D-331U

Any of 70 UHF channels................470 mc. to 890 mc.

Any of 12 VHF channels 54 mc. to 88 mc., 174 mc. to 216 mc.
(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency....................45.75 mc.

Sound I-F Carrier Frequency.....................41.25 mc.

POWER RATING ....325 watts

AUDIO POWER OUTPUT RATING............4 watts max.

VIDEO RESPONSE ....to 4 mc.

SWEEP DEFLECTION ....Magnetic

FOCUS ....Magnetic

ANTENNA INPUT IMPEDANCE

Model 27-D-331

Choice: 300 ohms balanced or 72 ohms unbalanced.

Model 27-D-331U

UHF—Choice: 300 ohms balanced or 72 ohms unbalanced.

VHF—300 ohms balanced.

CHASSIS DESIGNATIONS

KCS77A ....In model 27-D-331

KCS77B ....In model 27-D-331U

LOUDSPEAKERS..........(971490-4W) 8 Inch PM Dynamic

VOICE COIL IMPEDANCE........................3.2 ohms

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK22A (Model 27-D-331)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Tuner KRK12 (Model 27-D-331U)	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control
A 1N82 crystal is used as a mixer.	
Models 27-D-331 & 27-D-331U	
(1) RCA 6AU6	1st Picture I-F Amplifier
(2) RCA 6CB6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 6CB6	4th Picture I-F Amplifier
(5) RCA 6CL6	Video Amplifier
(6) RCA 6CL6	Peaking Amplifier
(7) RCA 6AL5	Agitation Compressor
(8) RCA 6AU6	1st Sound I-F Amplifier
(9) RCA 6AU6	2nd Sound I-F Amplifier
(10) RCA 6AL5	Ratio Detector
(11) RCA 6AV6	1st Audio Amplifier
(12) RCA 6AQ5	Audio Output
(13) RCA 12AU7	Vert. Sync Separator and AGC
(14) RCA 12AU7	Horiz. Sync Separator and Sync Amplifier
(15) RCA 6SN7GT	Vert. Sync Amplifier and Vert. Sweep Osc. and Dischg.
(16) RCA 6AQ5	Vertical Sweep Output
(17) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(18) RCA 6BQ6GT (2 tubes)	Horizontal Sweep Output
(19) RCA 6W4GT (2 tubes)	Dampers
(20) RCA 1B3GT/8016	High Voltage Rectifier
(21) RCA 5U4G (2 tubes)	Rectifiers
(22) RCA 27MP4	Kinescope

ELECTRICAL AND MECHANICAL SPECIFICATIONS (Continued)

SCANNING..................Interlaced, 525 line

HORIZONTAL SCANNING FREQUENCY ....15,750 cps

VERTICAL SCANNING FREQUENCY .....60 cps

FRAME FREQUENCY (Picture Repetition Rate)...............30 cps

OPERATING CONTROLS (front panel)

Channel Selector / Fine Tuning ....Dual Control Knobs

Brightness / Sound Volume and On-Off Switch ....Dual Control Knobs

Picture Horizontal Hold / Picture Vertical Hold ... Dual Control (Knurled)

Contrast-Peaking ....Single Control Knob

Tone Switch ....Single Control Knob

Sharpness Switch ....Single Control Knob

NON-OPERATING CONTROLS

Horizontal Centering .....top chassis adjustment
Vertical Centering ....top chassis adjustment
AGC ....rear chassis adjustment
Height ....front panel screwdriver adjustment
Vertical Linearity ...front panel screwdriver adjustment
Horizontal Locking ...rear chassis screwdriver adjustment
Horizontal Drive ......rear chassis screwdriver adjustment
Horizontal Linearity ......rear chassis adjustment
Horizontal Oscillator Frequency ....rear chassis adjustment
Horizontal Oscillator Waveform ....bottom chassis adjustment
Width ....rear chassis adjustment
Width Link ........H.V. compartment adjustment
Focus ....top chassis adjustment
Ion Trap Magnet ....top chassis adjustment
Focus Magnet ....top chassis adjustment
Deflection Coil ....top chassis adjustment

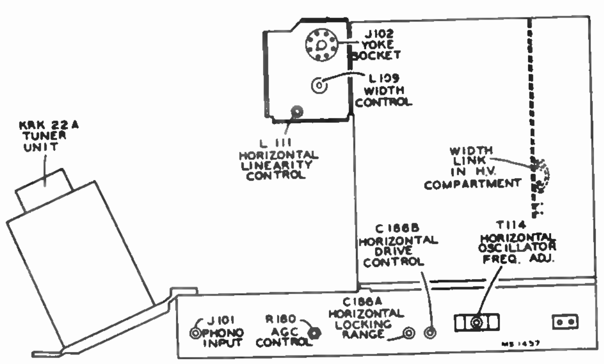


Figure 3—Rear Chassis Adjustments

CHASSIS TOP VIEW

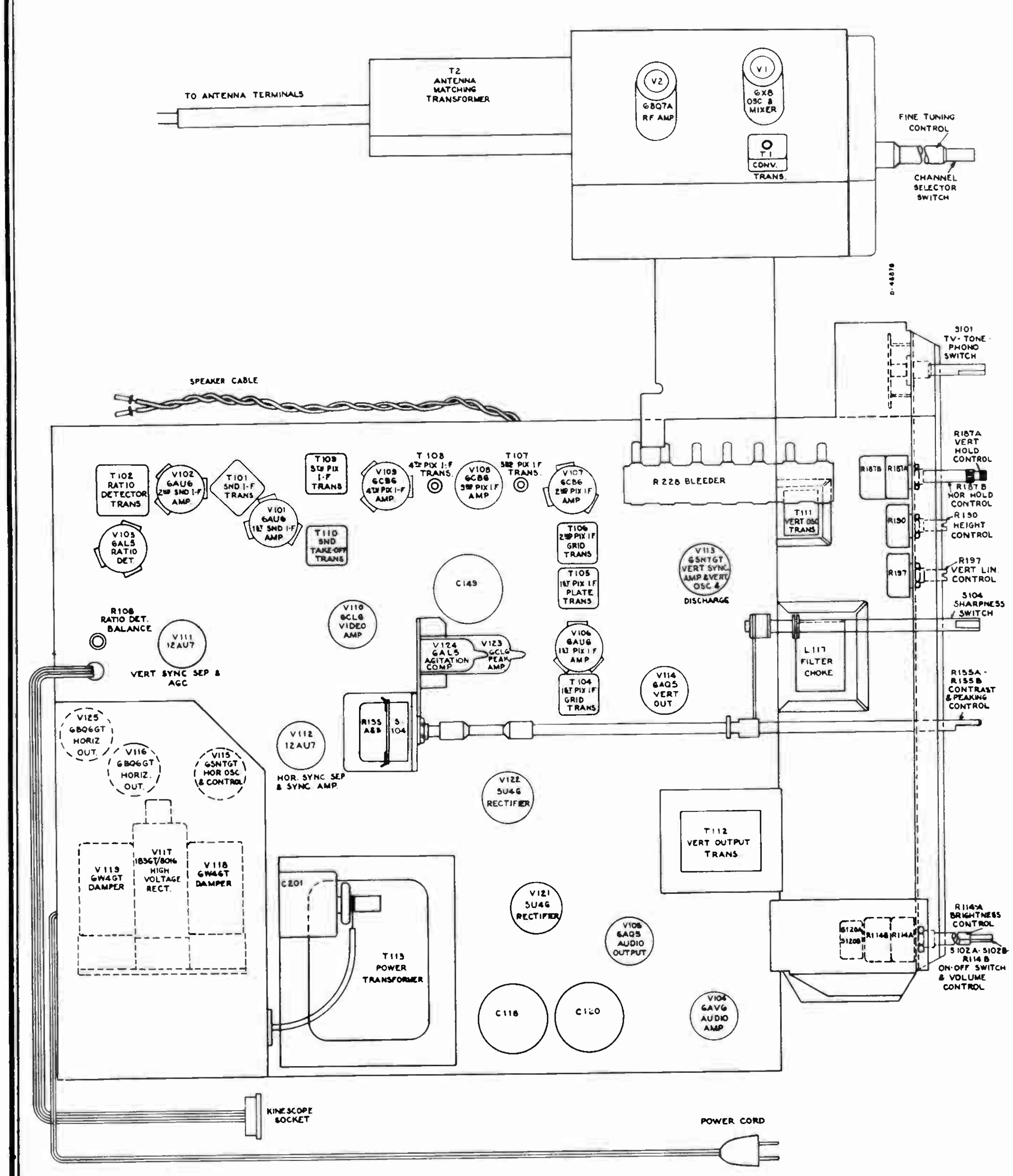


Figure 5—Chassis Top View (shown with KRK22A Tuner)

CHASSIS BOTTOM VIEW

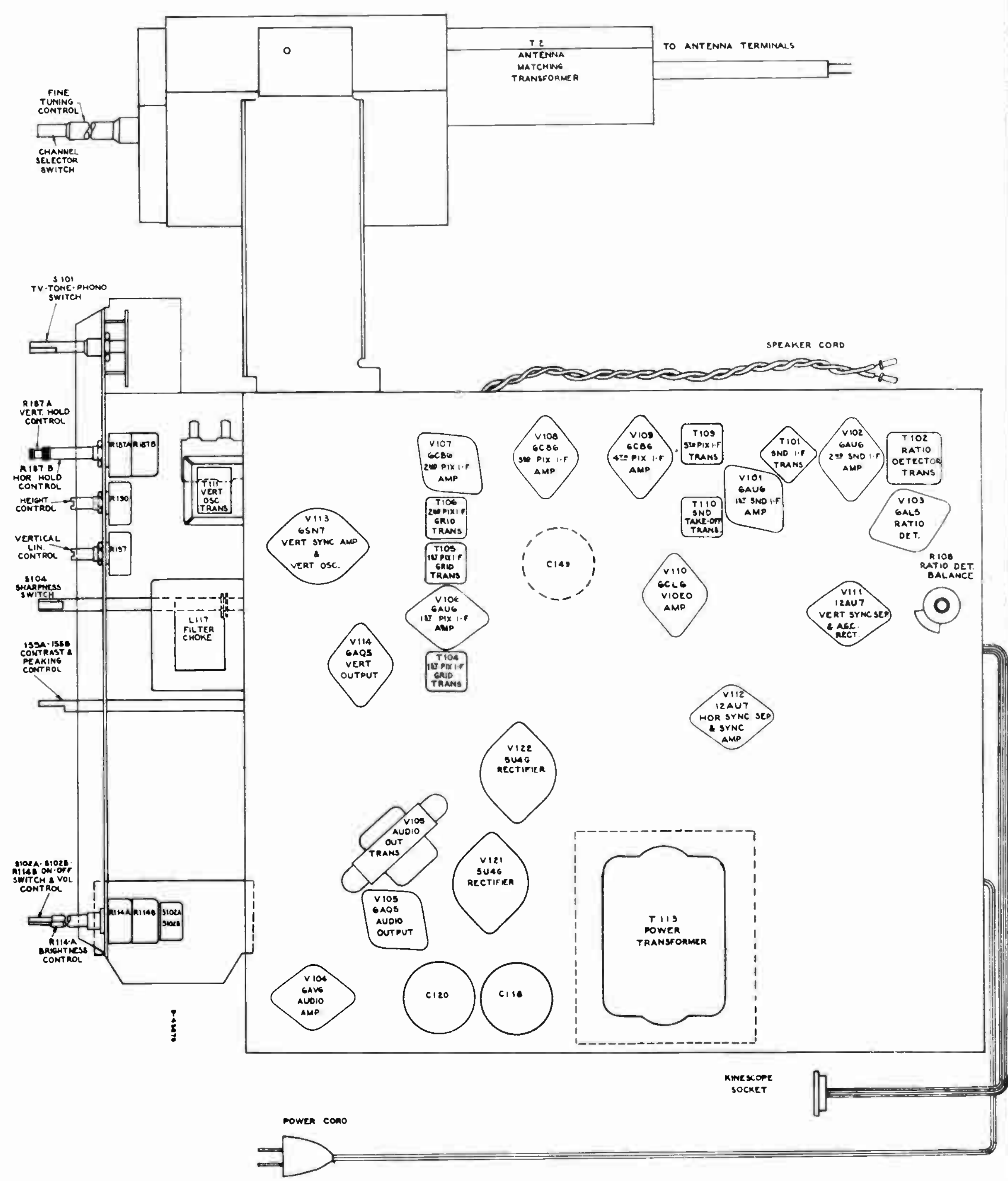


Figure 6—Chassis Bottom View (shown with KRK22A Tuner)

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12 Tuner. Wiring of adapter is shown in figure 14.

KRK22A ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The tuner unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the tuner unit should be re-aligned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L53 to the channel selector switch S4.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R133 and C133B. Set the potentiometer to produce approximately –5.0 volts of bias at the junction of R133 and C133B.

Connect an oscilloscope to pin 9 of V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L54 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L57 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

ALIGNMENT PROCEDURE

Connect a 300 ohm ½ watt composition resistor from L53 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L53 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 15 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L55 and L56 to obtain the response shown in figure 16. L55 is most effective in locating the position of the shoulder of the curve at 52 mc. and L56 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L53 and S4. Replace V106.

PICTURE I-F TRAP ADJUSTMENT.—Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R133 and C133B.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the positive terminal of one battery to chassis and the potentiometer arm to the junction of R133 and C133B. The second bias supply will be used later.

Set the bias to produce approximately –1.0 volt of bias at the junction of R133 and C133B.

Connect the "VoltOhmyst" to pin 9 of V110, the 6CL6 video amplifier.

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS.

Model 27-D-331

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with –1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to –1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in figure 20. For final adjustment set the output of the sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Adjust C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in figure 21.

Disconnect the diode probe, the 180 ohm and three 330 ohm resistors.

Model 27-D-331U

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with –1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to –1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110, the 6CL6 video amplifier.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in figure 20. For final adjustment set the output of the VHF sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align the crystal mixer and T2 and T104, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1,500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust the shunt trimmer C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in figure 12. Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see figure 12.

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

SWEEP ALIGNMENT OF PICTURE I.F.—

Connect the oscilloscope to pin 9 of V110.

Adjust the bias potentiometer to obtain –6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R133 and C133B.

Leave the sweep generator connected to the mixer grid test point TP2 on KRK22A Tuner or to the front terminal of the 1N82 crystal holder on KRK12 Tuner. Use the shortest leads possible with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

ALIGNMENT PROCEDURE

Retouch T108 and T109 to obtain the response shown in figure 2. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK22A TUNER ALIGNMENT.

Model 27-D-331

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T1 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 42.0 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner, at the terminal board, to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 42.0 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce -3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read -3.0 volts at the test point TP1, as read on the "VoltOhmyst". The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T1 core for maximum inductance (core turned counterclockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15, to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in figure 17.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read -3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in figure 17.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

ALIGNMENT PROCEDURE

Adjust L5 for an audible beat. Adjust L44, L46 and L41 for proper curve shape as shown in figure 17. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 17 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L41 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 17 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12 TUNER ALIGNMENT

Model 27-D-331U

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in figure 10. The proper curve shape is shown in figure 10(b). If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise and remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce -3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce -5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum marker indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust the UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in figure 11. The curve shape will usually vary from figure 11 (a) to figure 11 (c) going higher in frequency, however any of these responses are acceptable.

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce -3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce -5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used, and set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output of the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in figure 13.

Set the UHF marker gen. to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust the mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt DC scale.

Set oscillator injection adjustment to read .1 volts on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

RATIO DETECTOR ALIGNMENT.—In order to obtain good ratio detector alignment an AM modulated signal generator that is exceptionally free from FM modulation must be employed. Set the signal generator at 4.5 mc. and connect it to the second sound i-f grid, pin 1 of V102. Set the generator for 30% 400 cycle modulation.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. If used, connect it to the grid of the 4th pix i-f amplifier, pin 1, V109. Set the frequency of the calibrator to 45.75 (pix carrier) and modulate with 4.5 mc. crystal. Also turn on the internal AM audio modulation. The 4.5 mc. signal will be picked off at T110A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to the junction of R111 and C111.

Connect the oscilloscope across the speaker voice coil and turn the volume control for maximum output.

Tune the ratio detector primary T102 top core for maximum DC output on the "VoltOhmyst." Adjust the signal level from the signal generator for minus 10 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R110 and C110.

Adjust the T102 bottom core for zero d-c on the meter. Then, turn the core to the nearest minimum AM output on the oscilloscope.

Repeat adjustments of T102 top for maximum DC and T102 bottom for minimum output on the oscilloscope making final adjustment with the 4.5 mc. input level adjusted to produce 10 volts d-c on the "VoltOhmyst" at the junction of R111 and C111.

Connect the "VoltOhmyst" to the junction of R110 and C110 and note the amount of d-c present. If this voltage exceeds ±1.5 volts, adjust R108 by turning it in until zero d-c is obtained. Readjust the T102 bottom core for minimum output on the oscilloscope. Repeat adjustments of R108 and T102 bottom core until the voltage at R110 and C110 is less than ±1.5 volts when T102 bottom core is set for minimum output on the oscilloscope.

Connect the "VoltOhmyst" to the junction of R111 and C111 and repeak T102 top core for maximum d-c on the meter and again reset the generator so as to have -10 volts on the meter.

Repeat the adjustments in the above two paragraphs until the voltage at R110 and C110 is less than ±1.5 volts when the T102 top core is set for maximum d-c at the junction of R111 and C111 and the T102 bottom core is set for minimum indication on the oscilloscope.

SOUND I-F ALIGNMENT.—Connect the sweep generator to the first sound i-f amplifier grid, pin 1 of V101. Adjust the generator for a sweep width of 1 mc. at a center frequency of 4.5 mc.

Insert a 4.5 mc. marker signal from the signal generator into the first sound i-f grid. With the WR39B or WR39C calibrators the 4.5 mc. crystal signal may be obtained at the R-F out terminal by turning the variable osc. switch off, the calibrate switch to 4.5 mc. and the volume control with mod. off.

Connect the oscilloscope in series with a 10,000 ohm resistor to terminal A of T101.

Adjust T101 top and bottom cores for maximum gain and symmetry about the 4.5 mc. marker on the i-f response. The pattern obtained should be similar to that shown in figure 18.

The output level from the sweep should be set to produce approximately 2.0 volt peak-to-peak at terminal A of T101 when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion or weak signals.

Connect the oscilloscope to the junction of R110 and C110 and check the linearity of the response. The pattern obtained should be similar to that shown in figure 19.

SOUND TAKE-OFF ALIGNMENT.—Connect the 4.5 mc. generator in series with a 1,000 ohm resistor to terminal "C" of T110. The input signal should be approximately 0.5 volt.

Short the fourth pix i-f grid to ground, pin 1, V109, to prevent noise from masking the output indication.

As an alternate source of signal the RCA WR39B or WR39C calibrator may be used. In such a case, disregard the above two paragraphs. Connect calibrator across link circuit, T104 A, B and modulate 45.75 with 4.5 mc. crystal.

Connect the crystal diode probe of a "VoltOhmyst" to the plate of the video amplifier, pin 6 of V110.

Adjust the core of T110 for minimum output on the meter.

Remove the short from pin 1, V109 to ground, if used.

ALIGNMENT PROCEDURE

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it cannot be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R187B, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C186B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and one diagonal black bar sloping down to the right appears on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain one diagonal black bar on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture begins to fall out of sync with the diagonal bar sloping down to the right. Continue to turn the frequency core in the same direction. Additional bars should not appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in figure 23. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counterclockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C186A slightly clockwise. If less than 2 bars are present, adjust C186A slightly counterclockwise. Turn the horizontal hold control counterclockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES.—The response curves shown on pages 16 and 17 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTES ON TUNER ALIGNMENT.—Because of the frequency spectrum involved and the nature of the device, many of the tuner unit leads and components are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in their components and physical arrangement without being troublesome. When the tuner unit is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the unit is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonances do not exist which might present a faulty representation of tuner alignment.

The use of a crystal mixer in the KRK12 Tuner makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in figure 10 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in figure 10(b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in figures 10(a) and 10(c).

27-D-331, 27-D-331U

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V1 KRK22A	6X8	Mixer	5000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	—	—	
			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	—	—	
		R-F Oscillator	5000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	—	—	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	—	—	
V2 KRK22A	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	170	—	—	8	0.1	7	—	—	—	
			No Signal	6	133	—	—	8	1.1	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	136	6	136	7	0.76	1	—0.4	6.2	3.1	
			No Signal	5	131	6	131	7	0.73	1	—1.2	6.1	3.0	
V102	6AU6	2nd Sound I-F Amp.	5000 Mu. V. Signal	5	138	6	60	7	0	1	—10	2.9	1.2	
			No Signal	5	134	6	65	7	0	1	—5	2.1	1.0	
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	2 7	—9.2 1.0	—	—	5 1	1.0 9.2	—	—	—	—	
			No Signal	2 7	—8.0 0	—	—	5 1	0 8.0	—	—	—	—	
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	90	—	—	2	0	1	—0.7	0.65	—	At min. volume
			No Signal	7	88	—	—	2	0	1	—0.7	0.65	—	
V104	6AV6	R-F Bias Clamp	5000 Mu. V. Signal	5-6	—3.0	—	—	2	0	—	—	—	—	
			No Signal	5-6	0.3	—	—	2	0	—	—	—	—	
V105	6AQ5	Audio Output	5000 Mu. V. Signal	5	311	6	227	2	12.6	7	0	30.4	2.0	At min. volume
			No Signal	5	308	6	216	2	11.7	7	0	28.2	1.8	
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	160	6	215	7	0.17	1	—6.6	1.4	.4	
			No Signal	5	85	6	115	7	0.98	1	0	6.5	3.3	
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	227	6	225	2	0.1	1	—6.6	1.5	.25	
			No Signal	5	209	6	115	2	0.8	1	0	10.9	3.3	
V108	6CB6	3rd Pix. I-F Amplifier	5000 Mu. V. Signal	5	138	6	132	2	1.02	1	0	11.4	3.5	
			No Signal	5	134	6	126	2	.98	1	0	10.4	3.1	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	168	6	165	2	2.32	1	0	8.85	2.2	
			No Signal	5	156	6	161	2	2.07	1	0	8.6	2.1	
V110	6CL6	Video Amplifier	5000 Mu. V. Signal	6	130	3-8	159	1	.84	2-9	*—5.0	22.5	5.5	*Depends on picture
			No Signal	6	130	3-8	80	1	0.7	2-9	*—2.0	15.0	4.0	*Depends on picture

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V111A	12AU7	AGC Rectifier	5000 Mu. V. Signal	1	—30	—	—	3	142	—	—	0	—	AGC control set for normal operation
			No Signal	1	0	—	—	3	137	—	—	0	—	
V111B	12AU7	Vert. Sync. Separator	5000 Mu. V. Signal	6	110	—	—	8	0	7	—42	.25	—	*Depends on noise
			No Signal	6	45	—	—	8	0	7	*—5	.35	—	
V112A	12AU7	Hor. Sync. Separator	5000 Mu. V. Signal	1	323	—	—	3	192	2	116	.5	—	
			No Signal	1	320	—	—	3	132	2	112	.5	—	
V112B	12AU7	Sync. Amplifier	5000 Mu. V. Signal	6	78	—	—	8	0	7	—3.5	6.2	—	
			No Signal	6	78	—	—	8	0	7	—1.6	6.2	—	
V113A	6SN7GT	Vert. Sync. Amplifier	5000 Mu. V. Signal	2	140	—	—	3	19.2	1	—.35	0.1	—	
			No Signal	2	135	—	—	3	17.3	1	0	<0.1	—	
V113B	6SN7GT	Vert. Osc. & Discharge	5000 Mu. V. Signal	5	203	—	—	6	0	4	—56	.2	—	
			No Signal	5	208	—	—	6	0	4	—55	.2	—	
V114	6AQ5	Vertical Output	5000 Mu. V. Signal	5	300	6	314	2	29.2	1	0	23.5	1.5	
			No Signal	5	297	6	311	2	29	1	0	23.5	1.5	
V115	6SN7GT	Horizontal Osc. Control	5000 Mu. V. Signal	2	188	—	—	3	—9	1	—28	0.37	—	Hor. hold at mid-range
			No Signal	2	0	—	—	3	0	1	0	0	—	
		Horizontal Oscillator	5000 Mu. V. Signal	5	184	—	—	6	0	4	—72	2.5	—	Hor. hold at mid-range
			No Signal	5	182	—	—	6	0	4	—73	2.5	—	
V116 V125	6BQ6GT	Horizontal Output (2 tubes)	5000 Mu. V. Signal	Cap	*	4	176	8	15	5	—21	165	12.4	*High Voltage Pulse Present
			No Signal	Cap	*	4	176	8	15	5	—21	165	12.4	
V117	1B3GT /8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	
V118 V119	6W4GT	Dampers	5000 Mu. V. Signal	5	298	—	—	3	*	—	—	—	—	*High Voltage Pulse Present
			No Signal	5	295	—	—	3	*	—	—	—	—	
V120	27MP4	Kinescope	5000 Mu. V. Signal	Cone	16,000	10	525	11	140	2	*82	—	—	At average Brightness *0 voltage on Phono. position
			No Signal	Cone	16,400	10	520	11	132	2	*76	—	—	
V121 V122	5U4G	Rectifiers	5000 Mu. V. Signal	4 & 6	341	—	—	2 & 8	364	—	—	*175	—	*Per Tube
			No Signal	4 & 6	338	—	—	2 & 8	360	—	—	*150	—	
V123	6CL6	Peaking Amplifier	5000 Mu. V. Signal	6	190	8	165	1	4.4	—	—	20.5	4.25	
			No Signal	6	185	8	157	1	4.1	—	—	18.4	4.2	
V124	6AL5	Agitation Compressor	5000 Mu. V. Signal	2	142	—	—	1 & 5	142	—	—	—	—	
			No Signal	2	137	—	—	1 & 5	137	—	—	—	—	

ALIGNMENT DATA

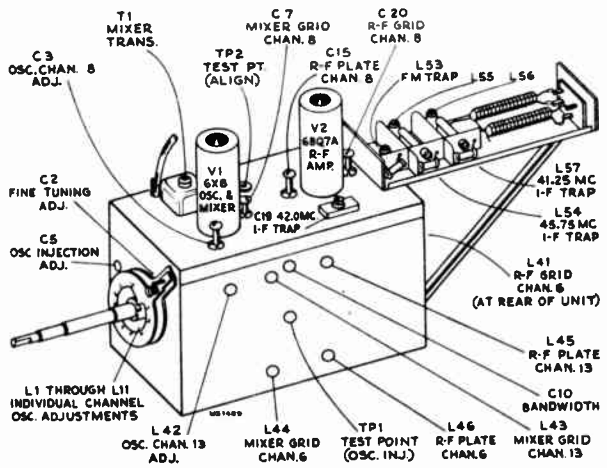


Figure 7—KRK22A Tuner Adjustments

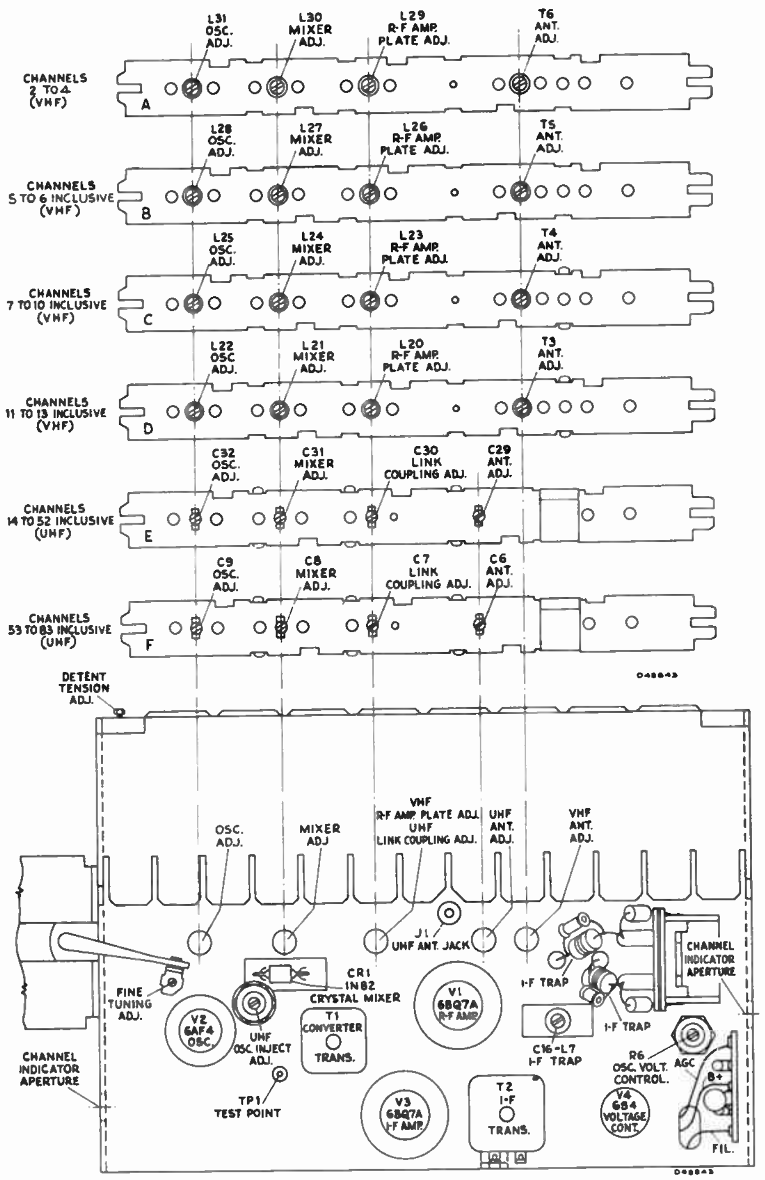


Figure 8—KRK12 Tuner Adjustments

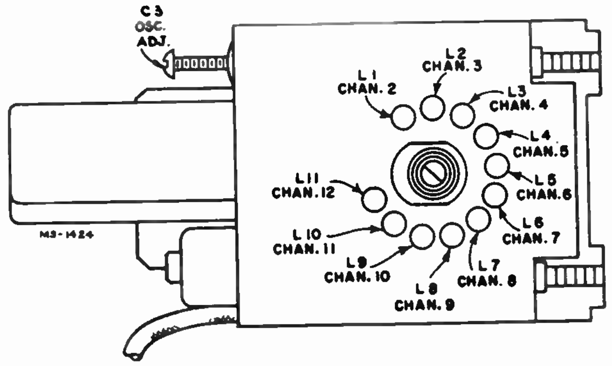


Figure 9—KRK22A R-F Oscillator Adjustments

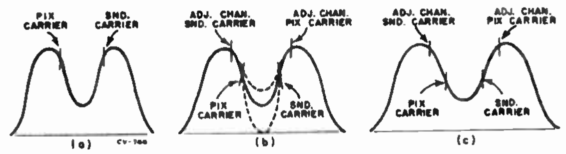


Figure 10—KRK12 VHF Insert Responses

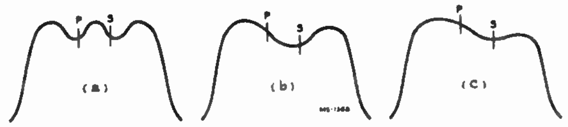


Figure 11—KRK12 UHF Insert Responses

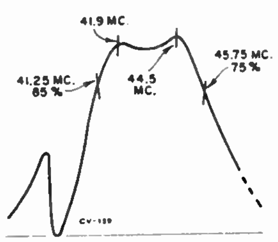


Figure 12—T2 and T104 Response with KRK12

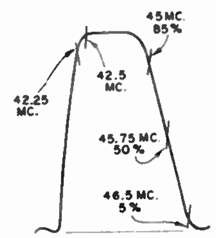


Figure 13—Over-all I-F Response with KRK12

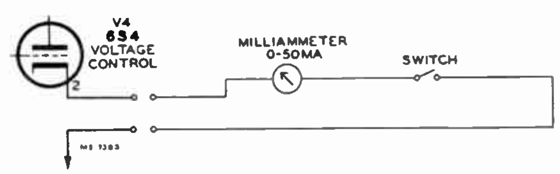


Figure 14—KRK12 Voltage Control Adapter

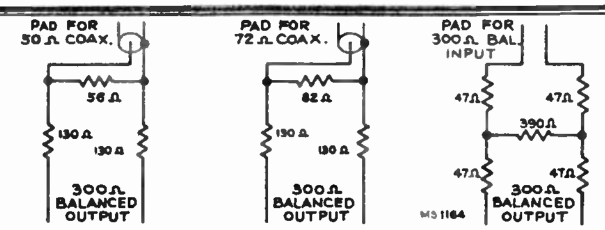


Figure 15—Sweep Attenuator Pads

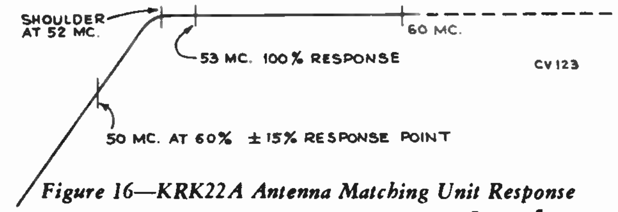


Figure 16—KRK22A Antenna Matching Unit Response

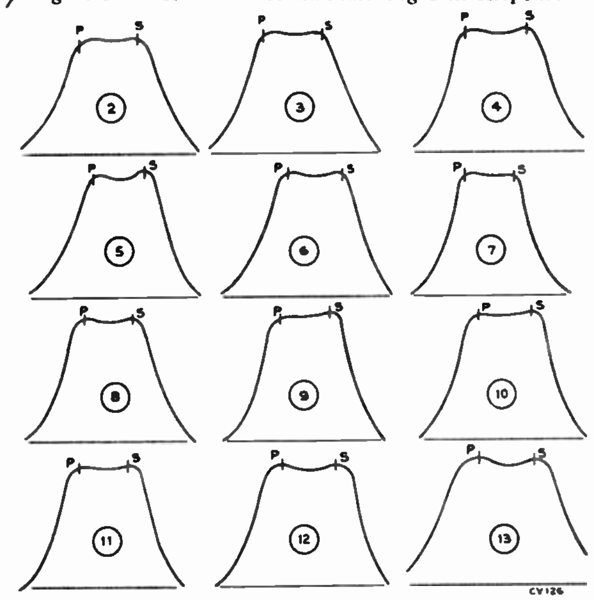


Figure 17—KRK22A R-F Response

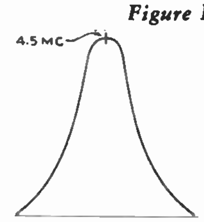


Figure 18 Sound I-F Response

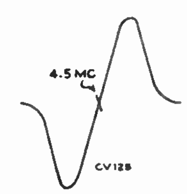


Figure 19 Ratio Det. Response

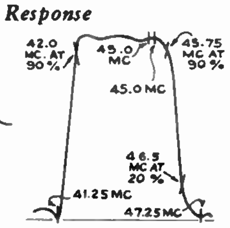


Figure 20 T105 and T106 Response

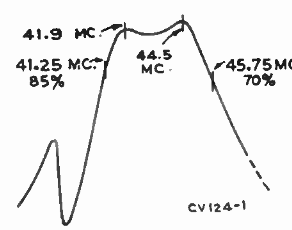


Figure 21 T1 and T104 Response with KRK22A

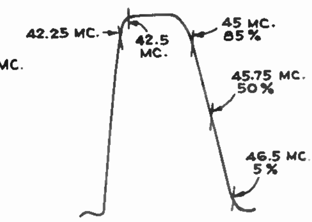


Figure 22 Over-all I-F Response with KRK22A

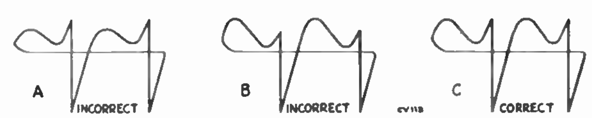


Figure 23—Horizontal Oscillator Waveforms

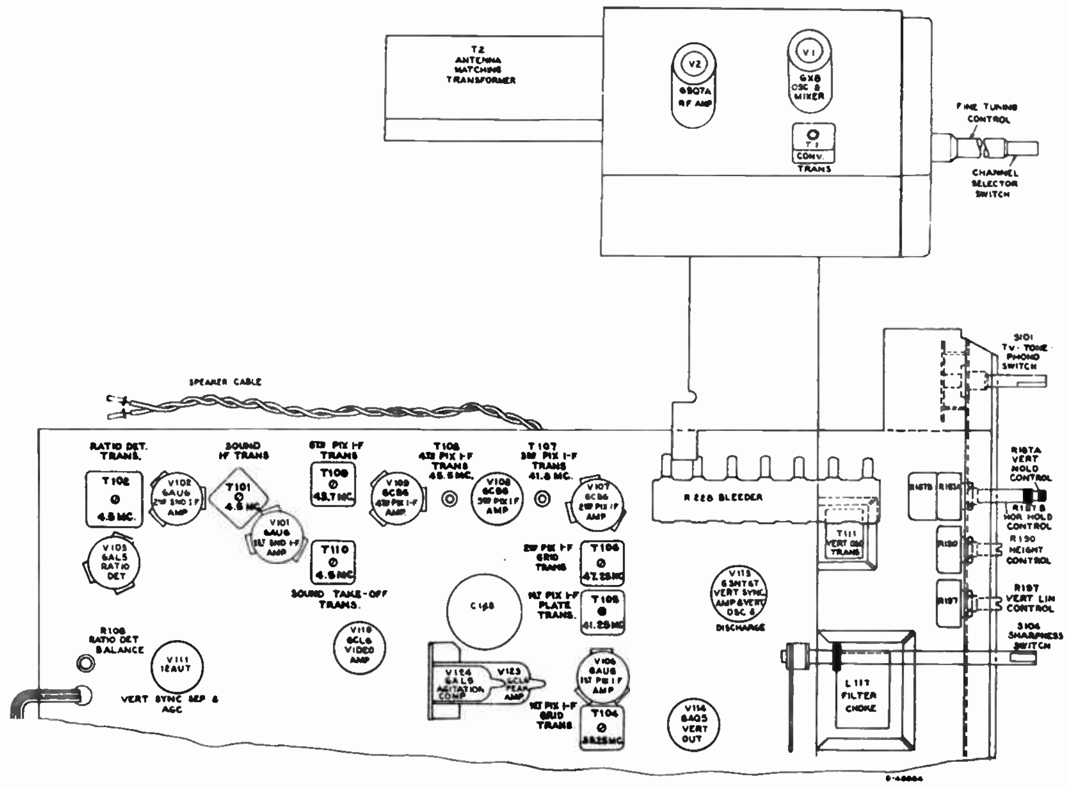


Figure 24—Top Chassis Adjustments (KRK22A Tuner Shown)

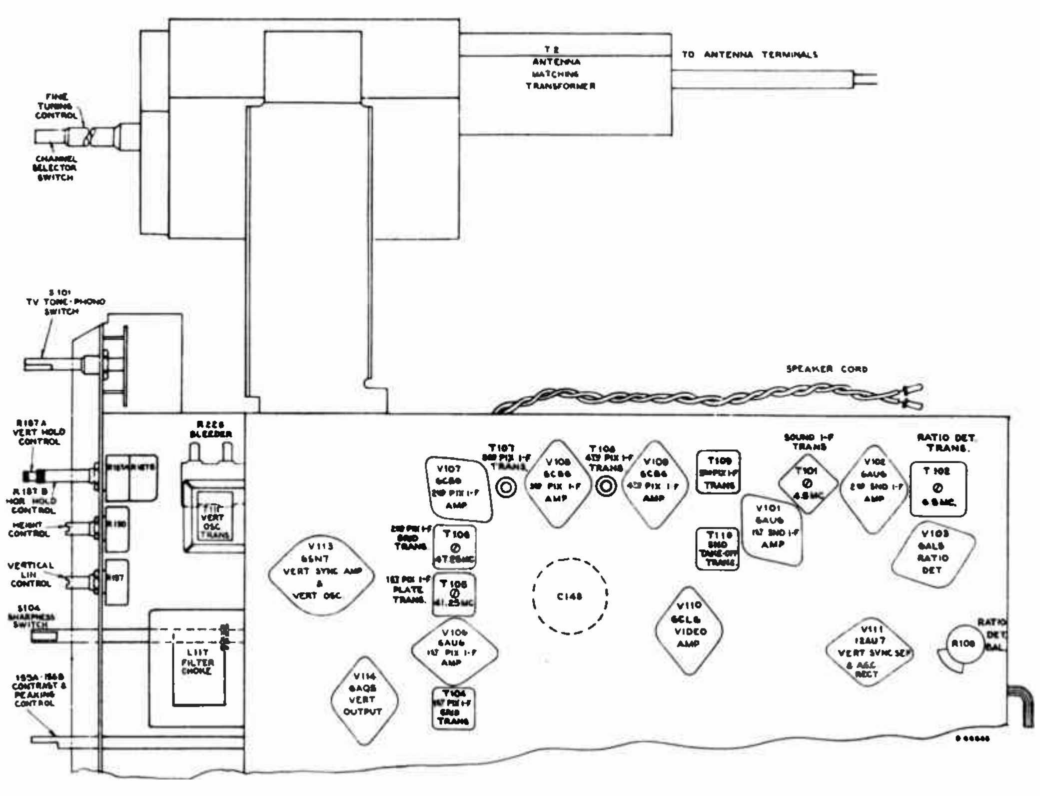


Figure 25—Bottom Chassis Adjustments (KRK22A Tuner Shown)

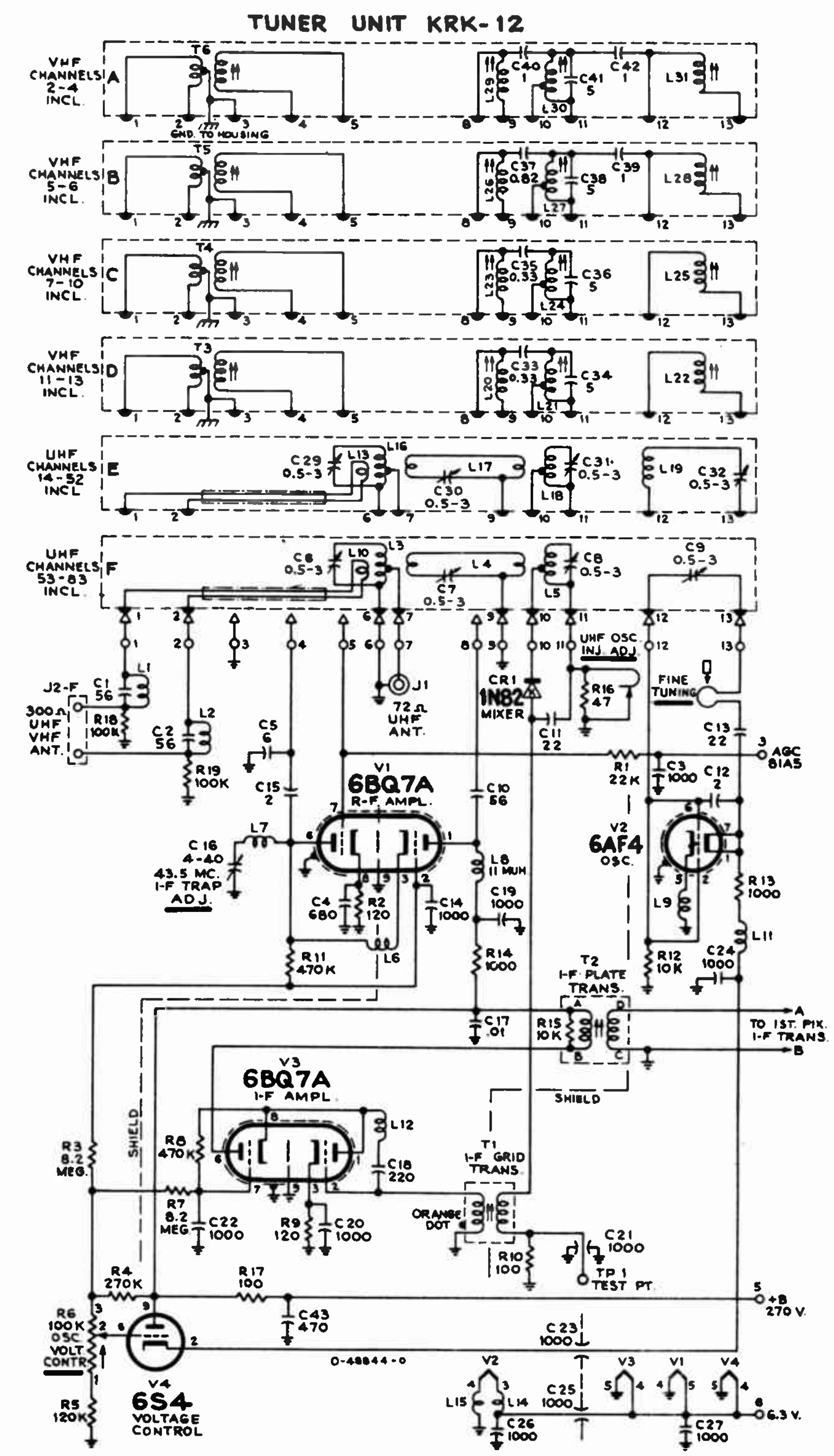
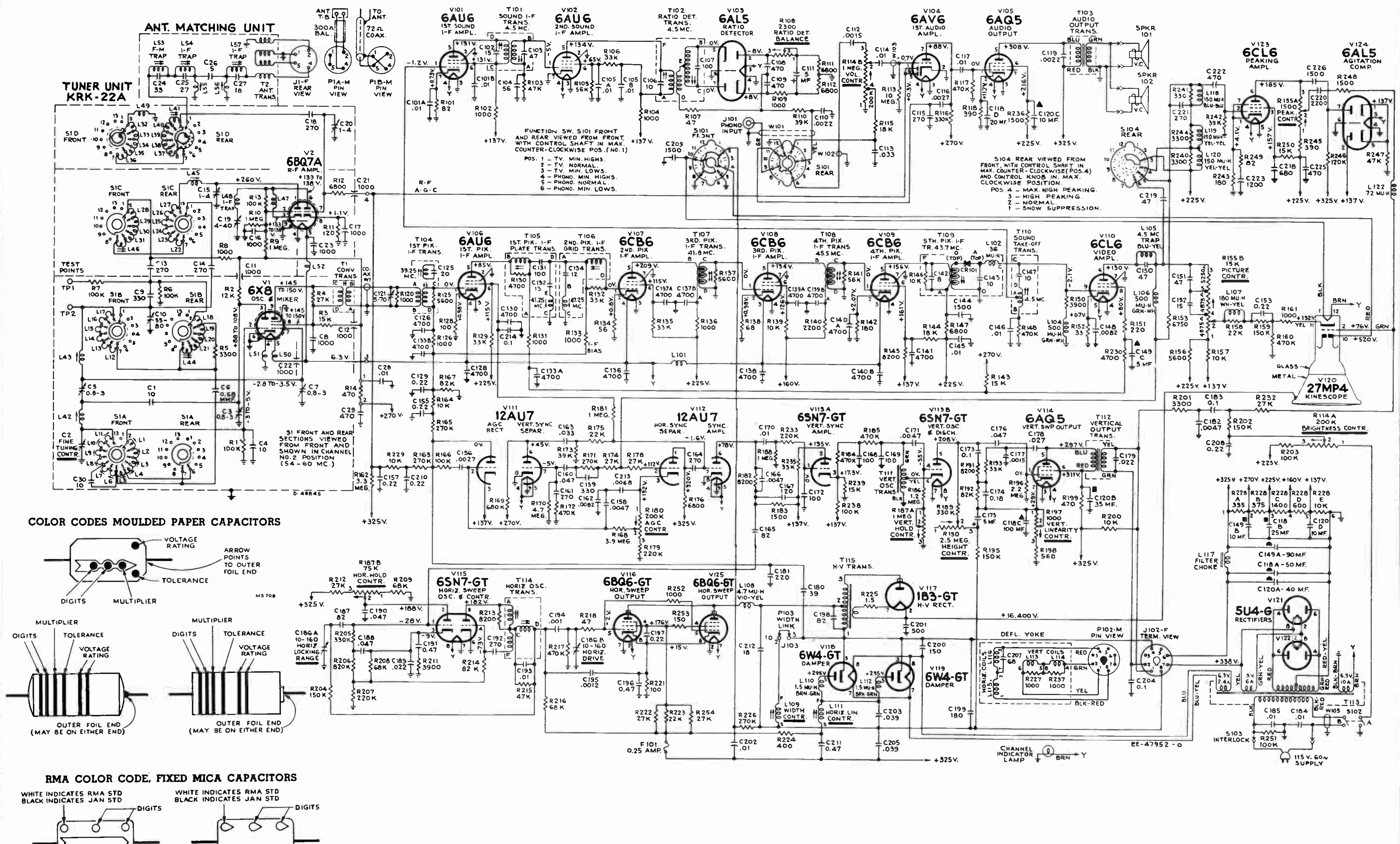


Figure 26—KRK12 Schematic Diagram



The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 27 Circuit Schematic Diagram

REPLACEMENT PARTS

STOCK No.	PART DESCRIPTION
	RF UNIT ASSEMBLIES KRK22A
76539	Board—Antenna matching transformer terminal board less coils and capacitors
76270	Board—Terminal board—4 contact
77850	Bracket—Side bracket for mounting coil and stators
77855	Can—Shield can for convertor transformer
77853	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
77913	Capacitor—Tubular, adjustable, steatite, 0.8-3.0 mmf. (C5)
71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts DC (C6)
77151	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. (C3, C7)
76532	Capacitor—Adjustable, steatite, 1-4 mmf. (C15, C20)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C19)
93056	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±0.5 mmf., 500 volts DC. Temp. coef. = 0 (C26)
77865	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts DC. Temp. coef. = 0 (C1, C30)
78247	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts. Temp. coef. = -750 (C4)
54207	Capacitor—Fixed, ceramic, non-insulated, 18 mmf., ±10%, 500 volts DC. Temp. coef. = 0 (C27)
70935	Capacitor—Fixed, ceramic, non-insulated, 27 mmf., ±10%, 500 volts DC. Temp. coef. = 0 (C25)
76739	Capacitor—Fixed, ceramic, non-insulated, 33 mmf., ±10%, 500 volts DC. Temp. coef. = 0 (C24)
76527	Capacitor—Mica trimmer, 55-80 mmf. (C10)
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf., ±20%, 500 volts DC. High "K" type (C13, C14, C18)
76552	Capacitor—Fixed, ceramic, insulated, 330 mmf., ±10%, 500 volts DC. High "K" type (C9)
77293	Capacitor—Fixed, ceramic, 470 mmf., ±100%, -0%, 500 volts DC. High "K" disc (C29)
77084	Capacitor—Ceramic, feed-thru, 1,000 mmf. (C11, C12, C21, C22)
77252	Capacitor—Fixed, ceramic, 1,000 mmf., +100%, -0%, 500 volts DC. High "K" disc (C8, C16, C17, C23)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, -0%, 500 volts DC. High "K" disc (C28)
77854	Clip—Mounting clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T2)
73874	Coil—Channel No. 6 mixer coil (L44)
73460	Coil—Channel No. 6 r.f. plate coil (L46)
77915	Coil—Channel No. 13 oscillator coil (L42)
77919	Coil—Channel No. 13 mixer coil (L43)
77921	Coil—Channel No. 13 r.f. plate coil (L45)
77206	Coil—Filament choke coil (L52)
76763	Coil—Heater choke coil (L50, L51)
76562	Coil—RF amplifier coupling coil (L47)
76537	Coil—Shunt coil complete with adjustable core (L55)
76538	Coil—Shunt coil complete with adjustable core (L56)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
77860	Connector—Grounding strap connector
77859	Connector—RF grid switch return connector (L49)
76460	Contact—Test point contact
77852	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for FM trap
77918	Core—¼-20 x ½" adjusting core for L44, L46
77914	Core—No. 8-32 x 27/64" adjusting core for L42, L43
77846	Detent—Detent mechanism and fibre shaft
77917	Form—Channel No. 6 coil form complete with core
77912	Form—Channel No. 13 coil form complete with core
77861	Guide—Bakelite guide for fine tuning lever
77847	Lever—Fine tuning lever
76728	Nut—Speed nut for capacitor 76532
	Resistor—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R11)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1,000 ohms, ±10%, ½ watt (R8)
503233	3,300 ohms, ±10%, ½ watt (R5)
503268	6,800 ohms, ±10%, ½ watt (R12)
523312	12,000 ohms, ±10%, 2 watts (R2)
523315	15,000 ohms, ±10%, 2 watts (R3)
502327	27,000 ohms, ±5%, ½ watt (R4)
503410	100,000 ohms, ±10%, ½ watt (R1, R6, R7, R13)
503510	1 megohm, ±10%, ½ watt (R9, R10)
14343	Retainer—Fine tuning shaft retainer ring
77849	Retainer—Retainer for fine tuning spring
75176	Screw—No. 4-40 x 7/16" adjusting screw for L5
76549	Screw—No. 4-40 x ⅜" adjusting screw for L1, L2, L3, L4
76547	Screw—No. 4-40 x ¼" adjusting screw for L6, L7, L8, L9, L10, L11
77848	Shaft—Fine tuning shaft and cam
77862	Shield—Front shield
76534	Shield—Tube shield
77851	Shield—"U" shape shield for underside of unit
76336	Socket—Tube socket, 9 pin, miniature, saddle mounted
77856	Spring—Fine tuning spring
78241	Spring—Former spring for fine tuning lever
77916	Stator—Mixer stator complete with rotor, coils, capacitor and resistors (S2, C6, C9, C13, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L43, L44, R5, R6, R7)
77911	Stator—Oscillator stator complete with rotor, coils and trimmer (S1, C5, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L42)
77910	Stator—RF grid stator complete with rotor and coils (S4, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41)
77920	Stator—RF plate stator complete with rotor, coils, capacitor and resistor (S3, C14, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L45, L46, R8)
76740	Stud—No. 6-32 x 1" adjusting stud for adjustable capacitor C5
77858	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
77857	Transformer—Convertor transformer (T1)
76540	Trap—FM trap complete with adjustable core (L53)
77628	Trap—I-F trap (L48)
76542	Trap—I-F trap (41.25 mc) complete with core (L57)
76541	Trap—I-F trap (45.75 mc) complete with core (L54)
75190	Washer—Insulating washer (neoprene) for adjustable capacitor C5
	RF UNIT ASSEMBLIES KRK12
77580	Ball—Steel ball (.125" dia.) (12 required)
77579	Ball—Steel ball (.187" dia.)
77575	Bracket—Drive mechanism mounting bracket
77589	Bracket—Lamp bracket
77619	Bracket—VHF input connector and bracket
76845	Bracket—Vertical bracket for oscillator tube shield
77591	Cam—Fine tuning cam
77691	Capacitor—Fixed, headed-lead type, .33 mmf., ±10%, 500 volts DC (C33, C35)
77689	Capacitor—Fixed, headed-lead type, .82 mmf., ±10%, 500 volts DC (C37)
71500	Capacitor—Fixed, headed-lead type, 1.5 mmf., ±10%, 500 volts DC (C39)
77690	Capacitor—Fixed, headed-lead type, 1.0 mmf., ±10%, 500 volts DC (C40)
78047	Capacitor—Fixed, headed-lead type, 2.0 mmf., ±10%, 500 volts DC (C42)
77210	Capacitor—Fixed, ceramic, non-insulated, 2 mmf., ±0.25 mmf., 500 volts DC. Temp. coef. = 0 (C15)
77667	Capacitor—Fixed, ceramic, insulated, comprising 1 section of 27 mmf., and 1 section of 22 mmf. Temp. coef. = -750 (C12, C13)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C16)
77688	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±.5 mmf., 500 volts DC. Temp. coef. = 0 (C34, C36, C38, C41)
74182	Capacitor—Fixed, ceramic, non-insulated, 6 mmf., ±0.5 mmf., 500 volts DC. Temp. coef. = 0 (C5)
77621	Capacitor—Fixed, ceramic, crystal holder, 22 mmf., ±10%. Temp. coef. = -750 (C11)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC. Temp. coef. = -750 (C10)
77625	Capacitor—Fixed, ceramic, 220 mmf., +100%, -0%, 500 volts DC. High "K" disc (C18)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, -0%, 500 volts DC. High "K" disc (C43)
77624	Capacitor—Fixed, ceramic, 680 mmf., +100%, -0%, 500 volts DC. High "K" disc (C4)
77084	Capacitor—Ceramic, feed-thru, 1,000 mmf. (C21, C23, C25)
77615	Capacitor—Ceramic, stand-off, 1,000 mmf. (C3, C19, C24, C26)
77252	Capacitor—Fixed, ceramic, 1,000 mmf., +100%, -0%, 500 volts DC. High "K" disc (C14, C20, C22, C27)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, -0%, 500 volts DC. High "K" disc (C17)
77628	Coil—I-F trap (L7)
77634	Coil—I-F neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—R-F plate coil (L8)
77633	Connector—Formed grounding connector
77623	Connector—UHF antenna input connector (J1)
77612	Contact—Bracket and spring contact assembly for grounding rotor—assembled to base
77618	Contact—Bracket and spring contact assembly for grounding rotor—assembled to oscillator shield
77606	Contact—Contact and support assembly—"L" shape—complete with two (2) contacts
77622	Contact—Contact and support assembly complete with two (2) contacts and UHF antenna input connector
77620	Contact—Contact and support assembly complete with four (4) contacts and holder for crystal rectifier
77607	Contact—Contact and support assembly complete with five (5) contacts—rear of chassis
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
77583	Core—Fine tuning core
77593	Coupling—Indicator shaft coupling
77596	Ferrule—Ferrule for UHF antenna input cable
77588	Gear—Rotor drive gear—nylon
77602	Insert—VHF coil assembly insert for channels 2, 3 or 4 (Includes C40, C41, C42, L29, L30, L31, T6)
77603	Insert—VHF coil assembly insert for channels 5 or 6 (Includes C37, C38, C39, L26, L27, L28, T5)
77604	Insert—VHF coil assembly insert for channels 7, 8, 9 or 10 (Includes C35, C36, L23, L24, L25, T4)
77605	Insert—VHF coil assembly insert for channels 11, 12 or 13 (Includes C33, C34, L20, L21, L22, T3)
77590	Lever—Actuating lever for fine tuning link
77582	Link—Fine tuning link (.188" dia. plunger) for early production
78245	Link—Fine tuning link (.253" dia. plunger) for late production
77581	Plate—Front plate and ball race
77489	Rectifier—Germanium rectifier 1N82 (CR1)
	Resistor—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1,000 ohms, ±10%, ½ watt (R13, R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
30340	Retainer—Retainer ring for fine tuning actuating lever stud
77599	Roller—Rotor detent roller and retainer
77574	Rotor—Rotor frame
77594	Screw—No. 8-32 x ¼" cup point set screw for indicator shaft coupling
77576	Shaft—Channel selector drive shaft complete with two (2) gears
77595	Shaft—Indicator shaft
77611	Shield—Oscillator shield and grounding spring assembly—underside of chassis
77577	Shield—Top shield
76967	Shield—Tube shield for V2
76534	Shield—Tube shield for V1, V3
77613	Sleeve—Insulating sleeve for fine tuning adjustable core
77274	Socket—Tube socket, 7 pin, miniature, saddle mounted, steatite for V2
77608	Socket—Tube socket, 9 pin, miniature, saddle mounted, moulded mica for V1, V3, V4
77578	Spring—Formed spring for holding rotor (on back of unit)
77584	Spring—Fine tuning link adjusting spring (7/32" I.D.)—used with 77582
78246	Spring—Fine tuning link adjusting spring (9/32" dia.)—used with link 78245
76961	Spring—Retaining spring for oscillator tube shield
77598	Spring—Rotor detent spring and roller complete with mounting bracket
77599	Roller—Rotor detent roller and retainer
77587	Stud—Mounting stud for fine tuning link actuating lever
77893	Stud—No. 6-32 x 21/32" adjusting stud for trimmer capacitor C9
77692	Stud—No. 6-32 x 25/32" adjusting stud for trimmer capacitors C6, C7, C8, C29, C30, C31, C32
77694	Stud—No. 10-32 x ⅜" adjusting stud for coils L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31 and transformers T3, T4, T5, T6
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I-F trap (L1, C1, L2, C2)
77585	Washer—"C" washer for drive and indicator shafts (3 required) or for fine tuning link spring 78246
77586	Washer—"C" washer for fine tuning link spring 77584
	CHASSIS ASSEMBLIES KCS77A (KRK22A) KCS77B (KRK12)
78238	Cap—Tube connector cap
	Capacitor—Ceramic:
76488	500 mmf., 30,000 volts (C201)
75166	Stand-off, 1,500 mmf. (C144)
	Capacitor—Fixed, ceramic:
77837	18 mmf., 6,000 volts (C212)
76574	39 mmf., 3,500 volts (C180)
77836	82 mmf., 6,000 volts (C198)
76576	150 mmf., 2,000 volts (C200)
76575	180 mmf., 3,500 volts (C199)
	Capacitor—Fixed, ceramic, high "K" disc:
77293	470 mmf., +100%, -0%, 500 volts DC (C225)
77624	680 mmf., +100%, -0%, 500 volts DC (C218)
73748	1,500 mmf., +100%, -0%, 500 volts DC (C209, C226)
77953	2,200 mmf., +100%, -0%, 500 volts DC (C220)
73473	4,700 mmf., +100%, -0%, 500 volts DC (C126, C128, C130, C136, C138, C141)
76470	Dual 4,700 mmf., +100%, -0%, 500 volts DC (C133A, C133B, C137A, C137B, C139A, C139B, C140A, C140B)
73960	10,000 mmf., +100%, -0%, 500 volts DC (C145, C146)
75877	Dual 10,000 mmf., +100%, -0%, 500 volts DC (C101A, C101B, C105A, C105B)
	Capacitor—Fixed, ceramic, insulated, high "K" disc:
77838	270 mmf., ±10%, 500 volts DC (C221)
75198	470 mmf., ±10%, 500 volts DC (C222)
77923	1,200 mmf., ±10%, 500 volts DC (C223)
	Capacitor—Fixed, ceramic, non-insulated, temp. coef. = -750
39044	15 mmf., ±10%, 500 volts DC (C152)
39042	47 mmf., ±10%, 500 volts DC (C151, C219)
71924	56 mmf., ±10%, 500 volts DC (C104)
39396	100 mmf., ±10%, 500 volts DC (C168, C169, C172)
71614	120 mmf., ±10%, 500 volts DC (C167)
47617	270 mmf., ±10%, 500 volts DC (C115, C164)
	Capacitor—Mica, trimmer:
71496	5-70 mmf. (C121)
75217	Dual 10-160 mmf. (C186A, C186B)
	Capacitor—Fixed, mica:
76474	82 mmf., 1,000 volts DC (C165, C187)
75248	220 mmf., 1,000 volts DC (C181)
39638	270 mmf., 500 volts DC (C161)
76579	270 mmf., 1,000 volts DC (C192)
39640	330 mmf., 500 volts DC (C159)
39644	470 mmf., 500 volts DC (C108, C109)
	Capacitor—Electrolytic:
74521	5 mfd., 50 volts (C111)
28417	5 mfd., 450 volts (C175)
77819	Comprising: 1 section of 40 mfd., 400 volts, 1 section of 35 mfd., 400 volts, 2 sections of 10 mfd., 400 volts (C120A, C120B, C120C, C120D)
77817	Comprising: 1 section of 50 mfd., 400 volts, 1 section of 25 mfd., 400 volts, 1 section of 100 mfd., 50 volts, and 1 section of 20 mfd., 25 volts (C118A, C118B, C118C, C118D)
77820	Comprising: 1 section of 90 mfd., 400 volts, 1 section of 10 mfd., 400 volts, and 1 section of 5 mfd., 400 volts (C149A, C149B, C149C)
	Capacitor—Fixed, tubular, paper, oil impregnated:
75643	.001 mfd., 1,000 volts (C194)
76508	.0015 mfd., 600 volts (C112)
73802	.0015 mfd., 1,000 volts (C177)
73595	.002 mfd., 600 volts (C110, C119)
73599	.0027 mfd., 600 volts (C116, C156)
73920	.0047 mfd., 600 volts (C158, C166, C182)
73789	.0068 mfd., 400 volts (C213)
73808	.0082 mfd., 1,000 volts (C148, C162)
73561	.01 mfd., 400 volts (C114, C117, C170, C202)
73562	.022 mfd., 400 volts (C179, C189)
73811	.027 mfd., 1,000 volts (C178)
73552	.033 mfd., 400 volts (C113, C163)
73813	.039 mfd., 1,000 volts (C203, C205)
73553	.047 mfd., 400 volts (C160, C188, C190)
73592	.047 mfd., 600 volts (C176)
73551	0.1 mfd., 400 volts (C183, C214)
73557	0.1 mfd., 600 volts (C173, C204)
77839	0.18 mfd., 200 volts (C174)
73794	0.22 mfd., 400 volts (C129, C153, C155, C157, C208, C210)
74957	0.22 mfd., 600 volts (C197)
73787	0.47 mfd., 200 volts (C191, C196, C211)
	Capacitor—Fixed, tubular, moulded paper, oil impregnated:
76995	.0012 mfd., 600 volts (C195)
73920	.0047 mfd., 600 volts (C171)
73594	.01 mfd., 600 volts (C184, C185, C193)
77824	Choke—Filter choke (L117)

STOCK No.	PART DESCRIPTION
76143	Clip—Mounting clip for stand-off capacitor
73477	Coil—Choke coil (L101)
76772	Coil—Filament winding only for hi-voltage transformer (Part of T115)
78197	Coil—Horizontal linearity coil complete with adjustable core (L111)
77842	Coil—Peaking coil (72 muh) (L122)
77840	Coil—Peaking coil (150 muh) (L118, R241)
77841	Coil—Peaking coil (150 muh) (L119, L120, R240, R244)
76647	Coil—Peaking coil (180 muh) (L107, R158)
75252	Coil—Peaking coil (500 muh) (L104, L106)
76640	Coil—RF choke coil (1.5 muh) (L110, L112)
76510	Coil—RF choke coil (4.7 muh) (L108)
76484	Coil—Width coil complete with adjustable core (L109)
76457	Connector—Second anode lead connector
75474	Connector—Single contact male connector for speaker cable
74594	Connector—2 contact male connector for power cord
50367	Connector—6 contact female connector for yoke leads (J102)
35787	Connector—Phono input connector (J101)
77654	Control—AGC control (R180)
77655	Control—Brightness control, volume control (R114A, R114B, S102)
77640	Control—Height control (R190)
77826	Control—Horizontal and vertical hold control (R187A, R187B)
77818	Control—Contrast and peaking controls (R155A, R155B)
77199	Control—Ratio detector balance control (R108)
77643	Control—Vertical linearity control (R197)
77647	Coupling—Coupling (nylon) for picture control or sharpness switch
77136	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
73600	Fuse—0.25 amp., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd anode lead exit
76480	Lead—Anode lead complete with eyelet
77829	Link—Link assembly for definition switch shafts
77834	Plate—Bakelite plate for mounting picture control and definition switch
77832	Plate—Hi-voltage plate (bakelite) complete less corona ring, transformer and socket
76675	Rectifier—Picture detector crystal rectifier (CR101)
	Resistor—Wire wound:
76468	1.5 ohms, 1/3 watt (R225)
77835	100 ohms, 4 watts (R221)
78223	400 ohms, 10 watts (R224)
77825	Comprising: 1 section of 335 ohms, 16 watts, 1 section of 375 ohms, 8 watts, 1 section of 1,400 ohms, 7 watts, 1 section of 600 ohms, 2 watts, and 1 section of 10,000 ohms, 5 watts (R228A, R228B, R228C, R228D, R228E)
76642	6,750 ohms, 10 watts (R153)
	Resistor—Fixed, composition:
503033	33 ohms, ±10%, ½ watt (R152)
503047	47 ohms, ±10%, ½ watt (R107, R218)
502056	56 ohms, ±5%, ½ watt (R134)
34763	68 ohms, ±5%, ½ watt (R138)
502082	82 ohms, ±5%, ½ watt (R101)
503082	82 ohms, ±10%, ½ watt (R249)
502110	100 ohms, ±5%, ½ watt (R128)
503115	150 ohms, ±10%, ½ watt (R253)
503118	180 ohms, ±10%, ½ watt (R142, R243)
503122	220 ohms, ±10%, ½ watt (R151)
503139	390 ohms, ±10%, ½ watt (R245)
513139	390 ohms, ±10%, 1 watt (R118)
503147	470 ohms, ±10%, ½ watt (R199)
503156	560 ohms, ±10%, ½ watt (R198)
503210	1,000 ohms, ±10%, ½ watt (R102, R104, R109, R120, R126, R131, R133, R136, R161, R252)
502215	1,500 ohms, ±5%, ½ watt (R183)
503215	1,500 ohms, ±10%, ½ watt (R236, R248)
503222	2,200 ohms, ±10%, ½ watt (R140)
502233	3,300 ohms, ±10%, ½ watt (R201)
502239	3,900 ohms, ±5%, ½ watt (R150)
503239	3,900 ohms, ±10%, ½ watt (R211)
503247	4,700 ohms, ±10%, ½ watt (R230)
502256	5,600 ohms, ±5%, ½ watt (R137)
513256	5,600 ohms, ±10%, 1 watt (R156)
14659	6,800 ohms, ±5%, ½ watt (R111, R112)
503268	6,800 ohms, ±10%, ½ watt (R176)
513268	6,800 ohms, ±10%, 1 watt (R147)
503282	8,200 ohms, ±10%, ½ watt (R145, R191, R213)
513282	8,200 ohms, ±10%, 1 watt (R182)
503310	10,000 ohms, ±10%, ½ watt (R139, R164, R200, R229)

STOCK No.	PART DESCRIPTION
513310	10,000 ohms, ±10%, 1 watt (R157)
503315	15,000 ohms, ±10%, ½ watt (R239)
513315	15,000 ohms, ±10%, 1 watt (R250)
523315	15,000 ohms, ±10%, 2 watts (R143)
503318	18,000 ohms, ±10%, ½ watt (R115, R144)
503322	22,000 ohms, ±10%, ½ watt (R175)
522322	22,000 ohms, ±5%, 2 watts (R223)
503327	27,000 ohms, ±10%, ½ watt (R174, R178, R212, R232)
523327	27,000 ohms, ±10%, 2 watts (R222, R254)
503333	33,000 ohms, ±10%, ½ watt (R106, R129, R132, R135, R235)
28744	33,000 ohms, ±5%, 2 watts (R193)
503339	39,000 ohms, ±10%, ½ watt (R110, R173, R242)
503347	47,000 ohms, ±10%, ½ watt (R103, R215)
512347	47,000 ohms, ±5%, 1 watt (R247)
502356	56,000 ohms, ±5%, ½ watt (R141)
503356	56,000 ohms, ±10%, ½ watt (R105)
503368	68,000 ohms, ±10%, ½ watt (R208, R209)
513368	68,000 ohms, ±10%, 1 watt (R216)
8064	82,000 ohms, ±5%, ½ watt (R167)
503382	82,000 ohms, ±10%, ½ watt (R192)
513382	82,000 ohms, ±10%, 1 watt (R214)
503410	100,000 ohms, ±10%, ½ watt (R166, R203, R238)
513410	100,000 ohms, ±10%, 1 watt (R251)
30180	120,000 ohms, ±5%, ½ watt (R246)
503415	150,000 ohms, ±10%, ½ watt (R159, R195, R202, R204)
502422	220,000 ohms, ±5%, ½ watt (R179)
503422	220,000 ohms, ±10%, ½ watt (R207, R233)
502427	270,000 ohms, ±5%, ½ watt (R163, R165)
503427	270,000 ohms, ±10%, ½ watt (R171, R266)
503433	330,000 ohms, ±10%, ½ watt (R116, R189, R205)
503447	470,000 ohms, ±10%, ½ watt (R117, R148, R160, R172, R184, R185, R217)
503468	680,000 ohms, ±10%, ½ watt (R169)
503482	820,000 ohms, ±10%, ½ watt (R206)
503510	1 megohm, ±10%, ½ watt (R181, R188)
502512	1.2 megohm, ±5%, ½ watt (R186)
503522	2.2 megohm, ±10%, ½ watt (R196)
72632	3.3 megohm, ±5%, 1 watt (R162)
503539	3.9 megohm, ±10%, ½ watt (R168)
503547	4.7 megohm, ±10%, ½ watt (R170)
503610	10 megohm, ±10%, ½ watt (R113)
77660	Shaft—Extension shaft for picture control
77831	Shaft—Definition switch extension shaft
77830	Shaft—Definition switch knob shaft
77661	Shell—Mounting shell for hi-voltage capacitor
73584	Shield—Tube shield for V101, V102, V103, V106, V107, V109
77659	Shield—Tube shield for V105
76741	Shield—Tube shield for V113
75718	Socket—Channel indicator lamp socket
74834	Socket—Kinescope socket
71508	Socket—Tube socket, 6 pin, moulded for V117
50367	Socket—Tube socket, 6 pin, moulded, saddle-mounted for V118, V119
73117	Socket—Tube socket, miniature, 7 pin, wafer for V101, V102, V103, V104, V106, V107, V108, V109, V124
77658	Socket—Tube socket, miniature, 7 pin, moulded, saddle-mounted for V105
71494	Socket—Tube socket, miniature, 7 pin, moulded, saddle-mounted for V114
31251	Socket—Tube socket, octal, wafer for V113, V116, V121, V122, V125)
77645	Socket—Tube socket, octal, wafer for V115
76971	Socket—Tube socket, miniature, 9 pin, wafer for V110, V111, V112, V123
77828	Switch—Definition switch (S104)
77827	Switch—Phono-tone switch (S101)
76463	Terminal—Screw type grounding terminal
77198	Transformer—First pix I.F. grid transformer complete with adjustable cores (T104, C125, R125)
77197	Transformer—First pix I.F. plate transformer complete with adjustable cores (T105, C131, C132, R130)
76435	Transformer—Second pix I.F. grid transformer complete with adjustable cores (T106, C134)
76433	Transformer—Third or fourth pix I.F. transformer (T107, T108)
76436	Transformer—Fifth pix I.F. transformer (T109, C142, C143, CR101, L102, R146)
77833	Transformer—Hi-voltage transformer (Part of T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T114)
77821	Transformer—Output transformer (T103)
77822	Transformer—Power transformer, 117 volts, 60 cycle (T113)

STOCK No.	PART DESCRIPTION
76439	Transformer—Ratio detector transformer complete with adjustable cores (T102, C106, C107)
76438	Transformer—Sound I.F. transformer complete with adjustable cores (T101, C102, C103)
76437	Transformer—Sound take-off transformer complete with adjustable cores (T110, C147)
77650	Transformer—Vertical oscillator transformer (T111)
77823	Transformer—Vertical output transformer (T112)
76482	Trap—4.5 MC trap (L105, C150)
77585	Washer—"C" washer for picture control extension shaft (2 required) or sharpness switch shafts (4 required)
	SPEAKER ASSEMBLIES 971490-4W RL 105 E11 RMA — 274
75024	Cone—Cone and voice coil (3.2 ohms)
77872	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms) Note: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instruments, number stamped on speaker and full description of part required.
	MISCELLANEOUS
77877	Back—Cabinet back complete with power cord
76184	Board—Antenna terminal board
77748	Bracket—Mounting bracket for hidden controls cover and case assembly
71807	Capacitor—Mica trimmer, 10-160 mmf. for Model 27D331U
71892	Catch—Bullet catch and strike for door
77755	Clamp—Polystyrene clamp for antenna cable and mount for FM trap for Model 27D331U
X3350	Cloth—Grille cloth for mahogany instruments
X3351	Cloth—Grille cloth for oak instruments
77870	Connector—Anode connector complete with contact and formed terminal
75474	Connector—Single contact male connector—part of antenna cable
77726	Connector—2 contact male connector—part of antenna cable for Model 27D331U
39153	Connector—4 contact male connector—part of antenna cable for Model 27D331
75542	Connector—6 contact male connector—part of deflection yoke (P102)
71457	Cord—Power cord and plug
77878	Cover—Cover and case assembly—brown—for hidden controls for mahogany instruments
77888	Cover—Cover and case assembly—medium beige—for hidden controls for oak instruments
77759	Cover—Cover assembly—maroon—complete with spring for channel markers for mahogany instruments for Model 27D331U
77760	Cover—Cover assembly — sand gray — complete with spring for channel markers for oak instruments for Model 27D331U
77869	Cushion—Rubber cushion for deflection yoke hood
77876	Cushion—Rubber cushion for safety glass
77874	Cushion—Rubber cushion (oyster white) for dust sealing the kinescope for mahogany instruments
77887	Cushion—Rubber cushion (dark tan) for dust sealing the kinescope for oak instruments
77782	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for mahogany instruments
77781	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for oak instruments
77756	Disc—Polystyrene indicator disc — maroon — for channel selections for mahogany instruments for Model 27D331U
77757	Disc—Polystyrene indicator disc—sand gray—for channel selections for oak instruments for Model 27D331U
77783	Emblem—"Deluxe" emblem
77700	Escutcheon—Channel marker escutcheon for Model 27D331
77880	Fastener—Fastener for deflection yoke hood support rod
77875	Glass—Safety glass
74308	Hinge—Cabinet door hinge (1 set)
77866	Hood—Deflection yoke hood less rubber cushions
77881	Insulator—Polystyrene support insulator for kinescope
77709	Knob—Brightness control knob—brown—for mahogany instruments (outer)
77718	Knob—Brightness control knob—medium beige—for oak instruments (outer)
77708	Knob—Channel selector knob for Model 27D331 (inner)
77751	Knob—Channel selector knob—brown—for mahogany instruments for Model 27D331U

STOCK No.	PART DESCRIPTION
77968	Knob—Channel selector knob (late type)—brown—for mahogany instruments for Model 27D331U
77752	Knob—Channel selector knob—medium beige—for oak instruments for Model 27D331U
77969	Knob—Channel selector knob (late type)—medium beige—for oak instruments for Model 27D331U
77707	Knob—Fine tuning control knob—brown—for mahogany instruments for Model 27D331 (outer)
77750	Knob—Fine tuning control knob for Model 27D331U
77699	Knob—Picture control knob—brown—for mahogany instruments
77719	Knob—Picture control knob—medium beige—for oak instruments
77735	Knob—Tone control or definition switch knob—brown—for mahogany instruments
77736	Knob—Tone control or definition switch knob—medium beige—for oak instruments
77710	Knob—Volume control and power switch knob
11765	Lamp—Channel marker escutcheon lamp—Mazda 51
77867	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
76633	Magnet—Pin cushion correction magnet complete with support arm
77765	Marker—UHF channels numbers markers for mahogany instruments for Model 27D331U
77766	Marker—UHF channels numbers markers for oak instruments for Model 27D331U
77762	Marker—VHF channels numbers markers for mahogany instruments for Model 27D331U
77763	Marker—VHF channels numbers markers for oak instruments for Model 27D331U
77701	Mask—Channel marker escutcheon light mask—brown—for mahogany instruments for Model 27D331
77873	Mask—Polystyrene masking panel (dark tan) for mahogany instruments
77886	Mask—Polystyrene masking panel (sand) for oak instruments
77784	Medallion—"His Master's Voice" medallion
77871	Nut—No. ¼-20 knurled nut for mounting deflection yoke
73634	Nut—Speed nut for speaker mounting screws
74337	Nut—Speed nut to fasten "Deluxe" emblem
77933	Plate—Back plates (1 set) for door pulls for mahogany instruments
77931	Pull—Cabinet door pull for mahogany instruments
77932	Pull—Cabinet door pull for oak instruments
77928	Retainer—Retainer for channel selector knob for Model 27D331U
77879	Rod—Formed threaded rod for supporting deflection yoke hood assembly
77712	Screw—No. 6 x ½" cross recessed pan head self-tapping screw (black) for fastening hidden controls cover and case to cabinet for mahogany instruments
77725	Screw—No. 6 x ½" cross recessed pan head self-tapping screw (zinc) for fastening hidden controls cover and case to cabinet for oak instruments
74113	Screw—No. 8-32 x 1" trimit head screw for door pull
74307	Screw—No. 8-32 x 1⅛" trimit head screw for door pull
77754	Shade—Channel marker escutcheon lamp shade for Model 27D331U
73643	Spring—Channel marker escutcheon spring clip for Model 27D331
77929	Spring—Formed spring for fine tuning knob for Model 27D331U
76837	Spring—Retaining spring for knobs 77699, 77708, 77709, 77718, 77719, 77735, 77736
30330	Spring—Retaining spring for knob 77710
72845	Spring—Retaining spring for knob 77707 for Model 27D331
74734	Spring—Retaining spring for channel markers covers 77759, 77760 for Model 27D331U
72936	Stop—Door stop
76600	Strap—Grounding strap (.005" soft copper strip)
76636	Stud—Adjusting stud complete with guard for focus magnet
77883	Support—Plywood support (lower R.H.) for polystyrene insulator
77884	Support—Plywood support (lower L.H.) for polystyrene insulator
77885	Support—Plywood support (upper) for polystyrene insulator
75500	Washer—Felt washer for back cover mounting screws
77882	Washer—Metal washer for support rod fastener (.0478" x 25/32" I.D. x 1⅛" O.D.)
77868	Yoke—Deflection yoke complete with 6 contact male connector (L113, L114, L115, L116, C207, P102, R227, R237)

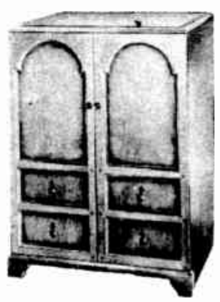
Model 21-T-356U "Bentley" Mahogany

Models 21-T-363, 21-T-363U "Hillsdale" Mahogany

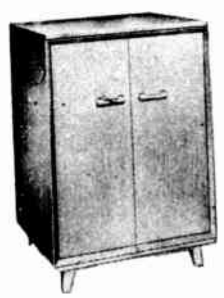
Models 21-T-364, 21-T-364U "Hayward" Mahogany, Oak

Models 21-T-365, 21-T-365U "Latham" Oak, Natural, Walnut

Models 21-T-372, 21-T-372U "Preston" Mahogany, Oak



Models 21-T-373, 21-T-373U "Powell" Maple, Red Cherry



Models 21-T-374, 21-T-374U "Sutton" Oak, Natural Walnut

Models 21-T-375, 21-T-375U "Chadwick" Mahogany, Walnut

GENERAL DESCRIPTION

All models are "21 inch" television receivers. Models 21-T-363, 21-T-364, 21-T-365, 21-T-372, 21-T-373, 21-T-374 and 21-T-375 are identical except for cabinets and speakers. These receivers feature full twelve channel VHF coverage. Models 21-T-356U, 21-T-363U, 21-T-364U, 21-T-365U, 21-T-372U, 21-T-373U, 21-T-374U and 21-T-375U, are identical except for cabinets and speakers. Model 21-T-356U has the additional difference of employing a 21EP4A glass kinescope. These receivers feature full twelve channel VHF coverage plus any four UHF channels desired.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE 227 sq. ins. on a 21AP4 or 21EP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

21-T-363, 364, 365, 372, 373, 374, 375

Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

21-T-356U, 363U, 364U, 365U, 372U, 373U, 374U, 375U

Any desired combination of 16 VHF and/or UHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc., 470 mc. to 890 mc.

Picture Carrier Frequency....................45.75 mc.

Sound Carrier Frequency....................41.25 mc.

RCA TUBE COMPLEMENT

Tube Used	Function
Chassis KCS83 using KRK29 Tuner	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Chassis KCS83B and KCS83E using KRK12A Tuner	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control

A 1N82 crystal is used as a mixer.

Tube Used	Function
All Models	
(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier

RCA TUBE COMPLEMENT

Tube Used	Function
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Det. and Horiz. Sync. Sep.
(5) RCA 6X8	Video Amplifier and Vert. Sync. Sep.
(6) RCA 12AU7	Video Output and AGC
(7) RCA 6AU6	1st Sound I-F Amplifier
(8) RCA 6AU6	2nd Sound I-F Amplifier
(9) RCA 6AL5	Ratio Detector
(10) RCA 6AV6	Audio Amplifier
(11) RCA 6K6GT	Audio Output
(12) RCA 6SN7GT	Vert. Osc. & Dischg. & Sync. Output
(13) RCA 6K6GT	Vertical Sweep Output
(14) RCA 6SN7GT	Horiz. Sweep Oscillator and Control
(15) RCA 6BQ6GT	Horizontal Sweep Output
(16) RCA 6AX4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
(18) RCA 21AP4	Kinescope
21EP4A	Model 21-T-356U only
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

CHASSIS DESIGNATIONS

KCS83 Models 21-T-363-364-365-372-373-374 and 375 employing a KRK29 Tuner.

KCS83B Models 21-T-363U-364U-365U-372U-373U-374U and 375U employing a KRK12A Tuner.

KCS83E Model 21-T-356U employing a KRK12A Tuner. (21EP4A Kinescope).

PICTURE INTERMEDIATE FREQUENCIES

Picture Carrier Frequency....................45.75 mc.

Adjacent Channel Sound Trap....................47.25 mc.

Sound Trap....................4.5 mc.

SOUND INTERMEDIATE FREQUENCIES

Sound Carrier Frequency............41.25 mc. and 4.5 mc.

VIDEO RESPONSE....................To 3.5 mc.

FOCUS....................Magnetic

SWEEP DEFLECTION....................Magnetic

SCANNING....................Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY....................15,750 cps

VERTICAL SWEEP FREQUENCY....................60 cps

FRAME FREQUENCY (Picture Repetition Rate)........30 cps

OPERATING CONTROLS (Front)

Channel Selector / Fine Tuning	Dual Control Knobs
Brightness	Single Control under Panel
Picture Horizontal Hold	Single Control under Panel
Picture Vertical Hold	Single Control under Panel
Sound Volume and On-Off Switch / Picture	Dual Control Knobs
TV-PH Tone Switch	Single Control under Panel

NON-OPERATING CONTROLS (under Front Panel)

Height	screwdriver adjustment
Vertical Linearity	screwdriver adjustment

NON-OPERATING CONTROLS (not including R-F and I-F adjustments)

Picture Centering	top chassis adjustment
Width	rear chassis adjustment
Horizontal Drive	rear chassis screwdriver adjustment
Horizontal Linearity	rear chassis adjustment
Horizontal Oscillator Frequency	rear chassis adjustment
Horizontal Oscillator Waveform	bottom chassis adjustment
Horizontal Locking Range	rear chassis adjustment
Focus	top chassis adjustment
Ion Trap Magnet	top chassis adjustment
Deflection Coil	top chassis adjustment
AGC Control	rear chassis adjustment

INSTALLATION INSTRUCTIONS

UNPACKING.—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle. Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ANTENNA INPUT

Models with a KRK29 Tuner

These tuner units are designed for VHF reception only. A 300 ohm antenna input is provided, however, by removing the jumper between pins 1 and 5 of the matching unit input jack, a 72 ohm coaxial line may be used. Jumpers must be added between pins 1 and 4 and also between pins 2 and 5 as shown in figure 27. The coaxial line is then fastened directly to pins 1 and 5, with the shield connected to pin 1 and the center conductor to pin 5.

Models with a KRK12A Tuner

The KRK12A tuner unit is designed for UHF-VHF reception. A common 300 ohm input is provided for UHF and/or VHF. When using a UHF antenna only, a VHF antenna only or a combination UHF-VHF antenna, connect the single transmission line to the receiver antenna terminal board. Do not connect the jumper from the crossover network terminal board. (Refer to Figure 28).

Signals from separate UHF and VHF antennas may be fed to the tuner. To do this the 300 ohm Crossover Network mounted on the cabinet back is used to match two 300 ohm lines, from separate UHF and VHF antennas, to the single 300 ohm tuner input.

Connect the short jumper, from the crossover terminal board, to the antenna terminals of the receiver. Connect the transmission lines, from the separate antennas, to their respective terminals on the crossover terminal board as shown in Figure 28.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 2. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Turn the focus control (shown in Figure 2) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.

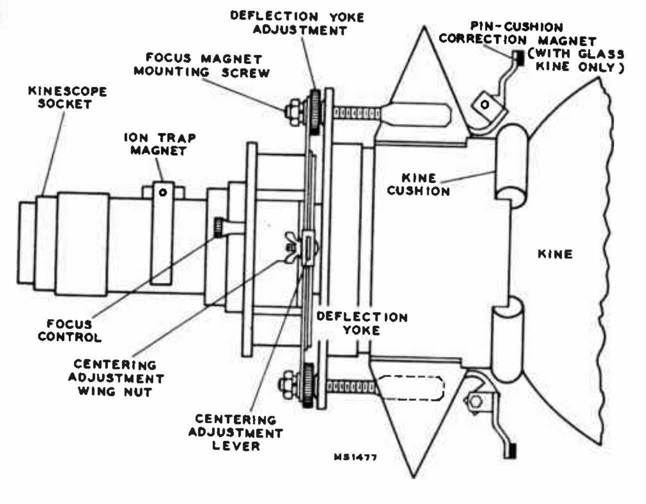


Figure 2—Yoke and Focus Magnet Adjustments

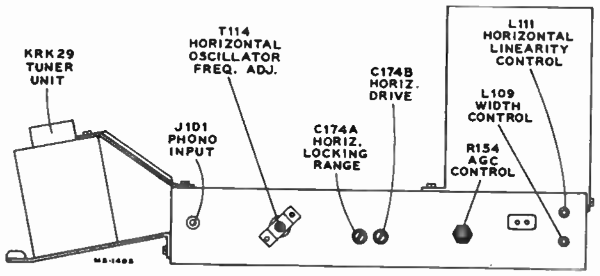


Figure 3—Rear Chassis Adjustments

INSTALLATION INSTRUCTIONS

ALIGNMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment.—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T114 horizontal frequency adjustment at the rear of the chassis until the picture is just out of snync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T114 core until the bar moves out of the picture leaving it in sync.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on page 13. For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENT.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear metal plate of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the center of the opening.

PIN-CUSHION CORRECTION

Model 21-T-356U only

Two pin-cushion correction magnets are employed to correct a small amount of pin-cushion of the raster due to the lens effect of the face of the kinescope. These magnets are mounted on small arms, one on each side of the kinescope as shown in Figure 2. The arms hinge in one plane on self tapping screws which act both as a hinge and an adjustment locking screw. When the magnets are swung towards the tube, maximum correction is obtained. Minimum correction is obtained when the arms are swung away from the tube. To adjust the magnets, loosen the two self tapping screws and position the magnets until the sides of the raster appear straight. Tighten the screws without shifting the position of the magnets. In some cases it may be necessary to twist or bend the magnet support arms to obtain the appearance of straight raster edges.

CENTERING ADJUSTMENT.—No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plates include a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture up and down and sidewise adjustment moves the picture side to side.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C174B counter-clockwise until the picture begins to "wrinkle" in the middle then clockwise until the "wrinkle" disappears.

Turn the horizontal linearity control L111 clockwise until the picture begins to "wrinkle" on the right and then counter-clockwise until the "wrinkle" disappears and best linearity is obtained.

Adjust the width control L109 to obtain correct picture width.

A slight readjustment of these three controls may be necessary to obtain the best linearity.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R173 behind front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R183 behind front control panel), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the knurled yoke nuts and the focus magnet mounting nuts are tight.

KRK29 R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 11. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis.

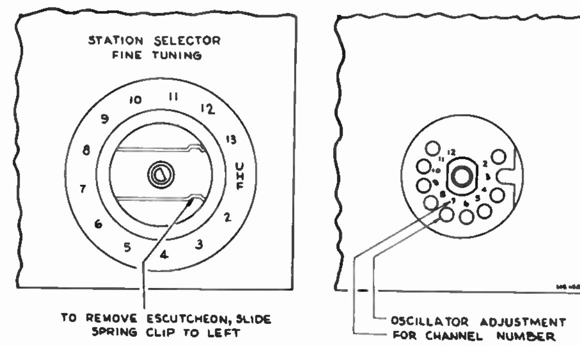


Figure 4—KRK29 R-F Oscillator Adjustments

KRK12A R-F OSCILLATOR ADJUSTMENTS.—Set the fine tuning control to the center of its range on the channel to be adjusted. Adjust the oscillator core for this channel to obtain maximum audio output without distortion. The adjustment location is the same for all channels, see Figure 5. The

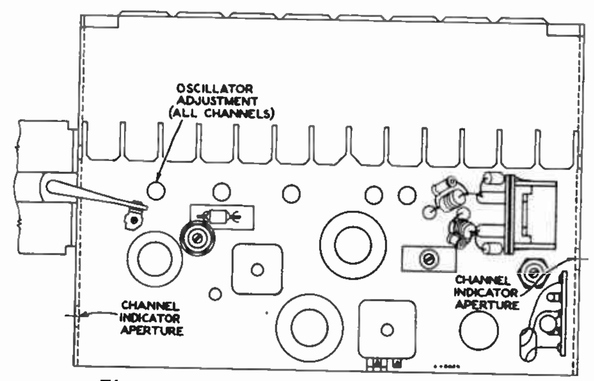


Figure 5—KRK12A Oscillator Adjustment

insert in the operating position can be determined by a stamping on the insert drum. This stamping is visible through either the front or rear apertures shown in Figure 5.

AGC THRESHOLD CONTROL.—The AGC threshold control R154 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R154. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R154 should be readjusted.

Turn R154 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R154 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R154 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R154 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is L5 on KRK29 tuners and is located on the antenna matching transformer.

CAUTION.—In some receivers, the FM trap L5 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L5 to make sure that it does not affect sensitivity on these two channels.

The FM trap on models using the KRK12A Tuner is fastened to the receiver antenna cable and is adjusted in the same manner as described above.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

REFLECTIONS.—Multiple images sometimes known as echoes or ghosts, are caused by the signal arriving at the antenna by two or more routes. The second or subsequent image occurs when a signal arrives at the antenna after being reflected off a building, a hill or other object. In severe cases of reflections, even the sound may be distorted. In less severe cases, reflections may occur that are not noticeable as reflections but that will instead cause a loss of definition in the picture.

CABINET ANTENNA.—A cabinet antenna is provided in all models using wooden cabinets and the leads are brought out near the antenna terminal board. The cabinet antenna may be employed for both UHF and VHF reception in place of the outdoor antenna in areas where the signals are strong and no reflections are experienced.

INTERFERENCE.—Auto ignition, street cars, electrical machinery and diathermy apparatus may cause interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least ¼ wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

Short-wave radio transmitting and receiving equipment may cause interference in the picture in the form of moving ripples. In some instances it may be possible to eliminate the interference by the use of a trap in the antenna transmission line. However, if the interfering signal is on the same frequency as the television station, a trap will provide no improvement.

RECEIVER LOCATION.—The owner should be advised of the importance of placing the receiver in the proper location in the room.

The location should be chosen—

- —Away from bright windows and so that no bright light will fall directly on the screen. (Some illumination in the room is desirable, however.)
- —To give easy access for operation and comfortable viewing.
- —To permit convenient connection to the antenna.
- —Convenient to an electrical outlet.
- —To allow adequate ventilation.

CHASSIS TOP VIEW

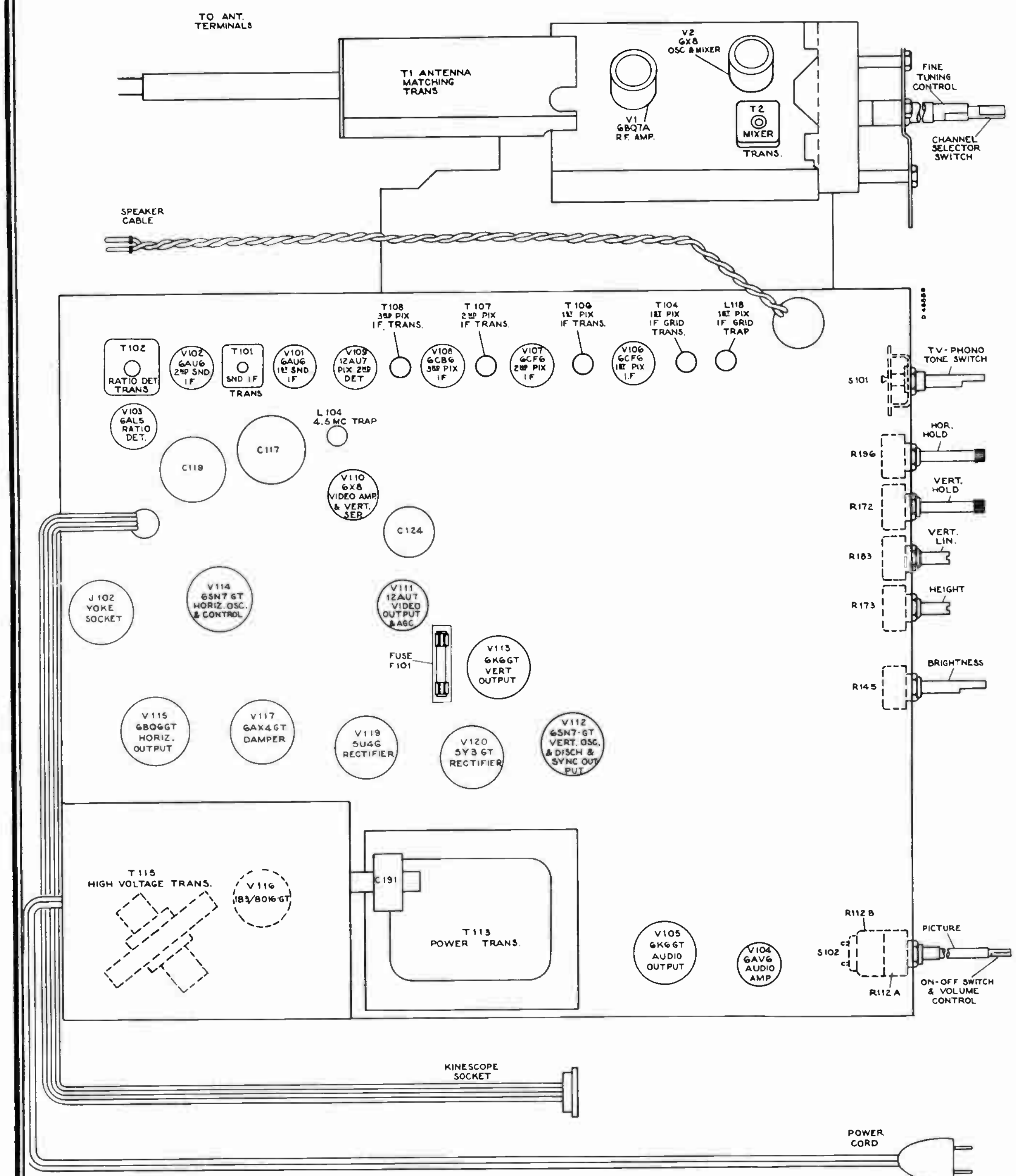


Figure 6—Chassis Top View (shown with KRK29 Tuner)

CHASSIS BOTTOM VIEW

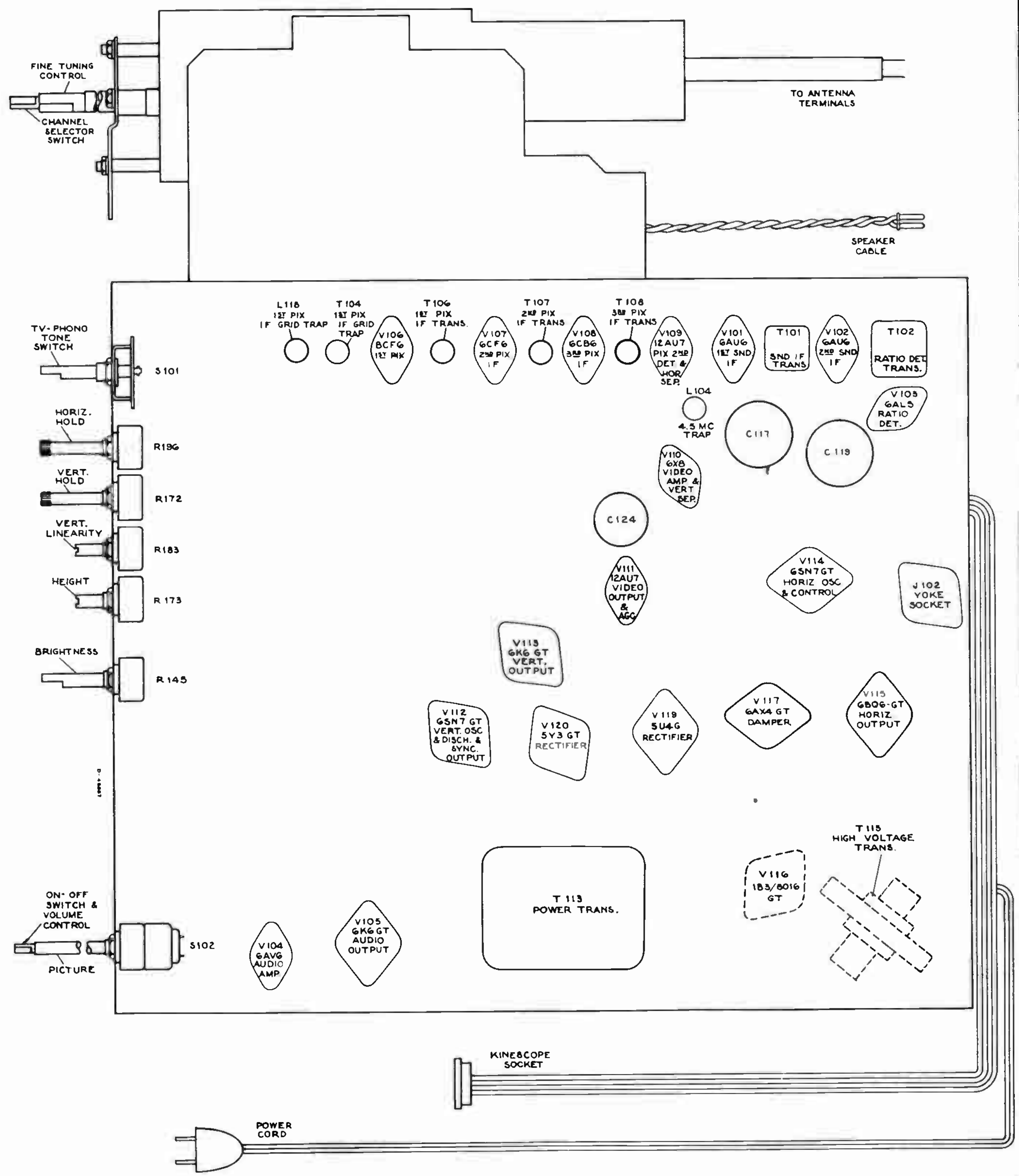


Figure 7—Chassis Bottom View (shown with KRK29 Tuner)

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12A Tuner. Wiring of adapter is shown in Figure 15

KRK29 ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R123 and C142. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R123 and C142.

Connect an oscilloscope to the junction of R135 and L102 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 10 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in figure 19. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 21-T-363 to 21-T-375 incl.

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R123 and C142. The second battery will be used later.

Set the bias to produce approximately —5.0 volt of bias at the junction of R123 and C142.

Connect the "VoltOhmyst" to junction of R135 and L102 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst". During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R123 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R135, L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	L118

Models 21-T-356U to 21-T-375U incl.

Connect the "VoltOhmyst" to the junction of R123 and C142.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R123 and C142. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst".

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Connect the output of the signal generator to the front terminal of the crystal mixer in series with a 1500 mmf. ceramic capacitor.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R135 and L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc.	L118

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 21-T-363 to 21-T-375 incl.

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R135 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 22. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 23.

Models 21-T-356U to 21-T-375U incl.

To align the crystal mixer circuit and T2 and T104 connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C122 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (top) for maximum gain at 43.5 mc. and with 45.75 mc. at 75% of maximum response.

ALIGNMENT PROCEDURE

Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 13.

Disconnect the diode probe, the 180 ohm and the two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Adjust the bias potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142.

Leave the sweep generator connected to the front terminal of the 1N82 crystal holder with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 14.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK29 TUNER ALIGNMENT

Models 21-T-363 to 21-T-375 incl.

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate if 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst". The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn the C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in Figure 10, to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in Figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48, and L32 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48, and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21, or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12A TUNER ALIGNMENT

Models 21-T-356U to 21-T-375U incl.

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 11. The proper curve shape is shown in Figure 11(b). (See Note on page 13 for detailed explanation of adjustment.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction of R123 and C142, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to the junction of R135 and L102. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

ALIGNMENT PROCEDURE

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 12. The curve shape will usually vary from Figure 12 (a) to Figure 12 (c) going higher in frequency, however any of these responses are acceptable.

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R123 and C142, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to junction of R135 and L102. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used.

Set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Figure 14.

Set the UHF marker generator to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt D.C. scale.

Set oscillator injection adjustment to read .1 volt on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volt. Adjust as necessary to read .3 volt or less at TP1.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L103 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst". Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R108 and C109.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst".

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R108 and C109. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst".

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 100 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the viedo amplifier, pin 9 of V110.

Adjust the core of L104 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be ommitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L104 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L104 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 9 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R196, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 24. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES.—The response curves shown on pages 14 and 15 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON KRK12A TUNER ALIGNMENT.—The use of a crystal mixer makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in Figure 11 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in figure 11(b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in figure 11(a) and 11(c).

The valley in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1, but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

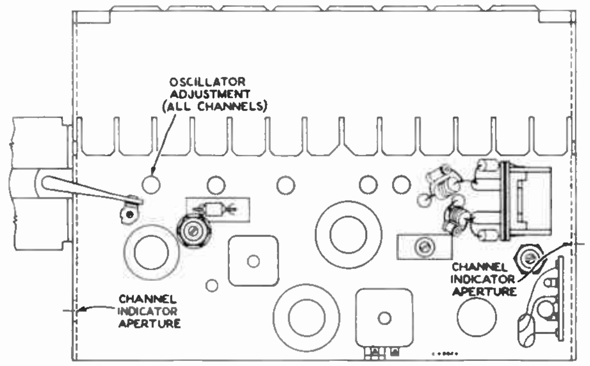


Figure 8—KRK12A Oscillator Adjustments

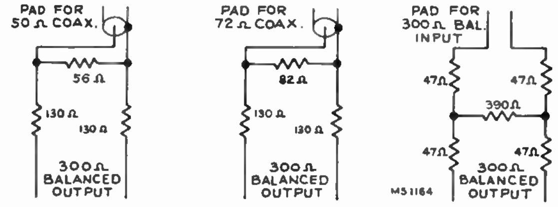


Figure 10—Sweep Attenuator Pads

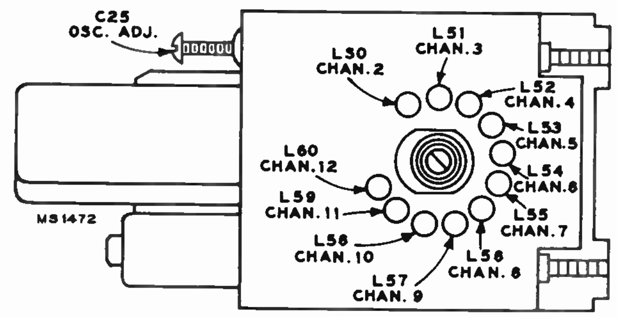


Figure 16—KRK29 R-F Oscillator Adjustments

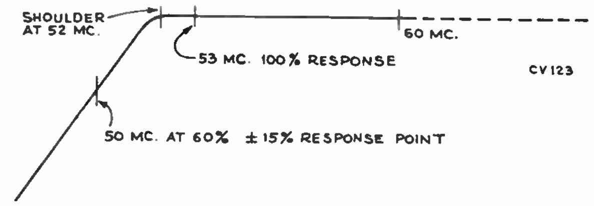


Figure 19—KRK29 Antenna Matching Unit Response

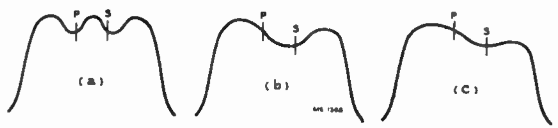


Figure 12—KRK12A UHF Insert Responses

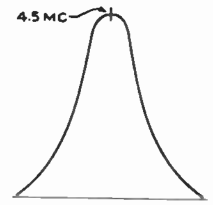


Figure 20—Sound I-F Response

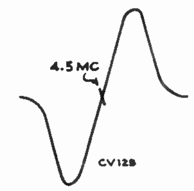


Figure 21—Ratio Det. Response

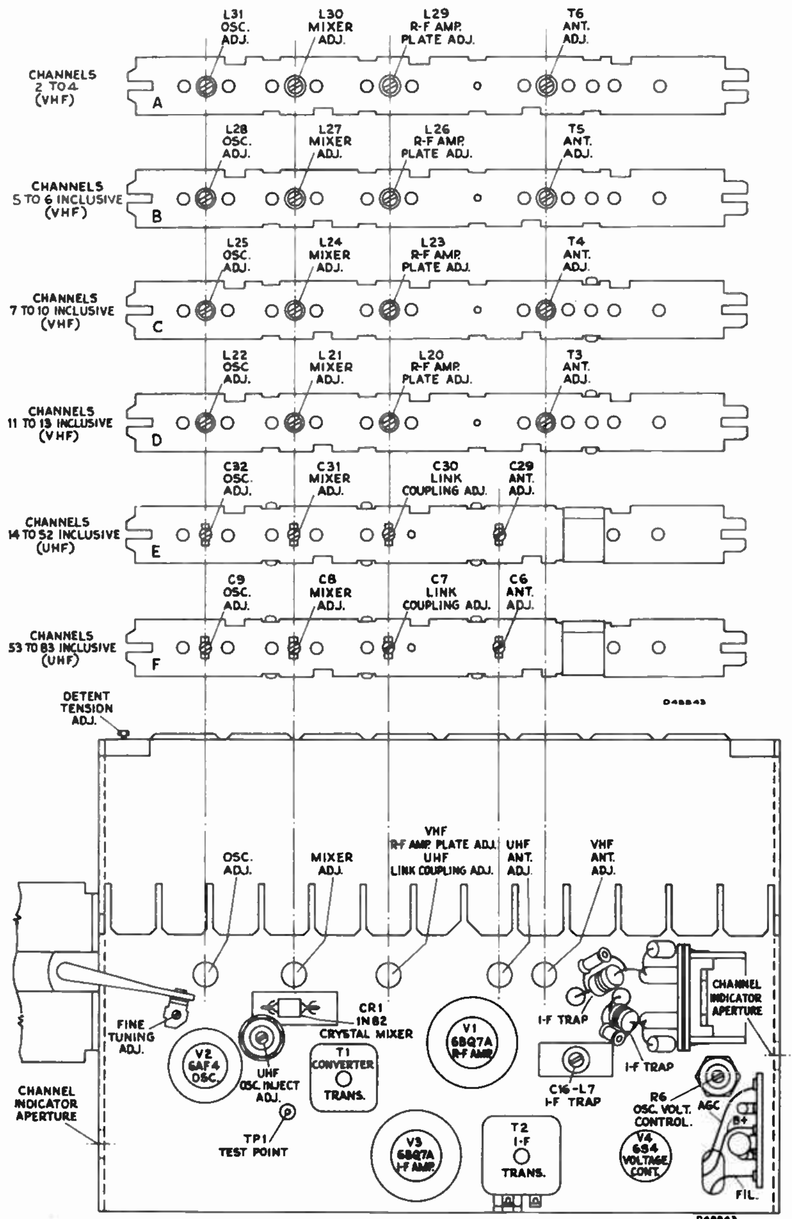


Figure 9—KRK12A Tuner Adjustments

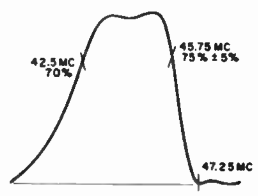


Figure 13—T2 and T104 Response with KRK12A

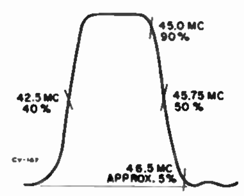


Figure 14—Over-all I-F Response with KRK12A

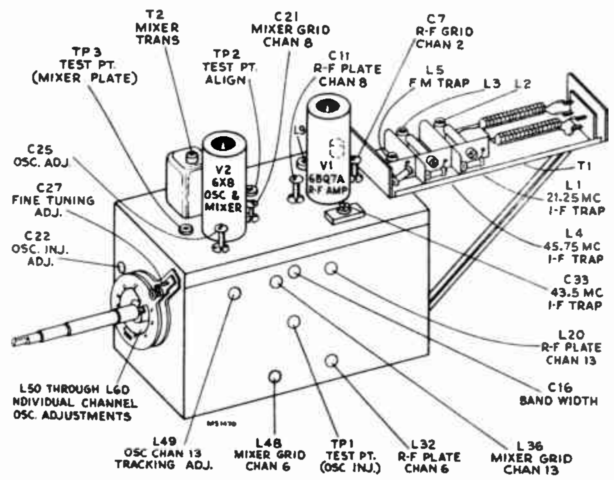


Figure 17—KRK29 Tuner Adjustments

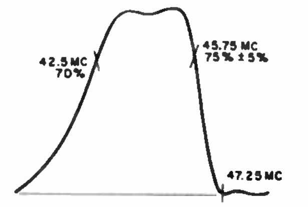


Figure 22—KRK29 T2 and T104 Response

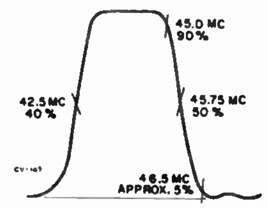


Figure 23—KRK29 Over-all I-F Response

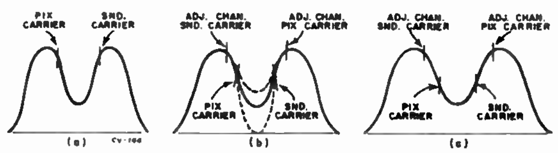


Figure 11—KRK12A VHF Insert Responses

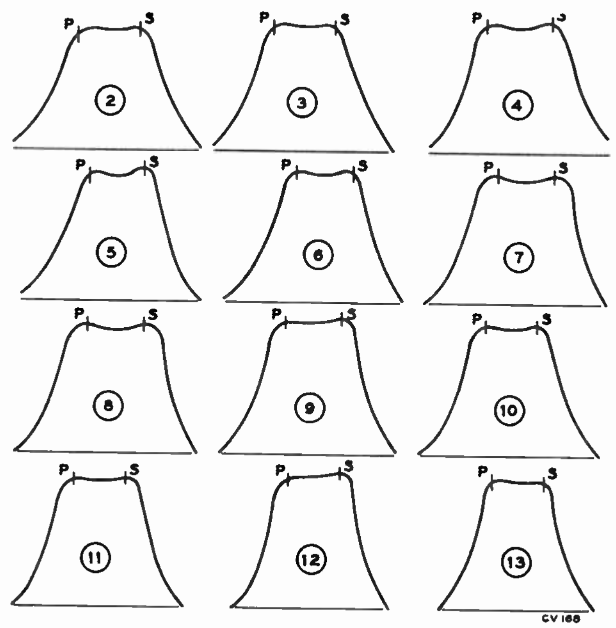


Figure 18—KRK29 R-F Response

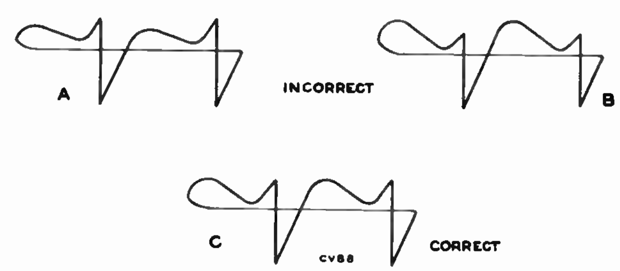


Figure 24—Horizontal Oscillator Wave Forms

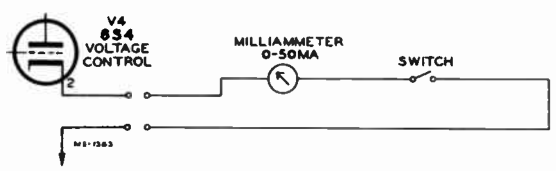
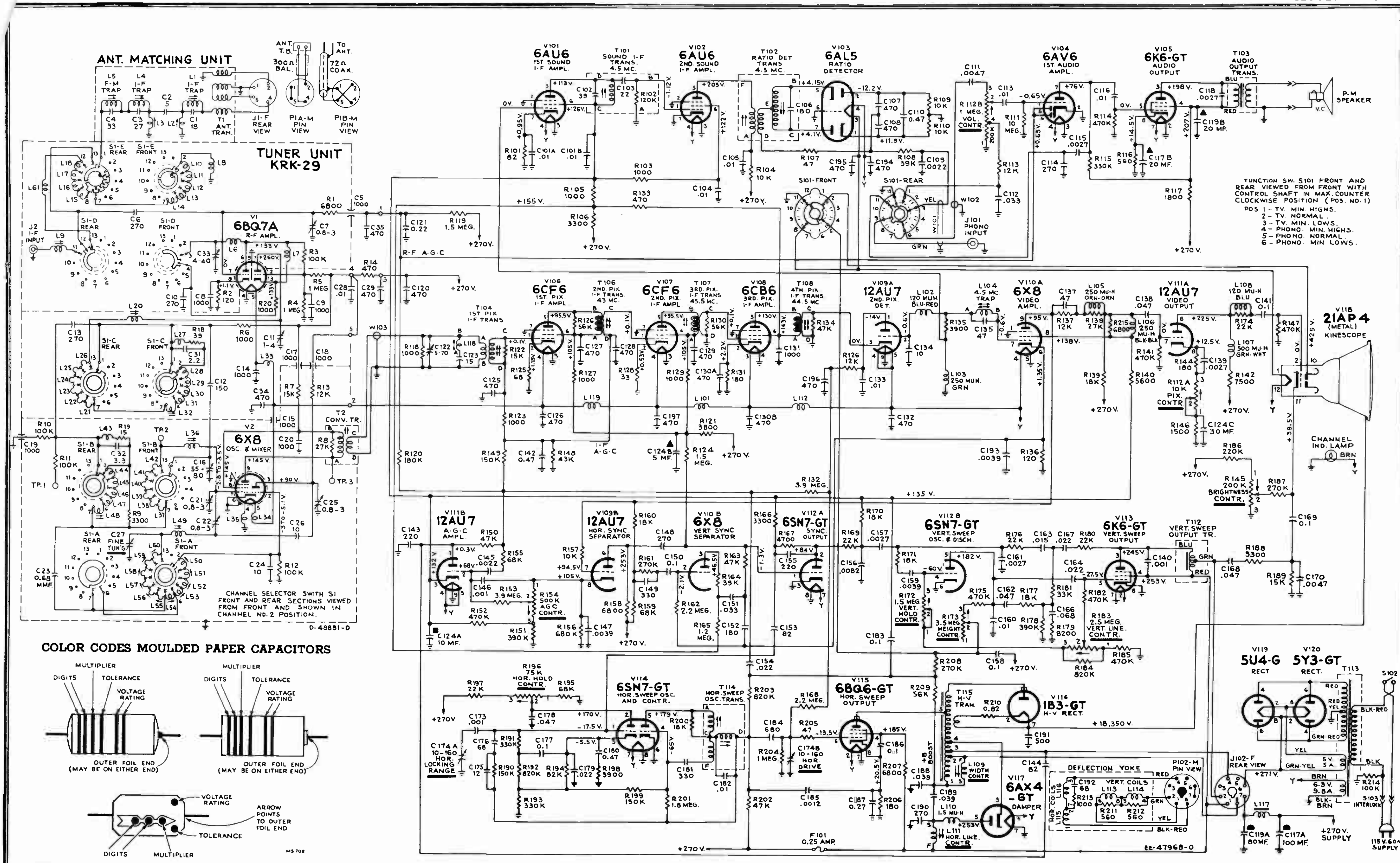


Figure 15—KRK12A Voltage Control Adapter

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1 KRK29	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 KRK29	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V1 KRK12A	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	
			No Signal	6	138	—	—	8	1.0	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	260	—	—	3	143	2	97	
			No Signal	1	250	—	—	3	137	2	97	
V2 KRK12A	6AF4	R-F Oscillator	15000 Mu. V. Signal	1 & 7	78	—	—	5	0	2 & 6	−8	
			No Signal	1 & 7	75	—	—	5	0	2 & 6	−6	
V3 KRK12A	6BQ7A	I-F Amplifier	15000 Mu. V. Signal	6	270	—	—	8	148	7	103	
			No Signal	6	260	—	—	8	142	7	99	
		I-F Amplifier	15000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	
			No Signal	1	143	—	—	3	1.2	2	0	
V4 KRK12A	6S4	Voltage Control	15000 Mu. V. Signal	9	270	—	—	2	94	6	*68	*Depends on adjustment of R6
			No Signal	9	260	—	—	2	90	6	*65	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	122	6	138	7	1.01	1	0	
			No Signal	5	113	6	126	7	.95	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	210	6	130	7	0	1	−2.05	
			No Signal	5	205	6	122	7	0	1	*−1.12	*Unreliable measuring point Voltage depends on noise
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	1.7	—	—	1	21	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	4.1	—	—	1	11.8	—	—	
		Ratio Detector	15000 Mu. V. Signal	2	1.7	—	—	5	21	—	—	
			No Signal	2	4.1	—	—	5	11.8	—	—	
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	78	—	—	2	0	1	−.7	At min. volume
			No Signal	7	76	—	—	2	0	1	−.65	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	205	4	220	8	15.2	5	0	At min. volume
			No Signal	3	198	4	207	8	14.5	5	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	218	6	240	2	132	1	−8.2	
			No Signal	5	95.5	6	105	2	1.18	1	*<0.1	*Unreliable measuring point. Make measurement at T104-B.
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	222	6	243	2	<0.1	1	−8.45	
			No Signal	5	95.5	6	105	2	0.53	1	<0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	138	6	150	2	2.3	1	0	
			No Signal	5	130	6	143	2	2.2	1	<0.1	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	−25.8	—	—	3	0	2	−1.85	
			No Signal	1	−14	—	—	3	0	2	−.6	
V109B	12AU7	Horiz. Sync Separator	15000 Mu. V. Signal	6	260	—	—	8	160	7	122	
			No Signal	6	253	—	—	8	105	7	94.5	
V110A	6X8	Video Amplifier	15000 Mu. V. Signal	9	120	8	147	6	.9	7	−1.85	AGC control set for normal operation
			No Signal	9	95	8	138	6	1.35	7	−.6	AGC control set for normal operation
V110B	6X8	Vert. Sync Separator	15000 Mu. V. Signal	3	79	—	—	6	.90	2	−26.8	
			No Signal	3	46.5	—	—	6	1.35	2	−2.1	
V111A	12AU7	Video Output	15000 Mu. V. Signal	6	231	—	—	8	13	7	0	
			No Signal	6	225	—	—	8	12.5	7	0	
V111B	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	−55	—	—	3	135	2	125	
			No Signal	1	0.3	—	—	3	132	2	68	
V112A	6SN7GT	Sync Output	15000 Mu. V. Signal	1	83	—	—	3	0	2	−3.28	
			No Signal	1	84	—	—	3	0	2	−1.3	
V112B	6SN7GT	Vertical Oscillator & Discharge	15000 Mu. V. Signal	1	80	—	—	8	0	7	−63.5	Depends on setting of Vert. hold control
			No Signal	6	182	—	—	8	0	7	−60	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	253	4	262	8	0	5	−28.8	
			No Signal	3	245	4	253	8	0	5	−27.5	
V114	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	175	—	—	3	−3.5	1	−21	
			No Signal	2	170	—	—	3	−5.5	1	−17.5	
	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	183	—	—	6	0	4	−67	
			No Signal	5	179	—	—	6	0	4	−65	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	193	8	22	5	−14	*High Voltage Pulse Present
			No Signal	Cap	*	4	185	8	20.5	5	−13.5	*High Voltage Pulse Present
V116	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	18,700	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	18,350	—	—	*High Voltage Pulse Present
V117	6AX4GT	Damper	15000 Mu. V. Signal	5	261	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	253	—	—	3	*	—	—	*High Voltage Pulse Present
V118	21AP4 or 21EP4	Kinescope	15000 Mu. V. Signal	Cap	18,700	10	428	11	44.5	2	0	At average Brightness
			No Signal	Cap	18,350	10	425	11	39.5	2	0	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	277	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	271	—	—	



RMA COLOR CODE, FIXED MICA CAPACITORS

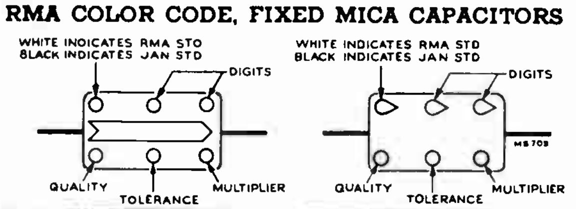


Figure 27—Circuit Schematic Diagram, KCS83

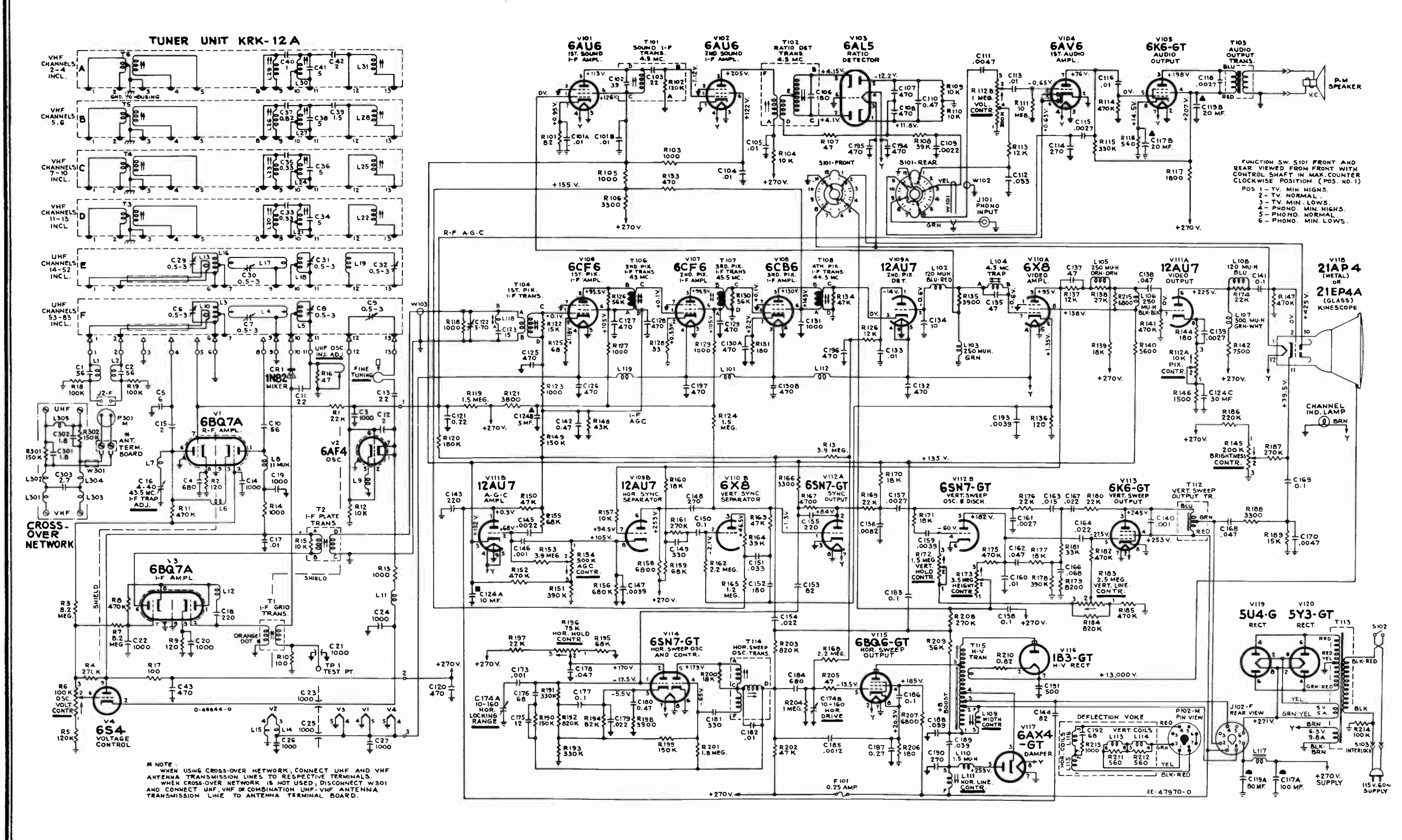
The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in FM and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

CIRCUIT SCHEMATIC DIAGRAM, KCS83B (KCS83E with 21EP4A Kinescope)



The schematic is shown in the latest condition at the time of printing. All resistance values in ohms. K = 1000.

All capacitance values less than 1 in FM and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 28—Circuit Schematic Diagram, KCS83B, KCS83E

ALIGNMENT DATA

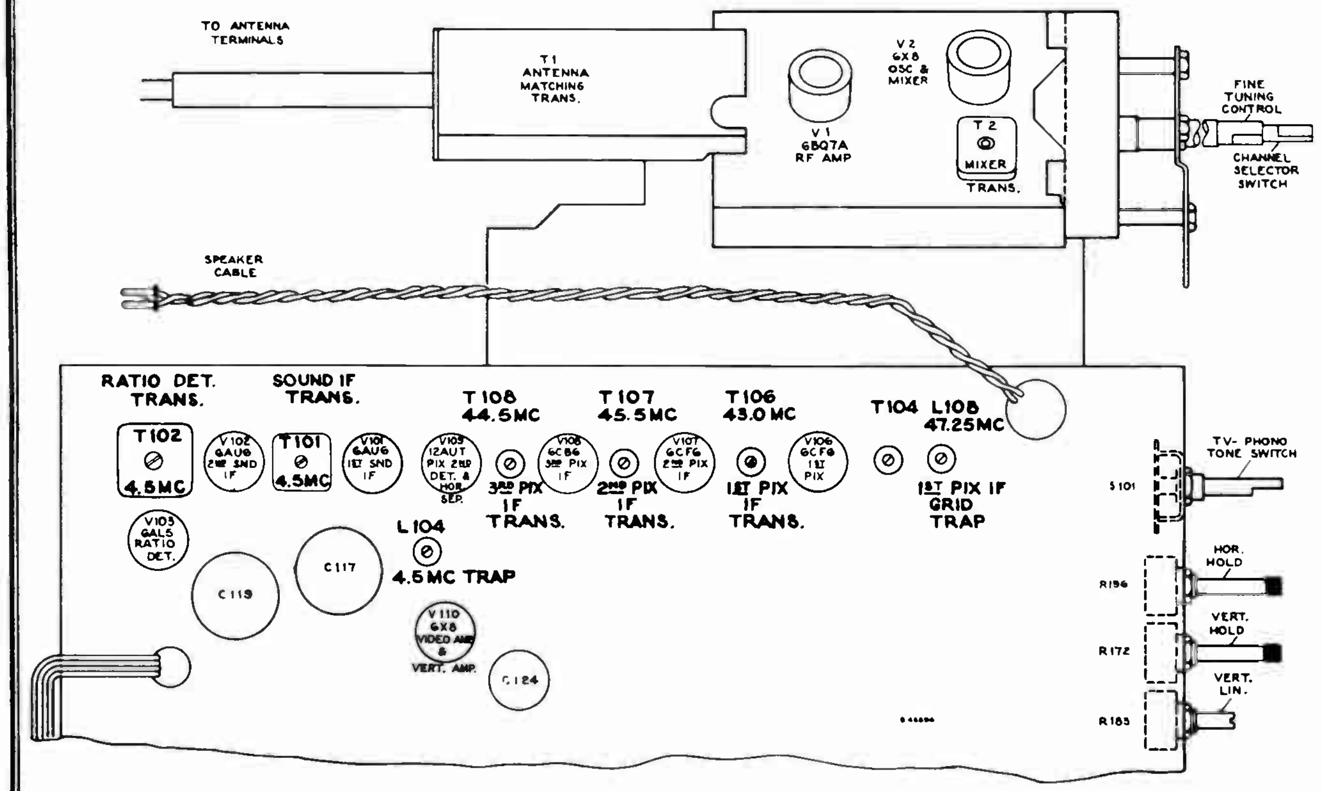


Figure 25—Top Chassis Adjustments (KRK29 Tuner shown)

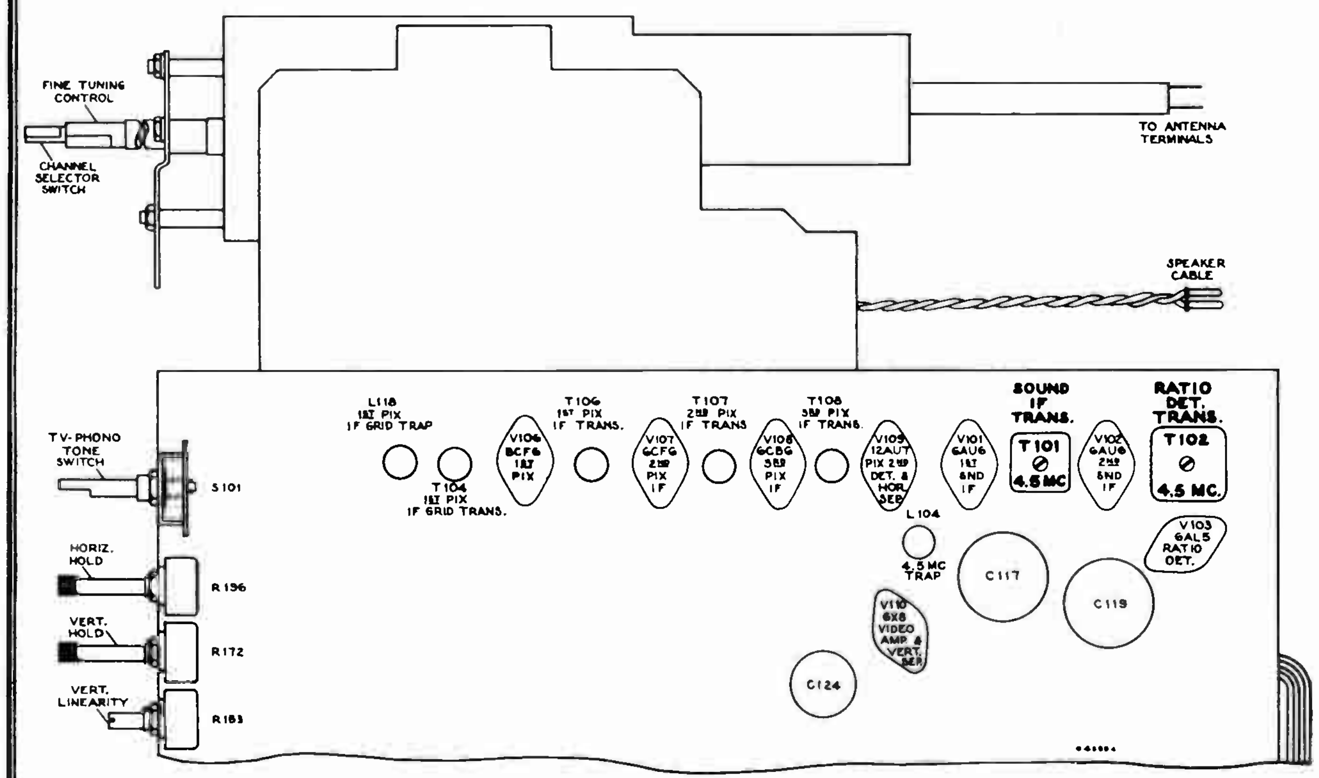


Figure 26—Bottom Chassis Adjustments (KRK29 Tuner shown)

REPLACEMENT PARTS (Continued)

STOCK No.	DESCRIPTION
39153	Connector—4 contact male connector for antenna cable for instruments using KRK29 tuner
75474	Connector—Single contact male connector for antenn cable
71457'	Cord—Power cord and plug
77761	Cover—Cover assembly—brown—complete with spring for channel markers for maple instruments using KRK12A tuner
77759	Cover—Cover assembly—maroon—complete with spring for channel markers for mahogany, red cherry or walnut instruments using KRK12A tuner
77760	Cover—Cover assembly—sand gray—complete with spring for channel markers for blonde or oak instruments using KRK12A tuner
78319	Cover—Cover and case assembly—brown—for hidden controls for mahogany, red cherry or walnut console instruments
78327	Cover—Cover and case assembly—dark red—for hidden controls for mahogany table instruments
78321	Cover—Cover and case assembly—dark tan—for hidden controls for maple instruments
78320	Cover—Cover and case assembly—medium beige—for hidden controls for blonde or oak instruments
77770	Cushion—Adhesive cushion for safety glass retainers for wood console instruments
78313	Cushion—Rubber cushion for dust sealing the kinescope in wood console instruments
77749	Cushion—Rubber cushion for safety glass for wood console instruments
76698	Cushion—Rubber cushion for kinescope masking panel support bracket for wood console instruments
78386	Decal—Volume control, brightness control, fine tuning control and channel selector switch decal for mahogany, natural walnut, red cherry or walnut instruments
78389	Decal—Volume control, brightness control, fine tuning control and channel selector switch decal for oak or maple instruments
77758	Disc—Polystyrene indicator disc—brown—for channel selections for maple instruments using KRK12A tuner
77757	Disc—Polystyrene indicator disc—sand gray—for channel selections for blonde or oak instruments using KRK12A tuner
77756	Disc—Polystyrene indicator disc—maroon—for channel selections for mahogany, red cherry or walnut instruments using KRK12A tuner unit
78315	Escutcheon—Channel marker escutcheon for instruments using KRK29 tuner
74889	Foot—Felt foot for Model 21T356U
77684	Gasket—Glass kinescope mounting strap gasket
78314	Glass—Safety glass for wood console instruments
78329	Glass—Safety glass for metal table instruments
37396	Grommet—Rubber grommet for mounting speaker stamped 92569-12
74308	Hinge—Cabinet door hinge (1 set) for Models 21T372, 21T372U, 21T373, 21T373U, 21T374, 21T374U, 21T375, 21T375U
77699	Knob—Brightness control knob—brown—for mahogany, red cherry or walnut instruments (outer)
77719	Knob—Brightness control knob—medium beige—for blonde or oak instruments (outer)
77738	Knob—Brightness control knob—tan—for maple instruments (outer)
77968	Knob—Channel selector knob—brown—for mahogany, red cherry or walnut instruments using KRK12A tuner
77969	Knob — Channel selector knob — medium beige — for blonde or oak instruments using KRK12A tuner
77970	Knob—Channel selector knob—tan—for maple instruments using KRK12A tuner
77708	Knob—Channel selector knob for instruments using KRK29 tuner (inner)
77750	Knob—Fine tuning control knob for instruments using KRK12A tuner
77707	Knob—Fine tuning control knob—brown—for mahogany, red cherry or walnut instruments using KRK29 tuner (outer)
77717	Knob—Fine tuning control knob—medium beige—for blonde or oak instruments using KRK29 tuner (outer)
77733	Knob—Fine tuning control knob—tan—for maple instruments using KRK29 tuner (outer)
77735	Knob—Function switch knob—brown—for mahogany, red cherry or walnut instruments
77736	Knob—Function switch knob—medium beige—for blonde or oak instruments
77737	Knob—Function switch knob—tan—for maple instruments
77709	Knob—Picture control knob—brown—for mahogany, red cherry or walnut instruments
77718	Knob—Picture control knob—medium beige—for blonde or oak instruments
77734	Knob—Picture control knob—tan—for maple instruments
77710	Knob—Volume control and power switch knob (inner)
11765	Lamp—Channel escutcheon lamp—Mazda 51
77766	Marker—UHF channel number markers for blonde or oak instruments using KRK12A tuner
77765	Marker—UHF channel number markers for mahogany, red cherry or walnut instruments using KRK12A tuner
77767	Marker—UHF channel number markers for maple instruments using KRK12A tuner
77763	Marker—VHF channel number markers for blonde or oak instruments using KRK12A tuner
77762	Marker—VHF channel number markers for mahogany, red cherry or walnut instruments using KRK12A tuner
77764	Marker—VHF channel number markers for maple instruments using KRK12A tuner
78316	Mask—Channel marker escutcheon light mask—brown—for mahogany, red cherry or walnut instruments using KRK29 tuner
78317	Mask—Channel marker escutcheon light mask—medium beige—for blonde or oak instruments using KRK29 tuner
78318	Mask—Channel marker escutcheon light mask—tan—for maple instruments using KRK29 tuner
78311	Mask—Polystyrene masking panel—gray and wine red—for mahogany, red cherry or walnut wood console instruments
78312	Mask—Polystyrene masking panel—pinkish white and light taupe—for oak or maple wood console instruments
78326	Nut—1/4-20 knurled nut for deflection yoke hood support
77683	Nut—Speed nut for glass kinescope mounting strap screw
73634	Nut—Speed nut for speaker mounting screw
76601	Pad—Kinescope edge support pad (rubber) for wood console instruments
78392	Plate—Back plate for upper door pull for Models 21T375, 21T375U
78390	Pull—Door pull for Models 21T372, 21T372U
77795	Pull—Door pull (lower) for Models 21T373, 21T373U (4 req'd)
77794	Pull—Door pull (upper) for Models 21T373, 21T373U (2 req'd)
78391	Pull—Door pull for Models 21T374, 21T374U
78394	Pull—Door pull (lower) for Models 21T375, 21T375U
78393	Pull—Door pull (upper), for Models 21T375, 21T375U (2 req'd)
502415	Resistor—Fixed, composition:— 150,000 ohms, ±10%, 1/2 watt (R1, R2)
77928	Retainer—Retainer for channel selector knob for instruments using KRK12A tuner
78328	Retainer—Safety glass retainer for metal table instruments
78249	Retainer—Side retainer for safety glass for wood console instruments
77952	Retainer—Top or bottom retainer for safety glass for wood console instruments
78322	Rod—Hook shape threaded rod for deflection yoke hood assembly
78388	Screw—#2 x 1/2" round head cross recessed screw for decorative clip for mahogany instruments for Models 21T364, 21T364U
77712	Screw—#6 x 1/2" cross recessed pan head self-tapping screw (black) for mounting hidden controls case and cover to cabinet for mahogany, red cherry or walnut instruments
77725	Screw—#6 x 1/2" cross recessed pan head self-tapping screw (zinc) for mounting hidden controls case and cover to cabinet for blonde, maple or oak instruments
76632	Screw—#8 x 5/8" hex head screw for masking panel support bracket for wood console instruments
74113	Screw—#8-32 x 1" trimit head screw for door pull 78390 for Models 21T372, 21T372U; for door pull 78391 for Models 21T374, 21T374U; for door pull 78393 for Models 21T375, 21T375U
75626	Screw—#8-32 x 1 1/4" trimit head screw for door pull 77794 for Models 21T373, 21T373U
75676	Screw—#8-32 x 3/16" trimit head screw for door pull 77795 for Models 21T373, 21T373U
75623	Screw—#8-32 x 5/8" trimit head screw for door pull for Models 21T375, 21T375U
77682	Screw—#12 x 1 1/2" hex head screw for glass kinescope mounting strap
78447	Shade—Lamp shade for instruments using KRK12A tuner
78324	Spring—Formed spring for glass retainer or back cover
76630	Spring—Formed spring for kinescope masking panel for wood console instruments
76837	Spring—Retaining spring for knobs 77699, 77708, 77709, 77718, 77719, 77734, 77735, 77736, 77737, 77738
72845	Spring—Retaining spring for knobs 77707, 77717, 77733
30330	Spring—Retaining spring for knob 77710
74734	Spring—Retaining spring for channel markers covers 77759, 77760, 77761
78325	Spring—Spring clip for channel marker escutcheon for instruments using KRK29 tuner
74936	Spring—Suspension spring for kinescope socket leads
72936	Stop—Cabinet door stop for Models 21T372, 21T372U, 21T373, 21T373U, 21T374, 21T374U, 21T375, 21T375U
77675	Strap—Top or bottom mounting strap for mounting glass kinescope
75500	Washer—Felt washer for kinescope masking panel mounting screw for wood console instruments

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
	TUNER UNIT ASSEMBLIES KRK29
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78235	Board—Terminal board, 5 contact and ground
78233	Bracket—Side bracket for mounting coil and stators
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:—
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:—
77151	0.8—3.0 mmf. (C11, C21, C25)
77913	0.8—3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:—
77084	Feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. =0
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:—
75437	100 mmf., ± 20%, 500 volts (C36)
77293	470 mmf., +100%, −0%, 500 volts (C29, C34, C35)
77252	1000 mmf., +100%, −0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., +100%, −0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K"
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. =0
93056	5 mmf., ±0.5% 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = −750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, headed-lead:—
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31)
71503	3.3 mmf., ±20%, 500 volts (C32)
	Capacitor—Mica trimmer:—
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r.f. plate coil (L20)
78224	Coil—Choke coil (.47 muh) (L27)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
76562	Coil—R.F. amplifier coupling coil (L7)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
	Capacitor—Fixed, ceramic:—
77667	Comprising 1 section of 2 mmf., and 1 section of 22 mmf. (C12, C13)
77621	Crystal holder, 22 mmf., temp. coef. = −750 (C11)
77084	Feed-thru, 1000 mmf. (C21, C23, C25)
77615	Stand-off, 1000 mmf. (C3, C19, C24, C26)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77210	2 mmf., ±0.25 mmf., 500 volts (C15)
77688	5 mmf., ±0.5 mmf., 500 volts (C34, C36, C38, C41)
74182	6 mmf., ±0.5 mmf., 500 volts (C5)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = −750
71924	56 mmf., ±10%, 500 volts (C100)
	Capacitor—Fixed, ceramic, High "K" disc:—
77625	220 mmf., +100%, −0%, 500 volts (C18)
77293	470 mmf., +100%, −0%, 500 volts (C43)
77624	680 mmf., +100%, −0%, 500 volts (C4)
77252	1000 mmf., +100%, −0%, 500 volts (C14, C20, C22, C27)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Converter transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—IF trap
76542	Trap—IF trap (41.25 mc) complete with core (L1)
76541	Trap—IF trap (45.75 mc) complete with core (L4)
75190	Washer—Insulating washer (neoprene) for capacitor
	TUNER UNIT ASSEMBLIES KRK12A
	Resistor—Fixed, composition:—
503015	15 ohms, ±10%, ½ watt (R19)
503039	39 ohms, ±10%, ½ watt (R18)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)

STOCK No.	DESCRIPTION
73960	10,000 mmf., +100%, −0%, 500 volts (C17)
	Capacitor—Fixed, headed-lead:—
77691	.33 mmf., ±10%, 500 volts (C33, C35)
77689	.82 mmf., ±10%, 500 volts (C37)
77690	1 mmf., ±10%, 500 volts (C40)
71500	1.5 mmf., ±10%, 500 volts (C39)
78047	2 mmf., ±10%, 500 volts (C42)
77634	Coil—I.F. neutralizing coil (L12)
77628	Coil—I.F. trap (L7)
77629	Coil—Oscillator cathode coil (L9)
77631	Coil—Oscillator heater coil (L14)
77632	Coil—Oscillator heater coil (L15)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
77489	Rectifier—#1N82 rectifier (CR1)
	Resistor—Fixed, composition:—
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
	CHASSIS ASSEMBLIES KCS 83—VHF CHASSIS KCS 83B—UHF CHASSIS (CONSOLES) KCS 83E—UHF CHASSIS (TABLES)
	Capacitor—Adjustable, mica:—
78220	5-70 mmf. (C122)
	Capacitor—Fixed, ceramic:—
78225	82 mmf., ±10%, 3500 volts (C144)
76488	500 mmf., 25,000 volts for KCS83, KCS83B (C191)
	Capacitor—Fixed, ceramic, High "K" disc:—
77293	470 mmf., +100%, −0%, 500 volts (C120, C125, C126, C127, C128, C129, C132, C194, C195, C196, C197)
77672	Dual 470 mmf., +100%, −0%, 500 volts (C130A, C130B)
77252	1000 mmf., +100%, −0%, 500 volts (C131)
73960	10,000 mmf., +100%, −0%, 500 volts (C104, C105, C133)
76991	Dual 10,000 mmf., +100%, −0%, 500 volts (C101A, C101B)
	Capacitor—Fixed, ceramic, non-insulated, Temp. Coef. −750
33098	10 mmf., ±1 mmf., 500 volts (C134)
33380	12 mmf., ±10%, 500 volts (C175)
39044	15 mmf., ±5%, 500 volts (C123)
39042	47 mmf., ±5%, 500 volts (C137)
71922	180 mmf., ±10%, 500 volts (C152)
47617	270 mmf., ±10%, 500 volts (C114)
	Capacitor—Fixed, mica:—
76475	68 mmf., ±5%, 1000 volts (C176)
76474	82 mmf., ±5%, 1000 volts (C153)
39636	220 mmf., ±10%, 500 volts (C155)
75248	220 mmf., ±10%, 1000 volts (C143)
78579	270 mmf., ±10%, 1000 volts (C148, C190)
39640	330 mmf., ±10%, 500 volts (C149)
76476	330 mmf., ±5%, 1000 volts (C181)
39644	470 mmf., ±5%, 500 volts (C107, C108)
	Capacitor—Mica trimmer:—
75217	Dual 10-160 mmf. (C174A, C174B)
	Capacitor—Electrolytic:—
78213	Comprising: 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 30 mfd., 50 volts (C124A, C124B, C124C)
77644	Comprising: 1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C119A, C119B)
78212	Comprising: 1 section of 100 mfd., 400 volts and 1 section of 20 mfd., 50 volts (C117A, C117B)
	Capacitor—Fixed, paper, oil impregnated:—
75643	.001 mfd., 1000 volts (C140, C146, C173)
73595	.0022 mfd., 600 volts (C109, C145)
73599	.0027 mfd., 600 volts (C115, C139, C157, C161)
73818	.0027 mfd., 1600 volts (C118)
73796	.0039 mfd., 600 volts (C147, C193)
73920	.0047 mfd., 600 volts (C111, C170)
73808	.0082 mfd., 1000 volts (C156)
73561	.01 mfd., 400 volts (C113, C116)
73565	.01 mfd., 1000 volts (C160)
73797	.015 mfd., 600 volts (C163)
73562	.022 mfd., 400 volts (C179)
73798	.022 mfd., 600 volts (C164, C167)
73810	.022 mfd., 1000 volts (C154)
73552	.033 mfd., 400 volts (C112, C151)
73813	.039 mfd., 1000 volts (C188, C189)
73553	.047 mfd., 400 volts (C178)

STOCK No.	DESCRIPTION
73592	.047 mfd., 600 volts (C138, C162, C168)
73792	.068 mfd., 400 volts (C166)
73551	.1 mfd., 400 volts (C150, C158, C169, C177)
73557	.1 mfd., 600 volts (C141, C183, C186)
73794	.22 mfd., 400 volts (C121)
73786	.27 mfd., 200 volts (C187)
73787	.47 mfd., 200 volts (C110, C142, C180)
	Capacitor—Fixed, moulded paper, mineral oil impregnated:—
76479	.00068 mfd., 600 volts (C184)
76995	.0012 mfd., 600 volts (C185)
78221	.0039 mfd., 600 volts (C159)
73594	.01 mfd., 600 volts (C182)
77676	Choke—Filter choke (L117)
73477	Coil—Filament choke coil (L101, L112, L119)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
75253	Coil—Peaking coil (120 muh) (L102)
71529	Coil—Peaking coil (120 muh) (L108, R174)
71526	Coil—Peaking coil (250 muh) (L103)
77674	Coil—Peaking coil (250 muh) (L105, R138)
78222	Coil—Peaking coil (250 muh) (L106, R215)
75252	Coil—Peaking coil (500 muh) (L107)
76640	Coil—RF choke coil (1.5 muh) (L110)
78205	Coil—Width coil complete with adjustable core (L109)
76975	Control—AGC control (R154)
78209	Control—Brightness control (R145)
78206	Control—Height control (R173)
77639	Control—Horizontal hold control (R196)
78208	Control—Picture control, volume control and power switch (R112A, R112B, S102)
78210	Control—Vertical hold control (R172)
78207	Control—Vertical linearity control (R183)
78199	Cover—Hi-voltage compartment cover
78214	Fuse—.3 amps., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd. anode lead connector
78218	Holder—Fuse holder
78215	Insulator—Polystyrene insulator for hi-voltage socket
78226	Lead—Anode lead complete with eyelet for KCS83, KCS83B
	Resistor—Fixed, wire wound:—
76382	0.82 ohms, 1/3 watts (R210)
76639	180 ohms, 2 watts (R206)
77670	3300 ohms, 7 watts (R106)
77671	3800 ohms, 7 watts (R121)
	Resistor—Fixed, composition:—
502033	33 ohms, ±5%, ½ watt (R127)
503047	47 ohms, ±10%, ½ watt (R107, R205)
502068	68 ohms, ±5%, ½ watt (R128)
503082	82 ohms, ±10%, ½ watt (R101)
503112	120 ohms, ±10%, ½ watt (R136)
502118	180 ohms, ±5%, ½ watt (R131)
503118	180 ohms, ±10%, ½ watt (R144)
503147	470 ohms, ±10%, ½ watt (R133)
513156	580 ohms, ±10%, 1 watt (R116)
503210	1000 ohms, ±10%, ½ watt (R103, R118, R123, R127, R129)
513210	1000 ohms, ±10%, 1 watt (R105)
503215	1500 ohms, ±10%, ½ watt (R146)
523218	1800 ohms, ±10%, 2 watts (R117)
30733	3300 ohms, ±5%, ½ watt (R166)
503233	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R135)
503239	3900 ohms, ±10%, ½ watt (R198)
503247	4700 ohms, ±10%, ½ watt (R167)
503256	5600 ohms, ±10%, ½ watt (R140)
503268	6800 ohms, ±10%, ½ watt (R158)
523268	6800 ohms, ±10%, 2 watts (R207)
512275	7500 ohms, ±5%, 1 watt (R142)
503282	8200 ohms, ±10%, ½ watt (R179)
502310	10,000 ohms, ±5%, ½ watt (R109, R110)
503310	10,000 ohms, ±10%, ½ watt (R157)
523310	10,000 ohms, ±10%, 2 watts (R104)
503312	12,000 ohms, ±10%, ½ watt (R113, R137, R216)
503315	15,000 ohms, ±10%, ½ watt (R122, R189)
502318	18,000 ohms, ±5%, ½ watt (R177)
503318	18,000 ohms, ±10%, ½ watt (R160, R170, R171, R200)
523318	18,000 ohms, ±10%, 2 watts (R139)
502322	22,000 ohms, ±5%, ½ watt (R180)
503322	22,000 ohms, ±10%, ½ watt (R169, R176, R197)
502333	33,000 ohms, ±5%, ½ watt (R181)
503339	39,000 ohms, ±10%, ½ watt (R106, R164)
502343	43,000 ohms, ±5%, ½ watt (R148)
503347	47,000 ohms, ±10%, ½ watt (R134, R163)
512347	47,000 ohms, ±5%, 1 watt (R202)
513347	47,000 ohms, ±10%, 1 watt (R150)
502356	56,000 ohms, ±5%, ½ watt (R126, R130)
503356	56,000 ohms, ±10%, ½ watt (R209)
503368	68,000 ohms, ±10%, ½ watt (R155, R159, R195)
503382	82,000 ohms, ±10%, ½ watt (R194)
503410	100,000 ohms, ±10%, ½ watt (R214)
502415	150,000 ohms, ±5%, ½ watt (R149)
503415	150,000 ohms, ±10%, ½ watt (R190)
512415	150,000 ohms, ±5%, 1 watt (R199)
502418	180,000 ohms, ±5%, ½ watt (R120)
503422	220,000 ohms, ±10%, ½ watt (R186)
503427	270,000 ohms, ±10%, ½ watt (R161, R187, R208)

STOCK No.	DESCRIPTION
503433	330,000 ohms, ±10%, ½ watt (R115, R191, R193)
503439	390,000 ohms, ±10%, ½ watt (R151, R178)
502447	470,000 ohms, ±5%, ½ watt (R185)
503447	470,000 ohms, ±10%, ½ watt (R114, R141, R147, R152, R175, R182)
503468	680,000 ohms, ±10%, ½ watt (R156)
502482	820,000 ohms, ±5%, ½ watt (R184)
503482	820,000 ohms, ±10%, ½ watt (R192, R203)
503510	1 megohm, ±10%, ½ watt (R204)
503512	1.2 megohm, ±10%, ½ watt (R165)
502515	1.5 megohm, ±5%, ½ watt (R119, R124)
512518	1.8 megohm, ±5%, 1 watt (R201)
503522	2.2 megohm, ±10%, ½ watt (R162, R168)
503539	3.9 megohm, ±10%, ½ watt (R132, R153)
503610	10 megohm, ±10%, ½ watt (R111)
78203	Transformer—1st. I.F. pix transformer complete with adjustable core (T104)
76433	Transformer—2nd., 3rd. or 4th. I.F. transformer (T106, T107, T108)
78201	Transformer—Hi-voltage transformer (T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable core (T114)
76997	Transformer—Output transformer (T103)
78200	Transformer—Power transformer 117 volts, 60 cycle (T113)
77112	Transformer—Ratio detector transformer complete with adjustable core (T102, C106)
76981	Transformer—Sound I.F. transformer complete with adjustable core (T101, C102, C103, R102)
78202	Transformer—Vertical output transformer (T112)
78204	Trap—1st. I.F. grid trap complete with adjustable core (L118)
76983	Trap—4.5 MC trap (L104, C135)
78219	Washer—Vellutex washer for tube socket and shield
	YOKE AND MAGNET ASSEMBLIES
76863	Connector—Anode connector complete with contact and terminal for metal kinescope
75542	Connector—6 contact male connector for deflection yoke (P102)
78309	Cushion—Round rubber cushion for deflection yoke
74956	Cushion—Rubber cushion for deflection yoke hood
78308	Hood—Deflection yoke hood less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
76633	Magnet—Pin cushion correction magnet complete with support arm for glass kinescope
78307	Plate—Metal plate for deflection yoke
78445	Spring—Grounding spring (coil) for deflection yoke
76310	Strap—Ground strap (formed) for deflection yoke for glass kinescope
76600	Strap—Ground strap (soft copper strip) for metal kinescope
76636	Stud—Adjusting stud complete with guard for focus magnet
76616	Yoke—Deflection yoke complete with 6 contact male connector (L113, L114, L115, L116, P102, C192, R211, R212, R213)
	SPEAKER ASSEMBLIES 971636-1 W RL101C5 RMA-274 (For Model 21T356U)
77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971490-3 W, 971490-R RL105E6 RMA-274, RMA-285 (For Models 21T383, 21T363U)
75024	Cone—Cone and voice coil for speakers stamped 971490-3W
77129	Cone—Cone and voice coil for speaker stamped 971490-3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 971692-1 (For Models 21T364, 21T364U, 21T365, 21T365U, 21T372, 21T372U, 21T374, 21T374U)
77777	Speaker—10" P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES 92569-12W RL-111A1 RMA-274 (For Models 21T373, 21T373U, 21T375, 21T375U)
75682	Cone—Cone and voice coil (3.2 ohms)
76093	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE:—If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.

Model 17-T-352U "Hayes" Metal-Mahogany Grain

Models 17-T-361, 17-T-361U "Highland" Mahogany, Oak

GENERAL DESCRIPTION

Models 17-T-352U, 17-T-361 and 17-T-361U are "17 inch" television receivers. Models 17-T-352U and 17-T-361U are identical except for cabinets, and speakers. Model 17-T-361 has full 12 channel VHF coverage. Models 17-T-352U and 17-T-361U feature full 12 channel VHF coverage plus any 4 UHF channels desired.

All models include intercarrier FM system; ratio detector; improved picture brilliance; pulsed picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; improved sync separator (3.5 mc. band width for picture channel); and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE....146 square inches on a 17CP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Model 17-T-361

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 17-T-352U & 17-T-361U

Any of 70 UHF channels..................470 mc. to 890 mc.

Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency....................45.75 mc.

Sound I-F Carrier Frequency.....................41.25 mc.

POWER RATING........................17-T-361-215 watts
17-T-352U & 17-T-361U-230 watts

AUDIO POWER OUTPUT RATING............4 watts max.

VIDEO RESPONSE.............................To 3.5 mc.

SWEEP DEFLECTION...........................Magnetic

FOCUS.......................................Magnetic

ANTENNA INPUT IMPEDANCE

Model 17-T-361

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 17-T-352U & 17-T-361U

UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29 (17-T-361)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Tuner KRK12B (17-T-352U & 17-T-361U)	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control

A 1N82 crystal is used as a mixer.

All Models	
(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Detector and Vert. Sync. Sep.
(5) RCA 6CL6	Video Amplifier
(6) RCA 6AU6	1st Sound I-F Amplifier
(7) RCA 6AU6	2nd Sound I-F Amplifier
(8) RCA 6AL5	Ratio Detector
(9) RCA 6AV6	1st Audio Amplifier
(10) RCA 6K6GT	Audio Output
(11) RCA 12AU7	Horiz. Sync. Sep. & AGC
(12) RCA 6SN7GT	Vertical Osc. & Sync. Output
(13) RCA 6K6GT	Vertical Sweep Output
(14) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(15) RCA 6BQ6GT	Horizontal Sweep Output
(16) RCA 6W4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
(18) RCA 17CP4	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

ELECTRICAL AND MECHANICAL SPECIFICATIONS (cont'd)

CHASSIS DESIGNATIONS

KCS78F Model 17-T-361 employing a KRK29 Tuner.

KCS78J Models 17-T-352U and 17-T-361U employing a KRK12B Tuner.

WEIGHT & DIMENSIONS

Model	Shipping Weight	Width Inches	Height Inches	Depth Inches
17-T-352U.... 88 lbs.	105 lbs.	21½	22¾	22
17-T-361..... 87 lbs.	112 lbs.	24¼	35¾	22
17-T-361U... 92 lbs.	117 lbs.	24¼	35¾	22

LOUDSPEAKERS

Model 17-T-352U..... (971636-1) 5" PM Dynamic, 3.2 ohms
Model 17-T-361...... (971490-3) 8" PM Dynamic, 3.2 ohms
Model 17-T-361U..... (971490-3) 8" PM Dynamic, 3.2 ohms

SCANNING............................Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY............15,750 cps

VERTICAL SWEEP FREQUENCY..................60 cps

FRAME FREQUENCY (Picture Repetition Rate).....30 cps

OPERATING CONTROLS (Front)

Channel Selector / Fine Tuning ....Dual Control Knobs
Picture........................Single Control under Panel
Picture Horizontal Hold ....Single Control under Panel
Picture Vertical Hold ....Single Control under Panel
Sound Volume and On-Off Switch / Brightness .....Dual Control Knobs

NON-OPERATING CONTROLS (under Front Panel)

Height ....screwdriver adjustment
Vertical Linearity ....screwdriver adjustment

NON-OPERATING CONTROLS (not including R-F and I-F adjustments)

Picture Centering ....top chassis adjustment
Width ....rear chassis adjustment
Horizontal Drive ....rear chassis screwdriver adjustment
Horizontal Linearity ....rear chassis adjustment
Horizontal Oscillator Frequency ....rear chassis adjustment
Horizontal Oscillator Waveform...bottom chassis adjustment
Horizontal Locking Range..........rear chassis adjustment
Focus ....top chassis adjustment
Ion Trap Magnet ....top chassis adjustment
Deflection Coil ....top chassis wing nut adjustment
AGC Control ....rear chassis adjustment

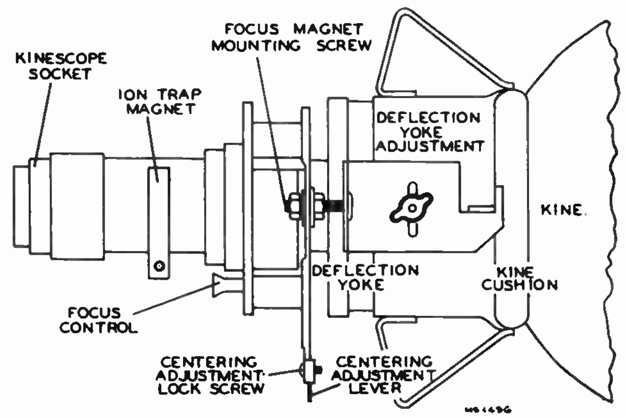


Figure 2—Yoke and Focus Magnet Adjustments

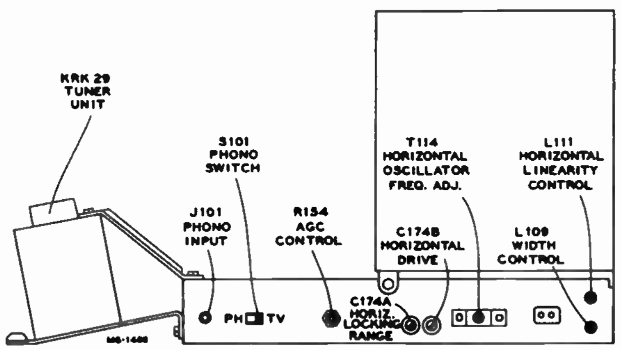


Figure 3—Rear Chassis Adjustments

Models 27-D-382, 27-D-382U "Swarthmore" Mahogany, Oak

Models 27-D-383, 27-D-383U "Copeland" Mahogany, Walnut

Models 27-D-384, 27-D-384U "Longchamps" Mahogany, Maple

GENERAL DESCRIPTION

Models 27-D-382, 27-D-382U, 27-D-383, 27-D-383U, 27-D-384 and 27-D-384U are Deluxe "27 Inch" television receivers. Models 27-D-382, 27-D-383 and 27-D-384 feature full 12 channel VHF coverage.

Models 27-D-382U, 27-D-383U and 27-D-384U feature full 12 channel VHF coverage plus any 4 UHF channels desired. These receivers have an auxiliary audio input jack to permit the use of an external record playing attachment. All models incorporate two 8" PM speakers.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE ... 420 square inches on a 27MP4 Kinescope

TELEVISION R-F FREQUENCY RANGE
Models 27-D-382, 27-D-383 and 27-D-384
All 12 VHF channels ... 54 mc. to 88 mc., 174 mc. to 216 mc.
Models 27-D-382U, 27-D-383U and 27-D-384U
Any of 70 UHF channels ... 470 mc. to 890 mc.
Any of 12 VHF channels 54 mc. to 88 mc., 174 mc. to 216 mc.
(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES
Picture I-F Carrier Frequency ... 45.75 mc.
Sound I-F Carrier Frequency ... 41.25 mc.

POWER RATING ... 325 watts

AUDIO POWER OUTPUT RATING ... 4 watts max.

VIDEO RESPONSE ... to 4 mc.

SWEEP DEFLECTION ... Magnetic

FOCUS ... Magnetic

ANTENNA INPUT IMPEDANCE
Models 27-D-382, 27-D-383 and 27-D-384
Choice: 300 ohms balanced or 72 ohms unbalanced.
Models 27-D-382U, 27-D-383U and 27-D-384U
UHF—300 ohms balanced.
VHF—300 ohms balanced.

CHASSIS DESIGNATIONS
KCS77C ... Models 27-D-383 and 27-D-384
KCS77D ... Models 27-D-383U and 27-D-384U
KCS77F ... Model 27-D-382
KCS77H ... Model 27-D-382U

LOUDSPEAKERS ... (971490-4W) 8 Inch PM Dynamic

VOICE COIL IMPEDANCE ... 3.2 ohms

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29B (Models 27-D-382, 27-D-383 and 27-D-384)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Tuner KRK12B (Models 27-D-382U, 27-D-383U and 27-D-384U)	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control
A 1N82 crystal is used as a mixer.	
All Models	
(1) RCA 6AU6	1st Picture I-F Amplifier
(2) RCA 6CB6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 6CB6	4th Picture I-F Amplifier
(5) RCA 6CL6	Video Amplifier
(6) RCA 6CL6	Peaking Amplifier
(7) RCA 6AL5	Agitation Compressor
(8) RCA 6AU6	1st Sound I-F Amplifier
(9) RCA 6AU6	2nd Sound I-F Amplifier
(10) RCA 6AL5	Ratio Detector
(11) RCA 6AV6	1st Audio Amplifier
(12) RCA 6AQ5	Audio Output
(13) RCA 12AU7	Vert. Sync Separator and AGC
(14) RCA 12AU7	Horiz. Sync Separator and Sync Amplifier
(15) RCA 6SN7GT	Vert. Sync Amplifier and Vert. Sweep Osc. and Dischg.
(16) RCA 6AQ5	Vertical Sweep Output
(17) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(18) RCA 6BQ6GT (2 tubes)	Horizontal Sweep Output
(19) RCA 6W4GT (2 tubes)	Dampers
(20) RCA 1B3GT/8016	High Voltage Rectifier
(21) RCA 5U4G (2 tubes)	Rectifiers
(22) RCA 27MP4	Kinescope

SCANNING ... Interlaced, 525 line

HORIZONTAL SCANNING FREQUENCY ... 15,750 cps

VERTICAL SCANNING FREQUENCY ... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) ... 30 cps

OPERATING CONTROLS (front panel)

Control	Type
Channel Selector / Fine Tuning	Dual Control Knobs
Brightness / Sound Volume and On-Off Switch	Dual Control Knobs
Picture Horizontal Hold / Picture Vertical Hold	Dual Control (Knurled)
Picture Contrast	Single Control Knob
Tone Switch	Single Control Knob
Definition Switch	Single Control Knob

NON-OPERATING CONTROLS

Control	Location
Horizontal Centering	top chassis adjustment
Vertical Centering	top chassis adjustment
AGC	rear chassis adjustment
Height	front panel screwdriver adjustment
Vertical Linearity	front panel screwdriver adjustment
Horizontal Locking	rear chassis screwdriver adjustment
Horizontal Drive	rear chassis screwdriver adjustment
Horizontal Linearity	rear chassis adjustment
Horizontal Oscillator Frequency	rear chassis adjustment
Horizontal Oscillator Waveform	bottom chassis adjustment
Width	rear chassis adjustment
Width Link	H.V. compartment adjustment
Focus	top chassis adjustment
Ion Trap Magnet	top chassis adjustment
Focus Magnet	top chassis adjustment
Deflection Coil	top chassis adjustment

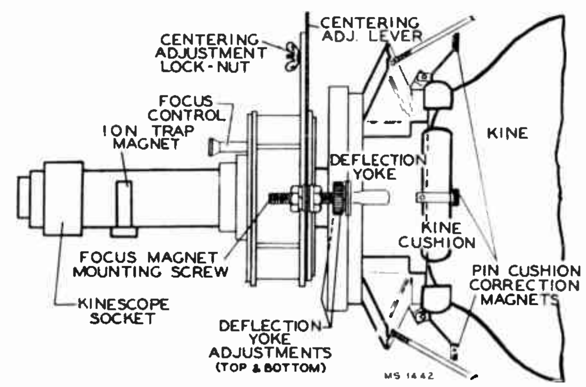


Figure 3—Ion Trap and Centering Magnet Adjustments

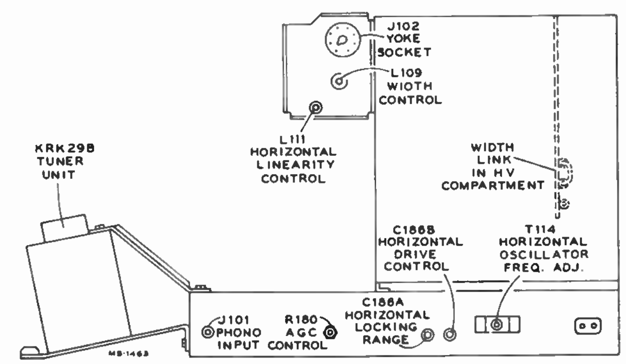


Figure 4—Rear Chassis Adjustments

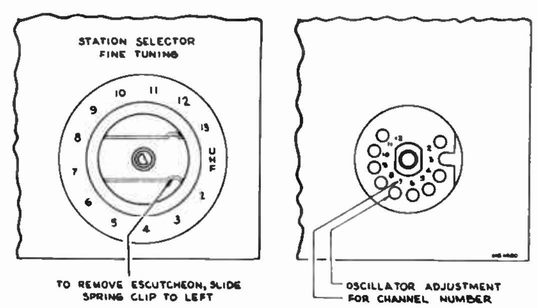


Figure 5—KRK29B R-F Oscillator Adjustments

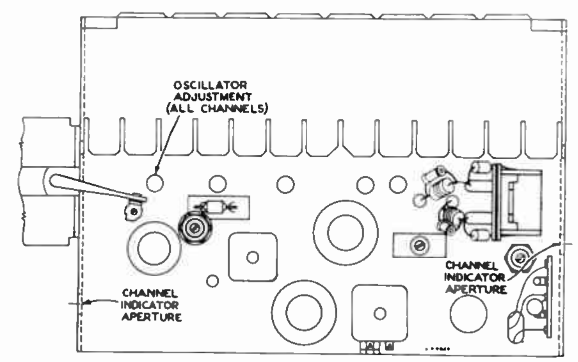


Figure 6—KRK12B Oscillator Adjustment

CHASSIS TOP VIEW

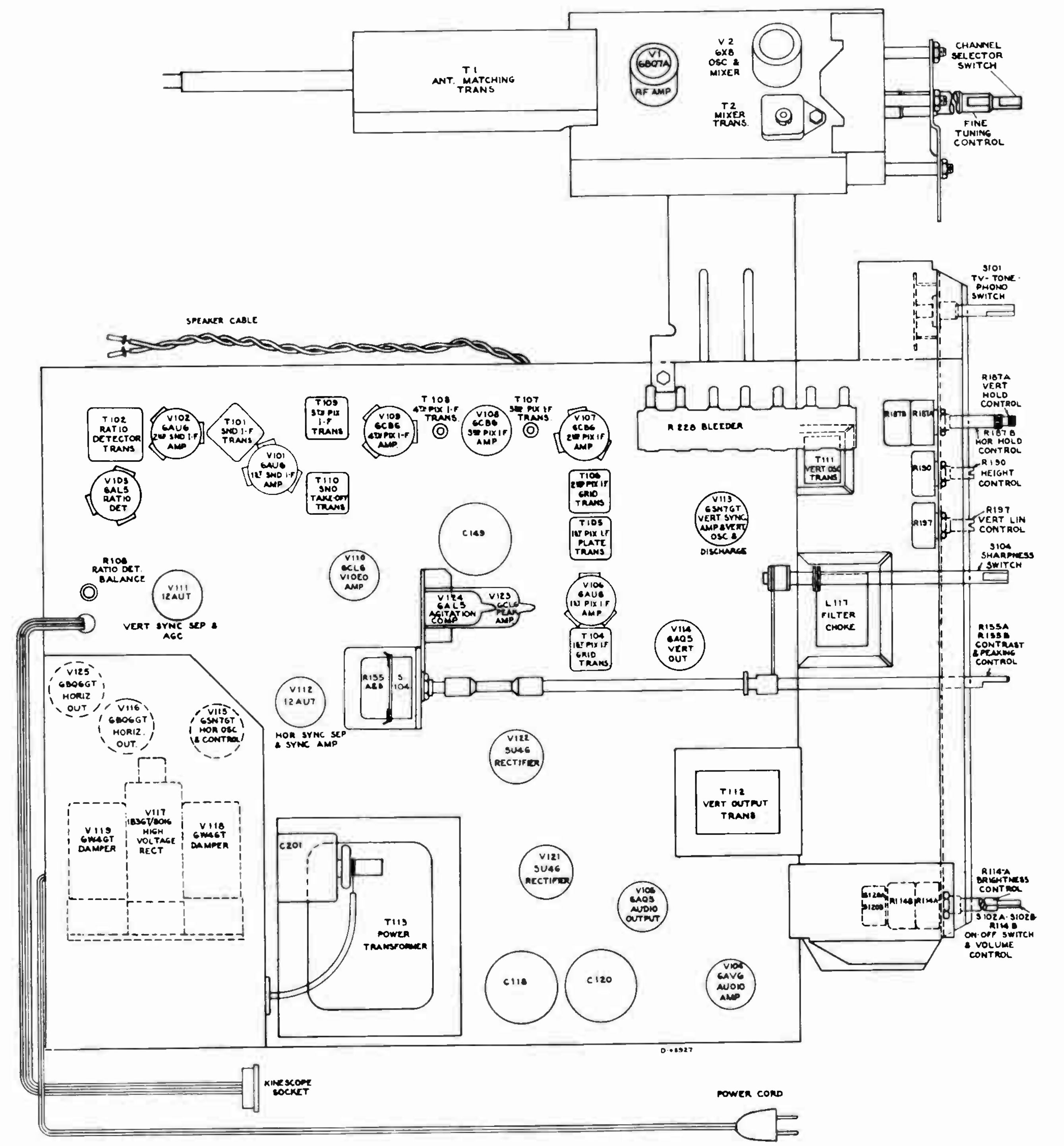


Figure 7—Chassis Top View (shown with KRK29B Tuner)

CHASSIS BOTTOM VIEW

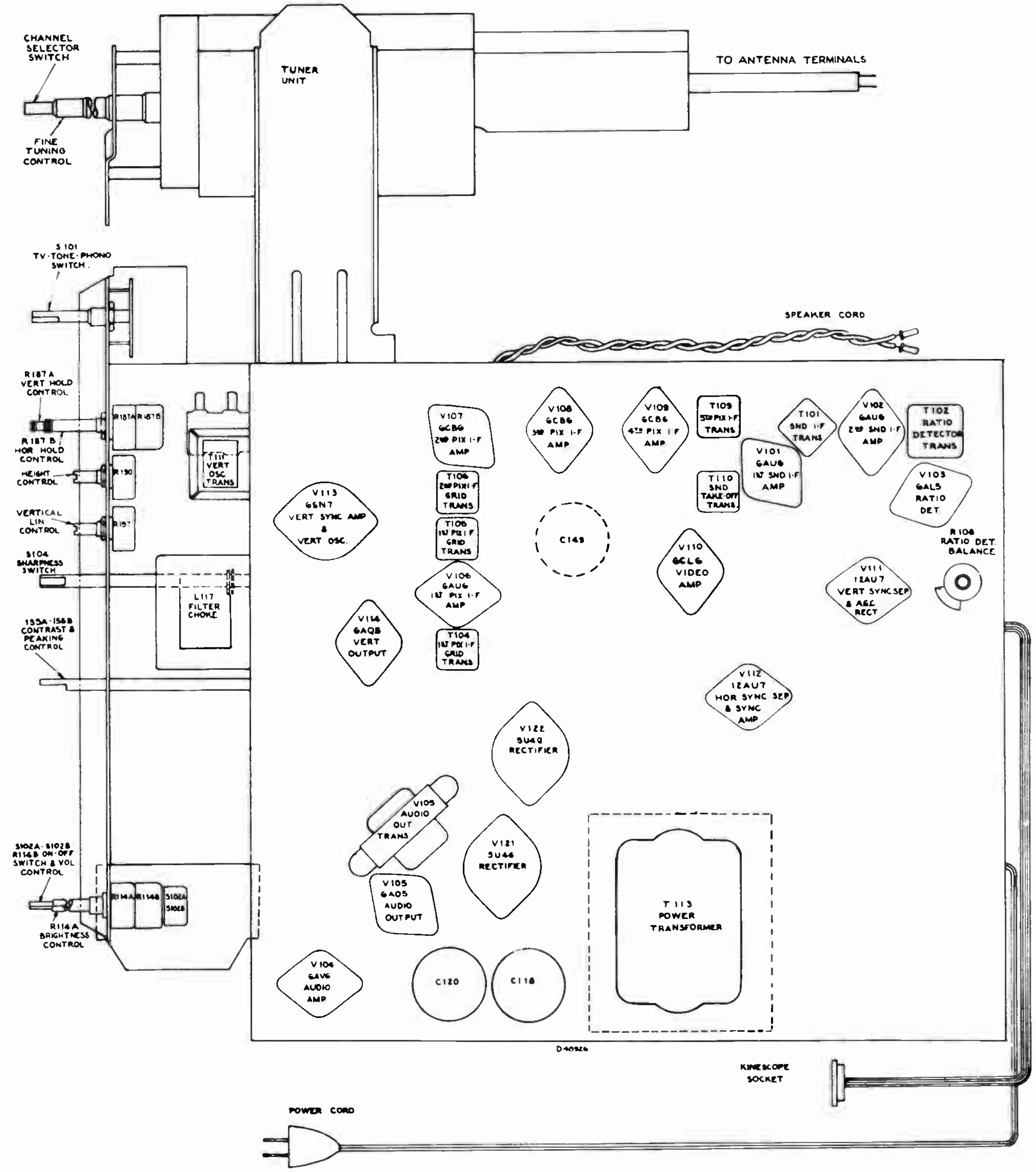


Figure 8—Chassis Bottom View (shown with KRK29B Tuner)

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.25	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	359.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12B Tuner. Wiring of adapter is shown in Figure 9.

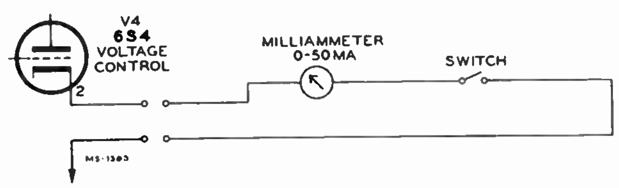


Figure 9—KRK12B Voltage Control Adapter

KRK29B ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal, especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1,000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R133 and C133B. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R133 and C133B.

ALIGNMENT PROCEDURE

Connect an oscilloscope to pin 9, V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 17 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in Figure 10. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

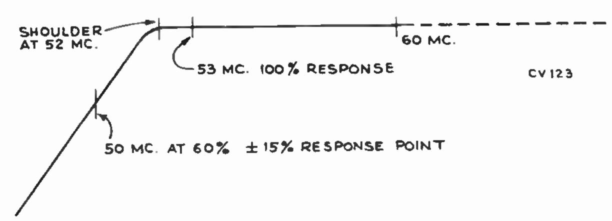


Figure 10—KRK29B Antenna Matching Unit Response

PICTURE I-F TRAP ADJUSTMENT.—Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R133 and C133B.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the positive terminal of one battery to chassis and the potentiometer arm to the junction of R133 and C133B.

Set the bias to produce approximately —1.0 volt of bias at the junction of R133 and C133B.

Connect the "VoltOhmyst" to pin 9 of V110, the 6CL6 video amplifier.

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS

Models 27-D-382, 27-D-383, 27-D-384

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with —1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to —1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 11. For final adjustment set the output of the sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

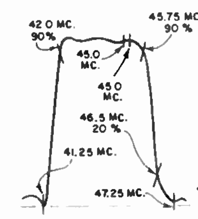


Figure 11—T105 and T106 Response

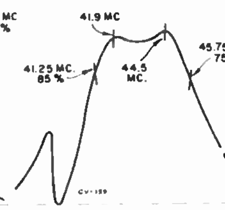


Figure 12—T2 and T104 Response with KRK29B

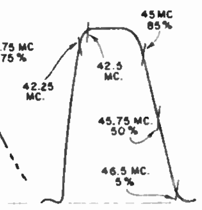


Figure 13—Over-all I-F Response with KRK29B

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals "A" and "B" of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust the shunt trimmer C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 12.

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

Models 27-D-382U, 27-D-383U, 27-D-384U

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with —1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to —1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110, the 6CL6 video amplifier.

ALIGNMENT PROCEDURE

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 11. For final adjustment set the output of the VHF sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align the crystal mixer and T2 and T104, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1,500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals "A" and "B" of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust the shunt trimmer C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 14. Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 15.

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

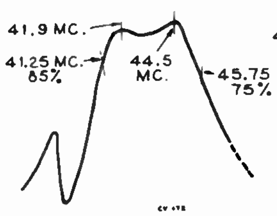


Figure 14—T2 and T104 Response with KRK12B

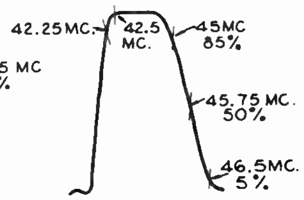


Figure 15—Over-all I-F Response with KRK12B

SWEEP ALIGNMENT OF PICTURE I-F

Connect the oscilloscope to pin 9 of V110.

Adjust the bias potentiometer to obtain —6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R133 and C133B.

Leave the sweep generator connected to the mixer grid test point TP2 on KRK29B Tuners or to the front terminal of the 1N82 crystal holder on KRK12B Tuners. Use the shortest leads possible with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T108 and T109 to obtain the response shown in Figure 15. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK29B TUNER ALIGNMENT

Models 27-D-382, 27-D-383, 27-D-384

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on the side of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

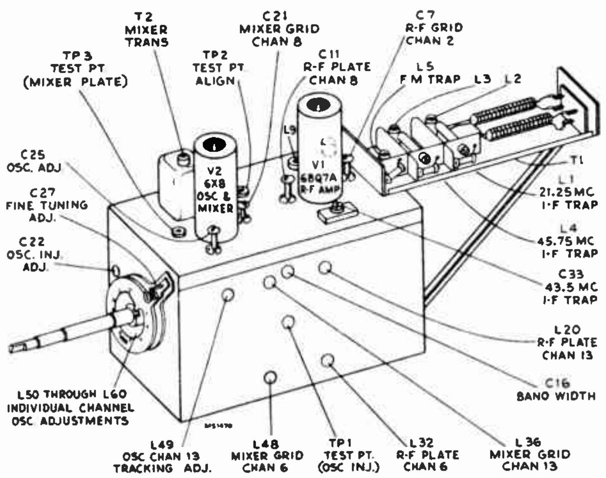


Figure 16—KRK29B Tuner Adjustments

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counterclockwise).

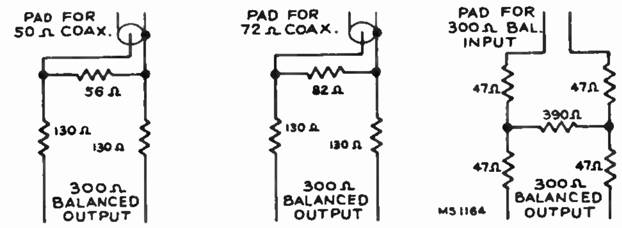


Figure 17—Sweep Attenuator Pads

Connect the sweep generator through a suitable attenuator, as shown in Figure 17 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and bandwidth as shown in Figure 18.

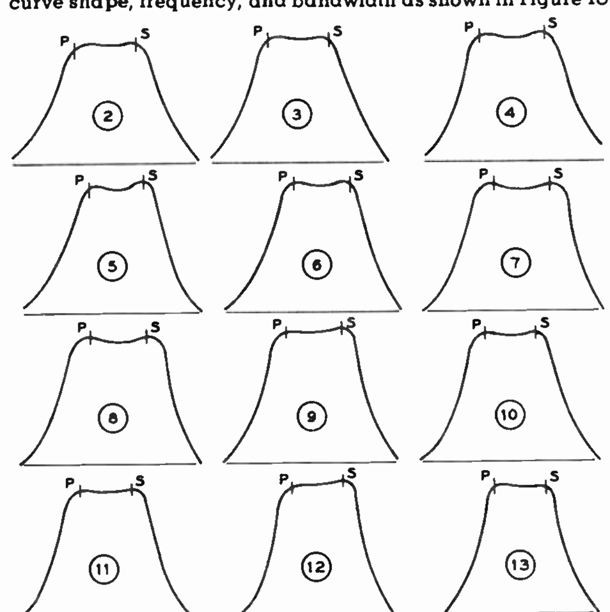


Figure 18—KRK29B R-F Response

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response bandwidth.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency, 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

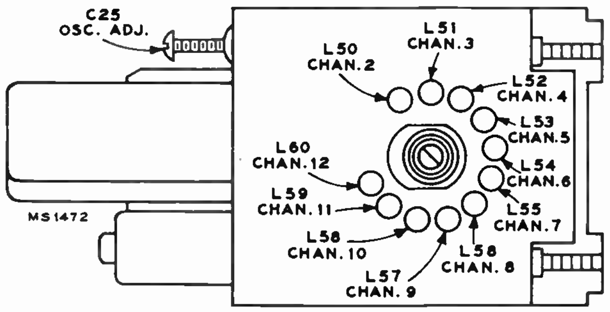


Figure 19—KRK29B R-F Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12B TUNER ALIGNMENT

Models 27-D-382U, 27-D-383U, 27-D-384U

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope through the preamplifier, if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 20. The proper curve shape is shown in Figure 20(b). (Refer to note on page 15 for detailed explanation of adjustments.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

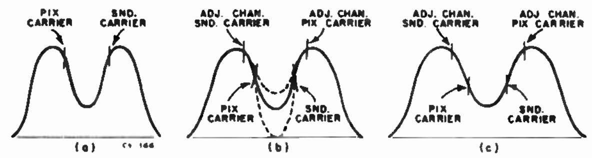


Figure 20—KRK12B VHF Insert Responses

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise and remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum marker indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

ALIGNMENT PROCEDURE

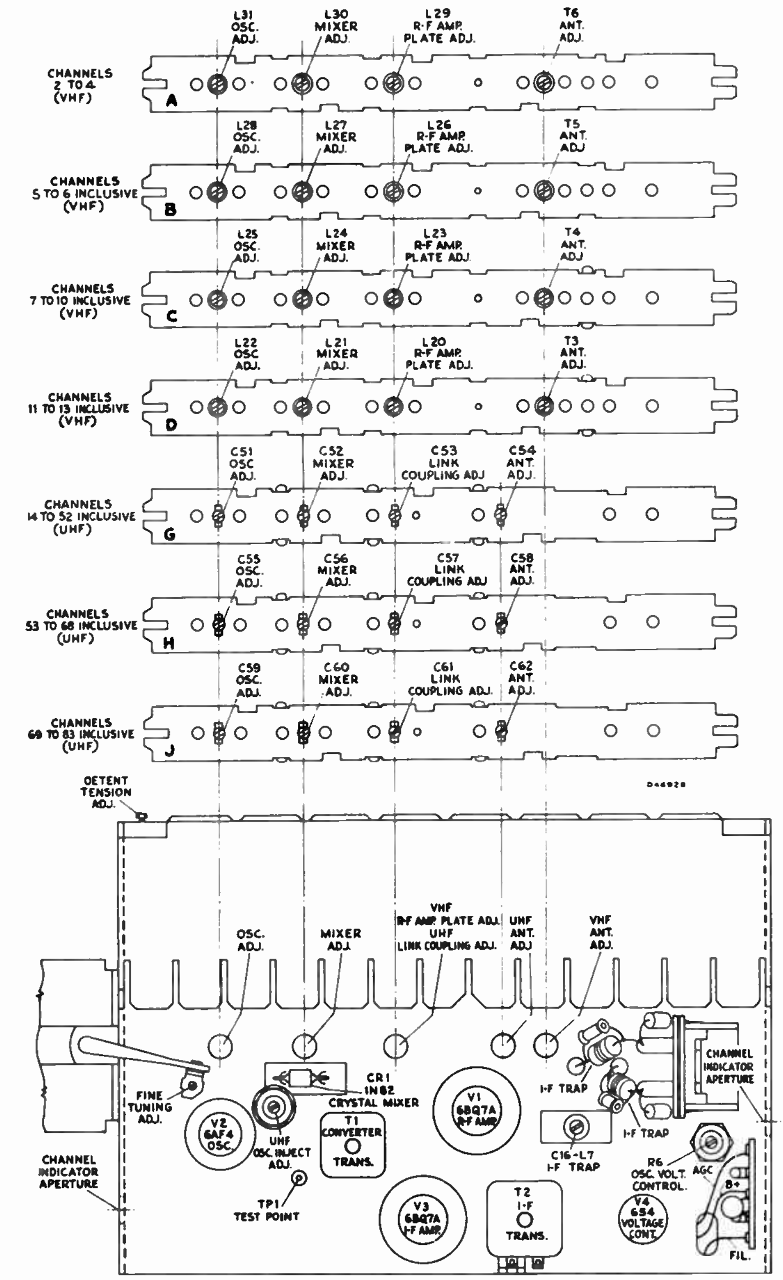


Figure 21—KRK12B Tuner Adjustments

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier frequencies for the desired channel (see Table on page 8).

Adjust the UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 22. The curve shape will usually vary from Figure 22 (a) to Figure 22 (c) going higher in frequency; however, any of these responses are acceptable.

Repeat the above steps for all UHF inserts used, adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier, if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used, and set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Figure 15.

Set the UHF marker generator to the picture carrier of the chonnel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust the mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt DC scale.

Set oscillator injection adjustment to read .1 volt on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "Volt-

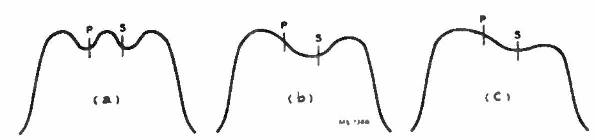


Figure 22—KRK12B UHF Insert Responses

ALIGNMENT PROCEDURE

Ohmyst" exceeds .3 volt. Adjust as necessary to read .3 volt or less at TP1.

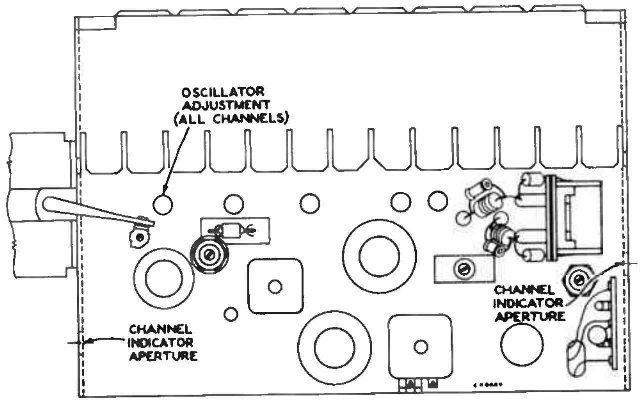


Figure 23—KRK12B Oscillator Adjustment

RATIO DETECTOR ALIGNMENT.—In order to obtain good ratio detector alignment an AM modulated signal generator that is exceptionally free from FM modulation must be employed. Set the signal generator at 4.5 mc. and connect it to the second sound i-f grid, pin 1 of V102. Set the generator for 30% 400 cycle modulation.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. If used, connect it to the grid of the 4th pix i-f amplifier, pin 1, V109. Set the frequency of the calibrator to 45.75 (pix carrier) and modulate with 4.5 mc. crystal. Also turn on the internal AM audio modulation. The 4.5 mc. signal will be picked off at T110A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to the junction of R111 and C111.

Connect the oscilloscope across the speaker voice coil and turn the volume control for maximum output.

Tune the ratio detector primary, T102 top core for maximum DC output on the "VoltOhmyst." Adjust the signal level from the signal generator for —10 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R110 and C110.

Adjust the T102 bottom core for zero d-c on the meter. Then, turn the core to the nearest minimum AM output on the oscilloscope.

Repeat adjustments of T102 top for maximum DC and T102 bottom for minimum output on the oscilloscope making final adjustment with the 4.5 mc. input level adjusted to produce 10 volts d-c on the "VoltOhmyst" at the junction of R111 and C111.

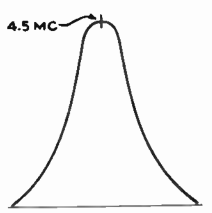


Figure 24—Sound I-F Response

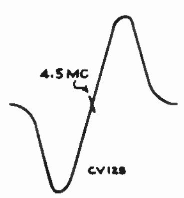


Figure 25—Ratio Det. Response

Connect the "VoltOhmyst" to the junction of R110 and C110 and note the amount of d-c present. If this voltage exceeds ±1.5 volts, adjust R108 by turning it in until zero d-c is obtained. Readjust the T102 bottom core for minimum output on the oscilloscope. Repeat adjustments of R108 and T102 bottom core until the voltage of R110 and C110 is less than ±1.5 volts when T102 bottom core is set for minimum output on the oscilloscope.

Connect the "VoltOhmyst" to the junction of R111 and C111 and repeak T102 top core for maximum d-c on the meter and again reset the generator so as to have —10 volts on the meter.

Repeat the adjustments in the above two paragraphs until the voltage at R110 and C110 is less than ±1.5 volts when the T102 top core is set for maximum d-c at the junction of R111 and C111 and the T102 bottom core is set for minimum indication on the oscilloscope.

SOUND I-F ALIGNMENT.—Connect the sweep generator to the first sound i-f amplifier grid, pin 1 of V101. Adjust the generator for a sweep width of 1 mc. at a center frequency of 4.5 mc.

Insert a 4.5 mc. marker signal from the signal generator into the first sound i-f grid. With the WR39B or WR39C calibrators the 4.5 mc. crystal signal may be obtained at the R-F out terminal by turning the variable osc. switch off, the calibrate switch to 4.5 mc. and the volume control with mod. off.

Connect the oscilloscope in series with a 10,000 ohm resistor to terminal A of T101.

Adjust T101 top and bottom cores for maximum gain and symmetry about the 4.5 mc. marker on the i-f response. The pattern obtained should be similar to that shown in Figure 24.

The output level from the sweep should be set to produce approximately 2.0 volt peak-to-peak at terminal A of T101 when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

Connect the oscilloscope to the junction of R110 and C110 and check the linearity of the response. The pattern obtained should be similar to that shown in Figure 25.

SOUND TAKE-OFF ALIGNMENT.—Connect the 4.5 mc. generator in series with a 1,000 ohm resistor to terminal "C" of T110. The input signal should be approximately 0.5 volt.

Short the fourth pix i-f grid to ground, pin 1, V109, to prevent noise from masking the output indication.

As an alternate source of signal the RCA WR39B or WR39C calibrator may be used. In such a case, disregard the above two paragraphs. Connect calibrator across link circuit, T104 A, B, and modulate 45.75 with 4.5 mc. crystal.

Connect the crystal diode probe of a "VoltOhmyst" to the plate of the video amplifier, pin 6 of V110.

Adjust the core of T110 for minimum output on the meter.

Remove the short from pin 1 V109 to ground, if used.

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

ALIGNMENT PROCEDURE

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R210, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C186B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and one diagonal black bar sloping down to the right appears on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain one diagonal black bar on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture begins to fall out of sync with the diagonal bar sloping down to the right. Continue to turn the frequency core in the same direction. Additional bars should not appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 26. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

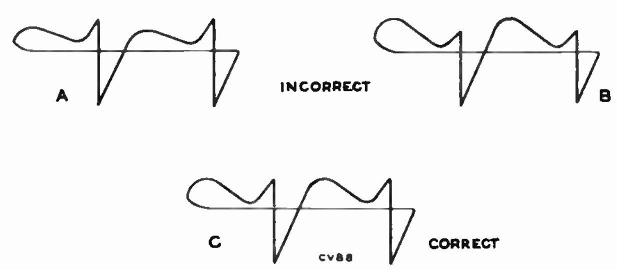


Figure 26—Horizontal Oscillator Waveforms

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counterclockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C186A slightly clockwise. If less than 2 bars are present, adjust C186A counterclockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

RESPONSE CURVES.—The response curves shown and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON KRK12B TUNER ALIGNMENT.—The use of a crystal mixer in the KRK12B Tuner makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in Figure 20 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in Figure 20(b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in Figures 20(a) and 20(c).

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1 but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

ALIGNMENT DATA

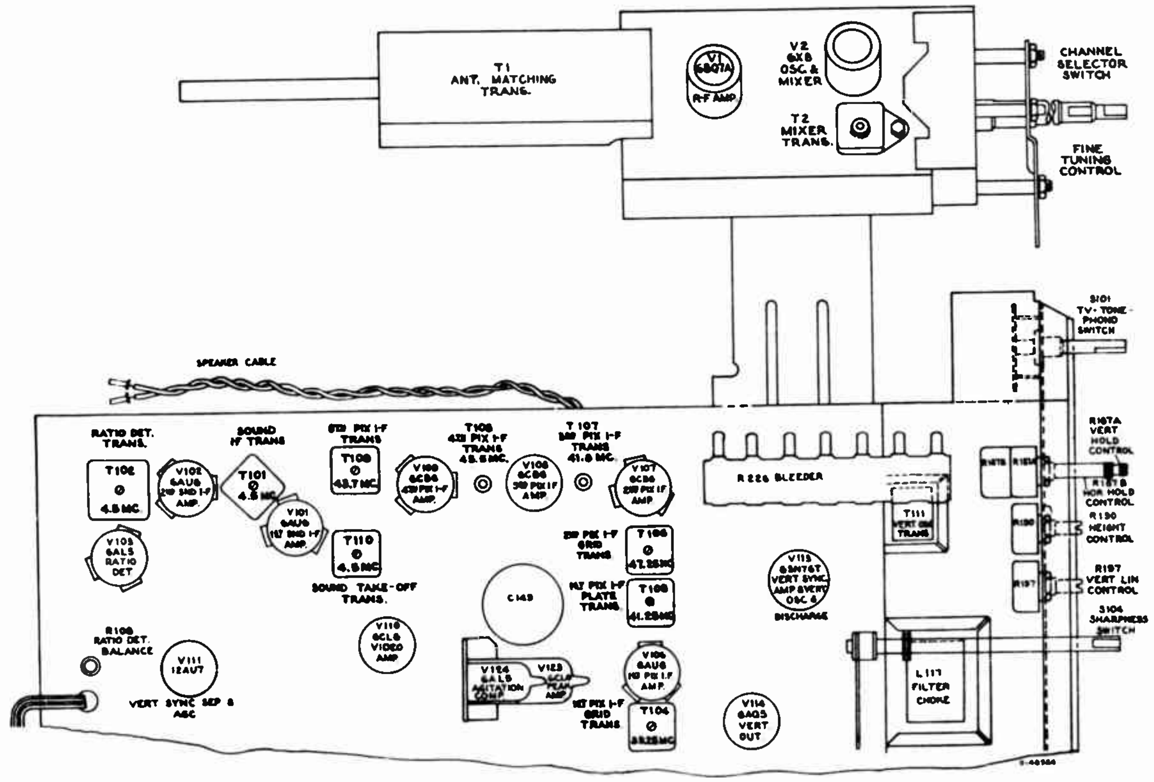


Figure 27—Top Chassis Adjustments (KRK29B Tuner Shown)

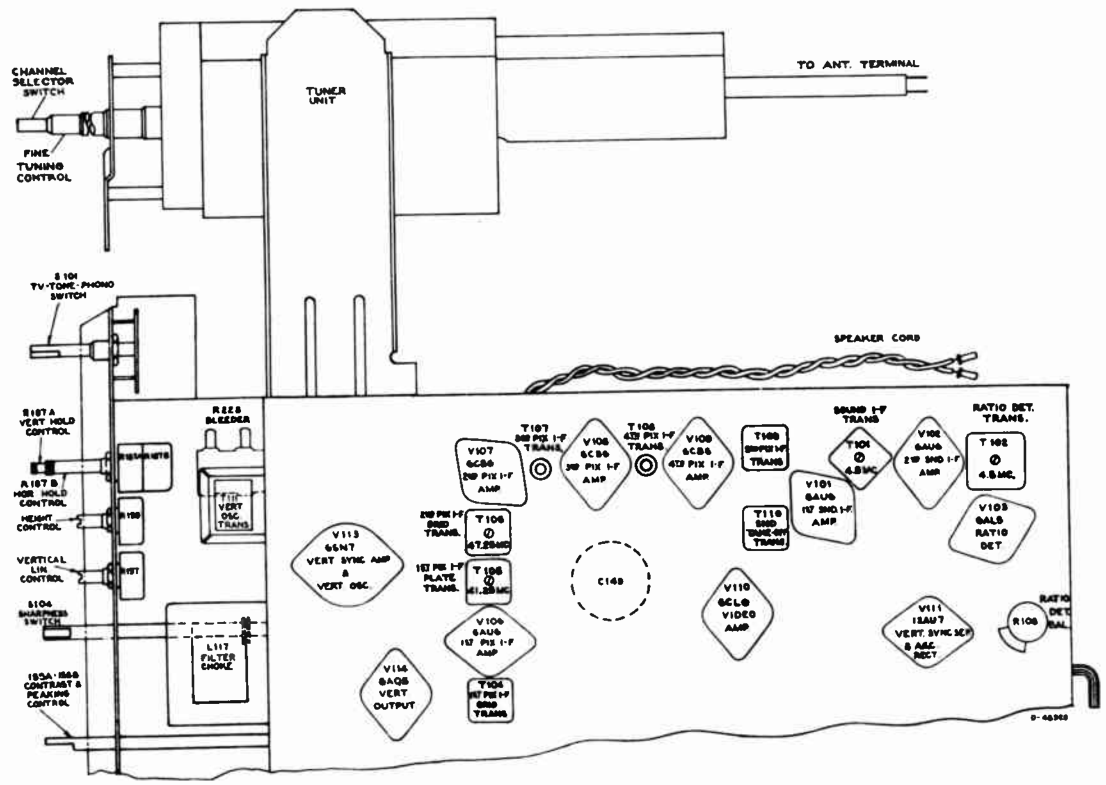


Figure 28—Bottom Chassis Adjustments (KRK29B Tuner Shown)

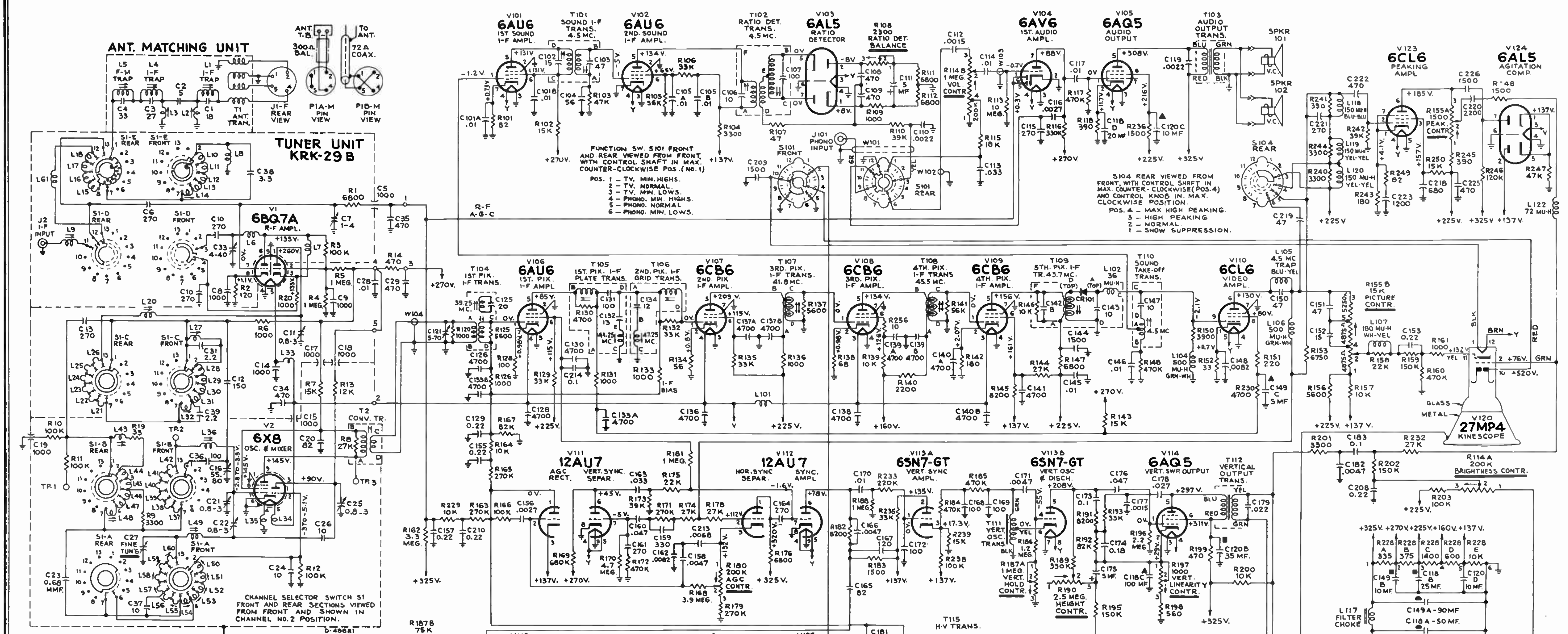
VOLTAGE CHART

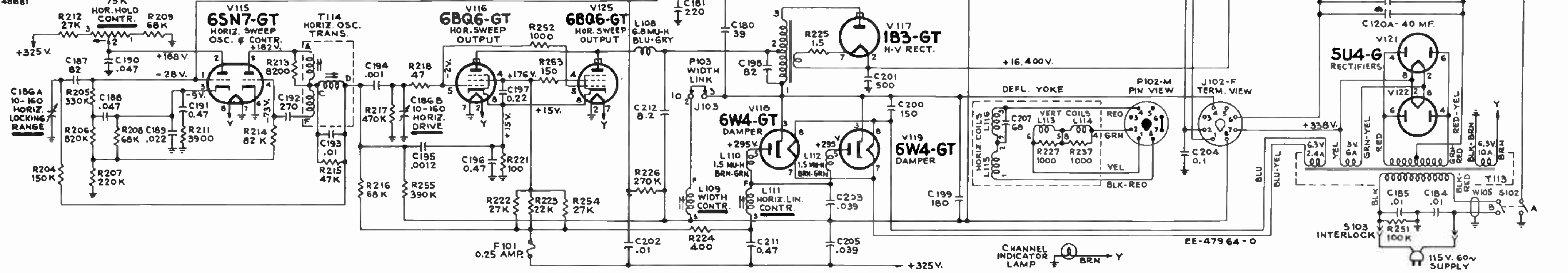
The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V1 KRK29B	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	170	—	—	8	0.1	7		—	—	
			No Signal	6	133	—	—	8	1.1	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	
V2 KRK29B	6X8	Mixer	5000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	—	—	
			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	—	—	
		R-F Oscillator	5000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	—	—	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	—	—	
V1 KRK12B	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	—	—	
			No Signal	6	138	—	—	8	1.0	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	260	—	—	3	143	2	97	—	—	
			No Signal	1	250	—	—	3	137	2	97	—	—	
V2 KRK12B	6AF4	R-F Oscillator	5000 Mu. V. Signal	1 & 7	78	—	—	5	0	2 & 6	—8	—	—	
			No Signal	1 & 7	75	—	—	5	0	2 & 6	—6	—	—	
V3 KRK12B	6BQ7A	I-F Amplifier	5000 Mu. V. Signal	6	270	—	—	8	148	7	103	—	—	
			No Signal	6	260	—	—	8	142	7	99	—	—	
		I-F Amplifier	5000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	—	—	
			No Signal	1	143	—	—	3	1.2	2	0	—	-	
V4 KRK12B	6S4	Voltage Control	5000 Mu. V. Signal	9	270	—	—	2	94	6	*68	—	—	*Depends on adjustment of R6.
			No Signal	9	260	—	—	2	90	6	*65	—	—	
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	136	6	136	7	0.76	1	—0.4	6.2	3.1	
			No Signal	5	131	6	131	7	0.73	1	—1.2	6.1	3.0	
V102	6AU6	2nd Sound I-F Amp.	5000 Mu. V. Signal	5	138	6	60	7	0	1	—10	2.9	1.2	
			No Signal	5	134	6	65	7	0	1	—5	2.1	1.0	
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	2 7	—9.2 1.0	—	—	5 1	1.0 9.2	—	—	—	—	
			No Signal	2 7	—8.0 0	—	—	5 1	0 8.0	—	—	—	—	
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	90	—	—	2	0	1	—0.7	0.65	—	At min. volume
			No Signal	7	88	—	—	2	0	1	—0.7	0.65	—	
V104	6AV6	R-F Bias Clamp	5000 Mu. V. Signal	5-6	—3.0	—	—	2	0	—	—	—	—	
			No Signal	5-6	0.3	—	—	2	0	—	—	—	—	
V105	6AQ5	Audio Output	5000 Mu. V. Signal	5	311	6	227	2	12.6	7	0	30.4	2.0	At min. Volume
			No Signal	5	308	6	216	2	11.7	7	0	28.2	1.8	
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	160	6	215	7	0.17	1	—6.6	1.4	.4	
			No Signal	5	85	6	115	7	0.98	1	0	6.5	3.3	
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	227	6	225	2	0.1	1	—6.6	1.5	.25	
			No Signal	5	209	6	115	2	0.8	1	0	10.9	3.3	

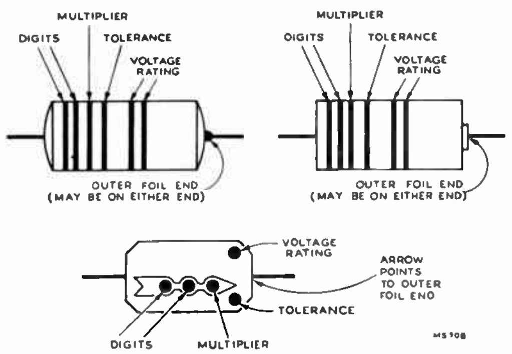
27-D-382, 27-D-383, 27-D-384

CIRCUIT SCHEMATIC DIAGRAM KCS77C, KCS77F

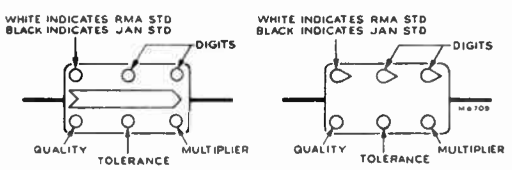




COLOR CODES, MOULDED PAPER CAPACITORS



RMA COLOR CODE, FIXED MICA CAPACITORS



The schematic is shown in the latest condition at the time of printing.

All resistance values in ohms. K = 1000.

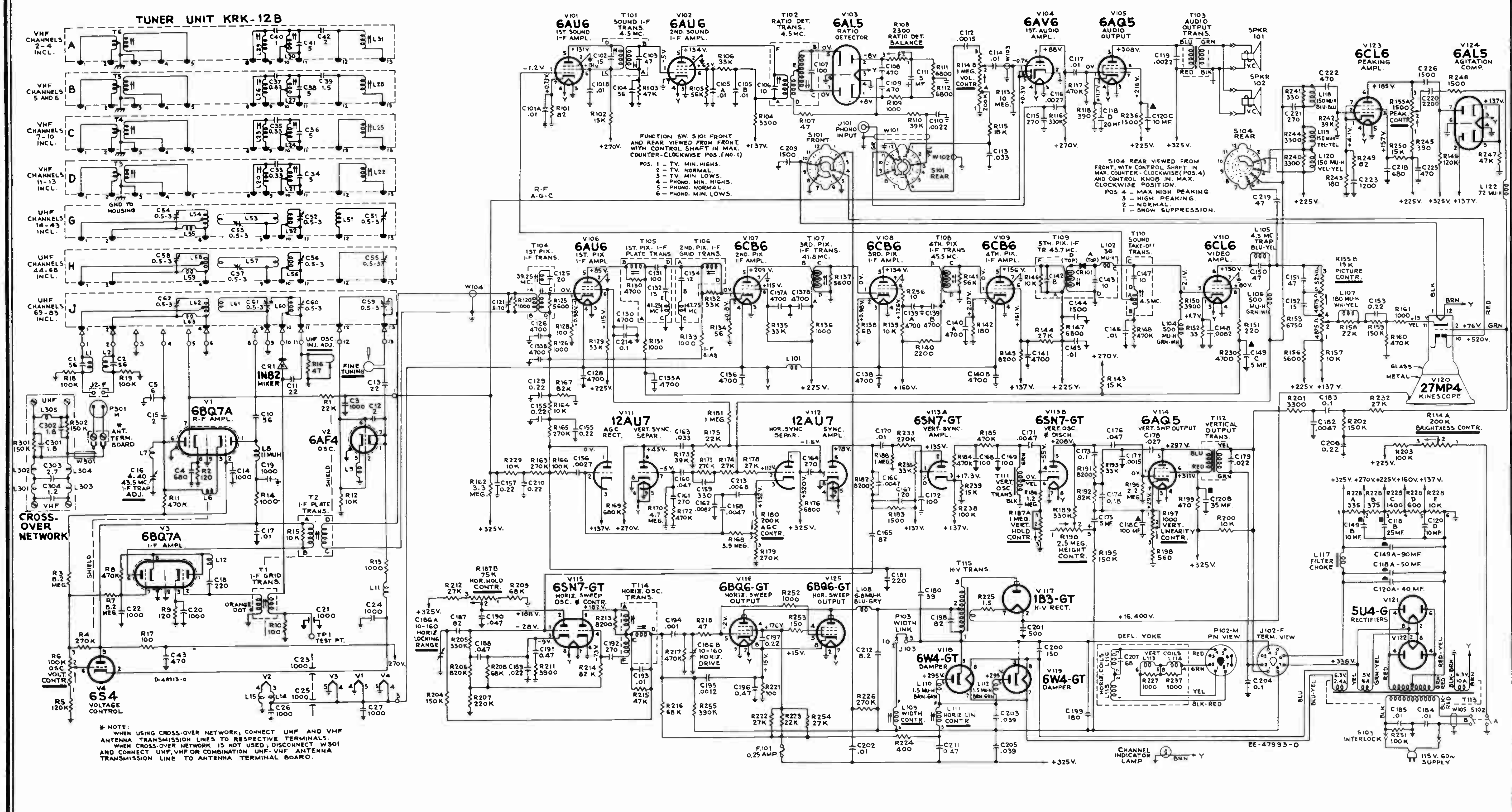
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ± 20% with 117 v. a-c supply.

Figure 29—Circuit Schematic Diagram, KCS77C or KCS77F

CIRCUIT SCHEMATIC DIAGRAM KCS77D, KCS77H



The schematic is shown in the latest condition at the time of printing.

All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 30—Circuit Schematic Diagram, KCS77D or KCS77H

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V108	6CB6	3rd Pix. I-F Amplifier	5000 Mu. V. Signal	5	138	6	132	2	1.02	1	0	11.4	3.5	
			No Signal	5	134	6	126	2	.98	1	0	10.4	3.1	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	168	6	165	2	2.32	1	0	8.85	2.2	
			No Signal	5	156	6	161	2	2.07	1	0	8.6	2.1	
V110	6CL6	Video Amplifier	5000 Mu. V. Signal	6	130	3-8	159	1	.84	2-9	*—5.0	22.5	5.5	*Depends on picture
			No Signal	6	130	3-8	80	1	0.7	2-9	*—2.0	15.0	4.0	*Depends on picture
V111A	12AU7	AGC Rectifier	5000 Mu. V. Signal	1	—30	—	—	3	142	—	—	0	—	AGC control set for normal operation
			No Signal	1	0	—	—	3	137	—	—	0	—	
V111B	12AU7	Vert. Sync. Separator	5000 Mu. V. Signal	6	110	—	—	8	0	7	—42	.25	—	
			No Signal	6	45	—	—	8	0	7	*—5	.35	—	*Depends on noise
V112A	12AU7	Hor. Sync. Separator	5000 Mu. V. Signal	1	323	—	—	3	192	2	116	.5	—	
			No Signal	1	320	—	—	3	132	2	112	.5	—	
V112B	12AU7	Sync. Amplifier	5000 Mu. V. Signal	6	78	—	—	8	0	7	—3.5	6.2	—	
			No Signal	6	78	—	—	8	0	7	—1.6	6.2	—	
V113A	6SN7GT	Vert. Sync. Amplifier	5000 Mu. V. Signal	2	140	—	—	3	19.2	1	—.35	0.1	—	
			No Signal	2	135	—	—	3	17.3	1	0	<0.1	—	
V113B	6SN7GT	Vert. Osc. & Discharge	5000 Mu. V. Signal	5	203	—	—	6	0	4	—56	.2	—	
			No Signal	5	208	—	—	6	0	4	—55	.2	—	
V114	6AQ5	Vertical Output	5000 Mu. V. Signal	5	300	6	314	2	29.2	1	0	23.5	1.5	
			No Signal	5	297	6	311	2	29	1	0	23.5	1.5	
V115	6SN7GT	Horizontal Osc. Control	5000 Mu. V. Signal	2	188	—	—	3	—9	1	—28	0.37	—	Hor. hold at mid-range
			No Signal	2	0	—	—	3	0	1	0	0	—	
		Horizontal Oscillator	5000 Mu. V. Signal	5	184	—	—	6	0	4	—72	2.5	—	Hor. hold at mid-range
			No Signal	5	182	—	—	6	0	4	—73	2.5	—	
V116 V125	6BQ6GT	Horizontal Output (2 tubes)	5000 Mu. V. Signal	Cap	*	4	176	8	15	5	—21	165	12.4	*High Voltage Pulse Present
			No Signal	Cap	*	4	176	8	15	5	—21	165	12.4	
V117	1B3GT /8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	
V118 V119	6W4GT	Dampers	5000 Mu. V. Signal	5	298	—	—	3	*	—	—	—	—	*High Voltage Pulse Present
			No Signal	5	295	—	—	3	*	—	—	—	—	
V120	27MP4	Kinescope	5000 Mu. V. Signal	Cone	16,000	10	525	11	140	2	*82	—	—	At average Brightness *0 voltage on Phono. position
			No Signal	Cone	16,400	10	520	11	132	2	*76	—	—	
V121 V122	5U4G	Rectifiers	5000 Mu. V. Signal	4 & 6	341	—	—	2 & 8	364	—	—	*175	—	*Per Tube
			No Signal	4 & 6	338	—	—	2 & 8	360	—	—	*150	—	
V123	6CL6	Peaking Amplifier	5000 Mu. V. Signal	6	190	8	165	1	4.4	—	—	20.5	4.25	
			No Signal	6	185	8	157	1	4.1	—	—	18.4	4.2	
V124	6AL5	Agitation Compressor	5000 Mu. V. Signal	2	142	—	—	1 & 5	142	—	—	—	—	
			No Signal	2	137	—	—	1 & 5	137	—	—	—	—	

REPLACEMENT PARTS

STOCK No.	PART DESCRIPTION
	R.F. UNIT ASSEMBLIES KRK29B
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78467	Board—Terminal board, 6 contact and ground
78233	Bracket—Side bracket for mounting coil and stators
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:—
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:—
77151	0.8-3.0 mmf. (C11, C21, C25)
77913	0.8-3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:—
77084	feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:—
77293	470 mmf., ±100%, —0%, 500 volts (C29, C34, C35)
77252	1000 mmf., ±100%, —0%, 500 volts (C8, C9, C14)
73960	10,000 mmf., ±100%, —0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K":—
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, ceramic, Temp. coef. —N1400
78603	82 mmf., ±10%, 500 volts (C20)
	Capacitor—Fixed, headed-lead:—
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31, C39)
71503	3.3 mmf., ±20%, 500 volts (C38)
	Capacitor—Mica trimmer:—
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r. f. plate coil (L32)
73458	Coil—Channel #6 r. f. grid coil (L14)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r. f. plate coil (L20)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
78583	Coil—Mixer I.F. coil (L43)
76562	Coil—R.F. amplifier coupling coil (L7)
78584	Coil—R.F. plate I.F. coil (L27)
76537	Coil—Shunt coil complete with adjustoble core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
	Resistor—Fixed, composition:—
503033	33 ohms, ±10%, ½ watt (R19)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78396	Transformer—Antenna matching tronsformer complete (T1)
78399	Transformer—Convertor transformer (T2, R8)
76540	Trap—F.M. trap complete with adjustable core (L5)
78466	Trap—I.F. trap
76542	Trap—I.F. trap (41.25 MC) complete with core (L1)
76541	Trap—I.F. trop (45.75 MC) complete with core (L4)
75190	Wosher—Insuloting washer (neoprene) for capacitor
	R.F. UNIT ASSEMBLIES KRK12B
	Capacitor—Ceramic:—
77084	feed-thru, 1000 mmf. (C21, C23, C25)
77615	stand-off, 1000 mmf. (C3, C19, C24, C26)
	Capacitor—Fixed, ceramic, crystal holder, Temp. coef. = —750
77621	22 mmf., ±10% (C11)
	Capacitor—Fixed, ceramic, High "K" disc:—
77625	220 mmf., +100%, —0%, 500 volts DC (C18)
77293	470 mmf., +100%, —0%, 500 volts DC (C43)
77624	680 mmf., +100%, —0%, 500 volts DC (C4)
77252	1000 mmf., +100%, —0%, 500 volts DC (C14, C20, C22, C27)
73960	10,000 mmf., +100%, —0%, 500 volts DC (C17)
	Capacitor—Fixed, ceramic, insulated:—
77667	comprising: 1 section of 2 mmf., and 1 section of 22 mmf. (C12, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77210	2 mmf., ±0.25 mmf., 500 volts DC (C15)
77688	5 mmf., ±.5 mmf., 500 volts DC (C34, C36, C38, C41)
74182	6 mmf., ±0.5 mmf., 500 volts DC (C5)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
71924	56 mmf., ±10%, 500 volts DC (C10)
	Capacitor—Fixed, headed-lead type:—
77691	.33 mmf., ±10%, 500 volts DC (C33, C35)
77689	.82 mmf., ±10%, 500 volts DC (C37)
77690	1.0 mmf., ±10%, 500 volts DC (C40)
71500	1.5 mmf., ±10%, 500 volts DC (C39)
78047	2 mmf., ±10%, 500 volts DC (C42)
77628	Coil—I.F. trap (L7)
77634	Coil—I.F. neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—R.F. plate coil (L8)
77489	Rectifier—Germanium rectifier IN82 (CR1)
	Resistor—Fixed, composition:—
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
77585	Washer—"C" washer for drive and indicator shafts (3 req'd) or for link spring
	CHASSIS ASSEMBLIES KCS77C—VHF Chassis KCS77D—UHF Chassis KCS77F—VHF Chassis KCS77H—UHF Chassis
78238	Cap—Tube connector cap
	Capacitor—Ceramic:—
76488	500 mmf., 30,000 volts (C201)
75166	Stand-off, 1500 mmf. (C144)
	Capacitor—Fixed, ceramic:—
76009	8.2 mmf., 5000 volts (C212)
76574	39 mmf., 3500 volts (C180)
77836	82 mmf., 6000 volts (C198)
76576	150 mmf., 2000 volts (C200)
76575	180 mmf., 3500 volts (C199)
	Capacitor—Fixed, ceramic, High "K" disc:—
77293	470 mmf., +100%, —0%, 500 volts DC (C225)
77624	680 mmf., +100%, —0%, 500 volts DC (C218)
73748	1500 mmf., +100%, —0%, 500 volts DC (C209, C226)
77953	2200 mmf., +10%, —0%, 500 volts DC (C220)
73473	4700 mmf., +100%, —0%, 500 volts DC (C126, C128, C130, C136, C138, C141)
76470	Dual 4700 mmf., +100%, —0%, 500 volts DC (C133A, C133B, C137A, C137B, C139A, C139B, C140A, C140B)
73960	10,000 mmf., +100%, —0%, 500 volts DC (C145, C146)
75877	Dual 10,000 mmf., +100%, —0%, 500 volts DC (C101A, C101B, C105A, C105B)
	Capacitor—Fixed, ceramic, insulated, High "K" type:—
77838	270 mmf., ±10%, 500 volts DC (C221)
75198	470 mmf., ±10%, 500 volts DC (C222)
77923	1200 mmf., ±10%, 500 volts DC (C223)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
39044	15 mmf., ±10%, 500 volts DC (C152)
39042	47 mmf., ±10%, 500 volts DC (C151, C219)
71924	56 mmf., ±10%, 500 volts DC (C104)
39396	100 mmf., ±10%, 500 volts DC (C168, C169, C172)
71614	120 mmf., ±10%, 500 volts DC (C167)
47617	270 mmf., ±10%, 500 volts DC (C115)
	Capacitor—Fixed, mica:—
76474	82 mmf., 1000 volts DC (C165, C187)
75248	220 mmf., 1000 volts DC (C181)
39638	270 mmf., 500 volts DC (C161)
76579	270 mmf., 1000 volts DC (C164, C192)
39640	330 mmf., 500 volts DC (C159)
39644	470 mmf., 500 volts DC (C108, C109)
	Capacitor—Mica trimmer:—
71496	5-70 mmf. (C121)
75217	Dual 10-160 mmf. (C186A, C186B)
	Capacitor—Electrolytic:—
74521	5 mfd., 50 volts (C111)
28417	5 mfd., 450 volts (C175)

REPLACEMENT PARTS (Continued)

STOCK No.	PART DESCRIPTION
77819	Comprising:—1 section of 40 mfd., 400 volts, 1 section of 35 mfd., 400 volts, 2 sections of 10 mfd., 400 volts (C120A, C120B, C120C, C120D)
77817	Comprising:—1 section of 50 mfd., 400 volts, 1 section of 25 mfd., 400 volts, 1 section of 100 mfd., 50 volts and 1 section of 20 mfd., 25 volts (C118A, C118B, C118C, C118D)
77820	Comprising:—1 section of 90 mfd., 400 volts, 1 section of 10 mfd., 400 volts and 1 section of 5 mfd., 400 volts (C149A, C149B, C149C)
	Capacitor—Fixed, tubular, paper, oil impregnated:—
75643	.001 mfd., 1000 volts (C194)
76508	.0015 mfd., 600 volts (C112)
73802	.0015 mfd., 1000 volts (C177)
73595	.0022 mfd., 600 volts (C110, C119)
73599	.0027 mfd., 600 volts (C116, C156)
73920	.0047 mfd., 600 volts (C158, C166, C182)
73789	.0068 mfd., 400 volts (C213)
73808	.0082 mfd., 1000 volts (C148, C162)
73561	.01 mfd., 400 volts (C114, C117, C170, C202)
73562	.022 mfd., 400 volts (C179)
78311	.027 mfd., 1000 volts (C178)
73552	.033 mfd., 400 volts (C113, C163, C189)
73813	.039 mfd., 1000 volts (C203, C205)
73553	.047 mfd., 400 volts (C160, C188, C190)
73592	.047 mfd., 600 volts (C176)
73551	0.1 mfd., 400 volts (C183, C214)
73557	0.1 mfd., 600 volts (C173, C204)
77839	0.18 mfd., 200 volts (C174)
73794	0.22 mfd., 400 volts (C129, C153, C155, C157, C208, C210)
74957	0.22 mfd., 600 volts (C197)
73787	0.47 mfd., 200 volts (C191, C196, C211)
	Capacitor—Fixed, tubular, moulded paper, oil impregnated:—
76995	.0012 mfd., 600 volts (C195)
73920	.0047 mfd., 600 volts (C171)
73594	.01 mfd., 600 volts (C184, C185, C193)
77824	Choke—Filter choke (L117)
76143	Clip—Mounting clip for stand-off capacitor
73477	Coil—Choke coil (L101)
76672	Coil—Filament winding only for hi-voltage transformer (Part of T115)
78197	Coil—Horizontal linearity coil complete with adjustable core (L111)
77842	Coil—Peaking coil (72 muh) (L122)
77841	Coil—Peaking coil (150 muh) (L119, R244, L120, R240)
77840	Coil—Peaking coil (150 muh) (L118, R241)
76647	Coil—Peaking coil (180 muh) (L107, R158)
75252	Coil—Peaking coil (500 muh) (L104, L106)
76640	Coil—R.F. choke coil (1.5 muh) (L110, L112)
78598	Coil—R.F. choke coil (6.8 muh) (L108)
76484	Coil—Width coil complete with adjustable core (L109)
74594	Connector—2 contact male connector for power cord
76457	Connector—2nd anode lead connector
50367	Connector—6 contact female connector for yoke leads (J102)
35787	Connector—Phono input connector (J101)
75474	Connector—Single contact male connector for speaker cable
77654	Control—AGC control (R180)
77655	Control—Brightness control, volume control and power switch (R114A, R114B, S102)
77640	Control—Height control (R190)
77826	Control—Horizontal and vertical hold control (R187A, R187B)
77818	Control—Picture and peaking control (R155A, R155B)
77199	Control—Ratio detector balance control (R108)
77643	Control—Vertical linearity control (R197)
78627	Coupling—Coupling (metal) for definition switch
77647	Coupling—Coupling (nylon) for picture control
77138	Cover—Back cover for hi-voltage compartment
78487	Cover—Side cover for hi-voltage compartment
73600	Fuse—0.25 amp., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd anode lead exit
76480	Lead—Anode lead complete with eyelet
77829	Link—Link assembly for definition switch shafts
77634	Plate—Bakelite plate for mounting picture control and definition switch
78485	Plate—Hi-voltage plate (bakelite) complete less corona ring, transformer and socket
76675	Rectifier—Picture detector crystal rectifier (CR101)
76468	Resistor—Wire wound, 1.5 ohms, 1/3 watt (R225)
77835	Resistor—Wire wound, 100 ohms, 4 watts (R221)
77825	Resistor—Wire wound comprising:—1 section of 335 ohms, 16 watts, 1 section of 375 ohms, 8 watts, 1 section of 1400 ohms, 7 watts, 1 section of 600 ohms, 2 watts, and 1 section of 10,000 ohms, 5 watts (R228A, R228B, R228C, R228D, R228E)

STOCK No.	PART DESCRIPTION
78223	Resistor—Wire wound, 400 ohms, 10 watts (R224)
76642	Resistor—Wire wound, 6750 ohms, 10 watts (R153)
	Resistor—Fixed, composition:—
503010	10 ohms, ±10%, ½ watt (R256)
503033	33 ohms, ±10%, ½ watt (R152)
503047	47 ohms, ±10%, ½ watt (R107, R218)
502056	56 ohms, ±5%, ½ watt (R134)
502068	68 ohms, ±5%, ½ watt (R138)
502082	82 ohms, ±5%, ½ watt (R101)
503082	82 ohms, ±10%, ½ watt (R249)
502110	100 ohms, ±5%, ½ watt (R128)
503115	150 ohms, ±10%, ½ watt (R253)
503118	180 ohms, ±10%, ½ watt (R142, R243)
503122	220 ohms, ±10%, ½ watt (R151)
503139	390 ohms, ±10%, ½ watt (R245)
513139	390 ohms, ±10%, 1 watt (R118)
503147	470 ohms, ±10%, ½ watt (R199)
503156	560 ohms, ±10%, ½ watt (R198)
503210	1000 ohms, ±10%, ½ watt (R109, R120, R126, R131, R133, R138, R161, R252)
502215	1500 ohms, ±5%, ½ watt (R183)
503215	1500 ohms, ±10%, ½ watt (R236, R248)
503222	2200 ohms, ±10%, ½ watt (R140)
502233	3300 ohms, ±10%, ½ watt (R104, R201)
502239	3900 ohms, ±5%, ½ watt (R150)
503239	3900 ohms, ±10%, ½ watt (R211)
503247	4700 ohms, ±10%, ½ watt (R230)
502256	5600 ohms, ±5%, ½ watt (R137)
513256	5600 ohms, ±10%, 1 watt (R156)
14659	6800 ohms, ±5%, ½ watt (R111, R112)
503268	6800 ohms, ±10%, ½ watt (R176)
513268	6800 ohms, ±10%, 1 watt (R147)
503282	8200 ohms, ±10%, ½ watt (R145, R191, R213)
513282	8200 ohms, ±10%, 1 watt (R182)
503310	10,000 ohms, ±10%, ½ watt (R139, R164, R200, R229)
513310	10,000 ohms, ±10%, 1 watt (R157)
503315	15,000 ohms, ±10%, ½ watt (R239)
513315	15,000 ohms, ±10%, 1 watt (R250)
523315	15,000 ohms, ±10%, 2 watts (R143, R102)
503318	18,000 ohms, ±10%, ½ watt (R115)
503322	22,000 ohms, ±10%, ½ watt (R175)
522322	22,000 ohms, ±5%, 2 watts (R223, R254)
503327	27,000 ohms, ±10%,½watt(R174,R178,R212,R232,R144)
523327	27,000 ohms, ±10%, 2 watts (R222)
503333	33,000 ohms, ±10%,½watt(R106,R129,R132,R135,R235)
522333	33,000 ohms, ±5%, 2 watts (R193)
503339	39,000 ohms, ±10%, ½ watt (R110, R173, R242)
503347	47,000 ohms, ±10%, ½ watt (R103, R215)
512347	47,000 ohms, ±5%, 1 watt (R247)
502356	56,000 ohms, ±5%, ½ watt (R141)
503356	56,000 ohms, ±10%, ½ watt (R105)
503368	68,000 ohms, ±10%, ½ watt (R208, R209)
513368	68,000 ohms, ±10%, 1 watt (R216)
8064	82,000 ohms, ±5%, ½ watt (R167)
503382	82,000 ohms, ±10%, ½ watt (R192)
513382	82,000 ohms, ±10%, 1 watt (R214)
503410	100,000 ohms, ±10%, ½ watt (R166, R203, R238)
513410	100,000 ohms, ±10%, 1 watt (R251)
30180	120,000 ohms, ±5%, ½ watt (R246)
503415	150,000 ohms, ±10%, ½ watt (R159, R195, R202, R204)
503422	220,000 ohms, ±10%, ½ watt (R207, R233)
502427	270,000 ohms, ±5%, ½ watt (R163, R165, R179)
503427	270,000 ohms, ±10%, ½ watt (R171, R226)
503433	330,000 ohms, ±10%, ½ watt (R116, R189, R205)
503439	390,000 ohms, ±10%, ½ watt (R255)
503447	470,000 ohms, ±10%, ½ watt (R117, R148, R160, R172, R184, R185, R217)
503468	680,000 ohms, ±10%, ½ watt (R169)
503482	820,000 ohms, ±10%, ½ watt (R206)
503510	1 megohm, ±10%, ½ watt (R181, R188)
502512	1.2 megohm, ±5%, ½ watt (R186)
503522	2.2 megohm, ±10%, ½ watt (R196)
72632	3.3 megohm, ±5%, 1 watt (R162)
503539	3.9 megohm, ±10%, ½ watt (R168)
503547	4.7 megohm, ±10%, ½ watt (R170)
503810	10 megohm, ±10%, ½ watt (R113)
77830	Shaft—Definition switch knob shaft
76626	Shaft—Definition switch extension shaft (6" overall)
77660	Shaft—Extension shaft for picture control
77661	Shell—Mounting shell for hi-voltage capacitor
76486	Shield—Hi-voltage shield less side and back covers
73584	Shield—Tube shield for V101, V102, V103, V106, V107, V109
77659	Shield—Tube shield for V105
76741	Shield—Tube shield for V113
75718	Socket—Channel indicator lamp socket
74834	Socket—Kinescope socket
71508	Socket—Tube socket, 6 pin, moulded for V117
50387	Socket—Tube socket, 6 pin, moulded, saddle-mounted for V118, V119

STOCK No.	PART DESCRIPTION
73117	Socket—Tube socket, miniature, 7 pin, wafer for V101, V102, V103, V104, V106, V107, V108, V109
77658	Socket—Tube socket, miniature, 7 pin, moulded, saddle-mounted for V105
71494	Socket—Tube socket, miniature, 7 pin, moulded, saddle-mounted for V114
73117	Socket—Tube socket, miniature, 7 pin, wafer for V124
31251	Socket—Tube socket, octal, wafer for V113, V116, V121, V122, V125
77645	Socket—Tube socket, octal, wafer for V115
76971	Socket—Tube socket, miniature, 9 pin, wafer for V110, V111, V112, V123
76428	Support—Bakelite support only—part of hi-voltage shield
77828	Switch—Definition switch (S104)
77827	Switch—Phono-tone switch (S101)
76463	Terminal—Screw type grounding terminal
77198	Transformer—1st pix I.F. grid transformer complete with adjustable cores (T104, C125, R125)
77197	Transformer—1st pix I.F. plate transformer complete with adjustable cores (T105, C131, C132, R130)
76435	Transformer—2nd pix I.F. grid transformer complete with adjustable cores (T106, C134)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
78488	Transformer—5th pix I.F. transformer (T109, C142, C143, CR101, L102, R146)
77833	Transformer—Hi-voltage transformer (Part of T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T114)
77821	Transformer—Output transformer (T103)
77822	Transformer—Power transformer, 117 volts, 60 cycle (T113)
76439	Transformer—Ratio detector transformer complete with adjustable cores (T102, C106, C107)
76438	Transformer—Sound I.F. transformer complete with adjustable cores (T101, C102, C103)
76437	Transformer—Sound take-off transformer complete with adjustable cores (T110, C147)
77650	Transformer—Vertical oscillator transformer (T111)
77823	Transformer—Vertical output transformer (T112)
76482	Trap—4.5 MC trap (L105, C150)
77585	Washer—"C" washer for picture control, extension shaft (2 req'd) or sharpness switch shafts (4 req'd)

SPEAKER ASSEMBLIES

971490-4W

RL105E1

RMA-274

STOCK No.	PART DESCRIPTION
75024	Cone—Cone and voice coil (3.2 ohms)
77872	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE:—If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.

MISCELLANEOUS

STOCK No.	PART DESCRIPTION
76624	Back—Cabinet back complete with power cord and cross-over network board for Models 27D382, 27D382U
78547	Back—Cabinet back complete with power cord and cross-over network board for models 27D383, 27D383U, 27D384, 27D384U
76184	Board—Antenna terminal board
78444	Board—Cross-over network board complete with cable, capacitors, coils and resistors
77748	Bracket—Mounting bracket for hidden controls, cover and case
71807	Capacitor—Adjustable, mica:— 10-160 mmf., for instruments using KRK12B tuner
	Capacitor—Fixed, headed-lead:—
78532	1.2 mmf., ±10%, 500 volts (C4)
78442	1.8 mmf., ±10%, 500 volts (C1, C2)
78443	2.7 mmf., ±10%, 500 volts (C3)
71892	Catch—Bullet catch and strike for doors
77755	Clamp—Polystyrene clamp for antenna cable and mount for F.M. trap for instruments using KRK12B tuner
X3349	Cloth—Grille cloth for mahogany or walnut instruments for Models 27D382, 27D382U, 27D383, 27D383U, or for maple instruments for Models 27D384, 27D384U
X3350	Cloth—Grille cloth for mahogany instruments for Models 27D384, 27D384U
X3371	Cloth—Grille cloth for oak instruments for Models 27D382, 27D382U
77870	Connector—Anode connector complete with contact and formed terminal
75474	Connector—Single contact male connector for antenna cable

GENERAL DESCRIPTION

Models 21-D-395 and 21-D-395U are deluxe "21 inch" television—AM-FM radio phonograph combinations. Model 21-D-395 features full 12 channel VHF coverage. Model 21-D-395U features full 12 channel VHF coverage plus any 4 UHF channels desired.

A three speed record changer is provided to play 33⅓, 45 and 78 RPM records.

The receivers are provided with cabinet antennas for AM, FM and television where local conditions permit their use.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE . 227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Model 21-D-395

All 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Model 21-D-395U

Any of 70 UHF channels .... 470 mc. to 890 mc.

Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency .... 45.75 mc.

Sound I-F Carrier Frequency .... 41.25 mc.

POWER RATING .... 395 watts max.

AUDIO POWER OUTPUT RATING .... 10 watts max.

CHASSIS DESIGNATIONS

Television Chassis .... Model 21-D-395—KCS81H

Model 21-D-395U—KCS81K

Radio Chassis RC1111A

Audio Chassis RS141E

Record Changer 930409-5

Refer to Service Data 930409 for record changer information

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK29—Model 21-D-395	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Tuner KRK12B—Model 21-D-395U	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control

A 1N82 crystal is used as a mixer.

RCA TUBE COMPLEMENT

Tube Used	Television Chassis	Function
	All Models	
(1) RCA 6AU6		1st Picture I-F Amplifier
(2) RCA 6CB6		2nd Picture I-F Amplifier
(3) RCA 6CB6		3rd Picture I-F Amplifier
(4) RCA 6CB6		4th Picture I-F Amplifier
(5) RCA 6CL6		Video Amplifier
(6) RCA 6AU6		1st Sound I-F Amplifier
(7) RCA 6AU6		2nd Sound I-F Amplifier
(8) RCA 6AL5		Ratio Detector
(9) RCA 6AV6		1st Audio Amplifier
(12) RCA 12AU7		Vert. Sync. Sep. and AGC
(13) RCA 12AU7		Horiz. Sync. Sep. and Sync. Ampl.
(14) RCA 6SN7GT		Vert. Sync. Amplifier and Vert. Sweep Osc.
(15) RCA 6AQ5		Vertical Sweep Output
(16) RCA 6SN7GT		Horizontal Sweep Oscillator and Control
(17) RCA 6CD6G		Horizontal Sweep Output
(18) RCA 6W4GT (2 tubes)		Dampers
(19) RCA 1B3-GT/8016		High Voltage Rectifier
(20) RCA 5U4G (2 tubes)		Rectifiers
(21) RCA 21AP4		Kinescope
	Radio Chassis RC1111A	
(1) RCA 6CB6		R-F Amplifier
(2) RCA 6J6		Mixer and Oscillator
(3) RCA 6BA6		I-F Amplifier
(4) RCA 6AU6		F-M Driver
(5) RCA 6AL5		Ratio Detector
(6) RCA 6AV6		AM Detector AVC and Audio Amplifier
	Audio Chassis RS141E	
(1) RCA 6C4		Phase Inverter
(2) RCA 6V6GT (2 tubes)		Audio Output
(3) RCA 5Y3GT		Rectifier

Models 21-D-395, 21-D-395U
"Bainbridge"
Mahogany

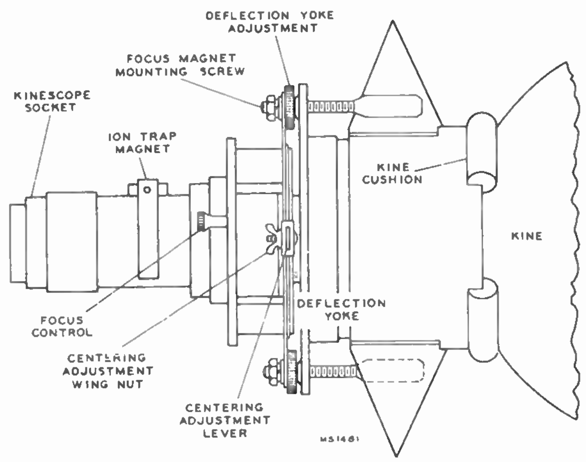


Figure 2—Yoke and Focus Magnet Adjustments

ELECTRICAL AND MECHANICAL SPECIFICATIONS (Continued)

RADIO TUNING RANGE

Broadcast .... 540-1,600 kc.

Frequency Modulation .... 88-108 mc.

Intermediate Frequency—AM .... 455 kc.

Intermediate Frequency—FM .... 10.7 mc.

ANTENNA INPUT IMPEDANCE

Model 21-D-395

Choice: 300 ohms balanced or 72 ohms unbalanced.

Model 21-D-395U

UHF—300 ohms balanced.

VHF—300 ohms balanced.

VIDEO RESPONSE .... To 4 mc.

FOCUS .... Magnetic

SWEEP DEFLECTION .... Magnetic

SCANNING .... Interlaced, 525 line

HORIZONTAL SCANNING FREQUENCY .... 15,750 cps

VERTICAL SCANNING FREQUENCY .... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) .... 30 cps

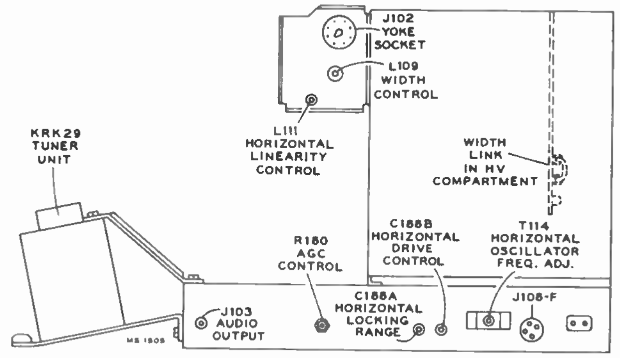


Figure 3—Rear Chassis Adjustments

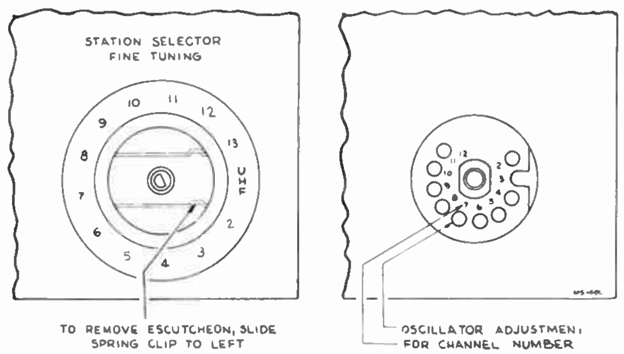


Figure 4—KRK29 R-F Oscillator Adjustments

OPERATING CONTROLS (front panel)

Channel Selector / Fine Tuning .... Dual Control Knobs

Brightness / Sound Volume and On-Off Switch .... Dual Control Knobs

Picture Horizontal Hold .... Single Control (Knurled)

Picture Vertical Hold .... Single Control (Knurled)

Picture .... Single Control Knob

Tone Switch .... Single Control Knob

Radio Tuning .... Single Control Knob

NON-OPERATING CONTROLS

Horizontal Centering .... top chassis adjustment

Vertical Centering .... top chassis adjustment

AGC .... rear chassis adjustment

Height .... front panel screwdriver adjustment

Horizontal Locking .... rear chassis screwdriver adjustment

Vertical Linearity .... front panel screwdriver adjustment

Horizontal Drive .... rear chassis screwdriver adjustment

Horizontal Oscillator Frequency .... rear chassis adjustment

Horizontal Oscillator Waveform .... bottom chassis adjustment

Width Link .... H.V. compartment adjustment

Focus .... top chassis adjustment

Ion Trap Magnet .... top chassis adjustment

Deflection Coil .... top chassis adjustment

Focus Magnet .... top chassis adjustment

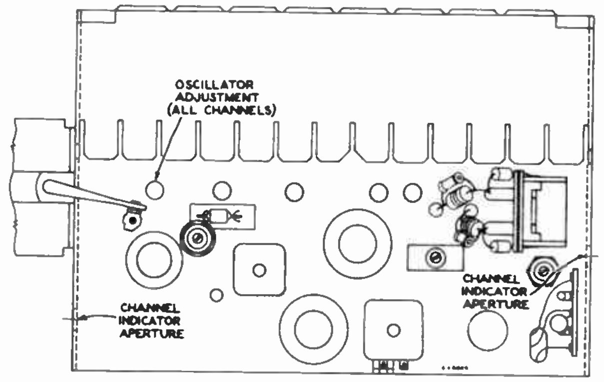


Figure 5—KRK12B Oscillator Adjustment

AGC THRESHOLD CONTROL.—The AGC Threshold Control R180 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not over-loading due to improper setting of R180. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R180 should be readjusted.

Turn R180 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R180 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R180 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R180 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

TELEVISION CHASSIS TOP VIEW

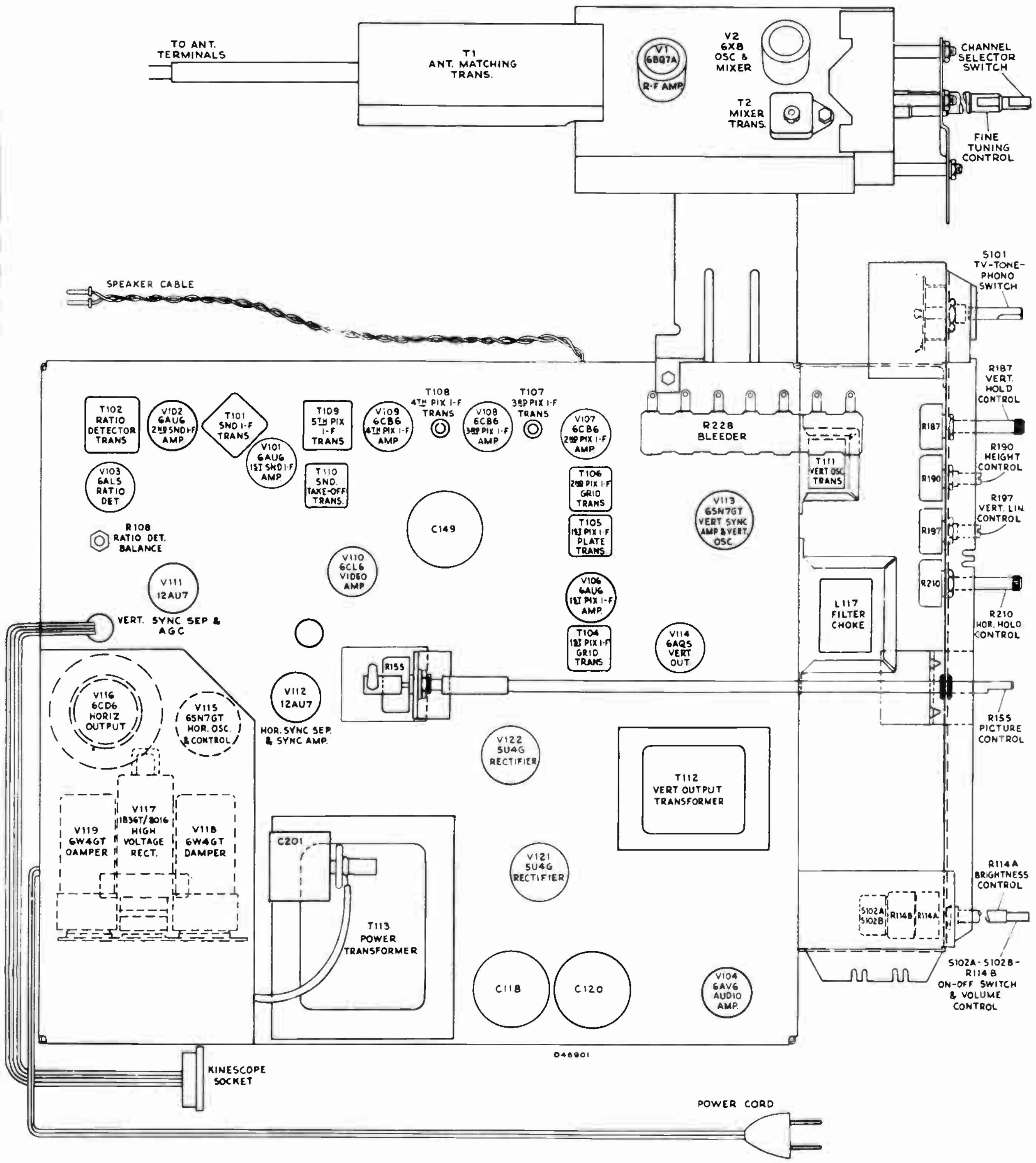


Figure 7—Television Chassis Top View (shown with KRK29 Tuner)

TELEVISION CHASSIS BOTTOM VIEW

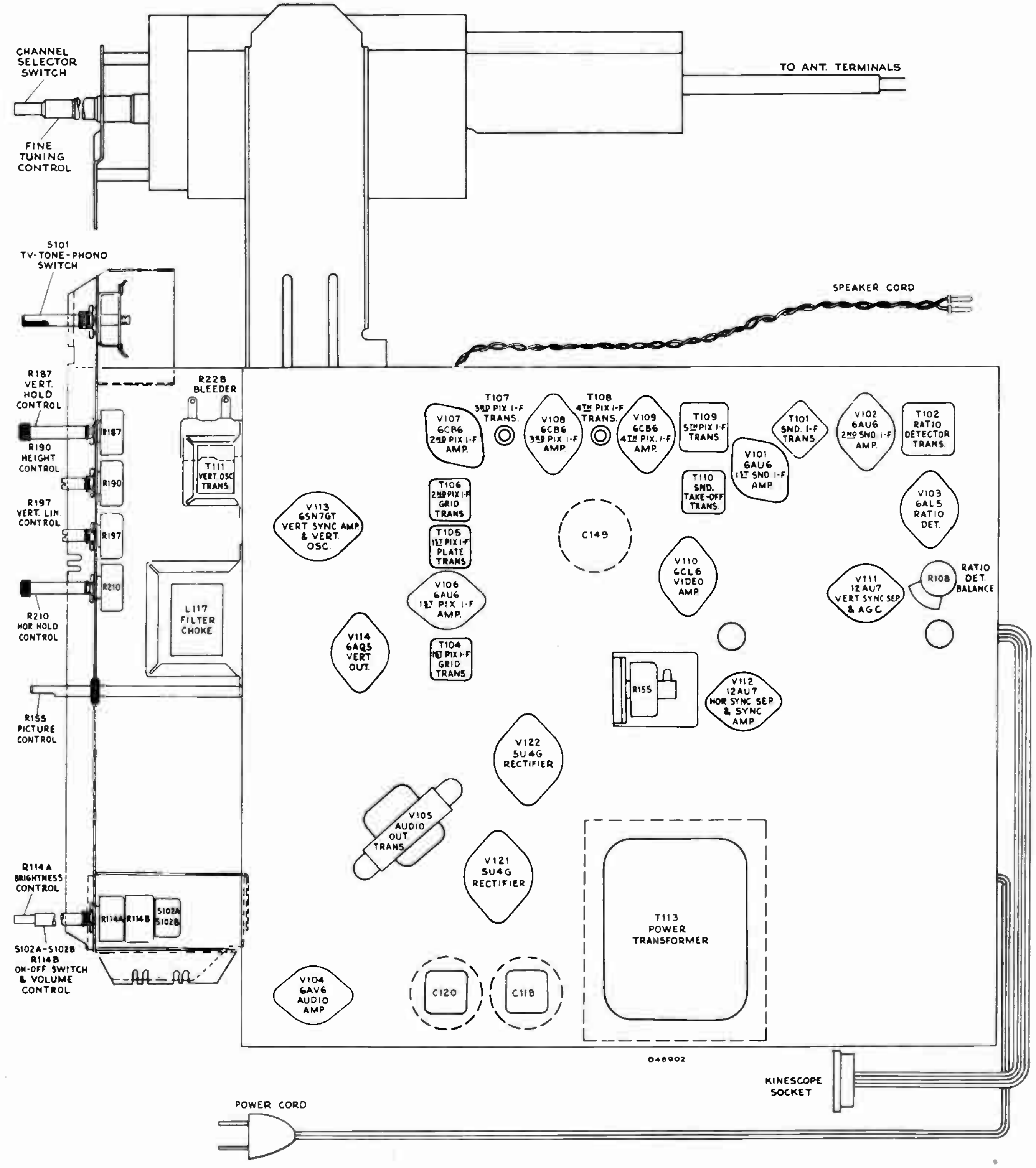


Figure 8—Television Chassis Bottom View (shown with KRK29 Tuner)

TELEVISION ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:
(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:
(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12B Tuner. Wiring of adapter is shown in Figure 9.

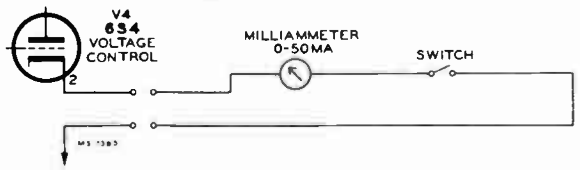


Figure 9—KRK12B Voltage Control Adapter

KRK29 ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal, especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1,000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R133 and C133B. Set the potentiometer to produce approximately -5.0 volts of bias at the junction of R133 and C133B.

Connect an oscilloscope to pin 9, V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 17 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in Figure 10. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

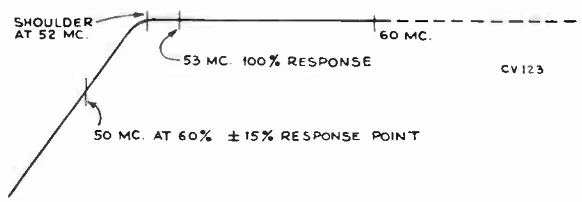


Figure 10—KRK29 Antenna Matching Unit Response

PICTURE I-F TRAP ADJUSTMENT.—Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R133 and C133B.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the positive terminal of one battery to chassis and the potentiometer arm to the junction of R133 and C133B.

Set the bias to produce approximately -1.0 volt of bias at the junction of R133 and C133B.

Connect the "VoltOhmyst" to pin 9 of V110, the 6CL6 video amplifier.

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS.—
Model 21-D-395

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with -1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to -1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 11. For final adjustment set the output of the sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

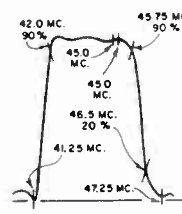


Figure 11—T105 and T106 Response

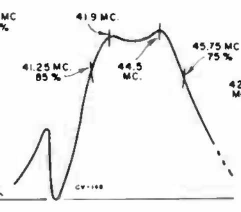


Figure 12—T2 and T104 Response with KRK29

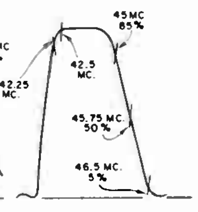


Figure 13—Over-all I-F Response with KRK29

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Connect a 180 ohm composition resistor between terminal "E" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 12.

Disconnect the diode probe, the 180 ohm and three 330 ohm resistors.

Model 21-D-395U

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with -1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to -1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110, the 6CL6 video amplifier.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 11. For final adjustment set the output of the VHF sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align the crystal mixer and T2 and T104, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1,500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust the shunt trimmer C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 14. Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 15.

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

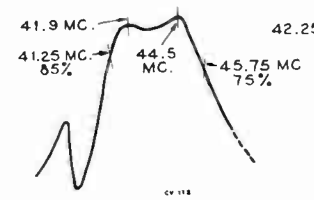


Figure 14—T2 and T104 Response with KRK12B

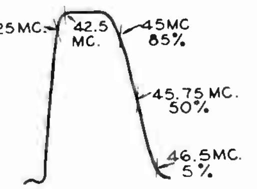


Figure 15—Over-all I-F Response with KRK12B

SWEEP ALIGNMENT OF PIX I-F.—

Connect the oscilloscope to pin 9 of V110.

Adjust the bias potentiometer to obtain -6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R133 and C133B.

Leave the sweep generator connected to the mixer grid test point TP2 on KRK29 Tuner or to the front terminal of the 1N82 crystal holder on KRK12B Tuner. Use the shortest leads possible with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T108 and T109 to obtain the response shown in Figure 13 for KRK29 or Figure 15 for KRK12B. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK29 TUNER ALIGNMENT
Model 21-D-395

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

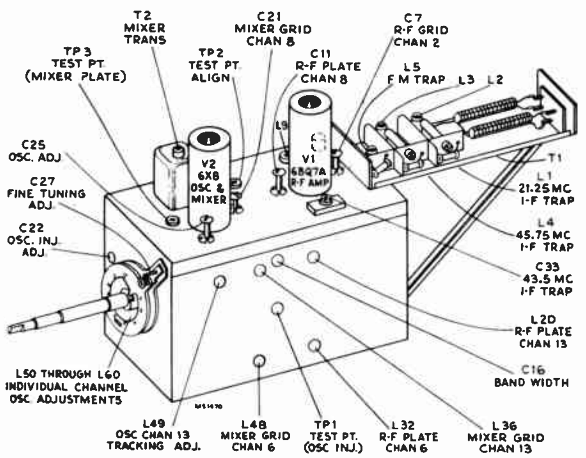


Figure 16—KRK29 Tuner Adjustments

Connect the oscilloscope to the test point TP1 on the side of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce -3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read -3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechnical center of its range.

NOTE.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

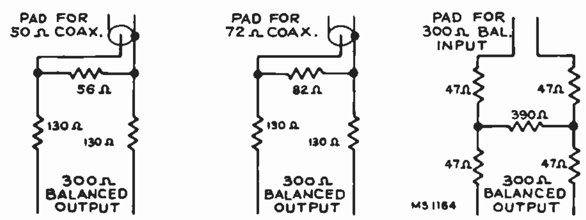


Figure 17—Sweep Attenuator Pads

Connect the sweep generator through a suitable attenuator, as shown in Figure 17 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and bandwidth as shown in Figure 18.

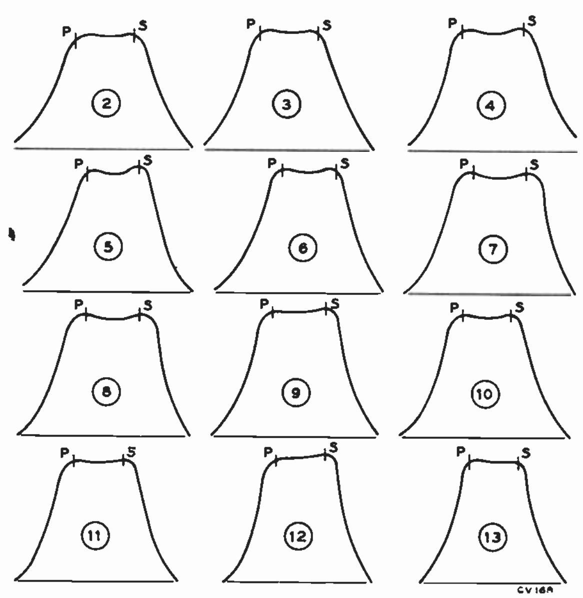


Figure 18—KRK29 R-F Response

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response bandwidth.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read -3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency, 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

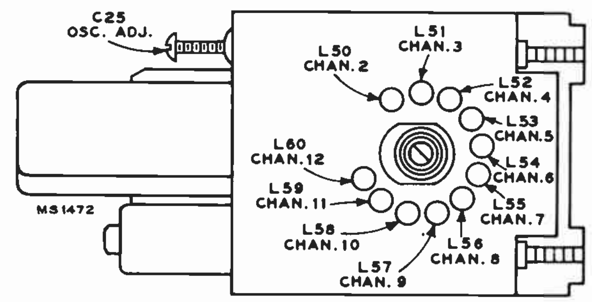


Figure 19—KRK29 R-F Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12B TUNER ALIGNMENT
Model 21-D-395

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(**NOTE:** The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope through the preamplifier, if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 20. The proper curve shape is shown in Fig-

TELEVISION ALIGNMENT PROCEDURE

use 20(b). (Refer to note on page 15 for detailed explanation of adjustments.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

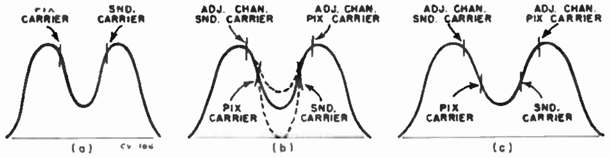


Figure 20—KRK12B VHF Insert Responses

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise and remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce −3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce −5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum marker indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

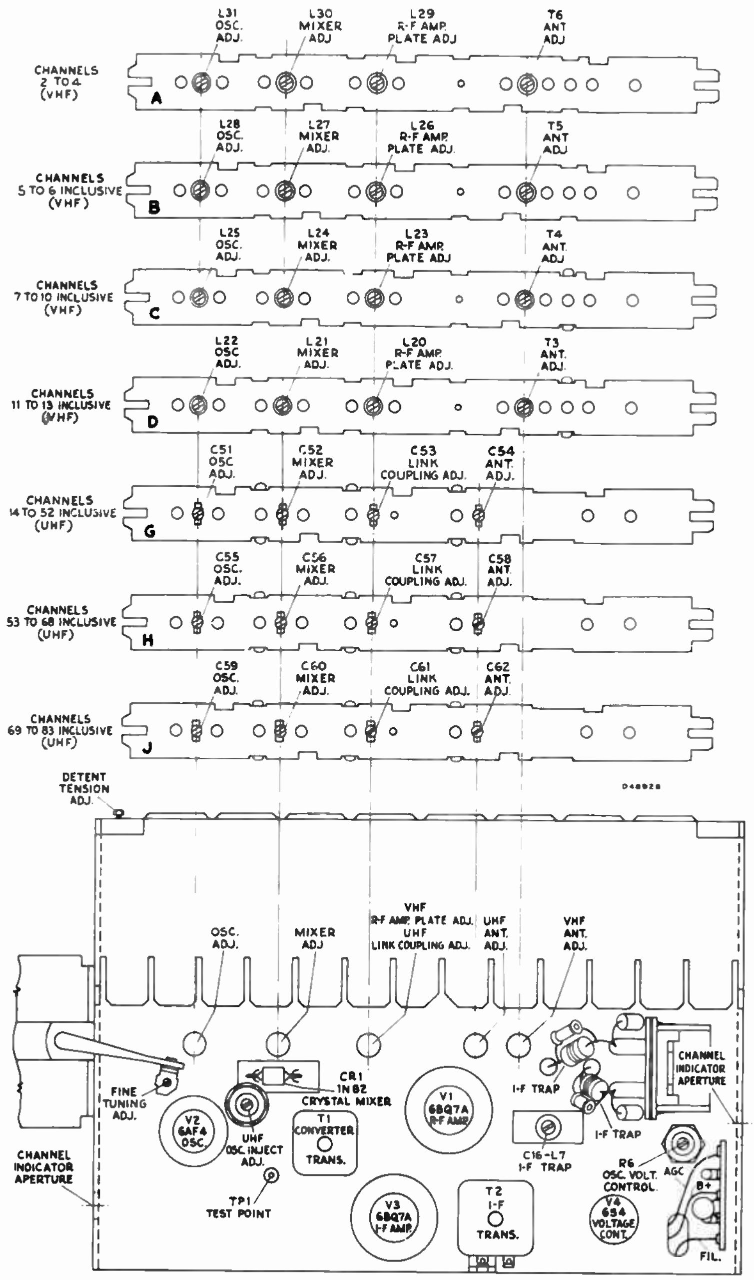


Figure 21—KRK12B Tuner Adjustments

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier frequencies for the desired channel (see Table on page 8).

Adjust the UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 22. The curve shape will usually vary from Figure 22 (a) to Figure 22 (c) going higher in frequency; however, any of these responses are acceptable.

Repeat the above steps for all UHF inserts used, adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier, if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce −3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce −5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used, and set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Figure 15.

Set the UHF marker generator to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust the mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt DC scale.

Set oscillator injection adjustment to read .1 volt on the "VoltOhmyst."

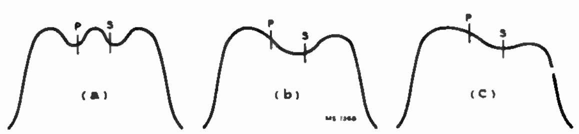


Figure 22—KRK12B UHF Insert Responses

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

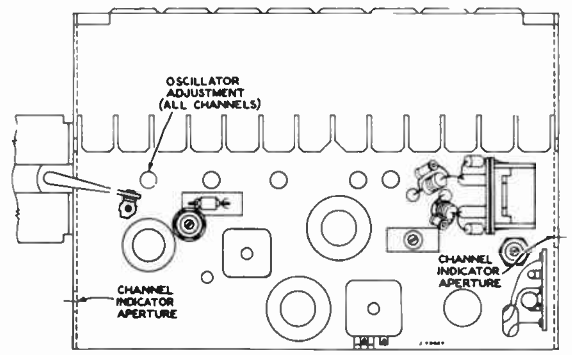


Figure 23—KRK12B Oscillator Adjustment

RATIO DETECTOR ALIGNMENT.—In order to obtain good ratio detector alignment an AM modulated signal generator that is exceptionally free from FM modulation must be employed. Set the signal generator at 4.5 mc. and connect it to the second sound i-f grid, pin 1 of V102. Set the generator for 30% 400 cycle modulation.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. If used, connect it to the grid of the 4th pix i-f amplifier, pin 1, V109. Set the frequency of the calibrator to 45.75 (pix carrier) and modulate with 4.5 mc. crystal. Also turn on the internal AM audio modulation. The 4.5 mc. signal will be picked off at T110A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to the junction of R111 and C111.

Connect the oscilloscope across the speaker voice coil and turn the volume control for maximum output.

Tune the ratio detector primary, T102 top core for maximum DC output on the "VoltOhmyst." Adjust the signal level from the signal generator for −10 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R110 and C110.

Adjust the T102 bottom core for zero d-c on the meter. Then, turn the core to the nearest minimum AM output on the oscilloscope.

Repeat adjustments of T102 top for maximum DC and T102 bottom for minimum output on the oscilloscope making final adjustment with the 4.5 mc. input level adjusted to produce 10 volts d-c on the "VoltOhmyst" at the junction of R111 and C111.

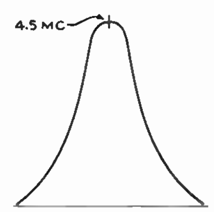


Figure 24—Sound I-F Response

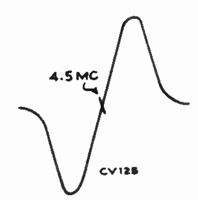


Figure 25—Ratio Det. Response

TELEVISION ALIGNMENT PROCEDURE

Connect the "VoltOhmyst" to the junction of R110 and C110 and note the amount of d-c present. If this voltage exceeds ±1.5 volts, adjust R108 by turning it in until zero d-c is obtained Readjust the T102 bottom core for minimum output on the oscilloscope. Repeat adjustments of R108 and T102 bottom core until the voltage at R110 and C110 is less than ±1.5 volts when T102 bottom core is set for minimum output on the oscilloscope.

Connect the "VoltOhmyst" to the junction of R111 and C111 and repeak T102 top core for maximum d-c on the meter and again reset the generator so as to have –10 volts on the meter.

Repeat the adjustments in the above two paragraphs until the voltage at R110 and C110 is less than ±1.5 volts when the T102 top core is set for maximum d-c at the junction of R111 and C111 and the T102 bottom core is set for minimum indication on the oscilloscope.

SOUND I-F ALIGNMENT.—Connect the sweep generator to the first sound i-f amplifier grid, pin 1 of V101. Adjust the generator for a sweep width of 1 mc. at a center frequency of 4.5 mc.

Insert a 4.5 mc. marker signal from the signal generator into the first sound i-f grid. With the WR39B or WR39C calibrators the 4.5 mc. crystal signal may be obtained at the R-F out terminal by turning the variable osc. switch off, the calibrate switch to 4.5 mc. and the volume control with mod. off.

Connect the oscilloscope in series with a 10,000 ohm resistor to terminal A of T101.

Adjust T101 top and bottom cores for maximum gain and symmetry about the 4.5 mc. marker on the i-f response. The pattern obtained should be similar to that shown in Figure 24.

The output level from the sweep should be set to produce approximately 2.0 volt peak-to-peak at terminal A of T101 when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

Connect the oscilloscope to the junction of R110 and C110 and check the linearity of the response. The pattern obtained should be similar to that shown in Figure 25.

SOUND TAKE-OFF ALIGNMENT.—Connect the 4.5 mc. generator in series with a 1,000 ohm resistor to terminal "C" of T110. The input signal should be approximately 0.5 volt.

Short the fourth pix i-f grid to ground, pin 1, V109, to prevent noise from masking the output indication.

As an alternate source of signal the RCA WR39B or WR39C calibrator may be used. In such a case, disregard the above two paragraphs. Connect calibrator across link circuit, T104 A, B, and modulate 45.75 with a 4.5 mc. crystal.

Connect the crystal diode probe of a "VoltOhmyst" to the plate of the video amplifier, pin 6 of V110.

Adjust the core of T110 for minimum output on the meter.

Remove the short from pin 1 V109 to ground, if used.

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it cannot be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R210, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C186B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and one diagonal black bar sloping down to the right appears on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain one diagonal black bar on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture begins to fall out of sync with the diagonal bar sloping down to the right. Continue to turn the frequency core in the same direction. Additional bars should not appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 26. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

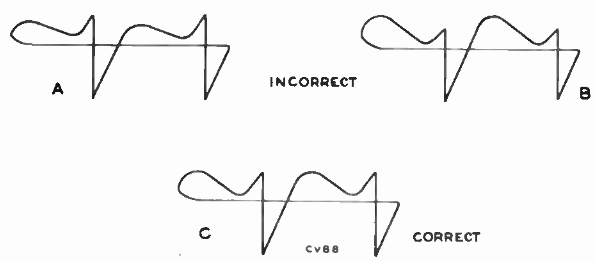


Figure 26—Horizontal Oscillator Wave Forms

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C186A slightly clockwise. If less than 2 bars are present, adjust C186A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

RESPONSE CURVES.—The response curves shown and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON KRK12B TUNER ALIGNMENT.—The use of a crystal mixer in the KRK12B Tuner makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in Figure 20 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in Figure 20(b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in Figures 20(a) and 20(c).

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1 but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

RADIO VOLTAGE CHART

Voltages shown are as read with "VoltOhmyst" between indicated terminal and chassis, with receiver operating on 117 volts, and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Tube	Pin No.	AM	FM	Phono.
V1 6CB6 R-F Amp	5	215	180	—
	6	74	62	—
	2	0.4	0.4	—
	1	—0.8	0.4	—
V2 6J6 Osc & Mixer	2	55	58	—
	5	—1.2	—1.3	—
	1	43	46	—
	6	—1.2	—1.2	—
V3 6BA6 I-F Amp	5	210	210	—
	6	126	115	—
	7	0.9	0.7	—
	1	—0.8	—0.2	—
V4 6AU6 Driver	5	216	216	—
	6	150	150	—
	7	1.5	1.5	—
	1	0	0	—
V5 6AL5 Ratio Det.	—	—	—	—
V6 6AV6 Audio Amp	7	88	88	104
	1	—0.7	—0.7	—0.8
V102 6C4 Phase Invert.	5	88	88	120
	7	—11	—11	—13
	6	—16	—16	—19
V103 & V104 6V6GT Audio Output	3	300	300	298
	4	224	224	292
	8	0	0	0
	9	—17	—17	—21
V101 5Y3GT Rect.	8	305	305	307

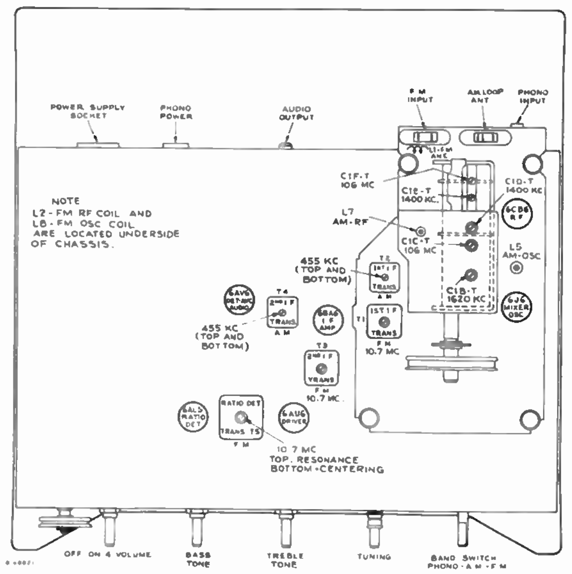
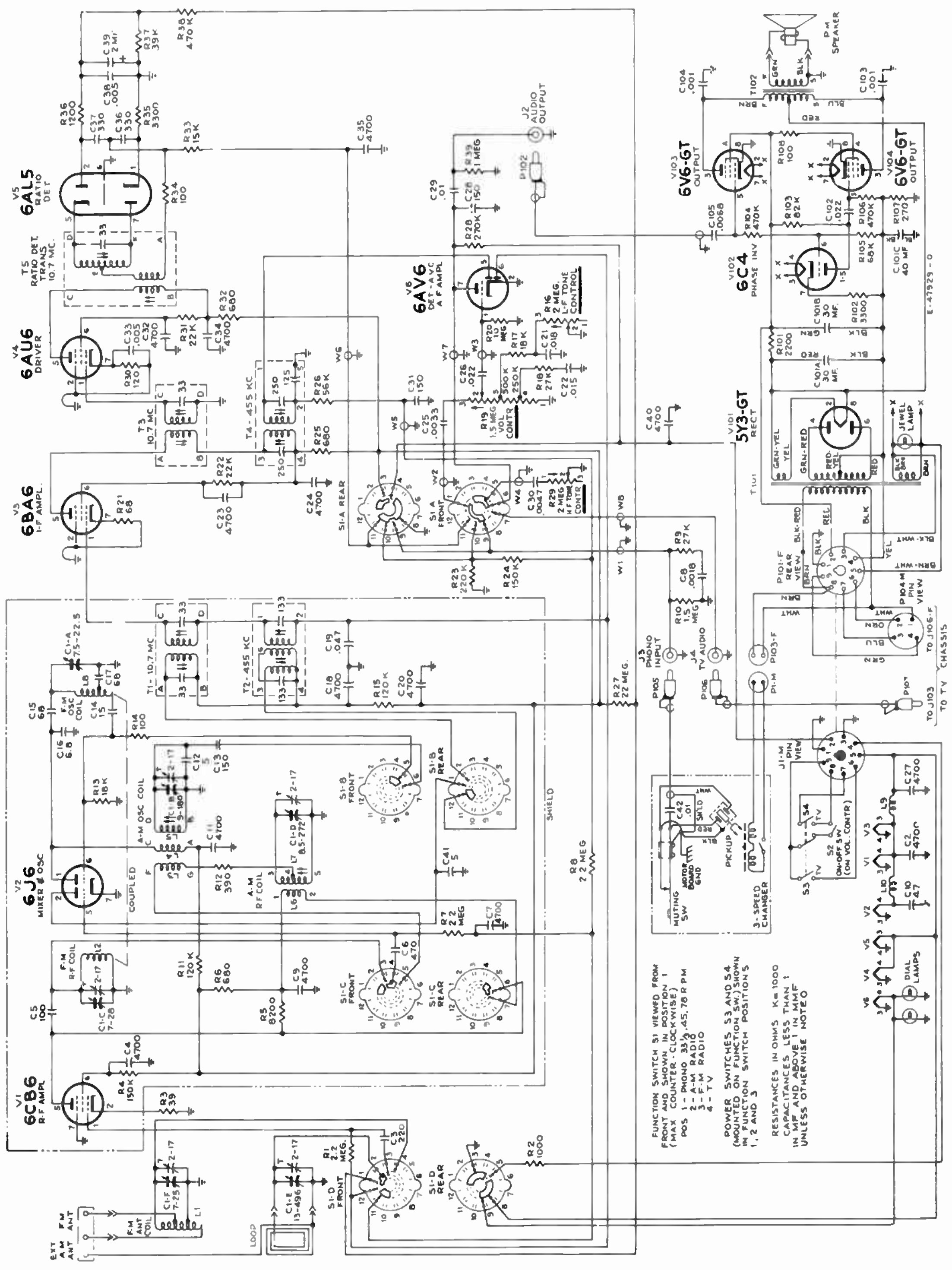


Figure 28—Radio Top View

TELEVISION ALIGNMENT PROCEDURE



RADIO SCHEMATIC DIAGRAM

Figure 27—Radio Schematic Diagram

All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

CRITICAL LEAD DRESS

1. The 1st F-M i-f plate lead should be dressed away from the r-f amp plate.
2. Dress the 1st AM i-f plate lead to the S2 wafer away from the AM r-f coil.
3. Dress the a-c power switch wires away from all audio components.
4. Dress C26 down toward the base between the terminal board and the side apron.
5. The C18 bypass ground should be as close to the r-f shelf ground strap as possible.
6. Dress C25 away from the arm contact of the volume control.
8. All leads from the r-f shelf leaving through the shields must be kept as short as possible.
9. All leads for FM should be kept short especially on the r-f shelf.
10. Dress the a-c leads in the RS141 chassis away from the audio input leads and components.
11. Dress all leads away from R101 in RS141.

RADIO ALIGNMENT PROCEDURE

Before aligning set, completely mesh the gang and set the dial pointer to the mechanical max. calibration point at extreme left end of dial. When making a complete alignment follow the table below in sequence. Connect the output meter across the speaker voice coil, and turn the receiver volume control to max. Turn tone controls for maximum highs and maximum lows.

"AM" I-F ALIGNMENT

Test-Oscillator.—Connect low side of the test-osc. to the chassis, and keep the output as low as possible to avoid a-v-c action.

Steps	Connect the High Side of the Test Osc. to—	Tune Test Osc. to—	Function Switch	Turn Radio Dial to—	Adjust the following
1	Pin No. 1 of (43) in series with .01 mfd.	455 kc. Modulated	AM	Low Freq. end of Dial	†Top and bot. cores of T4 For max. voltage across voice coil.
2	Stator of C1-D in series with .01 mfd.	455 kc. Modulated	AM	Low Freq. end of Dial	†Top and bot. cores of T2 For max. voltage across voice coil.

†For proper adjustment of the i-f cores start with the cores all the way out. The first peak obtained will be the correct one.

FM ALIGNMENT PROCEDURE

Connect probe of "VoltOhmyst" to negative side of C39 and low side to chassis. Top shield must be on and the bottom shield off.

Steps	Connect the High Side of the Test Osc. to—	Tune Test Osc. to—	Function Switch	Turn Radio Dial to—	Adjust the following
3	Pin No. 1 of V4 in series with .01 mfd.	10.7 mc. 30% AM Modulated	FM	———	Top of Ratio d-c† Trans. T5 for maximum DC on "VoltOhmyst."
4	Pin No. 1 of V4 in series with .01 mfd.		FM	———	Bottom of Ratio d-c† Trans. T5 for minimum audio output on meter.
5	Repeat steps 3 and 4 as necessary making final adjustment with input set to give approx. —4.0 v. on "VoltOhmyst."				
6	Pin No. 1 of V3 in series with .01 mfd.	10.7 mc.	FM	88 mc.	†Top and bottom cores of T3 for maximum d-c across C39.
7	Stator of C1-C in series with .01 mfd.	10.7 mc.	FM	88 mc.	†Top and bottom cores of T1 for maximum d-c across C39.
8	Connect sweep generator cable to antenna terminals through 120 ohms in each side of line.	90 mc. 22.5 kc. FM mod.	FM	90 mc.	OSC, L8 for max. audio output.
9		106 mc. 22.5 kc. FM mod.	FM	Tune to signal	ANT, C1-FT and R-F C1-CT for max. voltage across C39.
10		90 mc. 22.5 kc. FM mod.	FM	Tune to signal	ANT, L1 and R-F L2 for max. voltage across C39.
11	Repeat steps 8, 9 and 10 as required.				
12	Connect a scope to junct. R33 and C35. Check response and linearity. Peak separation should be at least 180 kc.				

†For proper adjustment of the i-f cores start with the cores all the way out. The first peak obtained will be the correct one.

"AM" R-F ALIGNMENT

Steps	Connect the High Side of the Test Osc. to—	Tune Test Osc. to—	Function Switch	Turn Radio Dial to—	Adjust the following
13	External radiating loop and couple loosely to receiver loop.	1,620 kc.	AM	Min. capacity	*Osc. C1-BT for maximum output.
14		1,400 kc.	AM	Tune to signal	*C1-DT and C1-ET for max. output.
15		600 kc.	AM	Tune to signal	‡Osc. L5 for max. output while rocking gang.
16		600 kc.	AM	Tune to signal	***R-F L7 for max. output.
17	Repeat steps 13, 14, 15 and 16 until no additional gain in sensitivity is obtained.				

‡Clip a 10,000 ohm resistor across C1-D when making this adjustment.
***Be sure the resistor employed in step 15 is removed for this adjustment.
*All R-F shields must be in place.

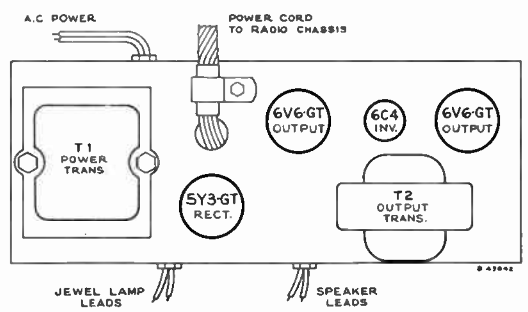


Figure 29—Audio Chassis Top View

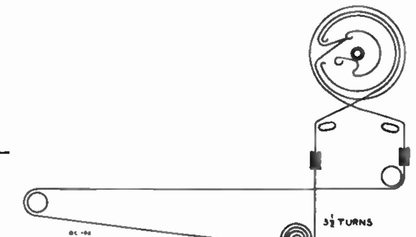


Figure 30—Dial Cord

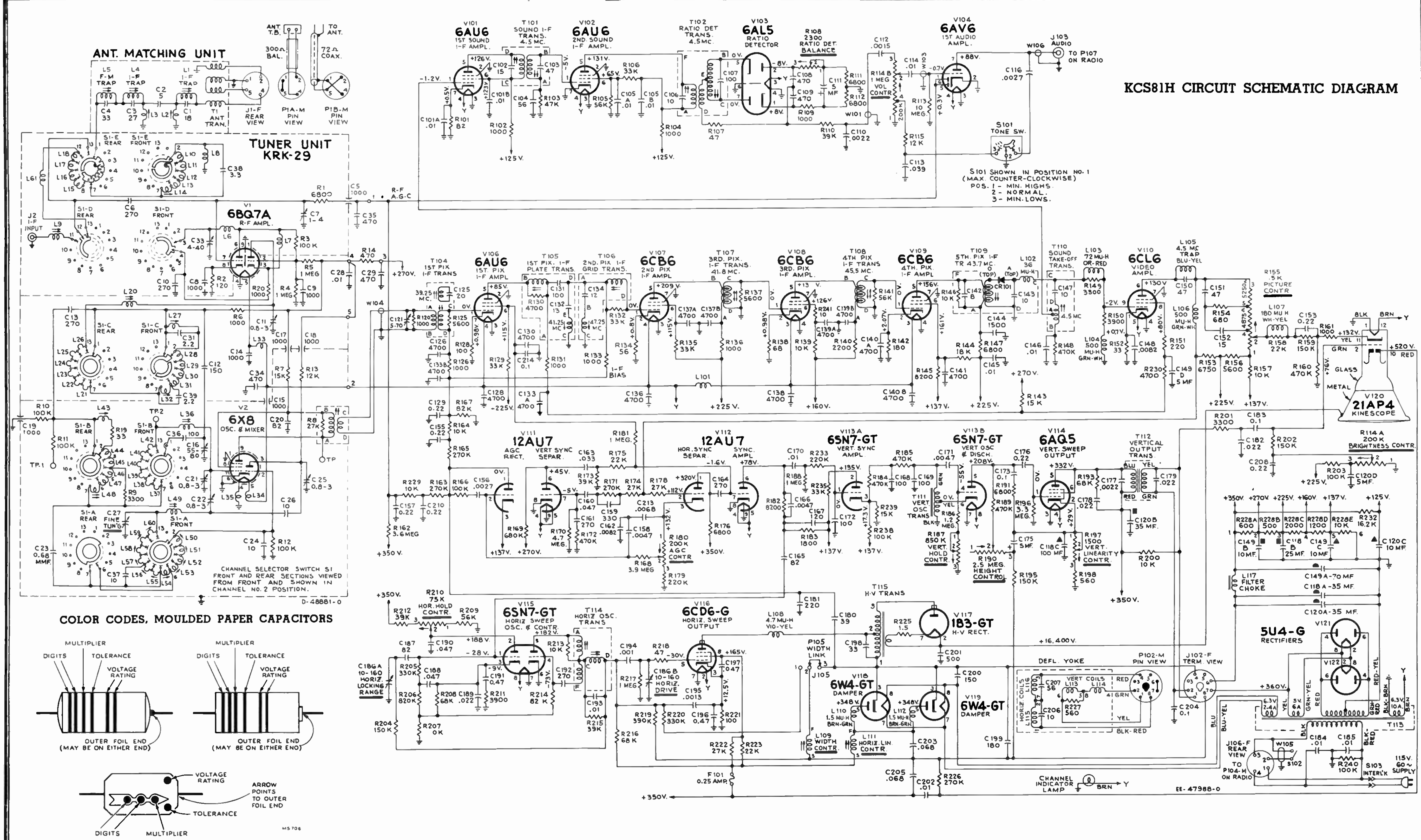
TELEVISION VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

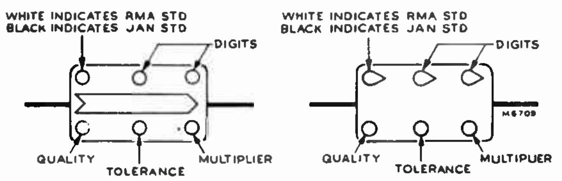
Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V1	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	170	—	—	8	0.1	7		—	—	
KRK29			No Signal	6	133	—	—	8	1.1	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	
V2	6X8	Mixer	5000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	—	—	
KRK29			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	—	—	
		R-F Oscillator	5000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	—	—	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	—	—	
V1	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	—	—	
KRK12B			No Signal	6	138	—	—	8	1.0	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	260	—	—	3	143	2	97	—	—	
			No Signal	1	250	—	—	3	137	2	97	—	—	
V2	6AF4	R-F Oscillator	5000 Mu. V. Signal	1 & 7	78	—	—	5	0	2 & 6	−8	—	—	
KRK12B			No Signal	1 & 7	75	—	—	5	0	2 & 6	−6	—	—	
V3	6BQ7A	I-F Amplifier	5000 Mu. V. Signal	6	270	—	—	8	148	7	103	—	—	
KRK12B			No Signal	6	260	—	—	8	142	7	99	—	—	
		I-F Amplifier	5000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	—	—	
			No Signal	1	143	—	—	3	1.2	2	0	—	—	
V4 KRK12B	6S4	Voltage Control	5000 Mu. V. Signal	9	270	—	—	2	94	6	*68	—	—	*Depends on adjustment of R6.
			No Signal	9	260	—	—	2	90	6	*65	—	—	
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	127	6	124	7	0.7	1	−0.4	6.0	3.0	
			No Signal	5	126	6	123	7	0.5	1	−1.2	5.0	3.0	
V102	6AU6	2nd Sound I-F Amp.	5000 Mu. V. Signal	5	132	6	60	7	0	1	−10	2.8	1.2	
			No Signal	5	131	6	65	7	0	1	−5	2.0	1.0	
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	2 7	−9.2 1.0	—	—	5 1	1.0 9.2	—	—	—	—	
			No Signal	2 7	−8.0 0	—	—	5 1	0 8.0	—	—	—	—	
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	90	—	—	2	0	1	−0.7	0.65	—	At min. volume
			No Signal	7	88	—	—	2	0	1	−0.7	0.65	—	
V104	6AV6	R-F Bias Clamp	5000 Mu. V. Signal	5-6	−3.0	—	—	2	0	—	—	—	—	
			No Signal	5-6	0.3	—	—	2	0	—	—	—	—	
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	160	6	215	7	0.17	1	−6.6	1.4	.4	
			No Signal	5	85	6	115	7	0.98	1	0	6.5	3.3	

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	227	6	225	2	0.1	1	−6.6	1.5	.25	
			No Signal	5	209	6	115	2	0.8	1	0	10.9	3.3	
V108	6CB6	3rd Pix. I-F Amplifier	5000 Mu. V. Signal	5	138	6	132	2	1.02	1	0	11.4	3.5	
			No Signal	5	134	6	126	2	.98	1	0	10.4	3.1	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	168	6	165	2	2.32	1	0	8.85	2.2	
			No Signal	5	156	6	161	2	2.07	1	0	8.6	2.1	
V110	6CL6	Video Amplifier	5000 Mu. V. Signal	6	130	3-8	159	1	.84	2-9	*−5.0	22.5	5.5	*Depends on picture
			No Signal	6	130	3-8	80	1	0.7	2-9	*−2.0	15.0	4.0	*Depends on picture
V111A	12AU7	AGC Rectifier	5000 Mu. V. Signal	1	−30	—	—	3	142	—	—	0	—	AGC control set for normal operation
			No Signal	1	0	—	—	3	137	—	—	0	—	
V111B	12AU7	Vert. Sync. Separator	5000 Mu. V. Signal	6	110	—	—	8	0	7	−42	.25	—	
			No Signal	6	45	—	—	8	0	7	*−5	.25	—	*Depends on noise
V112A	12AU7	Hor. Sync. Separator	5000 Mu. V. Signal	1	323	—	—	3	192	2	116	.5	—	
			No Signal	1	320	—	—	3	132	2	112	.5	—	
V112B	12AU7	Sync. Amplifier	5000 Mu. V. Signal	6	78	—	—	8	0	7	−3.5	6.2	—	
			No Signal	6	78	—	—	8	0	7	−1.6	6.2	—	
V113A	6SN7GT	Vert. Sync. Amplifier	5000 Mu. V. Signal	2	140	—	—	3	19.2	1	−.35	0.1	—	
			No Signal	2	135	—	—	3	17.3	1	0	<0.1	—	
V113B	6SN7GT	Vert. Osc. & Discharge	5000 Mu. V. Signal	5	203	—	—	6	0	4	−56	.2	—	
			No Signal	5	208	—	—	6	0	4	−55	.2	—	
V114	6AQ5	Vertical Output	5000 Mu. V. Signal	5	334	6	334	2	30	1	0	17.3	1.2	
			No Signal	5	332	6	332	2	29	1	0	17.3	1.2	
V115	6SN7GT	Horizontal Osc. Control	5000 Mu. V. Signal	2	188	—	—	3	−9	1	−28	0.37	—	Hor. hold at mid-range
			No Signal	2	0	—	—	3	0	1	0	0	—	
		Horizontal Oscillator	5000 Mu. V. Signal	5	184	—	—	6	0	4	−72	2.5	—	Hor. hold at mid-range
			No Signal	5	182	—	—	6	0	4	−73	2.5	—	
V116	6CD6G	Horizontal Output	5000 Mu. V. Signal	Cap	*	8	165	3	12.5	5	−30	110	15.0	*High Voltage Pulse Present
			No Signal	Cap	*	8	165	3	12.5	5	−30	110	15.0	
V117	1B3GT /8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	
V118 V119	6W4GT	Dampers	5000 Mu. V. Signal	5	352	—	—	3	*	—	—	57	—	*High Voltage Pulse Present
			No Signal	5	348	—	—	3	*	—	—	57	—	
V120	21AP4	Kinescope	5000 Mu. V. Signal	Cone	16,000	10	525	11	140	2	*82	0.2	—	At average Brightness
			No Signal	Cone	16,400	10	520	11	132	2	*76	0.2	—	*0 voltage on Phono. position
V121 V122	5U4G	Rectifiers	5000 Mu. V. Signal	4 & 6	364	—	—	2 & 8	364	—	—	*145	—	*Per Tube
			No Signal	4 & 6	360	—	—	2 & 8	360	—	—	*150	—	

KCS81H CIRCUIT SCHEMATIC DIAGRAM



RMA COLOR CODE, FIXED MICA CAPACITORS



The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

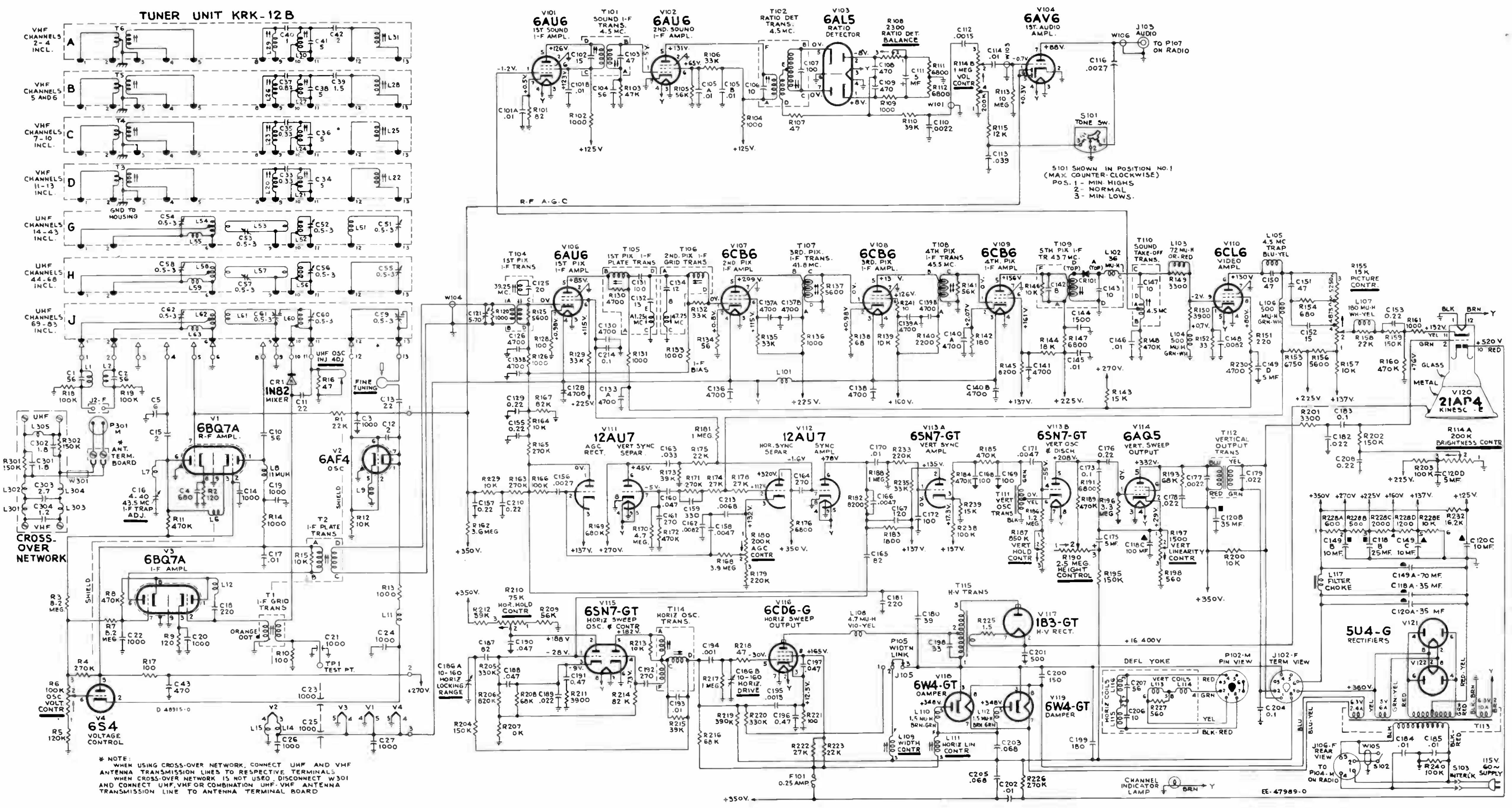
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 33—Circuit Schematic Diagram, KCS81H

KCS81K CIRCUIT SCHEMATIC DIAGRAM



The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 34—Circuit Schematic Diagram, KCS81K

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
	RF UNIT ASSEMBLIES—KRK29
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78235	Board—Terminal board, 5 contact and ground
78233	Bracket—Side bracket for mounting coil and stators
77853	Capacitor—Ceramic, variable, for fine tuning capacitor—plunger type (C27)
	Capacitor—Adjustable, mica:—
77616	4-40 mmf. (C33)
	Capacitor—Adjustable, steatite:—
77151	0.8—3.0 mmf. (C11, C21, C25)
77913	0.8—3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:—
77084	feed thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. =0
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:—
77293	470 mmf., +100%, —0%, 500 volts (C29, C34, C35)
77252	1000 mmf., +100%, —0%, 500 volts (C8, C9, C14)
73960	10,000 mmf., +100%, —0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K"
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. =0
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, ceramic, Temp. coef. =N1400
78603	82 mmf., ±10%, 500 volts (C20)
	Capacitor—Fixed, headed-lead:—
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31, C39)
71503	3.3 mmf., ±20%, 500 volts (C38)
	Capacitor—Mica trimmer:—
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
73458	Coil—Channel #6 r.f. grid coil (L14)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r.f. plate coil (L20)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
78583	Coil—Mixer I.F. coil (L43)
76562	Coil—RF amplifier coupling coil (L7)
78584	Coil—RF plate I.F. coil (L27)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
503033	33 ohms, ±10%, ½ watt (R19)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Convertor transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—IF trap
76542	Trap—IF trap (41.25 MC) complete with core (L1)
76541	Trap—IF trap (45.75 MC) complete with core (L4)
75190	Washer—Insulating washer (neoprene) for capacitor
	RF UNIT ASSEMBLIES—KRK12B
77580	Ball—Steel ball (.125" dia.) (12 req'd)
77579	Ball—Steel ball (.187 " dia.)
78601	Bracket—Bracket and spring contact assembly for rotor detent ground for units stamped KRK12B1-M1
77575	Bracket—Drive mechanism mounting bracket for unit stamped KRK12B1
78599	Bracket—Drive mechanism mounting bracket for units stamped KRK12B1-M1
77589	Bracket—Lamp bracket
77619	Bracket—VHF input connector and bracket
76845	Bracket—Vertical bracket for oscillator tube shield
77591	Cam—Fine tuning cam
	Capacitor—Adjustable, mica:—
77616	4-40 mmf. (C16)
	Capacitor—Ceramic:—
77084	feed-thru, 1000 mmf. (C21, C23, C25)
77615	stand-off, 1000 mmf. (C3, C19, C24, C26)
	Capacitor—Fixed, ceramic, crystal holder, temp. coef. = —750
77621	22 mmf., ±10% (C11)
	Capacitor—Fixed, ceramic, High "K" disc:
77625	220 mmf., +100%, —0%, 500 volts DC (C18)
77293	470 mmf., +100%, —0%, 500 volts DC (C43)
77624	680 mmf., +100%, —0%, 500 volts DC (C4)
77252	1000 mmf., +100%, —0%, 500 volts DC (C14, C20, C22, C27)
73960	10,000 mmf., +100%, —0%, 500 volts DC (C17)
	Capacitor—Fixed, ceramic, insulated:— (C12, C13)
77667	comprising: 1 section of 2 mmf., and 1 section of 22 mmf.
	Capacitor—Fixed, ceramic, non-insulated, Temp. Coef. —0
77210	2 mmf., ±0.25 mmf., 500 volts DC (C15)
77688	5 mmf., ±0.5 mmf., 500 volts DC (C34, C36, C38, C41)
74182	6 mmf., ±0.5 mmf., 500 volts DC (C5)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
71924	56 mmf., ±10%, 500 volts DC (C10)
	Capacitor—Fixed, headed-lead type:—
77691	.33 mmf., ±10%, 500 volts DC (C33, C35)
77689	.82 mmf., ±10%, 500 volts DC (C37)
77690	1.0 mmf., ±10%, 500 volts DC (C40)
71500	1.5 mmf., ±10%, 500 volts DC (C39)
78047	2 mmf., ±10%, 500 volts DC (C42)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
77489	Rectifier—Germanium rectifier IN82 (CR1)
	Resistor—Fixed, composition:—
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
77585	Washer—"C" washer for drive and indicator shafts (3 req'd) or for link spring
	CHASSIS ASSEMBLIES KCS 81H—VHF CHASSIS KCS 81K—UHF CHASSIS
76490	Bracket—Mounting bracket complete with insulator for picture control
12118	Cap—Tube connector cap
	Capacitor—Ceramic:—
76488	500 mmf., 30,000 volts (C201)
75166	stand-off, 1500 mmf. (C144)
	Capacitor—Fixed, ceramic:—
76577	33 mmf., 6000 volts (C198)
76574	39 mmf., 3500 volts (C180)
76576	150 mmf., 2000 volts (C200)
76575	180 mmf., 3500 volts (C199)
	Capacitor—Fixed, ceramic, High "K" disc:—
73473	4700 mmf., +100%, —0%, 500 volts DC (C126, C128, C130, C136, C138, C141)
76470	dual 4700 mmf., +100%, —0%, 500 volts DC (C133A, C133B, C137A, C137B, C139A, C139B, C140A, C140B)
73960	10,000 mmf., +100%, —0%, 500 volts DC (C145, A146)
75877	dual 10,000 mmf., +100%, —0%, 500 volts DC (C101A, C101B, C105A, C105B)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
39044	15 mmf., ±10%, 500 volts DC (C152)
39042	47 mmf., ±10%, 500 volts DC (C151)
71924	56 mmf., ±10%, 500 volts DC (C104)
39396	100 mmf., ±10%, 500 volts DC (C168, C169, C172)
71614	120 mmf., ±10%, 500 volts DC (C167)
	Capacitor—Fixed, mica:—
76474	82 mmf., 1000 volts DC (C165, C187)
75248	220 mmf., 1000 volts (C181)
39638	270 mmf., 500 volts DC (C161)
76579	270 mmf., 1000 volts DC (C164, C192)
39640	330 mmf., 500 volts DC (C159)
39644	470 mmf., 500 volts DC (C108, C109)
	Capacitor—Mica trimmer:—
71496	5-70 mmf. (C121)
75217	dual 10-160 mmf. (C186A, C186B)
	Capacitor—Electrolytic:—
74521	5 mfd., 50 volts (C111)
28417	5 mfd., 450 volts (C175)
75510	comprising:—2 sections of 35 mfd., 450 volts, 1 section of 10 mfd., 450 volts, and 1 section of 5 mfd., 450 volts (C120A, C120B, C120C, C120D)
77474	comprising:—1 section of 35 mfd., 450 volts, 1 section of 25 mfd., 450 volts, and 1 section of 100 mfd., 50 volts (C118A, C118B, C118C)
77657	comprising:—1 section of 70 mfd., 450 volts, 2 sections of 10 mfd., 450 volts, and 1 section of 5 mfd., 450 volts (C149A, C149B, C149C, C149D)
	Capacitor—Fixed, tubular, paper, oil impregnated:—
75643	.001 mfd., 1000 volts (C194)
73851	.0018 mfd., 1600 volts (C112)
73595	.0022 mfd., 600 volts (C110)
73803	.0022 mfd., 1000 volts (C177)
73599	.0027 mfd., 600 volts (C116, C156)
73920	.0047 mfd., 600 volts (C158, C166)
73789	.0068 mfd., 400 volts (C213)
73808	.0082 mfd., 1000 volts (C148, C162)
73561	.01 mfd., 400 volts (C114, C170, C202)
73562	.022 mfd., 400 volts (C178, C179, C189)
73798	.022 mfd., 600 volts (C182)
73552	.033 mfd., 400 volts (C163)
73790	.039 mfd., 400 volts (C113)
73553	.047 mfd., 400 volts (C160, C188, C190)
73592	.047 mfd., 600 volts (C197)
73815	.068 mfd., 1000 volts (C203, C205)
73551	0.1 mfd., 400 volts (C183, C214)
73557	0.1 mfd., 600 volts (C173, C204)
73794	0.22 mfd., 400 volts (C129, C153, C155, C157, C208, C210)
74957	0.22 mfd., 600 volts (C176)
73787	0.47 mfd., 200 volts (C191, C196)
	Capacitor—Fixed, tubular, moulded paper, oil impregnated:—
77727	.0013 mfd., 600 volts (C195)
73920	.0047 mfd., 600 volts (C171)
73594	.01 mfd., 600 volts (C184, C185, C193)
77676	Choke—Filter choke (L117)
76143	Clip—Mounting clip for stand-off capacitor
73477	Coil—Choke coil (L101)
76672	Coil—Filament winding only for hi-voltage transformer (Part of T115)
76483	Coil—Horizontal linearity coil complete with adjustable core (L111)
76646	Coil—Peaking coil (72 muh) (L103, R149)
76647	Coil—Peaking coil (180 muh) (L107, R158)
75252	Coil—Peaking coil (500 muh) (L104, L106)
76640	Coil—RF choke coil (1.5 muh) (L110, L112)
78598	Coil—RF choke coil (6.8 muh) (L108)
76484	Coil—Width coil complete with adjustable core (L109)
35787	Connector—Audio connector (J105)
76457	Connector—Second anode lead connector
75474	Connector—Single contact male connector for speaker cable
74594	Connector—2 contact male connector for power cord
77475	Connector—4 contact female connector for radio power input cable (J104)
50367	Connector—6 contact female connector for yoke leads (J102)
77654	Control—AGC control (R180)
77814	Control—Brightness control, volume control and power switch (R114A, R114B, S102)
77640	Control—Height control (R190)
77639	Control—Horizontal hold control (R210)
76445	Control—Picture control (R155)
77199	Control—Ratio detector balance control (R108)
77652	Control—Vertical hold control (R187)
77653	Control—Vertical linearity control (R197)
77647	Coupling—Coupling (nylon) for picture control
77136	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
73600	Fuse—0.25 amp., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd. anode lead exit
76480	Lead—Anode lead complete with eyelet
76500	Plate—Hi-voltage plate (bakelite) complete less transformer, socket and lead
76649	Radiator—Heat dissipating radiator for V116
76675	Rectifier—Picture detector crystal rectifier (CR101)
	Resistor—Wire wound:—
76468	1.5 ohms, ⅓ watt (R225)
74015	100 ohms, 2 watts (R221)
77812	comprising:—1 section of 600 ohms, 16 watts, 1 section of 500 ohms, 6 watts, 1 section of 2000 ohms, 5 watts, 1 section of 1200 ohms, 1 watt and 1 section of 10,000 ohms, 5 watts (R228A, R228B, R228C, R228D, R228E)
76642	6750 ohms, 10 watts (R153)
77815	16,200 ohms, 10 watts (R232)
	Resistor—Fixed, composition:—
503010	10 ohms, ±10%, ½ watt (R241)
503033	33 ohms, ±10%, ½ watt (R152)
503047	47 ohms, ±10%, ½ watt (R107, R218)
502056	56 ohms, ±5%, ½ watt (R134)
34763	68 ohms, ±5%, ½ watt (R138)
502082	82 ohms, ±5%, ½ watt (R101)
502110	100 ohms, ±5%, ½ watt (R128)
503118	180 ohms, ±10%, ½ watt (R142)
503122	220 ohms, ±10%, ½ watt (R151)
503156	560 ohms, ±10%, ½ watt (R198)
503168	680 ohms, ±10%, ½ watt (R154)
503210	1000 ohms, ±10%, ½ watt (R102, R104, R109, R120, R126, R131, R133, R136, R161)
502218	1800 ohms, ±5%, ½ watt (R183)
503222	2200 ohms, ±10%, ½ watt (R140)
502233	3300 ohms, ±10%, ½ watt (R201)
502239	3900 ohms, ±5%, ½ watt (R150)
503239	3900 ohms, ±10%, ½ watt (R211)
503247	4700 ohms, ±10%, ½ watt (R230)
502256	5600 ohms, ±5%, ½ watt (R137)
513256	5600 ohms, ±10%, 1 watt (R156)
14659	6800 ohms, ±5%, ½ watt (R111, R112, R191)
503268	6800 ohms, ±10%, ½ watt (R176)
513268	6800 ohms, ±10%, 1 watt (R147)
503282	8200 ohms, ±10%, ½ watt (R145)
513282	8200 ohms, ±10%, 1 watt (R182)
503310	10,000 ohms, ±10%, ½ watt (R139, R164, R200, R213, R229)
513310	10,000 ohms, ±10%, 1 watt (R157)
503312	12,000 ohms, ±10%, ½ watt (R115)
503315	15,000 ohms, ±10%, ½ watt (R239)
523315	15,000 ohms, ±10%, 2 watts (R143)
503318	18,000 ohms, ±10%, ½ watt (R144)
503322	22,000 ohms, ±10%, ½ watt (R175)
522322	22,000 ohms, ±10%, 2 watts (R223)
503327	27,000 ohms, ±10%, ½ watt (R174, R178)
523327	27,000 ohms, ±10%, 2 watts (R222)
503333	33,000 ohms, ±10%, ½ watt (R106, R129, R132, R135, R235)
503339	39,000 ohms, ±10%, ½ watt (R110, R173, R212, R215)
503347	47,000 ohms, ±10%, ½ watt (R102)
502356	56,000 ohms, ±5%, ½ watt (R141)
503356	56,000 ohms, ±10%, ½ watt (R209)
513356	56,000 ohms, ±10%, 1 watt (R105)
503368	68,000 ohms, ±10%, ½ watt (R208)
512368	68,000 ohms, ±5%, 1 watt (R193)
513368	68,000 ohms, ±10%, 1 watt (R216)
8064	82,000 ohms, ±5%, ½ watt (R167)
513368	82,000 ohms, ±10%, 1 watt (R214)
503410	100,000 ohms, ±10%, ½ watt (R166, R203, R238)
513510	100,000 ohms, ±10%, 1 watt (R240)
503415	150,000 ohms, ±10%, ½ watt (R159, R195, R202, R204)
503418	180,000 ohms, ±10%, ½ watt (R207)
502422	220,000 ohms, ±5%, ½ watt (R179)
503422	220,000 ohms, ±10%, ½ watt (R233)
502427	270,000 ohms, ±5%, ½ watt (R163, R165)
503427	270,000 ohms, ±10%, ½ watt (R171, R226)
503433	330,000 ohms, ±10%, ½ watt (R205, R220)
503439	390,000 ohms, ±10%, ½ watt (R219)
503447	470,000 ohms, ±10%, ½ watt (R148, R160, R172, R184, R185, R189)
503468	680,000 ohms, ±10%, ½ watt (R169)
503482	820,000 ohms, ±10%, ½ watt (R206)
503510	1 megohm, ±10%, ½ watt (R181, R188, R217)
503512	1.2 megohm ±10%, ½ watt (R186)
503533	3.3 megohm, ±10%, ½ watt (R196)
512536	3.6 megohm, ±5%, 1 watt (R162)
503539	3.9 megohm, ±10%, ½ watt (R168)
503547	4.7 megohm, ±10%, ½ watt (R170)
503610	10 megohm, ±10%, ½ watt (R113)
77198	Transformer—1st. pix I.F. grid transformer complete with adjustable cores (T104, C125, R125)
77197	Transformer—1st. pix I.F. plate transformer complete with adjustable cores (T105, C131, C132, R130)
76435	Transformer—2nd. pix I.F. grid transformer complete with adjustable cores (T106, C134)
76433	Transformer—3rd. or 4th. pix I.F. transformer (T107, T108)
76436	Transformer—5th. pix I.F. transformer (T109, C142, C143, CR101, L102, R146)
76501	Transformer—Hi-voltage transformer (Part of T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T114)
77649	Transformer—Power transformer 117 volts, 60 cycle (T113)
76439	Transformer—Ratio detector transformer complete with adjustable cores (T102, C106, C107)
76437	Transformer—Sound take-off transformer complete with adjustable cores (T110, C147)
76438	Transformer—Sound I.F. transformer complete with adjustable cores (T101, C102, C103)
77650	Transformer—Vertical oscillator transformer (T111)
76494	Transformer—Vertical output transformer (T112)
76482	Trap—4.5 MC trap (L105, C150)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)
	CHASSIS ASSEMBLIES—RC 1111A
77308	Capacitor—Variable tuning capacitor (C1A, C1B, C1C, C1D, C1E, C1F)
	Capacitor—Fixed, ceramic, high K disc:—
73473	4700 mmf., +100%, —0%, 500 volts DC (C2, C4, C7, C9, C11, C18, C20, C23, C24, C27, C32, C34, C35, C40)
	Capacitor—Fixed, ceramic, insulated, high K disc:—
76348	47 mmf., ±10%, 500 volts DC (C10)
75614	150 mmf., ±20%, 500 volts DC (C13, C28, C31)
75611	220 mmf., ±20%, 500 volts DC (C3)
	Capacitor—Fixed, ceramic, non-insulated, temp. coer. = —470, ±15%
77352	6.8 mmf., ±5%, 500 volts DC (C16)
	Capacitor—Fixed, ceramic, non-insulated, temp. coef. = —750
75613	5 mmf., ±1.0 mmf., 500 volts DC (C12, C41)
39044	15 mmf., ±10%, 500 volts DC (C14)
75612	68 mmf., ±10%, 500 volts DC (C15, C17)
39396	100 mmf., ±10%, 500 volts DC (C5)
	Capacitor—Fixed, mica:—
39640	330 mmf., 500 volts (C36, C37)
39644	470 mmf., 300 volts (C6)
	Capacitor—Electrolytic:—
73747	2 mfd., 50 volts (C39)
	Capacitor—Fixed, tubular, paper:—
77468	.0018 mfd., 600 volts (C8)
73795	.0033 mfd., 400 volts (C25)
73920	.0047 mfd., 600 volts (C30)
72490	.005 mfd., 200 volts (C33, C38)
73561	.01 mfd., 400 volts (C29)
73797	.015 mfd., 600 volts (C22)
77469	.018 mfd., 200 volts (C21)
73562	.022 mfd., 400 volts (C26)
73558	.047 mfd., 200 volts (C19)
73935	Clip—Mounting clip for I.F. transformers 75558 and 76328

REPLACEMENT PARTS (Continued)

STOCK No.	DESCRIPTION
77313	Coil—Antenna coil—F.M. (L1)
71942	Coil—Filament choke coil (L9, L10)
75569	Coil—Oscillator coil—AM—complete with adjustable core (L3, L4, L5)
77315	Coil—Oscillator coil—FM (L8)
77305	Coil—RF coil—AM—complete with adjustable core (L6, L7)
77314	Coil—RF coil—FM (L2)
33514	Connector—Dual single contact female connector for phono or TV audio (J3, J4)
35787	Connector—Single contact female connector for audio cable (J2)
74879	Connector—2 contact female connector for antenna leads
75062	Connector—9 contact male connector for power input (J1)
75562	Control—Tone control—HF (R29)
75561	Control—Tone control—LF (R16)
75537	Control—Volume control and power switch (R19, S2)
	Resistor—Fixed, composition:—
503039	39 ohms, ±10%, ½ watt (R3)
503068	68 ohms, ±10%, ½ watt (R21)
503110	100 ohms, ±10%, ½ watt (R14, R34)
503112	120 ohms, ±10%, ½ watt (R30)
503139	390 ohms, ±10%, ½ watt (R12)
503168	680 ohms, ±10%, ½ watt (R6, R25, R32)
503210	1000 ohms, ±10%, ½ watt (R2)
502212	1200 ohms, ±5%, ½ watt (R36)
502233	3300 ohms, ±5%, ½ watt (R35)
503282	8200 ohms, ±10%, ½ watt (R5)
503315	15,000 ohms, ±10%, ½ watt (R33)
503318	18,000 ohms, ±10%, ½ watt (R13, R17)
503322	22,000 ohms, ±10%, ½ watt (R22, R31)
503327	27,000 ohms, ±10%, ½ watt (R9, R18)
503339	39,000 ohms, ±10%, ½ watt (R37)
503356	56,000 ohms, ±10%, ½ watt (R26)
503412	120,000 ohms, ±10%, ½ watt (R11, R15)
503415	150,000 ohms, ±10%, ½ watt (R4, R24)
503422	220,000 ohms, ±10%, ½ watt (R23)
503427	270,000 ohms, ±10%, ½ watt (R28)
503447	470,000 ohms, ±10%, ½ watt (R38)
503510	1 megohm, ±10%, ½ watt (R39)
503515	1.5 megohm, ±10%, ½ watt (R10)
503522	2.2 megohm, ±10%, ½ watt (R1, R7, R8)
503610	10 megohm, ±10%, ½ watt (R20)
504622	22 megohm, ±20%, ½ watt (R27)
75540	Shaft—Tuning knob shaft
73584	Shield—Tube shield for V1, V6
75192	Shield—Tube shield for V2
77310	Slide—Slide mechanism (2 req'd)
31364	Socket—Dial lamp socket
74179	Socket—Tube socket, 7 contact, miniature, for V1, V3, V4, V5
77306	Socket—Tube socket, 7 pin, moulded saddle-mounted for V2
73117	Socket—Tube socket, 7 contact, miniature wafer for V6
77312	Spring—Actuating spring for bottom cover latch
76332	Spring—Drive cord spring
75563	Spring—Retaining spring for function switch extension shaft
76422	Spring—Retaining spring for slide mechanism stop pin
77304	Support—Polystyrene support for FM oscillator coil complete with mounting bracket
77476	Switch—Function switch (S1, S3, S4)
75558	Transformer—1st I.F. transformer—AM—complete with adjustable cores (T2)
75559	Transformer—1st I.F. transformer—FM—complete with adjustable cores (T1)
76328	Transformer—2nd I.F. transformer—AM—complete with adjustable cores (T4)
75560	Transformer—2nd I.F. transformer—FM—complete with adjustable cores (T3)
73743	Transformer—Ratio detector transformer complete with adjustable core (T5)
33726	Washer—"C" washer for tuning knob shaft or drive cord pulley

POWER AMPLIFIER ASSEMBLIES
RS 141E

STOCK No.	DESCRIPTION
74296	Cable—Shielded audio cable complete with pin plug—part of interconnecting cable
72447	Cable—Shielded audio cable complete with two (2) pin plugs—part of interconnecting cable
77324	Capacitor—Electrolytic comprising 1 section of 30 mfd., 450 volts; 1 section of 30 mfd., 350 volts; and 1 section of 40 mfd., 25 volts (C1A, C1B, C1C)
	Capacitor—Tubular, paper:—
73789	.0068 mfd., 400 volts (C5)
73562	.022 mfd., 400 volts (C2)
	Capacitor—Tubular, paper, oil impregnated:—
75643	.001 mfd., 1000 volts (C3, C4)
30868	Connector—2 contact female connector for phono power—part of interconnecting cable (P3)
77478	Connector—4 contact male connector for radio power input—part of interconnecting cable (P4)
75064	Connector—9 contact female connector for interconnecting cable (P1)
72776	Pin—Contact pin for speaker lead (2 req'd)
	Resistor—Wire wound:—
73627	2200 ohms, 5 watts (R1)
	Resistor—Fixed, composition:—
503110	100 ohms, ±10%, ½ watt (R8)
522127	270 onms, ±5%, 2 watts (R7)
802233	3300 ohms, ±5%, ½ watt (R2)
503368	68,000 ohms, ±10%, ½ watt (R5)
503382	82,000 ohms, ±10%, ½ watt (R3)
503447	470,000 ohms, ±10%, ½ watt (R4, R6)
77479	Shell—Shell for 4 contact male connector
31364	Socket—Pilot lamp socket
73117	Socket—Tube socket, 7 pin, miniature, wafer
31251	Socket—Tube socket, octal, wafer
77323	Transformer—Output transformer (T2)
75566	Transformer—Power transformer, 117 volt, 60 cycle (T1)

SPEAKER ASSEMBLIES
92569—12W RL—111A1 RMA—274

STOCK No.	DESCRIPTION
75682	Cone—Cone and voice coil (3.2 ohms)
76093	Speaker—12" PM speaker complete with cone and voice coil (3.2 ohms)

Note:—If stamping on speaker on instruments does not agree with above speaker number, order replacement parts by referring to Model number of instruments, number stamped on speaker and full description of part required.

STOCK No.	DESCRIPTION
	Capacitor—Adjustable, mica:—
71807	10-160 mmf. for instruments using KRK12B tuner
	Capacitor—Fixed, headed-lead:—
78532	1.2 mmf., ±10%, 500 volts (C4)
78442	1.8 mmf., ±10%, 500 volts (C1, C2)
78443	2.7 mmf., ±10%, 500 volts (C3)
	Capacitor—Fixed, tubular, paper:—
73561	.01 mfd., 400 volts
77726	Connector—2 contact male connector for TV antenna cable for instruments using KRK12B tuner
39153	Connector—4 contact male connector for TV antenna cable for instruments using KRK29 tuner
75542	Connector—6 contact male connector for deflection yoke leads (P102)
71457	Cord—Power cord and plug
77864	Cover—Cover and case assembly for hidden controls
77759	Cover—Cover assembly complete with spring for channel markers for instruments using KRK12B tuner
77770	Cushion—Adhesive cushion for safety glass retainer
77749	Cushion—Rubber cushion for safety glass
76698	Cushion—Rubber cushion for masking panel support bracket
78313	Cushion—Rubber cushion for dust sealing the kinescope
74956	Cushion—Rubber cushion for deflection yoke hood
77782	Decal—Brightness, tuning and volume controls and channel selector switch function decal
74273	Decal—"Victrola" decal
77756	Disc—Polystyrene indicator disc for channel selections for instruments using KRK12B tuner
78315	Escutcheon—Channel marker escutcheon for instruments using KRK29 tuner
78314	Glass—Safety glass
37396	Grommet—Rubber grommet for mounting speaker
73420	Hinge—Butt hinge for center door
78504	Hinge—Hinges (1 set) for lower doors
74308	Hinge—Hinges (1 set) for upper doors
78308	Hood—Deflection yoke hood less rubber cushions
77811	Knob—Radio function switch knob
77810	Knob—Radio tuning control, tone controls or volume control and power switch knob
77709	Knob—Television brightness control knob (outer)
77968	Knob—Television channel selector knob for instruments using KRK12B tuner (inner)
77708	Knob—Television channel selector knob for instruments using KRK29 tuner (inner)
77750	Knob—Television fine tuning control knob for instruments using KRK12B tuner (outer)
77707	Knob—Television fine tuning control knob for instruments using KRK29 tuner (outer)
77699	Knob—Television picture control knob
77735	Knob—Television tone switch knob
77710	Knob—Television volume control and power switch knob (inner)
11765	Lamp—Channel escutcheon or pilot lamp—Mazda 51
76167	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
77765	Marker—UHF channel number markers for instruments using KRK12B tuner
77762	Marker—VHF channel number markers for instruments using KRK12B tuner
78316	Mask—Channel marker escutcheon light mask for instruments using KRK29 tuner
78311	Mask—Polystyrene masking panel
77784	Madallion—"His Master's Voice" medallion
77783	Nameplate—"Deluxe" nameplate
78326	Nut—¼-20 knurled nut for deflection yoke hood support rod
73634	Nut—Speednut for speaker mounting screws
74337	Nut—Speednut to fasten "Deluxe" nameplate to cabinet
76601	Pad—Kinescope edge support pad (rubber)
78555	Pull—Door pull for lower doors
78502	Pull—Door pull for upper door
503415	Resistor—Fixed, composition:—150,000 ohms, ±10%, ½ watt (R1, R2)
77928	Retainer—Channel selector knob retainer for instruments using KRK12B tuner
78249	Retainer—Side retainer for safety glass
77747	Retainer—Top or bottom retainer for safety glass
78322	Rod—Hook shape threaded rod for deflection yoke hood assembly
77712	Screw—#6 x ½" cross recessed binder head self tapping screw for mounting hidden control cover and case bracket
76632	Screw—#8 x ⅝" hex head wood screw for kinescope masking panel support bracket
75623	Screw—#8 x ⅝" trimit head screw for door pull #78502
74113	Screw—#8 x 1" trimit head screw for door pull
78447	Shade—Channel indicator lamp shade for instruments using KRK12B tuner
76630	Spring—Formed spring for kinescope masking panel
78324	Spring—Formed spring for safety glass retainer
78445	Spring—Grounding spring for deflection yoke
76837	Spring—Retaining spring for knobs 77699, 77708, 77709, 77735
72845	Spring—Retaining spring for knob 77707
30330	Spring—Retaining spring for knob 77710
78325	Spring—Spring clip for channel marker escutcheon for instruments using KRK29 tuner or for channel indicator lamp shade instruments using KRK12B tuner
74734	Spring—Spring clip for radio control knobs and for channel markers cover assembly
74936	Spring—Suspension spring for kinescope socket leads
75902	Spring—Suspension spring for amplifier cable
72936	Stop—Door stop
76636	Stud—Adjusting stud complete with guard for focus magnet
75500	Washer—Felt washer for back cover or kinescope masking panel mounting screws
78628	Washer—Paper washer—brown—for hidden control knobs
78278	Yoke—Deflection yoke (L113, L114, L115, L116, C206, C207, P102, R227)

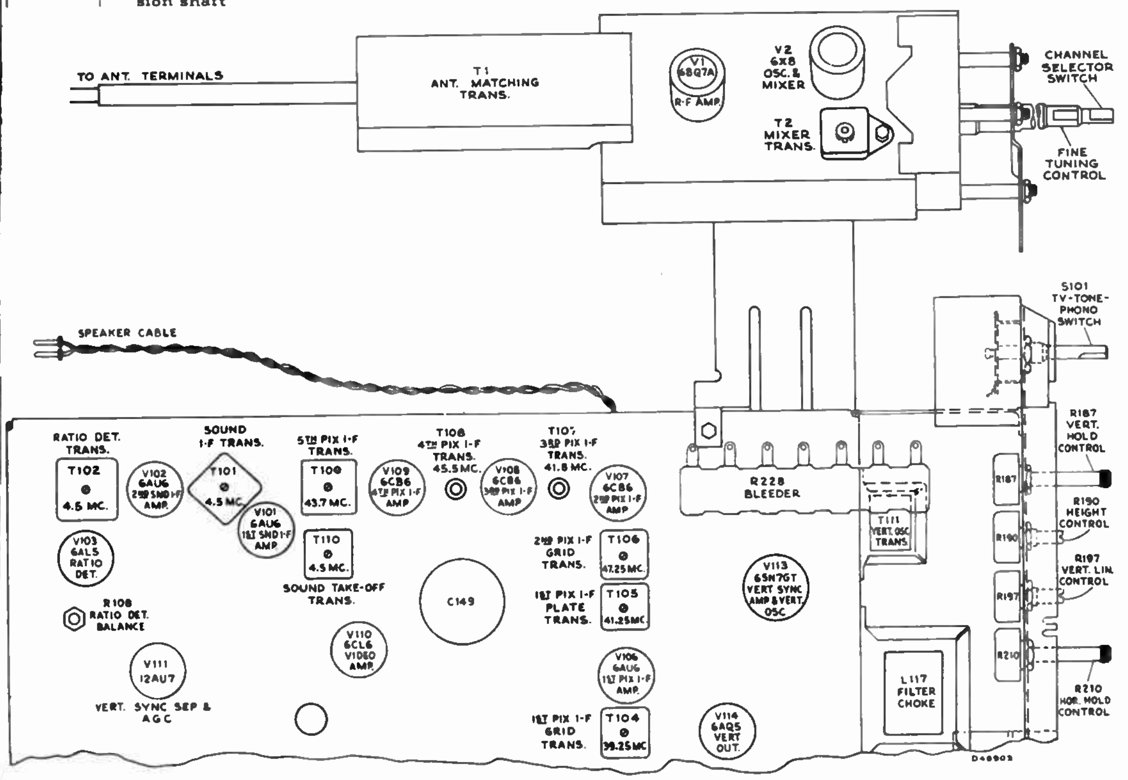


Figure 31—Television Top Chassis Adjustments (KRK29 Tuner Shown)

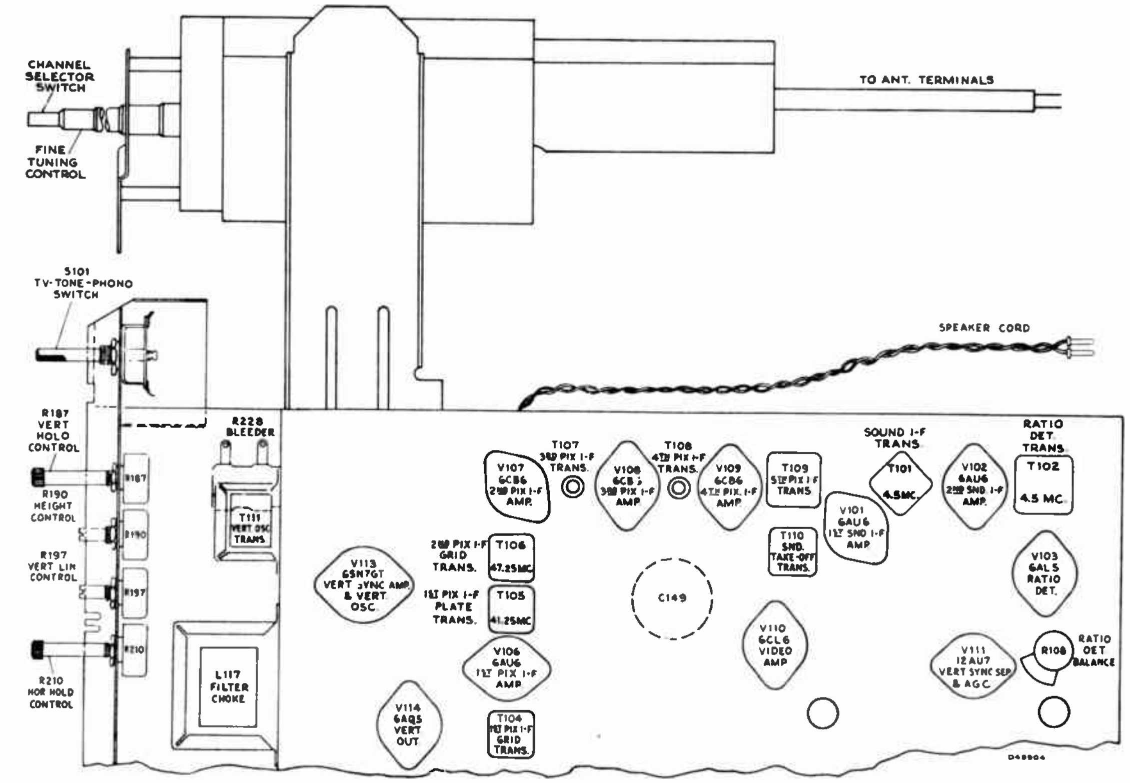


Figure 32—Television Bottom Chassis Adjustments (KRK29 Tuner Shown)

GENERAL DESCRIPTION

Models 21-T-392, 21-T-392U, 21-T-393 and 21-T-393U are "21 inch" television, radio, phonograph combinations. Model 21-T-392 features an AM radio and full 12 channel VHF coverage. Model 21-T-392U features an AM radio and full 12 channel VHF coverage plus any 4 UHF channels desired.

Model 21-T-393 features an AM/FM radio and full 12 channel VHF coverage.

Model 21-T-393U features an AM/FM radio and full 12 channel VHF coverage plus any 4 UHF channels desired. All models employ a three speed record changer and a 12 inch PM dynamic speaker.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE......227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 21-T-392 and 21-T-393

All 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 21-T-392U and 21-T-393U

Any of 70 UHF channels..................470 mc. to 890 mc.

Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc. (Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency......................45.75 mc.

Sound I-F Carrier Frequency.............4.5 mc and 41.25 mc.

VIDEO RESPONSE..............................To 3.5 mc.

SWEEP DEFLECTION..............................Magnetic

FOCUS..............................Magnetic

POWER SUPPLY RATING................115 volts, 60 cycles

21-T-392, 21-T-393............................215 watts max.

21-T-392U, 21-T-393U.........................230 watts max.

CHASSIS DESIGNATIONS

In Model 21-T-392......Television Chassis KCS83F, Radio Chassis RC1117B and Record Changer 930409-5 or -10.

In Model 21-T-393......Television Chassis KCS83F, Radio Chassis RC1111C, Audio Amplifier RS141D and Record Changer 930409-5 (mah.).

In Model 21-T-392U......Television Chassis KCS83H, Radio Chassis RC1117B and Record Changer 930409-5 or -10.

In Model 21-T-393U......Television Chassis KCS83H, Radio Chassis RC1111C, Audio Amplifier RS141D and Record Changer 930409-5 (mah.).

See Service Data 930409 for Record Changer information.

AUDIO OUTPUT RATING.....KCS83F, KCS83H, 4 watts max. RC1117B.......2.4 watts max., RS141D.......10 watts max.

LOUDSPEAKER.......(92569-12W) 12" PM Dynamic, 3.2 ohms

ANTENNA INPUT IMPEDANCE

Models 21-T-392 and 21-T-393

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 21-T-392U and 21-T-393U

UHF—300 ohms balanced.

VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Radio Chassis RC1117B Function
(1) RCA 12BE6	Converter
(2) RCA 12BA6	I-F Amplifier
(3) RCA 6AQ6	2nd Det. and Audio Amp.
(4) RCA 6AQ6	Phase Inverter
(5) RCA 35C5	Audio Output (2 tubes)

Radio Chassis RC1111C

(1) RCA 6CB6	R-F Amplifier
(2) RCA 6J6	Oscillator and Mixer
(3) RCA 6BA6	I-F Amplifier
(4) RCA 6AU6	FM Driver
(5) RCA 6AL5	Ratio Detector
(6) RCA 6AV6	AM 2nd Det. and 1st Audio Amp.

Audio Chassis RS141D

(1) RCA 6C4	Phase Inverter
(2) RCA 6V6GT	Audio Output (2 tubes)
(3) RCA 5Y3GT	Rectifier

ELECTRICAL AND MECHANICAL SPECIFICATIONS (Continued)

RCA TUBE COMPLEMENT—TELEVISION CHASSIS

KCS83F—KRK29 Tuner

Tube Used	Function
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

KCS83H—KRK12A Tuner

(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control

A 1N82 crystal is used as a mixer.

All Models

(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Det. and Horiz. Sync. Sep.
(5) RCA 6X8	Video Amplifier and Vert. Sync. Sep.
(6) RCA 12AU7	Video Output and AGC
(7) RCA 6AU6	1st Sound I-F Amplifier
(8) RCA 6AU6	2nd Sound I-F Amplifier
(9) RCA 6AL5	Ratio Detector
(10) RCA 6AV6	Audio Amplifier
(11) RCA 6K6GT	Audio Output
(12) RCA 6SN7GT	Vert. Osc. & Dischg. & Sync. Output
(13) RCA 6K6GT	Vertical Sweep Output
(14) RCA 6SN7GT	Horiz. Sweep Oscillator and Control
(15) RCA 6BQ6GT	Horizontal Sweep Output
(16) RCA 6AX4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
(18) RCA 21AP4	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

OPERATING CONTROLS (Front)

Channel Selector / Fine Tuning ....Dual Control Knobs

Sound Volume and On-Off Switch / Picture ......Dual Control Knobs

Brightness.........................Single Control under Panel

Picture Horizontal Hold............Single Control under Panel

Picture Vertical Hold...............Single Control under Panel

TV Tone.............................Single Control under Panel

NON-OPERATING CONTROLS (under Front Panel)

Height..............................screwdriver adjustment

Vertical Linearity...................screwdriver adjustment

NON-OPERATING CONTROLS (not including R-F and I-F adjustments)

Picture Centering......................top chassis adjustment

Width..............................rear chassis adjustment

Horizontal Drive...........rear chassis screwdriver adjustment

Horizontal Linearity..................rear chassis adjustment

Horizontal Oscillator Frequency.......rear chassis adjustment

Horizontal Oscillator Waveform......bottom chassis adjustment

Horizontal Locking Range............rear chassis adjustment

Focus..............................top chassis adjustment

Ion Trap Magnet.....................top chassis adjustment

Deflection Coil................top chassis wing nut adjustment

AGC Control.........................rear chassis adjustment

HORIZONTAL SWEEP FREQUENCY...............15,750 cps

VERTICAL SWEEP FREQUENCY......................60 cps

FRAME FREQUENCY (Picture Repetition Rate)..........30 cps

Models 21-T-392, 21-T-392U "Whitfield" Mahogany, Walnut

Models 21-T-393, 21-T-393U "Birchfield" Mahogany

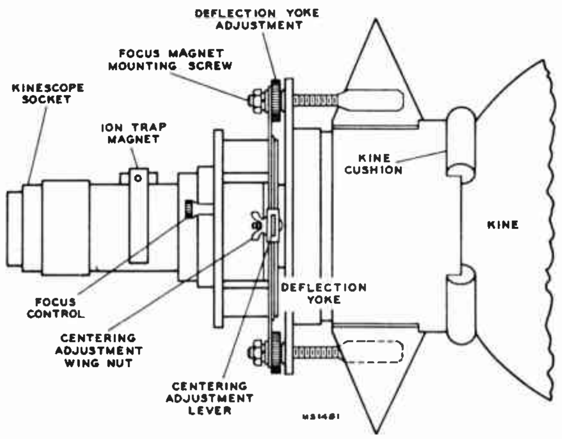


Figure 3—Yoke and Focus Magnet Adjustments

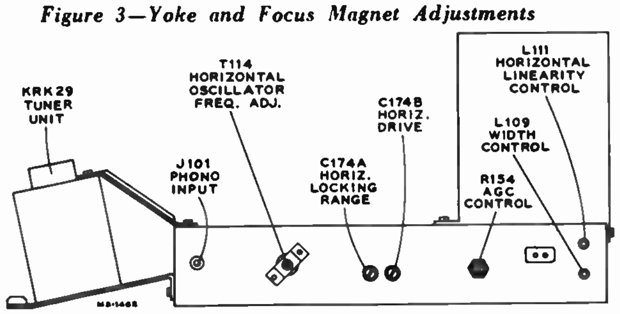


Figure 4—Rear Chassis Adjustments

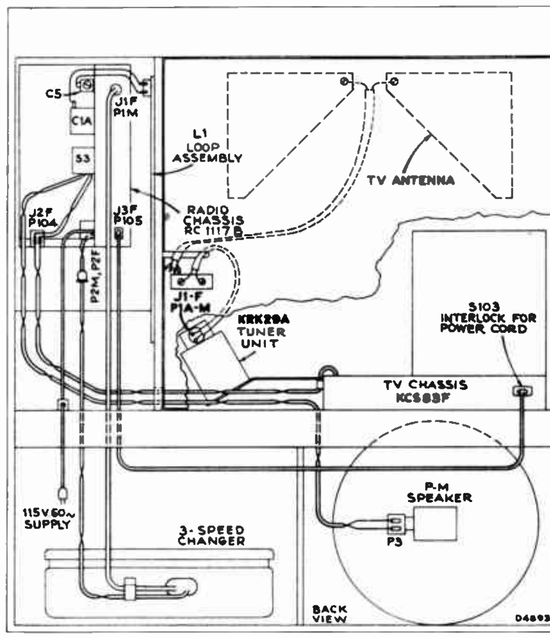


Figure 6—Models 21-T-392, 21-T-392U Cable Diagram

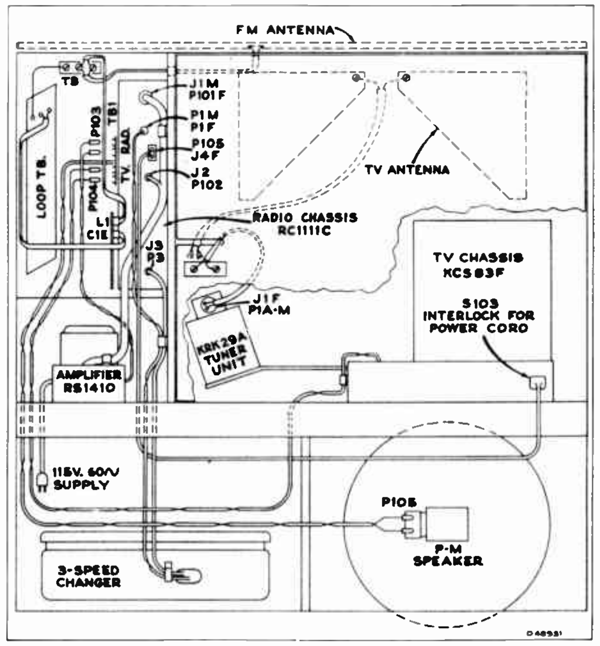


Figure 7—Models 21-T-393, 21-T-393U Cable Diagram

TELEVISION CHASSIS TOP VIEW

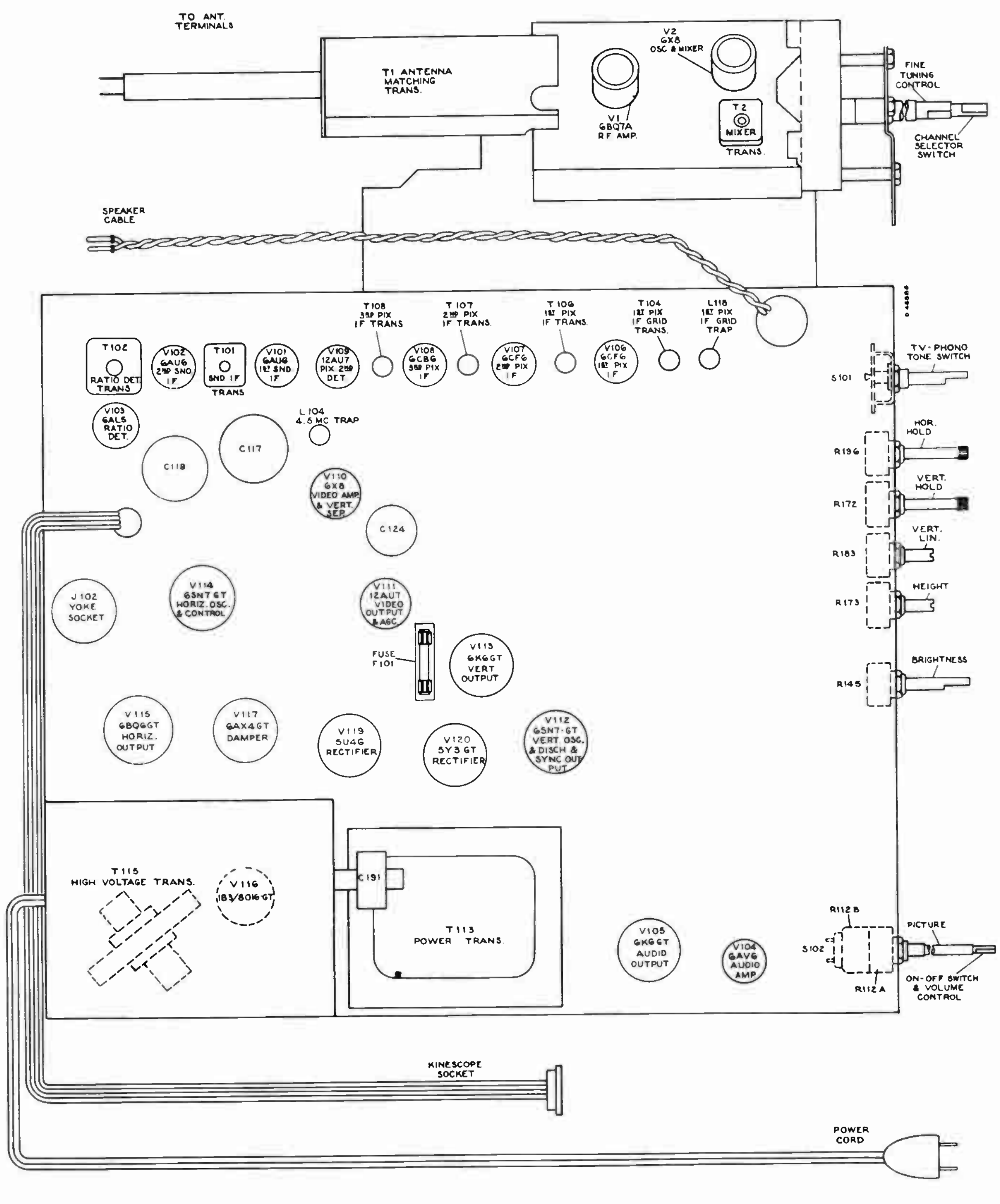


Figure 8—Television Chassis Top View (shown with KRK29 Tuner)

TELEVISION CHASSIS BOTTOM VIEW

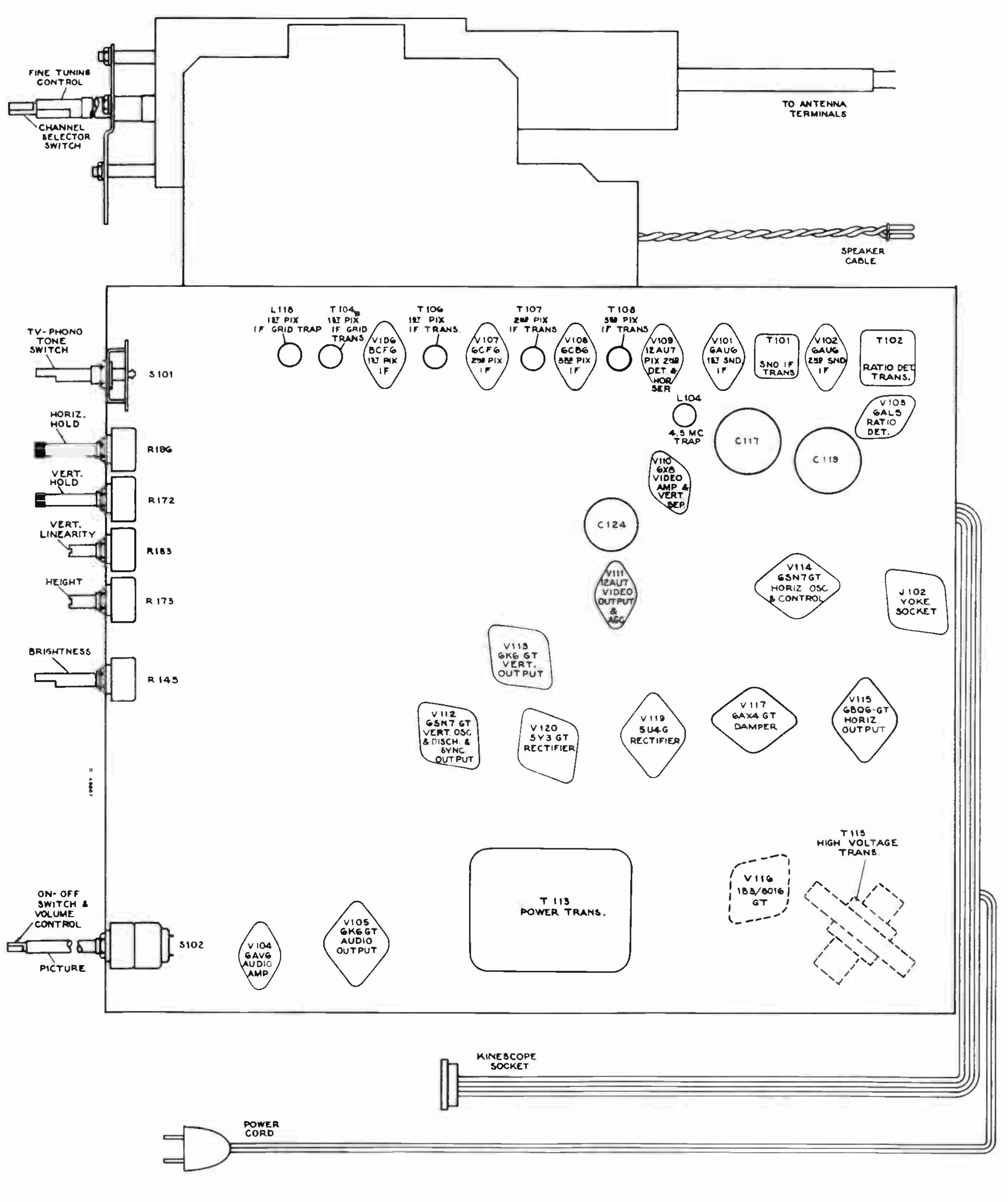


Figure 9—Television Chassis Bottom View (shown with KRK29 Tuner)

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) **Intermediate** frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12A Tuner. Wiring of adapter is shown in Figure 10.

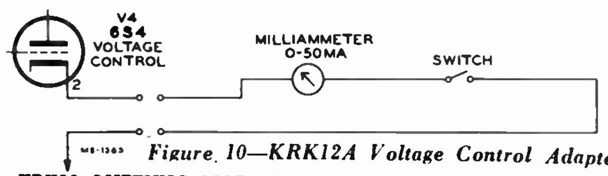


Figure 10—KRK12A Voltage Control Adapter

KRK29 ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1-E.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R123 and C142.

TELEVISION ALIGNMENT PROCEDURE

Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R123 and C142.

Connect an oscilloscope to the junction of R135 and L102 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order the prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 17 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 to obtain the response shown in Figure 11. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 and S1-E. Replace V106.

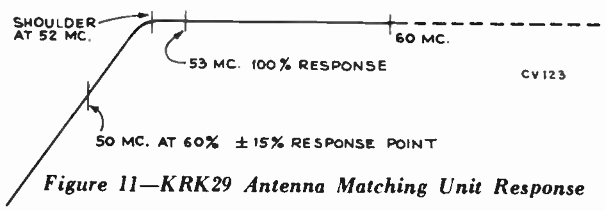


Figure 11—KRK29 Antenna Matching Unit Response

PICTURE I-F TRANSFORMER ADJUSTMENTS

Models 21-T-392 and 21-T-393

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R123 and C142. The second battery will be used later.

Set the bias to produce approximately —5.0 volt of bias at the junction of R123 and C142.

Connect the "VoltOhmyst" to junction of R135 and L102 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc. T108
45.5 mc. T107
43.0 mc. T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R135, L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. L118

Models 21-T-392U and 21-T-393U

Connect the "VoltOhmyst" to the junction of R123 and C142. Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R123 and C142. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Connect the output of the signal generator to the front terminal of the crystal mixer in series with a 1,500 mmf. ceramic capacitor.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc. T108
45.5 mc. T107
43.0 mc. T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R135 and L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc. L118

SWEEP ALIGNMENT OF PICTURE I-F

Models 21-T-392 and 21-T-393

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 12. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 13.

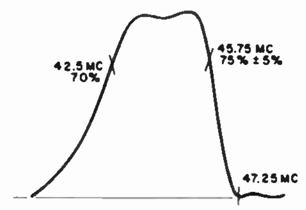


Figure 12—T2 and T104 Response with KRK29

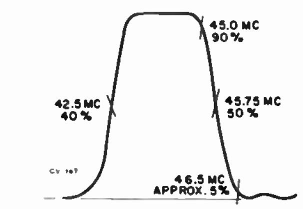


Figure 13—Over-all I-F Response with KRK29

Models 21-T-392U and 21-T-393U

To align the crystal mixer circuit and T2 and T104 connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C122 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (top) for maximum gain at 43.5 mc. and with 45.75 mc. at 75% of maximum response.

Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 14.

Disconnect the diode probe, the 180 ohm and the two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Adjust the bias potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142.

Leave the sweep generator connected to the front terminal of the 1N82 crystal holder with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 15.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

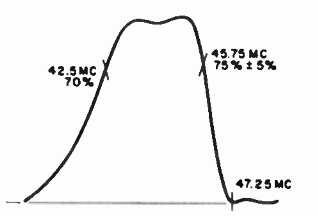


Figure 14—T2 and T104 Response with KRK12A

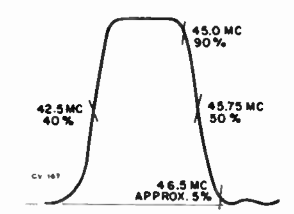


Figure 15—Over-all I-F Response with KRK12A

KRK29 TUNER ALIGNMENT

Models 21-T-392 and 21-T-393

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

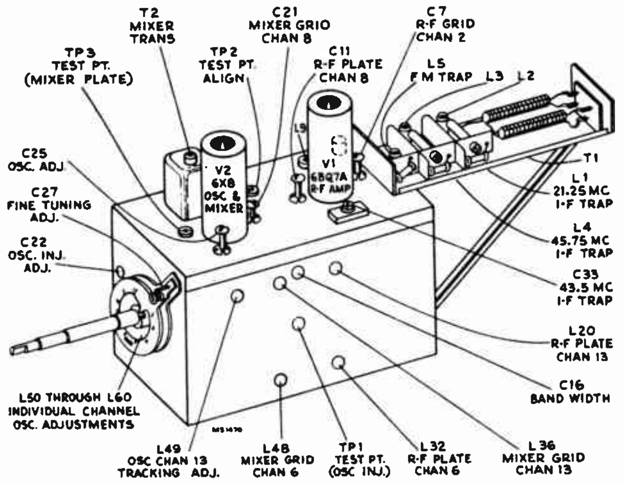


Figure 16—KRK29 Tuner Adjustments

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate if 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce −3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read −3.0 volts at the test point TP1, as read on the "VoltOhmyst". The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn the C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

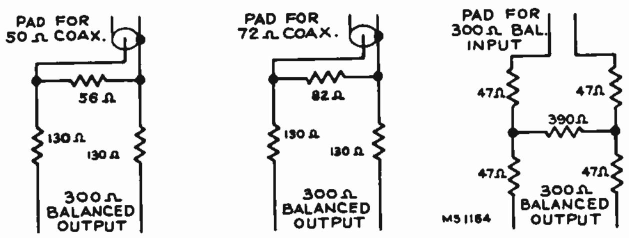


Figure 17—Sweep Attenuator Pads

Connect the sweep generator through a suitable attenuator, as shown in Figure 17, to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in Figure 18.

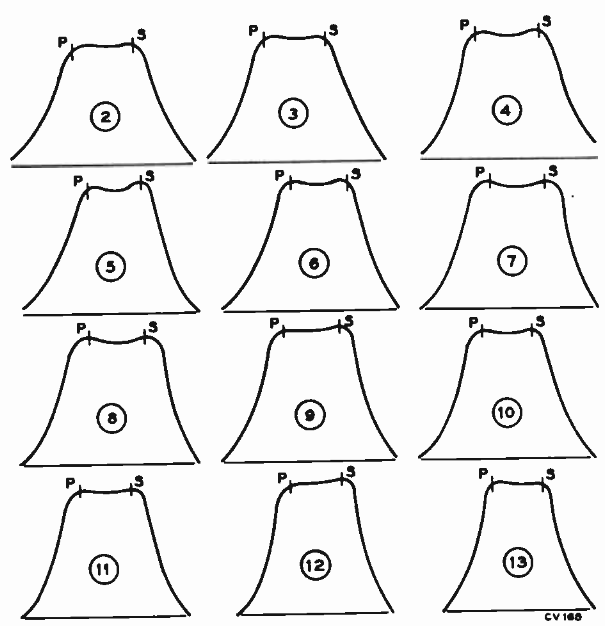


Figure 18—KRK29 R-F Response

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read −3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48, and L32 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48, and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21, or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

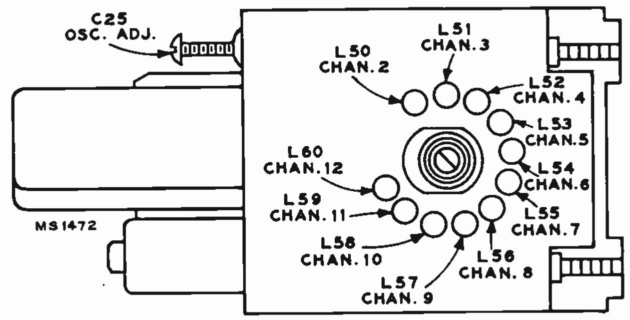


Figure 19—KRK29 R-F Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK12A TUNER ALIGNMENT

Models 21-T-392U and 21-T-393U

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep the contacts shorted while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

TELEVISION ALIGNMENT PROCEDURE

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 20. The proper curve shape is shown in Figure 20(b). (See Note on page 15 for detailed explanation of adjustment.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

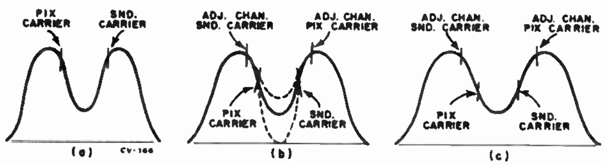


Figure 20—KRK12A VHF Insert Responses

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce –3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction of R123 and C142, and ground the positive battery terminal. Adjust the bias potentiometer to produce –5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to the junction of R135 and L102. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

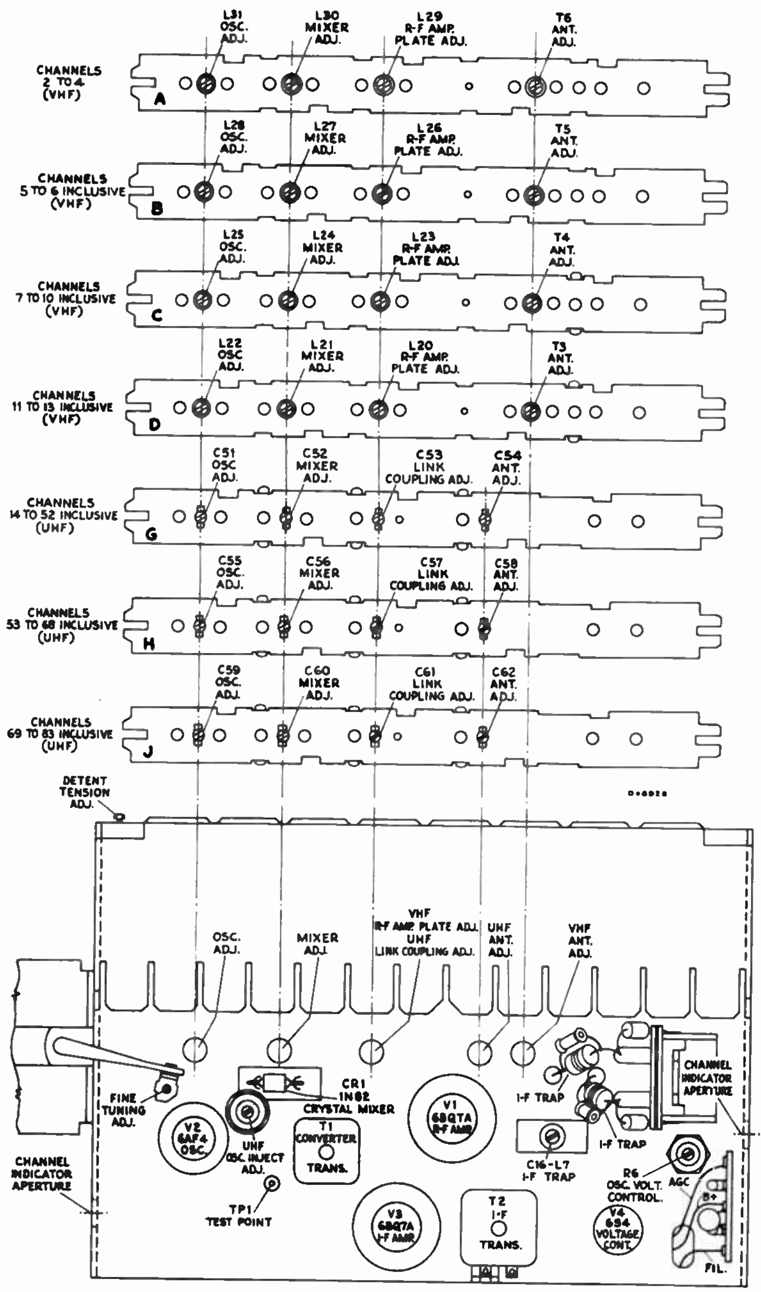


Figure 21—KRK12A Tuner Adjustments

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band. The responses are shown in Figure 22. The curve shape will usually vary from Fig. 22 (a) to Fig. 22 (c) going higher in frequency, however any of these responses are acceptable.

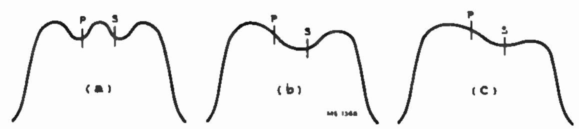


Figure 22—KRK12 UHF Insert Responses

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce –3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R123 and C142, and ground the positive battery terminal. Adjust the bias potentiometer to produce –5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to junction of R135 and L102. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used.

Set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Figure 15.

Set the UHF marker generator to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt D.C. scale.

Set oscillator injection adjustment to read .1 volt on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volt. Adjust as necessary to read .3 volt or less at TP1.

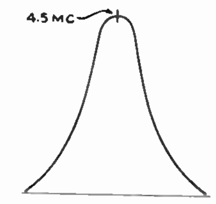


Figure 23—Sound I-F Response

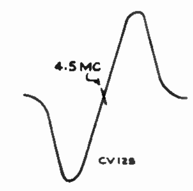


Figure 24—Ratio Det. Response

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L104 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L104 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 9 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R196, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

TELEVISION ALIGNMENT PROCEDURE

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 25. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

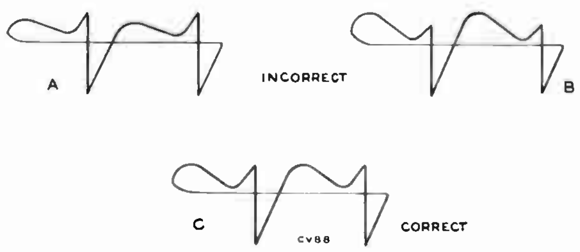


Figure 25—Horizontal Oscillator Wave Forms

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

REFLECTIONS.—Multiple images sometimes known as echoes or ghosts, are caused by the signal arriving at the antenna by two or more routes. The second or subsequent image occurs when a signal arrives at the antenna after being reflected off a building, a hill or other object. In severe cases of reflections, even the sound may be distorted. In less severe cases, reflections may occur that are not noticeable as reflections but that will instead cause a loss of definition in the picture.

Under certain extremely, unusual conditions, it may be possible to rotate or position the antenna so that it receives the cleanest picture over a reflected path. If such is the case, the antenna should be so positioned. However, such a position may give variable results as the nature of reflecting surfaces may vary with weather conditions. Wet surfaces have been known to have different reflecting characteristics than dry surfaces.

Depending upon the circumstances, it may be possible to eliminate the reflections by rotating the antenna or by moving it to a new location. In extreme cases, it may be impossible to eliminate the reflection.

INTERFERENCE.—Auto ignition, street cars, electrical machinery and diathermy apparatus may cause interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least ¼ wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

Short-wave radio transmitting and receiving equipment may cause interference in the picture in the form of moving ripples. In some instances it may be possible to eliminate the interference by the use of a trap in the antenna transmission line. However, if the interfering signal is on the same frequency as the television station, a trap will provide no improvement.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

KRK29.—Because of the frequency spectrum involved, many of the tuner leads are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in physical arrangement without being troublesome. When the tuner is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the unit is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonance does not exist which might present a faulty representation of alignment.

KRK12A.—The use of a crystal mixer makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in Figure 20 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in Figure 20 (b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in Figure 20 (a) and 20 (c).

TELEVISION ALIGNMENT DATA

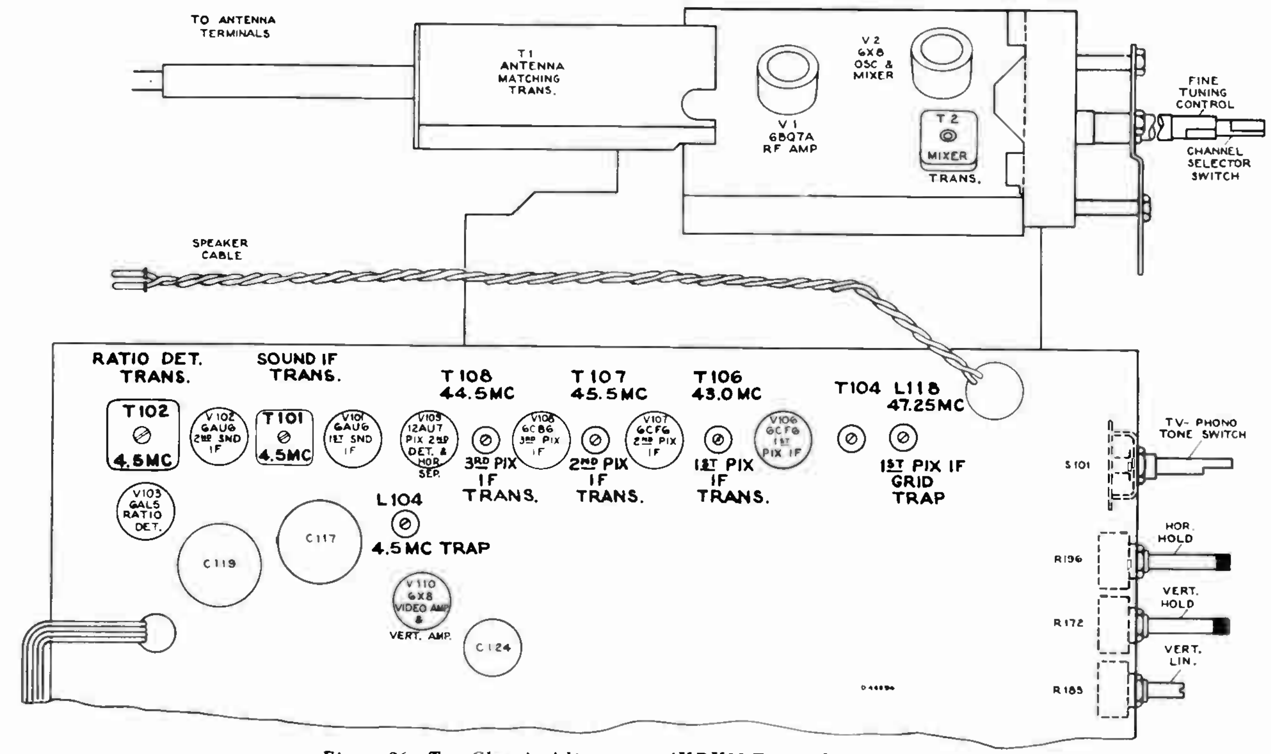


Figure 26—Top Chassis Adjustments (KRK29 Tuner shown)

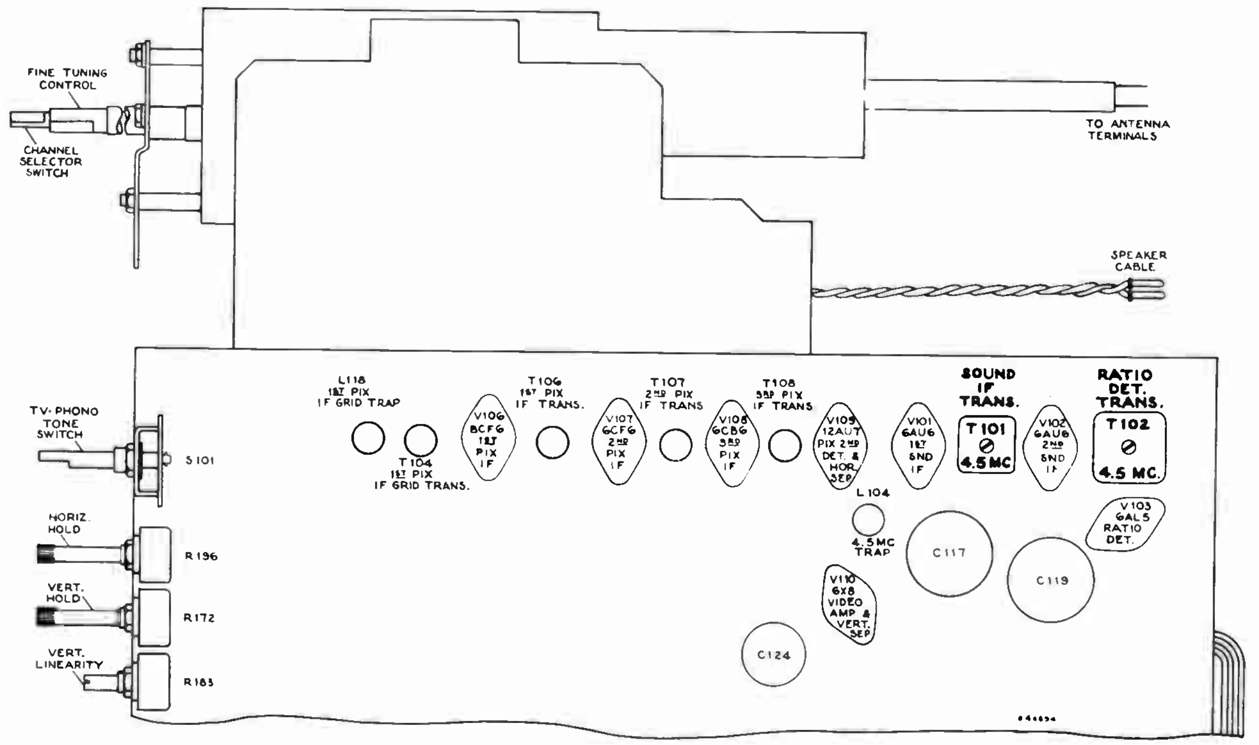


Figure 27—Bottom Chassis Adjustments (KRK29 Tuner shown)

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1, but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

RADIO SCHEMATIC DIAGRAM

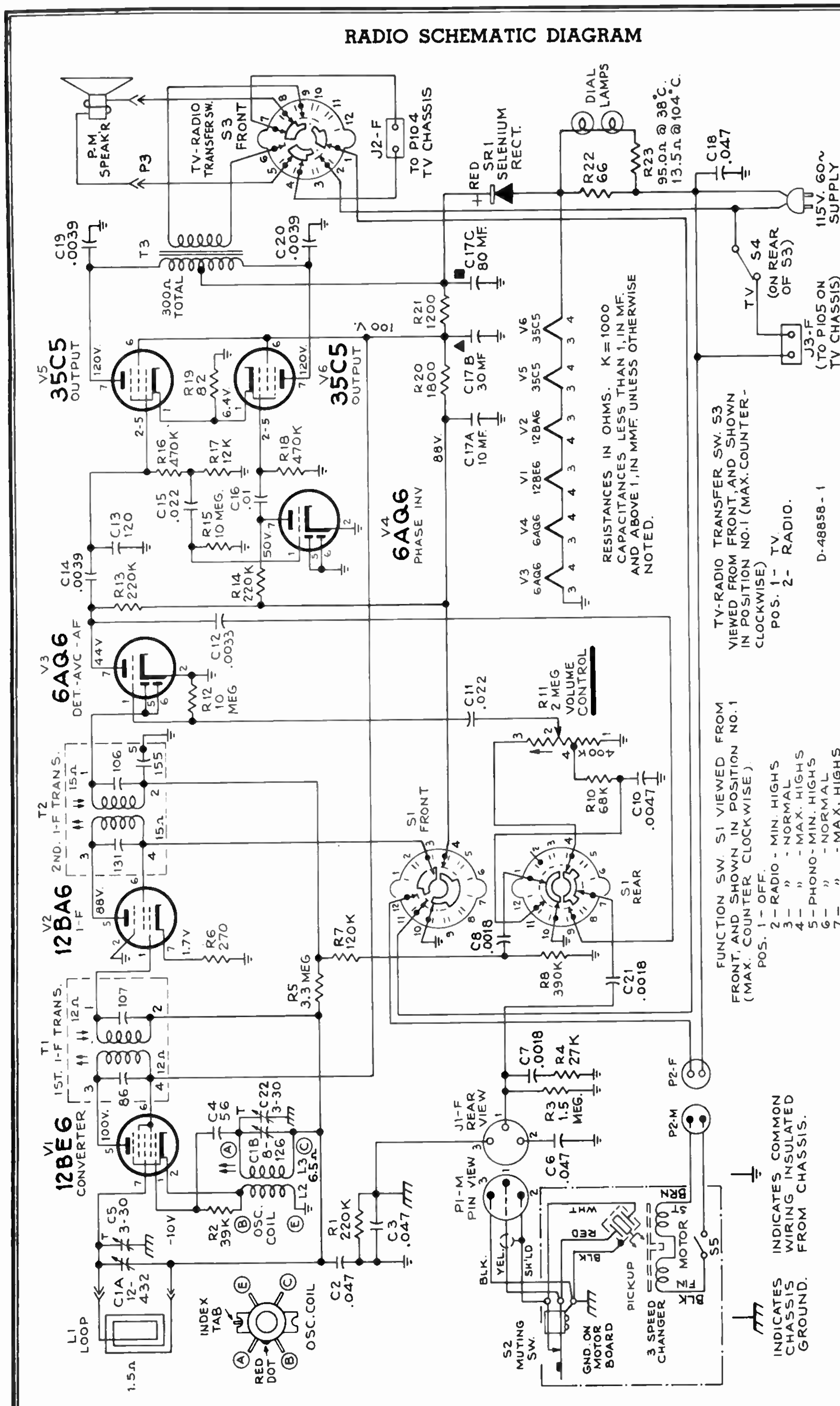


Figure 28—Radio Schematic Diagram Chassis RC1117B

Critical Lead Dress

1. Dress C15 (.022 mfd. at grid of phase inverter) over tube socket away from filament leads.
2. Keep all filament leads close to chassis.
3. Keep leads of R26 (270 ohms at I-F amplifier cathode) short as possible.
4. Connect outside foil of all capacitors as indicated in schematic diagram.
5. Dress output plate bypasses, C19 and C20, as near chassis as possible.

RADIO DATA

Dial Pointer Adjustment.—Rotate tuning condenser fully counter-clockwise (plates fully meshed). Adjust indicator pointer so that it is 3 15/16" from the left hand edge of the dial back plate.

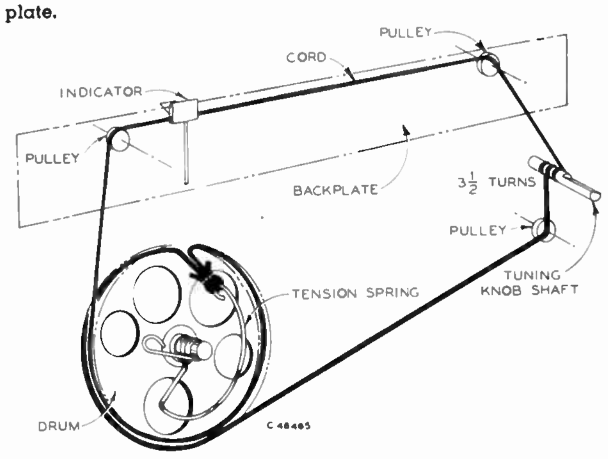


Figure 29—Dial Cord and Drive

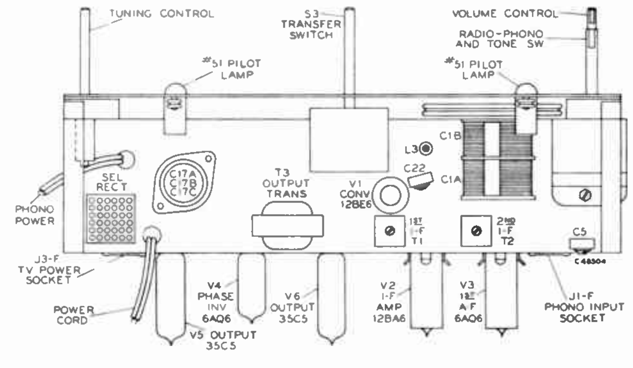


Figure 30—RC1117B Chassis Top View

Alignment Procedure

Output Meter.—Connect meter across speaker voice coil. Turn volume control to maximum.

Test Oscillator.—Connect low side of test oscillator to common wiring in series with a .1 mf. capacitor. If the test oscillator is a-c operated it may be necessary to use an isolation transformer for the receiver during alignment and the low side of the test oscillator connected directly to common wiring at the electrolytic capacitor. Keep the oscillator output low to prevent a-v-c action.

Steps	Connect the high side of test-oscillator to—	Tune test-osc. to—	Turn radio dial to—	Adjust the following for max. output
1	I-F grid, in series with .1 mfd.	455 kc	Quiet point 1,600 kc end of dial	Pri. & Sec. 2nd I-F transformer
2	Converter grid in series with .1 mfd.			Pri. & Sec. 1st I-F transformer
NOTE.—ANTENNA LOOP AND RECORD CHANGER MUST BE IN CABINET FOR THE FOLLOWING				
3	Short wire placed near loop for radiated signal	1,620 kc	Extreme R. H. end (gang open)	C22 (osc.)
4		1,400 kc	1,400 kc	C5 (ant.)
5		600 kc	Tune to Signal	Osc. L3 while rocking gang
6	Repeat steps 3, 4 and 5 if necessary.			

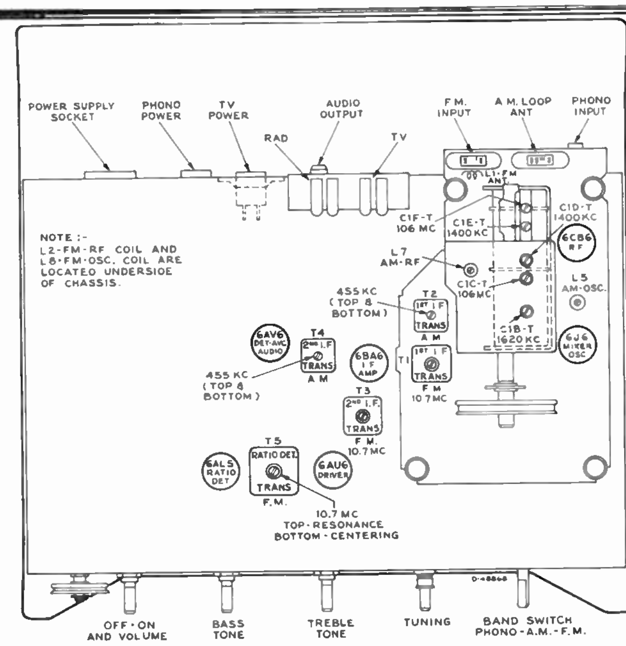


Figure 31—RC1111C Chassis Top View

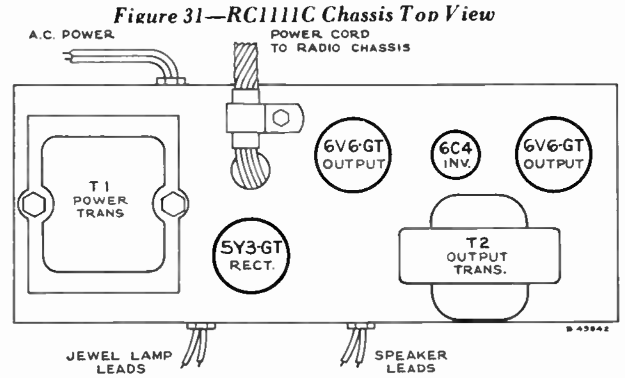


Figure 32—RS141D Chassis Top View

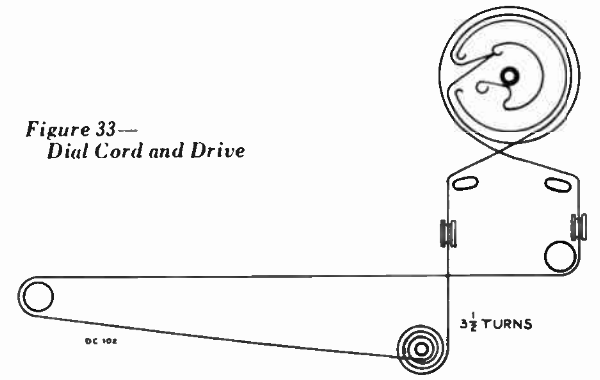


Figure 33—Dial Cord and Drive

CRITICAL LEAD DRESS

1. The 1st FM i-f plate lead should be dressed away from the r-f amp. plate.
2. Dress the 1st AM i-f plate lead to the S2 wafer away from the AM r-f coil.
3. Dress the a-c power switch wires away from all audio components.
4. Dress C26 down toward the base between the terminal board and the side apron.
5. The C18 bypass ground should be as close to the r-f shelf ground strap as possible.
6. Dress C25 away from the arm contact of the volume control.
7. All leads from the r-f shelf leaving through the shields must be kept as short as possible.
8. Dress the a-c leads in the RS141 chassis away from the audio input leads and components.

RADIO ALIGNMENT PROCEDURE

Before aligning set, completely mesh the gang and set the dial pointer to the mechanical max. calibration point at extreme left end of dial. When making a complete alignment follow the table below in sequence. Connect the output meter across the speaker voice coil, and turn the receiver volume control to max. Turn tone controls for maximum highs and maximum lows.

"AM" I-F ALIGNMENT

Test-Oscillator.—Connect low side of the test-osc. to the chassis, and keep the output as low as possible to avoid a-v-c action.

Steps	Connect the High Side of the Test Osc. to—	Tune Test Osc. to—	Function Switch	Turn Radio Dial to—	Adjust the following
1	Pin No. 1 of (V3) in series with .01 mfd.	455 kc. Modulated	AM	Low Freq. end of Dial	†Top and bot. cores of T4 For max. voltage across voice coil.
2	Stator of C1-D in series with .01 mfd.	455 kc. Modulated	AM	Low Freq. end of Dial	†Top and bot. cores of T2 For max. voltage across voice coil.

†For proper adjustment of the i-f cores start with the cores all the way out. The first peak obtained will be the correct one.

FM ALIGNMENT PROCEDURE

Connect probe of "VoltOhmyst" to negative side of C39 and low side to chassis. Top shield must be on and the bottom shield off.

Steps	Connect the High Side of the Test Osc. to—	Tune Test Osc. to—	Function Switch	Radio Dial Tuned to—	Adjust
3	Pin No. 1 of V4 in series with .01 mfd.	10.7 mc.	FM	———	Top of Ratio Det. Trans. T5 for maximum DC on "VoltOhmyst"
4	Pin No. 1 of V4 in series with .01 mfd.	30% AM Modulated	FM	———	Bottom of Ratio Det. Trans. T5 for minimum audio output on meter.
5	Repeat steps 3 and 4 as necessary making final adjustment with input set to give approx. –4.0 v. on "VoltOhmyst."				
6	Pin No. 1 of V3 in series with .01 mfd.	10.7 mc.	FM	88 mc.	†Top and bottom cores of T3 for maximum d-c across C39.
7	Stator of C1-C in series with .01 mfd.	10.7 mc.	FM	88 mc.	†Top and bottom cores of T1 for maximum d-c across C39.
8	Connect sweep generator cable to antenna terminals through 120 ohms in each side of line.	90 mc. 22.5 kc. FM mod.	FM	88 mc.	‡OSC, L8 for max. audio output.
9		106 mc. 22.5 kc. FM mod.	FM	Tune to signal	ANT, C1-FT and R-F C1-CT for max. voltage across C39.
10		90 mc. 22.5 kc. FM mod.	FM	Tune to signal	‡ANT, L1 and R-F L2 for max. voltage across C39.
11	Repeat steps 8, 9 and 10 as required.				
12	Connect a scope to junction R33 and C35, check response and linearity. Peak separation should be at least 180 kc.				

†For proper adjustment of the i-f cores start with the cores all the way out. The first peak obtained is the correct one.
‡Adjustable by increasing or decreasing spacing between turns.

"AM" R-F ALIGNMENT

Steps	Connect the High Side of the Test Osc. to—	Tune Test Osc. to—	Function Switch	Turn Radio Dial to—	Adjust the following
13	External radiating loop and couple loosely to receiver loop.	1,620 kc.	AM	Min. capacity	*Osc. C1-BT for maximum output.
14		1,400 kc.	AM	Tune to signal	*C1-DT and C1-ET for max. output.
15		600 kc.	AM	Tune to signal	‡Osc. L5 for max. output while rocking gang.
16		600 kc.	AM	Tune to signal	***R-F L7 for max. output.
17	Repeat steps 13, 14, 15 and 16 until no additional gain in sensitivity is obtained.				

‡Clip a 10,000 ohm resistor across C1-D when making this adjustment.
***Be sure the resistor employed in step 15 is removed for this adjustment.
*All R-F shields must be in place.

RADIO VOLTAGE CHART

Voltages shown are as read with "VoltOhmyst" between indicated terminal and chassis, with receiver operating on 117 volts, and with no signal input.

Tube Type and Function	Tube Element	Pin No.	AM	FM	Phono
V1 6CB6 R-F Amp	Plate Screen Cathode Grid	5 6 2 1	215 74 0.4 –0.8	180 62 0.4 0.4	— — — —
V2 6J6 Osc. and Mixer	Plate Grid Plate Grid	2 5 1 6	55 –1.2 43 –2.0	58 –1.3 46 –1.2	— — — —
V3 6BA6 I-F Amp	Plate Screen Cathode Grid	5 6 7 1	210 126 0.9 –0.8	210 115 0.7 –0.2	— — — —
V4 6AU6 Driver	Plate Screen Cathode Grid	5 6 7 1	216 150 1.5 0	216 150 1.5 0	— — — —

Tube Type and Function	Tube Element	Pin No.	AM	FM	Phono
V5 6AL5 Ratio Det.	— —	— —	— —	— —	— —
V6 6AV6 Audio Amp.	Plate Grid	7 1	88 –0.7	88 –0.7	104 –0.8
V7 6C4 Phase Inverter	Plate Cathode Grid	5 7 6	87.5 –11 –16	88 –11 –16	120 –13 –19
V8 6V6GT V9 6V6GT Audio Power Output	Plate Screen Cathode Grid	3 4 8 5	300 224 0 –17	300 224 0 –17	298 292 0 –21
V10 5Y3GT Rectifier	Fil.	8	305	305	307

RADIO SCHEMATIC DIAGRAM

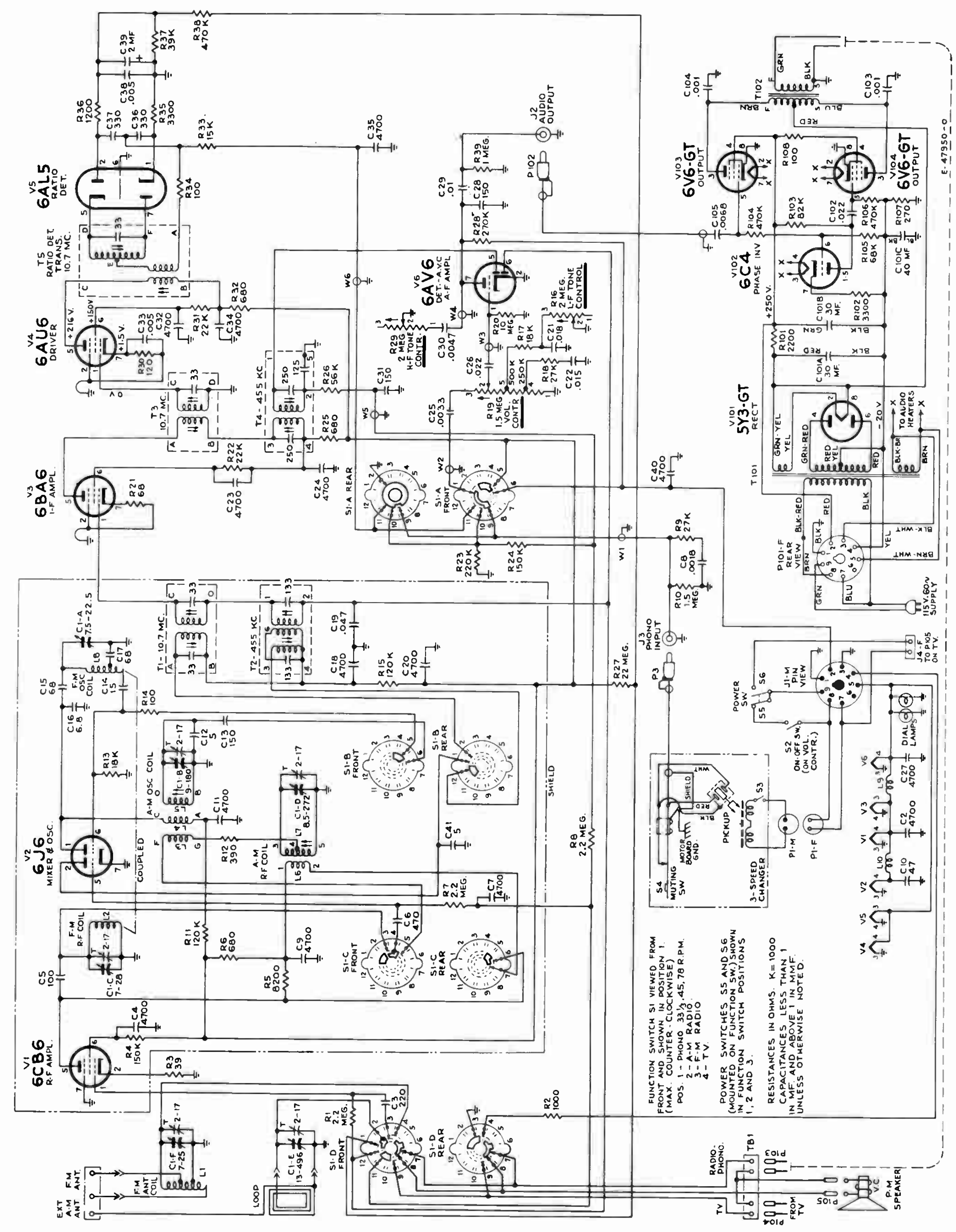


Figure 34—Radio Schematic Diagram Chassis RC1111C

TELEVISION VOLTAGE CHART

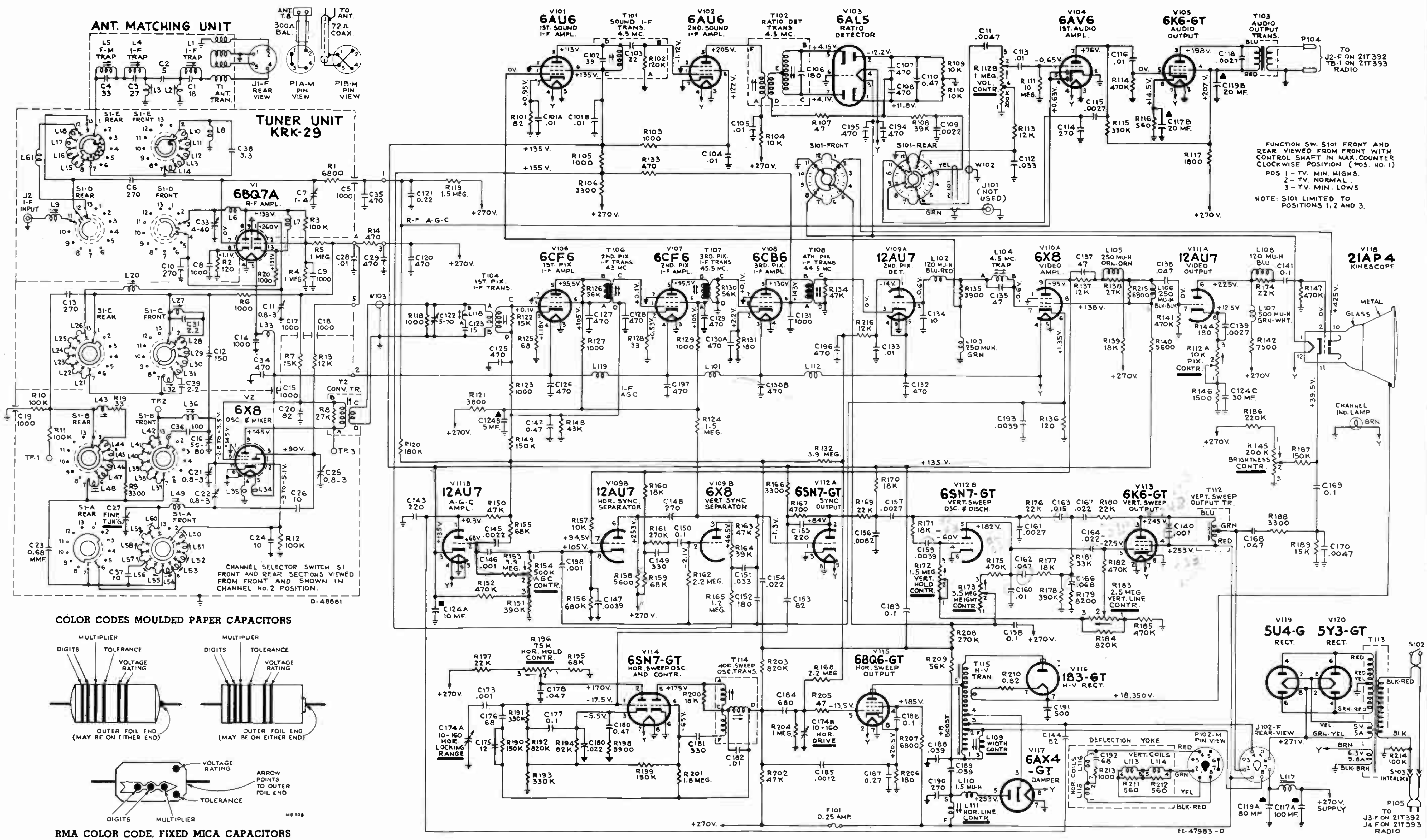
The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1 KRK29	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 KRK29	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	
			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	
V1 KRK12A	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	143	—	—	8	1.2	7	0	
			No Signal	6	138	—	—	8	1.0	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	260	—	—	3	143	2	97	
			No Signal	1	250	—	—	3	137	2	97	
V2 KRK12A	6AF4	R-F Oscillator	15000 Mu. V. Signal	1 & 7	78	—	—	5	0	2 & 6	—8	
			No Signal	1 & 7	75	—	—	5	0	2 & 6	—6	
V3 KRK12A	6BQ7A	I-F Amplifier	15000 Mu. V. Signal	6	270	—	—	8	148	7	103	
			No Signal	6	260	—	—	8	142	7	99	
		I-F Amplifier	15000 Mu. V. Signal	1	148	—	—	3	1.4	2	0	
			No Signal	1	143	—	—	3	1.2	2	0	
V4 KRK12A	6S4	Voltage Control	15000 Mu. V. Signal	9	270	—	—	2	94	6	*68	*Depends on adjustment of R6.
			No Signal	9	260	—	—	2	90	6	*65	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	122	6	138	7	1.01	1	0	
			No Signal	5	113	6	126	7	.95	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	210	6	130	7	0	1	—2.05	*Unreliable measuring point. Voltage depends on noise
			No Signal	5	205	6	122	7	0	1	*—1.12	
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	1.7	—	—	1	21	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	4.1	—	—	1	11.8	—	—	
		Ratio Detector	15000 Mu. V. Signal	2	1.7	—	—	5	21	—	—	
			No Signal	2	4.1	—	—	5	11.8	—	—	
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	78	—	—	2	0	1	—.7	At min. volume
			No Signal	7	76	—	—	2	0	1	—.65	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	205	4	220	8	15.2	5	0	At min. volume
			No Signal	3	198	4	207	8	14.5	5	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	218	6	240	2	132	1	—8.2	*Unreliable measuring point. Make measurement at T104-B.
			No Signal	5	95.5	6	105	2	1.18	1	*<0.1	
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	222	6	243	2	<0.1	1	—8.45	
			No Signal	5	95.5	6	105	2	0.53	1	<0.1	

TELEVISION VOLTAGE CHART

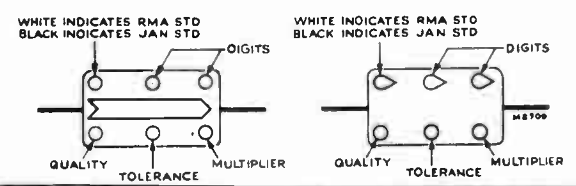
Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	138	6	150	2	2.3	1	0	
			No Signal	5	130	6	143	2	2.2	1	<0.1	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	—25.8	—	—	3	0	2	—1.85	
			No Signal	1	—14	—	—	3	0	2	—.6	
V109B	12AU7	Horiz. Sync Separator	15000 Mu. V. Signal	6	260	—	—	8	160	7	122	
			No Signal	6	253	—	—	8	105	7	94.5	
V110A	6X8	Video Amplifier	15000 Mu. V. Signal	9	120	8	147	6	.9	7	—1.85	AGC control set for normal operation
			No Signal	9	95	8	138	6	1.35	7	—.6	AGC control set for normal operation
V110B	6X8	Vert. Sync Separator	15000 Mu. V. Signal	3	79	—	—	6	.90	2	—26.8	
			No Signal	3	46.5	—	—	6	1.35	2	—2.1	
V111A	12AU7	Video Output	15000 Mu. V. Signal	6	231	—	—	8	13	7	0	
			No Signal	6	225	—	—	8	12.5	7	0	
V111B	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	—55	—	—	3	135	2	125	
			No Signal	1	0.3	—	—	3	132	2	68	
V112A	6SN7GT	Sync Output	15000 Mu. V. Signal	1	83	—	—	3	0	2	—3.28	
			No Signal	1	84	—	—	3	0	2	—1.3	
V112B	6SN7GT	Vertical Oscillator & Discharge	15000 Mu. V. Signal	1	80	—	—	8	0	7	—63.5	Depends on setting of Vert. hold control
			No Signal	6	182	—	—	8	0	7	—60	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	253	4	262	8	0	5	—28.8	
			No Signal	3	245	4	253	8	0	5	—27.5	
V114	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	175	—	—	3	—3.5	1	—21	
			No Signal	2	170	—	—	3	—5.5	1	—17.5	
	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	183	—	—	6	0	4	—67	
			No Signal	5	179	—	—	6	0	4	—65	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	193	8	22	5	—14	*High Voltage Pulse Present
			No Signal	Cap	*	4	185	8	20.5	5	—13.5	*High Voltage Pulse Present
V116	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	18,700	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	18,350	—	—	*High Voltage Pulse Present
V117	6AX4GT	Damper	15000 Mu. V. Signal	5	261	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	253	—	—	3	*	—	—	*High Voltage Pulse Present
V118	21AP4	Kinescope	15000 Mu. V. Signal	Cap	18,700	10	428	11	44.5	2	0	At average Brightness
			No Signal	Cap	18,350	10	425	11	39.5	2	0	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	277	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	271	—	—	

TELEVISION CIRCUIT SCHEMATIC DIAGRAM, KCS83F



COLOR CODES MOULDED PAPER CAPACITORS

RMA COLOR CODE, FIXED MICA CAPACITORS



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The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

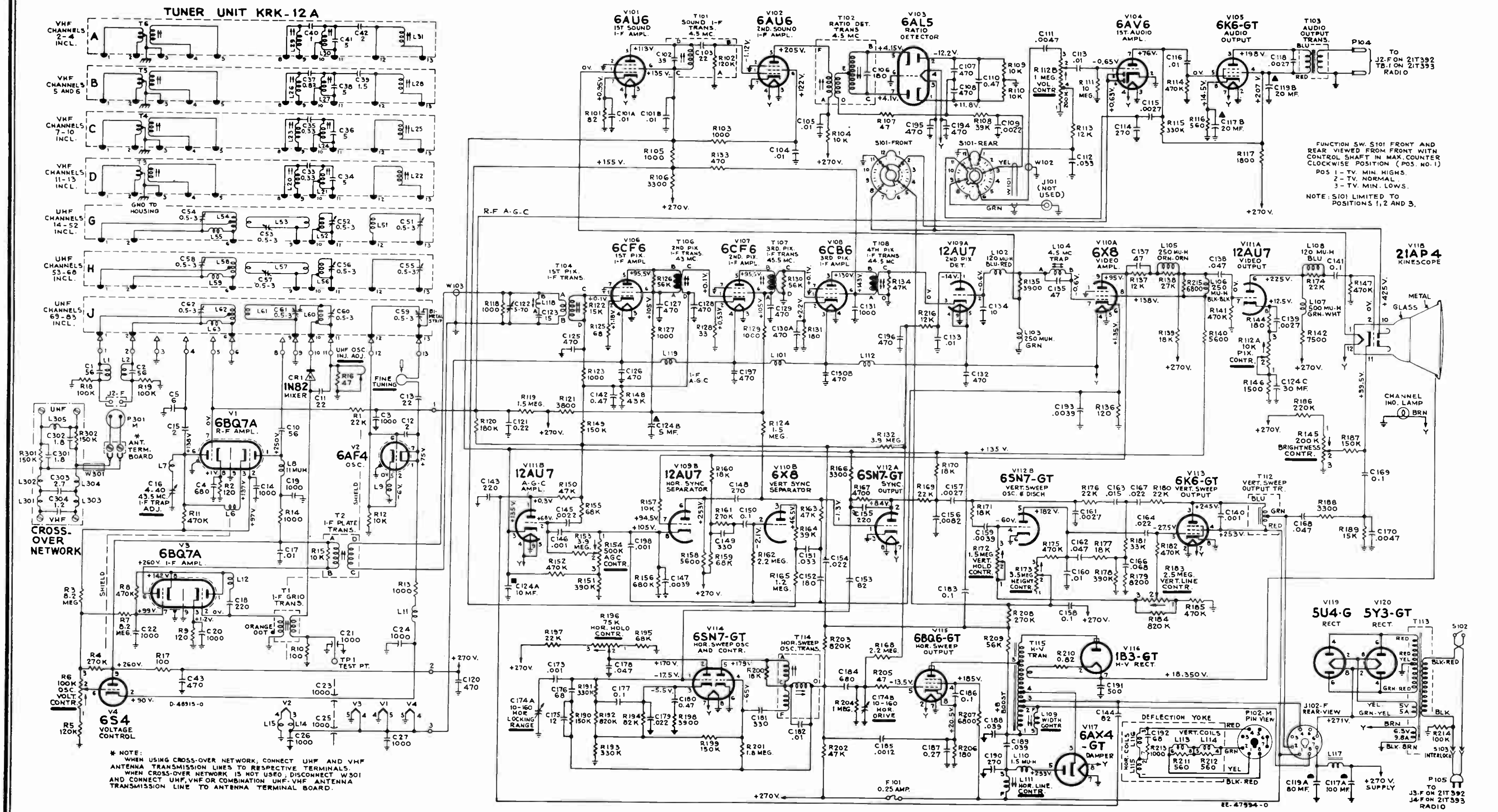
All capacitance values less than 1 in FM and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 35—Television Circuit Schematic Diagram, KCS83F

TELEVISION CIRCUIT SCHEMATIC DIAGRAM, KCS83H



All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 36—Television Circuit Schematic Diagram, KCS83H

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
	TUNER ASSEMBLIES
	KRK29
76539	Board—Antenna matching transformer terminal board less coils and capacitors
78235	Board—Terminal board, 5 contact and ground
78233	Bracket—Side bracket for mounting coil and stators
77853	Capacitor—Ceramic, variable, for fine tuning capacitor —plunger type (C27)
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C33)
	Capactior—Adjustable, steatite:
77151	0.8-3.0 mmf. (C11, C21, C25)
77913	0.8-3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitor—Ceramic:
77084	feed-thru, 1000 mmf. (C5, C15, C17, C18, C19)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, —0%, 500 volts (C29, C34, C35)
77252	1000 mmf., +100%, —0%, 500 volts (C8, C9, C14)
73960	10,000 mmf., +100%, —0%, 500 volts (C28)
	Capacitor—Fixed, ceramic, insulated, High "K"
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
93056	5 mmf., ±0.5% mmf., 500 volts (C2)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. ≠ —750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitor—Fixed, ceramic, Temp. coef.—N1400
78603	82 mmf., ±10%, 500 volts (C20)
	Capacitor—Fixed, headed-lead:
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31, C39)
71503	3.3 mmf., ±20%, 500 volts (C38)
	Capacitor—Mica trimmer:
78397	80-150 mmf. (C16)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
73874	Coil—Channel #6 mixer coil (L48)
73460	Coil—Channel #6 r.f. plate coil (L32)
73458	Coil—Channel #6 r.f. grid coil (L14)
78401	Coil—Channel #6 antenna coil (L61)
77915	Coil—Channel #13 oscillator coil (L49)
77919	Coil—Channel #13 mixer coil (L36)
77921	Coil—Channel #13 r.f. plate coil (L20)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
78583	Coil—Mixer I.F. coil (L43)
76562	Coil—RF amplifier coupling coil (L7)
78584	Coil—RF plate I.F. coil (L27)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
503033	33 ohms, ±10%, ½ watt (R19)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R6, R20)
503233	3300 ohms, ±10%, ½ watt (R9)
503268	6800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78399	Transformer—Convertor transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—IF trap
76542	Trap—IF trap (41.25 MC) complete with core (L1)
76541	Trap—IF trap (45.75 MC) complete with core (L4)
75190	Washer—Insulating washer (neoprene) for capacitor
	TUNER ASSEMBLIES
	KRK12A
77580	Ball—Steel ball (.125" dia.) (12 req'd)
77579	Ball—Steel ball (.187" dia.)
77618	Bracket—Bracket and spring contact assembly for grounding rotor—assembled to oscillator shield
78338	Bracket—Lamp bracket
77619	Bracket—VHF input connector and bracket
76845	Bracket—Vertical bracket for oscillator tube shield
77591	Cam—Fine tuning cam
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C16)
	Capacitor—Fixed, ceramic:
77667	comprising 1 section of 2 mmf., and 1 section of 22 mmf (C12, C13)
77621	crystal holder 22 mmf., temp. coef. = —750 (C11)
77084	feed-thru, 1000 mmf. (C21, C23, C25)
77615	stand-off, 1000 mmf. (C3, C19, C24, C26)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0
77210	2 mmf., ±0.25 mmf., 500 volts (C15)
77688	5 mmf., ±0.5 mmf., 500 volts (C34, C36, C38, C41)
74182	6 mmf., ±0.5 mmf., 500 volts (C5)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = —750
71924	56 mmf., ±10%, 500 volts (C10)
	Capacitor—Fixed, ceramic, High "K" disc:
77625	220 mmf., +100%, —0%, 500 volts (C18)
77293	470 mmf., +100%, —0%, 500 volts (C43)
77624	680 mmf., +100%, —0%, 500 volts (C4)
77252	1000 mmf., +100%, —0%, 500 volts (C14, C20, C22, C27)
73960	10,000 mmf., +100%, —0%, 500 volts (C17)
	Capacitor—Fixed, headed-lead:
77691	.33 mmf., ±10%, 500 volts (C33, C35)
77689	.82 mmf., ±10%, 500 volts (C37)
77690	1 mmf., ±10%, 500 volts (C40)
71500	1.5 mmf., ±10%, 500 volts (C39)
78047	2 mmf., ±10%, 500 volts (C42)
77634	Coil—I.F. neutralizing coil (L12)
77628	Coil—I.F. trap (L7)
77629	Coil—Oscillator cathode coil (L9)
77631	Coil—Oscillator heater coil (L14)
77632	Coil—Oscillator heater coil (L15)
78224	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R14)

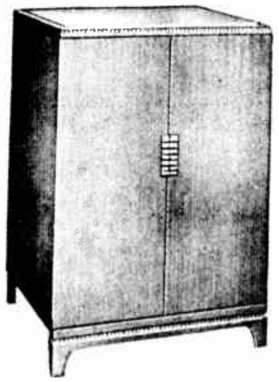
STOCK No.	DESCRIPTION
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
77585	Washer—"C" washer for indicator shaft or fine tuning link spring
	CHASSIS ASSEMBLIES
	KCS 83F—VHF CHASSIS
	KCS 83H—UHF CHASSIS
	Capacitor—Adjustable, mica:
78220	5-70 mmf. (C122)
	Capacitor—Fixed, ceramic:
78225	82 mmf., ±10%, 3500 volts (C144)
76438	500 mmf., 25,000 volts (C191)
	Capacitor—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, —0%, 500 volts (C120, C125, C126, C128, C132, C194, C195, C196, C197)
78622	470 mmf., ±20%, 500 volts (C127, C129)
77672	dual 470 mmf., +100%, —0%, 500 volts (C130)
78623	1000 mmf., ±20%, 500 volts (C131)
73960	10,000 mmf., +100%, —0%, 500 volts (C104, C105, C133)
76991	dual 10,000 mmf., +100%, —0%, 500 volts (C101A, C101B)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. —750
33098	10 mmf., ±1 mmf., 500 volts (C134)
33380	12 mmf., ±10%, 500 volts (C175)
39044	15 mmf., ±5%, 500 volts (C123)
39042	47 mmf., ±5%, 500 volts (C137)
71922	180 mmf., ±10%, 500 volts (C152)
47617	270 mmf., ±10%, 500 volts (C114)
	Capacitor—Fixed, mica:
76475	68 mmf., ±5%, 1000 volts (C176)
76474	82 mmf., ±5%, 1000 volts (C153)
39636	220 mmf., ±10%, 500 volts (C155)
75248	220 mmf., ±10%, 1000 volts (C143)
76579	270 mmf., ±10%, 1000 volts (C148, C190)
39640	330 mmf., ±10%, 500 volts (C149)
76476	330 mmf., ±5%, 1000 volts (C181)
39644	470 mmf., ±5%, 500 volts (C107, C108)
	Capacitor—Mica trimmer:
75217	dual 10-160 mmf. (C174A, C174B)
	Capacitor—Electrolytic:
78213	comprising: 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 30 mfd., 50 volts (C124A, C124B, C124C)
77644	comprising: 1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C119A, C119B)
78212	comprising: 1 section of 100 mfd., 400 volts and 1 section of 20 mfd., 50 volts (C117A, C117B)
	Capacitor—Fixed, paper, oil impregnated:
75643	.001 mfd., 1000 volts (C140, C146, C173, C198)
73595	.0022 mfd., 600 volts (C109, C145)
73599	.0027 mfd., 600 volts (C115, C139, C157, C161)
73818	.0027 mfd., 1600 volts (C118)
73796	.0039 mfd., 600 volts (C147, C193)
73920	.0047 mfd., 600 volts (C111, C170)
73808	.0082 mfd., 1000 volts (C156)
73561	.01 mfd., 400 volts (C113, C116)
73551	.01 mfd., 400 volts (C150, C158, C169, C177)
73565	.01 mfd., 1000 volts (C160)
73797	.015 mfd., 600 volts (C163)
73562	.022 mfd., 400 volts (C179)
73798	.022 mfd., 600 volts (C164, C167)
73810	.022 mfd., 1000 volts (C154)
73552	.033 mfd., 400 volts (C112, C151)
73813	.039 mfd., 1000 volts (C188, C189)
73553	.047 mfd., 400 volts (C178)
73592	.047 mfd., 600 volts (C138, C162, C168)
73792	.068 mfd., 400 volts (C166)
73557	.1 mfd., 600 volts (C141, C183, C186)
73794	.22 mfd., 400 volts (C121)
73786	.27 mfd., 200 volts (C187)
73787	.47 mfd., 200 volts (C110, C142, C180)
	Capacitor—Fixed, moulded paper, mineral oil impregnated:
76479	.00068 mfd., 600 volts (C184)
76995	.0012 mfd., 600 volts (C185)
78221	.0039 mfd., 600 volts (C159)
73594	.01 mfd., 600 volts (C182)
77676	Choke—Filter choke (L117)
73477	Coil—Filament choke coil (L101, L112, L119)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
75253	Coil—Peaking coil (120 muh) (L102)
71529	Coil—Peaking coil (120 muh) (L108, R174)
71526	Coil—Peaking coil (250 muh) (L103)
77674	Coil—Peaking coil (250 muh) (L105, R138)
78222	Coil—Peaking coil (250 muh) (L106, R215)
75252	Coil—Peaking coil (500 muh) (L107)
76640	Coil—RF choke coil (1.5 muh) (L110)
78205	Coil—Width coil complete with adjustable core (L109).
35787	Connector—Audio input connector (J101)
76457	Connector—Second anode lead connector
75474	Connector—Single contact male connector for speaker leads
74594	Connector—2 contact male connector for power cord
50367	Connector—6 contact female connector for yoke leads (J102)
76975	Control—AGC control (R154)
78209	Control—Brightness control (R145)
78206	Control—Height control (R173)
77639	Control—Horizontal hold control (R196)
78208	Control—Picture control, volume control and power switch (R112A, R112B, S102)
78210	Control—Vertical hold control (R172)
78207	Control—Vertical linearity control (R183)
78199	Cover—Hi-voltage compartment cover
78214	Fuse—.3 amp., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd anode lead conne
78218	Holder—Fuse holder
78215	Insulator—Polystyrene insulator for hi-voltage socket
78226	Lead—Anode lead complete with eyelet
	Resistor—Fixed, wire wound:
76382	0.82 ohms, 1/3 watt (R210)
76639	180 ohms, 2 watts (R206)
77670	3300 ohms, 7 watts (R106)
77671	3800 ohms, 7 watts (R121)
	Resistor—Fixed, composition:
502033	33 ohms, ±5%, ½ watt (R128)
503047	47 ohms, ±10%, ½ watt (R107, R205)
502068	68 ohms, ±5%, ½ watt (R125)

STOCK No.	DESCRIPTION
503112	120 ohms, ±10%, ½ watt (R136)
502118	180 ohms, ±5%, ½ watt (R131)
503118	180 ohms, ±10%, ½ watt (R144)
503147	470 ohms, ±10%, ½ watt (R133)
513156	560 ohms, ±10%, 1 watt (R116)
503210	1000 ohms, ±10%, ½ watt (R103, R118, R123, R127, R129)
513210	1000 ohms, ±10%, 1 watt (R105)
503215	1500 ohms, ±10%, ½ watt (R146)
523218	1800 ohms, ±10%, 2 watts (R117)
30733	3300 ohms, ±5%, ½ watt (R166)
503233	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R135)
503239	3900 ohms, ±10%, ½ watt (R198)
503247	4700 ohms, ±10%, ½ watt (R167)
503256	5600 ohms, ±10%, ½ watt (R140, R158)
523268	6800 ohms, ±10%, 2 watts (R207)
512275	7500 ohms, ±5%, 1 watt (R142)
503282	8200 ohms, ±10%, ½ watt (R179)
502310	10,000 ohms, ±5%, ½ watt (R109, R110)
503310	10,000 ohms, ±10%, ½ watt (R157)
523310	10,000 ohms, ±10%, 2 watts (R104)
503312	12,000 ohms, ±10%, ½ watt (R113, R137, R216)
503315	15,000 ohms, ±10%, ½ watt (R122, R189)
502318	18,000 ohms, ±5%, ½ watt (R177)
503318	18,000 ohms, ±10%, ½ watt (R160, R170, R171, R200)
523318	18,000 ohms, ±10%, 2 watts (R139)
502322	22,000 ohms, ±5%, ½ watt (R180)
503322	22,000 ohms, ±10%, ½ watt (R169, R176, R197)
502333	33,000 ohms, ±5%, ½ watt (R181)
503339	39,000 ohms, ±10%, ½ watt (R108, R164)
502343	43,000 ohms, ±5%, ½ watt (R148)
503347	47,000 ohms, ±10%, ½ watt (R134, R163)
512347	47,000 ohms, ±5%, 1 watt (R202)
513347	47,000 ohms, ±10%, 1 watt (R150)
502356	56,000 ohms, ±5%, ½ watt (R126, R130)
503356	56,000 ohms, ±10%, ½ watt (R209)
503368	68,000 ohms, ±10%, ½ watt (R155, R159, R195)
503382	82,000 ohms, ±10%, ½ watt (R194)
503410	100,000 ohms, ±10%, ½ watt (R214)
502415	150,000 ohms, ±5%, ½ watt (R149)
503415	150,000 ohms, ±10%, ½ watt (R187, R190)
512415	150,000 ohms, ±5%, 1 watt (R199)
502418	180,000 ohms, ±5%, ½ watt (R120)
503422	220,000 ohms, ±10%, ½ watt (R186)
503427	270,000 ohms, ±10%, ½ watt (R161, R208)
503433	330,000 ohms, ±10%, ½ watt (R115, R191, R193)
503439	390,000 ohms, ±10%, ½ watt (R151, R178)
502447	470,000 ohms, ±5%, ½ watt (R185)
503447	470,000 ohms, ±10%, ½ watt (R114, R141, R147, R152, R175, R182)
503468	680,000 ohms, ±10%, ½ watt (R156)
502482	820,000 ohms, ±5%, ½ watt (R184)
503482	820,000 ohms, ±10%, ½ watt (R192, R203)
503510	1 megohm, ±10%, ½ watt (R204)
503512	1.2 megohm, ±10%, ½ watt (R165)
502515	1.5 megohm, ±5%, ½ watt (R119, R124)
512518	1.8 megohm, ±5%, 1 watt (R201)
503522	2.2 megohm, ±10%, ½ watt (R162, R168)
503539	3.9 megohm, ±10%, ½ watt (R132, R153)
503610	10 megohm, ±10%, ½ watt (R111)
78203	Transformer—1st I.F. pix transformer complete with adjustable core (T104)
76433	Transformer—2nd, 3rd, or 4th, I.F. transformer (T106, T107, T108)
78201	Transformer—Hi-voltage transformer (T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable core (T114)
76997	Transformer—Output transformer (T103)
78200	Transformer—Power transformer 117 volts, 60 cycle (T113)
77112	Transformer—Ratio detector transformer complete with adjustable core (T102, C106)
76981	Transformer—Sound I.F. transformer complete with adjustable core (T101, C102, C103, R102)
78202	Transformer—Vertical output transformer (T112)
78204	Trap—1st I.F. grid trap complete with adjustable core (L118)
76983	Trap—4.5 MC trap (L104, C135)
78219	Washer—Vellutex washer for tube socket and shield
	RADIO CHASSIS ASSEMBLIES
	RC-1117 B
	(For Models 21T392, 21T392U)
76876	Antenna—Antenna loop complete
76867	Capacitor—Variable tuning capacitor complete with drive drum (C1A, C1B)
76872	Capacitor—Adjustable trimmer, 2.5—30 mmf., (C5, C22)
	Capacitor—Ceramic:—
77116	56 mmf. (C4)
76347	120 mmf. (C13)
73013	Capacitor—Electrolytic comprising 1 section of 80 mfd., 150 volts and 1 section of 30 mfd., 150 volts and 1 section of 10 mfd., 150 volts (C17A, C17B, C17C)
	Capacitor—Tubular, paper:—
73851	.0018 mfd., 1600 volts (C7, C8, C21)
73795	.0033 mfd., 400 volts (C12)
73796	.0039 mfd., 600 volts (C14, C19, C20)
73920	.0047 mfd., 600 volts (C10)
73562	.022 mfd., 400 volts (C11, C15)
73561	.01 mfd., 400 volts (C16)
73553	.047 mfd., 400 volts (C2, C3, C6)
	Capacitor—Tubular, moulded paper:—
75071	.047 mfd., 400 volts (C18)
76871	Rectifier—Selenium rectifier (SR1)
73072	Resistor—Nominal value 95 ohms @ 38°C. with negative temperature coefficient (R23)
77379	Resistor—Wire wound, 66 ohms, 5 watts (R22)
	Resistor—Fixed, composition:—
503082	82 ohms, ± 10%, ½ watt (R19)
503127	270 ohms, ±10%, ½ watt (R6)
513212	1200 ohms, ±10%, 1 watt (R21)
502218	1800 ohms, ±5%, ½ watt (R20)
503312	12,000 ohms, ±10%, ½ watt (R17)
503327	27,000 ohms, ±10%, ½ watt (R4)
503339	39,000 ohms, ±10%, ½ watt (R2)
503368	68,000 ohms, ±10%, ½ watt (R10)
503412	120,000 ohms, ±10%, ½ watt (R7)
503422	220,000 ohms, ±10%, ½ watt (R1, R13, R14)
503439	390,000 ohms, ±10%, ½ watt (R8)
503447	470,000 ohms, ±10%, ½ watt (R16, R18)
503515	1.5 megohm, ±10%, ½ watt (R3)
503533	3.3 megohm, ±10%, ½ watt (R5)
503610	10 megohm, ±10%, ½ watt (R12, R15)
76869	Shaft—Tuning knob shaft
76870	Shield—Tube shield
74697	Socket—Dial lamp socket
77115	Socket—Tube socket, 7 pin, miniature moulded
51955	Socket—Tube socket, 7 pin, miniature moulded saddle-mounted

STOCK No.	DESCRIPTION
76368	Spring—Drive cord spring
76873	Switch—Radio phono switch less volume control (S1)
77377	Switch—"Radio-TV" switch (S3, S4)
77122	Transformer—Output transformer (T3)
74918	Transformer—1st I.F. transformer complete with adjustable cores (T1)
73037	Transformer—2nd I.F. transformer complete with adjustable cores (T2)
33726	Washer—"C" washer for tuning knob shaft
	RADIO CHASSIS ASSEMBLIES
	RC-1111C
	(For Models 21T393, 21T393U)
77332	Antenna—Radio antenna loop complete less cable
77308	Capacitor—Variable tuning capacitor (C1-1, C1-2, C1-3, C1-4, C1-5, C1-6)
	Capacitor—Fixed, ceramic, high "K" disc:—
73473	4700 mmf., +100%, —0%, 500 volts DC (C2, C4, C7, C9, C11, C18, C20, C23, C24, C27, C32, C34, C35, C40)
	Capacitor—Fixed, ceramic, insulated, high "K" disc:—
76348	47 mmf., ±10%, 500 volts DC (C10)
75614	150 mmf., ±20%, 500 volts DC (C13, C28, C31)
75611	220 mmf., ±20%, 500 volts DC (C3)
	Capacitor—Fixed, ceramic, non-insulated, temp. coef. = —750:—
75613	5 mmf., ±1.0 mmf., 500 volts DC (C12, C14)
30944	15 mmf., ±10%, 500 volts DC (C14)
75612	68 mmf., ±10%, 500 volts DC (C15, C17)
39396	100 mmf., ±10%, 500 volts DC (C5)
	Capacitor—Fixed, ceramic, non-insulated, temp. coef. = —470 ±15%:—
77352	6.8 mmf., ±5%, 500 volts DC (C16)
	Capacitor—Fixed, mica:—
39640	330 mmf., 500 volts (C36, C37)
39644	470 mmf., 300 volts (C6)
73747	Capacitor—Electrolytic, 2 mfd., 50 volts (C39)
	Capacitor—Fixed, tubular, paper:—
77468	.0018 mfd., 600 volts (C8)
73795	.0033 mfd., 400 volts (C25)
73920	.0047 mfd., 600 volts (C30)
72490	.005 mfd., 200 volts (C33, C38)
73561	.01 mfd., 400 volts (C29)
73797	.015 mfd., 600 volts (C22)
77469	.018 mfd., 200 volts (C21)
73562	.022 mfd., 400 volts (C26)
73558	.047 mfd., 200 volts (C19)
73935	Clip—Mounting clip for I.F. transformer 75558 & 76328
77313	Coil—Antenna coil—F.M.(L1)
71942	Coil—Filament choke coil (L9, L10)
75569	Coil—Oscillator coil—AM—complete with adjustable core (L3, L4, L5)
77315	Coil—Oscillator coil—FM (L8)
77305	Coil—RF coil—AM—complete with adjustable core (L6, L7)
77314	Coil—RF coil—FM (L2)
75562	Control—Tone control—H.F. (R29)
75561	Control—Tone control—L.F. (R16)
75537	Control—Volume control and power switch (R19, S2)
72953	Cord—Drive cord (approx. 57" overall)
75564	Coupling—Spring coupling for function switch extension shaft
74839	Fastener—Push fastener to fasten RF shelf (4 req'd)
16058	Grommet—Rubber grommet for mounting RF shelf (4 req'd)
11765	Lamp—Dial lamp—Mazda 51
72602	Pulley—Drive cord pulley
35641	Pulley—Drive cord pulley—1⅝" dia.
	Resistor—Fixed, composition:—
503039	39 ohms, ±10%, ½ watt (R3)
503068	68 ohms, ±10%, ½ watt (R21)
503110	100 ohms, ±10%, ½ watt (R14, R34)
503112	120 ohms, ±10%, ½ watt (R30)
503139	390 ohms, ±10%, ½ watt (R12)
503168	680 ohms, ±10%, ½ watt (R6, R25, R32)
503210	1000 ohms, ±10%, ½ watt (R2)
502212	1200 ohms, ±5%, ½ watt (R36)
502233	3300 ohms, ±5%, ½ watt (R35)
503282	8200 ohms, ±10%, ½ watt (R5)
503315	15,000 ohms, ±10%, ½ watt (R33)
503318	18,000 ohms, ±10%, ½ watt (R13, R17)
503322	22,000 ohms, ±10%, ½ watt (R22, R31)
503327	27,000 ohms, ±10%, ½ watt (R9, R18)
503339	39,000 ohms, ±10%, ½ watt (R37)
503356	56,000 ohms, ±10%, ½ watt (R26)
503412	120,000 ohms, ±10%, ½ watt (R11, R15)
503415	150,000 ohms, ±10%, ½ watt (R4, R24)
503422	220,000 ohms, ±10%, ½ watt (R23)
503447	470,000 ohms, ±10%, ½ watt (R38)
503427	270,000 ohms, ±10%, ½ watt (R28)
503510	1 megohm, ±10%, ½ watt (R39)
503515	1.5 megohm, ±10%, ½ watt (R10)
503522	2.2 megohm, ±10%, ½ watt (R1, R7, R8)
503610	10 megohm, ±10%, ½ watt (R20)
504622	22 megohm, ±20%, ½ watt (R27)
75558	Transformer—First I.F. transformer—AM—complete with adjustable cores (T2)
75559	Transformer—First I.F. transformer—FM—complete with adjustable cores (T1)
76328	Transformer—Second I.F. transformer—AM—complete with adjustable cores (T4)
75560	Transformer—Second I.F. transformer—FM—complete with adjustable cores (T3)
73743	Transformer—Ratio detector transformer complete with adjustable core (T5)
33726	Washer—"C" washer for tuning knob shaft or drive cord pulley
	AMPLIFIER ASSEMBLIES
	RS-141D
	(For Models 21T393, 21T393U)
74296	Cable—Shielded audio cable complete with pin plug
77324	Capacitor—Electrolytic comprising 1 section of 30 mfd., 450 volts, 1 section of 30 mfd., 350 volts and 1 section of 40 mfd., 25 volts (C1A, C1B, C1C)
	Capacitor—Tubular, paper:—
73789	.0068 mfd., 400 volts (C5)
73562	.022 mfd., 400 volts (C2)
	Capacitor—Tubular, paper, oil impregnated:—
75643	.001 mfd., 1000 volts (C3, C4)
75064	Connector—9 contact female connector for power input cable (P1)
70392	Cord—Power cord and plug
74838	Grommet—Power cord strain relief (1 set)
72776	Pin—Contact pin for speaker lead (2 req'd)
73637	Resistor—Wire wound, 2200 ohms, 5 watts (R1)
	Resistor—Fixed, composition:—

STOCK No.	DESCRIPTION
503110	100 ohms, ±10%, ½ watt (R8)
522127	270 ohms, ±5%, 2 watts (R7)
502233	3300 ohms, ±5%, ½ watt (R2)
503368	68,000 ohms, ±10%, ½ watt (R5)
503382	82,000 ohms, ±10%, ½ watt (R3)
503447	470,000 ohms, ±10%, ½ watt (R4, R6)
31251	Socket—Tube socket, octal, wafer
73117	Socket—Tube socket, 7 pin, miniature, wafer
77323	Transformer—Output transformer (T2)
75566	Transformer—Power transformer, 117 volt, 60 cycle (T1)
	SPEAKER ASSEMBLIES
	92569-12W
	RL111A1
	RMA-274
75682	Cone—Cone and voice coil (3.2 ohms)
76093	Speaker—12" PM speaker complete with cone and voice coil (3.2 ohms)
	NOTE: If stamping on speaker in instrmuents does not agree with above speaker number, order replacement parts by referring to Model number of instruments, number stamped on speaker and full description of part required.
75696	Bumper—Rubber bumper for record changer carriage stop bracket
74579	Bumper—Rubber bumper for L.H. doors for Models 21T393, 21T393U
74296	Cable—Shielded pickup cable complete with pin plug for Models 21T393, 21T393U
	Capacitor—Adjustable, mica:
71807	10-160 mmf. for instruments using KRK12A tuner
	Capacitor—Fixed, headed-lead:
78532	1.2 mmf., ±10%, 500 volts (C4)
78442	1.8 mmf., ±10%, 500 volts (C1, C2)
78443	2.7 mmf., ±10%, 500 volts (C3)
71892	Catch—Cabinet door bullet catch and strike
77755	Clamp—Polystyrene clamp for antenna cable and mount for FM trap for instruments using KRK12A tuner
70142	Clamp—Radio dial clamp for Models 21T392, 21T392U
X3349	Cloth—Grille cloth for mahogany or walnut instruments
X3371	Cloth—Grille cloth for oak instruments
76863	Connector—Anode connector
75474	Connector—Single contact male connector for antenna cable
77726	Connector—2 contact male connector for antenna cable for instruments using KRK12A tuner
30870	Connector—2 contact male connector for motor cable
74752	Connector—2 contact male connector for AM-FM cable for Models 21T393, 21T393U
74192	Connector—3 contact male connector for pickup cable for Models 21T392, 21T392U
39153	Connector—4 contact male connector for antenna cable for instruments using KRK29 tuner
75542	Connector—6 contact male connector for deflection yoke leads (P102)
77461	Cord—Power cord and plug
77759	Cover—Cover assembly—maroon—complete with spring for channel markers for mahogany or walnut instruments using KRK12A tuner
77760	Cover—Cover assembly—sand gray—complete with spring for channel markers for oak instruments using KRK12A tuner
78538	Cover—Cover and case assembly—brown—for hidden controls for oak instruments
78490	Cover—Cover and case assembly—red—for hidden controls for mahogany or walnut instruments
77770	Cushion—Adhesive cushion for safety glass retainer
76698	Cushion—Rubber cushion for masking panel support bracket
78313	Cushion—Rubber cushion for dust sealing the kinescope
77749	Cushion—Rubber cushion for safety glass
74956	Cushion—Rubber cushion for deflection yoke hood
78309	Cushion—Round rubber cushion for deflection yoke
78386	Decal—Picture, volume, fine tuning controls and channel selector switch function decal for mahogany or walnut instruments
78389	Decal—Picture, volume, fine tuning controls and channel selector switch function decal for oak instruments
77344	Decal—Radio controls function decal for mahogany or walnut instruments for Models 21T392, 21T392U
77906	Decal—Radio controls function decal for Models 21T393, 21T393U
77345	Decal—Radio controls function decal for oak instruments for Models 12A392, 21T392U
74273	Decal—"Victrola" decal
77380	Dial—Radio dial for Models 21T392, 21T392U
77394	Dial—Radio dial for Models 21T393, 21T393U
77756	Disc—Polystyrene indicator disc—maroon—for channel selections for mahogany or walnut instruments using KRK12A tuner
77757	Disc—Polystyrene indicator disc—sand gray—for channel selections for oak instruments using KRK12A tuner unit
78315	Escutcheon—Channel marker escutcheon for instruments using KRK29 tuner
74205	Escutcheons—Radio dial escutcheon less dial for Models 21T392, 21T392U
77392	Escutcheon—Radio dial escutcheon less dial for Models 21T393, 21T393U
78314	Glass—Safety glass
74838	Grommet—Power cord strain relief
37396	Grommet—Rubber grommet for speaker mounting
77402	Handle—Pullout handle for record changer mounting carriage
74308	Hinge—Cabinet door hinge (1 set) for L.H. upper or R.H. upper doors for Models 21T392, 21T392U, 21T393, 21T393U and for R.H. lower door for Models 21T392, 21T392U
78501	Hinge—Cabinet door hinge for L.H. center door for Models 21T393, 21T393U
77346	Hinge—Cabinet door hinge (1 set) for R.H. center door for Models 21T393, 21T393U
78504	Hinge—Cabinet door hinge (1 set) for R.H. lower door for Models 21T393, 21T393U
78308	Hood—Deflection yoke hood less rubber cushions
77802	Knob—Radio-phono tone and power switch knob—brown—for mahogany or walnut instruments for Models 21T392, 21T392U (outer)
77803	Knob—Radio-phono tone and power switch knob—medium beige—for oak instruments for Models 21T392, 21T392U (outer)
77811	Knob—Radio-phono—TV function knob—brown—for Models 21T393, 21T393U
77804	Knob—Radio tuning control knob—brown—for mahogany or walnut instruments for Models 21T392, 21T392U (outer)
77805	Knob—Radio tuning control knob—medium beige—for oak instruments for Models 21T392, 21T392U (outer)

Models 24-T-420, 24-T-420U "Barrett" Mahogany, Oak



Models 24-T-435, 24-T-435U "Sewell" Mahogany, Oak

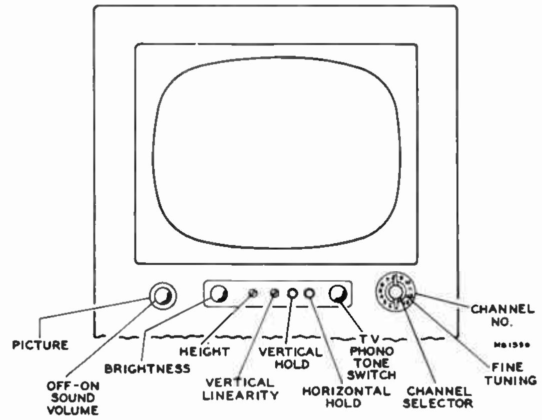


Figure 1—Receiver Operating Controls (VHF Models).

GENERAL DESCRIPTION

Models 24-T-420, 24-T-420U, 24-T-435 and 24-T-435U are "24 inch" television receivers. Models 24-T-420 and 24-T-435 are identical except for cabinets. Models 24-T-420U and 24-T-435U are identical except for cabinets. Models 24-T-420 and 24-T-435 have full 12 channel VHF coverage. Models 24-T-420U and 24-T-435U feature full 12 channel VHF coverage plus any UHF channels desired.

All models include intercarrier FM sound system; ratio detector; improved picture brilliance; pulsed picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; noise saturation circuits; improved sync separator (3.5 mc. band width for picture channel); and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE . . . 327 square inches on a 24CP4A Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 24-T-420 & 24-T-435

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 24-T-420U & 24-T-435U

Any of 70 UHF channels . . . . . 470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency . . . . . 45.75 mc.
Sound I-F Carrier Frequency . . . . . 41.25 mc.

POWER RATING . . . . . 245 watts

AUDIO POWER OUTPUT RATING . . . . . 4 watts max.

VIDEO RESPONSE . . . . . To 3.5 mc.

SWEEP DEFLECTION . . . . . Magnetic

FOCUS . . . . . Magnetic

ANTENNA INPUT IMPEDANCE

Models 24-T-420, 24-T-435

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 24-T-420U, 24-T-435U

UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK22C (24-T-420 & 24-T-435)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Tuner KRK29A/27 (24-T-420U, 24-T-435U)	
(1) RCA 6AF4	UHF Oscillator
(2) RCA 6BQ7A	VHF R-F Amplifier; UHF I-F Amplifier
(3) RCA 6X8	VHF R-F Oscillator & Mixer; UHF I-F Amplifier

A IN82 crystal is used as the UHF mixer.

All Models

Tube Used	Function
(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Det. and Horiz. Sync. Sep.
(5) RCA 6X8	Video Amplifier and Vert. Sync. Sep.
(6) RCA 12AU7	Video Output & AGC
(7) RCA 6AU6	1st Sound I-F Amplifier
(8) RCA 6AU6	2nd Sound I-F Amplifier
(9) RCA 6AL5	Ratio Detector
(10) RCA 6AV6	1st Audio Amplifier
(11) RCA 6AQ5	Audio Output
(12) RCA 12AU7	Vert. Osc. and Disch. & Sync. Output
(13) RCA 6AQ5	Vertical Sweep Output
(14) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(15) RCA 6CD6G	Horizontal Sweep Output
(16) RCA 6AU4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
(18) RCA 24CP4A	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

CHASSIS DESIGNATIONS

KCS84C Models 24-T-420 and 24-T-435 employing a KRK22C Tuner.

KCS84E Models 24-T-420U and 24-T-435U employing a KRK29A/27 Tuner.

WEIGHT & DIMENSIONS

Model	Shipping Weight	Weight	Width Inches	Height Inches	Depth Inches
24-T-420	138 lbs.	167 lbs.	41¼	29⅛	24¼
24-T-420U	143 lbs.	172 lbs.	41¼	29⅛	24¼
24-T-435	154 lbs.	191 lbs.	41¾	30⅜	28
24-T-435U	159 lbs.	196 lbs.	41¾	30⅜	28

LOUDSPEAKERS

Model 24-T-420 . . . . . (971692-1) 10" PM Dynamic, 3.2 ohms
Model 24-T-420U . . . . . (971692-1) 10" PM Dynamic, 3.2 ohms
Model 24-T-435 . . . . . (971692-1) 10" PM Dynamic, 3.2 ohms
Model 24-T-435U . . . . . (971692-1) 10" PM Dynamic, 3.2 ohms

SCANNING . . . . . Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY . . . . . 15,750 cps

VERTICAL SWEEP FREQUENCY . . . . . 60 cps

FRAME FREQUENCY (Picture Repetition Rate) . . . . . 30 cps

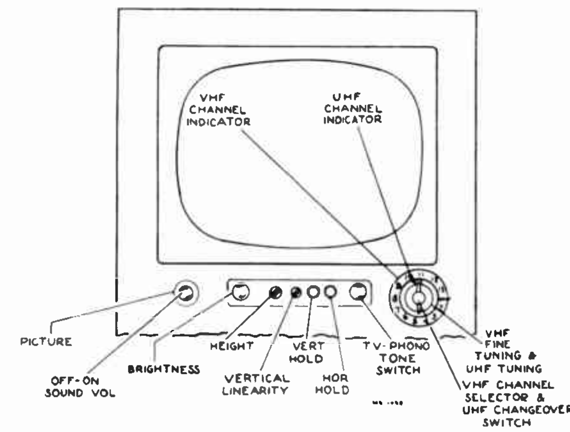


Figure 2—Receiver Operating Controls (UHF-VHF Models)

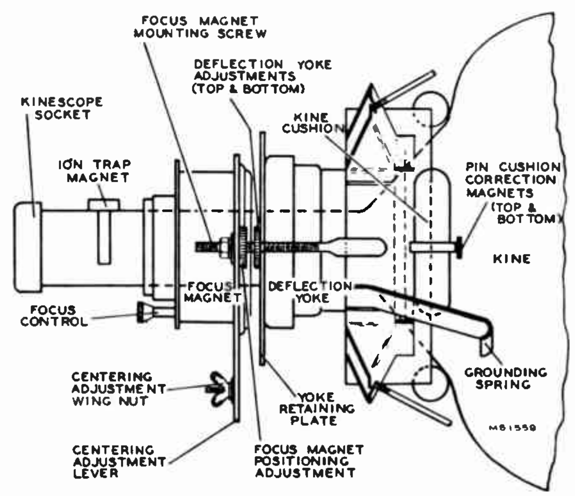


Figure 3—Yoke and Focus Magnet Adjustments

OPERATING CONTROLS (Front)

Models 24-T-420 & 24-T-435

Channel Selector, Fine Tuning . . . . . Dual Control Knobs

Models 24-T-420U & 24-T-435U

VHF Channel Selector and UHF Changeover Switch, VHF Fine Tuning and UHF Tuning . . . Dual Control Knobs

All Models

Brightness . . . . . Single Control under Panel
Picture Horizontal Hold . . . . . Single Control under Panel
Picture Vertical Hold . . . . . Single Control under Panel
Sound Volume and On-Off Switch, Picture . . . . . Dual Control Knobs
TV-PH tone switch . . . . . Single Control under Panel

NON-OPERATING CONTROLS (under Front Panel)

Height . . . . . screwdriver adjustment
Vertical Linearity . . . . . screwdriver adjustment

NON-OPERATING CONTROLS (not including R-F and I-F adjustments)

Picture Centering . . . . . top chassis adjustment
Width . . . . . rear chassis adjustment
Horizontal Drive . . . . . rear chassis screwdriver adjustment
Horizontal Linearity . . . . . rear chassis adjustment
Horizontal Oscillator Frequency . . . . . rear chassis adjustment
Horizontal Oscillator Waveform . . . bottom chassis adjustment
Horizontal Locking Range . . . . . rear chassis adjustment
Focus . . . . . top chassis adjustment
Ion Trap Magnet . . . . . top chassis adjustment
Deflection Coil . . . . . top chassis adjustment
AGC Control . . . . . rear chassis adjustment

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 120 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Focus Magnet Adjustment."

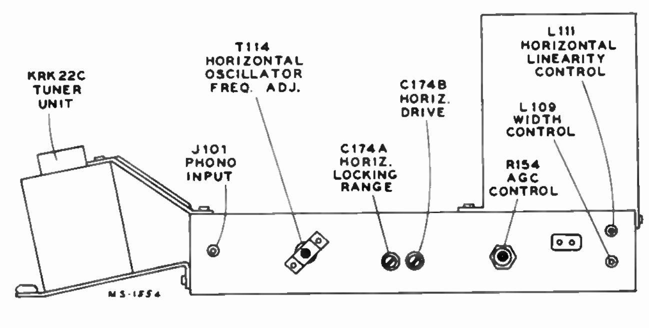


Figure 4—Rear Chassis Adjustments

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C174B counter-clockwise until the picture begins to "wrinkle" in the middle then clockwise until the "wrinkle" disappears.

Turn the horizontal linearity control L111 clockwise until the picture begins to "wrinkle" on the right and then counter-clockwise until the "wrinkle" disappears and best linearity is obtained.

Adjust the width control L109 to obtain correct picture width.

A slight readjustment of these three controls may be necessary to obtain the best linearity.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R173 behind front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R183 behind front control panel), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the yoke knurled nuts and the focus magnet mounting screws are tight.

KRK22C OR KRK29A VHF R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 11. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 5 or 6. Adjustment for channel 13 is on top of the chassis. The oscillator for the KRK27 UHF tuner section of the KRK29A/27 tuner should be adjusted by the method outlined on page 12 under Alignment Procedure.

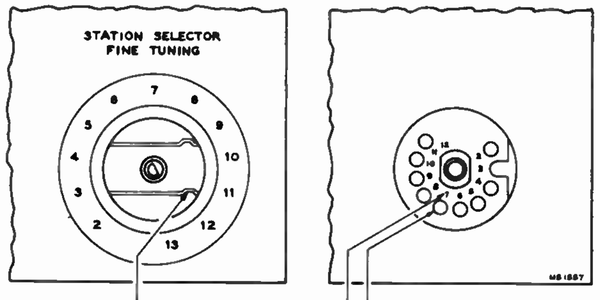


Figure 5—KRK22C R-F Oscillator Adjustments

AGC THRESHOLD CONTROL.—The AGC threshold control R154 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R154. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R154 should be readjusted.

Turn R154 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R154 clockwise

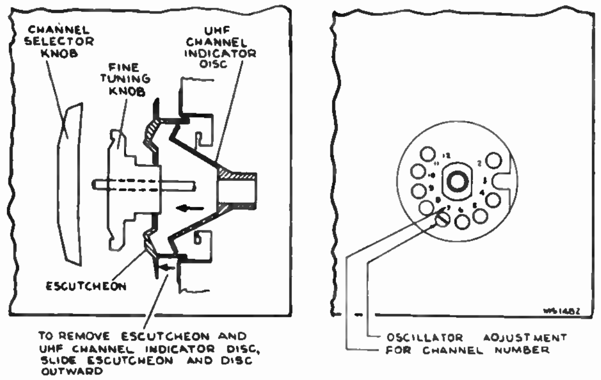


Figure 6—KRK29A/27 VHF R-F Oscillator Adjustment

until there is a very, very slight bend or change of bend in the picture. Then turn R154 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R154 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is L53 on KRK22C and L5 on KRK29A tuners and is located on the antenna matching transformer.

CAUTION.—In some receivers, the FM trap L5 or L53 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L5 or L53 to make sure that it does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

CABINET ANTENNA.—A cabinet antenna is provided in all models using wooden cabinets and the leads are brought out near the antenna terminal board. The cabinet antenna may be employed for both UHF and VHF reception in place of the outdoor antenna in areas where the signals are strong and no reflections are experienced.

RECEIVER LOCATION.—The owner should be advised of the importance of placing the receiver in the proper location in the room.

The location should be chosen—

—Away from bright windows and so that no bright light will fall directly on the screen. (Some illumination in the room is desirable, however.)

—To give easy access for operation and comfortable viewing.

—To permit convenient connection to the antenna.

—Convenient to an electrical outlet.

—To allow adequate ventilation.

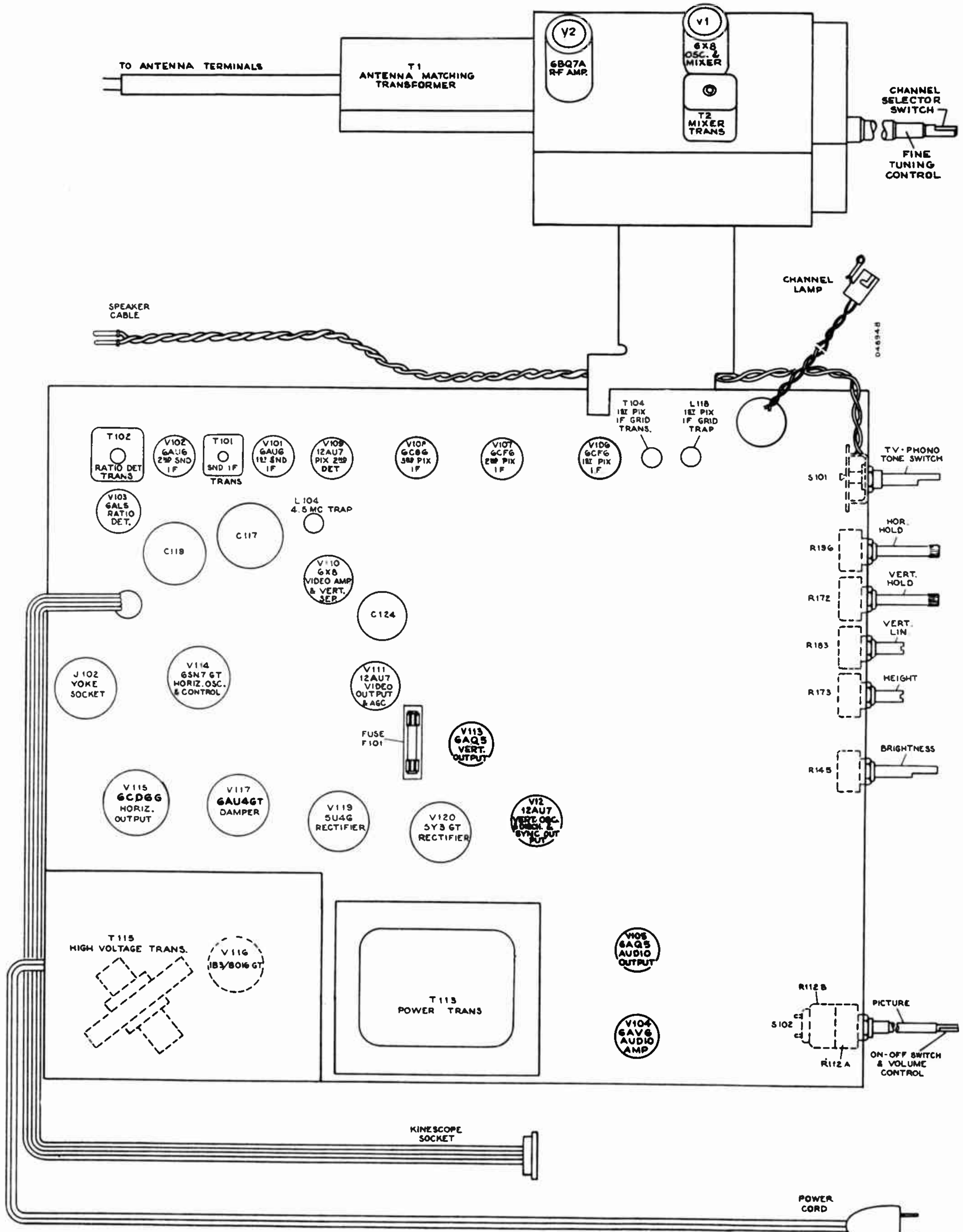


Figure 7—Chassis Top View (shown with KRK22C Tuner)

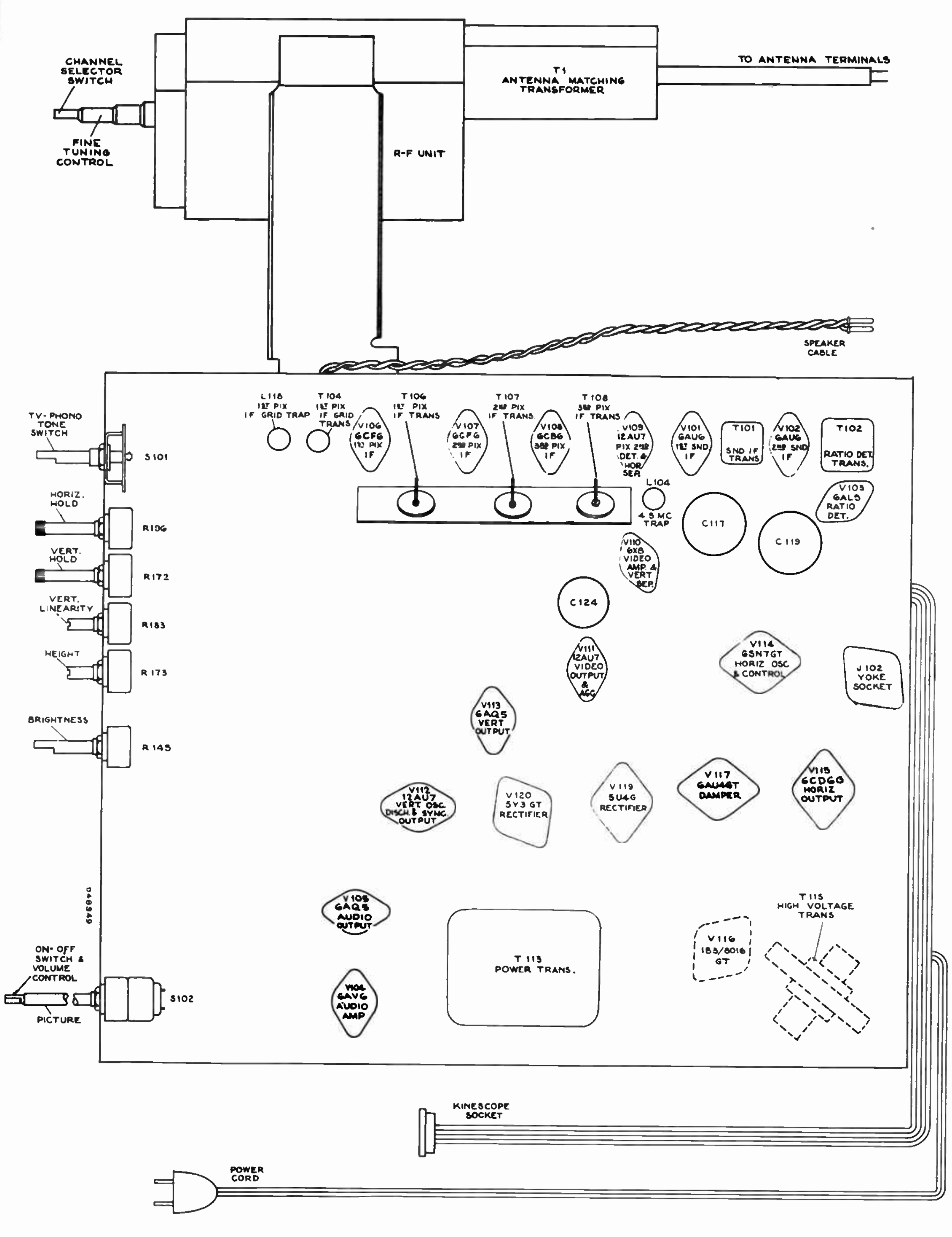


Figure 8—Chassis Bottom View (shown with KRK22C Tuner)

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

KRK22C OR KRK29A ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 (or L53) to the channel selector switch S1-E (or S4).

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R127 and R148. Set the poteniometer to produce approximaely –5.0 volts of bias at the junction of R127 and R148.

Connect an oscilloscope to the junction of R135 and L102 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 (or L54) in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 (or L57) for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 (or L53) to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 (or L53) to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 19 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 (or L56) and L3 (or L55) to obtain the response shown in figure 20. L3 (or L55) is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 (or L56) should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 (or L53) and S1-E (or S4). Replace V106.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 24-T-420 and 24-T-435

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R123 and C142. The second battery will be used later.

Set the bias to produce approximately —5.0 volt of bias at the junction of R123 and C142.

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R135, L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	L118

Models 24-T-420U and 24-T-435U

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R123 and C142. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R135 and L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc.	L118

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 24-T-420 and 24-T-435

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 23. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 24.

Models 24-T-420U and 24-T-435U

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 12.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 13.

To align the I-F amplifier circuit of the KRK29A/27, connect the VHF sweep generator to the rear terminal of the IN82 crystal holder in series with a 1000 ohms and 1500 mmf ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING to channel 47 at 670 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground. Connect the oscilloscope diode probe to the junction between the resistor and capacitor.

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.3 or less peak-to-peak on the oscilloscope.

Adjust L307, on the KRK27 section, and L9, on the KRK29A section, of the tuner for maximum gain with picture and sound carrier markers as shown in figure 14.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to the junction of R135 and L102. Use 3.0v. peak-to-peak on the oscilloscope.

Retouch L307 and L9 slightly, if necessary, to produce the curve shown in figure 14. Do not retouch T2, T104, T106, T107 or T108.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at —3.0 V and the I-F bias at —5.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 13. Retouch T107 and T108 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 13, retouching T107 and T108 if necessary to correct any overall tilt.

Remove the sweep and marker generators and the bias supplies.

KRK22C TUNER ALIGNMENT

Models 24-T-420 and 24-T-435

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn the C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in Figure 19, to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers, of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in Figure 18.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46, and L58 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK29A/27 TUNER ALIGNMENT

Models 24-T-420U and 24-T-435U

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 19 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for appromixately correct curve shape, frequency, and band width as shown in figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT.—Ground the I-F transformer L307 by inserting a clip lead through the aperture provided in the top of the tuner. Ground the other end of the clip lead to the tuner case.

Connect the oscilloscope to the test point TP301, employing the preamplifier if needed with the oscilloscope used.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 9° and 168° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. By placing a 1/16" shim between the stop pin on the tuner and the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 168°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the rear terminal of the crystal holder and insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitors C315 and C316 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 11(A).

Adjust the oscillator trimmer capacitor C307 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 11(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 9°, Channel 14, position.

Adjust R-F coils L1 and L2 for a maximum amplitude overcoupled curve centered at 473.5 mc. as shown in figure 11(B). Adjust the oscillator trimmer C308 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates may be knifed through the two holes provided on the left side of the tuner. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" to test point TP301. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .05 and .4 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedence or an oscillator tube outside allowable limits.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 9). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L103 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R108 and C109.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst."

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R108 and C109. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst."

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 100 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 9 of V110.

Adjust the core of L104 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L104 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L104 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 9 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT.— Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R196, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 24. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

ALIGNMENT DATA

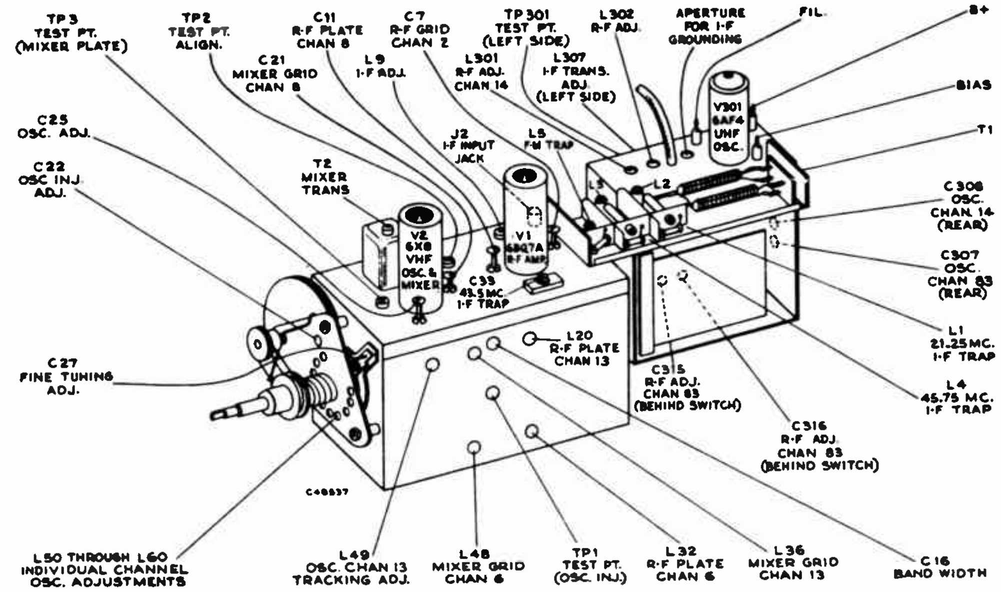


Figure 9—KRK29A/27 Tuner Adjustments

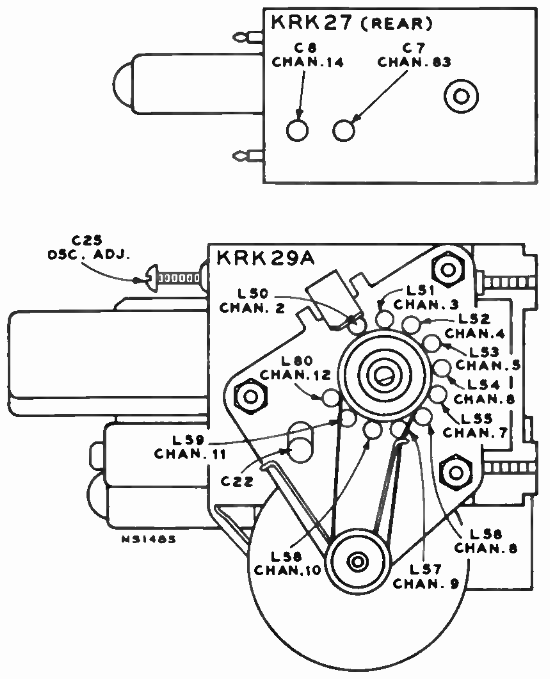


Figure 10—KRK29A/27 Oscillator Adjustments

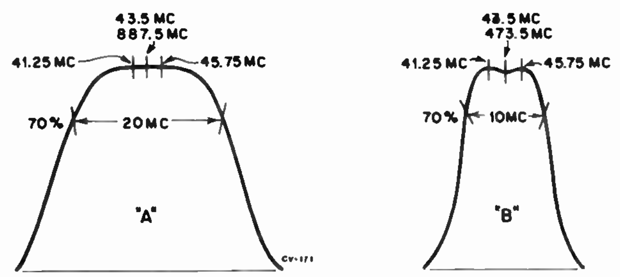


Figure 11—KRK27 R-F Response

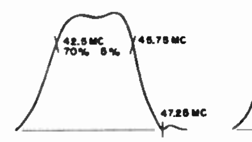


Figure 12—
KRK29A/27-T2
and T104
Response

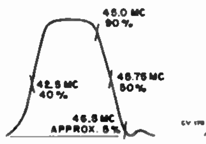


Figure 13—
Overall
I-F Response
with KRK29A/27

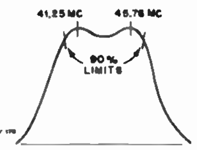


Figure 14—
KRK29A/27
L9 and L307
I-F Response

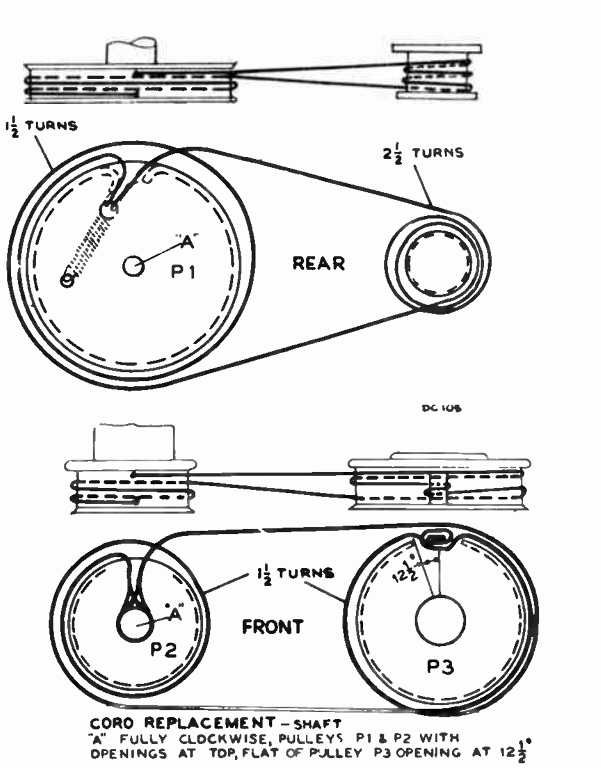


Figure 15—KRK29A/27 Dial Cords

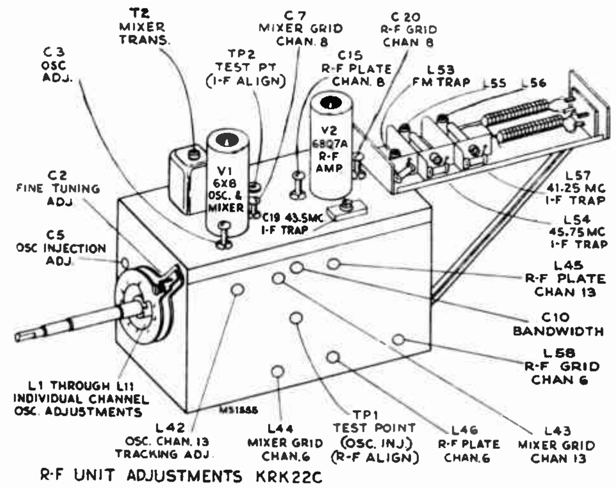


Figure 16—KRK22C Tuner Adjustments

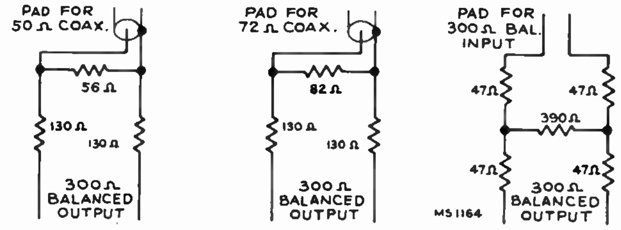


Figure 19—Sweep Attenuator Pads

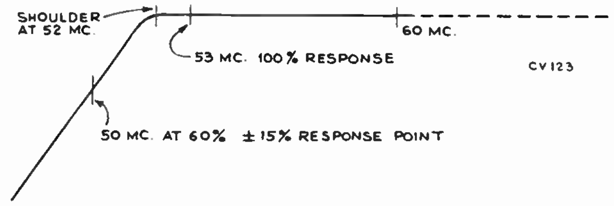


Figure 20—KRK22C or KRK29A Antenna Matching Unit Response

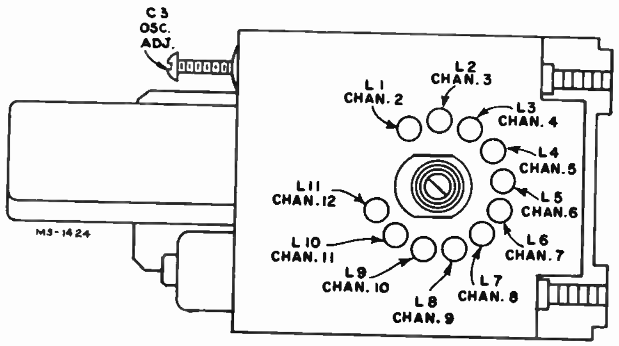


Figure 17—KRK22C R-F Oscillator Adjustments

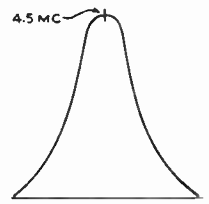


Figure 21—Sound I-F Response

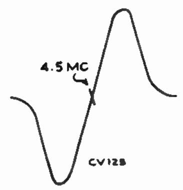


Figure 22—Ratio Det. Response

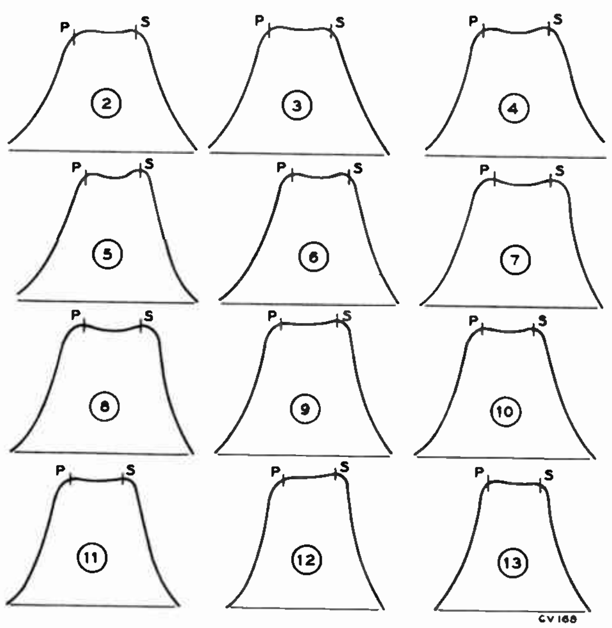


Figure 18—KRK22C or KRK29A R-F Response

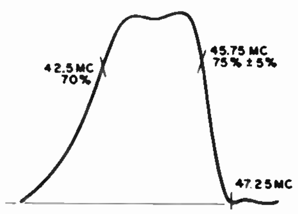


Figure 23—KRK22C T2 and T104 Response

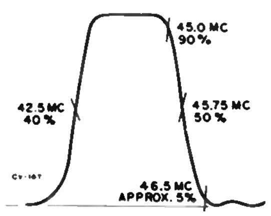


Figure 24—Overall I-F Response with KRK22C

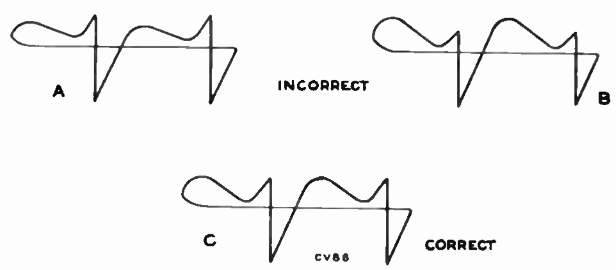


Figure 25—Horizontal Oscillator Wave Forms

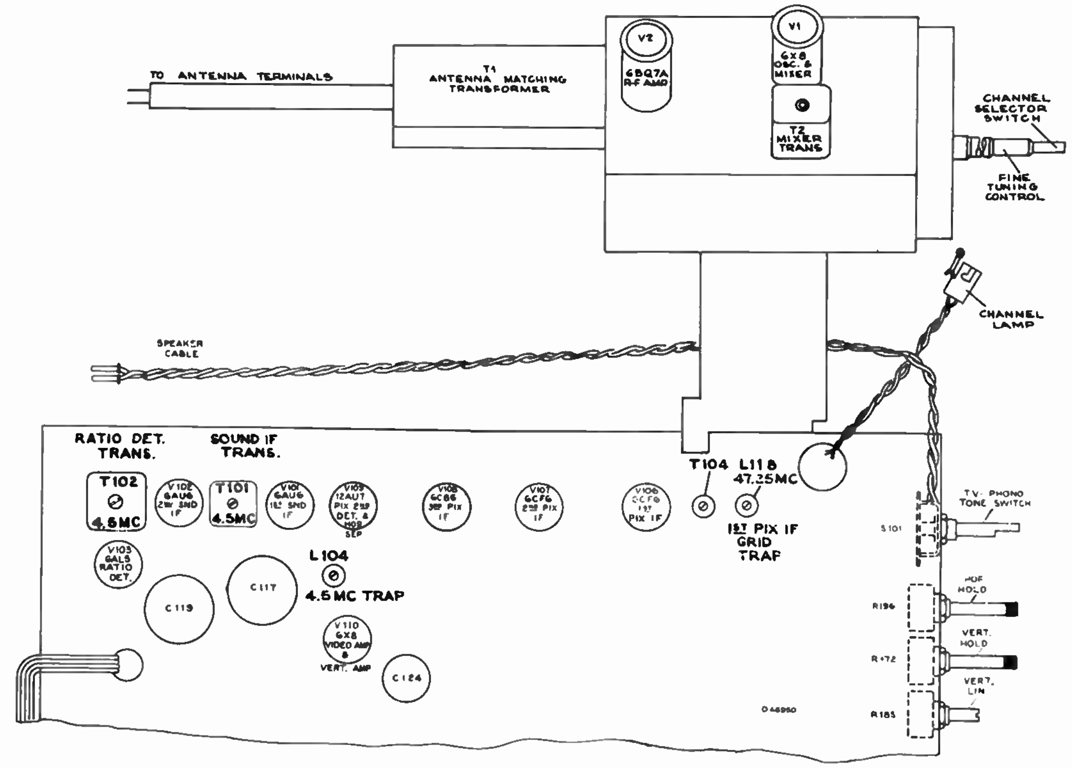


Figure 26—Top Chassis Adjustments (KRK22C Tuner Shown)

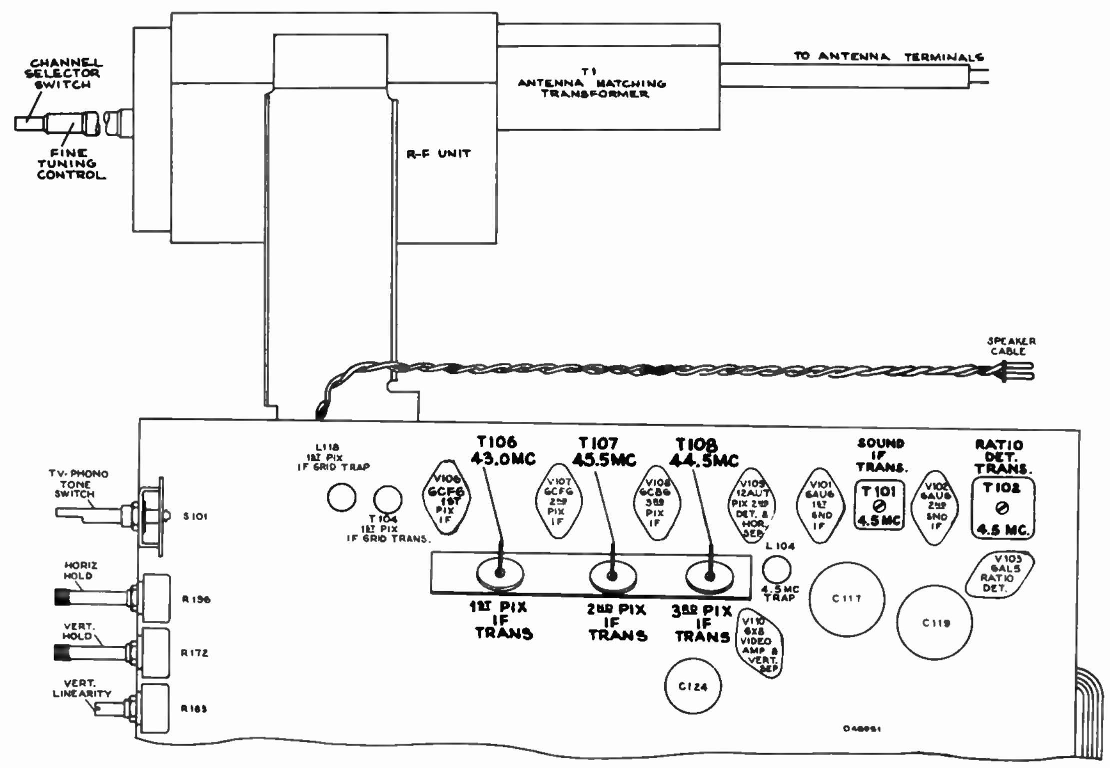


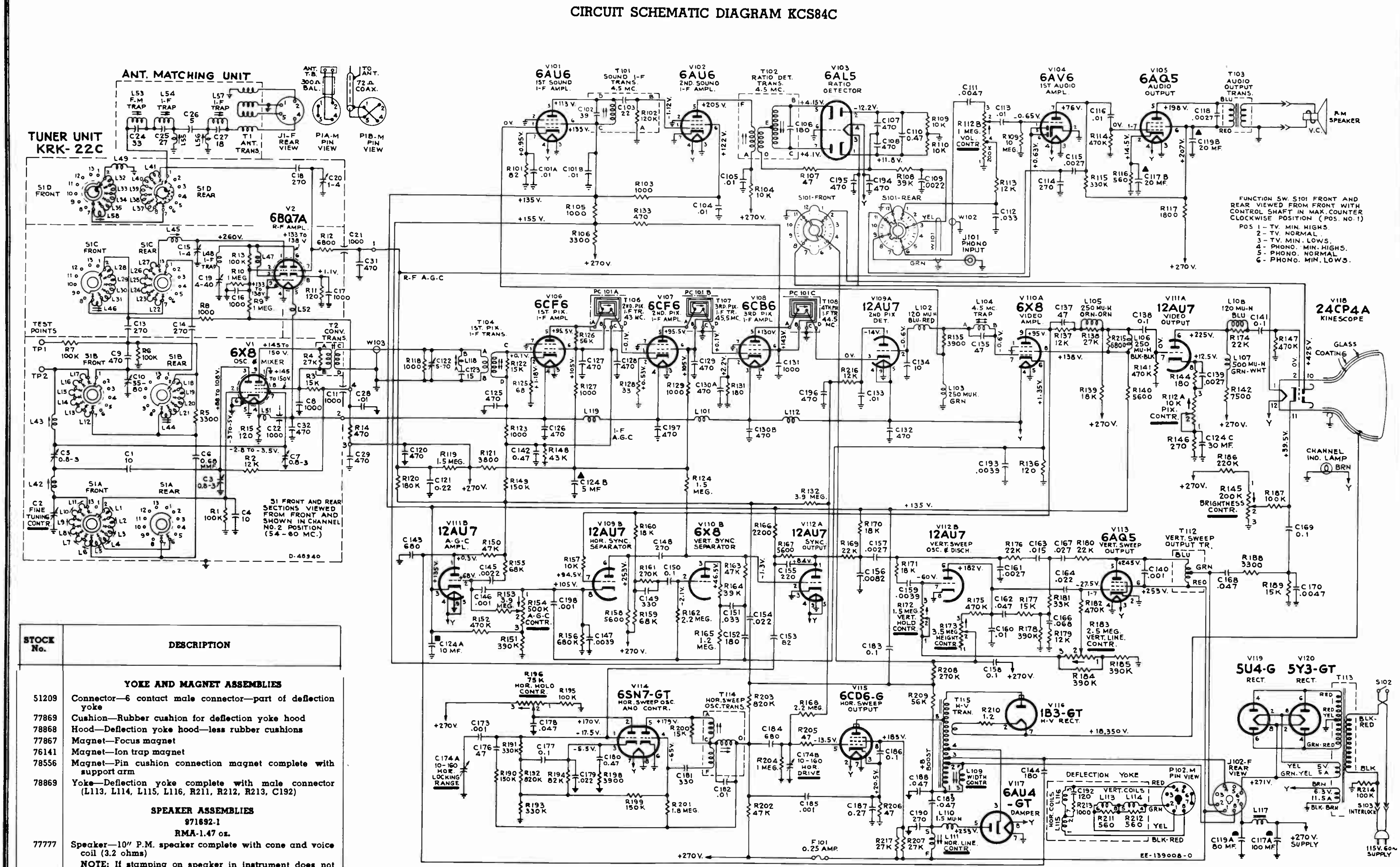
Figure 27—Bottom Chassis Adjustments (KRK22C Tuner Shown)

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1 KRK22C or KRK29A	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 KRK22C or KRK29A	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	122	6	138	7	1.01	1	0	
			No Signal	5	113	6	126	7	.95	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	210	6	130	7	0	1	−2.05	*Unreliable measuring point. Voltage depends on noise.
			No Signal	5	205	6	122	7	0	1	*−1.12	
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	1.7		—	1	21	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	4.1	—	—	1	11.8	—	—	
		Ratio Detector	15000 Mu. V. Signal	2	1.7	—	—	5	21	—	—	
			No Signal	2	4.1	—	—	5	11.8	—	—	
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	78	—	—	2	0	1	−.7	At min. volume
			No Signal	7	76	—	—	2	0	1	−.65	At min. volume
V105	6AQ5	Audio Output	15000 Mu. V. Signal	5	205	6	220	2	15.2	1-7	0	At min. volume
			No Signal	5	198	6	207	2	14.5	1-7	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	218	6	240	2	132	1	−8.2	*Unreliable measuring point. Make measurement at T104-B.
			No Signal	5	95.5	6	105	2	1.18	1	*<0.1	
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	222	6	243	2	<0.1	1	−8.45	
			No Signal	5	95.5	6	105	2	0.53	1	<0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	138	6	150	2	2.3	1	0	
			No Signal	5	130	6	143	2	2.2	1	<0.1	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	−25.8	—	—	3	0	2	−1.85	
			No Signal	1	−14	—	—	3	0	2	−.6	
V109B	12AU7	Horiz. Sync Separator	15000 Mu. V. Signal	6	260	—	—	8	160	7	122	
			No Signal	6	253	—	—	8	105	7	94.5	
V110A	6X8	Video Amplifier	15000 Mu. V. Signal	9	120	8	147	6	.9	7	−1.85	AGC control set for normal operation
			No Signal	9	95	8	138	6	1.35	7	−.6	AGC control set for normal operation
V110B	6X8	Vert. Sync Separator	15000 Mu. V. Signal	3	79	—	—	6	.90	2	−26.8	
			No Signal	3	46.5	—	—	6	1.35	2	−2.1	
V111A	12AU7	Video Output	15000 Mu. V. Signal	6	231	—	—	8	13	7	0	
			No Signal	6	225	—	—	8	12.5	7	0	
V111B	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	−55	—	—	3	135	2	125	
			No Signal	1	0.3	—	—	3	132	2	68	
V112A	12AU7	Sync Output	15000 Mu. V. Signal	1	83	—	—	3	0	2	−3.28	
			No Signal	1	84	—	—	3	0	2	−1.3	
V112B	12AU7	Vertical Oscillator & Discharge	15000 Mu. V. Signal	6	80	—	—	8	0	7	−63.5	Depends on setting of Vert. hold control
			No Signal	6	182	—	—	8	0	7	−60	Voltages shown are synced pix adjustment
V113	6AQ5	Vertical Output	15000 Mu. V. Signal	5	253	6	262	2	0	1-7	−28.8	
			No Signal	5	245	6	253	2	0	1-7	−27.5	
V114	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	175	—	—	3	−3.5	1	−21	
			No Signal	2	170	—	—	3	−5.5	1	−17.5	
	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	183	—	—	6	0	4	−67	
			No Signal	5	179	—	—	6	0	4	−65	
V115	6CD6G	Horizontal Output	15000 Mu. V. Signal	Cap	*	8	193	3	22	5	−14	*High Voltage Pulse Present
			No Signal	Cap	*	8	185	3	20.5	5	−13.5	*High Voltage Pulse Present
V116	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	18,700	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	18,350	—	—	*High Voltage Pulse Present
V117	6AU4GT	Damper	15000 Mu. V. Signal	5	261	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	253	—	—	3	*	—	—	*High Voltage Pulse Present
V118	24CP4A	Kinescope	15000 Mu. V. Signal	Cap	18,700	10	428	11	44.5	2	0	At average Brightness
			No Signal	Cap	18,350	10	425	11	39.5	2	0	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	277	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	271	—	—	

CIRCUIT SCHEMATIC DIAGRAM KCS84C



STOCK No.	DESCRIPTION
	YOKE AND MAGNET ASSEMBLIES
51209	Connector—6 contact male connector—part of deflection yoke
77869	Cushion—Rubber cushion for deflection yoke hood
78868	Hood—Deflection yoke hood—less rubber cushions
77867	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
78556	Magnet—Pin cushion connection magnet complete with support arm
78869	Yoke—Deflection yoke complete with male connector (L113, L114, L115, L116, R211, R212, R213, C192)
	SPEAKER ASSEMBLIES
	971692-1
	RMA-1.47 oz.
77777	Speaker—10" P.M. speaker complete with cone and voice coil (3.2 ohms)
	NOTE: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to Model number of instruments, number stamped on speaker and full description of part required.

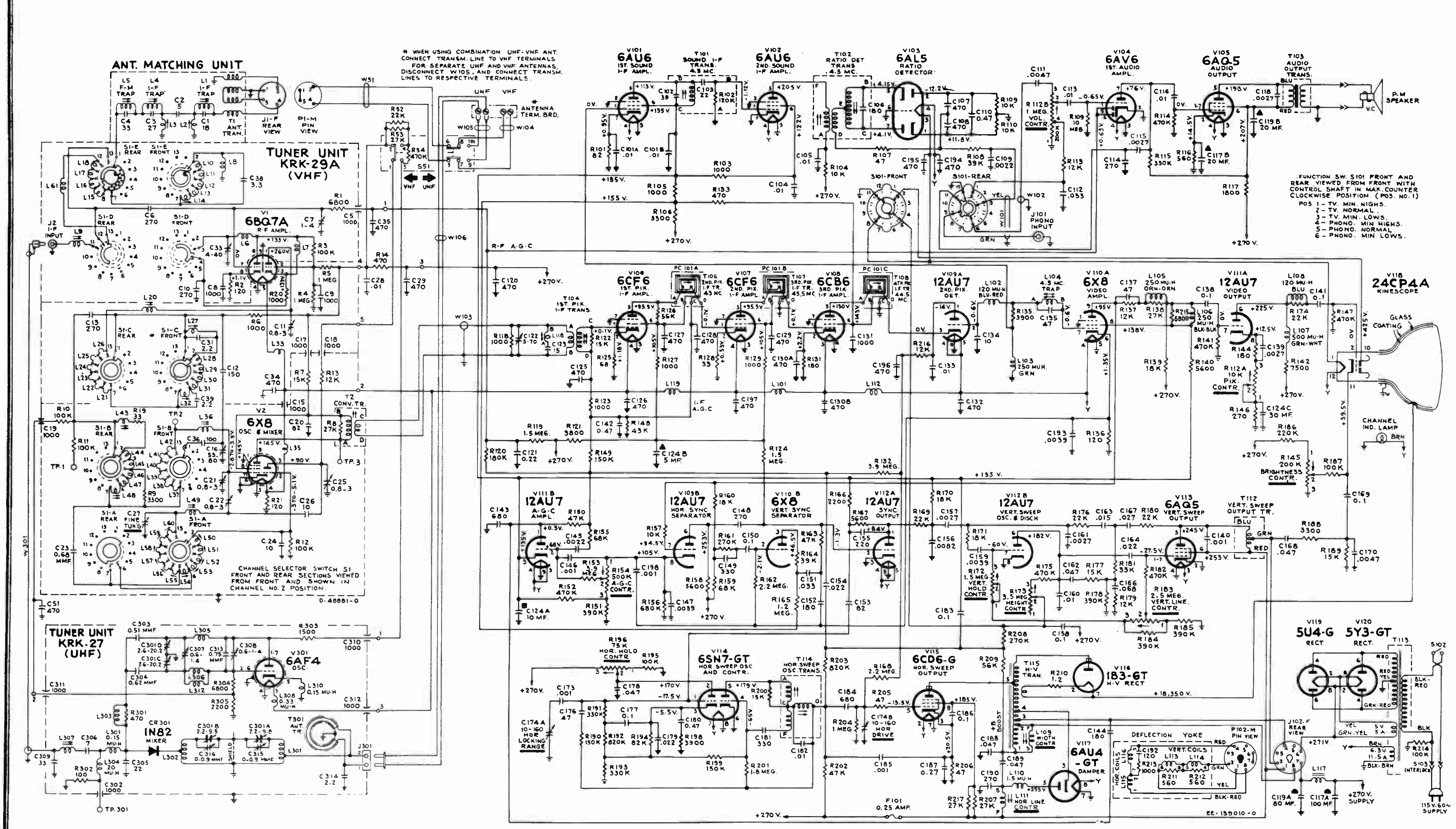
The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 28—Schematic Diagram KCS84C

CIRCUIT SCHEMATIC DIAGRAM KCS84E



The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

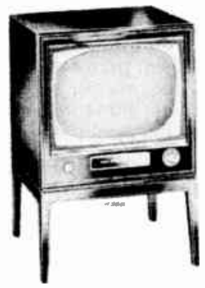
Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 29—Schematic Diagram KCS84E

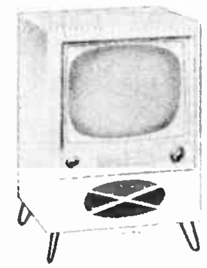
STOCK No.	DESCRIPTION
	TUNER UNIT ASSEMBLIES KRK22C
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C19)
	Capacitors—Adjustable, steatite:
77151	0.8-3.0 mmf. (C3, C7)
76532	1-4 mmf. (C15, C20)
	Capacitors—Ceramic:
77853	Variable for fine tuning—plunger type (C2)
77084	1,000 mmf., feed-thru (C11, C21, C22)
	Capacitors—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, -0%, 500 volts DC (C29, C31, C32)
77252	1,000 mmf., +100%, -0%, 500 volts DC (C8, C16, C17)
73960	10,000 mmf., +100%, -0%, 500 volts DC (C28)
	Capacitor—Fixed, ceramic, insulated, High "K" disc:
75199	270 mmf., ±20%, 500 volts DC (C18)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. -0
77865	10 mmf., ±1.0 mmf., 500 volts DS (C1)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. -750
33098	10 mmf., ±1.0 mmf., 500 volts DC (C4)
	Capacitor—Mica trimmer:
76527	55-80 mmf. (C10)
77854	Clip—Mounting clip for fine tuning core
77206	Coil—Filament choke coil (L52)
79067	Coil—Heater choke coil (L50, L51)
76562	Coil—R.F. amplifier coupling coil (L47)
78466	Coil—R.F. choke coil (L48)
	Resistors—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R11)
504147	470 ohms, ±20%, ½ watt (R14)
504268	6,800 ohms, ±20%, ½ watt (R12)
523312	12,000 ohms, ±10%, 2 watts (R2)
523315	15,000 ohms, ±10%, 2 watts (R3)
504410	100,000 ohms, ±20%, ½ watt (R1, R13)
503510	1.0 megohm, ±10%, ½ watt (R9, R10)
78396	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
78399	Transformer—Convertor transformer (T1)
	TUNER UNIT ASSEMBLIES KRK29A
	Capacitor—Adjustable, mica:
77616	4-40 mmf. (C33)
	Capacitors—Adjustable, steatite:
77151	0.8-3.0 mmf. (C11, C21, C25)
77913	0.8-3.0 mmf. (C22)
76532	1-4 mmf. (C7)
	Capacitors—Ceramic:
77853	Variable, for fine tuning capacitor—plunger type (C27)
77084	Feed-thru, 1,000 mmf. (C5, C15, C17, C18, C19)
	Capacitors—Fixed, ceramic, High "K" disc:
77293	470 mmf., +100%, -0%, 500 volts (C29, C34, C35, C51)
77252	1,000 mmf., +100%, -0%, 500 volts (C8, C9, C14, C20)
73960	10,000 mmf., +100%, -0%, 500 volts (C28)
	Capacitors—Fixed, ceramic, insulated, High "K":
75437	100 mmf., ±20%, 500 volts (C36)
78276	150 mmf., ±10%, 500 volts (C12)
75199	270 mmf., ±20%, 500 volts (C6, C10, C13)
	Capacitors—Fixed, ceramic, non-insulated, Temp. coef. = 0
93056	5 mmf., ±0.5 mmf., 500 volts (C2)
77865	10 mmf., ±1 mmf., 500 volts (C26, C37)
54207	18 mmf., ±10%, 500 volts (C1)
70935	27 mmf., ±10%, 500 volts (C3)
76739	33 mmf., ±10%, 500 volts (C4)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
78247	10 mmf., ±10%, 500 volts (C24)
	Capacitors—Fixed, headed-lead:
71504	0.68 mmf., ±20%, 500 volts (C23)
71502	2.2 mmf., ±20%, 500 volts (C31, C39)
71503	3.3 mmf., ±20%, 500 volts (C38)
77854	Clip—Fine tuning clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T1)
78401	Coil—Channel No. 6 antenna coil (L81)
73874	Coil—Channel No. 6 mixer coil (L48)
73460	Coil—Channel No. 6 r.f. plate coil (L32)
73453	Coil—Channel No. 6 r.f. grid coil (L14)
77919	Coil—Channel No. 13 mixer coil (L36)
77915	Coil—Channel No. 13 oscillator coil (L49)
77921	Coil—Channel No. 13 r.f. plate coil (L20)
77206	Coil—Filament choke coil (L33)
76763	Coil—Heater choke coil (L34, L35)
78271	Coil—I.F. input coil complete with adjustable core (L9)
78583	Coil—Mixer I.F. coil (L43)
76562	Coil—R.F. amplifier coupling coil (L7)
78584	Coil—R.F. plate I.F. coil (L27)
76537	Coil—Shunt coil complete with adjustable core (L3)
76538	Coil—Shunt coil complete with adjustable core (L2)
	Resistors—Fixed, composition:
503033	33 ohms, ±10%, ½ watt (R19)
503112	120 ohms, ±10%, ½ watt (R2)
503147	470 ohms, ±10%, ½ watt (R14, R54)
503210	1,000 ohms, ±10%, ½ watt (R6, R20)
503233	3,300 ohms, ±10%, ½ watt (R9)
503268	6,800 ohms, ±10%, ½ watt (R1)
523312	12,000 ohms, ±10%, 2 watts (R13)
523315	15,000 ohms, ±10%, 2 watts (R7)
523322	22,000 ohms, ±10%, 2 watts (R52)
523327	27,000 ohms, ±10%, 2 watts (R53)
503410	100,000 ohms, ±10%, ½ watt (R3, R10, R11, R12)
503510	1 megohm, ±10%, ½ watt (R4, R5)
78396	Transformer—Antenna matching transformer complete (T1)
78399	Transformer—Convertor transformer (T2, R8)
76540	Trap—FM trap complete with adjustable core (L5)
78466	Trap—I.F. trap (L6)
76542	Trap—I.F. trap (41.25 mc) complete with core (L1)
76541	Trap—I.F. trap (45.75 mc) complete with core (L4)
	TUNER UNIT ASSEMBLIES KRK27
	Capacitor—Adjustable, steatite:
78259	0.6-1.4 mmf. complete with adjustable core (C7, C8)
	Capacitor—Fixed, ceramic:
77084	1,000 mmf., feed-thru (C2, C10, C11, C12)
	Capacitors—Fixed, ceramic, non-insulated, Temp. coef. = 0
78262	7 mmf., ±0.5 mmf., 500 volts DC (C6)
78261	22 mmf., ±5%, 500 volts DC (C5)
70596	33 mmf., ±5%, 500 volts DC (C9)
	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = -750
78263	0.75 mmf., ±0.25 mmf., 500 volts DC (C13)
	Capacitors—Fixed, headed-lead:
78137	0.51 mmf., ±10%, 500 volts DC (C3)
78260	0.62 mmf., ±10%, 500 volts DC (C4)
71502	2.2 mmf., ±10%, 500 volts DC (C14)
78257	Capacitor—Variable tuning capacitor (C1A, C1B, C1C, C1D, C15, C16, L1, L2)
78258	Coil—I.F. coil complete with adjustable core (L7)
78264	Coil—Peaking coil (L3, R1)
72618	Coil—Peaking coil (20 muh) (L4)
78267	Coil—R.F. choke coil (0.15 muh) (L10, L11)
77279	Coil—R.F. choke coil (0.33 muh) (L8, L9)
78269	Connector—Single contact male connector for I.F. output cable
78255	Connector—2 contact female connector for UHF antenna (J1)
78256	Holder—Crystal holder
77489	Rectifier—Crystal rectifier IN82 (CR1)
	Resistors—Fixed, composition:
503110	100 ohms, ±10%, ½ watt (R2)
503215	1,500 ohms, ±10%, ½ watt (R3)
503222	2,200 ohms, ±10%, ½ watt (R5)
503268	6,800 ohms, ±10%, ½ watt (R4)
78268	Transformer—Antenna input transformer (T1)
	CHASSIS ASSEMBLIES KCS84C (KRK22C) KCS84E (KRK29A/27)
	Capacitors—Fixed, ceramic:
33098	10 mmfd., ±10%, 500 volts (C134
39044	15 mmf., ±5%, 500 volts (C123)
39042	47 mmf., ±10%, 500 volts (C137)
71922	180 mmf., ±10%, 500 volts (C152)
47617	270 mmf., ±10%, 500 volts (C114)
	Capacitors—Fixed, ceramic, High "K" disc:
78622	470 mmf., ±20%, 500 volts (C127, C129)
77293	470 mmf., +100%, -0%, 500 volts (C120, C125, C126, C128, C132, C194, C195, C196, C197
77672	470-470 mmf., +100%, -0%, 500 volts (C130A, C130B)
78623	1,000 mmf., ±20%, 500 volts (C131)
76991	10,000 mmf., +100%, -0%, 500 volts (C101)
73960	10,000 mmf., +100%, -0%, 500 volts (C104, C105, C133)
	Capacitors—Fixed, mica:
79063	47 mmf., ±5%, 1,000 volts (C176)
76474	82 mmf., ±5%, 1,000 volts (C153)
76575	180 mmf., 3,500 volts (C144)
39636	220 mmf., ±10%, 500 volts (C155)
76579	270 mmf., ±10%, 1,000 volts (C148, C190)
39640	330 mmf., ±10%, 500 volts (C149)
76476	330 mmf., ±5%, 1,000 volts (C181)
39644	470 mmf., ±5%, 500 volts (C107, C108)
78796	680 mmf., ±10%, 1,000 volts (C143)
	Capacitor—Mica trimmer:
75217	Dual, 10-160 mmf. (C174A, C174B)
	Capacitor—Trimmer, adjustable:
78220	5-70 mmf., 200 volts (C122)
	Capacitors—Electrolytic comprising:
78213	1 section of 10 mfd., 350 volts; 1 section of 5 mfd., 350 volts; and 1 section of 30 mfd., 50 volts (C124A, C124B, C124C)
77644	1 section of 80 mfd., 400 volts; and 1 section of 20 mfd., 400 volts (C119A, C119B)
78212	1 section of 100 mfd., 400 volts; and 1 section of 20 mfd., 50 volts (C117A, C117B)
	Capacitor—Fixed, paper, oil impregnated, 85° operating temperature:
75249	.001 mfd., ±10%, 600 volts (C143, C173, C198)
75643	.001 mfd., ±20%, 1,000 volts (C140)
73595	.0022 mfd., ±10%, 600 volts (C109, C145)
73599	.0027 mfd., ±10%, 600 volts (C115, C139, C157, C161)
79020	.0027 mfd., ±10%, 1,000 volts (C118)
79018	.0039 mfd., ±10%, 400 volts (C193)
78221	.0039 mfd., ±10%, 600 volts (C147)
79017	.0047 mfd., ±20%, 400 volts (C111, C170)
79019	.0082 mfd., ±10%, 400 volts (C156)
79014	.01 mfd., ±20%, 200 volts (C113)
73561	.01 mfd., ±20%, 400 volts (C116)
73594	.01 mfd., ±10%, 600 volts (C160)
73794	.015 mfd., ±10%, 400 volts (C163)
73562	.022 mfd., ±20%, 400 volts (C179)
73798	.022 mfd., ±20%, 600 volts (C164)
73810	.022 mfd., ±20%, 1,000 volts (C154)
75345	.027 mfd., ±10%, 600 volts (C167)
79015	.033 mfd., ±10%, 200 volts (C112)
73552	.033 mfd., ±20%, 400 volts (C151)
73553	.047 mfd., ±20%, 400 volts (C178)
73592	.047 mfd., ±10%, 600 volts (C162, C168)
73597	.047 mfd., ±10%, 1,000 volts (C188, C189)
79016	.068 mfd., ±10%, 200 volts (C166)
73551	0.1 mfd., ±20%, 400 volts (C150, C158, C169, C177)
73557	0.1 mfd., ±20%, 600 volts (C138, C141, C183, C186)
73794	0.22 mfd., ±10%, 200 volts (C121)
73786	0.27 mfd., ±10%, 200 volts (C187)
73787	0.47 mfd., ±20%, 200 volts (C110, C142, C180)
	Capacitors—Fixed, moulded paper, oil impreg.
76479	.00068 mfd., ±10%, 600 volts (C184)
75249	.001 mfd., ±5%, 600 volts (C185)
78221	.0039 mfd., ±5%, 600 volts (C159)
73594	.01 mfd., ±5%, 600 volts (C182)
77676	Choke—Filter choke (L117)
73477	Coil—Choke coil (L101, L112, L119)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
78743	Coil—Printed I.F. circuit assemble (PC101)
	Coils—Peaking coils:
75253	(120 muh) (L102)
71529	(120 muh) (L108, R174)
98482	(250 muh) (L103)
77674	(250 muh) (L105, R138)
78222	(250 muh) (L106, R215)
75252	(500 muh) (L107)
76640	Coil—R.F. choke coil (1.5 muh) (L110)
76441	Coil—Width coil complete with adjustable core (L109)
	Resistors—Wire wound:
78795	1.2 ohms, ±5%, 1/3 watt (R210)
78797	47 ohms, ±10%, 2 watts (R206)
77670	3,300 ohms, ±10%, 7 watts (R106)
77671	3,800 ohms, ±10%, 7 watts (R121)
	Resistors—Fixed, composition:
30789	33 ohms, ±5%, ½ watt (R128)
503047	47 ohms, ±10%, ½ watt (R107)
504047	47 ohms, ±20%, ½ watt (R205)
34763	68 ohms, ±5%, ½ watt (R125)
503082	82 ohms, ±10%, ½ watt (R101)
503112	120 ohms, ±10%, ½ watt (R136)
502118	180 ohms, ±5%, ½ watt (R131)
503118	180 ohms, ±10%, ½ watt (R144)
503127	270 ohms, ±10%, ½ watt (R146)
504147	470 ohms, ±20%, ½ watt (R133)
513156	560 ohms, ±10%, 1 watt (R116)
503210	1,000 ohms, ±10%, ½ watt (R118)
504210	1,000 ohms, ±20%, ½ watt (R103, R123, R127, R129)
513210	1,000 ohms, ±10%, 1 watt (R105)
523218	1,800 ohms, ±10%, 2 watts (R117)
502222	2,200 ohms, ±5%, ½ watt (R166)
503233	3,300 ohms, ±10%, ½ watt (R188)
502239	3,900 ohms, ±5%, ½ watt (R135)
503239	3,900 ohms, ±10%, ½ watt (R198)
503256	5,600 ohms, ±10%, ½ watt (R140, R158)
513256	5,600 ohms, ±10%, 1 watt (R167)
522275	7,500 ohms, ±5%, 2 watts (R142)
502310	10,000 ohms, ±5%, ½ watt (R109, R110)
503310	10,000 ohms, ±10%, ½ watt (R157)
523310	10,000 ohms, ±10%, 2 watts (R104)
503312	12,000 ohms, ±10%, ½ watt (R113, R137, R179, R216)
36714	15,000 ohms, ±5%, ½ watt (R177)
503315	15,000 ohms, ±10%, ½ watt (R122, R189, R200)
503318	18,000 ohms, ±10%, ½ watt (R160, R170, R171)
523318	18,000 ohms, ±10%, 2 watts (R139)
503322	22,000 ohms, ±10%, ½ watt (R169, R176)
71989	22,000 ohms, ±5%, 1 watt (R180)
523327	27,000 ohms, ±10%, 2 watts (R207, R217)
502333	33,000 ohms, ±5%, ½ watt (R181)
503339	39,000 ohms, ±10%, ½ watt (R108, R164)
70351	43,000 ohms, ±5%, ½ watt (R148)
503347	47,000 ohms, ±10%, ½ watt (R163)
512347	47,000 ohms, ±5%, 1 watt (R202)
514347	47,000 ohms, ±20%, 1 watt (R150)
502356	56,000 ohms, ±5%, ½ watt (R126)
503356	56,000 ohms, ±10%, ½ watt (R209)
503368	68,000 ohms, ±10%, ½ watt (R155, R159)
503382	82,000 ohms, ±10%, ½ watt (R194)
503410	100,000 ohms, ±10%, ½ watt (R195)
504410	100,000 ohms, ±20%, ½ watt (R187, R214)
502415	150,000 ohms, ±5%, ½ watt (R149)
503415	150,000 ohms, ±10%, ½ watt (R190)
512415	150,000 ohms, ±5%, 1 watt (R199)
11959	180,000 ohms, ±5%, ½ watt (R120)
503422	220,000 ohms, ±10%, ½ watt (R186)
503427	270,000 ohms, ±10%, ½ watt (R161, R208)
503433	330,000 ohms, ±10%, ½ watt (R191, R193)
504433	330,000 ohms, ±20%, ½ watt (R115)
502439	390,000 ohms, ±5%, ½ watt (R184, R185)
503439	390,000 ohms, ±10%, ½ watt (R151, R178)
503447	470,000 ohms, ±10%, ½ watt (R152, R175, R182)
504447	470,000 ohms, ±20%, ½ watt (R114, R141, R147)
30562	680,000 ohms, ±10%, ½ watt (R156)
503482	820,000 ohms, ±10%, ½ watt (R192, R203)
503510	1.0 megohm, ±10%, ½ watt (R204)
503512	1.2 megohm, ±10%, ½ watt (R165)
31449	1.5 megohm, ±5%, ½ watt (R119)
503515	1.5 megohm, ±10%, ½ watt (R124)
39063	1.8 megohm, ±5%, 1 watt (R201)
503522	2.2 megohm, ±10%, ½ watt (R162)
504522	2.2 megohm, ±20%, ½ watt (R168)
502539	3.9 megohm, ±5%, ½ watt (R132, R153)
504610	10 megohm, ±20%, ½ watt (R111)
78203	Transformer—1st I.F. pix transformer complete with adjustable core (T106)
78204	Transformer—1st I.F. grid trap complete with adjustable core (L118)
78810	Transformer—Horizontal deflection output transformer (T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable core (T114)
76997	Transformer—Output transformer (T103)
78805	Transformer—Power transformer, 117 volts, 60 cycle (T113)
77112	Transformer—Ratio detector transformer (T102, C106)
76981	Transformer—Sound I.F. transformer with adjustable core (T101, C102, C103)
78809	Transformer—Vertical output transformer (T112)
76983	Trap—4.5 MC trap (L104, C135)

Models 21-S-348K, 21-S-348KU
"Master 21"
Ebony, Maroon

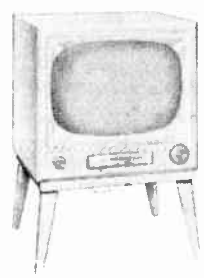


Models 21-S-355K, 21-S-355KU
"Cameron"
Brown Maroon

Models 21-S-367K, 21-S-367KU
"Ft. Knox"
Mahogany



Models 21-S-369K, 21-S-369KU
"Farrell"
Oak



Models 21-S-357K, 21-S-357KU
"Modernette"
Oak

Models 21-S-362K, 21-S-362KU
"Talbot"
Mahogany

GENERAL DESCRIPTION

All models are "21 inch" television receivers. Models without a "U" designation in the model number are receivers with VHF only and feature full 12 channel VHF coverage. Models with the "U" designation in the model number are UHF/VHF receivers and feature full 12 channel VHF coverage plus any UHF channels desired. All models have an auxiliary audio input jack to permit the use of an external record playing attachment except Models 21-S-348K and 21-S-348KU.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE...........227 square inches on a 21ZP4A or 21ZP4B Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 21-S-348K to 21-S-369K Incl.

All 12 VHF channels......54 mc. to 88 mc., 174 mc. to 216 mc.

Models 21-S-348KU to 21-S-369KU Incl.

Any of 70 UHF channels................470 mc. to 890 mc.

Any of 12 VHF channels..54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency....................45.75 mc.

Sound I-F Carrier Frequency....................41.25 mc.

POWER RATING..............................175 watts

AUDIO POWER OUTPUT RATING...........1.5 watts max.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK22D (Models with VHF only)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK31 (UHF/VHF Models)	
(1) RCA 6AF4	UHF Oscillator
(2) RCA 6BQ7A	VHF R-F Amplifier; UHF I-F Amplifier
(3) RCA 6X8	VHF R-F Oscillator & Mixer; UHF I-F Amplifier
A 1N82 crystal is used as the UHF mixer	
All Models	
(1) RCA 6CB6	1st Picture I-F Amplifier
(2) RCA 6CB6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 6X8	1st Video Amplifier and 1st Sync.
(5) RCA 12AU7	Video Output & AGC
(6) RCA 6AU6	Sound I-F Amplifier
(7) RCA 6AL5	Ratio Detector
(8) RCA 6AV6	1st Audio Amplifier
(9) RCA 6AS5	Audio Output
(10) RCA 12AU7	Vert. Osc. and Disch. & Sync. Output
(11) RCA 6K6GT	Vertical Sweep Output
(12) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(13) RCA 6BQ6GT	Horizontal Sweep Output
(14) RCA 6AX4GT	Damper
(15) RCA 1B3-GT/8016	High Voltage Rectifier
(16) RCA 21ZP4B; RCA 21ZP4A (Models 21-S-348K(KU) only)	Kinescope
(17) RCA 5U4G	Rectifier

A crystal diode is used for the Picture 2nd Detector

21-S-348K to 21-S-369K incl.
21-S-348KU to 21-S-369KU incl.

ELECTRICAL AND MECHANICAL SPECIFICATIONS (cont'd)

CHASSIS DESIGNATIONS

CHASSIS	TUNER	KINE-SCOPE	MODELS
KCS88	KRK22D	21ZP4B	21-S-355K 21-S-357K 21-S-362K 21-S-357K 21-S-369K
KCS88A	KRK22D	21ZP4A	21-S-348K
KCS88F	KRK31	21ZP4B	21-S-355KU 21-S-357KU 21-S-362KU 21-S-367KU 21-S-369KU
KCS88H	KRK31	21ZP4A	21-S-348KU

OPERATING CONTROLS (Front)

Models with VHF only

Channel Selector / Fine Tuning ....Dual Control Knobs

UHF/VHF Models

VHF Channel Selector and UHF Changeover Switch / VHF Fine Tuning and UHF Tuning ....Dual Control Knobs

All Models

Brightness....................Single Control under Panel

Horizontal (Freq.) ....Single Control under Panel

Vertical Hold ....Single Control under Panel

OPERATING CONTROLS (Front)

Sound Volume and On-Off Switch / Picture ....Dual Control Knobs

*TV-PH tone switch............Single Control under Panel

**Except Models 21-S-348K and 21-S-348KU*

NON-OPERATING CONTROLS (under Front Panel)

Height ....screwdriver adjustment

Vertical Linearity..................screwdriver adjustment

Horizontal Drive....................screwdriver adjustment

Horizontal Linearity ....screwdriver adjustment

NON-OPERATING CONTROLS
(not including R-F and I-F adjustments)

Picture Centering...................top chassis adjustment

Width...........................rear chassis adjustment

Horizontal Oscillator Waveform......top chassis adjustment

Focus.............................top chassis adjustment

Ion Trap Magnet....................top chassis adjustment

Deflection Coil.....................top chassis adjustment

AGC Control........................rear chassis adjustment

SCANNING..........................Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY...........15,750 cps.

VERTICAL SWEEP FREQUENCY..................60 cps.

FRAME FREQUENCY (Picture Repetition Rate).....30 cps.

INSTALLATION INSTRUCTIONS

CENTERING ADJUSTMENT.—No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plate includes a wing nut which must be loosened before centering. Up and down adjustment of the plate moves the picture up and down and sidewise adjustment moves the picture from side to side.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH AND DRIVE ADJUSTMENTS.—Set the horizontal control at the "pull-in" point. Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer counter-clockwise until a bright vertical line appears in the middle of the picture then clockwise until the bright line just disappears.

At maximum brightness adjust the width control to obtain correct picture width.

Return the brightness to normal level and readjust the drive trimmer C171 as before.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R165 behind front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R174 behind front control panel), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

AGC THRESHOLD CONTROL.—The AGC threshold control R149 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R149. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R149 should be readjusted.

Turn R149 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R149 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R149 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R149 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

PIN-CUSHION CORRECTION

Two pin-cushion correction magnets are employed to correct a small amount of pin-cushion of the raster due to the lens effect of the face of the kinescope. These magnets are mounted on small arms, one on each side of the kinescope as shown in Figure 3. The arms hinge in one plane on self tapping screws which act both as a hinge and an adjustment locking screw. When the magnets are swung towards the tube, maximum correction is obtained. Minimum correction is obtained when the arms are swung away from the tube. To adjust the magnets, loosen the two self tapping screws and position the magnets until the sides of the raster appear straight. Tighten the screws without shifting the position of the magnets. In some cases it may be necessary to twist or bend the magnet support arms to obtain the appearance of straight raster edges.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the yoke knurled nuts and the focus magnet mounting screws are tight.

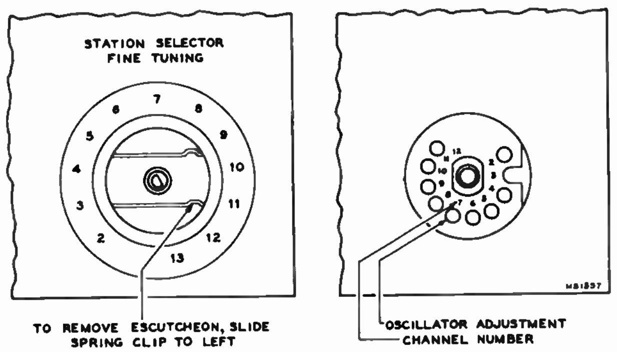


Figure 5—KRK22D R-F Oscillator Adjustments

KRK22D, OR KRK31 VHF R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 11. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 5 or 6. Adjustment for channel 13 is on top of the chassis. The oscillator for the KRK27 UHF tuner section of the KRK31 tuner should be adjusted by the method outlined on page 14 under Alignment Procedure.

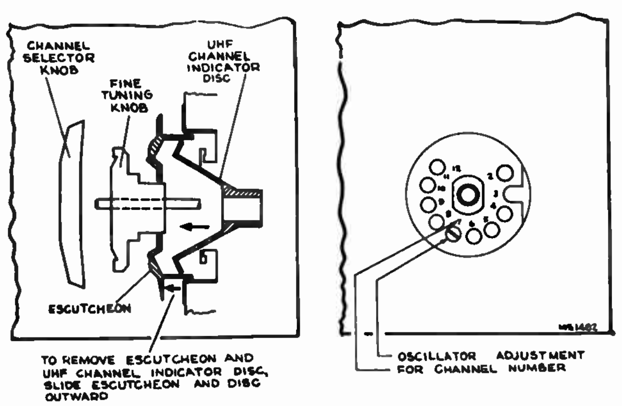


Figure 6—KRK31 VHF R-F Oscillator Adjustment

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is L58 on KRK22D or L5 on KRK31 tuners and is located on the antenna matching transformer.

CAUTION.—In some receivers, the FM trap L5 or L58 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L5 or L58 to make sure that it does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

21-S-348K to 21-S-369K incl.
21-S-348KU to 21-S-369KU incl.

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—
Models 21-S-348K to 21-S-369K Incl.

Connect the i-f signal generator, in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R118, R146 and C120 and to ground. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R118, R146 and C120. The second battery will be used later.

Set the bias to produce approximately —4.0 volt of bias at the junction of R118, R146 and C120.

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." (Note: These transformers should be peaked with their cores at the ends of the coils nearest the chassis.) During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —4.0 volts of i-f bias at the junction of R118, R146 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R129, L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

Models 21-S-348KU to 21-S-369KU Incl.

Connect the i-f signal generator in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R118, R146 and C120.

CHASSIS TOP VIEW

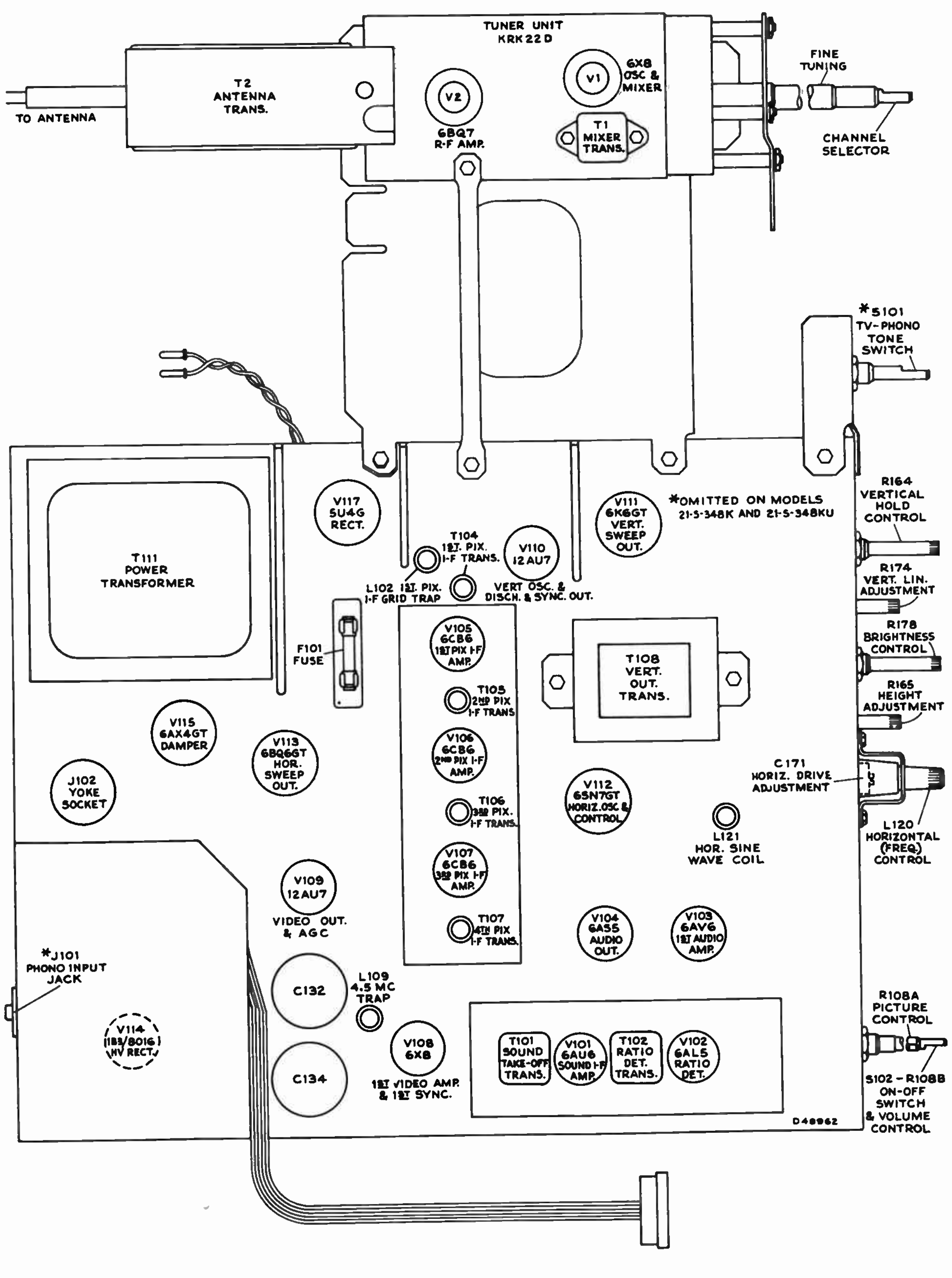


Figure 7—Chassis Top View (shown with KRK22D Tuner)

CHASSIS BOTTOM VIEW

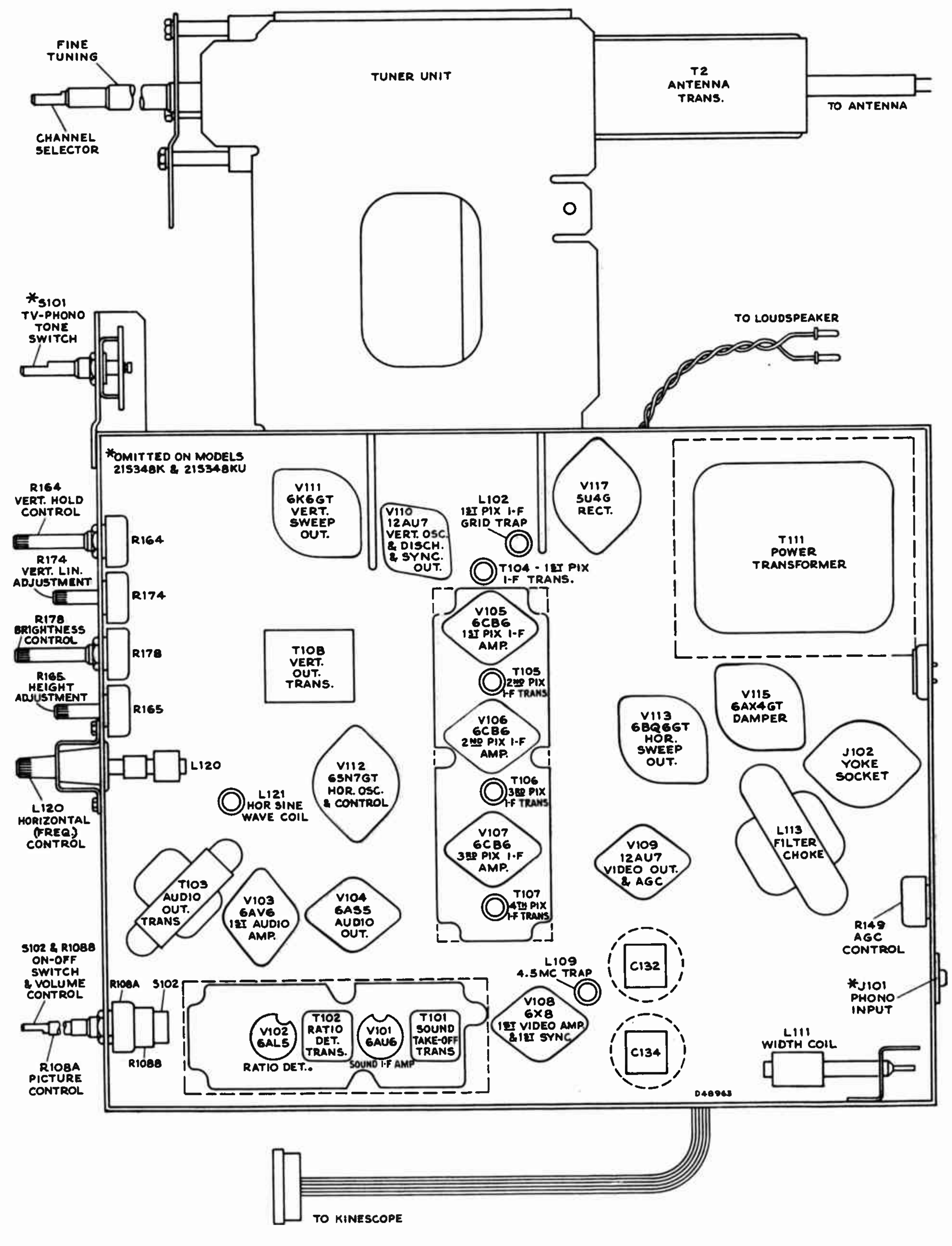


Figure 8—Chassis Bottom View (shown with KRK22D Tuner)

ALIGNMENT PROCEDURE

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R118, R146 and C120. Adjust the potentiometer for —4.0 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —4.0 volts of i-f bias at the junction of R118, R146 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

(Note: Peak transformers with cores at end of coils nearest chassis.)

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R129 and L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 21-S-348K to 21-S-369K Incl.

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip a 330 ohm resistor between pin 1 of V107 and ground.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —4.0 volts of bias as measured by a "VoltOhmyst" at the junction of R118, R146 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T1 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 9. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and the 330 ohm resistors.

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

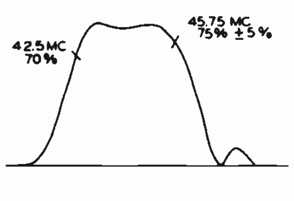


Figure 9— KRK22D T1 and T104 Response

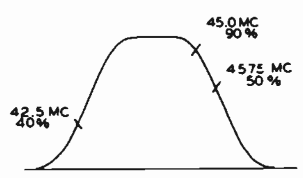


Figure 10— Overall I-F Response with KRK22D

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 25 and 35 times down with curve as shown in Figure 10.

Move the sweep generator to the antenna terminals. Connect —3.0 volts bias to pin 5 of V103. Adjust T106 and T107 slightly to correct for any overall tilt while switching from channel to channel.

Models 21-S-348KU to 21-S-369KU Incl.

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip a 330 ohm resistor between pin 1 of V107 and ground.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —4.0 volts of bias as measured by a "VoltOhmyst" at the junction of R118, R146 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 11. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and the 330 ohm resistors.

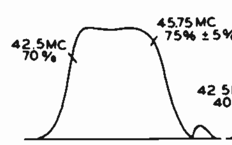


Figure 11— KRK31 T2 and T104 Response

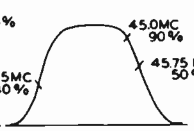


Figure 12— Overall I-F Response with KRK31

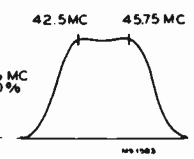


Figure 13— KRK31 L9 and L307 I-F Response

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 0.5 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T105, T106 and T107 to obtain the response shown in Figure 12.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 25 and 35 times down with curve as shown in Figure 12.

To align the I-F amplifier circuit of the KRK31, connect the VHF sweep generator to the rear terminal of the 1N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING to channel 47 at 670 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground.

Connect the oscilloscope diode probe to the junction between the resistor and capacitor. (See Figure 20.)

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.5 volt or less peak-to-peak on the oscilloscope.

Adjust L307, on the KRK27 section, and L9, on the KRK29D section, of the tuner for maximum gain with 45.75 mc. and 42.5 mc. markers as shown in figure 13.

If necessary adjust L27 to place the 45.75 mc. marker at the peak of the curve. Adjust L43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to the junction of R129 and L103. Use 3.0v peak-to-peak on the oscilloscope.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at —3.0 V and the I-F bias at —4.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 12. Retouch T106 and T107 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 12, retouching L307 and L9 if necessary to correct any overall tilt.

Do not retouch T2, T104, T105, T106 or T107.

Remove the sweep and marker generators and the bias supplies.

KRK22D TUNER ALIGNMENT.—

Models 21-S-348K to 21-S-369K Incl.

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T1 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" or T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst". The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

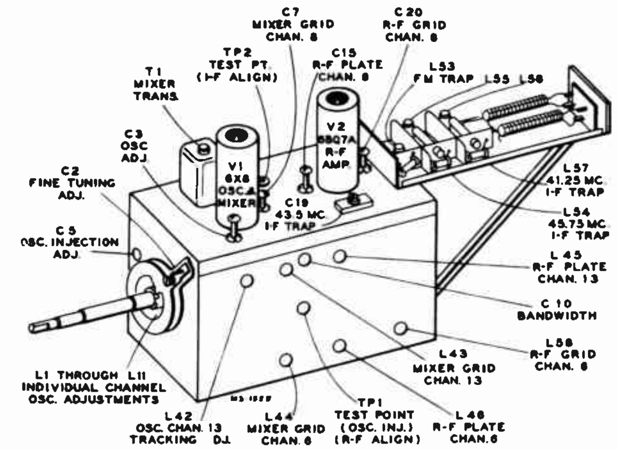


Figure 14— KRK22D Tuner Adjustments

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T1 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15, to the input terminals of the antenna matching unit.

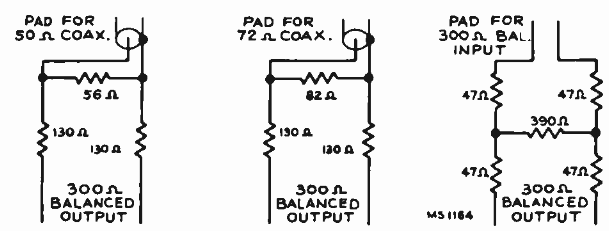


Figure 15—Sweep Attenuator Pads

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

ALIGNMENT PROCEDURE

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in figure 16.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

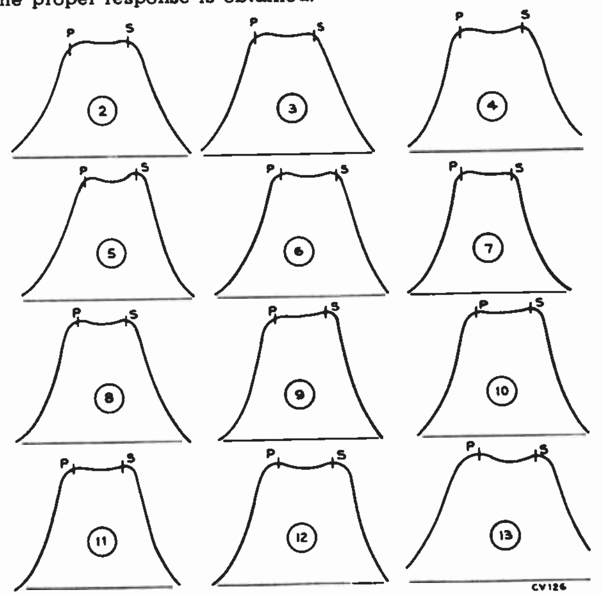


Figure 16—KRK22D R-F Response

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in figure 16.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46 and L58 for proper curve shape as shown in figure 16. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 16 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 16 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

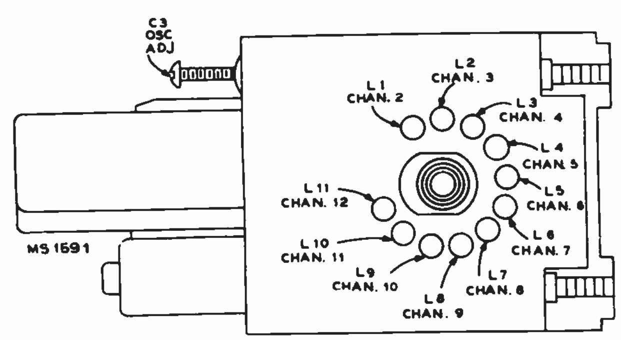


Figure 17—KRK22D Oscillator Adjustments

KRK22D ANTENNA MATCHING UNIT ALIGNMENT. —The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L53 to the channel selector switch S4.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R118, R146 and C120. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R118, R146 and C120.

Connect an oscilloscope to the junction of R129 and L103 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L54 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L57 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L53 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L53 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 15 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L55 and L56 to obtain the response shown in figure 18. L55 is most effective in locating the position of the shoulder of the curve at 52 mc. and L56 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L53 and S4. Replace V106.

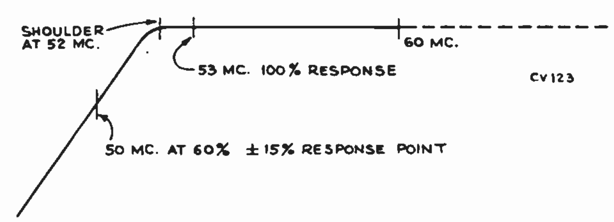


Figure 18—KRK22D Antenna Matching Unit Response

KRK31 TUNER ALIGNMENT

Models 21-S-348K to 21-S-369KU Incl.

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency of each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

ALIGNMENT PROCEDURE

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 19.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts.dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 19.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

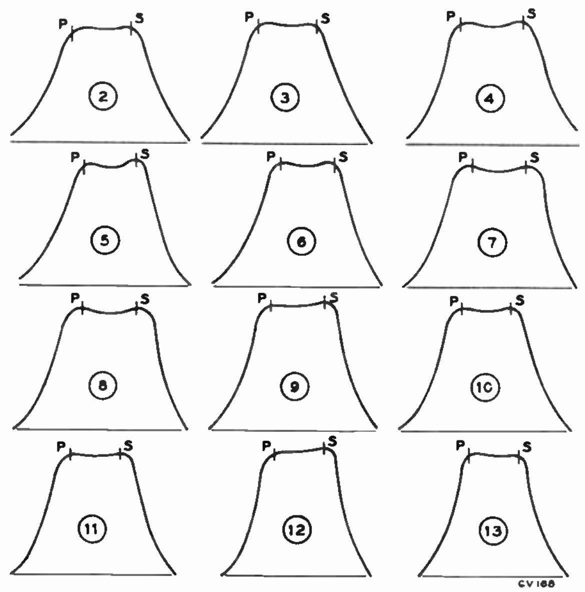
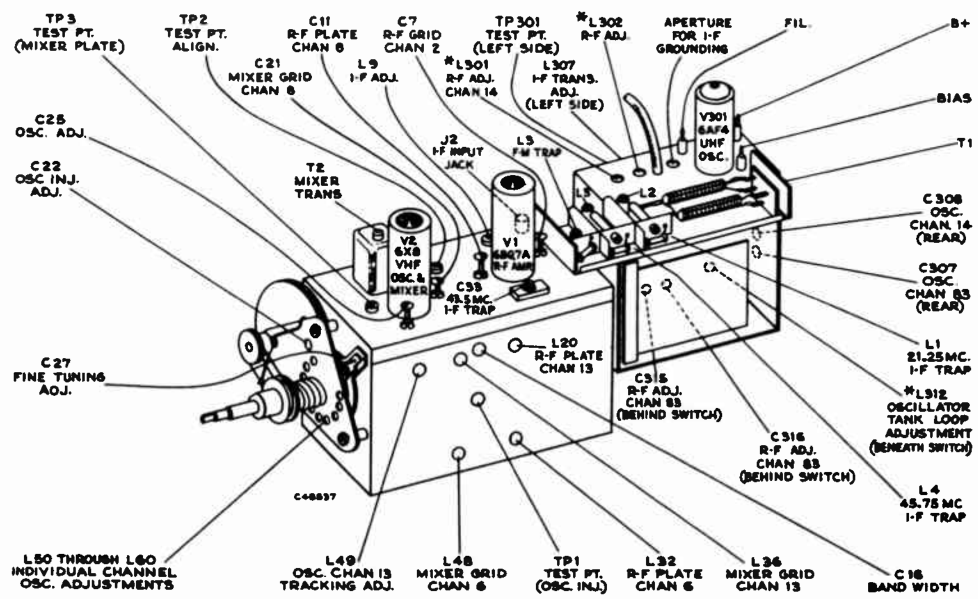


Figure 19—KRK31 VHF R-F Response

If the initial setting of the oscillator injection trimmer was far off it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.



*ON LATER PRODUCTION, L301 & L302 ARE NOT ADJUSTABLE.– L312 IS ADDED. REFER TO ALIGNMENT PROCEDURE

Figure 20—KRK31 Tuner Adjustments

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L48 and L32 for proper curve shape as shown in figure 19. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 19 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 19 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

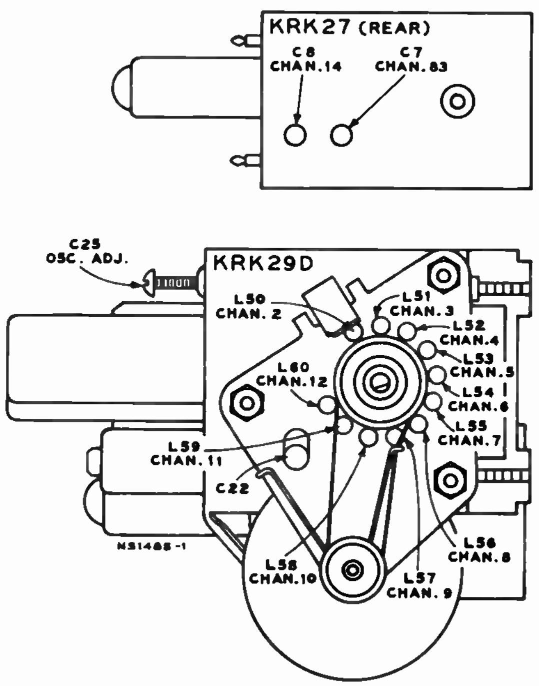


Figure 21—KRK31 VHF Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT.—Ground the I-F transformer L307 by inserting a clip lead through the aperture provided in the top of the tuner. Ground the other end of the clip lead to the tuner case.

Connect the oscilloscope to the test point TP301, employing the preamplifier if needed with the oscilloscope used.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 9° and 168° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. By placing a 1/16" shim between the stop pin on the tuner and the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 168°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the rear terminal of the crystal holder and insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitors C315 and C316 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 22(A).

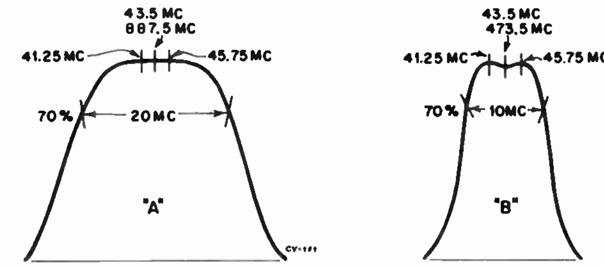


Figure 22—KRK31 UHF R-F Response

Adjust the oscillator trimmer capacitor C307 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 22(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 9°, Channel 14, position.

Adjust the oscillator trimmer C308 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown. The inductance loop L312 across the oscillator tank coil, may be repositioned, if necessary, to bring the oscillator trimmer within range. Refer to figure 20 for location of the aperture for making this adjustment.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates may be knifed through the two front holes provided on the left side of the tuner. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required. Note: The two holes at the rear on the left side of the tuner are for factory use only.

Connect the "VoltOhmyst" to test point TP301. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .05 and .4 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 25). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range

ALIGNMENT PROCEDURE

will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 7 of V108A, in series with a .01 mfd. capacitor.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V107.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at pin 9 of V108A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst." (Adjust with core at chassis end of coil.)

Repeat adjustments of T102 top for maximum d-c at pin 7 of V102 and T102 bottom for zero d-c at the junction of R104 and C107. Make the final adjustments with the signal input level adjusted to produce 5 volts d-c on the "VoltOhmyst" at pin 7 of V102.

SOUND TAKE-OFF ALIGNMENT.—Connect the signal generator to the first video amplifier grid, pin 7 of V108A.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the T101 top core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

(Alternate Method for Ratio Detector and Sound I-F Alignment)

Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 7 of V108A in series with a .01 mfd. capacitor.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the ratio detector secondary T102 bottom core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked, when making the above adjustments.

Tune the T101 (top) core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the T101 adjustment are made.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune T102 bottom for zero d-c at the junction of R104 and C107. (Make adjustment with core at chassis end of coil.)

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1500 mmf. capacitor to pin 7 of V108A. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V107, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video output, pin 6 of V109A.

Adjust the core of L109 for minimum output on the oscilloscope. (Make adjustment with core at chassis end of coil.)

Remove the short from pin 1, V107 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L109 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L109 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V109A.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR AND OUTPUT ALIGNMENT.—Normally the alignment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned.

Turn the horizontal drive trimmer C171 fully clockwise then counter-clockwise one full turn. Set the stud of the width coil L111 flush with the inside rear edge of the chassis.

Place a jumper across the terminals of the sine wave coil L121 and adjust the horizontal (frequency) control until the picture pulls into sync. Remove the short across the sine wave coil.

Connect the low capacity probe of an oscilloscope to the junction of L120, L121 and R189. Turn the horizontal (frequency) control clockwise until the picture falls out of sync, then counter-clockwise until the picture just pulls into sync. The pattern on the oscilloscope should be as shown in Figure 23. Adjust the sine wave adjustment core L121 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the horizontal (frequency) control if necessary.

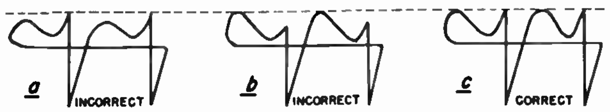


Figure 23—Horizontal Oscillator Waveforms

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator may occur. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Drive Adjustment (for correct locking range). Turn the horizontal (frequency) control until the picture falls out of sync with the diagonal lines sloping down to the right. Slowly turn the horizontal control counter-clockwise and note the number of diagonal bars obtained just before the picture pulls into sync.

Pull-in should occur with one and one-half to three bars present.

With the horizontal control set at the pull-in point, adjust the horizontal drive trimmer C171 counter-clockwise for a bright vertical line in the center of the picture. Turn the trimmer clockwise until the line just disappears.

Set the brightness control to maximum and adjust the width control so the picture fills the mask. Return the brightness control to normal and readjust the horizontal drive trimmer as above.

The picture should pull into sync with one and one-half to three bars present, remain in sync for approximately two full turns counter-clockwise from pull-in, and fall out of sync with between 2 and 5 bars present before interrupted oscillation (motorboating) occurs.

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 30000 microvolt test pattern signal was fed into the receiver the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuit ing the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1 (V2)	6BQ7A	R-F Amplifier	30000 Mu. V. Signal	6	170	—	—	8	0.1	7		
KRK22D or KRK29D			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	30000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 (V1)	6X8	Mixer	30000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
KRK22D or KRK29D			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	30000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V101	6AU6	Sound I-F Amp.	30000 Mu. V. Signal	5	126	6	136	7	1.2	1	0.2	
			No Signal	5	120	6	130	7	1.1	1	0	
V102	6AL5	Ratio Detector	30000 Mu. V. Signal	7	−8.0	—	—	1	−0.3	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	−2.9	—	—	1	−0.1	—	—	
		Ratio Detector	30000 Mu. V. Signal	2	−0.4	—	—	5	7.2	—	—	
			No Signal	2	−0	—	—	5	3.2	—	—	
V103	6AV6	1st Audio Amplifier	30000 Mu. V. Signal	7	98	—	—	2	0	1	−0.8	At min. volume
			No Signal	7	96	—	—	2	0	1	−0.8	At min. volume
V104	6AS5	Audio Output	30000 Mu. V. Signal	7	250	6	262	1	149	2 & 5	141	At min. volume
			No Signal	7	240	6	252	1	142	2 & 5	135	At min. volume
V105	6CB6	1st Pix. I-F Amplifier	30000 Mu. V. Signal	5	132	6	144	2	0	1	−4.7	*Unreliable measuring point
			No Signal	5	112	6	123	2	1.2	1	*0.1	
V106	6CB6	2nd Pix. I-F Amplifier	30000 Mu. V. Signal	5	250	6	278	2	145	1	129	
			No Signal	5	230	6	255	2	136	1	124	
V107	6CB6	3rd Pix. I-F Amplifier	30000 Mu. V. Signal	5	130	6	142	2	2.3	1	0	
			No Signal	5	121	6	136	2	2.2	1	0	

ALIGNMENT DATA

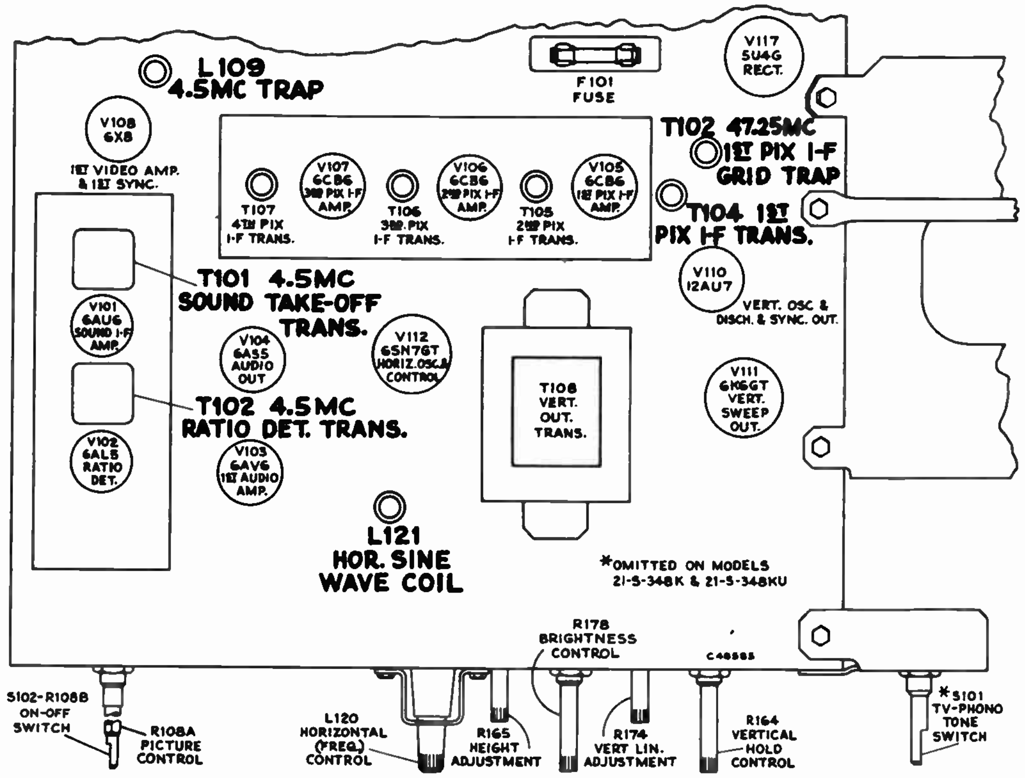


Figure 24—Top Chassis Adjustments (KRK22D Tuner Shown)

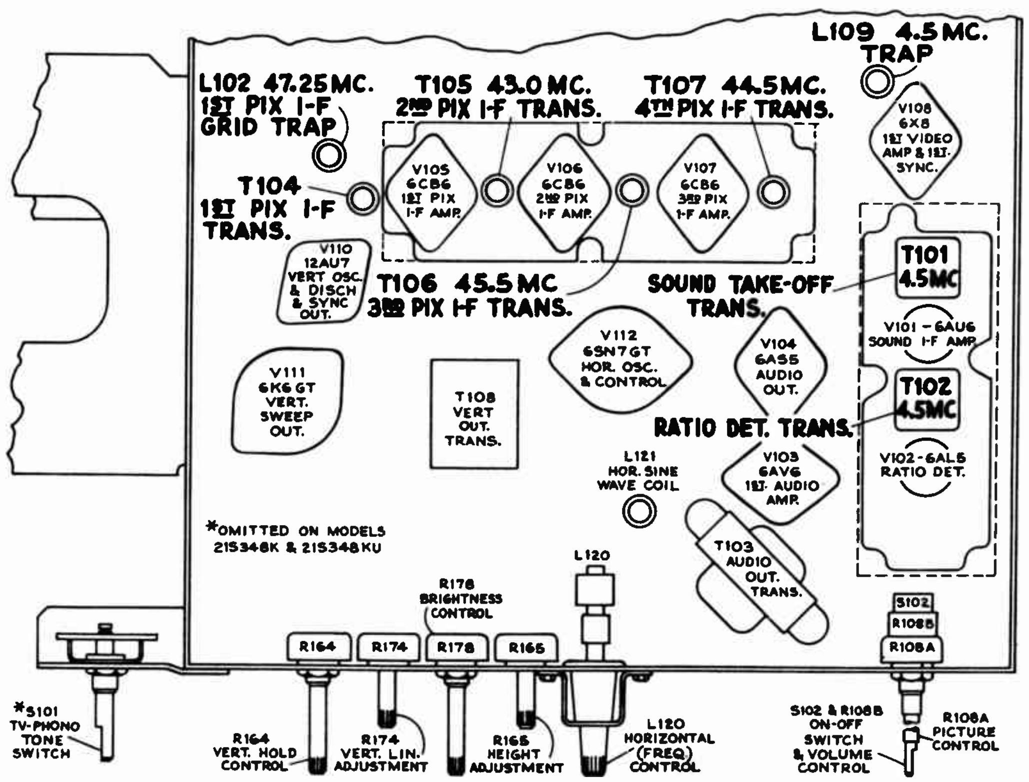


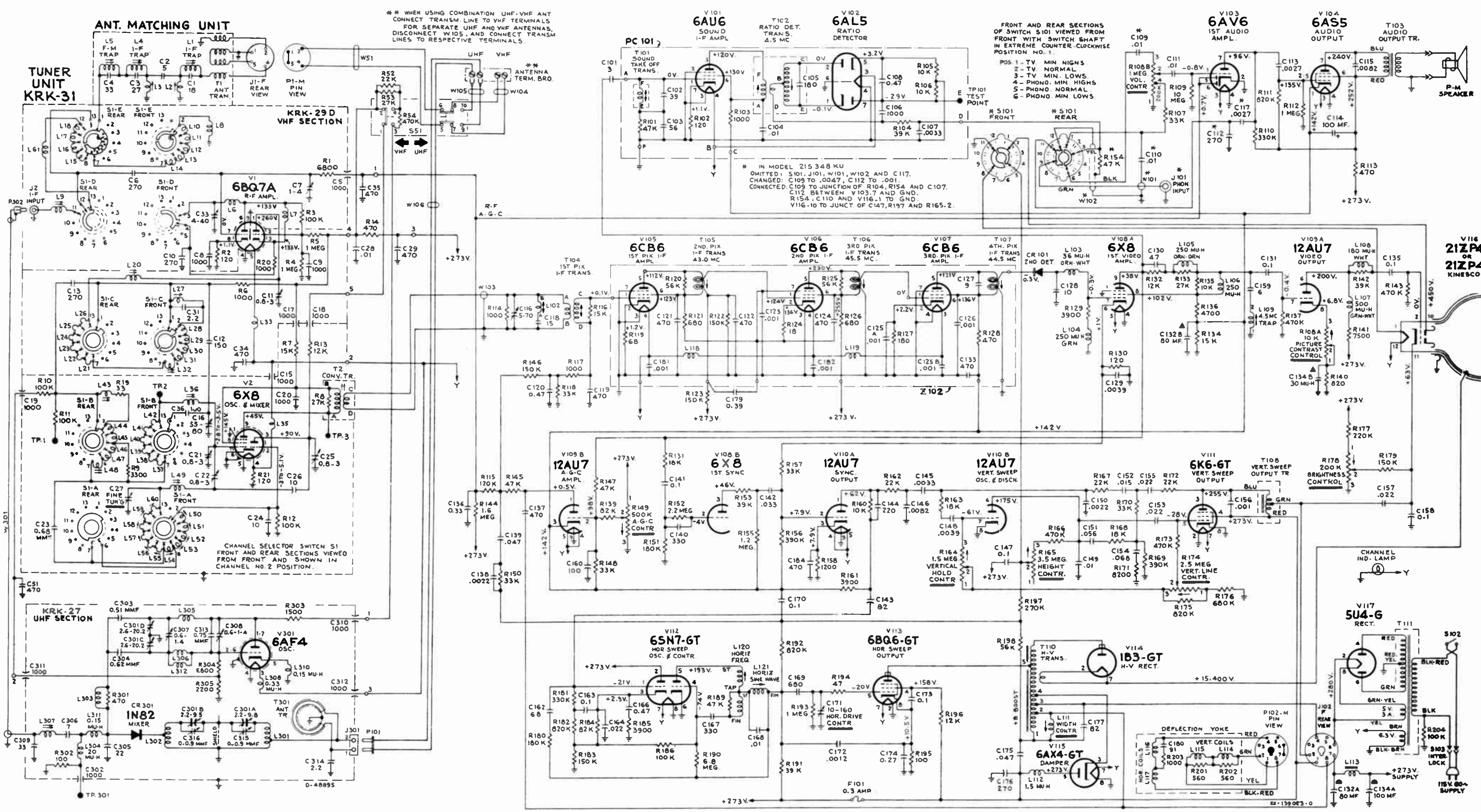
Figure 25—Bottom Chassis Adjustments (KRK22D Tuner Shown)

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V108A	6X8	1st Video Amplifier	30000 Mu. V. Signal	9	70	8	118	6	0.8	7	−1.5	AGC control set for normal operation
			No Signal	9	38	8	102	6	1.0	7	−0.3	AGC control set for normal operation
V108B	6X8	1st Sync	30000 Mu. V. Signal	3	50	—	—	6	0.8	2	−34	
			No Signal	3	46	—	—	6	1.0	2	−4	
V109A	12AU7	Video Output	30000 Mu. V. Signal	6	235	—	—	8	4.0	7	−8.5	Contrast control at maximum
			No Signal	6	200	—	—	8	6.8	7	−0.4	
V109B	12AU7	AGC Amplifier	30000 Mu. V. Signal	1	−43	—	—	3	148	2	112	
			No Signal	1	0.5	—	—	3	142	2	98	
V110A	12AU7	Sync Output	30000 Mu. V. Signal	1	65	—	—	3	8.0	2	7.4	
			No Signal	1	62	—	—	3	7.9	2	7.9	
V110B	12AU7	Vertical Oscillator & Discharge	30000 Mu. V. Signal	6	180	—	—	8	0	7	−63	Depends on setting of Vert. hold control
			No Signal	6	175	—	—	8	0	7	−61	Voltages shown are synced pix adjustment
V111	6K6GT	Vertical Output	30000 Mu. V. Signal	3	262	4	280	8	0	5	−29	
			No Signal	3	255	4	273	8	0	5	−28	
V112	6SN7GT	Horizontal Osc. Control	30000 Mu. V. Signal	2	280	—	—	3	−2.5	1	−23.5	
			No Signal	2	273	—	—	3	−2.3	1	−21	
	6SN7GT	Horizontal Oscillator	30000 Mu. V. Signal	5	200	—	—	6	0	4	−75	
			No Signal	5	193	—	—	6	0	4	−74	
V113	6BQ6GT	Horizontal Output	30000 Mu. V. Signal	Cap	*	4	164	8	11.0	5	−21	*High Voltage Pulse Present
			No Signal	Cap	*	4	158	8	10.5	5	−20	*High Voltage Pulse Present
V114	1B3GT /8016	H. V. Rectifier	30000 Mu. V. Signal	Cap	*	—	—	2 & 7	16,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	15,400	—	—	*High Voltage Pulse Present
V115	6AX4GT	Damper	30000 Mu. V. Signal	5	280	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	273	—	—	3	*	—	—	*High Voltage Pulse Present
V116	21ZP4A or 21ZP4B	Kinescope	30000 Mu. V. Signal	Cap	16,000	10	465	11	65	2	0	At average Brightness
			No Signal	Cap	15,400	10	450	11	63	2	0	At average Brightness
V117	5U4G	Rectifier	30000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	290	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	280	—	—	

CIRCUIT SCHEMATIC DIAGRAM KCS88F or KCS88H

21-S-348KU to 21-S-369KU incl.



NOTE: Chassis KCS88H is identical to chassis 88F except as noted on schematic diagram.

The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

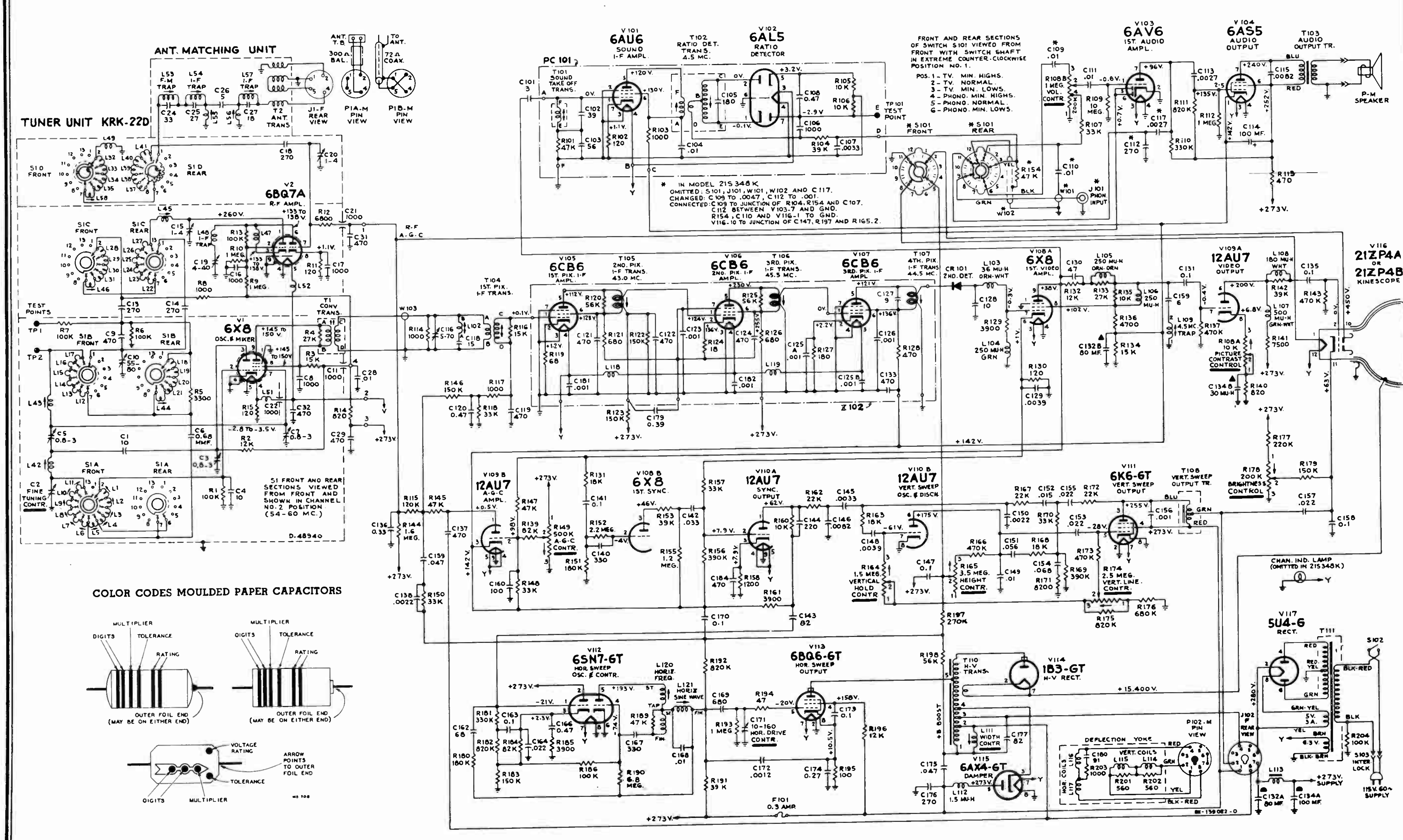
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 27—Circuit Schematic Diagram KCS88F or KCS88H

CIRCUIT SCHEMATIC DIAGRAM KCS88 or KCS88A



*NOTE: Chassis KCS88A is identical to chassis KCS88 except as noted on schematic diagram.

The schematic is shown in the latest condition at the time of printing. All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 26—Circuit Schematic Diagram KCS88 or KCS88A

REPLACEMENT PARTS

SYMBOL NO.	STOCK NO.	DESCRIPTION
		TUNER UNIT ASSEMBLIES KRK22D
C1	77865	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. −0, 10 mmf., ±1.0 mmf., 500 volts DC
C2	77853	Capacitor—Ceramic, variable, for fine tuning-plunger type
C3	77151	Capacitor—Adjustable, steatite, 0.8-3.0 mmf.
C4	33098	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. −750, 10 mmf., ±1.0 mmf., 500 volts DC
C5		Part of S1A
C6		Part of S1B
C7		Same as C2
C8	77252	Capacitor—Fixed, ceramic, High "K" disc, 1000 mmf., +100%, −0%, 500 volts DC
C9		Part of S1B
C10	76527	Capacitor—Mica trimmer, 55-80 mmf.
C11	77084	Capacitor—Ceramic, feed-thru, 1000 mmf.
C12		Not used
C13		Part of S1B
C14		Part of S1C
C15	76532	Capacitor—Adjustable, steatite, 1-4 mmf.
C16, C17		Same as C8
C18	73199	Capacitor—Fixed, ceramic, insulated, High "K" disc, 270 mmf., ±20%, 500 volts DC
C19	77616	Capacitor—Adjustable, mica, 4-40 mmf.
C20		Same as C15
C21, C22		Same as C11
C23		Not used
C24, C25, C26, C27		Part of T2
C28	73960	Capacitor—Fixed, ceramic, High "K" disc, 10,000 mmf., ±100%, −0%, 500 volts DC
C29	77293	Capacitor—Fixed, ceramic, High "K" disc, 470 mmf., +100%, −0%, 500 volts DC
C30		Not used
C31, C32		Same as C29
J1		Part of T2
L1 to L11 Incl.		Part of S1A
L12 to L21 Incl.		Part of S1B
L22 to L31 Incl.		Part of S1C
L32 to L41 Incl.		Part of S1D
L42		Part of S1A
L43, L44		Part of S1B
L45, L46		Part of S1C
L47	76562	Coil—RF amplifier coupling coil
L48	78466	Coil—RF choke coil
L49	77859	Connector—RF grid switch return connector
L50, L51	79097	Coil—Heater choke coil
L52	77206	Coil—Filament choke coil
L53 to L57 Incl.		Part of T2
R1	504410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ watt
R2	523312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 watts
R3	523315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 watts
R4		Part of T1
R5, R6, R7		Part of S1B
R8		Part of S1C
R9, R10	503510	Resistor—Fixed, composition, 1.0 megohm, ±10 %, ½ watt
R11	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ watt
R12	504268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ watt
R13		Same as R1
R14	503182	Resistor—Fixed, composition, 820 ohms, ±10%, ½ watt
S1A	77911	Stator—Oscillator stator complete with rotors, coils, and trimmer (C5, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L42)
S1B	78800	Stator—Mixer stator complete with rotor, coils, capacitors, and resistors (C6, C9, C13, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L43, L44, R5, R6, R7)
S1C	78801	Stator—RF plate stator complete with rotor, coils, capacitors and resistors (C14, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L45, L46, R8)
S1D	78802	Stator—RF grid stator complete with rotor and coils (L32, L33, L34, L35, L36, L37, L38, L39, L40, L41)
T1	78399	Transformer—Convertor transformer
T2	78396	Transformer—Antenna matching transformer complete (C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
	77850	Bracket—Side bracket for mounting coil and stators
	77854	Clip—Mounting clip for fine tuning core
	77860	Connector—Grounding strap connector
	76460	Contact—Test point contact
	77852	Core—Adjustable core for fine tuning capacitor
	79198	Detent—Detent mechanism with steel shaft
	77861	Guide—Bakelite guide for fine tuning lever
	78270	Lever—Fine tuning lever
	14343	Retainer—Fine tuning shaft retainer ring
	77849	Retainer—Retainer for fine tuning spring
	79199	Shaft—Fine tuning shaft and cam
	78236	Shield—Front shield
	76534	Shield—Tube shield
	77851	Shield—"U" shaped shield for underside of unit
	76336	Socket—Tube socket, 9 pin miniature, saddle mounted
	77856	Spring— Fine tuning core spring
	78241	Spring—Formed, for stabilizing fine tuning lever
		TUNER UNIT ASSEMBLIES KRK31 (KRK29D/27)
C1	54207	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 18 mmf., ±10%, 500 volts
C2	3056	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 5 mmf., ±0.5 mmf., 500 volts
C3	70935	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 27 mmf., ±10%, 500 volts
C4	76739	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 33 mmf., ±10%, 500 volts
C5	77084	Capacitor—Ceramic, feed-thru, 1,000 mmf.
C6	75199	Capacitor—Fixed, ceramic, insulated, High "K" disc, 270 mmf., ±20%, 500 volts
C7	76532	Capacitor—Adjustable, steatite, 1-4 mmf.
C8, C9	77252	Capacitor—Fixed, ceramic, High "K" disc, 1,000 mmf., +100%, −0%, 500 volts
C10		Same as C6 (Part of S1D)
C11	77151	Capacitor—Adjustable, steatite, 0.8-3.0 mmf.
C12	78276	Capacitor—Fixed, ceramic, insulated, High "K" disc, 150 mmf., ±10%, 500 volts
C13		Same as C6 (Part of S1B)
C14		Same as C8
C15		Same as C5
C16		Not used
C17, C18, C19		Same as C5
C20		Same as C8
C21		Same as C11
C22	77913	Capacitor—Adjustable, steatite, 0.8-3.0 mmf.
C23	71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20 %, 500 volts
C24	78247	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = −750, 10 mmf., ±10%, 500 volts
C25		Same as C11
C26	77865	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 10 mmf., ±1 mmf., 500 volts
C27	77853	Capacitor—Ceramic, variable, for fine tuning-plunger type
C28	73960	Capacitor—Fixed, ceramic, High "K" disc, 10,000 mmf., +100%, −0%, 500 volts
C29	77293	Capacitor—Fixed, ceramic, High "K" disc, 470 mmf., +100%, -0%, 500 volts
C30		Not used
C31	71502	Capacitor—Fixed, headed-lead type, 2.2 mmf., ±20%, 500 volts
C32		Not used
C33	77616	Capacitor—Adjustable, mica, 4-40 mmf.
C34, C35		Same as C29
C36	75437	Capacitor—Fixed, ceramic, insulated, High "K" disc, 100 mmf., ±20%, 500 volts
C37		Same as C26 (Part of S1A)
C38	71503	Capacitor—Fixed, headed-lead type, 3.3 mmf., ±20%, 500 volts
C39		Same as C31 (Part of S1C)
C40 to C50 Incl.		Not used
C51		Same as C29
C301-A B, C, D	78257	Capacitor—Variable tuning capacitor
C302	77084	Capacitor—Fixed, ceramic, 1,000 mmf., feed-thru

REPLACEMENT PARTS (Continued)

SYMBOL NO.	STOCK NO.	DESCRIPTION
C303	78137	Capacitor—Fixed, headed-lead type, 0.51 mmf., ±10%, 500 volts DC
C304	78260	Capacitor—Fixed, headed-lead type, 0.62 mmf. ±10%, 500 volts DC
C305	78261	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 22 mmf., ±5%, 500 volts DC
C306	78262	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 7 mmf., ±0.5 mmf., 500 volts DC
C307, C308	78259	Capacitor—Adjustable, steatite, 0.6-1.4 mmf., complete with adjustable core
C309	70596	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = 0, 33 mmf., ±5%, 500 volts DC
C310, C311 C312		Same as C302
C313	78263	Capacitor—Fixed, ceramic, non-insulated, Temp. coef. = −750 0.75 mmf., ±0.25 mmf., 500 volts DC
C314	71502	Capacitor—Fixed, headed-lead type, 2.2 mmf., ±10%, 500 volts DC
C315, C316		Part of C301 assembly
CR301	77489	Rectifier—crystal rectifier 1N82
J1	38853	Connector—4 contact female connector-part of antenna matching transformer
J2	78237	Connector—Single contact female connector for UHF connection
J301	78255	Connector—2 contact female connector for UHF antenna
L1	76542	Trap—IF trap (41.25 mc) complete with core
L2	76538	Coil—Shunt coil complete with adjustable core
L3	76537	Coil—Shunt coil complete with adjustable core
L4	76541	Trap—IF trap (45.75 mc) complete with core
L5	76540	Trap—FM trap complete with adjustable core
L6	78466	Trap—IF trap
L7	76562	Coil—RF amplifier coupling coil
L8	77859	Connector—RF grid switch return connector
L9	78271	Coil—IF input coil complete with adjustable core
L10, L11, L12, L13		Part of S1E
L14	73458	Coil—Channel 6 RF grid coil (Part of S1E)
L15, L16, L17, L18		Part of S1E
L19		Not used
L20	77921	Coil—Channel 13 RF plate coil (Part of S1C)
L21 to L26 Incl.		Part of S1C
L27	78584	Coil—RF plate IF coil (Part of S1C)
L28 to L31 Incl.		Part of S1C
L32	73460	Coil—Channel 6 RF plate coil (Part of S1C)
L33	77206	Coil—Filament choke coil
L34, L35	76763	Coil—Heater choke coil
L36	77919	Coil—Channel 13 mixer coil (Part of S1B)
L37 to L42 Incl.		Part of S1B
L43	78583	Coil—Mixer IF coil (Part of S1B)
L44 to L47 Incl.		Part of S1B
L48	73874	Coil—Channel 6 mixer coil (Part of S1B)
L49	77915	Coil—Channel 13 oscillator coil (Part of S1A)
L50 to L60 Incl.		Part of S1A
L61	78401	Coil—Channel 6 antenna coil
L301, L302		Part of C301 assembly
L303	78264	Coil—Peaking coil
L304	72618	Coil—Peaking coil, 20 muh.
L305	78265	Strip—Inductance strip
L306	78266	Strip—Inductance strip and plate
L307	78258	Coil—IF coil complete with adjustable core
L308, L309	77279	Coil—RF choke coil, 0.33 muh.
L310, L311	78267	Coil—RF choke coil, 0.15 muh.
P51	39153	Connector—4 contact male connector
R1	503268	Resistor—Fixed, composition, 6800 ohms, ±10%, ½ watt
R2	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ watt
R3	503410	Resistor—Fixed, composition, 100,000 ohms, ±10%, ½ watt
R4, R5	503510	Resistor—Fixed, composition, 1 megohm, ±10%, ½ watt
R6	503210	Resistor—Fixed, composition, 1,000 ohms, ±10%, ½ watt
R7	523315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 watts
R8		Part of T2
R9	503233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ watt
R10, R11		Same as R3 (Part of S1B)
R12		Same as R3
R13	523312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 watts
R14	503147	Resistor—Fixed, composition, 470 ohms, ±10%, ½ watt
R15 to R18 Incl.		Not used
R19	503033	Resistor—Fixed, composition, 33 ohms, ±10%, ½ watt
R20		Same as R6
R21 to R51 Incl.		Not used
R52	523322	Resistor—Fixed, composition, 22,000 ohms, ±10%, 2 watts
R53	523327	Resistor—Fixed, composition, 27,000 ohms, ±10%, 2 watts
R54		Same as R14
R301		Part of L303
R302	503110	Resistor—Fixed, composition, 100 ohms, ±10%, ½ watt
R303	503215	Resistor—Fixed, composition, 1500 ohms, ±10%, ½ watt
R304	503268	Resistor—Fixed, composition, 6800 ohms, ±10%, ½ watt
R305	503222	Resistor—Fixed, composition, 2200 ohms, ±10%, ½ watt
S1A	77911	Stator—Oscillator coil and stator complete with rotor, coils and trimmer (C22, C37, L49, L50, L51, L52, L53, L54, L55, L56, L57, L58, L59, L60)
S1B	78272	Stator—Mixer stator complete with rotor (C13, C36, L36, L37, L38, L39, L40, L41, L42, L43, L44, L45, L46, L47, L48, R9, R10, R11, R19)
S1C	78274	Stator—RF plate stator complete with rotor, coils, capacitors and resistors (C12, C31, C39, L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L32, R6)
S1D	78277	Stator—Input selector switching stator complete with rotor and capacitor (C10)
S1E	78398	Stator—RF grid stator complete with rotor and coils (C38, L10, L11, L12, L13, L14, L15, L16, L17, L18)
S51	78429	Switch—Antenna slide switch
T1	78396	Transformer—Antenna matching transformer complete
T2	78399	Transformer—Convertor transformer
T301	78268	Transformer—UHF antenna input transformer
	76539	Board—Antenna matching transformer terminal board less coils and capacitors
	78467	Board—Terminal board-6 contact
	78233	Bracket—Side bracket for mounting coils and stators
	78430	Cam—Actuating cam for antenna slide switch
	78417	Cam—Fine tuning cam for VHF
	77854	Clip—Fine tuning clip for fine tuning core
	73591	Coil—Antenna matching coil (Part of T1)
	77860	Connector—Grounding strap connector
	78269	Connector—Single contact male connector for IF output cable
	76460	Contact—Test point contact
	77852	Core—Adjustable core for fine tuning capacitor
	76543	Core—Adjusting core for FM trap
	77918	Core—½-20 x ½" adjusting core for L14, L32, L48
	77914	Core—8-32 x 27/64" adjustable core for L20, L36, L49
	78582	Core—10-32 x ½" adjustable core for L27, L43
	79328	Detent—Detent mechanism and shaft
	77917	Form—Channel 6 coil form complete with core
	77912	Form—Channel 13 coil form complete with core
	78581	Form—IF coils L27, L43 coil form complete with core
	78406	Gear—Tuner drive gear—20 teeth—for KCS88 chassis
	77861	Guide—Bakelite guide for fine tuning lever
	78256	Holder—Crystal holder
	78431	Insulator—Insulator for antenna slide switch
	78270	Lever—Fine tuning lever
	76728	Nut—Speednut for capacitors C7, C11, C21, C25
	78421	Pin—Clutch mechanism operating pin
	79327	Plate—Mounting plate for shafts (front)
	78404	Pulley—Tuner driven pulley complete with bushing for KCS88 chassis
	78405	Pulley—UHF channel marker escutcheon drive pulley for KCS88 chassis
	78423	Pulley—UHF channel marker escutcheon pulley
	79236	Pulley—UHF channel marker pulley assembly
	78420	Pulley—UHF tuner drive pulley

REPLACEMENT PARTS (Continued)

SYMBOL NO.	STOCK NO.	DESCRIPTION
	14343	Retainer—Fine tuning shaft retainer ring
	77849	Retainer—Retainer for fine tuning spring
	78419	Ring—Retaining ring for UHF channel marker escutcheon pulley
	76547	Screw—No. 4-40 x ½" adjusting screw for L55, L56, L57, L58, L59, L60
	76549	Screw—No. 4-40 x ⅜" adjusting screw for L50, L51, L52, L53
	75176	Screw—No. 4-40 x 1/16" adjusting screw for L54
	79325	Shaft—UHF channel selector knob shaft and clutch disc
	78407	Shaft—Tuner connecting shaft for KCS88 chassis
	78236	Shield—Front shield for KRK29D section
	78252	Shield—Oscillator shield for KRK27 section
	78253	Shield—RF shield for KRK27 section
	78254	Shield—Shield for crystal rectifier
	76534	Shield—Tube shield for KRK29D section
	76967	Shield—Tube shield for KRK27 section
	77851	Shield—"U" shaped shield for underside of KRK29D section
	76336	Socket—Tube socket, 9 pin miniature saddle-mounted (KRK29D)
	77274	Socket—Tube socket, miniature, 7 pin ceramic, saddle-mounted (KRK27)
	78427	Spring—Clutch mechanism operating pin coil spring
	77856	Spring—Fine tuning spring
	78241	Spring—Formed spring for fine tuning lever
	78422	Spring—Formed spring for actuating clutch disc
	78585	Spring—Formed spring for UHF channel marker escutcheon
	78409	Spring—Tuner drive cord tension spring
	78428	Spring—UHF channel marker escutcheon pulley coil spring
	78403	Stop—Metal stop for connecting shaft for KCS88 chassis
	76740	Stud—No. 6-32 x 1" adjusting stud for capacitor C22
	78426	Washer—"C" washer for clutch mechanism
	75190	Washer—Insulating washer (neoprene) for capacitor
	78424	Washer—Retaining washer for knob shaft spring
	78425	Washer—Spring washer for clutch mechanism
		CHASSIS ASSEMBLIES KCS88, KCS88A, (KRK22D) KCS88F, KCS88H (KRK31)
C101	76507	Capacitor—Fixed, ceramic, 3 mmf., ±1 mmf., 500 volts
C102	79323	Capacitor—Fixed, ceramic, 39 mmf., ±10%, 500 volts
C103	79234	Capacitor—Fixed, ceramic, 56 mmf., ±10%, 500 volts
C104	73960	Capacitor—Fixed, ceramic, .01 mfd., +100%, −0%, 500 volts
C105		Part of T102
C106	39652	Capacitor—Fixed, mica, 1000 mmfd., ±5%, 500 volts
C107	79315	Capacitor—Fixed, paper, .0033 mf., ±10%, 400 volts
C108	79148	Capacitor—Fixed, paper, 0.47 mf., ±10%, 200 volts
C109	79017	Capacitor—Fixed, paper, oil impregnated, .0047 mf., ±20%, 400 volts for KCS88A, KCS88H only
C109	79014	Capacitor—Fixed, paper, 0.01 mf., ±20%, 200 volts for KCS88, KCS88F only
C110	79316	Capacitor—Fixed, paper, .01 mf., ±10%, 200 volts
C111	79014	Capacitor—Fixed, paper, .01 mf., ±20%, 200 volts
C112	47617	Capacitor—Fixed, ceramic, 270 mmf., ±10%, 500 volts for KCS88, KCS88F only
C112	75643	Capacitor—Fixed, paper, .001 mf., ±10%, 600 volts for KCS88A, KCS88H only
C113	73599	Capacitor—Fixed, paper, 0.0027 mf., ±10%, 400 volts
C114	79314	Capacitor—Electrolytic, 100 mf., +100%, −10%, 250 volts
C115	73805	Capacitor—Fixed, paper, 0.0047 mf., ±10%, 1000 volts
C116	78220	Capacitor—Adjustable, 5-70 mmf. mica
C117		Same as C113
C118	39044	Capacitor—Fixed, ceramic, 15 mmf., ±5%, 500 volts
C119	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 volts

SYMBOL NO.	STOCK NO.	DESCRIPTION
C120	73787	Capacitor—Fixed, paper, 0.47 mf., ±20%, 200 volts
C121	77293	Capacitor—Fixed, ceramic, 470 mmf., ±20%, 500 volts
C122	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 volts
C123	77252	Capacitor—Fixed, ceramic, .001 mfd., +100%, −0%, 500 volts
C124		Same as C121
C125A, B	79319	Capacitor—Fixed, electrolytic, 2 sections:—.001 mf., 500 volts
C126	78623	Capacitor—Fixed, ceramic, .001 mf., ±20%, 500 volts
C127	79164	Capacitor—Fixed, ceramic, 9 mmfd., ±0.5 mmf., 500 volts
C128	33098	Capacitor—Fixed, ceramic, 10 mmf., ±1 mmf., 500 volts
C129	79018	Capacitor—Fixed, paper, .0039 mf., ±10%, 400 volts
C130	39042	Capacitor—Fixed, ceramic, 47 mmf., ±10%, 500 volts
C131	79149	Capacitor—Fixed, paper, 0.1 mf., ±20%, 600 volts
C132A, B	79147	Capacitor—Electrolytic comprising: 1 section of 80 mfd., 400 volts and 1 section of 80 mfd., 200 volts
C133		Same as C122
C134A, B	79146	Capacitor—Electrolytic comprising:— 1 section of 100 mfd., 400 volts and 1 section of 30 mfd., 50 volts
C135	73557	Capacitor—Fixed, paper, 0.1 mf., ±20%, 600 volts
C136	76994	Capacitor—Fixed, paper, 0.33 mf., ±20%, 200 volts
C137	59667	Capacitor—Fixed, mica, 470 mmf., ±10%, 1000 volts
C138		Same as C135
C139	73592	Capacitor—Fixed, paper, 0.047 mf., ±10%, 600 volts
C140	39640	Capacitor—Fixed, mica, 330 mmf., ±10%, 500 volts
C141	73551	Capacitor—Fixed, paper, 0.1 mf., ±20%, 400 volts
C142	73552	Capacitor—Fixed, paper, 0.033 mf., ±20%, 400 volts
C143	76474	Capacitor—Fixed, mica, 82 mf., ±5%, 1000 volts
C144	39636	Capacitor—Fixed, mica, 220 mmf., ±10%, 500 volts
C145		Same as C107
C146	79019	Capacitor—Fixed, paper, 0.0082 mf., ±10%, 400 volts
C147		Same as C141
C148	78221	Capacitor—Fixed, paper, 0.0039 mf., ±5%, 600 volts
C149	73594	Capacitor—Fixed, paper, 0.01 mf., ±10%, 600 volts
C150	73595	Capacitor—Fixed, paper, 0.0022 mf., ±10%, 600 volts
C151	79317	Capacitor—Fixed, paper, 0.056 mf., ±10%, 600 volts
C152	73797	Capacitor—Fixed, paper, 0.015 mf., ±10%, 400 volts
C153	73798	Capacitor—Fixed, paper, 0.022 mf., ±20%, 600 volts
C154	73792	Capacitor—Fixed, paper, 0.068 mf., ±10%, 200 volts
C155	73798	Capacitor—Fixed, paper, 0.022 mf., ±10%, 600 volts
C156	78980	Capacitor—Fixed, paper, 0.001 mf., ±20%, 1600 volts
C157		Same as C153
C158		Same as C141
C159	77364	Capacitor—Fixed, ceramic, 6 mmf., ±1.0 mmf., 500 volts
C160	39396	Capacitor—Fixed, ceramic, 100 mmf., ±10%, 500 volts
C162	76475	Capacitor—Fixed, mica, 68 mmf., ±5%, 1000 volts
C163		Same as C141
C164	73562	Capacitor Fixed, paper, 0.022 mf., ±20%, 400 volts
C166		Same as C120
C167	76476	Capacitor—Fixed, mica, 330 mmf., ±5%, 1000 volts
C168	73594	Capacitor Fixed, paper, 0.01 mf., ±5%, 600 volts
C169	76479	Capacitor Fixed, paper, 680 mmf., ±10%, 600 volts
C170		Same as C135
C171	71807	Capacitor Mica trimmer, 10-160 mmf.

REPLACEMENT PARTS (Continued)

SYMBOL NO.	STOCK NO.	DESCRIPTION
C172	76995	Capacitor—Fixed, paper, 0.0012 mf., ±5%, 600 volts
C173		Same as C135
C174	73786	Capacitor—Fixed, paper, 0.27 mf., ±10%, 200 volts
C175	73597	Capacitor—Fixed, paper, 0.047 mf., ±10%, 1000 volts
C176	79022	Capacitor—Fixed, mica, 270 mmf., ±20%, 1000 volts
C177	77836	Capacitor—Fixed, ceramic, 82 mmf., ±10%, 6000 volts
C179	79318	Capacitor—Fixed, paper, 0.39 mf., ±10%, 200 volts
C180		Part of Yoke
C181, C182		Same as C123
C184	78622	Capacitor—Fixed, ceramic, 470 mmf., ±20%, 500 volts
CR101	76675	Crystal—Crystal operating frequency 44.5 M.C.
F101	78214	Fuse—0.3 amp., 250 volts
J101	35787	Connector—Phono input connector for KCS88, KCS88F
J102	68590	Connector—8 contact female connector for yoke leads
L102	78204	Trap—1st. I.F. grid trap complete with adjustable core
L103	76011	Coil—Peaking (36 mh)
L104	98482	Coil—Peaking (250 mh)
L105	77674	Coil—Peaking (250 mh)
L106	79321	Coil—Peaking (250 mh)
L107	75252	Coil—Peaking (500 mh)
L108	71528	Coil—Peaking (180 mh)
L109	79157	Coil—4.5 M.C. video trap with adjustable core (includes C159)
L111	79144	Coil—Width coil complete with adjustable core
L112	76640	Coil—R.F. insul. choke, 1.5 mh
L113	77676	Choke—Filter choke
L114, L115, L116, L117		Part of Yoke
L118, L119	73477	Coil—2nd. and 3rd. I.F. pix choke coils
L120	79160	Coil—Horizontal oscillator coil complete with adjustable core
L121	79161	Coil—Horizontal sine wave coil with adjustable core
PC101	79142	Circuit—Printed I.F. sound assembly (includes C102, C103, C104, C106, C107, C108, R101, R102, R103, R104, R105, R106, T101, T102)
R101	503347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ watt
R102	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ watt
R103	504210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ watt
R104	503339	Resistor—Fixed, composition, 39,000 ohms, ±10%, ½ watt
R105, R106	502310	Resistor—Fixed, composition, 10,000 ohms, ±5%, ½ watt
R107	503333	Resistor—Fixed, composition, 33,000 ohms, ±10%, ½ watt
R108A, B	78208	Control—Volume and contrast control
R109	504610	Resistor—Fixed, composition, 10 megohms, ±20%, ½ watt
R110	504433	Resistor—Fixed, composition, 330,000 ohms, ±20%, ½ watt
R111	503482	Resistor—Fixed, composition, 820,000 ohms, ±5%, ½ watt
R112	502510	Resistor—Fixed, composition, 1 megohm, ±5%, ½ watt
R113	524147	Resistor—Fixed, composition, 470 ohms, ±20%, 2 watts
R114	504210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ watt
R115	30180	Resistor—Fixed, composition, 120,000 ohms, ±5%, ½ watt
R116	503315	Resistor—Fixed, composition, 15,000 ohms, ±10%, ½ watt
R117		Same as R114
R118	502333	Resistor—Fixed, composition, 33,000 ohms, ±5%, ½ watt
R119	502068	Resistor—Fixed, composition, 68 ohms, ±5%, ½ watt
R120	502356	Resistor—Fixed, composition, 56,000 ohms, ±5%, ½ watt
R121	504168	Resistor—Fixed, composition, 680 ohms, ±20%, ½ watt
R122, R123	502415	Resistor—Fixed, composition, 150,000 ohms, ±5%, ½ watt
R124	33568	Resistor—Fixed, composition, 18 ohms, ±5%, ½ watt

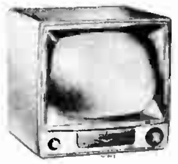
SYMBOL NO.	STOCK NO.	DESCRIPTION
R125		Same as R120
R126		Same as R121
R127	502118	Resistor—Fixed, composition, 180 ohms, ±5%, ½ watt
R128	504147	Resistor—Fixed, composition, 470 ohms, ±20%, ½ watt
R129	502239	Resistor—Fixed, composition, 3900 ohms, ±5%, ½ watt
R130	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ watt
R131	503318	Resistor—Fixed, composition, 18,000 ohms, ±10%, ½ watt
R132	503312	Resistor—Fixed, composition, 12,000 ohms, ±10%, ½ watt
R133		Part of L105
R134	524315	Resistor—Fixed, composition, 15,000 ohms, ±20%, 2 watts
R135		Part of L106
R136	513247	Resistor—Fixed, composition, 4700 ohms, ±10%, 1 watt
R137	504447	Resistor—Fixed, composition, 470,000 ohms, ±20%, ½ watt
R139	503382	Resistor—Fixed, composition, 82,000 ohms, ±10%, ½ watt
R140	503182	Resistor—Fixed, composition, 820 ohms, ±10%, ½ watt
R141	512275	Resistor—Fixed, composition, 7500 ohms, ±5%, 1 watt
R142		Part of L108
R143		Same as R137
R144	502516	Resistor—Fixed, composition, 1.6 megohm, ±5%, ½ watt
R145	514347	Resistor—Fixed, composition, 47,000 ohms, ±20%, 1 watt
R146		Same as R122
R147	503347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ watt
R148		Same as R107
R149	78808	Control—AGC control
R150		Same as R107
R151	503418	Resistor—Fixed, composition, 180,000 ohms, ±10%, ½ watt
R152	503522	Resistor—Fixed, composition, 2.2 megohm, ±10%, ½ watt
R153	503339	Resistor—Fixed, composition, 39,000 ohms, ±10%, ½ watt
R154		Same as R147
R155	503512	Resistor—Fixed, composition, 1.2 megohm, ±10%, ½ watt
R156	503439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ watt
R157		Same as R107
R158	503212	Resistor—Fixed, composition, 1200 ohms, ±10%, ½ watt
R160	513310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 1 watt
R161	502239	Resistor—Fixed, composition, 3900 ohms, ±5%, ½ watt
R162	503322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ watt
R163		Same as R131
R164	78210	Control—Vertical hold control
R165	78806	Control—Height control
R166	503447	Resistor—Fixed, composition, 470,000 ohms, ±10%, ½ watt
R167	503322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ watt
R168	19 32	Resistor—Fixed, composition, 18,000 ohms, ±5%, ½ watt
R169	503439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ watt
R170	502333	Resistor—Fixed, composition, 33,000 ohms, ±5%, ½ watt
R171	503282	Resistor—Fixed, composition, 8200 ohms, ±10%, ½ watt
R172	502232	Resistor—Fixed, composition, 22,000 ohms, ±5%, ½ watt
R173		Same as R166
R174	78807	Control—Vertical linearity control
R175		Same as R111
R176	30562	Resistor—Fixed, composition, 680,000 ohms, ±5%, ½ watt
R177	503422	Resistor—Fixed, composition, 220,000 ohms, ±10%, ½ watt
R178	79139	Control—Brightness control
R179	504415	Resistor—Fixed, composition, 150,000 ohms, ±20%, ½ watt
R180	503418	Resistor—Fixed, composition, 180,000 ohms, ±10%, ½ watt

SYMBOL NO.	STOCK NO.	DESCRIPTION
R181	503433	Resistor—Fixed, composition, 330,000 ohms, ±10%, ½ watt
R182	503482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ watt
R183	502415	Resistor—Fixed, composition, 150,000 ohms, ±5%, ½ watt
R184	8064	Resistor—Fixed, composition, 82,000 ohms, ±5%, ½ watt
R185	503239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ watt
R186	512410	Resistor—Fixed, composition, 100,000 ohms, ±5%, 1 watt
R189	503347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ watt
R190	503568	Resistor—Fixed, composition, 6.8 megohm, ±10%, ½ watt
R191	513339	Resistor—Fixed, composition, 39,000 ohms, ±10%, 1 watt
R192	503482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ watt
R193	503510	Resistor—Fixed, composition, 1 megohm, ±10%, ½ watt
R194	504047	Resistor—Fixed, composition, 47 ohms, ±20%, ½ watt
R195	74015	Resistor—Fixed, wire wound, 100 ohms, ±10%, 2 watts
R196	523312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 watts
R197	503427	Resistor—Fixed, composition, 270,000 ohms, ±10%, ½ watt
R198	503356	Resistor—Fixed, composition, 56,000 ohms, ±10%, ½ watt
R201, R202, R203		Part of Yoke
R204	504410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ watt
S102	78211	Switch—T.V. phono-tone switch for KCS88, KCS88F
T101	79140	Coil—Sound take-off coil, 4.5 M.C.
T102	79141	Transformer—I.F. ratio detector complete with adjustable cores
T103	79159	Transformer—Audio output transformer
T104	78203	Transformer—1st. pix I.F. grid complete with adjustable core
T105, T106, T107	76433	Transformer—1st., 2nd., and 3rd. pix I.F. transformer
T108	79143	Transformer—Vertical output transformer
T110	79145	Transformer—High voltage transformer
T111	79162	Transformer—Power transformer, 117 volts, 60 cycle
Z102	79156	Plate—I.F. picture plate complete (includes C121, C122, C123, C124, C125A, C125B, C126, C127, C133, C181, C182, L118, L119, R119, R120, R121, R122, R124, R125, R126, R127, R128)
	74594	Connector—2 contact male connector for power cord
	79138	Cover—Back cover for high voltage compartment
	76459	Grommet—Rubber grommet for 2nd. anode lead
	78218	Holder—Fuse holder
	61139	Holder—Tube holder for V117
	78215	Insulator—Polystyrene insulator for high voltage socket
	79150	Knob—Horizontal frequency tuning knob (brown maroon)
	79320	Lead—Anode lead assembly complete
	79155	Plate—I.F. pix mounting plate
	79158	Shield—Side shield for high voltage compartment
	76972	Shield—Tube shield for V108A, B
	73584	Shield—Tube shield for V101, V102 & V107
	79154	Socket—Tube socket, 7 pin, miniature for V102
	73117	Socket—Tube socket, 7 pin, miniature, wafer for V103, V104, V105, V106, V107
	79153	Socket—Tube socket, 7 pin, miniature with jumper bar for V101
	68590	Socket—Tube socket, octal, for V111, V115
	77645	Socket—Tube socket, octal, wafer for V112
	31251	Socket—Tube socket, octal, wafer for V113, V117
	74834	Socket—Tube, kine tube socket assembly
	76971	Socket—Tube socket, 9 pin, miniature wafer for V108A, B, V109A, B, V110A, B
	78243	Strap—Polystyrene strap for 2nd. anode lead

SYMBOL NO.	STOCK NO.	DESCRIPTION
	79239	Washer—Spring washer for horizontal frequency coil knob
	78219	Washer—#8 vellutex washer for high voltage insulator
		SPEAKER ASSEMBLIES 971636-1W RL101C5 RMA-274 (FOR MODELS 21S348K,KU; 21S355K,KU; 21S357K,KU)
	77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)
		SPEAKER ASSEMBLIES 971490-3W RL105-E11 RMA-274 (FOR MODELS 21S362K,KU; 21S367K,KU; 21S369K,KU)
	75024	Cone—Cone and voice coil (3.2 ohms)
	77872	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)
		NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.
		MISCELLANEOUS
	79214	Back—Cabinet back complete with power cord for Models 21S348K, 21S355K, 21S357K
	79233	Back—Cabinet back complete with power cord for Models 21S348KU, 21S355KU, 21S357KU
	79236	Back—Cabinet back complete with power cord for Models 21S362K, 21S367K, 21S369K
	79237	Back—Cabinet back complete with power cord for Models 21S362KU, 21S367KU, 21S369KU
	79229	Bracket—Channel marker escutcheon lamp bracket for Models 21S348K, KU; 21S355K, KU; 21S357K, KU
	79297	Bracket—Channel marker escutcheon lamp bracket for Models 21S362K, KU; 21S367K, KU; 21S369K, KU
	X3372	Cloth—Grille cloth for mahogany grain instruments for Models 21S362K, KU; 21S367K, KU
	X3371	Cloth—Grille cloth for oak instruments for Models 21S369K, KU
	79217	Cover—Cover and case assembly—ebony—for hidden controls for 21S348K, KU
	79218	Cover—Cover and case assembly—maroon—for hidden controls for 21S348K, KU
	79232	Cover—Cover and case assembly—maroon—for hidden controls for 21S355K, KU; 21S362K KU; 21S367K, KU
	79225	Cover—Cover and case assembly—oak—for hidden controls for 21S357K, KU; 21S369K, KU
	74956	Cushion—For deflection yoke hood assembly
	78309	Cushion—Rubber cushion for dust sealing the kinescope for maroon and ebony instruments
	79238	Cushion—Rubber cushion for safety glass for Models 21S362K, KU; 21S367K, KU; 21S369K, KU
	79239	Cushion—Rubber cushion for safety glass for Models 21S362K, KU; 21S367K, KU; 21S369K, KU
	77770	Cushion—Safety glass retainer cushion
	78386	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for mahogany grain instuments for Models 21S362K, KU; 21S367K, KU
	78389	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for oak instruments for Models 21S369K, KU
	79076	Escutcheon—Channel marker escutcheon for Model 21S348K
	79219	Escutcheon—Channel marker escutcheon for Models 21S348KU, 21S355KU, 21S357KU, 21S362KU, 21S367KU, 21S369KU
	78870	Escutcheon—Channel marker escutcheon for Models 21S355K, 21S357K, 21S362K, 21S367K, 21S369K
	78345	Escutcheon—UHF channel marker escutcheon for instruments using KRK31 tuner unit

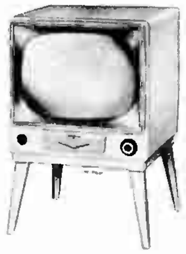
SYMBOL NO.	STOCK NO.	DESCRIPTION
	78329	Glass—Safety glass for Models 21S348K, KU
	79322	Glass—Safety glass for Models 21S355K, KU 21S357K, KU
	79235	Glass—Safety glass for 21S362K, KU; 21S367K, KU; 21S369K, KU
	79312	Grille—Metal grille for mahogany instruments for Models 21S362K, KU; 21S367K, KU
	79313	Grille—Metal grille for oak instruments for Models 21S369K, KU
	79234	Hood—Deflection yoke hood assembly
	79221	Knob—Channel selector knob—black—for ebony instruments for Models 21S348K, KU
	79222	Knob—Channel selector knob—brown—for maroon instruments for Models 21S348K, KU
	79230	Knob—Channel selector knob—brown—for maroon instruments for Models 21S355K, KU; 21S362K, KU; 21S367K, KU
	79226	Knob—Channel selector knob—medium beige—for oak & mahogany grain instruments for Models 21S357K, KU; 21S369K, KU
	79077	Knob—Fine tuning control knob—for ebony and maroon instruments for Model 21S348K
	79081	Knob—Fine tuning control knob for ebony and maroon instruments for Model 21S348KU
	77707	Knob—Fine tuning knob—brown—for maroon instruments for Models 21S355K, 21S362K, 21S367K
	78343	Knob—Fine tuning control knob—brown—for maroon instruments for Models 21S355KU, 21S362KU, 21S367KU
	77717	Knob—Fine tuning control knob—medium beige—for oak instruments for Models 21S357K, 21S369K
	78432	Knob—Fine tuning control knob—medium beige—for oak instruments for Models 21S357KU, 21S369KU
	79080	Knob—Picture control knob for ebony & maroon instruments for Models 21S348K, KU
	77709	Knob—Picture control knob for maroon instruments—brown—for Model 21S355K, KU; 21S362K, KU; 21S367K, KU
	77718	Knob—Picture control knob—medium beige—for oak instruments for Models 21S357K, KU; 21S369K, KU
	79133	Knob—Tone control or definition switch knob for maroon instruments for Models 21S355K, KU; 21S357K, KU
	77735	Knob—Tone control or definition switch knob—brown—for mahogany instruments for Models 21S362K, KU; 21S367K, KU
	77736	Knob—Tone control or definition switch knob—medium beige—for oak instruments for Models 21S369K, KU
	79223	Knob—Volume control and power switch knob—black—for ebony instruments for Models 21S348K, KU
	79224	Knob—Volume control and power switch knob—brown—for maroon instruments for Models 21S348K, KU
	79231	Knob—Volume control and power switch knob—brown—for maroon instruments for Models 21S355K, KU; 21S362K, KU; 21S367K, KU
	79227	Knob—Volume control and power switch knob—medium beige—for oak instruments for Models 21S357K, KU; 21S369K, KU
	11765	Lamp—Channel marker escutcheon lamp—Mazda 51
	76168	Magnet—Focus magnet
	76141	Magnet—Ion trap magnet
	79215	Mask—Channel marker escutcheon mask for ebony instuments for Model 21S348K

SYMBOL NO.	STOCK NO.	DESCRIPTION
	78621	Mask—Channel marker escutcheon mask for ebony instruments for Model 21S348KU
	79216	Mask—Channel marker escutcheon mask for maroon instruments for Model 21S348K
	79220	Mask—Channel marker escutcheon mask for maroon instruments for Model 21S348KU
	79130	Mask—Channel marker escutcheon mask for maroon instruments for Models 21S355K, 21S362K, 21S367K
	78316	Mask—Channel marker escutcheon mask for maroon instruments for Models 21S355KU, 21S362KU, 21S367KU
	79131	Mask—Channel marker escutcheon mask for oak instruments for Models 21S357K, 21S362K, 21S367K
	78317	Mask—Channel marker escutcheon mask for oak instruments for Models 21S357KU, 21S369KU
	78814	Mask—Metal masking panel for mahogany instruments for Models 21S362K, KU; 21S367K, KU
	79071	Mask—Metal masking panel for oak instruments for Models 21S369K, KU
	77871	Nut—#¼-20 Knurled nut for mounting deflection yoke
	78866	Nut—#¼-20 knurled nut for deflection yoke plate
	79137	Pad—Deflection yoke plate pad
	78817	Plate—Deflection yoke hood plate
	78346	Retainer—Retainer for channel selector knob for Models 21S348KU, 21S355KU, 21S357KU, 21S362KU, 21S367KU, 21S369KU
	79084	Retainer—Safety glass retainer for ebony instruments for Models 21S348K, KU
	78328	Retainer—Safety glass retainer for maroon instruments for Models 21S348K, KU, 21S355K, KU
	79136	Retainer—Safety glass retainer for oak instruments for Models 21S357K, KU
	79070	Retainer—Safety glass retainer—sides—for Models 21S362K, KU, 21S367K, KU, 21S369K, KU
	79069	Retainer—Safety glass retainer—top and bottom—for Models 21S362K, KU, 21S367K, KU, 21S369K, KU
	78322	Rod—Formed threaded rod for supporting deflection yoke hood assembly for Models 21S348K, KU, 21S355K, KU, 21S357K,KU
	78816	Rod—Formed threaded rod for supporting deflection yoke hood assembly for Models 21S362K, KU, 21S367K, KU, 21S369K, KU
	78325	Spring—Channel marker escutcheon spring clip for Models using KRK22D
	78347	Spring—Channel marker escutcheon spring clip for Models using KRK31 tuning unit
	78445	Spring—Deflection yoke grounding spring
	74936	Spring—Kine socket and yoke leads retaining spring
	73914	Spring—Retaining spring for knobs 77707, 77717, 78343, 78432, 79077, 79081
	76837	Spring—Retaining spring for knobs 77709, 77718, 77735, 77736, 79080, 79221, 79222, 79226, 79230
	30330	Spring—Retaining spring for knobs 79223, 79224, 79227, 79231
	78324	Spring—Safety glass retainer spring
	78310	Strap—Grounding strap
	79228	Washer—For tone control or definition switch knob
	77697	Yoke—Deflection yoke complete with 6 contact male connector (includes L113, L114, L115, L116, C192, P102, R214, R215, R216)



Models 21-S-505(U) "Ellis" Gold Tone

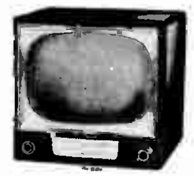
Models 21-S-506(U) "Rupert" Mahogany



Models 21-S-517(U) "Consolette" Oak

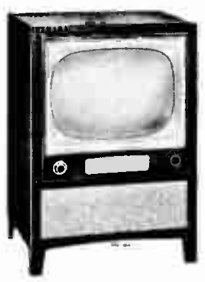
Models 21-S-501(U) "Medalist 21" Ebony

Models 21-S-502(U) "Lambert" Maroon

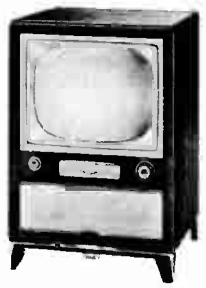


Models 21-S-503(U) "Arlen" Ebony

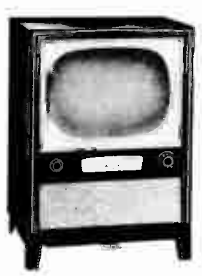
Models 21-S-504(U) "Kent" Maroon



Models 21-S-518(U) "Trafton" Mahogany, Limed Oak



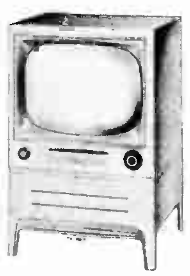
Models 21-S-519(U) "Radnor" Mahogany



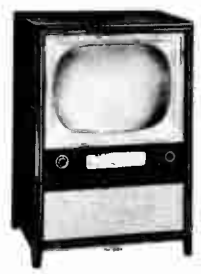
Models 21-S-521(U) "Felton" Mahogany

Models 21-S-522(U) "Benson" Blonde Tropical Hardwood

Models 21-S-523(U) "Pickford" Mahogany, Blonde Tropical Hardwood



"Wister" Models 21-S-525(U)—Oak 21-S-5251(U)—Charcoal Oak 21-S-5252(U)—Nat. Walnut



Models 21-S-526(U) "Carrol" Mahogany, Oak

Models 21-S-537(U) "Bromley" Mahogany, Blonde Tropical Hardwood

GENERAL DESCRIPTION

All models are "21 inch" television receivers. Models without a "U" designation in the model number are receivers with VHF only and feature full 12 channel VHF coverage. Models with the "U" designation in the model number are UHF/VHF receivers and feature full 12 channel VHF coverage plus any UHF channels desired. All models have an auxiliary audio input jack to permit the use of an external record playing attachment except Models 21-S-501(U), 21-S-502(U) and 21-S-518(U). Models 21-S-523(U) and 21-S-537(U) feature dual loudspeakers and Models 21-S-526(U) incorporate three loudspeakers for sound reproduction.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE .... 227 square inches on a 21ZP4A or 21ZP4B Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 21-S-501 to 21-S-537 Incl.

All 12 VHF channels .... 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 21-S-501U to 21-S-537U Incl.

Any of 70 UHF channels .... 470 mc. to 890 mc.
Any of 12 VHF channels .. 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency .... 45.75 mc.
Sound I-F Carrier Frequency .... 41.25 mc.

POWER RATING .... 175 watts

AUDIO POWER OUTPUT RATING .... 1.5 watts max.

VIDEO RESPONSE .... to 3.2 mc.

SCANNING .... Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY .... 15,750 cps.

VERTICAL SWEEP FREQUENCY .... 60 cps.

FRAME FREQUENCY (Picture Repetition Rate) ..... 30 cps.

RCA TUBE COMPLEMENT

Tube Used — Function

Tuner KRK22D (Models with VHF only)

(1) RCA 6BQ7A .... R-F Amplifier
(2) RCA 6X8 .... R-F Oscillator and Mixer

Tuner KRK30 (UHF/VHF Models)

(1) RCA 6AF4 .... UHF Oscillator
(2) RCA 6BQ7A .... { VHF R-F Amplifier / UHF I-F Amplifier }
(3) RCA 6X8 .... { VHF R-F Oscillator & Mixer / UHF I-F Amplifier }

A K3D or 1N82 crystal is used as the UHF mixer

All Models

(1) RCA 6CB6 .... 1st Picture I-F Amplifier
(2) RCA 6CB6 .... 2nd Picture I-F Amplifier
(3) RCA 6CB6 .... 3rd Picture I-F Amplifier
(4) RCA 6X8 .... 1st Video Amplifier and 1st Sync.
(5) RCA 12AU7 .... Video Output & AGC
(6) RCA 6AU6 .... Sound I-F Amplifier
(7) RCA 6AL5 .... Ratio Detector
(8) RCA 6AV6 .... 1st Audio Amplifier
(9) RCA 6AS5 .... Audio Output
(10) RCA 12AU7 .... Vert. Osc. and Disch. & Sync. Output
(11) RCA 6K6GT .... Vertical Sweep Output
(12) RCA 6SN7GT Horizontal Sweep Oscillator and Control
(13) RCA 6BQ6GT .... Horizontal Sweep Output
(14) RCA 6AX4GT .... Damper
(15) RCA 1B3-GT/8016 .... High Voltage Rectifier
(16) RCA 21ZP4B .... Kinescope
RCA 21ZP4A (Models 21-S-501(U) & 21-S-502(U) only)
(17) RCA 5U4G .... Rectifier

A crystal diode is used for the Picture 2nd Detector

CHASSIS DESIGNATIONS

CHASSIS	TUNER	KINE-SCOPE	MODELS	LOUD-SPEAKERS
KCS88B	KRK22D	21ZP4B	21-S-503 21-S-504 21-S-505 21-S-506 21-S-517	1–5 inch
			21-S-519 21-S-521 21-S-522	1–8 inch
			21-S-525 21-S-5251 21-S-5252	1–5 inch
KCS88C (No Phono Jack)	KRK22D	21ZP4A 21ZP4A 21ZP4B	21-S-501 21-S-502 21-S-518	1–5 inch 1–5 inch 1–8 inch
KCS88D	KRK22D	21ZP4B	21-S-537	2–8 inch
KCS88E	KRK22D	21ZP4B	21-S-526	1–8 inch 2–5 inch
KCS88J	KRK30	21ZP4B	21-S-503U 21-S-504U 21-S-505U 21-S-506U 21-S-517U	1–5 inch
			21-S-519U 21-S-521U 21-S-522U	1–8 inch
			21-S-525U 21-S-5251U 21-S-5252U	1–5 inch
KCS88K (No Phono Jack)	KRK30	21ZP4A 21ZP4A 21ZP4B	21-S-501U 21-S-502U 21-S-518U	1–5 inch 1–5 inch 1–8 inch
KCS88L	KRK30	21ZP4B	21-S-537U	2–8 inch
KCS88M	KRK30	21ZP4B	21-S-526U	1–8 inch 2–5 inch
KCS88V (Vertical Mounting)	KRK22D	21ZP4B	21-S-523	2–8 inch
KCS88VA (Vertical Mounting)	KRK30	21ZP4B	21-S-523U	2–8 inch

NOTE: Any chassis designation with an "X" stamped after the final letter indicates plate assembly Z102 is used, instead of printed circuit PC102, for picture I-F section. Refer to partial schematic

UNPACKING.—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt ac power source and into the receiver interlock receptacle.

ANTENNA INPUT
Models 21-S-501 to 21-S-537 Incl.

The KRK22D tuner unit is designed for VHF reception only. A 300 ohm antenna input is provided, however, by removing the jumper between pins 1 and 5 of the matching unit input jack, a 72 ohm coaxial line may be used. Jumpers must be added between pins 1 and 4 and also between pins 2 and 5 as shown in figure 26. The coaxial line is then fastened directly to pins 1 and 5, with the shield connected to pin 1 and the center conductor to pin 5.

Models 21-S-501U to 21-S-537U Incl.

The KRK30 tuner unit is designed for UHF-VHF reception with 300 ohm inputs provided for UHF and VHF use. When using a UHF antenna only or a VHF antenna only connect the single transmission line to the proper receiver antenna terminals. Do not connect the terminal board jumper W105. (Refer to figure 27.)

When a combination UHF-VHF antenna is used, connect the transmission line to the VHF terminals on the terminal board. Connect the jumper W105 to the UHF terminals as shown in figure 27.

Signals from separate UHF and VHF antennas may be fed to the tuner. To do this connect the individual transmission lines to their respective terminals on the terminal board. Do not connect the jumper W105. Where a "crossover network" is employed to match the two separate antennas to a common 300 ohm line, connect the line to the VHF terminals. Connect the jumper W105 to the UHF terminals on the terminal board.

CHECK FOR PROPER OPERATION.—Turn the power switch to the "on" position and check the operation of the receiver.

Each unit has been completely and accurately adjusted at the factory and should operate normally at this point. However, a check of all the various functions should be performed. Adjustment should be made as outlined below, only where an indication of improper operation is evident.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 3. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Turn the focus control (shown in Figure 3) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.

DEFLECTION YOKE ADJUSTMENT.—If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the knurled yoke adjustment nuts.

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern or picture in order to make further adjustments.

When the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R149 on the rear apron (see Figure 4) counter-clockwise until the set operates normally and the picture can be synced.

CHECK OF HORIZONTAL OSCILLATOR ADJUSTMENT.—Turn the horizontal hold control to the extreme clockwise position. The picture should be out of sync, with approximately twelve bars slanting downward to the right. Turn the control counter-clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 1½ to 3 bars sloping downward to the right are obtained, the picture will pull into sync upon slight additional counter-clockwise rotation of the control. The picture should remain in sync for approximately two full turns of additional counter-clockwise rotation of the control. Continue counter-clockwise rotation until the picture falls out of sync. Rotation beyond fall-out position should produce between 2 and 5 bars before interrupted oscillation (motorboat occurs). Interrupted oscillation (motorboat) should be reached before full counter-clockwise rotation.

When the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Adjustment of Horizontal Oscillator" and proceed with "Focus Magnet Adjustment."

ADJUSTMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync over two full turns of counter-clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Turn the horizontal drive trimmer C171 fully clockwise, then counter-clockwise one full turn. Set the width coil L111 with the stud flush with the inside edge of the chassis. Set the sine wave coil L121 fully counter-clockwise.

Adjustment of the horizontal frequency control in the counter-clockwise direction will show a multiple number of bars before "motorboat" occurs. Adjust the sine wave coil L121 until 3 or 4 bars are present before "motorboat" occurs, when the horizontal frequency control is rotated counter-clockwise from the fall out point.

If it is impossible to sync the picture and the AGC system is in proper adjustment it will be necessary to align the Horizontal Oscillator by the method outlined in the alignment procedure on page

FOCUS MAGNET ADJUSTMENT.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear plate of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck centered in the opening.

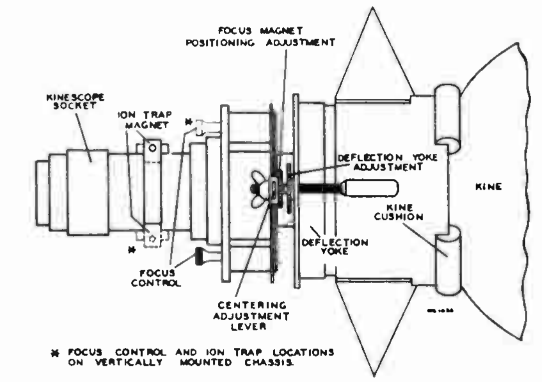


Figure 3—Yoke and Focus Magnet Adjustments

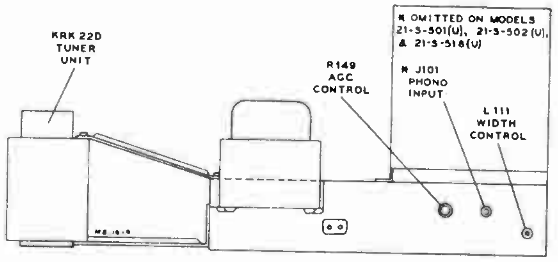


Figure 4—Rear Chassis Adjustments

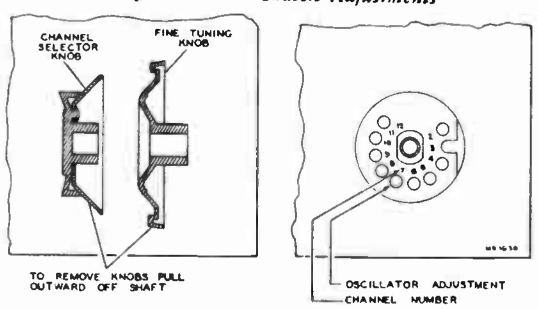


Figure 5—KRK22D R-F Oscillator Adjustments

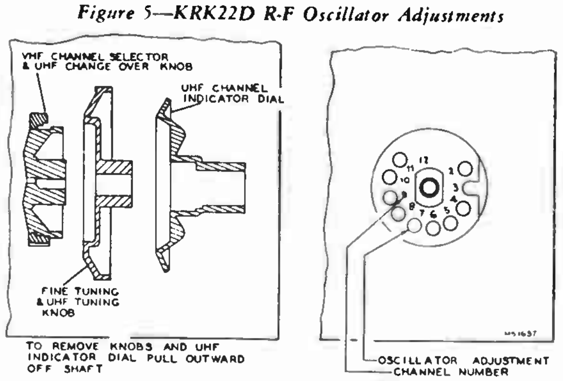


Figure 6—KRK30 VHF R-F Oscillator Adjustment

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 21-S-501 to 21-S-537 Incl.

Connect the i-f signal generator, in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R118, R146 and C120 and to ground. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R118, R146 and C120. The second battery will be used later.

Set the bias to produce approximately —4.0 volt of bias at the junction of R118, R146 and C120.

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." (Note: These transformers should be peaked with their cores at the ends of the coils nearest the chassis.) During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —4.0 volts of i-f bias at the junction of R118, R146 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R129, L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

Models 21-S-501U to 21-S-537U Incl.

Connect the i-f signal generator in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R118, R146 and C120.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R118, R146 and C120. Adjust the potentiometer for —4.0 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —4.0 volts of i-f bias at the junction of R118, R146 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

(Note: Peak transformers with cores at end of coils nearest chassis.)

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R129 and L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 21-S-501 to 21-S-537 Incl.

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip a 330 ohm resistor between pin 1 of V107 and ground.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —4.0 volts of bias as measured by a "VoltOhmyst" at the junction of R118, R146 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T1 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 9. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and the 330 ohm resistors.

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

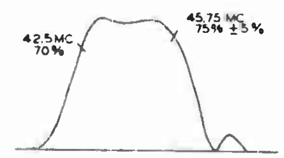


Figure 9—KRK22D T1 and T104 Response

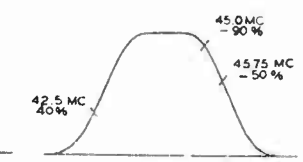


Figure 10—Overall I-F Response with KRK22D

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 25 and 35 times down with curve as shown in Figure 10.

Move the sweep generator to the antenna terminals. Connect —3.0 volts bias to pin 5 of V103. Adjust T106 and T107 slightly to correct for any overall tilt while switching from channel to channel.

Models 21-S-501U to 21-S-537U Incl.

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip a 330 ohm resistor between pin 1 of V107 and ground.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —4.0 volts of bias as measured by a "VoltOhmyst" at the junction of R118, R146 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

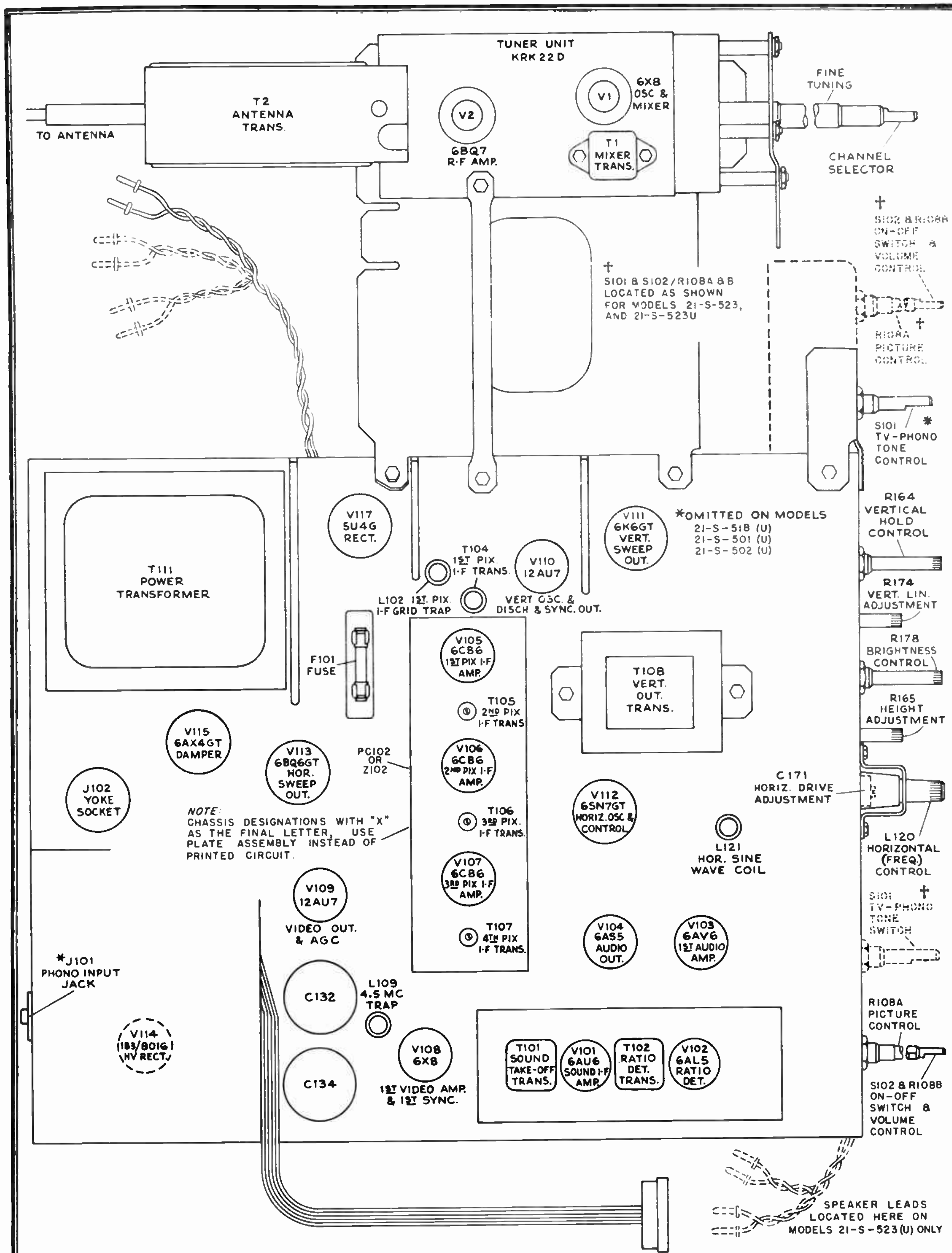


Figure 7—Chassis Top View (shown with KRK22D Tuner)

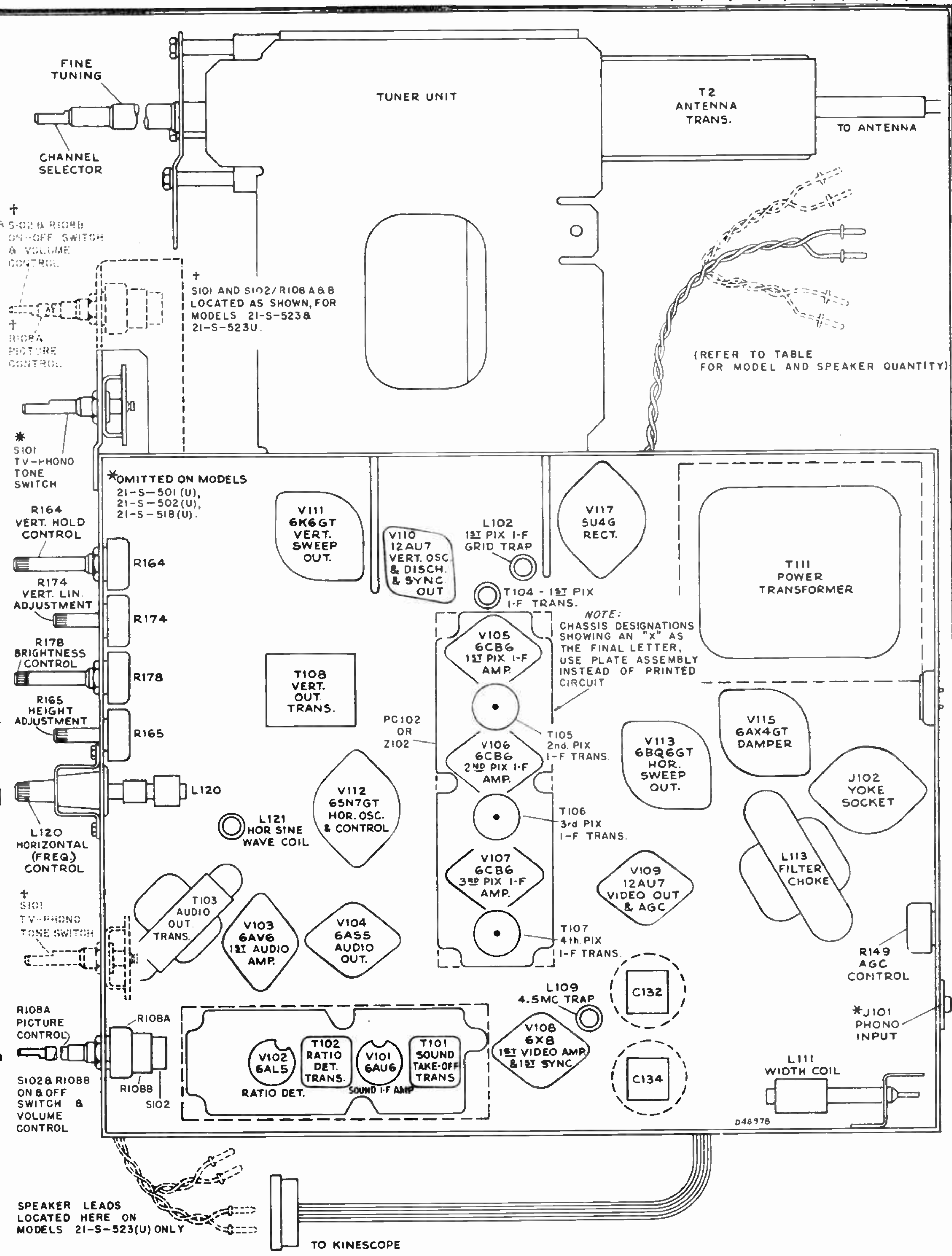


Figure 8—Chassis Bottom View (shown with KRK22D Tuner)

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 11. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and the 330 ohm resistors.

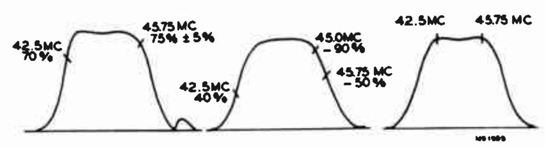


Figure 11—KRK30 T2 and T104 Response

Figure 12—Overall I-F Response with KRK30

Figure 13—KRK30 L9 and C308 I-F Response

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 0.5 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T105, T106 and T107 to obtain the response shown in Figure 12.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 30 and 40 times down with curve as shown in Figure 12.

To align the I-F amplifier circuit of the KRK30, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.

To do this, remove the crystal cover and connect the resistor, after insulating the lead with tubing, to the crystal front terminal.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING between channels 68 and 69 at 800 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground.

Connect the oscilloscope diode probe to the junction between the resistor and capacitor. (See Figure 20.)

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.5 volt or less peak-to-peak on the oscilloscope.

Adjust C308, on the UHF section, and L9, on the VHF section, of the tuner for maximum gain with 45.75 mc. and 42.5 mc. markers as shown in figure 13.

If necessary adjust L27 to place the 45.75 mc. marker at the peak of the curve. Adjust L43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to the junction of R129 and L103. Use 3.0v peak-to-peak on the oscilloscope.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at —3.0 V and the I-F bias at —4.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 12. Retouch T106 and T107 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 12, retouching C308 and L9 if necessary to correct any overall tilt.

Do not retouch T2, T104, T105, T106 or T107.

Remove the sweep and marker generators and the bias supplies.

KRK22D TUNER ALIGNMENT.—

Models 21-S-501 to 21-S-537 Incl.

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T1 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" or T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 43,5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst". The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

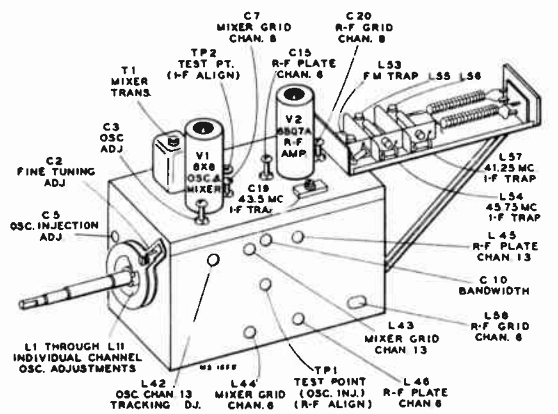


Figure 14— KRK22D Tuner Adjustments

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T1 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15, to the input terminals of the antenna matching unit.

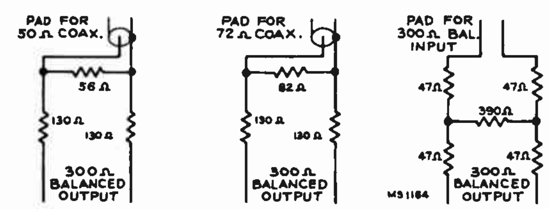


Figure 15—Sweep Attenuator Pads

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in figure 16.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

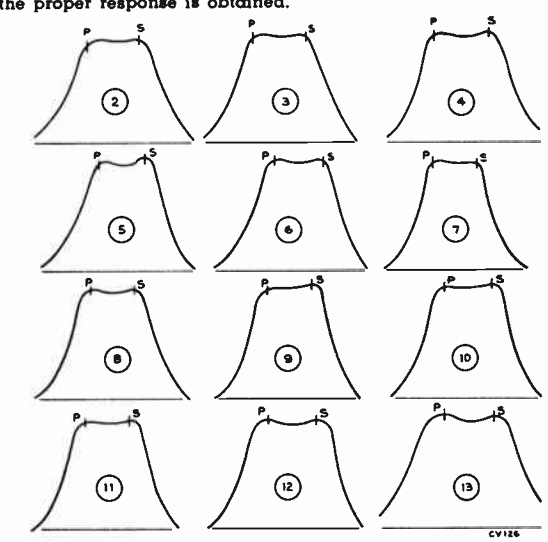


Figure 16—KRK22D Tuner R-F Responses

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in figure 16.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response. If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46 and L58 for proper curve shape as shown in figure 16. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 16 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 16 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

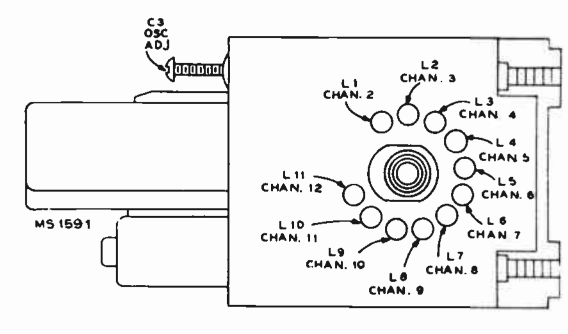


Figure 17—KRK22D Tuner Oscillator Adjustments

KRK22D or KRK30 ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be re-aligned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L53 (L5) to the channel selector switch S4 (S1E).

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R118, R146 and C120. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R118, R146 and C120.

Connect an oscilloscope to the junction of R129 and L103 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L54 (L4) in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L57 (L1) for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L53 (L5) to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L53 (L5) to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 15 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L55 (L3) and L56 (L2) to obtain the response shown in figure 18. L55 (L3) is most effective in locating the position of the shoulder of the curve at 52 mc. and L56 (L2) should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Restore the connection between L53 (L5) and S4 (S1E). Replace V106.

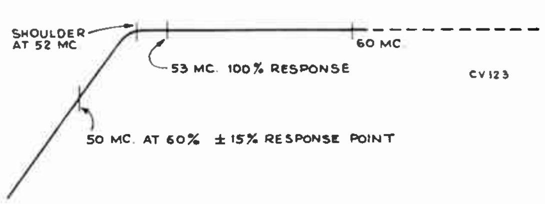


Figure 18—KRK22D or KRK30 Antenna Matching Unit Response

KRK30 TUNER ALIGNMENT

Models 21-S-501U to 21-S-537U Incl.

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency of each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 19.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 19.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

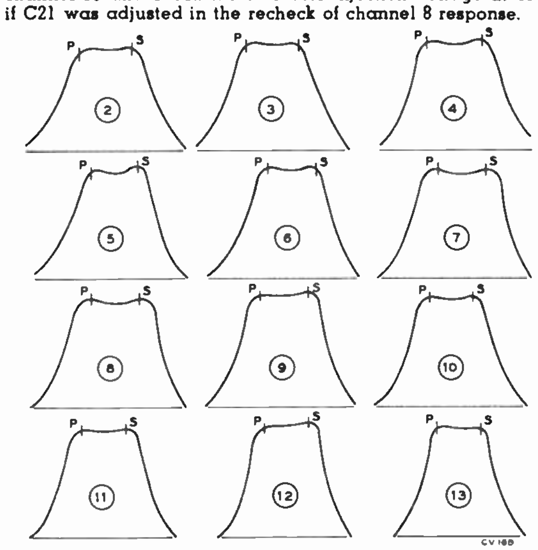


Figure 19—KRK30 Tuner VHF R-F Responses

If the initial setting of the oscillator injection trimmer was far off it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L14, L48 and L32 for proper curve shape as shown in figure 19. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 19 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

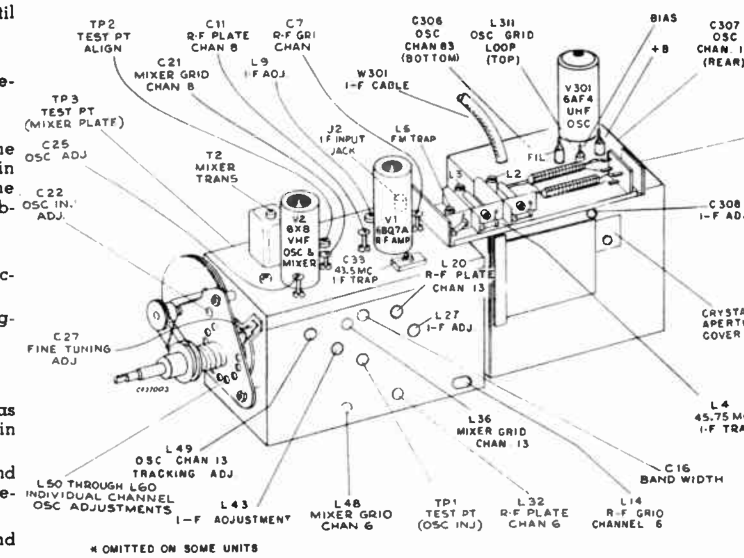
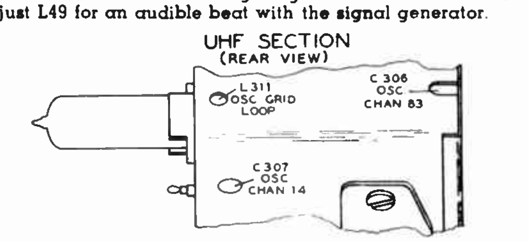


Figure 20—KRK30 Tuner Adjustments

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 19 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.



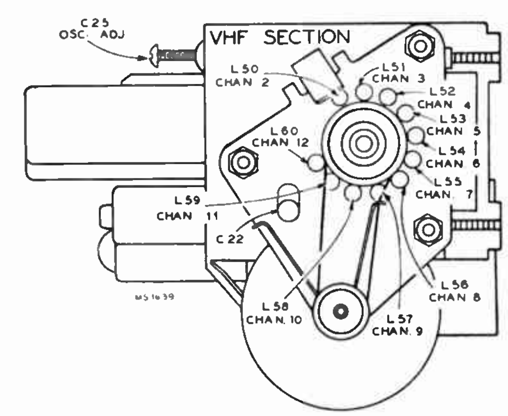


Figure 21—KRK30 Tuner Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT R-F.—Alignment of the UHF section of the tuner may only be performed with the UHF section removed from the tuner assembly. RF adjustments require removal of the tuner shield which may only be done with the UHF tuner separate from its mounting.

I-F and oscillator adjustment may be accomplished without removing the tuner.

Connect a 100 ohm composition resistor between the center conductor of the I-F cable W301 and the tuner case.

Connect the oscilloscope to the center conductor of W301 at the 100 ohm resistor, employing the preamplifier if needed with the oscilloscope used. Ground the oscilloscope to the tuner case.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 5° and 164° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. With the stop pin on the tuner against the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 164°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the junction of W301 and L310. This may be done by inserting the lead from the resistor, which should be covered with insulated tubing, through the aperture provided for crystal removal. (See figure 20.) Insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitor tabs C304 and C305 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 22(A).

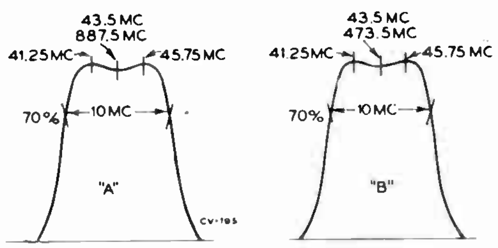


Figure 22—KRK30 Tuner UHF R-F Responses

Adjust the oscillator trimmer capacitor C306 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 22(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 5°, Channel 14, position.

Adjust the oscillator trimmer C307 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown. The inductance loop L311 across the oscillator grid coil on some units, may be repositioned, if necessary, to bring the oscillator trimmer within range. Refer to figure 20 for location of the aperture for making this adjustment.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates must be knifed with the shield cover removed. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" between the center conductor of W301 and ground. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .03 and .35 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits. This voltage is an indication of correct crystal current and may be varied by repositioning the flag L309 with respect to L303.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 20). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 7 of V108A, in series with a .01 mfd. capacitor.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V107.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at pin 9 of V108A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst." (Adjust with core at chassis end of coil.)

Repeat adjustments of T102 top for maximum d-c at pin 7 of V102 and T102 bottom for zero d-c at the junction of R104 and C107. Make the final adjustments with the signal input level adjusted to produce 5 volts d-c on the "VoltOhmyst" at pin 7 of V102.

SOUND TAKE-OFF ALIGNMENT.—Connect the signal generator to the first video amplifier grid, pin 7 of V108A.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the T101 top core for maximum d c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

(Alternate Method for Ratio Detector and Sound I-F Alignment)

Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 7 of V108A in series with a .01 mfd. capacitor.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the ratio detector secondary T102 bottom core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked, when making the above adjustments.

Tune the T101 (top) core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the T101 adjustment are made.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune T102 bottom for zero d-c at the junction of R104 and C107. (Make adjustment with core at chassis end of coil.)

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1500 mmf. capacitor to pin 7 of V108A. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V107, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video output, pin 6 of V109A.

Adjust the core of L109 for minimum output on the oscilloscope. (Make adjustment with core at chassis end of coil.)

Remove the short from pin 1, V107 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L109 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L109 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V109A.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR AND OUTPUT ALIGNMENT.—Normally the alignment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned.

Turn the horizontal drive trimmer C171 fully clockwise then counter-clockwise one full turn. Set the stud of the width coil L111 flush with the inside rear edge of the chassis.

Place a jumper across the terminals of the sine wave coil L121 and adjust the horizontal (frequency) control until the picture pulls into sync. Remove the short across the sine wave coil.

Connect the low capacity probe of an oscilloscope to the junction of L120, L121 and R189. Turn the horizontal (frequency) control clockwise until the picture falls out of sync, then counter-clockwise until the picture just pulls into sync. The pattern on the oscilloscope should be as shown in Figure 23. Adjust the sine wave adjustment core L121 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the horizontal (frequency) control if necessary.

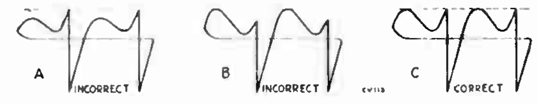


Figure 23—Horizontal Oscillator Waveforms

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator may occur. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Drive Adjustment (for correct locking range). Turn the horizontal (frequency) control until the picture falls out of sync with the diagonal lines sloping down to the right. Slowly turn the horizontal control counter-clockwise and note the number of diagonal bars obtained just before the picture pulls into sync.

Pull-in should occur with one and one-half to three bars present.

With the horizontal control set at the pull-in point, adjust the horizontal drive trimmer C171 counter-clockwise for a bright vertical line in the center of the picture. Turn the trimmer clockwise until the line just disappears.

Set the brightness control to maximum and adjust the width control so the picture fills the mask. Return the brightness control to normal and readjust the horizontal drive trimmer as above.

The picture should pull into sync with one and one-half to three bars present, remain in sync for approximately two full turns counter-clockwise from pull-in, and fall out of sync with between 2 and 5 bars present before interrupted oscillation (motorboating) occurs.

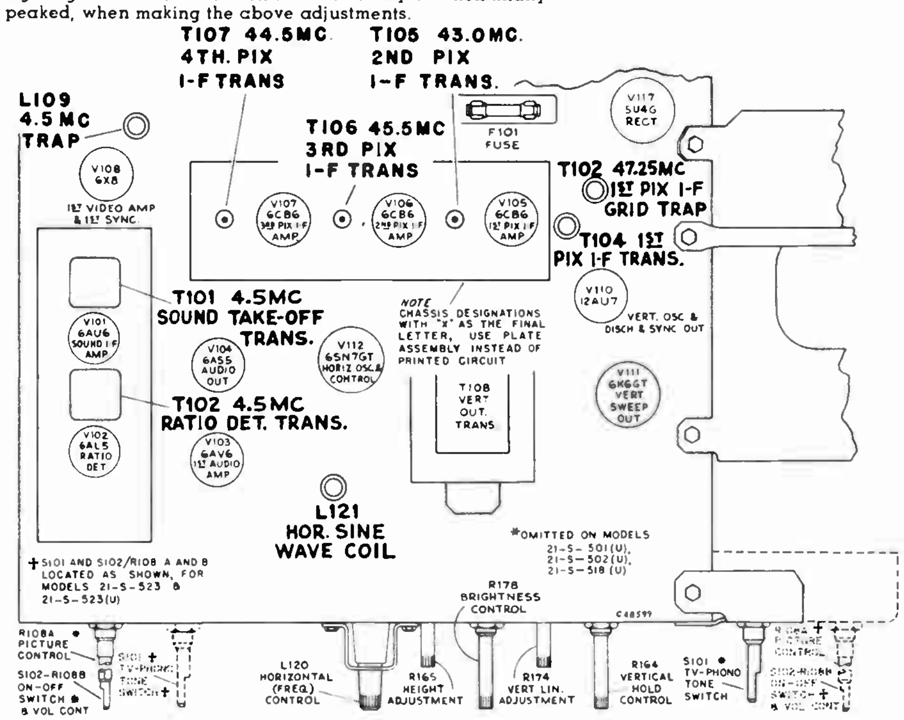


Figure 24—Top Chassis Adjustments

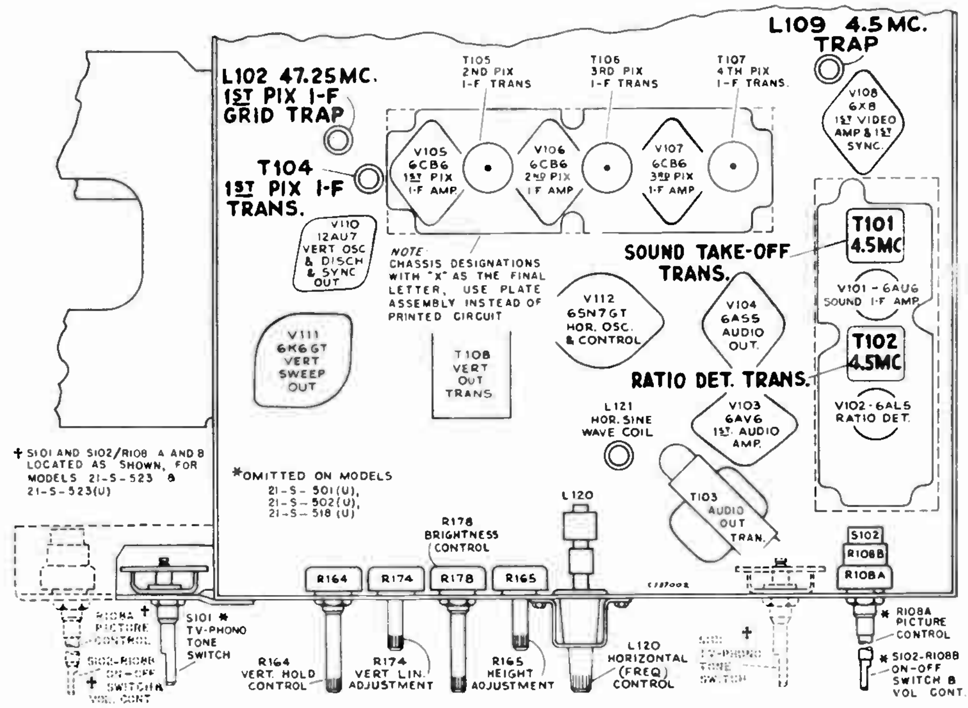


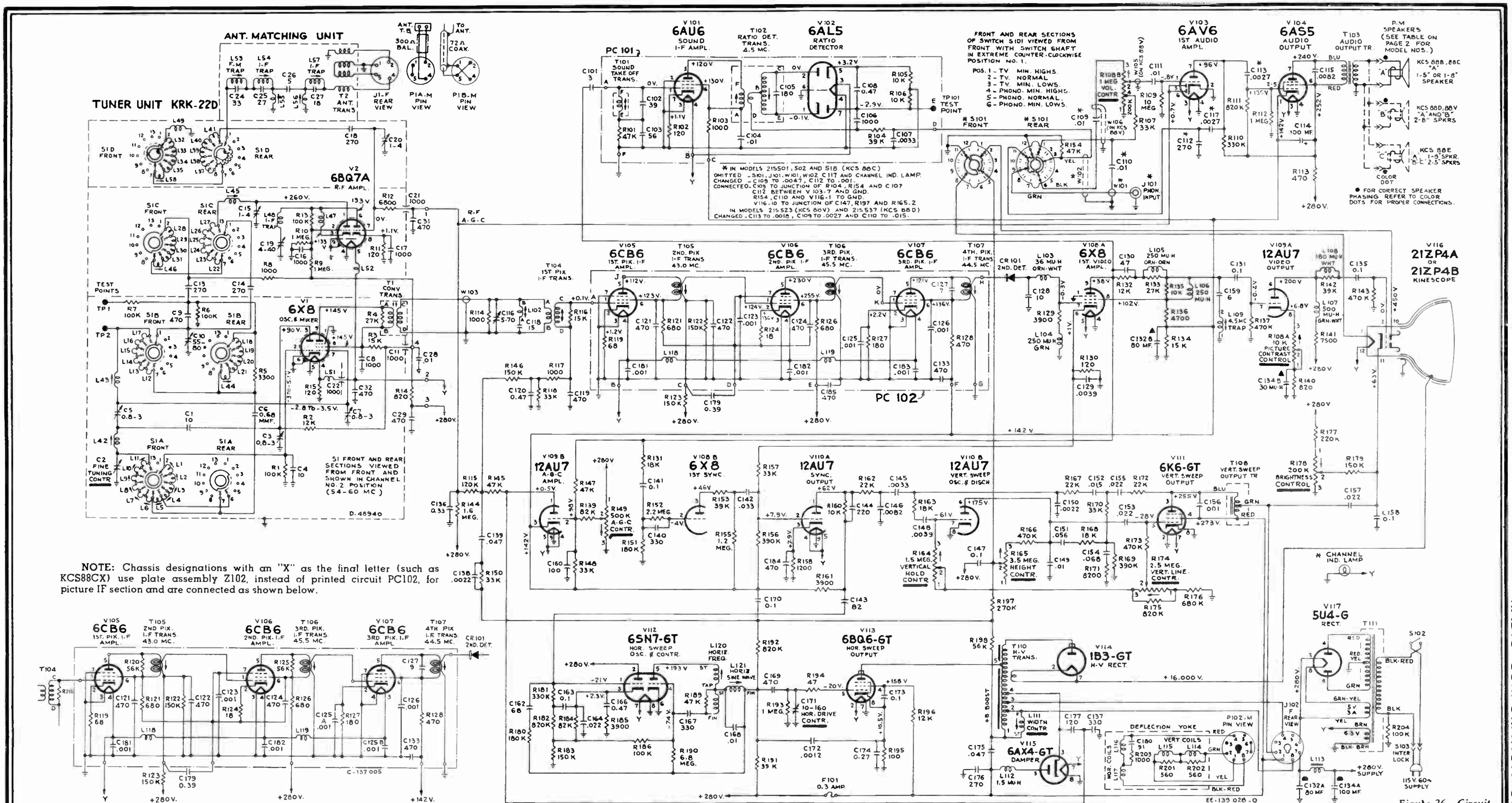
Figure 25—Bottom Chassis Adjustments

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 30000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1 (V2) KRK22D or KRK30	6BQ7A	R-F Amplifier	30000 Mu. V. Signal	6	170	—	—	8	0.1	7		
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	30000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 (V1) KRK22D or KRK30	6X8	Mixer	30000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	30000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V101	6AU6	Sound I-F Amp.	30000 Mu. V. Signal	5	126	6	136	7	1.2	1	0.2	
			No Signal	5	120	6	130	7	1.1	1	0	
V102	6AL5	Ratio Detector	30000 Mu. V. Signal	7	−8.0	—	—	1	−0.3	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	−2.9	—	—	1	−0.1	—	—	
		Ratio Detector	30000 Mu. V. Signal	2	−0.4	—	—	5	7.2	—	—	
			No Signal	2	−0	—	—	5	3.2	—	—	
V103	6AV6	1st Audio Amplifier	30000 Mu. V. Signal	7	98	—	—	2	0	1	−0.8	At min. volume
			No Signal	7	96	—	—	2	0	1	−0.8	At min. volume
V104	6AS5	Audio Output	30000 Mu. V. Signal	7	250	6	262	1	149	2 & 5	141	At min. volume
			No Signal	7	240	6	252	1	142	2 & 5	135	At min. volume
V105	6CB6	1st Pix. I-F Amplifier	30000 Mu. V. Signal	5	132	6	144	2	0	1	−4.7	*Unreliable measuring point
			No Signal	5	112	6	123	2	1.2	1	*0.1	
V106	6CB6	2nd Pix. I-F Amplifier	30000 Mu. V. Signal	5	250	6	278	2	145	1	129	
			No Signal	5	230	6	255	2	136	1	124	
V107	6CB6	3rd Pix. I-F Amplifier	30000 Mu. V. Signal	5	130	6	142	2	2.3	1	0	
			No Signal	5	121	6	136	2	2.2	1	0	

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V108A	6X8	1st Video Amplifier	30000 Mu. V. Signal	9	70	8	118	6	0.8	7	−1.5	AGC control set for normal operation
			No Signal	9	38	8	102	6	1.0	7	−0.3	AGC control set for normal operation
V108B	6X8	1st Sync	30000 Mu. V. Signal	3	50	—	—	6	0.8	2	−34	
			No Signal	3	46	—	—	6	1.0	2	−4	
V109A	12AU7	Video Output	30000 Mu. V. Signal	6	235	—	—	8	4.0	7	−8.5	Contrast control at maximum
			No Signal	6	200	—	—	8	6.8	7	−0.4	
V109B	12AU7	AGC Amplifier	30000 Mu. V. Signal	1	−43	—	—	3	148	2	112	
			No Signal	1	0.5	—	—	3	142	2	98	
V110A	12AU7	Sync Output	30000 Mu. V. Signal	1	65	—	—	3	8.0	2	7.4	
			No Signal	1	62	—	—	3	7.9	2	7.9	
V110B	12AU7	Vertical Oscillator & Discharge	30000 Mu. V. Signal	6	180	—	—	8	0	7	−63	Depends on setting of Vert. hold control
			No Signal	6	175	—	—	8	0	7	−61	Voltages shown are synced pix adjustment
V111	6K6GT	Vertical Output	30000 Mu. V. Signal	3	262	4	280	8	0	5	−29	
			No Signal	3	255	4	273	8	0	5	−28	
V112	6SN7GT	Horizontal Osc. Control	30000 Mu. V. Signal	2	280	—	—	3	−2.5	1	−23.5	
			No Signal	2	273	—	—	3	−2.3	1	−21	
	6SN7GT	Horizontal Oscillator	30000 Mu. V. Signal	5	200	—	—	6	0	4	−75	
			No Signal	5	193	—	—	6	0	4	−74	
V113	6BQ6GT	Horizontal Output	30000 Mu. V. Signal	Cap	*	4	164	8	11.0	5	−21	*High Voltage Pulse Present
			No Signal	Cap	*	4	158	8	10.5	5	−20	*High Voltage Pulse Present
V114	1B3GT /8016	H. V. Rectifier	30000 Mu. V. Signal	Cap	*	—	—	2 & 7	16,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	15,400	—	—	*High Voltage Pulse Present
V115	6AX4GT	Damper	30000 Mu. V. Signal	5	280	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	273	—	—	3	*	—	—	*High Voltage Pulse Present
V116	21ZP4A or 21ZP4B	Kinescope	30000 Mu. V. Signal	Cap	16,000	10	465	11	65	2	0	At average Brightness
			No Signal	Cap	15,400	10	450	11	63	2	0	At average Brightness
V117	5U4G	Rectifier	30000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	290	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	280	—	—	



NOTE: Chassis designations with an "X" as the final letter (such as KCS88CX) use plate assembly Z102, instead of printed circuit PC102, for picture IF section and are connected as shown below.

All chassis listed above are identical except as noted on schematic diagram. The physical location of controls S102/R108A&B and S101 are interchanged on vertically mounted chassis KCS88V.

The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 26—Circuit Schematic Diagram KCS88B, KCS88C, KCS88D, KCS88E or KCS88V

REPLACEMENT PARTS

SYMBOL NO.	STOCK NO.	DESCRIPTION
L49	77859	Connector—RF grid switch return connector
L50, L51	79067	Coil—Heater choke coil
L52	77206	Coil—Filament choke coil
L53 to L57 Incl.		Part of antenna matching transformer T2
L58		(Part of S4)
R1	504410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w.
R2	523312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R3	523315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 w.
R4		(Part of T1)
R5	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w. (Part of S2)

SYMBOL NO.	STOCK NO.	DESCRIPTION
R6, R7	502410	Resistor—Fixed, composition, 100,000 ohms, ±10%, ½ w. (Part of S2)
R8	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. (Part of S3)
R9, R10	503510	Resistor—Fixed, composition, 1.0 megohm, ±10%, ½ w.
R11	503112	Resistor — Fixed, composition, 120 ohms, ±10%, ½ w.
R12	504268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ w.
R13		Same as R1
R14	503182	Resistor — Fixed, composition, 820 ohms, ±10%, ½ w.
R15		Same as R11

SYMBOL NO.	STOCK NO.	DESCRIPTION
T1	78399	Transformer—Converter transformer
T2	78396	Transformer—Antenna matching transformer complete (C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
C1 to C4 Incl.		Part of antenna matching transformer
C5	77084	Capacitor—Ceramic, feed-thru, 1000 mmf.
C6	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v.
C7	76532	Trimmer—Adjustable, 1-4 mmf.
C8, C9	77252	Capacitor — Fixed, ceramic, 1000 mmf., +100%, —0%, 500 v.
C10	75199	Capacitor — Fixed, ceramic, 270 mmf., ±20%, 500 v. DC. Part of S4
C11	77151	Trimmer—Adjustable, 0.8-3.0 mmf.

SYMBOL NO.	STOCK NO.	DESCRIPTION
C12	78276	Capacitor—Fixed, ceramic, 150 mmf., ±10%, 500 v. DC. Part of S3
C13	71599	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. DC. Part of S2
C15		Same as C5
C16	78397	Trimmer—Mica, 80-150 mmf.
C17 to C19 Incl.		Same as C5
C20	78603	Capacitor—Fixed, ceramic, 82 mmf., ±10%, 500 v.
C21		Same as C11
C22	77913	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. Part of S1
C23	71504	Capacitor—Fixed, headed-lead, 0.68 mmf., ±20%, 500 v. DC. Part of S2

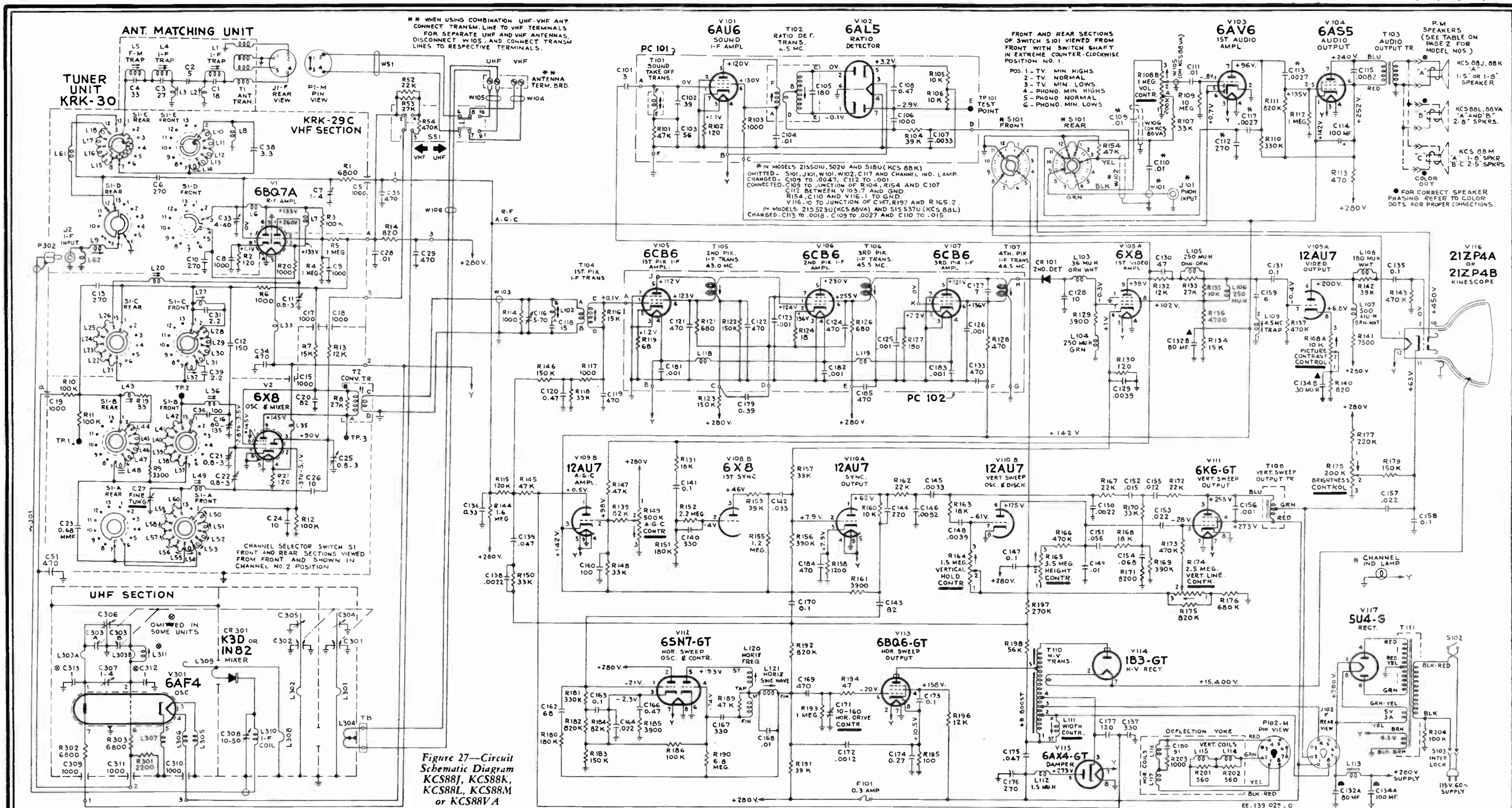


Figure 27—Circuit Schematic Diagram KCS88J, KCS88K, KCS88L, KCS88M or KCS88VA

SYMBOL NO.	STOCK NO.	DESCRIPTION
C24	78247	Capacitor—Fixed, ceramic, 10 mmf., ±1 mmf., 500 v.
C25		Same as C11
C26	77865	Capacitor—Fixed, ceramic, 10 mmf., ±1.0 mmf., 500 v.
C27	79192	Trimmer — Ceramic, variable — fine tuning type
C28	73960	Capacitor — Fixed, ceramic, 10,000 mmf., 500 v.
C29	77293	Capacitor — Fixed, ceramic, 470 mmf., +100%, —0%, 500 v. Part of S3
C31		Capacitor—Fixed, headed-lead type, 2.2 mmf., ±20%, 500 v. DC
C33	77616	Capacitor—Adjustable mica, 4-40 mmf.
C34, C35		Same as C29
C36	75437	Capacitor — Fixed, ceramic, 100 mmf., ±20%, 500 v. DC. Part of S2
C38	71503	Capacitor—Fixed, headed-lead type, 3.3 mmf., ±20%, 500 v. DC. Part of S5
C39		Same as C31. Part of S3

SYMBOL NO.	STOCK NO.	DESCRIPTION
L1 to L5 Incl.		Part of antenna matching transformer
L6	78466	Coil—RF choke
L7	76562	Coil—RF amplifier coupling coil
L8	77859	Coil—RF grid switch return connector coil
L9	79542	Coil—I.F. input coil complete with adjustable core
L10 to L13 Incl.		Part of S3 and S5
L14	73458	Coil—Channel No. 6 RF grid coil. Part of S3 and S5
L15 to L19 Incl.		Part of S3 and S5
L20	77921	Coil—Channel No. 13 RF plate coil. Part of S3 and S5
L21 to L26 Incl.		Part of S3 and S5
L27	78584	Coil—RF plate I.F. coil. Part of S3
L28 to L31 Incl.		Part of S3 and S5

SYMBOL NO.	STOCK NO.	DESCRIPTION
L32	73460	Coil—Channel No. 6 RF plate coil. Part of S3 and S5
L33	77206	Coil—Filament choke coil
L35	76763	Coil—Heater choke coil
L36	77919	Coil—Channel No. 13 mixer coil.
L37 to L42 Incl.		Part of S1 and S2
L43	78583	Coil—Mixer I.F. coil. Part of S1 and S2
L44 to L47 Incl.		Part of S1 and S2
L48	73874	Coil—Channel No. 6 mixer coil. Part of S1 and S2
L49	77915	Coil—Channel No. 13 oscillator coil. Part of S1 and S2
L50 to L60 Incl.		Part of S1 and S2
L61	78401	Coil—Channel No. 6 antenna coil
R1	502268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ w.

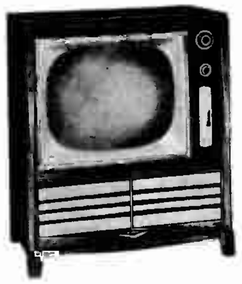
SYMBOL NO.	STOCK NO.	DESCRIPTION
R2	502112	Resistor — Fixed, composition, 120 ohms, ±10%, ½ w.
R3	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w. Part of S2
R4, R5	502510	Resistor—Fixed, composition, 1 meg., ±10%, ½ w.
R6	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. Part of S3
R7	522315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 w.
R8		Part of T2
R9	502233	Resistor—Fixed, composition, 3300 ohms, ±10% ½ w. Part of S2
R10, R11		Same as R3. Part of S2
R12		Same as R3
R13	522312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R14	502182	Resistor — Fixed, composition, 820 ohms, ±10%, ½ w.

SYMBOL NO.	STOCK NO.	DESCRIPTION
R19	502033	Resistor — Fixed, composition, 33 ohms, ±10%, ½ w. Part of S2
R20		Same as R6
R21		Same as R2
S1	79068	Stator—Oscillator coil and stator complete with rotor, coils and trimmer (C22, L36 to L60)
S2	78272	Stator—Mixer stator complete with rotor (C13, C23, C36, L36 to L60, R9, R10, R11, R19)
S3	78274	Stator—RF plate stator complete with rotor, coils, resistors and capacitors (C12, C31, C39, L10 to L32, R6)
S4	78277	Stator—Input selector switching stator complete with rotor and capacitor (C10)
S5	78398	Stator—RF grid stator complete with rotor, coils and capacitors (C38, L10 to L32)
T1	78396	Transformer—Antenna matching transformer complete
T2	78399	Transformer—Converter transformer (R8)
C301 to C303 Incl.	79553	Capacitor—Variable tuning capacitor
C304, C305	79554	Stator—Oscillator stator assembly
C306	79555	Capacitor—Oscillator trimmer capacitor
C307	79556	Capacitor — Adjustable, ceramic, 0.8-3.5 mmf.
C308	79558	Capacitor—Trimmer, 10-50 mmf.
C309 to C311 Incl.	79559	Capacitor—Feed thru, 1000 mmf.
C312, C313	79560	Capacitor—Fixed, ceramic, 1 mmf., ±0.1 mmf., 500 v. DC, non-insulated
CR301	77489	Rectifier—UHF diode crystal germanium rectifier
L301, L302		Coil—RF tank plate
L303	79557	Tank Assembly—complete with capacitor (C7)
L304	79564	Board—Antenna terminal board assembly
L305 to L307 Incl.	79565	Choke—RF choke
L308, L309		Coil—Mixer coupling coil for oscillator and output section
L310	79567	Coil—I.F. output coil 0.15 microhenries
L311	79566	Coil—Oscillator loop coil
R301	502222	Resistor—Fixed, composition, 2200 ohms, ±10%, ½ w.
R302	512268	Resistor—Fixed, composition, 6800 ohms, ±10%, 1 w.
R303	502268	Resistor—Fixed, composition, 6800 ohms, ±10%, ½ w.
C101	76507	Capacitor—Fixed, ceramic, 3 mmf., ±1 mmf., 500 volts DC
C102 to C108 Incl.		Part of PC101
C109	79014	Capacitor—Fixed, paper, .01 mf., ±20%, 200 volts DC (For KCS-88B, E, J, M only)
C109	79017	Capacitor—Fixed, paper, .0047 mf., ±20%, 400 v. DC (For KCS-88C, K only)
C109	73599	Capacitor—Fixed, paper, 0.0027 mf., ±10%, 600 volts DC (For KCS-88D, L, V, VA only)
C110	79316	Capacitor—Fixed, paper, .01 mf., ±10%, 200 v. DC (For KCS-88B, C, E, J, K, M)
C110	79530	Capacitor—Fixed, paper, .015 mf., ±10%, 200 v. DC (For KCS-88D, L, V, VA only) 85° oper. temp.
C111	79014	Capacitor—Fixed, paper, .01 mf., ±20%, 200 v. DC
C112	47617	Capacitor—Fixed, ceramic, 270 mmf., ±10%, 500 v. DC (For KCS-88B, D, E, J, L, M, V, VA)
C112	75643	Capacitor—Fixed, paper, .001 mf., ±10%, 600 v. DC (For KCS-88C, K only)
C113	73599	Capacitor—Fixed, paper, .0027 mf., ±10%, 600 v. DC (For KCS-88B, C, E, J, K, M)
C113	79531	Capacitor—Fixed, paper, .0018 mf., ±10%, 600 v. DC (For KCS-88D, L, V, VA only)
C114	79314	Capacitor—Fixed, electrolytic, 100 mf., —10%, +100%, 250 v. DC
C115	78979	Capacitor—Fixed, paper, .0082 mf., ±10%, 1000 v. DC
C116	78220	Capacitor—Variable mica, 5-70 trimmer
C117	73599	Capacitor—Fixed, paper, .0027 mf., ±10%, 600 v. DC (For all chassis except KCS-88C, K)
C118	39044	Capacitor—Fixed, ceramic, 15 mmf., ±5%, 500 v. DC
C119	77293	Capacitor — Fixed, ceramic, 470 mmf., +100%, —0%, 500 v. DC
C120	73787	Capacitor—Fixed, paper, 0.47 mf., ±20%, 200 v. DC
C121 to C127 Incl.		Part of Z102 or PC102
C128	33098	Capacitor—Fixed, ceramic, 10 mmf., ±1.0 mmf., 500 volts
C129	79018	Capacitor—Fixed, paper, 0.0039 mf., ±10%, 400 volts
C130	39042	Capacitor—Fixed, ceramic, 47 mmf., ±10%, 500 volts
C131	79149	Capacitor—Fixed, paper, 0.1 mf., ±20%, 600 volts
C132A, B	79147	Capacitor—Fixed, electrolytic, 80 mfd., —10%, +50%, 400 v. DC 80 mfd., —10%, +100%, 200 v. DC

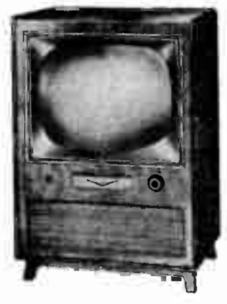
SYMBOL NO.	STOCK NO.	DESCRIPTION
C133		Part of Z102 or PC102
C134A, B	79146	Capacitor—Fixed, electrolytic, 100 mfd., —10%, +50%, 400 v. DC 30 mfd., —10%, +250%, 50 v. DC
C135	73557	Capacitor—Fixed, paper, 0.1 mf., ±20%, 600 volts
C136	76994	Capacitor—Fixed, paper, 0.33 mf., ±20%, 200 volts
C137	76476	Capacitor—Fixed, mica, 330 mmf., ±10%, 1000 volts
C138	73595	Capacitor—Fixed, paper, 0.0022 mf., ±10%, 600 volts
C139	73592	Capacitor—Fixed, paper, 0.047 mf., ±10%, 600 volts
C140	39640	Capacitor—Fixed, mica, 330 mmf., ±10%, 500 volts
C141	73551	Capacitor—Fixed, paper, 0.1 mf., ±20%, 400 volts
C142	73552	Capacitor—Fixed, paper, 0.033 mf., ±20%, 400 volts
C143	76474	Capacitor—Fixed, mica, 82 mmf., ±5%, 1000 volts
C144	58271	Capacitor—Fixed, mica, 220 mmf., ±10%, 500 volts
C145	79315	Capacitor—Fixed, paper, 0.0033 mf., ±10%, 400 volts
C146	79019	Capacitor — Fixed, paper, 0.0082 mf., ±10%, 400 volts
C147		Same as C141
C148	78221	Capacitor—Fixed, paper, 0.0039 mf., ±5%, 600 volts
C149	73594	Capacitor—Fixed, paper, 0.01 mf., ±10%, 600 volts
C150		Same as C138
C151	79317	Capacitor—Fixed, paper, 0.056 mf., ±10%, 600 volts
C152	73797	Capacitor—Fixed, paper, 0.015 mf., ±10%, 400 volts
C153	73798	Capacitor—Fixed, paper, 0.022 mf., ±20%, 600 volts
C154	79016	Capacitor—Fixed, paper, 0.068 mf., ±10%, 200 volts
C155	73798	Capacitor—Fixed, paper, 0.022 mf., ±10%, 600 volts
C156	78980	Capacitor—Fixed, paper, 0.001 mf., ±20%, 1600 volts
C157		Same as C153
C158		Same as C141
C159	77364	Capacitor—Fixed, ceramic, 6 mmf., ±1.0 mmf., 500 volts
C160	39396	Capacitor — Fixed, ceramic, 100 mmf., ±10%, 500 volts
C162	76475	Capacitor—Fixed, mica, 68 mmf., ±5%, 1000 volts
C163		Same as C141
C164	73562	Capacitor—Fixed, paper, 0.022 mf., ±20%, 400 volts
C166		Same as C120
C167	76476	Capacitor—Fixed, mica, 330 mmf., ±5%, 1000 volts
C168	73594	Capacitor—Fixed, paper, 0.01 mf., ±5%, 600 volts
C169	59667	Capacitor—Fixed, mica, 470 mmf., ±10%, 1000 v. DC
C170		Same as C135
C171	71807	Trimmer—Horizontal drive 10-160 mmf.
C172	76995	Capacitor—Fixed, paper, 0.0012 mf., ±5%, 600 volts
C173		Same as C135
C174	73786	Capacitor—Fixed, paper, 0.27 mf., ±10%, 200 volts
C175	73597	Capacitor—Fixed, paper, 0.047 mf., ±10%, 1000 volts
C176	79022	Capacitor—Fixed, mica, 270 mmf., ±20%, 1000 volts
C177	79532	Capacitor — Fixed, ceramic, 120 mmf., ±10%, 3500 v. DC
C179	79318	Capacitor—Fixed, paper, 0.39 mf., ±10%, 200 volts
C180		Part of Yoke
C181 to C183 Incl.		Part of Z102 or PC102
C184	78622	Capacitor—Fixed, ceramic, 470 mmf., ±20%, 500 volts
C185		Part of PC102
CR101	76675	Crystal—2nd. detector
F101	78214	Fuse—.3 amps., 250 volts
J101	35787	Connector—Phono input connector (For all chassis except KCS-88C and K)
J102	68590	Plug—Female plug for deflection yoke
L102	78204	Trap—1st. I.F. grid trap
L103	76011	Coil—Peaking 36 UH
L104	98482	Coil—Peaking 250 UH
L105	77674	Coil—Peaking 250 UH (Includes R133)
L106	79321	Coil—Peaking 250 UH
L107	75252	Coil—Peaking 500 UH
L108	71528	Coil—Peaking 180 UH (Includes R142)
L109	79157	Trap—4.5 M.C. trap

SYMBOL NO.	STOCK NO.	DESCRIPTION
L111	79144	Coil—Width coil
L112	76640	Reactor—RF., insulated choke, 1.5 MH
L113	77676	Choke—Filter choke
L114 to L117 Incl.		Part of Yoke
L118, L119		Part of PC102 or Z102
L120	79534	Coil—Horizontal frequency coil (Square nut on adjustable core)
L120	79160	Coil—Horizontal frequency coil (Hexagon nut on core)
L121	79161	Coil—Horizontal sine wave coil
PC101	79142	Circuit—Printed I.F. sound circuit assembly
PC102	79479	Circuit—Printed I.F. picture circuit assembly
R101 to R106 Incl.		Part of PC101
R107	503333	Resistor—Fixed, composition, 33,000 ohms, ±10%, ½ w.
R108A, B	78208	Control—"On-Off" volume and picture control
R109	504610	Resistor — Fixed, composition, 10 meg., ±20%, ½ w.
R110	504433	Resistor—Fixed, composition, 330,000 ohms, ±20%, ½ w.
R111	502482	Resistor—Fixed, composition, 820,000 ohms, ±5%, ½ w.
R112	502510	Resistor—Fixed, composition, 1 megohm, ±5%, ½ w.
R113	524147	Resistor — Fixed, composition, 470 ohms, ±20%, 2 watts
R114	504210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w.
R115	30180	Resistor—Fixed, composition, 120,000 ohms, ±5%, ½ w.
R116	503315	Resistor—Fixed, composition, 15,000 ohms, ±10%, ½ w.
R117		Same as R114
R118	502333	Resistor—Fixed, composition, 33,000 ohms, ±5%, ½ w.
R119 to R122 Incl.		Part of Z102 or PC102
R123	502415	Resistor—Fixed, composition, 150,000 ohms, ±5%, ½ w.
R124 to R128 Incl.		Part of Z102 or PC102
R129	502239	Resistor—Fixed, composition, 3900 ohms, ±5%, ½ w.
R130	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ w.
R131	503318	Resistor—Fixed, composition, 18,000 ohms, ±10%, ½ w.
R132	513312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 1 w.
R133		Part of L105
R134	524315	Resistor—Fixed, composition, 15,000 ohms, ±20%, 2 watts
R135		Part of L106
R136	503247	Resistor—Fixed, composition, 4700 ohms, ±10%, ½ w.
R137	504447	Resistor—Fixed, composition, 470,000 ohms, ±20%, ½ w.
R139	503382	Resistor—Fixed, composition, 82,000 ohms, ±10%, ½ w.
R140	503182	Resistor — Fixed, composition, 820 ohms, ±10%, ½ w.
R141	46441	Resistor — Fixed, composition, 7500 ohms, ±5%, 1 w.
R142		Part of L108
R143		Same as R137
R144	502516	Resistor — Fixed, composition, 1.6 meg., ±5%, ½ w.
R145	514347	Resistor—Fixed, composition, 47,000 ohms, ±20%, 1 w.
R146		Same as R123
R147	503347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ w.
R148		Same as R107
R149	78808	Control—AGC control
R150		Same as R107
R151	503418	Resistor—Fixed, composition, 180,000 ohms, ±10%, ½ w.
R152	503522	Resistor — Fixed, composition, 2.2 meg., ±10%, ½ w.
R153	503339	Resistor—Fixed, composition, 39,000 ohms, ±10%, ½ w.
R154		Same as R147
R155	503512	Resistor — Fixed, composition, 1.2 meg., ±10%, ½ w.
R156	503439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ w.
R157		Same as R107
R158	503212	Resistor — Fixed composition, 1200 ohms, ±10%, ½ w.
R160	513310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 1 w.
R161	502239	Resistor — Fixed, composition, 3900 ohms, ±5%, ½ w.
R162	503322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R163		Same as R131
R164	78210	Control—Vertical hold control
R165	78806	Control—Height adjustment control

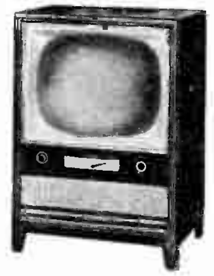
SYMBOL NO.	STOCK NO.	DESCRIPTION
R166	503447	Resistor—Fixed, composition, 470,000 ohms, ±10%, ½ w.
R167	503322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R168	3219	Resistor—Fixed, composition, 18,000 ohms, ±5%, ½ w.
R169	503439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ w.
R170	502333	Resistor—Fixed, composition, 33,000 ohms, ±5%, ½ w.
R171	503282	Resistor—Fixed, composition, 8200 ohms, ±10%, ½ w.
R172	502322	Resistor—Fixed, composition, 22,000 ohms, ±5%, ½ w.
R173		Same as R166
R174	78807	Control—Vertical linearity control
R175		Same as R111
R176	30562	Resistor—Fixed, composition, 680,000 ohms, ±5%, ½ w.
R177	503422	Resistor—Fixed, composition, 220,000 ohms, ±10%, ½ w.
R178	79139	Control—Brightness control
R179	504415	Resistor—Fixed, composition, 150,000 ohms, ±20%, ½ w.
R180	503418	Resistor—Fixed, composition, 180,000 ohms, ±10%, ½ w.
R181	503433	Resistor—Fixed, composition, 330,000 ohms, ±10%, ½ w.
R182	503482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ w.
R183	502415	Resistor—Fixed, composition, 150,000 ohms, ±5%, ½ w.
R184	502382	Resistor—Fixed, composition, 82,000 ohms, ±5%, ½ w.
R185	503239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ w.
R186	512410	Resistor—Fixed, composition, 100,000 ohms, ±5%, 1 w.
R189	503347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ w.
R190	503568	Resistor—Fixed, composition, 6.8 megohm, ±10%, ½ w.
R191	513339	Resistor—Fixed, composition, 39,000 ohms, ±10%, 1 w.
R192	503482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ w.
R193	503510	Resistor — Fixed, composition, 1 meg., ±10%, ½ w.
R194	504047	Resistor — Fixed, composition, 47 ohms, ±20%, ½ w.
R195	74015	Resistor—Fixed, wire wound, 100 ohms, ±10%, 2 w.
R196	523312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R197	503427	Resistor—Fixed, composition, 270,000 ohms, ±10%, ½ w.
R198	70351	Resistor—Fixed, composition, 56,000 ohms, ±5%, ½ w.
R201 to R203 Incl.		Part of Yoke
R204	504410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w.
S101	78211	Switch—T.V.—Phono-tone switch (For all chassis except KCS-88C and K)
T101, T102		Part of PC101
T103	79159	Transformer—Audio transformer (For KCS-88B, C, J, K only)
T103	79476	Transformer—Audio transformer (For KCS-88D, E, L, M, V, VA only)
T104	78203	Transformer—1st. I.F. grid transformer
T105 to T107 Incl.		Part of PC102 or Z102
T108	79143	Transformer—Vertical output transformer
T110	79145	Transformer—High voltage transformer
T111	79162	Transformer—Power transformer
Z102	79156	Circuit—Picture I.F. circuit plate assembly
		SPEAKER ASSEMBLIES 971636-1W RL101C5 RMA-274 (FOR MODELS 21S501 & U, 21S502 & U, 21S503 & U, 21S504 & U, 21S505 & U, 21S506 & U, 21S517 & U, 21S519 & U, 21S521 & U, 21S522 & U, 21S525 & U, 21S526 & U, 21S537 & U)
	77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)
		SPEAKER ASSEMBLIES 92586-4W (FOR MODELS 21S518 & U, 21S519 & U, 21S521 & U, 21S523 & U, 21S537 & U)
	74664	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)
		NOTE: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.



Models 24-S-531, 24-S-531U
"Bartram"
Mahogany, Blonde Tropical Hardwood



Models 24-S-532, 24-S-532U
"Martel"
Birch



Models, 24-S-529, 24-S-529U
"Brentwood"
Mahogany, Oak

PICTURE SIZE...327 square inches on a 24CP4A Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 24-S-529, 24-S-531 & 24-S-532

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 24-S-529U, 24-S-531U & 24-S-532U

Any of 70 UHF channels....................470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency....................45.75 mc.
Sound I-F Carrier Frequency....................41.25 mc.

POWER RATING....................245 watts

AUDIO POWER OUTPUT RATING..........4 watts max.

VIDEO RESPONSE....................To 3.5 mc.

SWEEP DEFLECTION....................Magnetic

FOCUS....................Magnetic

ANTENNA INPUT IMPEDANCE

Models 24-S-529, 24-S-531 & 24-S-532

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 24-S-529U, 24-S-531U & 24-S-532U

UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK22D (24-S-529, 24-S-531 & 24-S-532)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK30D (or E) (24-S-529U, 24-S-531U & 24-S-532U)	
(1) RCA 6AF4	UHF Oscillator
(2) RCA 6BQ7A	VHF R-F Amplifier UHF I-F Amplifier
(3) RCA 6X8	VHF R-F Oscillator & Mixer UHF I-F Amplifier

A K3D or 1N82 crystal is used as the UHF mixer.

All Models

(1) RCA 6CF6	1st Picture I-F Amplifier
(2) RCA 6CF6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Det. and Horiz. Sync. Sep.
(5) RCA 6X8	Video Amplifier and Vert. Sync. Sep.
(6) RCA 12AU7	Video Output & AGC
(7) RCA 6AU6	1st Sound I-F Amplifier
(8) RCA 6AU6	2nd Sound I-F Amplifier
(9) RCA 6AL5	Ratio Detector
(10) RCA 6AV6	1st Audio Amplifier
(11) RCA 6AQ5	Audio Output
(12) RCA 12AU7	Vert. Osc. and Disch. & Sync. Output
(13) RCA 6AQ5	Vertical Sweep Output
(14) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(15) RCA 6CD6G	Horizontal Sweep Output
(16) RCA 6AU4GT	Damper
(17) RCA 1B3-GT	High Voltage Rectifier
(18) RCA 24CP4A	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

SCANNING....................Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY..........15,750 cps

VERTICAL SWEEP FREQUENCY....................60 cps

FRAME FREQUENCY (Picture Repetition Rate).....30 cps

CHASSIS DESIGNATIONS

CHASSIS	TUNER	KINE-SCOPE	MODELS
KCS84F	KRK22D	24CP4A	24-S-529 24-S-532 (Horizontal Mounting)
KCS84H	KRK30D	24CP4A	24-S-529U 24-S-532U (Horizontal Mounting)
KCS84J	KRK22D	24CP4A	24-S-531 (Vertical Mounting)
KCS84K	KRK30E	24CP4A	24-S-531U (Vertical Mounting)

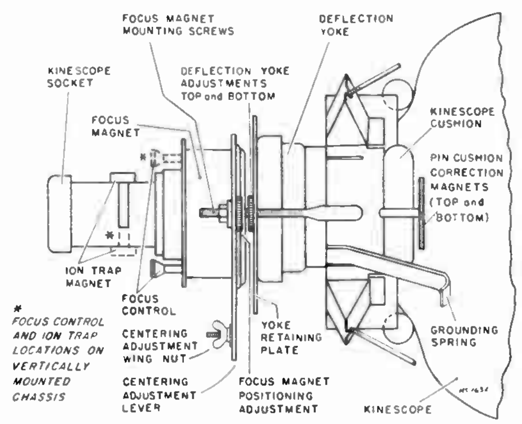


Figure 3—Yoke and Focus Magnet Adjustments

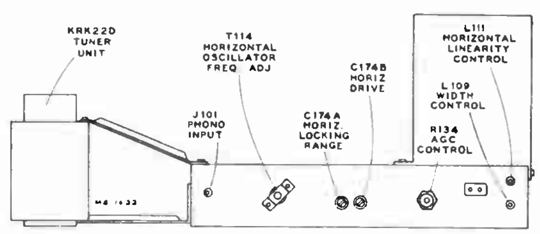


Figure 4—Rear Chassis Adjustments

Figure 5—KRK22D R-F Oscillator Adjustments

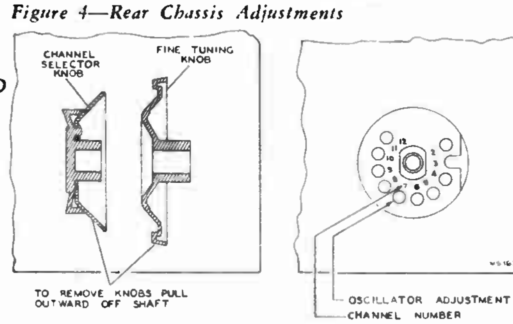
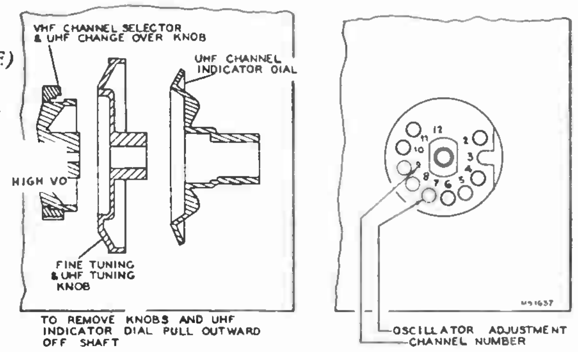


Figure 6—KRK30D (or E) VHF R-F Oscillator



ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable preamplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

KRK22D OR KRK30D (OR E) ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 (or L53) to the channel selector switch S1-E (or S4).

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R127 and R148. Set the poteniometer to produce approximaely −5.0 volts of bias at the junction of R127 and R148.

Connect an oscilloscope to the junction of R135 and L102 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 (or L54) in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 (or L57) for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 (or L53) to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 (or L53) to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 19 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 (or L56) and L3 (or L55) to obtain the response shown in figure 20. L3 (or L55) is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 (or L56) should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L5 (or L53) and S1-E (or S4). Replace V106.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 21-S-529, 21-S-531 and 21-S-532

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R123 and C142. The second battery will be used later.

Set the bias to produce approximately —5.0 volt of bias at the junction of R123 and C142.

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R135, L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	L118

Models 24-S-529U, 24-S-531U and 24-S-532U

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R123 and C142.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R123 and C142. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R135 and L102 and to ground.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R135 and L102 with —5.0 volts of i-f bias at the junction of R123 and C142.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction

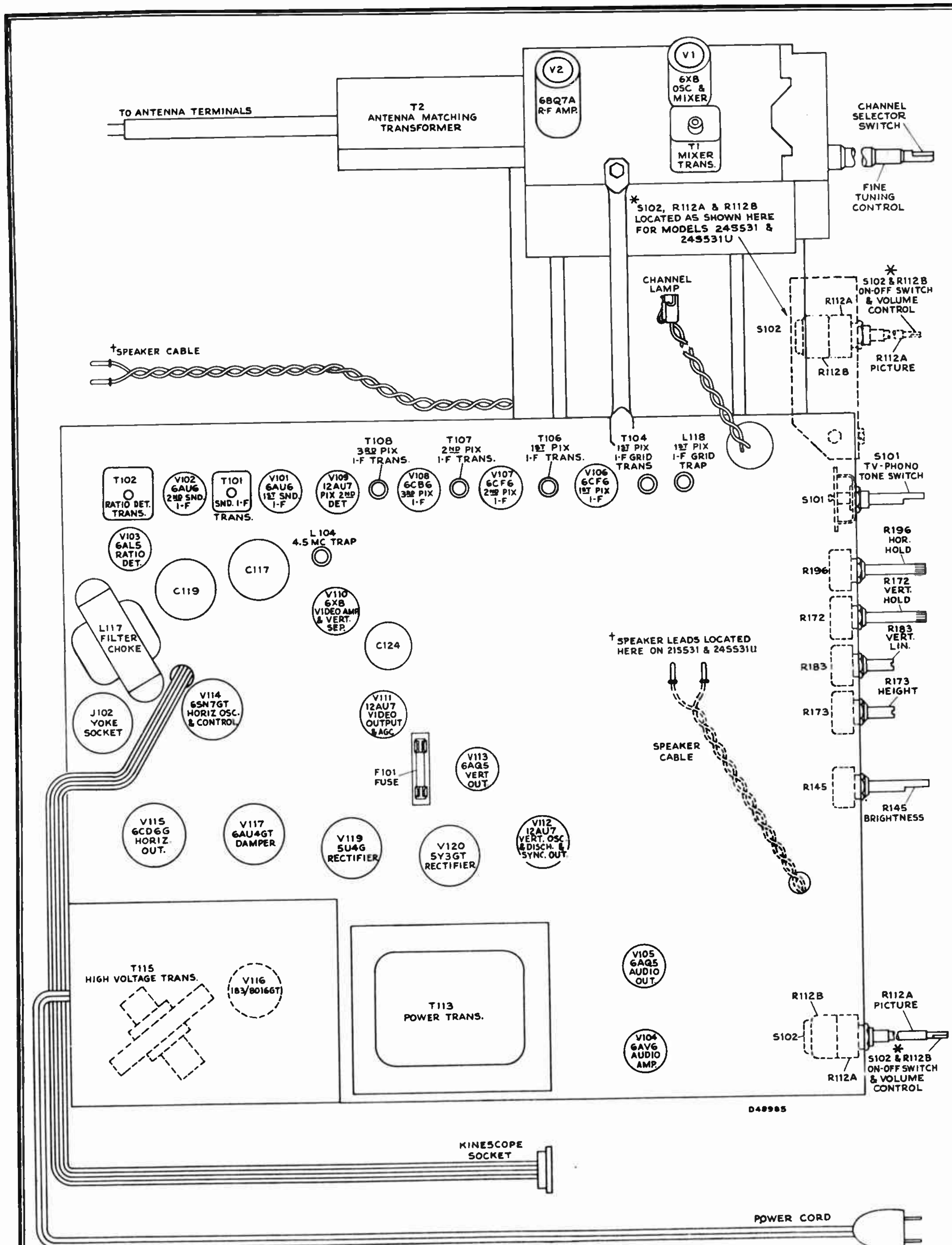


Figure 7—Chassis Top View (shown with KRK22D Tuner)

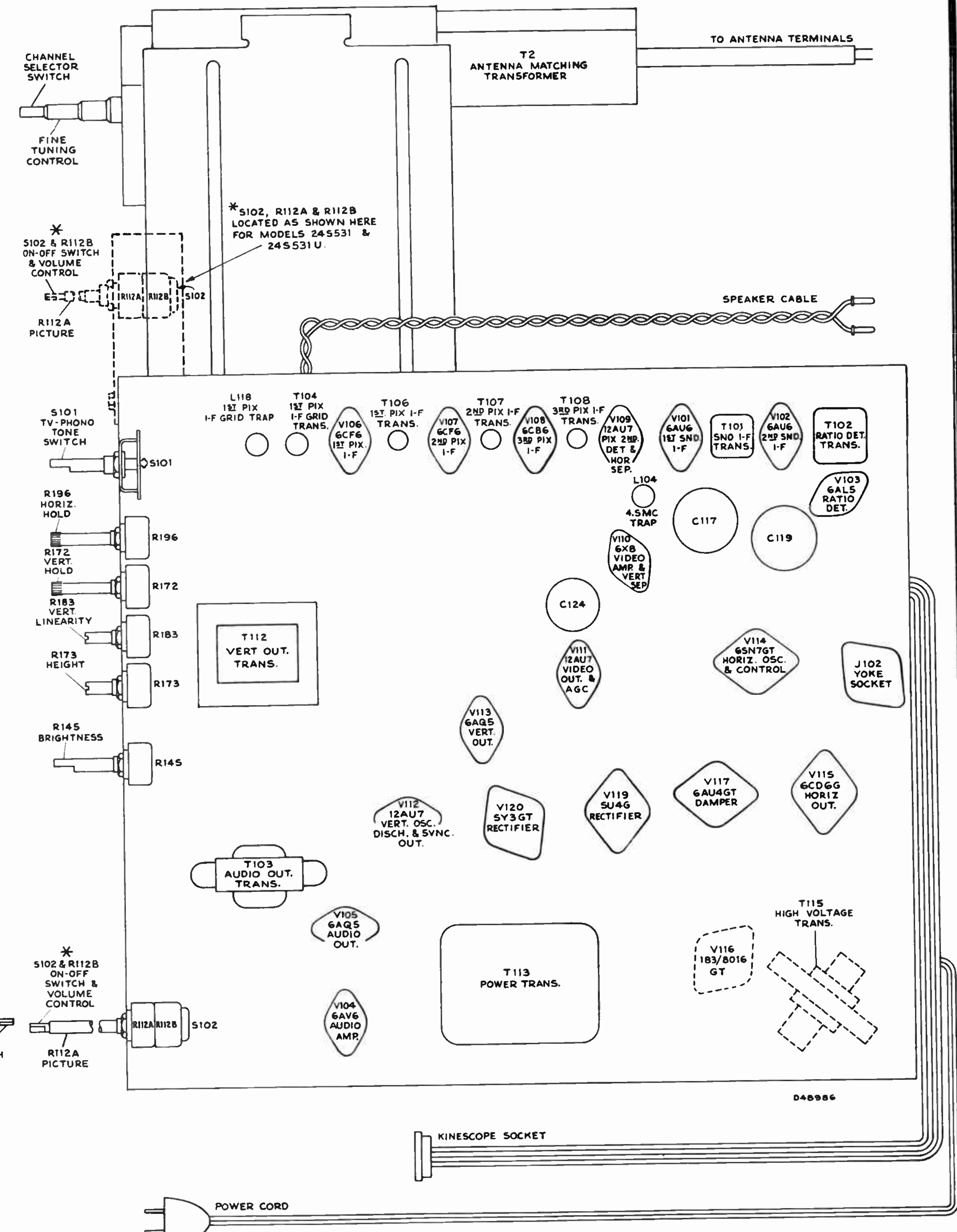


Figure 8—Chassis Bottom View (shown with KRK22D Tuner)

of R135 and L102. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc. L118

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 21-S-529, 21-S-531 and 21-S-532

To align T1 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T1 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 23. Maximum allowable tilt is 20%.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 24.

Models 21-S-529U, 21-S-531U and 21-S-532U

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C122 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R123 and C142. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C122 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 12.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to the junction of R135 and L102.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 13.

To align the I-F amplifier circuit of the KRK30D (or E), connect the VHF sweep generator to the front terminal of the IN82 crystal holder in series with a 1000 ohms and 1500 mmf ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.

To do this, remove the crystal cover and connect the resistor, after insulating the lead with tubing, to the crystal front terminal.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING between channels 68 and 69 at 800 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground. Connect the oscilloscope diode probe to the junction between the resistor and capacitor.

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.3 or less peak-to-peak on the oscilloscope.

Adjust C308, on the UHF section, and L9, on the VHF section, of the tuner for maximum gain with picture and sound carrier markers as shown in figure 14.

If necessary adjust L27 to place the 45.75 mc. marker at the peak of the curve. Adjust L43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to the junction of R135 and L102. Use 3.0v. peak-to-peak on the oscilloscope.

Retouch L307 and L9 slightly, if necessary, to produce the curve shown in figure 14. Do not retouch T2, T104, T106, T107 or T108.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at —3.0 V and the I-F bias at —5.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 13. Retouch T107 and T108 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 13, retouching T107 and T108 if necessary to correct any overall tilt.

Remove the sweep and marker generators and the bias supplies.

KRK22D TUNER ALIGNMENT

Models 24-S-529, 24-S-531 and 21-S-532

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn the C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in Figure 19, to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers, of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in Figure 18.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in Figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and bandwidth.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46, and L58 for proper curve shape as shown in Figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See Figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK30D (OR E) TUNER ALIGNMENT

Models 24-S-529U, 24-S-531U and 21-S-532U

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 19 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 18.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 18.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L14, L48 and L32 for proper curve shape as shown in figure 18. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 18 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 18 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT.—R-F alignment of the UHF section of the tuner may only be performed with the UHF section removed from the tuner assembly. RF adjustments require removal of the tuner shield which may only be done with the UHF tuner separate from its mounting.

I-F and oscillator adjustments may be accomplished without removing the tuner.

Connect a 100 ohm composition resistor between the center conductor of the I-F cable W301 and the tuner case.

Connect the oscilloscope to the center conductor of W301 at the 100 ohm resistor, employing the preamplifier if needed with the oscilloscope used. Ground the oscilloscope to the tuner case.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 5° and 164° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. With the stop pin on the tuner against the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 164°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the junction of W301 and L310. This may be done by inserting the lead from the resistor, which should be covered with insulated tubing, through the aperture provided for removal of the crystal. (See figure 9.) Insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitor tabs C304 and C305 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 11(A).

Adjust the oscillator trimmer capacitor C306 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 11(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 5°, Channel 14, position.

Adjust the oscillator trimmer C307 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown. The inductance loop L311 across the oscillator grid coil on some units, may be repositioned, if necessary, to bring the oscillator trimmer within range. Refer to figure 9 for location of the aperture for making this adjustment.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates must be knifed with the cover shield removed. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" between the center conductor of W301 and ground. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .03 and .35 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 9). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L103 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R108 and C109.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst."

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R108 and C109. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst."

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 100 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 9 of V110.

Adjust the core of L104 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L104 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L104 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 9 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT.— Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R196, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 24. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

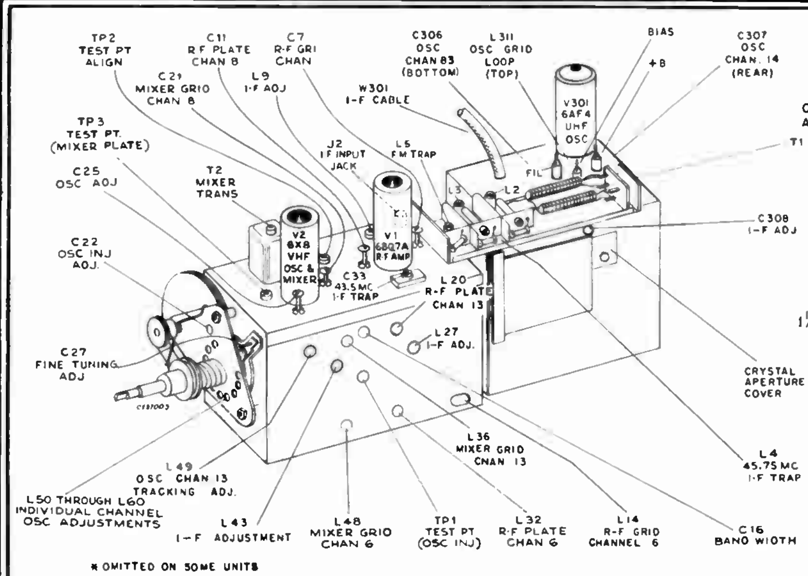


Figure 9—KRK30D (or E) Tuner Adjustments

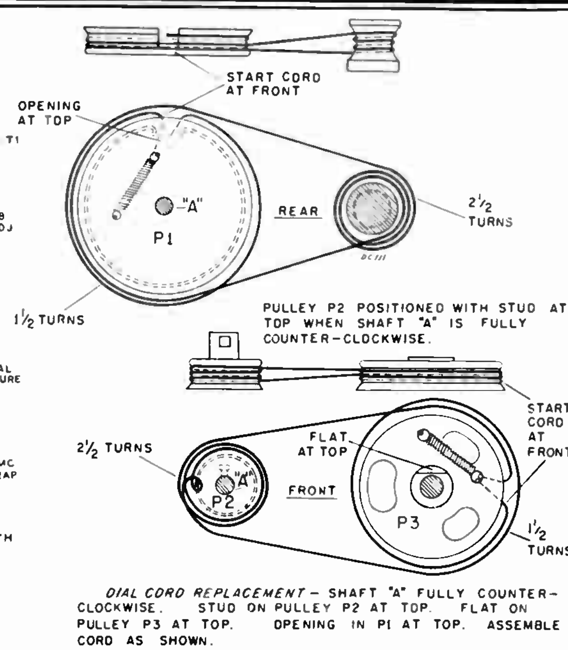


Figure 15—KRK30D (or E) Dial Cords

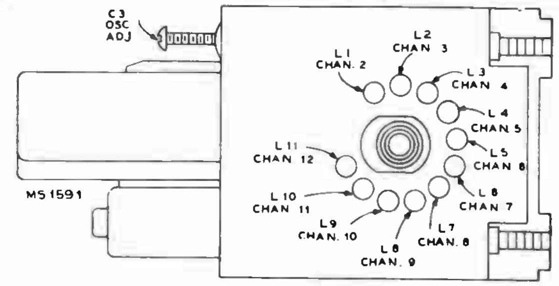


Figure 17—KRK22D R-F Oscillator Adjustments

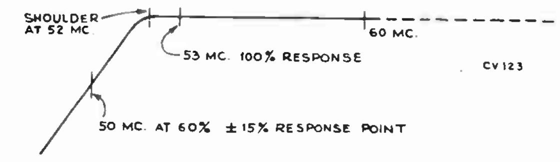


Figure 20—KRK22D or KRK30D (or E) Antenna Matching Unit Response

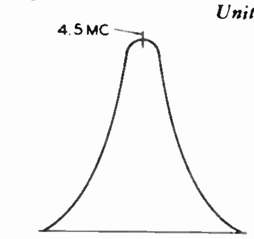


Figure 21—Sound I-F Response

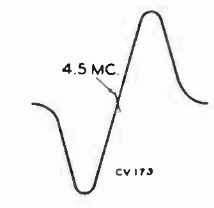


Figure 22—Ratio Det. Response

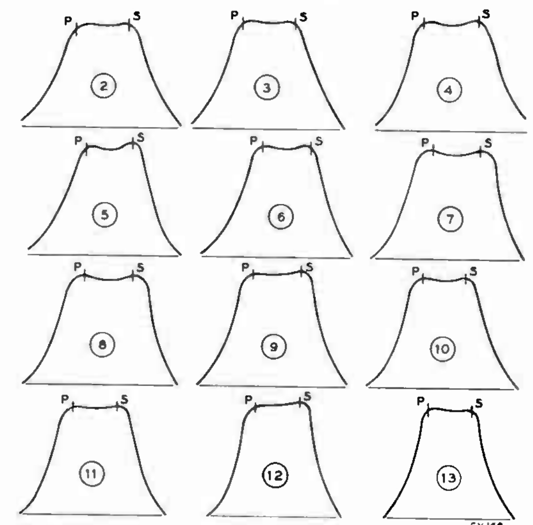


Figure 18—KRK22D or KRK30D (or E) R-F Response

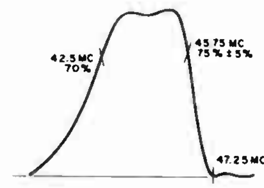


Figure 23—KRK22D T1 and T104 Response

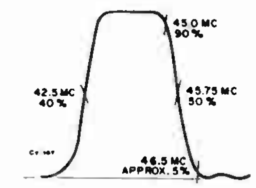


Figure 24—Overall I-F Response with KRK22D

UHF SECTION (REAR VIEW)

VHF SECTION

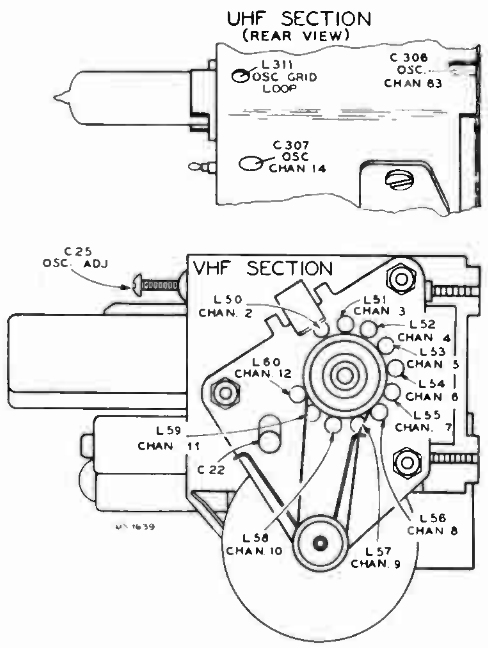


Figure 10—KRK30D (or E) Oscillator Adjustments

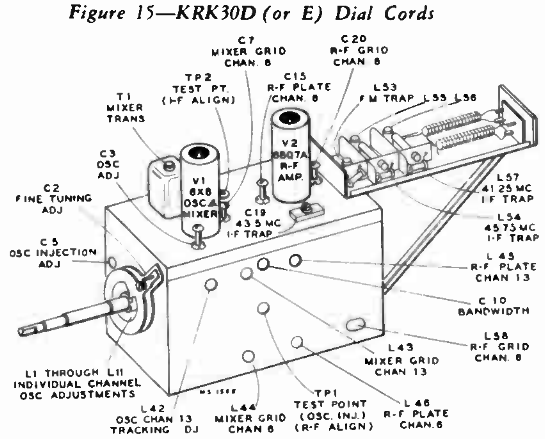


Figure 16—KRK22D Tuner Adjustments

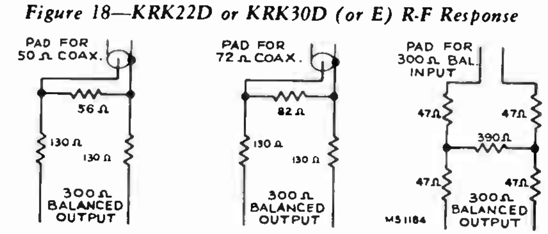


Figure 19—Sweep Attenuator Pads

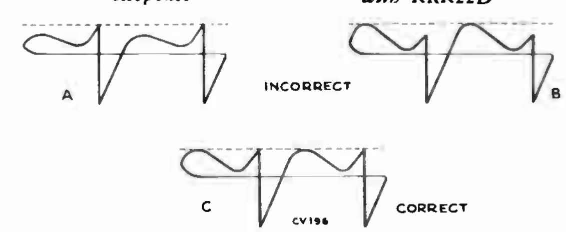


Figure 25—Horizontal Oscillator Wave Forms

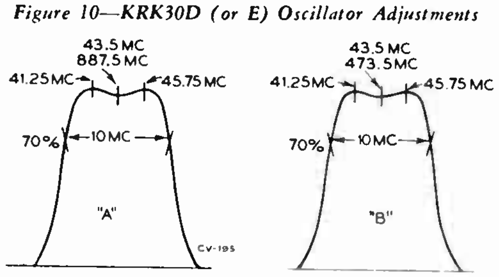


Figure 11—KRK30D (or E) R-F Response

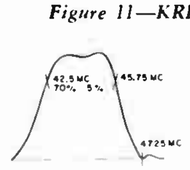


Figure 12—KRK30D (or E) T2 and T104 Response

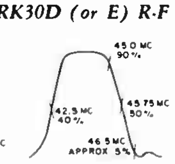


Figure 13—Overall I-F Response with KRK30D (or E)

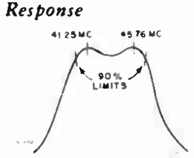


Figure 14—KRK30D (or E) L9 and C308 I-F Response

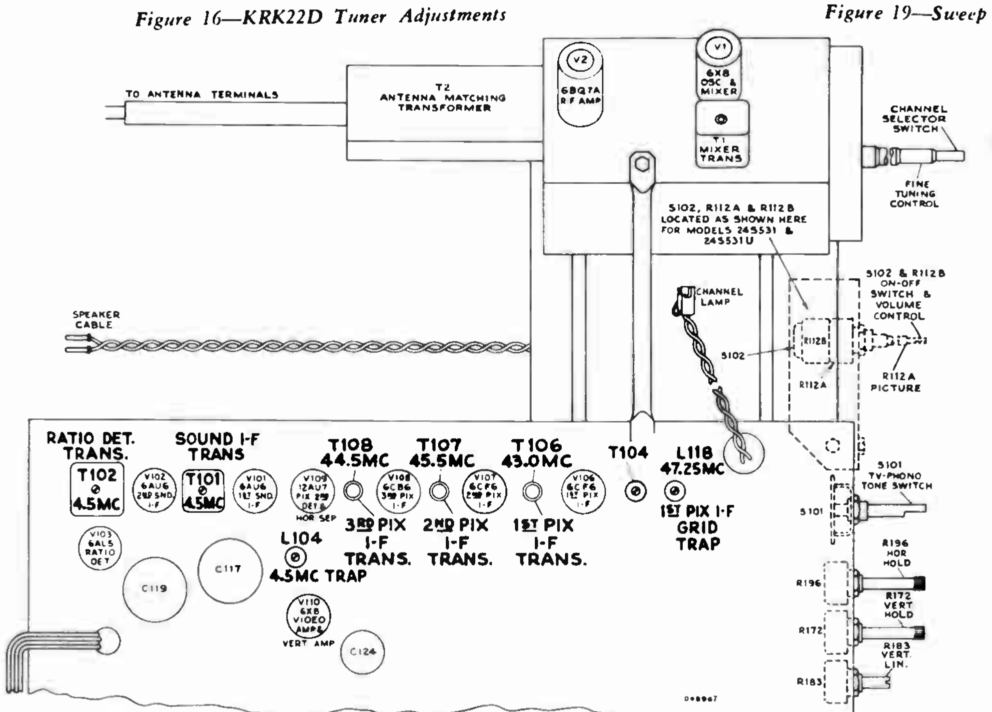


Figure 26—Top Chassis Adjustments (KRK22D Tuner Shown)

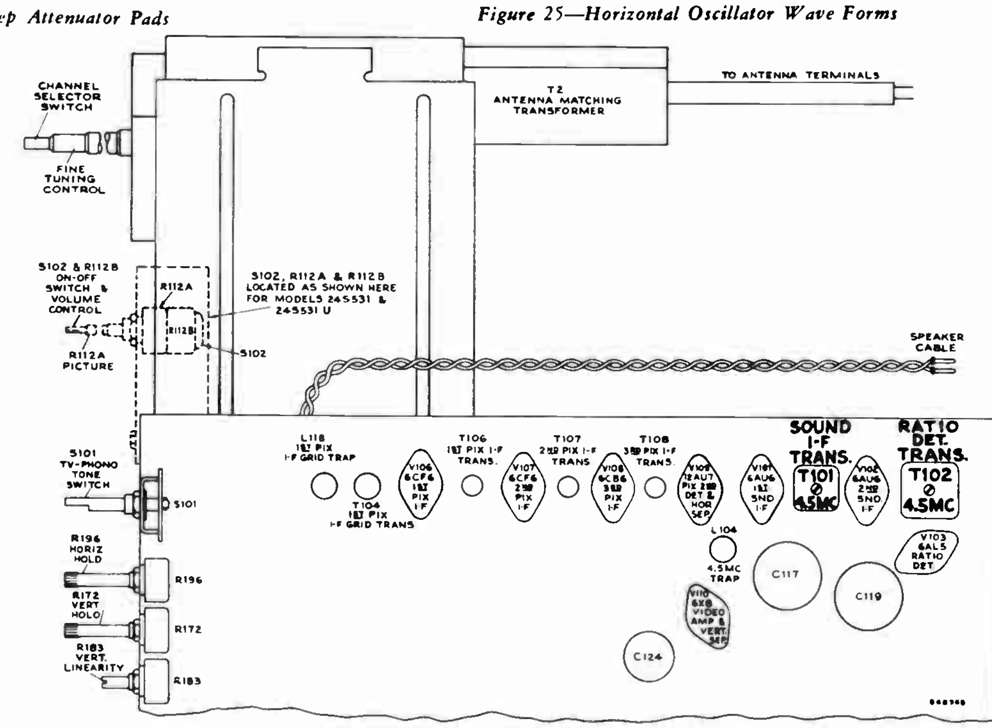
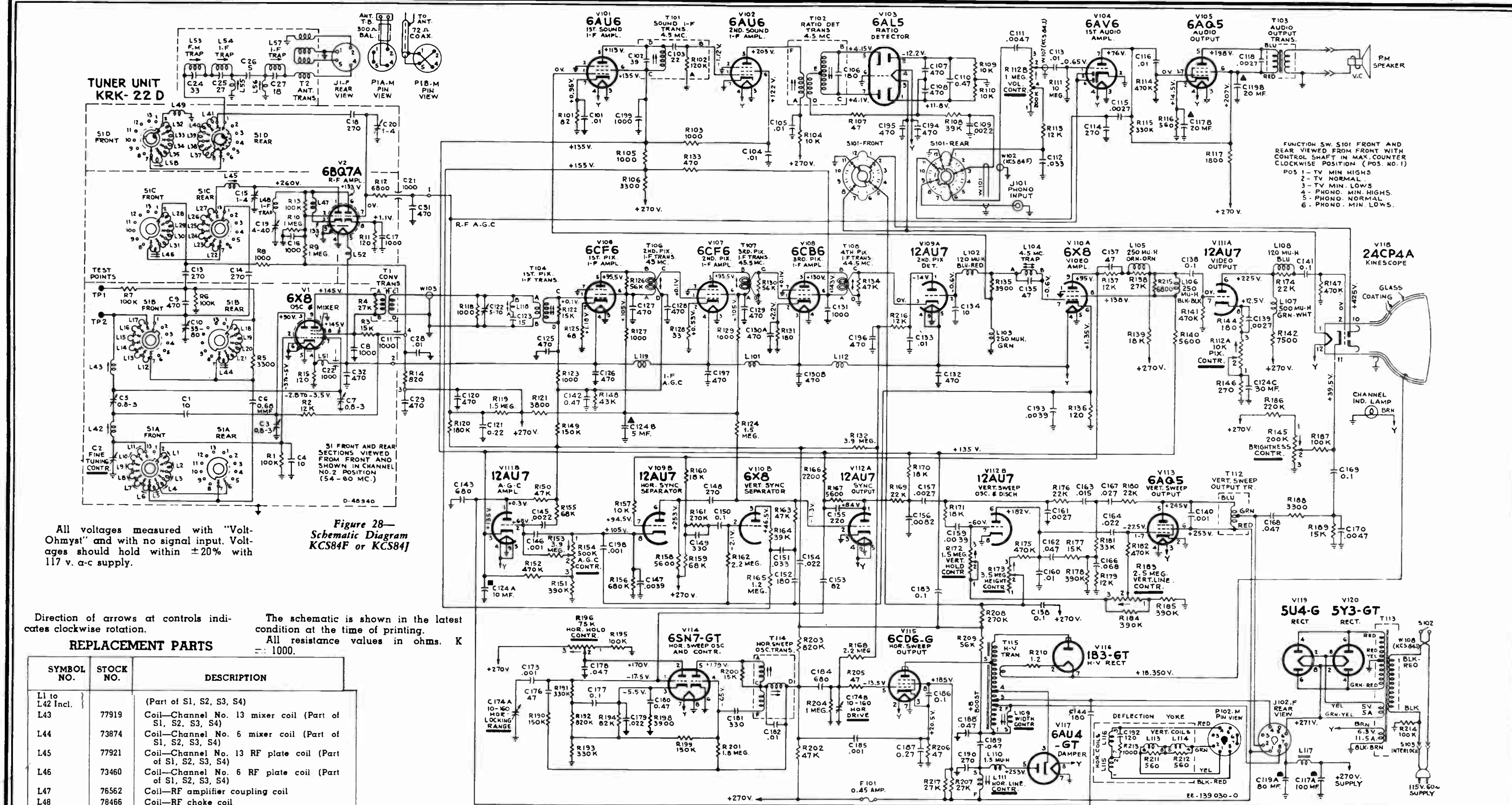


Figure 27—Bottom Chassis Adjustments (KRK22D Tuner Shown)

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, d-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1 (V2) KRK22D or KRK30D (or E)	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2 (V1) KRK22D or KRK30D (or E)	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	122	6	138	7	1.01	1	0	
			No Signal	5	113	6	126	7	.95	1	0	
V102	6AU6	2nd Sound I-F Amp.	15000 Mu. V. Signal	5	210	6	130	7	0	1	−2.05	*Unreliable measuring point. Voltage depends on noise.
			No Signal	5	205	6	122	7	0	1	* −1.12	
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	1.7	—	—	1	21	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	4.1	—	—	1	11.8	—	—	
		Ratio Detector	15000 Mu. V. Signal	2	1.7	—	—	5	21	—	—	
			No Signal	2	4.1	—	—	5	11.8	—	—	
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	78	—	—	2	0	1	−.7	At min. volume
			No Signal	7	76	—	—	2	0	1	−.65	At min. volume
V105	6AQ5	Audio Output	15000 Mu. V. Signal	5	205	6	220	2	15.2	1-7	0	At min. volume
			No Signal	5	198	6	207	2	14.5	1-7	0	At min. volume
V106	6CF6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	218	6	240	2	132	1	−8.2	*Unreliable measuring point. Make measurement at T104-B.
			No Signal	5	95.5	6	105	2	1.18	1	* <0.1	
V107	6CF6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	222	6	243	2	<0.1	1	−8.45	
			No Signal	5	95.5	6	105	2	0.53	1	<0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	138	6	150	2	2.3	1	0	
			No Signal	5	130	6	143	2	2.2	1	<0.1	
V109A	12AU7	Picture 2nd Det.	15000 Mu. V. Signal	1	−25.8	—	—	3	0	2	−1.85	
			No Signal	1	−14	—	—	3	0	2	−.6	
V109B	12AU7	Horiz. Sync Separator	15000 Mu. V. Signal	6	260	—	—	8	160	7	122	
			No Signal	6	253	—	—	8	105	7	94.5	
V110A	6X8	Video Amplifier	15000 Mu. V. Signal	9	120	8	147	6	.9	7	−1.85	AGC control set for normal operation
			No Signal	9	95	8	138	6	1.35	7	−.6	AGC control set for normal operation
V110B	6X8	Vert. Sync Separator	15000 Mu. V. Signal	3	79	—	—	6	.90	2	−26.8	
			No Signal	3	46.5	—	—	6	1.35	2	−2.1	
V111A	12AU7	Video Output	15000 Mu. V. Signal	6	231	—	—	8	13	7	0	
			No Signal	6	225	—	—	8	12.5	7	0	
V111B	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	−55	—	—	3	135	2	125	
			No Signal	1	0.3	—	—	3	132	2	68	
V112A	12AU7	Sync Output	15000 Mu. V. Signal	1	83	—	—	3	0	2	−3.28	
			No Signal	1	84	—	—	3	0	2	−1.3	
V112B	12AU7	Vertical Oscillator & Discharge	15000 Mu. V. Signal	6	80	—	—	8	0	7	−63.5	Depends on setting of Vert. hold control
			No Signal	6	182	—	—	8	0	7	−60	Voltages shown are synced pix adjustment
V113	6AQ5	Vertical Output	15000 Mu. V. Signal	5	253	6	262	2	0	1-7	−28.8	
			No Signal	5	245	6	253	2	0	1-7	−27.5	
V114	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	175	—	—	3	−3.5	1	−21	
			No Signal	2	170	—	—	3	−5.5	1	−17.5	
	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	183	—	—	6	0	4	−67	
			No Signal	5	179	—	—	6	0	4	−65	
V115	6CD6G	Horizontal Output	15000 Mu. V. Signal	Cap	*	8	193	3	22	5	−14	*High Voltage Pulse Present
			No Signal	Cap	*	8	185	3	20.5	5	−13.5	*High Voltage Pulse Present
V116	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	18,700	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	18,350	—	—	*High Voltage Pulse Present
V117	6AU4GT	Damper	15000 Mu. V. Signal	5	261	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	253	—	—	3	*	—	—	*High Voltage Pulse Present
V118	24CP4A	Kinescope	15000 Mu. V. Signal	Cap	18,700	10	428	11	44.5	2	0	At average Brightness
			No Signal	Cap	18,350	10	425	11	39.5	2	0	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	277	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	271	—	—	



All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 28—Schematic Diagram KCS84F or KCS84J

Direction of arrows at controls indicates clockwise rotation.

The schematic is shown in the latest condition at the time of printing.

All resistance values in ohms. K = 1000.

REPLACEMENT PARTS

SYMBOL NO.	STOCK NO.	DESCRIPTION
L1 to L42 Incl.		(Part of S1, S2, S3, S4)
L43	77919	Coil—Channel No. 13 mixer coil (Part of S1, S2, S3, S4)
L44	73874	Coil—Channel No. 6 mixer coil (Part of S1, S2, S3, S4)
L45	77921	Coil—Channel No. 13 RF plate coil (Part of S1, S2, S3, S4)
L46	73460	Coil—Channel No. 6 RF plate coil (Part of S1, S2, S3, S4)
L47	76562	Coil—RF amplifier coupling coil
L48	78466	Coil—RF choke coil
L49	77859	Connector—RF grid switch return connector
L50, L51	79067	Coil—Heater choke coil
L52	77206	Coil—Filament choke coil
L53 to L57 Incl.		Part of Antenna matching transformer
L58		(Part of S4)
R1	504410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w.
R2	523312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R3	523315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 w.
R4		(Part of T1)
R5	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w. (Part of S2)
R6, R7	502410	Resistor—Fixed, composition, 100,000 ohms, ±10%, ½ w. (Part of S2)
R8	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. (Part of S3)
R9, R10	503510	Resistor—Fixed, composition, 1.0 megohms, ±10%, ½ w.
R11	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ w.

SYMBOL NO.	STOCK NO.	DESCRIPTION
R12	504268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ w.
R13		Same as R1
R14	503182	Resistor—Fixed, composition, 820 ohms, ±10%, ½ w.
R15		Same as R11
S4	78802	Stator—RF grid stator complete with rotor and coils (L32 to L41 Incl.)
T1	78399	Transformer—Convertor transformer
T2	78396	Transformer—Antenna matching transformer complete (C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
C1 to C4 Incl.		Part of Antenna matching transformer
C5	77084	Capacitor—Ceramic, feed-thru, 1000 mmf.
C6	75199	Capacitor — Fixed, ceramic, 270 mmf., ±20%, 500 v.
C7	76532	Trimmer—Adjustable, 1-4 mmf.

SYMBOL NO.	STOCK NO.	DESCRIPTION
C8, C9	77252	Capacitor — Fixed, ceramic, 1000 mmf., +100%, —0%, 500 v.
C10	75199	Capacitor — Fixed, ceramic, 270 mmf., ±20%, 500 v. DC (Part of S4)
C11	77151	Trimmer—Adjustable, 0.8-3.0 mmf.
C12	78276	Capacitor — Fixed, ceramic, 150 mmf., ±10%, 500 v. DC (Part of S3)
C13	71599	Capacitor — Fixed, ceramic, 270 mmf., ±20%, 500 v. DC (Part of S2)
C15		Same as C5
C16	78397	Trimmer—Mica, 80-150 mmf.
C17 to C19 Incl.		Same as C5
C20	78603	Capacitor — Fixed, ceramic, 82 mmf., ±10%, 500 v.
C21		Same as C11
C22	77913	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. (Part of S1)
C23	71504	Capacitor—Fixed, headed-lead, 0.68 mmf., ±20%, 500 v. DC (Part of S2)

SYMBOL NO.	STOCK NO.	DESCRIPTION
C24	78247	Capacitor—Fixed, ceramic, 10 mmf., ±1 mmf., 500 v.
C25		Same as C11
C26	77865	Capacitor—Fixed, ceramic, 10 mmf., ±1.0 mmf., 500 v.
C27	79192	Trimmer—Ceramic, variable—fine tuning type
C28	73960	Capacitor—Fixed, ceramic, 10,000 mmf., 500 v.
C29	77293	Capacitor — Fixed, ceramic, 470 mmf., +100%, —0%, 500 v. (Part of S3)
C31		Capacitor—Fixed, headed-lead type, 2.2 mmf., ±20%, 500 v. DC
C33	77616	Capacitor—Adjustable, mica, 4-40 mmf.
C34, C35		Same as C29
C36	75437	Capacitor — Fixed, ceramic, 100 mmf., ±20%, 500 v. DC (Part of S2)
C38	71503	Capacitor—Fixed, headed-lead type, 3.3 mmf., ±20%, 500 v. DC (Part of S5)
C39		Same as C31 (Part of S3)

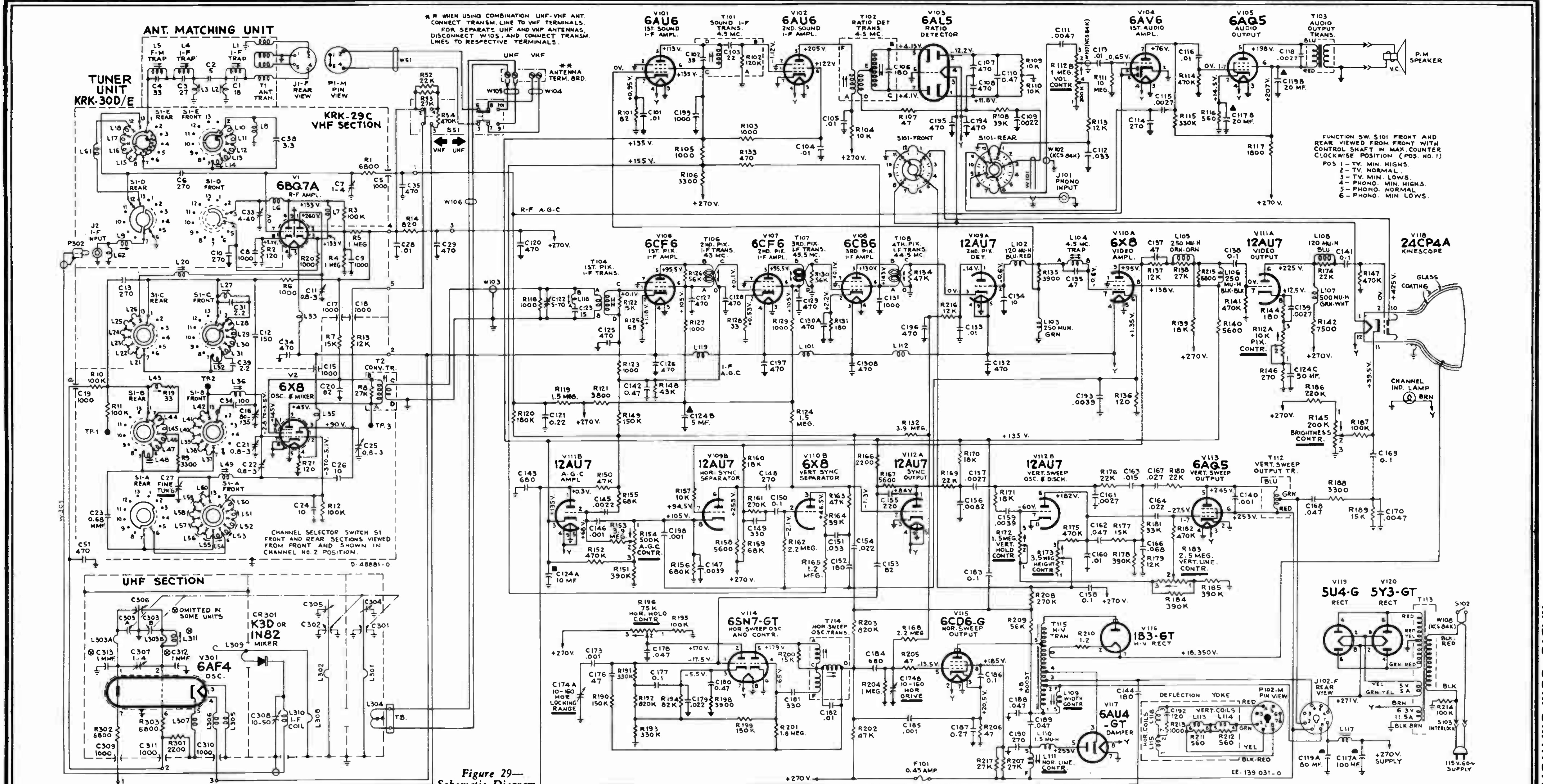


Figure 29—
Schematic Diagram
KCS84H or KCS84K

SYMBOL NO.	STOCK NO.	DESCRIPTION
C102, C103		(Part of T101)
C104, C105		Same as C101
C106		(Part of T102)
C107, C108	39644	Capacitor—Fixed, mica, 470 mmf., ±5%, 500 v. DC
C109	73595	Capacitor—Fixed, paper, 0.0022 mf., ±10%, 600 v. DC
C110	73787	Capacitor—Fixed, paper, 0.47 mf., ±20%, 200 v. DC
C111	79017	Capacitor—Fixed, paper, 0.0047 mf., ±20%, 400 v. DC
C112	79015	Capacitor—Fixed, paper, 0.033 mf., ±10%, 200 v. DC
C113	79014	Capacitor—Fixed, paper, 0.01 mf., ±20%, 200 v. DC
C114	47617	Capacitor—Fixed, ceramic, 270 mmf., 500 v. DC
C115	73599	Capacitor—Fixed, paper, 0.0027 mf., ±10%, 600 v. DC
C116	73561	Capacitor—Fixed, paper, 0.01 mf., ±20%, 400 v. DC

SYMBOL NO.	STOCK NO.	DESCRIPTION
C117A, B	78212	Capacitor—Electrolytic, 100/20 mf., 400/50 v. DC
C118	79020	Capacitor—Fixed, paper, 0.0027 mf., ±10%, 1000 v. DC
C119A, B	77644	Capacitor—Electrolytic, 80/20 mf., 400/400 v. DC
C120	77293	Capacitor—Fixed, ceramic, 470 mmf., +100 —0%, 500 v. DC
C121	73794	Capacitor—Fixed, paper, 0.22 mf., ±10%, 200 v. DC
C122	78220	Capacitor—Adjustable, mica, 5-70 mmf.
C123	39044	Capacitor—Fixed, ceramic, 15 mmf., 500 v. DC
C124A, B, C	78213	Capacitor — Electrolytic, 10/5/30 mf., 350/350/50 v. DC
C125, C126		Same as C120
C127	78622	Capacitor — Fixed, ceramic, 470 mmf., ±20%, 500 v. DC
C128		Same as C120
C129		Same as C127

NO. SYMBOL	STOCK NO.	DESCRIPTION
C130A, B	77672	Capacitor—Fixed, ceramic, dual, 470/470 mmf., +100 —0%, 500 v. DC
C131	78623	Capacitor — Fixed, ceramic, 1000 mmf., ±20%, 500 v. DC
C132		Same as C120
C133	73960	Same as C101
C134	33098	Capacitor—Fixed, ceramic, 10 mmf., 500 v. DC
C135		(Part of L104)
C137	39042	Capacitor—Fixed, ceramic, 47 mmf., 500 v. DC
C138	73557	Capacitor—Fixed, paper, 0.1 mf., ±20%, 600 v. DC
C139		Same as C115
C140	78980	Capacitor—Fixed, paper, 0.001 mf., ±20%, 1600 v. DC
C141		Same as C138
C142		Same as C110
C143	78796	Capacitor—Fixed, mica, 680 mmf., ±10%, 1000 v. DC
C144	76575	Capacitor — Fixed, ceramic, 180 mmf., ±10%, 3500 v. DC

	STOCK NO.	DESCRIPTION
C145		Same as C109
C146	75249	Capacitor—Fixed, paper, 0.001 mf., ±20%, 600 v. DC
C147	78221	Capacitor—Fixed, paper, 0.0039 mf., ±10%, 600 v. DC
C148	76579	Capacitor—Fixed, mica, 270 mmf., ±5%, 1000 v. DC
C149	39640	Capacitor—Fixed, mica, 330 mmf., 500 v. DC
C150	73551	Capacitor—Fixed, paper, 0.1 mf., ±20%, 400 v. DC
C151	73552	Capacitor—Fixed, paper, 0.033 mf., ±20%, 400 v. DC
C152	71922	Capacitor—Fixed, ceramic, 180 mmf., 500 v. DC
C153	76474	Capacitor—Fixed, mica, 82 mmf., ±5%, 1000 v. DC
C154	73810	Capacitor—Fixed, paper, 0.022 mf., ±20%, 1000 v. DC
C155	58271	Capacitor—Fixed, mica, 220 mmf., ±10%, 500 v. DC
C156	79019	Capacitor—Fixed, paper, 0.0082 mf., ±10%, 400 v. DC

SYMBOL NO.	STOCK NO.	DESCRIPTION
C157		Same as C115
C158		Same as C150.
C159	78221	Capacitor—Fixed, paper, 0.0039 mf., ±5%, 600 v. DC
C160	73594	Capacitor—Fixed, paper, 0.01 mf., ±10%, 600 v. DC
C161		Same as C115
C162	73592	Capacitor—Fixed, paper, 0.047 mf., ±10%, 600 v. DC
C163	73797	Capacitor—Fixed, paper, 0.015 mf., ±10%, 400 v. DC
C164	73798	Capacitor—Fixed, paper, 0.022 mf., ±20%, 600 v. DC
C166	79016	Capacitor—Fixed, paper, 0.068 mf., ±10%, 200 v. DC
C167	75345	Capacitor—Fixed, paper, 0.027 mf., ±10%, 600 v. DC
C168	73592	Capacitor—Fixed, paper, 0.047 mf., ±20%, 600 v. DC
C169		Same as C150
C170		Same as C111
C173		Same as C146
C174A, B	75217	Trimmer—dual trimmer, 10-160 mmf.
C176	79063	Capacitor—Fixed, mica, 47 mmf., ±5%, 1000 v. DC
C177		Same as C150
C178	73553	Capacitor—Fixed, paper, 0.047 mf., ±20%, 400 v. DC
C179	73562	Capacitor—Fixed, paper, 0.022 mf., ±20%, 400 v. DC
C180		Same as C110
C181	76476	Capacitor—Fixed, mica, 330 mmf., ±5%, 1000 v. DC
C182	73594	Capacitor—Fixed, paper, 0.01 mf., ±5%, 600 v. DC
C183		Same as C138.
C184	6479	Capacitor—Fixed, paper, 680 mmf., ±10% 600 v. DC
C185	75249	Capacitor—Fixed, paper, 0.001 mf., ±5%, 600 v. DC
L1 to L5 Incl.		Part of Antenna matching transformer
L6	78466	Coil—RF choke
L7	76562	Coil—RF amplifier coupling coil
L8	77859	Coil—RF grid switch return connector coil
L9	79542	Coil—I.F. input coil complete with adjustable core
L10 to L13 Incl.		(Part of S3 and S5)
L14	73458	Coil—Channel No. 6 RF grid coil (Part of S3 and S5)
L15 to L19 Incl.		(Part of S3 and S5)
L20	77921	Coil—Channel No. 13 RF plate coil (Part of S3 and S5)
L21 to L26 Incl.		(Part of S3 and S5)
L27	78584	Coil—RF plate I.F. coil (Part of S3)
L28 to L31 Incl.		(Part of S3 and S5)
L32	73460	Coil—Channel No. 6 RF plate coil (Part of S3 and S5)
L33	77206	Coil—Filament choke coil
L35	76763	Coil—Heater choke coil
L36	77919	Coil—Channel No. 13 mixer coil
L37 to L42 Incl.		(Part of S1 and S2)
L43	78583	Coil—Mixer I.F. coil (Part of S1 and S2)
L44 to L47 Incl.		(Part of S1 and S2)
L48	73874	Coil—Channel No. 6 mixer coil (Part of S1 and S2)
L49	77915	Coil—Channel No. 13 oscillator coil (Part of S1 and S2)
L50 to L60 Incl.		(Part of S1 and S2)
L61	78401	Coil—Channel No. 6 antenna coil
R1	502268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ w.
R2	502112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ w.
R3	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w. (Part of S2)
R4, R5	502510	Resistor — Fixed, composition, 1 meg., ±10%, ½ w.
R6	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. (Part of S3)
R7	522315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 w.
R8		(Part of T2)
R9	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w. (Part of S2)
R10, R11		Same as R3 (Part of S2)
R12		Same as R3
R13	522312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R14	502182	Resistor—Fixed, composition, 820 ohms, ±10%, ½ w.
R19	502033	Resistor — Fixed, composition, 33 ohms, ±10%, ½ w. (Part of S2)

SYMBOL NO.	STOCK NO.	DESCRIPTION
R20		Same as R6
R21		Same as R2
T1	78396	Transformer—Antenna matching transformer complete
T2	78399	Transformer—Convertor transformer (R8)
C301 to C303 Incl.	79553	Capacitor—Variable tuning capacitor
C304, C305	79554	Stator—Oscillator stator assembly
C306	79555	Capacitor—Oscillator trimmer capacitor
C307	79556	Capacitor — Adjustable, ceramic, 0.8-3.5 mmf.
C308	79558	Capacitor—Trimmer, 10-50 mmf.
C309 to C311 Incl.	79559	Capacitor—Feed thru, 1000 mmf.
C312, C313	79560	Capacitor—Fixed, ceramic, 1 mmf., ±0.1 mmf., 500 v. DC, non-insulated
CR301	77489	Rectifier — UHF diode crystal germanium rectifier
L301, L302		Coil—RF tank plate
L303	79557	Tank Assembly—complete with capacitor (C7)
L304	79564	Board—Antenna terminal board assembly
L305 to L307 Incl.	79565	Choke—RF choke
L308, L309		Coil—Mixer coupling coil for oscillator and output section
L310	79567	Coil—I.F. output coil 0.15 microhenries
L311	79566	Coil—Oscillator loop coil
R301	502222	Resistor—Fixed, composition, 2200 ohms, ±10%, ½ w.
R302	512268	Resistor—Fixed, composition, 6800 ohms, ±10%, 1 w.
R303	502268	Resistor—Fixed, composition, 6800 ohms, ±10%, ½ w.
C186	73557	Capacitor—Fixed, paper, 0.1 mf., ±10%, 600 v. DC
C187	73786	Capacitor—Fixed, paper, 0.27 mf., ±10%, 200 v. DC
C188, C189	73597	Capacitor—Fixed, paper, 0.047 mf., ±10%, 1000 v. DC
C190	79022	Capacitor—Fixed, mica, 270 mmf., ±20%, 1000 v. DC
C192		Part of Yoke
C193	79018	Capacitor—Fixed, mica, 0.0039 mf., ±10%, 400 v. DC
C194 to C197 Incl.		Same as C120
C198	75643	Capacitor—Fixed, paper, 0.001 mf., ±10%, 600 v. DC
C199	73960	Capacitor—Fixed, ceramic, 1000 mmf., 500 v. DC
F101	78798	Fuse—0.45 amp
J101	35787	Connector—Phono input connector
J102	68590	Connector—Deflection Yoke connector, 8 contact, female
L101	73477	Choke—Filament choke coil
L102	75253	Coil—Peaking coil, 120 UH
L103	98482	Coil—Peaking coil, 250 UH
L104	76983	Coil—4.5 MC. trap
L105	77674	Coil—Peaking coil, 250 UH
L106	78222	Coil—Peaking coil, 250 UH
L107	75252	Coil—Peaking coil, 500 UH
L108	71529	Coil—Peaking coil, 120 UH
L109	76441	Coil—width coil
L110	76640	Choke—RF choke, 1.5 UH
L111	76442	Coil—Horizontal linearity coil
L112	73477	Choke—Filament choke
L113 to L116 Incl.		Part of Yoke
L117	77676	Choke—Filter choke
L118	78204	Coil—1st I.F. grid trap
L119		Same as L112.
P102	74594	Connector—Male connector for deflection yoke
PC101	76433	Transformer—1st, 2nd and 3rd Pix. I.F. transformers Includes T106, T107 and T108
R101	502082	Resistor — Fixed, composition, 82 ohms, ±10%, ½ w.
R102		(Part of T101)
R103	502210	Resistor — Fixed, composition, 1000 ohms, ±20%, ½ w.
R104	522310	Resistor — Fixed, composition, 10,000 ohms, ±20%, 2 w.
R105	512210	Resistor—Fixed, composition, 1000 ohms, ±10%, 1 w.
R106	77670	Resistor—Fixed, wire wound, 3300 ohms, ±10%, 7 w.
R107	502047	Resistor — Fixed, composition, 47 ohms, ±10%, ½ w.
R108	502339	Resistor—Fixed, composition, 39,000 ohms, ±10%, ½ w.
R109, R110	502310	Resistor—Fixed, composition, 10,000 ohms, ±5%, ½ w.
R111	502610	Resistor—Fixed, composition, 10 megohms, ±20%, ½ w.
R112A, B	78208	Control—Power, volume and picture control
R113	502312	Resistor—Fixed, composition, 12,000 ohms, ±10%, ½ w.

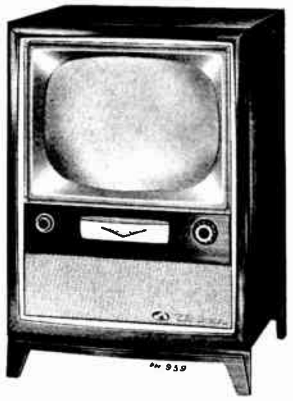
SYMBOL NO.	STOCK NO.	DESCRIPTION
R114	502447	Resistor—Fixed, composition, 470,000 ohms, ±20%, ½ w.
R115	502433	Resistor—Fixed, composition, 330,000 ohms, ±20%, ½ w.
R116	512156	Resistor—Fixed, composition, 560 ohms, ±10%, 1 w.
R117	522218	Resistor—Fixed, composition, 1800 ohms, ±10%, 2 w.
R118	502210	Resistor—Fixed, composition, 1000 ohms, ±10%, ½ w.
R119	502515	Resistor—Fixed, composition, 1.5 megohms, ±5%, ½ w.
R120	502418	Resistor—Fixed, composition, 180,000 ohms, ±5%, ½ w.
R121	77671	Resistor—Fixed, composition, 3800 ohms, ±10%, 7 w.
R122	502315	Resistor—Fixed, composition, 15,000 ohms, ±10%, ½ w.
R123		Same as R103
R124	502515	Resistor—Fixed, composition, 1.5 megohms, ±10%, ½ w.
R125	502068	Resistor — Fixed, composition, 68 ohms, ±5%, ½ w.
R126	502356	Resistor—Fixed, composition, 56,000 ohms, ±5%, ½ w.
R127		Same as R103
R128	502033	Resistor — Fixed, composition, 33 ohms, ±5%, ½ w.
R129		Same as R103
R130		Same as R126
R131	502118	Resistor — Fixed, composition, 180 ohms, ±5%, ½ w.
R132	502539	Resistor—Fixed, composition, 3.9 megohms, ±10%, ½ w.
R133	502147	Resistor — Fixed, composition, 470 ohms, ±20%, ½ w.
R134	502347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ w.
R135	502239	Resistor — Fixed, composition, 3900 ohms, ±5%, ½ w.
R136	502112	Resistor — Fixed, composition, 120 ohms, ±10%, ½ w.
R137		Same as R113
R138		(Part of L105)
R139	522318	Resistor—Fixed, composition, 18,000 ohms, ±10%, 2 w.
R140	502256	Resistor—Fixed, composition, 5600 ohms, ±10%, ½ w.
R141		Same as R114
R142	522275	Resistor — Fixed, composition, 7500 ohms, ±5%, 2 w.
R144	502118	Resistor — Fixed, composition, 180 ohms, ±10%, ½ w.
R145	78209	Control—Brightness control
R146	502127	Resistor — Fixed, composition, 270 ohms, ±10%, ½ w.
R147		Same as R114
R148	502343	Resistor—Fixed, composition, 43,000 ohms, ±5%, ½ w.
R149	502415	Resistor—Fixed, composition, 150,000 ohms, ±5%, ½ w.
R150	512347	Resistor—Fixed, composition, 47,000 ohms, ±20%, 1 w.
R151	502439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ w.
R152	502447	Resistor—Fixed, composition, 470,000 ohms, ±10%, ½ w.
R153		Same as R132
R154	78808	Control—AGC Control
R155	502368	Resistor—Fixed, composition, 68,000 ohms, ±10%, ½ w.
R156	502468	Resistor—Fixed, composition, 680,000 ohms, ±10%, ½ w.
R157	502310	Resistor—Fixed, composition, 10,000 ohms, ±10%, ½ w.
R158		Same as R140
R159		Same as R155
R160	502318	Resistor—Fixed, composition, 18,000 ohms, ±10%, ½ w.
R161	502427	Resistor—Fixed, composition, 270,000 ohms, ±10%, ½ w.
R162	502522	Resistor—Fixed, composition, 2.2 megohms, ±10%, ½ w.
R163	502347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ w.
R164		Same as R108
R165	502512	Resistor—Fixed, composition, 1.2 megohms, ±10%, ½ w.
R166	502222	Resistor—Fixed, composition, 2200 ohms, ±5%, ½ w.
R167	512256	Resistor—Fixed, composition, 5600 ohms, ±10%, 1 w.
R168	502522	Resistor—Fixed, composition, 2.2 megohms, ±10%, ½ w.
R169	502322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R170, R171		Same as R160
R172	78210	Control—Vertical hold control
R173	78806	Control—Height control
R174		(Part of L108)

SYMBOL NO.	STOCK NO.	DESCRIPTION
R175		Same as R152
R176	502322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R177	502315	Resistor—Fixed, composition, 15,000 ohms, ±5%, ½ w.
R178	502439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ w.
R179	502312	Resistor—Fixed, composition, 12,000 ohms, ±10%, ½ w.
R180	512322	Resistor—Fixed, composition, 22,000 ohms, ±5%, 1 w.
R181	502333	Resistor—Fixed, composition, 33,000 ohms, ±5%, ½ w.
R182	502447	Resistor—Fixed, composition, 470,000 ohms, ±10%, ½ w.
R183	78807	Control—Vertical Linearity Control
R184, R185	502439	Resistor—Fixed, composition, 390,000 ohms, ±5%, ½ w.
R186	502422	Resistor—Fixed, composition, 220,000 ohms, ±10% ½ w.
R187	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w.
R188	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w.
R189	502315	Resistor—Fixed, composition, 15,000 ohms, ±20%, ½ w.
R190	502415	Resistor—Fixed, composition, 150,000 ohms ±10%, ½ w.
R191	502433	Resistor—Fixed, composition, 330,000 ohms ±10%, ½ w.
R192	502482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ w.
R193	502433	Resistor—Fixed, composition, 330,000 ohms ±10%, ½ w.
R194	502382	Resistor—Fixed, composition, 82,000 ohms, ±10%, ½ w.
R195	502410	Resistor—Fixed, composition, 100,000 ohms, ±5%, ½ w.
R196	77639	Control—Horizontal Hold Control
R198	502239	Resistor—Fixed, composition, 3900 ohms ±10%, ½ w.
R199	512415	Resistor—Fixed, composition, 150,000 ohms, ±5%, 1 w.
R200	502315	Resistor—Fixed, composition, 15,000 ohms, ±10%, ½ w.
R201	512518	Resistor—Fixed, composition, 1.8 megohms, ±5%, 1 w.
R202	512347	Resistor—Fixed, composition, 47,000 ohms, ±5%, 1 w.
R203		Same as R192
R204	502510	Resistor—Fixed, composition, 1 megohm, ±10%, ½ w.
R205	502047	Resistor — Fixed, composition, 47 ohms ±20%, ½ w.
R206	78797	Resistor—Fixed, wire wound, 47 ohms, ±10%, 2 w.
R207	522327	Resistor—Fixed, composition, 27,000 ohms, ±10%, 2 w.
R208		Same as R161
R209	502356	Resistor—Fixed, composition, 56,000 ohms, ±10%, ½ w.
R210	78795	Resistor—Fixed, wire wound, 1.2 ohms, ±5%, ½ w.
R211 to R213 Incl.		(Part of Yoke)
R214	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w.
R215		(Part of L106)
R216		Same as R113
R217		Same as R207
S101	78211	Switch—TV, Phono and Tone Switch
T101	76981	Transformer—Sound I.F. transformer
T102	77112	Transformer—Ratio Det. transformer
T103	76997	Transformer—Audio output transformer
T104	78203	Transformer—1st I.F. Grid transformer
T106 to T108 Incl.		(Part of PC101)
T112	78809	Transformer—Vertical output transformer
T113	78805	Transformer—Power transformer
T114	76440	Transformer—Syncroguide transformer
T115	78810	Transformer—Hi Voltage transformer
	78869	Yoke—Deflection yoke complete with male connector L113, L114, L115, L116, R211, R212, R213, C192. For Models 24S529 and U, 24S532 and U
	79490	Yoke—Deflection yoke complete with male connector for Models 24S531 and U.

SPEAKER ASSEMBLIES
971692-1
RMA 274

	77777	Speaker—10" PM. (1.47 oz.) speaker complete with cone and voice coil (3.2 ohms) Plug-in type terminal board

NOTE: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.



Models 21-D-527, 21-D-527U
"Ashland"
Mahogany, Blonde Tropical Hardwood

PICTURE SIZE...227 square inches on a 21ZP4B Kinescope

TELEVISION R-F FREQUENCY RANGE

Model 21-D-527

All 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Model 21-D-527U

Any of 70 UHF channels................470 mc. to 890 mc.

Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency........................45.75 mc.

Sound I-F Carrier Frequency........................41.25 mc.

VIDEO RESPONSE...To 3.6 mc.

SEE POWER RATING.............................250 watts max.

AUDIO POWER OUTPUT RATING.............4.5 watts max.

CHASSIS DESIGNATIONS.........Model 21-D-527—KCS90
Model 21-D-527U—KCS90A

FOCUS..Magnetic

SWEEP DEFLECTION...Magnetic

SCANNING..Interlaced, 525 line

HORIZONTAL SCANNING FREQUENCY.........15,750 cps

VERTICAL SCANNING FREQUENCY................60 cps

FRAME FREQUENCY (Picture Repetition Rate).....30 cps

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK22D—Model 21-D-527	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Tuner KRK30C—Model 21-D-527U	
(1) RCA 6AF4	UHF Oscillator
(2) RCA 6BQ7A	VHF R-F Amplifier / UHF I-F Amplifier
(3) RCA 6X8	VHF R-F Oscillator & Mixer / UHF I-F Amplifier

A K3D or a 1N82 crystal is used as the UHF mixer

Tube Used	Function
All Models	
(1) RCA 6AU6	1st Picture I-F Amplifier
(2) RCA 6CB6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 6CB6	4th Picture I-F Amplifier
(5) RCA 6CL6	Video Amplifier
(6) RCA 6AU6	1st Sound I-F Amplifier
(7) RCA 6AU6	2nd Sound I-F Amplifier
(8) RCA 6AL5	Ratio Detector
(9) RCA 6AV6	1st Audio Amplifier
(10) RCA 6AQ5	Audio Output
(11) RCA 12AU7	Vert. Sync. Sep. and AGC
(12) RCA 12AU7	Horiz. Sync. Sep. and Sync. Ampl.
(13) RCA 6J5	Vert. Sweep Osc. and Discharge
(14) RCA 6AQ5	Vertical Sweep Output
(15) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(16) RCA 6BQ6GT	Horizontal Sweep Output
(17) RCA 6AX4GT	Damper
(18) RCA 1B3-GT	High Voltage Rectifier
(19) RCA 5U4G (2 tubes)	Rectifiers
(20) RCA 21ZP4B	Kinescope

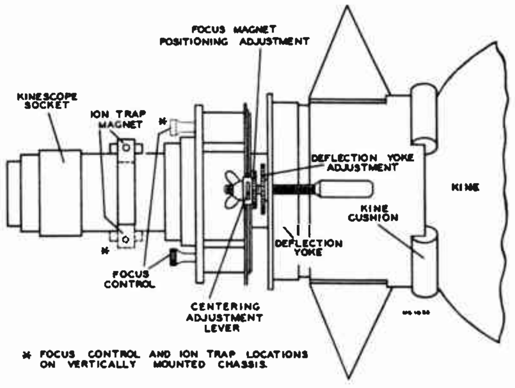


Figure 3—Yoke and Focus Magnet Adjustments

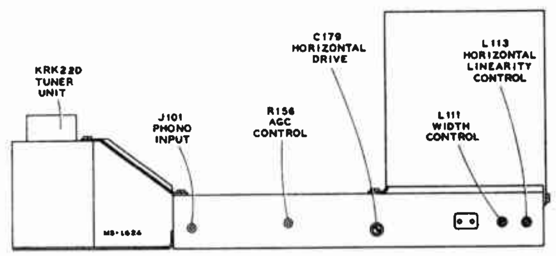


Figure 4—Rear Chassis Adjustments

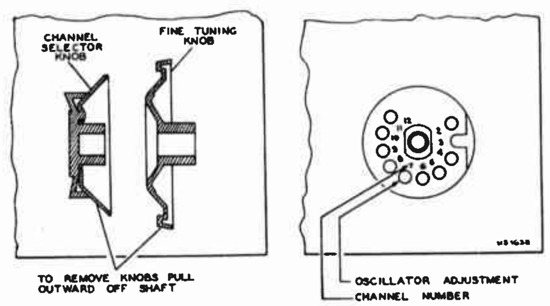


Figure 5—KRK22D R-F Oscillator Adjustments

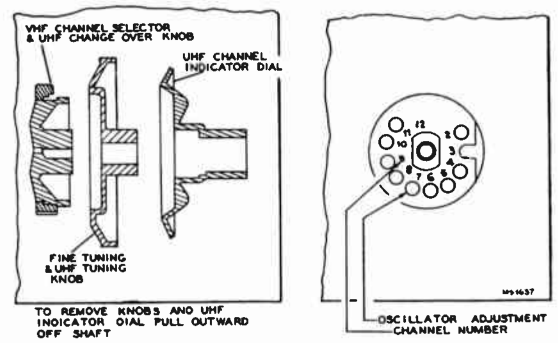


Figure 6—KRK30C VHF R-F Oscillator Adjustment

CHASSIS REMOVAL.—To remove the chassis from the cabinet for repair or installation of a new kinescope, remove the control knobs, the cabinet back, unplug the speaker cable, the kinescope socket, the antenna cable, the yoke and high voltage cable. Take out the chassis bolts under the cabinet. Withdraw the chassis from the back of the cabinet.

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generators (two) to provide the following frequencies with crystal accuracy (See Sound Take-Off Alignment on page 15):

Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
Radio frequencies
Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable preamplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 21-D-527 and 21-D-527U

Note: All alignment adjustments should be made with cores at chassis end of coils except T108 (top) which should be peaked with core at end of coil away from chassis.

Connect the i-f signal generator, in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R152, R153 and C122 and to ground. Turn the AGC control to minimum.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R152, R153 and C122. The second battery will be used later.

Set the bias to produce approximately —5.0 volts of bias at the junction of R152, R153 and C122.

Connect the "VoltOhmyst" to pin 9 of V110 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at pin 9 of V110 with —5.0 volts of i-f bias at the junction of R152, R153 and C122.

44.0 mc.	T107
45.5 mc.	T106
42.75 mc.	T105

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the final adjustment is made.

39.25 mc.	L101
41.25 mc.	T104 top core
47.25 mc.	L119

SWEEP ALIGNMENT OF PICTURE I-F.—

Model 21-D-527

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner case.

Set the channel selector to channel 4.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R121 and R125.

Short the grids of the third and fourth picture I-F amplifiers to ground, pin 1 of V108 and V109.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Set the sweep output for 0.5 volts peak-to-peak on the oscilloscope. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C119 across terminals "A" and "F" of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T1 (top) and T104 (top and bottom) for maximum gain with 45.75 mc. at 75% of maximum response.

Adjust the shunt trimmer C119 until 42.25 mc. is at 75% response with respect to the low frequency shoulder as shown in Figure 9. Readjust T1 and T104 if necessary to obtain proper wave shape, see Figure 9. Maximum allowable tilt is 25%.

To align the fourth picture i-f transformer T108 connect the sweep generator to the fourth picture i-f grid, pin 1 of V109. Couple the signal generator loosely to obtain markers.

Connect the oscilloscope to pin 9 of V110 and set to read 3 to 5 volts peak-to-peak.

Adjust T108 top and bottom cores for maximum gain and curve shape as shown in Figure 12.

Adjust C193 to place the 41.25 mc. marker at 80% and 45.75 mc. marker at 90%. Readjust T108 for flat top curve as shown in figure 12.

NOTE: C193 is incorporated as part of T108, fourth picture I-F transformer. Adjustment is made by varying the penetration of the insulated lead, from terminal "E", into the ceramic sleeve at the bottom of T108 as seen in figure 26 on page 16. Care should be taken when adjusting to prevent damage to the lead or its insulation.

Remove the 180 ohm resistor and the shorts on pin 1 of V108 and V109.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R152, R153 and C122.

Connect the sweep generator to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

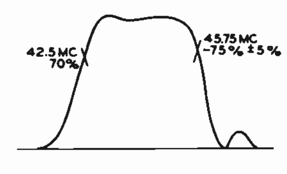


Figure 9—KRK22D T1 and T104 Response

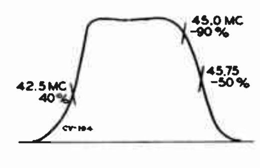


Figure 10—Overall I-F Response

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 30 and 40 times down with curve as shown in Figure 10.

Move the sweep generator to the antenna terminals. Connect —3.0 volts bias to pin 5 of V103. Adjust T106 and T107 slightly to correct for any overall tilt while switching from channel to channel.

Model 21-D-527U

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R121 and R125.

Short the grids of the third and fourth picture I-F amplifiers to ground, pin 1 of V108 and V109.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Set the sweep output for 0.5 volts peak-to-peak on the oscilloscope. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C119 across terminals "A" and "F" of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (top and bottom) for maximum gain with 45.75 mc. at 75% of maximum response.

Adjust the shunt trimmer C119 until 42.25 mc. is at 75% response with respect to the low frequency shoulder as shown in Figure 11. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 11. Maximum allowable tilt is 25%.

To align the fourth picture I-F transformer T108, connect the sweep generator to the fourth picture i-f grid, pin 1 of V109. Couple the signal generator loosely to obtain markers.

Connect the oscilloscope to pin 9 of V110 and set to read 3 to 5 volts peak-to-peak.

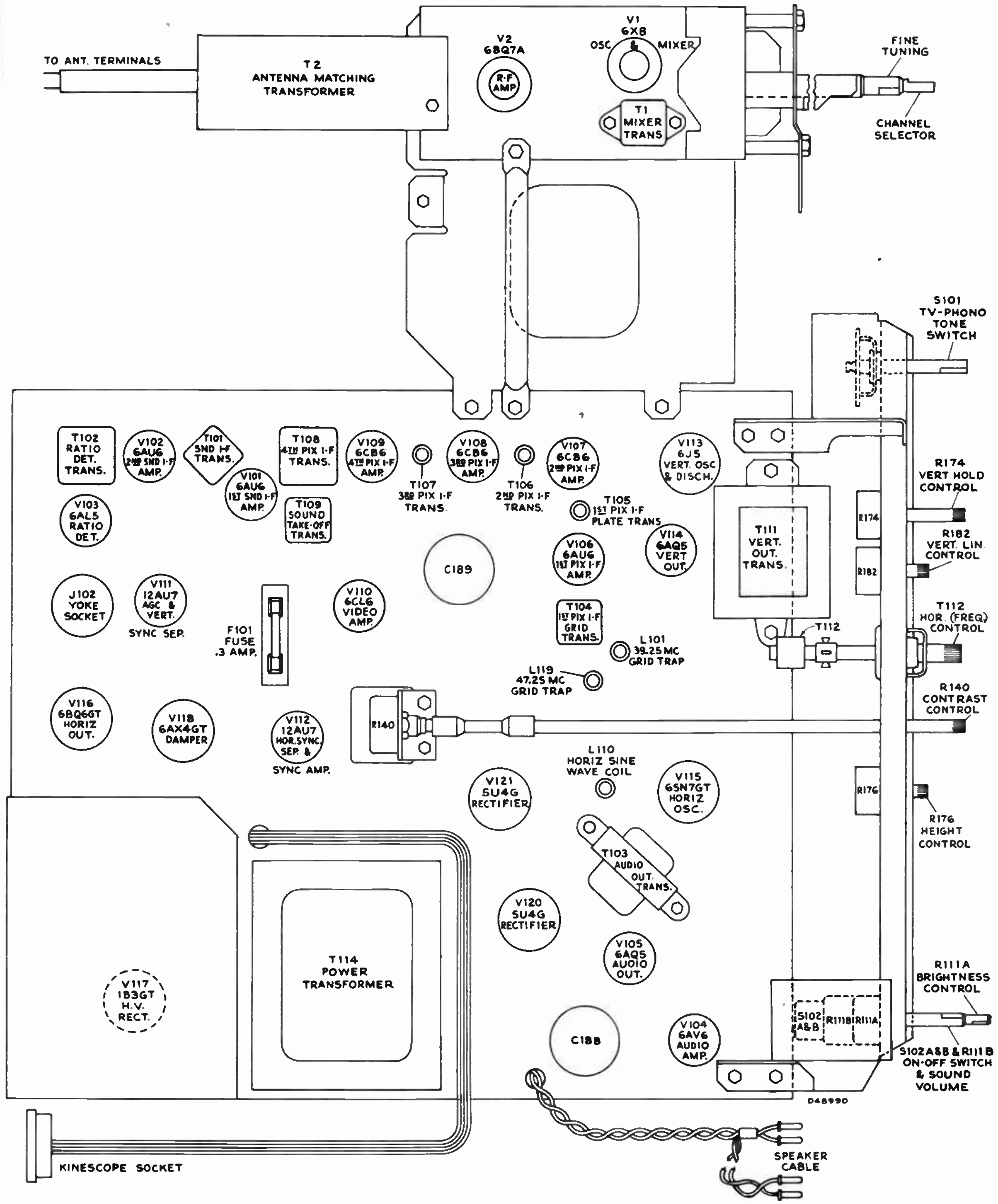


Figure 7—Chassis Top View (shown with KRK22D Tuner)

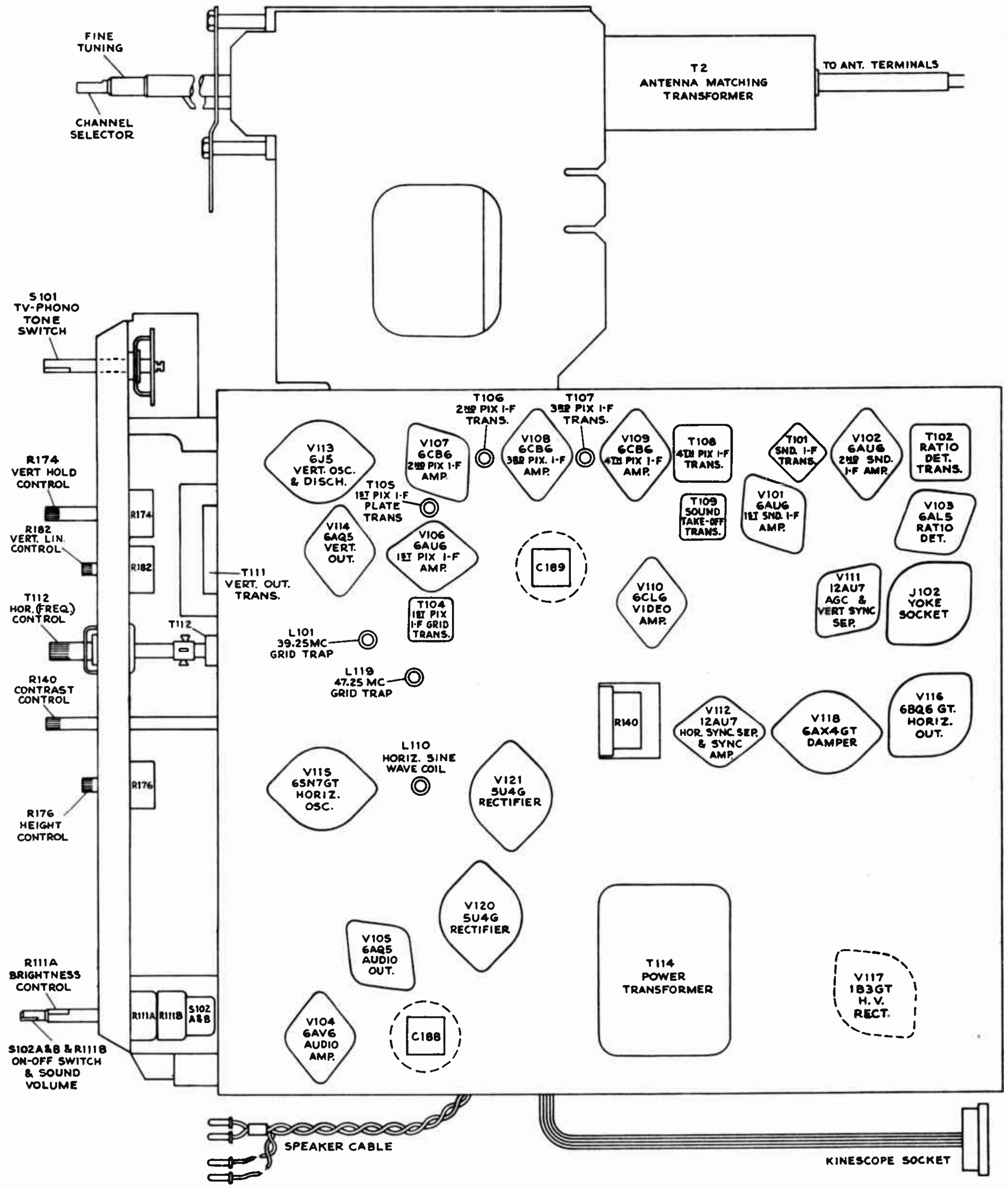


Figure 8—Chassis Bottom View (shown with KRK22D Tuner)

Adjust T108 top and bottom cores for maximum gain and curve shape as shown in Figure 12.

Adjust C193 to place the 41.25 mc. marker at 80% and 45.75 mc. marker at 90%. Readjust T108 for flat top curve as shown in Figure 12.

NOTE: C193 is incorporated as part of T108, fourth picture I-F transformer. Adjustment is made by varying the penetration of the insulated lead, from terminal "E", into the ceramic sleeve at the bottom of T108 as seen in figure 26 on page 16. Care should be taken when adjusting to prevent damage to the lead or its insulation.

Remove the 180 ohm resistor and the shorts on pin 1 of V108 and V109.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R152, R153 and C122.

Connect the sweep generator to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 0.5 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

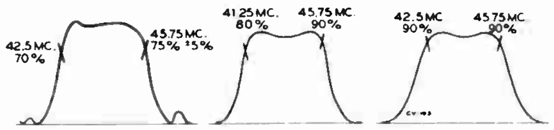


Figure 11—KRK30C T2 and T104 Response

Figure 12—T108—4th Picture I-F Response

Figure 13—KRK30C L9 and C308 I-F Response

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 30 and 40 times down with curve as shown in Figure 10.

To align the I-F amplifier circuit of the KRK30C, connect the VHF sweep generator to the rear terminal of the 1N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case. To do this, remove the crystal cover at the right side of the UHF tuner section. (Refer to Figure 20.) Cover one lead of the 1000 ohm resistor with a short piece of insulated tubing and fashion a hook at the end of this lead. Connect to the front terminal of the crystal holder through the aperture under the crystal cover. Connect the capacitor and generator as stated above.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING between channels 68 and 69 at 800 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground.

Connect the oscilloscope diode probe to the junction between the resistor and capacitor.

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.5 volt or less peak-to-peak on the oscilloscope.

Adjust C308, on the UHF section, and L9, on the VHF section, of the tuner for maximum gain with 45.75 mc. and 42.25 mc. markers as shown in figure 13.

If necessary adjust L27 to place the 45.75 mc. marker at 90% on the curve. Adjust L43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to pin 9 of V110. Use 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Connect the VHF sweep generator to the VHF antenna terminals. Keep the AGC bias at —3.0 V and the I-F bias at —5.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 10. Retouch T106 and T107 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the UHF antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 10, retouching C308 and L9 if necessary to correct any overall tilt.

Do not retouch L27, L43, T2, T104, T105, T106 or T107.

Remove the sweep and marker generators and the bias supplies.

KRK22D TUNER ALIGNMENT.—

Model 21-D-527

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T1 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" or T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

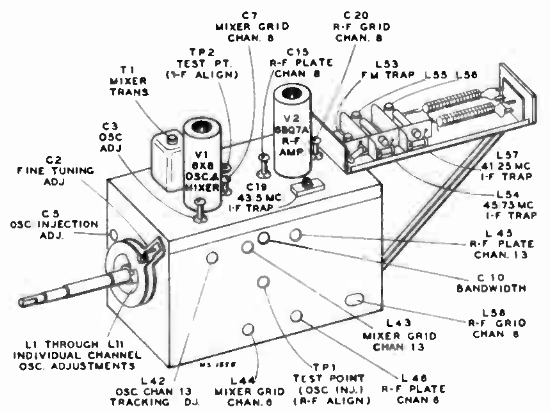


Figure 14—KRK22D Tuner Adjustments

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T1 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15, to the input terminals of the antenna matching unit.

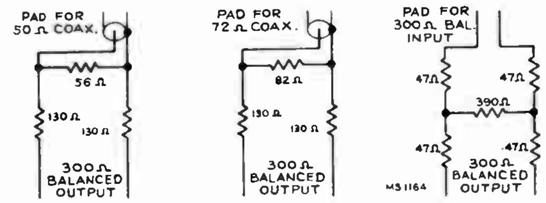


Figure 15—Sweep Attenuator Pads

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in figure 16.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

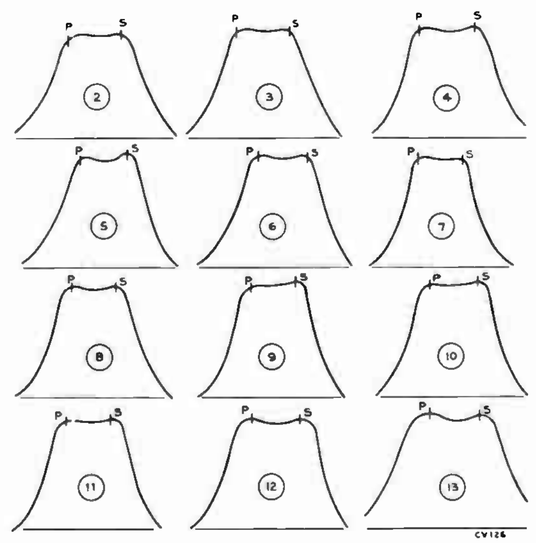


Figure 16—KRK22D R-F Responses

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in figure 16.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46 and L58 for proper curve shape as shown in figure 16. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 16 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 16 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

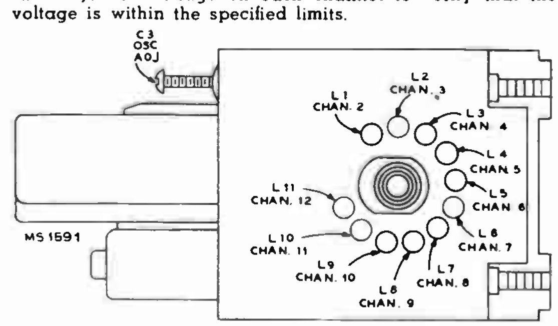


Figure 17—KRK22D Oscillator Adjustments

KRK22D OR KRK30C ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L53 (L5) to the channel selector switch S4 (S1E).

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R118, R146 and C120. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R118, R146 and C120.

Connect an oscilloscope to the junction of R129 and L103 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L54 (L4) in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L57 (L1) for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L53 (L5) to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L53 (L5) to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 15 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L55 (L3) and L56 (L2) to obtain the response shown in figure 18. L55 (L3) is most effective in locating the position of the shoulder of the curve at 52 mc. and L56 (L2) should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L53 (L5) and S4 (S1E). Replace V106.

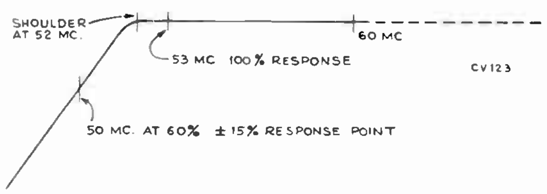


Figure 18—KRK22D or KRK30C Antenna Matching Unit Response

KRK30C TUNER ALIGNMENT

Model 21-D-527U

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency of each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 19.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in

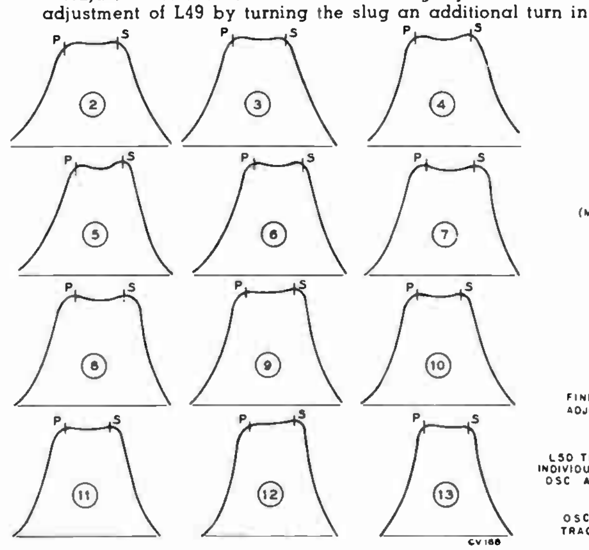


Figure 19—KRK30C VHF R-F Response

the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 19.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L14, L48 and L32 for proper curve shape as shown in figure 19. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 19 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 19 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

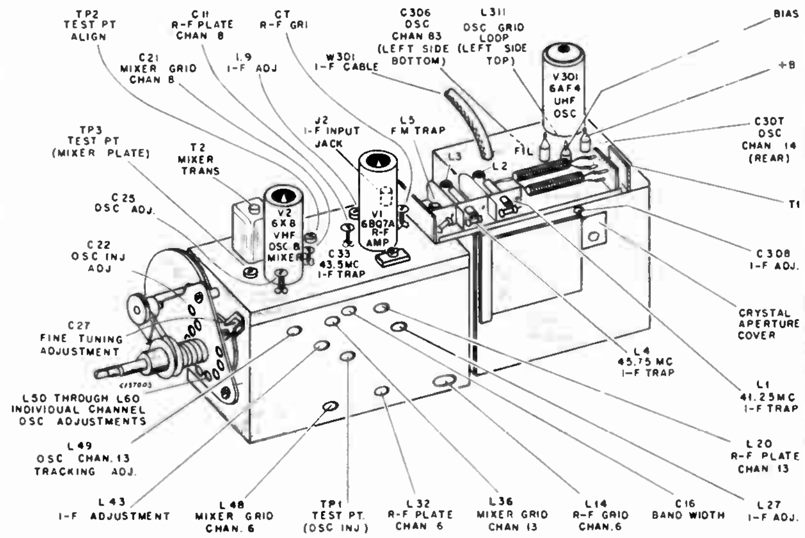


Figure 20—KRK30C Tuner Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT.—R-F alignment of the UHF section of the tuner may only be performed with the UHF section removed from the tuner assembly. R-F adjustments require removal of the tuner shield which may only be done with the UHF tuner separate from its mounting.

I-F and oscillator adjustments may be accomplished without removing the tuner.

Connect a 100 ohm composition resistor between the center conductor of the I-F cable W301 and the tuner case.

Connect the oscilloscope to the center conductor of W301 at the 100 ohm resistor, employing the preamplifier if needed with the oscilloscope used. Ground the oscilloscope to the tuner case.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 5° and 164° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. With the stop pin on the tuner against the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 164°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the junction of W301 and L310. This may be done by inserting the lead from the resistor, which should be covered with insulated tubing, through the aperture provided for crystal removal. (See figure 20.) Insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitor tabs C304 and C305 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 22(A).

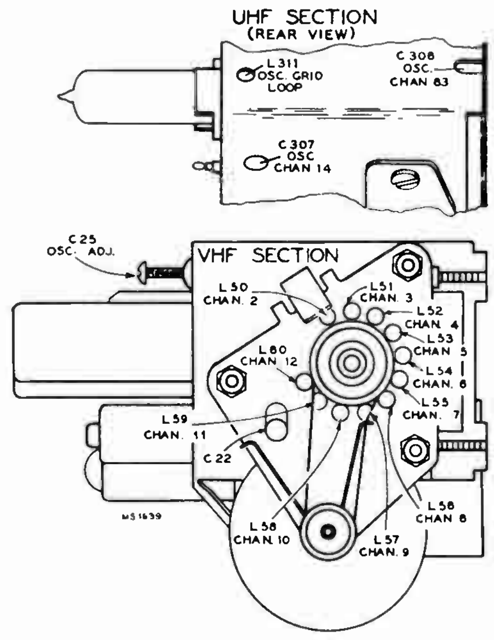


Figure 21—KRK30C Oscillator Adjustments

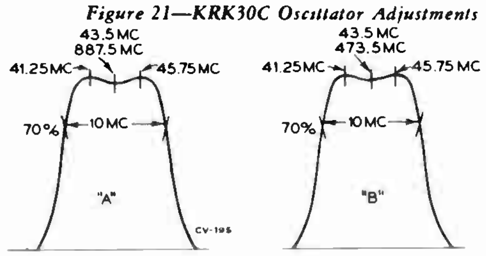
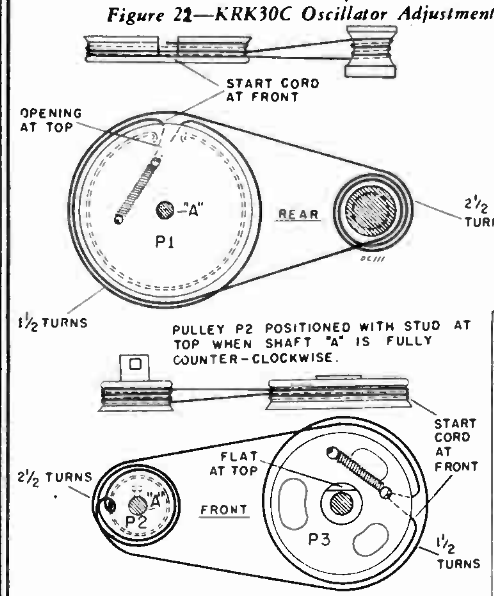


Figure 22—KRK30C Oscillator Adjustments



DIAL CORD REPLACEMENT — SHAFT "A" FULLY COUNTER-CLOCKWISE. STUD ON PULLEY P2 AT TOP. FLAT ON PULLEY P3 AT TOP. OPENING IN P1 AT TOP. ASSEMBLE CORD AS SHOWN.

Figure 23—KRK30C Dial Cords

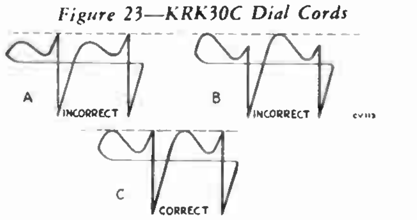


Figure 24—Horizontal Oscillator Waveforms

Adjust the oscillator trimmer capacitor C306 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 22(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 5°, Channel 14, position.

Adjust the oscillator trimmer C307 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown. The inductance loop L311 across the oscillator grid coil on some units, may be repositioned, if necessary, to bring the oscillator trimmer within range. Refer to figure 20 for location of the aperture for making this adjustment.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates must be knifed with the shield cover removed. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" between the center conductor of W301 and ground. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .03 and .35 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits. This voltage is an indication of correct crystal current and may be varied by repositioning the flag L309 with respect to L3.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 20). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

SOUND I-F AND RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101 in series with a 1500 mmf. capacitor.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector secondary T102 bottom core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked, when making the above adjustments.

Tune the T101 (top) core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the T101 adjustment are made.

Connect the "VoltOhmyst" to the junction of R107 and C109.

Tune T102 bottom for zero d-c at the junction of R107 and C109. (Make adjustment with core at chassis end of coil.)

SOUND TAKE-OFF ALIGNMENT.—Connect two (2) signal generators to the grid of the fourth picture i-f amplifier, pin 1 of V109.

Set one generator to 45.75 mc., unmodulated, and adjust output for .5 volts.

Set the second generator to 41.25 mc., and modulate 30%, at 400 cycles, with an output of .2 volts.

Connect the oscilloscope, in series with diode probe, to the plate of the video amplifier, pin 6 of V110.

Set the oscilloscope to maximum gain.

Adjust T109 for minimum output indication on the oscilloscope.

As an alternate method, this may be accomplished by using a received signal as the source for adjustment.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, short the terminals of the fixed 4.5 mc. trap L105. With a 4.5 mc. beat present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust T109 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ALIGNMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it usually can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal (freq.) control, then adjust the waveform adjustment core (top of chassis) out of the coil several turns from its original position and readjust the frequency control until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive trimmer C179, the width control L111 and the linearity control L113, until the picture is correct.

Connect the low capacity probe of an oscilloscope to the center terminal of T112, at the junction of R195. Dress the oscilloscope probe at least one inch away from the sine wave coil L110. Turn the horizontal frequency control so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 24. Adjust the waveform adjustment coil L110 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the frequency control if necessary.

Remove the oscilloscope upon completion of this adjustment.

Turn the horizontal frequency control to the extreme clockwise position. The picture should be out of sync, with a minimum of twelve bars slanting downward to the left. Turn the control counter-clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 1½ to 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional counter-clockwise rotation of the control. The picture should remain in sync for approximately two full turns of additional counter-clockwise rotation of the control. Continue counter-clockwise rotation until the picture falls out of sync. Rotation beyond the fall-out position should produce between 2 and 5 bars before interrupted oscillation (motorboat) occurs. Interrupted oscillation (motorboat) should be reached before full counter-clockwise rotation.

When the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned.

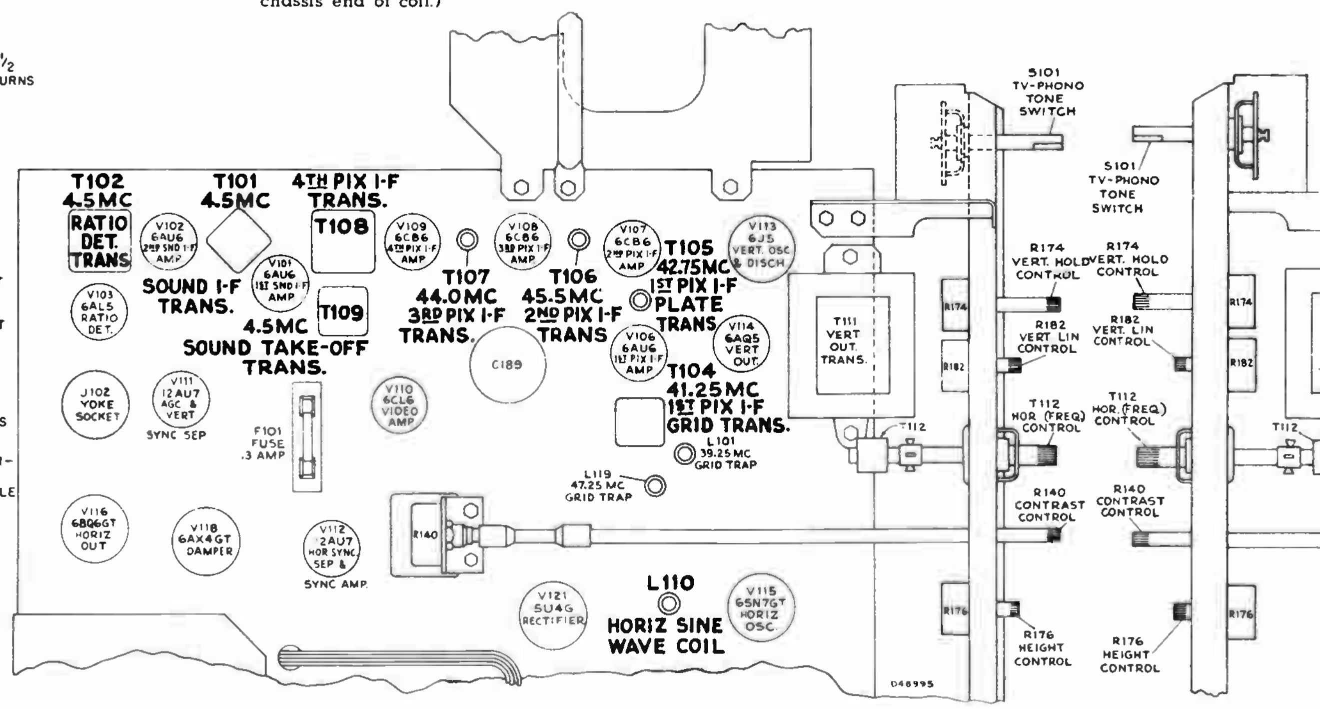


Figure 25—Top Chassis Adjustments

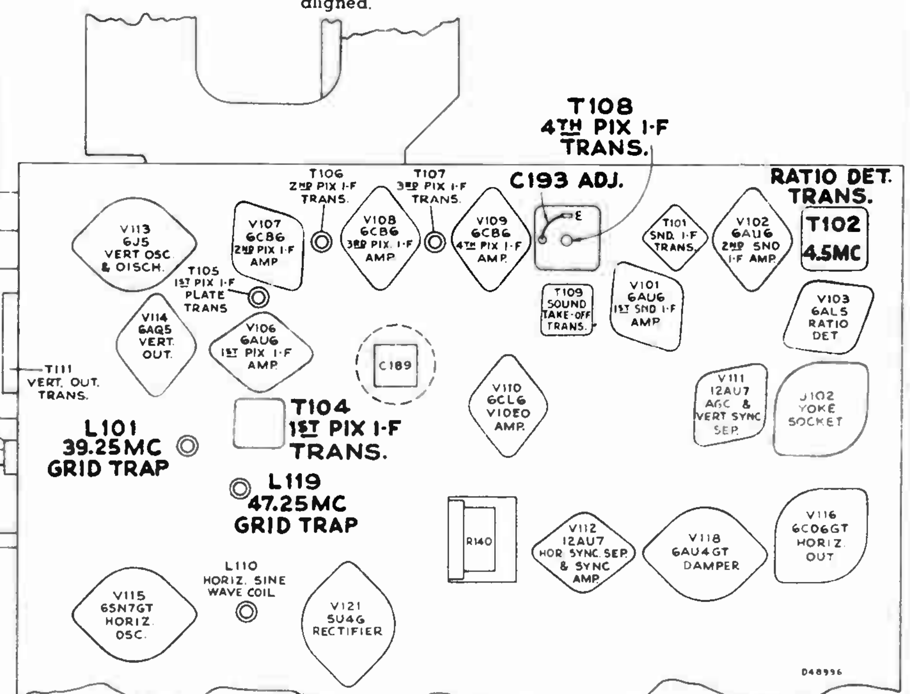


Figure 26—Bottom Chassis Adjustments

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 30,000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V1 (V2)	6X8	Mixer	30,000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	—	—	
			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	—	—	
KRK22D or KRK30C		R-F Oscillator	30,000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	—	—	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	—	—	
V2 (V1)	6BQ7A	R-F Amplifier	30,000 Mu. V. Signal	6	170	—	—	8	0.1	7		—	—	
			No Signal	6	133	—	—	8	1.1	7	0	—	—	
KRK22D or KRK30C		R-F Amplifier	30,000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	
V101	6AU6	1st Sound I-F Amp.	30,000 Mu. V. Signal	5	110	6	120	7	0.9	1	—0.08	—	—	
			No Signal	5	104	6	114	7	0.88	1	—0.24	—	—	
V102	6AU6	2nd Sound I-F Amp.	30,000 Mu. V. Signal	5	114	6	124	7	0	1	—4.8	—	—	
			No Signal	5	111	6	121	7	0	1	—2.95	—	—	
V103	6AL5	Ratio Detector	30,000 Mu. V. Signal	2 7	—10.3 1.22	—	—	5 1	1.22 10.7	—	—	—	—	
			No Signal	2 7	—7.5 3.5	—	—	5 1	2.9 7.9	—	—	—	—	
V104	6AV6	1st Audio Amplifier	30,000 Mu. V. Signal	7	92	—	—	2	0	1	—0.7	—	—	At min. volume
			No Signal	7	91	—	—	2	0	1	—0.88	—	—	
V104	6AV6	R-F Bias Clamp	30,000 Mu. V. Signal	5-6	—5-1	—	—	—	—	—	—	—	—	
			No Signal	5-6	.56	—	—	—	—	—	—	—	—	
V105	6AQ5	Audio Output	30,000 Mu. V. Signal	5	249	6	264	2	16	7	0	—	—	At min. volume
			No Signal	5	243	6	256	2	15.3	7	0	—	—	
V106	6AU6	1st Pix. I-F Amplifier	30,000 Mu. V. Signal	5	236	6	257	7	0.03	1	—7.9	—	—	
			No Signal	5	117	6	130	7	1.08	1	0.07	—	—	
V107	6CB6	2nd Pix. I-F Amplifier	30,000 Mu. V. Signal	5	235	6	256	2	0.02	1	—7.9	—	—	
			No Signal	5	107	6	115	2	0.47	1	0.07	—	—	
V108	6CB6	3rd Pix. I-F Amplifier	30,000 Mu. V. Signal	5	109	6	117	2	1.0	1	0	—	—	
			No Signal	5	104	6	111	2	.96	1	0	—	—	
V109	6CB6	4th Pix. I-F Amplifier	30,000 Mu. V. Signal	5	196	6	129	2	1.8	1	0	—	—	
			No Signal	5	185	6	123	2	1.65	1	0	—	—	

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V110	6CL6	Video Amplifier	30,000 Mu. V. Signal	6	131	3-8	179	1	1.14	2-9	*—2.8	—	—	*Depends on picture
			No Signal	6	120	3-8	128	1	1.05	2-9	*—1.03	—	—	*Depends on picture
V111A	12AU7	AGC Rectifier	30,000 Mu. V. Signal	1	—43	—	—	3	130	2	107	—	—	AGC control set for normal operation
			No Signal	1	.04	—	—	3	124	2	62	—	—	
V111B	12AU7	Vert. Sync. Separator	30,000 Mu. V. Signal	6	53	—	—	8	0	7	65	—	—	
			No Signal	6	66	—	—	8	0	7	10.5	—	—	
V112A	12AU7	Hor. Sync. Separator	30,000 Mu. V. Signal	1	305	—	—	3	190	2	110	—	—	
			No Signal	1	296	—	—	3	118	2	97	—	—	
V112B	12AU7	Sync. Amplifier	30,000 Mu. V. Signal	6	52	—	—	8	0	7	—0.49	—	—	
			No Signal	6	50	—	—	8	0	7	—0.27	—	—	
V113	6J5	Vert. Osc. & Discharge	30,000 Mu. V. Signal	3	102	—	—	8	.015	5	—36.5	—	—	
			No Signal	3	100	—	—	8	.015	5	—34.5	—	—	
V114	6AQ5	Vertical Output	30,000 Mu. V. Signal	5	294	6	309	2	24	1	.04	—	—	
			No Signal	5	288	6	300	2	23	1	.03	—	—	
V115	6SN7GT	Horizontal Osc. Control	30,000 Mu. V. Signal	2	306	—	—	3	5.5	1	—25	—	—	
			No Signal	2	298	—	—	3	—4.6	1	—26.8	—	—	
		Horizontal Oscillator	30,000 Mu. V. Signal	5	191	—	—	6	0	4	—85	—	—	
			No Signal	5	187	—	—	6	0	4	—92	—	—	
V116	6BQ6	Horizontal Output	30,000 Mu. V. Signal	Cap	* 135	4	185	8	24	5	—16	—	—	*High Voltage Pulse Present (40 Megs. in series with VTVM)
			No Signal	Cap.	* 130	4	185	8	24	5	—15.5	—	—	
V117	1B3GT	H. V. Rectifier	30,000 Mu. V. Signal	Cap	*	—	—	2 & 7	17,250	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	16,800	—	—	—	—	
V118	6AX4	Damper	30,000 Mu. V. Signal	5	302	—	—	3	*130	—	—	—	—	*High Voltage Pulse Present (40 Megs. in series with VTVM)
			No Signal	5	298	—	—	3	*125	—	—	—	—	
V119	212PAB	Kinescope	30,000 Mu. V. Signal	Cone	17,250	10	550	11	138	2	92	—	—	At average Brightness
			No Signal	Cone	16,800	10	530	11	127	2	89	—	—	
V120 V121	5U4G	Rectifiers	30,000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	320	—	—	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	313	—	—	—	—	

The schematic is shown in the latest condition at the time of printing.

All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

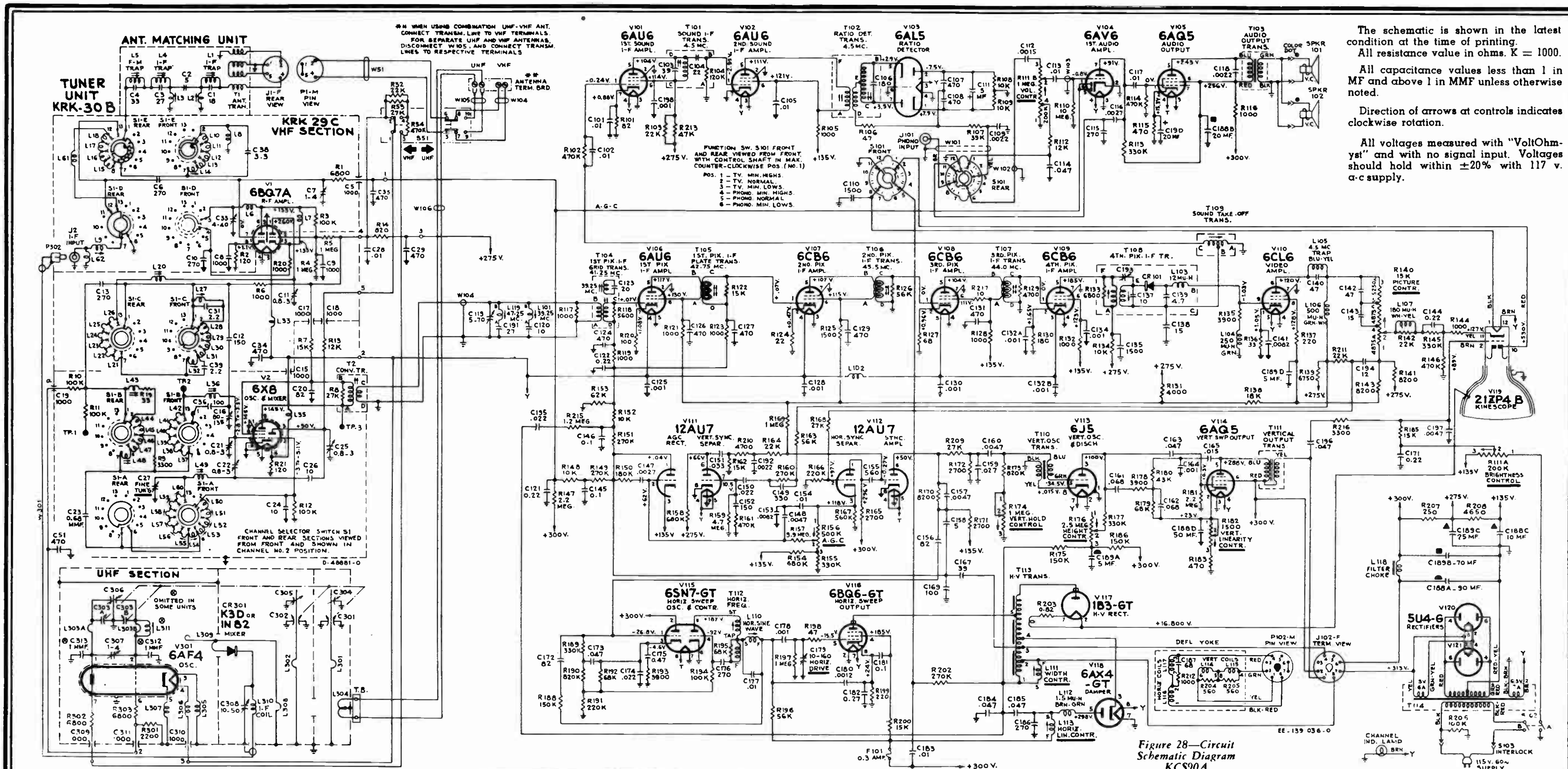


Figure 28—Circuit Schematic Diagram KCS90A

REPLACEMENT PARTS

SYMBOL NO.	STOCK NO.	DESCRIPTION
L48	78466	Coil—R.F. choke coil
L49	77859	Connector—R.F. grid switch return connector
L50, L51	79067	Coil—Heater choke coil
L52	77206	Coil—Filament choke coil
L53 to L57 Incl.		Part of Antenna matching transformer
L58		Part of S4
R1	504410	Resistor — Fixed, composition, 100,000 ohms, ±20%, ½ w.
R2	523312	Resistor — Fixed, composition, 12,000 ohms, ±10%, 2 w.
R3	523315	Resistor — Fixed, composition, 15,000 ohms, ±10%, 2 w.
R4		Part of T1
R5	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w. (Part of S2)
R6, R7	502410	Resistor—Fixed, composition, 100,000 ohms, ±10%, ½ w. (Part of S2)
R8	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. (Part of S3)
R9, R10	503510	Resistor—Fixed, composition, 1.0 megohm, ±10%, ½ w.
R11	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ w.
R12	504268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ w.
R13		Same as R1
R14	503182	Resistor—Fixed, composition, 820 ohms, ±10%, ½ w.
R15		Same as R11
S1	79068	Stator—Oscillator stator complete with rotor, coils and trimmer (C5, L1 to L11 Incl., L42)
S2	78800	Stator—Mixer stator complete with rotor, coils, capacitors and resistors (C6, C9, C13, L12 to L21 Incl., L43, L44, R5, R6, R7)
S3	78801	Stator—R.F. plate stator complete with rotor, coils, capacitors and resistors (C14, L22 to L31 Incl., L45, L46, R8)
S4	78802	Stator—R.F. grid stator complete with rotor and coils (L32 to L41 Incl.)
T1	78399	Transformer—Convertor transformer
T2	78396	Transformer—Antenna matching transformer complete (C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
C1 to C4 Incl.		Part of Antenna matching transformer
C5	77084	Capacitor — Ceramic, feed-thru, 1000 mmf.
C6	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v.
C7	76532	Trimmer—Adjustable, 1-4 mmf.
C8, C9	77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, —0%, 500 v.
C10	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. D.C. (Part of S4)
C11	77151	Trimmer—Adjustable, 0.8-3.0 mmf.
C12	78276	Capacitor—Fixed, ceramic, 150 mmf., ±10%, 500 v. D.C. (Part of S3)
C13	71599	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. D.C. (Part of S2)
C15		Same as C5
C16	78397	Trimmer—Mica, 80-150 mmf.
C17, to C19 Incl.		Same as C5
C20	78603	Capacitor—Fixed, ceramic, 82 mmf., ±10%, 500 v.
C21		Same as C11
C22	77913	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. (Part of S1)
C23	71504	Capacitor — Fixed, headed-lead, 0.68 mmf., ±20%, 500 v. D.C. (Part of S2)
C24	78247	Capacitor—Fixed, ceramic, 10 mmf., ±1 mmf., 500 v.
C25		Same as C11
C26	77865	Capacitor—Fixed, ceramic, 10 mmf., ±1.0 mmf., 500 v.
C27	79192	Trimmer—Ceramic, variable—fine tuning type
C28	73960	Capacitor—Fixed, ceramic, 10,000 mmf., 500 v.
C29	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 v.
C31		(Part of S3) Capacitor—Fixed, headed-lead type, 2.2 mmf., ±20%, 500 v. D.C.
C33	77616	Capacitor—Adjustable, mica, 4-40 mmf.
C34, C35		Same as C29
C36	75437	Capacitor—Fixed, ceramic, 100 mmf., ±20%, 500 v. D.C. (Part of S2)
C38	71503	Capacitor—Fixed, headed-lead type, 3.3 mmf., ±20%, 500 v. D.C. (Part of S5)
C39		Same as C31 (Part of S3)

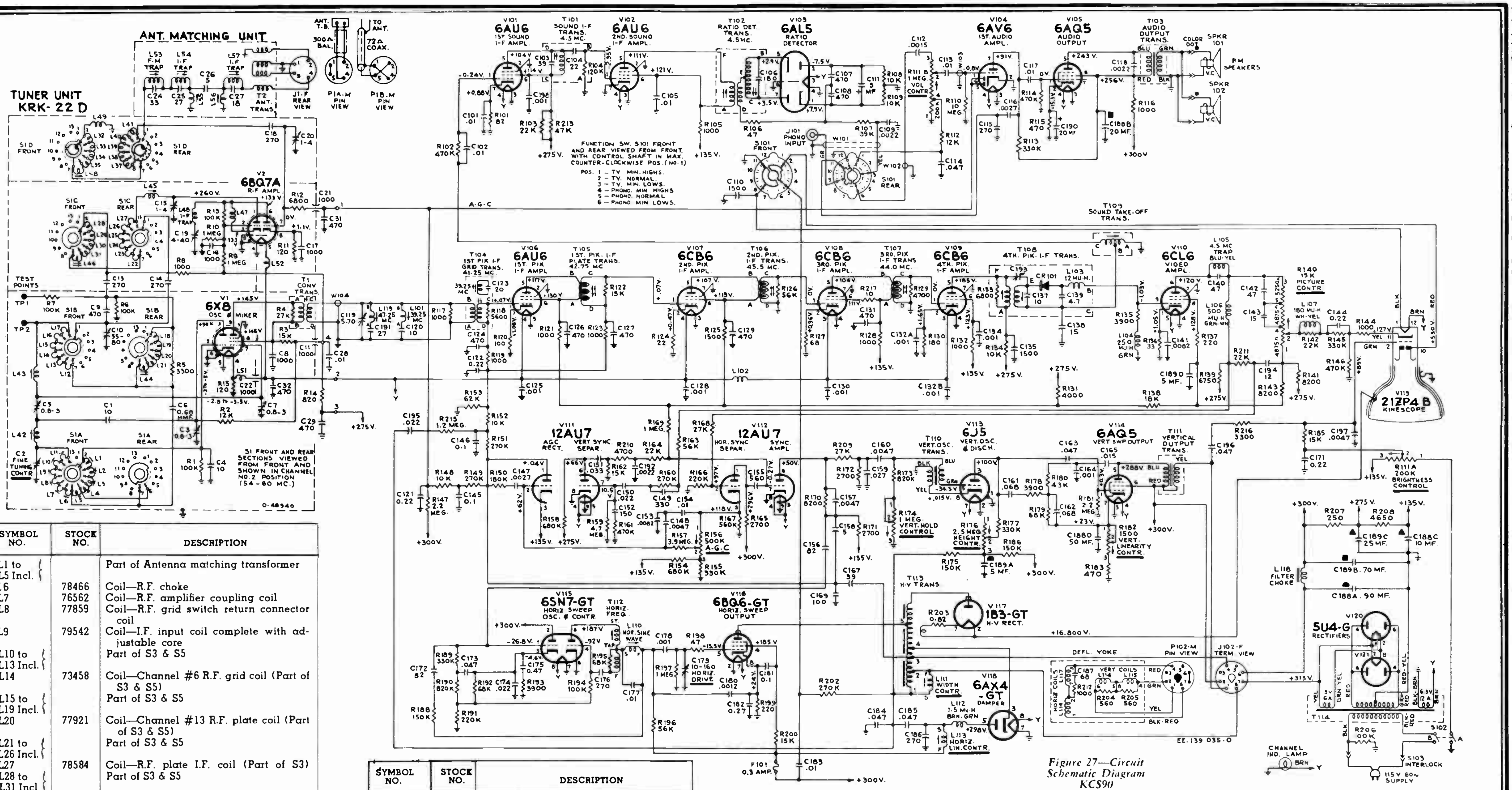


Figure 27—Circuit Schematic Diagram KCS90

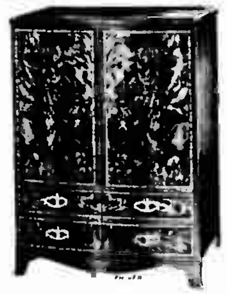
SYMBOL NO.	STOCK NO.	DESCRIPTION
L1 to L5 Incl.		Part of Antenna matching transformer
L6	78466	Coil—R.F. choke
L7	76562	Coil—R.F. amplifier coupling coil
L8	77859	Coil—R.F. grid switch return connector coil
L9	79542	Coil—I.F. input coil complete with adjustable core
L10 to L13 Incl.		Part of S3 & S5
L14	73458	Coil—Channel #6 R.F. grid coil (Part of S3 & S5)
L15 to L19 Incl.		Part of S3 & S5
L20	77921	Coil—Channel #13 R.F. plate coil (Part of S3 & S5)
L21 to L26 Incl.		Part of S3 & S5
L27	78584	Coil—R.F. plate I.F. coil (Part of S3)
L28 to L31 Incl.		Part of S3 & S5
L32	73460	Coil—Channel #6 R.F. plate coil (Part of S3 & S5)
L33	77206	Coil—Filament choke coil
L35	76763	Coil—Heater choke coil
L36	77919	Coil—Channel #13 mixer coil
L37 to L42 Incl.		Part of S1 & S2
L43	78583	Coil—Mixer I.F. coil (Part of S1 & S2)
L44 to L47 Incl.		Part of S1 & S2
L48	73874	Coil—Channel #6 mixer coil (Part of S1 & S2)
L49	77915	Coil—Channel #13 oscillator coil (Part of S1 & S2)
L50 to L60 Incl.		Part of S1 & S2
L61	78401	Coil—Channel #6 antenna coil
R1	502268	Resistor—Fixed, composition, 6800 ohms, ±20%, 1/2 w.
R2	502112	Resistor—Fixed, composition, 120 ohms, ±10%, 1/2 w.
R3	502410	Resistor — Fixed, composition, 100,000 ohms, ±20%, 1/2 w. (Part of S2)
R4, R5	502510	Resistor—Fixed, composition, 1 meg., ±10%, 1/2 w.

SYMBOL NO.	STOCK NO.	DESCRIPTION
R6	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, 1/2 w. (Part of S3)
R7	522315	Resistor — Fixed, composition, 15,000 ohms, ±10%, 2 w.
R8		Part of T2
R9	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, 1/2 w. (Part of S2)
R10, R11		Same as R3 (Part of S2)
R12		Same as R3
R13	522312	Resistor — Fixed, composition, 12,000 ohms, ±10%, 2 w.
R14	502182	Resistor—Fixed, composition, 820 ohms, ±10%, 1/2 w.
R19	502033	Resistor—Fixed, composition, 33 ohms, ±10%, 1/2 w. (Part of S2)
R20		Same as R6
R21		Same as R2
T1	78396	Transformer—Antenna matching transformer complete
T2	78399	Transformer—Convertor transformer (R8)
C301 to C303 Incl.	79553	Capacitor—Variable tuning capacitor

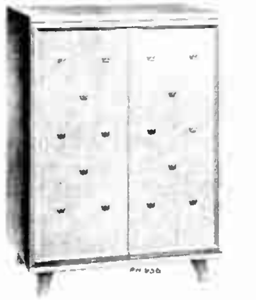
SYMBOL NO.	STOCK NO.	DESCRIPTION
C304, C305	79554	Stator—Oscillator stator assembly
C306	79555	Capacitor—Oscillator trimmer capacitor
C307	79556	Capacitor—Adjustable, ceramic, 0.8-3.5 mmf.
C308	79558	Capacitor—Trimmer, 10-50 mmf.
C309 to C311 Incl.	79559	Capacitor—Feed thru, 1000 mmf.
C312, C313	79560	Capacitor—Fixed, ceramic, 1 mmf., ±0.1 mmf., 500 v. D.C., non-insulated
CR301	77489	Rectifier—UHF diode crystal germanium rectifier
L301, L302		Coil—R.F. tank plate
L303	79557	Tank Assembly—complete with capacitor (C7)
L304	79564	Board—Antenna terminal board assembly
L305 to L307 Incl.	79565	Choke—R.F. choke
L308, L309		Coil—Mixer coupling coil for oscillator & output section
L310	79567	Coil—I.F. output coil 0.15 microhenries

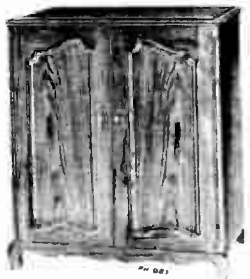
SYMBOL NO.	STOCK NO.	DESCRIPTION
L311	79566	Coil—Oscillator loop coil
R301	502222	Resistor—Fixed, composition, 2200 ohms, ±10%, 1/2 w.
R302	512268	Resistor—Fixed, composition, 6800 ohms, ±10%, 1 w.
R303	502268	Resistor—Fixed, composition, 6800 ohms, ±10%, 1/2 w.
C101, C102	73960	Capacitor—Fixed, ceramic, 0.01 mf., +100%, —0%, 500 v.
C103, C104		Part of T101
C105		Same as C101
C106		Part of T102
C107, C108	39644	Capacitor—Fixed, mica, 470 mmf., ±5%, 500 v.
C109	73595	Capacitor—Fixed, paper, 0.0022 mf., ±5%, 600 v.
C110	73748	Capacitor—Fixed, ceramic, 1500 mmf., +100%, —0%, 500 v.
C111	74521	Capacitor—Electrolytic, 5 mf., +100%, —0%, 50 v.

SYMBOL NO.	STOCK NO.	DESCRIPTION
C112	76508	Capacitor—Fixed, paper, 0.0015 mf., ±5%, 600 v.
C113	73561	Capacitor—Fixed, paper, 0.01 mf., ±10%, 400 v.
C114	73558	Capacitor—Fixed, paper, 0.047 mf., ±10%, 200 v.
C115	47617	Capacitor—Fixed, ceramic, 270 mmf., ±10%, 500 v.
C116	73599	Capacitor—Fixed, paper, 0.0027 mmf., ±10%, 600 v.
C117		Same as C113
C118		Same as C109
C119	71496	Capacitor—Adjustable, mica, 5/70 mmf.
C120	53511	Capacitor—Fixed, ceramic, 10 mmf., ±5%, 500 v.
C121, C122	78905	Capacitor—Fixed, paper, 0.22 mf., ±20%, 200 v.
C123		Part of T104
C124	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 v.
C125	73960	Capacitor—Fixed, ceramic, 0.001 mf., +100%, —0%, 500 v. D.C.
C126	78622	Capacitor—Fixed, ceramic, 470 mmf., ±20%, 500 v. D.C.
C127		Same as C124
C128		Same as C125
C129		Same as C126
C130		Same as C125
C131		Same as C126
C132A,B	97947	Capacitor—Fixed, ceramic, 0.001/0.001 mf., +100%, —0%, 500 v. D.C.
C134	78623	Capacitor—Fixed, ceramic, 1000 mmf., ±20%, 500 v. D.C.
C135	75166	Capacitor—Stand-off capacitor, 1500 mmf., 500 volts
C137		Part of T108
C138	39044	Capacitor—Fixed, ceramic, 15 mmf., ±10%, 500 v.
C139		Part of T108
C140		Part of L105
C141	79019	Capacitor—Fixed, paper, 0.0082 mf., ±10%, 400 v.
C142	39042	Capacitor—Fixed, ceramic, 47 mmf., ±10%, 500 v.
C143		Same as C138
C144	73794	Capacitor—Fixed, paper, 0.22 mf., ±10%, 400 v.
C145, C146	73784	Capacitor—Fixed, paper, 0.1 mf., ±10%, 200 v.
C147		Same as C116
C148	73920	Capacitor—Fixed, paper, 0.0047 mf., ±5%, 400 v.
C149	39640	Capacitor—Fixed, mica, 330 mf., ±5%, 500 v.
C150	73562	Capacitor—Fixed, paper, 0.022 mf., ±10%, 400 v.
C151	73552	Capacitor—Fixed, paper, 0.033 mf., ±10%, 400 v.
C152	39632	Capacitor—Fixed, mica, 150 mmf., ±10%, 500 v. D.C.
C153		Same as C141
C154	73561	Capacitor—Fixed, paper, 0.01 mf., ±10%, 400 v.
C155	74250	Capacitor—Fixed, mica, 560 mmf., ±10%, 1000 v.
C156	76474	Capacitor—Fixed, mica, 82 mf., ±5%, 1000 v.
C157	79017	Capacitor—Fixed, paper, 0.0047 mf., ±20%, 400 v.
C158	72809	Capacitor—Fixed, mica, 5 mmf., ±20%, 1500 v.
C159	73554	Capacitor—Fixed, paper, 0.027 mf., ±10%, 400 v. D.C.
C160	73920	Capacitor—Fixed, paper, 0.0047 mf., ±5%, 600 v.
C161	79543	Capacitor—Fixed, paper, 0.068 mf., ±10%, 600 v.
C162	73792	Capacitor—Fixed, paper, 0.068 mf., ±10%, 200 v. D.C.
C163	73592	Capacitor—Fixed, paper, 0.047 mf., ±10%, 600 v.
C164	78980	Capacitor—Fixed, paper, 0.001 mf., ±10%, 1600 v.
C165	73809	Capacitor—Fixed, paper, 0.015 mf., ±10%, 1000 v. D.C.
C167	76574	Capacitor—Fixed, ceramic, 39 mmf., ±10%, 3500 v.
C169	76578	Capacitor—Fixed, mica, 100 mmf., ±10%, 1000 v.
C171		Same as C144
C172		Same as C156
C173	73553	Capacitor—Fixed, paper, 0.047 mf., ±10%, 400 v.
C174		Same as C150
C175	73787	Capacitor—Fixed, paper, 0.47 mf., ±10%, 200 v.
C176	76579	Capacitor—Fixed, mica, 270 mmf., ±5%, 1000 v.
C177	73594	Capacitor—Fixed, paper, 0.01 mf., ±5%, 600 v.
C178	75643	Capacitor—Fixed, paper, 0.001 mf., ±5%, 1000 v.
C179	79376	Trimmer—Mica, 10-160 mmf.
C180	76995	Capacitor—Fixed, paper, 0.0012 mf., ±5%, 600 v.
C181	73557	Capacitor—Fixed, paper, 0.1 mf., ±5%, 600 v.
C182	73786	Capacitor—Fixed, paper, 0.27 mf., ±10%, 200 v.
C183		Same as C113
C184, C185	73597	Capacitor—Fixed, paper, 0.047 mf., ±10%, 1000 v.
C186	79022	Capacitor—Fixed, mica, 270 mmf., ±20%, 1000 v.
C187		Part of Yoke
C188 A,B,C,D	79391	Capacitor—Fixed, electrolytic, 90-20-10-50 mfd., 400-400-400-50 volts respectively
C189 A,B,C,D	79392	Capacitor—Fixed, electrolytic, 5-70-25-5 mfd., 450-400-400-400 volts respectively
C190	79380	Capacitor—Electrolytic, 20 mf., —10%, +250%, 25 v.
C191	79488	Capacitor—Fixed, ceramic, 27 mf., ±5%, 500 v.
C192		Same as C109
C193		Part of T108
C194	33380	Capacitor—Fixed, ceramic, 12 mmf., ±5%, 500 v.
C195	73798	Capacitor—Fixed, paper, 0.022 mf., ±10%, 600 v.
C196		Same as C163
C197		Same as C157
C198		Same as C125
F101	78214	Fuse—0.3 amp.
J101	35787	Connector—Phone input connector
J102	68590	Connector—Deflection yoke connector female
L101	79383	Transformer—1st I.F. grid trap
L102	73477	Coil—Choke coil
L103		Part of T108
L104	98482	Coil—Peaking, 250 UH
L105	76482	Trap—4.5 MC trap (with C140)
L106	75252	Coil—Peaking, 500 UH
L107	76647	Coil—Peaking, 180 UH
L110	79161	Coil—Horizontal sine wave coil
L111	76441	Coil—Width coil
L112	76640	Reactor—R.F. choke, 1.5 UH
L113	76442	Coil—Horizontal linearity coil
L114 to L117 Incl.		Part of Yoke
L118	77676	Choke—Filter choke
L119	79390	Transformer—1st I.F. grid trap
R101	503082	Resistor—Fixed, composition, 82 ohms, ±10%, ½ w.
R102	504447	Resistor—Fixed, composition, 470,000 ohms, ±20%, ½ w.
R103	523322	Resistor—Fixed, composition, 22,000 ohms, ±10%, 2 w.
R104		Part of T101
R105	503210	Resistor—Fixed, composition, 1000 ohms, ±10%, ½ w.
R106	503047	Resistor—Fixed, composition, 47 ohms, ±10%, ½ w.
R107	503339	Resistor—Fixed, composition, 39,000 ohms, ±10%, ½ w.
R108, R109	502310	Resistor—Fixed, composition, 10,000 ohms, ±5%, ½ w.
R110	504610	Resistor—Fixed, composition, 10 meg., ±20%, ½ w.
R111A, B	77655	Control—Volume "On-Off" brightness control
R112	503312	Resistor—Fixed, composition, 12,000 ohms, ±10%, ½ w.
R113	504433	Resistor—Fixed, composition, 330,000 ohms, ±20%, ½ w.
R114		Same as R102
R115	513147	Resistor—Fixed, composition, 470 ohms, ±10%, 1 w.
R116	523210	Resistor—Fixed, composition, 1000 ohms, ±10%, 2 w.
R117	504210	Resistor—Fixed, composition, 1000 ohms, ±10%, ½ w.
R118		Part of T104
R119	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w.
R120	502110	Resistor—Fixed, composition, 100 ohms, ±5%, ½ w.
R121		Same as R119
R122	36714	Resistor—Fixed, composition, 15,000 ohms, ±5%, ½ w.
R123		Same as R119
R124	502022	Resistor—Fixed, composition, 22 ohms, ±5%, ½ w.
R125	512215	Resistor—Fixed, composition, 1500 ohms, ±20%, ½ w.
R126	502356	Resistor—Fixed, composition, 56,000 ohms, ±5%, ½ w.
R127	502068	Resistor—Fixed, composition, 68 ohms, ±5%, ½ w.
R128		Same as R119
R129	502247	Resistor—Fixed, composition, 4700 ohms, ±5%, ½ w.
R130	502118	Resistor—Fixed, composition, 180 ohms, ±5%, ½ w.
R131	77668	Resistor—Fixed, w.w., 4000 ohms, ±10%, 7 w.
R132		Same as R119
R133		Part of T108
R134	523310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 2 w.
R135	502239	Resistor—Fixed, composition, 3900 ohms, ±5%, ½ w.
R136	503033	Resistor—Fixed, composition, 33 ohms, ±10%, ½ w.
R137	504122	Resistor—Fixed, composition, 220 ohms, ±20%, ½ w.
R138	513318	Resistor—Fixed, composition, 18,000 ohms, ±10%, 1 w.
R139	76642	Resistor—Fixed, w.w., 6750 ohms, ±10%, 10 w.
R140	76445	Control—Contrast control
R141	523282	Resistor—Fixed, composition, 8200 ohms, ±10%, 2 w.
R142		Part of L107
R143	513282	Resistor—Fixed, composition, 8200 ohms, ±10%, 1 w.
R144	504210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w.
R145	503433	Resistor—Fixed, composition, 330,000 ohms, ±10%, ½ w.
R146	503447	Resistor—Fixed, composition, 470,000 ohms, ±10%, ½ w.
R147	512522	Resistor—Fixed, composition, 2.2 meg., ±5%, 1 w.
R148	503310	Resistor—Fixed, composition, 10,000 ohms, ±10%, ½ w.
R149	502427	Resistor—Fixed, composition, 270,000 ohms, ±5%, ½ w.
R150	503418	Resistor—Fixed, composition, 180,000 ohms, ±10%, ½ w.
R151		Same as R149
R152		Same as R148
R153	502362	Resistor—Fixed, composition, 62,000 ohms, ±5%, ½ w.
R154	502468	Resistor—Fixed, composition, 680,000 ohms, ±10%, ½ w.
R155		Same as R145
R156	78808	Control—AGC control
R157	503539	Resistor—Fixed, composition, 3.9 meg., ±10%, ½ w.
R158	503468	Resistor—Fixed, composition, 680,000 ohms, ±10%, ½ w.
R159	503547	Resistor—Fixed, composition, 4.7 meg., ±10%, ½ w.
R160	503427	Resistor—Fixed, composition, 270,000 ohms, ±10%, ½ w.
R162	36714	Resistor—Fixed, composition, 15,000 ohms, ±10%, ½ w.
R163	502356	Resistor—Fixed, composition, 56,000 ohms, ±10%, ½ w.
R164	503322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R165	503227	Resistor—Fixed, composition, 2700 ohms, ±10%, ½ w.
R166	503422	Resistor—Fixed, composition, 220,000 ohms, ±10%, ½ w.
R167	503456	Resistor—Fixed, composition, 560,000 ohms, ±10%, ½ w.
R168	503327	Resistor—Fixed, composition, 27,000 ohms, ±10%, ½ w.
R169	503310	Resistor—Fixed, composition, 1 meg., ±10%, ½ w.
R170		Same as R143
R171	30733	Resistor—Fixed, composition, 3300 ohms, ±5%, ½ w.
R172	503318	Resistor—Fixed, composition, 18,000 ohms, ±10%, ½ w.
R173	503482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ w.
R174	79384	Control—Vertical hold control
R175	503415	Resistor—Fixed, composition, 150,000 ohms, ±10%, ½ w.
R176	78807	Control—Height control
R177		Same as R113
R178	502239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ w.
R179	502368	Resistor—Fixed, composition, 68,000 ohms, ±10%, ½ w.
R180	522343	Resistor—Fixed, composition, 43,000 ohms, ±5%, 2 w.
R181	503522	Resistor—Fixed, composition, 2.2 meg., ±20%, ½ w.
R182	79491	Control—Vertical linearity control
R183	514147	Resistor—Fixed, composition, 470 ohms, ±20%, 1 w.
R185	504315	Resistor—Fixed, composition, 15,000 ohms, ±20%, ½ w.
R186		Same as R175
R188	503415	Resistor—Fixed, composition, 150,000 ohms, ±10%, ½ w.
R189	503433	Resistor—Fixed, composition, 330,000 ohms, ±10%, ½ w.
R190		Same as R173
R191	503422	Resistor—Fixed, composition, 220,000 ohms, ±10%, ½ w.
R192	503368	Resistor—Fixed, composition, 68,000 ohms, ±10%, ½ w.
R193	503239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ w.
R194	513410	Resistor—Fixed, composition, 100,000 ohms, ±10%, 1 w.
R195		Same as R192
R196	513356	Resistor—Fixed, composition, 56,000 ohms, ±10%, 1 w.
R197		Same as R169
R198	504047	Resistor—Fixed, composition, 47 ohms, ±20%, ½ w.
R199	76410	Resistor—Fixed, wire wound, 220 ohms, ±10%, 4 w.
R200	523315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 w.
R202		Same as R160
R203	76382	Resistor—Fixed, w.w., 0.82 ohms, ±5%, ⅓ w.
R204, R205		Part of Yoke
R206	514410	Resistor—Fixed, composition, 100,000 ohms, ±20%, 1 w.
R207	79377	Resistor—Fixed, w.w., 250 ohms, ±10%, 7 w.
R208	76989	Resistor—Fixed, w.w., 4650 ohms, ±10%, 7 w.
R209	513327	Resistor—Fixed, composition, 27,000 ohms, ±10%, 1 w.
R210	503247	Resistor—Fixed, composition, 4700 ohms, ±10%, ½ w.
R211		Same as R164
R212		Part of Yoke
R213	514347	Resistor—Fixed, composition, 47,000 ohms, ±10%, 1 w.
R215	503512	Resistor—Fixed, composition, 1.2 meg., ±10%, ½ w. (in yoke)
R216	503233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w.
R217	502010	Resistor—Fixed, composition, 10 ohms, ±20%, ½ w.
S101	77656	Control—Rotary switch control tone
T101	76981	Transformer—1st sound transformer
T102	77112	Transformer—Ratio detector transformer
T103	77821	Transformer—Audio output transformer
T104	79388	Transformer—1st I.F. grid transformer
T105, T106, T107	76433	Transformer—1st, 2nd & 3rd pix transformer
T108	79389	Transformer—4th pix I.F. transformer
T109	79386	Transformer—Sound take-off transformer
T110	79379	Transformer—Vertical oscillator transformer
T111	79394	Transformer—Vertical output transformer
T112	79160	Coil—Horizontal frequency coil
T113	78810	Transformer—High voltage transformer
T114	79387	Transformer—Power transformer



Models 24-D-542 24-D-542U "Chesterton" Mahogany





Models 24-D-543, 24-D-543U "Freemont" Natural Walnut, Blonde Tropical Hardwood

Models 24-D-544, 24-D-544U "Prentiss" Natural Walnut, Mahogany

PICTURE SIZE . . . 327 square inches on a 24CP4A Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 24-D-542, 24-D-543 and 24-D-544

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 24-D-542U, 24-D-543U and 24-D-544U

Any of 70 UHF channels . . . . 470 mc. to 890 mc.

Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency . . . . 45.75 mc.

Sound I-F Carrier Frequency . . . . 41.25 mc.

POWER RATING . . . . 275 watts

AUDIO POWER OUTPUT RATING . . . . . . 4.5 watts max.

VIDEO RESPONSE . . . . To 3.6 mc.

SWEEP DEFLECTION . . . . Magnetic

FOCUS . . . . Magnetic

ANTENNA INPUT IMPEDANCE

Models 24-D-542, 24-D-543 and 24-D-544

Choice: 300 ohms balanced or 72 ohms unbalanced.

Models 24-D-542U, 24-D-543U and 24-D-544U

UHF—300 ohms balanced.

VHF—300 ohms balanced.

CHASSIS DESIGNATIONS

CHASSIS	TUNER	KINE-SCOPE	MODELS
KCS89	KRK22D	24CP4A	24-D-542 24-D-543 (Horizontal Mounting)
KCS89A	KRK30B	24CP4A	24-D-542U 24-D-543U (Horizontal Mounting)
KCS89B	KRK22D	24CP4A	24-D-544 (Vertical Mounting)
KCS89C	KRK30B	24CP4A	24-D-544U (Vertical Mounting)

RCA TUBE COMPLEMENT

Tube Used — Function

Tuner KRK22D (Models with VHF only)

(1) RCA 6BQ7A . . . . R-F Amplifier

(2) RCA 6X8 . . . . R-F Oscillator and Mixer

RCA TUBE COMPLEMENT

Tube Used — Function

Tuner KRK30B (UHF/VHF Models)

(1) RCA 6AF4 . . . . UHF Oscillator

(2) RCA 6BQ7A . . . . VHF R-F Amplifier / UHF I-F Amplifier

(3) RCA 6X8 . . . . VHF R-F Oscillator & Mixer / UHF I-F Amplifier

A K3D or a 1N82 crystal is used as the UHF mixer.

All Models

(1) RCA 6AV6 . . . . 1st Picture I-F Amplifier

(2) RCA 6CB6 . . . . 2nd Picture I-F Amplifier

(3) RCA 6CB6 . . . . 3rd Picture I-F Amplifier

(4) RCA 6CB6 . . . . 4th Picture I-F Amplifier

(5) RCA 6CL6 . . . . Video Amplifier

(6) RCA 6AU6 . . . . 1st Sound I-F Amplifier

(7) RCA 6AU6 . . . . 2nd Sound I-F Amplifier

(8) RCA 6AL5 . . . . Ratio Detector

(9) RCA 6AV6 . . . . 1st Audio Amplifier

(10) RCA 6AQ5 . . . . Audio Output

(11) RCA 12AU7 . . . . Vertical Sync Separator and AGC

(12) RCA 12AU7 . . . Horiz. Sync Separator and Sync Amplifier

(13) RCA 6J5 . . . . Vert. Sweep Osc. and Discharge

(14) RCA 6AQ5 . . . . Vertical Sweep Output

(15) RCA 6SN7GT . . . Horizontal Sweep Oscillator and Control

(16) RCA 6CD6G . . . . Horizontal Sweep Output

(17) RCA 6AU4GT . . . . Damper

(18) RCA 1B3GT . . . . High Voltage Rectifier

(19) RCA 5U4G (2 tubes) . . . . Rectifiers

(20) RCA 24CP4A . . . . Kinescope

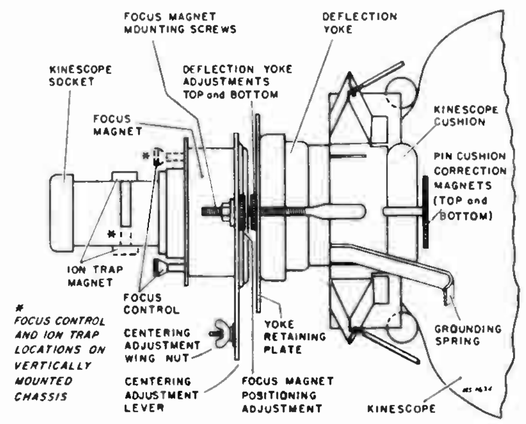


Figure 3—Yoke and Focus Magnet Adjustments

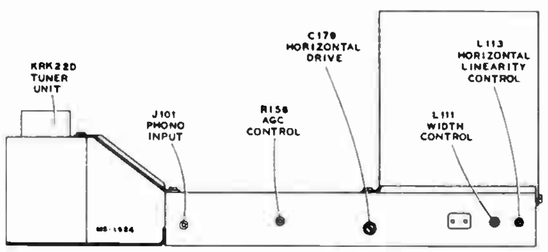


Figure 4—Rear Chassis Adjustments

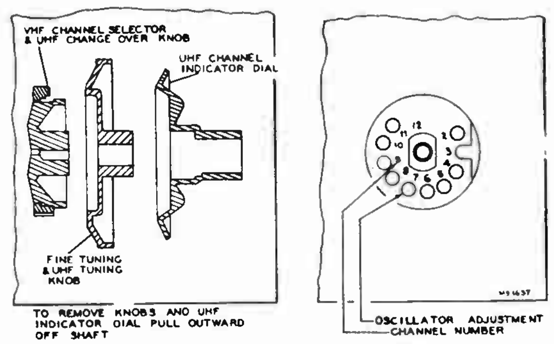


Figure 6—KRK30B VHF R-F Oscillator Adjustment

CHECK OF HORIZONTAL OSCILLATOR ADJUSTMENT.—Turn the horizontal (freq.) control to the extreme clockwise position. The picture should be out of sync, with a minimum of twelve bars slanting downward to the left. Turn the control counter-clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 1½ to 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional counter-clockwise rotation of the control. The picture should remain in sync for approximately two full turns of additional counter-clockwise rotation of the control. Continue counter-clockwise rotation until the picture falls out of sync. Rotation beyond the fall-out position should produce between 2 and 5 bars before interrupted oscillation (motorboat occurs). Interrupted oscillation (motorboat) should be reached before full counter-clockwise rotation.

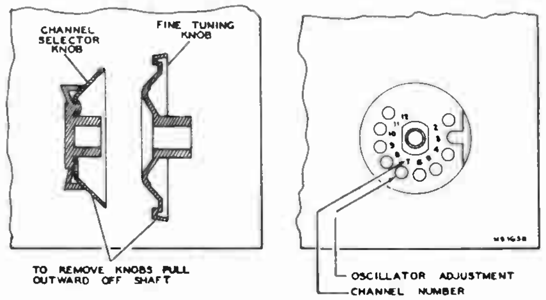


Figure 5—KRK22D R-F Oscillator Adjustments

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges

35 to 90 mc., 1 mc. to 12 mc. sweep width

170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generators (two) to provide the following frequencies with crystal accuracy (See Sound Take-Off Alignment on page 15):

Intermediate frequencies

4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

All Models

Note: All alignment adjustments should be made with cores at chassis end of coils except T108 (top) which should be peaked with core at end of coil away from chassis.

Connect the i-f signal generator, in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R152, R153 and C122 and to ground. Turn the AGC control to minimum.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R152, R153 and C122. The second battery will be used later.

Set the bias to produce approximately —5.0 volts of bias at the junction of R152, R153 and C122.

Connect the "VoltOhmyst" to pin 9 of V110 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at pin 9 of V110 with —5.0 volts of i-f bias at the junction of R152, R153 and C122.

44.0 mc. T107

45.5 mc. T106

42.75 mc. T105

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the final adjustment is made.

39.25 mc. L101

41.25 mc. . . . . T104 top core

47.25 mc. L119

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 24-D-542, 24-D-543 and 24-D-544

To align T2 and T104, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner case.

Set the channel selector to channel 4.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R121 and R125.

Short the grids of the third and fourth picture I-F amplifiers to ground, pin 1 of V108 and V109.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Set the sweep output for 0.5 volts peak-to-peak on the oscilloscope. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C119 across terminals "A" and "F" of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T1 (top) and T104 (top and bottom) for maximum response at 45.75 mc. at 75% of maximum response.

Adjust the shunt trimmer C119 until 42.25 mc. is at 75% response with respect to the low frequency shoulder as shown in Figure 9. Readjust T1 and T104 if necessary to obtain proper wave shape, see Figure 9. Maximum allowable tilt is 25%.

To align the fourth picture i-f transformer T108 connect the sweep generator to the fourth picture i-f grid, pin 1 of V109. Couple the signal generator loosely to obtain markers.

Connect the oscilloscope to pin 9 of V110 and set to read 3 to 5 volts peak-to-peak.

Adjust T108 top and bottom cores for maximum gain and curve shape as shown in Figure 12.

Adjust C193 to place the 41.25 mc. marker at 80% and 45.75 mc. marker at 90%. Readjust T108 for flat top curve as shown in figure 12.

NOTE: C193 is incorporated as part of T108, fourth picture I-F transformer. Adjustment is made by varying the penetration of the insulated lead, from terminal "E", into the ceramic sleeve at the bottom of T108 as seen in figure 26 on page 16. Care should be taken when adjusting to prevent damage to the lead or its insulation.

Remove the 180 ohm resistor and the shorts on pin 1 of V108 and V109.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R152, R153 and C122.

Connect the sweep generator to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

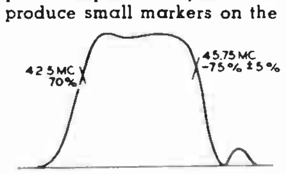


Figure 9—KRK22D T1 and T104 Response

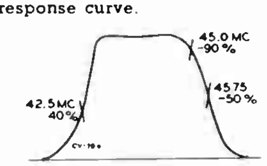


Figure 10—Overall I-F Response

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 30 and 40 times down with curve as shown in Figure 10.

Move the sweep generator to the antenna terminals. Connect —3.0 volts bias to pin 5 of V103. Adjust T106 and T107 slightly to correct for any overall tilt while switching from channel to channel.

Models 24-D-542U, 24-D-543U and 24-D-544U

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R121 and R125.

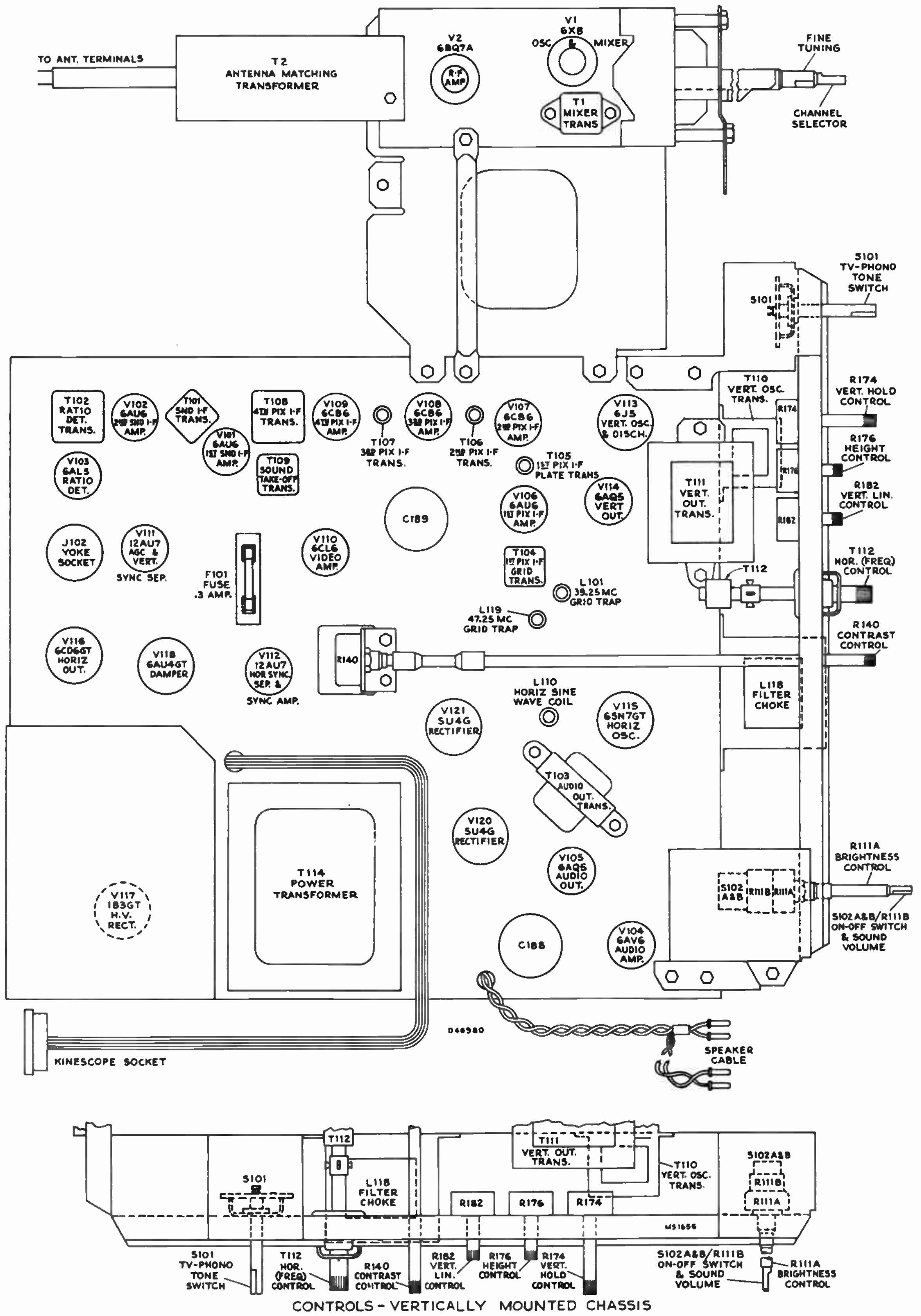


Figure 7—Chassis Top View (shown with KRK22D Tuner)

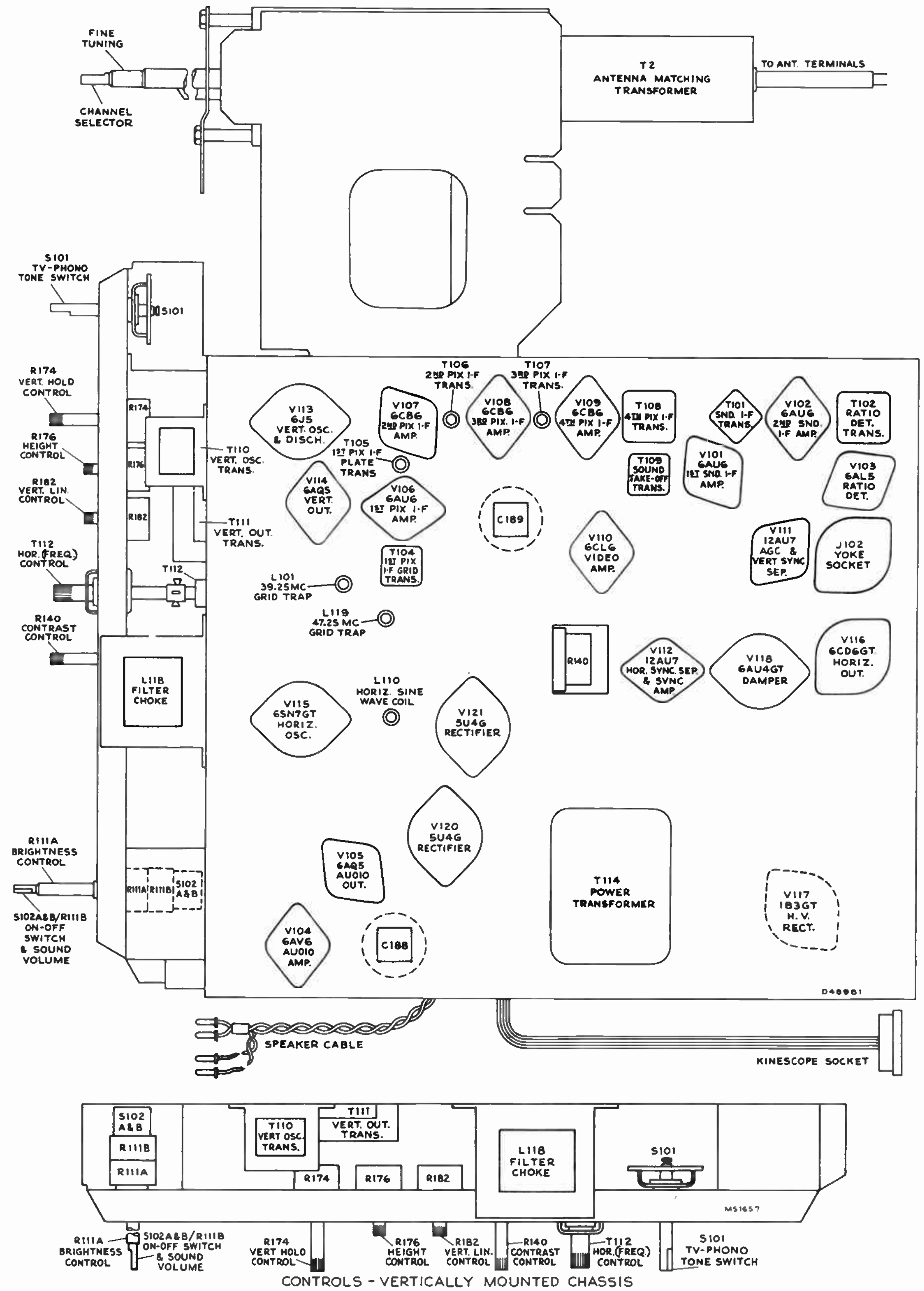


Figure 8—Chassis Bottom View (shown with KRK22D Tuner)

Short the grids of the third and fourth picture I-F amplifiers to ground, pin 1 of V108 and V109.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Set the sweep output for 0.5 volts peak-to-peak on the oscilloscope. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C119 across terminals "A" and "F" of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (top and bottom) for maximum gain with 45.75 mc. at 75% of maximum response.

Adjust the shunt trimmer C119 until 42.25 mc. is at 75% response with respect to the low frequency shoulder as shown in Figure 11. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 11. Maximum allowable tilt is 25%.

To align the fourth picture I-F transformer T108, connect the sweep generator to the fourth picture i-f grid, pin 1 of V109. Couple the signal generator loosely to obtain markers.

Connect the oscilloscope to pin 9 of V110 and set to read 3 to 5 volts peak-to-peak.

Adjust T108 top and bottom cores for maximum gain and curve shape as shown in Figure 12.

Adjust C193 to place the 41.25 mc. marker at 80% and 45.75 mc. marker at 90%. Readjust T108 for flat top curve as shown in Figure 12.

NOTE: C193 is incorporated as part of T108, fourth picture I-F transformer. Adjustment is made by varying the penetration of the insulated lead, from terminal "E", into the ceramic sleeve at the bottom of T108 as seen in figure 26 on page 16. Care should be taken when adjusting to prevent damage to the lead or its insulation.

Remove the 180 ohm resistor and the shorts on pin 1 of V108 and V109.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R152, R153 and C122.

Connect the sweep generator to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 0.5 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

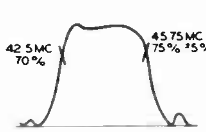


Figure 11—KRK30B T2 and T104 Response

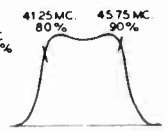


Figure 12—T108—4th Picture I-F Response

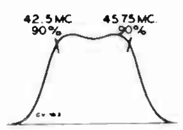


Figure 13—KRK30B L9 and C308 I-F Response

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 30 and 40 times down with curve as shown in Figure 10.

To align the I-F amplifier circuit of the KRK30B, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case. To do this, remove the crystal cover at the right side of the UHF tuner section. (Refer to Figure 20.) Cover one lead of the 1000 ohm resistor with a short piece of insulated tubing and fashion a hook at the end of this lead. Connect to the front terminal of the crystal holder through the aperture under the crystal cover. Connect the capacitor and generator as stated above.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING between channels 68 and 69 at 800 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground.

Connect the oscilloscope diode probe to the junction between the resistor and capacitor.

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.5 volt or less peak-to-peak on the oscilloscope.

Adjust C308, on the UHF section, and L9, on the VHF section, of the tuner for maximum gain with 45.75 mc. and 42.25 mc. markers as shown in figure 13.

If necessary adjust L27 to place the 45.75 mc. marker at 90% on the curve. Adjust L43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to pin 9 of V110. Use 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Connect the VHF sweep generator to the VHF antenna terminals. Keep the AGC bias at —3.0 V and the I-F bias at —5.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 10. Retouch T106 and T107 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the UHF antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 10, retouching C308 and L9 if necessary to correct any overall tilt.

Do not retouch L27, L43, T2, T104, T105, T106 or T107.

Remove the sweep and marker generators and the bias supplies.

KRK22D TUNER ALIGNMENT.—

Models 24-D-542, 24-D-543 and 24-D-544

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T1 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" or T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the FM trap L53.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

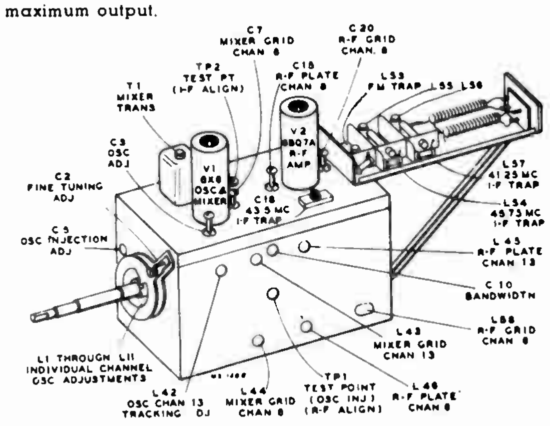


Figure 14—KRK22D Tuner Adjustments

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3

Set the T1 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15, to the input terminals of the antenna matching unit.

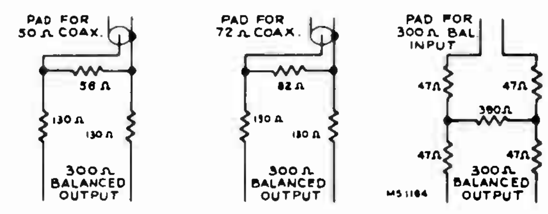


Figure 15—Sweep Attenuator Pads

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

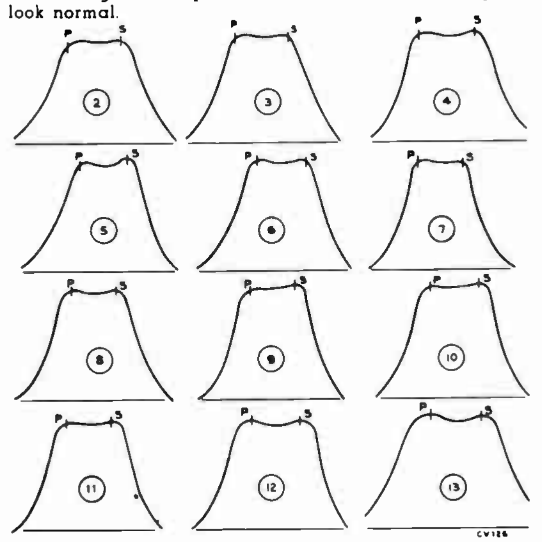


Figure 16—KRK22D R-F Responses

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in figure 16.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in figure 16.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

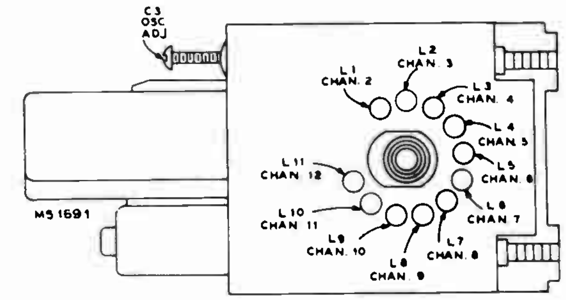


Figure 17—KRK22D Oscillator Adjustments

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46 and L58 for proper curve shape as shown in figure 16. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 16 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L58 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 16 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK22D OR KRK30B ANTENNA MATCHING UNIT ALIGNMENT.—The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L53 (L5) to the channel selector switch S4 (S1E).

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R118, R146 and C120. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R118, R146 and C120.

Connect an oscilloscope to the junction of R129 and L103 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L54 (L5) in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L57 (L1) for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L53 (L5) to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L53 (L5) to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 15 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L55 (L3) and L56 (L2) to obtain the response shown in figure 18. L55 (L3) is most effective in locating the position of the shoulder of the curve at 52 mc. and L56 (L2) should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L53 (L5) and S4 (S1E). Replace V106.

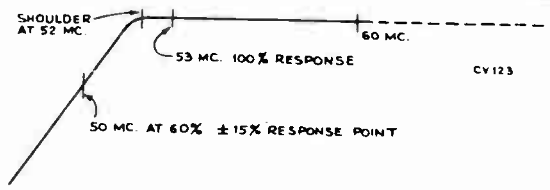


Figure 18—KRK22D or KRK30B Antenna Matching Unit Response

KRK30B TUNER ALIGNMENT

Models 24-D-542U, 24-D-543U and 24-D-544U

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

NOTE:—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency of each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

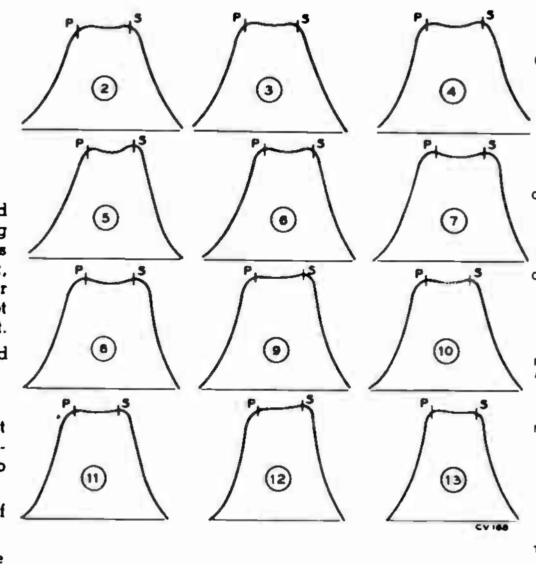


Figure 19—KRK30B VHF R-F Response

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 19.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 19.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

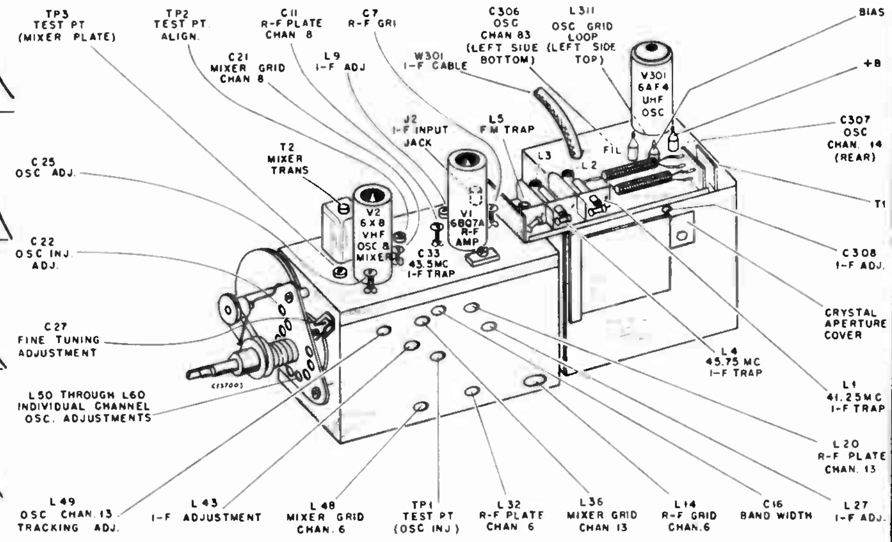


Figure 20—KRK30B Tuner Adjustments

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L14, L48 and L32 for proper curve shape as shown in figure 19. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 19 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 19 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT.—R-F alignment of the UHF section of the tuner may only be performed with the UHF section removed from the tuner assembly. R-F adjustments require removal of the tuner shield which may only be done with the UHF tuner separate from its mounting.

I-F and oscillator adjustments may be accomplished without removing the tuner.

Connect a 100 ohm composition resistor between the center conductor of the I-F cable W301 and the tuner case.

Connect the oscilloscope to the center conductor of W301 at the 100 ohm resistor, employing the preamplifier if needed with the oscilloscope used. Ground the oscilloscope to the tuner case.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft

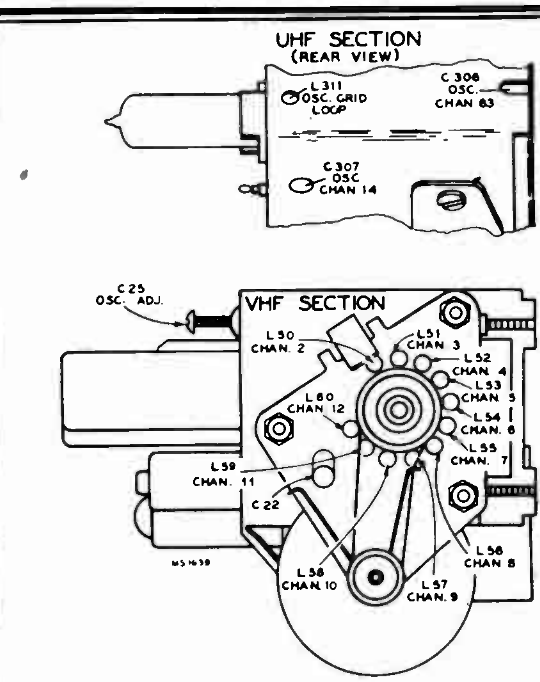


Figure 21—KRK30B VHF Oscillator Adjustments

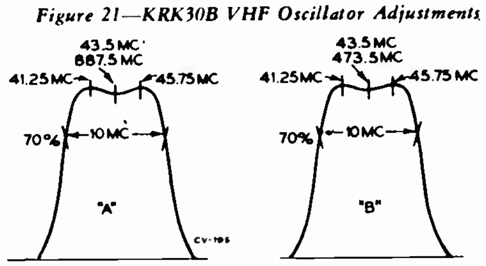


Figure 22—KRK30B UHF R-F Response

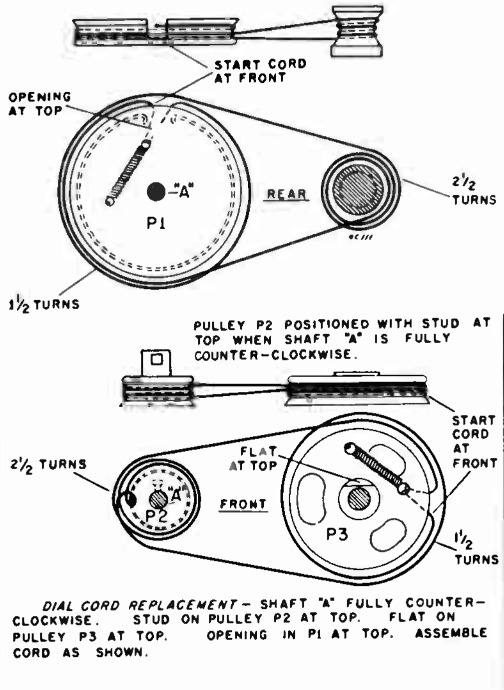


Figure 23—KRK30B Dial Cords

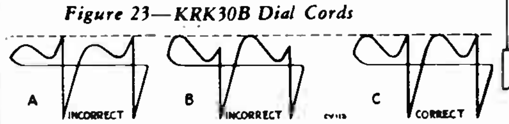


Figure 24—Horizontal Oscillator Waveforms

is necessary for accurate alignment. Scribe marks at 0°, 5° and 164° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. With the stop pin on the tuner against the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 164°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the junction of W301 and L310. This may be done by inserting the lead from the resistor, which should be covered with insulated tubing, through the aperture provided for crystal removal. (See figure 20.) Insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitor tabs C304 and C305 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 22(A).

Adjust the oscillator trimmer capacitor C306 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 22(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 5°, Channel 14, position.

Adjust the oscillator trimmer C307 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown. The inductance loop L311 across the oscillator grid coil on some units, may be repositioned, if necessary, to bring the oscillator trimmer within range. Refer to figure 20 for location of the aperture for making this adjustment.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates must be knifed with the shield cover removed. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" between the center conductor of W301 and ground. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .03 and .35 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits. This voltage is an indication of correct crystal current and may be varied by repositioning the flag L309 with respect to L3.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 20). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

SOUND I-F AND RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101 in series with a 1500 mmf. capacitor.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector secondary T102 bottom core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked, when making the above adjustments.

Tune the T101 (top) core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the T101 adjustment are made.

Connect the "VoltOhmyst" to the junction of R107 and C109.

Tune T102 bottom for zero d-c at the junction of R107 and C109. (Make adjustment with core at chassis end of coil.)

SOUND TAKE-OFF ALIGNMENT.—Connect two (2) signal generators to the grid of the fourth picture i-f amplifier, pin 1 of V109.

Set one generator to 45.75 mc., unmodulated, and adjust output for .5 volts.

Set the second generator to 41.25 mc., and modulate 30%, at 400 cycles, with an output of .2 volts.

Connect the oscilloscope, in series with diode probe, to the plate of the video amplifier, pin 6 of V110.

Set the oscilloscope to maximum gain.

Adjust T109 for minimum output indication on the oscilloscope.

As an alternate method, this may be accomplished by using a received signal as the source for adjustment.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, short the terminals of the fixed 4.5 mc. trap L105. With a 4.5 mc. beat present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust T109 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ALIGNMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it usually can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal (freq.) control, then adjust the waveform adjustment core (top of chassis) out of the coil several turns from its original position and readjust the frequency control until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive trimmer C179, the width control L111 and the linearity control L113, until the picture is correct.

Connect the low capacity probe of an oscilloscope to the center terminal of T112, at the junction of R195. Dress the oscilloscope probe at least one inch away from the sine wave coil L110. Turn the horizontal frequency control so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 24. Adjust the waveform adjustment coil L110 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the frequency control if necessary.

Remove the oscilloscope upon completion of this adjustment.

Turn the horizontal frequency control to the extreme clockwise position. The picture should be out of sync, with a minimum of twelve bars slanting downward to the left. Turn the control counter-clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 1½ to 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional counter-clockwise rotation of the control. The picture should remain in sync for approximately two full turns of additional counter-clockwise rotation of the control. Continue counter-clockwise rotation until the picture falls out of sync. Rotation beyond the fall-out position should produce between 2 and 5 bars before interrupted oscillation (motorboat) occurs. Interrupted oscillation (motorboat) should be reached before full counter-clockwise rotation.

When the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned.

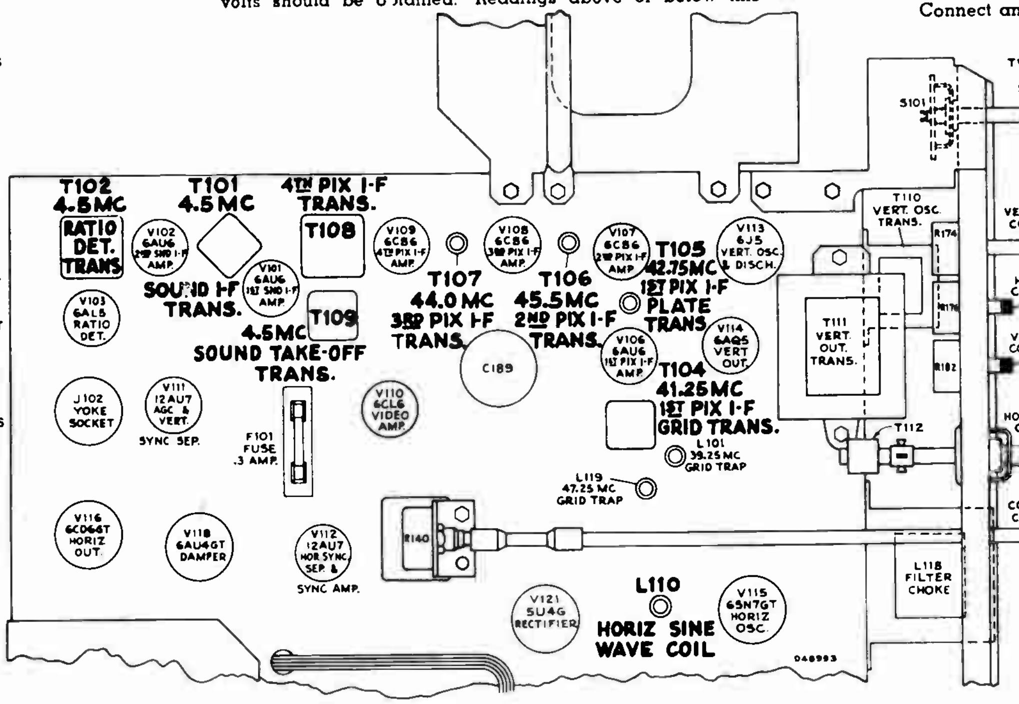


Figure 25—Top Chassis Adjustments

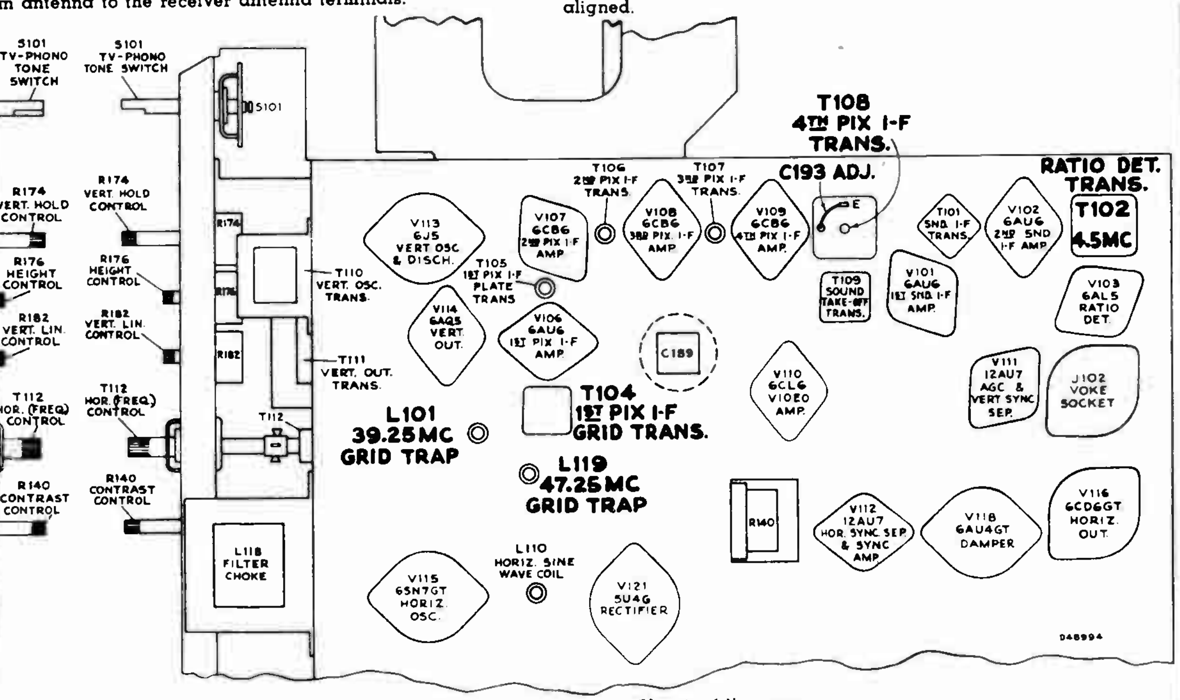


Figure 26—Bottom Chassis Adjustments

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 30,000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V1 (V2)	6X8	Mixer	30,000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	—	—	
KRK22D or KRK30B			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	—	—	
		R-F Oscillator	30,000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	—	—	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	—	—	
V2 (V1)	6BQ7A	R-F Amplifier	30,000 Mu. V. Signal	6	170	—	—	8	0.1	7		—	—	
KRK22D or KRK30B			No Signal	6	133	—	—	8	1.1	7	0	—	—	
		R-F Amplifier	30,000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	
V101	6AU6	1st Sound I-F Amp.	30,000 Mu. V. Signal	5	110	6	120	7	0.9	1	—0.08	—	—	
			No Signal	5	104	6	114	7	0.88	1	—0.24	—	—	
V102	6AU6	2nd Sound I-F Amp.	30,000 Mu. V. Signal	5	114	6	124	7	0	1	—4.8	—	—	
			No Signal	5	111	6	121	7	0	1	—2.95	—	—	
V103	6AL5	Ratio Detector	30,000 Mu. V. Signal	2 7	—10.3 1.22	—	—	5 1	1.22 10.7	—	—	—	—	
			No Signal	2 7	—7.5 3.5	—	—	5 1	2.9 7.9	—	—	—	—	
V104	6AV6	1st Audio Amplifier	30,000 Mu. V. Signal	7	92	—	—	2	0	1	—0.7	—	—	At min. volume
			No Signal	7	91	—	—	2	0	1	—0.88	—	—	
V104	6AV6	R-F Bias Clamp	30,000 Mu. V. Signal	5-6	—5.1	—	—	—	—	—	—	—	—	
			No Signal	5-6	.56	—	—	—	—	—	—	—	—	
V105	6AQ5	Audio Output	30,000 Mu. V. Signal	5	249	6	264	2	16	7	0	—	—	At min. volume
			No Signal	5	243	6	256	2	15.3	7	0	—	—	
V106	6AU6	1st Pix. I-F Amplifier	30,000 Mu. V. Signal	5	236	6	257	7	0.03	1	—7.9	—	—	
			No Signal	5	117	6	130	7	1.08	1	0.07	—	—	
V107	6CB6	2nd Pix. I-F Amplifier	30,000 Mu. V. Signal	5	235	6	256	2	0.02	1	—7.9	—	—	
			No Signal	5	107	6	115	2	0.47	1	0.07	—	—	
V108	6CB6	3rd Pix. I-F Amplifier	30,000 Mu. V. Signal	5	109	6	117	2	1.0	1	0	—	—	
			No Signal	5	104	6	111	2	.96	1	0	—	—	
V109	6CB6	4th Pix. I-F Amplifier	30,000 Mu. V. Signal	5	196	6	129	2	1.8	1	0	—	—	
			No Signal	5	185	6	123	2	1.65	1	0	—	—	

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V110	6CL6	Video Amplifier	30,000 Mu. V. Signal	6	131	3-8	179	1	1.14	2-9	*—2.8	—	—	*Depends on picture
			No Signal	6	120	3-8	128	1	1.05	2-9	*—1.03	—	—	*Depends on picture
V111A	12AU7	AGC Rectifier	30,000 Mu. V. Signal	1	—43	—	—	3	130	2	107	—	—	AGC control set for normal operation
			No Signal	1	.04	—	—	3	124	2	62	—	—	
V111B	12AU7	Vert. Sync. Separator	30,000 Mu. V. Signal	6	53	—	—	8	0	7	65	—	—	
			No Signal	6	66	—	—	8	0	7	10.5	—	—	
V112A	12AU7	Hor. Sync. Separator	30,000 Mu. V. Signal	1	305	—	—	3	190	2	110	—	—	
			No Signal	1	296	—	—	3	118	2	97	—	—	
V112B	12AU7	Sync. Amplifier	30,000 Mu. V. Signal	6	52	—	—	8	0	7	—0.49	—	—	
			No Signal	6	50	—	—	8	0	7	—0.27	—	—	
V113	6J5	Vert. Osc. & Discharge	30,000 Mu. V. Signal	3	176	—	—	8	0	5	—58	—	—	
			No Signal	3	177	—	—	8	0	5	—58	—	—	
V114	6AQ5	Vertical Output	30,000 Mu. V. Signal	5	290	6	303	2	25	1	0.13	—	—	
			No Signal	5	285	6	298	2	24.5	1	0.10	—	—	
V115	6SN7GT	Horizontal Osc. Control	30,000 Mu. V. Signal	2	306	—	—	3	5.5	1	—25	—	—	
			No Signal	2	298	—	—	3	—4.6	1	—26.8	—	—	
		Horizontal Oscillator	30,000 Mu. V. Signal	5	191	—	—	6	0	4	—85	—	—	
			No Signal	5	187	—	—	6	0	4	—92	—	—	
V116	6CD6G	Horizontal Output	30,000 Mu. V. Signal	Cap	* 137	8	160	3	22	5	—12	—	—	*High Voltage Pulse Present (40 Megs. in series with VTVM)
			No Signal	Cap	* 141	8	162	3	22	5	—12	—	—	
V117	1B3GT	H. V. Rectifier	30,000 Mu. V. Signal	Cap	*	—	—	2 & 7	19,750	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	19,250	—	—	—	—	
V118	6AU4	Damper	30,000 Mu. V. Signal	5	300	—	—	3	*134	—	—	—	—	*High Voltage Pulse Present (40 Megs. in series with VTVM)
			No Signal	5	291	—	—	3	*134	—	—	—	—	
V119	24CP4A	Kinescope	30,000 Mu. V. Signal	Cone	19,750	10	600	11	133	2	70	—	—	At average Brightness
			No Signal	Cone	19,250	10	590	11	122	2	66	—	—	
V120 V121	5U4G	Rectifiers	30,000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	320	—	—	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	313	—	—	—	—	

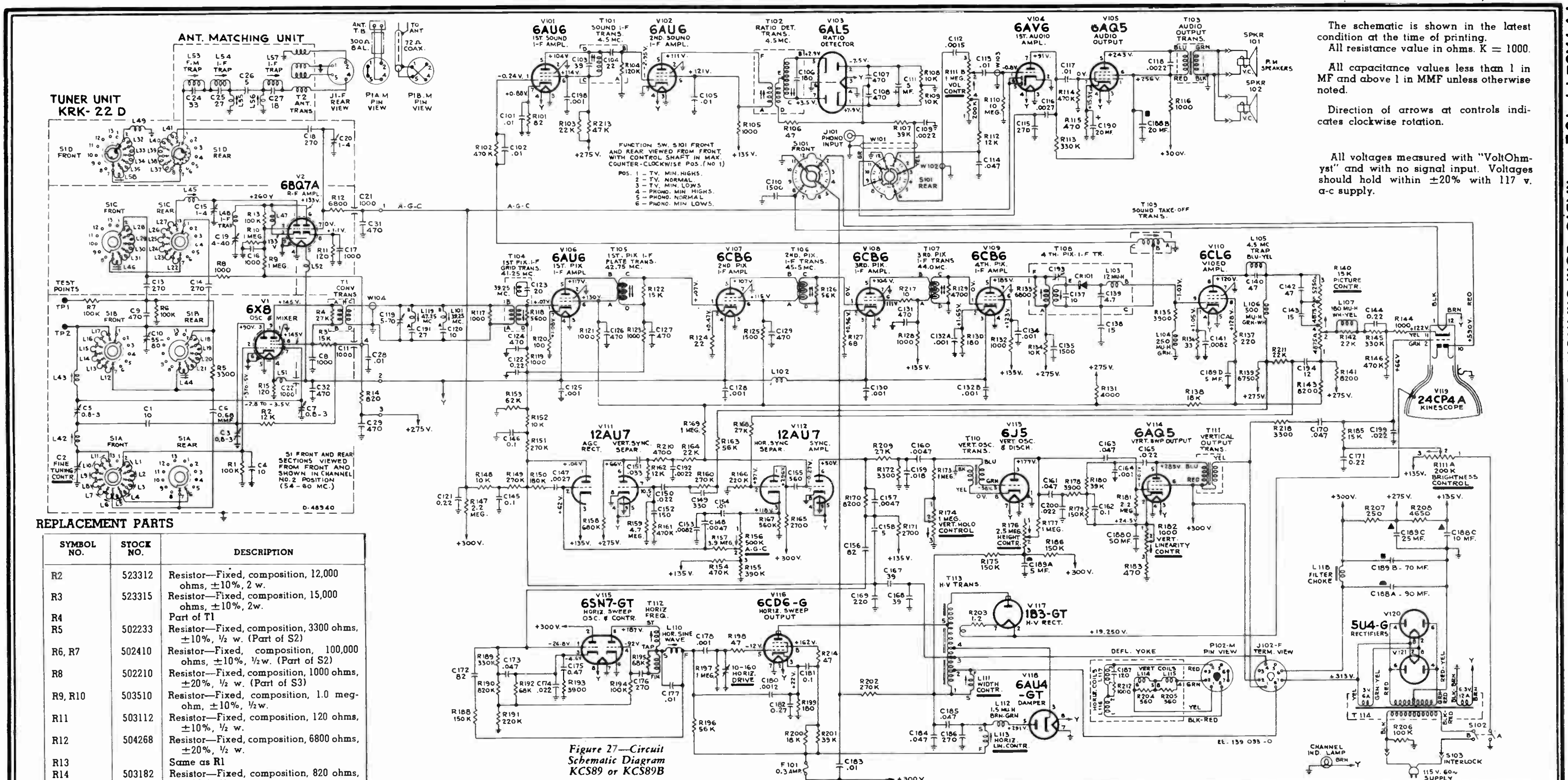


Figure 27—Circuit Schematic Diagram KCS89 or KCS89B

The schematic is shown in the latest condition at the time of printing.
All resistance value in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

REPLACEMENT PARTS

SYMBOL NO.	STOCK NO.	DESCRIPTION
R2	523312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R3	523315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2w.
R4		Part of T1
R5	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w. (Part of S2)
R6, R7	502410	Resistor—Fixed, composition, 100,000 ohms, ±10%, ½w. (Part of S2)
R8	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. (Part of S3)
R9, R10	503510	Resistor—Fixed, composition, 1.0 megohm, ±10%, ½w.
R11	503112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ w.
R12	504268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ w.
R13		Same as R1
R14	503182	Resistor—Fixed, composition, 820 ohms, ±10%, ½w.
R15		Same as R11
T1	78399	Transformer—Convertor transformer
T2	78396	Transformer—Antenna matching transformer complete (C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
C1 to C4 Incl.		Part of Antenna matching transformer
C5	77084	Capacitor—Ceramic, feed-thru, 1000 mmf.
C6	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v.
C7	76532	Trimmer—Adjustable, 1-4 mmf.
C8, C9	77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, —0%, 500 v.
C10	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. D.C. (Part of S4)
C11	77151	Trimmer—Adjustable, 0.8-3.0 mmf.
C12	78276	Capacitor—Fixed, ceramic, 150 mmf., ±10%, 500 v. D.C. (Part of S3)
C13	71599	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. D.C. (Part of S2)
C15		Same as C5
C16	78397	Trimmer—Mica, 80-150 mmf.
C17 to C19 Incl.		Same as C5
C20	78603	Capacitor—Fixed, ceramic, 82 mmf., ±10%, 500 v.
C21		Same as C11
C22	77913	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. (Part of S1)
C23	71504	Capacitor—Fixed, headed-lead, 0.68 mmf., ±20%, 500 v. D.C. (Part of S2)
C24	78247	Capacitor—Fixed, ceramic, 10 mmf., ±1 mmf., 500 v.
C25		Same as C11
C26	77865	Capacitor—Fixed, ceramic, 10 mmf., ±1.0 mmf., 500 v.
C27	79192	Trimmer—Ceramic, variable—fine tuning type
C28	73960	Capacitor—Fixed, ceramic, 10,000 mmf., 500 v.
C29	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 v.
C31		(Part of S3) Capacitor—Fixed, headed-lead type, 2.2 mmf., ±20%, 500 v. D.C.
C33	77616	Capacitor—Adjustable, mica, 4-40 mmf.
C34, C35		Same as C29
C36	75437	Capacitor—Fixed, ceramic, 100 mmf., ±20%, 500 v. D.C. (Part of S2)
C38	71503	Capacitor—Fixed, headed-lead type, 3.3 mmf., ±20%, 500 v. D.C. (Part of S5)
C39		Same as C31 (Part of S3)
L1 to L5 Incl.		Part of Antenna matching transformer
L6	78466	Coil—R.F. choke
L7	76562	Coil—R.F. amplifier coupling coil
L8	77859	Coil—R.F. grid switch return connector coil
L9	79542	Coil—I.F. input coil complete with adjustable core
L10 to L13 Incl.		Part of S3 & S5
L14	73458	Coil—Channel #6 R.F. grid coil (Part of S3 & S5)
L15 to L19 Incl.		Part of S3 & S5
L20	77921	Coil—Channel #13 R.F. plate coil (Part of S3 & S5)
L21 to L26 Incl.		Part of S3 & S5
L27	78584	Coil—R.F. plate I.F. coil (Part of S3)
L28 to L31 Incl.		Part of S3 & S5
L32	73460	Coil—Channel #6 R.F. plate coil (Part of S3 & S5)
L33	77206	Coil—Filament choke coil
L35	76763	Coil—Heater choke coil
L36	77919	Coil—Channel #13 mixer coil
L37 to L42 Incl.		Part of S1 & S2
L43	78583	Coil—Mixer I.F. coil (Part of S1 & S2)
L44 to L47 Incl.		Part of S1 & S2
L48	73874	Coil—Channel #6 mixer coil (Part of S1 & S2)
L49	77915	Coil—Channel #13 oscillator coil (Part of S1 & S2)
L50 to L60 Incl.		Part of S1 & S2
L61	78401	Coil—Channel #6 antenna coil
R1	502268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½w.
R2	502112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ w.
R3	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w. (Part of S2)

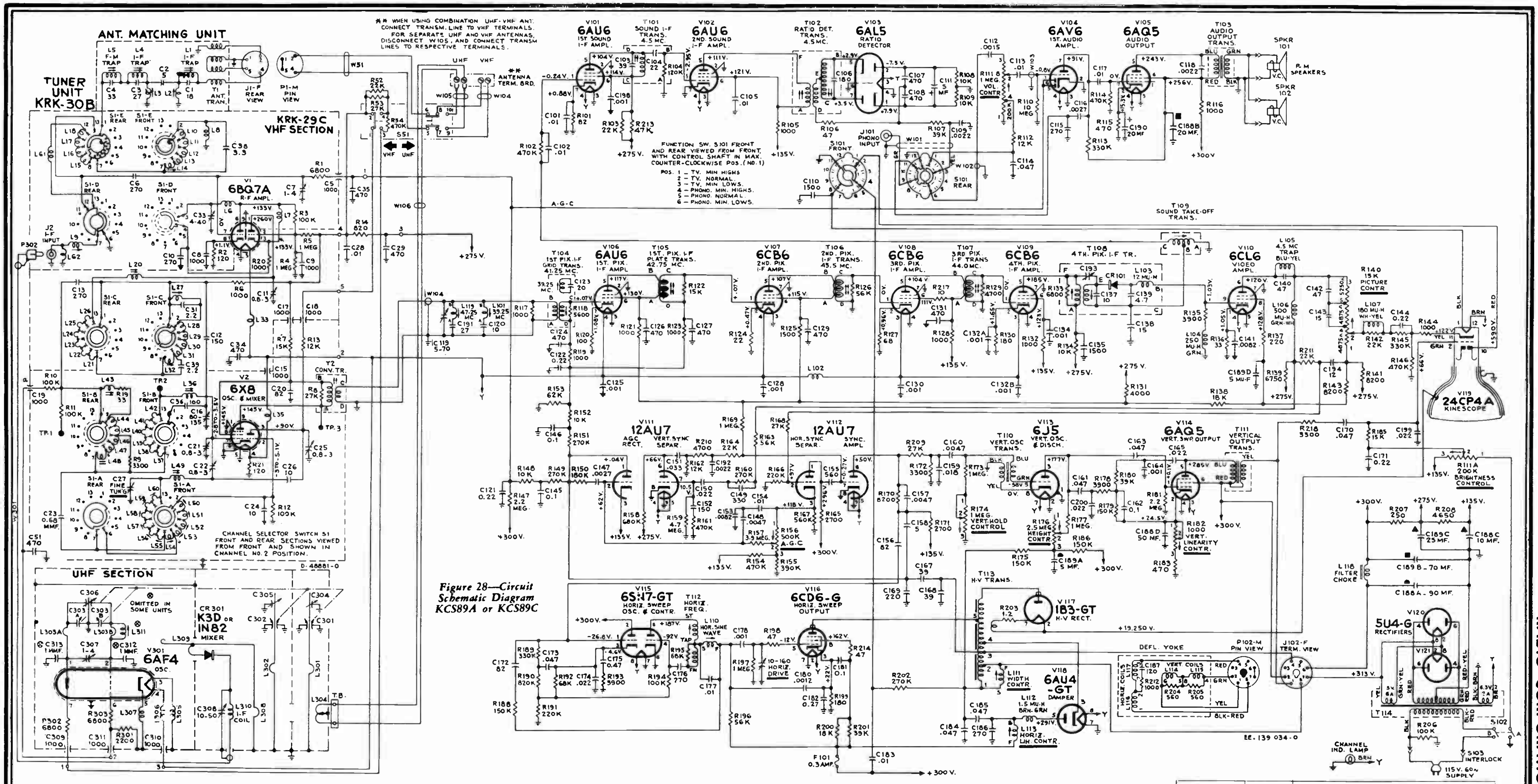


Figure 28—Circuit Schematic Diagram KCS89A or KCS89C

SYMBOL NO.	STOCK NO.	DESCRIPTION
R4, R5	502510	Resistor—Fixed, composition, 1 meg., ±10%, ½ w.
R6	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. (Part of S3)
R7	522315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 w.
R8		Part of T2
R9	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w. (Part of S2)
R10, R11		Same as R3 (Part of S2)
R12		Same as R3
R13	522312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R14	502182	Resistor—Fixed, composition, 820 ohms, ±10%, ½ w.
R19	502033	Resistor—Fixed, composition, 33 ohms, ±10%, ½ w. (Part of S2)
R20		Same as R6
R21		Same as R2

SYMBOL NO.	STOCK NO.	DESCRIPTION
T1	78396	Transformer—Antenna matching transformer complete
T2	78399	Transformer—Convertor transformer (R8)
C301 to C303 Incl.	79553	Capacitor—Variable tuning capacitor
C304, C305	79554	Stator—Oscillator stator assembly
C306	79555	Capacitor—Oscillator trimmer capacitor
C307	79556	Capacitor—Adjustable, ceramic, 0.8-3.5 mmf.
C308	79558	Capacitor—Trimmer, 10-50 mmf.
C309 to C311 Incl.	79559	Capacitor—Feed thru, 1000 mmf.
C312, C313	79560	Capacitor—Fixed, ceramic, .1 mmf., ±0.1 mmf., 500 v. D.C. non-insulated
CR301	77489	Rectifier—UHF diode crystal germanium rectifier
L301, L302		Coil—R.F. tank plate
L303	79557	Tank Assembly—complete with capacitor (C7)

SYMBOL NO.	STOCK NO.	DESCRIPTION
L304	79564	Board—Antenna terminal board assembly
L305 to L307 Incl.	79565	Choke—R.F. choke
L308, L309		Coil—Mixer coupling coil for oscillator & output section
L310	79567	Coil—I.F. output coil 0.15 microhenries
L311	79566	Coil—Oscillator loop coil
R301	502222	Resistor—Fixed, composition, 2200 ohms, ±10%, ½ w.
R302	512268	Resistor—Fixed, composition, 6800 ohms, ±10%, 1 w.
R303	502268	Resistor—Fixed, composition, 6800 ohms, ±10%, ½ w.
C101, C102	73960	Capacitor—Fixed, ceramic, .01 mf., 500 v.
C103, C104		Part of T101
C105		Same as C101
C106		Part of T102
C107, C108	39644	Capacitor—Fixed, mica, 470 mmf., ±5%, 500 v.

SYMBOL NO.	STOCK NO.	DESCRIPTION
C109	73595	Capacitor—Fixed, paper, .0022 mf., ±5%, 600 v.
C110	73748	Capacitor—Fixed, ceramic, 1500 mmf., 500 v.
C111	74521	Capacitor—Electrolytic, 5 mfd., 50 v.
C112	76508	Capacitor—Fixed, paper, .0015 mf., ±5%, 600 v.
C113	73561	Capacitor—Fixed, paper, .01 mf., ±10%, 400 v.
C114	73558	Capacitor—Fixed, paper, .047" mf., ±10%, 200 v.
C115	47617	Capacitor—Fixed, ceramic, 270 mmf., 500 v.
C116	73599	Capacitor—Fixed, paper, .0027 mf., ±10%, 600 v.
C117	73561	Capacitor—Fixed, paper, .01 mf., ±10%, 400 v. D.C.
C118	73595	Capacitor—Fixed, paper, .0022 mf., ±5%, 600 v. D.C.
C119	71496	Capacitor—Adjustable mica, 4-70 mmf.
C120	98225	Capacitor—Fixed, ceramic, 10 mmf., 500 v. D.C.
C121, C122	78905	Capacitor—Fixed, paper, 0.22 mf., ±20%, 200 v. D.C.

SYMBOL NO.	STOCK NO.	DESCRIPTION
C123		Part of T104
C124	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 v. D.C.
C125	73960	Capacitor—Fixed, ceramic, 0.001 mf., 500 v. D.C.
C126	78622	Capacitor—Fixed, ceramic, 470 mmf., ±10%, 500 v. D.C.
C127		Same as C124
C128		Same as C125
C129		Same as C126
C130		Same as C125
C131		Same as C126
C132A,B	79319	Capacitor—Fixed, ceramic, 0.001/0.001 mf., +100%, —0%, 500 v. D.C.
C134		Same as C125
C135	75166	Capacitor—Fixed, ceramic, 1500 mmf., +100%, —0%, 500 v.
C137		Part of T108
C138	39044	Capacitor—Fixed, ceramic, 15 mmf., 500 v. D.C.
C139		Part of T108
C140		Part of L105
C141	79019	Capacitor—Fixed, paper, 0.0082 mf., +10%, 400 v. D.C.
C142	39042	Capacitor—Fixed, ceramic, 47 mmf., 500 v. D.C.
C143		Same as C138
C144	73794	Capacitor—Fixed, paper, 0.22 mf., ±20%, 400 v. D.C.
C145, C146	73784	Capacitor—Fixed, paper, 0.1 mf., ±20%, 200 v. D.C.
C147	73599	Capacitor—Fixed, paper, 0.0027 mf., +10%, 600 v. D.C.
C148	73920	Capacitor—Fixed, paper, 0.0047 mf., ±10%, 400 v. D.C.
C149	39640	Capacitor—Fixed, mica, 330 mmf., ±5%, 500 v. D.C.
C150	73562	Capacitor—Fixed, paper, 0.022 mf., ±20%, 400 v. D.C.
C151	73552	Capacitor—Fixed, paper, 0.033 mf., ±20%, 400 v. D.C.
C152	39632	Capacitor—Fixed, mica, 150 mf., ±10%, 500 v. D.C.
C153		Same as C141
C154	73561	Capacitor—Fixed, paper, 0.01 mf., ±10%, 400 v. D.C.
C155	74250	Capacitor—Fixed, mica, 560 mmf., ±10%, 1000 v. D.C.
C156	76474	Capacitor—Fixed, mica, 82 mmf., ±5%, v. D.C.
C157	79017	Capacitor—Fixed, paper, 0.0047 mf., ±20%, 400 v. D.C.
C158	72809	Capacitor—Fixed, mica, 5 mmf., ±20%, 1500 v. D.C.
C159	58476	Capacitor—Fixed, paper, 0.018 mf., ±10%, 400 v. D.C.
C160	73920	Capacitor—Fixed, paper, 0.0047 mf., ±5%, 600 v. D.C.
C161	73592	Capacitor—Fixed, paper, 0.047 mf., ±10%, 600 v. D.C.
C162	73784	Capacitor—Fixed, paper, 0.1 mf., ±10%, 200 v. D.C.
C163	73592	Capacitor—Fixed, paper, 0.047 mf., ±20%, 600 v. D.C.
C164	73849	Capacitor—Fixed, paper, 0.001 mf., ±10%, 1600 v. D.C.
C165	73798	Capacitor—Fixed, paper, 0.022 mf., ±10%, 600 v. D.C.
C167, C168	76574	Capacitor—Fixed, ceramic, 39 mmf., ±10%, 3500 v. D.C.
C169	79021	Capacitor—Fixed, mica, 220 mmf., ±10%, 1000 v. D.C.
C170	73553	Capacitor—Fixed, paper, 0.047 mf., ±10%, 400 v. D.C.
C171		Same as C144
C172	76474	Capacitor—Fixed, mica, 82 mmf., ±5%, 1000 v. D.C.
C173	73553	Capacitor—Fixed, paper, 0.047 mf., ±20%, 400 v. D.C.
C174		Same as C150
C175	73787	Capacitor—Fixed, paper, 0.47 mf., ±20%, 200 v. D.C.
C176	76579	Capacitor—Fixed, mica, 270 mmf., ±5%, 1000 v. D.C.
C177	73594	Capacitor—Fixed, paper, 0.01 mf., ±5%, 600 v. D.C.
C178	75643	Capacitor—Fixed, paper, 0.001 mf., ±10%, 1000 v. D.C.
C179	79376	Capacitor—Trimmer, 10-160 mmfd.
C180	76995	Capacitor—Fixed, paper, 0.0012 mf., ±5%, 600 v. D.C.
C181	73557	Capacitor—Fixed, paper, 0.1 mf., ±10%, 600 v. D.C.
C182	73786	Capacitor—Fixed, paper, 0.27 mf., ±10%, 200 v. D.C.
C183	73561	Capacitor—Fixed, paper, 0.01 mf., ±20%, 400 v. D.C.
C184, C185	73597	Capacitor—Fixed, paper, 0.047 mf., ±10%, 1000 v. D.C.
C186	79022	Capacitor—Fixed, mica, 270 mmf., ±20%, 1000 v. D.C.
C187		Part of Yoke
C188 A,B,C,D	79391	Capacitor—Fixed, electrolytic, 90-20-10 —10 +50%, 450 v.; 70-25-5 mf., —10 mf., —10 +250%, 50 v. D.C.
C189 A,B,C,D	79292	Capacitor—Fixed, electrolytic, 5 mf., mfd., —10 +50%, 400 volts D.C.; 50 +50%, 400 v.
C190	79380	Capacitor—Electrolytic, 20 mf., —10 +250%, 25 v.
C191	79488	Capacitor—Fixed, ceramic, 27 mmf., ±5%, 500 v. Temp. coef. —750° non-insulated
C192	73595	Capacitor—Fixed, paper, 0.0022 mf., ±10%, 600 v. D.C.
C193		Part of T108
C194	33380	Capacitor—Fixed, ceramic, 18 mmf., ±5%, 500 v.
C198		Same as C125
C199		Same as C150
C200		Capacitor—Fixed, paper, .022 mfd., ±10%, 200 v. D.C.
F101	78214	Fuse—.3 amp
J101	35787	Connector—Phono input connector
J102	68590	Connector—Deflection yoke connector —female
L101	79383	Trap—I.F. grip trap—39.25 MC
L102	73477	Coil—Choke coil
L103		Part of T108
L104	98482	Coil—Peaking coil, 250 mh
L105	76482	Coil—Trap, 4.5 M.C. trap includes C140
L106	75252	Coil—Peaking, 500 mh
L107	76647	Coil—Peaking, 180 mh includes R142
L110	79161	Coil—Horizontal sine wave coil
L111	76441	Coil—Width coil
L112	76640	Coil—R.F. choke coil—1.5 mh
L113	76442	Coil—Horizontal linearity coil
L114 to L117 Incl.		Part of Yoke
L118	77676	Choke—Filter choke
L119	79390	Trap—I.F. grid trap 47.25 MC
R101	502082	Resistor—Fixed, composition, 82 ohms, ±10%, ½ w.
R102	502447	Resistor—Fixed, composition, 470,000 ohms, ±20%, ½w.
R103	522322	Resistor—Fixed, composition, 22,000 ±10%, 2 w.
R104		Part of T101
R105	502210	Resistor—Fixed, composition, 1000 ohms, ±10%, ½ w.
R106	502047	Resistor—Fixed, composition, 47 ohms, ±10%, ½ w.
R107	502339	Resistor—Fixed, composition, 39,000 ohms, ±10%, ½ w.
R108, R109	502310	Resistor—Fixed, composition, 10,000 ohms, ±5%, ½ w.
R110	502610	Resistor—Fixed, composition, 10 meg-ohm, ±20%, ½ w.
R111A,B	77655	Control—Volume—"On-Off" brightness control
R112	502312	Resistor—Fixed, composition, 12,000 ohms, ±10%, ½ w.
R113	502430	Resistor—Fixed, composition, 330,000 ohms, ±20%, ½ w.
R114		Same as R102
R115	512147	Resistor—Fixed, composition, 470 ohms, ±10%, 1 w.
R116	522210	Resistor—Fixed, composition, 1000 ohms, ±10%, 2 w.
R117	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w.
R118		Part of T104
R119		Same as R117
R120	502110	Resistor—Fixed, composition, 100 ohms, ±5%, ½ w.
R121		Same as R117
R122	36714	Resistor—Fixed, composition, 15,000 ohms, ±5%, ½ w.
R123		Same as R117
R124	502022	Resistor—Fixed, composition, 22 ohms, ±5%, ½ w.
R125	512215	Resistor—Fixed, composition, 1500 ohms, ±20%, 1 w.
R126	502356	Resistor—Fixed, composition, 56,000 ohms, ±5%, ½ w.
R127	502068	Resistor—Fixed, composition, 68 ohms, ±5%, ½ w.
R128		Same as R117
R129	502247	Resistor—Fixed, composition, 4700 ohms, ±5%, ½ w.
R130	502118	Resistor—Fixed, composition, 180 ohms, ±5%, ½ w.
R131	77668	Resistor—Fixed, wire wound, 4000 ohms, ±10%, 7 w.
R132		Same as R117
R133		Part of T108
R134	522310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 2 w.
R135	502239	Resistor—Fixed, composition, 3900 ohms, ±5%, ½ w.
R136	502033	Resistor—Fixed, composition, 33 ohms, ±10%, ½ w.
R137	502122	Resistor—Fixed, composition, 220 ohms, ±20%, ½ w.
R138	512318	Resistor—Fixed, composition, 18,000 ohms, ±10%, 1 w.
R139	76642	Resistor—Fixed, wire wound, 6750 ohms, ±10%, 10 w.
R140	76445	Control—Contrast control
R141	522282	Resistor—Fixed, composition, 8200 ohms, ±10%, 2 w.
R142		Part of L107
R143	512282	Resistor—Fixed, composition, 8200 ohms, ±10%, 1w.
R144		Same as R117
R145	502433	Resistor—Fixed, composition, 330,000 ohms, ±10%, ½ w.
R146	502447	Resistor—Fixed, composition, 470,000 ohms, ±10%, ½ w.
R147	512522	Resistor—Fixed, composition, 2.2 meg-ohm, ±5%, 1 w.
R148	502410	Resistor—Fixed, composition, 10,000 ohms, ±10%, ½ w.
R149	502427	Resistor—Fixed, composition, 270,000 ohms, ±5%, ½ w.
R150	502418	Resistor—Fixed, composition, 180,000 ohms, ±10%, ½ w.
R151		Same as R149
R152		Same as R148
R153	70320	Resistor—Fixed, composition, 62,000 ohms, ±5%, ½ w.
R154		Same as R146
R155	502439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ w.
R156	78808	Control—AGC control
R157	502539	Resistor—Fixed, composition, 3.9 meg-ohm, ±10%, ½ w.
R158	502468	Resistor—Fixed, composition, 680,000 ohms, ±10%, ½ w.
R159	502543	Resistor—Fixed, composition, 4.7 meg., ±10%, ½ w.
R160	502427	Resistor—Fixed, composition, 270,000 ohms, ±10%, ½ w.
R161		Same as R102
R162	502312	Resistor—Fixed, composition, 12,000 ohms, ±10%, ½ w.
R163	502356	Resistor—Fixed, composition, 56,000 ohms, ±10%, ½ w.
R164	502322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R165	502227	Resistor—Fixed, composition, 2700 ohms, ±10%, ½ w.
R166	502422	Resistor—Fixed, composition, 220,000 ohms, ±10%, ½ w.
R167	502456	Resistor—Fixed, composition, 560,000 ohms, ±10%, ½ w.
R168	502327	Resistor—Fixed, composition, 27,000 ohms, ±10%, ½ w.
R169	502510	Resistor—Fixed, composition, 1 meg., ±10%, ½ w.
R171	502227	Resistor—Fixed, composition, 2700 ohms, ±5%, ½ w.
R170		Same as R143
R172	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w.
R173		Same as R169
R174	79384	Control—Vertical hold control
R175	502415	Resistor—Fixed, composition, 150,000 ohms, ±10%, ½ w.
R176	78807	Control—Height control
R177	502510	Resistor—Fixed, composition, 1.0 meg., ±20%, ½ w.
R178	502239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ w.
R179	502415	Resistor—Fixed, composition, 150,000 ohms, ±10%, ½ w.
R180	522339	Resistor—Fixed, composition, 39,000 ohms, ±5%, 2 w.
R181	502522	Resistor—Fixed, composition, 2.2 meg., ±20%, ½ w.
R182	79385	Control—Vertical linearity control
R183	512147	Resistor—Fixed, composition, 470 ohms, ±20%, 1 w.
R185	36714	Resistor—Fixed, composition, 15,000 ohms, ±10%, ½ w.
R186		Same as R175
R188	502415	Resistor—Fixed, composition, 150,000 ohms, ±10%, ½ w.
R189	502433	Resistor—Fixed, composition, 330,000 ohms, ±10%, ½ w.
R190	502482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ w.
R191	502422	Resistor—Fixed, composition, 220,000 ohms, ±10%, ½ w.
R192	502368	Resistor—Fixed, composition, 68,000 ohms, ±10%, ½ w.
R193	502239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ w.
R194	512410	Resistor—Fixed, composition, 100,000 ohms, ±10%, 1 w.
R195		Same as R192
R196	512356	Resistor—Fixed, composition, 56,000 ohms, ±10%, 1 w.
R197		Same as R169
R198	502047	Resistor—Fixed, composition, 47 ohms, ±20%, ½ w.
R199	79378	Resistor—Fixed, wire wound, 180 ohms, ±10%, 4 w.
R200	522318	Resistor—Fixed, composition, 18,000 ohms, ±10%, 2w.
R201	512339	Resistor—Fixed, composition, 39,000 ohms, ±10%, 1 w.
R202	502427	Resistor—Fixed, composition, 270,000 ohms, ±10%, ½ w.
R203	78795	Resistor—Fixed, wire wound, 1.2 ohms, ±5%, ⅓ w.
R204, R205		Part of Yoke
R206	512410	Resistor—Fixed, composition, 100,000 ohms, ±20%, 1 w.
R207	79377	Resistor—Fixed, wire wound, 250 ohms, ±10%, 7 w.
R208	76989	Resistor—Fixed, wire wound, 4650 ohms, ±10%, 7 w.
R209	512327	Resistor—Fixed, composition, 27,000 ohms, ±10%, 1 w.
R210	502247	Resistor—Fixed, composition, 4700 ohms, ±10%, ½ w.
R211		Same as R164
R212		Part of Yoke
R213	512347	Resistor—Fixed, composition, 47,000 ohms, ±10%, 1 w.
R214	502047	Resistor—Fixed, composition, 47,000 ohms, ±20%, ½ w.
R217	502010	Resistor—Fixed, composition, 10 ohms, ±20%, ½ w.
R218		Same as R172
S101	77656	Switch—Phono-tone switch
T101	76981	Transformer—1st I.F. sound transformer, 4.5 m.c. includes C103, C104, R104
T102	77112	Transformer—Ratio detector center frequency 4.5 M.C. includes C106
T103	77821	Transformer—Audio output
T104	79386	Transformer—I.F. sound take-off, 4.5 M.C. includes C123, R118
T105 to T107 Incl.	76433	Transformer—1st, 2nd and 3rd pix transformer
T108	79389	Transformer—4th I.F. picture, 44 M.C. includes R133, C137, C139, C193, L103
T109	79388	Transformer—1st I.F. grid transformer
T110	79379	Transformer—Vertical oscillator
T111	79382	Transformer—Vertical output
T112	79160	Coil—Horizontal frequency coil
T113	78810	Transformer—High voltage transformer
T114	79387	Transformer—Power transformer
	79490	Yoke—Deflection yoke assembly includes C187, L114, L115, L116, L117, R204, R205, R212

SPEAKER ASSEMBLY
92586-4W
FOR MODELS
24D542 & U
24D543 & U

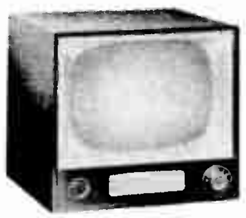
	75024	Cone—Cone and voice coil (3.2 ohms)
	74664	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

SPEAKER ASSEMBLY
FOR MODELS 24D544 & U ONLY

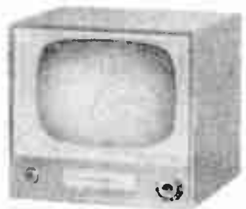
	77777	Speaker—10" P.M. speaker

Note: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to model number of instrument, number stamped on speaker and full description of part required.

Models 17-S-450, 17-S-450U "Trent" Metal-Ebony



Models 17-S-451, 17-S-451U "Newton" Metal-Maroon



Models 17-S-453, 17-S-453U "Ashburn" Metal-Oak Grain

GENERAL DESCRIPTION

All models are "17 inch" television receivers. Models 17-S-450, 17-S-451 and 17-S-453 are identical except for cabinets. Models 17-S-450U, 17-S-451U and 17-S-453U are identical except for cabinets. Models 17-S-450, 17-S-451 and 17-S-453 feature full 12 channel VHF coverage. Models 17-S-450U, 17-S-451U and 17-S-453U feature full 12 channel VHF coverage plus any UHF channels desired.

All models include intercarrier FM sound system; ratio detector; improved picture brilliance; A-F-C horizontal hold; stabilized vertical hold; and reduced hazard high voltage supply.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE

..........Approx. 156 sq. ins. on a 17HP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

Models 17-S-450, 17-S-451 & 17-S-453

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Models 17-S-450U, 17-S-451U & 17-S-453U

Any of 70 UHF channels..................470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency......................45.75 mc.
Sound I-F Carrier Frequency.......................41.25 mc.
POWER RATING ....175 watts
AUDIO POWER OUTPUT RATING............1.5 watts max.
VIDEO RESPONSE ....To 3.2 mc.
SWEEP DEFLECTION ....Magnetic
FOCUS ....Electrostatic

ANTENNA INPUT IMPEDANCE

Models 17-S-450, 17-S-451 & 17-S-453

300 ohms balanced.

Models 17-S-450U, 17-S-451U & 17-S-453U

UHF—300 ohms balanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used — **Function**

Tuner KRK30A (17-S-450U, 17-S-451U & 17-S-453U)

(1) RCA 6AF4 ....UHF Oscillator
(2) RCA 6BQ7A .... VHF R-F Amplifier / UHF I-F Amplifier
(3) 6X8 ....VHF R-F Oscillator and Mixer / UHF I-F Amplifier

A K3D or a 1N82 crystal is used as the UHF mixer.

All Models

(1) RCA 6CF6 ....1st Picture I-F Amplifier
(2) RCA 6CB6 ....2nd Picture I-F Amplifier
(3) RCA 6CB6 ....3rd Picture I-F Amplifier
(4) RCA 6AN8 ....1st Video Ampl. & 1st Sync.
(5) RCA 6C4 ....Video Output
(6) RCA 6AU6 ....Sound I-F Amplifier
(7) RCA 6AL5 ....Ratio Detector
(8) RCA 6AV6 ....1st Audio Amplifier
(9) RCA 6AS5 ....Audio Output
(10) RCA 12AU7 ....Sync. Output & Vert. Osc. and Disch.
(11) RCA 6K6GT ....Vertical Sweep Output
(12) RCA 6SN7GT....Horizontal Sweep Oscillator and Control
(13) RCA 6BQ6GT ....Horizontal Sweep Output
(14) RCA 6AX4GT .... Damper
(15) RCA 1B3-GT ....High Voltage Rectifier
(16) RCA 17HP4 .... Kinescope
(17) RCA 5U4G .... Rectifier

Tuner KRK32 (17-S-450, 17-S-451 & 17-S-453)

(1) RCA 6CB6 ....R-F Amplifier
(2) RCA 6U8 ....R-F Oscillator and Mixer

CHASSIS DESIGNATIONS

KCS87..........Models 17-S-450, 17-S-451 and 17-S-453 employing a KRK32 Tuner.

KCS87A..........Models 17-S-450U, 17-S-451U and 17-S-453U employing a KRK30A Tuner.

INSTALLATION INSTRUCTIONS

UNPACKING—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle.

Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ANTENNA INPUT

Models 17-S-450, 17-S-451 & 17-S-453

The KRK32 tuner unit is designed for VHF reception only, with a 300 ohm antenna input provided.

Models 17-S-450U, 17-S-451U & 17-S-453U

The KRK30A tuner unit is designed for UHF-VHF reception with 300 ohm inputs provided for UHF and VHF use. When using a UHF antenna only or a VHF antenna only connect the single transmission line to the proper receiver antenna terminals. Do not connect the terminal board jumper W105. (Refer to figure 27.)

When a combination UHF-VHF antenna is used, connect the transmission line to the VHF terminals on the terminal board. Connect the jumper W105 to the UHF terminals as shown in figure 27.

Signals from separate UHF and VHF antennas may be fed to the tuner. To do this connect the individual transmission lines to their respective terminals on the terminal board. Do not connect the jumper W105. Where a "crossover network" is employed to match the two separate antennas to a common 300 ohm line, connect the line to the VHF terminals. Connect the jumper W105 to the UHF terminals on the terminal board.

CHECK FOR PROPER OPERATION.—Turn the power switch to the "on" position and check the operation of the receiver.

Each unit has been completely and accurately adjusted at the factory and should operate normally at this point. However, a check of all the various functions should be performed. Adjustment should be made as outlined below, only where an indication of improper operation is evident.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 3. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.

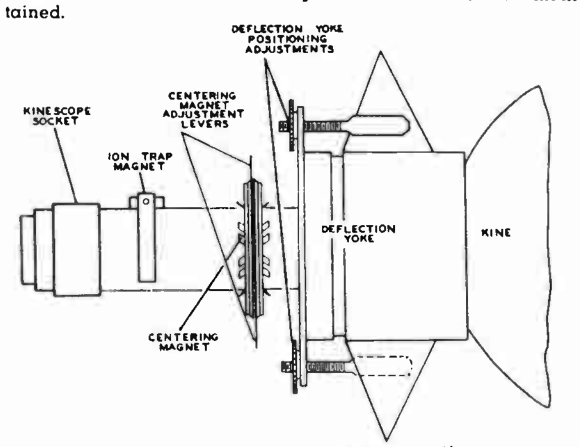


Figure 3—Yoke and Centering Magnet Adjustments

DEFLECTION YOKE ADJUSTMENT.—If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the knurled yoke nuts.

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern or picture in order to make further adjustments.

When the Horizontal Oscillator is operating properly, it should be possible to sync the picture at this point. However, if the AGC (LOCAL-DISTANT) control is misadjusted on UHF-VHF receivers, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, readjust LOCAL-DISTANT control until the set operates normally and the picture can be synced.

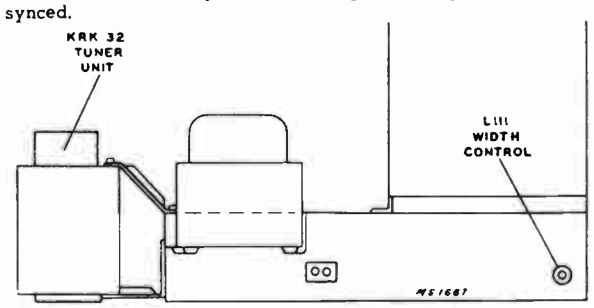


Figure 4—Rear Chassis Adjustments

CHECK OF HORIZONTAL OSCILLATOR ADJUSTMENT.—Turn the horizontal (freq.) control clockwise until the picture is out of sync, with approximately twelve bars slanting downward to the left. Turn the control counter-clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 1½ to 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional counter-clockwise rotation of the control. The picture should remain in sync for approximately two full turns of additional counter-clockwise rotation of the control. Continue counter-clockwise rotation until the picture falls out of sync. Rotation beyond fall-out position should produce between 2 and 5 bars before interrupted oscillation (motorboat occurs). Interrupted oscillation (motorboat) should be reached before full counter-clockwise rotation.

When the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Adjustment of Horizontal Oscillator" and proceed with "Centering Adjustment."

ADJUSTMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync over two full turns of counter-clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Turn the horizontal drive trimmer C171 fully clockwise, then counter-clockwise one full turn. Set the width coil L111 with the stud flush with the inside edge of the chassis. Set the sine wave coil L121 fully counter-clockwise.

Adjustment of the horizontal frequency control in the counter-clockwise direction will show a multiple number of bars before "motorboat" occurs. Adjust the sine wave coil L121 until 3 or 4 bars are present before "motorboat" occurs, when the horizontal frequency control is rotated counter-clockwise from the fall-out point.

If it is impossible to sync the picture and the AGC control (UHF/VHF receivers only) is in proper adjustment it will be necessary to align the Horizontal Oscillator by the method outlined in the alignment procedure

CENTERING ADJUSTMENT—The electrostatic focus kinescope is provided with special centering magnets. These magnets are in the form of two discs mounted on a non-magnetic tube which is placed around the neck of the kinescope at a distance of about one-fourth of an inch in back of the deflection yoke plate. When the magnets are rotated on the tube so that the levers are together, maximum centering effect is produced. To shift the picture, rotate one of the magnets with respect to the other. To shift the picture in the desired direction rotate the entire centering magnet assembly on the neck of the kinescope. By alternately rotating one magnet with respect to the other, then rotating the entire assembly around the neck of the tube, proper centering of the picture can be obtained.

WIDTH AND DRIVE ADJUSTMENTS.—Set the horizontal control at the "pull-in" point. Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer counter-clockwise until a bright vertical line appears in the middle of the picture then clockwise until the bright line just disappears.

At maximum brightness adjust the width control L111 to obtain correct picture width.

Return the brightness to normal level and readjust the drive trimmer C171 as before.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R165 behind front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R174 behind front control panel), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—An electrostatic focus type kinescope is employed in these receivers. The receivers operate with fixed focus, having a fixed voltage applied to the focusing electrode.

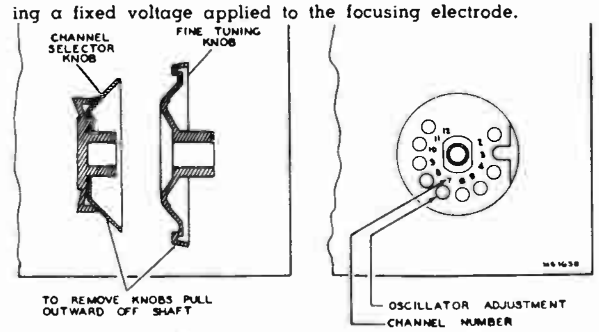


Figure 5—KRK32 R-F Oscillator Adjustments

KRK32, or KRK30A VHF R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 11 or 14. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the channel selector and fine tuning knobs and the indicator dial on UHF-VHF models as shown in Figure 5 or 6. The oscillator for the UHF tuner section of the KRK30A tuner should be adjusted by the method outlined on page 14 under Alignment Procedure.

AGC CONTROL.—The AGC (LOCAL-DISTANT) control R149 is provided as a customer control on UHF/VHF models. Adjustment should be made as outlined under "OPERATING INSTRUCTIONS"

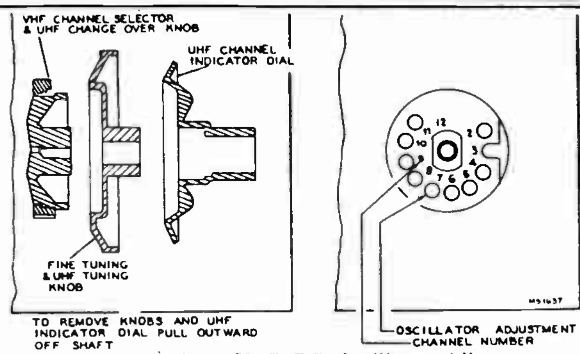


Figure 6—KRK30A VHF R-F Oscillator Adjustment

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is L5 and is located on the antenna matching transformer.

CAUTION.—In some receivers, the FM trap L5 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L5 to make sure that adjustment does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding the back are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

INTERFERENCE.—Auto ignition, street cars, electrical machinery and diathermy apparatus may cause interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least ¼ wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

Short-wave radio transmitting and receiving equipment may cause interference in the picture in the form of moving ripples. In some instances it may be possible to eliminate the interference by the use of a trap in the antenna transmission line. However, if the interfering signal is on the same frequency as the television station, a trap will provide no improvement.

CHASSIS TOP VIEW

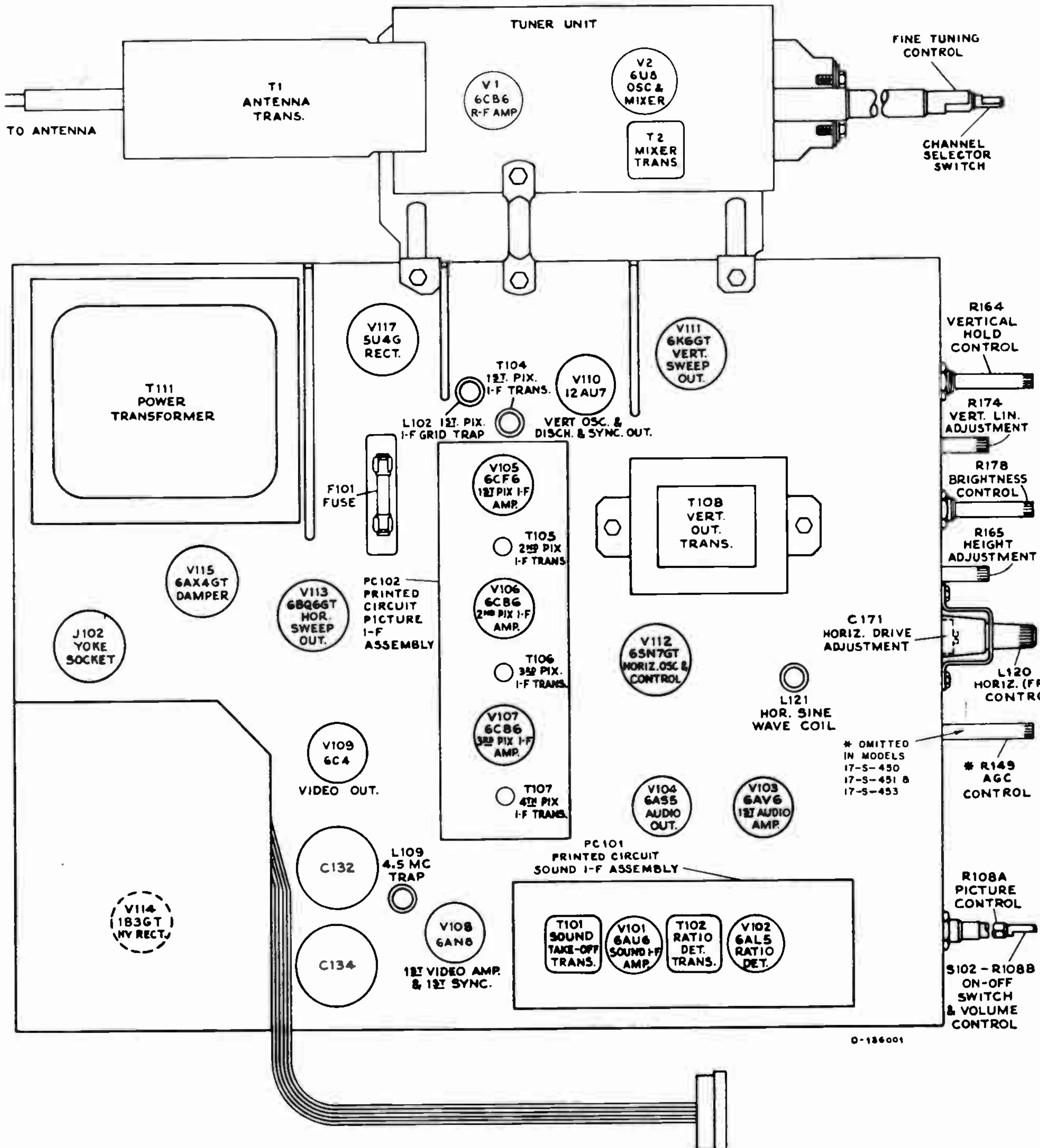


Figure 7—Chassis Top View (shown with KRK32 Tuner)

CHASSIS BOTTOM VIEW

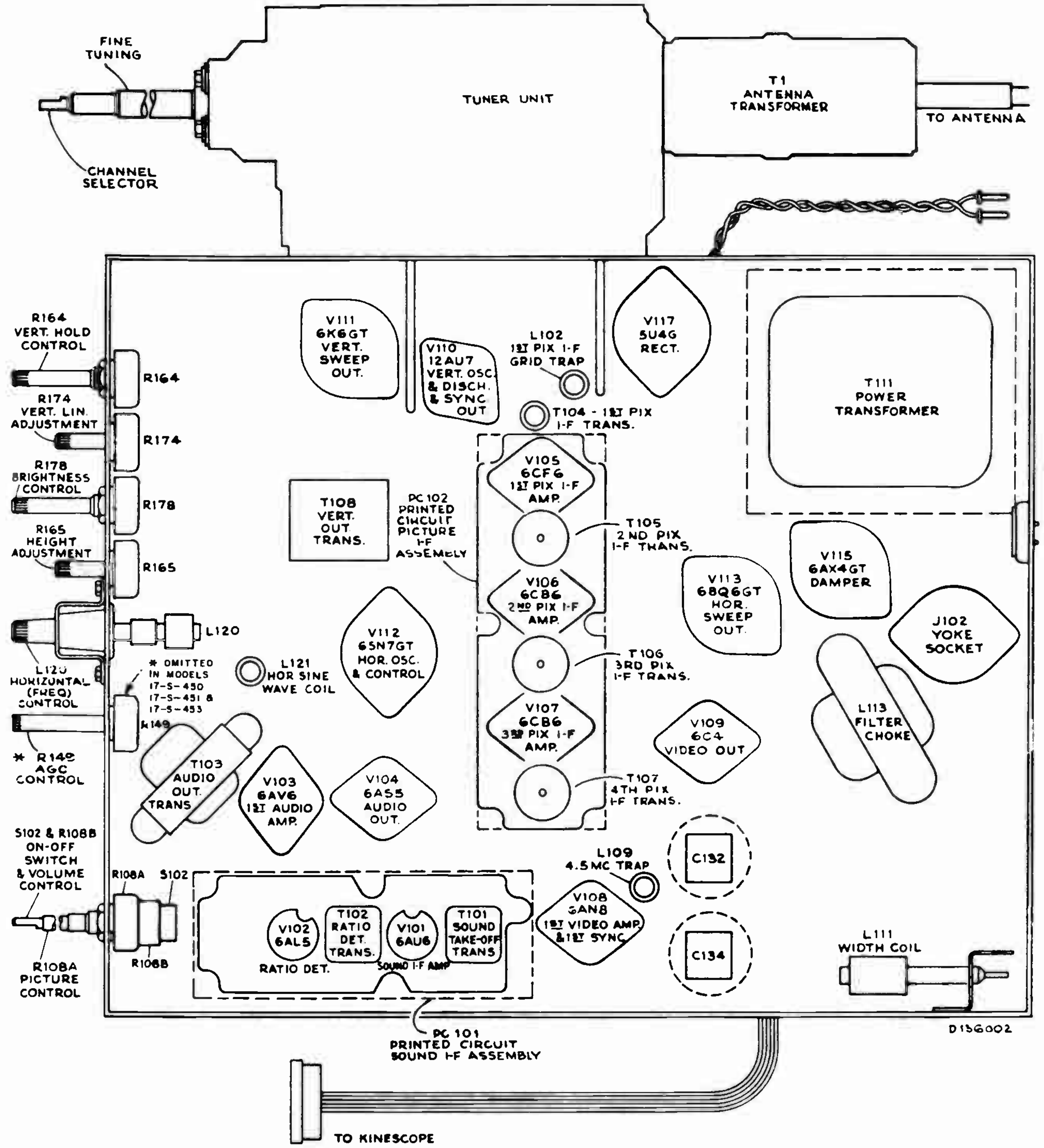


Figure 8—Chassis Bottom View (shown with KRK32 Tuner)

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:
(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:
(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least 1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 5 millivolts per inch is required. A suitable preamplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—
Models 17-S-450, 17-S-451 & 17-S-453

Connect the i-f signal generator, in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R115, R117 and C120 and to ground.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R115, R117 and C120. The second battery will be used later.

Set the bias to produce approximately —3.5 volts of bias at the junction of R115, R117 and C120.

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." (Note: These transformers should be peaked with their cores at the ends of the coils nearest the chassis.) During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —3.5 volts of i-f bias at the junction of R115, R117 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R129, L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

Models 17-S-450U, 17-S-451U & 17-S-453U

Connect the i-f signal generator in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R115, R117 and C120.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R115, R117 and C120. Adjust the potentiometer for —3.5 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —3.5 volts of i-f bias at the junction of R115, R117 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

(Note: Peak transformers with cores at end of coils nearest chassis.)

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R129 and L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

SWEEP ALIGNMENT OF PICTURE I-F.—
Models 17-S-450, 17-S-451 & 17-S-453

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —3.5 volts of bias as measured by a "VoltOhmyst" at the junction of R115, R117 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T1 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 9. Maximum allowable tilt is 20%.

Readjust T1 and T104 if necessary to obtain proper wave shape as in Figure 9.

Disconnect the diode probe and the 180 ohm resistor.

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

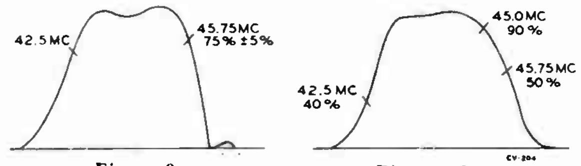


Figure 9— T1 and T104 Response with KRK32

Figure 10— Overall I-F Response with KRK32

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.5 mc. Adjust T105 and T107 to set 41.25 mc. between 25 and 35 times down with curve as shown in Figure 10.

Move the sweep generator to the antenna terminals. Connect —3.5 volts bias to pin 5 of V103. Adjust T106 and T107 slightly to correct for any overall tilt while switching from channel to channel.

Models 17-S-450U, 17-S-451U & 17-S-453U

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —3.5 volts of bias as measured by a "VoltOhmyst" at the junction of R115, R117 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 11. Maximum allowable tilt is 20%.

Disconnect the diode probe and the 180 ohm resistor.

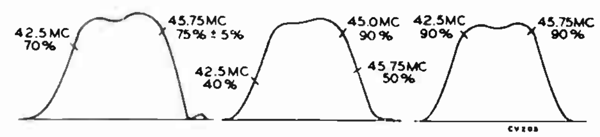


Figure 11— T2 and T104 Response with KRK30A

Figure 12— Overall I-F Response with KRK30A

Figure 13— KRK30A L9 and C308 I-F Response

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 0.5 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T105, T106 and T107 to obtain the response shown in Figure 12.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 25 and 35 times down with curve as shown in Figure 12.

To align the I-F amplifier circuit of the KRK30A, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.

To do this, remove the crystal cover and connect the resistor, after insulating the lead with tubing, to the crystal front terminal.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING between channels 68 and 69 at 800 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground.

Connect the oscilloscope diode probe to the junction between the resistor and capacitor. (See Figure 20.)

Couple the VHF signal generator loosely to the diode probe in order to obtain markers.

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.5 volt or less peak-to-peak on the oscilloscope.

Adjust C308, on the UHF section, and L9, on the VHF section, of the tuner for maximum gain with 45.75 mc. and 42.5 mc. markers as shown in figure 13.

If necessary adjust L27 to place the 45.75 mc. marker at the peak of the curve. Adjust L43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to pin 8 of V110. Use 3.0v peak-to-peak on the oscilloscope.

Connect the VHF sweep generator to the antenna terminals. Keep the R-F AGC bias at —3.5 V and the I-F bias at —3.5 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 12. Retouch T106 and T107 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 12, retouching C308 and L9 if necessary to correct any overall tilt.

Do not retouch L27, L43, T2, T104, T105, T106 or T107. Remove the sweep and marker generators and the bias supplies.

KRK32 TUNER ALIGNMENT.—

Models 17-S-450, 17-S-451 & 17-S-453

A tuner unit which is operative and requires only touch up adjustments requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from the terminals of T2 and shunt the terminals with a 39 ohm composition resistor.

Connect the oscilloscope to the test point TP1 on the side of the tuner unit. Set the oscilloscope to maximum gain.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts. Since there is no adjustment for varying the oscillator injection voltage, a check for injection voltage being within limits should be made after proper oscillator tracking has been established on channels 8 through 13.

Turn the fine tuning control to the mechanical center of its range.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C18. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

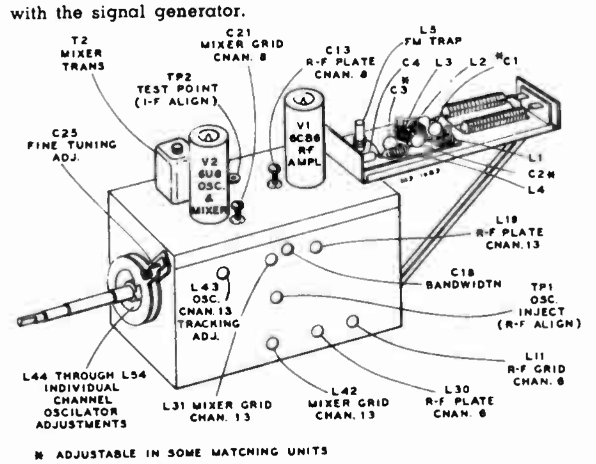


Figure 14—KRK32 Tuner Adjustments

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L43 to obtain proper channel 13 oscillator frequency as indicated in the table

Then, switch to channel 12 and adjust L54 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L43 and back to channel 8 and adjust C25.

Connect the sweep generator through a suitable attenuator, as shown in figure 15, to the input terminals of the antenna matching unit.

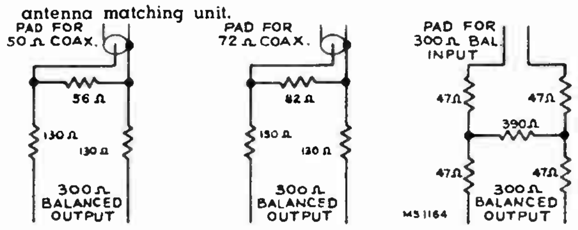


Figure 15—Sweep Attenuator Pads

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the maximum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C13, C18 and C21 for approximately correct curve shape, frequency, and band width as shown in figure 16.

C-13 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably. C18 is the coupling adjustment and hence primarily affects the response band width.

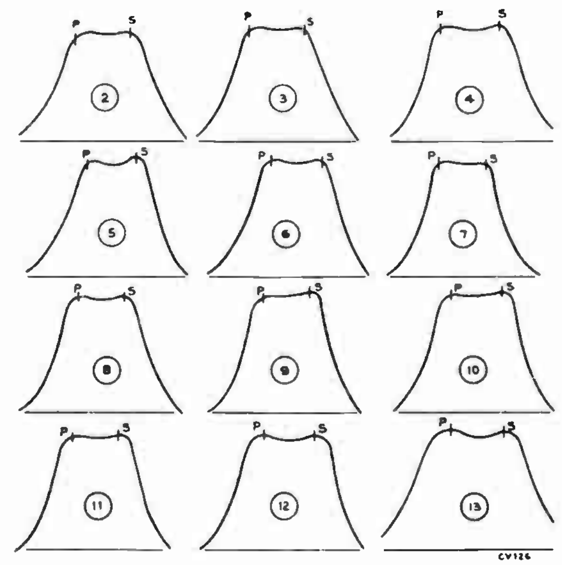


Figure 16—KRK32 Tuner R-F Responses

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control to the mechanical center of its range.

Adjust L43 to obtain an audible beat. Slightly overshoot the adjustment of L43 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C25 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L19 and L31 for proper response as shown in figure 16.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Where the voltage is not within the previously specified limits after the correct adjustment for oscillator tracking on channels 8 through 13 has been achieved, the 6U8 oscillator-mixer tube should be replaced. If the voltage is still outside limits, replace C22.

If it was necessary to replace the 6U8 or C22, turn the sweep and signal generators back on and repeat the oscillator tracking procedure for channels 8 through 13.

Set the receiver channel selector switch to channel 8 and readjust C25 for proper channel 8 oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C13, C18 and C21 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L48 for an audible beat. Adjust L11, L30 and L42 for proper curve shape as shown in figure 16. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified.

The correct adjustment of L11 is indicated by maximum amplitude of the curve midway between the markers. L30 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. L42 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that L11 has been properly adjusted).

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 16 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L11, L30 and L42 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 16 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C13, C21, or C18 to obtain the proper response.

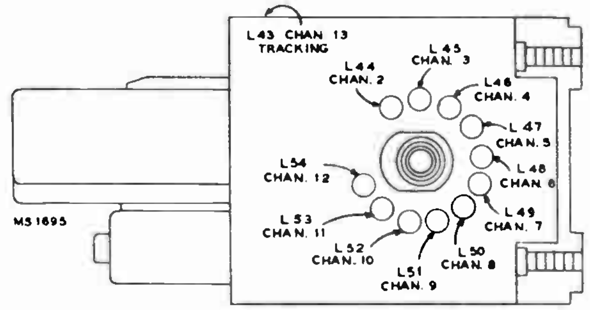


Figure 17—KRK32 Tuner Oscillator Adjustments

With the receiver and signal generator on channel 13 adjust L43 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

KRK32 or KRK30A ANTENNA MATCHING UNIT ALIGNMENT. —The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The tuner unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the tuner unit should be re-aligned.

The F-M Trap which is counted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L5 to the channel selector switch S1D (S1E).

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R115, R117 and C120. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R115, R117 and C120.

Connect an oscilloscope to the junction of R129 and L103 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Note.—Inductances in KRK32 matching units are not slug tuned and therefore must be knifed for adjustment except those units in which C1, C2 and C3 are variable.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L4 (core or knife coil) or C3 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L1 (core or knife coil) or C1 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L5 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L5 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 15 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L2 and L3 (core or knife coil) of C2 to obtain the response shown in figure 18. L3 is most effective in locating the position of the shoulder of the curve at 52 mc. and L2 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary. (Note.—Second harmonic output from the sweep generator may cause distortion of the response. Tune L5 F-M trap for maximum inductance to eliminate distortion when adjusting the matching unit. Be sure to return the L5 slug to its original position after adjusting the matching unit to prevent attenuation on channel 5 or 6.)

Restore the connection between L5 and S1D (S1E). Replace V106.

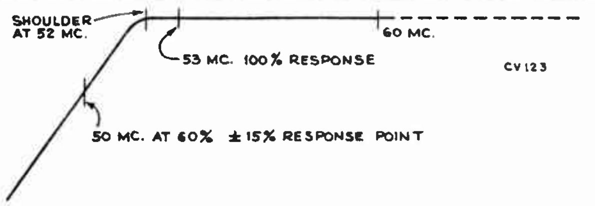


Figure 18—KRK32 or KRK30A Antenna Matching Unit Response

KRK30A TUNER ALIGNMENT

Models 17-S-450U, 17-S-451U & 17-S-453U

VHF ALIGNMENT.—A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C27 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T2 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from the terminals of T2 and shunt the terminals with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 43.5 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP2 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L5 and C4 at the bottom of the FM trap L5.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C33 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C33 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C22 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst." The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C25 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C16. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f" in terminal of the signal generator. Adjust C25 to obtain an audible beat with the signal generator.

Turn C27 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Return the fine tuning control to the mechanical center of its range.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C25, switch to channel 13 and adjust L49 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L60 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency of each channel. Then again on channel 8, adjust C25 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L49 and back to channel 8 and adjust C25.

Set the T2 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator, as shown in figure 15 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals. Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C21, C16, C11 and C7 for approximately correct curve shape, frequency, and band width as shown in figure 19.

The correct adjustment of C7 is indicated by maximum amplitude of the curve midway between the markers. C11 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C21 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C7 has been properly adjusted). C16 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C22 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C27, C21, C16 and C11 for proper response. Adjust C7 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

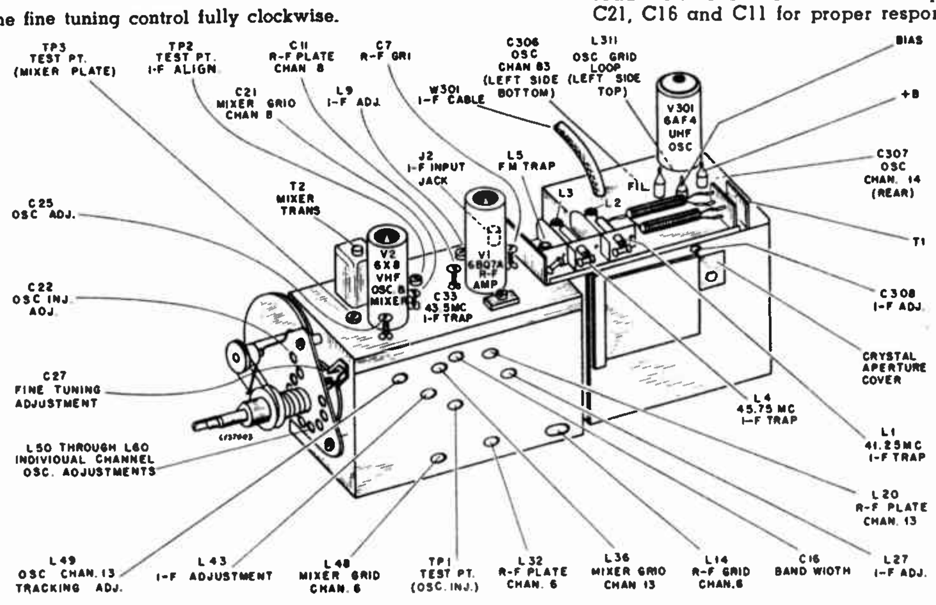


Figure 20—KRK30A Tuner Adjustments

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L49 to obtain an audible beat. Slightly overshoot the adjustment of L49 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C27 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L36 and L20 for proper response as shown in figure 19.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C22, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L36 and L20 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C27 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C21, C16, C11 and C7 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C21 was adjusted in the recheck of channel 8 response.

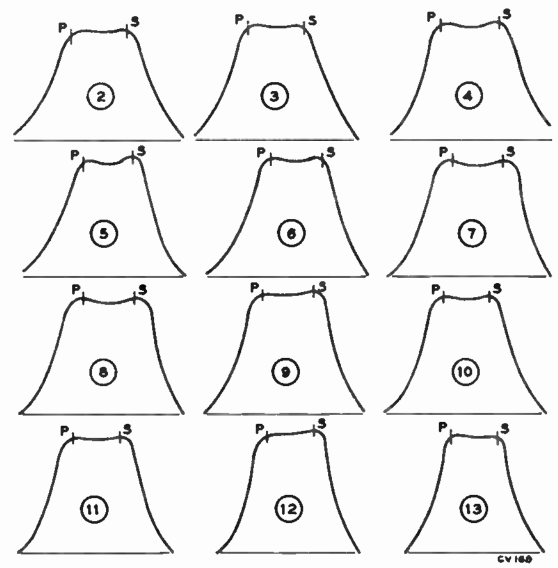


Figure 19—KRK30A Tuner VHF R-F Responses

If the initial setting of the oscillator injection trimmer was far off it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L54 for an audible beat. Adjust L14, L48 and L32 for proper curve shape as shown in figure 19. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C22 if necessary.

If C22 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C21 for correct curve shape and recheck C27 and C25 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 19 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L48 and L32 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to figure 19 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C11, C21 or C16 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L49 for an audible beat with the signal generator.

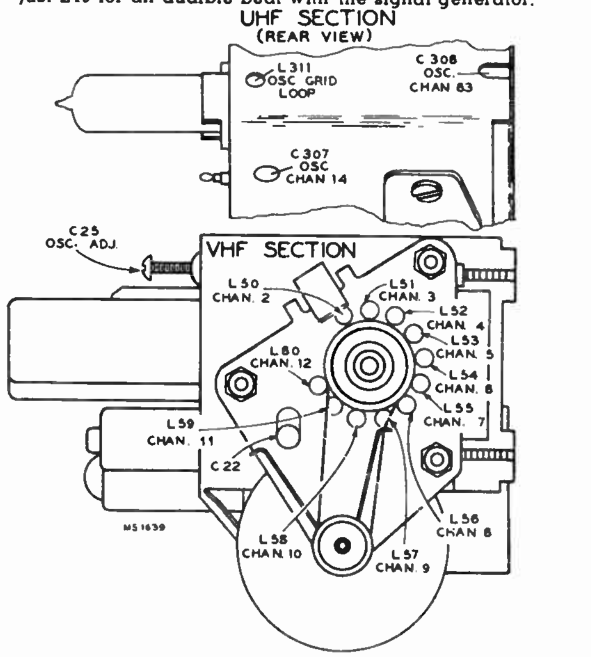


Figure 21—KRK30A Tuner Oscillator Adjustments

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

UHF ALIGNMENT R-F.—Alignment of the UHF section of the tuner may only be performed with the UHF section removed from the tuner assembly. RF adjustments require removal of the tuner shield which may only be done with the UHF tuner separate from its mounting.

I-F and oscillator adjustment may be accomplished without removing the tuner.

Connect a 100 ohm composition resistor between the center conductor of the I-F cable W301 and the tuner case.

Connect the oscilloscope to the center conductor of W301 at the 100 ohm resistor, employing the preamplifier if needed with the oscilloscope used. Ground the oscilloscope to the tuner case.

Connect the output of the UHF sweep generator, through a 300 ohm attenuator pad, to the antenna terminals and set the sweep generator to sweep channel 83, centered on 887.5 mc. Adjust the output of the sweep generator to full sweep width.

A test dial made to fit over the split gear on the tuner shaft is necessary for accurate alignment. Scribe marks at 0°, 5° and 164° should be marked on the test dial for reference. The 0° reference point is located with the capacitor plates fully meshed. With the stop pin on the tuner against the stop plate on the gear assembly the plates will be in the proper fully meshed position.

Rotate the tuning dial to the 164°, Channel 83, position.

Connect the VHF signal generator in series with a 1000 ohm resistor to the junction of W301 and L310. This may be done by inserting the lead from the resistor, which should be covered with insulated tubing, through the aperture provided for crystal removal. (See figure 20.) Insert markers for 41.25 mc., 43.5 mc. and 45.75 mc.

Connect the UHF marker generator loosely to the antenna terminals and insert a marker at 887.5 mc.

Adjust R-F trimmer capacitor tabs C304 and C305 for a maximum amplitude overcoupled response curve centered at 887.5 mc. as shown in figure 22(A).

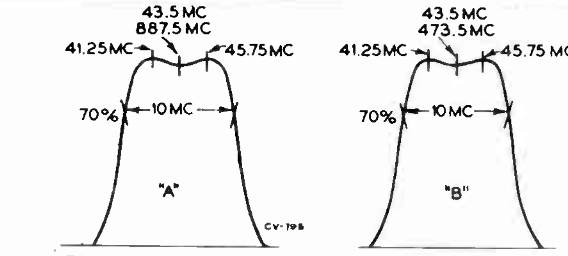


Figure 22—KRK30A Tuner UHF R-F Responses

Adjust the oscillator trimmer capacitor C306 until the 43.5 mc. marker coincides with the marker at 887.5 mc. The markers for 41.25 and 45.75 should be symmetrically located on the top of the response curve as in figure 22(A).

Set the UHF sweep and marker generators to 473.5 mc. Rotate the tuning dial to the 5°, Channel 14, position.

Adjust the oscillator trimmer C307 until the 43.5 mc. marker coincides with the 473.5 mc. marker, with the 41.25 and 45.75 markers as shown. The inductance loop L311 across the oscillator grid coil on some units, may be repositioned, if necessary, to bring the oscillator trimmer within range. Refer to figure 20 for location of the aperture for making this adjustment.

Repeat the above adjustments, as necessary, until the proper responses are obtained. Tune through the entire range and check the tracking. When perfectly tracked the three markers will be on the top of the response curves, however, mistracking to the extent that the 41.25 mc. and 45.75 mc. ride down the sides of the curves to a point not less than 70% will not seriously affect the alignment. Should the markers fall below this level, it will be necessary to knife the RF plates to correct the mistracking. The plates must be knifed with the shield cover removed. Always knife the plates while tuning lower in frequency to prevent affecting the tracking above the point of knifing. Check which section requires knifing by touching the plates with the knifing tool while observing the response, then proceed with the knifing of the proper section or of both sections if required.

Connect the "VoltOhmyst" between the center conductor of W301 and ground. Set the "VoltOhmyst" to the 1.5v. DC scale. Tune over the entire range observing the reading on the meter. A reading between .03 and .35 volts should be obtained. Voltages outside these limits are an indication of low B voltage, low or high crystal impedance or an oscillator tube outside allowable limits. This voltage is varied by repositioning the flag L309 with respect to L303.

Connect the "VoltOhmyst" to the "bias" terminal of the tuner (refer to figure 20). A reading between 0.5 and 2.5 volts should be obtained. Readings above or below this range will cause crystal currents outside allowable limits and in such cases the oscillator tube should be replaced. Replacement of the oscillator tube will require recalibration at the high and low frequency ends of the band as previously outlined.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 8 of V108A, in series with a .01 mfd. capacitor.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix r-f amplifier, pin 1 of V107.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at pin 6 of V108A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst." (Adjust with core at chassis end of coil.)

Repeat adjustments of T102 top for maximum d-c at pin 7 of V102 and T102 bottom for zero d-c at the junction of R104 and C107. Make the final adjustments with the signal input level adjusted to produce 5 volts d-c on the "VoltOhmyst" at pin 7 of V102.

SOUND TAKE-OFF ALIGNMENT.—Connect the signal generator to the first video amplifier grid, pin 8 of V108A.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the T101 top core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

(Alternate Method for Ratio Detector and Sound I-F Alignment)

Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 8 of V108A in series with a .01 mfd. capacitor.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the ratio detector secondary T102 bottom core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked, when making the above adjustments.

Tune the T101 (top) core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the T101 adjustment are made.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune T102 bottom for zero d-c at the junction of R104 and C107. (Make adjustment with core at chassis end of coil.)

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1500 mmf. capacitor to pin 8 of V108A. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V107, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video output, pins 1-5 of V109A.

Adjust the core of L109 for minimum output on the oscilloscope. (Make adjustment with core at chassis end of coil.)

Remove the short from pin 1, V107 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L109 requires no adjustment. If a 4.5 mc. beat is present, tune the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L109 for minimum beat.

HORIZONTAL OSCILLATOR AND OUTPUT ALIGNMENT.—Normally the alignment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned.

Turn the horizontal drive trimmer C171 fully clockwise then counter-clockwise one full turn. Set the stud of the width coil L111 flush with the inside rear edge of the chassis.

Place a jumper across the terminals of the sine wave coil L121 and adjust the horizontal (frequency) control until the picture pulls into sync. Remove the short across the sine wave coil.

Connect the low capacity probe of an oscilloscope to the junction of L120, L121 and R189. Turn the horizontal (frequency) control clockwise until the picture falls out of sync, then counter-clockwise until the picture just pulls into sync. The pattern on the oscilloscope should be as shown in Figure 23. Adjust the sine wave adjustment core L121 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the horizontal (frequency) control if necessary.

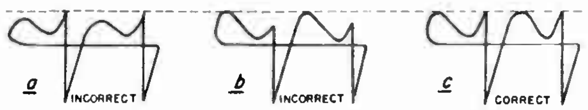


Figure 23—Horizontal Oscillator Waveforms

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator may occur. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Drive Adjustment *(for correct locking range)*. Turn the horizontal (frequency) control until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal control counter-clockwise and note the number of diagonal bars obtained just before the picture pulls into sync.

Pull-in should occur with one and one-half to three bars present.

With the horizontal control set at the pull-in point, adjust the horizontal drive trimmer C171 counter-clockwise for a bright vertical line in the center of the picture. Turn the trimmer clockwise until the line just disappears.

Set the brightness control to maximum and adjust the width control so the picture fills the mask. Return the brightness control to normal and readjust the horizontal drive trimmer as above.

The picture should pull into sync with one and one-half to three bars present, remain in sync for approximately two full turns counter-clockwise from pull-in, and fall out of sync with between 2 and 5 bars present before interrupted oscillation (motorboating) occurs.

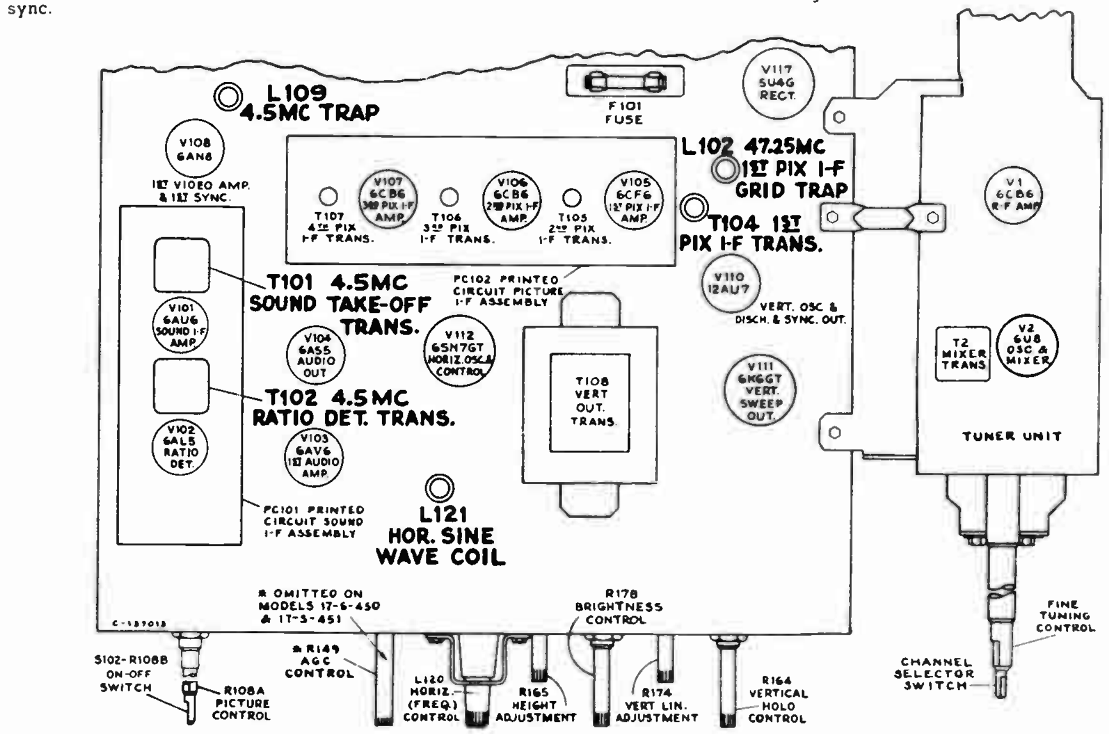


Figure 24—Top Chassis Adjustments

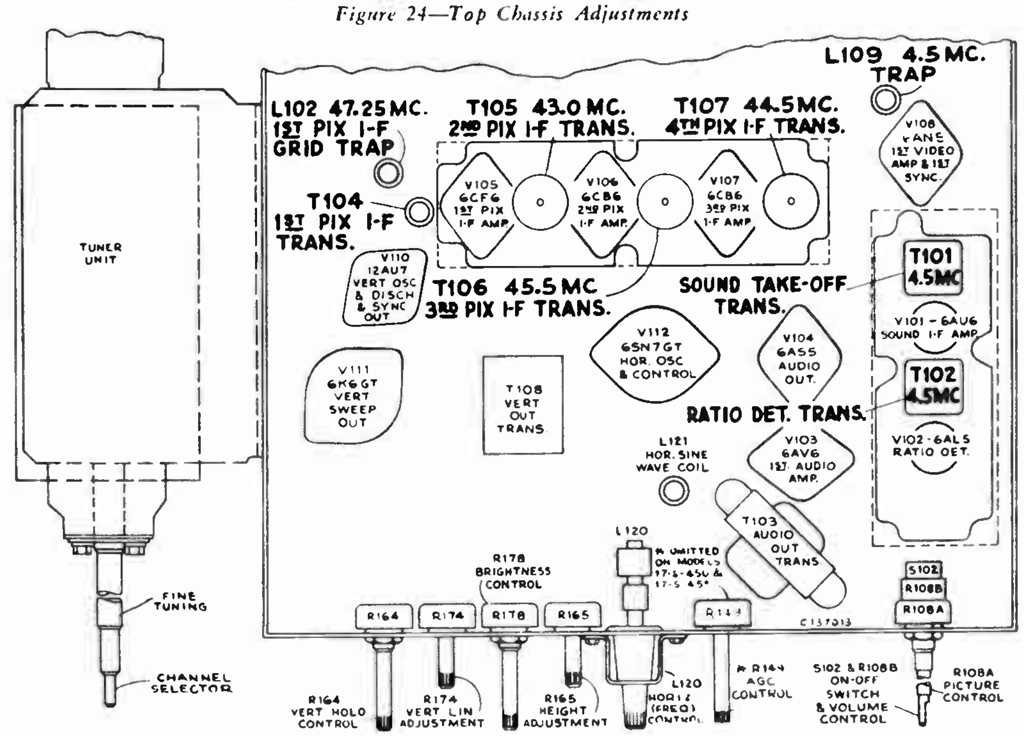


Figure 25—Bottom Chassis Adjustments

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 30000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1	6BQ7A	R-F Amplifier	30000 Mu. V. Signal	6	170	—	—	8	0.1	7	0	
			No Signal	6	133	—	—	8	1.1	7	0	
KRK30A		R-F Amplifier	30000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V2	6X8	Mixer	30000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	
			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	
KRK30A		R-F Oscillator	30000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	
V1 KRK32	6CB6	R-F Amplifier	30000 Mu. V. Signal	5	260	6	135	2	0	1	—	
			No Signal	5	250	6	78	2	0	1	—	
V2 KRK32	6U8	Mixer	30000 Mu. V. Signal	6	103	3	103	7	0	2	—3.0 to —4.0	
			No Signal	6	98	3	98	7	0	2	—3.5 to —4.5	
		R-F Oscillator	30000 Mu. V. Signal	1	228	—	—	8	103	9	—4.5 to —7.5	
			No Signal	1	224	—	—	8	98	9	—3.5 to —6.5	
V101	6AU6	Sound I-F Amp.	30000 Mu. V. Signal	5	126	6	136	7	1.2	1	0.2	
			No Signal	5	121	6	131	7	1.1	1	0	
V102	6AL5	Ratio Detector	30000 Mu. V. Signal	7	—8.0	—	—	1	—0.3	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	—2.9	—	—	1	—0.1	—	—	
		Ratio Detector	30000 Mu. V. Signal	2	—0.4	—	—	5	7.2	—	—	
			No Signal	2	—0	—	—	5	3.2	—	—	
V103	6AV6	1st Audio Amplifier	30000 Mu. V. Signal	7	98	—	—	2	0	1	—0.8	At min. volume
			No Signal	7	96	—	—	2	0	1	—0.8	At min. volume
V104	6AS5	Audio Output	30000 Mu. V. Signal	7	250	6	262	1	150	2 & 5	141	At min. volume
			No Signal	7	242	6	253	1	145	2 & 5	138	At min. volume
V105	6CF6	1st Pix. I-F Amplifier	30000 Mu. V. Signal	5	132	6	144	2	0	1	—4.3	*Unreliable measuring point
			No Signal	5	118	6	129	2	1.05	1	*0.4	
V106	6CB6	2nd Pix. I-F Amplifier	30000 Mu. V. Signal	5	250	6	278	2	145	1	129	
			No Signal	5	240	6	263	2	140	1	128	
V107	6CB6	3rd Pix. I-F Amplifier	30000 Mu. V. Signal	5	130	6	142	2	2.3	1	0	
			No Signal	5	121	6	137	2	2.2	1	0	
V108A	6AN8	1st Video Amplifier	30000 Mu. V. Signal	6	80	7	110	9	5.0	8	4.2	Normal contrast
			No Signal	6	74	7	102	9	4.8	8	3.9	Normal contrast
V108B	6AN8	1st Sync	30000 Mu. V. Signal	1	27	—	—	3	0	2	—20	
			No Signal	1	11	—	—	3	0	2	—1.0	
V109	6C4	Video Output	30000 Mu. V. Signal	1-5	220	—	—	7	10.5	6	0	Contrast control at maximum
			No Signal	1-5	217	—	—	7	10	6	0	
V110A	12AU7	Sync Output	30000 Mu. V. Signal	1	58	—	—	3	0	2	—1.1	
			No Signal	1	52	—	—	3	0	2	0.3	
V110B	12AU7	Vertical Oscillator & Discharge	30000 Mu. V. Signal	6	180	—	—	8	0	7	—63	Depends on setting of Vert. hold control
			No Signal	6	175	—	—	8	0	7	—61	Voltages shown are synced pix adjustment
V111	6K6GT	Vertical Output	30000 Mu. V. Signal	3	262	4	280	8	0	5	—29	
			No Signal	3	255	4	274	8	0	5	—28	
V112	6SN7GT	Horizontal Osc. Control	30000 Mu. V. Signal	2	280	—	—	3	2.5	1	—23.5	
			No Signal	2	274	—	—	3	2.3	1	—21	
	6SN7GT	Horizontal Oscillator	30000 Mu. V. Signal	5	200	—	—	6	0	4	—75	
			No Signal	5	193	—	—	6	0	4	—74	
V113	6BQ6GT	Horizontal Output	30000 Mu. V. Signal	Cap	*	4	150	8	9.5	5	—19	*High Voltage Pulse Present
			No Signal	Cap	*	4	148	8	9.0	5	—18	*High Voltage Pulse Present
V114	1B3GT	H. V. Rectifier	30000 Mu. V. Signal	Cap	*	—	—	2 & 7	15,800	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	15,300	—	—	*High Voltage Pulse Present
V115	6AX4GT	Damper	30000 Mu. V. Signal	5	280	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	273	—	—	3	*	—	—	*High Voltage Pulse Present
V116	17HP4	Kinescope	30000 Mu. V. Signal	Cap	15,800	10	465	11	65	2	0	At average Brightness
			No Signal	Cap	15,300	10	450	11	63	2	0	At average Brightness
V117	5U4G	Rectifier	30000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	290	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	280	—	—	

REPLACEMENT PARTS

SYMBOL NO.	STOCK NO.	DESCRIPTION
		KRK30A—TUNER UNIT ASSEMBLY (VHF SECTION)
C5	77084	Capacitor—Ceramic, feed-thru, 1000 mmf.
C6	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v.
C7	76532	Trimmer—Adjustable, 1-4 mmf.
C8, C9	77252	Capacitor — Fixed, ceramic, 1000 mmf., +100%, —0%, 500 v.
C10	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. D.C. Part of S4
C11	77151	Trimmer—Adjustable, 0.8-3.0 mmf.
C12	78276	Capacitor—Fixed, ceramic, 150 mmf., ±10%, 500 v. D.C. Part of S3
C13	71599	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. D.C. Part of S2
C16	78397	Trimmer—Mica, 80-150 mmf.
C20	78603	Capacitor—Fixed, ceramic, 82 mmf., ±10%, 500 v.
C22	77913	Capacitor—Adjustable, steatite, 0.8-3.0 mmf. Part of S1
C23	71504	Capacitor—Fixed, headed-lead, 0.68 mmf., ±20%, 500 v. D.C. Part of S2
C24	78247	Capacitor—Fixed, ceramic, 10 mmf., ±1 mmf., 500 v.
C25		Same as C11
C26	77865	Capacitor—Fixed, ceramic, 10 mmf., ±1.0 mmf., 500 v.
C27	79192	Trimmer—Ceramic, variable — fine tuning type
C28	73960	Capacitor—Fixed, ceramic, 10,000 mmf., 500 v.
C29	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 v. Part of S3
C31		Capacitor — Fixed, headed-lead type, 2.2 mmf., ±20%, 500 v. D.C.
C33	77616	Capacitor—Adjustable, mica, 4-40 mmf.
C34, C35		Same as C29
C36	75437	Capacitor—Fixed, ceramic, 100 mmf., ±20%, 500 v. D.C. Part of S2
C38	71503	Capacitor—Fixed, headed-lead type, 3.3 mmf., ±20%, 500 v. D.C. Part of S5
C39		Same as C31. Part of S3

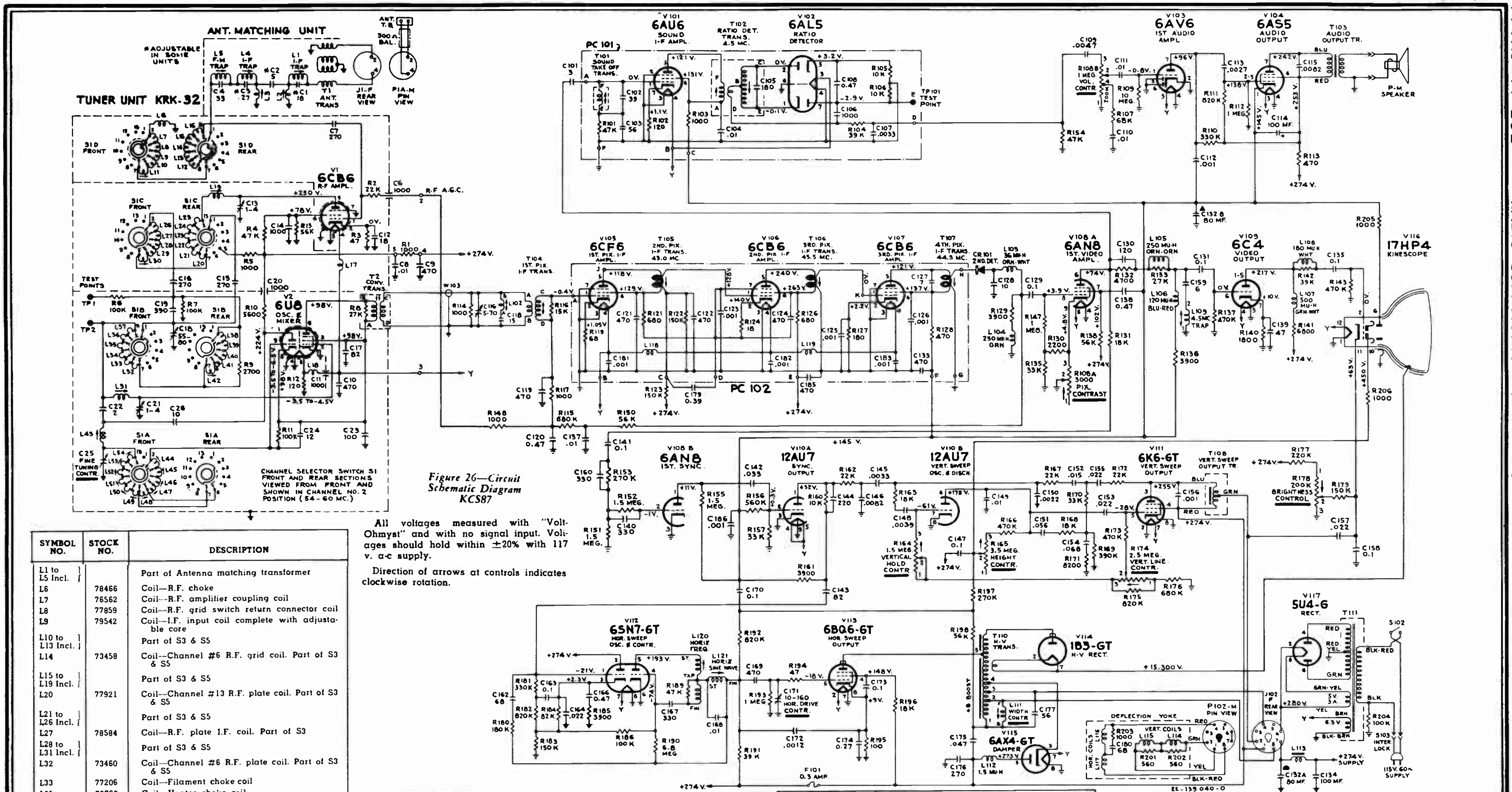


Figure 26—Circuit Schematic Diagram KCS87

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Direction of arrows at controls indicates clockwise rotation.

SYMBOL NO.	STOCK NO.	DESCRIPTION
L1 to L5 Incl.		Part of Antenna matching transformer
L6	78466	Coil—R.F. choke
L7	76562	Coil—R.F. amplifier coupling coil
L8	77859	Coil—R.F. grid switch return connector coil
L9	79542	Coil—I.F. input coil complete with adjustable core
L10 to L13 Incl.		Part of S3 & S5
L14	73458	Coil—Channel #6 R.F. grid coil. Part of S3 & S5
L15 to L19 Incl.		Part of S3 & S5
L20	77921	Coil—Channel #13 R.F. plate coil. Part of S3 & S5
L21 to L26 Incl.		Part of S3 & S5
L27	78584	Coil—R.F. plate I.F. coil. Part of S3
L28 to L31 Incl.		Part of S3 & S5
L32	73460	Coil—Channel #6 R.F. plate coil. Part of S3 & S5
L33	77206	Coil—Filament choke coil
L35	76763	Coil—Heater choke coil
L36	77919	Coil—Channel #13 mixer coil
L37 to L42 Incl.		Part of S1 & S2
L43	78583	Coil—Mixer I.F. coil. Part of S1 & S2
L44 to L47 Incl.		Part of S1 & S2
L48	73874	Coil—Channel #6 mixer coil. Part of S1 & S2
L49	77915	Coil—Channel #13 oscillator coil. Part of S1 & S2
L50 to L60 Incl.		Part of S1 & S2
L61	78401	Coil—Channel #6 antenna coil
R1	502268	Resistor—Fixed, composition, 6800 ohms, ±20%, ½ w.
R2	502112	Resistor—Fixed, composition, 120 ohms, ±10%, ½ w.
R3	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w. Part of S2
R4, R5	502510	Resistor—Fixed, composition, 1 meg., ±10%, ½ w.
R6	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. Part of S3
R7	522315	Resistor—Fixed, composition, 15,000 ohms, ±10%, 2 w.

SYMBOL NO.	STOCK NO.	DESCRIPTION
R8		Part of T2
R9	502233	Resistor—Fixed, composition, 3300 ohms, ±10%, ½ w. Part of S2
R10, R11		Same as R3. Part of S2
R12		Same as R3
R13	522312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 2 w.
R14	502182	Resistor—Fixed, composition, 820 ohms, ±10%, ½ w.
R19	502033	Resistor—Fixed, composition, 33 ohms, ±10%, ½ w. Part of S2
R20		Same as R6
R21		Same as R2
T1	78396	Transformer—Antenna matching transformer complete
T2	78399	Transformer—Convertor transformer (R8)
		(UHF SECTION)
C301 to C303 Incl.	79553	Capacitor—Variable tuning capacitor

SYMBOL NO.	STOCK NO.	DESCRIPTION
C304, C305	79554	Stator—Oscillator stator assembly
C306	79555	Capacitor—Oscillator trimmer capacitor
C307	79556	Capacitor—Adjustable, ceramic, 0.8-3.5 mmf.
C308	79558	Capacitor—Trimmer, 10-50 mmf.
C309 to C311 Incl.	79559	Capacitor—Feed thru, 1000 mmf.
C312, C313	79560	Capacitor—Fixed, ceramic, 1 mmf., ±0.1 mmf., 500 v. D.C., non-insulated
CR301	77489	Rectifier—UHF diode crystal germanium rectifier
L301, L302		Coil—R.F. tank plate
L303	79557	Tank Assembly—complete with capacitor
L304	79564	Board—Antenna terminal board assembly
L305 to L307 Incl.	79565	Choke—R.F. choke
L308, L309		Coil—Mixer coupling coil for oscillator & output section
L310	79567	Coil—I.F. output coil 0.15 microhenries
L311	79566	Coil—Oscillator loop coil

SYMBOL NO.	STOCK NO.	DESCRIPTION
R301	502222	Resistor—Fixed, composition, 2200 ohms, ±10%, ½ w.
R302	512268	Resistor—Fixed, composition, 6800 ohms, ±10%, 1 w.
R303	502268	Resistor—Fixed, composition, 6800 ohms, ±10%, ½ w.
		KRK32—TUNER UNIT ASSEMBLY
C1 to C4 Incl.		Part of antenna matching transformer
C6	77084	Capacitor—Fixed, ceramic, feed-thru, 1000 mmf., +100%, −0%, 500 v. D.C.
C7	75199	Capacitor—Fixed, ceramic, 270 mmf., ±20%, 500 v. D.C. Part of S4
C8	73960	Capacitor—Fixed, ceramic, .01 mf., +100%, −0%, 500 v. D.C.
C9 C10	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 v. D.C.
C11		Same as C6
C12	54207	Capacitor—Fixed, ceramic, 18 mmf., ±10%, 500 v. D.C.
C13	76532	Capacitor—Adjustable trimmer, steatite, 1-4 mmf.

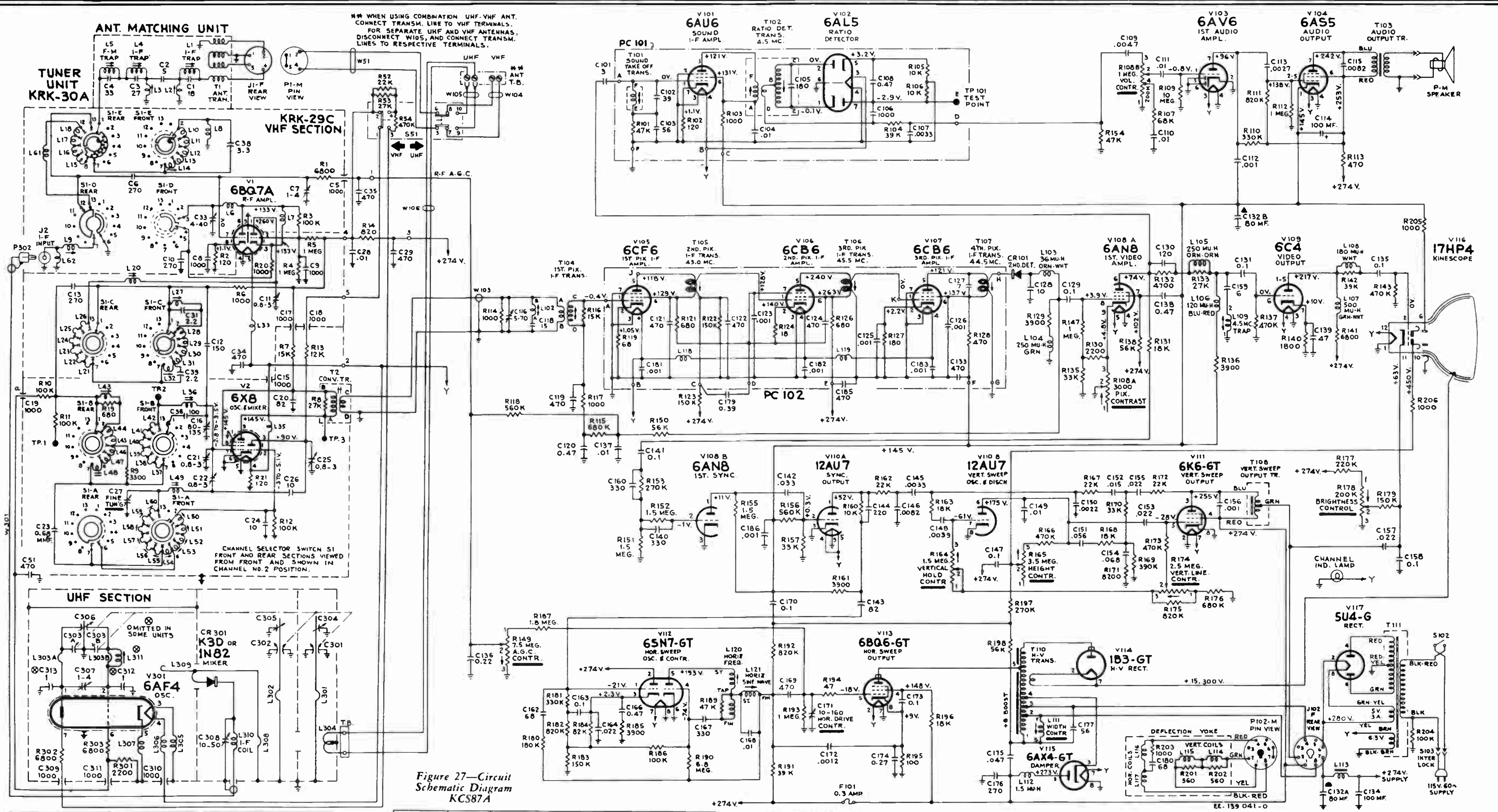


Figure 27—Circuit Schematic Diagram KCS87A

SYMBOL NO.	STOCK NO.	DESCRIPTION
C14	77252	Capacitor — Fixed, ceramic, 1000 mmf., +100%, —0%, 500 v. D.C.
C15		Same as C7. Part of S3
C16		Same as C7. Part of S2
C17	78603	Capacitor—Fixed, ceramic, 82 mmf., ±10%, 500 v. D.C.
C18	79551	Capacitor—Trimmer, 55-80 mmf.
C19	75641	Capacitor—Fixed, ceramic, 390 mmf., ±10%, 500 v. D.C. Part of S2
C20		Same as C6
C21		Same as C13
C22	78047	Capacitor—Fixed, headed-lead type, 2 mmf., ±10%, 500 v. D.C. Part of S2
C23	79735	Capacitor—Fixed, ceramic, 100 mmf., +100%, —0%, 500 v. D.C.
C24	79710	Capacitor—Fixed, ceramic disc, 12 mmf., ±5%, 500 v. D.C. Temp. coeff. —750° C
C25	79192	Capacitor—Fine tuning capacitor plunger type

SYMBOL NO.	STOCK NO.	DESCRIPTION
C26	77865	Capacitor—Fixed, ceramic, 10 mmf., ±1 mmf., 500 v. D.C.
L1 to L5 Incl.		Part of antenna matching transformer
L6	77859	Connector—R.F. grid switch return connector.
L7		Part of S4
L8	79728	Coil—Channel #3 R.F. grid coil. Part of S4
L9	79716	Coil—Channel #4 R.F. grid coil. Part of S4
L10	79714	Coil—Channel #5 R.F. grid coil. Part of S4
L11	73461	Coil—Channel #6 R.F. grid coil. Part of S4
L12	79727	Coil—Channel #8 R.F. grid coil. Part of S4
L13	71469	Coil—Channel #9 front or rear oscillator coil. Part of S4
L14	79713	Coil—Channel #10 R.F. grid coil. Part of S4
L15	71472	Coil—Channel #11 rear oscillator coil. Part of S4
L16	79712	Coil—Channel #12 R.F. grid coil. Part of S4
L17, L18	79720	Coil—Filament choke
L19	77921	Coil—Channel #13 R.F. plate coil. Part of S3

SYMBOL NO.	STOCK NO.	DESCRIPTION
L20 to L25 Incl.		Part of S3
L26	79731	Coil—Channel #2 R.F. plate coil. Part of S3
L27	79727	Coil—Channel #3 R.F. plate coil. Part of S3
L28	79717	Coil—Channel #4 R.F. plate coil. Part of S3
L29	79732	Coil—Channel #5 R.F. plate coil. Part of S3
L30	73460	Coil—Channel #6 R.F. plate coil. Part of S3
L31	73461	Coil—Channel #6 mixer coil. Part of S2
L32 to L38 Incl.		Part of S2
L39	79715	Coil—Channel #3 mixer coil. Part of S2
L40	79730	Coil—Channel #2 and 4 mixer coil. Part of S2
L41	79729	Coil—Channel #5 mixer coil. Part of S2
L42		Part of S2
L43 to L54 Incl.		Part of S1
R1	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w.

SYMBOL NO.	STOCK NO.	DESCRIPTION
R2	502322	Resistor—Fixed, composition, 22,000 ohms, ±20%, ½ w.
R3	502047	Resistor — Fixed, composition, 47 ohms, ±10%, ½ w.
R4	512347	Resistor—Fixed, composition, 47,000 ohms, ±10%, 1 w.
R5	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. Part of S3
R6, R7	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w. Part of S2
R8		Part of T2
R9	502227	Resistor—Fixed, composition, 2700 ohms, ±10%, ½ w. Part of S2
R10	502256	Resistor—Fixed, composition, 5600 ohms, ±10%, ½ w.
R11	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w.
R12	502112	Resistor — Fixed, composition, 120 ohms, ±10%, ½ w.

SYMBOL NO.	STOCK NO.	DESCRIPTION
R13	502356	Resistor—Fixed, composition, 56,000 ohms, ±10%, ½ w.
T1	79733	Transformer—Antenna matching transformer, complete with capacitors and coils. (C1, C2, C3, C4, L1, L2, L3, L4, L5)
T2	79734	Transformer—Converter transformer
		CHASSIS ASSEMBLIES KCS87, KCS87A
C101	76507	Capacitor—Fixed, ceramic, 3.0 mmf., ±1 mmf., 500 v.
C102	79323	Capacitor—Fixed, ceramic, 39 mmf., ±10%, 500 v. Part of PC101
C103	79234	Capacitor—Fixed, ceramic, 56 mmf., ±10%, 500 v. Part of PC101
C104	73960	Capacitor—Fixed, ceramic, .01 mfd., +100%, —0%, 500 v. Part of PC101
C105		Part of T102
C106	39652	Capacitor—Fixed, mica, 1000 mmfd., ±5%, 500 v. Part of PC101
C107	79315	Capacitor—Fixed, paper, .0033 mf., ±10%, 400 v. Part of PC101
C108	79148	Capacitor—Fixed, paper, 0.47 mf., ±10%, 200 v. Part of PC101
C109	79017	Capacitor—Fixed, paper, 0.0047 mf., ±20%, 400 v.
C110	79316	Capacitor—Fixed, paper, 0.01 mf., ±10%, 200 v.
C111	79014	Capacitor—Fixed, paper, 0.01 mf., ±20%, 200 v.
C112	75643	Capacitor—Fixed, paper, 0.001 mf., ±10%, 600 v.
C113	73599	Capacitor—Fixed, paper, 0.0027 mf., ±10%, 600 v.
C114	79314	Capacitor—Electrolytic, 100 mf., +100%, —10%, 250 v.
C115	78979	Capacitor—Fixed, paper, 0.0082 mf., ±10%, 1000 v.
C116	78220	Capacitor—Fixed, mica, 5-70 mmf.
C118	39044	Capacitor—Fixed, ceramic, 15 mmf., ±5%, 500 v.
C119	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 v.
C120	73787	Capacitor—Fixed, paper, 0.47 mf., ±20%, 200 v.
C121	77293	Capacitor—Fixed, ceramic, 470 mmf., ±20%, 500 v. Part of PC102
C122	77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 v. Part of PC102
C123	77252	Capacitor—Fixed, ceramic, .001 mfd., +100%, —0%, 500 v. Part of PC102
C124		Same as C121
C125A, B	79319	Capacitor—Fixed, electrolytic, 2 sections:—.001 mf., 500 v. Part of PC102
C126	78623	Capacitor—Fixed, ceramic, .001 mf., ±20%, 500 v. Part of PC102
C127	79164	Capacitor—Fixed, ceramic, 9 mmfd., ±0.5 mmf., 500 v. Part of PC102
C128	33098	Capacitor—Fixed, ceramic, 10 mmf., ±1.0 mmf., 500 v.
C129	73784	Capacitor—Fixed, paper, 0.1 mf., ±10%, 200 v.
C130	71614	Capacitor—Fixed, ceramic, 120 mmf., ±5%, 500 v.
C131	79149	Capacitor—Fixed, paper, 0.1 mf., ±20%, 600 v.
C132A, B	79147	Capacitor—Electrolytic, 80 80 mf., 400 200 v.
C133		Same as C122. Part of PC102
C134	79700	Capacitor—Electrolytic, 100 mf., 400 v.
C135	73557	Capacitor—Fixed, paper, 0.1 mf., ±20%, 600 v.
C136	78905	Capacitor—Fixed, paper, 0.22 mf., ±20%, 200 v.
C137	73960	Capacitor—Fixed, ceramic, 0.01 mf., +100%, —0%, 500 v.
C138	73787	Capacitor—Fixed, paper, 0.47 mf., ±20%, 200 v. D.C. Same as C120
C139	39620	Capacitor—Fixed, mica, 47 mmf., ±5%, 500 v. D.C.
C140	39640	Capacitor—Fixed, mica, 330 mmf., ±10%, 500 v.
C141	73551	Capacitor—Fixed, paper, 0.1 mf., ±20%, 400 v.
C142	73552	Capacitor—Fixed, paper, 0.033 mf., ±20%, 400 v.
C143	76474	Capacitor—Fixed, mica, 82 mmf., ±5%, 1000 v.
C144	58271	Capacitor—Fixed, mica, 220 mmf., ±10%, 500 v.
C145	79315	Capacitor—Fixed, paper, 0.0033 mf., ±10%, 400 v.
C146	79019	Capacitor—Fixed, paper, 0.0082 mf., ±10%, 400 v.
C147		Same as C141
C148	78221	Capacitor—Fixed, paper, 0.0039 mf., ±5%, 600 v.
C149	73594	Capacitor—Fixed, paper, 0.01 mf., ±10%, 600 v.
C150	73595	Capacitor—Fixed, paper, 0.0022 mf., ±10%, 600 v.
C151	79317	Capacitor—Fixed, paper, 0.056 mf., ±10%, 600 v.
C152	73797	Capacitor—Fixed, paper, 0.015 mf., ±10%, 400 v.
C153	73798	Capacitor—Fixed, paper, 0.022 mf., ±20%, 600 v.
C154	79016	Capacitor—Fixed, paper, 0.068 mf., ±10%, 200 v.
C155	73798	Capacitor—Fixed, paper, 0.022 mf., ±10%, 600 v.
C156	78980	Capacitor—Fixed, paper, 0.001 mf., ±20%, 1600 v.
C157		Same as C153
C158		Same as C141
C159	77364	Capacitor—Fixed, ceramic, 0.1 mf., ±1.0 mmf., 500 v.
C160		Same as C140
C162	76475	Capacitor—Fixed, mica, 68 mmf., ±5%, 1000 v.
C163		Same as C141
C164	73562	Capacitor—Fixed, paper, 0.022 mf., ±20%, 400 v.
C166		Same as C120
C167	76476	Capacitor—Fixed, mica, 330 mmf., ±5%, 1000 v.
C168	73594	Capacitor—Fixed, paper, 0.01 mf., ±5%, 600 v
C169	59667	Capacitor—Fixed, mica, 470 mmf., ±10%, 1000 v.
C170		Same as C135
C171	71807	Capacitor—Variable mica trimmer, 10-160 mmf. hor. drive
C172	76995	Capacitor—Fixed, paper, 0.0012 mf., ±5%, 600 v.
C173		Same as C135
C174	73786	Capacitor—Fixed paper, 0.27 mf., ±10%, 200 v.
C175	73597	Capacitor—Fixed, paper, 0.047 mf., ±10%, 1000 v.
C176	79022	Capacitor—Fixed, mica, 270 mmf., ±20%, 1000 v.
C177	79830	Capacitor—Fixed, ceramic, 56 mmf., ±10%, 6000 v. D.C.
C179	79318	Capacitor—Fixed, paper, 0.39 mf., ±10%, 200 v.
C180		Part of Yoke
C181 to C183		Same as C123. Part of PC102
C185		Same as C122. Part of PC102
C186	77252	Capacitor—Fixed, ceramic, 0.001 mf., +100%, —0%, 500 v.
CR101	76675	Rectifier—2nd detector rectifier
F101	78214	Fuse—.3 amp.
J102	68590	Plug—Deflection yoke plug female
L102	78204	Coil—1st I.F. grid trap
L103	76011	Coil—Peaking, 36 microhenries
L104	71526	Coil—Peaking, 250 microhenries
L105	77674	Coil—Peaking, 250 microhenries (with R133)
L106	75253	Coil—Peaking, 120 microhenries
L107	75252	Coil—Peaking, 500 microhenries
L108	71528	Coil—Peaking, 180 microhenries
L109	79157	Coil—4.5 MC trap
L111	79144	Coil—Width coil
L112	76640	Choke—R.F. insulated choke 1.5 microhenries
L113	77676	Choke—Filter choke
L14 to L117		Part of Yoke
L118, L119	73477	Coil—Filament choke coil. Part of PC102
L120	79534	Coil—Horizontal frequency coil
L121	79161	Coil—Horizontal sine wave coil
PC101	79142	Printed Circuit—I.F. sound assembly
PC102	79479	Printed Circuit—I.F. picture assembly
R101	503347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ w. Part of PC101
R102	503112	Resistor — Fixed, composition, 120 ohms, ±10%, ½ w. Part of PC101
R103	504210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w. Part of PC101
R104	503339	Resistor—Fixed, composition, 39,000 ohms, ±10%, ½ w. Part of PC101
R105, R106	502310	Resistor—Fixed, composition, 10,000 ohms, ±5%, ½ w. Part of PC101
R107	502368	Resistor—Fixed, composition, 68,000 ohms, ±10%, ½ w.
R108A, B	79699	Control—"On-Off" volume control
R109	502610	Resistor—Fixed, composition, 10 meg., ±20%, ½ w.
R110	502433	Resistor—Fixed, composition, 330,000 ohms, ±20%, ½ w.
R111	502482	Resistor—Fixed, composition, 820,000 ohms, ±5%, ½ w.
R112	502510	Resistor—Fixed, composition, 1 meg., ±5%, ½ w.
R113	522147	Resistor — Fixed, composition, 470 ohms, ±20%, 2 w.
R114	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w.
R115	30562	Resistor—Fixed, composition, 680,000 ohms, ±10%, ½ w.
R116	36714	Resistor—Fixed, composition, 15,000 ohms, ±10%, ½ w.
R117		Same as R114
R118	502456	Resistor—Fixed, composition, 560,000 ohms, ±10%, ½ w.
R119	502068	Resistor—Fixed, composition, 68 ohms, ±5%, ½ w. Part of PC102
R120		Same as R114
R121	504168	Resistor — Fixed, composition, 680 ohms, ±20%, ½ w. Part of PC102
R122	502415	Resistor—Fixed, composition, 150,000 ohms, ±5%, ½ w. Part of PC102
R123		Same as R122
R124	33568	Resistor—Fixed, composition, 18 ohms, ±5%, ½ w. Part of PC102
R126		Same as R121. Part of PC102
R127	502118	Resistor — Fixed, composition, 180 ohms, ±5%, ½ w. Part of PC102
R128	504147	Resistor — Fixed, composition, 470 ohms, ±20%, ½ w. Part of PC102
R129	502239	Resistor—Fixed, composition, 3900 ohms, ±5%, ½ w.
R130	502222	Resistor—Fixed, composition, 2200 ohms, ±10%, ½ w.
R131	3219	Resistor—Fixed, composition, 18,000 ohms, ±10%, ½ w.
R132	502247	Resistor—Fixed, composition, 4700 ohms, ±10%, ½ w.
R133		Part of L105
R135	502333	Resistor—Fixed, composition, 33,000 ohms, ±10%, ½ w.
R136	502239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ w.
R137	502447	Resistor—Fixed, composition, 470,000 ohms, ±20%, ½ w.
R138	512356	Resistor—Fixed, composition, 56,000 ohms, ±10%, 1 w.
R140	502218	Resistor—Fixed, composition, 1800 ohms, ±10%, ½ w.
R141	512268	Resistor—Fixed, composition, 6800 ohms, ±5%, 1 w.
R142		Part of L108
R143		Same as R137
R147	502510	Resistor—Fixed, composition, 1 megohm, ±10%, ½ w.
R149	79697	Control—AGC control—"Local-Distant" (For 17S450U only)
R150	502356	Resistor—Fixed, composition, 56,000 ohms, ±10%, ½ w.
R151, R152	502515	Resistor—Fixed, composition, 1.5 megohm, ±5%, ½ w.
R153	502427	Resistor—Fixed, composition, 270,000 ohms, ±10%, ½ w.
R154	502347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ w.
R155		Same as R151
R156		Same as R118
R157		Same as R135
R160	512310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 1 w.
R161	502239	Resistor—Fixed, composition, 3900 ohms, ±5%, ½ w.
R162	502322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R163		Same as R131
R164	78210	Control—Vertical hold control
R165	78806	Control—Height control
R166	502447	Resistor—Fixed, composition, 470,000 ohms, ±10%, ½ w.
R167	502322	Resistor—Fixed, composition, 22,000 ohms, ±10%, ½ w.
R168	3219	Resistor—Fixed, composition, 18,000 ohms, ±5%, ½ w.
R169	502439	Resistor—Fixed, composition, 390,000 ohms, ±10%, ½ w.
R170	502333	Resistor—Fixed, composition, 33,000 ohms, ±5%, ½ w.
R171	502282	Resistor—Fixed, composition, 8200 ohms, ±10%, ½ w.
R172	502322	Resistor—Fixed, composition, 22,000 ohms, ±5%, ½ w.
R173		Same as R166
R174	78807	Control—Vertical linearity control
R175		Same as R111
R176	30562	Resistor—Fixed, composition, 680,000 ohms, ±5%, ½ w.
R177	502422	Resistor—Fixed, composition, 220,000 ohms, ±10%, ½ w.
R178	79139	Control—Brightness control
R179	502415	Resistor—Fixed, composition, 150,000 ohms, ±20%, ½ w.
R180	502418	Resistor—Fixed, composition, 180,000 ohms, ±10%, ½ w.
R181	502433	Resistor—Fixed, composition, 330,000 ohms, ±10%, ½ w.
R182	502482	Resistor—Fixed, composition, 820,000 ohms, ±10%, ½ w.
R183	502415	Resistor—Fixed, composition, 150,000 ohms, ±5%, ½ w.
R184	502382	Resistor—Fixed, composition, 82,000 ohms, ±5%, ½ w.
R185	502239	Resistor—Fixed, composition, 3900 ohms, ±10%, ½ w.
R186	512410	Resistor—Fixed, composition, 100,000 ohms, ±5%, 1 w.
R187	11769	Resistor—Fixed, composition, 1.8 megohm, ±10%, ½ w.
R189	502347	Resistor—Fixed, composition, 47,000 ohms, ±10%, ½ w.
R190	31071	Resistor—Fixed, composition, 6.8 megohm, ±10%, ½ w.
R191	71084	Resistor—Fixed, composition, 39,000 ohms, ±10%, 1 w.
R192		Same as R182
R193	502510	Resistor—Fixed, composition, 1 meg., ±10%, ½ w. Same as R147
R194	502047	Resistor — Fixed, composition, 47 ohms, ±20%, ½ w.
R195	79701	Resistor—Fixed, wire wound, 100 ohms, ±10%, 2 w.
R196	522318	Resistor—Fixed composition, 18,000 ohms, ±10%, 2 w.
R197		Same as R153
R198		Same as R150
R201 to R203		Part of Yoke
R204	502410	Resistor—Fixed, composition, 100,000 ohms, ±20%, ½ w.
R205, R206	502210	Resistor—Fixed, composition, 1000 ohms, ±20%, ½ w.
T101	79140	Coil—Sound take-off coil, 4.5 MC. Part of PC101
T102	79141	Transformer—Ratio detector transformer complete with adjustable cores. Part of PC101
T103	79159	Transformer—Audio output transformer
T104	78203	Transformer—1st I.F. grid transformer
T105 to T107	76433	Transformer—1st, 2nd and 3rd I-F picture transformer. Part of PC102
T108	79143	Transformer—Vertical output transformer
T110	79736	Transformer—High voltage transformer
T111	79162	Transformer—Power transformer
		YOKE AND MAGNET ASSEMBLY
	79460	Cushion—Deflection yoke hood cushion
	78309	Cushion—Deflection yoke plate cushion
	79695	Hood—Deflection yoke hood assembly
	76375	Magnet—Centering magnet
	76141	Magnet—Ion trap magnet
	78817	Plate—Deflection yoke hood plate
	79687	Rod—Deflection yoke rod
	78445	Spring—Deflection yoke spring
	79510	Yoke—Deflection yoke
		SPEAKER ASSEMBLY 972308-2
	79696	Speaker—4" P.M. speaker (3.2 ohms)

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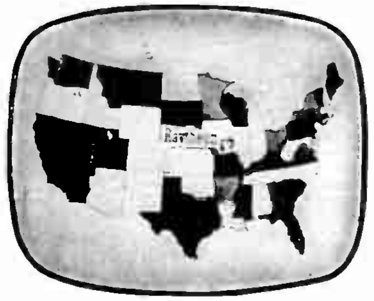


AVERAGE PICTURE

An average picture is portrayed as a guide or reference to enable a better analysis of the conditions when attempting to observe the various distortions and deviations.

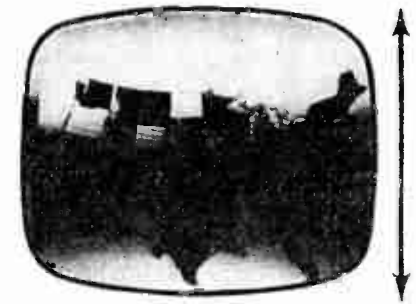
60 CYCLE HUM

Usually caused by a filament to cathode short or leakage in the RF, IF or video amplifier tube.

CHECK:

V-4-5-6	IF Amplifier (6CB6)
V-2	VHF RF Amplifier (6BZ7)
V-9	Video Amplifier (25C6)

NOTE: A quick method other than substituting tubes, is to short each tube's cathode to ground while observing the picture. Shorting the cathode of the defective tube will produce a radical reduction of hum or a filament failure.



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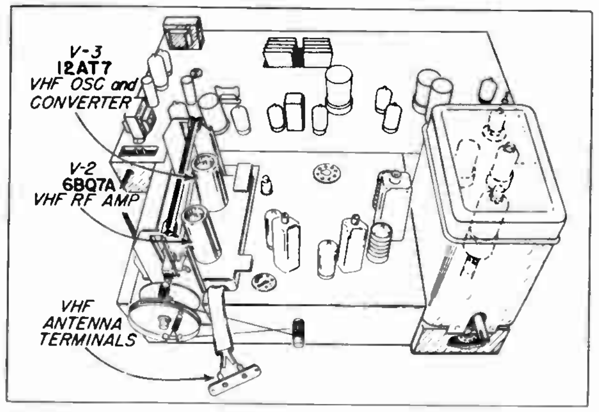
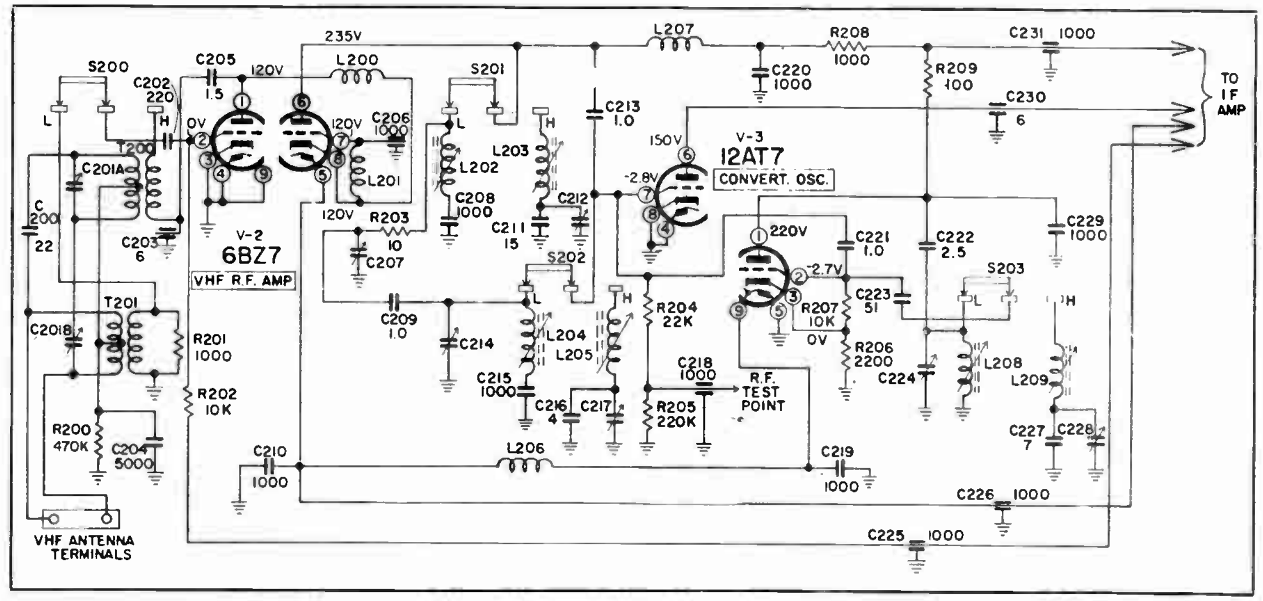
TUNER SERVICE HINTS

When attempting tuner servicing, it may prove helpful to bear in mind that when trouble occurs in the oscillator the picture will generally disappear and when there is a defect in the RF or mixer stage a decrease in signal will usually result.

If a condition arises where trouble occurs on either the high or low VHF band only, then it can be assumed that the trouble is definitely in the VHF tuner or VHF antenna installation. One other possibility may be due to defective switch contacts. Defective switch contacts can easily be replaced by removing the two question mark shaped springs, lifting up the switch plate assembly and removing the black switch contact holder and replacing the switch contact.





VHF TUNER SCHEMATIC

1

MISTUNING:

Condition is generally caused by a lack of care when tuning in a station. A similar condition may be due to a faulty antenna installation or result from a defective oscillator or RF Amplifier tube.

CHECK:

V-2	VHF RF Amplifier (6BZ7)
V-3	VHF Oscillator—Converter (12AT7)

***WEAK PICTURE WITH SNOW**
***NO PICTURE WITH SNOW (Raster Visible)**

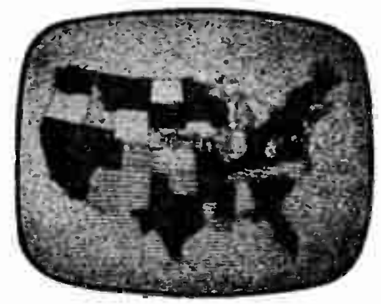
This condition is usually caused by a defective antenna installation or a defective tube or component in the tuner or possibly the first IF Amplifier.

CHECK:

Antenna Installation and Connections

V-2	VHF RF Amplifier (6BZ7)
V-3	VHF Oscillator-Converter (12AT7)
V-4	IF Amplifier (6CB6)
R208	V-2 Decoupling Resistor
L207-301	B Supply Choke
C229	V-3Plate Capacitor
C220-230-231-301	Decoupling Capacitor

*Based on the assumption that the receiver was once functioning normally.



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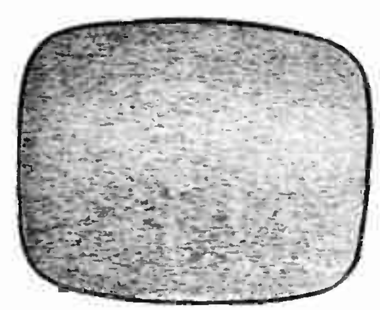

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REPLACEMENT PARTS

Ref. No.	Part No.	Description
C201A-B	8E-17142	5-20 mmf, dual trimmer
C203	8G-20880	6 mmf, ceramic feed thru
C207-214-217-224-228	201-22333	Trimmer condenser
C212	201-15142	Trimmer condenser
C218-225-226-231	8G-20878	1000 mmf, ceramic feed thru
C230	8G-20879	6 mmf, ceramic feed thru
T200	13E-22082	H.B. antenna transformer
T201	13E-21673	L.B. antenna transformer
L200	13M-20781	Cascode coil
L201	13M-20780	Cascode coil
L202	13E-12046	L.B. RF primary coil
L203	13E-17140	H.B. RF primary coil
L204	13E-12046	L.B. RF secondary coil
L205	13E-17140	H.B. RF secondary coil
L206	16A-20777	Filament coil

Ref. No.	Part No.	Description
L207	16A-17128	RF choke coil
L208	13D-12155	L.B. oscillator coil
L209	13E-17140	H.B. oscillator coil
	201-22081	Antenna transformer assembly
S200-201-202-203	2J-16310	Sliding switch contact
	5F-16311	Switch contact holder
	201-20769	Capacitor plate assembly
	2M-16276	Core mounting clip
	43A2-5444	Iron core nuts
	51A-15713	Iron core (white) for L209
	51A-17162	Iron core (brown) for L203-205
	51A-21200	Iron core (pink) for L208
	51A-15715	Iron core (blue) for L202
	51A-17161	Iron core (orange) for L204
	49A-18799	Link spring
	2M-19150-1	Flat spring

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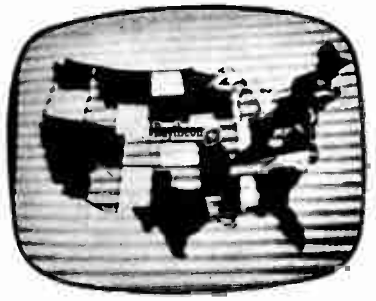


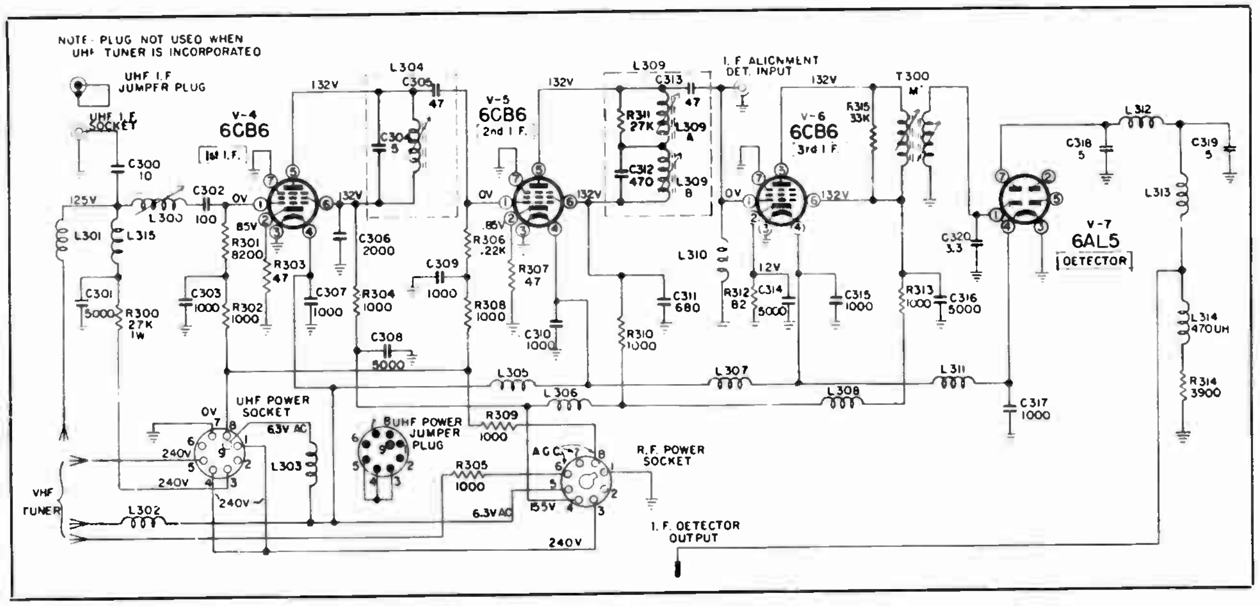
SOUND BARS:

The appearance of sound bars may possibly be due to mistuning of the receiver, microphonic station equipment or due to microphonic RF, IF, or Video Amplifier tubes.

CHECK:

V-15B	Vertical Blocking Oscillator (12AU7)
V-16	Vertical Output (6S4)
V-4-5-6	IF Amplifier (6CB6)
V-2	VHF RF Amplifier (6BZ7)
V-3	VHF Converter (12AT7)
V-9	Video Amplifier (25C5)

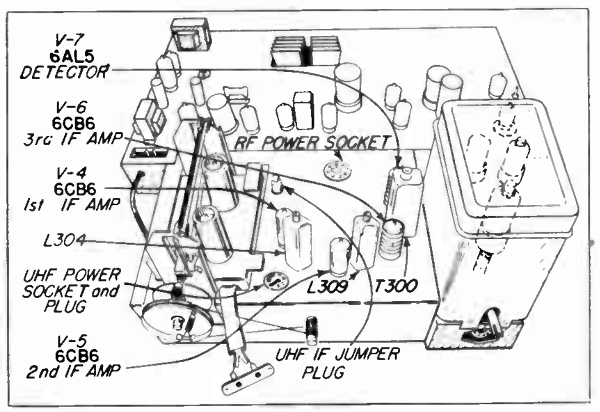
NOTE: To determine possible cause of condition, properly tune in a station and then turn the volume control to its minimum volume setting. If the bars remain visible the trouble is usually due to the station or outside interference. If however, the bars disappear and by jarring the cabinet they reappear, the cause is most likely due to microphonic tube. Gently tap each tube specified above while observing the picture.



IF AMPLIFIER SCHEMATIC

REPLACEMENT PARTS

Ref. No.	Part No.	Description
T300	13B-22939	Output IF transformer
L300	201-22924	Converter coil
L301	16A-21656	RF choke coil
L302-303	16A-17937	Filament choke coil
L304	201-22927	IF coil assembly
L305	16A-17937	Filament choke coil
L306	16A-18776	RF choke coil
L307	16A-17937	Filament choke coil
L308	16A-18676	RF choke coil
L309	201-22929	IF coil assembly
L310	201-15608	RF choke coil
L311	16A-17937	Filament choke coil
L312-313	16A-22923	Peaking coil
L314	16A-19365	Peaking coil
L315	201-20265	Peaking coil
	201-21657	UHF IF jumper plug
	19A-21244	UHF power jumper plug



WEAK PICTURE
NO PICTURE (Raster Visible)

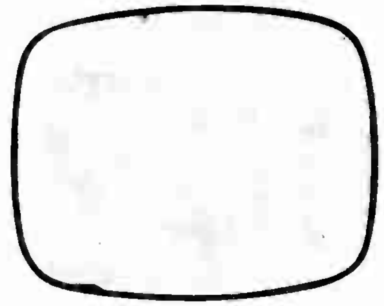
These conditions are generally caused by a defective tube or component in the IF or Video Amplifiers. Note the absence of snow.

CHECK:

R409	Picture Control
V-5-6	IF Amplifier (6CB6)
V-9	Video Amplifier (25C5)
R310-313	Decoupling Resistors
L304-309-310-T300	IF Coils
L312-313-314	Detector Peaking Coil
L400-401-402	V-9 Peaking Coils
C404	V-9 Coupling Capacitor
R412-413	V-9 Plate Resistor

NOTE: Check RF Power and detector output plugs for proper seating.

As a fast method to help localize the defective stage causing the trouble, observe the face of the picture tube at both minimum and maximum picture control settings. If an increase in snow is NOT apparent at the maximum picture control setting the trouble is usually in the video amplifier, video detector or IF amplifier circuits. If an increase in snow is observed the trouble may be in the tuner or possibly the first IF amplifier stage.



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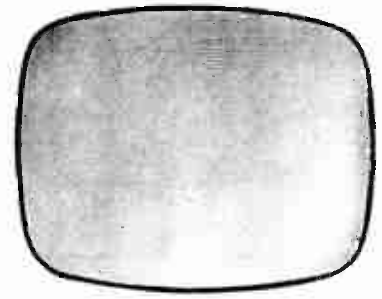

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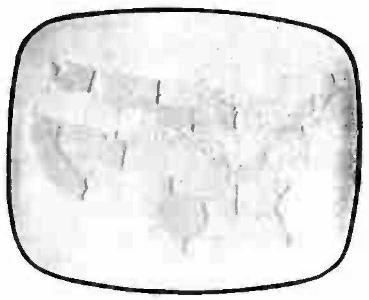
OVERLOADING WASHOUT



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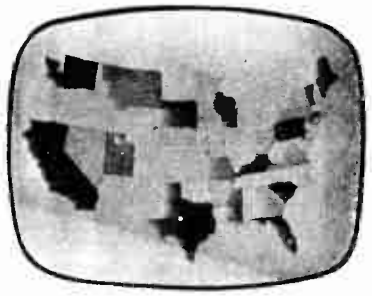
A washout condition (or insevere cases overloading) is generally caused by a defect in the IF amplifiers, video amplifier or A.G.C. circuits.

CHECK:

V-4-5-6	IF amplifier (6BC6)
V-7	Video Detector (6AL5)
V-9	Video Amplifier (25C5)
V-2	VHF RF Amplifier (6BZ7)

NOTE: A defective picture tube may cause a similar condition. Check as a last resort.

R400-C400	AGC Filter Network
C303-309	AGC Decoupling Capacitors
C302-305-313	IF Grid Coupling Capacitors
R314	Detector Load Resistor
R409	Picture Control



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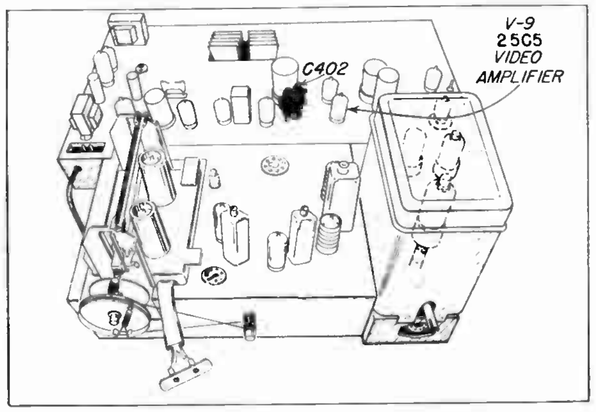
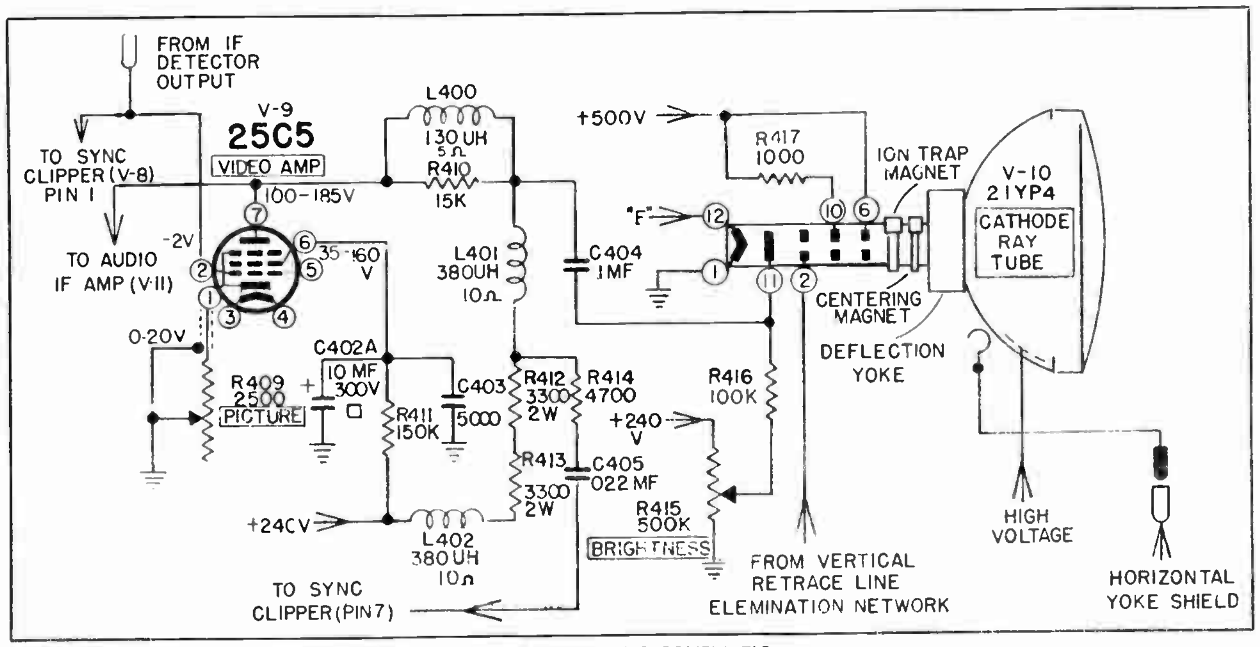
NOTE: Check RF Power plug for proper seating. For a rapid AGC check disconnect antenna lead-in wire from receiver and couple close to antenna terminals to reduce signal strength. If picture improves the AGC can be suspected. Compare AGC and detector output voltage. Under normal operating conditions these two negative voltages should be approximately equal. If the AGC voltage is low, the cause may be due to a gassy RF or IF tube, leaky IF grid coupling capacitor or a defective component in the AGC circuit.



REPLACEMENT PARTS

Ref. No.	Part No.	Description
R409	10B-22311	Picture control—2500 ohm
R415	10B-21456	Brightness control—500K ohm
C402A	8C-22523	10 mfd, 300 volt,—part of lytic
L400	16A-20021	Peaking coil 130 UH
L401-402	16A-19486	Peaking coil—380UH
T405	201-22697	Deflection yoke assembly
	15B-17278-9	CRT socket and cable
	16M-19906	Ion trap magnet
	16M-20697	Centering magnet
	16M-22602	Linearity magnet
	16M-22607	Anti-pin cushion magnet



VIDEO AMPLIFIER SCHEMATIC

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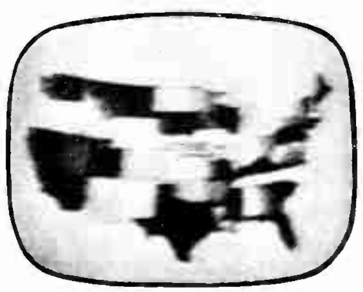


SMEAR

This condition is generally due to a defective tube or component in the IF or Video Amplifier circuits.

CHECK:

V-9	Video Amplifier (25C5)
V-7	Video Detector (6AL5)
V-4-5-6	IF Amplifiers (6CB6)
R412-413	V-9 Plate Resistors
L312-313-314	Detector Peaking Coils
L400-401-402	V-9 Peaking Coils
C404	V-9 Coupling Capacitor
R314	Detector Load Resistor
R411	V-9 Screen Capacitor
C402A-403	V-9 Screen Resistor
R409	Picture Control

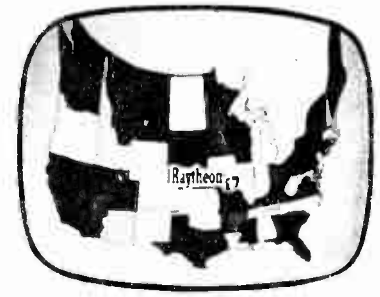
POOR VERTICAL LINEARITY

Condition is generally due to a misadjustment of the vertical size, linearity or centering controls.

CHECK:

R440	Vertical Size Control Adjustment
R442	Vertical Linearity Control Adjustment
	Centering Control Adjustment
V-15B	Vertical Blocking Oscillator (12AU7)
V-16	Vertical Output (6S4)
T403	Vertical Output Transformer
R443	V-16 Plate resistor
C427	V-16 Plate capacitor
C426	Coupling capacitor
C402B	V-16 Cathode by-pass
R441	V-16 Grid resistor

NOTE: In the absence of a test pattern it is possible to adjust the receiver for reasonable vertical distribution. Turn the V. Size and the V. Linearity controls to their minimum adjustment position and then with the centering control properly adjust the remaining picture to the vertical center of the tube. Adjust the V. Size and V. Linearity controls until the picture fills the mask, bearing in mind that the size control effects the bottom portion of the picture and the linearity control affects the upper portion of the picture. To check vertical distribution, roll the picture slowly using the V. Hold Control and observe the blanking bar as it drifts. If the V. Size, V. Linearity and centering controls are properly adjusted the thickness of the bar will not change during its movement.



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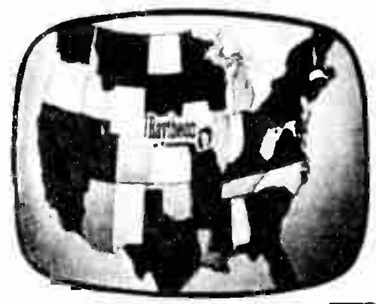

EXCESSIVE VERTICAL SIZE

This condition is generally due to misadjustment of the vertical size and linearity controls.

CHECK:

R440	Vertical Size Control Adjustment
R442	Vertical Linearity Control Adjustment

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INSUFFICIENT VERTICAL SIZE

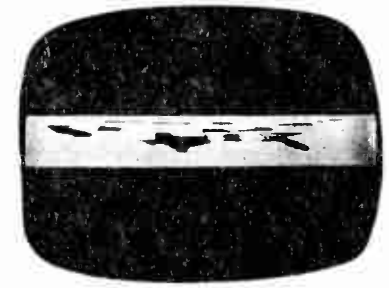
This condition is usually caused by misadjustment of the vertical size and linearity controls or due to a defective tube or component in the vertical deflection circuit.

CHECK:

R440	Vertical Size Control Adjustment
R442	Vertical Linearity Control Adjustment
V-15B	Vertical Blocking Osclllator (12AU7)
V-16	Vertical Output (6S4)
T403	Vertical Output Transformer
T405	Deflection Yoke
R443	V-16 Plate Resistor
C427	V-16 Plate Capacitor
C402B	V-16 Cathode By-pass
C426	V-16 Coupling Capacitor

REPLACEMENT PARTS

Ref. No.	Part No.	Description
R437	10B-17318	Vertical hold control—3 meg
R440	10B-22307	Vertical size control—750K ohm
R442	10B-22304	Vertical linearity control—6000 ohm
C402B	8C-22523	60 mfd, 50 volt—part of lytic
C442	17A-22376	Printed circuit
T402	12M-18241	Vertical oscillator transformer
T403	12C-20761-2	Vertical output transformer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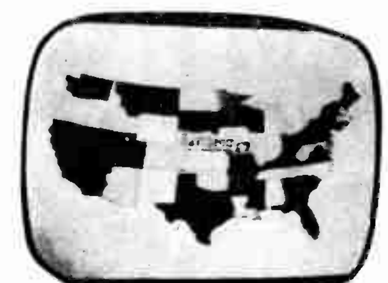
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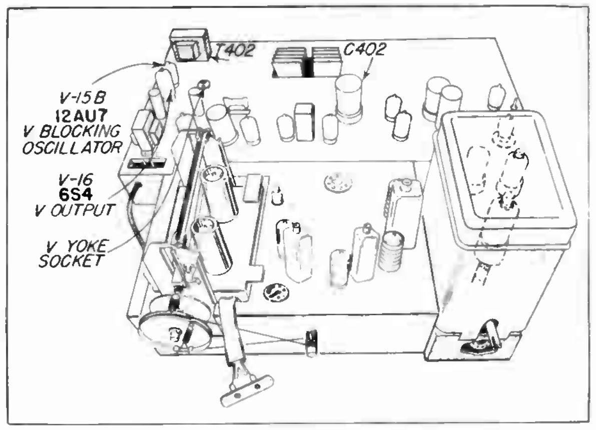
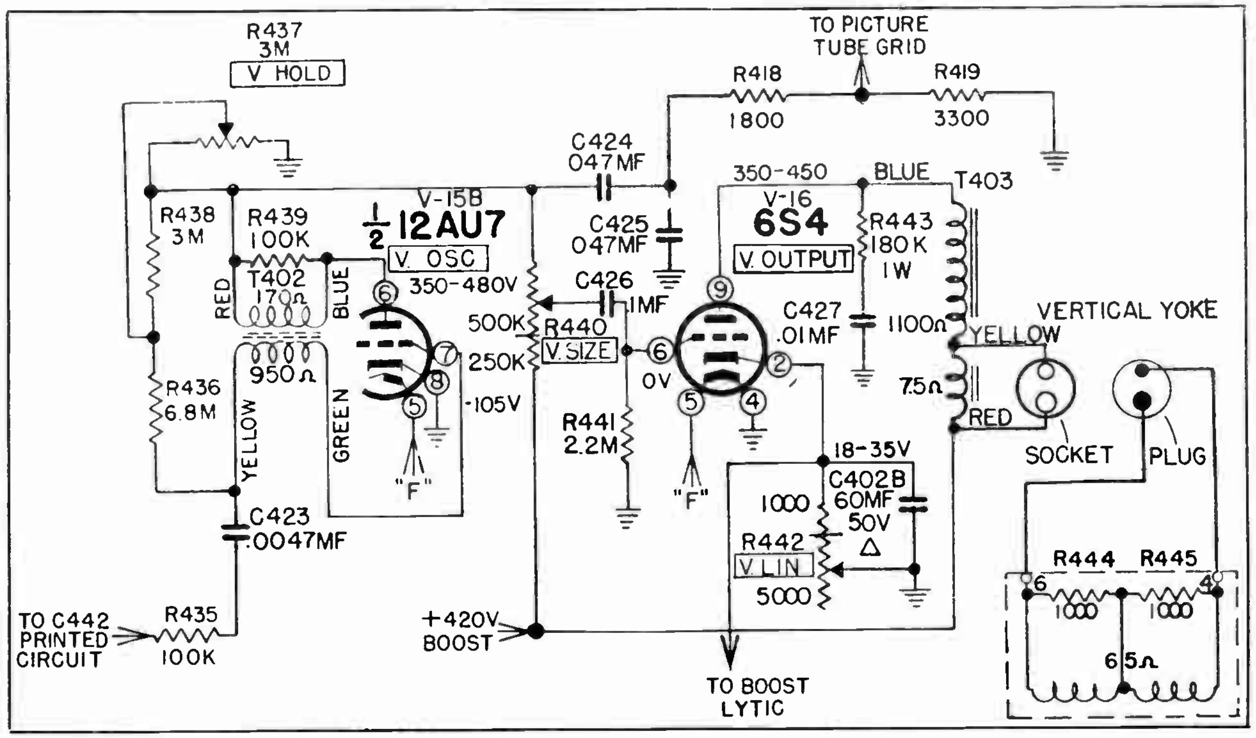


V. Hold:

The Vertical Hold control should be adjusted when the picture is rolling or flipping up or down. The proper setting of the vertical hold control is that point where the picture is moving slowly upward and just locks into place. At this control setting, noise will have the least tendency to interrupt vertical sync.

V. Size and V. Linearity:

The vertical size and linearity controls should be adjusted while a test pattern is being received. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necessary.



VERTICAL DEFLECTION SCHEMATIC

NO VERTICAL SWEEP

This condition is generally caused by a defective tube or component in the vertical deflection circuit.

CHECK:

V-15B	Vertical Blocking Oscillator (12AU7)
V-16	Vertical Output (6S4)
T402	Vertical Blocking Oscillator Transformer
T403	Vertical Output Transformer
T405	Deflection Yoke
C426-423-424	Coupling Capacitor
R440	Vertical Size Control

NOTE: Check Vertical Yoke socket for proper seating. One method of isolating the defective stage is to apply a 60 cycle 6.3 filament voltage through a .5 MFD capacitor to various points in the vertical deflection circuit. If an increase of vertical deflection is not observed as the 60 cycle voltage is applied the defect is located between the point tested and the deflection yoke.

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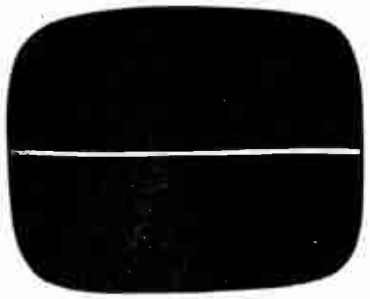
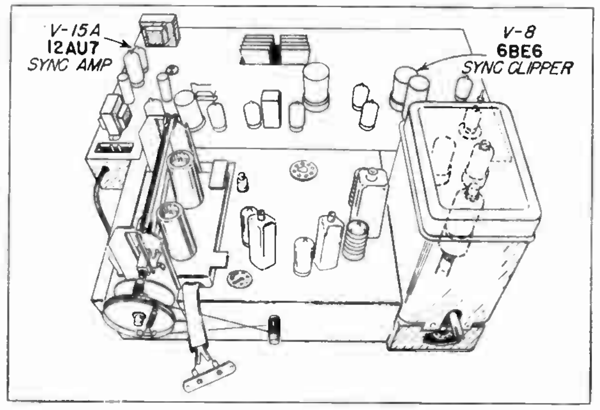


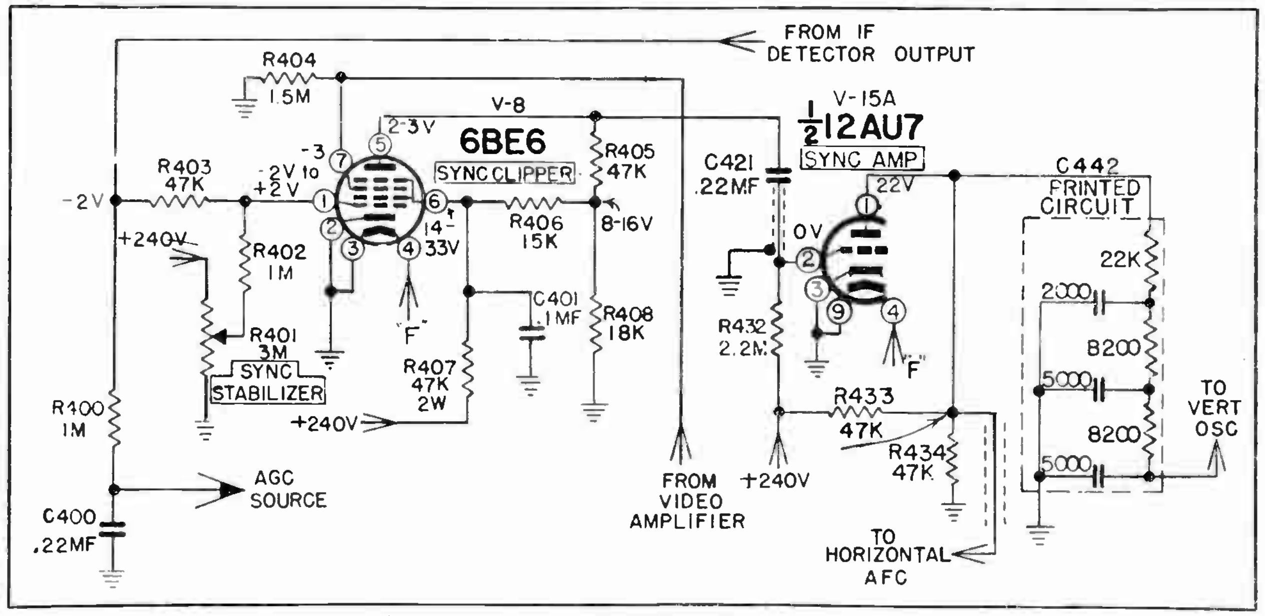


Sync Stabilizer:

The control varies the operational characteristics of the sync clipper stage to obtain the optimum operation point for the least effect of noise interrupting synchronization. The control should be adjusted for a steady picture.

REPLACEMENT PARTS

Ref. No.	Part No.	Description
R401	10B-17318	Sync Stabilizer control—3 meg
C442	17A-22376	Printed circuit



SYNC CLIPPER AND AMPLIFIER SCHEMATIC

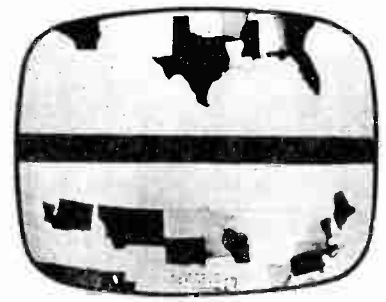
POOR VERTICAL SYNC

Poor vertical sync is generally caused by improper adjustment of the vertical hold control or a defect in the oscillator, sync amplifier or sync clipper circuits.

CHECK:

R437	Vertical Hold Control Adjustment
R401	Sync Stabilizer Control Adjustment
V-15	Vertical Blocking Oscillator and Sync Amplifier (12AU7)
V-8	Sync Clipper (6BE6)
C422	Intergrating network
R435-436-437-438	Vertical Hold Control Resistors
C423	Coupling Capacitor
T402	Oscillator Transformer

NOTE: A poor vertical sync condition may possibly be due to a defect in the RF, IF or video amplifier stages. This may be quickly checked by observing the blanking bar as illustrated in condition 16. If the detail in the blanking bar is not blacker than the blackest portion of the picture an overloading condition exists. Refer to overloading, condition number 33.



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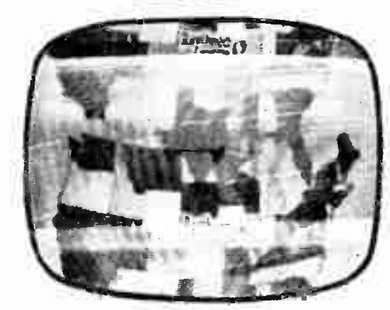

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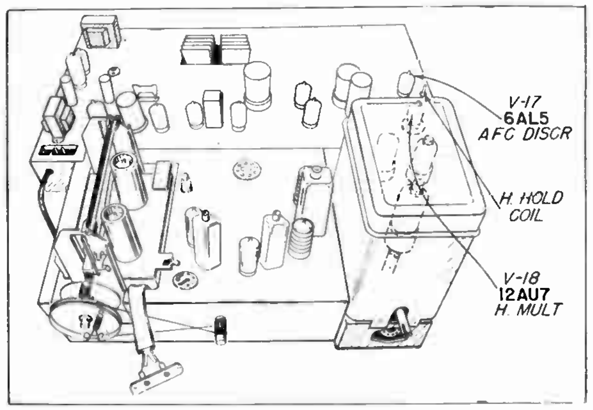
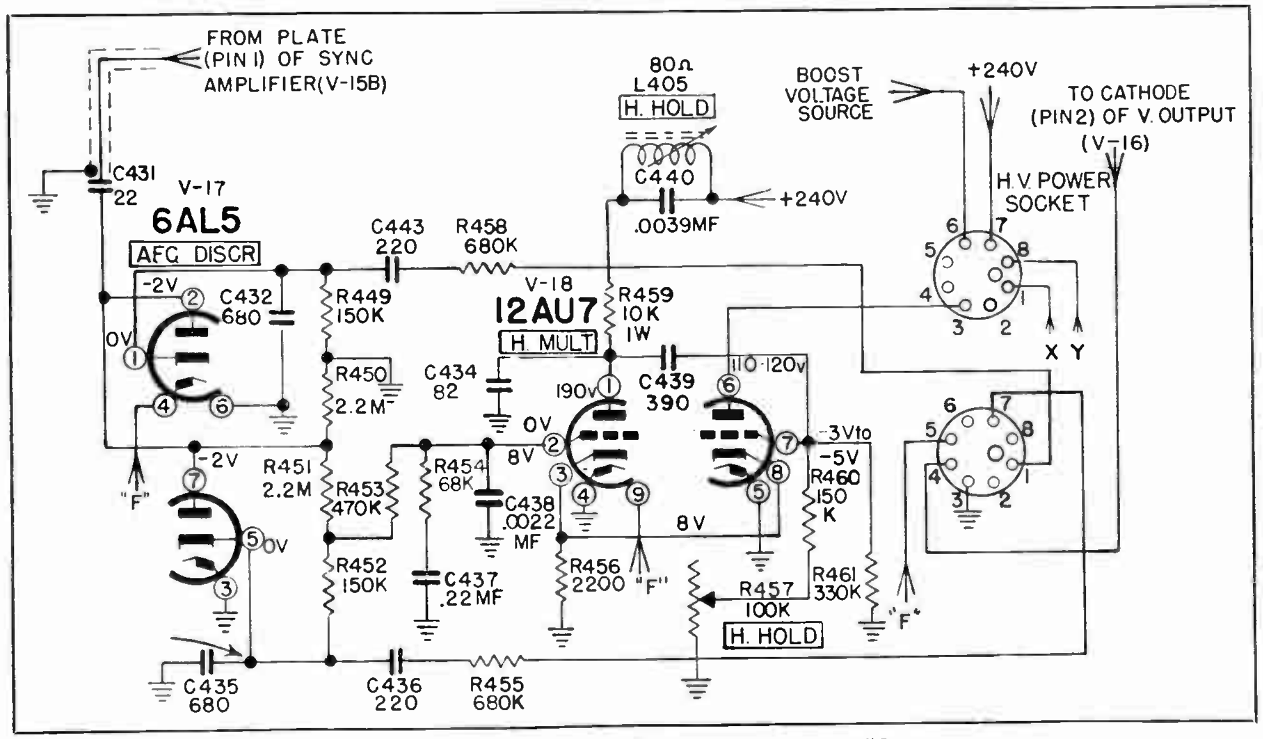


H. Hold:

Set the H. Hold control on the front of the set to the center of its range. Adjust the H. Hold coil on top of the chassis until a steady picture is obtained. Set the H. Hold coil to the center of its range (center position before going out of sync in either direction). To check the adjustment, tune from one station to another. If the controls are properly adjusted the picture will remain in sync at all times.

REPLACEMENT PARTS

Ref. No.	Part No.	Description
R457	108-17275	Horizontal hold control—100k ohm
L405	201-22302	Horizontal hold coil
	51A-21740	Iron core for L405



AFC AND HORIZONTAL MULTIVIBRATOR SCHEMATIC

SERVICE HINTS

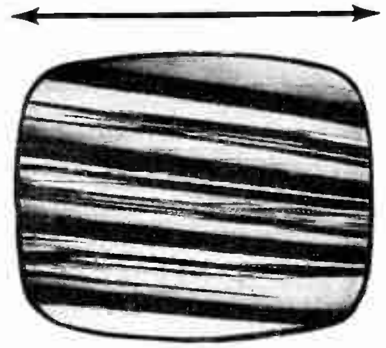
Whenever the sync, AFC, Horizontal Multivibrator or H. Pulse Amplifier stage is suspected as the cause of the trouble, it will prove helpful to short the input grid of the Horizontal Multivibrator (pin 2, V18) to ground, readjust the horizontal hold control and then observe the picture. If the condition disappears you can assume that the source of the trouble is before the input grid of the oscillator. If, however, the condition remains, the trouble is probably after the grid of the multivibrator.

POOR HORIZONTAL SYNC

Poor horizontal sync is usually caused by misadjustment of the horizontal hold control, hold coil or the sync stabilizer control or due to a defective tube or component in the horizontal multivibrator, AFC, sync amplifier or sync clipper circuits.

CHECK:

R457-L405	Horizontal Hold Control Adjustment
R401	Sync Stabilizer Control Adjustment
V-18	Horizontal Multivibrator (12AU7)
V-17	Horizontal AFC Discriminator (6AL5)
V-15A	Sync Amplifier (12AU7)
V-8	Sync Clipper (6BE6)
L405	Horizontal Hold Coil
C440	Horizontal Hold Coil Capacitor
C437-438	V-18 Grid Capacitors
C431-439	V-18 Coupling Capacitors
R458-455	V-17 Feedback Resistors
C443-436	V-17 Feedback Capacitors
R456-459-460-500	V-18 Plate and Grid Resistors
R433-434	Voltage Divider Resistors



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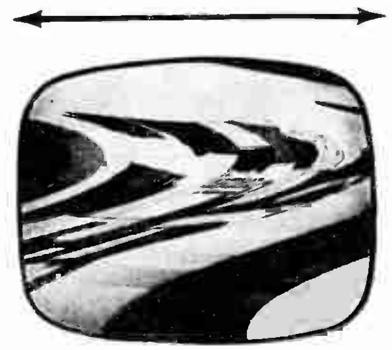

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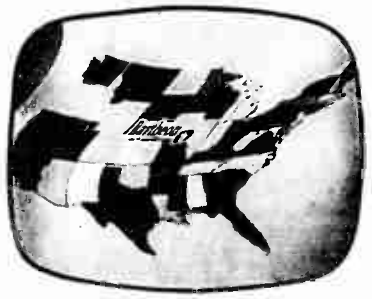
HORIZONTAL DISPLACEMENT

Condition can be caused by improper adjustment of the sync stabilizer or horizontal hold control or a defective tube or component in the sync clipper or amplifier, AFC, horizontal multivibrator or pulse amplifier circuits.

CHECK:

R457-L405	Horizontal Hold Control Adjustment
R401	Sync Stabilizer Control Adjustment
V-17	AFC Discriminator (6AL5)
V-18	Horizontal Multivibrator (12AU7)
V-19	Horizontal Pulse Amplifier (25BQ6)
V-15A	Sync Amplifier (12AU7)
V-8	Sync Clipper (6BE6)
C503-R503	Boost Voltage Filter
R500	V-18 Plate Resistor
C437-438	V-18 Grid Capacitor
R458-455	AFC Feedback Resistor
C443-436	AFC Feedback Capacitor

NOTE: Check H.V. Power and Yoke plug.



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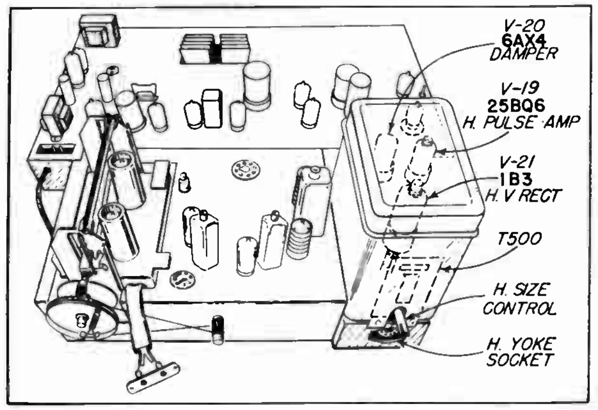
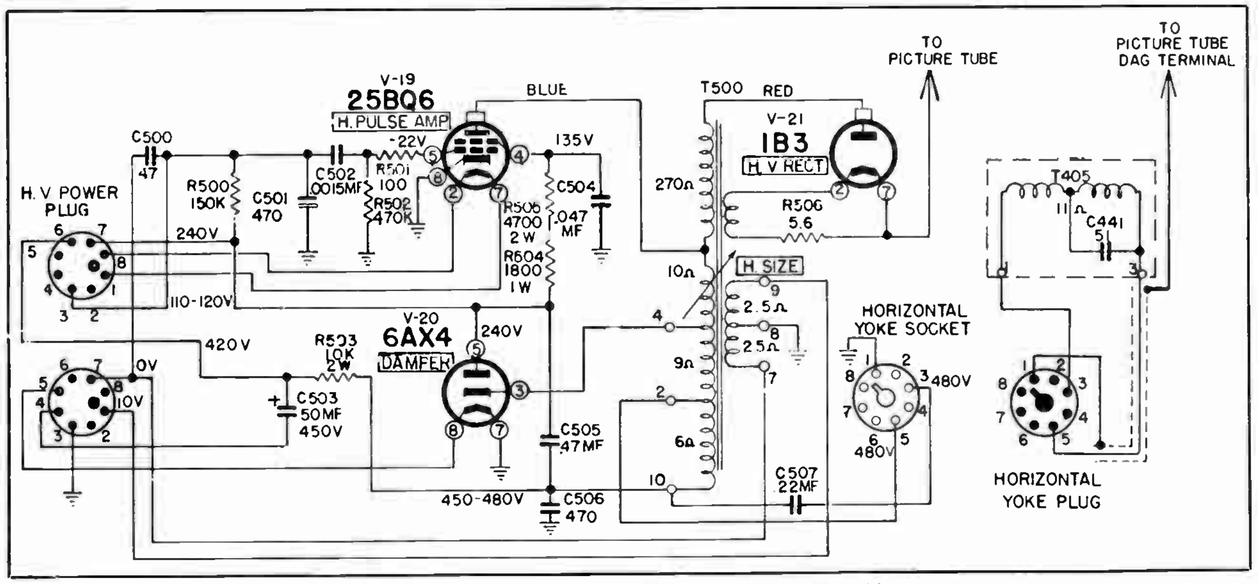


H. Size:

The horizontal size control should be adjusted until the picture fills the entire screen horizontally. A clockwise rotation will decrease size. To some extent the vertical size control setting may be affected by a major horizontal size adjustment.

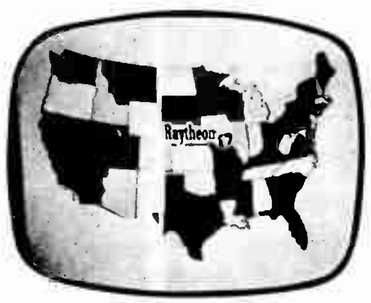
REPLACEMENT PARTS

Ref. No.	Part No.	Description
C503	8C-22544	50 mfd, 450 volt, lytic
C506	8G-21440	470 mmf, 1000 volt, ceramic
T500	201-22396	H. V. Deflection transformer
T405	201-22697	Deflection yoke assembly



HORIZONTAL OUTPUT AND HIGH VOLTAGE SCHEMATIC

21



DRIVE BAR

This condition is generally caused by a defective tube or component in the horizontal output section.

CHECK:

	Horizontal Size Control Adjustment
V-19	Horizontal Pulse Amplifier (25BQ6)
V-20	Horizontal Damper (6AX4)
V-18	Horizontal Multivibrator (12AU7)
R504-505	V-19 Screen Resistor
R502	V-19 Grid Resistor
C504	V-19 Screen Capacitor
C501-502	V-19 Grid Capacitor
R500	V-18 Plate resistor

NOTE: Check H.V. Power plug for proper seating.

INSUFFICIENT HORIZONTAL SIZE

This condition is usually caused by misadjustment of the horizontal size control or a defective tube or component in the high voltage circuit.

CHECK:

	Horizontal Size Control Adjustment
V-19	Horizontal Pulse Amplifier (25BQ6)
V-20	Horizontal Damper (6AX4)
R504-505	V-19 Screen Resistor
R500	V-18 Plate Resistor
R502	V-19 Grid Resistor
C501-502	V-19 Grid Capacitor

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NO RASTER WITH NORMAL SOUND

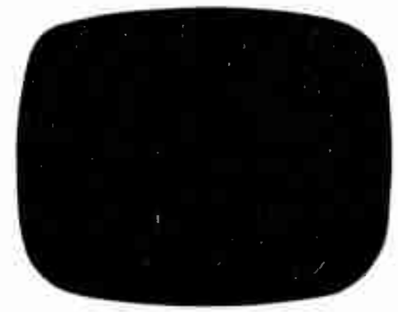
No Raster (no brightness on face of picture tube) with normal sound is usually caused by a defect in the high voltage supply or the components associated with the picture tube.

CHECK:

R415	Brightness Control Adjustment
	Ion Trap Magnet Adjustment
V-21	High Voltage Rectifier (1B3)
V-19	Horizontal Pulse Amplifier (25BQ6)
V-18	Horizontal Multivibrator (12AU7)
V-20	Horizontal Damper (6AX4)
V-10	Picture Tube (21YP4)
R504-505	V-19 Screen Resistor
C504	V-19 Screen Capacitor
R500	V-18 Plate Resistor
T500	H.V. Deflection Transformer
T405	Deflection Yoke

NOTE: Check H.V. Power and H. Yoke plugs for proper seating, CRT sockets and high voltage anode lead for proper connections.

31A



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NO RASTER NO SOUND

A condition of No Raster with No Sound is generally caused by a filament failure in the series filament string or a defect in the B supply voltage source.

CHECK:

V-9	Video Amplifier (25C5)
V-14	Audio Output (25C5)
V-19	Horizontal Pulse Amplifier (25BQ6)
R446	Resistor Type Fuse
R447	Series Filament Resistor
C402A-414C	B Supply Filter Lytics
R448	Voltage Divider Resistor
L404	B Supply Filter Choke
T404	Filament Transformer
	Selenium Rectifiers

31B

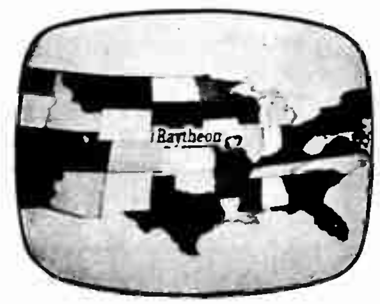
NOTE: Check AC line cord, safety interlock and on-off switch.

EXCESSIVE HORIZONTAL WIDTH

Condition is generally due to improper adjustment of the H. Size control, insufficient high voltage or possibly caused by high AC line voltage.

CHECK:

	Horizontal Size Control Adjustment
V-21	High Voltage Rectifier (1B3)
V-19	Horizontal Pulse Amplifier (25BQ6)
V-20	Horizontal Damper (6AX4)
V-18	Horizontal Multivibrator (12AU7)
R504-505	V-19 Screen Resistor
C504	V-19 Screen Capacitor
R502	V-19 Grid Resistor
C501-C502	V-19 Grid Capacitor
R500	V-18 Plate Resistor
T500	H.V. Deflection Transformer
R506	V-21 Filament Resistor



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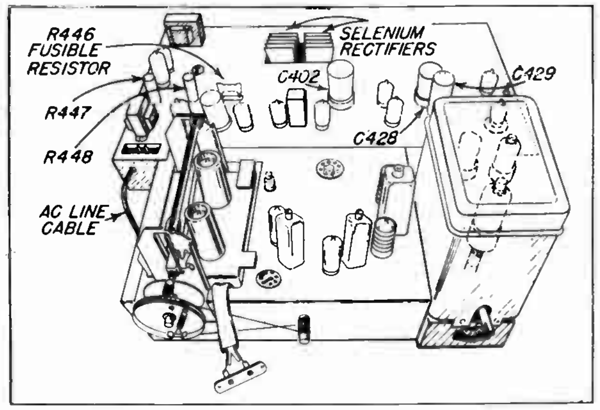
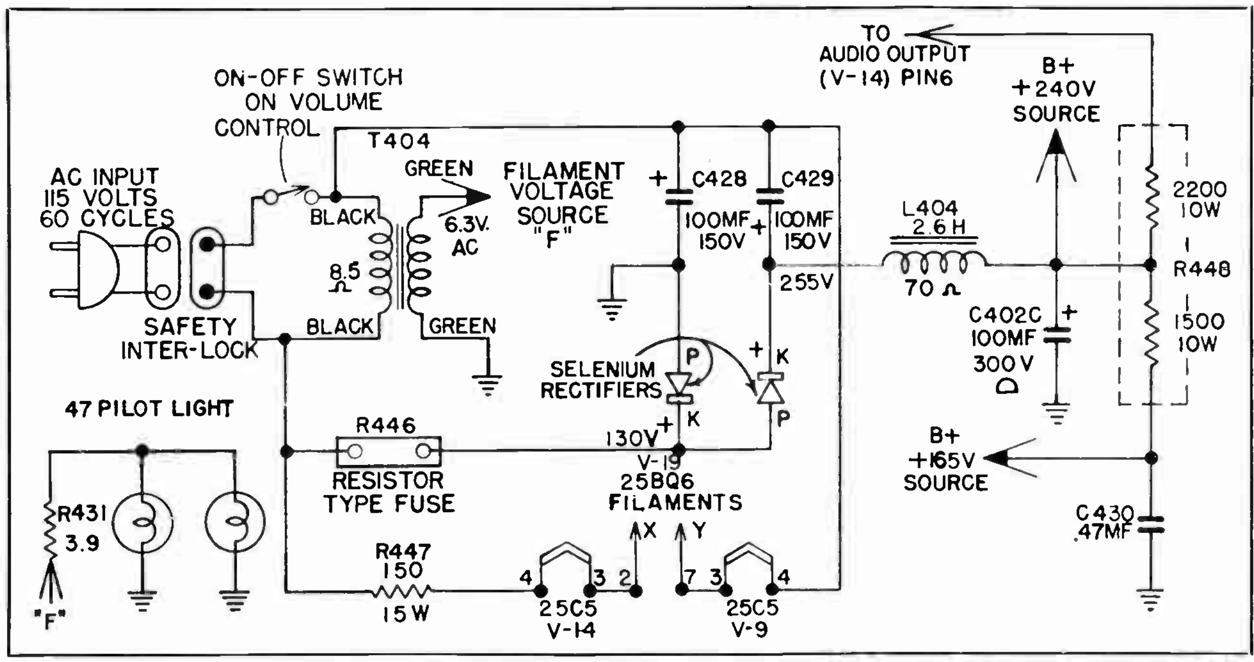


REPLACEMENT PARTS

Ref. No.	Part No.	Description
R446	46M-22301	Resistor type fuse
R447	9M-22837	150 ohm, 15 watt, 10%
R448	9M-22275	2200 ohm, 10 watt, 10% 1500 ohm, 10 watt, 10%
C402C	8C-22523	100 mfd, 300 volt—part of lytic
C428	8C-22285	100 mfd, 150 volt, lytic
C429	8C-22286	100 mfd, 150 volt, lytic
T404	12D-22586	Filament transformer
L404	16A-21214	Filter choke
	15B-21186	Mounting plate for C429
	21J-20097	Selenium rectifier
	201-22551	AC line cable assm.



LOW VOLTAGE SCHEMATIC

BLOOMING

The blooming effect will vary with adjustment of the picture and brightness controls and is usually caused by a defective tube or component in the high voltage or B supply voltage circuits.

CHECK:

V-21	High Voltage Rectifier (1B3)
V-19	Horizontal Pulse Amplifier (25BQ6)
V-20	Horizontal Damper (6AX4)
V-10	Picture Tube (21YP4)
R506	V-21 Filament Resistor
R503-C503	Boost Voltage Filter
T500	H. V. Deflection Transformer
C402C-428-429	B Supply Filter Lytics
L404	Filter Choke
	Selenium Rectifiers

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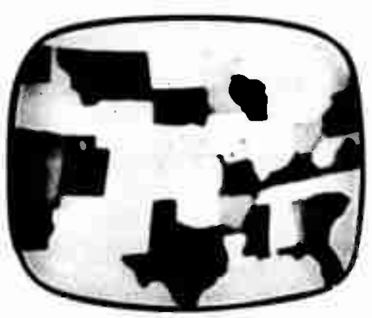


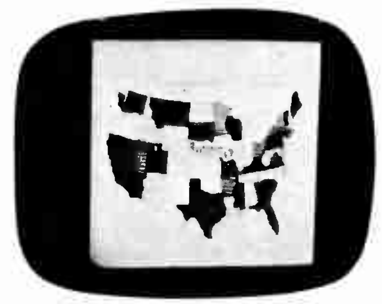
INSUFFICIENT HORIZONTAL AND VERTICAL SIZE

This condition can possibly be caused by incorrect horizontal size, vertical size and linearity control adjustments, low B supply voltage or possibly due to low AC line voltage.

CHECK:

V-19	Horizontal Pulse Amplifier (25BQ6)
V-20	Horizontal Damper (6AX4)
R503-C503	Boost Voltage Filter
C402C-428-429	B Supply Filter Capacitors
	Selenium Rectifiers

NOTE: Check H.V. power plug for proper seating and AC line voltage



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POOR FOCUS

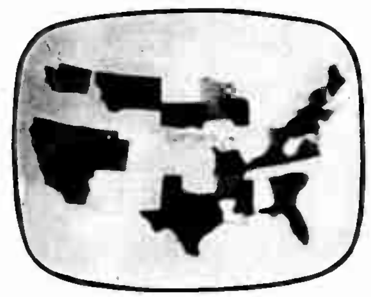
This condition is generally caused by an incorrect adjustment of the ion trap magnet, insufficient high voltage or a defect in the B supply voltage source.

CHECK:

Ion Trap Magnet Adjustment

V-21	High Voltage Rectifier (1B3)
V-19	Horizontal Pulse Amplifier (25BQ6)
V-20	Horizontal Damper (6AX4)
V-18	Horizontal Multivibrator (12AU7)
V-10	Picture Tube (21YP4)
C402C-428-429	B Supply Filter Lytics
T405	Deflection Yoke
	Selenium Rectifiers

NOTE: Since the centering control will be effective in either of two positions, the preferred position is approximately 180 degrees away from the magnet of the ion trap to minimize interaction.



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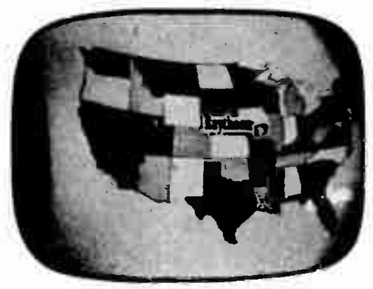
INCORRECT CENTERING

Condition is due to incorrect adjustment of the centering control.

CHECK:

Centering Control Adjustment (Refer to page 20)

NOTE: Do not attempt to correct for vertical centering with either the vertical size or linearity controls and do not use the horizontal hold control to affect horizontal centering.



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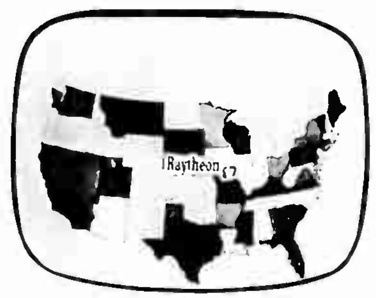

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18

TILTED PICTURE

This condition is caused by an incorrectly positioned deflection yoke.

CHECK:

Deflection Yoke Positioning Adjustment

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TUBE SHADOW

This condition is usually caused by an incorrectly positioned deflection yoke or a misadjusted centering control or ion trap magnet.

CHECK:

Deflection Yoke Positioning Adjustment
Centering Magnet Adjustment
Ion Trap Magnet Adjustment

REPLACEMENT PARTS

Part No.	Description	Part No.	Description
201-22697	Deflection yoke assembly	16M-20697	Centering magnet
15B-17278-9	CRT socket and cable	16M-22602	Linearity magnet
16M-19906	Ion trap magnet	16M-22607	Anti-pin cushion magnet

Anti-Pin Cushion Magnet:

Adjust centering until left edge of the raster is visible. Loosen the positioning screw and slide the magnet until the edge of the raster is vertically straight. If keystoning is noticed adjust magnet in vertical plane.

Deflection Yoke:

The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow. Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a position adjustment is necessary, loosen the yoke wing nut located at the top of the picture tube assembly.

H. Linearity Magnet:

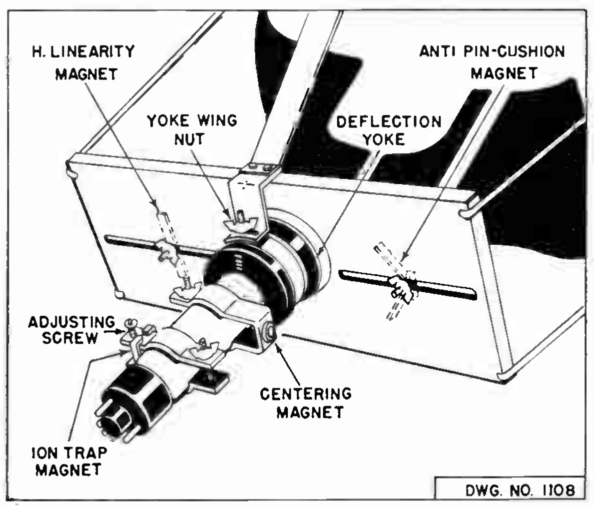
The horizontal linearity magnet affects the linearity of the right side of the picture only. The magnet pulls or stretches the right side and has a greater effect when closer to the picture tube.

Ion Trap Magnet:

If adjustment is determined necessary, loosen the wing nut, rotate and slide the magnet until the position which gives maximum illumination is found. Adjust the screw for maximum illumination. Repeat the above two steps. Rotate and slide the magnet until the best focus position is found without sacrificing brilliance. Tighten wing nut. Adjustment should be made with brightness and picture controls set for normal viewing. The position of the ion trap magnet MUST be over the grid of the picture tube (second cylinder from the base identified by a flared forward lip) after the adjustment is complete.

Centering Magnet:

The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture can be moved up or down. To the left or right of the neck of the picture tube, the picture can be moved either to the left or right. The position of the centering magnet should be 1/4 to 1/2 inch behind the deflection yoke.

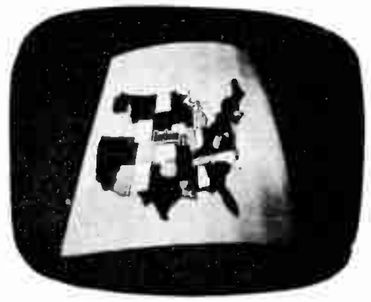


TRAPEZOIDAL RASTER

A trapezoidal raster is generally caused by a defective deflection yoke or associated components.

CHECK:

T405	Deflection Yoke
R444-445	Yoke Loading Resistors
C441	Yoke Equalizing Capacitors



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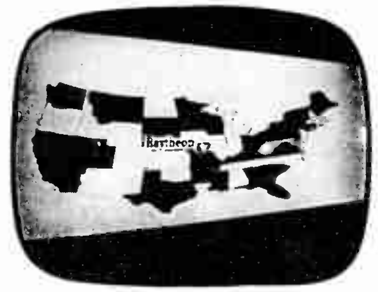

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SOUND CONDITIONS

It will always prove helpful when analysing a service condition to first determine if the sound section is functioning normally. Since the receiver is of the intercarrier type, both the sound and picture information are amplified simultaneously by the tuner, I F and video amplifiers. Due to the design of the receiver the video amplifier also amplifies both the sound and picture information. By analysing the above, it can be assumed that if the picture appears to be normal and the sound is not functioning properly the defect is located between the sound take off point (plate of the video amplifier) and speaker.

B - NO SOUND

A no sound condition with a normal picture is generally caused by a defective tube or component between the plate of the video amplifier and speaker.

CHECK:

V-11	Audio I F Amplifier (6AU6)
V-12	Audio Detector (6AL5)
V-13	Audio Amplifier (6AV6)
V-14	Audio Output (25C5)
R422	V-11 Screen Resistor
C410	V-11 Screen Capacitor
R428	V-13 Plate Resistor
R425	Volume Control
C418	Coupling Capacitor
R448	Voltage Divider Resistor
R430	V-14 Cathode Resistor
T401	Output Transformer
T400	Ratio Detector Transformer
	Speaker

NOTE: Check Speaker cable connections.

C - WEAK SOUND

A weak sound condition is generally caused by a weak tube or misalignment of the sound section.

CHECK:

V-11	Audio I F Amplifier (6AU6)
V-13	Audio Amplifier (6AV6)
V-14	Audio Output (25C5)
T400	Ratio Detector Transformer Adjustment (Primary-Bottom Slug)
L403	Audio Pick-Off Coil Adjustment

SOUND CONDITIONS

D - DISTORTED SOUND

This condition is usually caused by a defective tube or component in the sound section.

CHECK:

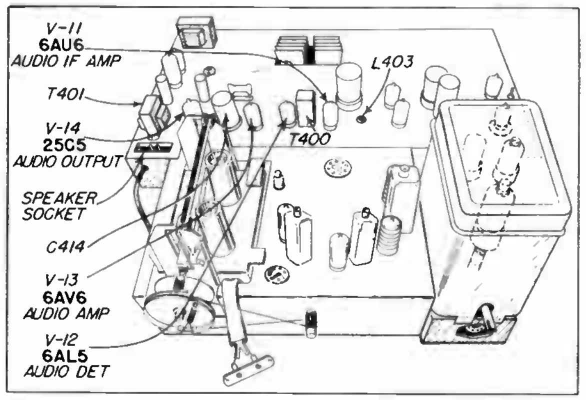
V-14	Audio Output (25C5)
V-12	Audio Detector (6AL5)
V-13	Audio Amplifier (6AV6)
C-414A-B-C	Filter Lytic
C418	Coupling Capacitor
R428	V-13 Plate Resistor
R430	V-14 Cathode Resistor
T400	Ratio Detector Transformer
	Speaker
T400	Ratio Detector Transformer Adjustment (Secondary - Top Slug)

E - HUM OR BUZZ IN SOUND

This condition is generally due to a defective tube or component in the sound section or due to a misalignment of the sound coils.

CHECK:

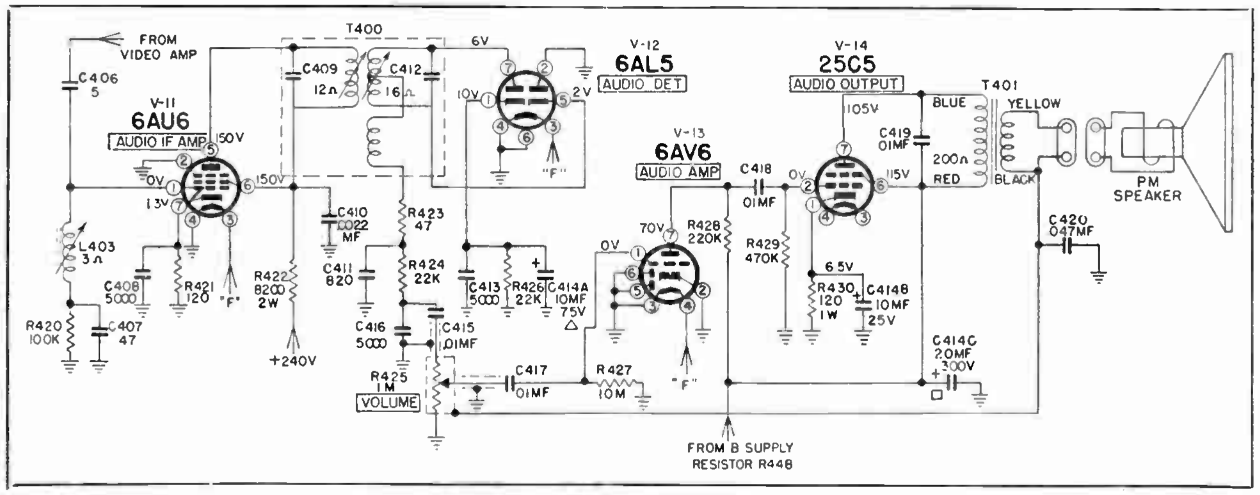
V-12	Audio Detector (6AL5)
V-14	Audio Output (25C5)
V-13	Audio Amplifier (6AV6)
V-11	Audio I F Amplifier (6AU6)
C414A-B-C	Filter Lytic
C420	Speaker Voice Coil Bypass
T400	Ratio Detector Transformer Adjustment (Secondary-Top Slug)
L403	Audio Pick-Off Coil Adjustment



NOTE: A fast method of isolating the defective stage when a troublesome sound condition occurs is to apply a 60 cycle 6.3 filament voltage through a .5 mfd capacitor to various points in the sound section. If an increase of volume is not observed as the 60 cycle is applied, the defect is located between the point tested and the speaker.

REPLACEMENT PARTS

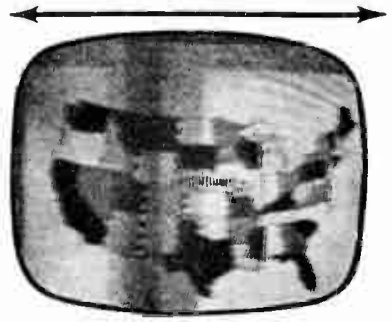
Ref. No.	Part No.	Description
R425	10A-22305	On-off volume control—1 meg.
C414A-B-C	8C-22524	10 mfd, 75 volt—10 mfd, 25 volt—20mfd, 300 volt—lytic
T400	13M-22303	Ratio detector transformer
T401	12C-22508	Audio output transformer
L403	201-22581	Video trap coil
	51A-22370	Iron core for L403



SOUND SECTION SCHEMATIC

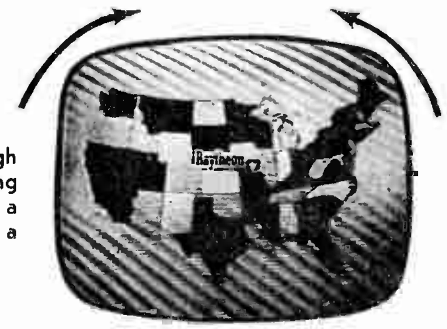
EXTERNAL INTERFERENCE

The five service conditions below which are usually caused by external interference have been included in the "Service Saver" as they are common service complaints. These conditions are presented so that they can easily be identified and usually the effects in the picture are little affected by a control adjustment, tube or component substitution or circuit modification. These conditions result from an interfering external signal and are seldom caused or due to a defect in the receiver.



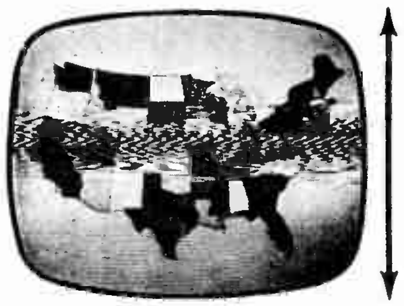
CHANNEL CROSS TALK 2

Due to interference from a nearby station on same channel or due to adjacent channel interference—Orientation, relocation or an antenna with sharper directivity characteristics and the use of traps are suggested to reduce or eliminate channel cross talk.



RF INTERFERENCE 3

Due to a beat frequency between the incoming signal and high powered radio equipment or a local oscillator in a receiver being operated in the vicinity—Orientation, relocation or installing a higher gain and more directional type antenna or the use of a booster may be effective in eliminating this interference.

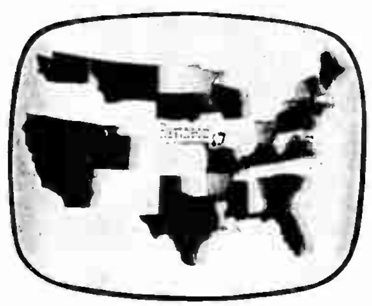


DIATHERMY INTERFERENCE 5

Caused by X-Ray, commercial RF heating, ultra-violet and fluorescent lights, brush motors and other 60 cycle operated equipment—Filters or other corrective measures installed at the source of interference may be tried to eliminate the herring-bone pattern from the picture.

IGNITION INTERFERENCE 7

Caused by ignition systems of cars or trucks or by breaking contact type of electrical appliances in vicinity. Similar condition may result from arcing in high voltage supply. — Effects in the picture may be reduced by relocation or installing a more directional type antenna, shielding or redressing the transmission line or by installing a power line filter.



GHOSTS 13

Due to the transmitted signal being reflected from buildings, hills or mountains and other surrounding structures. — To eliminate or reduce the effects in the picture, orientation, relocation or probing, or installing an antenna with improved directivity characteristics should be attempted.

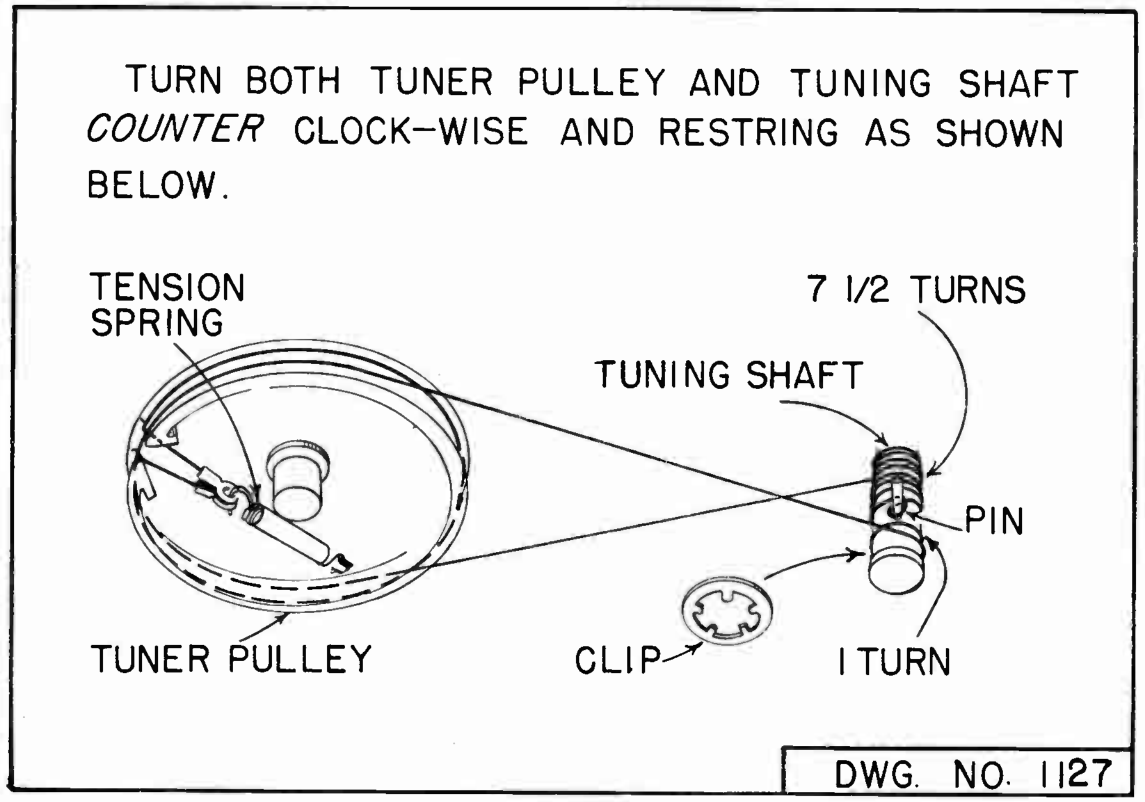


Figure 1. Dial Stringing

CIRCUIT CHANGES

CHASSIS CODE	SUB UNIT	CODE UNIT	CHANGE	REASON
233	DEF	C	R403 (47K) changed to 68K.	Reduce horizontal phase shift.
633	HV	G	C507 (.22MF) changed to .1MF, R504 (1800-1W) deleted and T500 part number changed to -1	To increase high voltage.
134	RF	L	R306 (33K) changed to 22K.	Improve IF response.
933	DEF	J	R434 (47K) changed to 100K.	To improve vertical and horizontal sync.
243	DEF	M	C437 (.22MF) changed to .1MF.	Reduce horizontal waves.
443	DEF	P	R417 wired to boost instead of 240V.	Increase resolution.
543	DEF	Q	R419 (3300) changed to 5600, R418 (1800) changed to 22K and relocated, and C443 (100) added to pin 2 of V-10.	Improve vertical retrace.
643	RF	O	V-2 (6BQ7A) changed to 6BZ7.	To increase sensitivity.
743	HV	S	V-20 (6AX4) changed to 25AX4, V-19-20 filament wiring revised and T404 changed.	Reduce cost.
743	DEF	S	R447 (150-15W) changed to 47-5W.	

CHASSIS CODE	SUB UNIT	CODE UNIT	CHANGE	REASON
943	DEF	U	R428 (220K) changed to 470K and wired to 240V, C406 (5) changed to 3.3 and wired to detector output, L406 (270 UH) and R463 (10K) added to pin 2 of V9, L403 (sound-pick-off coil) changed and C444 (22) added across L403.	Eliminate smear.
No Code Change	DEF	V	L407 and C445 added to cathode lead of CRT.	Eliminate sand in picture.
No Code Change	DEF		C411 (470) replaced by a Trimmer.	Correct unbalance in Ratio Detector transformer.

NOTE: Earlier code 21" deflection and high voltage units cannot be interchanged with code "S" units.
DEF—Deflection sub-chassis.
H.V.—High voltage sub-chassis.
R.F.—Tuner and IF sub-chassis.

PARTS LIST

Ref. No.	Part No.	Description	Price
C406	8G-12495-5	3.3 mmf. ceramic	.25
C407	8G-12198	47 mmf, ceramic	.25
C411	8E-23378	80-480 mmf, trimmer	.55
C437	8J-16085	.1 mfd, 200 volt, molded	.30
C443	8G-22657	100 mmf, ceramic	.25
C444	8G-11789	10 mmf, ceramic	.25
C445	8G-22657	100 mmf, ceramic	.25
C507	8J-16085	.1 mfd, 200 volt, molded	.30
R306	9B1-78	22K ohm, ½ watt, ±10%	.25
R403	9B1-84	68K ohm, ½ watt 10%	.25
R416	9B1-90	100K ohm, ½ watt, ±10%	.25
R418	9B1-78	22K ohm, ½ watt, 10%	.25
R419	9B1-71	5600 ohm, ½ watt, 10%	.25
R428	9B1-94	470K ohm, ½ watt, 10%	.25
R434	9B1-86	100K ohm, ½ watt, 10%	.25
R446	46M-23018	Fuse Resistor, 5.6 Amp.	.55
R447	9C12-1083	47 ohm, 5 watt, 10%	.30
R460	9B1-88	150K ohm, ½ watt, ±10%	.25
R463	9B1-74	10K ohm ½ watt, 10%	.25
L107-108	13E-23181	UHF Antenna trap coil	.05
L403 (inc. R420, C407, C406, and C444)	201-23477	Sound pick-off coil	—
L406	16A-20970	Choke coil—270 UH	.50
L407 (incl. C445)	201-22571	Video trap coil	1.30
T500	201-22396-1	H. V. Deflection transformer	—
V-2	6BZ7	VHF RF amplifier	3.80
V-20	25AX4	Damper	2.75

MISCELLANEOUS PART CHANGES

Ref. No.	Part No.	Description	Price
	2C-21201	Capacitor plate	2.15
	201-20183	L403 core and clips assem.	.15
	14C-22282-21	H. V. Cable assembly	.50
	47A-22592	R. H. Pilot light socket bracket	.25
	47A-22513	L. H. Pilot light socket bracket	.25
	37A-22512	Pilot light shield	.05
	2D-22564	Pilot light mounting bracket	.05
L405 (incl. C440)	201-23180	H. Hold coil	2.50
T404	12D-21160-1	Filament transformer	3.66
T402	12M-18241-3	Vertical oscillator transformer	2.05

V–S

CAPACITORS CAPACITOR VALUES ARE REPRESENTED IN MICRO-MICROFARAD (MMF) UNLESS OTHERWISE INDICATED. "MF" DENOTES MICROFARAD.

RESISTORS RESISTOR WATTAGE IS REPRESENTED IN 1/2 WATT UNLESS OTHERWISE INDICATED "K" DENOTES X 1,000 & "M" DENOTES X1,000,000.

SWITCHES ALL SWITCHES ARE SHOWN IN THE POSITION FOR VHF OPERATION.

VOLTAGE READINGS THE VOLTAGE READINGS INDICATED AT THE VARIOUS TUBE SOCKET PINS WERE MEASURED WITH A 20,000 OHM PER VOLT VOLTMETER, NORMAL OPERATION, NO SIGNAL INPUT AND LINE VOLTAGE AT 115V AC WHERE CONTROL SETTINGS AFFECT VOLTAGE READINGS THE MINIMUM AND MAXIMUM ARE INDICATED. (SEE WARNING BELOW)

HIGH VOLTAGE HIGH VOLTAGE ON PLATE CAPS OF THE 1B3 HIGH VOLTAGE RECTIFIER AND 25BQ6 HORIZONTAL PULSE AMPLIFIER. DO NOT MEASURE THIS VOLTAGE. MEASURE CRT 2nd ANODE VOLTAGE WITH H. V. PROBE

COIL DC RESISTANCE THE DC RESISTANCE READING INDICATED NEAR THE TRANSFORMERS AND COILS HAVE BEEN TAKEN WITH AN OHMMETER DIRECTLY ACROSS THE COIL BEING MEASURED. COILS SHOWN WITHOUT A RESISTANCE READING HAVE A DC RESISTANCE OF LESS THAN ONE OHM. A TOLERANCE OF ±10% IS PERMISSIBLE. DO NOT MEASURE WITH SET TURNED ON.

WAVE FORMS THE WAVE FORMS ILLUSTRATED ARE EXACT COPIES OF THAT SHOWN ON A LABORATORY OSCILLOSCOPE. THE WAVE FORMS WERE TAKEN UNDER NORMAL OPERATING CONDITIONS, WITH A TRANSMITTED SIGNAL AND THE PICTURE IN SYNC AT ALL TIMES. WITH EACH WAVE FORM IS THE PEAK-TO-PEAK VOLTAGE AND A HORIZONTAL OR A VERTICAL NOTATION REPRESENTING VERTICAL (60 CYCLES) OR HORIZONTAL (15,750 CYCLES) SCOPE FREQ. THE WAVE FORM AND PEAK-TO-PEAK VOLTAGE READINGS MAY VARY SOMEWHAT DEPENDING ON THE STRENGTH OF THE SIGNAL, THE PICTURE INFORMATION BEING TRANSMITTED AND THE ADJUSTMENT OF THE VARIOUS CONTROLS. WHEN CHECKING WAVE FORMS, CONNECT THE GROUND LEAD FROM THE OSCILLOSCOPE TO THE CHASSIS AND THE HOT LEAD TO THE POSITION INDICATED BY THE ARROW. (SEE WARNING BELOW)

REPLACING TUBES BEFORE REPLACING TUBES THE CABINET BACK MUST FIRST BE REMOVED. REMOVING THE CABINET BACK DISENGAGES THE SAFETY INTERLOCK AND REMOVES THE POWER TO THE RECEIVER. DO NOT TAMPER WITH OR ATTEMPT TO DEFEAT THE PURPOSE OF THE SAFETY INTERLOCK, AS SEVERE SHOCK MAY RESULT. DO NOT REMOVE TUBES WHILE THE RECEIVER IS IN OPERATION AS OVERLOADING OR COMPONET FAILURE MAY RESULT.

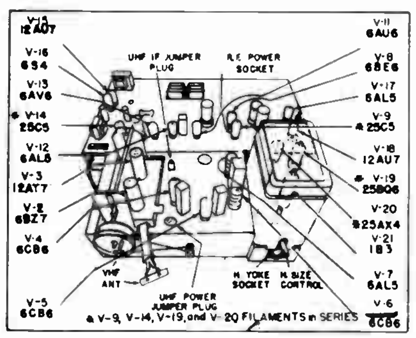
PICTURE TUBE HANDLING DUE TO LARGE SURFACE AND EXTREME HIGH VACUUM OF THE PICTURE TUBE, CARE SHOULD BE USED WHEN HANDLING THE CHASSIS OUTSIDE THE CABINET. DO NOT SUBJECT THE TUBE TO EXCESSIVE PRESSURE OR ROUGH HANDLING AS AN IMPLOSION MAY RESULT CAUSING SERIOUS PERSONAL INJURY.

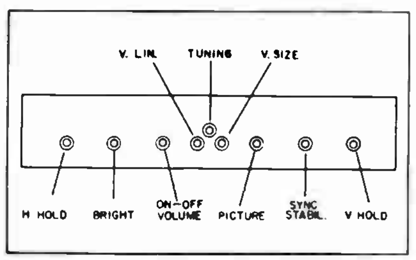
WARNING

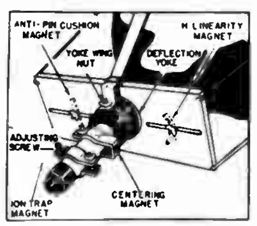
AT ALL TIMES DURING OPERATION THE CHASSIS IS AT 125 VOLTS DC POTENTIAL ABOVE GROUND AND IT ALSO MAY BE AT THE LINE VOLTAGE POTENTIAL DEPENDING ON HOW THE LINE CORD PLUG IS INSERTED IN THE POWER RECEPTACLE.

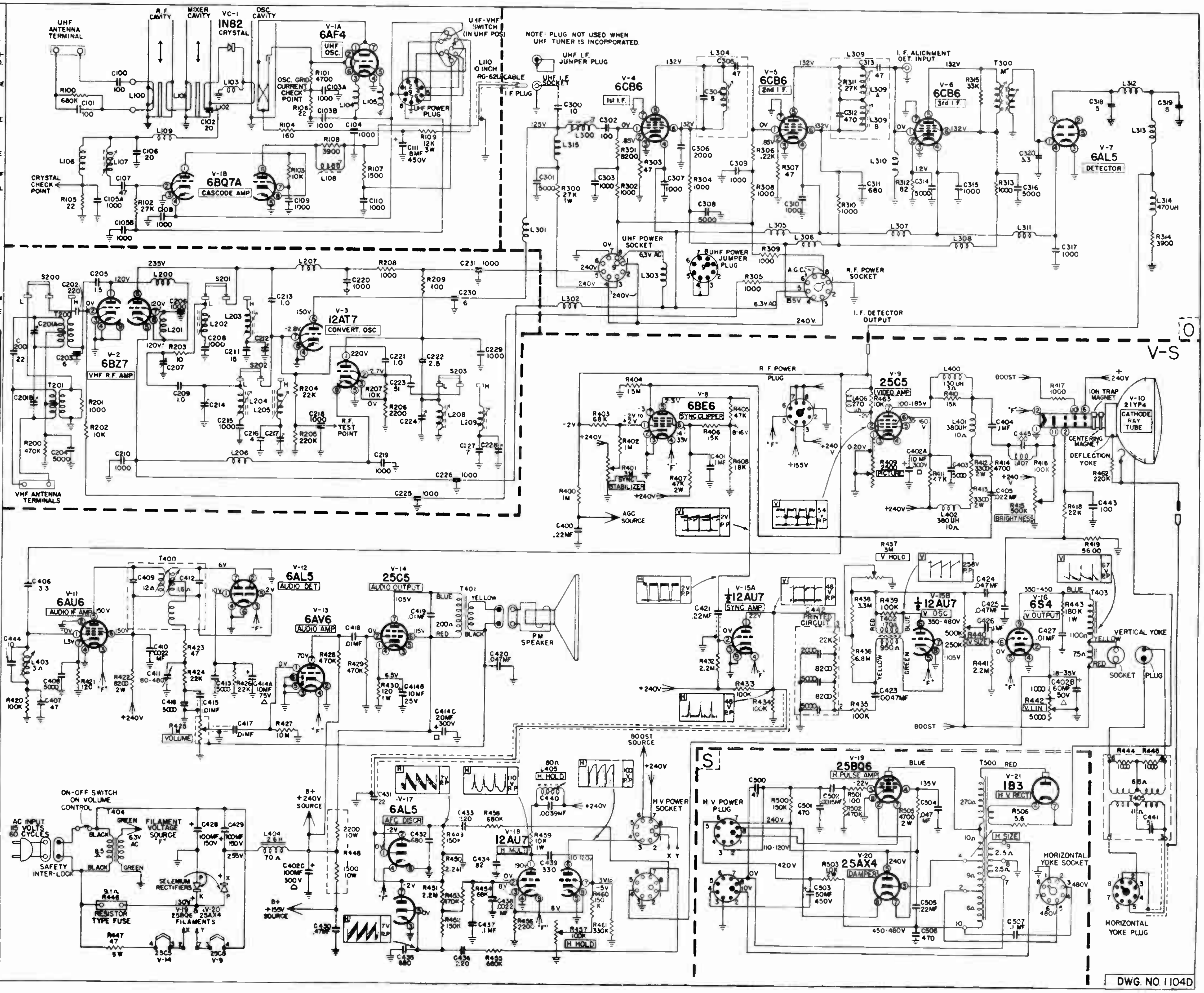
EXTREME CAUTION MUST BE OBSERVED WHEN WORKING WITH THE CHASSIS OUTSIDE THE CABINET AND WHEN POWER IS APPLIED TO THE RECEIVER WITH THE CABINET BACK REMOVED. *SEVERE SHOCK* MAY RESULT FROM CONTACT WITH CHASSIS.

AN ISOLATION TRANSFORMER BETWEEN THE LINE CORD PLUG AND POWER RECEPTACLE MUST BE USED WHEN SERVICE IS REQUIRED. THIS REMOVES AC LINE SHOCK HAZARDS. DAMAGE TO THE RECEIVER AND TEST EQUIPEMENT MAY RESULT WITHOUT THE USE OF AN ISOLATION TRANSFORMER.









VIDEO IF ALIGNMENT

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	23.9 26.3	25	IF alignment input	Scope at IF detector output	Connect short between pin 5 and 6 of tube 5	T300 pri. (top) T300 sec. (bot.) Coupling rod	
2	Markers should fall 10% down. If response curve is not as shown., readjust coupling rod (bottom T300) for proper bandwidth and T300 primary and secondary for flat response and maximum gain.						
3	21.2	———	Converter grid	VTVM at IF detector output	Remove short. Adjust generator for output of approx. 2 volts DC.	L309B (bottom core)	Maximum reading
4	26.5	———	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L309A (top core)	Maximum reading
5	21.2	———	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L309B (bottom core)	Maximum reading
6	24.0	———	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L304	Maximum reading
7	25.0	———	Converter grid	VTVM at IF detector output	Adjust generator for output of approx. 2 volts DC.	L300	Maximum reading
8	———	25	Converter grid	Scope at IF detector output	———	T300 pri. (top)	Rock for flat response
9	23.8 26.65	25	Converter grid	Scope at IF detector output	Markers should be 50% down and response curve should be as shown. If not, repeat alignment	Check point only	

Picture IF frequency 26.75 MC — Sound IF frequency 22.25MC.

NOTE: A very short lead from the generator must be used to prevent regeneration.

VIDEO TRAP COIL (L-403) ADJUSTMENT

1. Tune in a station.
2. Adjust the tuner until sound bars just appear.
3. Turn L-403 slug all the way out (counter-clockwise).
4. Turn the slug in (clockwise) until the horizontal scanning lines are smooth and continuous.

SOUND IF ALIGNMENT

Short antenna to ground

1	4.5	———	IF Detector Output	VTVM across C-416	———	T400 Primary (Botom of can)	Maximum Reading on V.T.V.M.
2	———	4.5	IF Detector Output	Scope across C-416	Sweep approx. ± 100 KC. Adjust for maximum linearity	T400 Secondary (Top of can)	
3	———	4.5	IF Detector Output	Scope across C-416	Sweep approx. ± 100 KC. Adjust for maximum linearity	T400 Primary (Botom of can)	

PRE-ALIGNMENT PRECAUTIONS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot lead as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. When aligning the IF Amplifier be sure tuner is set approximately to channel 11.

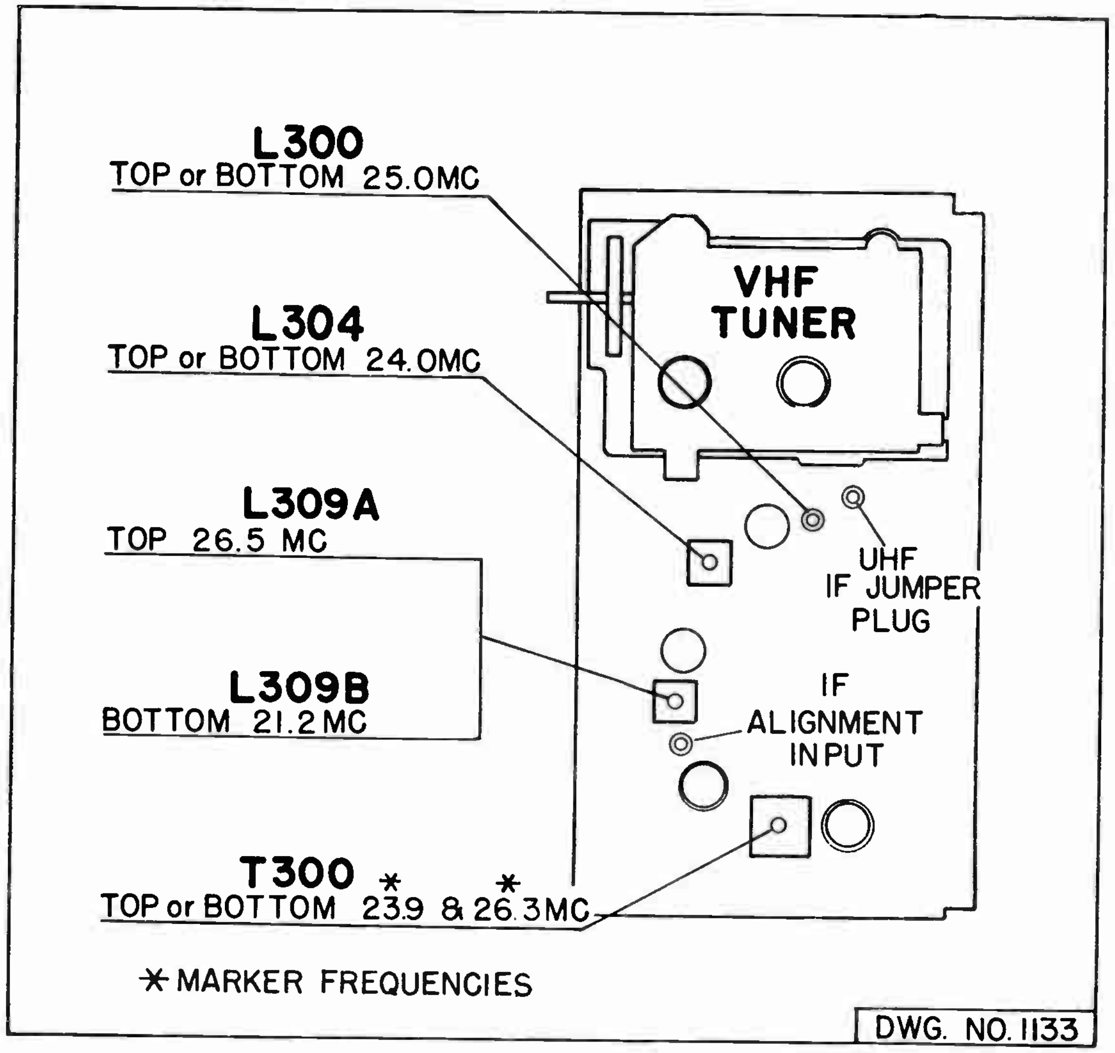


Figure 2. Top RF Chassis View

TUNER ALIGNMENT

1. Preset trimmer screws C-212-217-207-214-228-224 to dimensions shown on page 29.
2. Preset coil cores L-203-202-205-204-209-208 in the following manner.
   - (a) In low band position, turn tuner to top of stroke (cores furthest out of coil).
   - (b) Switch will be in low band position.
   - (c) Adjust coil cores 1.6 inch from core to end of coil form (use core aligning tool if available).

V-video
S-sound

LOW BAND RF TRACKING Turn Tuner to Channel 6.

NOTE: Low Band must be aligned before High Band.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V—83.25 S—87.75	Channel 6	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-201B	
2	V—83.25 S—87.75	Channel 6	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-207 C-214	
3	V—77.25 S—81.75 V—67.25 S—71.75 V—61.25 S—65.75 V—55.25 S—59.75	Channel 5 Channel 4 Channel 3 Channel 2	Antenna Terminals	R. F. Test Point	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-207 C-214	V S

HIGH BAND RF TRACKING Turn Tuner to Channel 13.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V—211.25 S—215.75	Channel 13	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-201-A	
2	V—211.25 S—215.75	Channel 13	Antenna Terminals	R. F. Test Point	Adjust for maximum response	C-212 C-217	
3	V—205.25 S—209.75 V—199.25 S—203.75 V—193.25 S—197.75 V—187.25 S—191.75 V—181.25 S—185.75 V—175.25 S—179.75	Channel 12 Channel 11 Channel 10 Channel 9 Channel 8 Channel 7	Antenna Terminals	R. F. Test Point	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-212 C-217	V S

LOW BAND OSCILLATOR TRACKING Turn Tuner to Channel 6.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	83.25	Channel 6	Antenna Terminals	Scope at IF Detector Output	Adjust until marker is 50% down on low frequency slope	C-224	50% VIDEO LOW FREQ.
2	67.25 55.25	Channel 4 Channel 2	Antenna Terminals	Scope at IF Detector Output	Marker should be 50% down on low frequency slope	———	50% VIDEO LOW FREQ.

HIGH BAND OSCILLATOR TRACKING Turn Tuner to Channel 13.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	211.25	Channel 13	Antenna Terminals	Scope at IF Detector Output	Adjust until marker is 50% down on low frequency slope	C-228	50% VIDEO LOW FREQ.
2	193.25 175.25	Channel 10 Channel 7	Antenna Terminals	Scope at IF Detector Output	Marker should be 50% down on low frequency slope	———	50% VIDEO LOW FREQ.

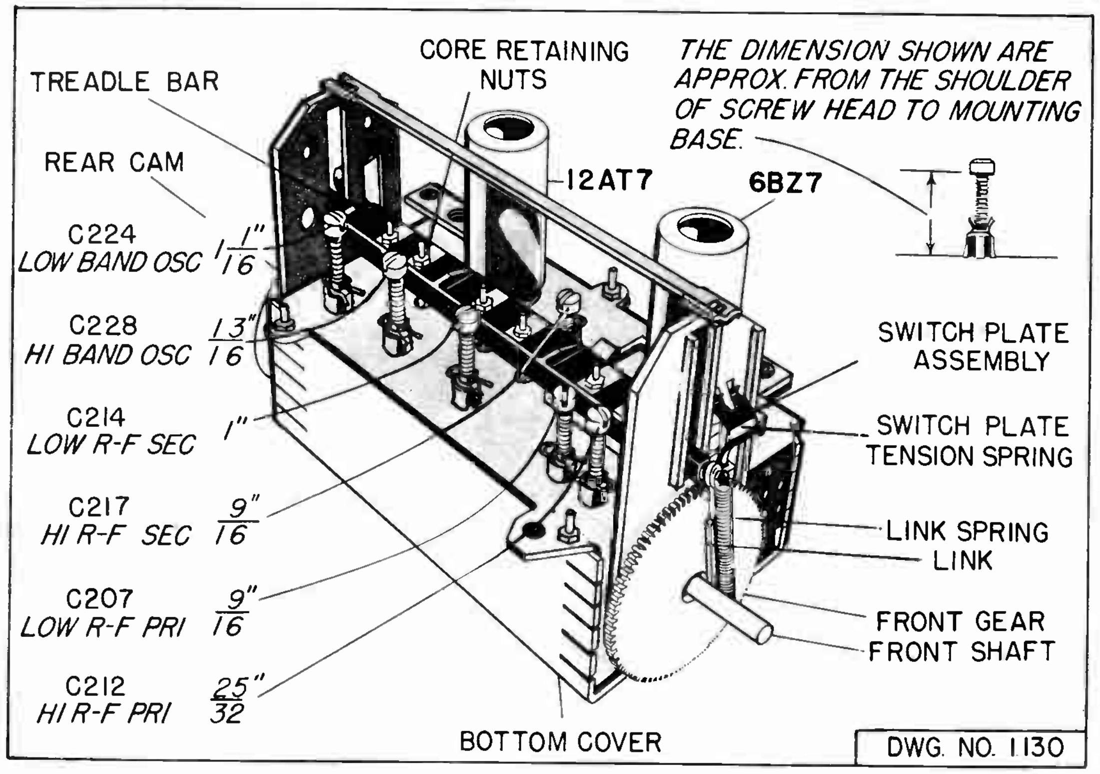


Figure 3. Top VHF Tuner View

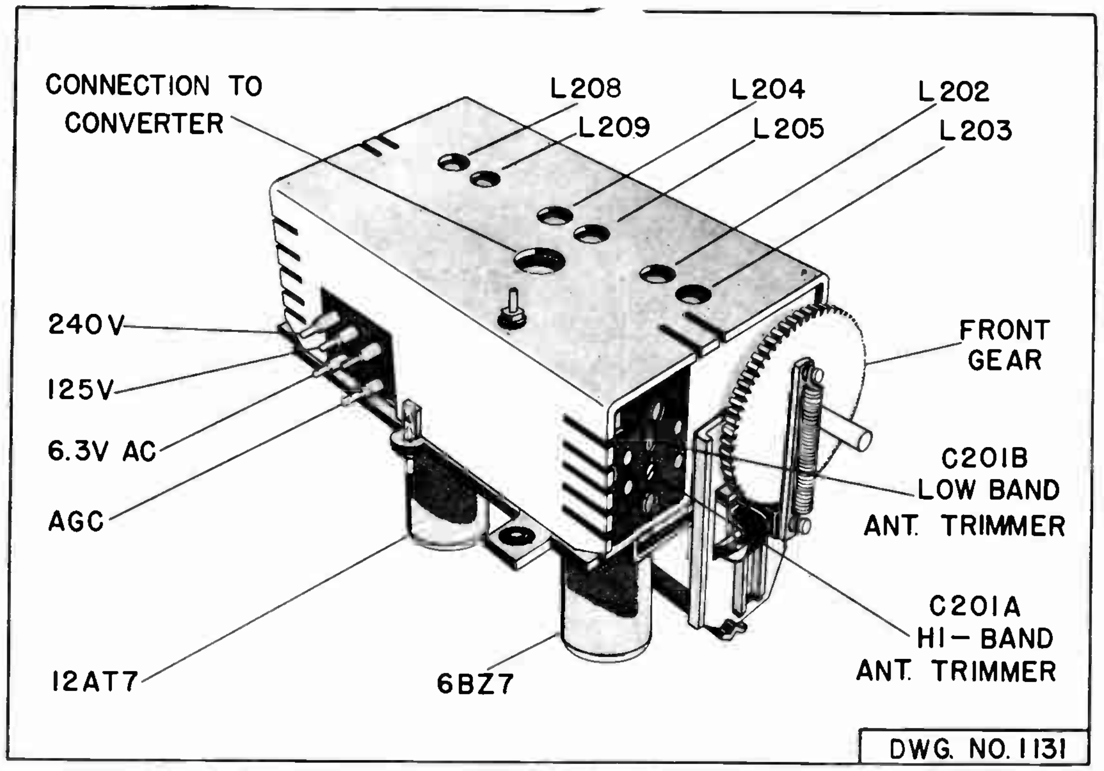


Figure 4. Bottom VHF Tuner View

CAPACITORS CAPACITOR VALUES ARE REPRESENTED IN MICRO-MICROFARAD (MMF) UNLESS OTHERWISE INDICATED. "MF" DENOTES MICRO-FARAD.

RESISTORS RESISTOR WATTAGE IS REPRESENTED IN 1/2 WATT UNLESS OTHERWISE INDICATED. "K" DENOTES X 1,000 & "M" DENOTES X1,000,000.

SWITCHES ALL SWITCHES ARE SHOWN IN THE POSITION FOR VHF OPERATION

VOLTAGE READINGS THE VOLTAGE READINGS INDICATED AT THE VARIOUS TUBE SOCKET PINS WERE MEASURED WITH A 20,000 OHM PER VOLT VOLTMETER, NORMAL OPERATION, NO SIGNAL INPUT AND LINE VOLTAGE AT 115V AC WHERE CONTROL SETTINGS AFFECT VOLTAGE READINGS THE MINIMUM AND MAXIMUM ARE INDICATED. (SEE WARNING BELOW)

HIGH VOLTAGE HIGH VOLTAGE ON PLATE CAPS OF THE 1B3 HIGH VOLTAGE RECTIFIER AND 25BQ6 HORIZONTAL PULSE AMPLIFIER. DO NOT MEASURE THIS VOLTAGE. MEASURE CRT 2nd ANODE VOLTAGE WITH H V PROBE

COIL DC RESISTANCE THE DC RESISTANCE READING INDICATED NEAR THE TRANSFORMERS AND COILS HAVE BEEN TAKEN WITH AN OHMMETER DIRECTLY ACROSS THE COIL BEING MEASURED COILS SHOWN WITHOUT A RESISTANCE READING HAVE A DC RESISTANCE OF LESS THAN ONE OHM. A TOLERANCE OF ±10% IS PERMISSIBLE. DO NOT MEASURE WITH SET TURNED ON.

WAVE FORMS THE WAVE FORMS ILLUSTRATED ARE EXACT COPIES OF THAT SHOWN ON A LABORATORY OSCILLOSCOPE. THE WAVE FORMS WERE TAKEN UNDER NORMAL OPERATING CONDITIONS, WITH A TRANSMITTED SIGNAL AND THE PICTURE IN SYNC AT ALL TIMES. WITH EACH WAVE FORM IS THE PEAK-TO-PEAK VOLTAGE AND A HORIZONTAL OR A VERTICAL NOTATION REPRESENTING VERTICAL (60 CYCLES) OR HORIZONTAL (15,750 CYCLES) SCOPE FREQ. THE WAVE FORM AND PEAK-TO-PEAK VOLTAGE READINGS MAY VARY SOMEWHAT DEPENDING ON THE STRENGTH OF THE SIGNAL, THE PICTURE INFORMATION BEING TRANSMITTED AND THE ADJUSTMENT OF THE VARIOUS CONTROLS WHEN CHECKING WAVE FORMS, CONNECT THE GROUND LEAD FROM THE OSCILLOSCOPE TO THE CHASSIS AND THE HOT LEAD TO THE POSITION INDICATED BY THE ARROW. (SEE WARNING BELOW)

REPLACING TUBES BEFORE REPLACING TUBES THE CABINET BACK MUST FIRST BE REMOVED REMOVING THE CABINET BACK DISENGAGES THE SAFETY INTERLOCK AND REMOVES THE POWER TO THE RECEIVER DO NOT TAMPER WITH OR ATTEMPT TO DEFEAT THE PURPOSE OF THE SAFETY INTERLOCK, AS SEVERE SHOCK MAY RESULT DO NOT REMOVE TUBES WHILE THE RECEIVER IS IN OPERATION AS OVERLOADING OR COMPONET FAILURE MAY RESULT

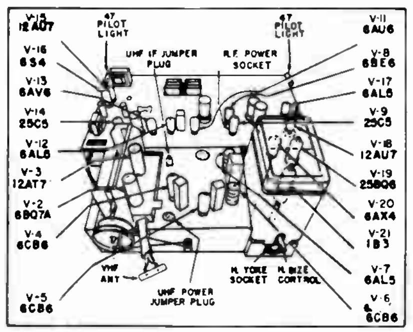
PICTURE TUBE HANDLING DUE TO LARGE SURFACE AND EXTREME HIGH VACUUM OF THE PICTURE TUBE, CARE SHOULD BE USED WHEN HANDLING THE CHASSIS OUTSIDE THE CABINET DO NOT SUBJECT THE TUBE TO EXCESSIVE PRESSURE OR ROUGH HANDLING AS AN IMPLOSION MAY RESULT CAUSING SERIOUS PERSONAL INJURY

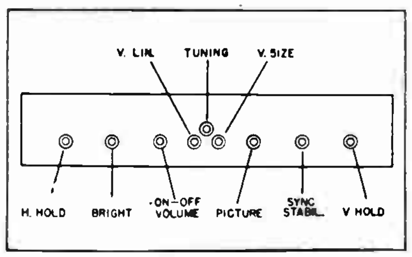
WARNING

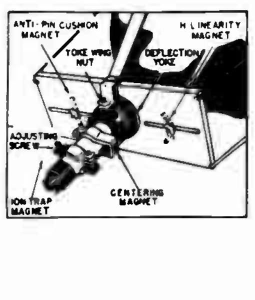
AT ALL TIMES DURING OPERATION THE CHASSIS IS AT 125 VOLTS DC POTENTIAL ABOVE GROUND AND IT ALSO MAY BE AT THE LINE VOLTAGE POTENTIAL DEPENDING ON HOW THE LINE CORD PLUG IS INSERTED IN THE POWER RECEPTACLE

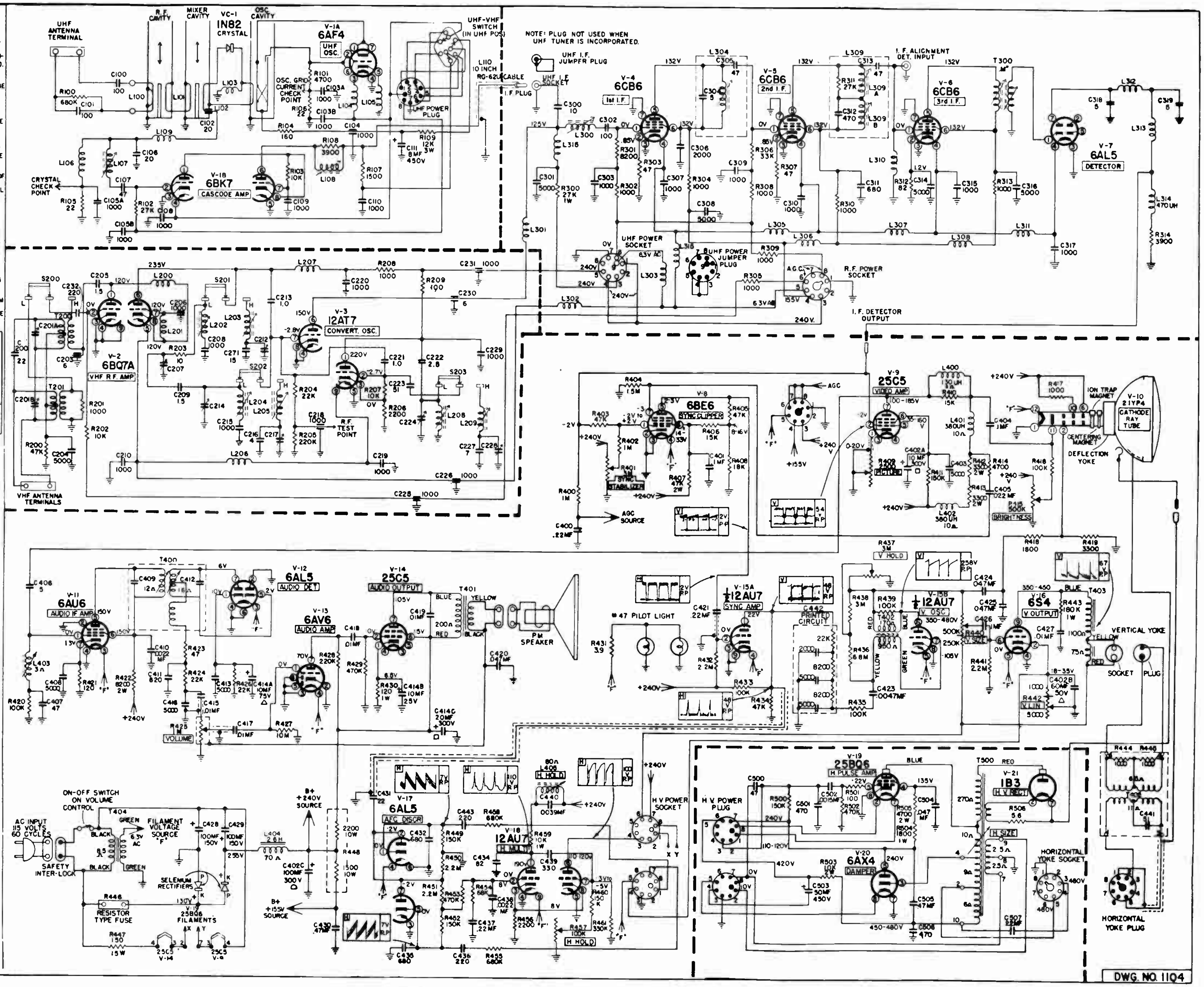
EXTREME CAUTION MUST BE OBSERVED WHEN WORKING WITH THE CHASSIS OUTSIDE THE CABINET AND WHEN POWER IS APPLIED TO THE RECEIVER WITH THE CABINET BACK REMOVED. *SEVERE SHOCK* MAY RESULT FROM CONTACT WITH CHASSIS.

AN ISOLATION TRANSFORMER BETWEEN THE LINE CORD PLUG AND POWER RECEPTACLE MUST BE USED WHEN SERVICE IS REQUIRED. THIS REMOVES AC LINE SHOCK HAZARDS DAMAGE TO THE RECEIVER AND TEST EQUIPEMENT MAY RESULT WITHOUT THE USE OF AN ISOLATION TRANSFORMER









SCHEMATIC DIAGRAM

REPLACEMENT PARTS LIST

20MC VHF TUNER

Capacitors

Ref. No.	Part No.	Description	Selling Price
C200	8G-11892	22 mmf, ceramic	.25
C201A-B	8E-17142	5-20 mmf, dual trimmer	.35
C202	8G-16045	220 mmf, ceramic	.25
C203	8G-20880	6 mmf, ceramic feed thru	.45
C204	8G-22612	5000 mmf, ceramic	.25
C205	8G-12495-8	1.5 mmf, ceramic	.25
C206	8G-21747	1000 mmf, ceramic	.25
C207	201-22333	Trimmer condenser	.35
C208	8G-13201	1000 mmf, ceramic	.25
C209	8G-12495-2	1.0 mmf, ceramic	.25
C210	8G-13201	1000 mmf, ceramic	.25
C211	8G-13017	15 mmf, ceramic	.25
C212	201-15142	Trimmer condenser	.30
C213	8G-12495-2	1.0 mmf, ceramic	.25
C214	201-22333	Trimmer condenser	.35
C215	8G-13201	1000 mmf, ceramic	.25
C216	8G-19314	4 mmf, ceramic	.25
C217	201-22333	Trimmer condenser	.35
C218	8G-20878	1000 mmf, feed thru	.55
C219-220	8G-13201	1000 mmf, ceramic	.25
C221	8G-12495-2	1.0 mmf, ceramic	.25
C222	8G-19568	2.5 mmf, ceramic	.30
C223	8G-11891	51 mmf, ceramic	.25
C224	201-22333	Trimmer condenser	.35
C225-226	8G-20878	1000 mmf, ceramic feed thru	.55
C227	8G-15224	7 mmf, ceramic	.25
C228	201-22333	Trimmer condenser	.35
C229	8G-13201	1000 mmf, ceramic	.25
C230	8G-20879	6 mmf, ceramic feed thru	.55
C231	8G-20878	1000 mmf, ceramic feed thru	.55

Resistors

Ref. No.	Part No.	Description	Selling Price
R200	9B1-94	470K ohm, ½ watt, 10%	.25
R201	9B1-62	1000 ohm, ½ watt, 10%	.25
R202	9B1-74	10K ohm, ½ watt, 10%	.25
R203	9B1-38	10 ohm, ½ watt, 10%	.25
R204	9B1-78	22K ohm, ½ watt, 10%	.25
R205	9B1-27	220K ohm, ½ watt, 20%	.25
R206	9B1-66	2200 ohm, ½ watt, 10%	.25
R207	9B1-74	10K ohm, ½ watt, 10%	.25
R208	9B1-13	1000 ohm, ½ watt, 20%	.25
R209	9B1-50	100 ohm, ½ watt, 10%	.25

Chokes, Transformers, Coils

Ref. No.	Part No.	Description	Selling Price
T200	13E-22082	H.B. Antenna transformer	1.00
T201	13E-21673	L.B. Antenna transformer	.70
L200	13M-20781	Cascode coil	.15
L201	13M-20780	Cascode coil	.15
L202	13E-12046	L.B. RF primary coil	.35
L203	13E-17140	H.B. RF primary coil	.95
L204	13E-12046	L.B. RF secondary coil	.35
L205	13E-17140	H.B. RF secondary coil	.95
L206	16A-20777	Filament coil	.30
L207	16A-17128	RF choke coil	.60
I 208	13D-12155	L.B. Oscillator coil	.90
L209	13E-17140	H.B. Oscillator coil	.95

Miscellaneous

Ref. No.	Part No.	Description	Selling Price
S200-201-202-203	2J-16310	Sliding switch contact	.05
	201-22081	Antenna transformer assembly (Includes C200,C201A-B, C204, R200, T200 and T201)	4.40
	200-20772	Antenna shield assembly	.40
	201-20766	Coil alignment strip	.20
	5F-16311	Switch contact holder	.15
	200-20779	Switch lever assembly	.55
	2D-20893	Switch lever bracket	.05
	200-18824	Rear cam	.20
	200-22803	Shaft and front cam	1.00
	200-20881	Bottom cover	.50
	201-20769	Capacitor plate assembly (Includes C218,225,226,230,231)	6.00
	49A-20763	Hair pin spring	.03
	5M-18807	Treadle bar	.65
	2M-16276	Core mounting clips	.05
	43A2-5444	Hex-nut, 2-56x3/16	05
	51A-15713	Iron core (white) for L209	.35
	51A-17162	Iron core (brown) for L203-205	.30
	51A-21200	Iron core (pink) for L208	.30
	51A-15715	Iron core (blue) for L202	.35
	51A-17161	Iron core (orange) for L204	.35
	2C-18804-1	Front end plate	.30
	2C-18805-1	Rear end plate	.35
	49A-18799	Link spring	.40
	2M-18800	Front link	.10
	2M-21278	Rear link	.10
	2M-19150-1	Flat spring	.05
	2B-19323	Tube shield	.25
	7B-13050	Antenna terminal board	.15

20MC IF AMPLIFIER

Capacitors

Ref. No.	Part No.	Description	Selling Price
C300	8G-19502	10 mmf, ceramic	.20
C301	8G-13962	5000 mmf, ceramic disk	.25
C302	8F3-8	100 mmf, mica	.25
C303	8G-13201	1000 mmf, ceramic	.25
C304-305		Included with L304	
C306	8G-19522	2000 mmf, ceramic	.30
C307	8G-13201	1000 mmf, ceramic	.25
C308	8G-13962	5000 mmf, ceramic disk	.25
C309-310	8G-13201	1000 mmf, ceramic	.25
C311	8G-21105	680 mmf, ceramic	.20
C312-313		Included with L309	
C314	8G-13962	5000 mmf, ceramic disk	.25
C315	8G-13201	1000 mmf, ceramic	.25
C316	8G-13962	5000 mmf, ceramic disk	.25
C317	8G-13201	1000 mmf, ceramic	.25
C318-319	8G-12166	5 mmf, ceramic	.25
C320	8G-12495-5	3.3 mmf, ceramic	.25

Resistors

Ref. No.	Part No.	Description	Selling Price
R300	9B2-79	27K ohm, 1 watt, 10%	.30
R301	9B1-73	8200 ohm, ½ watt, 10%	.25
R302	9B1-62	1000 ohm, ½ watt, 10%	.25
R303	9B1-46	47 ohm, ½ watt, 10%	.25
R304-305	9B1-62	1000 ohm, ½ watt, 10%	.25
R306	9B1-80	33K ohm, ½ watt, 10%	.25
R307	9B1-46	47 ohm, ½ watt, 10%	.25
R308-309-310	9B1-62	1000 ohm, ½ watt, 10%	.25
R311		Included with L309	
R312	9B1-49	82 ohm, ½ watt, 10%	.25
R313	9B1-62	1000 ohm, ½ watt, 10%	.25
R314	9B1-69	3900 ohm, ½ watt, 10%	.25
R315	9B1-80	33K ohm, ½ watt, 10%	.25

Chokes, Transformers, Coils

Ref. No.	Part No.	Description	Selling Price
T300	13B-22939	Output IF transformer	2.10
L300	201-22924	Converter coil	.55
L301	16A-21656	RF choke coil	.45
L302-303	16A-17937	Filament choke coil	.40
L304	201-22927	IF coil assembly	1.60
L305	16A-17937	Filament choke coil	.40
L306	16A-18676	RF choke coil	.20
L307	16A-17937	Filament choke coil	.40
L308	16A-18676	RF choke coil	.20
L309	201-22929	IF coil assembly	2.60
L310	201-15608	RF choke coil	.55
L311	16A-17937	Filament choke coil	.40
L312-313	16A-22923	Peaking coil	.35
L314	16A-19365	Peaking coil	.30
L315	201-20265	Peaking coil	.35

Miscellaneous

Ref. No.	Part No.	Description	Selling Price
	2D-22253	Chassis bolt bracket	.10
	39A-22252	Bracket insulator	.05
	15C-16007	7-pin, tube socket	.15
	2M-17589	Shield base	.05
	15B-10440	RF power socket	.15
	19B-19922	UHF IF socket and IF alignment input socket	.10
	201-21657	UHF IF jumper plug	.25
	19B-11920	UHF Tuner power socket	.15
	19A-21244	UHF Power jumper plug	.20

21" DEFLECTION CHASSIS

Capacitors

Ref. No.	Part No.	Description	Selling Price
C400	8J-16082	.22 mfd, 200 volt, molded	.45
C401	8J-16085	.1 mfd, 200 volt, molded	.30
C402A-B-C	8C-22523	10 mfd, 300 volt; 60 mfd, 50 volt; 100 mfd, 300 volt, lytic	3.65
C403	8G-13962	5000 mmf, ceramic disk	.25
C404	8J-16083	.1 mfd, 400 volt, molded	.40
C405	8J-19757	.022 mfd, 400 volt, molded	.25
C406	8G-12166	5 mmf, ceramic	.25
C407	8G-12198	47 mmf, ceramic	.25
C408	8G-13962	5000 mmf, ceramic	.25
C409		Included with T400	
C410	8J-20634	.0022 mfd, 400 volt, molded	.30
C411	8F3-124	820 mmf, 300 volt, mica	.30
C412		Included with T400	
C413	8G-13962	5000 mmf, ceramic	.25
C414A-B-C	8C-22524	10 mfd, 75 volt; 10 mfd, 15 volt; 20 mfd, 300 volt, lytic	1.26
C415	8J-20582	.01 mfd, 200 volt, molded	.25
C416	8G-22132	5000 mmf, ceramic	.20
C417	8J-20582	.01 mfd, 200 volt, molded	.25
C418	8J-16084	.01 mfd, 400 volt molded	.25
C419	8G-21208	.01 mfd, ceramic	.25
C420	8J-16081	.047 mfd, 400 volt, molded	.30
C421	8J-16095	.22 mfd, 400 volt, molded	.30
C422	17A-22376	Printed circuit	.75
C423	8J-20580	.0047 mfd, 200 volt, molded	.30
C424	8J-16081	.047 mfd, 400 volt, molded	.30
C425	8J-16096	.047 mfd, 200 volt, molded	.30
C426	8J-16083	.1 mfd, 400 volt, molded	.40
C427	8J-16097	.01 mfd, 600 volt, molded	.30
C428	8C-22285	100 mfd, 150 volt, lytic	1.85
C429	8C-22286	100 mfd, 150 volt, lytic	1.98
C430	8J-21505	.47 mfd, 400 volt, molded	.95
C431	8G-11892	22 mmf, ceramic	.25
C432	8F3-123	680 mmf, 300 volt, mica	.30
C433	8F3-117	220 mmf, 500 volt, mica	.25
C434	8F3-112	82 mmf, 500 volt, mica	.25
C435	8F3-123	680 mmf, 300 volt, mica	.30
C436	8F3-117	220 mmf, 500 volt mica	.25
C437	8J-16082	.22 mfd, 200 volt, molded	.45
C438	8J-20578	.0022 mfd, 200 volt, molded	.25
C439	8F3-119	330 mmf, mica	.25
C440	8J-20613	.0039 mfd, 600 volt, molded	.30
C441		Included with T405	
C442	17A-22376	Printed circuit	.75

Resistors

Ref. No.	Part No.	Description	Selling Price
R400	9B1-98	1 megohm, ½ watt, 10%	.25
R401	10B-17318	Sync Stabilizer control, 3 meg	.80
R402	9B1-92	330K ohm, ½ watt, 10%	.25
R403	9B1-82	47K ohm, ½ watt, 10%	.25
R404	9B1-100	1.5 megohm, ½ watt, 10%	.25
R405	9B1-82	47K ohm, ½ watt, 10%	.25
R406	9B1-76	15K ohm, ½ watt, 10%	.25
R407	9B4-82	47K ohm, 2 watt, 10%	.35
R408	9B1-77	18K ohm, ½ watt, 10%	.25
R409	10B-22311	Picture control, 2500 ohm	.80
R410	9B1-76	15K ohm, ½ watt, 10%	.25
R411	9B1-88	150K ohm, ½ watt, 10%	.25
R412-413	9B4-68	3300 ohm, 2 watt, 10%	.35
R414	9B1-70	4700 ohm, ½ watt, 10%	.25
R415	10B-21456	Brightness control, 500K ohm	.75
R416	9B1-90	220K ohm, ½ watt, 10%	.25
R417	9B1-62	1000 ohm, ½ watt, 10%	.25
R418	9B1-65	1800 ohm, ½ watt, 10%	.25
R419	9B1-68	3300 ohm, ½ watt, 10%	.25
R420	9B1-86	100 K ohm, ½ watt, 10%	.25
R421	9B1-51	120 ohm, ½ watt, 10%	.25
R422	9B4-73	8200 ohm, 2 watt, 10%	.35
R423	9B1-46	47 ohm, ½ watt, 10%	.25
R424	9B1-78	22K ohm, ½ watt, 10%	.25
R425	10A-22305	On-Off Volume control, 1 meg	1.05
R426	9B1-78	22K ohm, ½ watt, 10%	.25
R427	9B1-110	10 megohm, ½ watt, 10%	.25
R428	9B1-90	220K ohm, ½ watt, 10%	.25
R429	9B1-94	470K ohm, ½ watt, 10%	.25
R430	9B2-51	120 ohm, 1 watt, 10%	.35
R431	9C1-1070	3.9 ohm, ½ watt, 10%	.25
R432	9B1-102	2.2 megohm, ½ watt, 10%	.25
R433-434	9B1-82	47K ohm, ½ watt, 10%	.25
R435	9B1-86	100K ohm ½ watt, 10%	.25
R436	9B1-108	6.8 megohm, ½ watt, 10%	.25
R437	10B-17318	Vertical Hold control, 3 meg.	.80
R438	9B1-102	2.2 megohm, ½ watt, 10%	.25
R439	9B1-86	100K ohm, ½ watt, 10%	.25
R440	10B-22307	Vertical Size control, 750K ohm	.75
R441	9B1-102	2.2 megohm, ½ watt, 10%	.25
R442	10B-22304	Vertical Linearity control, 6000 ohm	.80
R443	9B2-89	180K ohm, 1 watt, 10%	.35
R444-445	9B1-62	1000 ohm, ½ watt, 10%	.25
R446	46M-22301	Resistor type fuse	.55
R447	9M-22837	150 ohm, 15 watt, 10%	.85
R448	9M-22275	2200 ohm, 10 watt, 10% 1500 ohm, 10 watt, 10%	1.10
R449	9B1-88	150K ohm, ½ watt, 10%	.25
R450-451	9B1-102	2.2 megohm, ½ watt, 10%	.25
R452	9B1-88	150K ohm, ½ watt, 10%	.25
R453	9B1-94	470K ohm, ½ watt, 10%	.25
R454	9B1-84	68K ohm, ½ watt, 10%	.25
R455	9B1-96	680K ohm, ½ watt, 10%	.25
R456	9B1-64	1500 ohm, ½ watt, 10%	.25
R457	10B-17275	Horizontal Hold control 100K ohm	.65
R458	9B1-96	680K ohm, ½ watt, 10%	.25
R459	9B2-74	10K ohm, 1 watt, 10%	.35
R460	9B1-90	220K ohm, ½ watt, 10%	.25

Chokes, Transformers, Coils

Ref. No.	Part No.	Description	Selling Price
T400	13M-22303	Ratio Detector transformer	2.20
T401	12C-22508	Audio Output transformer	1.95
T402	12M-18241	Vertical Oscillator transformer	1.75
T403	12C-20761-2	Vertical Output transformer	5.05
T404	12D-22586	Filament transformer	7.55
T405 (Incl. R444-445 & C441)	201-22697	Deflection yoke assembly	11.30
L400	16A-20021	Peaking coil (130UH)	.35
L401-402	16A-19486	Peaking coil (380UH)	.30
L403 (Incl. C406-407 & R420	201-22581	Video Trap Coil assm.	1.55
L404	16A-21214	Filter choke (2.6 H)	4.15
L405 (Incl. C440	201-22302	H. Hold coil assm.	1.75

Miscellaneous

Ref. No.	Part No.	Description	Selling Price
	14M-22510	Speaker cable (2131 only)	.45
	14M-22846	Speaker cable	.50
	18A-21216	5" PM speaker (2131) only	3.80
	18A-19927	8" PM speaker	6.85

21" H.V. SUPPLY

Capacitors

Ref. No.	Part No.	Description	Selling Price
C500	8G-19863	47 mmf, ceramic	.25
C501	8F3-121	470 mmf, 500 volt, mica	.25
C502	8J-20589	.0015 mfd, 400 volt, molded	.25
C503	8C-22544	50 mfd, 450 volt, lytic	2.20
C504	8J-16081	.047 mfd, 400 volt, molded	.30
C505	8J-21505	.47 mfd, 400 volt, molded	.95
C506	8G-21440	470 mmf, 1000 volt, ceramic	.30
C507	8J-16082	.22 mfd, 200 volt, molded	.45

Resiste rs

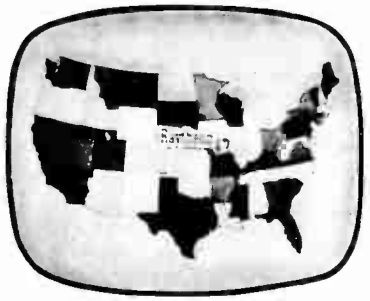
Ref. No.	Part No.	Description	Selling Price
R500	9B1-88	150K ohm, ½ watt, 10%	.25
R501	9B1-50	100 ohm, ½ watt, 10%	.25
R502	9B1-94	470K ohm, ½ watt, 10%	.25
R503	9B4-74	10K ohm, 2 watt, 10%	.35
R504	9B2-65	1800 ohm, 1 watt, 10%	.30
R505	9B4-70	4700 ohm, 2 watt, 10%	.35
R506	9C1-1070	3.9 ohm, ½ watt, 10%	.25

Chokes, Transformers, Coils

Ref. No.	Part No.	Description	Selling Price
T500	201-22396	H. V. Deflection transformer	11.25
	2D-22253	Chassis bolt bracket	.10

AVERAGE PICTURE

An average picture is portrayed as a guide or reference to enable a better analysis of the conditions when attempting to observe the various distortions and deviations.



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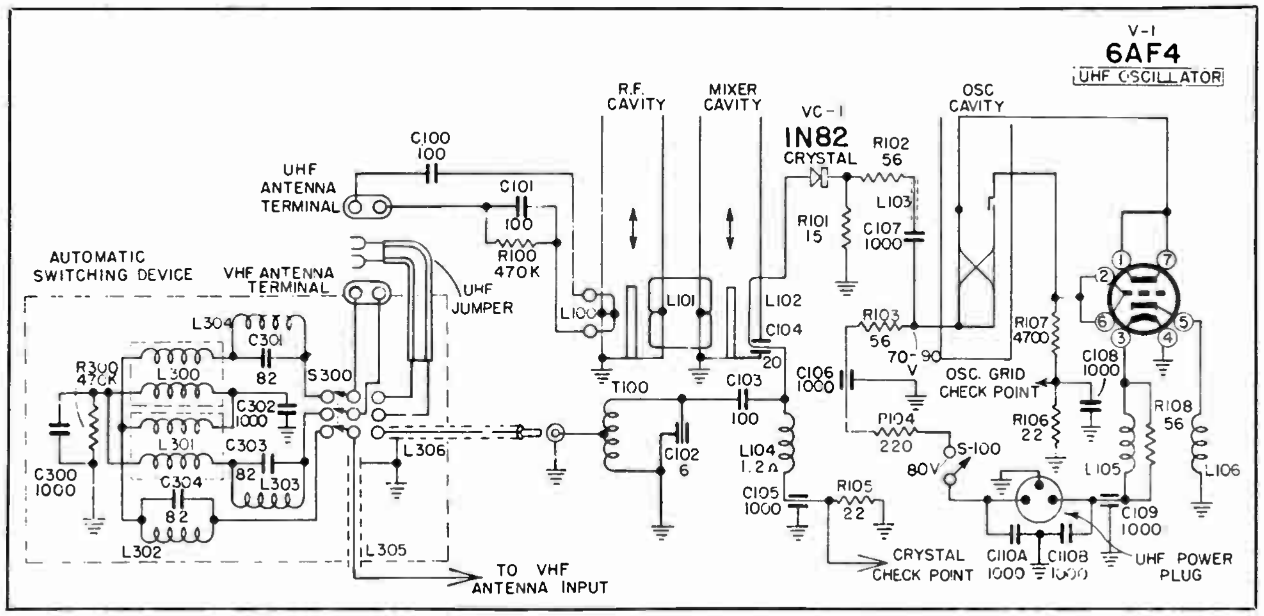
TUNER SERVICE HINTS

A convenient service check point is provided for measuring the UHF oscillator grid current to determine whether the oscillator is functioning. To measure this current place a multimeter on the 100 microamperes scale across resistor R106 (22 ohms). A reading of 10 to 30 microamperes should be obtained if the oscillator is functioning normally. Another check point has been provided for measuring the crystal current to check both the UHF crystal detector and oscillator. Place a multimeter on the 100 microamperes scale across resistor R105 (22 ohms) and a reading of 5 to 40 microamperes should be obtained if both the oscillator and crystal are functioning normally.

Before attempting service of the UHF tuner, it may prove helpful to check, if the same condition appears when tuned to a VHF station. If the condition appears on both UHF and VHF the cause of the trouble will generally be located in the I F amplifier or Video amplifier circuits. If, however, the condition appears only on UHF and a normal picture is observed on VHF, the UHF antenna installation should be checked for the possible source of trouble before suspecting the UHF tuner.

When attempting UHF servicing, it may prove helpful to bear in mind that when trouble occurs in the oscillator the picture will generally disappear and when there is a defect in the RF or mixer stage a decrease in signal will usually result.

If a condition arises where trouble occurs on either high or low VHF band only, then it can be assumed that the trouble is definitely in the VHF tuner or VHF antenna installation. One other possibility may be due to defective switch contacts. Defective switch contacts can easily be replaced by removing the two question mark shaped springs, lifting up the switch plate assembly and removing the black switch contact holder and replacing the switch contact.



UHF TUNER SCHEMATIC

1

MISTUNING:

Condition is generally caused by a lack of care when tuning in a station. A similar condition may be due to a faulty antenna installation or result from a defective oscillator or RF Amplifier tube.

CHECK:

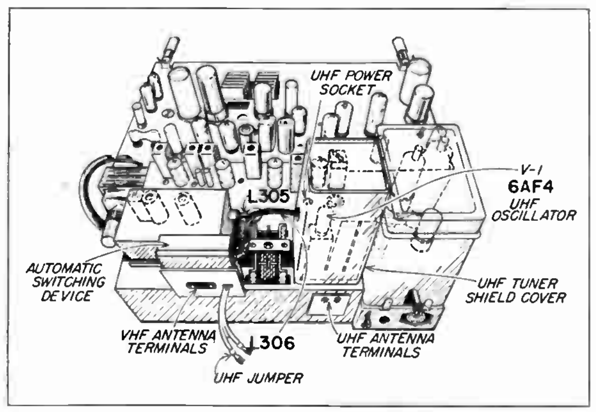
V-1	UHF Oscillator (6AF4)
V-2	VHF RF Amplifier (6BZ7)
V-3	VHF Oscillator—Converter (6U8)

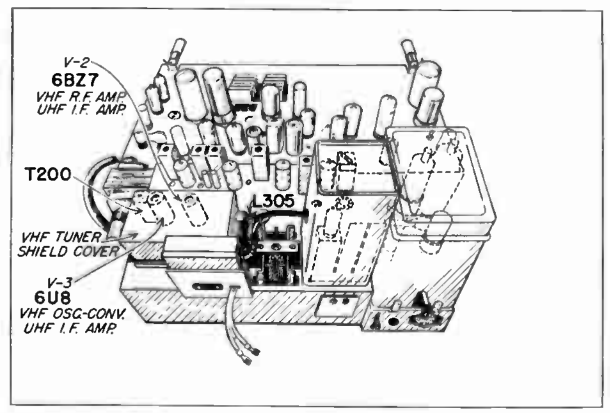
VHF TUNER REPLACEMENT PARTS

Ref. No.	Part No.	Description
C204-205-208-211-213-217-229-231	201-15142	Trimmer condenser
C216-218-224-232	8G-20878	1000 mmf, ceramic feed thru
C207-215-223	2C-22188	Capacitor plate assembly
T200	13B-22428	Converter transformer
L200	13M-22328	L. B. Antenna coil
L201	13E-17140	H. B. Antenna coil
L202	201-20405	Antenna shunt coil
L203	13M-22312	Cascode Coil
L204	16A-17128	RF Choke
L205	13E-17140	H. B. RF Primary Coil
L206	13M-22325	L. B. RF Primary Coil
L207	201-20405	Filament choke
L208	16A-20777	Filament choke
L209	13M-22327	L. B. RF Secondary Coil
L210	13E-17140	H. B. RF Secondary Coil
L211	13M-22738	Choke Coil
L212	201-15608	RF Choke Coil
L213	13M-22703	L. B. Oscillator Coil
L214	13E-17140	H. B. Oscillator Coil
S200-201 202-203	2J-16310	Sliding switch contacts
S204	201-22202	VHF Cathode switch
	5F-16311	Sliding switch contact holder
	5M-22380	Iron core plastic nut
	51A-22404	Iron core (for L214)
	51A-22409	Iron core (for L201-205-210)
	51A-22406	Iron core (for L213)
	51A-22407	Iron core (for L206)
	51A-22405	Iron core (for L209)
	51A-22408	Iron core (for L200)
	49A-18799	Link arm spring
	2M-19150-1	Switch lever springs

UHF TUNER REPLACEMENT PARTS

Ref. No.	Part No.	Description
C102	8G-20880	6 mmf, ceramic feed thru
C104	8G-21315	20 mmf, ceramic feed thru
C105-106	8G-20878	1000 mmf, ceramic feed thru
C109	8G-22120	1000 mmf, ceramic feed thru
C110A-B	8G-19506	1000 mmf, dual ceramic disk
T100	13B-22410	Output IF transformer
L104	16A-22362	RF Choke
L105-106	16A-22411	Choke coil
L300-301	12M-22482	Balun coil
L302	13M-22702	45MC trap coil
L303-304	13M-22425	43MC trap coil
VC-1	IN82	UHF crystal detector
S-100	20M-22462	UHF Oscillator switch
S-300	20B-22422	Antenna Switch
	2M-22209	Antenna switch lever
	49A-22527	Antenna switch lever spring
	6M-21936	Oscillator bar center support
	200-21331	Oscillator shorting bar assm.
	201-21328	6AF4 tube socket
	201-22368	Power cable assembly
	55A-20501	Nylon cord
	49A-21932	Cavity tension spring
	49A-22861	Oscillator tension spring
	2B-21801	6AF4 Tube shield
	49A-21511	Tube shield spring





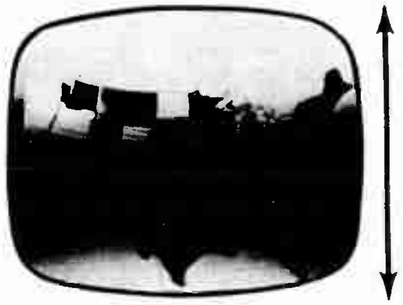
60 CYCLE HUM

Usually caused by a filament to cathode short or leakage in the RF, IF or video amplifier tube.

CHECK:

V-4-5-6-7	I F Amplifier (6CB6)
V-2	VHF RF Amplifier— UHF I F Amplifier (6BZ7)
V-9	Video Amplifier (6AH6V)

NOTE: A quick method other than substituting tubes, is to short each tube's cathode to ground while observing the picture. Shorting the cathode of the defective tube will produce a radical reduction of hum or a filament failure.



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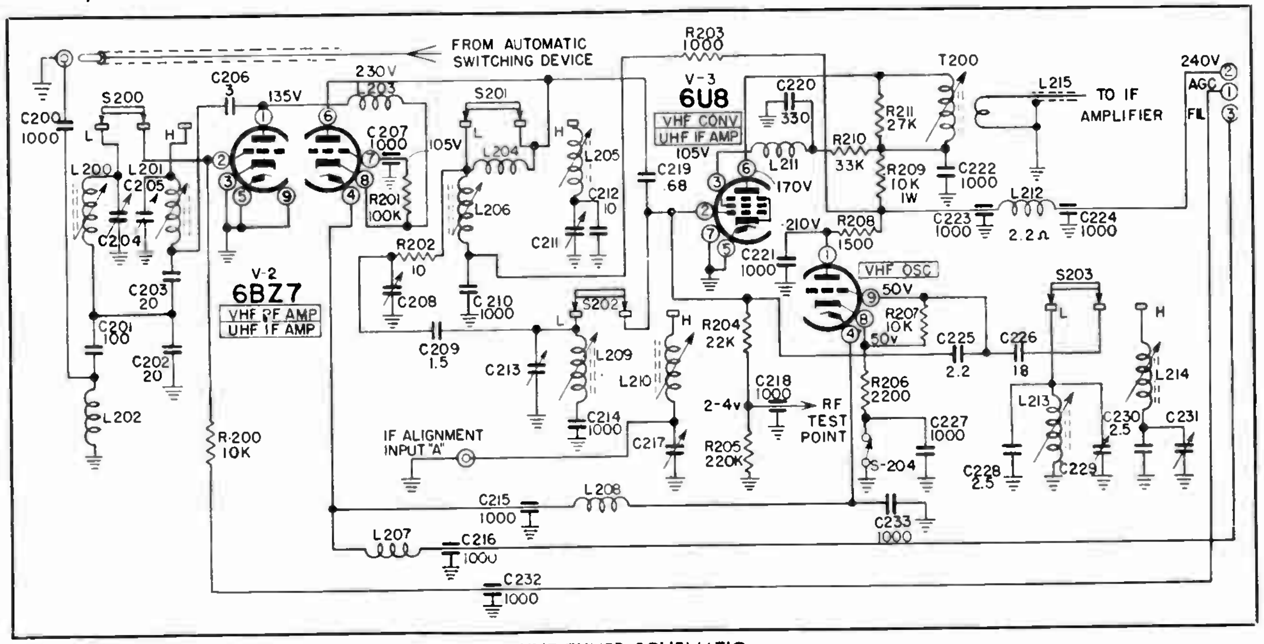


VHF TUNER SCHEMATIC

***WEAK PICTURE WITH SNOW**

***NO PICTURE WITH SNOW (Raster Visible)**

This condition is usually caused by a defective antenna installation or a defective tube or component in the tuner or possibly the first IF Amplifier.

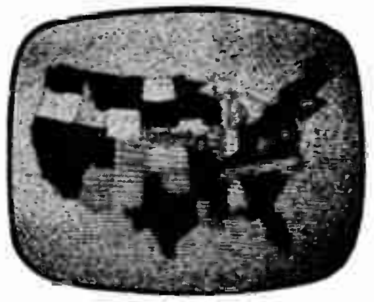
CHECK:

Antenna Installation and Connections

V-1	UHF Oscillator (6AF4)
V-2	VHF RF Amplifier— UHF IF Amplifier (6BZ7)
V-3	VHF Oscillator-Converter— UHF IF Amplifier (6U8)
V-4	IF Amplifier (6CB6)
VC-1	UHF Crystal (1N82)
R203	V-2 Decoupling Resistor
R209	V-3 Decoupling Resistor
R210	V-3 Screen Resistor
L212-307	B Supply Choke
C222	V-3 Plate Capacitor
C220	V-3 Screen Capacitor
C210-309-223-224	Decoupling Capacitor
T200	IF Transformer
S300	Antenna Switch & Associated Components
S204	VHF Oscillator Cathode Switch
S100	UHF Oscillator Switch

NOTE: Check antenna plugs to tuners and UHF power plug for proper seating.

*Based on the assumption that the receiver was once functioning normally.



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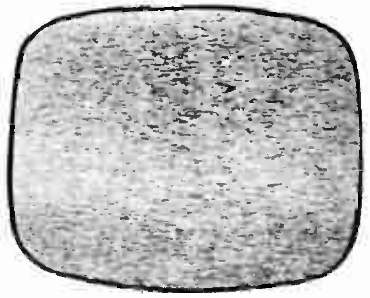

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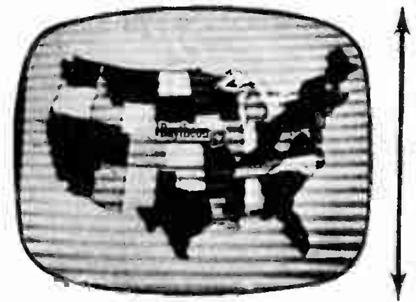
SOUND BARS:

The appearance of sound bars may possibly be due to mistuning of the receiver, microphonic station equipment or due to microphonic Vertical, RF, IF, or Video Amplifier tubes.

CHECK:

V-17	Vertical Blocking Oscillator (6BF6)
V-18	Vertical Output (6S4)
V-4-5-6-7	IF Amplifier (6CB6)
V-2	VHF RF Amplifier— VHF IF Amplifier (6BZ7)
V-3	VHF Converter—UHF IF Amplifier (6U8)
V-9	Video Amplifier (6AH6V)

NOTE: To determine possible cause of condition, properly tune in a station and then turn the volume control to its minimum volume setting. If the bars remain visible the trouble is usually due to the station or outside interference. If however, the bars disappear and by jarring the cabinet they reappear, the cause is most likely due to a microphonic tube. Gently tap each tube specified above while observing the picture.



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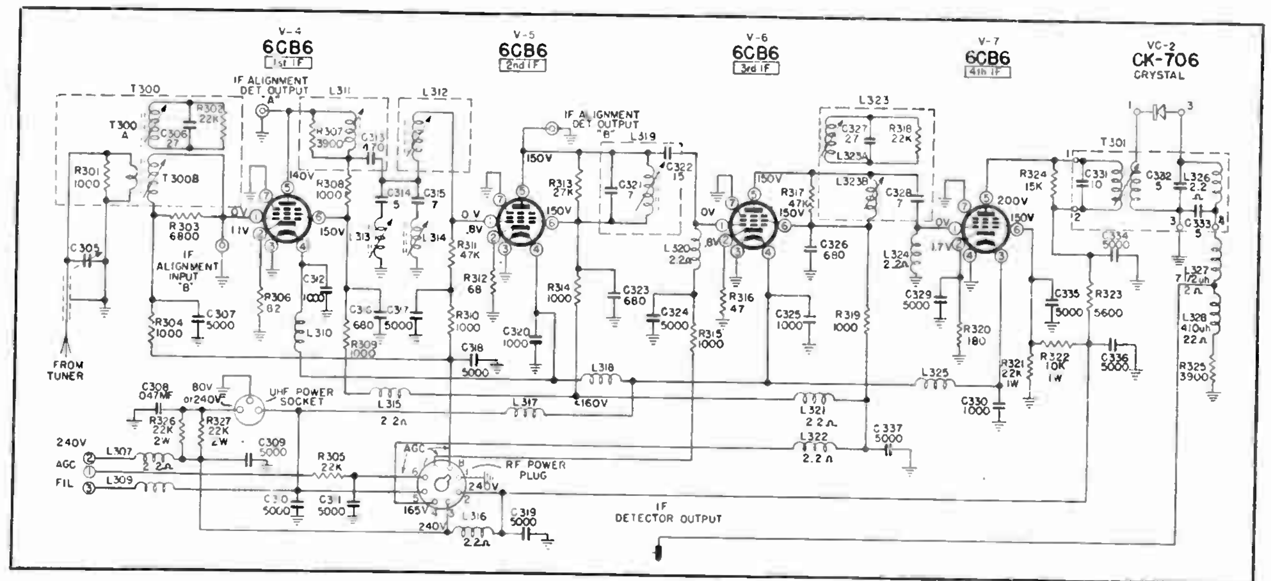
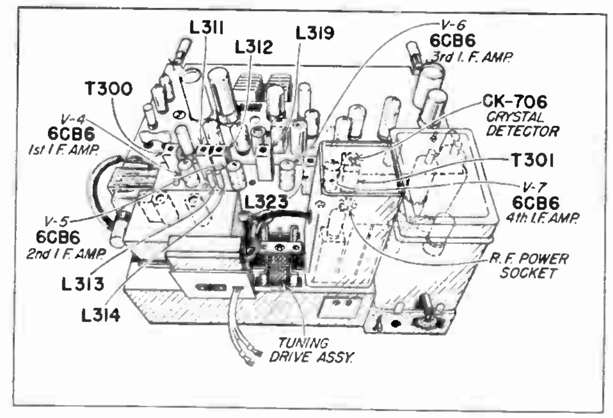


IF AMPLIFIER SCHEMATIC

REPLACEMENT PARTS

Ref. No.	Part No.	Description
C305	8E-22419	Trimmer condenser
T300	201-22456	Link Input transformer assm.
T301	13B-22430	Output transformer assm.
L307-315-316-320-321-324	201-15608	RF choke
L309-310-317-318-325	16A-17937	RF choke
L311	201-22562	Plate coil assembly
L312	201-22570	Grid coil assembly
L313	201-22585	Trap coil assembly
L314	201-22588	Trap coil assembly
L319	201-22426	Plate coil assembly
L323	201-22435	Plate coil assembly
L327	16A-22427	Peaking coil
L328	16A-19365	Peaking coil
	2H-17588	Tube shield
	200-22722	IF coil shield can
	2C-22167	Drive coupling bar
	49A-22223	Coupling bar spring
	53A-22815	Dial drive cord
	49A-22277	Cord tension spring



WEAK PICTURE
NO PICTURE (Raster Visible)

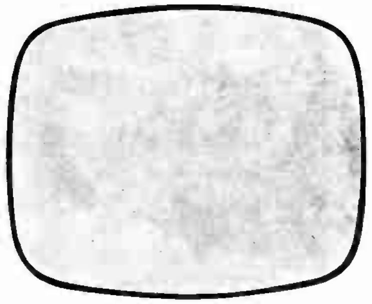
These conditions are generally caused by a defective tube or component in the IF or Video Amplifiers. Note the absence of snow.

CHECK:

V-5-6-7	IF Amplifier (6CB6)
V-9	Video Amplifier (6AH6V)
VC-2	Crystal Detector (CK-706)
R321-322	V-7 Screen Resistors
R314-319-323	Decoupling Resistors
T301-L319-323	IF Coils
L320-324	IF Grid Coils
L327-328	Detector Peaking Coil
L400-401-402-403	V-9 Peaking Coils
C403	V-9 Coupling Capacitor
R411	V-9 Plate Resistor
R407	Picture Control
R408	V-9 Screen Resistor
C401A-402	V-9 Screen Capacitor

NOTE: Check RF Power and detector output plugs for proper seating

As a fast method to help localize the defective stage causing the trouble, observe the face of the picture tube at both minimum and maximum picture control settings. If an increase in snow is NOT apparent at the maximum picture control setting the trouble is usually in the video amplifier, video detector or IF amplifier circuits. If an increase in snow is observed the trouble may be in the tuner or possibly the first IF amplifier stage.



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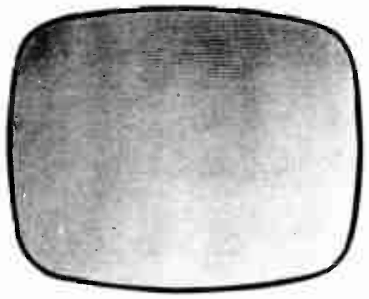

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OVERLOADING WASHOUT

A washout condition (or in severe cases overloading) is generally caused by a defect in the IF amplifiers, video amplifier or A.G.C. circuits.

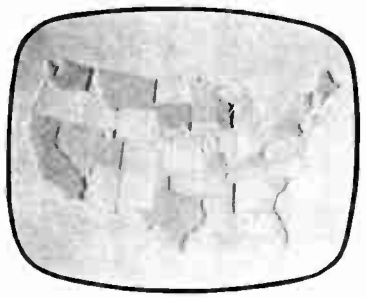
CHECK:

V-15	AGC Amplifier (6AU6)
V-4-5-6-7	IF amplifier (6CB6)
V-9	Video Amplifier (6AH6V)
VC-2	Video Detector (CK-706)
V-2	VHF RF Amplifier— UHF IF Amplifier (6BZ7)

NOTE: A defective picture tube may cause a similar condition. Check as a last resort.

C424-425-426-427	A.G.C. Capacitors
R434-435-436-437-443	A.G.C. Resistors
T500	H. V. Deflection Transformer
C307-311-317 318-324-232	AGC Decoupling Capacitors
C313-322-328	IF Grid Coupling Capacitors
R325	Detector Load Resistor
R407	Picture Control
R409-411	V-9 Plate Resistors

NOTE: Check RF Power plug for proper seating. For a rapid AGC check disconnect antenna lead-in wire from receiver and couple close to antenna terminals to reduce signal strength. If picture improves the AGC can be suspected. Compare AGC and detector output voltage. Under normal operating conditions these two negative voltages should be approximately equal. If the AGC voltage is low, the cause may be due to a gassy RF or IF tube, leaky IF grid coupling capacitor or a defective component in the AGC circuit.



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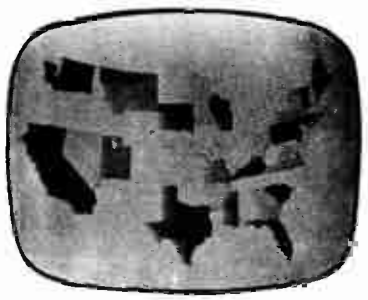

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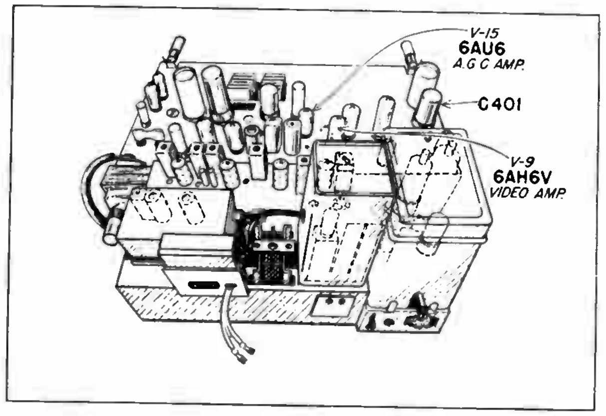
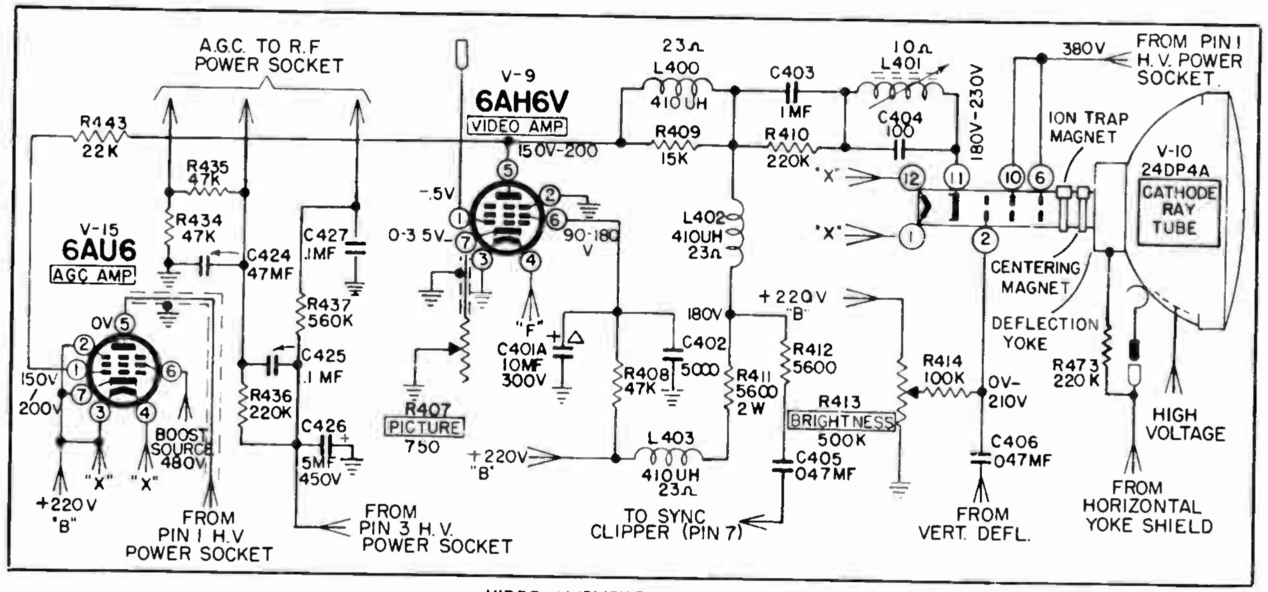


REPLACEMENT PARTS

Ref. No.	Part No.	Description
C401A	8C-22536	10 mfd, 300 volt—part of lytic
C426	8C-20557	5 mfd, 50 volt, lytic
R407	10B-22306	Contrast Control—750 ohm
R413	10B-21456	Brightness Control—500K ohm
L400	16A-19365	Peaking Coil—240 UH
L401	201-22571	Video Trap Coil Assembly
L-402-403	16A-19365	Peaking Coil—240 UH
T406	201-22857	Deflection Yoke Assembly
	15B-17278-10	C.R.T. Socket and Cable
	16M-22873	Anti-Pin Cushion Magnet
	16M-20697	Centering Magnet
	16M-19906	Ion Trap Magnet



VIDEO AMPLIFIER SCHEMATIC

SMEAR

This condition is generally due to a defective tube or component in the IF or Video Amplifier circuits.

CHECK:

V-9	Video Amplifier (6AH6V)
VC-2	Crystal detector (CK-706)
V-4-5-6-7	IF Amplifiers (6CB6)
R411	V-9 Plate Resistor
L327-328	Detector Peaking Coils
L400-401-402-403	V-9 Peaking Coils
C403	V-9 Coupling Capacitor
R325	Detector Load Resistor
R408	V-9 Screen Resistor
C-401A-402	V-9 Screen Capacitor
R407	Picture Control

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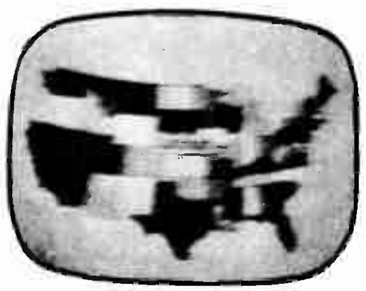

POOR VERTICAL LINEARITY

Condition is generally due to a misadjustment of the vertical size, linearity or centering controls.

CHECK:

R447	Vertical Size Control Adjustment
R450	Vertical Linearity Control Adjustment
	Centering Control Adjustment
V-17	Vertical Blocking Oscillator (6BF6)
V-18	Vertical Output (6S4)
T403	Vertical Output Transformer
R451	V-18 Plate resistor
C437	V-18 Plate capacitor
C435	Coupling capacitor
C401D	V-18 Cathode by-pass
R448	V-18 Grid resistor

NOTE: In the absence of a test pattern it is possible to adjust the receiver for a reasonable vertical distribution. Turn the V. Size and the V. Linearity controls to their minimum adjustment position and then with the centering control properly adjust the remaining picture to the vertical center of the tube. Adjust the V. Size and V. Linearity controls until the picture fills the mask, bearing in mind that the size control effects the bottom portion of the picture and the linearity control affects the upper portion of the picture. To check vertcial distribution, roll the picture slowly using the V. Hold Control and observe the blanking bar as it drifts. If the V. Size, V. Linearity and centering controls are properly adjusted the thickness of the bar will not change during its movement.

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EXCESSIVE VERTICAL SIZE

This condition is genreally due to misadjustment of the vertical size and linearity controls.

CHECK:

R447	Vertical Size Control Adjustment
R450	Vertical Linearity Control Adjustment

INSUFFICIENT VERTICAL SIZE

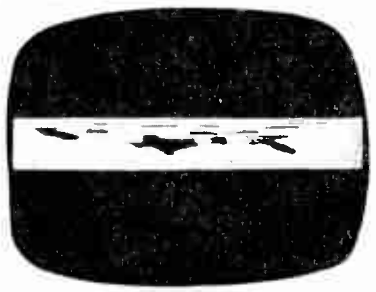
This condition is usually caused by misadjustment of the vertical size and linearity controls or due to a defective tube or component in the vertical deflection circuit.

CHECK:

R447	Vertical Size Control Adjustment
R450	Vertical Linearity Control Adjustment
V-17	Vertical Blocking Oscillator (6BF6)
V-18	Vertical Output (6S4)
T403	Vertical Output Transformer
T406	Deflection Yoke
R451	V-18 Plate Resistor
C437	V-18 Plate Capacitor
C401D	V-18 Cathode By-pass
C435	V-18 Coupling Capacitor

REPLACEMENT PARTS

Ref. No.	Part No.	Description
C401D	8C-22536	60 mfd, 50 volt,—part of lytic
C429	17A-22376	Printed Circuit
C436	8C-22550	20 mfd, 450 volt, lytic
R445	10B-17318	V. Hold Control—3M ohm
R447	10B-22307	V. Size Control—750K ohm
R450	10B-22687	V. Linearity Control—5000 ohm
T402	12M-18241	Vertical Oscillator Transformer
T403	12C-20761-2	Vertical Output Transformer



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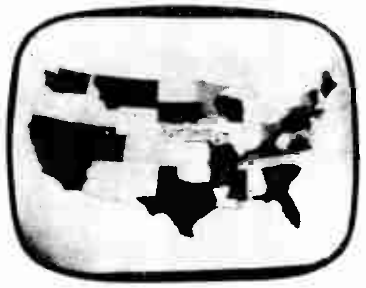

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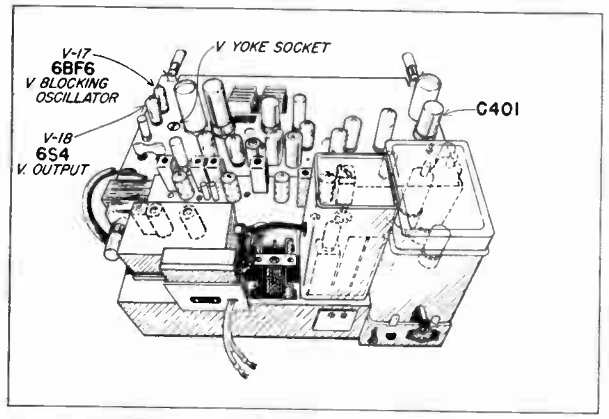
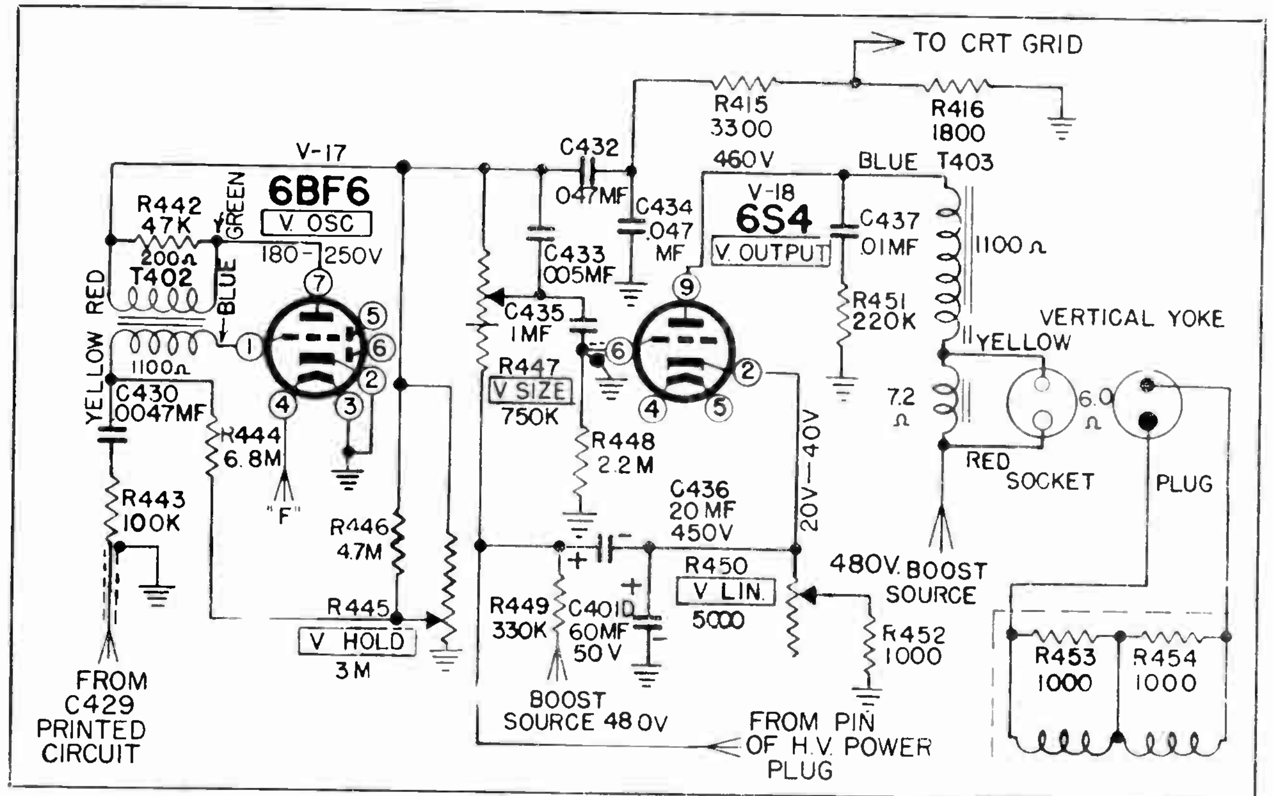


V. Hold:

The Vertical Hold control should be adjusted when the picture is rolling or flipping up or down. The proper setting of the vertical hold control is that point where the picture is moving slowly upward and just locks into place. At this control setting, noise will have the least tendency to interrupt vertical sync.

V. Size and V. Linearity:

The vertical size and linearity controls should be adjusted while a test pattern is being received. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necesary.



VERTICAL DEFLECTION SCHEMATIC

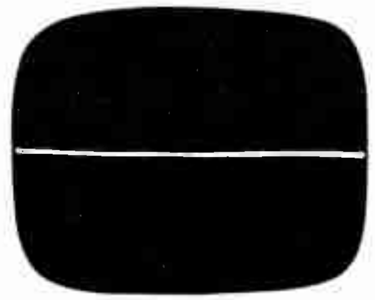
NO VERTICAL SWEEP

This condition is generally caused by a defective tube or component in the vertical deflection circuit.

CHECK:

V-17	Vertical Blocking Oscillator (6BF6)
V-18	Vertical Output (6S4)
T402	Vertical Blocking Oscillator Transformer
T403	Vertical Output Transformer
T406	Deflection Yoke
C430-432-435	Coupling Capacitor
R447	Vertical Size Control

NOTE: Check Vertical Yoke socket for proper seating. One method of isolating the defective stage is to apply a 60 cycle 6.3 filament voltage through a .5 MFD capacitor to various points in the vertical deflection circuit. If an increase of vertical deflection is not observed as the 60 cycle voltage is applied the defect is located between the point tested and the deflection yoke.



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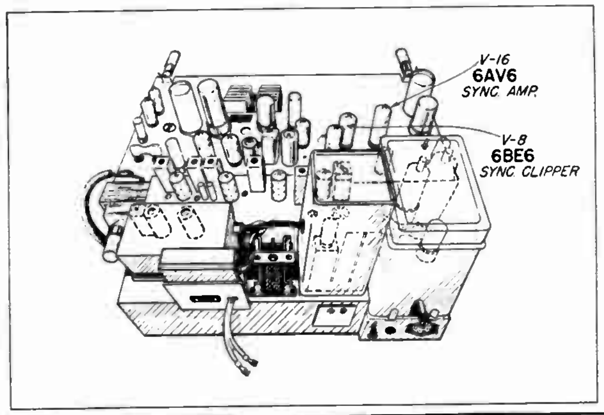
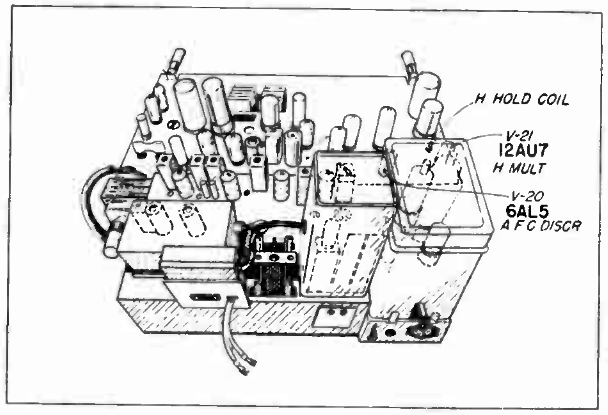


Service Hint

A poor vertical sync condition may possibly be due to a defect in the RF, IF or video amplifier stages. This may be quickly checked by observing the blanking bar as illustrated in condition 16. If the detail in the blanking bar is not blacker than the blackest portion of the picture an overloading condition exists. Refer to overloading, condition number 33.

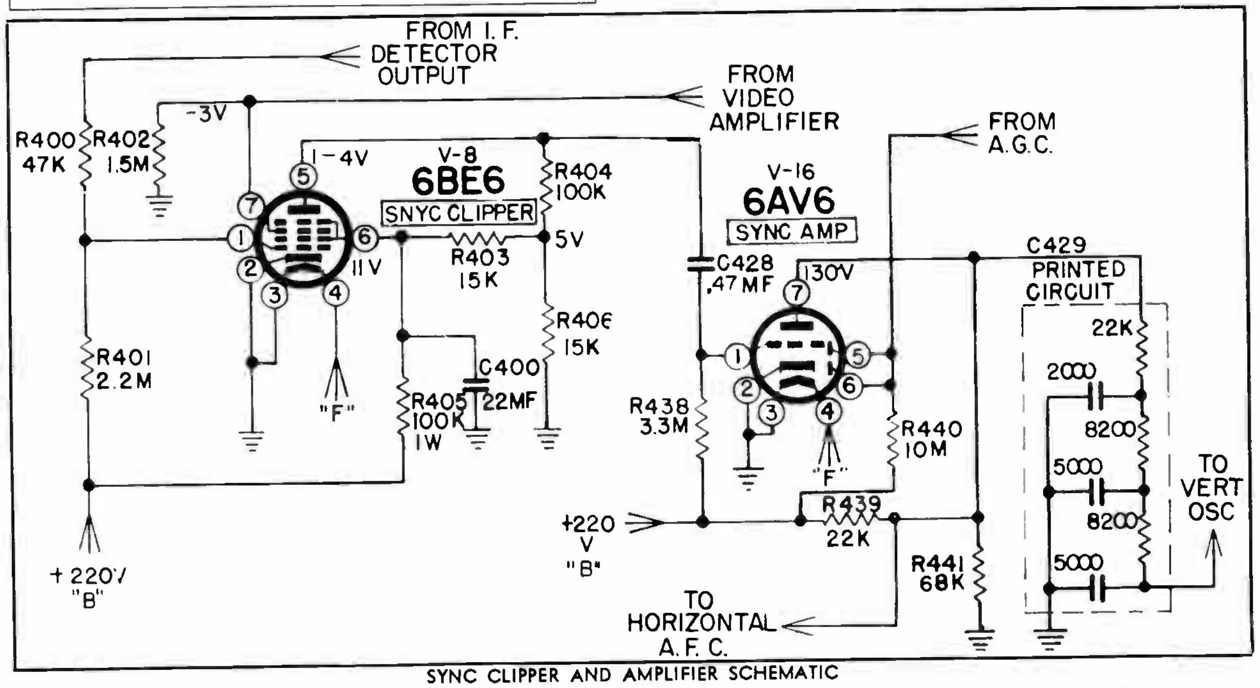


H. Hold:

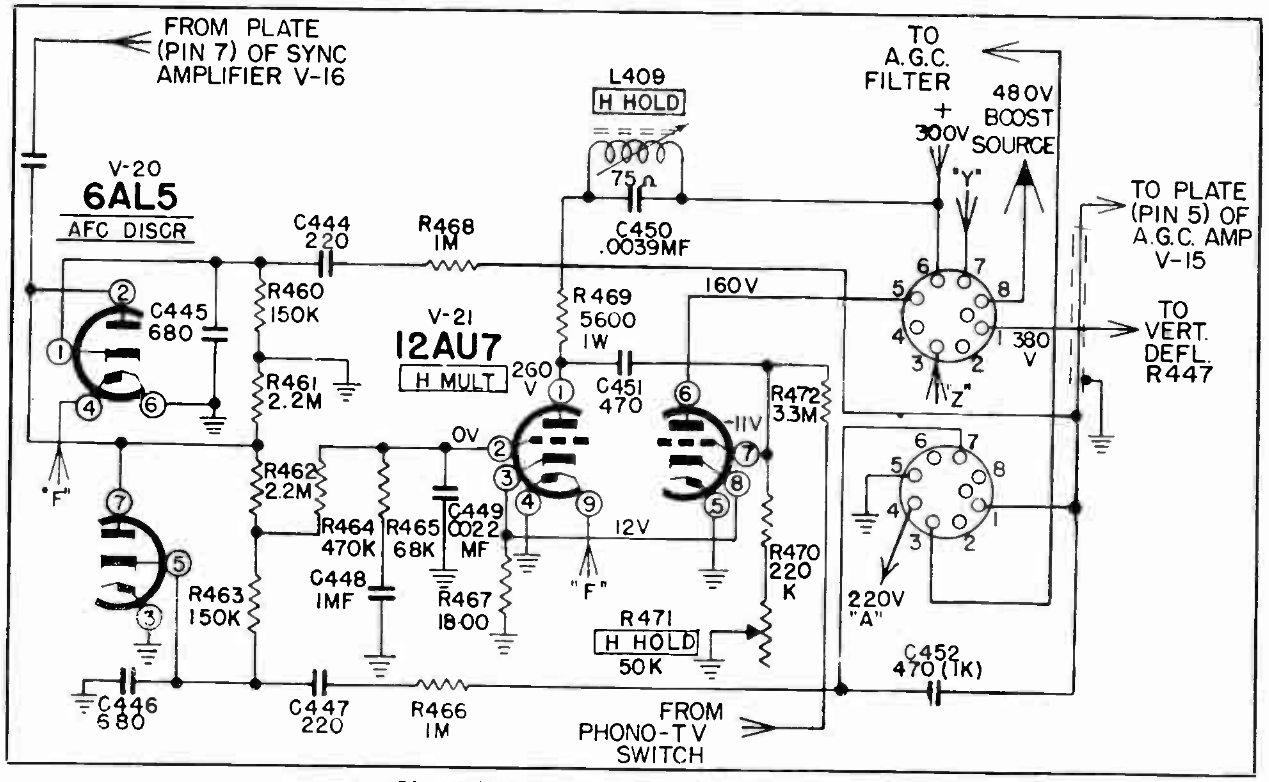
Set the H. Hold control on the front of the set to the center of its range. Adjust the H. Hold coil on top of the chassis until a steady picture is obtained. Set the H. Hold coil to the center of its range (center position before going out of sync in either direction). To check the adjustment, tune from one station to another. If the controls are properly adjusted the picture will remain in sync at all times.

REPLACEMENT PARTS

Ref. No.	Part No.	Description
C452	8G-21440	470 mmf, 1000 volt, ceramic
R471	10B-17764	H. Hold Control—50K ohm
L409	201-22949	H. Hold Coil
	51A-19322	Iron Core for L409



SYNC CLIPPER AND AMPLIFIER SCHEMATIC



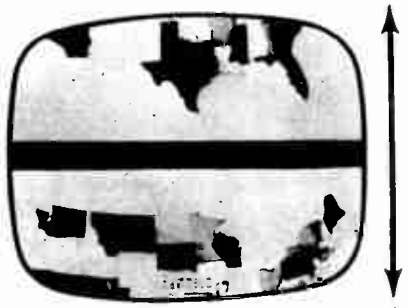
AFC AND HORIZONTAL MULTIVIBRATOR SCHEMATIC

POOR VERTICAL SYNC

Poor vertical sync is generally caused by improper adjustment of the vertical hold control or a defect in the oscillator, sync amplifier or sync clipper circuits.

CHECK:

R445	Vertical Hold Control Adjustment
V-16	Sync Amplifier (6AV6)
V-17	Vertical Blocking Oscillator (6BF6)
V-8	Sync Clipper (6BE6)
C429	Intergrating network
R443-444-445-446	Vertical Hold Control Resistors
C430	Coupling Capacitor
T402	Oscillator Transformer



16

17

SERVICE HINTS

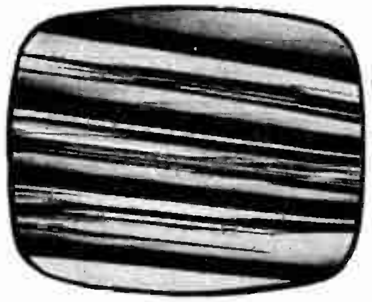
Whenever the sync, AFC, Horizontal Multivibrator or H. Pulse Amplifier stage is suspected as the cause of the trouble, it will prove helpful to short the input grid of the Horizontal Multivibrator (pin 2, V21) to ground, readjust the horizontal hold control and then observe the picture. If the condition disappears you can assume that the source of the trouble is before the input grid of the oscillator. If, however, the condition remains, the trouble is probably after the grid of the multivibrator.

POOR HORIZONTAL SYNC

Poor horizontal sync is usually caused by misadjustment of the horizontal hold control, hold coil or due to a defective tube or component in the horizontal multivibrator, AFC, sync amplifier or sync clipper circuits.

CHECK:

R471-L409	Horizontal Hold Control Adjustment
V-21	Horizontal Multivibrator (12AU7)
V-20	Horizontal AFC Discriminator (6AL5)
V-16	Sync Amplifier (6AV6)
V-8	Sync Clipper (6BE6)
L409	Horizontal Hold Coil
C450	Horizontal Hold Coil Capacitor
C-448-449	V-21 Grid Capacitors
C443-451	V-21 Coupling Capacitors
R466-468	V-20 Feedback Resistors
C444-447	V-20 Feedback Capacitors
R467-469-470-501	V-21 Plate and Grid Resistors
R439-441	V-16 Voltage Divider Resistors



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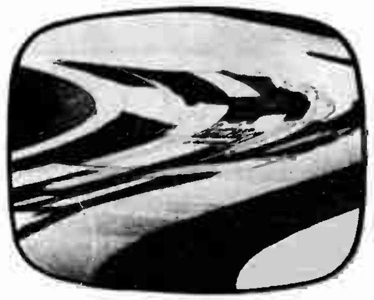
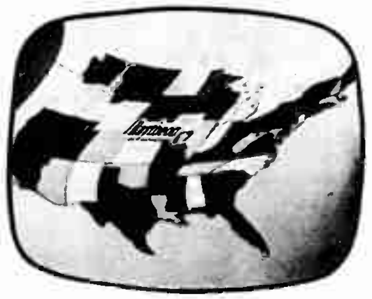


20

HORIZONTAL DISPLACEMENT

Condition can be caused by improper adjustment of the Horizontal Hold control or a defective tube or component in the sync clipper or amplifier, AFC, horizontal multivibrator or pulse amplifier circuits.



22

CHECK:

R471-L409	Horizontal Hold Control Adjustment
V-20	AFC Discriminator (6AL5)
V-21	Horizontal Multivibrator (12AU7)
V-22	Horizontal Pulse Amplifier (25CD6)
V-16	Sync Amplifier (6AV6)
V-8	Sync Clipper (6BE6)
C502-R502	Boost Voltage Filter
R501	V-21 Plate Resistor
C448-449	V-21 Grid Capacitor
R466-468	AFC Feedback Resistor
C444-447	AFC Feedback Capacitor

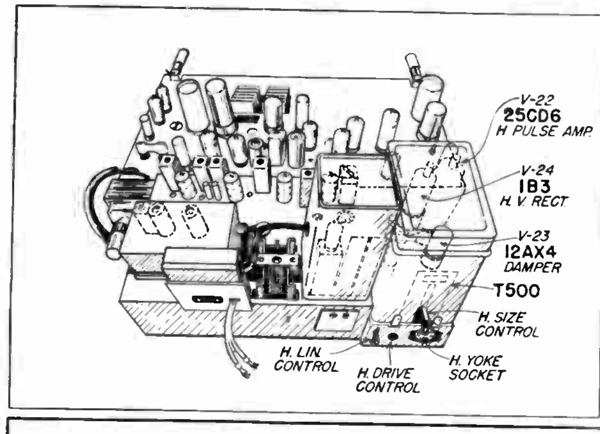
NOTE: Check H. V. Power and Yoke plug.

H. Drive

The H. Drive control should be adjusted only after a station is properly tuned in and the H. Size and H. Linearity controls are adjusted for correct size and good linearity. The Drive control should be turned clockwise until a fold-over (sectional scan slow down evidenced by a white vertical line) appears in the center portion of the picture. Turn the Drive control counter-clockwise until all traces of fold over disappear and then give an additional one-eighth turn counter-clockwise. As a check turn the brightness control to maximum and minimum brilliance and observe the face of the picture tube. If the Drive control is adjusted properly a fold over will not appear as the brightness control is varied.

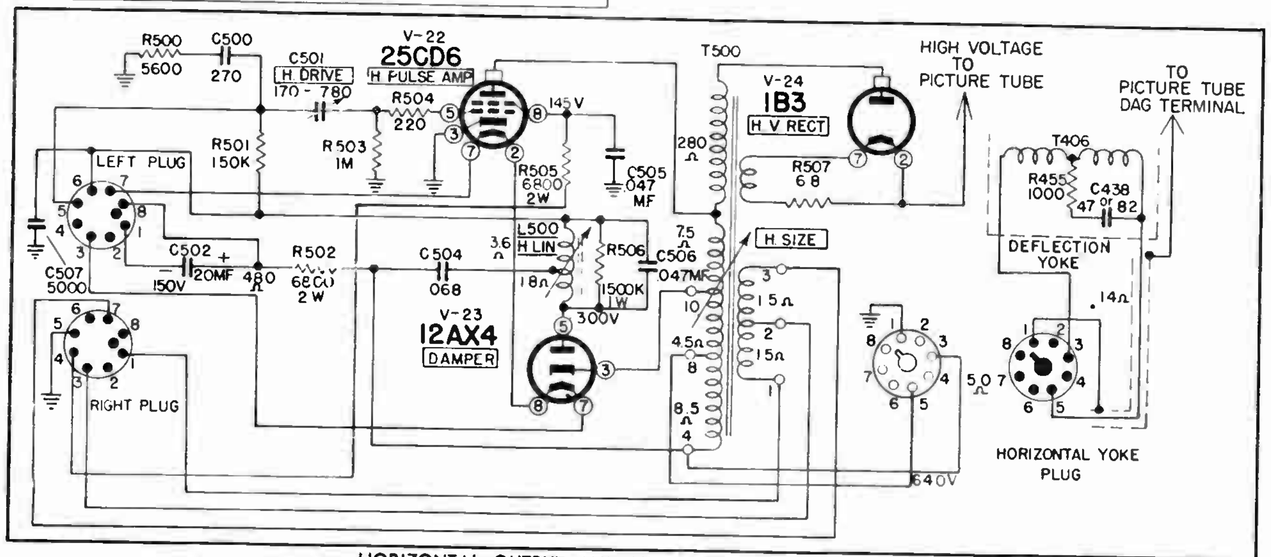
H. Size and H. Linearity

The H. Size and H. Linearity controls should be adjusted while a test pattern is being received. The Size control should be adjusted until the raster fills the entire screen horizontally and the Linearity control should be adjusted for a horizontal symmetrical test pattern. The H. Size and Centering controls may require readjustment. Each time a major adjustment of either the H. Size or Linearity controls are made the H. Drive control should be re-adjusted.



REPLACEMENT PARTS

Ref. No.	Part No.	Description
C501	8E-22538	170-780 mmf, H. Drive Trimmer
C502	8C-19546	20 mfd, 150 volt, lytic
T500	201-22382	H. V. Deflection Transformer
T406	201-22857	Deflection Yoke Assembly
L500	201-20186-1	H. Linearity Coil
	51A-19322	Iron Core for L500



HORIZONTAL OUTPUT AND HIGH VOLTAGE SCHEMATIC

DRIVE BAR

This condition is generally caused by misadjustment of the H. Drive control or due to a defective tube of component in the horizontal output section.

21

CHECK:

C501	H. Drive Control Adjustment
L500	H. Linearity Control Adjustment
	Horizontal Size Control Adjustment
V-22	Horizontal Pulse Amplifier (25CD6)
V-23	Horizontal Damper (12AX4)
V-21	Horizontal Multivibrator (12AU7)
R505	V-22 Screen Resistor
R503	V-22 Grid Resistor
C505	V-22 Screen Capacitor
C501-502	V-22 Grid Capacitor
R500-501	V-21 Plate Resistor
C500	V-21 Plate Capacitor

NOTE: Check H.V. Power plug for proper seating.

INSUFFICIENT HORIZONTAL SIZE

This condition is usually caused by misadjustment of the horizontal size control or a defective tube or component in the high voltage circuit.

23

CHECK:

	Horizontal Size Control Adjustment
V-22	Horizontl Pulse Amplifier (25CD6)
V-23	Horizontal Damper (12AX4)
R-505	V-22 Screen Resistor
R500-501	V-21 Plate Resistor
R503	V-22 Grid Resistor
C500	V-21 Plate Capacitor

NO RASTER WITH NORMAL SOUND

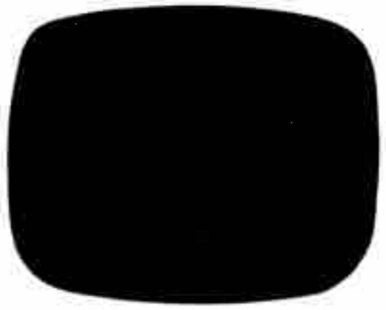
No Raster (no brightness on face of picture tube) with normal sound is usually caused by a defect in the high voltage supply or the components associated with the picture tube.

CHECK:

R413	Brightness Control Adjustment
	Ion Trap Magnet Adjustment
V-24	High Voltage Rectifier (1B3)
V-22	Horizontal Pulse Amplifier (25CD6)
V-21	Horizontal Multivibrator (12AU7)
V-23	Horizontal Damper (12AX4)
V-10	Picture Tube (24DP4)
R505	V-22 Screen Resistor
C505	V-22 Screen Capacitor
R501	V-21 Plate Resistor
T500	H.V. Deflection Transformer
T406	Deflection Yoke

NOTE: Check H.V. Power and H. Yoke plugs for proper seating, CRT sockets and high voltage anode lead for proper connections.

31A



31

NO RASTER NO SOUND

A condition of No Raster with No Sound is generally caused by a filament failure in the series filament string or a defect in the B supply voltage source.

CHECK:

S-300	Phono-TV Switch Position
V-18	Vertical Output (6S4)
V-23	Horizontal Damper (12AX4)
V-14	Audio Output (50C5)
V-19	Horizontal Pulse Amplifier (25CD6)
R456	Resistor Type Fuse
R457-458	Series Filament Resistor
C401-439-440-441	B Supply Filter Lytics
R459	Voltage Divider Resistor
L406-407-408	B Supply Filter Choke
T405	Power Transformer
	Selenium Rectifiers

NOTE: Check AC line cord, safety interlock and on-off switch.

31B

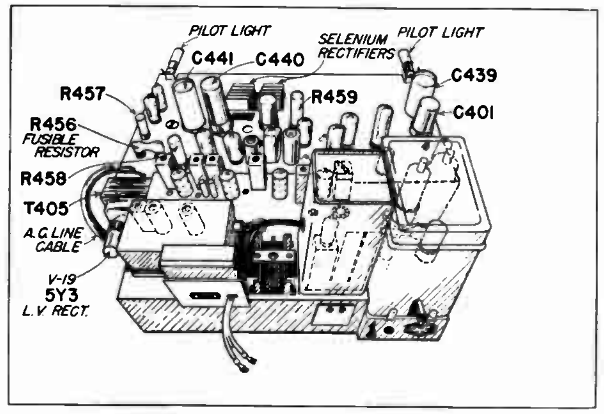
EXCESSIVE HORIZONTAL WIDTH

Condition is generally due to improper adjustment of the H. Size control, insufficient high voltage or possibly caused by high AC line voltage.

CHECK:

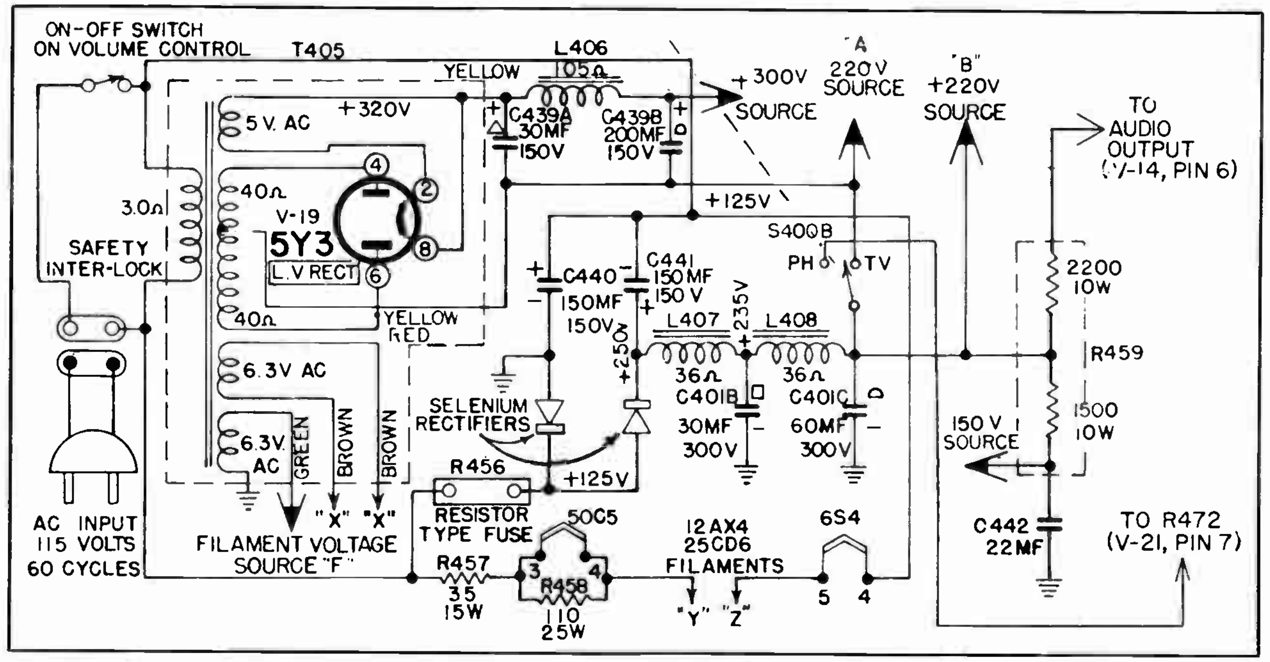
	Horizontal Size Control Adjustment
V-24	High Voltage Rectifier (1B3)
V-22	Horizontal Pulse Amplifier (25CD6)
V-23	Horizontal Damper (12AX4)
V-21	Horizontal Multivibrator (12AU7)
R505	V-22 Screen Resistor
C505	V-22 Screen Capacitor
R503	V-22 Grid Resistor
C501-C502	V-22 Grid Capacitor
R500-501	V-21 Plate Resistor
T500	H.V. Deflection Transformer
R507	V-24 Filament Resistor
C500	V-21 Plate Capacitor

9



REPLACEMENT PARTS

Ref. No.	Part No.	Description
C401B-C	8C-22536	30 mfd, 300 volt—60 mfd, 300 volt—part of lytic
C439A-B	8C-22730	30 mfd, 150 volt—200 mfd, 150 volt, lytic
C440	8C-22463	150 mfd, 150 volt, lytic
C441	8C-22464	150 mfd, 150 volt, lytic
R432	9C1-1072	5.6 ohm, 1/2 watt, 10%
R456	46M-23018	Resistor Type Fuse
R457	9M-22542	35 ohm, 15 watt
R458	9M-22583	110 ohm, 25 watt
R459	9M-22275	2200 ohm, 10 watt 1500 ohm, 10 watt,
T405	12A-22509	Power Transformer
L406	16A-22584	Filter Choke
L407-408	16A-22584	Filter Choke
S300	20A-22479	Phono-TV Switch
	21J-22274	Selenium Rectifier
	15B-21186	Mounting Plate for C441
	15B-22731	Mounting Plate for C439
	201-22551	AC Line Cable Assm.



LOW VOLTAGE SCHEMATIC

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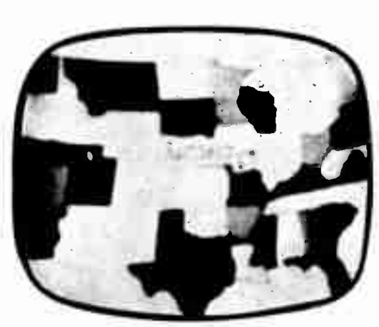


BLOOMING

The blooming effect will vary with adjustment of the picture and brightness controls and is usually caused by a defective tube or component in the high voltage or B supply voltage circuits.

CHECK:

V-24	High Voltage Rectifier (1B3)
V-22	Horizontal Pulse Amplifier 25CD6)
V-23	Horizontal Damper (12AX4)
V-19	Low Voltage Rectifier (5Y3)
V-10	Picture Tube (24DP4)
R507	V-24 Filament Resistor
R502-C502	Boost Voltage Filter
T500	H. V. Deflection Transformer
C401-439-440-441	B Supply Filter Lytics
L406-407-408	Filter Choke
	Selenium Rectifiers

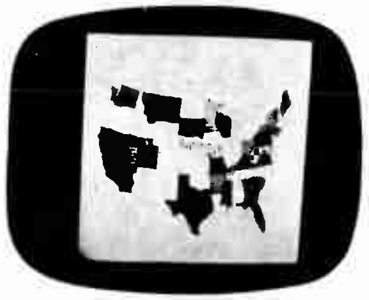
INSUFFICIENT HORIZONTAL AND VERTICAL SIZE

This condition can possibly be caused by incorrect horizontal size, vertical size and linearity control adjustments, low B supply voltage or possibly due to low AC line voltage.

CHECK:

V-19	Low Voltage Rectifier (5Y3)
V-22	Horizontal Pulse Amplifier (25CD6)
V-23	Horizontal Damper (12AX4)
C502-R502	Boost Voltage Filter
C401-439-440-441	B Supply Filter Capacitors
	Selenium Rectifiers

NOTE: Check H.V. power plug for proper seating and AC line voltage.



24

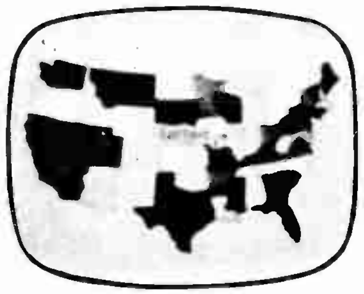
POOR FOCUS

This condition is generally caused by an incorrect adjustment of the ion trap magnet, insufficient high voltage or a defect in the B supply voltage source.

CHECK:

	Ion Trap Magnet Adjustment
V-21	Low Voltage Rectifier (5Y3)
V-24	High Voltage Rectifier (1B3)
V-22	Horizontal Pulse Amplifier (25CD6)
V-23	Horizontal Damper (12AX4)
V-21	Horizontal Multivibrator (12AU7)
V-10	Picture Tube (24DP4)
C401-439-440-441	B Supply Filter Lytics
T406	Deflection Yoke
	Selenium Rectifiers

NOTE: Since the centering control will be effective in either of two positions, the preferred position is approximately 180 degrees away from the magnet of the ion trap to minimize interaction.



35

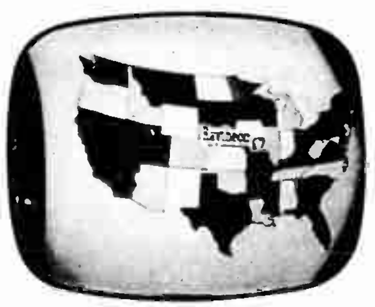
INCORRECT CENTERING

Condition is due to incorrect adjustment of the centering control.

CHECK:

Centering Control Adjustment (Refer to page 20)

NOTE: Do not attempt to correct for vertical centering with either the vertical size or linearity controls and do not use the horizontal hold control to affect horizontal centering.



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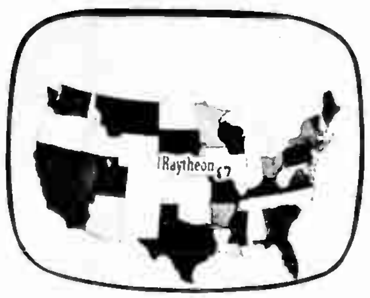


25

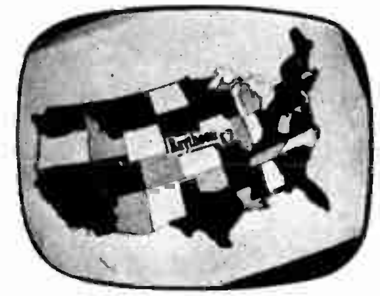
TILTED PICTURE

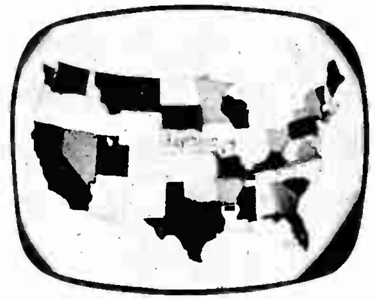
18

This condition is caused by an incorrectly positioned deflection yoke.

CHECK:

Deflection Yoke Positioning Adjustment





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TUBE SHADOW

This condition is usually caused by an incorrectly positioned deflection yoke or a misadjusted centering control or ion trap magnet.

CHECK:

Deflection Yoke Positioning Adjustment
Centering Magnet Adjustment
Ion Trap Magnet Adjustment

REPLACEMENT PARTS

Ref. No.	Part No.	Description
	201-22857	Deflection Yoke Assembly
	15B-17278-10	CRT Socket and Cable
	16M-19906	Ion Trap Magnet
	16M-20697	Centering Magnet
	16M-22873	Anti-Pin Cushion Magnet

Ion Trap Magnet:

If adjustment is determined necessary, loosen the wing nut, rotate and slide the magnet until the position which gives maximum illumination is found. Adjust the screw for maximum illumination. Repeat the above two steps. Rotate and slide the magnet until the best focus position is found without sacrificing brilliance. Tighten wing nut. Adjustment should be made with brightness and picture controls set for normal viewing. The position of the ion trap magnet MUST be over the grid of the picture tube (second cylinder from the base identified by a flared forward lip) after the adjustment is complete.

Centering Magnet:

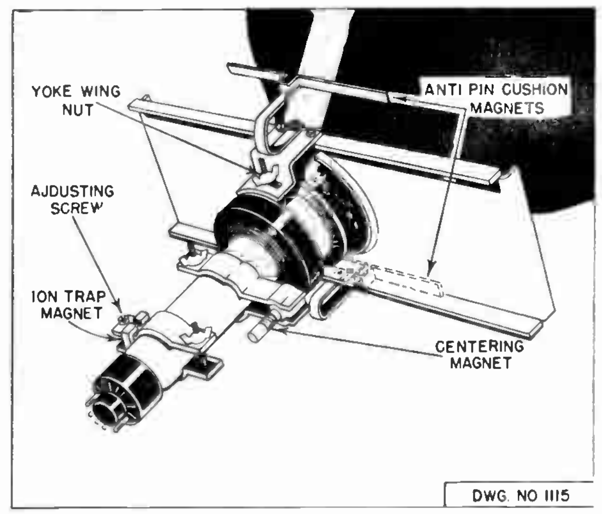
The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture can be moved up or down. To the left or right of the neck of the picture tube, the picture can be moved either to the left or right. The position of the centering magnet should be $\frac{1}{4}$ to $\frac{1}{2}$ inch behind the deflection yoke.

Anti-Pin Cushion Magnet:

Adjust centering until edge of the raster is visible. Loosen the positioning screw and slide the magnet until the edge of the raster is vertically straight. If keystoning is noticed adjust magnet in vertical plane.

Deflection Yoke:

The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow. Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a position adjustment is necessary, loosen the yoke wing nut located at the top of the picture tube assembly.

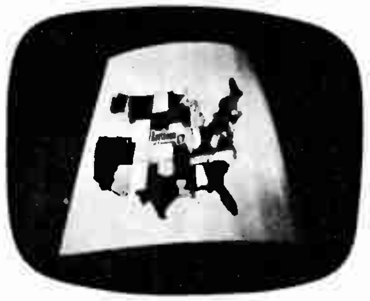


TRAPEZOIDAL RASTER

A trapezoidal raster is generally caused by a defective deflection yoke or associated components.

CHECK:

T406	Deflection Yoke
R453-454-455	Yoke Loading Resistors
C438	Yoke Equalizing Capacitors



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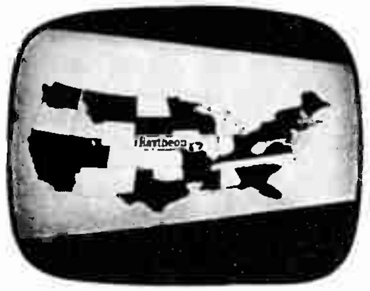

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SOUND CONDITIONS

It will always prove helpful when analysing a service condition to first determine if the sound section is functioning normally. Since the receiver is of the intercarrier type, both the sound and picture information are amplified simultaneously by the tuner and IF amplifiers. By analysing the above, it can be assumed that if the picture appears to be normal and the sound is not functioning properly the defect is located between the sound take off point (IF Detector Output) and speaker.

B - NO SOUND

A no sound condition with a normal picture is generally caused by a defective tube or component between the IF Detector Output and speaker.

CHECK:

S400	Phono-TV Switch Position
V-11	Audio I F Amplifier (6AU6)
V-12	Audio Detector (6AL5)
V-13	Audio Amplifier (6AV6)
V-14	Audio Output (50C5)
R419	V-11 Screen Resistor
C415	V-11 Screen Capacitor
R427	V-13 Plate Resistor
R422	Volume Control
C422	Coupling Capacitor
R459	Voltage Divider Resistor
R430	V-14 Cathode Resistor
T401	Output Transformer
T400	Ratio Detector Transformer
	Speaker

NOTE: Check Speaker cable connections.

C - WEAK SOUND

A weak sound condition is generally caused by a weak tube or misalignment of the sound section.

CHECK:

V-11	Audio I F. Amplifier (6AU6)
V-13	Audio Amplifier (6AV6)
V-14	Audio Output (50C5)
T400	Ratio Detector Transformer Adjustment (Primary-Bottom Slug)
L404	Audio Pick-Off Coil Adjustment

SOUND CONDITIONS

D - DISTORTED SOUND

This condition is usually caused by a defective tube or component in the sound section.

CHECK:

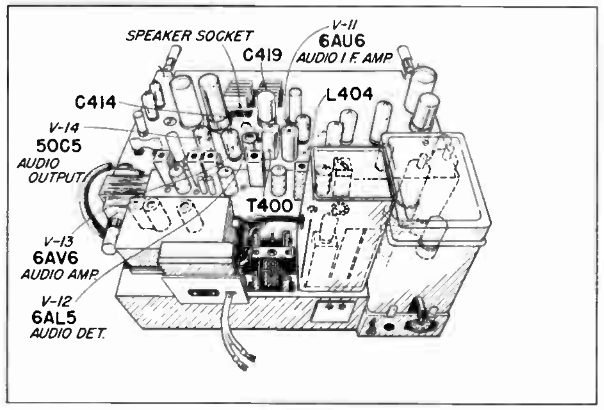
V-14	Audio Output (50C5)
V-12	Audio Detector (6AL5)
V-13	Audio Amplifier (6AV6)
C-419A-B-C	Filter Lytic
C422	Coupling Capacitor
R427	V-13 Plate Resistor
R430	V-14 Cathode Resistor
T400	Ratio Detector Transformer
	Speaker
T400	Ratio Detector Transformer Adjustment (Secondary-Top Slug)

E - HUM OR BUZZ IN SOUND

This condition is generally due to a defective tube or component in the sound section or due to a misalignment of the sound coils.

CHECK:

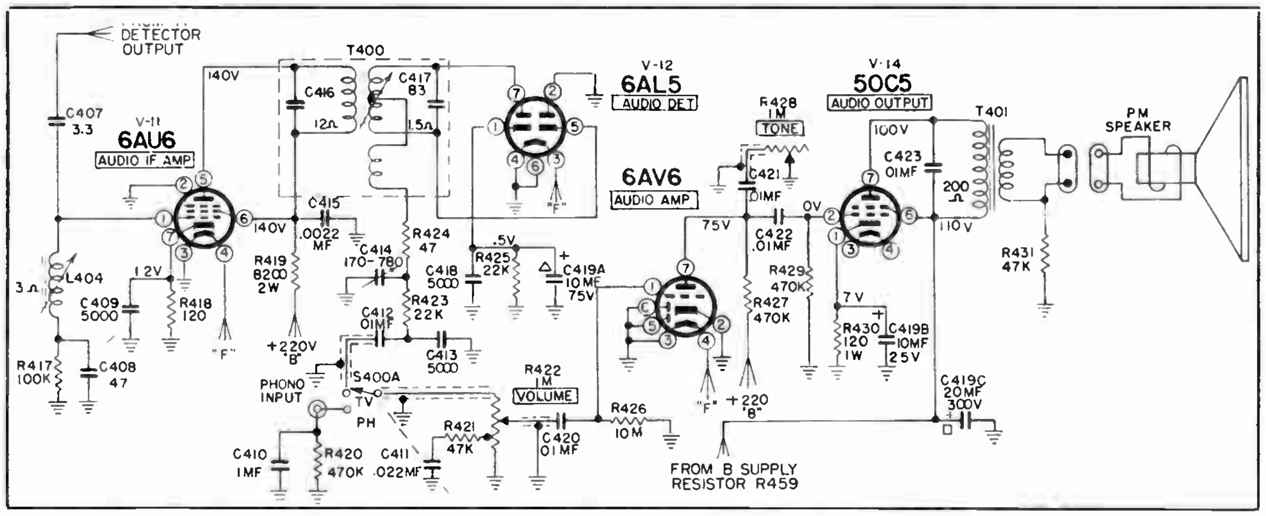
V-12	Audio Detector (6AL5)
V-14	Audio Output (50C5)
V-13	Audio Amplifier (6AV6)
V-11	Audio IF Amplifier (6AU6)
C419A-B-C	Filter Lytic
T400	Ratio Detector Transformer Adjustment (Secondary -TopSlug)
L404	Audio Pick-Off Coil Adjustment
C414	Buzz Control Adjustment



NOTE: A fast method of isolating the defective stage when a troublesome sound condition occurs is to apply a 60 cycle 6.3 filament voltage through a .5 mfd capacitor to various points in the sound section. If an increase of volume is not observed as the 60 cycle is applied, the defect is located between the point tested and the speaker.

REPLACEMENT PARTS

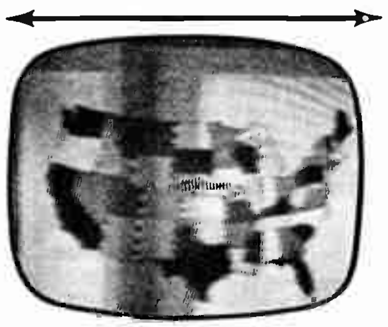
Ref. No.	Part No.	Description
C414	8E-22538	170-780 mmf, Trimmer
C419A-B-C	8C-22524	10 mfd, 75 volt—10 mfd, 25 volt—20 mfd, 300 volt, lytic
R422	10A-22308	Volume Control & Switch—1M ohm
R428	10B-19542	Tone Control—1M ohm
T400	13M-22303	Ratio Detector Transformer
T401	12C-22508	Audio Output Transformer
L404	201-22582	Sound Pick-Off Coil
S400	20A-22479	Phono-TV Switch



SOUND SECTION SCHEMATIC

EXTERNAL INTERFERENCE

The five service conditions below which are usually caused by external interference have been included in the "Service Saver" as they are common service complaints. These conditions are presented so that they can easily be identified and usually the effects in the picture are little affected by a control adjustment, tube or component substitution or circuit modification. These conditions result from an interfering external signal and are seldom caused or due to a defect in the receiver.



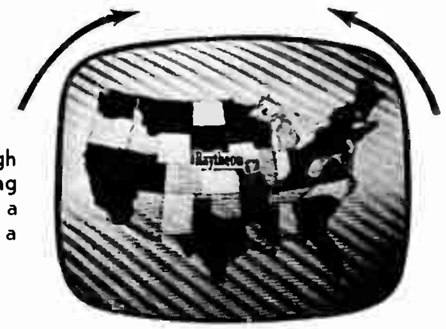
CHANNEL CROSS TALK

Due to interference from a nearby station on same channel or due to adjacent channel interference—Orientation, relocation or an antenna with sharper directivity characteristics and the use of traps are suggested to reduce or eliminate channel cross talk.

2

RF INTERFERENCE

Due to a beat frequency between the incoming signal and high powered radio equipment or a local oscillator in a receiver being operated in the vicinity—Orientation, relocation or installing a higher gain and more directional type antenna or the use of a booster may be effective in eliminating this interference.



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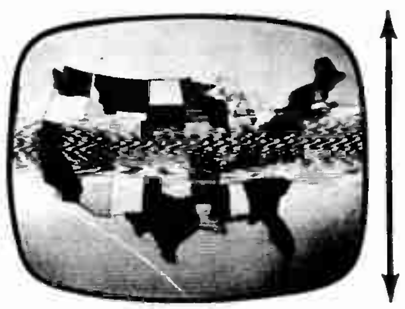


DIATHERMY INTERFERENCE

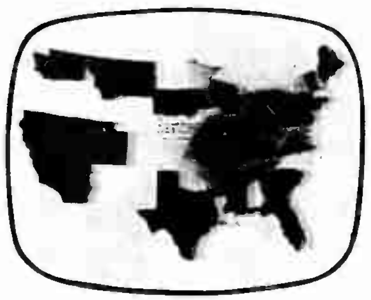
Caused by X-Ray, commercial RF heating, ultra-violet and fluorescent lights, brush motors and other 60 cycle operated equipment—Filters or other corrective measures installed at the source of interference may be tried to eliminate the herring-bone pattern from the picture.

5

IGNITION INTERFERENCE

Caused by ignition systems of cars or trucks or by breaking contact type of electrical appliances in vicinity. Similar condition may result from arcing in high voltage supply. — Effects in the picture may be reduced by relocation or installing a more directional type antenna, shielding or redressing the transmission line or by installing a power line filter.

7



GHOSTS

Due to the transmitted signal being reflected from buildings, hills or mountains and other surrounding structures. — To eliminate or reduce the effects in the picture, orientation, relocation or probing, or installing an antenna with improved directivity characteristics should be attempted.

13

TUNER DRIVE ASSEMBLY

TO REMOVE TUNER DRIVE ASSEMBLY FROM RF CHASSIS

1. Remove coupling arm spring from each side of tuner drive assembly.
2. Remove coupling arm connecting bar from each side of tuner drive assembly.
3. Remove the four tuner drive mounting screws from top of RF chassis and remove tuner drive assembly from bottom of RF chassis.

TO DISASSEMBLE TUNER DRIVE ASSEMBLY

1. Place tuner drive assembly on it's VHF side, the end plate assembly is now the top end, which is the UHF side. (See Fig. 1.)
2. Remove coupling arm screw, two washers, lock washer and coupling arm.
3. Disconnect locking arm spring.
4. Loosen tie plate mounting screws and remove the top one from each tie plate.
5. Loosen four set screws. Two on each locking collar located on each end of tuning shaft.
6. Loosen dial cord.
7. Remove top end plate assembly.
8. Remove dial cords.
9. Remove two idler pulleys.
10. Remove thrust spring.
11. Remove driven plate assembly.
12. Remove three small and one large ball bearing.
13. Remove drive pulley.

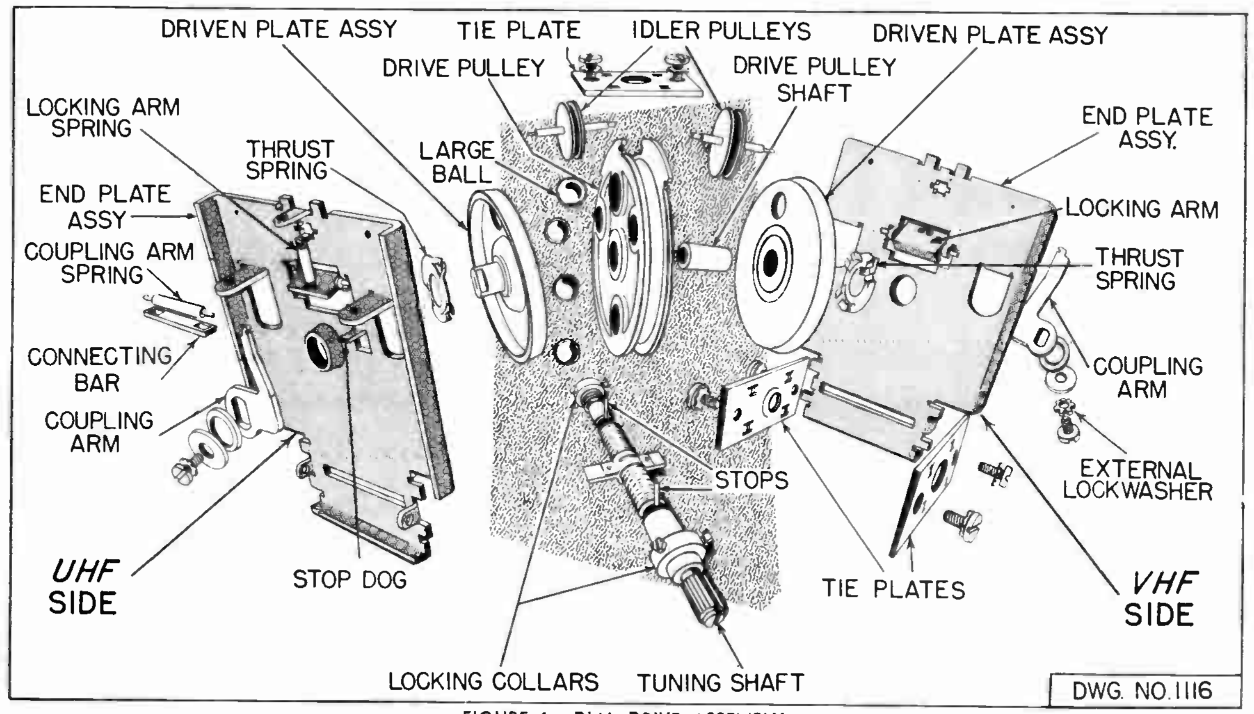


FIGURE 1. DIAL DRIVE ASSEMBLY

TO ASSEMBLE TUNER DRIVE ASSEMBLY AND RESTRING DIAL CORD

1. Place tuner drive assembly on it's VHF side.
2. Cut dial cord to 33 inches length as needed.
3. On one end of dial cord tie a tension spring and insert the other through locking collar hole and tie a knot. (See Fig. 2.)
4. Place the above dial cord with tension spring and collar on one end of drive pulley. Place dial cord tension spring on right side of right wing. (on out side of drive pulley). Wrap around wing and make two full turns in clock-wise direction. Tape may be used on right side of right wing to hold dial cord tight.
5. Place second dial cord with tension spring on left side (on outside of drive pulley) of left wing. Wrap around wing and make two complete turns in a counter clock-wise direction. Again tape may be used on left side of left wing to hold dial cord tight.
6. Insert drive pulley over drive pulley shaft.
7. Put the 3 small ball bearings and 1 large ball bearing in their respective holes in drive pulley.
8. Place driven plate assembly over drive pulley shaft
9. Place thrust spring over driven plate (refer to Figure 1).
10. Insert two idler pulleys at top of end plate assembly. Make sure excess dial cord is on the outside of idler pulleys.
11. Add end plate assembly, making sure that locking arm can swing out.
12. Replace three tie plate screws.

13. The next three steps are most easily done with the help of an assistant. Set tuning shaft 6½ turns from either stop and hold at that point. Also set drive pulley to center position, wings will be centered looking through hole at top tie plate. Remove tape from right wing. By-pass idler pulley and wrap dial string around knurl end of tuning shaft in a counter-clockwise direction. (See Figure 2.)
14. Remove tape from left wing, by-pass other idler pulley and wrap dial string around tuning shaft in a clockwise direction (looking from knurl end of shaft).
15. Take a small screw driver or pick, and increase spring tension of both dial cords and place over idler pulleys. Dial cord should be fairly tight. If not, (keep drive pulley in center of wings and tuning shaft at 6½ turns from either stop) take up all slack of dial cord with locking collars at both ends of tuning shaft and lock in place with set screws.
16. Tighten all tie plate screws.
17. Hook up locking arm spring.
18. Assemble coupling arm and washers. With both wings in center of top tie plate hole, and tuning shaft still at 6½ turns. Coupling arms should both be touching their respective stop dogs.
19. As a check to determine if the tuner drive assembly was assembled correctly, measure distance from both coupling arms to their respective stop dogs when tuning shaft is turned from one stop to other stop. This distance should be equal (approximately ⅛") on both sides. (opposite side of stop dog as in step 18)
20. Mechanical tracking is incorrect if distance between locking arm and stop dogs are not equal on both sides. If not equal, let up on dial string by loosening set screws on locking collar on the side which has the locking arm further away from stop dog. Loosen set screw on other locking collar and take up slack in dial cord and tighten screws on that collar. (If so desired, take dial string off of idler pulleys to relieve tension on dial string.
21. If tuner drive assembly tunes both UHF and VHF at same time, the drive assembly has not been correctly assembled and the following checks should be made.
    (a) Check both coupling arms to make sure that they are touching stop dogs with tuning shaft at 6½ turns.
    (b) Make sure the UHF tuner is set slightly off its stop at the high frequency end when tuner drive assembly is installed.
    (c) Make sure VHF coupling arm hits stop dog before VHF tuner reaches its mechanical stop. (transfer position)
    (d) Where the VHF tuner drives correctly, but UHF tuner tends to jam at time of transfer, check collar of UHF tuner coupling arm. Make sure that the UHF switch is open when slightly off the high frequency end stop (ribbons out of cavity) and then measure to see if connecting bar will fit between the UHF tuner coupling and drive assembly coupling arm. Loosen allen screws on UHF tuner locking collar so connecting bar will fit, then tighten set screws on collar.

    UHF or VHF tuner stops must not prevent coupling arms on tuner drive assembly from touching their respective stop dogs at time of transfer. Uncouple connecting bars to check if either tuner is causing unit to jam.

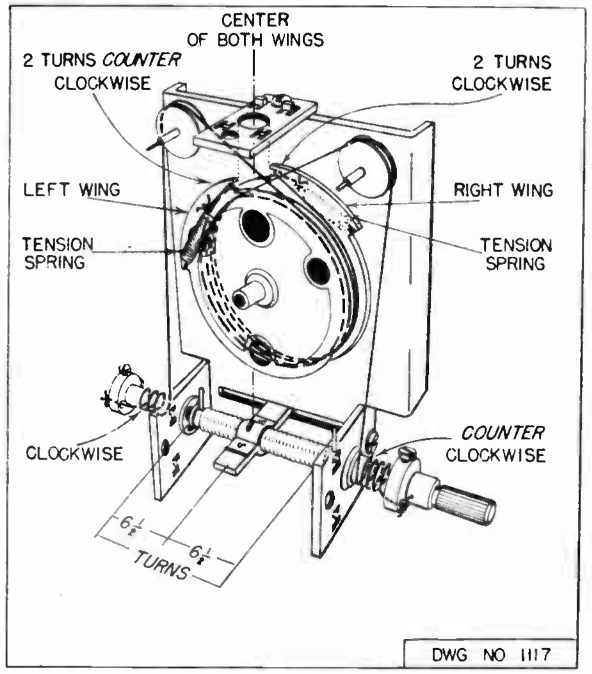


FIGURE 2. DIAL CORD REPLACEMENT

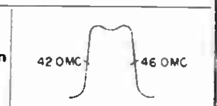
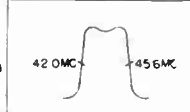
TO INSTALL TUNER DRIVE ASSEMBLY INTO RF CHASSIS

1. Make sure that the tuning shaft is 6½ turns from either stop, wings in center, looking through top tie plate hole.
2. Replace tuner drive assembly through bottom of RF chassis, and mount with the four self-tapping screws from top of RF chassis. The tuner drive assembly will fit only one way.
3. Set the UHF tuner slightly away from the high frequency end stop where the cam opens up the UHF switch. Set VHF tuner at the low frequency end. (where cam actuates VHF oscillator switch.
4. Replace coupling arm connecting bars and springs.

NOTE: Jamming will result at time of transfer if either tuner reaches its stop and prevents coupling arms on drive unit to reach their respective stop dogs. Adjust coupling arm collar set screws on tuners if necessary. Make sure tuners actuate their respective switches.

VIDEO IF ALIGNMENT

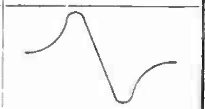
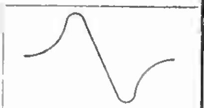
NOTE: (a) Preheat the unit for at least five minutes.
(b) Set VHF tuner to approximately Channel 7.
(c) Use 10K ohm resistor (isolation) in series with VTVM and scope for the following steps.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	43.7	——	IF Alignment Input "A"	VTVM at IF Detector Output	Adjust generator for output of approx. 2 volts DC on VTVM	T-301	Maximum Reading
2	41.4	——	IF Alignment Input "A"	VTVM at IF Detector Output	Adjust generator for output of approx. 2 volts DC on VTVM	L-323A (Top)*	Minimum Reading
3	45.15	——	IF Alignment Input "A"	VTVM at IF Detector Output	Adjust generator for output of approx. 2 volts DC on VTVM	L-323B (Bottom)*	Maximum Reading
4	42.1	——	IF Alignment Input "A"	VTVM at IF Detector Output	Adjust generator for output of approx. 2 volts DC on VTVM	L-319	Maximum Reading
5	41.25	——	IF Alignment Input "A"	VTVM at IF Detector Output	Adjust generator for output of approx. 2 volts DC on VTVM	L-313 (Bottom)	Minimum Reading
6	47.25	——	IF Alignment Input "A"	VTVM at IF Detector Output	Adjust generator for output of approx. 2 volts DC on VTVM	L-314 (Bottom)	Minimum Reading
7	41.4	——	IF Alignment Input "A"	VTVM at IF Detector Output	Adjust generator for output of approx. 2 volts DC on VTVM	T-300A (Top)*	Minimum Reading
8	Remove VTVM from IF Detector output and substitute an oscilloscope in its place. Calibrate scope for sensitivity of one volt per inch.						
9	42.0 46.0	40	IF Alignment Input "B"	Scope at IF Detector Output	Adjust wave form for approx. 20 divisions on scope with sweep gen.	L-311 (Bottom) L-312 (Bottom) Adjust for maximum amplitude with proper bandwidth	
10	42.0 45.6	40	IF Alignment Input "A"	Scope at IF Detector Output	Adjust wave form for approx. 20 divisions on scope with sweep gen.	T-200 T-300B (Bottom)* C-305 Adjust for maximum amplitude with proper bandwidth	

* NOTE: Two Peaks can be obtained. Use Peak with core furthest out of coil form.

SOUND IF ALIGNMENT

NOTE: Short antenna to ground.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	4.5	——	IF Detector Output	VTVM across C-413	——	L-404 T400 Primary (Bottom of can)	Maximum Reading on V.T.V.M.
2	——	4.5	IF Detector Output	Scope across C-413	Sweep approx. ± 100 KC. Adjust for maximum Linearity	T400 Secondary (Top of can)	
3	——	4.5	IF Detector Output	Scope across C-413	Sweep approx. ± 100 KC. Adjust for symmetry of peaks	T400 Primary (Bottom of can)	
4	——	——	——	——	Tune in any Station	C-414 Repeat step No. 2	Adjust for minimum noise in speaker

VIDEO TRAP COIL (L-401) ADJUSTMENT

(a) Tune in station.
(b) Adjust tuner until sound bars just appear.
(c) Turn L-401 Slug all the way out (counter-clockwise).
(d) Turn the slug in (clockwise) until the horizontal scanning lines are smooth and continuous.

ALIGNMENT PLUG

For ease of alignment and to reduce the possibility of regeneration, it is suggested that a simple generator alignment plug be made and used during the alignment.

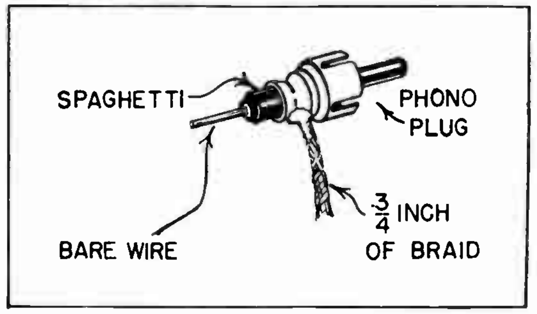


FIGURE 3. ALIGNMENT PLUG

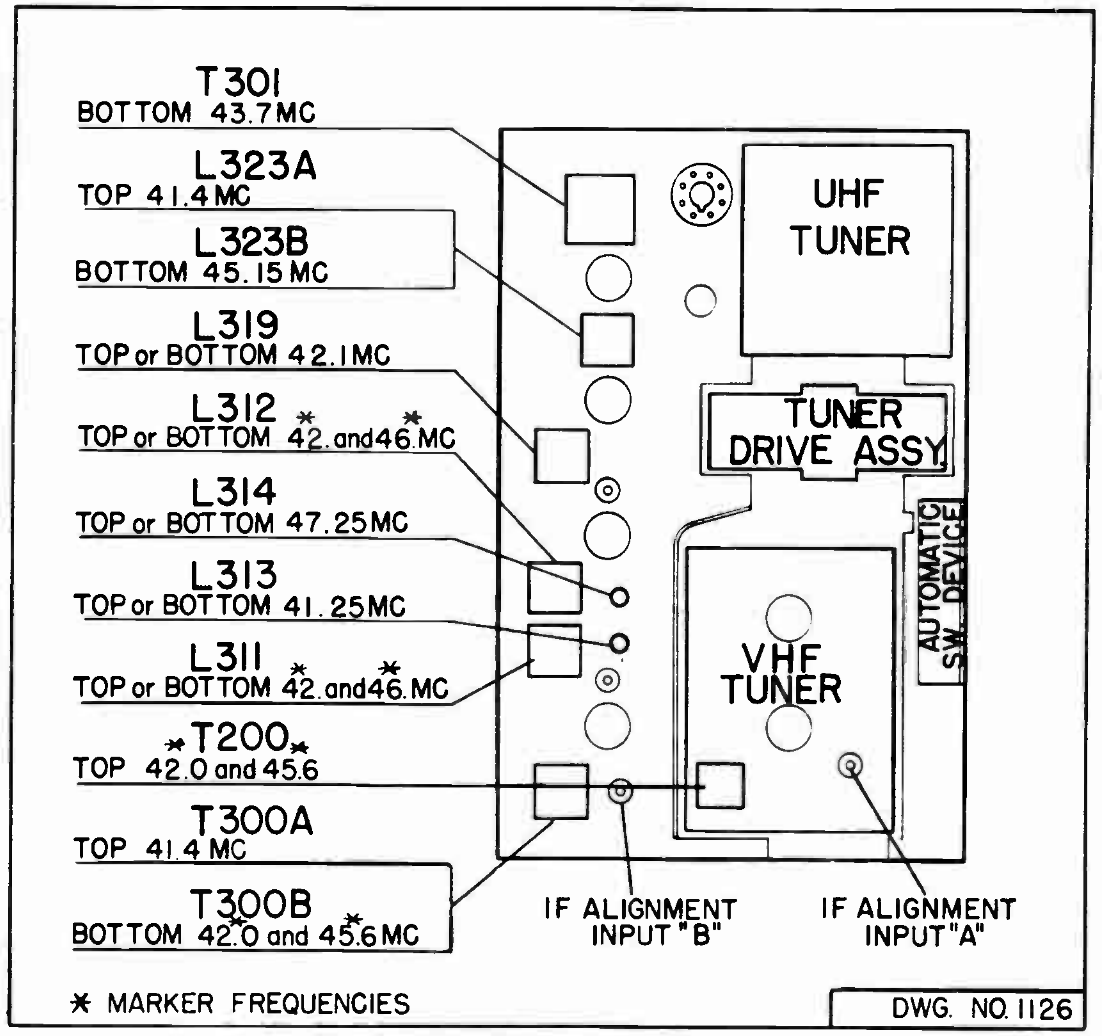


FIGURE 4. TOP RF CHASSIS VIEW

V—Video
S—Sound

LOW BAND RF ALIGNMENT (Turn Tuner to Channel 6)

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V - 83.25 S - 87.75	Channel 6	VHF Antenna Terminals	RF Test Point	Adjust for max. gain and Flat Response	C208 & C213	
2	V - 83.25 S - 87.75	Channel 6	VHF Antenna Terminals	RF Test Point	Adjust for max. gain between markers	C204	
3	V - 83.25	Channel 6 Note: 1	VHF Antenna Terminals	IF Detector Output	Adjust osc. trimmer until marker is 50% down on video side of curve.	C230	
4	V - 83.25 S - 87.75	Channel 6	VHF Antenna Terminals	RF Test Point	Re-adjust for max. gain and flat response	C208 & C213	
5	V - 55.25	Channel 2 Note: 2	VHF Antenna Terminals	IF Detector Output	Adjust osc. core until marker is 50% down on video side of curve.	L-213 (Repeat step 3)	
6	42.0 45.5	40 Note: 3	Antenna Input	IF Detector Output	Check over all IF response	C-204	
7	V - 77.25 S - 81.75 V - 67.25 S - 71.75 V - 61.25 S - 65.75 V - 55.25 S - 59.75	Channel 5 Channel 4 Channel 3 Channel 2	VHF Antenna Terminals	IF Detector Output	Adjust tuner until response curve appears.	Check Point Only	

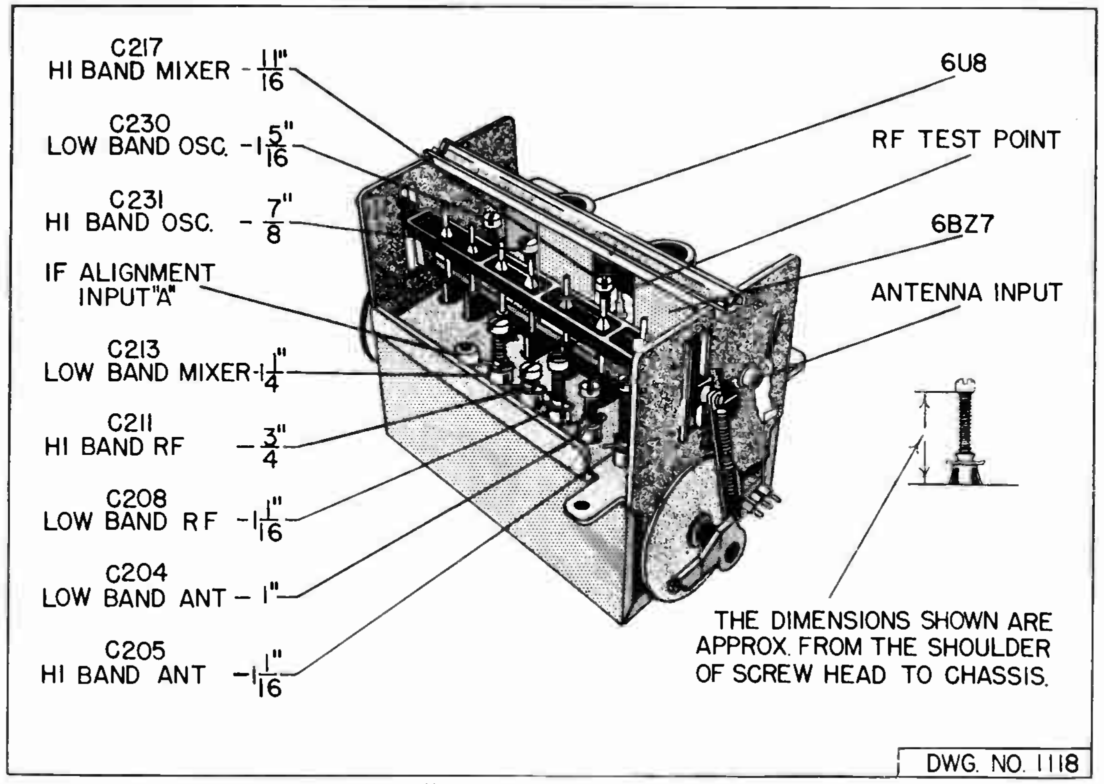


FIGURE 5. TOP VHF TUNER VIEW

V - Video
S - Sound

HIGH BAND RF ALIGNMENT (Turn to Channel 13)

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V - 211.25 S - 215.75	Channel 13	VHF Antenna Terminals	RF Test Point	Adjust for maximum gain and flat response	C-211 & C-217	
2	V - 211.25 S - 215.75	Channel 13	VHF Antenna Terminals	RF Test Point	Adjust for maximum gain between markers	C-205	
3	V - 211.25	Channel 13 Note 1	VHF Antenna Terminals	IF Detector Output	Adjust osc. trimmer until marker is 50% down on video side of curve	C-231	50%
4	V - 211.25 S - 215.75	Channel 13	VHF Antenna Terminals	RF Test Point	Re-adjust for maximum gain and flat response	C-211 & C-217	
5	V - 175.25	Channel 7 Note 4	VHF Antenna Terminals	IF Detector Output	Adjust osc. core until marker is 50% down on video side of curve	L-214 (Repeat Step 3)	50%
6	V - 205.25 S - 209.75 V - 199.25 S - 203.75 V - 193.25 S - 197.75 V - 187.25 S - 191.75 V - 181.25 S - 185.75 V - 175.25 S - 179.75	Channel 12 Channel 11 Channel 10 Channel 9 Channel 8 Channel 7	VHF Antenna Terminals	IF Detector Output	Adjust tuner until response curve appears on scope	Check point only	

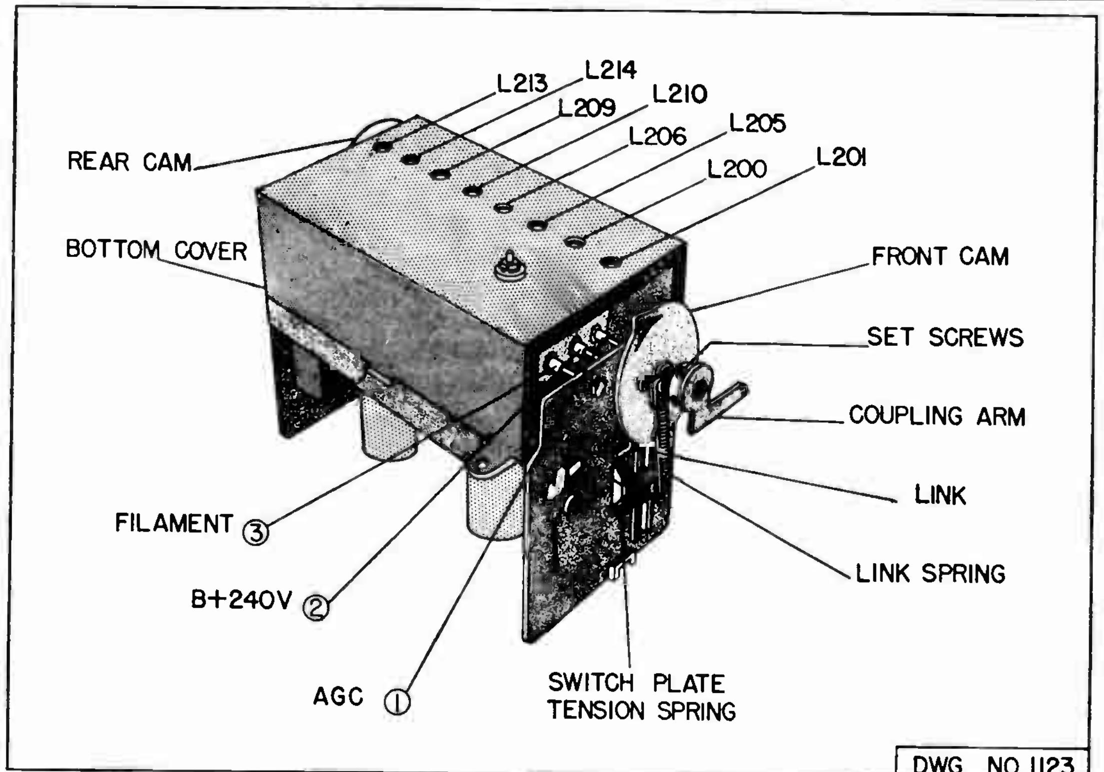


FIGURE 6. BOTTOM VHF TUNER VIEW

VHF TUNER ALIGNMENT

NOTE: IF amplifier must be aligned before tuner adjustments are made. Also Low Band of Tuner must be aligned before High Band.

1. Preset trimmer screws as shown in Figure 5.
2. Preset coil cores as following:
   (A) With Band Sw. in Low Band pos., set treadle bar to top of stroke (Cores furthest out of coil)
   (B) Adjust Cores: L200, L201, L205, L206, L209, L210 to 1-1/2" from cores to end of coil form.
   (C) Adjust Core: L213, L214 to 1-5/8" from cores to end of coil form. (See Figure 6.)

Note 1: From bottom of treadle bar 1¾" to top of tuner chassis.
Note 2: From bottom of treadle bar 1⅛" to top of tuner chassis.
Note 3: From bottom of treadle bar ⅝" to top of tuner chassis.
Note 4: From bottom of treadle bar ⅞" to top of tuner chassis.

UHF TUNER SERVICE DATA

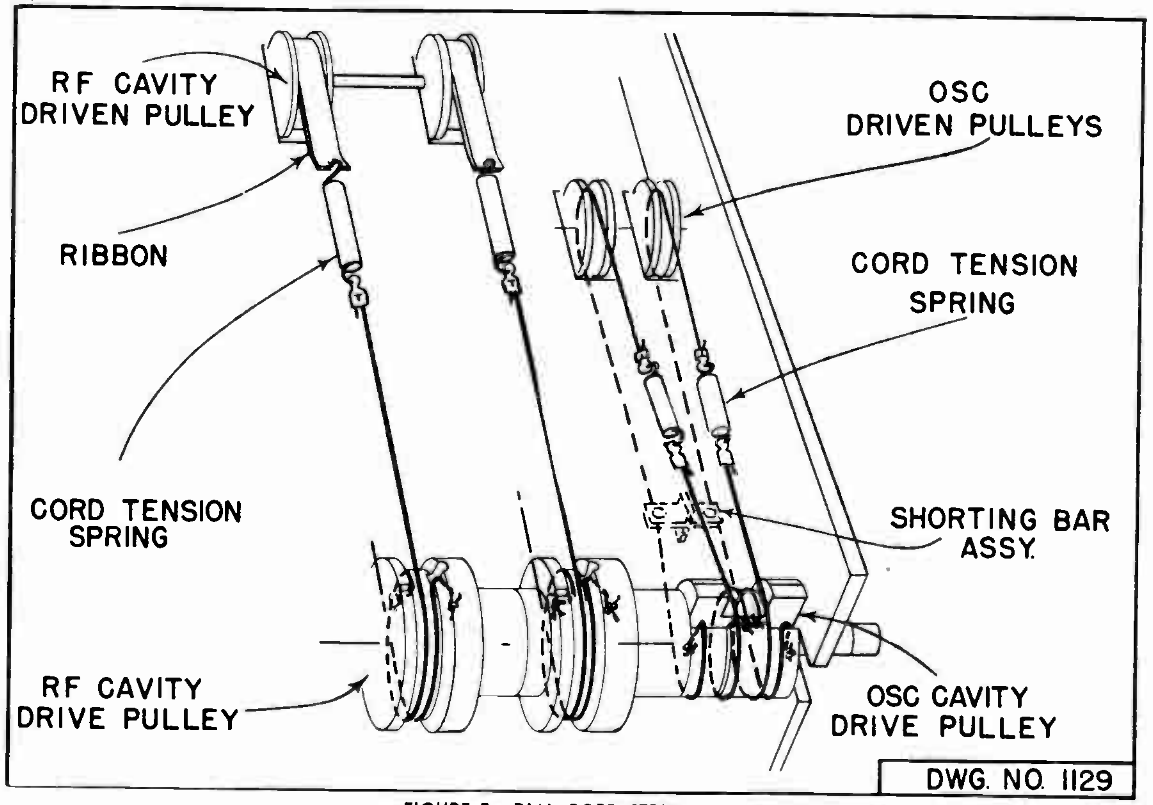


FIGURE 7. DIAL CORD STRINGING

OSCILLATOR GRID CHECK

To determine whether the oscillator section is functioning, a convenient check point has been provided where the oscillator grid current can be measured. To measure the oscillator grid current, place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22 ohm resistor (R106). See Figure 8. A reading of 10 to 30 microamperes should be obtained if the oscillator is functioning normally.

CRYSTAL CHECK

Both the oscillator and crystal detector can easily be checked by measuring the oscillator injection current. Place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22 ohm resistor (R105) at the terminal indicated in Figure 8. A reading of 5 to 40 microamperes should be obtained if both the oscillator and crystal are functioning normally.

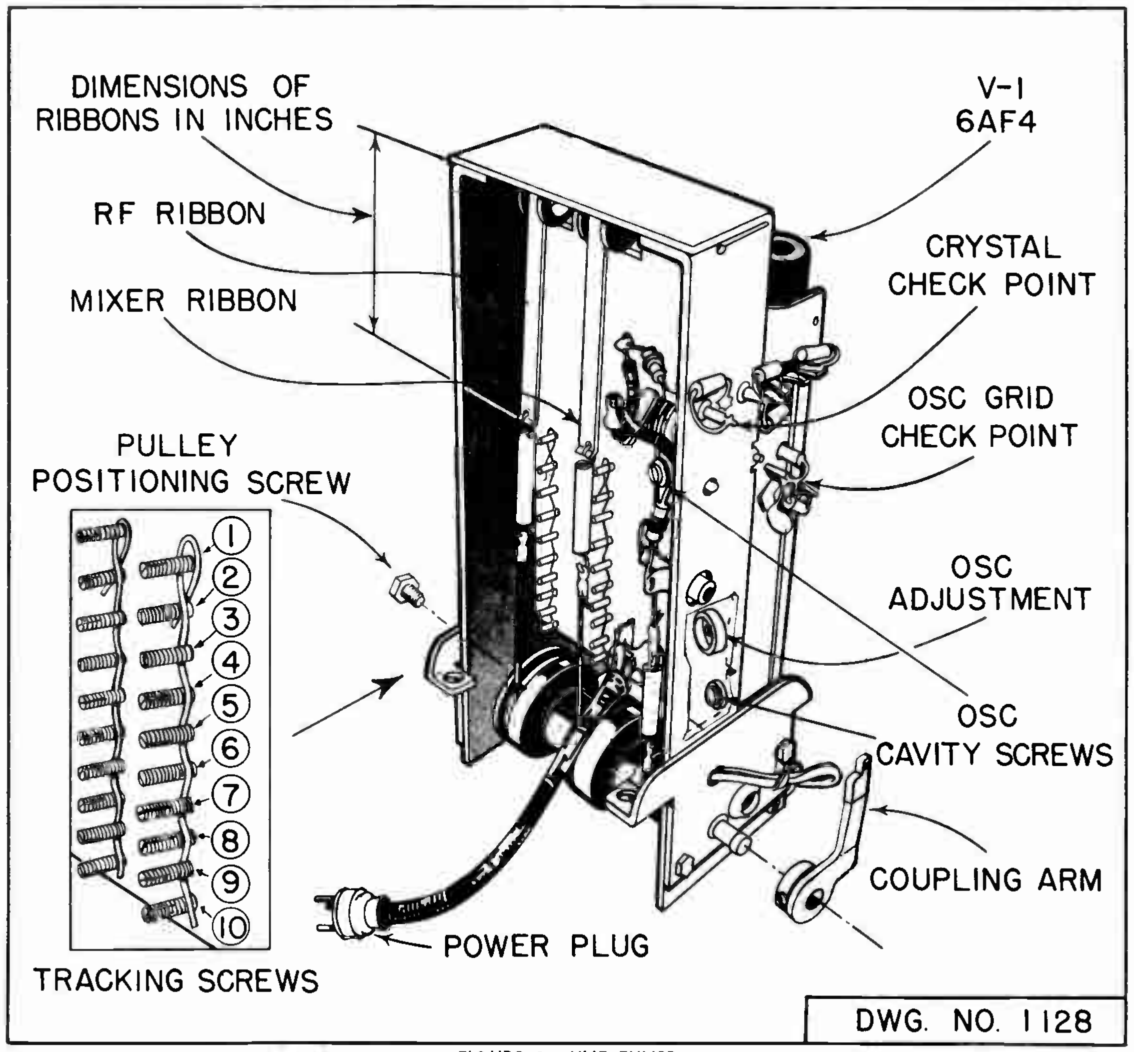


FIGURE 8. UHF TUNER

UHF ALIGNMENT

Read Following Notes Before Proceeding With the Alignment.

NOTE:

(A) Both the VHF Tuner and Video IF must be properly aligned before attempting UHF alignment.

(B) Accurate sweep and marker generators are required for the alignment. Do not attempt alignment without proper equipment.

(C) Do not remove UHF Tuner from chassis.

(D) Make sure 6AF4 tube is firmly seated in its socket and the shield clip is seated in the tube shield notch.

(E) Check oscillator grid current and crystal current. Meter readings must be within specifications. Refer to page 30.

(F) Check mechanical alignment of RF and Mixer ribbons.

1. Disconnect spring and connecting bar on UHF Tuner coupling arm.
2. Turn UHF Tuner coupling arm to its counterclockwise stop .
3. RF and Mixer ribbons should be 4⅞ inches as indicated in Figure 8.
4. If ribbons are not at correct distance loosen pulley positioning screw slightly and reposition by turning drive pulleys. For easy accessibility of the pulley positioning screw it is suggested that the High Voltage Chassis be removed.
5. Reinstall spring and connecting bar on UHF Tuner coupling arm.

UHF ALIGNMENT PROCEDURE

STEP 1: Use a 10K ohm isolation resistor in series with hot lead of the oscilloscope and connect to IF Detector output.

STEP 2: Connect a 6 volt bias battery to the AGC with positive to ground and negative to pin 8 of RF Power socket. Connect a jumper between pins 7 and 8 of RF power socket.

STEP 3: Connect sweep generator with output impedance of 300 ohms to the UHF antenna terminals and loosely couple signal generator to sweep generator leads.

STEP 4: Set RF and Mixer ribbons to the dimensions listed in the chart below and adjust the sweep generator until the response curve indicated in figure 9 appears on the scope.

STEP 5: Adjustments should be made for maximum gain with marker appearing at the 6db or 50% point on the video slope of the IF response curve (see Figure 9).

STEP NUMBER	RIBBON DIMENSION IN INCHES	SWEEP GENERATOR FREQ. (MC)	SIGNAL GENERATOR FREQ. (MC)	ADJUST TRACKING SCREW PAIR
1	4¾	890	895	See Note "I"
2	4⅝	865	870.5	# 1
3	4-3/16	775	780.5	# 2
4	3⅞	726	731	# 3
5	3-7/16	671	676	# 4
6	3⅛	624	629.5	# 5
7	2¾	585	590	# 6
8	2-7/16	545	550	# 7
9	2-1/16	507	512	# 8
10	1-11/16	478	483.5	# 9
11	1⅜	455	460	#10

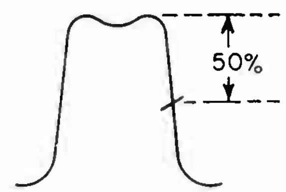


FIGURE 9.

NOTE "I" Loosen two oscillator cavity screws and turn oscillator adjustment so that the 895 MC marker falls at the point indicated in Figure 9. Tighten both oscillator cavity screws.

NOTE "II" Adjustment of tracking screws must be made from the back or crystal side of the tuner and in sequence from 1 through 10.

NOTE "III" To reach position number 11 it may require disconnecting the spring and connecting bar on the UHF tuner coupling arm and turning the UHF Tuner coupling arm clockwise.

F

CAPACITORS CAPACITOR VALUES ARE REPRESENTED IN MICRO-MICROFARAD (MMF) UNLESS OTHERWISE INDICATED. "MF" DENOTES MICRO-FARAD

RESISTORS RESISTORS WATTAGE IS REPRESENTED IN 1/2 WATT UNLESS OTHERWISE INDICATED "K" DENOTES X 1,000 & "M" DENOTES X1,000,000.

SWITCHES ALL SWITCHES ARE SHOWN IN THE POSITION FOR VHF OPERATION

VOLTAGE READINGS THE VOLTAGE READINGS INDICATED AT THE VARIOUS TUBE SOCKET PINS WERE MEASURED WITH A 20,000 OHM PER VOLT VOLTMETER, NORMAL OPERATION, NO SIGNAL INPUT AND LINE VOLTAGE AT 115V AC WHERE CONTROL SETTINGS AFFECT VOLTAGE READINGS THE MINIMUM AND MAXIMUM ARE INDICATED.

WARNING HIGH VOLTAGE ON PLATE CAPS OF THE 1B3 HIGH VOLTAGE RECTIFIER AND 25CD6 HORIZONTAL PULSE AMPLIFIER. DO NOT MEASURE THIS VOLTAGE

COIL DC RESISTANCE THE DC RESISTANCE READING INDICATED NEAR THE TRANSFORMERS AND COILS HAVE BEEN TAKEN WITH AN OHMMETER DIRECTLY ACROSS THE COIL BEING MEASURED COILS SHOWN WITHOUT A RESISTANCE READING HAVE A DC RESISTANCE OF LESS THAN ONE OHM A TOLERANCE OF + OR − 5 % IS PERMISSIBLE

WAVE FORMS THE WAVE FORMS ILLUSTRATED ARE EXACT COPIES OF THAT SHOWN ON A LABORATORY OSCILLOSCOPE THE WAVE FORMS WERE TAKEN UNDER NORMAL OPERATING CONDITIONS, WITH A TRANSMITTED SIGNAL AND THE PICTURE IN SYNC AT ALL TIMES WITH EACH WAVE FORM IS THE PEAK-TO-PEAK VOLTAGE AND A HORIZONTAL OR A VERTICAL NOTATION REPRESENTING VERTICAL (60 CYCLES) OR HORIZONTAL (15,750 CYCLES) SCOPE PATTERN THE WAVE FORM AND PEAK-TO PEAK VOLTAGE READINGS MAY VARY SOMEWHAT DEPENDING ON THE STRENGTH OF THE SIGNAL, THE PICTURE INFORMATION BEING TRANSMITTED AND THE ADJUSTMENT OF THE VARIOUS CONTROLS WHEN CHECKING WAVE FORMS, CONNECT THE GROUND LEAD FROM THE OSCILLOSCOPE TO THE CHASSIS AND THE HOT LEAD TO THE POSITION INDICATED BY THE ARROW.

REPLACING TUBES BEFORE REPLACING TUBES THE CABINET BACK MUST FIRST BE REMOVED REMOVING THE CABINET BACK DISENGAGES THE SAFETY INTERLOCK AND REMOVES THE POWER TO THE RECEIVER DO NOT TAMPER WITH OR ATTEMPT TO DEFEAT THE PURPOSE OF THE SAFETY INTERLOCK, AS SEVERE SHOCK MAY RESULT DO NOT REMOVE TUBES WHILE THE RECEIVER IS IN OPERATION AS OVERLOADING OR COMPONET FAILURE MAY RESULT

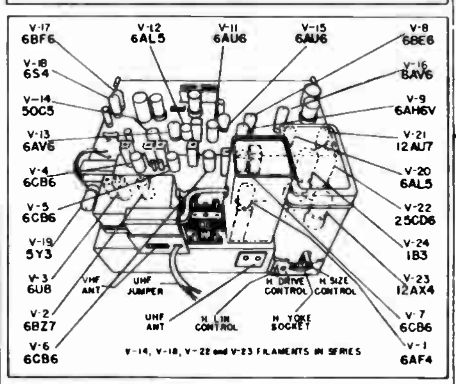
PICTURE TUBE HANDLING DUE TO LARGE SURFACE AND EXTREME HIGH VACUUM OF THE PICTURE TUBE, CARE SHOULD BE USED WHEN HANDLING THE CHASSIS OUTSIDE THE CABINET DO NOT SUBJECT THE TUBE TO EXCESSIVE PRESSURE OR ROUGH HANDLING AS AN IMPLUSION MAY RESULT CAUSING SERIOUS PERSONAL INJURY

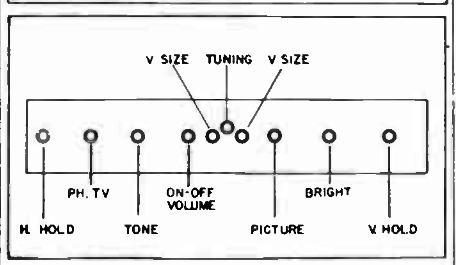
WARNING

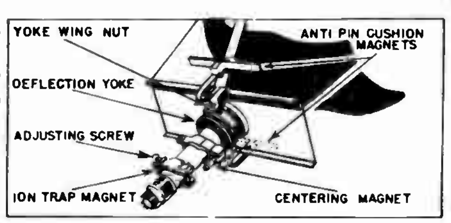
AT ALL TIMES DURING OPERATION THE CHASSIS IS AT 125 VOLTS DC POTENTIAL ABOVE GROUND AND IT ALSO MAY BE AT THE LINE VOLTAGE POTENTIAL DEPENDING ON HOW THE LINE CORD PLUG IS INSERTED IN THE POWER RECEPTACLE

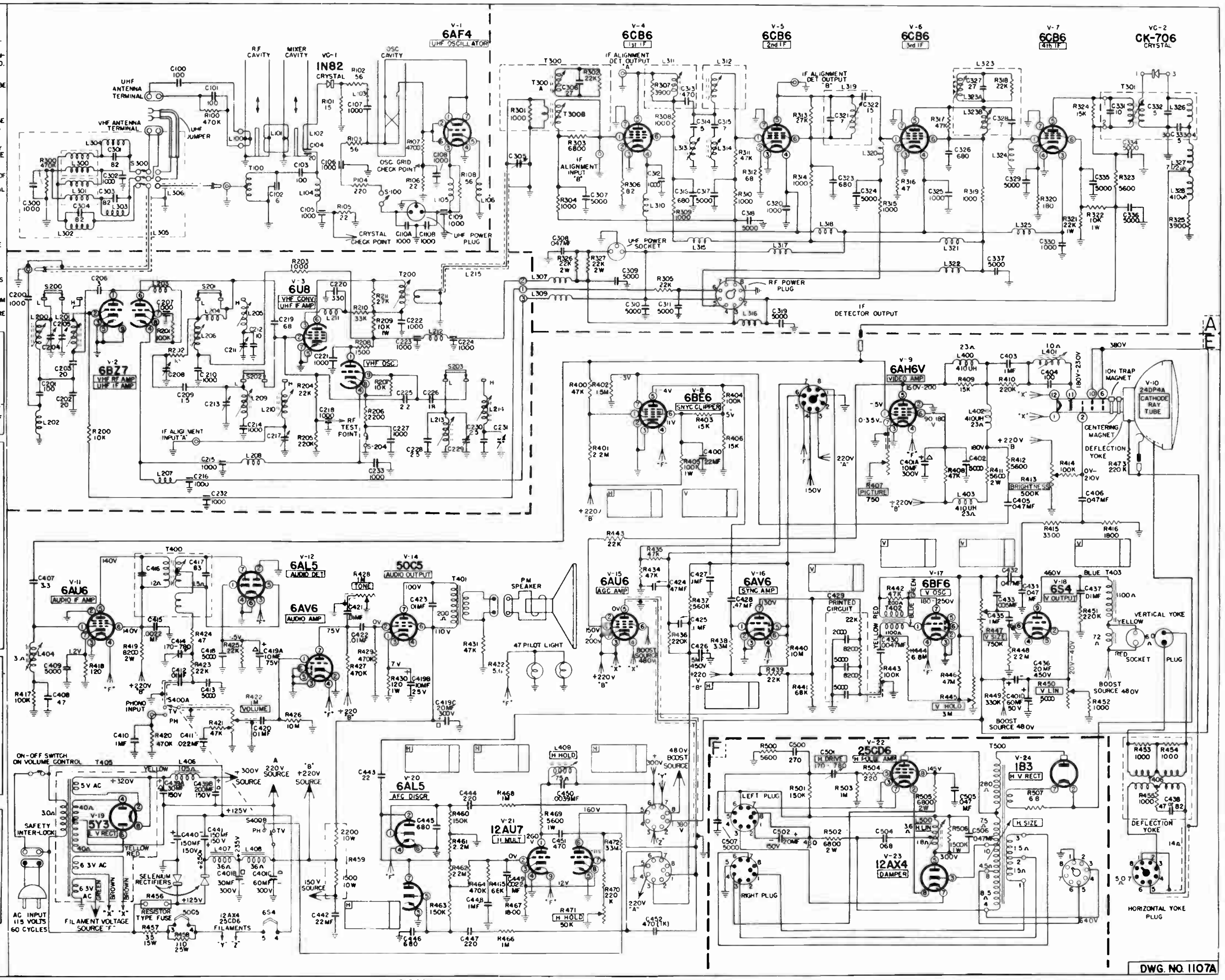
EXTREME CAUTION MUST BE OBSERVED WHEN WORKING WITH THE CHASSIS OUTSIDE THE CABINET AND WHEN POWER IS APPLIED TO THE RECEIVER WITH THE CABINET BACK REMOVED *SEVERE SHOCK* MAY RESULT FROM CONTACT WITH CHASSIS

AN ISOLATION TRANSFORMER BETWEEN THE LINE CORD PLUG AND POWER RECEPTACLE MUST BE USED WHEN SERVICE IS REQUIRED. THIS REMOVES ALL SHOCK HAZARDS AND IS THE *ONLY* SAFEGUARD. DAMAGE TO THE RECEIVER AND TEST EQUIPEMENT MAY RESULT WITHOUT THE USE OF AN ISOLATION TRANSFORMER









SCHEMATIC DIAGRAM

REPLACEMENT PARTS LIST

40MC UHF TUNER

Ref. No.	Part No.	Description	Selling Price
Capacitors			
C100-101	8G-22657	100 mmf, ceramic	.25
C102	8G-20880	6 mmf, ceramic feed thru	.45
C103	201-22887	100 mmf, ceramic	.25
C104	8G-21315	20 mmf, ceramic feed thru	.30
C105-106	8G-20878	1000 mmf, ceramic feed thru	.55
C107-108	8G-22383	1000 mmf, ceramic disk	.25
C109	8G-22120	1000 mmf, ceramic feed thru	.25
C110A-B	8G-19506	1000 mmf, dual ceramic disk	.30
Resistors			
R100	9B1-29	470K ohm, ½ watt, 20%	.25
R101	9B1-40	15 ohm, ½ watt, 10%	.25
R102-103	9B1-47	56 ohm, ½ watt, 10%	.25
R104	9B1-54	220 ohm, ½ watt, 10%	.25
R105-106	9B1-42	22 ohm, ½ watt, 10 %	.25
R107	9B1-70	4700 ohm, ½ watt, 10%	.25
R108	9B1-47	56 ohm, ½ watt, 10%	.25
Chokes, Transformers, Coils			
T100	13B-22410	Output IF transformer	.55
L100	62D-22401	Input link	.03
L101	62D-22254	Coupling link	.30
L102	62D-22360	Output link	.03
L103	62W-22A10	Cable	.04
L104	16A-22362	RF Choke	.45
L105-106	16A-22411	Choke coil	.10
Miscellaneous			
S-100	20M-22462	UHF Oscillator switch	.45
VC-1	8M-22649	IN82 Crystal	4.40
	201-22692	Crystal holder assembly	.70
	201-22240	Rear Cavity contact arm	.45
	201-22241	Front Cavity contact arm	.70
	2M-22853	Cavity ground spring	.05
	5M22232	Cavity hollow pulley	.10
	5M-22287	Flange washer for above	.05
	3A-22235	Pulley shaft	.05
	29C-21288	Retaining ring for above	.05
	5M-22237	Osc. pulley	.10
	3A-22236	Osc. pulley shaft	.05
	29C-21288	Retaining ring for above	.05
	3A-21292	Osc. idler shaft	.15
	6M-21936	Osc. bar center support	.10
	6M-21332	Osc. bar bottom support	.10
	200-21331	Osc. shorting bar assn.	1.40
	201-21330	Osc. bar and tube contact	1.20
	201-21329	Osc. bar and insulated tube contact	1.35
	201-21328	6AF4 Socket assembly	.35
	2C-22338	Osc. cavity cover	.10
	5M-22341	Osc. drive pulley	.40
	3M-21370	Groove pin for above	.01
	3A-22231	Pulley drive shaft	.25
	5M-22452	Half drive pulley	.10
	5M-22454	Half drive pulley	.10
	29A-22226	Flat washer	.01
	3C-22233	Sleeve	.05
	32F8SE-15381	Pulley positioning screw	.03
	2D-22119	Mounting bracket	.15
	2C-22402	Cavity cover	.20
	6M-21939	Finger setting screw	.12
	42B4-22900	Tracking screw	.02
	62M-21306	Tracking screw locking wire	.02
	201-22368	Power cable assem.	.65
	19B-19922	Phono socket	.10
	200-21359	Cavity ribbon	.65
	55A-20501	Nylon cord	.05 ft.
	26B-21573	Tie lug	.02
	49A-21932	Cavity tension spring	.05
	49A-22861	Osc. tension spring	.05
	2B-22506	Back shield	.50
	2B-21801	Tube shield	.25
	49A-21511	Tube shield Spring	.05
	2B-22443	UHF Tuner shield	.85
	5M-22502	Nylon nut	.10
	41M-22486	Fibre insulator	.10
	38A-22735	Insulator	.15

40MC VHF TUNER

Ref. No.	Part No.	Description	Selling Price
Capacitors			
C200	8G-22656	1000 mmf, ceramic	.25
C201	8G-19862	100 mmf, ceramic	.20
C202-203	8G-22276	20 mmf, ceramic	.25
C204-205	201-15142	Trimmer condenser	.30
C206	8G-22772	3 mmf, ceramic	.25
C207		Included with capacitor plate	
C208	201-15142	Trimmer condenser	.30
C209	8G-12495-8	1.5 mmf, ceramic	.25
C210	8G-13201	1000 mmf, ceramic	.25
C211	201-15142	Trimmer condenser	.30
C212	8G-11789	10 mmf, ceramic	.25
C213	201-15142	Trimmer condenser	.30
C214	8G-13201	1000 mmf ceramic	.25
C215		Included with capacitor plate	
C216	8G-20878	1000 mmf, ceramic feed thru	.55
C217	201-15142	Trimmer condenser	.30
C218	8G-20878	1000 mmf, ceramic feed thru	.55
C219	8G-12495-1	.68 mmf, ceramic	.25
C220	8G-17349	330 mmf, ceramic	.25
C221-222	8G-13201	1000 mmf, ceramic	.25
C223		Included with ceramic plate	
C224	8G20878	1000 mmf, ceramic feed thru	.55
C225	8G-12495-4	2.2 mmf, ceramic	.25
C226	8G-22227	18 mmf, ceramic	.25
C227	8G-22383	1000 mmf, ceramic disk	.25
C228	8G-22367	2.5 mmf, ceramic	.30
C229	201-15142	Trimmer condenser	.30
C230	8G-19568	2.5 mmf, ceramic	.30
C231	201-15142	Trimmer condenser	.30
C232	8G-20878	1000 mmf ceramic feed thru	.55
C233	8G-13201	1000 mmf, ceramic	.25
Resistors			
R200	9B1-74	10K ohm, ½ watt, 10%	.25
R201	9B1-86	100K ohm, ½ watt, 10%	.25
R202	9B1-38	10 ohm, ½ watt, 10%	.25
R203	9B1-62	1000 ohm, ½ watt, 10%	.25
R204	9B1-78	22K ohm, ½ watt, 10%	.25
R205	9B1-27	220K ohm, ½ watt, 20%	.25
R206	9B1-66	2200 ohm, ½ watt, 10%	.25
R207	9B1-74	10K ohm, ½ watt, 10%	.25
R208	9B1-14	1500 ohm, ½ watt, 20%	.25
R209	9B2-74	10K ohm, 1 watt, 20%	.30
R210	9B1-80	33K ohm, ½ watt, 10%	.25
R211	9B1-79	27K ohm, ½ watt, 10%	.25
Chokes, Transformers, Coils			
T200	13B-22428	Converter transformer	1.35
L200	13M-22328	L. B. Antenna coil	.55
L201	13E-17140	H. B. Antenna Coil	.95
L202	201-20405	Antenna shunt coil	.25
L203	13M-23044	Cascode coil	
L204	16A-17128	R.F. Choke	.60
L205	13E-17140	H. B. RF Primary coil	.95
L206	13M-22325	L. B. RF Primary coil	.55
L207	201-20405	Filament choke	.25
L208	16A-20777	Filament choke	.30
L209	13M-22327	L. B. RF Secondary coil	.55
L210	13E-17140	H. B. RF Secondary coil	.95
L211	13M-22738	Choke coil	.08
L212	201-15608	RF choke coil	.55
L213	13M-22703	L. B. Oscillator coil	.55
L214	13E-17140	H. B. Oscillator coil	.95
L215	14B-22481	Shielded cable	.45

40MC VHF TUNER (Cont'd)

Ref. No.	Part No.	Description	Selling Price
Miscellaneous			
S200-201-202-203	A-2J-16310	Sliding switch contacts	.05
S204	201-22202	VHF Cathode switch	.60
	5F-16311	Sliding switch contact holder	.15
	2C-22188	Capacitor plate assembly Includes C207-215-223)	1.40
	3A-22210	Tuner shaft	.08
	29E-466	Spring washer	.02
	200-22249	Cam assembly	
	201-22176	Coil support and terminal board	.25
	2M-22187	Switch lever	.35
	2M-19150-1	Switch lever springs	.05
	5M-22191	Treadle bar	.50
	5M-22380	Iron core plastic nut	.05
	51A-22404	Iron core (for L214)	.30
	51A-22409	Iron core (for L201-205-210)	.30
	51A-22406	Iron core (for L213)	.35
	51A-22407	Iron core (for L206)	.30
	51A-22405	Iron core (for L209)	.30
	51A-22408	Iron core (for L200)	.40
	2M-22181	Link arm	.05
	49A-18799	Link arm spring	.10
	49A-20763	Hair pin spring	.03
	200-22201	Rear end plate	
	2C-22190	Front end plate	.70
	2M-22185	End plate support bar	.05
	2B-19323	Tube shield	.25
	2B-22194	Bottom cover	.25
	2B-22193	Top cover	.30
	32T6-22369	Thumb screw	.05
	15B-22485	Tube socket	.55
	19B-19922	Phono sockets	.10

40MC RF CHASSIS

Ref. No.	Part No.	Description	Selling Price
Capacitors			
C300	8G-22656	1000 mmf, ceramic	.25
C301		Included with L304	
C302	8G-22656	1000 mmf, ceramic	.25
C303		Included with L303	
C304		Included with L302	
C305	8E-22419	Trimmer condenser	.35
C306		Included with T300	
C307	8G-13962	5000 mmf, ceramic disk	.25
C308	8J-16081	.047 mfd, 400 volt, molded	.30
C309-310-311	8G-13962	5000 mmf, ceramic disk	.25
C312	8G-13201	1000 mmf, ceramic	.25
C313		Included with L311	
C314	8G-12166	5 mmf, ceramic	.25
C315	8G-11790	7mmf, ceramic	.25
C316	8G-21105	680 mmf, ceramic	.20
C317-318-319	8G-13962	5000 mmf, ceramic disk	.25
C320	8G-13201	1000 mmf, ceramic	.25
C321-322		Included with L319	
C323	8G-21105	680 mmf, ceramic	.20
C324	8G-13962	5000 mmf, ceramic disk	.25
C325	8G-13201	1000 mmf, ceramic	.25
C326	8G-21105	680 mmf, ceramic	.20
C327-328		Included with L323	
C329	8G-13962	5000 mmf, ceramic disk	.25
C330	8G-13201	1000 mmf, ceramic	.25
C331-332-333		Included with T301	
C334-335-336-337	8G-13962	5000 mmf, ceramic disk	.25
Resistors			
R300	9B1-29	470K ohm, ½ watt, 20%	.25
R301-302		Included with T300	
R303	9B1-72	6800 ohm, ½ watt, 10%	.25
R304	9B1-62	1000 ohm, ½ watt, 10%	.25
R305	9B1-78	22K ohm, ½ watt, 10%	.25
R306	9B1-49	82 ohm, ½ watt, 10%	.25
R307		Included with L311	
R308-309-310	9B1-62	1000 ohm, ½ watt, 10%	.25
R311	9B1-199	47Kohm, ½ watt, 5%	.30
R312	9B1-48	68 ohm, ½watt, 10%	.25
R313	9B1-193	27K ohm, ½ watt, 5%	.30
R314-315	9B1-62	1000 ohm, ½ watt, 10%	.25
R316	9B1-46	47 ohm, ½ watt, 10%	.25
R317	9B1-199	47K ohm, ½ watt, 5%	.30
R318		Included with L323	
R319	9B1-62	1000 ohm, ½ watt, 10%	.25
R320	9B1-53	180 ohm, ½ watt, 10%	.25
R321	9B2-78	22K ohm, 1 watt, 10%	.30
R322	9B2-74	10K ohm, 1 watt, 10%	.30
R323	9B1-71	5600 ohm, ½ watt, 10%	.25
R324	9B1-187	15K ohm, ½ watt, 5%	.30
R325	9B1-69	3900 ohm, ½ watt, 10%	.25
R326	9B4-78	22K ohm, 2 watt, 10%	.35
R327	9B4-75	12K ohm, 2 watt, 10%	.35
Chokes, Transformers, Coils			
T300 (Incl. R301-302 & C306)	201-22456	Link input transformer assm.	2.00
T301 (Incl. C331-332-333 & L326)	13B-22430	Output transformer assm.	3.50
L300-301	12M-22482	Balun coil	.75
L302 (Incl. C304)	13M-22702	45MC Trap coil	.65
L303 (Incl. C303)	13M-22425	43MC Trap coil	.65
L304 (Incl. L302)	13M-22425	43MC Trap coil	.65
L305	201-22477	Coaxial cable assm.	.60
L306	201-22476	Coaxial cable assm.	.60
L307	201-15608	RF choke	.55
L309-310	16A-17937	Filament choke	.60
L311 (Incl. C313 & R307)	201-22562	Plate coil assembly	1.25
L312	201-22570	Grid coil assembly	.85
L313 (Incl. C314)	201-22585	Trap coil assembly	.95
L314 (Incl. C315	201-22588	Trap coil assembly	1.00
L315-316	201-15608	RF choke	.55
L317-318	16A-17937	Filament choke	.60
L319 (Incl. C321-322)	201-22426	Plate coil assembly	1.35
L320-321-322	201-15608	RF choke	.55
L323 (Incl. C327-328 & R318	201-22435	Plate coil assembly	1.60
L324	16A-23024	RF choke	.32
L325	16A-17937	Filament choke	.60
L326		Included with T301	
L327	16A-22427	Peaking coil (7½ uh)	.35
L328	16A-19365	Peaking coil (410 uh)	.30
Miscellaneous			
S-300	20B-22422	Antenna switch	1.20
VC-2	8M-21959	CK-706 Crystal	.20
	2D-22253	Chassis bolt bracket	.10
	39A-22252	Bracket insulator	.05
	15C-16007	7-pin tube socket	.15
	2M-17589	Shield base for above	.05
	2H-17588	Tube shield	.10
	15B-10440	8-pin power socket	.15
	19B-19922	Phono socket	.10
	7A-22610	UHF Antenna terminal board	.50
	19B-12515	UHF power socket	.10
	200-22722	IF Coil shield can	.20
	43D-19967	IF Coil fastener	.05
	2M-22433	Diode shield	.15
	200-22438	Diode shield cover	.40
	2C-22472	IF Shield	.05

REPLACEMENT PARTS LIST

40MC RF CHASSIS (cont'd)

Miscellaneous (Cont'd)

Ref. No.	Part No.	Description	Selling Price
	201-22414	IF Output lead assm.	.15
	201-22421	UHF Ant. transmission line assm.	.25
	200-22400	Tuner coupling arm & bushing	.30
	2C-22167	Coupling bar	.05
	49A-22223	Coupling bar spring	.05
	2M-22209	Antenna switch lever	.02
	49A-22527	Antenna switch lever spring	.05
	14MA-18385-6	UHF Jumper	.15
	200-22417	Antenna switch housing	.75
	200-22413	Antenna switch cover assm.	.60
	3A-22135	Tuning shaft	.95
	2C-22271	Shaft follower plate	.05
	2M-22554	Shaft follower spring	.05
	3M-22389	Driv-lok pin (2 used)	.02
	3B-22151	Tuning shaft collar (2 used)	.25
	52C-11339	Collar set screw (4 used)	.10
	2C-22146	Tie plate (3 used)	.05
	53A-22815	Dial drive cord	.12
	49A-22277	Cord tension spring (2 used)	.05
	4M-22149	Drive pulley	1.20
	3A-22136	Drive pulley shaft	.10
	55C-22139	Large metal ball	.02
	55C-22140	Small metal ball (3 used)	.02
	200-22153	Driven plate assm (2 used)	.85
	29E-22144	Driven plate thrust spring (2 used)	.03
	2C-22148	End plate (2 used)	.65
	2M-22270	Locking arm (2 used)	.15
	3M-22138	Locking arm pin (2 used)	.04
	49A-22273	Locking arm spring (2 used)	.04
	29C-22395	Retaining "E" ring (2 used)	.05
	200-22152	Idler pulley and shaft (2 used)	.10
	2D-22165	Coupling arm (2 used)	.05

24 INCH DEFLECTION CHASSIS

Capacitors

Ref. No.	Part No.	Description	Selling Price
C400	8J-16082	.22 mfd, 200 volt, molded	.45
C401A-B-C-D	8C-22536	10 mfd., 300 volt; 30 mfd., 300 volt; 60 mfd, 300 volt; 60 mfd, 50 volt, lytic	3.95
C402	8G-13962	5000 mmf, ceramic disk	.25
C403	8J-16085	.1 mfd, 200 volt, molded	.30
C404		Included with L401	
C405	8J-16081	.047 mfd, 400 volt, molded	.30
C406	8J-16098	.033 mfd, 200 volt, molded	.25
C407-408		Included with L404	
C409	8G-13962	5000 mmf, ceramic disk	.25
C410	8M-22982	.1 mfd, 400 volt, molded	.35
C411	8M-22694	.022 mfd, 400 volt, molded	.30
C412	8G-20269	.01 mfd, ceramic disk	.20
C413	8G-13962	5000 mmf, ceramic disk	.25
C414	8E-22538	170-780 mmf, trimmer	.70
C415	8J-20634	.0022 mfd, 400 volt, molded	.30
C416-417		Included with T400	
C418	8G-13962	5000 mmf, ceramic disk	.25
C419A-B-C	8C-22524	10 mfd, 75 volt; 10 mfd 25 volt; 20 mfd, 300 volt, lytic	2.10
C420-421	8G-20269	.01 mfd, ceramic disk	.20
C422	8J-16084	.01 mfd, 400 volt, molded	.25
C423	8G-20269	.01 mfd, ceramic disk	.20
C424	8J-20587	.47 mfd, 200 volt, molded	.55
C425	8J-16085	.1 mfd 200 volt, molded	.30
C426	8C-20557	5 mfd, 50 volt, lytic	1.25
C427	8J-16085	.1 mfd, 200 volt, molded	.30
C428	8J-20587	.47 mfd, 200 volt, molded	.55
C429	17A-22376	Printed circuit	.75
C430	8J-20592	.0047 mfd, 400 volt, molded	.25
C432	8J-16081	.047 mfd, 400 volt, molded	.30
C433	8G-13962	5000 mmf, ceramic disk	.25
C434	8J-16096	.047 mfd, 200 volt, molded	.30
C435	8J-20607	.1 mfd, 600 volt, molded	.50
C436	8C-22550	20 mfd, 450 volt, lytic	1.40
C437	8J-16097	.01 mfd, 600 volt, molded	.30
C438		Included with T406	
C439A-B	8C-22730	30 mfd, 150 volt; 200 mfd, 150 volt, lytic	3.00
C440	8C-22463	150 mfd, 150 volt, lytic	2.05
C441	8C-22464	150 mfd, 150 volt, lytic	2.15
C442	8J-16095	.22 mfd, 400 volt, molded	.30
C443	8G-19863	47 mmf, ceramic	.25
C444	8F3-117	220 mmf, 500 volt, mica	.25
C445-446	8F3-123	680 mmf, 300 volt, mica	.30
C447	8F3-117	220 mmf, 500 volt, mica	.25
C448	8J-16085	.1 mfd, 200 volt, molded	.30
C449	8J-20578	.0022 mfd, 200 volt, molded	.25
C450	8F11-132	3900 mmf, 500 volt, mica	1.15
C451	8F3-121	470 mmf, 500 volt, mica	.25
C452	8G-21440	470 mmf, 1000 volt, ceramic	.30

Resistors

Ref. No.	Part No.	Description	Selling Price
R400	9B1-82	47K ohm, ½ watt, 10%	.25
R401	9B1-102	2.2M ohm, ½ watt, 10%	.25
R402	9B1-100	1.5M ohm, ½ wat, 10%	.25
R403	9B1-76	15K ohm, ½ wat, 10%	.25
R404	9B1-86	100K ohm, ½ watt, 10%	.25
R405	9B2-86	100K ohm, 1 watt, 10%	.30
R406	9B1-76	15K ohm, ½ watt, 10%	.25
R407	10B-22306	Contrast Control—750 ohm	.85
R408	9B1-82	47K ohm, ½ watt, 10%	.25
R409	9B1-76	15K ohm, ½ watt, 10%	.25
R410	9B1-90	220K ohm, ½ watt, 10%	.25
R411	9B4-71	5600 ohm, 2 watt, 10%	.35
R412	9B1-71	5600 ohm, ½ watt, 10%	.25
R413	10B-21456	Brightness Control, 500K ohm	.75
R414	9B1-86	100K ohm, ½ watt, 10%	.25
R415	9B1-68	3300 ohm, ½ watt, 10%	.25
R416	9B1-65	1800 ohm, ½ watt, 10%	.25
R417		Included with L404	
R418	9B1-51	120 ohm, ½ watt, 10%	.25
R419	9B4-73	8200 ohm, 2 watt, 10%	.35
R420	9B1-94	470K ohm, ½ watt, 10%	.25
R421	9B1-82	47K ohm, ½ watt, 10%	.25
R422	10A-22308	Volume Control and Switch 1M ohm	1.15
R423	9B1-78	22K ohm, ½ watt, 10%	.25
R424	9B1-46	47 ohm, ½ watt, 10%	.25
R425	9B1-78	22K ohm, ½ watt, 10%	.25
R426	9B1-110	10M ohm, ½ watt, 10%	.25
R427	9B1-94	470K ohm, ½ watt, 10%	.25
R428	10B-19542	Tone Control, IM ohm	.70
R429	9B1-94	470K ohm, ½ watt, 10%	.25
R430	9B2-51	120 ohm, 1 watt, 10%	.30
R431	9B1-82	47K ohm, ½ watt, 10%	.25
R432	9C1-1072	5.6 ohm, ½ watt, 10%	.12
R434-435	9B1-82	47K ohm, ½ watt, 10%	.25
R436	9B1-90	220K ohm, ½ watt, 10%	.25
R437	9B1-95	560K ohm, ½ watt, 10%	.25
R438	9B1-104	3.3M ohm, ½ watt, 10%	.25
R439	9B1-78	22K ohm, ½ watt, 10%	.25
R440	9B1-110	10M ohm, ½ watt, 10%	.25
R441	9B1-84	68K ohm, ½ watt, 10%	.25
R442	9B1-82	47K ohm, ½ watt, 10%	.25
R443	9B1-86	100K ohm, ½ watt, 10%	.25
R444	9B1-108	6.8M ohm, ½ watt, 10%	.25
R445	10B-17318	V. Hold Control—3M ohm	.65
R446	9B1-106	4.7M ohm, ½ watt, 10%	.25
R447	10B-22307	V. Size Control—750K ohm	.75
R448	9B1-102	2.2M ohm, ½ watt, 10%	.25
R449	9B1-92	330K ohm, ½ watt, 10%	.25
R450	10B-22687	V. Linearity Control, 5000 ohm	.75
R451	9B1-90	220K ohm, ½ watt, 10%	.25
R452	9B1-62	1000 ohm, ½ watt, 10%	.25
R453-454-455		Included with T406	

24-INCH DEFLECTION CHASSIS (cont'd)

Resistors (cont'd)

Ref. No.	Part No.	Description	Selling Price
R456	46M-23018	Resistor Type Fuse	.55
R457	9M-22542	35 ohm, 15 watt	.85
R458	9M-22583	110 ohm, 25 watt	.85
R459	9M-22275	2200 ohm, 10 watt 1500 ohm, 10 watt	1.10
R460	9B1-88	150K ohm, ½ watt, 10%	.25
R461-462	9B1-102	2.2M ohm, ½ watt, 10%	.25
R463	9B1-88	150K ohm, ½ watt, 10%	.25
R464	9B1-94	470K ohm, ½ watt, 10%	.25
R465	9B1-84	68K ohm, ½ watt, 10%	.25
R466	9B1-98	1M ohm, ½ watt, 10%	.25
R467	9B1-64	1500 ohm, ½ watt, 10%	.25
R468	9B1-98	1M ohm, ½ watt, 10%	.25
R469	9B2-71	5600 ohm, 1 watt, 10%	.30
R470	9B1-90	220K ohm, ½ watt, 10%	.25
R471	10B-17764	H. Hold Control, 50K ohm	.65

Chokes, Transformers, Coils

Ref. No.	Part No.	Description	Selling Price
T400	13M-22303	Ratio detector transformer	2.20
T401	12C-22508	Audio output transformer	1.95
T402	12M-18241	Vertical oscillator transformer	1.75
T403	12C-20761-2	Vertical output transformer	5.05
T405	12A-22509	Power transformer	15.20
T406	201-22857	Deflection Yoke Assembly	17.50
L400	16A-19365	Peaking Coil (240 UH)	.30
L401 (Incl. C404)	201-22571	Video trap coil assembly	1.30
L402-403	16A-19365	Peaking coil (240 UH)	.30
L404	201-22582	Sound pick-off coil	1.45
L406	16A-22584	Filter choke	2.00
L407-408	16A-22448	Filter choke	2.80
L409	201-22949	H. Hold coil	.70

Miscellaneous

Ref. No.	Part No.	Description	Selling Price
	2D-22253	Chassis bolt bracket	.10
	39A-22252	Bracket insulator	.05
	41M-22358	Front control insulator	.80
	15C-16007	7-pin tube socket	.15
	2M-17589	7-pin tube shield base	.05
	2H-17588	Tube shield	.10
	15B-21968	6S4 tube socket	.25
	15C-22595	9-pin socket and spring assm.	.30
	19A-22525	Speaker socket	.10
	19B-22672	Vertical yoke socket	.10
	15B-21186	Lytic mounting plate for C441	.10
	15B-22731	Lytic mounting plate for C439	.12
	19B-22541	H. V. power socket	.40
	7M-22266	R456 terminal board	.25
	7M-22267	Video input terminal board	.25
	43F-15390	Control mounting nut (9 used)	.03
	20A-22479	Phono-TV switch	1.00
	21J-22274	Selenium rectifier	4.75
	15B-17278-10	CRT socket and cable	1.15
	201-22444	R.F. power plug and cable	.75
	201-22551	AC line and phono cable assm. (Includes 5 items below)	.60
	41M-22434	Mounting plate	.15
	19A-19446	AC receptacle	.20
	19B-19922	Phono socket	.10
	14B-20286	49-inch shielded wire	.15
	55A-19313	8-inch sleeving	.15
	51A-19322	Iron core for L409	.15
	43D-11666-1	Coil fastener for L409	.03
	2D-11490	Large condenser mounting clip	.10
	2D-12053	Small condenser mounting clip	.05
	47A-22513	Pilot light bracket & socket (right)	.25
	47A-22592	Pilot light bracket & socket (left)	.25
	37A-22512	Pilot light shield	.05
	46A-10793	Pilot light bulb (T47)	.15
	46B-16510	Shielded wire	.10
	3A-22575	Tuning shaft	.75
	5M-22451	Tuning shaft coupling	.25

24" HIGH VOLTAGE SUPPLY

Capacitors

Ref. No.	Part No.	Description	Selling Price
C500	8F3-118	270 mmf, 500 volt, mica	.25
C501	8E-22538	170-780 mmf, H. Drive trimmer	.70
C502	8C-19546	20 mfd, 150 volt, lytic	1.05
C504	8J-20596	.068 mfd, 400 volt, molded	.35
C505	8J-16081	.047 mfd, 400 volt, molded	.30
C506	8J-16096	.047 mfd, 200 volt, molded	.30

Resistors

Ref. No.	Part No.	Description	Selling Price
R500	9B1-71	5600 ohm, ½ watt, 10%	.25
R501	9B1-88	150K ohm, ½ watt, 10%	.25
R502	9B4-72	6800 ohm, 2 watt, 10%	.35
R503	9B1-98	1 megohm, ½ watt, 10%	.25
R504	9B1-54	220 ohm, ½ watt, 10%	.25
R505	9B4-80	33K ohm, 2 watt, 10%	.35
R506	9B2-14	1500 ohm, 1 watt, 10%	.30
R507	9B2-38	10 ohm, 1 watt, 10%	.30

Chokes, Transformers, Coils

Ref. No.	Part No.	Description	Selling Price
T500	201-22382	H. V. Deflection transformer	11.25
L500	201-20186-1	H. Linearity coil	.75

Miscellaneous

Ref. No.	Part No.	Description	Selling Price
	2D-22253	Chassis bolt bracket	.10
	39A-22252	Bracket insulator	.05
	15B-22335	Yoke socket	.25
	15B-10440	25CD6 tube socket	.15
	15B-20860	12AX4 tube socket	.20
	201-22591	Dual H. V. power plug	1.70
	2D-12053	Mounting clip for C502	.05
	201-20817-1	1B3 Socket assembly	1.20
	6M-20296	Socket cover	.15
	14C-22282-20	H. V. Cable assembly	.55
	6M-14372	Cable clamp	.10
	2B-22162	Shield can	1.00
	2B-22164	Shield can cover	.35
	49A-22633	Ring	.05
	49A-23029	Retainer spring	.15
	51A-19322	Iron core for L500	.15
	43D-19967	Coil fastener for L500	.05
	49A-19012	Core spring for L500	.05

CRT MOUNTING ASSEMBLY

Ref. No.	Part No.	Description	Selling Price
	200-22852	Tube strap assm. (Includes 3 items below)	2.00
	2M-22665	Tube strap	.95
	2D-22666	Tube strap bracket	.25
	2D-22660	Tube mounting bracket	.50
	25M-22630	Tube cushion	.45
	23M-22706	Carriage bolt (2 used)	.10
	43A14-22707	Carriage bolt nut	.05
	200-22872	Tube support bracket assm.	2.25
	25M-22754	Retaining ring	.35
	3M-22727	Tie rod	.25
	49A-22865	Spring	.25
	38A-22678	H.V. Cable retainer shield	.03
	16M-22873	Anti-pin cushion magnet	.75
	16M-20697	Centering magnet	1.00
	16M-19906	Ion trap magnet	1.00
	32T8-20807	Yoke wing nut	.05
	201-22857	Deflection yoke assm (small) (Includes 5 items below)	17.50
	13M-22810	Deflection yoke	14.50
	9B1-62	1000 ohm, ½ watt, 10%	.25
	8G-22875	47 mmf, 1000 volt, ceramic	.35
	201-22489-1	Horizontal yoke cable	.85
	201-22690	Vertical yoke cable	.40

	DESCRIPTION	CHASSIS NUMBER
1260	20" Mahogany Table Model Television Receiver With Built-in Antenna	456.150 456.150-2
1261	20" Mahogany Table Model Television Receiver With Built-in Antenna	456.150-2
1266	20" Mahogany Consolette Model Television Receiver with Built-in Antenna	456.150 456.150-2
1268-21	21" Mahogany Console Model Television Receiver With Built-in Antenna	456.150-1
1270-21	21" Mahogany Console Model Television Receiver With Built-in Antenna	456.150-1
1271-21	21" Mahogany Console Model Television Receiver With Built-in Antenna	456.150-1
1272-21	21" Oak Console Model Television Receiver With Built-in Antenna	456.150-1
1273-21	21" Oak Console Model Television Receiver With Built-in Antenna	456-150-1
1274-21	21" Maple Console Model Television Receiver With Built-in Antenna	456.150-1
1275-21	21" Maple Console Model Television Receiver With Built-in Antenna	456.150-1
4120	20" Table Model Television Receiver With Built-in Antenna, Available in Mahogany, Maple, Oak, and Walnut	456.150 456.150-2

TUBE COMPLEMENT

V1	6CB6	1st I.F. Amplifier	V13	*12BH7	Vertical Deflection Amplifier
V2	6CB6	2nd I.F. Amplifier	V14	6SN7	Horizontal Oscillator and Control Tube
V3	6CB6	3rd I.F. Amplifier	V15	6AU5	Horizontal Deflection Amplifier
V4	12AX7	Video Detector and Noise Balance Tube	V16	6W4	Damper
V5	6CB6	Video Amplifier	V17	1B3	High Voltage Rectifier
V6	6AU6	Audio I.F. Amplifier	V18	5U4	Low Voltage Rectifier
V7	6AL5	Ratio Detector	V19	20CP4	20" Rect. Glass Picture Tube (Chassis 456.150 and 456.150-2)
V8	6AV6	1st Audio Amplifier	V19	21AP4	21" Rect. Metal Picture Tube (Chassis 456.150-1)
V9	6AQ5	Audio Output			
V10	12AU7	Sync Separator			
V11	6AU6	AGC Tube			
V12	6AV6	Vert. Oscillator and Noise Balance Bias Rectifier			

*Type 6S4 used in Chassis 456.150 only.

TUNER

V20	6CB6, 6BC5, or 6AG5	R. F. Amplifier	V21	6J6	Mixer - Osc.

CHASSIS DIFFERENCES

The chassis used in the models differ mainly with respect to picture tube size and type, and the associated picture tube mounting parts. Chassis 456.150 and 456.150-2 use a 20 inch glass rectangular picture tube, and chassis 456.150-1 uses a 21 inch metal rectangular picture tube. Chassis 456.150 differs somewhat in tube complement and circuitry from its successors chassis 456.150-1 and 456.150-2. The vertical sweep output tube in the 456.150 chassis was a type 6S4. This was changed in the later models to a type 12BH7. Other changes were made in the video amplifier output circuits. These differences can be seen in the schematic diagrams and Repair Parts List.

NOISE BALANCE CONTROL

This Silvertone television chassis is equipped with a unique circuit which allows it to perform satisfactorily in the presence of interference of the type encountered in fringe areas and congested business locations. It is particularly effective on the type of noise caused by automobiles, street cars, electrical storms, etc. To adjust for best performance under these conditions turn the channel selector to the strongest station which can be received. Start with the Noise Balance control in the fully clockwise position and then adjust it slowly counterclockwise until the picture just starts to show a distorted shape, then advance the control slightly so that the picture shape is normal. Turn the channel selector to all other stations one at a time. If the picture shape is distorted on any channel advance the control slightly clockwise to restore normal shape. The Noise Balance control is now set.

NOTE - WHENEVER DISTORTED PICTURES OR SLANTING BARS ARE ENCOUNTERED WHICH CANNOT BE ADJUSTED CORRECTLY WITH THE HORIZONTAL LOCK OR FINE TUNING CONTROLS ALWAYS SET THE NOISE BALANCE CONTROL FULLY CLOCKWISE BEFORE MAKING OTHER ADJUSTMENTS.

SERVICE ADJUSTMENTS

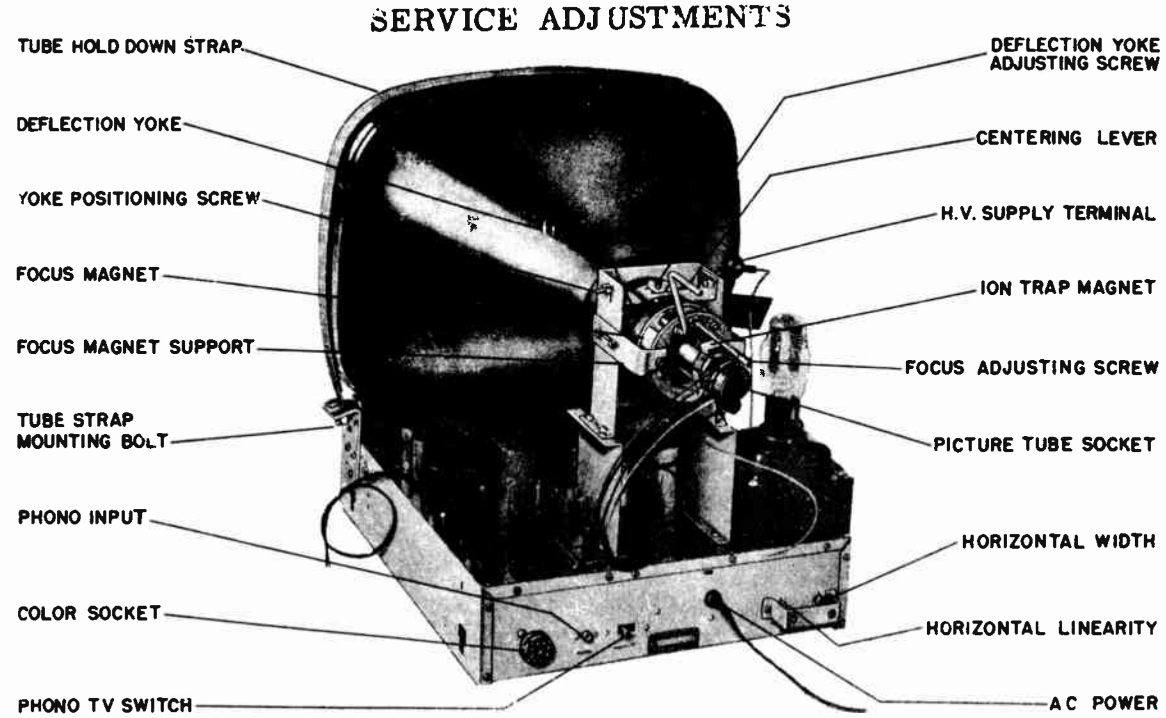


FIGURE 4

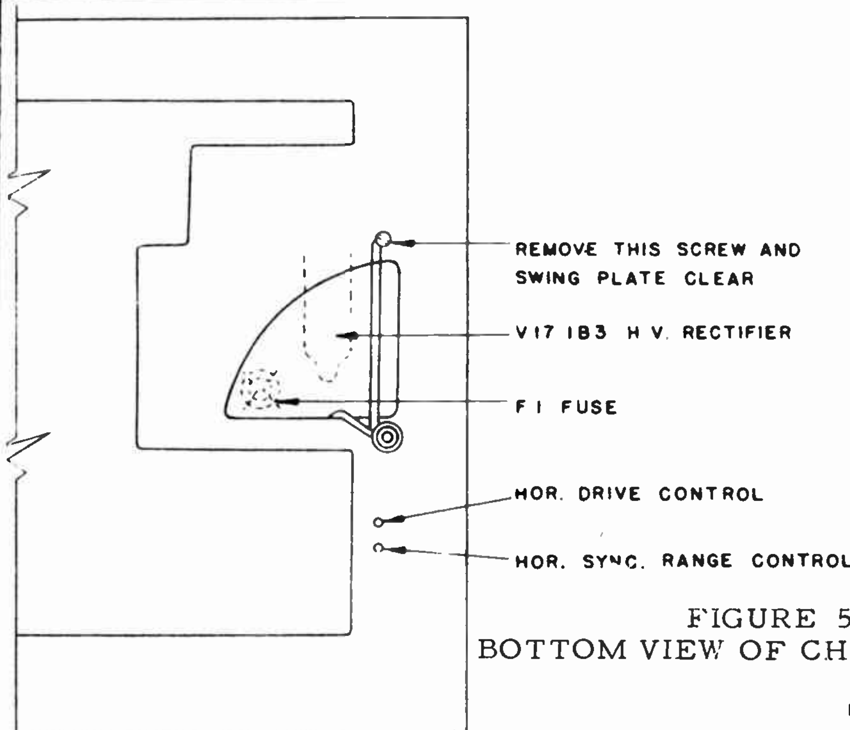


FIGURE 5
BOTTOM VIEW OF CHASSIS SHELF

The Service Adjustments normally will need an occasional minor adjustment if any circuit work or tube replacement is required. A test pattern, generated either locally in the shop or obtained from a television station is recommended for best results. The operating and auxiliary controls, located on the front panel and the rear apron should be set for as good a pattern as possible before making the following adjustments.

CENTERING MISADJUSTMENTS

If the picture is not properly centered move the Centering Control Lever on the rear of the receiver a short distance in any direction necessary to correctly center the picture. Do not use force in making this adjustment as excessive strain may be exerted on the neck of the picture tube. If proper centering cannot be restored in this manner a slight readjustment of the deflection yoke or focus magnet mountings may be necessary.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT

1. Turn the Horizontal Hold control (front panel auxiliary controls) to the extreme counterclockwise position, and momentarily interrupt the signal by switching to another channel and then switching back again. The picture should hold horizontal sync.

2. Turn the Horizontal Hold control fully clockwise and momentarily interrupt the signal. The picture should break sync and resolve into approximately 3 sloping bars.

3. Rotating the Horizontal Hold control counterclockwise (within 1/2 turn) should make the picture lock in.

If the receiver passes the above checks, the horizontal oscillator is adjusted and need not be aligned. In that case, merely set the Horizontal Hold control to a position where the picture locks in instantly when switching channels.

HORIZONTAL OSCILLATOR ALIGNMENT

1. Set the NOISE BALANCE control to maximum clockwise.
2. Connect the oscilloscope to terminal "D" on the synchroguide transformer T8 through a small capacitor approximately 15 mmfd, or use a low capacity probe.
3. Set the HORIZONTAL LOCK to 1/4 rotation from counterclockwise side.
4. Adjust front screw of synchroguide to lock picture horizontally.
5. Set drive control C51b to show bright drive line in center of raster, then screw in 1 turn.
6. Adjust inside core of synchroguide can to give correct scope waveform (a). Readjust front screw simultaneously to keep in sync. Use non-metallic screwdriver on inside core.

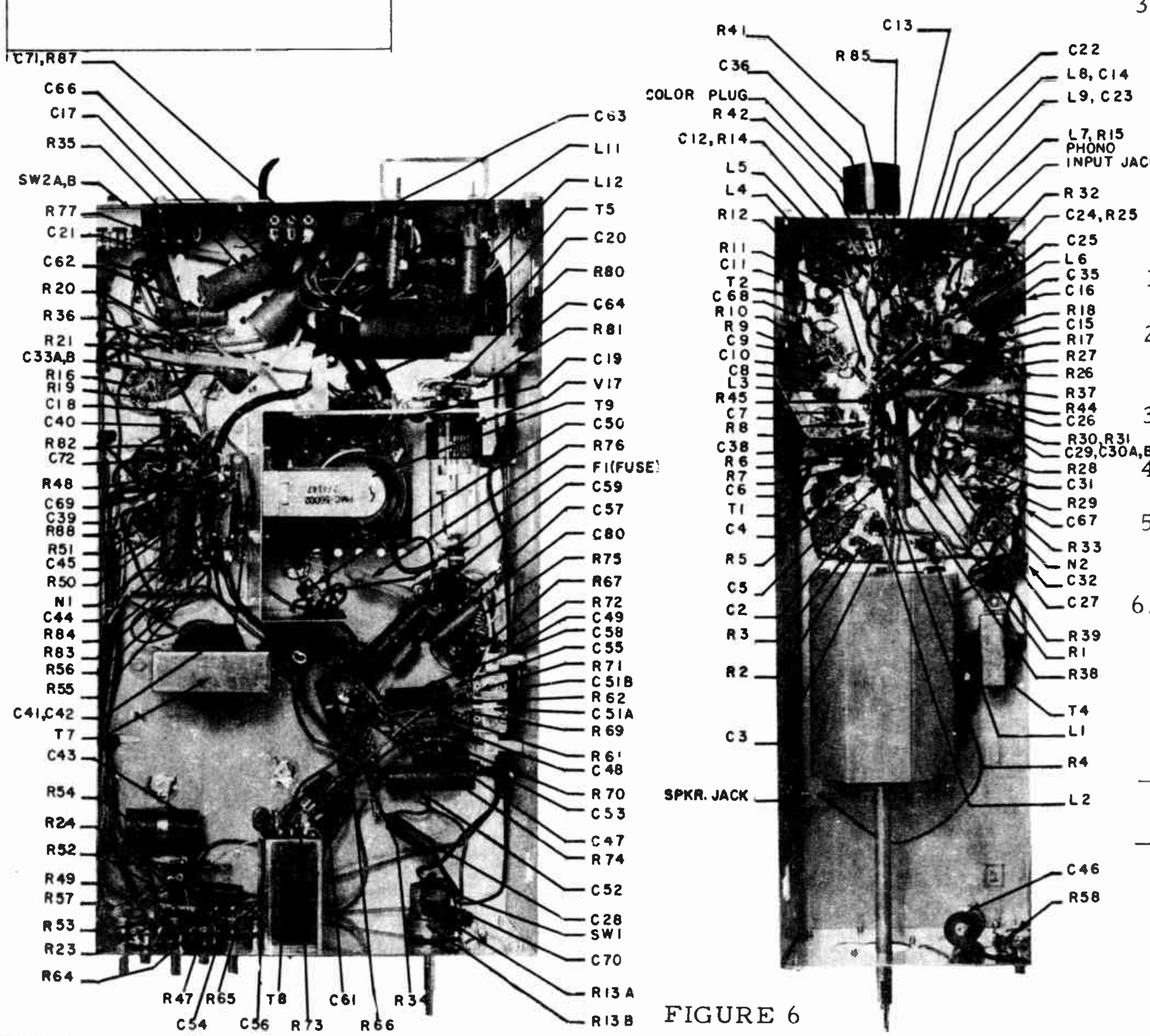


FIGURE 6

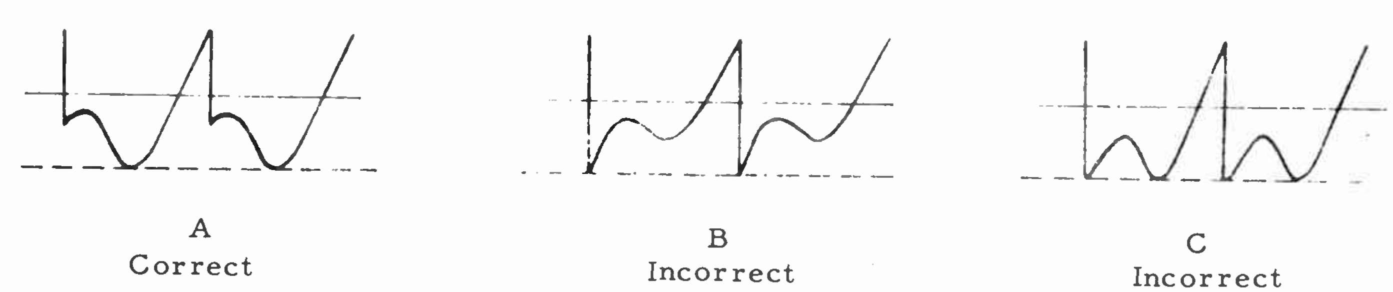


FIGURE 14

HORIZONTAL OSCILLATOR ALIGNMENT - Continued

7. Trim front screw to get approximately 3 bars breakout with HORIZONTAL LOCK in maximum clockwise position when switching channels. Sync should hold in maximum counterclockwise position and picture should not jitter at any position of the HORIZONTAL LOCK control. If it does jitter leave the HORIZONTAL LOCK in maximum counterclockwise position and adjust front screw of the synchroguide in clockwise direction until the jitter stops. Recheck breakout on clockwise end when switching channels. Horizontal sync should pull in when switching channels over at least 1/2 of the rotation range of the HORIZONTAL LOCK control. If it does not, unscrew sync amplitude control C51a 1/4 turn at a time until correct lock-in range is established.

TELEVISION ALIGNMENT PROCEDURE

NOTE:

Always set noise balance control fully clockwise before making any alignment tests or adjustments.

Preliminary

This alignment is an exacting procedure and should be undertaken only when necessary. Before deciding that alignment is necessary, check the following:

IN HOME OF CUSTOMER:

1. Be sure of the antenna installation.
2. Check all operating controls and adjustments.
3. Check reception on all channels.
4. Check tubes by substitution of known good tubes.

IN THE REPAIR SHOP

5. Substitute a known good picture tube.
6. If picture definition is still inadequate, observe the overall I.F. response curve by following step (11) below

ALIGNMENT PROCEDURE

1. TEST EQUIPMENT

CATHODE RAY OSCILLOSCOPE

SWEEP GENERATOR - The sweep generator used should cover the range from 20 to 220 megacycles. The output should be flat over a sweep range of 20 Mc. It should be capable of an output of about 0.1 volt.

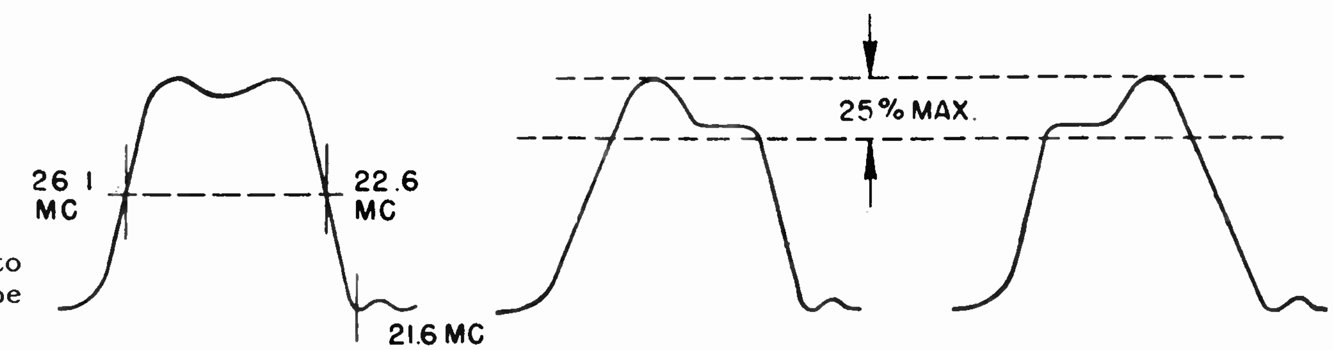
AM SIGNAL GENERATOR - This generator should have a frequency range of from 4.0 to 220 megacycles. As this generator is used occasionally as a marker generator, accuracy is an important factor. It should be capable of 0.1 volt output.

VACUUM TUBE VOLTMETER - Almost any standard VTVM will do. It should preferably have a reversible polarity switch.

I. F. ALIGNMENT

1. Lift the top section of the shield on the 6J6 mixer so that the shield does not make electrical contact with the base of the shield. Connect the output of the AM signal generator to the shield, and the ground lead to the chassis.
2. Connect the VTVM across R12, 4.7K video detector load.
3. Set the volume and contrast controls to minimum position.
4. Tune the signal generator to 24.35 Mc. and attenuate the signal generator output for a reading of -1 to -1.5 volts to avoid overload and consequent inaccurate alignment.
5. Peak the fourth I.F. transformer T2 to 24.35 Mc. keeping the VTVM reading at -1 to -1.5 volts by adjustment of the attenuator on the signal generator.
6. Connect a 1K resistor from the grid of V1 to the junction of R2 and R4. Adjust the first I.F. coil located (L9 Fig. I) on the tuner for a maximum reading on the VTVM of between -1 and -1.5 volts. Remove the 1K resistor.
7. Place the tuner turret so that it is between any two channels and adjust L1 for maximum indication on the VTVM. (Note: On sets below serial number 10525 L1 is fixed and step 7 should be disregarded for these sets.)
8. Peak the third I.F. coil L3 to 23.2 Mc. keeping the VTVM reading at -1 to -1.5 volts.
9. Tune the signal generator to 25.2 Mc. and adjust the second I.F. transformer T1 for maximum keeping the VTVM reading at -1 to -1.5 volts.
10. Adjust the signal generator to 21.6 Mc. and tune the trap L2 for a minimum reading.
11. The I.F. passband may be observed by connecting a sweep generator across the terminals of the AM signal generator, connected as in (1), and substituting an oscilloscope for the VTVM as described in the above procedure. Place a 3V battery with the positive terminal connected to the chassis and the negative terminal connected to the junction of R2 and R4. The sweep generator should be set to approximately 24.35 Mc. and then adjusted to center the waveform on the scope face. To avoid overload, and to assure a true view of the wave shape, the output of the sweep generator should be attenuated until further attenuation has a minimum effect on the curve shape.

If necessary a slight adjustment of the I.F. transformers may be made to obtain a close approximation to the ideal curve. Adjustment of T2 affects the slope of the top, while adjustment of L3 or T1 affects the bandwidth.



Correct Acceptable Acceptable

G
FIGURE 15

I. F. ALIGNMENT CHART

Signal Generator Frequency AM	Adjustment	V.T.V.M. Indication
24.35 Mc.	T2	Maximum
24.35 Mc.	1st I.F. Coil on Tuner (See step 6 in text for detailed instructions)	Maximum
24.35 Mc. (With tuner turret between channels) *	L1	Maximum
23.2 Mc.	L3	Maximum
25.2 Mc.	T1	Maximum
21.6 Mc.	L2	Minimum

(*) This adjustment can be disregarded on those few early chassis which had a FIXED L1.

SOUND ALIGNMENT

Connect an AM signal generator tuned to 4.5 Mc. between the grid of V5 (6CB6) and ground. Connect the alignment test circuit as shown below, and tune L8 for a minimum reading on the VTVM.

47 mmf Mica

100,000 1/2 W

Connect to Pin No. 11 of Picture Tube

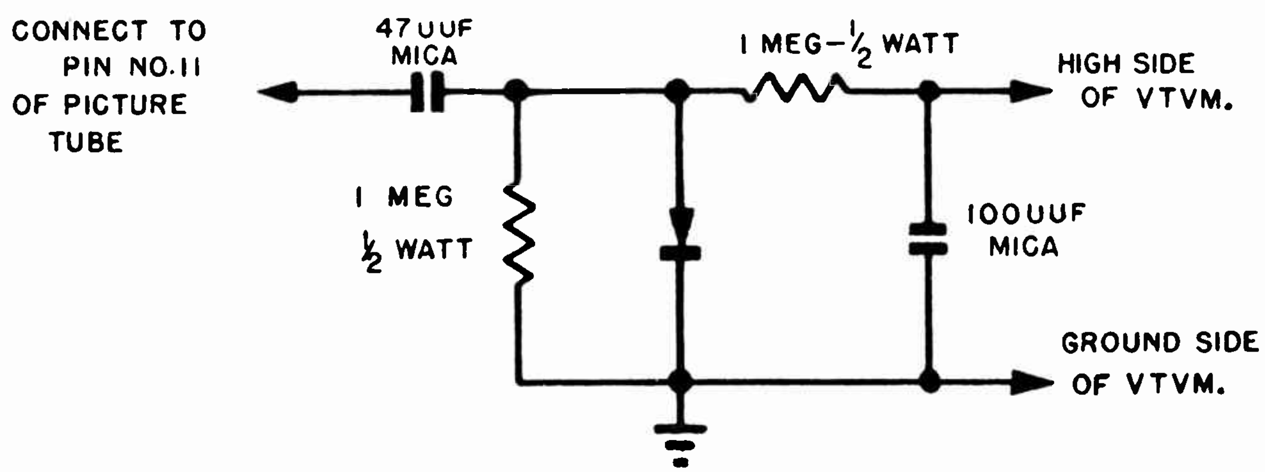
Connect High Side of V.T.V.M. here

1 Meg 1/2 W

1N34 Crystal

Ground Lead of V.T.V.M.

Gnd



SOUND ALIGNMENT TEST CIRCUIT

2. Disconnect the alignment test circuit and connect the VTVM to ground and Pin 5 of V7 (6AL5). Adjust L9 and primiary (Bottom) of the ratio detector transformer for maximum indication.

3. Remove the VTVM and reconnect it to ground and junction of R27 and R28. Adjust secondary of ratio detector coil (top) for zero. (Note: When tuning through the proper setting, the meter reading should swing negative on one side and positive on the other side.)

TELEVISION CHANNELS VS. CARRIER, OSCILLATOR & I. F. FREQUENCIES

Chan. No.	Channel Freq. (Mc.)	Picture Carrier	Sound Carrier	Receiver Osc.Freq.(Mc)	Picture I.F. Freq.(Mc)	Sound I.F. Freq. (Mc)	Picture I.F. Less Sound I.F. (Mc)
2	54-60	55.25	59.75	81.35	26.1	21.6	4.5
3	60-66	61.25	65.75	87.35	26.1	21.6	4.5
4	66-72	67.25	71.75	93.35	26.1	21.6	4.5
5	76-82	77.25	81.75	103.35	26.1	21.6	4.5
6	82-88	83.25	87.75	109.35	26.1	21.6	4.5
7	174-180	175.25	179.75	201.35	26.1	21.6	4.5
8	180-186	181.25	185.75	207.35	26.1	21.6	4.5
9	186-192	187.25	191.75	213.35	26.1	21.6	4.5
10	192-198	193.25	197.75	219.35	26.1	21.6	4.5
11	198-204	199.25	203.75	225.35	26.1	21.6	4.5
12	204-210	205.25	209.75	231.35	26.1	21.6	4.5
13	210-216	211.25	215.75	237.35	26.1	21.6	4.5

TUNER ALIGNMENT

The tuner supplied with this television receiver was carefully aligned at the factory and should not require complete realignment under normal conditions. A slight readjustment of the individual oscillator slugs may be required as the tubes in the tuner age or are replaced. In some rare cases it will be necessary to realign the tuner after replacing either of the two tubes. If any service work is performed on the tuner, realignment may or may not be required. NO ATTEMPT TO REALIGN THE TUNER SHOULD BE MADE UNTIL THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITION AND IS PROPERLY ALIGNED. When replacing the R. F. amplifier tube use the same type tube as the one found in the tuner. The other alternate tubes may be used for V-20 but the use of a tube other than the type found in the tuner may make it necessary to realign the R. F. and mixer stages.

R. F. AND MIXER ALIGNMENT

1. Set the CHANNEL SELECTOR to Channel 12.
2. Connect the oscilloscope through a 10,000 ohms resistor to test point (Fig. 1).

3. Connect the negative side of a 1.5 volt battery to the AGC lead of the tuner which is soldered to the blank lug of L2. The positive side of the battery should be connected to the receiver chassis.
4. Set the FINE TUNING control at the approximate midpoint of its tuning range.
5. Connect the sweep generator to the 300 ohm antenna terminals and adjust the output to sweep Channel 12.
6. Loosely couple the output from the marker generator to the antenna terminals. Use the minimum amount of coupling and signal from the marker generator required to give a good marker or pip on the oscilloscope pattern.
7. Adjust A1, A2, and A16 in the tuner for maximum gain and flat-top response curve approximately 4.5 mc. wide. All other channels should be checked to be sure they have approximately the same responses. The correct marker frequencies for each channel are given in the Picture Carrier and Sound Carrier columns of the chart on page 16. The response to the two marker frequencies should be essentially equal.
8. Disconnect the battery used to obtain negative bias.
9. Disconnect the test equipment and air check the receiver on all active channels. If it is possible to receive a normal picture on all active channels by adjusting the Fine Tuning control, further alignment will not be necessary.

OSCILLATOR ALIGNMENT

1. Set the Fine Tuning control at the approximate midpoint of its tuning range.
2. Place a non-metallic screwdriver through the openings provided in the front of the chassis and the tuner assembly and adjust the individual oscillator coil slug for each active channel to give the best possible picture. (A3 - A14 Fig. 1) This is usually the point just before sound breakup occurs.

If the oscillator slug adjustment does not have sufficient range to tune in a good picture on any active channel, it will be necessary to adjust (A15) in the tuner. The procedure for this adjustment is as follows:

WITH INSTRUMENTS

3. Set the Channel Selector to Channel 12.
4. Connect the marker generator to one of the 300 ohm antenna terminals and ground. Set the generator to 209.753 Mc.
5. Connect the output of another signal generator through 47,000 ohm resistor to Pin 3, the cathode of V4, the 12AX7 video detector and adjust the signal generator frequency to 26.1 Mc.

WITHOUT INSTRUMENTS

3. Set the Channel Selector switch to any channel on which a picture or test pattern can be received. Preferably select a station operating on the highest frequency.
4. Adjust A15 for best possible picture.
5. Repeat steps 1 and 2.
6. Repeat steps 3 through 5 if necessary

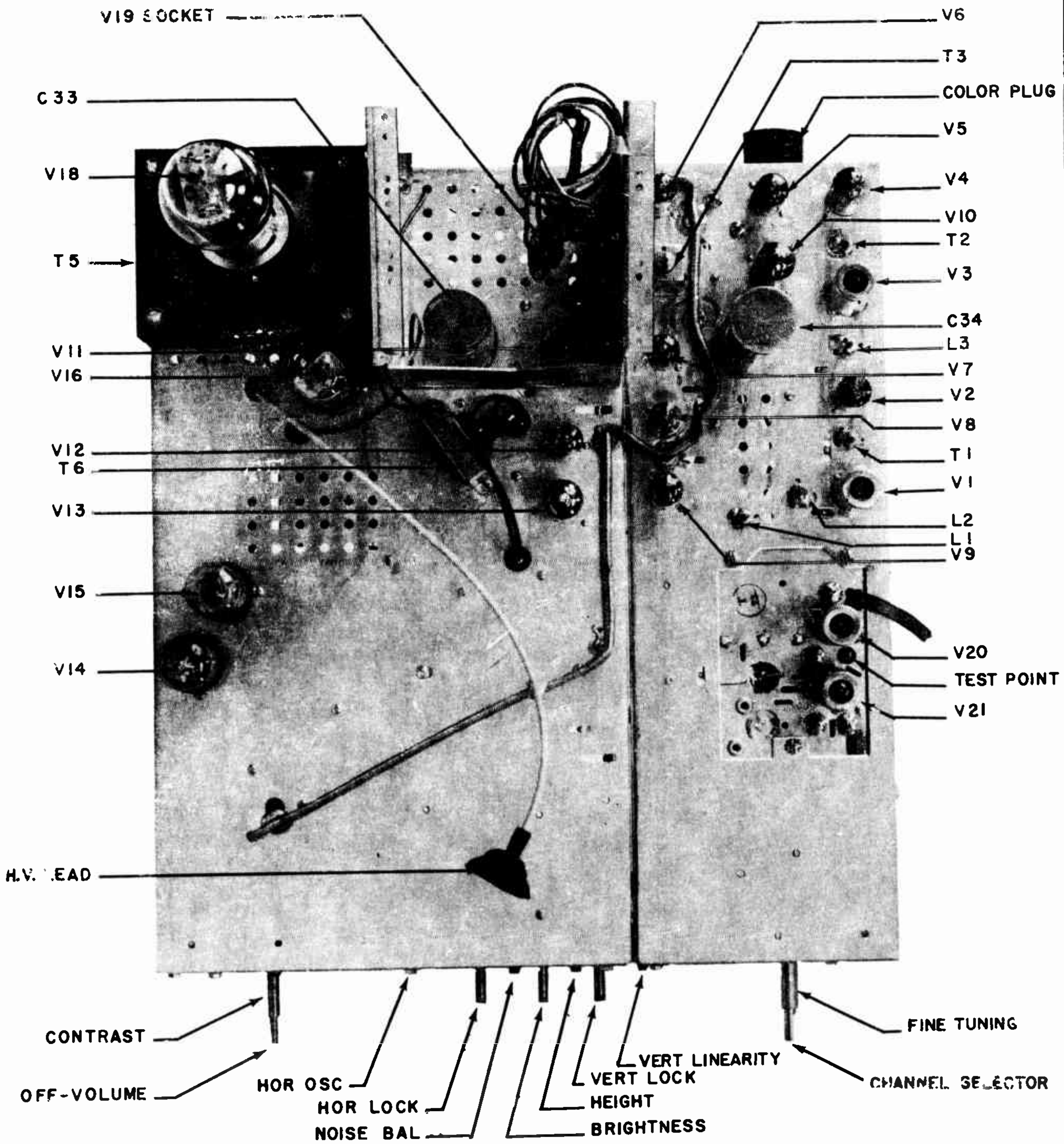


FIGURE 17
TOP VIEW - COMPONENT LOCATION

6. Connect the VTVM across C26 and adjust A15 for a zero reading on the VTVM between a positive and negative peak.
7. Use the lowest signal generator output which will provide an adequate meter indication.
8. Repeat steps 1 and 2.
9. Repeat steps 3 through 8 if necessary.

NOTES

1. Last C - 62; last R - 88. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,818, Terminal 1, N2 connected directly to 290 B+.
   b. After serial No. 46,264, Linearity coil (L-11) and capacitor C-63 eliminated from circuit and Pin 3, V16, directly connected to jumper between terminals 7 & 8, T9.
   c. After serial No. 46,889 by-pass capacitors C-70 & C-71 eliminated from primary of T-5.
   d. After serial No. 46,610, a 220 UUF by-pass capacitor (C-73) added from Pin 7, V4 to ground
   e. Previous serial No. 47,610 C-25 connected Pin 2 to Pin 7, V8.

† C-19 100 UUF, 456.150-2
470 UUF, 456.150-1.

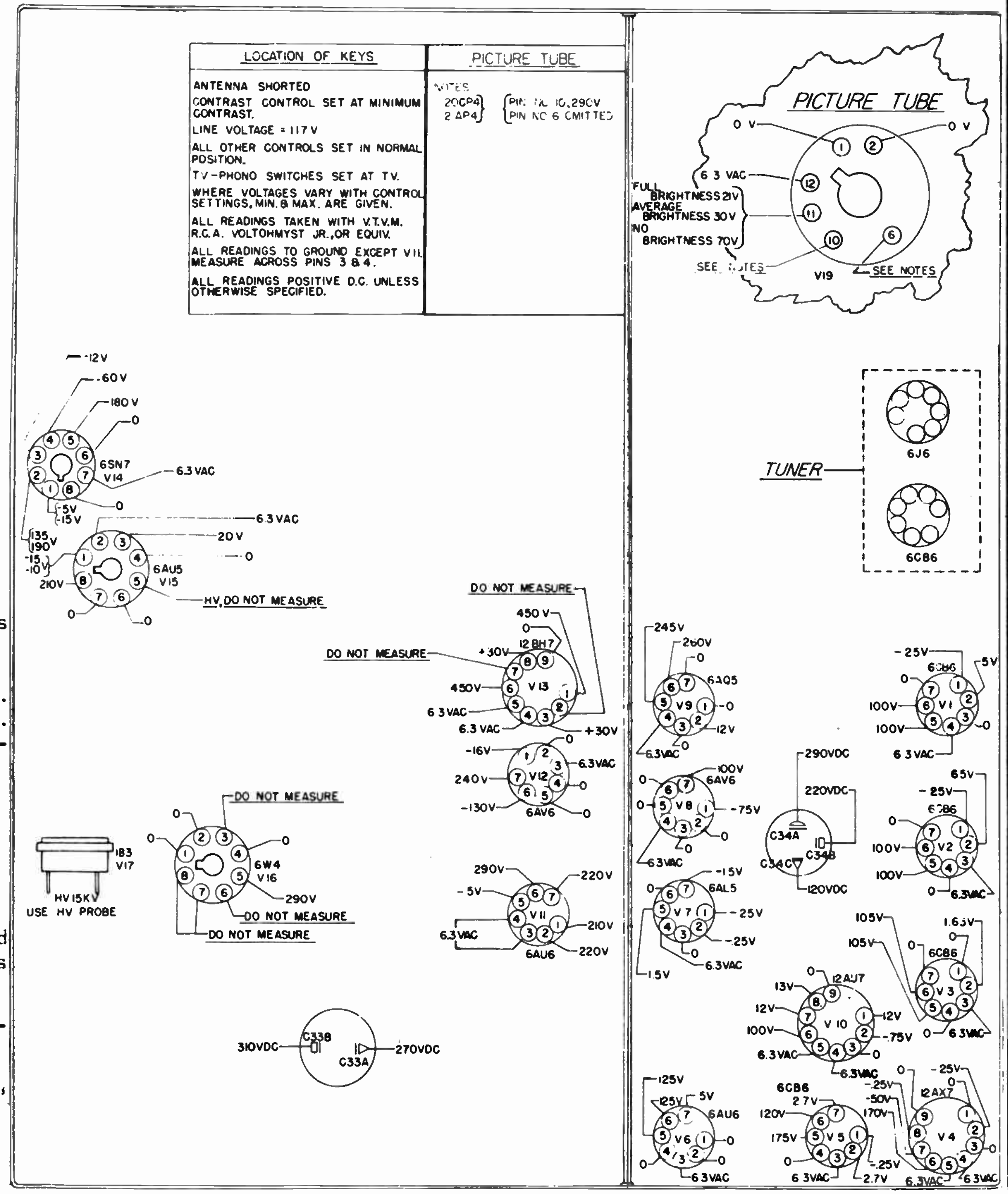
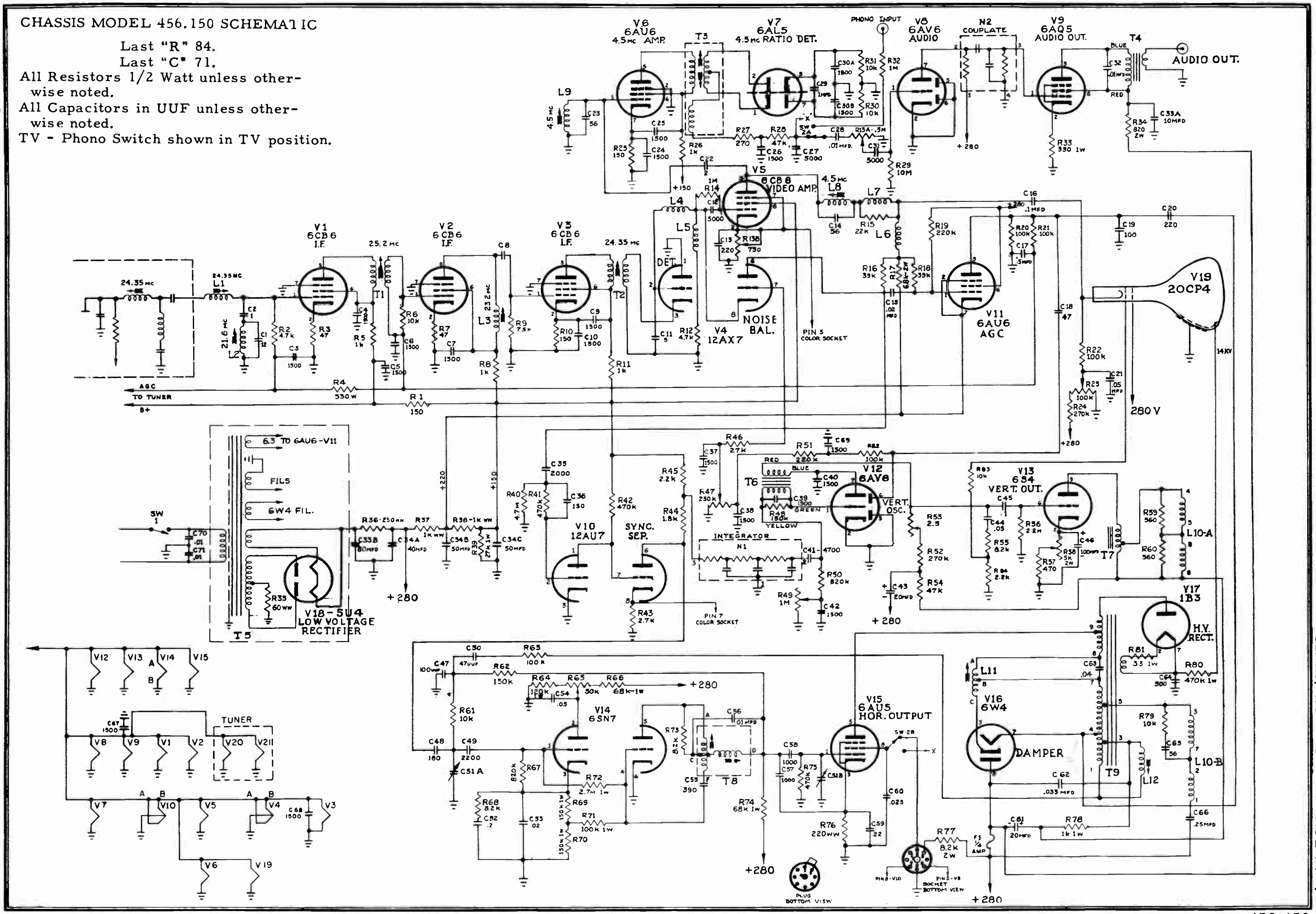


FIGURE 18
VOLTAGE CHART
CHASSIS NOS. 456.150-1
456.150-2

CHASSIS MODEL 456.150 SCHEMATIC

Last "R" 84.
Last "C" 71.

All Resistors 1/2 Watt unless otherwise noted.
All Capacitors in UUF unless otherwise noted.
TV - Phono Switch shown in TV position.

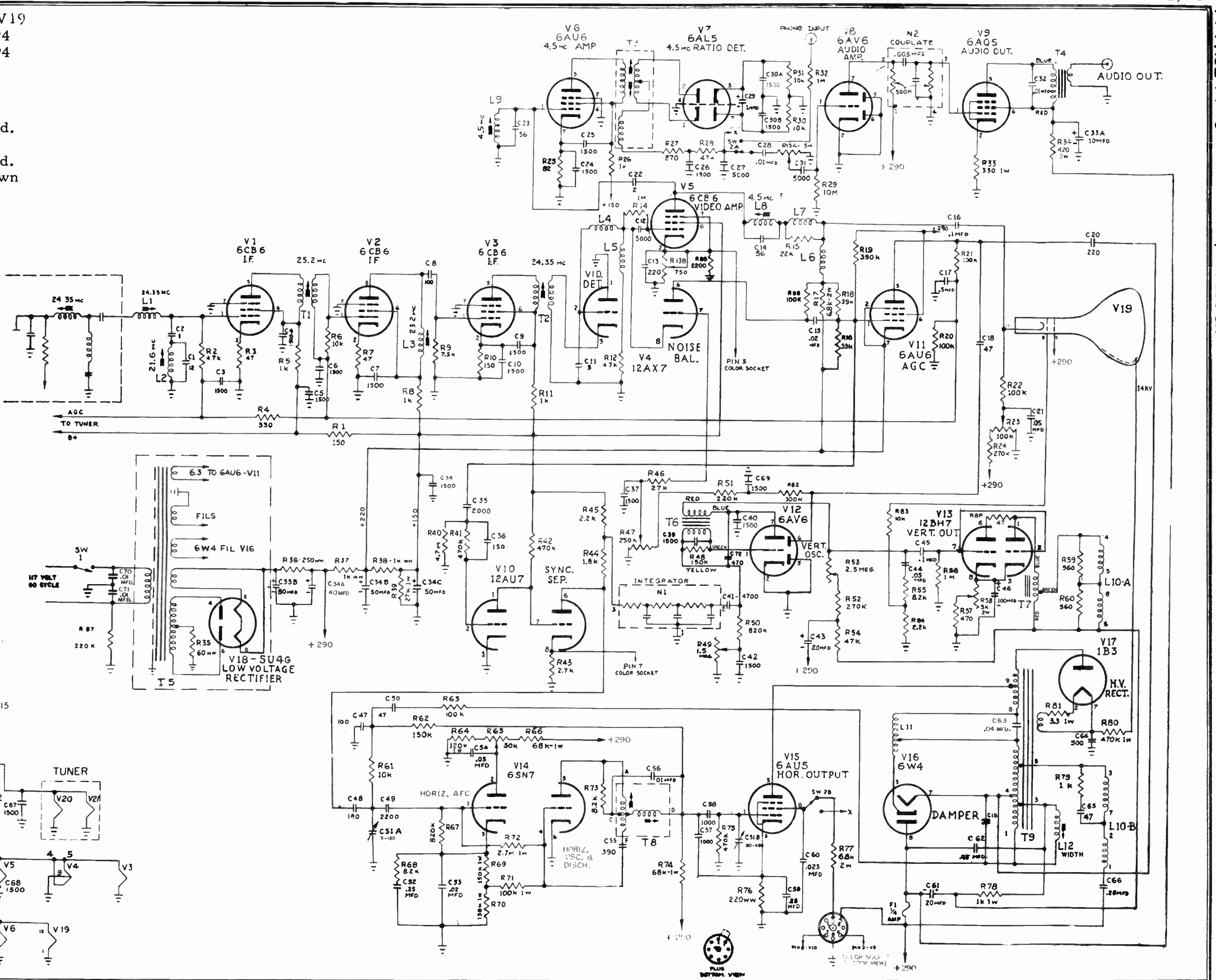


CHASSIS MODEL NO. V19

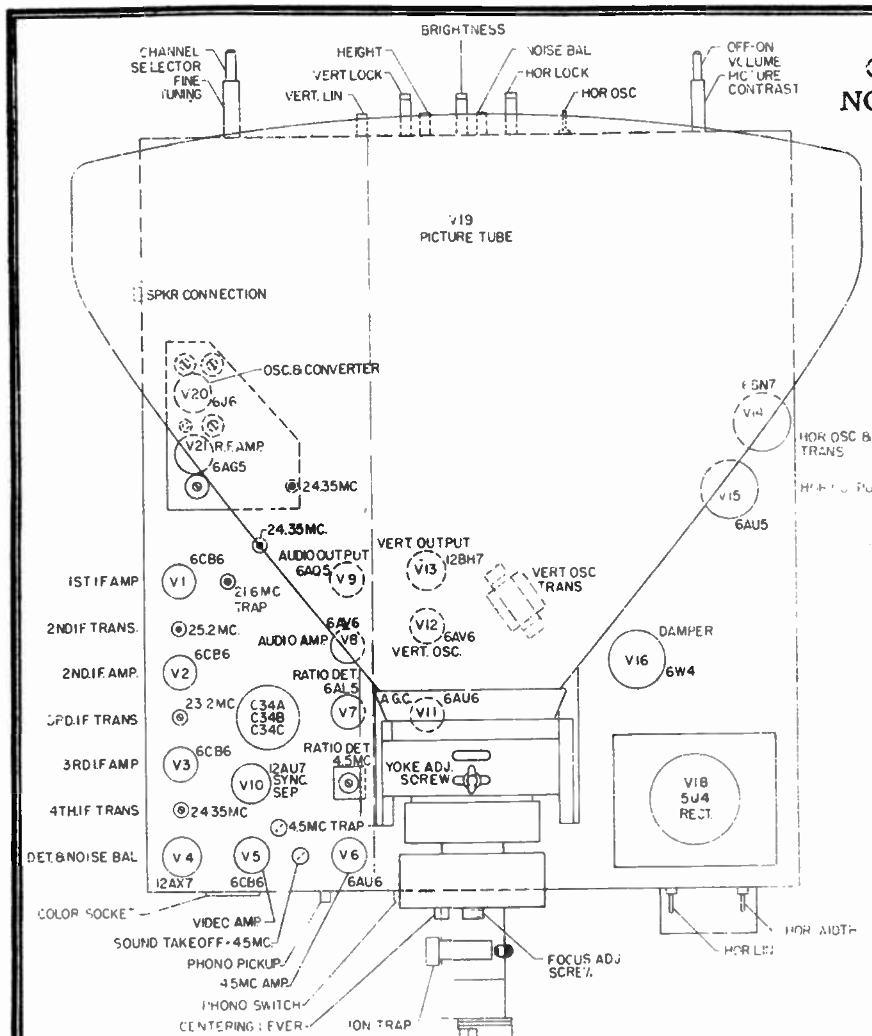
456.150-1	21AP4
456.150-2	20CP4

Last "R" 88.
Last "C" 72.

All Resistors 1/2 Watt unless otherwise noted.
All Capacitors in UUF unless otherwise noted.
TV - Phono Switch shown in TV position.
R87 & R88 not used in early sets.



TOP VIEW
CHASSIS COMPONENTS
NOS. 456.150-1 - 456.150-2



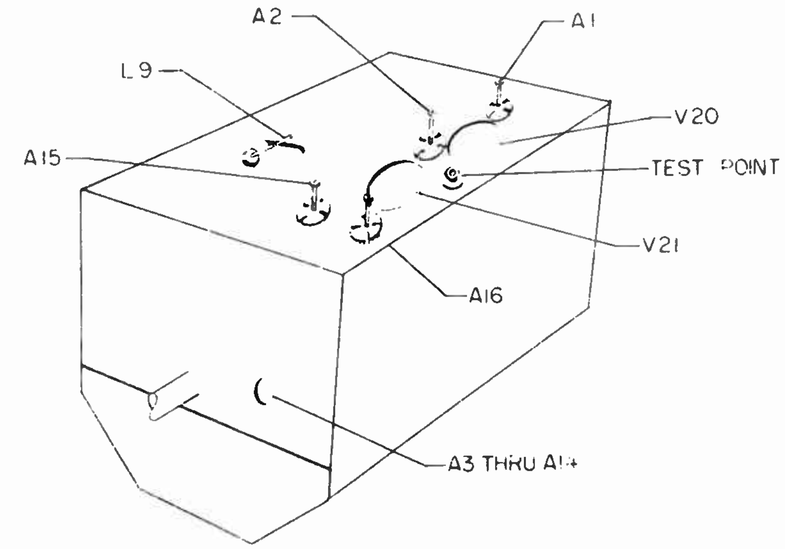
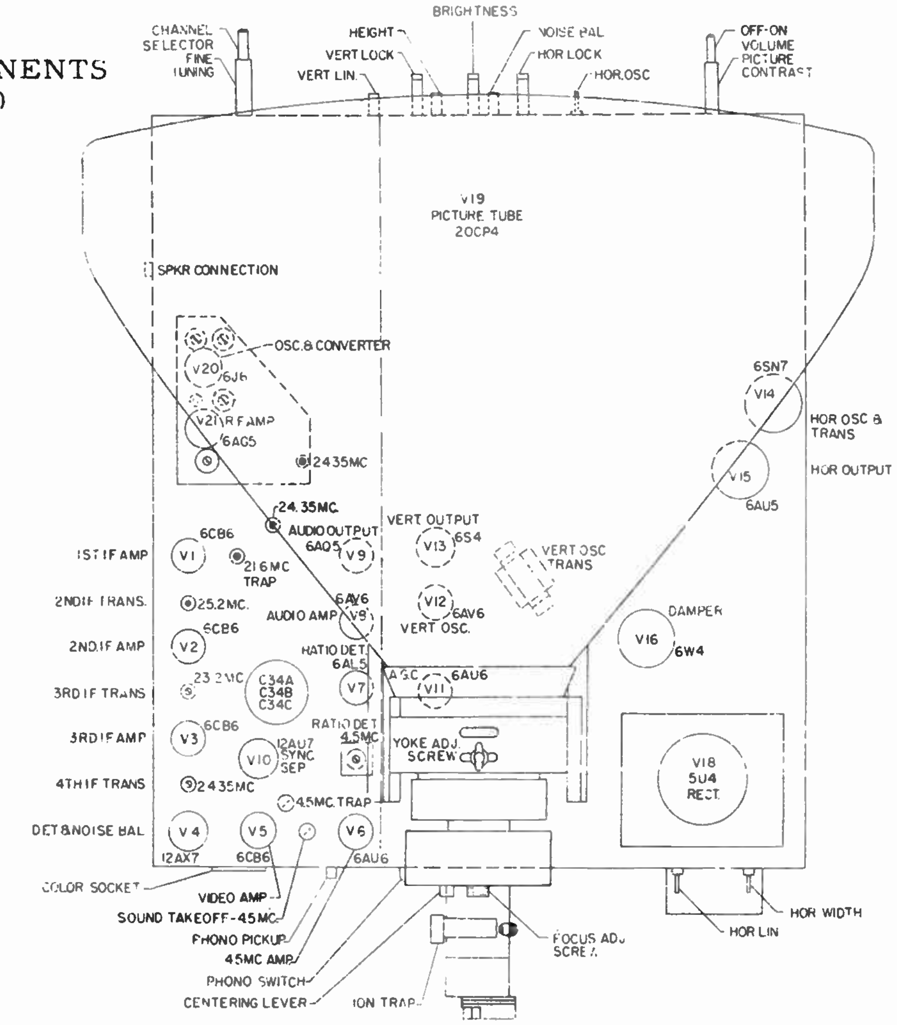
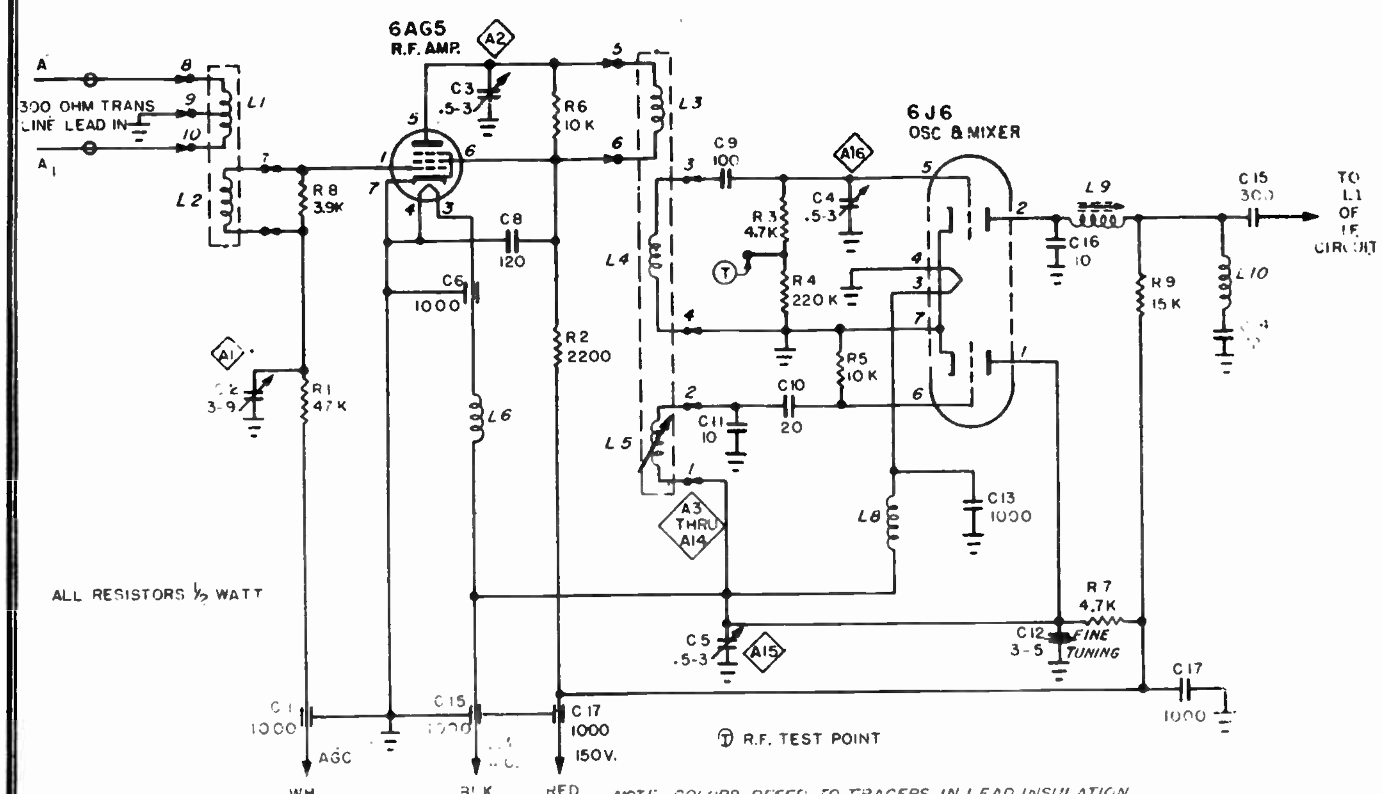


FIGURE 19

TOP VIEW
CHASSIS COMPONENTS
NO. 456.150





REPAIR PARTS LIST FOR TUNER PMB-57001

PMA-31B-302 thru 31B-313 (channels 2 thru 13)	Antenna Coil Assemblies	2.14
PMA-31B-410 thru 31B-413 (channels 10 thru 13)	Oscillator Coil Assemblies	2.56
PMA-31B-422 thru 31B-429 (channels 2 thru 9)	Oscillator Coil Assemblies	2.56
PMA-31A-066-68	Fine Tuning Assembly	3.13
PMA-31B-005	Detent Spring	.43
PMA-31B-016-2	Roller	.43
PMA-31B-277	I. F. Coil Assembly	3.46
PMA-31B-030	Retainer Spring	.43
PMA-27A-055	6J6 Tube Shield	.29
PMA-27A-021	6AG5 Tube Shield	.29
PMA-31B-267	Contact Bracket Assembly	8.19
PMA-31B-203-68	Coil Support Assembly	9.56
PMA-31B-012-1343	Fine Tuner Ground Plate	.86
PMA-31B-043	Side Shield	2.14
PMA-31B-044	Bottom Shield	2.56

REPAIR PARTS LIST FOR 150 CHASSIS

All items same as chassis 150-1 and 150-2, except:

C65	PMB-40003-17	Capacitor - 56 mmf, 1000 V, Mica	.52
R56	PMA-45015-65	Resistor - 2.2 Meg, 1/2 Watt	.15
R77	PMA-45019-6	Resistor - 8.2K, 2 Watt	.45
R19	PMA-45015-53	Resistor - 220K, 1/2 Watt	.15
R49	PMA-48014-4	1 Meg. Variable, Vertical Hold	1.45

Part Number	DESCRIPTION	Selling Price Each
PM-90012	Speaker 8" PM.	6.46
PMA-90012	Speaker 8" PM.	6.46
PM-90017	Speaker 10" PM	7.64
PMA-90018	Speaker 5" PM.	$ 4.76
PMA-90019	Speaker 8" PM (may be used as alternate)	6.00

REPAIR PARTS LIST FOR 150-1 AND 150-2 CHASSIS

Schematic Symbol	Part Number	DESCRIPTION	Selling Price Each
L1,L3	PMA-52021	I.F. Coil - 24 mc.	$ 1.45
L2	PMA-52020	I.F. Trap - 21.5 mc.	1.70
L4	PMA-52023	Peaking Coil - 100 uh	.68
L5,L6	PMA-52024	Peaking Coil - 450 uh	.68
L7 and R15	PMA-52025	Peaking Coil - 200 uh - Wound on 22K Resistor	.83
L8 and C14	PMA-52028-2	Take-off Trap - 4.5 mc.	1.70
L9 and C23	PMA-52028-1	Take-off Trap - 4.5 mc.	1.70
L10a,L10b	PMA-56000	Yoke	9.57
L11	PMA-56001	Linearity Coil	2.50
L12	PMA-56003	Width Coil	2.34
N1	PMA-95000	Vertical Integrating Network	1.70
N2	PMA-95001	Audio Couplate	1.38
	PMA-62004	Plug - Color Adapter	.40
R1,R10	PMA-45015-15	Resistor - 150 Ohms, 1/2 Watt	.15
R2,R12	PMA-45015-33	Resistor - 4.7K, 1/2 Watt	.15
R3,R7,R88(*)	PMA-45015-9	Resistor - 47 Ohms, 1/2 Watt	.15
R4	PMA-45015-19	Resistor - 330 Ohms, 1/2 Watt	.15
R5,R8,R11,R26,R79	PMA-45015-25	Resistor - 1000 Ohms, 1/2 Watt	.15
R6,R30,R31,R61,R83	PMA-45015-37	Resistor - 10K, 1/2 Watt	.15
R9	PMA-45014-70	Resistor - 7.5K, 1/2 Watt	.30
R13a,R13b,SW1	PMB-48015	.5 Meg, 750 Ohms, Variable Volume, Contrast Control, with Switch	3.95
R14,R32,R56(**)	PMA-45015-61	Resistor - 1 Meg, 1/2 Watt	.15
R16,R18	PMA-45015-44	Resistor - 39K, 1/2 Watt	.15
R17,R77(**)	PMA-45019-35	Resistor - 6.8K, 2 Watt	.15
R19(**)	PMA-45015-56	Resistor - 390K, 1/2 Watt	.15
R20,R21,R22,R63,R82, R86 (*)	PMA-45015-49	Resistor - 100K, 1/2 Watt	.15
R23	PMB-48014-2	100K - Variable, Brightness Control	1.45
R24,R52	PMA-45015-54	Resistor - 270K, 1/2 Watt	.15
R25	PMA-45015-12	Resistor - 82 Ohms, 1/2 Watt	.15
R27	PMA-45015-18	Resistor - 270 Ohms, 1/2 Watt	.15
R28,R54	PMA-45015-45	Resistor - 47K, 1/2 Watt	.15
R29	PMA-45015-73	Resistor - 10 Meg, 1/2 Watt	.15
R33	PMA-45017-19	Resistor - 330 Ohms, 1/2 Watt	.15
R34	PMA-45019-24	Resistor - 820 Ohms, 2 Watt	.45
R35	PMB-47007-4	Resistor - 60 Ohms, 6 Watt, Wire-Wound	.68
R36	PMB-47007-5	Resistor - 250 Ohms, 15 Watt, Wire-Wound	.68
R37,R38	PMB-47007-1	Resistor - 1K, 7.5 Watt, Wire-Wound	.68
R39	PMA-45017-42	Resistor - 27K, 1 Watt	.30
R40	PMA-45015-69	Resistor - 4.7 Meg, 1/2 Watt	.15
R41,R42,R75	PMA-45015-57	Resistor - 470K, 1/2 Watt	.15
R43	PMA-45015-30	Resistor - 2.7K, 1/2 Watt	.15
R44	PMA-45015-28	Resistor - 1800 Ohms, 1/2 Watt	.15
R45,R84,R85 (*)	PMA-45015-29	Resistor - 2200 Ohms, 1/2 Watt	.15
R46	PMA-45015-42	Resistor - 27K, 1/2 Watt	.15
R47	PMB-48014-3	Resistor - 250K, Variable Noise Inverter Control	1.45
R48,R62	PMA-45015-51	Resistor - 150K, 1/2 Watt	.15
R49(**)	PMB-48014-7	1.5 Meg, Variable, Vertical Hold Control	1.45
R50,R67	PMA-45015-60	Resistor - 820K, 1/2 Watt	.15
R51,R87 (*)(#)	PMA-45015-53	Resistor - 220K, 1/2 Watt	.15
R53	PMB-48014-5	2.5 Meg, Variable, Vertical Height Control	1.45
R57	PMA-45015-21	Resistor - 470 Ohms, 1/2 Watt	.15
R58	PMA-48016	5K, Variable, Vertical Linearity Control	1.45
R59,R60	PMA-45015-22	Resistor - 460 Ohms, 1/2 Watt	.15
R64	PMA-45017-50	Resistor - 120K, 1 Watt	.30
R65	PMB-48014-1	50K, Variable, Horizontal Hold Control	1.45
R66,R74	PMA-45017-47	Resistor - 68K, 1Watt	.30
R69,R70	PMA-45017-51	Resistor - 150K, 1 Watt	.30
R71	PMA-45017-49	Resistor - 100K, 1 Watt	.30
R72	PMA-45017-66	Resistor - 2.7K, 1 Watt	.30
R76	PMB-47007-3	Resistor - 220 Ohms, 4 Watt	.68
R78	PMA-47017-25	Resistor - 1K, 1 Watt	.30
R80	PMA-45017-57	Resistor - 470K, 1 Watt	.30
R81	PMA-45013-1	Resistor - 3.3 Ohms, 1/2 Watt	.15
SW2	PMA-60004	Switch, Slide Lever, TV-Phono, DPDT	.68
	PMA-61106	Socket, 9-Pin Molded Base	.26
	PMB-61012-1	Socket, 7-Pin Miniature Wafer	.20
	PMB-61012-2	Socket, 9-Pin Miniature Wafer	.23
	PMB-61012-4	Socket, Octal Molded (for V15 and V16)	.25
	PMB-61011	Socket, Octal Molded (for V17)	.25
	PMB-61012-3	Socket, Octal Molded (for V14 and Color Socket)	.25
	PMA-61014	Socket, Picture Tube, with 20" Leads	1.45

(*) Not used in 150 chassis. (**) See Additional List for value used in 150 chassis.
† All AA5 unless otherwise noted.
(#) Used only in chassis 150-1 and 150-2 with serial numbers above approximately 22,000, or those WITHOUT the Armite support for the H.V. Lead.

REPAIR PARTS LIST FOR 150-1 AND 150-2 CHASSIS

Schematic Symbol	Part Number	DESCRIPTION	Selling Price Each
C1		Capacitor - 12 mmf, 500 V, Ceramic (part of L2)	$ .29
C2	PMA-40519-1	Capacitor - 1 mmf, Composition	.17
C3,C4,C5,C6,C7,C9 C10,C24,C25,C26,C37, C38,C42,C67,C68,C69	PMA-40517-2	Capacitor - 1500 mmf, 500 V, Ceramic	.34
C8,C47	PMB-40518-14	Capacitor - 100 mmf, 500 V, Ceramic	.29
C11	PMB-40518-1	Capacitor - 5 mmf, 500 V, Ceramic	.29
C12,C31	PMA-40517-3	Capacitor - 5000 mmf, 500 V, Ceramic	.34
C13	PMB-40518-19	Capacitor - 220 mmf, 500 V, Ceramic	.29
C14,C23		Capacitor - 56 mmf, 500 V, Ceramic (part of L8 & L9)	.29
C15,C53	PMB-41006-9	Capacitor - .02 mfd, 200 V, Paper	.34
C16,C45	PMB-41006-51	Capacitor - .1 mfd, 600 V, Paper	.50
C17	PMB-41008	Capacitor - .5 mfd, 100 V, Paper	.86
C18,C50	PMB-40003-15	Capacitor - 47 mmf, 500 V, Mica	.29
C19,	PMA-40005-2	Capacitor - 100 mmf, 1500 V, Mica	.52
C20	PMA-40005-1	Capacitor - 220 mmf, 1500 V, Mica	.50
C21,C54	PMB-41006-30	Capacitor - .05 mfd, 400 V, Paper	.40
C22	PMB-40519-3	Capacitor - 2 mmf, Composition	.17
C27	PMB-40518-32	Capacitor - 5000 mmf, 500 V, Ceramic	.34
C28	PMB-41006-7	Capacitor - .01 mfd, 200 V, Paper	.34
C29	PMA-42002	Capacitor - 1 mfd, 50 V, Paper	1.48
C30a,C30b	PMA-40517-4	Capacitor - 1500 mmf, 500 V, Ceramic Dual	.52
C32	PMB-41006-45	Capacitor - .01 mfd, 600 V, Paper	.34
C33a,C33b	PMA-42000	Capacitor - 80 mfd, 450 V, 10 mfd, 400 V Electrolytic	4.90
C34a,C34b,C34c	PMA-42001	Capacitor - 40 mfd, 450 V, 50 mfd, 400 V 50 mfd, 300 V, Electrolytic	5.06
C35	PMB-40518-27	Capacitor - 2000 mmf, 500 V, Ceramic	.34
C36	PMB-40518-17	Capacitor - 150 mmf, 500 V, Ceramic	.29
C39,C40	PMB-40518-24	Capacitor - 1500 mmf, 500 V, Ceramic	.34
C41	PMB-40003-63	Capacitor - 4700 mmf, 500 V, Mica	1.28
C43,C61	PMA-42006	Capacitor - 20 mfd, 300 V, Paper Case Electrolytic	2.62
C44	PMB-41006-49	Capacitor - .05 mfd, 600 V, Paper	.52
C46	PMA-42005	Capacitor - 100 mfd, 50 V, Paper Case Electrolytic	2.57
C48	PMB-40003-29	Capacitor - 180 mmf, 500 V, Mica	.34
C49	PMB-40003-55	Capacitor - 2200 mmf, 500 V, Mica	.83
C51a,C51b	PMA-43001	Capacitor - 9 to 180 mmf, 80 to 480 mmf, Mica Trimmers	1.37
C52,C59	PMB-41006-15	Capacitor - .25 mfd, 200 V, Paper	.59
C55	PMB-40003-37	Capacitor - 390 mmf, 500 V, Mica	.52
C56	PMA-41009	Capacitor - .01 mfd, 200 V, Oil Filled, Paper	.34
C57	PMB-4003-47	Capacitor - 1000 mmf, 500 V, Mica	.59
C58	PMB-41006-39	Capacitor - .001 mfd, 600 V, Paper	.29
C60	PMB-41006-47	Capacitor - .025 mfd, 600 V, Paper	.40
C62	PMB-41006-75	Capacitor - .03 mfd, 400 V, Paper	.40
C63	PMB-41006-76	Capacitor - .04 mfd, 400 V, Paper	.40
C64	PMA-40004	Capacitor - 500 mmf, 20 KV, Mica	2.62
C65(**)	PMB-40002-15	Capacitor - 47 mmf, 1000 V, Mica	.34
C66	PMB-41006-53	Capacitor - .25 mfd, 600 V, Paper	.86
C70,C71	PMA-41007-45	Capacitor - .01 mfd, 600 V, Molded Bakelite Paper	.52
C72 (*)	PMA-40518-23	Capacitor - 470 mmf, 500 V, Ceramic	.34
F1	PMA-95002-1	Fuse - 1/4 Amp., 250 V, Type 3AG	.29
	PMA-62001	Jack - Speaker & Phono Connection, Similar to Cinch 8134	.20

(*) Not used in 150 chassis. (**) See Additional List for value used in 150 chassis.

REPAIR PARTS LIST FOR 150-1 AND 150-2 CHASSIS - Continued

Schematic Symbol	Part Number	DESCRIPTION	Selling Price Each
T1	PMA-52029	Bifilar I. F. Coil	$ 1.28
T2	PMA-52029-2	Bifilar I. F. Coil	1.28
T3	PMA-52027	4.5 Mc. Ratio Detector Transformer	3.70
T4	PMB-51005	Audio Output Transformer	2.63
T5	PMB-50003	Power Transformer	21.84
T6	PMA-56005	Vertical Oscillator Transformer	3.07
T7	PMA-56004	Vertical Output Transformer	4.64
T8	PMB-52019	Synchroguide	3.60
T9	PMC-56002	Horizontal Output Transformer	8.43

This supplement covers certain modifications in the basic 456.150 Series television receiver chassis described in 57 RL 639. These modifications entail the use of one or more of the following:

A. Electrostatic focus picture tube.
B. Twenty tube chassis.
C. Rotary switch tuner (PMB-57003).

The model numbers of chassis which have these modifications, are:

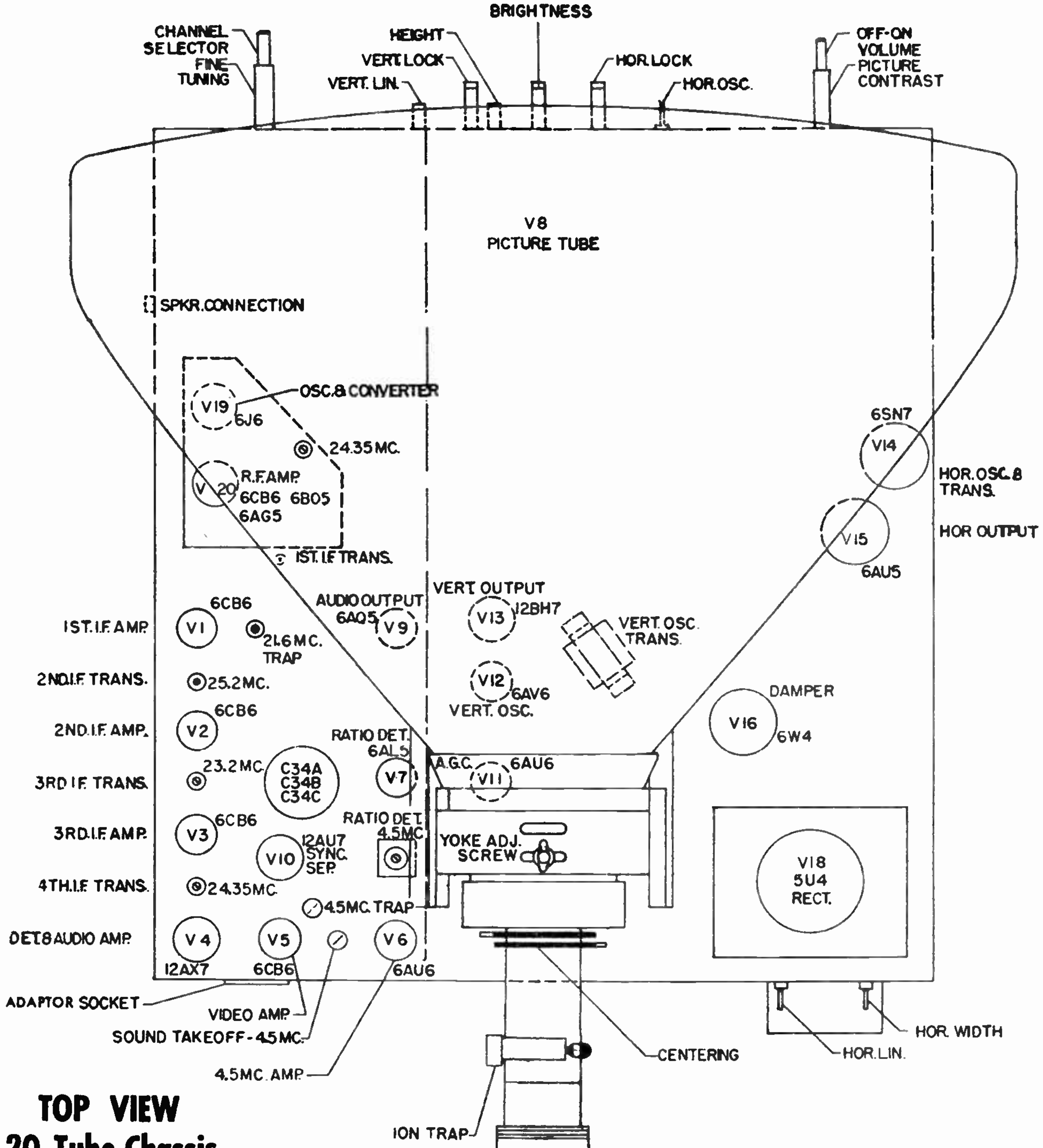
CHASSIS MODEL NUMBER	ELECTROSTATIC-FOCUS PICTURE TUBE SIZE	ELECTROSTATIC-FOCUS PICTURE TUBE TYPE	R-F TUNER	CHASSIS CIRCUIT
456.150-3	21"	21MP4	Turret Pentode (PMB-57001)*	20 Tube
456.150-6	20"	20HP4/20MP4	Rotary Switch (PMB-57003)†	21 Tube*
456.150-7	17"	17HP4	Rotary Switch	20 Tube
456.150-9	17"	17HP4	Turret Pentode*	21 Tube*
456.150-12	17"	17HP4	Turret Pentode*	20 Tube
456.150-13	20"	20HP4/20MP4	Turret Pentode*	21 Tube*
456.150-17	17"	17HP4	Rotary Switch	21 Tube*

*This is the chassis circuit and tuner described in Service Instructions 57 RL 639.
†Chassis 456.150-6 used the Rotary Switch tuner only in limited production. It is now being produced with Turret Pentode tuner.

The Chassis Listed Above Are Used in the Following Models:

CATALOG NO.	TYPE	CHASSIS NUMBERS
1260*	Table Model	456.150-6
1266*	Consolette	456.150-6
1299	Table Model	456.150-7; 456.150-9; 456.150-12; 456.150-17
2260*	Table Model	456.150-6
2266	Consolette	456.150-6
2280	Table Model	456.150-6; 456.150-13
2286	Consolette	456.150-6
2287	Consolette	456.150-6
2289	Table Model	456.150-9; 456.150-12; 456.150-17
2290	Consolette	456.150-9; 456.150-17
2297	Consolette	456.150-3
2298	Consolette	456.150-3

*Some units of these models also contain the chassis described in Service Instructions 57 RL 639.



TOP VIEW
20 Tube Chassis

ALL MODELS USING THE TWENTY TUBE CHASSIS

The twenty tube chassis is similar to the basic chassis described in Service Instructions 57 RL 639 except for the omission of the Noise Balance circuit.

The second half of V-4 (Type 12AX7), which formerly functioned as the Noise Balance Control, is used as the audio amplifier in these models, and V-8, the type 6AV6 tube, which was formerly used for audio amplification is omitted. There is no coupling between the two halves of the twin triode V-4, in the twenty tube receivers even though they are in the same envelope. The output from the first half, the video detector, is coupled to the video amplifier (V-5) only. The signal input to the second half of V-4 is taken off the potentiometer, R13A (Volume Control), across which is developed the audio signal voltage from the 4.5 Mc ratio detector, V-7. There is no phono jack on the twenty tube chassis. The voltage reading on the pins of V-4 are as follows:

VIDEO DETECTOR PIN NO.	VIDEO DETECTOR VOLTAGE	FUNCTION	AUDIO AMPLIFIER PIN NO.	AUDIO AMPLIFIER VOLTAGE
1	0	Plate	6	100
2	—.25	Control Grid	7	—.75
3	0	Cathode	8	0
4	6.3 AC	Filament	5	6.3 AC

Pin No. 9 is a common ground for both halves of the filament. The voltage readings on the pins of the other tubes in the twenty tube chassis are the same as for the twenty-one tube chassis described in Service Instructions

ALL MODELS USING AN ELECTROSTATIC FOCUS PICTURE TUBE

The use of an electrostatic focus picture tube requires no change in the basic 456.150 Series chassis circuit described in Service Instructions The voltage for the focusing element, Pin 6 (Omitted on electromagnetic focus tubes), is applied to the corresponding pin in the picture tube socket of all chassis. This voltage is taken from a binding post on a terminal strip, and is derived, by means of a jumper, from the red lead of the vertical output transformer (T-7). This terminal is also the source for the voltage on Pin 10 of the 20HP4, 20MP4, and 21MP4 type tubes. Pin 10 of the 17HP4 type picture tube (And all electromagnetic focus tubes) receives its voltage from the 290V B+ supply.

To remove or install an electrostatic focus picture tube, follow the directions given in 57 RL 639 on picture tubes except for reference to the focus assembly and focus adjusting screw, which are not used with these tubes.
Centering adjustment is accomplished by the Centering Rings, consisting of two co-axial rings adjustable with respect to each other. These rings should be located as far forward on the neck of the tube as possible. To make the centering adjustments, rotate each of the Centering Rings separately until the picture is properly centered. With the picture properly centered, set the Brightness control slightly above its normal value and re-adjust the Ion Trap Magnet for maximum brightness.

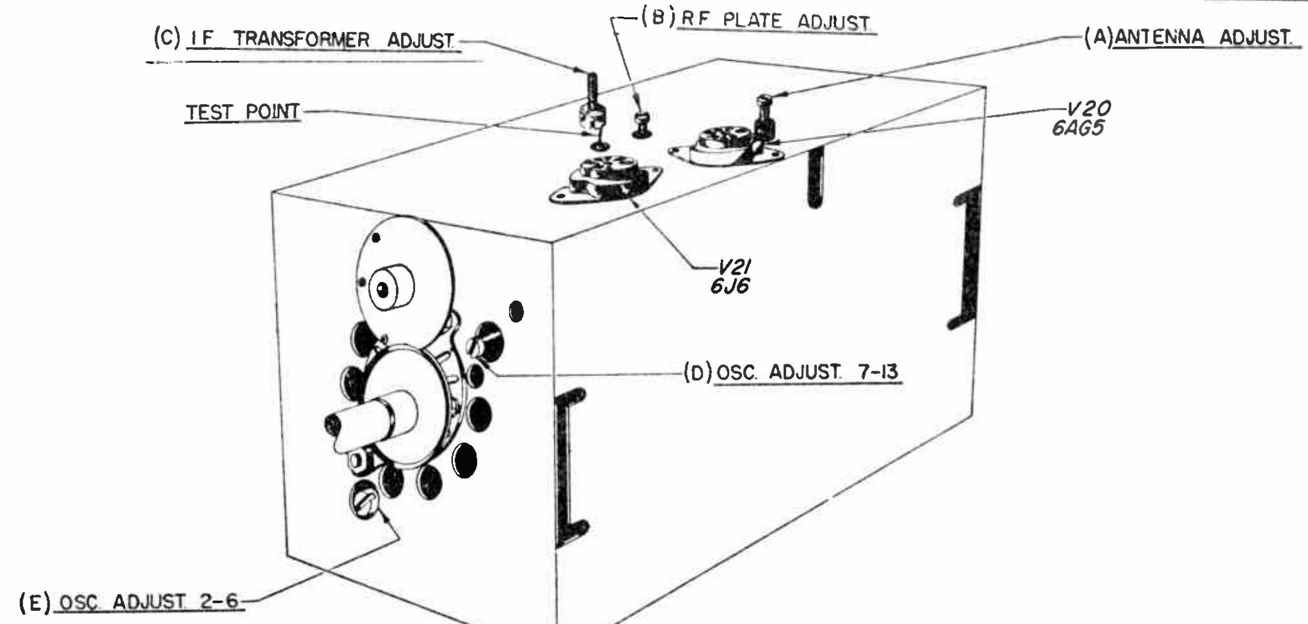
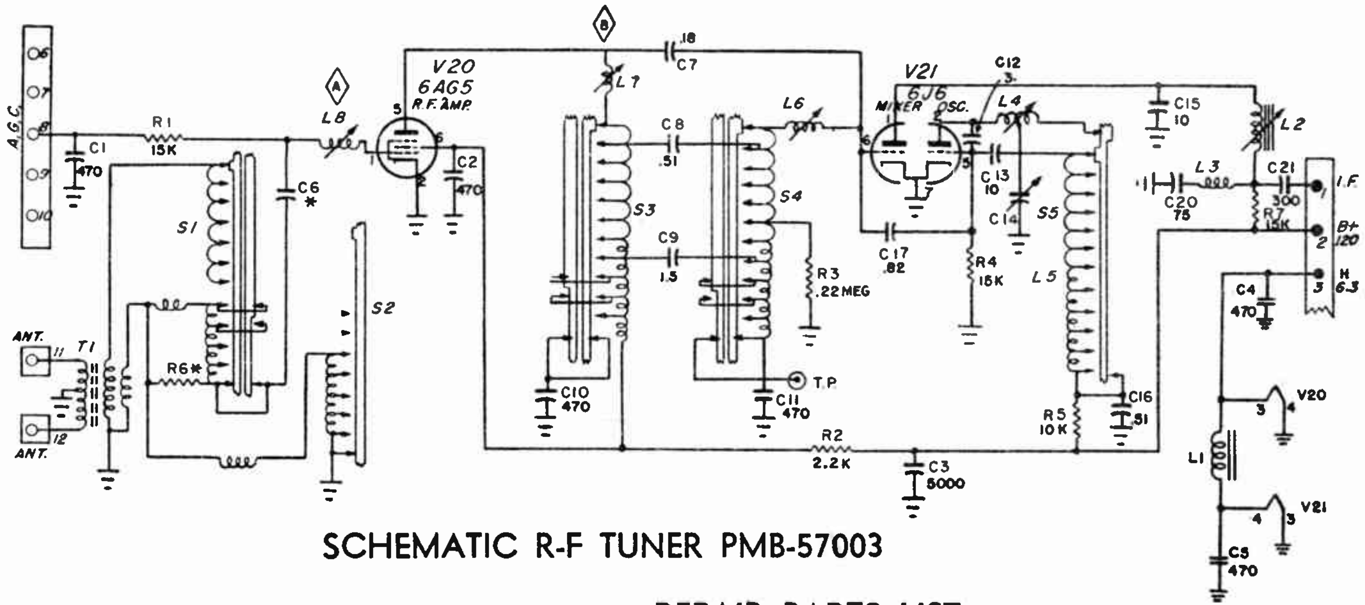


DIAGRAM R-F TUNER PMB-57003

ALL MODELS USING THE ROTARY SWITCH TUNER — PMB-57003

The Rotary Switch tuner has an R-F selector that is electrically equivalent to a tapped coil whose inductance is reduced from its maximum value by means of a rotary switch. This switch progressively shorts additional taps to ground as the selector knob is rotated and the oscillator coils are switched in and out of the circuit from channel 2 to channel 13.

The R-F amplifier tube is a type 6AG5, 6BC5, or 6CB6. A twin triode, type 6J6, is used for the combination mixer and oscillator.



SCHEMATIC R-F TUNER PMB-57003

ALIGNMENT PROCEDURE

Note: This tuner has been carefully checked and aligned at the factory to give the best possible performance. Alignment should not be necessary in the field unless tubes or other components are replaced.

OSCILLATOR ADJUSTMENT

1. Turn station selector to channel 13.
2. Connect signal generator, adjusted to correct channel 13 oscillator frequency, to the antenna.
3. Connect oscilloscope to test point through 10,000 ohms.
4. Set fine tuning in center of range. Check channel 13 and 6 for zero beat on scope.

If necessary to make adjustments to the oscillator, the following steps should be followed:

A. Align high channels for correct frequency with channel 13 oscillator screw (Adjustment "D," see illustration). A non-metallic screwdriver is advisable.

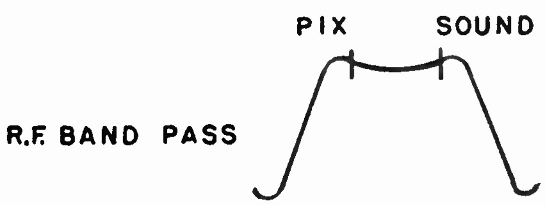
B. Align low channels for correct frequency with channel 6 oscillator screw (Adjustment E).

C. Adustment of channel 13 and channel 6 oscillator brings all other channels in adjustment. Do not back up the screws more than 8 turns from tight. At that point the electrical effect has ceased. Further backing will cause the screw to drop out.

Notes: Cover and tube shields to be on. Have rated supply voltages fed to tuner. Allow at least 3 minutes to warm up. When replacing oscillator tube, select one which requires minimum touch-up. Clockwise rotation of screws increases frequency.

BAND PASS ALIGNMENT

1. Use R-F sweep to antenna and oscilloscope to the test point through 10,000 ohms.



2. The oscillator must be operating for each channel at nearly the correct frequency.
3. Align channel 13 R-F plate (Adjustment B) and R-F grid (Adjustment A) end inductances. Align channel 13 mixer grid end inductances by spreading or pushing together the turns. The band pass should include both carriers, have steep sides, and maximum gain.
4. Align the incremental loops of the R-F plate, R-F grid, and mixer grid from 12 to 7, in that order. Pushing the loops inwards increases the frequency.
5. Align channel 6 R-F plate, R-F grid, and mixer grid to obtain a flat response with maximum gain. Spreading the coils increases the frequency. Band pass should include both carriers and have steep sides.
6. Align incremental coils of R-F plate, R-F grid, and mixed grid from 5 to 2 in that order. Spreading coils increases the frequency. A tuning wand may be used to determine what change is necessary.

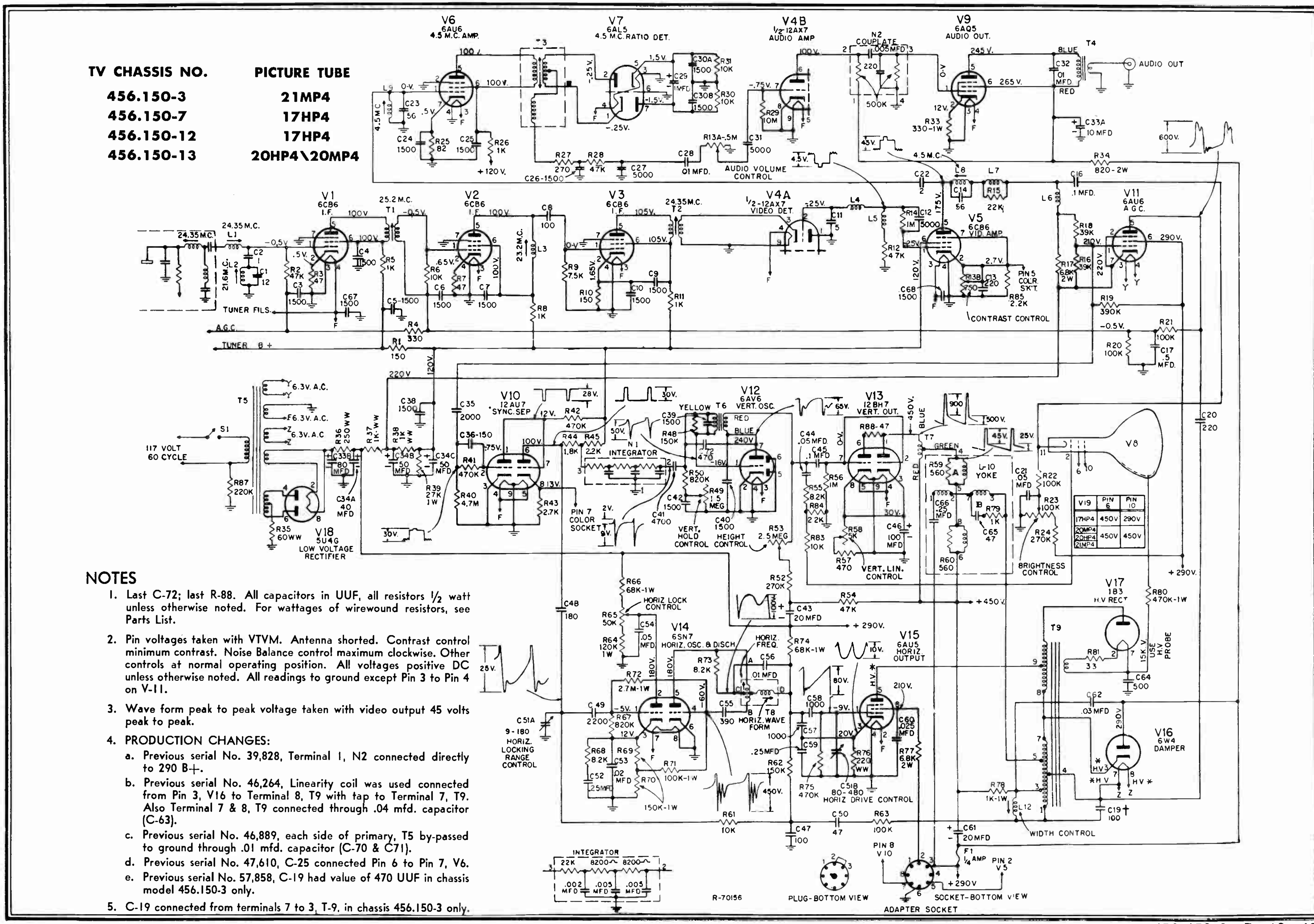
CAUTION: Band pass alignment is carefully made at the factory. Attempt this alignment only with proper equipment and set-up.

B+ Supply .... 120 Volts
Heater Supply .... 6.3 Volts A.C.
Grid Bias .... —.5 Volts

REPAIR PARTS LIST
TV CHASSIS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION			SEARS RL PRICE
		COMPOSITION CAPACITORS			
C2	PMA-40519-1	1 UUF			.17
C22	PMA-40519-3	2 UUF			.17
		CERAMIC CAPACITORS			
C11	PMB-40518-1	5 UUF		500 DCWV	.29
C1		12 UUF†	(Part of L2)	500 DCWV	.17
C14, C23		47 UUF	(Part of L8 & L9)	500 DCWV	1.70
C8, C47	PMB-40518-14	100 UUF		500 DCWV	.29
C36	PHB-40518-17	150 UUF		500 DCWV	.29
C13	PMB-40518-19	220 UUF		500 DCWV	.29
C25, C39, C40	PMB-40518-24	1500 UUF		500 DCWV	.34
C3, C4, C5, C6, C7, C9, C10, C24, C26, C38, C42, C67, C68	PMA-40517-2	1500 UUF		500 DCWV	.34
C30a, C30b	PMA-40517-4	1500 UUF	Dual	500 DCWV	.52
C35	PMB-40518-27	2000 UUF		500 DCWV	.34
C27	PMB-40518-32	5000 UUF		500 DCWV	.34
C12, C31	PMA-40517-3	5000 UUF		500 DCWV	.34
C72	PMA-40520-23	470 UUF		1000 DCWV	.34

TV CHASSIS NO.	PICTURE TUBE
456.150-3	21MP4
456.150-7	17HP4
456.150-12	17HP4
456.150-13	20HP4\20MP4



NOTES

1. Last C-72; last R-88. All capacitors in UUF, all resistors 1/2 watt unless otherwise noted. For wattages of wirewound resistors, see Parts List.
2. Pin voltages taken with VTVM. Antenna shorted. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltage taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 B+.
   b. Previous serial No. 46,264, Linearity coil was used connected from Pin 3, V16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminal 7 & 8, T9 connected through .04 mfd. capacitor (C-63).
   c. Previous serial No. 46,889, each side of primary, T5 by-passed to ground through .01 mfd. capacitor (C-70 & C71).
   d. Previous serial No. 47,610, C-25 connected Pin 6 to Pin 7, V6.
   e. Previous serial No. 57,858, C-19 had value of 470 UUF in chassis model 456.150-3 only.
5. C-19 connected from terminals 7 to 3, T-9, in chassis 456.150-3 only.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE
		PRINTED CIRCUIT	
N1	PMA-95000	Vert. Integrating Network	1.70
N2	PMA-95001	Audio Couplet	1.10
		COMPOSITION RESISTORS	
R81	PMA-45013-1	3.3 Ohms ½ Watt	.15
R3, R7, R88	PMA-45015-9	47 Ohms ½ Watt	.15
R25	PMA-45015-12	82 Ohms ½ Watt	.15
R1, R10	PMA-45015-15	150 Ohms ½ Watt	.15
R27	PMA-45015-18	270 Ohms ½ Watt	.15
R4	PMA-45015-19	330 Ohms ½ Watt	.15
R33	PMA-45017-19	330 Ohms 1 Watt	.30
R57	PMA-45015-21	470 Ohms ½ Watt	.15
R59, R60	PMA-45015-22	560 Ohms ½ Watt	.30
R34	PMA-45019-24	820 Ohms 2 Watt	.45
R5, R8, R11, R26, R79	PMA-45015-25	1K ½ Watt	.15
R78	PMA-45017-25	1K 1 Watt	.30
R44	PMA-45015-28	1.8K ½ Watt	.15
R45, R84, R85	PMA-45015-29	2.2K ½ Watt	.15
R43	PMA-45015-30	2.7K ½ Watt	.15
R2, R12	PMA-45015-33	4.7K ½ Watt	.15
R17, R77	PMA-45019-35	6.8K 2 Watt	.30
R9	PMA-45014-70	7.5K* ½ Watt	.30
R55, R68, R73	PMA-45015-36	8.2K ½ Watt	.15
R6, R30, R31, R61, R83	PMA-45015-37	10K ½ Watt	.15
R39	PMA-45017-42	27K 1 Watt	.30
R16, R18	PMA-45015-44	39K ½ Watt	.15
R28, R54	PMA-45015-45	47K ½ Watt	.15
R66, R74	PMA-45017-47	68K 1 Watt	.30
R20, R21, R22, R63	PMA-45015-49	100K ½ Watt	.15
R71	PMA-45017-49	100K 1 Watt	.30
R64	PMA-45017-50	120K 1 Watt	.30
R48, R62	PMA-45015-51	150K ½ Watt	.15
R69, R70	PMA-45017-51	150K 1 Watt	.30
R87	PMA-45015-53	220K ½ Watt	.15
R24, R52	PMA-45015-54	270K ½ Watt	.15
R19	PMA-45015-56	390K ½ Watt	.15
R41, R42, R75	PMA-45015-57	470K ½ Watt	.15
R80	PMA-45017-57	470K 1 Watt	.30
R50, R67	PMA-45015-60	820K ½ Watt	.15
R14, R56	PMA-45015-61	1 MEG ½ Watt	.15
R72	PMA-45017-66	2.7 MEG 1 Watt	.30
R40	PMA-45015-69	4.7 MEG ½ Watt	.15
R29	PMA-45015-73	10 MEG ½ Watt	.15
		WIRE WOUND RESISTORS	
R35	PMB-47007-4	60 Ohms 6 Watt	.68
R76	PMB-47007-3	220 Ohms 4 Watt	.68
R36	PMB-47007-5	250 Ohms 15 Watt	.68
R37, R38	PMB-47007-1	1K 7.5 Watt	.68
		VARIABLE RESISTORS	
R58	PMA-48016	5K, Linearity, Vertical	1.45
R65	PMB-48014-1	50K, Control, Horizontal Hold	1.45
R23	PMB-48014-2	100K, Brightness	1.45
R13a, R13b, SW1	PMB-48015	.5 Meg, 750 Ohms, Volume, Contrast SW Control	3.95
R49	PMB-48014-7	1.5 Meg, Control,—Vertical Hold	1.45
R53	PMB-48014-5	2.5 Meg, Control—Vertical Height	1.45
		TRANSFORMERS	
T1, T2	PMA-52029	Bifilier I. F. Coil	1.28
T3	PMA-52027	4.5 MC Ratio Detector	3.70
T4	PMB-51005	Audio Output Transformer	2.63
T5	PMB-50003	Power Transformer	21.84
T6	PMA-56005	Vertical Oscillator Transformer	3.07
T7	PMA-56004	Vertical Output Transformer	4.64
T8	PMB-52019	Synchroguide	3.60
T9	PMC-56002	Horizontal Output Transformer	8.43

Resistors Marked * ± 5% Tolerance.

	PART NO.	DESCRIPTION	SEARS RL PRICE
		PAPER CAPACITORS	
C58	PMB-41006-39	.001 MFD 600 V	.29
C56	PMA-41009	.01 MFD Oil Filled 200 V	.34
C32	PMB-41006-45	.01 MFD 600 V	.45
C28	PMB-41006-7	.01 MFD 200 V	.34
C53	PMB-41006-9	.02 MFD 400 V	.34
C60	PMB-41006-47	.025 MFD 600 V	.40
C62	PMB-41006-75	.03 MFD 400 V	.40
C44	PMB-41006-49	.05 MFD 600 V	.52
C21, C54	PMB-41006-30	.05 MFD 400 V	.40
C45, C16	PMB-41006-51	.1 MFD 600 V	.50
C52, C59	PMB-41006-15	.25 MFD 200 V	.59
C66	PMB-41006-53	.25 MFD 600 V	.86
C17	PMA-41008	.5 MFD 100 V	.86
		MICA CAPACITORS	
C50	PMB-40003-15	47 UUF† 500 V	.29
C65	PMB-40002-15	47 UUF† 1000 V	.34
C19	PMA-40005-2	100 UUF 1500 V	.52
C48	PMB-40003-29	180 UUF† 500 V	.34
C20	PMA-40005-1	220 UUF† 1500 V	.59
C55	PMB-40003-37	390 UUF† 500 V	.52
C64	PMA-40004	500 UUF 20 KV	2.62
C57	PMB-40003-47	1000 UUF† 500 V	.59
C49	PMB-40003-55	2200 UUF† 500 V	.83
C41	PMB-40003-63	4700 UUF† 500 V	1.28
		ELECTROLYTIC CAPACITORS	
C29	PMA-42002	1 MFD 50 V	1.48
C61, C43	PMA-42006	20 MFD Paper Case 300 V	2.62
C34a, C34b, C34c	PMA-42001	40 MFD 450 V; 50 MFD 350 V; 50 MFD 300 V	5.06
C33a, C33b	PMA-42000	10 MFD 400 V; 80 MFD 450 V	4.90
C46	PMA-42005	100 MFD Paper Case 50 V	2.57
		MICA TRIMMER CAPACITOR	
C51a, C51b	PMA-43001	9 to 180 UUF, 80 to 480 UUF	1.37
		COILS	
L2	PMA-52020	21.5 MC I. F. Trap	1.70
L1, L3	PMA-52021	24 MC I. F. Coil	1.40
L4	PMA-52023	100 UH Peaking Coil	.68
L5, L6	PMA-52024	450 UH Peaking Coil	.68
L7 & R15	PMA-52025	200 UH Peaking Coil Wound on 22K Resistor	.83
L8 & C14, L9 & C23	PMA-52028-2	4.5 MC Take-Off Trap	1.70
L10a, L10b	PMA-56000	Yoke	9.57
L12	PMA-56003	Width Coil	2.34

Capacitors Marked † ± 10% Tolerance.

PART NO.	DESCRIPTION	SEARS RL PRICE
PMA-4017	Knife Disconnect (Chassis 456.150-3)	.29
PMB-23025	Yoke Mount Strap	2.14
PMA-23027	Plastic Ring (Chassis 456.150-3)	4.94
PMA-23046-1	Tube Mount Strap (20" CRT)	1.71
PMA-23046-3	Tube Mount Strap (17" CRT)	1.45
PMA-23057	Tube Mount Strap (21" CRT)	2.05
PMC-28001	Cradle, Wood (20" CRT)	1.28
PMB-28002-1	Cradle, Tube Mount, left (21" CRT)	1.28
PMB-28002-2	Cradle, Tube Mount, right (21" CRT)	1.28
PMB-28022	Cradle, Wood (17" CRT)	1.28
PMA-52017	Antenna	.71
PMB-56012	Centering Magnet	1.45
PMA-56013	Ion Trap	1.22
PMB-57001	Tuner Turret Pentode	39.13
PMB-57003	Tuner, Rotary-Switch	34.50
PMB-61012-4	Tube Socket, Octal, Molded (V-16 & V-17)	.25
PMB-61012-5	Tube Socket, Octal, Molded (V-15)	.25
PMA-61106	Tube Socket, 9 Pin, Molded (V-13)	.25
PMA-62001	Jack, Speaker	.29
PMA-95002	Fuse, ½ Amp	.29
PMA-90019	Speaker 8"	6.00
PMA-90021	Speaker 5"	4.30

TELEVISION RECEIVER REPAIR PARTS LIST and SERVICE INSTRUCTIONS

This supplement covers certain modifications in the basic 456.150 Series television receiver chassis described in Service Instructions 57 RL 639. These modifications entail the use of either or both of the following:

A. Turret cascode R-F tuner, PMB-57002 or PMB-57002-1.

B. 24 inch picture tube, type 24AP4.

The model numbers of the chassis in which these modifications appear, are:

CHASSIS MODEL NUMBER	PICTURE TUBE TYPE	R-F TUNER
456.150-5	24AP4	Turret Pentode (PMB-57001)*
456.150-11†	21AP4	Turret Cascode (PMB-57002 or PMB-57002-1)
456.150-15†	20HP4/20MP4	Turret Cascode
456.150-16†	17HP4	Turret Cascode
456.150-21†	20CP4	Turret Cascode
456.150-51	24AP4	Turret Cascode
456.150-81†	21MP4	Turret Cascode

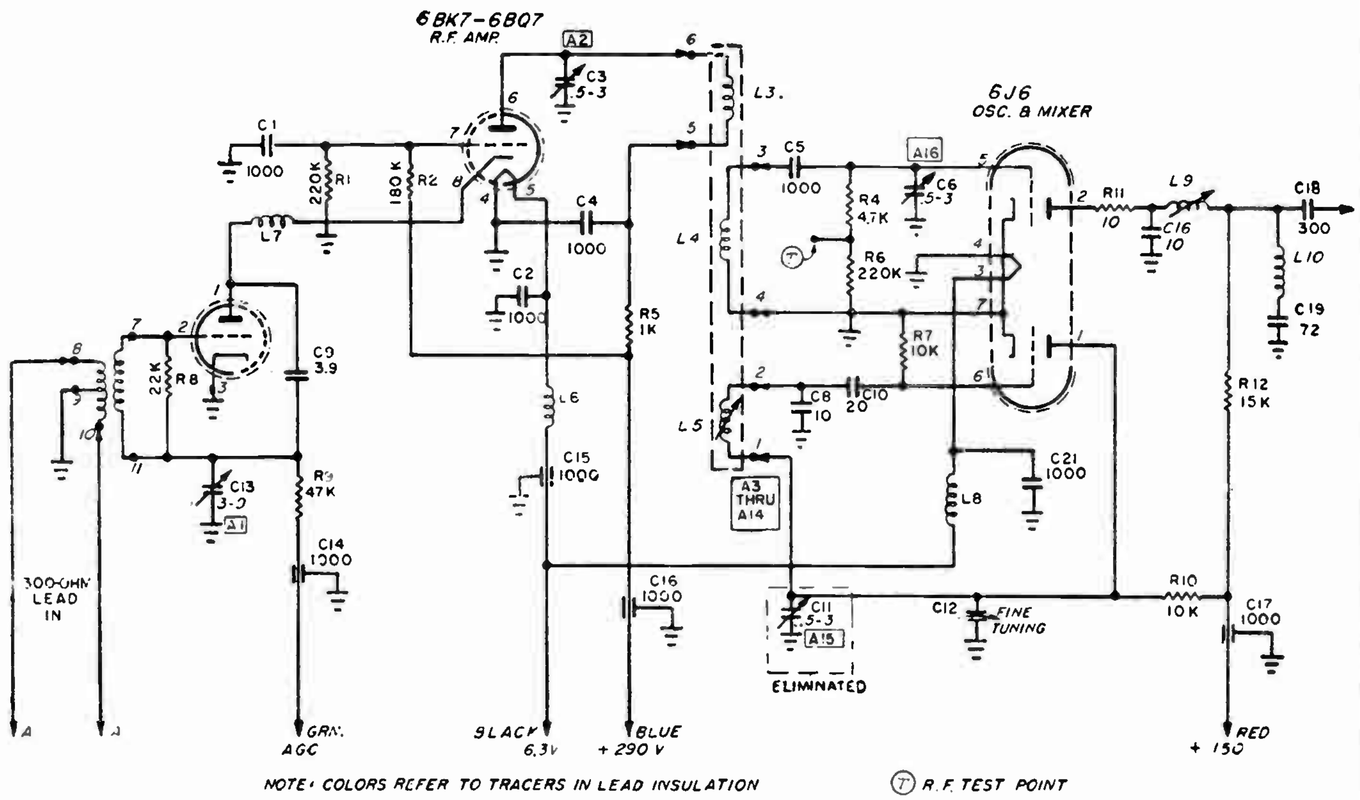
* Described in Service Instructions 57 RL 639.

† Except for CRT & R-F tuner, these chassis are same as basic 150-Series chassis. See 57 RL 639 for Repair Parts List & service Instructions.

The Chassis Listed Above Are Used in the Following Models:

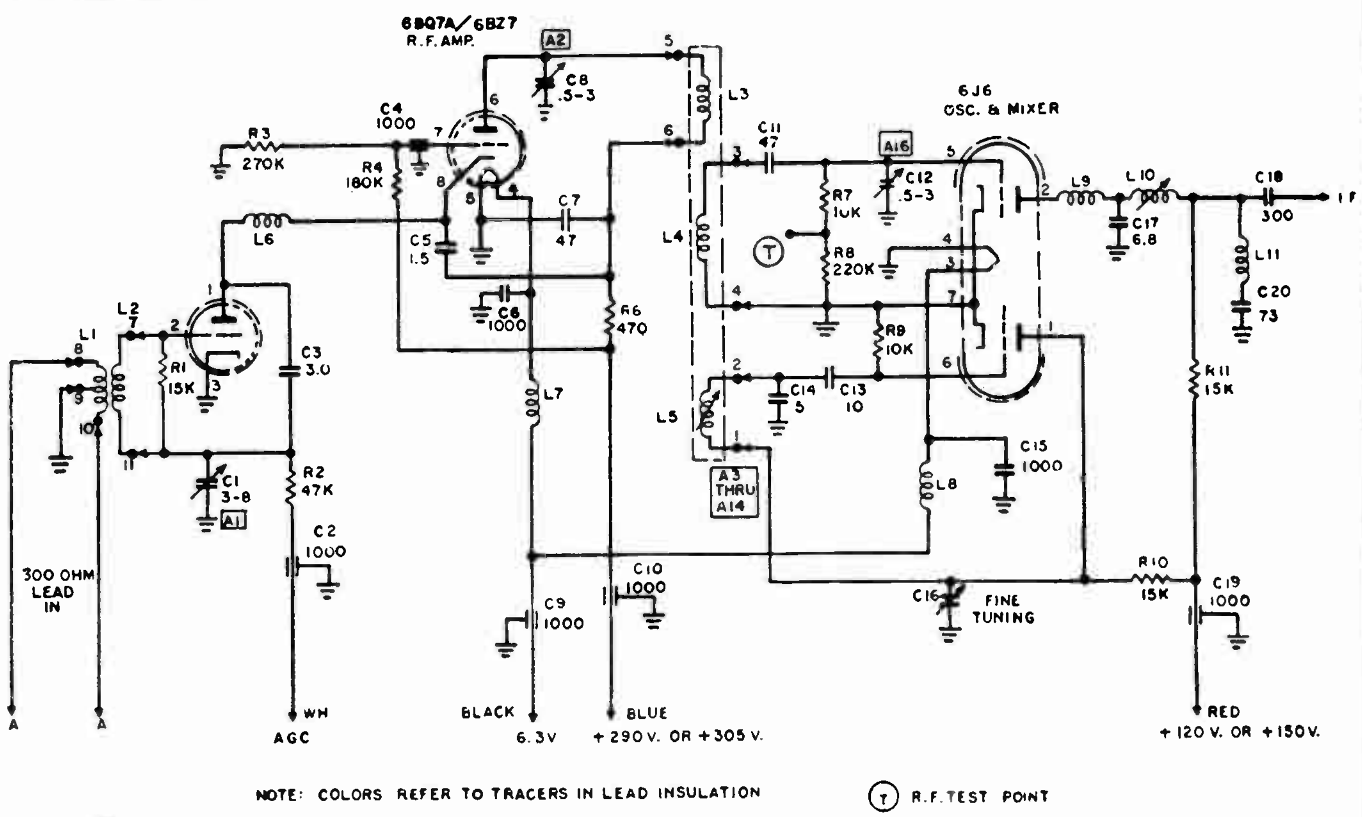
CATALOG NUMBER	TYPE	CHASSIS NUMBERS
1260*	Table Model	456.150-15
1261*	Table Model	456.150-21
1266*	Consolette	456.150-15
1268*	Console	456.150-11; 456.150-81
1270*	Console	456.150-11
1271*	Console	456.150-11
1272*	Console	456.150-11; 456.150-81
1273*	Console	456.150-11
1274*	Console	456.150-11
1275*	Console	456.150-11
2260*	Table Model	456.150-15
2264	Table Model	456.150-11; 456.150-81
2265	Table Model	456.150-11; 456.150-81
2266*	Consolette	456.150-15
2286*	Consolette	456.150-15
2287*	Consolette	456.150-15
2297*	Consolette	456.150-81
2298*	Consolette	456.150-81
57PC24	Console	456.150-5; 456.150-51

All models marked with * were also produced containing other chassis than those listed above. See Service Instructions 57 RL 639 and Supplement No. 1.



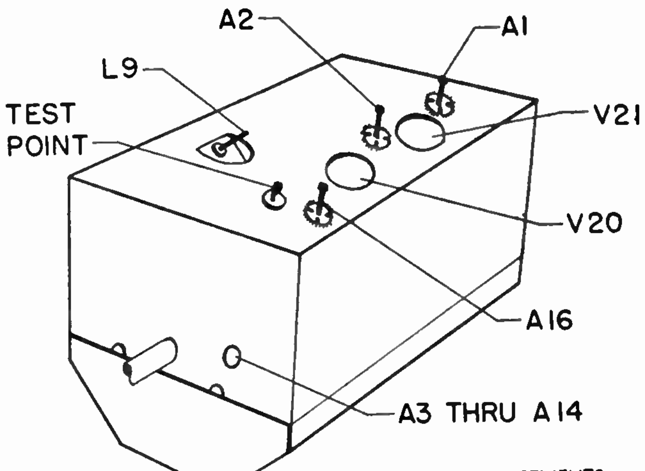
USE TYPE "K" COIL ASSEMBLY STRIPS

R-F TUNER PMB-57002



USE TYPE "Q" COIL ASSEMBLY STRIPS

R-F TUNER PMB-57002-1



TURRET TUNER ADJUSTMENTS

ALL MODELS USING THE TURRET CASCODE TUNER PMB-57002

The turret cascode tuner is a radio frequency selector that functions in the same manner as the turret pentode tuner (PMB-57001) used with the chassis models described in Service Instructions 57 RL 639 and Supplement No. 1. However, the turret cascode tuner has a twin triode tube (Type 6BK7 or 6BQ7) for the R-F amplifier. This provides two stages of R-F amplification. The second stage, a grounded grid amplifier, is directly coupled to the first stage.

The mixer-oscillator circuit in this tuner and the one in the turret pentode tuner is similar including the use of a twin triode tube, type 6J6.

The antenna, R-F, and oscillator coil assemblies are separate units for each channel and are made up of small strips that are easily removed and replaced. Each strip is held in place by a spring detent. These strips are marked with the channel number and an identification letter, which differs with each type of tuner.

For example: 3G channel 3, G type tuner.

PMB-57002-1

Certain improvements were made in the turret cascode tuner, and, beginning with production unit, Serial No. 63,838, this revised model (PMB-57002-1) replaced the original version (PMB-57002) in all applicable chassis.

There is little modification in the wiring circuit of the new cascode tuner although the value of the components have been changed. See schematic. The principal difference is in the antenna, R-F, and oscillator coil assemblies. A type 6BQ7A or 6BZ7 tube is used for the R-F amplifier.

The following identification letters have been used on the coil assembly strips of the turret tuners.

Pentode tuners, PMB-57001: "F" or "G."

Cascode tuner PMB-57002: "K."

Cascode tuner PMB-57002-1: "Q."

WHEN REPLACING A COIL ASSEMBLY STRIP, ALWAYS USE THE SAME TYPE (LETTER) AS THE ONE FOUND IN THE TUNER.

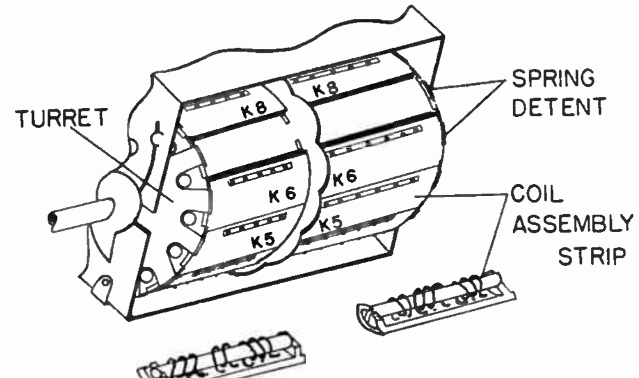
"F" and "G" strips are interchangeable in an emergency, but a substitution may make aligning adjustment difficult.

"K" and "Q" strips are never interchangeable.

In addition to the markings on the strips for each channel, a "K" or "Q" is stamped on the back of the chassis above the chassis number, to identify which cascode tuner is in the set. The new tuners are also stamped PMB-57002-1 on the bottom shield.

REPLACING A COIL ASSEMBLY

1. Remove the bottom shield of the tuner. This shield is a clip-on type, but it may be anchored in place with two machine screws on the front of the tuner.
2. Rotate the turret until the strips of the desired channel are exposed.
3. Remove the antenna coil strip or the R-F & Oscillator strip by gently prying outward on the spring detent, and pressing upward and outward on the edge of the strip.
4. Replace the strip with one for the same channel and same identification letter.
5. Replace bottom shield.



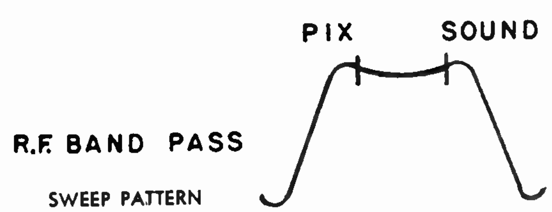
TURRET ASSEMBLY

ALIGNMENT

The following suggested method of alignment takes into consideration the changes in turret tuners discussed in the above paragraphs.

R-F AND MIXER

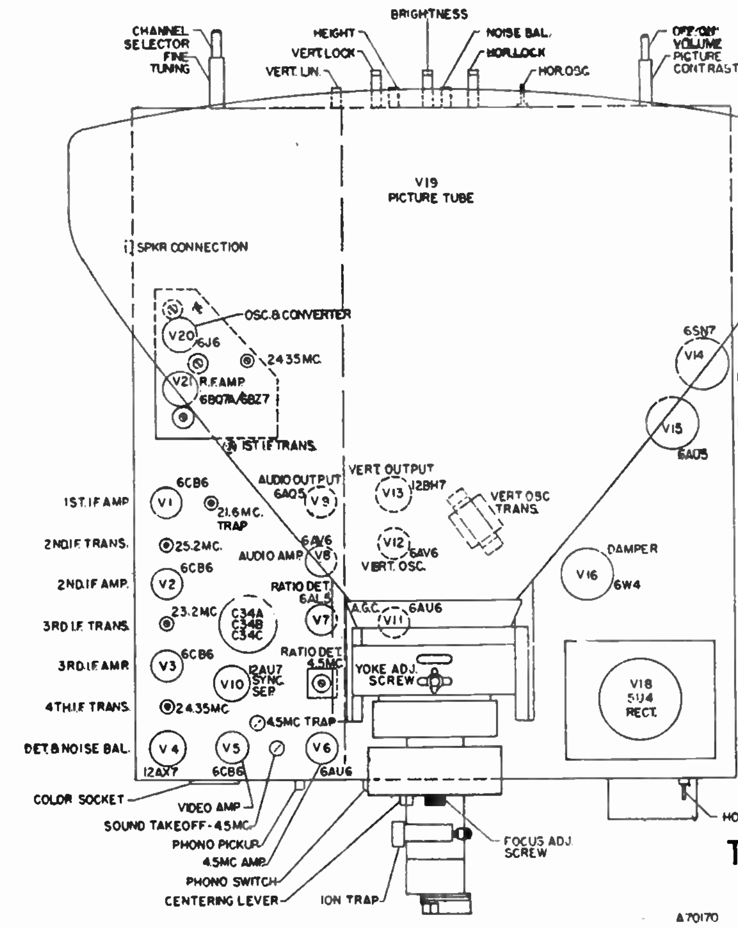
1. Set the Selector to channel 10, with the Fine-Tuning control at the approximate mid-point of its range.
2. Connect an oscilloscope through a 10,000 ohms resistor to test point.
3. Connect 2 volts negative bias to the AGC lead of the tuner. This lead is soldered to the blank lug of L-2 in the I-F circuit.
4. Connect a sweep generator to the 300 ohms antenna terminals and adjust the output to sweep channel 10.
5. Loosely couple the output from an A-M marker generator to the antenna terminals. Use the minimum amount of coupling and signal required to give a good marker or pip on the oscilloscope pattern.
6. Adjust A-1, A-2, and A-16 for maximum gain and flat top response curve, approximately 4.5 Mc wide. The amplitude of the middle of the curve should be judged when determining the maximum gain.
7. Set Selector and sweep generator to channel 6 and adjust A-1 (Antenna trimmer) only.
8. Check all other channels for approximately the same response. The response to the two marker frequencies should be essentially equal.
9. Disconnect equipment and air-check receiver on all active channels.



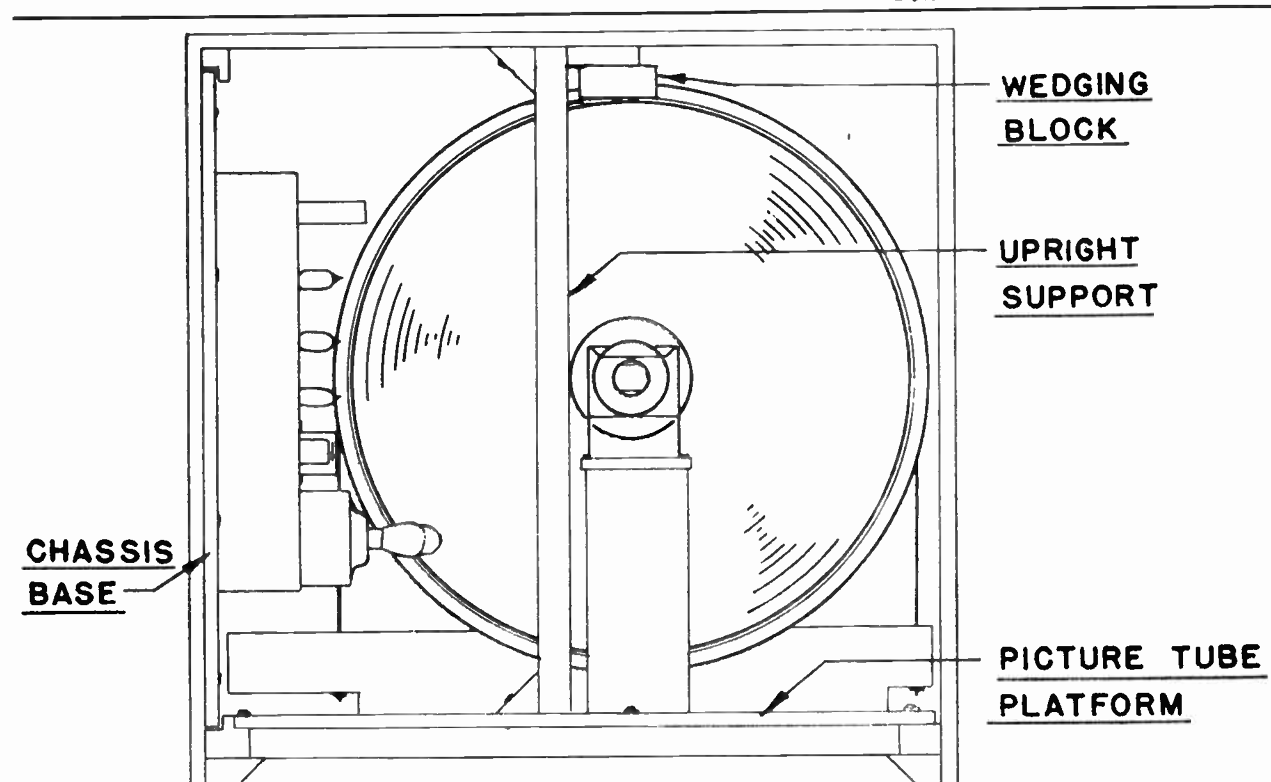
OSCILLATOR

1. Set the Fine Tuning control at the approximate mid-point of its range.
2. Place a non-metallic screwdriver through the openings provided in the front of the chassis and the tuner assembly, and adjust the individual oscillator coil slugs (A-3 through A-14) for each active channel to give the best possible picture. This is usually the point just before sound break-up occurs.

NOTE: Alignment should not be necessary unless tubes or other components have been replaced. Prior to alignment (If it is necessary), check B+ voltage supply with antenna leads disconnected and the two wires shorted. The DC voltage should be 305 volts in chassis 456.150-51, and 290 volts in the other chassis.



TUBE LAYOUT CHART
MODEL 57PC24

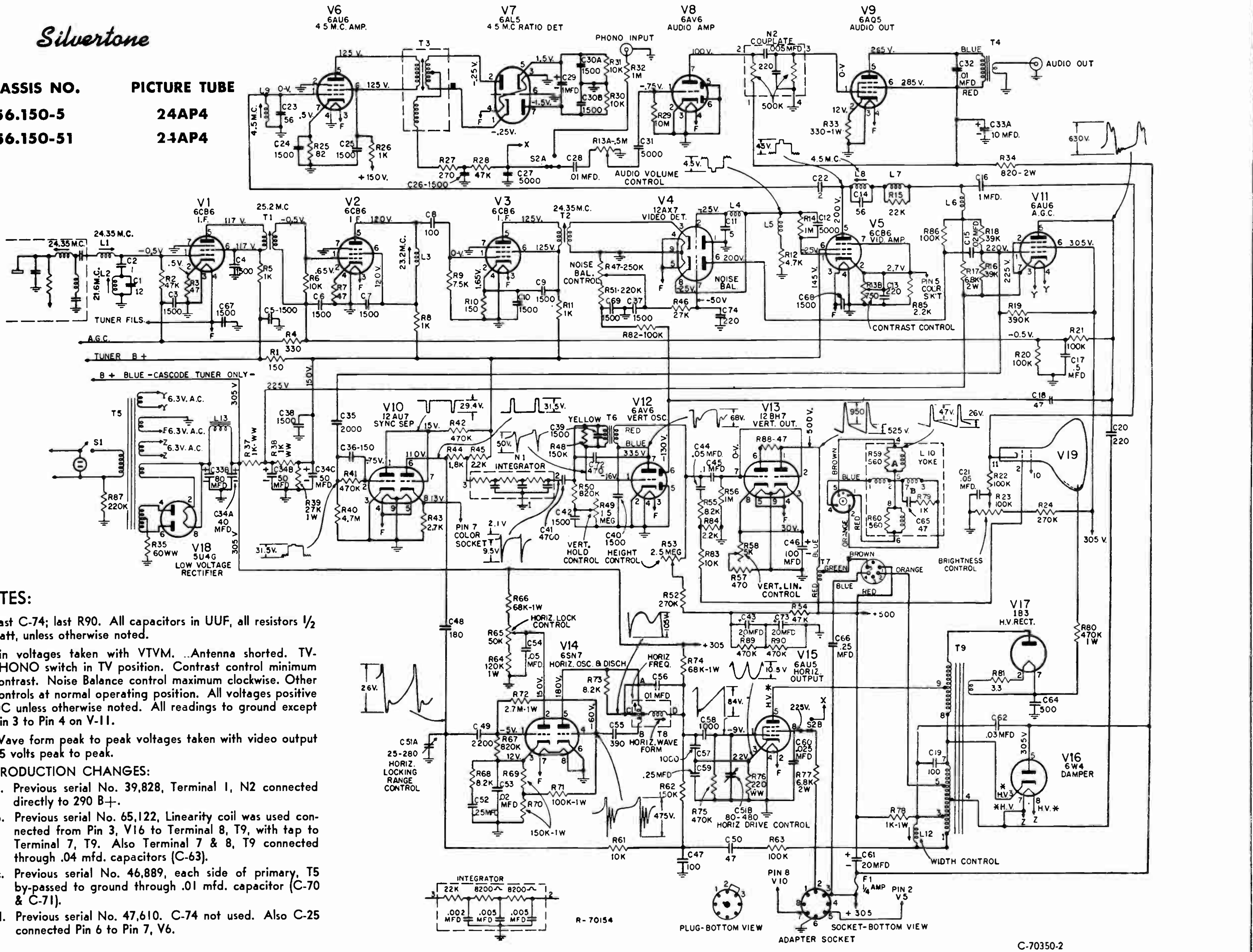


REAR VIEW MODEL 57PC24

Silvertone

TV CHASSIS NO. 456.150-5, 456.150-51 — PICTURE TUBE 24AP4, 24AP4

TV CHASSIS NO.	PICTURE TUBE
456.150-5	24AP4
456.150-51	24AP4



NOTES:

1. Last C-74; last R90. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 B+.
   b. Previous serial No. 65,122, Linearity coil was used connected from Pin 3, V16 to Terminal 8, T9, with tap to Terminal 7, T9. Also Terminal 7 & 8, T9 connected through .04 mfd. capacitors (C-63).
   c. Previous serial No. 46,889, each side of primary, T5 by-passed to ground through .01 mfd. capacitor (C-70 & C-71).
   d. Previous serial No. 47,610. C-74 not used. Also C-25 connected Pin 6 to Pin 7, V6.

REPAIR PARTS LIST
TV CHASSIS 456.150-5 & 456.150-51

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE
		COMPOSITION CAPACITORS	
C2	PMA-40519-1	1 UUF	.17
C22	PMA-40519-3	2 UUF	.17
		CERAMIC CAPACITORS	
C11	PMB-40518-1	5 UUF 500 DCWV	.29
C1		12 UUF† (Part of L2) 500 DCWV	1.70
C14, C23		56 UUF (Part of L8 & L9) 500 DCWV	1.70
C8, C47	PMB-40518-14	100 UUF 500 DCWV	.29
C19	PMA-40523-23	100 UUF 2 KV	.65
C36	PMB-40518-17	150 UUF 500 DCWV	.29
C13, C74	PMB-40518-19	220 UUF 500 DCWV	.29
C72	PMB-40520-23	470 UUF 1000 DCWV	.50
C25, C39, C40	PMB-40518-24	1500 UUF 500 DCWV	.34
C3, C4, C5, C6, C7, C9, C10, C24, C26, C37, C38, C42, C67, C68, C69	PMA-40517-2	1500 UUF 500 DCWV	.34
C30a, C30b	PMA-40517-4	1500 UUF Dual 500 DCWV	.52
C27	PMA-40518-32	5000 UUF 500 DCWV	.34
C12, C31	PMA-40517-3	5000 UUF 500 DCWV	.34
		MOLDED PAPER CAPACITORS	
C15	PMB-41007-74	.02 MFD 400 DCWV	.40
C35	PMB-41007-85	.02 MFD 600 DCWV	.49
C62	PMB-41007-86	.03 MFD 400 DCWV	.43
C21	PMB-41007-30	.05 MFD 400 DCWV	.52
C16	PMB-41007-51	.1 MFD 600 DCWV	.78
C66	PMB-41007-53	.25 MFD 600 DCWV	1.20
C17	PMB-41007-17	.5 MFD 200 DCWV	.82
		PAPER CAPACITORS	
C58	PMB-41006-39	.001 MFD 600 V	.29
C56	PMA-41009	.01 MFD Oil Filled 200 V	.34
C32	PMB-41006-45	.01 MFD 600 V	.45
C28	PMB-41006-7	.01 MFD 200 V	.34
C53	PMB-41006-28	.02 MFD 400 V	.34
C60	PMB-41006-47	.025 MFD 600 V	.40
C44	PMB-41006-49	.05 MFD 600 V	.52
C54	PMB-41006-30	.05 MFD 400 V	.40
C45, C66	PMB-41006-51	.1 MFD 600 V	.50
C52, C59	PMB-41006-15	.25 MFD 200 V	.59
		MICA CAPACITORS	
C18, C50	PMB-40003-15	47 UUF† 500 V	.29
C65	PMB-40002-15	47 UUF* 1000 V	.34
C48	PMB-40003-29	180 UUF† 500 V	.34
C20	PMA-40005-1	220 UUF† 1500 V	.59
C55	PMB-40003-37	390 UUF† 500 V	.52
C64	PMA-40004	500 UUF 20 KV	2.62
C57	PMB-40003-47	1000 UUF† 500 V	.59
C49	PMB-40003-55	2200 UUF† 500 V	.83
C41	PMB-40003-63	4700 UUF† 500 V	1.28
		ELECTROLYTIC CAPACITORS	
C29	PMA-42002	1 MFD 50 V	1.48
C43, C61, C73	PMA-42006	20 MFD Paper Case 300 V	2.62
C34a, C34b, C34c	PMA-42001	40 MFD 450 V; 50 MFD 350 V; 50 MFD 300 V	5.06
C33a, C33b	PMA-42000	10 MFD 400 V; 80 MFD 450 V	4.90
C46	PMA-42005	100 MFD Paper Case 50 V	2.57
		MICA TRIMMER CAPACITORS	
C51a, C51b	PMA-43001	25 to 280 UUF, 80 to 480 UUF	1.37

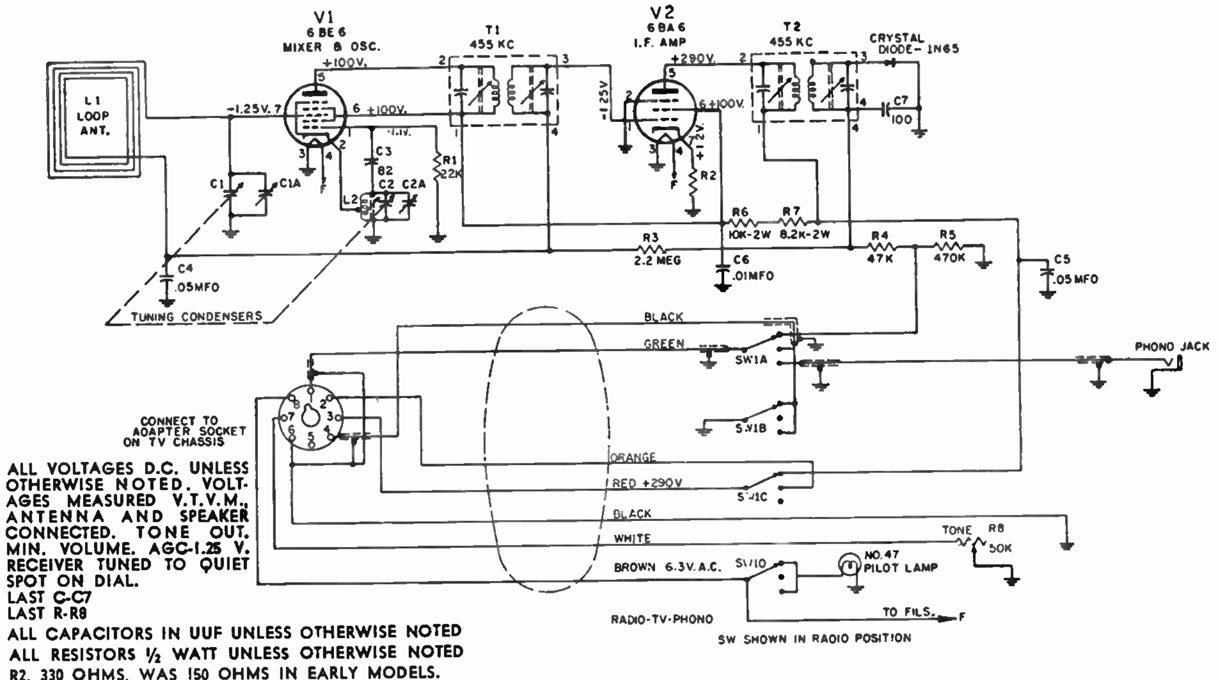
Capacitor Values ± 20% Tolerance Except * ± 5%; † ± 10%.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE
		COILS	
L2	PMA-52020	21.5 MC I. F. Trap	1.70
L1, L3	PMA-52021	24 MC I. F. Coil	1.40
L4	PMA-52023	100 UH Peaking Coil	.68
L5, L6	PMA-52024	450 UH Peaking Coil	.68
L7 & R15	PMA-52025	200 UH Peaking Coil Wound on 22K Resistor	.83
L8 & C14, L9 & C23	PMA-52028-2	4.5 MC Take-Off Trap	1.70
L10a, L10b	PMA-56000	Yoke	9.57
L12	PMA-56003	Width Coil	2.34
L13	PMB-56011	Filter Choke	4.93
		PRINTED CIRCUITS	
N1	PMA-95000	Vert. Integrating Network (Centralab PC-100)	1.70
N2	PMA-95001	Audio Couplate (Centralab PC-70)	1.10
		COMPOSITION RESISTORS	
R81	PMA-45013-1	3.3 Ohms ½ Watt	.15
R3, R7, R88	PMA-45015-9	47 Ohms ½ Watt	.15

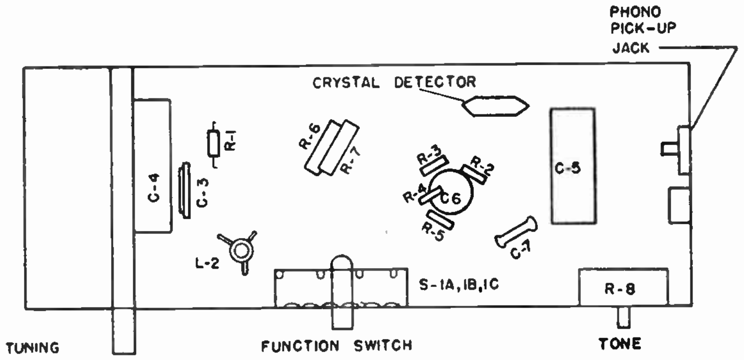
SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE
R25	PMA-45015-12	82 Ohms ½ Watt	.15
R1, R10	PMA-45015-15	150 Ohms ½ Watt	.15
R27	PMA-45015-18	270 Ohms ½ Watt	.15
R4	PMA-45015-19	330 Ohms ½ Watt	.15
R33	PMA-45017-19	330 Ohms 1 Watt	.30
R57	PMA-45015-21	470 Ohms ½ Watt	.15
R59, R60	PMA-45015-22	560 Ohms ½ Watt	.15
R34	PMA-45019-24	820 Ohms 2 Watt	.45
R5, R8, R11, R26, R79	PMA-45015-25	1K ½ Watt	.15
R78	PMA-45017-25	1K 1 Watt	.30
R44	PMA-45015-28	1.8K Watt	.15
R45, R84, R85	PMA-45015-29	2.2K ½ Watt	.15
R43	PMA-45015-30	2.7K ½ Watt	.15
R2, R12	PMA-45015-33	4.7K ½ Watt	.15
R17, R77	PMA-45019-35	6.8K 2 Watt	.45
R9	PMA-45014-70	7.5K* ½ Watt	.30
R55, R68, R73	PMA-45015-36	8.2K ½ Watt	.15
R6, R30, R31, R61, R83	PMA-45015-37	10K ½ Watt	.15
R46	PMA-45015-42	27K ½ Watt	.15
R39	PMA-45017-42	27K 1 Watt	.30
R16, R18	PMA-45015-44	39K Watt	.15
R28, R54	PMA-45015-45	47K ½ Watt	.15
R66, R74	PMA-45017-47	68K 1 Watt	.30
R20, R21, R22, R63, R82, R86	PMA-45015-49	100K ½ Watt	.15
R71	PMA-45017-49	100K 1 Watt	.30
R64	PMA-45017-50	120K 1 Watt	.30
R48, R62	PMA-45015-51	150K ½ Watt	.15
R69, R70	PMA-45017-51	150K 1 Watt	.30
R51, R87	PMA-45015-53	220K ½ Watt	.15
R24, R52	PMA-45015-54	270K ½ Watt	.15
R19	PMA-45015-56	390K ½ Watt	.15
R41, R42, R75, R89, R90	PMA-45015-57	470K ½ Watt	.15
R80	PMA-45017-57	470K 1 Watt	.30
R50, R67	PMA-45015-60	820K ½ Watt	.15
R14, R32, R56	PMA-45015-61	1 MEG ½ Watt	.15
R72	PMA-45017-66	2.7 MEG 1 Watt	.30
R40	PMA-45015-69	4.7 MEG ½ Watt	.15
R29	PMA-45015-73	10 MEG ½ Watt	.15

Resistor Values ± 10% Tolerance, Except * 5%.

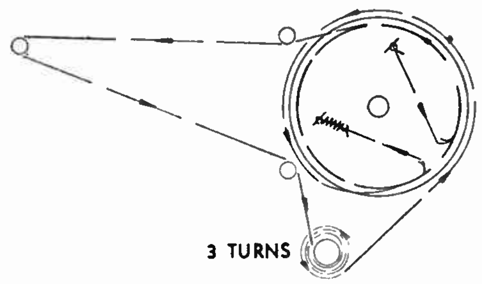
SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE
		WIRE WOUND RESISTORS	
R35	PMB-47007-4	60 Ohms 6 Watt	.68
R76	PMB-47007-3	220 Ohms 4 Watt	.68
R37, R38	PMB-47007-1	1K 7.5 Watt	.68
		VARIABLE RESISTORS	
R58	PMA-48016	5K, Linearity, Vertical	1.45
R65	PMB-48014-8	50K, Control, Horizontal Hold	1.45
R23	PMB-48014-9	100K, Brightness	1.45
R47	PMB-48014-3	250K Control, Noise Converter	1.45
R13a, R13b, SW1	PMB-48015	.5 Meg, 750 Ohms, Volume, Contrast SW Control	3.95
R49	PMB-48014-10	1.5 Meg Control—Vertical Hold	1.45
R53	PMB-48014-5	2.5 Meg Control—Vertical Height	1.45
		TRANSFORMERS	
T1, T2	PMA-52029	Bifilar I-F Coil	1.28
T3	PMA-52027	4.5 MC Ratio Detector	3.70
T4	PMB-51005	Audio Output Transformer	2.63
T5	PMB-50003	Power Transformer	21.84
T6	PMA-56005	Vertical Oscillator Transformer	3.07
T7	PMA-56004	Vertical Output Transformer	4.64
T8	PMB-52019	Synchroguide	3.60
T9	PMC-56002	Horizontal Output Transformer	8.43
	PMA-90021	Speaker, 5"	4.30
	PMA-90019	Speaker, 8"	6.00
	PMA-90017	Speaker, 10"	8.40
	PMA-90016	Speaker, 12"	8.80



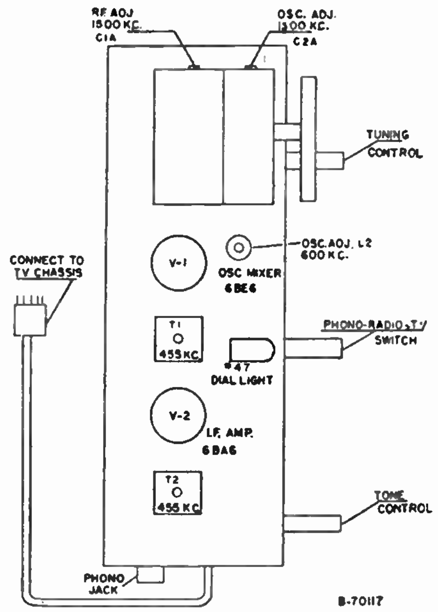
CHASSIS 456.155 — SCHEMATIC



CHASSIS 456.155 — BOTTOM VIEW



456.155 RADIO DIAL STRINGING



CHASSIS 456.155 — TOP VIEW

A-M RADIO TUNER, CHASSIS 456.155

This A-M radio tuner is mounted in the phono drawer below the picture tube and has a control panel separate from the television controls. The audio amplifying and audio output circuits of the television receiver provide these functions for radio reception. The automatic record changer, 456.216, also uses the audio circuit of the television receiver. A three position function switch on the radio control panel S-1a, 1b, 1c (radio schematic) permits changing the source of the audio signal voltage across the volume control potentiometer (R-13a, TV schematic) from TV to radio or phonograph, as desired. The A-M radio tuner is connected to the television circuit through an adapter socket on the back of the TV chassis. The AC line from the phono motor is also plugged into the back of the TV chassis, but the phono pick-up lead is plugged into the A-M radio tuner.

AM RADIO TUNER CHASSIS 456.155 ALIGNMENT PROCEDURE

PRELIMINARY INSTRUCTIONS

Disconnect radio plug and phono motor from television chassis.

Remove radio chassis from phono drawer after disconnecting phono jack. The radio chassis mounting board is held in place with wood screws that may be reached from the underside of the phono drawer. The drawer can be withdrawn from the cabinet by removing the two pins in the metal drawer slides on the bottom.

After removing the radio chassis, replace plug-connect on back of television chassis.

Set RADIO-PHONO-TV function switch to RADIO position.

Set Volume and Tone control at full clockwise position.

With tuning gang fully closed, align dial pointer exactly ⅝" from left edge of dial panel background.

Connect output meter across voice coil.

NOTES: Use an insulated alignment screwdriver.

Use signal generator having 30% modulation at 400 cycles.

Attenuate signal generator to keep output meter reading below 1.25 volts A.C.

DUMMY ANTENNA	SIG. GEN. COUPLING	SIG. GEN. FREQUENCY	DIAL SETTING	ADJUST	REMARKS
1.) .1 mfd.	High side to Pin No. 7, V-1 Radio, through .05 mfd. Low side to ground.	455 KC	Tuning gang fully open.	Top & Bottom T1. 1st I-F Top & Bottom T2 2nd I-F.	Adjust for Maximum.
2.) None	To loop (form from a few turns of wire). Place in proximity of built-in antenna.	1500 KC	Adjust gang to bring pointer 4⅛" from left edge of dial panel background.	C-2a Osc. trimmer.	Adjust for Maximum.
3.) None	Same as (2).	600 KC	1½" from left edge.	L-2 Osc. Slug Rock Gang.	Adjust for Maximum.
4.) None	Same as (2).	1500 KC	4⅛" from left edge.	C-1a R-F.	Adjust for Maximum.
		Repeat (2), (3) and (4) if necessary.			

For Service Instructions on record changer 456.216 see 57 RL 570, Supplement No. 1.

REPAIR PARTS LIST

RADIO CHASSIS NO. 155

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE	M. U. CODE
		CAPACITORS		
C3	PMB-40006-21	82 UUF Mica 300 DCWV	.31	
C7	PMB-40518-14	100 UUF Ceramic 500 DCWV	.31	
C1, C1a, C2, C2a	PMB-44001	420/162 UUF Variable	3.77	A5
C6	PMA-40517-5	.01 MFD Ceramic 500 DCWV	.38	
C4	PMB-41006-30	.05 MFD Paper 400 DCWV	.38	
C5	PMB-41006-49	.05 MFD Paper 600 DCWV	.45	
		COMPOSITION RESISTORS		
R2	PMB-45015-19	330 Ohms ½ Watt	.15	
R7	PMB-45019-36	8.2K 2 Watt	.45	
R6	PMB-45019-37	10K 2 Watt	.45	
R1	PMB-45015-41	22K ½ Watt	.15	
R4	PMB-45015-45	47K ½ Watt	.15	
R5	PMB-45015-57	470K ½ Watt	.15	
R3	PMB-45015-65	2.2 Meg ½ Watt	.15	
R8	PMB-48018-2	50K Variable	1.23	
		COILS & TRANSFORMERS		
L1	PMB-52034	Coil—Antenna Loop	3.12	AAO
L2	PMB-52032	Coil—Oscillator	1.53	
T1, T2	PMB-52033	Transformer—I-F	2.64	
S1a, S1b, S1c, S1d	PMB-60006-1	Switch, Rotary	2.72	AAO
	PMA-57502	Crystal Diode, 1N65	3.22	AAO
		Pilot Light, Type 47	.27	
	PMA-61104	Pilot Light Socket	.73	
	PMB-61012-1	Tube Socket, 7 Pin Mini	.26	
	PMA-62001	Jack	.29	
	PMA-5005	Dial Cord	.17	
	320-3S-CP	Dial Cord Spring	.86	

TV CHASSIS 456.150-14 & 456.150-61

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE	M. U. CODE
		COMPOSITION CAPACITORS		
C2	PMA-40519-1	1 UUF	.17	
C22	PMA-40519-3	2 UUF	.17	
		CERAMIC CAPACITORS		
C11	PMB-40518-1	5 UUF 500 DCWV	.29	
C1		12 UUF† (Part of L2) 500 DCWV	1.70	
C14, C23		47 UUF (Part of L8 & L9) 500 DCWV	1.70	
C8, C47	PMB-40518-14	100 UUF 500 DCWV	.29	
C19	PMA-40523-23	100 UUF 2 KV	.51	
C36	PMB-40518-17	150 UUF 500 DCWV	.29	
C13, C74	PMB-40518-19	220 UUF 500 DCWV	.29	
C72	PMA-40520-23	470 UUF 1000 DCWV	.34	
C25, C39, C40	PMB-40518-24	1500 UUF 500 DCWV	.34	
C3, C4, C5, C6, C7, C9, C10, C24, C26, C37, C38, C42, C67, C68, C69	PMA-40517-2	1500 UUF 500 DCWV	.34	
C30a, C30b	PMA-40517-4	1500 UUF Dual 500 DCWV	.52	
C27	PMB-40518-32	5000 UUF 500 DCWV	.34	
C12, C31	PMA-40517-3	5000 UUF 500 DCWV	.34	
		MOLDED PAPER CAPACITORS		
C15	PMB-41007-74	.02 MFD 400 DCWV	.40	
C35	PMB-41007-85	.02 MFD 600 DCWV	.49	
C62	PMB-41007-86	.03 MFD 400 DCWV	.43	
C21	PMB-41007-30	.05 MFD 400 DCWV	.52	
C16	PMB-41007-51	.1 MFD 600 DCWV	.78	
C66	PMB-41007-53	.25 MFD 600 DCWV	1.20	
C17	PMB-41007-17	.5 MFD 200 DCWV	.82	
		PAPER CAPACITORS		
C58	PMB-41006-39	.001 MFD 600 V	.29	
C56	PMA-41009	.01 MFD Oil Filled 200 V	.34	
C32	PMB-41006-45	.01 MFD 600 V	.45	
C28	PMB-41006-7	.01 MFD 200 V	.34	
C53	PMB-41006-28	.02 MFD 400 V	.34	
C60	PMB-41006-47	.025 MFD 600 V	.40	
C44, C73	PMB-41006-49	.05 MFD 600 V	.52	
C54	PMB-41006-30	.05 MFD 400 V	.40	
C45	PMB-41006-51	.1 MFD 600 V	.50	
C52, C59	PMB-41006-15	.25 MFD 200 V	.59	
		MICA CAPACITORS		
C18, C50	PMB-40003-15	47 UUF† 500 V	.29	
C65	PMB-40002-15	47 UUF* 1000 V	.34	
C48	PMB-40003-29	180 UUF† 500 V	.34	
C20	PMA-40005-1	220 UUF† 1500 V	.59	
C55	PMB-40003-37	390 UUF† 500 V	.52	
C64	PMA-40004	500 UUF 20 KV	2.62	
C57	PMB-40003-47	1000 UUF† 500 V	.59	
C49	PMB-40003-55	2200 UUF† 500 V	.83	
C41	PMB-40003-63	4700 UUF† 500 V	1.28	
		ELECTROLYTIC CAPACITORS		
C29	PMA-42002	1 MFD 50 V	1.48	
C43, C61	PMA-42006	20 MFD Paper Case 300 V	2.62	
C34a, C34b, C34c	PMA-42001	40 MFD 450 V; 50 MFD 350 V; 50 MFD 300 V	5.06	B5
C33a, C33b	PMA-42000	10 MFD 400 V; 80 MFD 450 V	4.90	AO
C46	PMA-42005	100 MFD Paper Case 50 V	2.57	
		MICA TRIMMER CAPACITOR		
C51a, C51b	PMA-43001	25 to 280 UUF, 80 to 480 UUF	1.37	

Capacitor Values ± 20% Tolerance Except * ± 5%; † ± 10%.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE	M. U. CODE
		PRINTED CIRCUIT		
N1	PMA-95000	Vert. Integrating Network (Centralab PC-100)	1.70	
N2	PMA-95001	Audio Couplate (Centralab PC-70)	1.10	

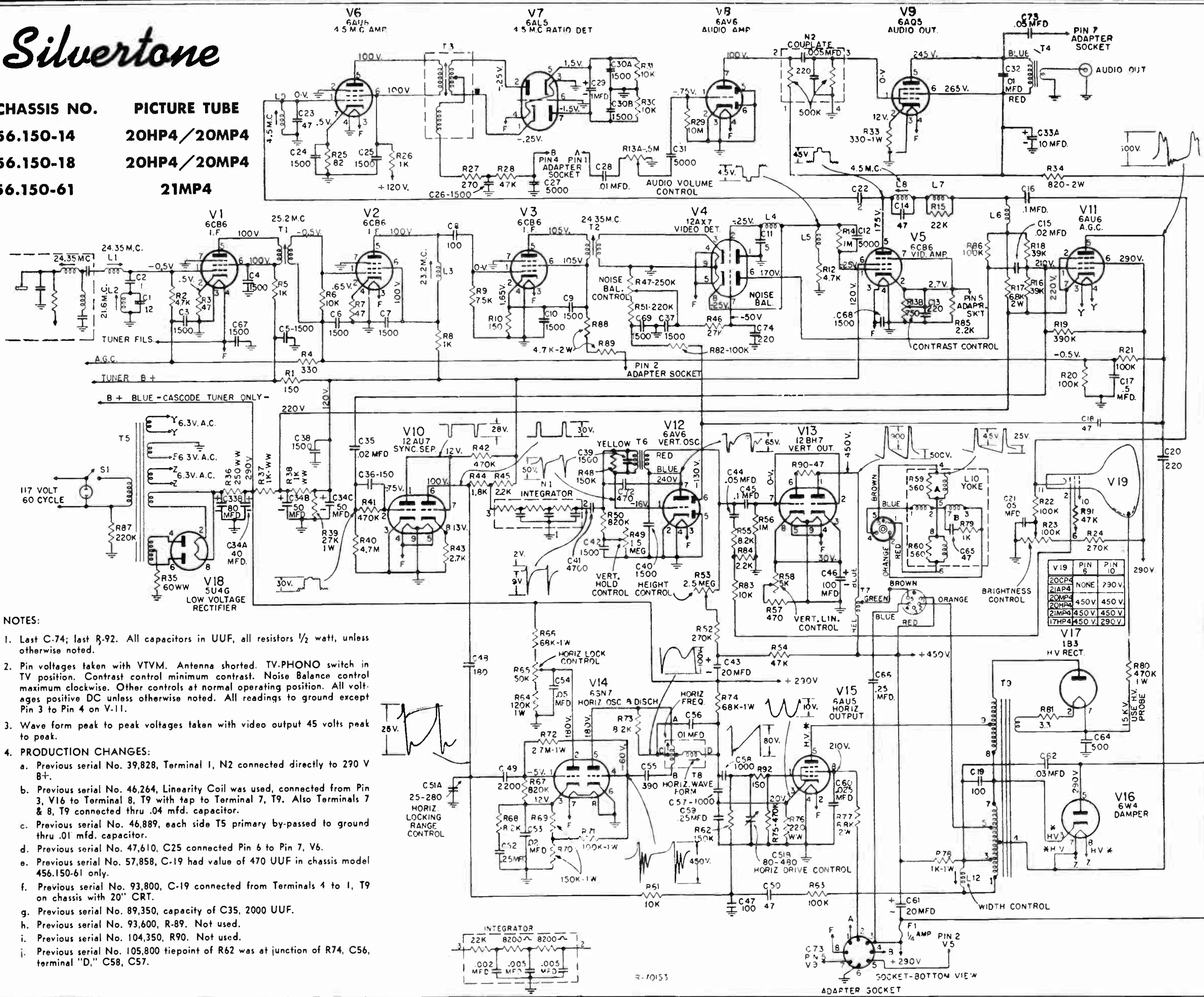
SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE	M. U. CODE
		COMPOSITION RESISTORS		
R81	PMA-45013-1	3.3 Ohms ½ Watt	.15	
R3, R7, R90	PMA-45015-9	47 Ohms ½ Watt	.15	
R25	PMA-45015-12	82 Ohms ½ Watt	.15	
R1, R10, R92	PMA-45015-15	150 Ohms ½ Watt	.15	
R27	PMA-45015-18	270 Ohms ½ Watt	.15	
R4	PMA-45015-19	330 Ohms ½ Watt	.15	
R33	PMA-45017-19	330 Ohms 1 Watt	.30	
R57	PMA-45015-21	470 Ohms ½ Watt	.15	
R59, R60	PMA-45015-22	560 Ohms ½ Watt	.15	
R34	PMA-45019-24	820 Ohms 2 Watt	.45	
R5, R8, R26, R79	PMA-45015-25	1K ½ Watt	.15	
R78	PMA-45017-25	1K 1 Watt	.30	
R44	PMA-45015-28	1.8K ½ Watt	.15	
R45, R84, R85	PMA-45015-29	2.2K ½ Watt	.15	
R43	PMA-45015-30	2.7K ½ Watt	.15	
R2, R12	PMA-45015-33	4.7K ½ Watt	.15	
R89, R90	PMA-45019-33	4.7K 2 Watt	.45	
R17, R77	PMA-45019-35	6.8K 2 Watt	.45	
R9	PMA-45014-70	7.5K* ½ Watt	.15	
R55, R68, R73	PMA-45015-36	8.2K ½ Watt	.15	
R6, R30, R31, R61, R83	PMA-45015-37	10K ½ Watt	.15	
R46	PMA-45015-42	27K ½ Watt	.15	
R39	PMA-45017-42	27K 1 Watt	.30	
R16, R18	PMA-45015-44	39K ½ Watt	.15	
R28, R54, R91	PMA-45015-45	47K ½ Watt	.15	
R66, R74	PMA-45017-47	68K 1 Watt	.30	
R20, R21, R22, R63, R82, R86	PMA-45015-49	100K ½ Watt	.15	
R71	PMA-45017-49	100K 1 Watt	.30	
R64	PMA-45017-50	120K 1 Watt	.30	
R48, R62	PMA-45015-51	150K ½ Watt	.15	
R69, R70	PMA-45017-51	150K 1 Watt	.30	
R51, R87	PMA-45015-53	220K ½ Watt	.15	
R24, R52	PMA-45015-54	270K ½ Watt	.15	
R19	PMA-45015-56	390K ½ Watt	.15	
R41, R42, R75	PMA-45015-57	470K ½ Watt	.15	
R80	PMA-45017-57	470K 1 Watt	.30	
R50, R67	PMA-45015-60	820K ½ Watt	.15	
R14, R56	PMA-45015-61	1 MEG ½ Watt	.15	
R72	PMA-45017-66	2.7 MEG 1 Watt	.30	
R40	PMA-45015-69	4.7 MEG ½ Watt	.15	
R29	PMA-45015-73	10 MEG ½ Watt	.15	
		WIRE WOUND RESISTORS		
R35	PMB-47007-4	60 Ohms 6 Watt	.68	
R76	PMB-47007-3	220 Ohms 4 Watt	.68	
R36	PMB-47007-5	250 Ohms 15 Watt	.68	
R37, R38	PMB-47007-1	1K 7.5 Watt	.68	
		VARIABLE RESISTORS		
R58	PMA-48016	5K, Linearity, Vertical	1.45	
R65	PMB-48014-8	50K, Control, Horizontal Hold	1.45	
R23	PMB-48014-9	100K, Brightness	1.45	
R47	PMB-48014-3	250K Control, Noise Inverter	1.45	
R13a, R13b, SW1	PMB-48015	.5 Meg, 750 Ohms, Volume, Contrast SW Control	3.95	A5
R49	PMB-48014-10	1.5 Meg, Control,—Vertical Hold	1.45	
R53	PMB-48014-5	2.5 Meg, Control—Vertical Height	1.45	

Resistor Values ± 10% Tolerance, Except * 5%.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE	M. U. CODE
		TRANSFORMERS		
T1, T2	PMA-52029	Bifilar I. F. Coil	1.28	
T3	PMA-52027	4.5 MC Ratio Detector	3.70	AAO
T4	PMB-51005	Audio Output Transformer	2.63	AAO
T5	PMB-50003	Power Transformer	21.84	B5
T6	PMA-56005	Vertical Oscillator Transformer	3.07	AAO
T7	PMA-56004	Vertical Output Transformer	4.64	B5
T8	PMB-52019	Synchroguide	3.60	A5
T9	PMC-56002	Horizontal Output Transformer	8.43	B5
		COILS		
L2	PMA-52020	21.5 MC I. F. Trap	1.70	
L1, L3	PMA-52021	24 MC I. F. Coil	1.40	
L4	PMA-52023	100 UH Peaking Coil	.68	
L5, L6	PMA-52024	450 UH Peaking Coil	.68	
L7 & R15	PMA-52025	200 UH Peaking Coil Wound on 22K Resistor	.83	

Silvertone

TV CHASSIS NO.	PICTURE TUBE
456.150-14	20HP4/20MP4
456.150-18	20HP4/20MP4
456.150-61	21MP4



V19	PIN 6	PIN 10
20CP4 21AP4	NONE	290V
20MP4 20HP4	450V	450V
21MP4	450V	450V
17HP4	450V	290V

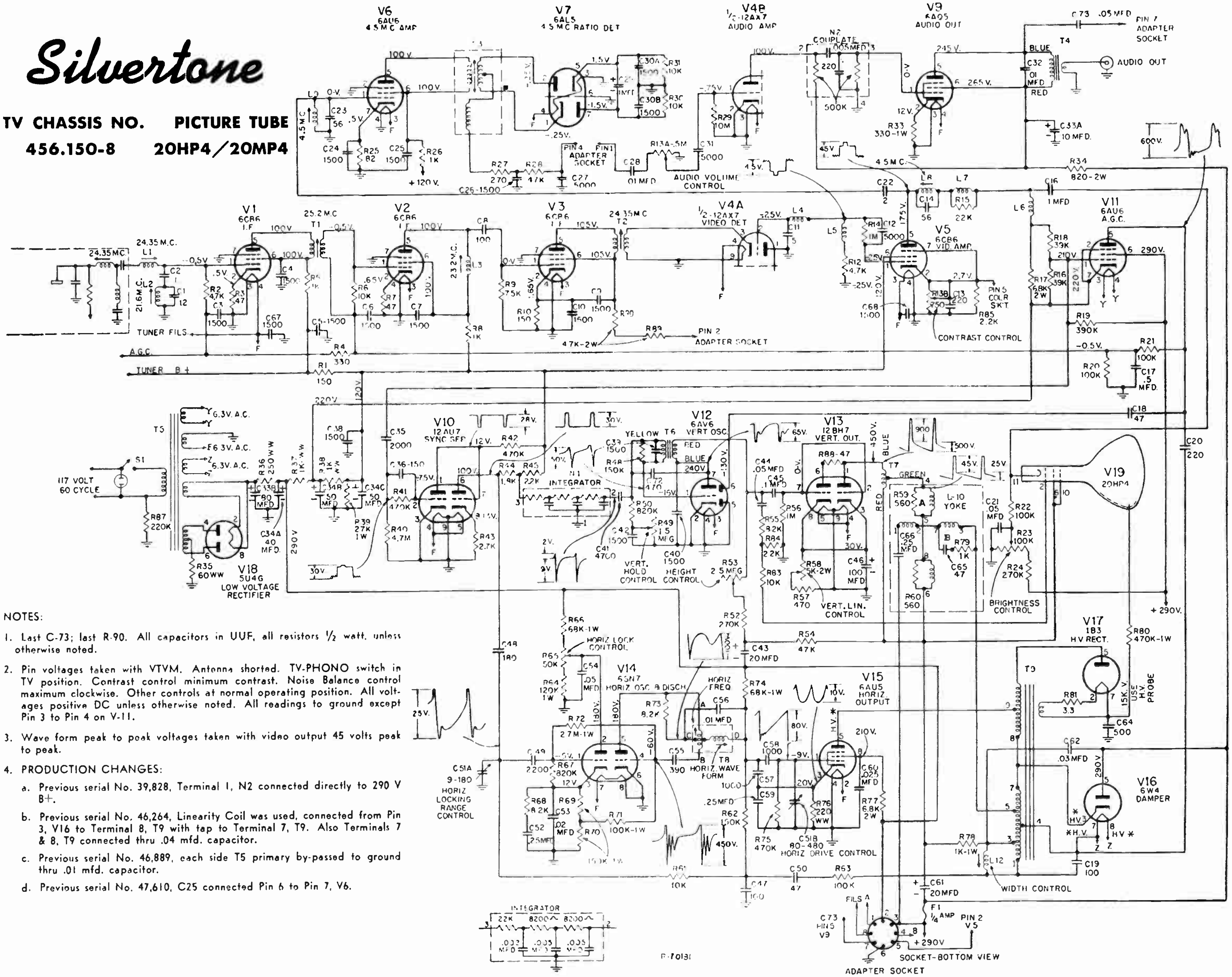
NOTES:

1. Last C-74; last R-92. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 V B+.
   b. Previous serial No. 46,264, Linearity Coil was used, connected from Pin 3, V16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminals 7 & 8, T9 connected thru .04 mfd. capacitor.
   c. Previous serial No. 46,889, each side T5 primary by-passed to ground thru .01 mfd. capacitor.
   d. Previous serial No. 47,610, C25 connected Pin 6 to Pin 7, V6.
   e. Previous serial No. 57,858, C-19 had value of 470 UUF in chassis model 456.150-61 only.
   f. Previous serial No. 93,800, C-19 connected from Terminals 4 to 1, T9 on chassis with 20" CRT.
   g. Previous serial No. 89,350, capacity of C35, 2000 UUF.
   h. Previous serial No. 93,600, R-89. Not used.
   i. Previous serial No. 104,350, R90. Not used.
   j. Previous serial No. 105,800 tiepoint of R62 was at junction of R74, C56, terminal "D," C58, C57.

Silvertone

TV CHASSIS NO. 456.150-8

PICTURE TUBE 20HP4/20MP4



NOTES:

1. Last C-73; last R-90. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 V B+.
   b. Previous serial No. 46,264, Linearity Coil was used, connected from Pin 3, V16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminals 7 & 8, T9 connected thru .04 mfd. capacitor.
   c. Previous serial No. 46,889, each side T5 primary by-passed to ground thru .01 mfd. capacitor.
   d. Previous serial No. 47,610, C25 connected Pin 6 to Pin 7, V6.

SUPPLEMENT NO. 3

MODEL NUMBER	DESCRIPTION	TV CHASSIS NUMBER	RADIO CHASSIS NO.	RECORD CHANGER
2276	Consolette Combination	456.150-8 456.150-14 456.150-18	456.155	456.216
3276	Consolette Combination	456.150-61	456.155	456.216
2277	Consolette Combination	456.150-8 456.150-14 456.150-18	456.155	456.216
3277	Consolette Combination	456.150-61	456.155	456.216
2278	Console Combination	456.150-11 456.150-81	456.860-1	456.216
2279	Console Combination	456.150-11 456.150-81	456.860-1	456.216

Models 2276 and 2277

Chassis 456.150-8, used in models 2276 and 2277, is a 20 tube chassis with a 20 inch electrostatic focus picture tube, type 20HP4 or 20MP4, and Rotary Switch tuner, PMB-57003. For a description of a chassis of this design, see Supplement No. 1.

Chassis 456.150-14, also used in models 2276 and 2277, is a 21 tube chassis with a 20 inch electrostatic focus picture tube, type 20HP4 or 20MP4, and Turret Pentode tuner, PMB-57001. A chassis of this design is also described in Supplement No. 1. Chassis 456.150-18 is the same as chassis 456.150-14 except that it uses a Turret Cascode tuner, PMB-57002-1.

Models 3276 and 3277

Chassis 456.150-61, used in models 3276 and 3277, is a 21 tube chassis with a 21 inch electrostatic focus picture tube, type 21MP4, and a Turret Cascode tuner, PMB-57002-1. For a description of a chassis of this design, see Supplements No. 1 and No. 2.

For radio reception, these four models use chassis 456.155, a two tube A-M radio tuner. Chassis 456.155 has a built-in loop antenna and uses a type 6BE6 for the converter tube, a type 6BA6 for the 455 Kc I-F amplifier tube, and a crystal diode detector, type 1N65.

Models 2278 and 2279

Chassis 456.150-11, used in models 2278 and 2279, is a 21 tube chassis, with a 21 inch electromagnetic focus picture tube, type 21AP4, and a Turret Cascode tuner, PMB-57002-1. For a description of this chassis, see Service Instructions Supplement No. 2.

456.150-81, the alternate chassis used in these models, is a 21 tube chassis with a 21 inch electrostatic focus picture tube, type 21MP4, and a Turret Cascode tuner, PMB-57002-1. For a description of this chassis, see Service Instructions Supplements No. 1 and No. 2.

A-M - F-M radio chassis No. 456.860-1 is an eight tube superheterodyne radio receiver. For a complete description of this radio see Service Instructions

Both the television and radio units are complete within themselves, with separate chassis and control panels. However, only one speaker is used, with the secondaries of the two voice coils coupled in parallel. The radio's AC power is supplied from the television's AC power line. The phonograph operates through the audio circuit of the radio, and the phonograph motor receives its power from the radio's AC power line.

SUPPLEMENT NO. 4

Silvertone

TELEVISION RECEIVER REPAIR PARTS LIST and SERVICE INSTRUCTIONS

This Supplement covers 456.150-Series television receivers that use a type 21YP4/21AFP4, electrostatic focus, glass CRT. There are also repair parts, listed in this supplement, for catalog numbers not covered previously, that contain a 456.150-Series chassis.

Chassis No. 456.150-19 has 21 tubes and uses the turret cascode tuner, PMB-57002-1. It is identical to chassis No. 456.150-81, except for the substitution of a 21YP4/21AFP4 for the 21MP4 CRT. See Service Instructions 57 RL 639 and Supplement No. 2 for a complete description of this chassis.

No. 456.150-19 is used in the following catalog numbers:

3260 Table Model	3272 Console	3280 Table Model	3298 Consolette
3261 Table Model	3273 Console	3295 Consolette	4114W Table Model
3268 Console	3274 Console	3296 Consolette	
3271 Console	3275 Console	3297 Consolette	

These catalog numbers may also use chassis No. 456.150-81.

Chassis No. 456.150-22 has 23 tubes, including the two tube AM radio tuner 456.155, and also uses the turret cascode tuner PMB-57002-1. This chassis is an alternate and is identical to No. 456.150-61 except for the CRT substitution. See Service Instructions 57 RL 639 and Supplement No. 3 for a complete description of this chassis.

No. 456.150-22 is used in the following catalog numbers:

3276 Consolette Combination — 3277 Consolette Combination

These models have a 456.216 record changer. See Service Instructions 57 RL 570, Supplement No. 1, for description.

Chassis No. 456.150-16 has 21 tubes, and uses the PMB-57002-1 tuner and a 17HP4 CRT. See Service Instructions 57 RL 639 and Supplements Nos. 1 and 2 for description.

No. 456.150-22 is used in the following catalog numbers:

3263 Table Model — 3289 Table Model — 3290 Consolette — 3299 Table Model

PMA-90012	Speaker, 8"
PMA-90017	Speaker, 10"
PMA-90018	Speaker, 5"
PMA-90020	Speaker, 5" x 7"
PMA-90030	Speaker, 6"

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SEARS RL PRICE	MU CODE
L8 & C14, L9 & C23	PMA-52028-2	4.5 MC Take-Off Trap	1.70	
L10	PMA-56000	Yoke	9.57	B5
L12	PMA-56003	Width Coil	2.34	
	PMA-52017	Antenna	.71	
	PMA-4017	Knife Disconnect (21" CRT Only)	.29	
	PMA-23057	Tube Mount Strap (21" CRT)	2.05	
	PMA-23046-1	Tube Mount Strap (20" CRT)	1.71	
	PMA-23027	Plastic Ring (21" CRT)	4.94	AO
	PMB-97088	Plug—Yoke Connection	1.18	
	PMB-97089	Receptacle—Yoke Connection	1.45	
	PMA-56013	Ion Trap	1.22	
	PMB-56008	Focus Magnet (21AP4 CRT Only)	6.21	B5
	PMB-56012	Centering Magnet (21MP4, 20HP4 CRT's)	1.45	
	PMA-95002-1	Fuse, 1/4 Amp., 250 Volts, Type 3AG	.29	
	PMA-62001	Jack	.29	
	PMB-61012-4	Tube Socket, Octal Molded (V16 & V17)	.25	
	PMB-61012-5	Tube Socket, Octal Molded (V-15)	.25	
	PMA-61106	Tube Socket, 9 Pin Molded (V-13)	.25	
	PMB-57001	Turret Pentode Tuner	39.13	B5
	PMB-57002-1	Turret Cascode Tuner	41.25	B5
	PMB-57003	Rotary Switch Tuner	34.50	B5

TV CHASSIS NO. 456.150-8

All items same as No. 456.150-14, except—OMIT:

C37, C69	1500 UUF	R51	220K
C15	.02 MFD	R82, R86	100K
C18	47 UUF	R46	27K
C74	220 UUF	R47	250K Variable
		R91	47K
		R92	150 Ohms

TV CHASSIS NO. 456.150-11 & NO. 456.150-81

See Service Instructions 57 RL 639 and Supplements No. 1 and No. 2.

CABINET ACCESSORIES

PART NO.	DESCRIPTION	SEARS RL PRICE	MU CODE
PMB-80098	Back, Models 2276 & 2277	3.49	AAO
PMB-80104	Back, Models 2278 & 2279	4.63	AO
PMB-80185	Back, Models 3276 & 3277	2.63	AAO
PMA-80053-1	Knob, Picture Contrast, Models 2276 & 2278	.34	
PMA-80053-2	Knob, Picture Contrast, Models 2277 & 2279	.34	
PMA-80138-1	Knob, Picture Contrast, Models 3276 & 3277	.57	
PMA-80054-1	Knob, Fine Tuning, Models 2276 & 2278	.34	
PMA-80054-2	Knob, Fine Tuning, Models 2277 & 2279	.34	
PMA-80139-1	Knob, Fine Tuning, Models 3276 & 3277	1.03	
PMA-80055-1	Knob, On-Off-Volume, Models 2276, 2277, 2278 & 2279	1.71	
PMA-80136-1	Knob, On-Off-Volume, Model 3276	1.14	
PMA-80136-2	Knob, On-Off-Volume, Model 3277	1.14	
PMA-80056-1	Knob, Channel Selector, Models 2276, 2277, 2278 & 2279	1.71	
PMA-80137-1	Knob, Channel Selector, Model 3276	1.48	
PMA-80137-2	Knob, Channel Selector, Model 3277	1.48	
PMA-80068-2	Knob, Radio Tune & Tone, Models 2276 & 2278	.65	
PMA-80068-6	Knob, Radio Tune & Tone, Models 2277 & 2279	.65	
PMA-80068-12	Knob, Radio Tune & Tone, Models 3276 & 3277	.65	
PMA-80087-1	Knob, Radio Function Switch, Models 2276 & 2278	.73	
PMA-80087-3	Knob, Radio Function Switch, Models 2277 & 2279	.73	
PMA-80087-5	Knob, Radio Function Switch, Models 3276 & 3277	.73	
PMB-80097	Dial Glass, 155 Radio	1.78	
PMD-7016	Mask, Models 2276 & 2277	5.83	B5
PMD-7031	Mask, Models 2278, 2279, 3276, & 3277	5.18	B5
PMA-80107	Safety Glass, 16" x 20"	6.00	B5
PMB-80151-2	Safety Glass, 16" x 20½"	6.78	B6
PMB-30007-1	CRT Protection Cup, 2" Deep	1.07	
PMB-30026-1	CRT Protection Cup, 3" Deep	1.28	
PMA-90021	Speaker, 5"	4.30	AO
PMA-90019	Speaker, 8"	6.00	B5
PMA-90017	Speaker, 10"	8.40	B5
PMA-90016	Speaker, 12"	8.80	B5

SPECIFICATIONS

POWER SUPPLY

All models 117 volts AC, 60 cycle unless otherwise specified. Power Consumption 105 watts.

FREQUENCY RANGE

Standard Broadcast	540-1600 KC.
Frequency Modulation (FM)	88-108 MC.

ANTENNA EQUIPMENT

These models have a Silvertone built-in antenna system which will provide excellent local reception on both the AM and FM bands. For locations where an outside antenna is necessary a special Silvertone AM-FM Antenna Kit Catalog No. 6710 is available.

INTERMEDIATE FREQUENCIES

AMIF Carrier	455 KC.
FM IF Carrier	10.7 MC.

POWER OUTPUT

Undistorted	2.75 Watts
Maximum	4.50 Watts

ALIGNMENT PROCEDURE

WARNING: No attempt should be made to adjust the alignment of this receiver without using the following equipment: Signal Generator, FM Sweep Generator, Cathode Ray Oscilloscope, Output Meter Insulated Screw Driver.

AM ALIGNMENT

Output meter connection	Across speaker voice coil
Generator ground lead connection	Receiver chassis
Generator modulation	30% 400 cycles
Position of volume control	Fully on
Position of tone control	Fully counterclockwise
Position of FM-AM-PHO Switch	AM

A Hazeltine loop may be used to radiate a signal into the receiver loop instead of the dummy antenna connections listed below.

TUNER POSITION	GENERATOR FREQUENCY	DUMMY ANTENNA	GENERATOR CONNECTION	CORE & TRIMMER ADJUSTMENTS (IN ORDER SHOWN)	CORE OR TRIMMER FUNCTION
Open	455 KC.	0.1 Mfd.	Transl-Grid	T4-A, T4-B T2-A, T2-B	I. F.
1650 KC.	1650 KC.	50 Mmfd.	Ext. Ant.	C11	Osc.
1400 KC.	1400 KC.	50 Mmfd.	Ext. Ant.	C 5	Ant.

FM IF ALIGNMENT

Sweep generator frequency	10.7 MC.
Sweep generator deviation	300 KC.
Dummy antenna	0.1 Mfd.
Sweep generator ground lead connection	Receiver chassis
Position of tuner	Open
Position of volume control	Fully on
Position of tone control	Fully counterclockwise
Position of FM-AM-PHO switch	FM

Make shielded probe shown in Figure 1 for use with Oscilloscope where indicated below.

GENERATOR CONNECTION	OSCILLOSCOPE CONNECTION	CORE ADJUSTMENTS	ADJUST FOR CURVE IN	CORE FUNCTION
FM - First IF grid	Probe - across T5 - Primary	T3-A, T3-B	Figure 2	IF
Trans-Grid	Probe - across T5 - Primary	T1-A, T1-B	Figure 2	IF
FM - Second IF grid	Across C35	T5-A, T5-B	Figure 3	Disc.

FM RF ALIGNMENT

Output meter connection	Across speaker voice coil
Sweep generator deviation	22.5 KC.
Dummy antenna	Two 120 ohm resistors
Sweep generator connection	FM antenna board
Position of volume control	Fully on
Position of tone control	Fully counterclockwise
Position of FM-AM-PHO switch	FM

POSITION OF TUNER	GENERATOR FREQUENCY	TRIMMER & COIL ADJUSTMENT	TRIMMER OR COIL FUNCTION
Open	108.5 MC.	C10	Osc.
108MC.	108.0 MC.	C 9	Transl.
Closed	88.5 MC.	L 4	Osc.
88 MC.	88.0 MC.	L 3	Transl.

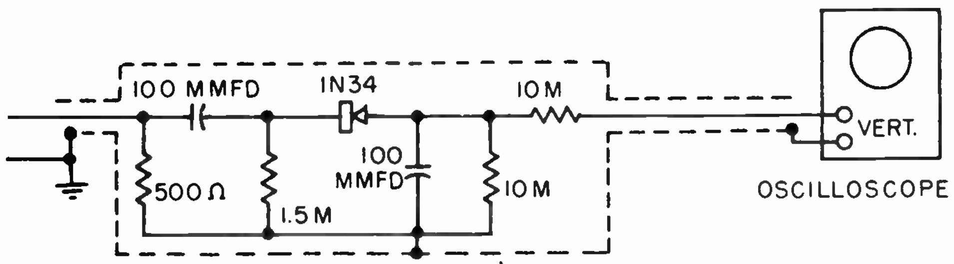


FIG. 1 - SHIELDED PROBE FOR FM I.F. ALIGNMENT

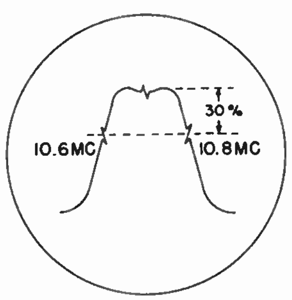


FIG. 2 - FM I.F. RESPONSE

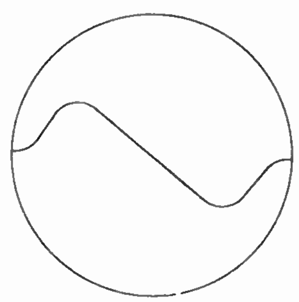


FIG. 3 - FM DISCRIMINATOR OUTPUT

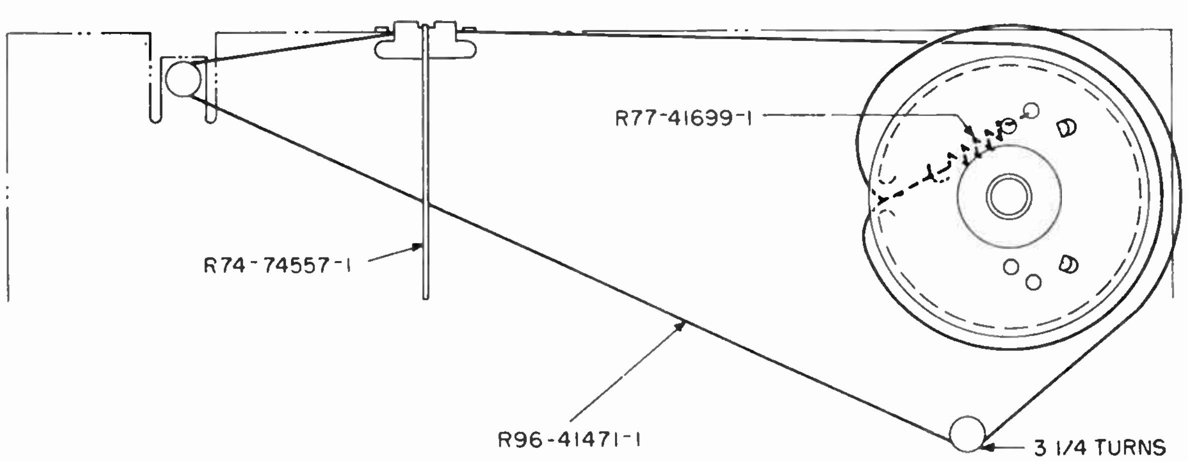


FIG. 4 - STRING AND POINTER HOOKUP

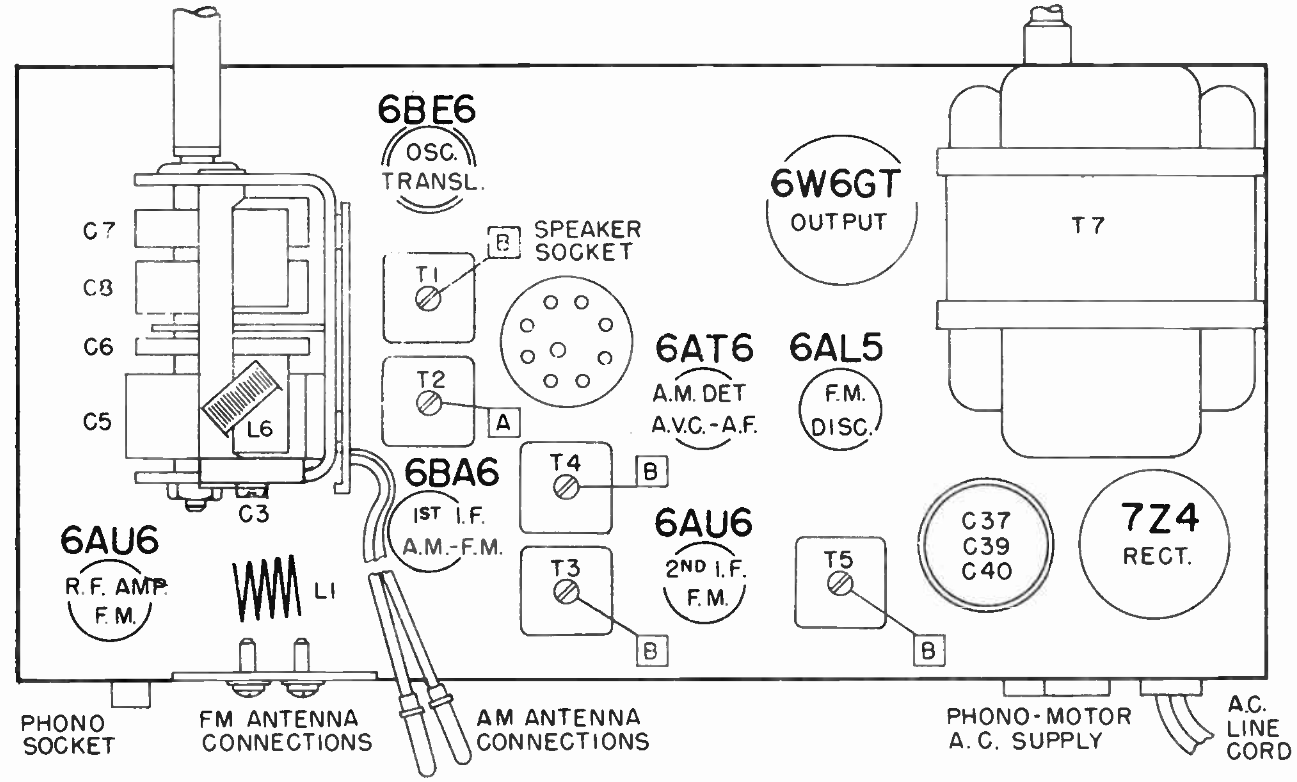


FIG. 5 - RADIO CHASSIS LAYOUT - TOP VIEW

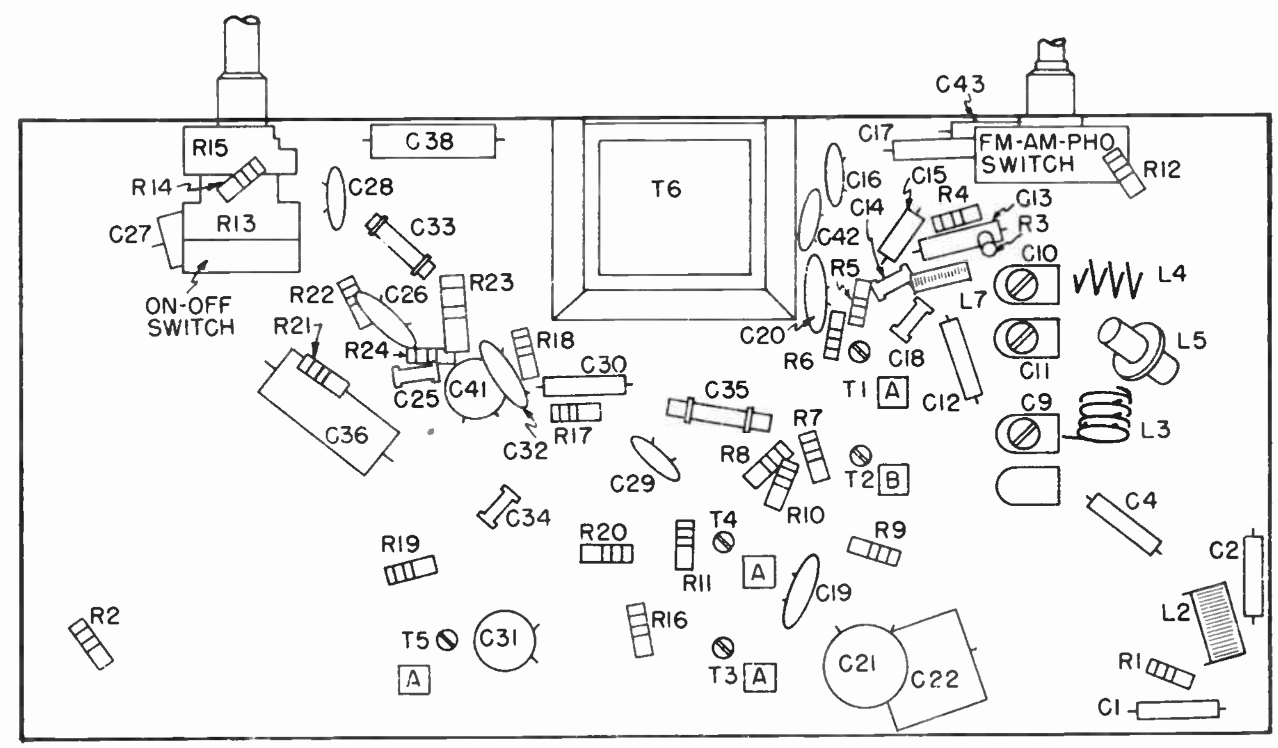
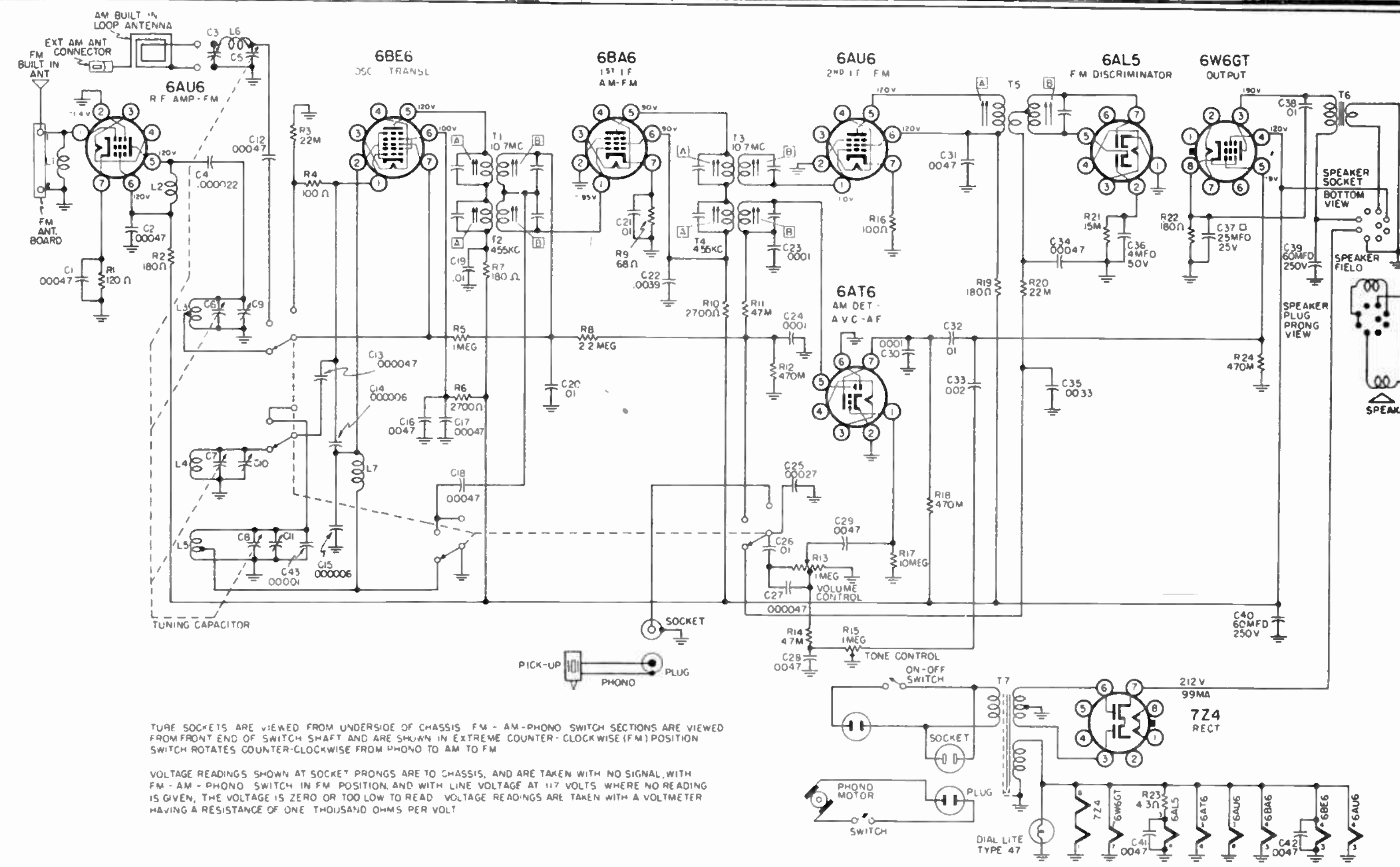


FIG. 6 - RADIO CHASSIS LAYOUT - BOTTOM VIEW

SCHEMATIC LOCATION	PART NUMBER	DESCRIPTION
	R85-61164-1	Adapter - Record
	R81-66167-1	Arm - Stop Assembly (1062, 1063)
	R74-74742-1	Background - Dial
	R73-74597-1	Board - Antenna - FM
	R71-66224-1	Bushing - Line Cord
	R86-74751-1	Bushing - Rubber
	R71-65538-1	Button - Snap
C38	R45-641032-1	Capacitor - .01 Mfd. - 400 V. - Molded Paper
C14, C15	R43-74592-2	Capacitor - 6.0 Mmfd. - Ceramic
C43	R43-74592-3	Capacitor - 10.0 Mmfd. - Ceramic
C25	R43-602710-20	Capacitor - 270 Mmfd. - Ceramic
C18, C34	R43-604710-20	Capacitor - 470 Mmfd. - Ceramic
C33	R43-602020-36	Capacitor - .002 Mfd. - Ceramic
C35	R43-603329-33	Capacitor - .0033 Mfd. - Ceramic
C16, C28, C29, C31, C41, C42	R43-704726-62	Capacitor - .0047 Mfd. - Ceramic
C19, C20, C21, C26, C32	R43-701036-63	Capacitor - .01 Mfd. - Ceramic
C4	R44-452202-20	Capacitor - 22 Mmfd. - Mica
C13, C27	R44-454701-20	Capacitor - 47 Mmfd. - Mica
C23, C24, C30	R44-351012-20	Capacitor - 100 Mmfd. - Mica
C1, C2, C12, C17	R44-454712-20	Capacitor - 470 Mmfd. - Mica
C22	R44-353921-30	Capacitor - .0039 Mfd. - Mica
C36	R41-69193-1	Capacitor - Electrolytic 4 Mfd. - 50 V.
	R41-74576-1	Capacitor - Electrolytic
C39		60 Mfd. - 250 V.
C40		60 Mfd. - 250 V.
C37		25 Mfd. - 25 V.
C3	R42-61629-1	Capacitor - Trimmer - Loop
	R42-74596-1	Capacitor - Variable - 4 Gang
	R71-67326-1	Clip - Transformer Mounting
	R71-17319-1	Clip - Tuning Shaft Retaining
L6	R50-74626-1	Coil - AM Antenna
L5	R50-66184-1	Coil - AM Oscillator
L1	R50-74586-1	Coil - FM Antenna
L4	R50-74588-1	Coil - FM Oscillator
L7	R50-74589-1	Coil - FM Oscillator - Cathode Choke
L2	R50-74626-1	Coil - FM RF - Plate Choke
L3	R50-74591-1	Coil Assembly - FM RF Grid
	R37-74577-1	Control - Dual
R13		Volume & On-Off
R15		Tone
	R19-74593-1	Cord - Line
	R74-74746-1	Dial - Station - Lucite
	R74-74555-1	Escutcheon
	R71-47266-1	Grommet
	R74-74753-1	Knob - Function
	R74-74752-1	Knob - ON-OFF & Volume
	R74-67965-2	Knob - Outer
	R30-20963-1	Lamp - Mazda #47
	R05-72417-1	Leaflet - Instruction
	R27-74729-1	Loop - Antenna - AM
	R74-74802-1	Nameplate
	R73-67023-1	Plug - 2 Prong - Female
	R74-74557-1	Pointer - Dial
	R80-67187-1	Pulley
R23	R36-67223-1	Resistor - 4.3 Ohm - 1/2 W.
R9	R35-336801-1	Resistor - 68 Ohm - 1/2 W.
R4, R16	R35-331011-1	Resistor - 100 Ohm - 1/2 W.
R1	R35-331211-1	Resistor - 120 Ohm - 1/2 W.
R2, R7, R19	R35-331811-1	Resistor - 180 Ohm - 1/2 W.
R6, R10	R35-332721-1	Resistor - 2,700 Ohm - 1/2 W.
R21	R35-331531-1	Resistor - 15,000 Ohm - 1/2 W.
R3, R20	R35-332231-1	Resistor - 22,000 Ohm - 1/2 W.
R11, R14	R35-334731-1	Resistor - 47,000 Ohm - 1/2 W.
R12, R18, R24	R35-334741-1	Resistor - 470,000 Ohm - 1/2 W.
R5	R35-331051-1	Resistor - 1 Megohm - 1/2 W.
R8	R35-332251-1	Resistor - 2.2 Megohm - 1/2 W.
R17	R35-331061-1	Resistor - 10 Megohm - 1/2 W.
R22	R35-431811-1	Resistor - 180 Ohm - 1 W.
	R71-66225-1	Retainer - Line Cord
	R81-74553-1	Shaft - Tuning
	R81-67091-1	Shield - Tube - Miniature
	R73-44897-1	Socket - 1 Prong
	R73-74598-1	Socket - 8 Prong
	R72-73227-1	Socket - Tube - 7 Prong - Miniature
	R72-73227-2	Socket - Tube - 7 Prong - Miniature
	R72-74694-1	Socket - Pilot Lamp
	R72-61013-1	Socket - Tube - 8 Prong - Lock-in - Molded
	R72-41542-1	Socket - Tube - 8 Prong - Octal
	R12-74757-1	Speaker - 10" EM (1058, 1059)
	R73-64567-1	Plug - 8 Prong
	R12-74762-1	Speaker - 12" EM (1062, 1063)
	R73-64567-1	Plug - 8 Prong
	R77-41699-1	Spring - Drive String Tension
	R77-66164-1	Spring - Tension - Stop Arm Actuating (1062, 1063)
	R86-66173-1	Stop - Rubber (1062, 1063)
	R96-41471-1	String - Drive (35")
	R71-74763-1	Stud - Stop Arm Mounting (1062, 1063)
	R33-74578-1	Switch - FM, AM, PHO



SCHEMATIC DIAGRAM

SCHEMATIC LOCATION	PART NUMBER	DESCRIPTION
T2	R57-74580-1	Transformer - IF #1 - AM
T4	R57-74582-1	Transformer - IF #2 - AM
T1	R57-74579-1	Transformer - IF #1 - FM
T3	R57-74581-1	Transformer - IF #2 - FM
T5	R57-74583-1	Transformer - Discriminator - FM
T6	R56-74584-1	Transformer - Output
T7	R55-74585-1	Transformer - Power

The models covered in this RL are fundamentally the same, differences being mainly in values of component parts rather than in basic circuit arrangement. All employ a 23 tube circuit and provide for 82 channel reception by the use of a 12 channel, turret type, VHF tuner, and a continuous tuning UHF converter. See Fig. 1 for tubes and function.

Chassis 528.247, 528.247-1, 528.247-2 and 528.256 use a 21AP4 Silvertone metal picture tube; all other chassis use a 21ZP4 Silvertone glass picture tube. In addition all chassis except 528.256, 528.263, 528.263-1 and 528.263-2 are equipped with a tone control, and phono jack and switch for use with any standard phonograph.

Component parts differences within the four basic chassis groups of 528.247, 528.256, 528.263 and 528.266 are shown in the parts price lists at the rear of this booklet, and in the schematic diagrams of all the models.

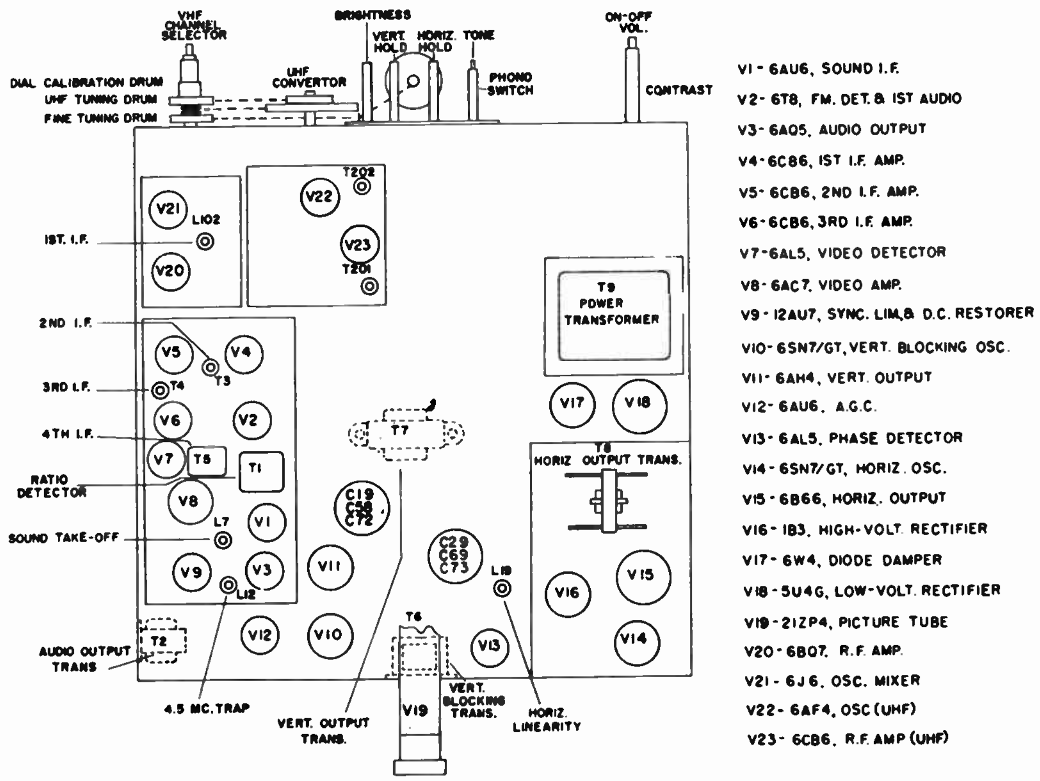


Fig. 2 Top View—Chassis 528.247, 247-1, 247-2 and 528.266, 266-1
(Components shown in broken lines can be reached from bottom of chassis.)

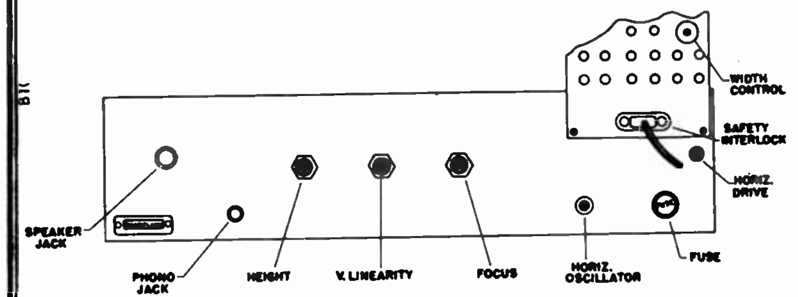


Fig. 4. Rear view of chassis showing controls

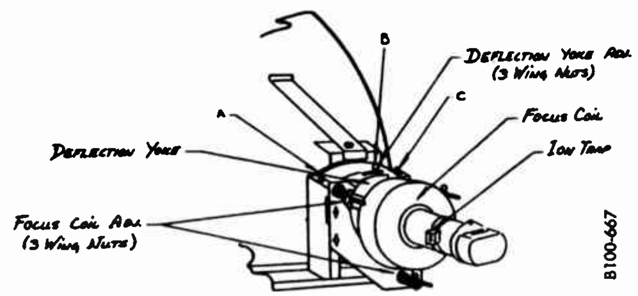


Fig. 5. Deflection and Focus Adjustments

(Chassis 528.256, 263, 263-1 and 263-2 do not contain Phono Jack.)

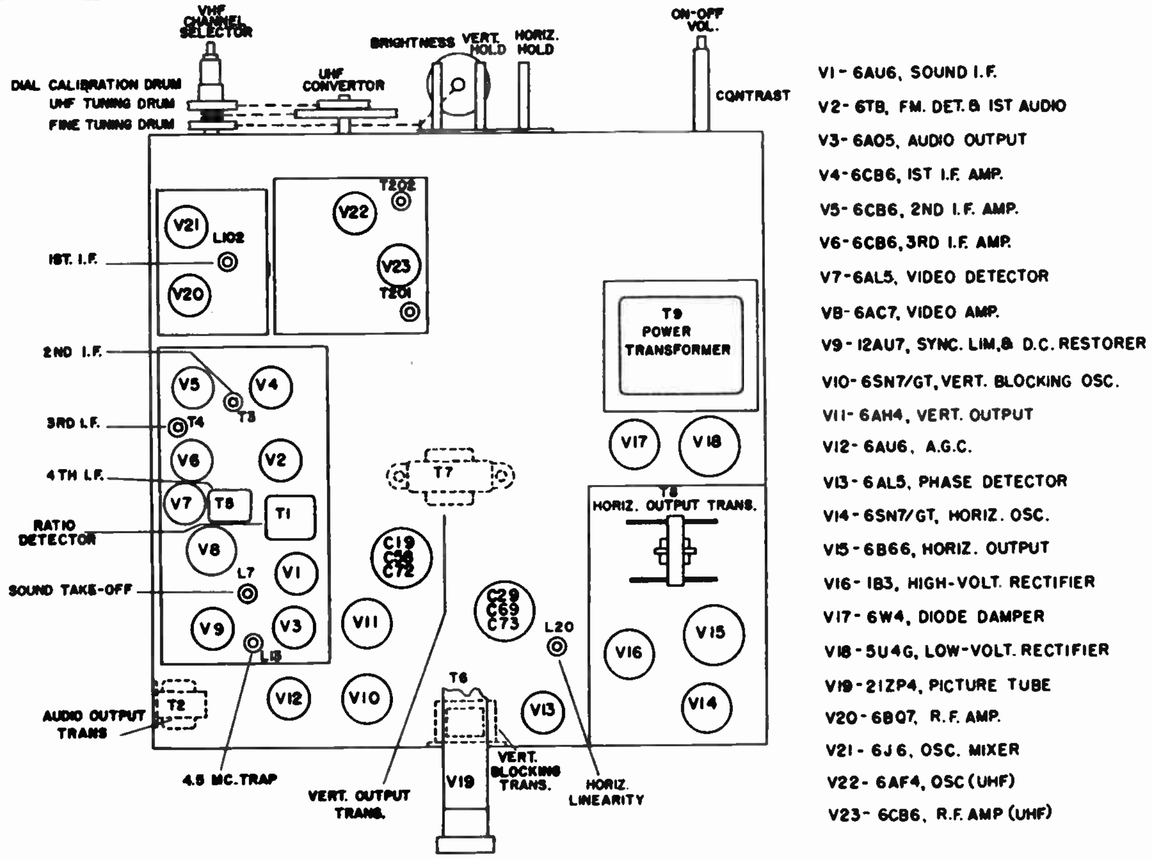


Fig. 3. Top View—Chassis 528.256 and 528.263, 263-1, 263-2
(Components show in broken lines can be reached from bottom of chassis)

TELEVISION SERVICE ADJUSTMENTS

CAUTION HIGH VOLTAGES are used in the operation of this receiver. The back cover, while in place, prevents accidental contact with this voltage and therefore should not be removed by anyone except a qualified television serviceman.

THE HIGH VOLTAGE LEAD, which supplies 12 to 16 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves. Be sure to discharge the voltage developed across the capacitor formed by the inner and outer coating of the picture tube. This can be done by connecting the high voltage socket on the tube to the outer coating.

HORIZONTAL OSCILLATOR ADJUSTMENT
If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver-adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal oscillator adjustment screw. Check the control action on various channels and alter the screw adjustment as required to provide sync on all channels with these two controls.

DEFLECTION YOKE, ION TRAP ADJUSTMENT
Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.
The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1. The Deflection Yoke should be moved as far forward as possible on the neck of the picture tube.
2. The Brightness control should be turned to maximum (clockwise) and the Picture control should be turned to minimum (counterclockwise).
3. The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on the screen.
4. The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.
5. The Brilliance control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.
6. Center the picture within the opening of the mask and eliminate shaded corners by adjusting the three positioning wing-nuts on the focus coil. Corner-cutting or shadows at the corners may be caused by mis-adjustment of either the ion trap magnet or the Focus coil, and the two may require simultaneous adjustment to secure the brightest, yet evenly distributed light on the screen. Four self-tapping screws on the focus coil U-bracket are provided to permit vertical movement of the focus coil when necessary.

CAUTION: While adjusting the focus coil, make sure there is no strain exerted by the focus coil on the neck of the picture tube. The focus coil is supported by a U-shaped bracket held in place by four screws. Loosen these screws and raise or lower the bracket until focus coil is centered about neck of tube.

HORIZONTAL DRIVE, WIDTH AND LINEARITY ADJUSTMENTS

The horizontal drive control should be adjusted by the following procedure:
Turn the Channel Selector off of a station and loosen the Horizontal Drive Control screw until a white vertical line appears approximately 1/3 from the left edge of the raster. Then slowly tighten the Horizontal Drive until the line just disappears. Re-adjustment of the horizontal drive control may necessitate readjustment of the horizontal oscillator. Turn Channel Selector knob back to test pattern. Adjust width and horizontal linearity controls for proper width and linearity picture.
The Width control (in the H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

HEIGHT AND FOCUS ADJUSTMENTS

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be accurately made on moving transmission. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area delineated by the mask.
With Brightness and Picture controls at normal positions for a station being received, adjust the Focus control (rear of chassis) for well-defined scanning lines.

The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically. At this point the Focus adjustment previously set, should be retouched for maximum definition of the lines in the vertical wedge of the test pattern. Proper adjustment and alignment of the receiver should result in clear and sharp definition.

4.5 MEGACYCLE TRAP ADJUSTMENT

The adjustment of the 4.5 megacycle trap as given in the alignment table is a very critical adjustment; very often, satisfactory results may be obtained by adjusting this coil very slightly while looking at the picture on the raster. If this coil is adjusted very slowly and carefully the 4.5 megacycle interference can be cleaned up.
This interference may be described as a moving, shadowy bead-like appearance in the picture which is caused by a break-up at extremely close intervals in the horizontal lines. This is most easily discernable in the neutral grey shades in the raster.

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE

If raster cannot be obtained, check following for possible causes:

1. Ion trap magnet adjustment is incorrect.
2. Check ¼ amp. fuse in plate circuit of horizontal output tube.
3. No high voltage—check horizontal output tube (6BG6) and high voltage rectifier (1B3) tubes and circuits.
4. Damper tube (6W4) defective. Plate voltage supply for (6BG6) horizontal output tube is obtained through damper tube. Check tube and heater winding on power transformer.
5. Defective picture tube. Heater open, cathode return circuit open.
6. No plate voltage. Electrolytic capacitor shorted. All B+ voltages are accessible for measurement underneath chassis.

HORIZONTAL DEFLECTION ONLY

If only horizontal deflection is obtained as evidenced by straight line across the face of the picture tube, it can be caused by the following:

1. Vertical oscillator (6SN7) inoperative. Check voltages on grid and plate.
2. Vertical output transformer open.
3. Yoke vertical coils open.
4. Vertical blocking transformer open or shorted.
5. Vertical output tube (6AH4) defective.

POOR VERTICAL LINEARITY

If adjustment of the vertical height and linearity controls will not correct this condition, any of the following may be the cause:

1. Vertical output transformer.
2. Vertical oscillator (6SN7) defective; check voltages.
3. Low plate and bias voltages. Check rectifier tube, capacitors in B+ supply, and cathode circuit.

SMALL RASTER

This condition can be caused by:
Low B+ or line voltage.

2. Insufficient output from horizontal output tube (6BG6). Replace tube.
3. Insufficient output from vertical output tube (6AH4) or vertical oscillator tube (6SN7). Replace tube.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND

This condition can be caused by:

1. No signal on picture tube cathode. Check for open coupling condenser.
2. Bad contact to picture tube or lead to socket broken.

PICTURE CANNOT BE SYNCHRONIZED HORIZONTALLY AND VERTICALLY

A condition of this nature can be caused by:

1. Defective sync limiter (12AU7).
2. If tube is O.K. check voltages and associated circuits.

PICTURE STABLE BUT WITH POOR RESOLUTION

If the picture resolution is not up to standard, it may be caused by any of the following:

1. Defective video detector tube (6AL5) or video amplifier tube (6AC7).
2. Open video peaking coil. Check the following coils for continuity:
   a. On chassis 528.247, 247-1, 247-2, and chassis 528.266, 266-1, check L9, L10, L11, L12, and L13.
   b. On chassis 528.256, and 528.263, 263-1, 263-2, check L10, L11, L12, L13 and L14.
3. Leakage in grid capacitor of video amplifier tube (6AC7), or in capacitor C36 of picture tube cathode circuit.

POOR HORIZONTAL LINEARITY

Check the following:

1. Horizontal output tube (6BG6) screen voltage.
2. Horizontal drive for incorrect adjustment.
3. Horizontal output tube (6BG6).
4. Damper tube (6W4).

TRAPEZOIDAL RASTER

Check for defective yoke.

PICTURE JITTER

1. Vertical instability may be due to loose connections or noise received with the signal.
2. Horizontal instability may be due to unstable transmitted sync or to noise.

If above components are found to be not defective, check the following:

A. Check all potentials in video circuits.

B. Check the picture tube socket for poor or dirty contacts.

C. Check adjustment of focus control. It should be effective on either side of proper focus.

D. Check, and re-align if necessary, the picture IF and the local oscillator.

PICTURE SMEAR

1. Normal smear can be attributed to phase shift at the low frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits.
2. This trouble can also originate at the transmitter. Check reception from another station.

TELEVISION ALIGNMENT PROCEDURE

PRELIMINARY

This alignment is an exacting procedure and should be undertaken only when necessary. Before fully deciding that alignment is necessary and before removing the chassis from the customer's home:

1. Be sure of the antenna installation.
2. Check all operating controls and adjustments including the channel selector.
3. Check reception on all channels.
4. Check tubes by substitution of known good tubes.

TEST EQUIPMENT REQUIRED

1. Signal generator (with an output variable and at least 0.1 volt max.) to provide the following frequencies:
   (a) 4.5 Mc Sound IF
   (b) 21.75 Mc Trap (Top T5)
   (c) 24.0 Mc 1st IF (L102)
   (d) 26.1 Mc 2nd IF (T3)
   (e) 23.2 Mc 3rd IF (T4)
   (f) 25.2 Mc 4th IF (Bottom T5)
2. Vacuum tube voltmeter (VTVM).
3. Cathode ray oscilloscope, preferably with a wide band vertical amplifier and an input calibrating source.
4. Sweep generator, providing both IF and RF sweep frequencies.

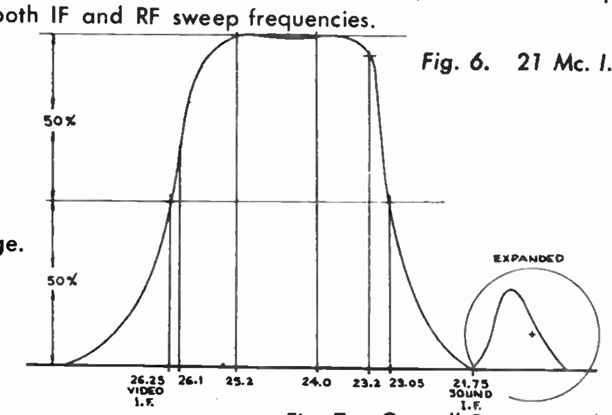
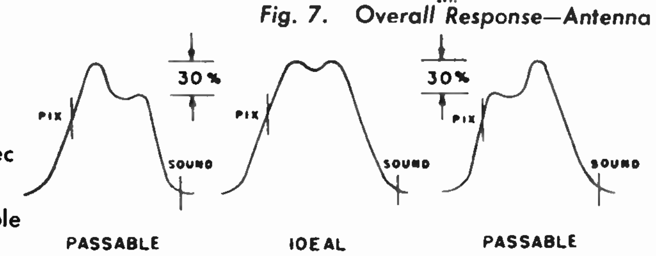
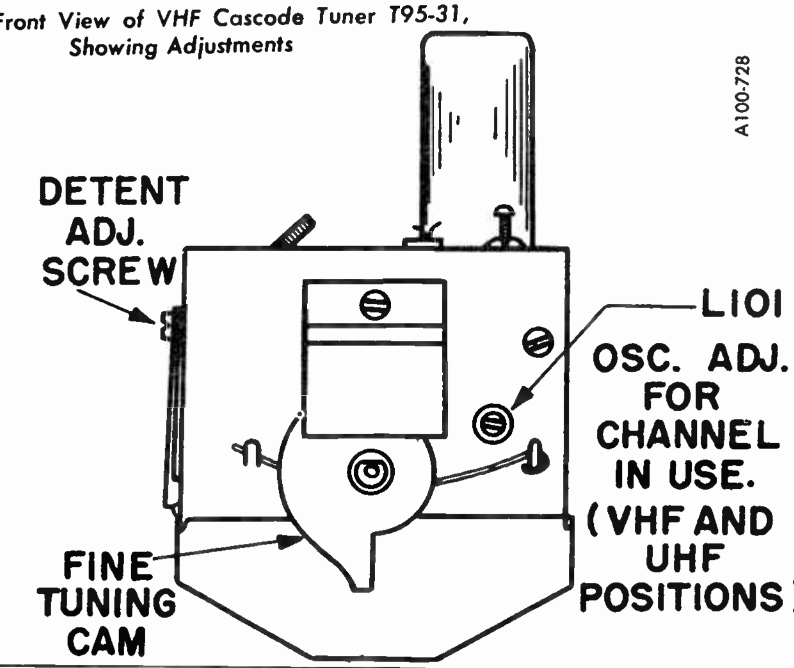


Fig. 6. 21 Mc. I.F. Response

Fig. 7. Overall Response—Antenna to Picture Dectector



Front View of VHF Cascode Tuner T95-31, Showing Adjustments



ALIGNMENT PROCEDURE

I-F ADJUSTMENTS

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
1	Raise tube shield on V21 (tuner-oscillator), so that it is not grounded, then clip the "hot" lead of the signal generator to the tube shield.	25.2	Junction R29 and L9 on Chassis 528.247, 247-1 247-2, 266 and 266-1. Junction R29 and L10 on Chassis 528.256, 263, 263-1 and 263-2	Disconnect the antenna. Set channel selector to channel on which there is no signal and no interference such as harmonics or I.F.).	T5 (bottom maximum
2		23.2			T4 maximum
3		26.1			T3 maximum
4		24.0			L102 maximum
5		21.75			T5 (top) minimum

RATIO DETECTOR AND SOUND I-F ALIGNMENT

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
1	Video Grid (pin 4, V-8)	4.5 .1 volt output	Pin 2, V2	Meter on 10 Volt scale	T1 (bottom) and L7 for max. on meter.
2	Video Grid (pin 4, V-8)	4.5 .1 volt output	See Note 1	Meter on 3 volt scale	T1 (top) for zero (center) on meter
3	Junction C36, R39	4.5 .1 volt output	Pin 2, V-2	Meter on 10 Volt scale	L12 for min. on Chassis 247, 247-1, 247-2, 266, 266-1. L13 for min. on Chassis 256, 263, 263-1, 263-2.

NOTE 1: Connect two 100K ohm resistors in series. Connect one end to pin 2 of V-2 (6T8) and the other end to ground Connect the hot side of VTVM to center of the two 100K resistors, and ground side to following:

(a) In chassis 528.247, 247-1, 247-2, 266, 266-1, connect to junction of R89 (150 ohms) and R88 (47 K ohms).

(b) In chassis 528.256, 263, 263-1, 263-2, connect to junction of R88 (150 ohms) and R1 (47 K ohms).

VHF TUNER ALIGNMENT PROCEDURE

Before attempting to align the VHF tuner it is necessary that the IF amplifier be correctly aligned. It is desirable that all adjustments of the trimmers be made at channel No. 12. Where schematic locations are given in the instructions below, refer to tuner schematic diagram – Fig. 14. Refer also to Figs. 8 and 9 for adjustment points. To align the tuner proceed as follows:

(1) Connect an RF sweep generator to the antenna terminals, and a 3 volt negative bias battery to AGC bus.

(2) If the generator is not provided with internal crystal controlled or crystal calibrated markers, connect a marker generator to the antenna terminals.

(3) Connect a cathode ray oscilliscope across the picture detector diode load resistor (6.8 K ohms).

(4) Adjust the RF generator for a 10 Mc. sweep width with a center frequency at approximately 207 Mc.

(5) Adjust the marker generator for the sound carrier of channel 12 (209.75 Mc.).

(6) Set the range switch to channel 12 with the fine tuning in the middle of its range.

(7) Turn the receiver on and allow it 15 minutes to warm up and stabilize.

(8) Set the PICTURE control for 1 volt, measured from pin "5" of Video Amplifier to chassis.

(9) Align C101, C102, and C103 for a curve similar to that shown in Fig. 7.

(10) Change the station selector to the various channels and using the correct setting of the RF sweep generator (to center it in the channel) and the correct marker frequency for the sound carrier, adjust the core in L101 so that the sound marker will be in the proper position on the curve (Fig. 7).

NOTE: Each core is independent of those for other channels. This enables you to adjust any one channel without changing the adjustment on all other channels.

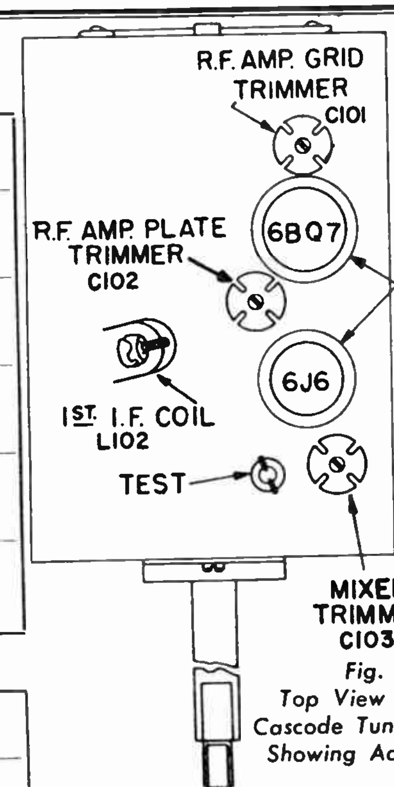


Fig. 8. Top View of VHF Cascode Tuner T95-31, Showing Adjustments

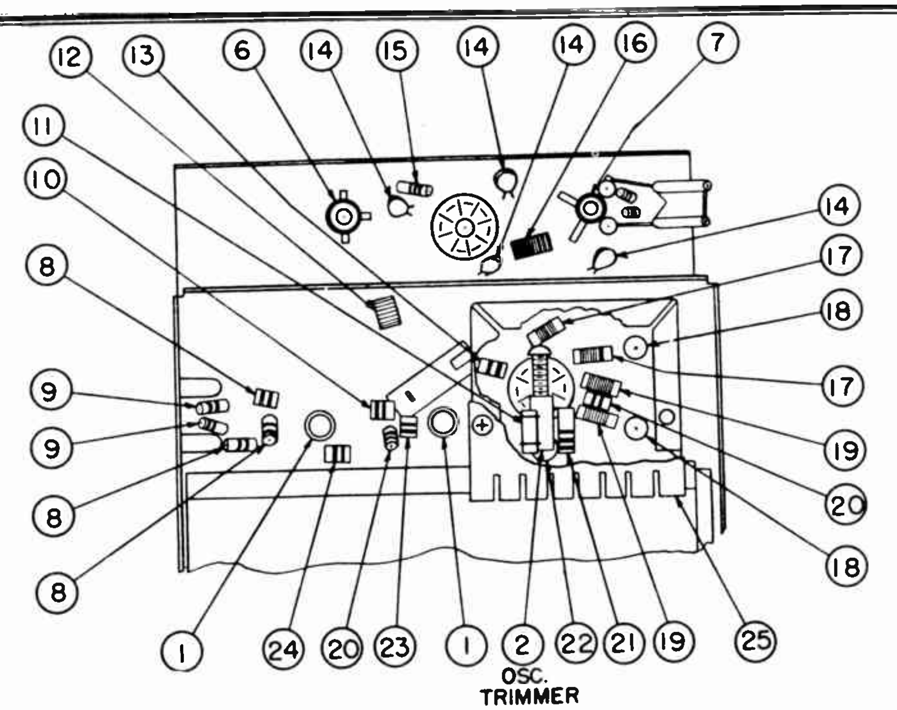
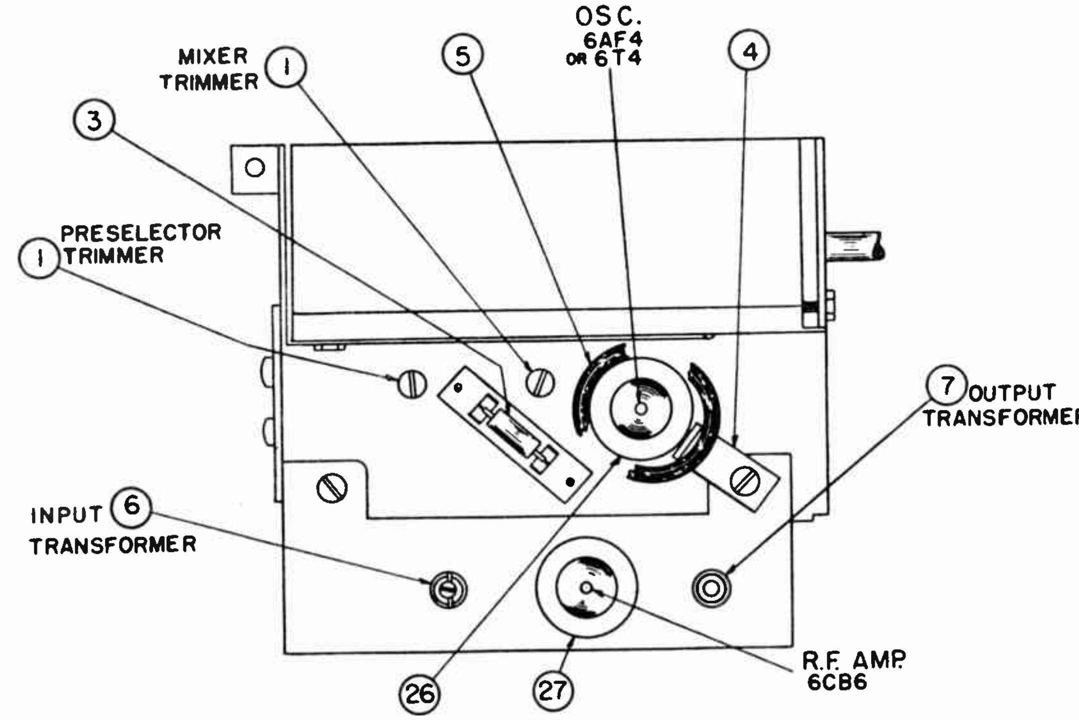


Fig. 11. Top and Bottom Views Showing Location of Parts on T-95-32 UHF Converter

PART LISTS — UHF CONVERTER T95-32
(See Fig. 11)



Location	Description	Part No.
1	Capacitor, variable, .8-6.5 mmfd.	T600-220-1
2	Capacitor, variable, 3-10 mmfd.	T600-282-3
3	Crystal (mixer) IN72	T600-236-1
4	Bracket, Oscillator tube	T600-465-1
5	Grommet, Osc. tube	T600-466-1
6	Input Transformer	T630-210-1
7	Output Transformer	T630-209-1
8	Capacitor, 1.0 mmfd.	T600-025-6
9	Resistor, 1500 ohm	T600-029-17
10	Capacitor, .25 mmfd.	T600-025-12
11	Capacitor, 4 mmfd.	T600-535-1
12	Choke	T600-407-1
13	Capacitor, .68 mmfd.	T600-025-13
14	Capacitor, 1000 mmfd.	T600-027-1

Location	Description	Part No.
15	Resistor, 150 ohm	T600-111-2
16	Choke, 1.222 uh	T600-033-3
17	Choke	T600-033-2
18	Capacitor, 68 mmfd.	T600-281-1
19	Choke, .38 uh	T600-240-3
20	Capacitor, 1.5 mmfd.	T600-025-2
21	Resistor, 12K ohm	T600-116-12
22	Capacitor, 15 mmfd.	T600-463-5
23	Capacitor, 2.5 mmfd.	T600-025-17
24	Capacitor, .4 mmfd.	T600-389-2
25	Oscillator shield lid	T600-298-1
26	Tube shield (6AF4)	T600-035-1
27	Tube shield (6J6)	T600-035-3

UHF CONVERTER ALIGNMENT PROCEDURE

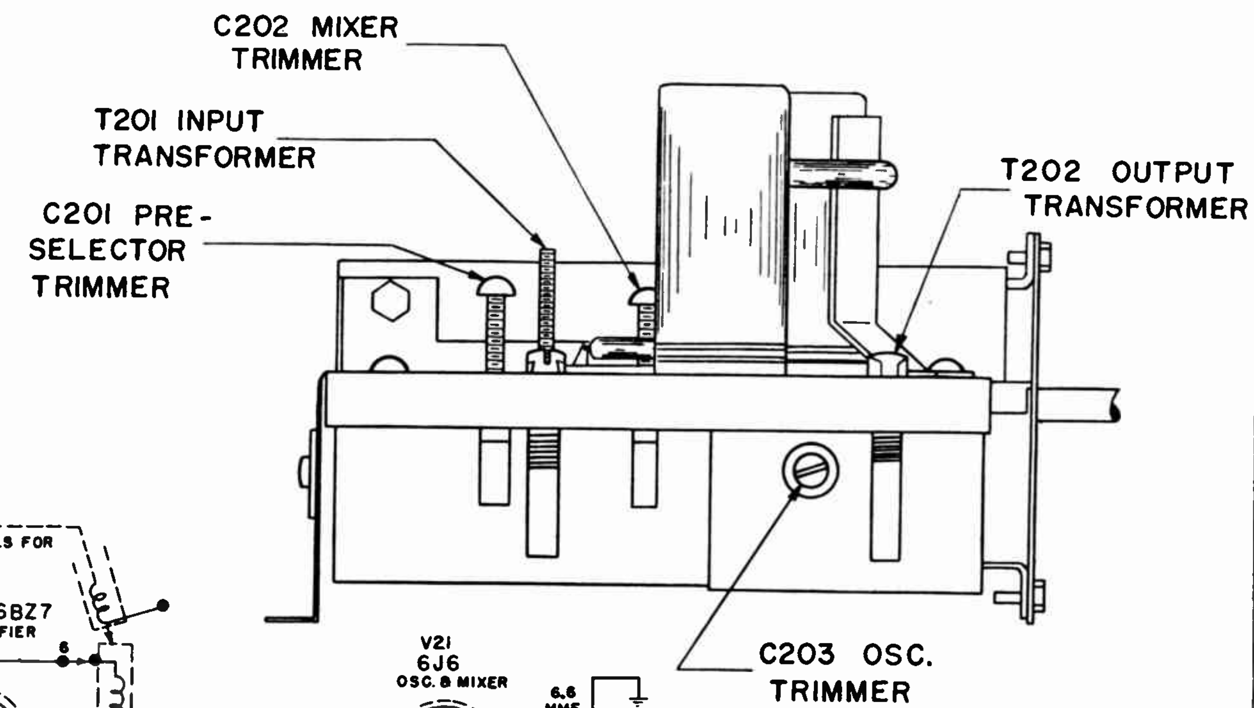
(Where schematic locations are given ,in the below instructions, refer to schematic diagram, Fig. 13. Refer also to Fig. 12, below, for adjustment points.)

1. VHF should be aligned properly before setting up UHF.
2. Remove UHF Oscillator Tube 6AF4 from socket; connect VTVM across video detector laod resistor of receiver. (L101, Fig. 12), same as on all VHF channel oscillator slugs.
3. Turn chnanel knob to UHF position.
4. Note that the oscillator slug for converter channel (124 Mc) is accessible from the front end of the tuner slugs.
5. Adjust oscillator slug for converter channel with 124 Mc signal into UHF antenna lead. Use 124 Mc signal from VHF Marker Generator Hickok 680.
6. Replace 6AF4.
7. A UHF signal from a suitable UHF signal generator should be fed into the antenna terminal of the UHF converter; attach vacuum tube voltmeter or detector probe to TV set detector.
8. Adjust two transformer slugs (T201, T202) for maximum meter indications.

ON AIR ADJUSTMENTS

1. Tune UHF receiver to a UHF station.
2. Adjust transformer (T201, T202) on UHF tuner for best sound and picture.

Fig. 12. UHF Converter T95-31 — Side View Showing Adjustments



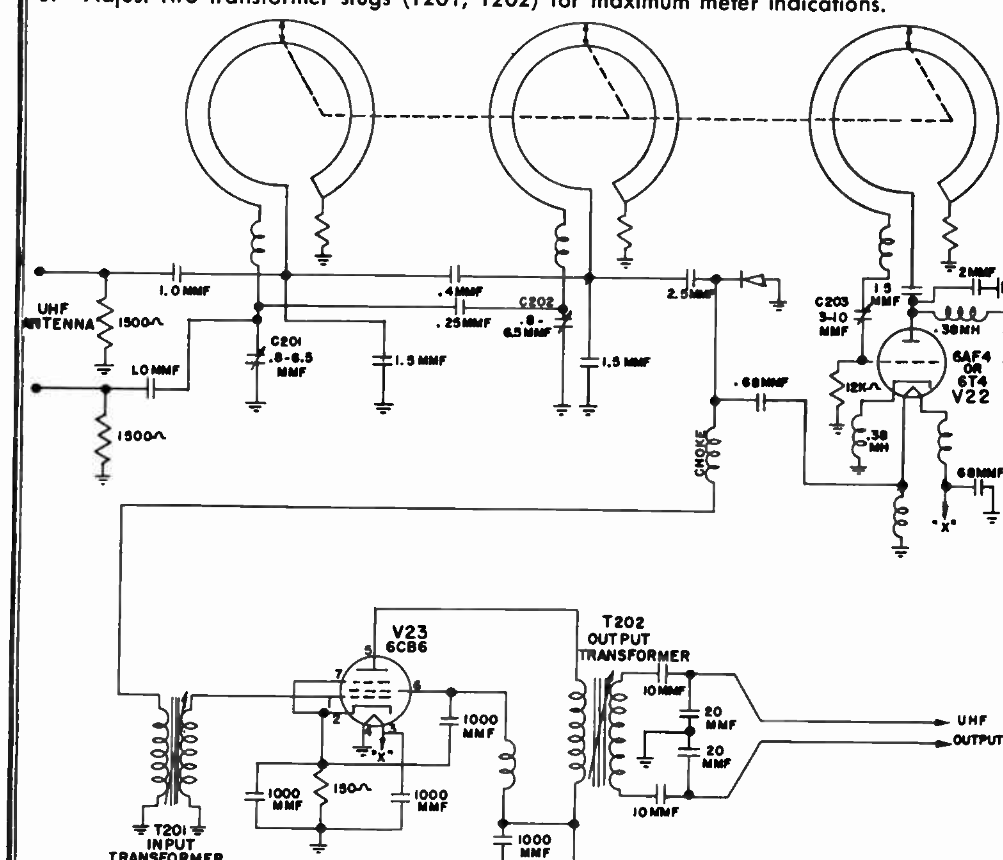


Fig. 13. Schematic Diagram of UHF Converter T95-32

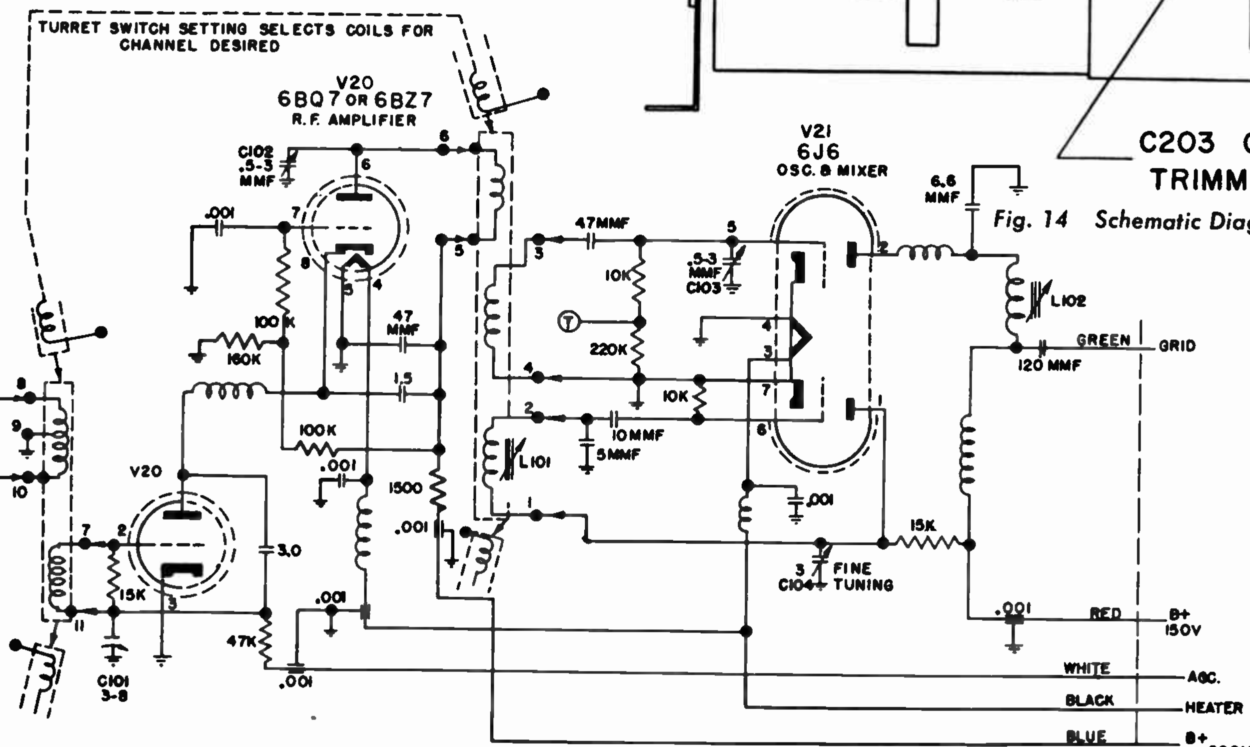
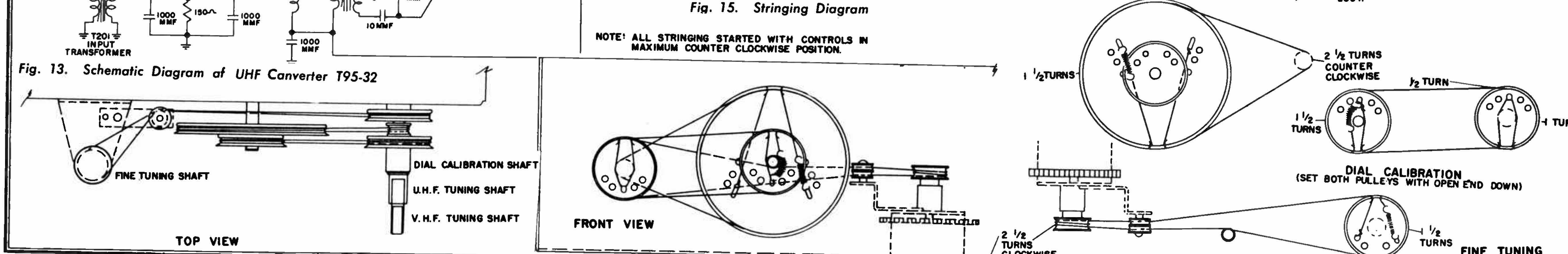


Fig. 14 Schematic Diagram of VHF Cascode Tuner T95-31

Fig. 15. Stringing Diagram

NOTE: ALL STRINGING STARTED WITH CONTROLS IN MAXIMUM COUNTER CLOCKWISE POSITION.



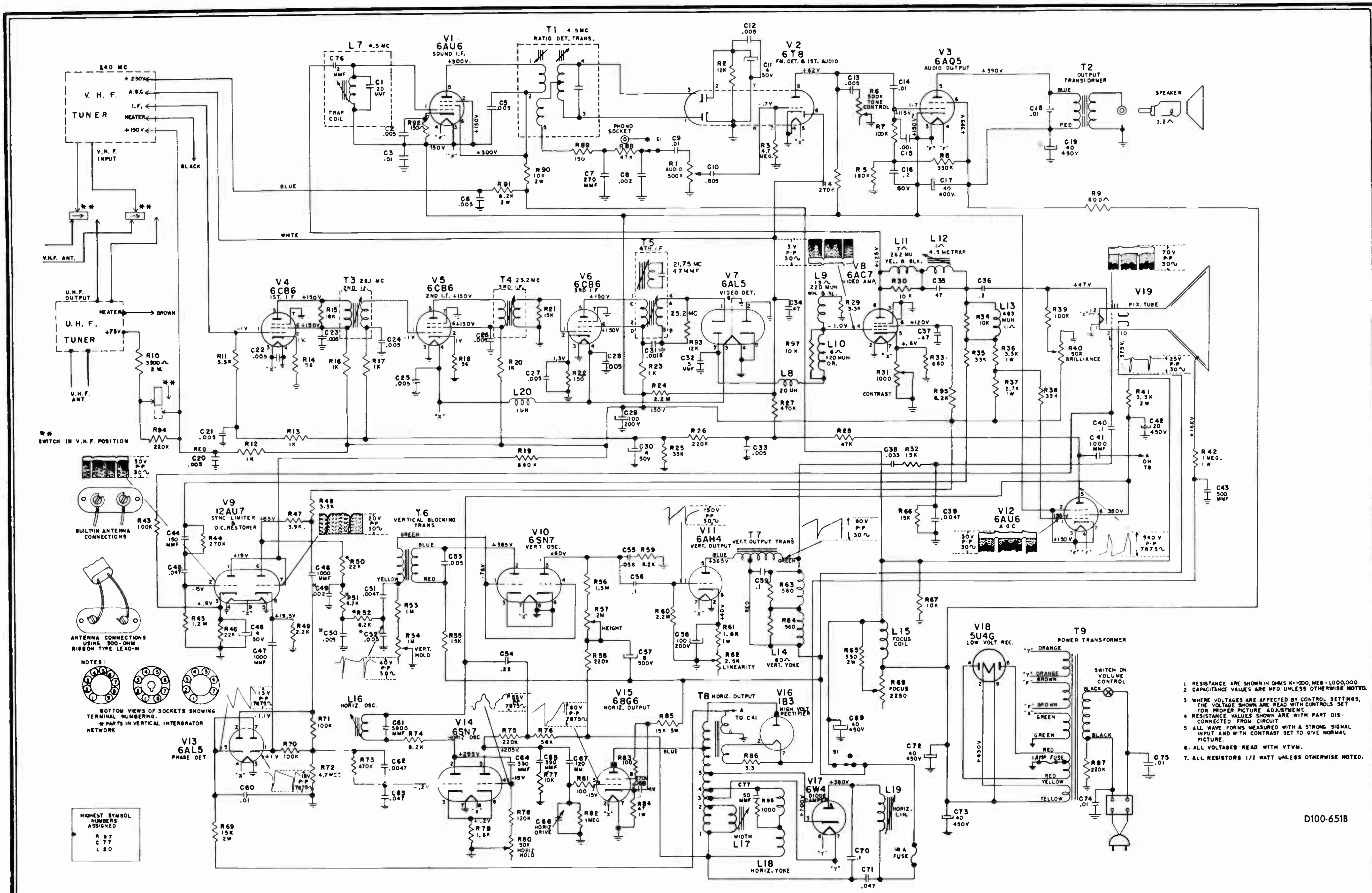


Fig. 16. Schematic Diagram for Chassis 528.247, 247-1, 247-2 and 528.266, 266-1
These chassis are the same except that 528.247, 247-1 and 247-2 contain a metal picture tube and 528.266 and 266-1 contain a glass tube.
For other differences see notes at right.

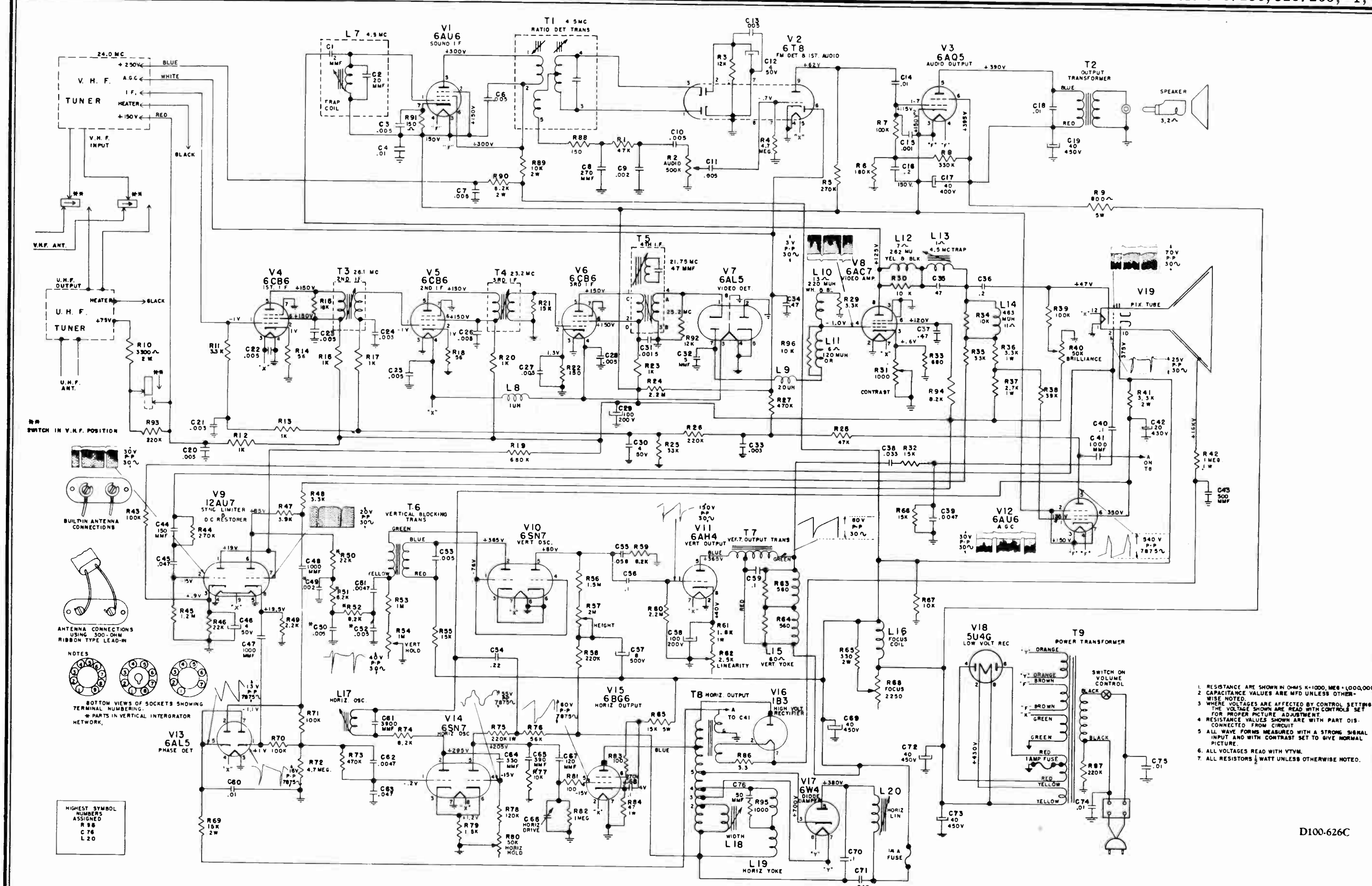


Fig. 17. Schematic Diagram for Chassis 528.256 and 528.263, 263-1, 263-2

These chassis are the same except that chassis 528.256 contains a metal picture tube and chassis 528.263, 263-1 and 263-2 contain a glass tube.

For other differences see notes at left

REPAIR PARTS LIST

CAPACITORS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each	MU Code
C1, C76		Part of coil 4.5 Mc Sound take-off (L7)		
C2, C3, C5, C6, C10, C12, C13, C20, C21, C22, C23, C24, C25, C26, C27, C28, C33, C53	T16-177	Capacitor, ceramic; .005 mfd.	$ .25	
C3‡‡	T15-211	Capacitor, ceramic; .01 mfd.	.30	
C7	T15-242	Capacitor, mica, 270 mmfd.	.25	
C8	T15-228	Capacitor, ceramic; .002 mfd.	.25	
C9	T15-211	Capacitor, ceramic; .01 mfd.	.30	
C11, C30, C46	T18-292	Capacitor, electrolytic; 4 mfd. 50 v.	1.25	
C14, C18, C60, C74, C75	T16-237	Capacitor, molded; .01 mfd. 600 v.	.30	
C15, C41, C47, C48	T15-220	Capacitor, ceramic; .001 mfd.	.30	
C16	T16-188	Capacitor, tubular; .2 mfd. 400 v.	.50	
C17	T18-308	Capacitor, electrolytic; 40 mfd. 400 v.	2.20	
C19, C29, C58, C69, C72, C73	T18-295	Capacitor, electrolytic; 40-40 mfd. 450 v.; 100 mfd. 200 v.	5.10	
C31	T16-241	Capacitor, ceramic; 1500 mmfd.	.25	
C32	T15-222	Capacitor, ceramic; 5 mmfd. 10%	.20	
C34, C37	T16-240	Capacitor, molded tubular; .47 mfd. 200 v.	.70	
C35		Part of coil, 4.5 Mc Trap (L12)		
C36	T16-212	Capacitor, tubular; .2 mfd. 600 v.	.60	
C37**	T16-177	Capacitor, ceramic; .005 mfd.	.25	
C38	T16-234	Capacitor, molded; .033 mfd. 600 v.	.40	
C39, C51, C62	T16-233	Capacitor, molded; .0047 mfd. 600 v. 10%	.35	
C40, C56, C68	T16-238	Capacitor, molded; .1 mfd. 600 v.	.65	
C42	T18-276	Capacitor, electrolytic; 20 mfd. 450 v.	2.15	
C43	T15-239	Capacitor, 500 mmfd., +50% −20%, 20,000 v.	1.50	
C44	T15-235	Capacitor, mica; 150 mmfd.	.25	
C45, C63	T16-235	Capacitor, molded; .047 mfd. 600 v.	.40	
C49, C50, C52		Parts of vertical integrator network		
C54	T16-218	Capacitor, molded; tubular; .22 mfd. 600 v.	.95	
C55	T16-236	Capacitor, molded; .056 mfd. 600 v. 10%	.45	
C57	T18-298	Capacitor, electrolytic; 8 mfd. 500 v.	1.65	
C59	T16-187	Capacitor, tubular, .1 mfd. 400 v.	.30	
C61		Part of coil, Horizontal Oscillator (L16)		
C64	T15-226	Capacitor, silver mica; 330 mmfd. 10%	.45	
C65	T15-231	Capacitor, mica; 390 mmfd.	.30	
C66	T20-145	Capacitor, trimmer; HORIZONTAL DRIVE	.50	
C67	T15-232	Capacitor, mica, 120 mmfd., 10%	.25	
C70	T16-231	Capacitor, molded tubular; .1 mfd. 1,000 v. 10%	1.00	
C71	T16-239	Capacitor, molded; .047 mfd. 1,000 v.	.60	
C77		Part of Deflection Yoke (L14, L18)		

RESISTORS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each	MU Code
R1, R31	T24-206	Resistor, Dual On/Off VOLUME 500K and CONTRAST 1K ohm	$ 2.25	
R2, R93	T60-811	Resistor, 12K ohm, ½ w. 10%	.20	
R3, R72	T60-779	Resistor, 4.7 megohm ½ w.	.20	
R4, R44	T60-747	Resistor, 270K ohm, ½ w. 10%	.20	
R5	T60-788	Resistor, 180K ohm, ½ w. 5%	.20	
R6	T25-23	Resistor, variable, 500K ohm TONE AND PHONO SWITCH	3.25	
R6‡	T24-207	Resistor, variable, 500K ohm, TONE AND PHONO SWITCH	2.05	
R7, R39, R43, R70, R71	T60-801	Resistor, 100K ohm, ½ w. 10%	.20	
R8	T60-787	Resistor, 330K ohm, ½ w. 5%	.20	
R9	T60-800	Resistor, 800 ohm, 5 w. 10%	.45	
R10, R41	T60-816	Resistor, 3300 ohm, 2 w. 10%	.30	
R11, R29, R48	T60-882	Resistor, 3.3K ohm, ½ w. 10%	.20	
R12, R13, R16, R17, R20, R23	T60-703	Resistor, 1K ohm, ½ w. 10%	.20	
R14, R18	T60-806	Resistor, 56 ohm, ½ w. 10%	.20	
R15	T60-777	Resistor, 18K ohm, ½ w. 10%	.20	
R19	T60-807	Resistor, 680K ohm, ½ w. 10%	.20	
R21, R32, R55, R66	T60-783	Resistor, 15K ohm, ½ w. 10%	.20	
R22, R89, R92	T60-767	Resistor, 150 ohm, ½ w. 10%	.20	
R24, R60	T60-898	Resistor, 2.2 megohm, ½ w. 10%	.20	
R25, R35	T60-748	Resistor, 33K ohm, ½ w. 10%	.20	
R26, R58, R87, R94*	T60-672	Resistor, 220K ohm, ½ w. 10%	.20	
R27	T60-902	Resistor, 470K ohm, ½ w. 10%	.20	
R28, R88	T60-730	Resistor, 47K ohm, ½ w.	.20	
R30		Part of coil, Peaking, 175 uh (L11)		
R33	T60-708	Resistor, 680 ohm, ½ w. 10%	.20	
R34		Part of coil, Peaking, 410 uh (L13)		
R36	T60-724	Resistor, 3.3K ohm, 1 w. 10%	.20	
R37	T60-892	Resistor, 2.7K ohm, 1 w. 10%	.20	
R38	T60-893	Resistor, 39K ohm, ½ w. 10%	.20	
R40, R80	T25-21	Resistor, variable, 50K ohm; BRIGHTNESS & HORIZONTAL HOLD	.90	
R42	T60-877	Resistor, 1 megohm, 1 w.	.20	
R45, R53	T60-782	Resistor, 1.2 megohm, ½ w. 10%	.20	
R46	T60-744	Resistor, 22K ohm, ½ w. 10%	.20	
R47	T60-710	Resistor, 3.9 ohm, ½ w. 10%	.20	
R49	T60-714	Resistor, 2.2K ohm, ½ w. 10%	.20	
R50, R51, R52		Part of Vertical Intergrator Network		
R53‡‡	T60-909	Resistor, 1 megohm ½ w. 10%	.30	
R54	T25-22	Resistor, variable, 1 megohm, VERTICAL HOLD	.95	
R56	T60-880	Resistor, 1.5 megohm, ½ w. 10%	.20	
R57	T25-15	Resistor, variable, 2 megohm, HEIGHT	.90	
R59, R74, R95**	T60-778	Resistor, 8.2K ohm, ½ w. 10%	.20	
R61	T60-899	Resistor, 1.8K ohm, 1 w. 10%	.20	
R62	T25-13	Resistor, variable, 2.5K ohm, VERTICAL LINEARITY	.90	
R63, R64, R96		Part of coil, Deflection Yoke (L14, L18)		
R65	T60-814	Resistor, 330 ohm, 2 w. 10%	.30	
R67	T60-897	Resistor, 10K ohm, 20 w. 10%	1.40	
R68	T25-14	Resistor, variable, 2250 ohm, 4 w., FOCUS	2.00	
R69	T60-901	Resistor, 15K ohm, 2 w. 10%	.30	
R73	T60-731	Resistor, 470K ohm, ½ w.	.20	
R75	T60-886	Resistor, 220K ohm, 1 w. 10%	.20	
R76	T60-802	Resistor, 56K ohm, ½ w. 10%	.20	
R77	T60-760	Resistor, 10K ohm, ½ w. 10%	.20	
R78	T60-817	Resistor, 120K ohm, ½ w. 10%	.20	
R79	T60-729	Resistor, 1500 ohm, ½ w. 10%	.20	
R81, R83	T60-752	Resistor, 100 ohm, ½ w. 10%	.20	
R82	T60-668	Resistor, 1 megohm, ½ w.	.20	
R84	T60-805	Resistor, 47 ohm, 1 w. 10%	.20	
R85	T60-804	Resistor, 15K ohm, 5 w. 10%	1.00	
R86	T60-884	Resistor, 3.3 ohm, ½ w. 10%	.20	
R90	T60-900	Resistor, 10K ohm, 2 w. 10%	.30	
R91	T60-878	Resistor, 8.2K ohm, 2 w. 10%	.30	
R97‡‡		Part of Peaking Coil, 120 uh (L10)		

TRANSFORMERS AND COILS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each	MU Code
T1	T10-552	Transformer, Ratio Dectector, 4.5 Mc	$ 3.15	
T2	T80-253	Transformer, Output (audio)	2.25	
T3	T10-541	Transformer, 2nd I.F. (blue)	1.05	
T4	T10-542	Transformer, 3rd I.F. (white)	1.05	
T5	T10-588	Transformer, 4th I.F. (sound trap) (inc. 21.75 wave trap)	2.05	
T6	T80-257	Transformer, Vertical Blocking	2.15	
T6‡	T80-284	Transformer, Vertical Blocking	2.15	
T7	T80-277	Transformer, Vertical Output	3.60	
T8	T80-278	Transformer, Horizontal Output	9.60	AO
T9	T80-264	Transformer, Power	19.00	AO
L7	T10-587	Coil, 4.5 Mc sound take-off	2.30	
L8	T33-226	Choke, 14 uh, 10%	.75	
L8‡‡	T33-237	Choke, 20 uh, 10%	.45	
L9	T10-579	Coil, Peaking; (white and black) 550 uh	.45	
L9‡‡	T10-609	Coil, Peaking; (black and blue) 220 uh	.45	
L10	T10-557	Coil, Peaking; (orange) 90 uh	.45	
L10‡‡	T10-607	Coil, Peaking; (black and orange) 120 uh; wound on 10K ohm resistor (includes R97)	.45	
L11	T10-580	Coil, Peaking; (yellow and black) 175 uh wound on 8.2K ohm, ½ w. resistor (includes R30)	.45	
L11‡‡	T10-610	Coil, Peaking; (white and brown) 262 uh; wound on 10K ohm resistor (includes R30)	.45	
L12	T10-581	Coil, 4.5 Mc Trap	1.20	
L13	T10-578	Coil, (yellow and red) Peaking; 410 uh wound on 10K ohm, ½ w. resistor (includes R34)	.45	
L13‡‡	T10-608	Coil, Peaking; (white and blue) 463 uh; wound on 10K ohm resistor (includes R34)	.45	
L14, L18	T83-743	Deflection Yoke (includes R63, R64, R96 and C77)	9.10	AO
L15	T10-560	Coil, Focus	8.70	AO
L16	T10-583	Coil, Horizontal oscillator (includes C61)	2.20	
L17	T10-551	Coil, Width Control	1.05	
L19	T10-582	Coil, Horizontal Linearity Control	1.05	
L20	T33-236	Choke, Insulated, 1 uh, 10%	.30	

REPAIR PARTS LIST

CAPACITORS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each	MU Code
C1, C2		Part of coil 4.5 Mc sound take-off (L7)		
C3, C4, C6, C7, C10, C11, C13, C20, C21, C22, C23, C24, C25, C26, C27, C28, C33, C37, C53	T16-177	Capacitor, ceramic; .005 mfd.	$ .25	
C4†	T15-211	Capacitor, ceramic; .01 mfd. 600 v.	.30	
C8	T15-242	Capacitor, mica; 270 mmfd.	.25	
C9	T15-228	Capacitor, ceramic; .002 mfd.	.25	
C12, C30, C46	T18-292	Capacitor, electrolytic; 4 mfd. 50 v.	1.25	
C14, C18, C60, C74, C75	T16-237	Capacitor, molded; .01 mfd. 600 v.	.30	
C15, C41, C47, C48	T15-220	Capacitor, ceramic; .001 mfd.	.30	
C16	T16-188	Capacitor, tubular; .2 mfd. 400 v.	.50	
C17	T18-308	Capacitor, electrolytic; 40 mfd. 400 v.	2.20	
C19, C29, C58, C69, C72, C73	T18-295	Capacitor, electrolytic; 40-40 mfd. 450 v.; 100 mfd. 200 v.	5.10	
C31	T16-241	Capacitor, ceramic; 1500 mmfd.	.25	
C32	T15-222	Capacitor, ceramic; 5 mmfd. 10%	.20	
C34	T16-240	Capacitor, molded tubular; .47 mfd. 200 v.	.70	
C35		Part of coil, 4.5 Mc Trap (L13)		
C36	T16-212	Capacitor, tubular; .2 mfd. 600 v.	.60	
C37*	T16-240	Capacitor, molded tubular; .47 mfd. 200 v.	.70	
C38	T16-234	Capacitor, molded; .033 mfd. 600 v.	.40	
C39, C51, C62	T16-233	Capacitor, molded; .0047 mfd. 600 v. 10%	.35	
C40, C56, C68	T16-238	Capacitor, molded; .1 mfd. 600 v.	.65	
C42	T18-276	Capacitor, electrolytic; 20 mfd. 450 v.	2.15	
C43	T15-239	Capacitor, 500 mmfd., +50% −20%, 20,000 v.	1.50	
C44	T15-235	Capacitor, mica; 150 mmfd.	.25	
C45, C63	T16-235	Capacitor, molded; .047 mfd. 600 v.	.40	
C49, C50, C52		Parts of Vertical Integrator Network		
C54	T16-218	Capacitor, molded; tubular; .22 mfd. 600 v.	.95	
C55	T16-236	Capacitor, molded; .056 mfd. 600 v. 10%	.45	
C57	T18-298	Capacitor, electrolytic; 8 mfd. 500 v.	1.65	
C59	T16-187	Capacitor, tubular, 1 mfd. 400 v.	.30	
C61		Part of coil, Horizontal Oscillator (L17)		
C64	T15-226	Capacitor, silver mica; 330 mmfd. 10%	.45	
C65	T15-231	Capacitor, mica; 390 mmfd.	.30	
C66	T20-145	Capacitor, trimmer; HORIZONTAL DRIVE	.50	
C67	T15-232	Capacitor, mica, 120 mmfd., 10%	.25	
C70	T16-231	Capacitor, molded tubular; .1 mfd. 1,000 v. 10%	1.00	
C71	T16-239	Capacitor, molded; .047 mfd. 1,000 v.	.60	
C76		Part of Deflection Yoke (L15, L19)		

RESISTORS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each	MU Code
R1, R28	T60-730	Resistor, 47K ohm, ½ w.	.20	
R2, R31	T24-206	Resistor, Dual ON/OFF Volume 500K and Contrast 1K ohm	2.25	
R3, R92	T60-811	Resistor, 12K ohm, ½ w. 10%	.20	
R4, R72	T60-779	Resistor, 4.7 megohm, ½ w.	.20	
R5, R44	T60-747	Resistor, 270K ohm, ½ w. 10%	.20	
R6	T60-788	Resistor, 180K ohm, ½ w. 5%	.20	
R7, R39, R43, R70, R71	T60-801	Resistor, 100K ohm, ½ w. 10%	.20	
R8	T60-787	Resistor, 330K ohm, ½ w. 5%	.20	
R9	T60-800	Resistor, 800 ohm, 5 w. 10%	.45	
R10, R41	T60-816	Resistor, 3300 ohm, 2 w. 10%	.30	
R11, R29, R48	T60-882	Resistor, 3.3K ohm, ½ w. 10%	.20	
R12, R13, R16, R17, R20, R23	T60-703	Resistor, 1K ohm, ½ w. 10%	.20	
R14, R18	T60-806	Resistor, 56 ohm, ½ w. 10%	.20	
R15	T60-777	Resistor, 18K ohm, ½ w. 10%	.20	
R19	T60-807	Resistor, 680K ohm, ½ w. 10%	.20	
R21, R32, R55, R66	T60-783	Resistor, 15K ohm, ½w. 10%	.20	
R22, R88, R91	T60-767	Resistor, 150 ohm, ½ w. 10%	.20	
R24, R60	T60-898	Resistor, 2.2 megohm, ½ w. 10%	.20	
R25, R35	T60-748	Resistor, 33K ohm, ½ w. 10%	.20	
R26, R58, R87, R93	T60-672	Resistor, 220K ohm, ½ w. 10%	.20	
R27	T60-902	Resistor, 470K ohm, ½ w. 10%	.20	
R30		Part of coil, Peaking, 175 uh (L12)		
R33	T60-708	Resistor, 680 ohm, ½ w. 10%	$ .20	
R34		Part of coil, Peaking 410 uh (L14)		
R36	T60-724	Resistor, 3.3K ohm, 1 w. 10%	.20	
R37	T60-892	Resistor, 2.7K ohm, 1 w. 10%	.20	
R38	T60-893	Resistor, 39K ohm, ½ w. 10%	.20	
R40, R80	T25-21	Resistor, variable, 50K ohm, BRIGHTNESS & HORIZONTAL HOLD	.90	
R42	T60-877	Resistor, 1 megohm, 1 w.	.20	
R45, R53	T60-782	Resistor, 1.2 megohm, ½ w. 10%	.20	
R46	T60-744	Resistor, 22K ohm, ½ w. 10%	.20	
R47	T60-710	Resistor, 3.9 ohm, ½ w. 10%	.20	
R49	T60-714	Resistor, 2.2K ohm, ½ w. 10%	.20	
R50, R51, R52		Part of Vertical Integrator Network		
R53†	T60-909	Resistor, 1 megohm, ½ w. 10%	.20	
R54	T25-22	Resistor, variable, 1 megohm, VERTICAL HOLD	.95	
R56	T60-880	Resistor, 1.5 megohm, ½ w. 10%	.20	
R57	T25-15	Resistor, variable, 2 megohm, HEIGHT	.90	
R59, R74, R94*	T60-778	Resistor, 8.2K ohm, ½ w. 10%	.20	
R61	T60-899	Resistor, 1.8K ohm, 1 w. 10%	.20	
R62	T25-13	Resistor, variable, 2.5K ohm, VERTICAL LINEARITY	.90	
R63, R64, R95		Part of coil, Deflection Yoke (L15, L19)		
R65	T60-814	Resistor, 330 ohm, 2 w. 10%	.30	
R67	T60-897	Resistor, 10K ohm, 20 w. 10%	1.40	
R68	T25-14	Resistor, variable, 2250 ohm, 4 w., FOCUS	2.00	
R69	T60-901	Resistor, 15K ohm, 2 w. 10%	.30	
R73	T60-731	Resistor, 470K ohm, ½ w.	.20	
R75	T60-886	Resistor, 220K ohm, 1 w. 10%	.20	
R76	T60-802	Resistor, 56K ohm, ½ w. 10%	.20	
R77	T60-760	Resistor, 10K ohm, ½ w. 10%	.20	
R78	T60-817	Resistor, 120K ohm, ½ w. 10%	.20	
R79	T60-729	Resistor, 1500 ohm, ½ w. 10%	.20	
R81, R83	T60-752	Resistor, 100 ohm, ½ w. 10%	.20	
R82	T60-668	Resistor, 1 megohm, ½ w.	.20	
R84	T60-805	Resistor, 47 ohm, 1 w. 10%	.20	
R85	T60-804	Resistor, 15K ohm, 5 w. 10%	1.00	
R86	T60-884	Resistor, 3.3 ohm, ½ w. 10%	.20	
R89	T60-900	Resistor, 10K ohm, 2 w. 10%	.30	
R90	T60-878	Resistor, 8.2K ohm, 2 w. 10%	.30	
R96†		Part of Coil, Peaking (L11)		

TRANSFORMERS AND COILS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each	MU Code
T1	T10-552	Transformer, Ratio Detector, 4.5 Mc	3.15	
T2	T80-253	Transformer, Output (audio)	2.25	
T3	T10-541	Transformer, 2nd I.F. (blue)	1.05	
T4	T10-542	Transformer, 3rd I.F. (white)	1.05	
T5	T10-588	Transformer, 4th I.F. (sound trap; (inc. 21.75 wave trap)	2.05	
T6	T80-284	Transformer, Vertical Blocking	2.15	
T7	T80-277	Transformer, Vertical Output	3.60	
T8	T80-278	Transformer, Horizontal Output	9.60	AO
T9	T80-264	Transformer, Power	19.00	AO
L7	T10-587	Coil, 4.5 Mc sound take-off	2.30	
L8	T33-236	Choke, Insulated; 1 uh, 10%	.30	
L9	T33-226	Choke, 14 uh, 10%	.75	
L9†	T33-237	Choke, 20 uh, 10%	.45	
L10	T10-579	Coil, Peaking; (white and black) 550 uh	.45	
L10†	T10-609	Coil, Peaking; (black and blue) 220 uh	.45	
L11	T10-557	Coil, Peaking; (orange) 90 uh	.45	
L11†	T10-607	Coil, Peaking; (black and orange), 120 uh, wound on 10K ohm, ½ w. resistor (includes R96)	.45	
L12	T10-580	Coil, Peaking; (yellow and black) 175 uh, wound on 8.2K ohm, ½ w. resistor (includes R30)	.45	
L12†	T10-610	Coil, Peaking; (white and brown) 262 uh, wound on 10K ohm, ½ w. resistor (includes R30)	.45	
L13	T10-581	Coil, 4.5 Mc Trap	1.20	
L14	T10-578	Coil, (yellow and red) Peaking; 410 uh, wound on 10K ohm, ½ w. resistor (includes R34)	.45	
L14†	T10-608	Coil, Peaking; (white and blue), 463 uh, wound on 10K ohm, ½ w. resistor (includes R34)	.45	
L15, L19	T83-743	Deflection Yoke (includes R63, R64)	9.10	AO
L16	T10-560	Coil, Focus	8.70	AO
L17	T10-583	Coil, Horizontal Oscillator (includes C61)	2.70	
L18	T10-551	Coil, Width Control	1.05	
L20	T10-582	Coil, Horizontal Linearity Control	1.05	

CABINET REPAIR PARTS LIST

Part Number	DESCRIPTION	Sears Selling Price Each	MU Code
T79-398	Speaker, 6" P.M.	4.80	
T79-397	Speaker, 5" P.M.	4.00	

PRODUCTION CHANGES

(See schematic diagram — Fig. 17.)

The following changes were made on the above chassis as production progressed. These changes, while representing certain improvements, are not retroactive. If you have a production model which does not incorporate the changes below, do not make the change except to correct an actual complaint.

To prevent overloading of the video amplifier tube, resistor R94 has been added to chassis 528.263-1 and 263-2. Chassis 528.256 and 263 do not contain this resistor. With this change, capacitor C37 changed value. On chassis 528.263-1 and 263-2 the capacitor (C37) marked "" has replaced the other listed.

†On chassis 528.263-2 these parts replace the others listed.

PRODUCTION CHANGES

(For part numbers of these components see parts list. See also, notes, page 23.)

This diagram has incorporated the following changes, which were made c these chassis as production progressed, in order to make certain improvements. The changes are not retroactive. If you have an earlier production chassis which does n include them, do not make the change except to correct an actual complaint.

Schematic Location	Connected:	Change:
*R94	In series with screen grid of V8.	Added to chassis 528.263-1 and 263- (To prevent overloading of V8.)
*C37	Pin 6 of V8 to B minus.	Changed value — .005 mfd. in chass 528.256 and 263; now .47 mfd., in chass 528.263-1 and 263-2, as shown. (Th change accompanied change in R94 above.)
†C4	Junction of L7 and C3, to B minus	Changed value — .005 mfd. in chass 528.256, 263, and 263-1; now .01 mfd as shown. (To eliminate regeneration i sound IF.)
†R53	T6 to Vertical Hold (R54).	Changed value — 1.2 megohm in chassi 528.256, 263 and 263-1; now 1 megohn as shown. (To provide better centerin of Vertical Hold.)

The changes in the coils listed below were made simultaneously in order to improve video response.

†L9	Pin 7 of V7 to L11.	Changed value—14 uh in chassis 528.256 263 and 263-1; now 20 uh as shown.
†L10	L11 to R29.	Changed value — 550 uh in chassis 528.256, 263, and 263-1; now 220 uh as shown.
†L11	L9 to L10.	Changed value—90 uh in chassis 528.256 263 and 263-1; now 120 uh, wound or 10K ohm resistor (R96), as shown.
†L12	Pin 8 of V8 to L13.	Changed value — 175 uh, wound on 8.2K ohm resistor in chassis 528.256, 263 and 263-1; now 262 uh, wound on 10K ohm resistor (R30) as shown.
†L14	L13 to R36.	Changed value — 410 uh in chassis 528.256, 263 and 263-1; now 463 uh as shown.

PRODUCTION CHANGES

PRODUCTION CHANGES

(See schematic diagram — Fig. 16.)

The following changes were made on the above chassis as production progressed. These changes, while representing certain improvements, are not retroactive. If you have a production model which does not incorporate the changes below, do not make the change except to correct an actual complaint.

*To supply reduced B+ voltage to the UHF converter, the resistor R94 has been added to all chassis except early models of chassis 528.247. These early models do not contain this resistor.

To prevent overloading of the video amplifier tube, resistor R95 has been added to all chassis except 528.247. Chassis 528.247 does not contain this resistor. With this change capacitor C37 changed value. On chassis 528.247, the capacitor (C37) marked "" is used in place of the other listed.

†On chassis 528.247-2 this part has replaced the other listed.

††On chassis 528.266, this part has replaced the other part listed.

‡On chassis 528.247-2, 266 and 266-1, these parts have replaced the other parts listed.

‡‡On chassis 528.247-2 and 266-1, these parts have replaced the other parts listed.

This diagram has incorporated the following changes, which were made on these chassis as production progressed, in order to make certain improvements. These changes are not retroactive. If you have an earlier production chassis which does not include them, do not make the change except to correct an actual complaint.

Schematic Location	Connected:	Change:
*R94	In series with screen grid of V8.	Added to chassis 528.263-1 and 263-2 (To prevent overloading of V8.)
*C37	Pin 6 of V8 to B minus.	Changed value — .005 mfd. in chassis 528.256 and 263; now .47 mfd., in chassis 528.263-1 and 263-2, as shown. (This change accompanied change in R94 above.)
†C4	Junction of L7 and C3, to B minus	Changed value — .005 mfd. in chassis 528.256, 263, and 263-1; now .01 mfd., as shown. (To eliminate regeneration in sound IF.)
†R53	T6 to Vertical Hold (R54).	Changed value — 1.2 megohm in chassis 528.256, 263 and 263-1; now 1 megohm as shown. (To provide better centering of Vertical Hold.)

The changes in the coils listed below were made simultaneously in order to improve video response.

†L9	Pin 7 of V7 to L11.	Changed value—14 uh in chassis 528.256, 263 and 263-1; now 20 uh as shown.
†L10	L11 to R29.	Changed value — 550 uh in chassis 528.256, 263, and 263-1; now 220 uh as shown.
†L11	L9 to L10.	Changed value—90 uh in chassis 528.256, 263 and 263-1; now 120 uh, wound on 10K ohm resistor (R96), as shown.
†L12	Pin 8 of V8 to L13.	Changed value — 175 uh, wound on 8.2K ohm resistor in chassis 528.256, 263 and 263-1; now 262 uh, wound on 10K ohm resistor (R30) as shown.
†L14	L13 to R36.	Changed value — 410 uh in chassis 528.256, 263 and 263-1; now 463 uh as shown.

TELEVISION ALIGNMENT PROCEDURE

PRELIMINARY

This alignment is an exacting procedure and should be undertaken only when necessary. Before fully deciding that alignment is necessary and before removing the chassis from the customer's home:

1. Be sure of the antenna installation.
2. Check all operating controls and adjustments including the channel selector.
3. Check reception on all channels.
4. Check tubes by substitution of known good tubes.

TEST EQUIPMENT REQUIRED

1. Signal generator (with an output variable and at least 0.1 volt max.) to provide the following frequencies:

(a) 4.5 mc	Sound IF	(d) 25.5 mc	2nd IF (T5)
(b) 21.75 mc	Trap (L8)	(e) 23.8 mc	3rd IF (T4)
(c) 24.0 mc	1st IF (L6)	(f) 26.1 mc	4th IF (T3)

2. R.F. Sweep Generator with a frequency range from 40 to 220 megacycles with a sweep width of 10 megacycles and an adjustable output of at least 0.1 volts.
3. Crystal controlled or crystal calibrated markers for the sound carrier of each channel. Picture carrier markers are desirable but not necessary.
4. Cathode ray oscilloscope, preferably with a wide band vertical amplifier and an input calibrating source.
5. Vacuum tube voltmeter (VTVM).

ALIGNMENT PROCEDURE

I-F ADJUSTMENTS

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
3	Raise tube shield on V18 (tuner-oscillator), so that it is not grounded, then clip the "hot" lead of the signal generator to the tube shield.	26.1	Junction R13 and L2	Disconnect the antenna. Set channel selector to channel on which there is no signal and no interference (such as harmonics of I.F.).	T3 (top) maximum
4		23.8			T2 (top) maximum
5		25.5			T1 (top) maximum
6		24.0			L15 maximum
7		21.75			L14 minimum

ALIGNMENT TABLE

DISCRIMINATOR AND SOUND I-F ALIGNMENT

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
1	Video Grid (pin 1, V-8)	4.5 .1 volt output	Pin 2 V-2	Meter on 10 Volt scale	T1 (bottom) and L7 for max. on meter. L12 for min.
2	Video Grid (pin 1, V-8)	4.5 .1 volt output	See Note 1	Meter on 3 volt scale	T1 (top) for zero on meter

NOTE 1: Connect two 100K resistors in series. Connect one end to pin of V-2 (6T8) and the other end tion of R4 (150 ohms) and R5 (47K ohms).

HORIZONTAL OSCILLATOR ADJUSTMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal oscillator adjustment screw. Check the control action on various channels and alter the screw adjustment as required to provide sync on all channels with these two controls.

DEFLECTION YOKE, ION TRAP ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but *not* connected to an antenna. These steps should then be taken in the following order:

1. The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.
2. The Brightness control should be turned to maximum (clockwise) and the Picture control should be turned to minimum (counterclockwise).
3. The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on the screen.
4. The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.
5. The Brilliance control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.
6. Center the picture within the opening of the mask and eliminate shaded corners by adjusting the three positioning wing-nuts on the focus coil. Corner-cutting or shadows at the corners may be caused by mis-adjustment of either the ion trap magnet or the Focus coil, and the two may require simultaneous adjustment to secure the brightest, yet evenly distributed light on the screen. Four self-tapping screws on the focus coil U-bracket are provided to permit vertical movement of the focus coil when necessary.

HORIZONTAL DRIVE, WIDTH AND LINEARITY ADJUSTMENTS

The horizontal drive control should be adjusted by the following procedure:

Turn the Channel Selector off of a station and loosen the Horizontal Drive Control screw until a white vertical line appears approximately 1/3 from the left edge of the raster. Then slowly tighten the Horizontal Drive until the line just disappears. Readjustment of the horizontal drive control may necessitate readjustment of the horizontal oscillator. Turn Channel Selector knob back to test pattern. Adjust width, horizontal and linearity control for proper width and linearity picture.

On this receiver (20") there are two points on the adjustment of the the horizontal linearity control where good linearity is obtained.

The proper linearity adjustment is with the core screwed down into its coil to the second position. The first or upper position (which is improper) is with the adjustment screw protruding from the chassis to a greater extent. (Do not leave it in this position or other troubles may develop.) Recheck horizontal drive control setting and adjustment of focus control.

The Width control (in the H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

HEIGHT AND FOCUS ADJUSTMENTS

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be accurately made on moving transmissions. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area delineated by the mask.

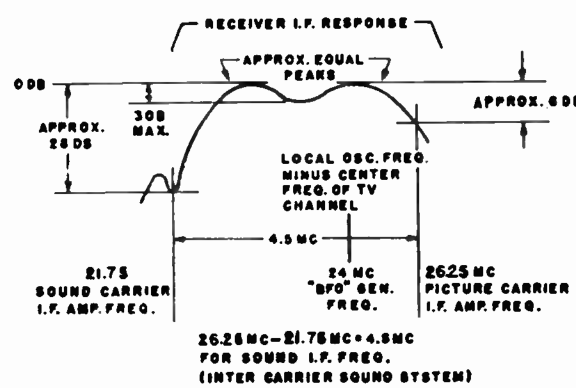
With Brightness and Picture controls at normal positions for a station being received, adjust the Focus control (rear of chassis) for well-defined scanning lines.

The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically. At this point the Focus adjustment previously set, should be retouched for maximum definition of the lines in the vertical wedge of the test pattern. Proper adjustment and alignment of the receiver should result in clear and sharp definition.

4.5 MEGACYCLE TRAP ADJUSTMENT

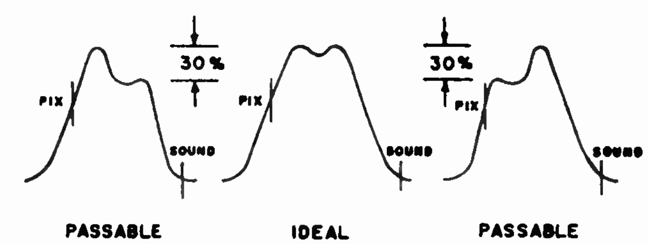
The adjustment of the 4.5 megacycle trap (L12) as given in the alignment table is a very critical adjustment; very often, satisfactory results may be obtained by adjusting this coil very slightly while looking at the picture on the raster. If this coil is adjusted very slowly and carefully the 4.5 megacycle interference can be cleaned up.

This interference may be described as a moving, shadowy bead-like appearance in the picture which is caused by a break-up at extremely close intervals in the horizontal lines. This is most easily discernable in the neutral grey shades in the raster.



A100-380

Fig. 6. I.F. Amplifier Response



A100-223

Fig. 7. Overall Response—Antenna to Picture Detector

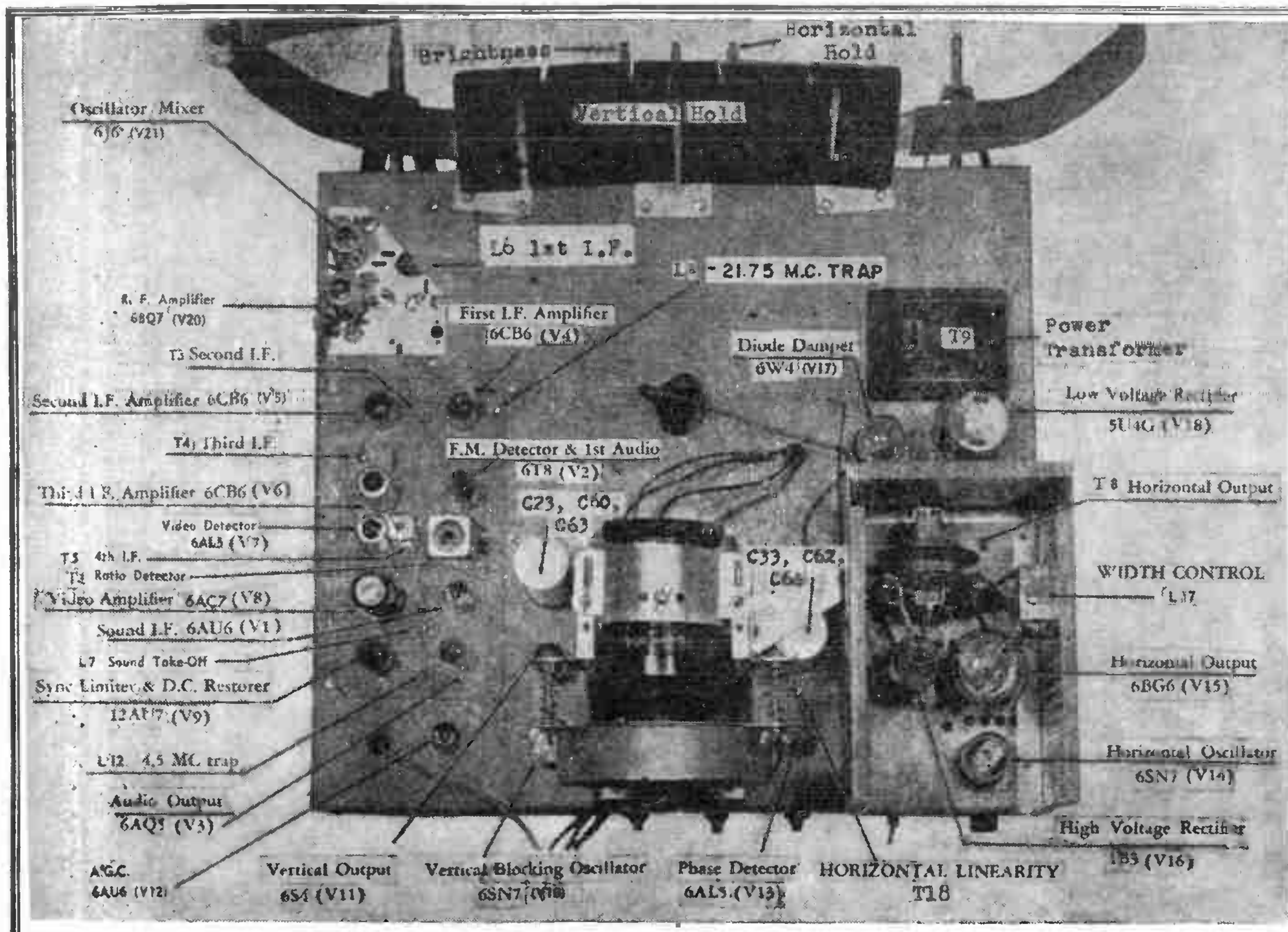


Fig. 2. Top View of Chassis 528.242

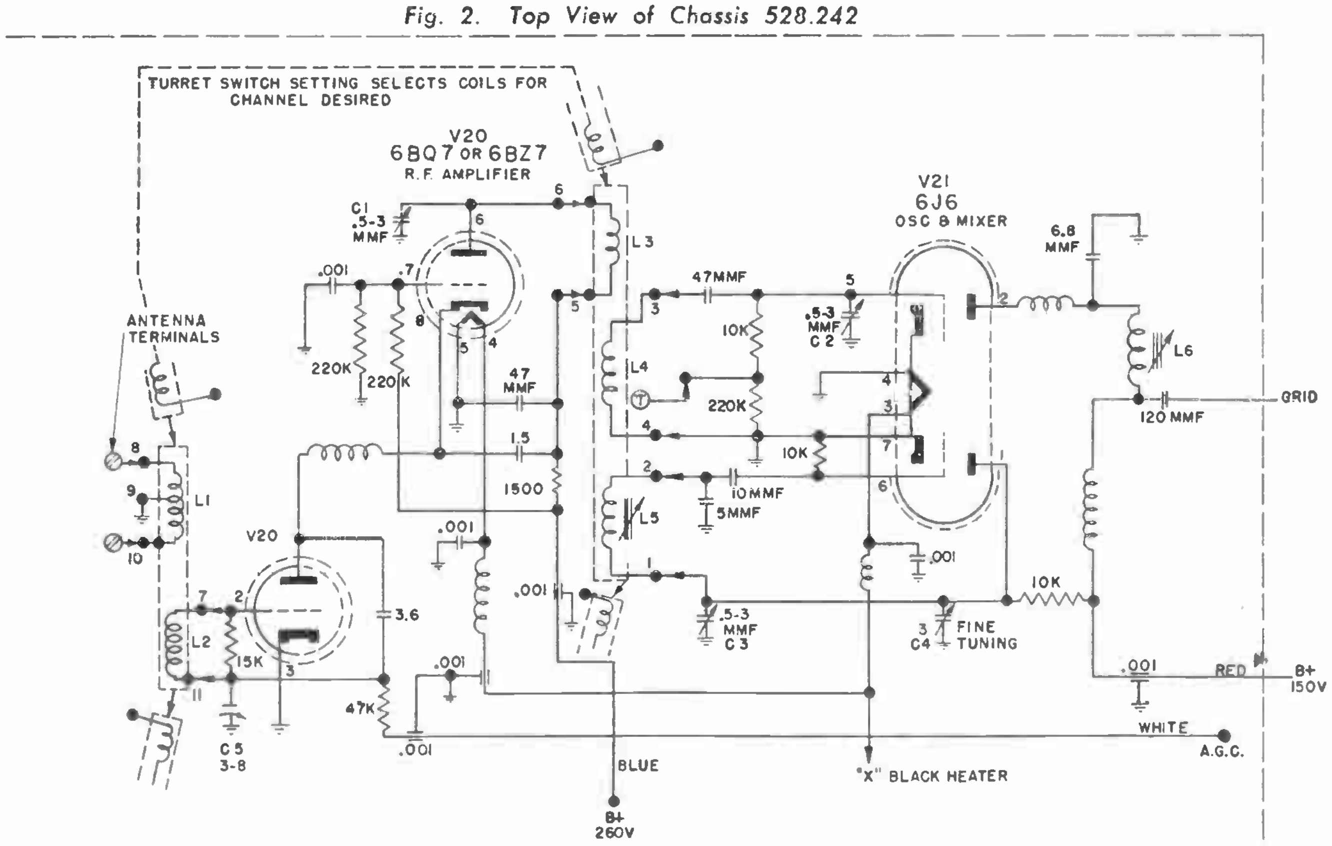


Fig. 3. Schematic Diagram of Tuner T95-30

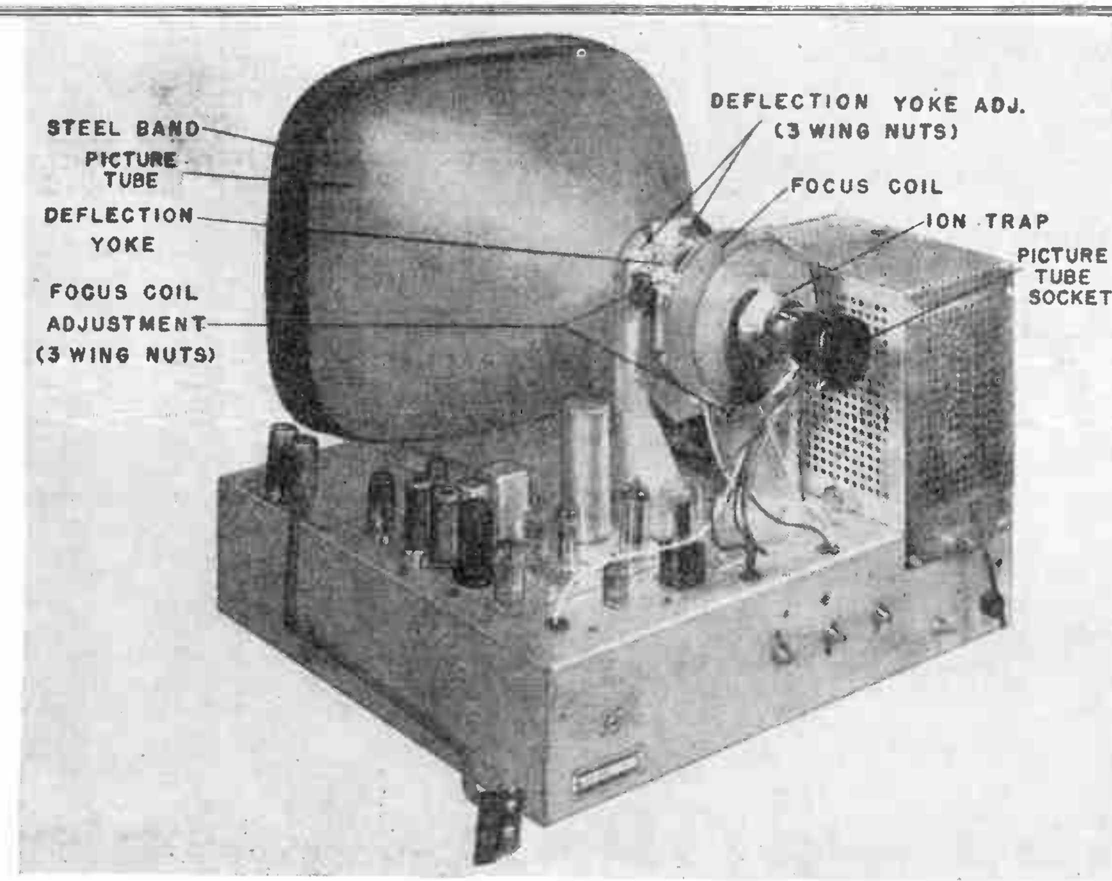


Fig. 5. Rear Chassis View

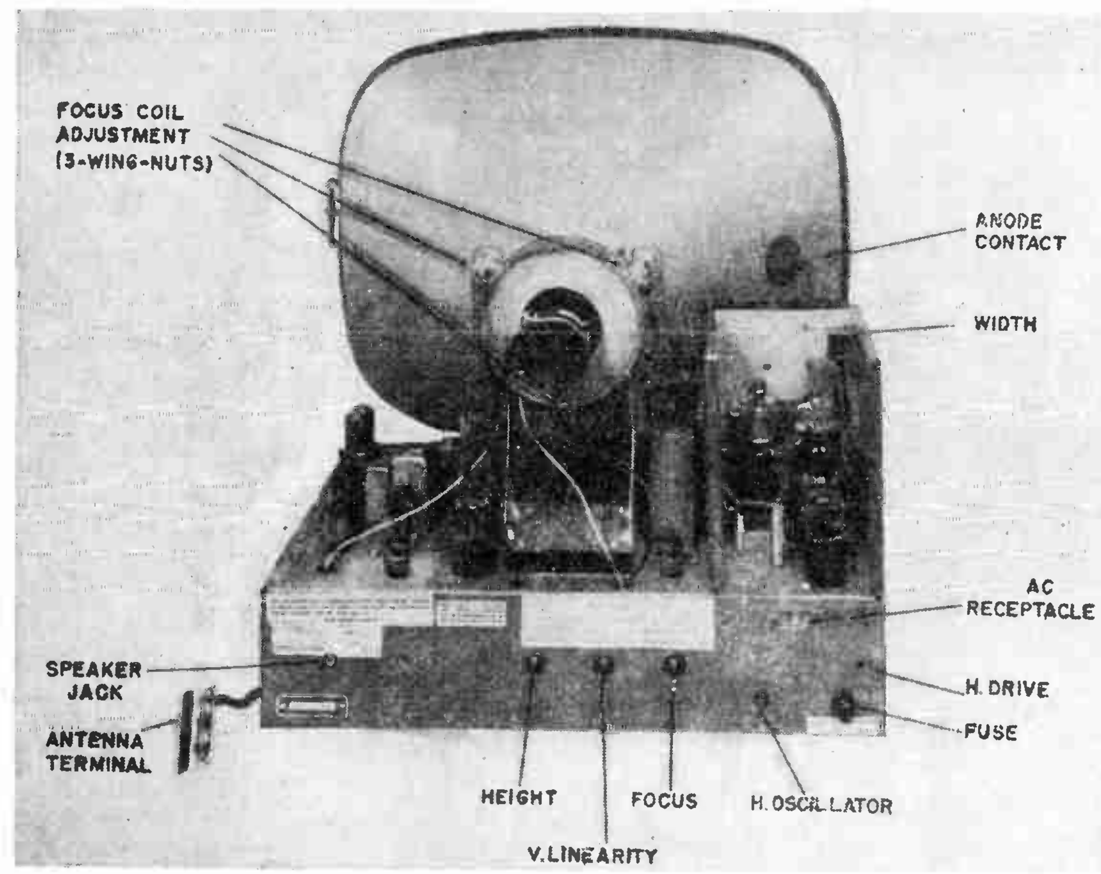
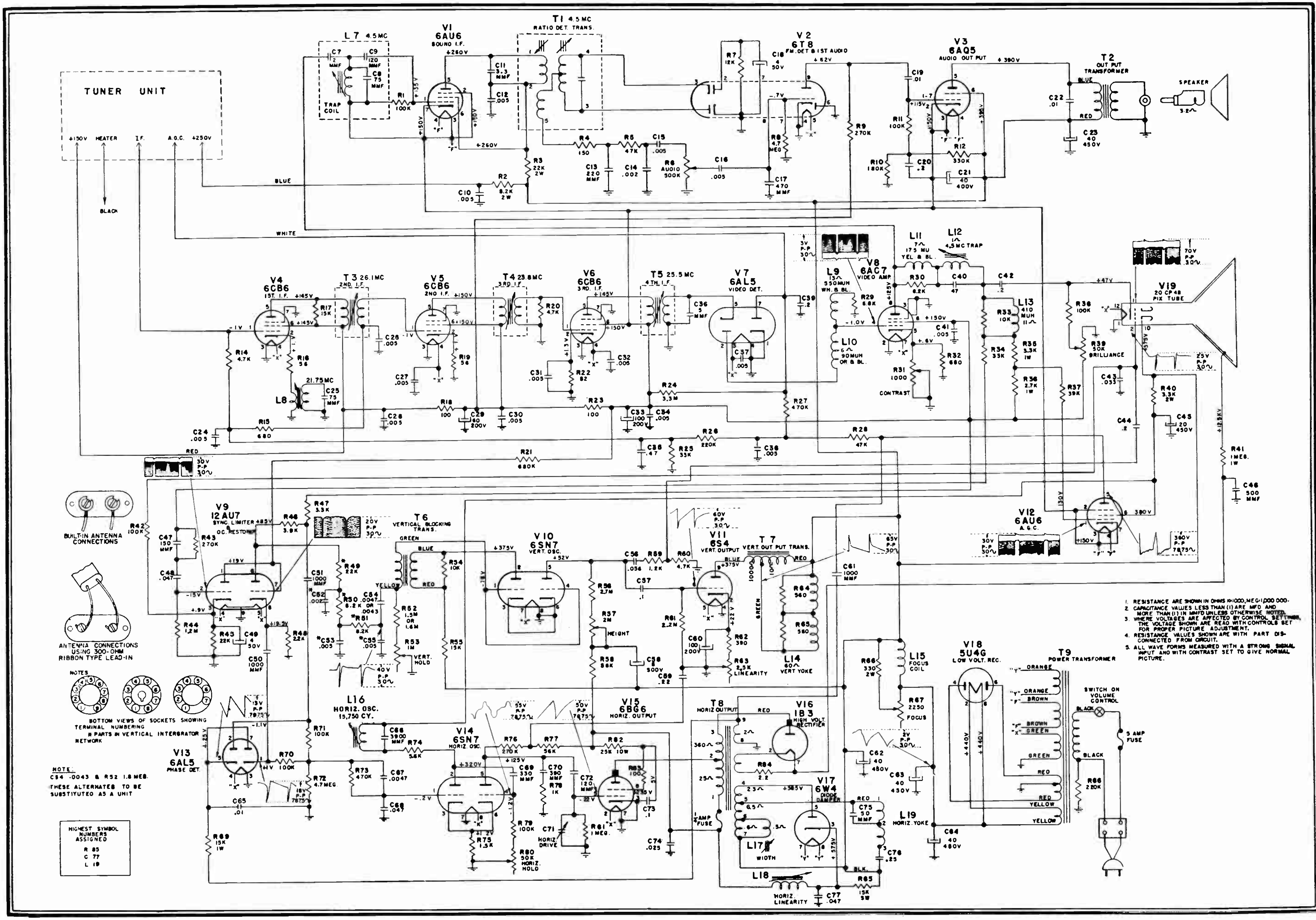


Fig. 4. Picture Tube Mounting Detail


TUNER UNIT
V1 6AU6 SOUND I.F.
T1 4.5MC RATIO DET. TRANS.
V2 6T8 FM. DET & 1ST AUDIO
V3 6AQ5 AUDIO OUT PUT
T2 OUT PUT TRANSFORMER
SPEAKER
V4 6CB6 1ST. I.F.
V5 6CB6 2ND I.F.
V6 6CB6 3RD. I.F.
V7 6AL5 VIDEO DET.
V8 6AC7 VIDEO AMP.
V19 20 CP 4B PIX TUBE
V9 12AU7 SYNC LIMITER & D.C. RESTORER
T6 VERTICAL BLOCKING TRANS.
V10 6SN7 VERT. OSC.
V11 6S4 VERT. OUTPUT
T7 VERT. OUT PUT TRANS.
V12 6AU6 A.G.C.
BUILT-IN ANTENNA CONNECTIONS
ANTENNA CONNECTIONS USING 300-OHM RIBBON TYPE LEAD-IN
BOTTOM VIEWS OF SOCKETS SHOWING TERMINAL NUMBERING
PARTS IN VERTICAL INTERGRATOR NETWORK
V13 6AL5 PHASE DET.
L16 HORIZ. OSC. 15,750 CY.
V14 6SN7 HORIZ. OSC.
V15 6BG6 HORIZ. OUTPUT
T8 HORIZ OUTPUT
V16 1B3 HIGH VOLT RECTIFIER
V17 6W4 DIODE DAMPER
L19 HORIZ. YOKE
V18 5U4G LOW VOLT. REC.
T9 POWER TRANSFORMER
SWITCH ON VOLUME CONTROL
5 AMP FUSE
NOTE: C84 .0043 & R52 1.8 MEG. THESE ALTERNATES TO BE SUBSTITUTED AS A UNIT
HIGHEST SYMBOL NUMBERS ASSIGNED R 85 C 77 L 19
1. RESISTANCE ARE SHOWN IN OHMS K=1000, MEG=1,000,000.
2. CAPACITANCE VALUES LESS THAN (1) ARE MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED.
3. WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGE SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT.
4. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
5. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE NORMAL PICTURE.

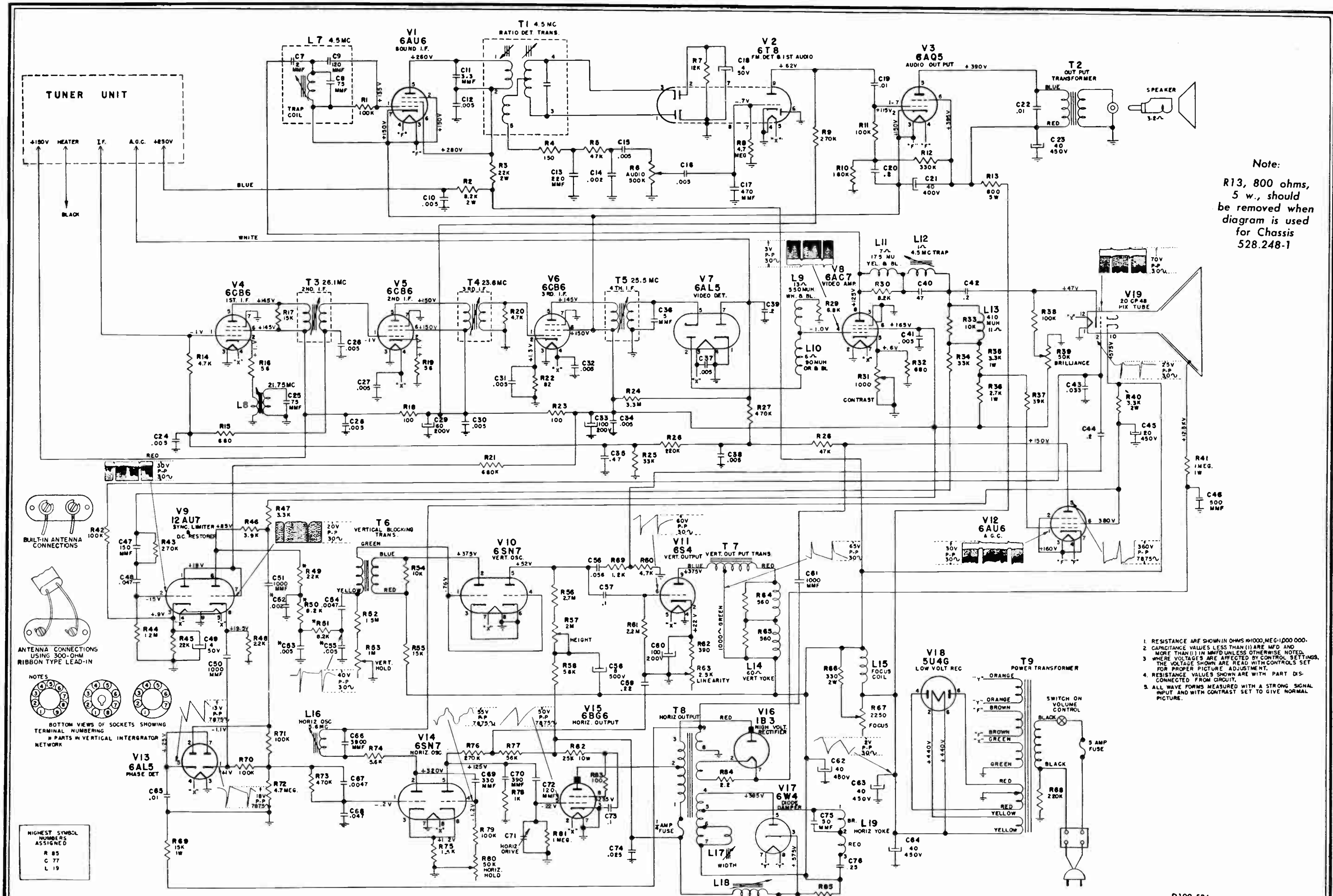
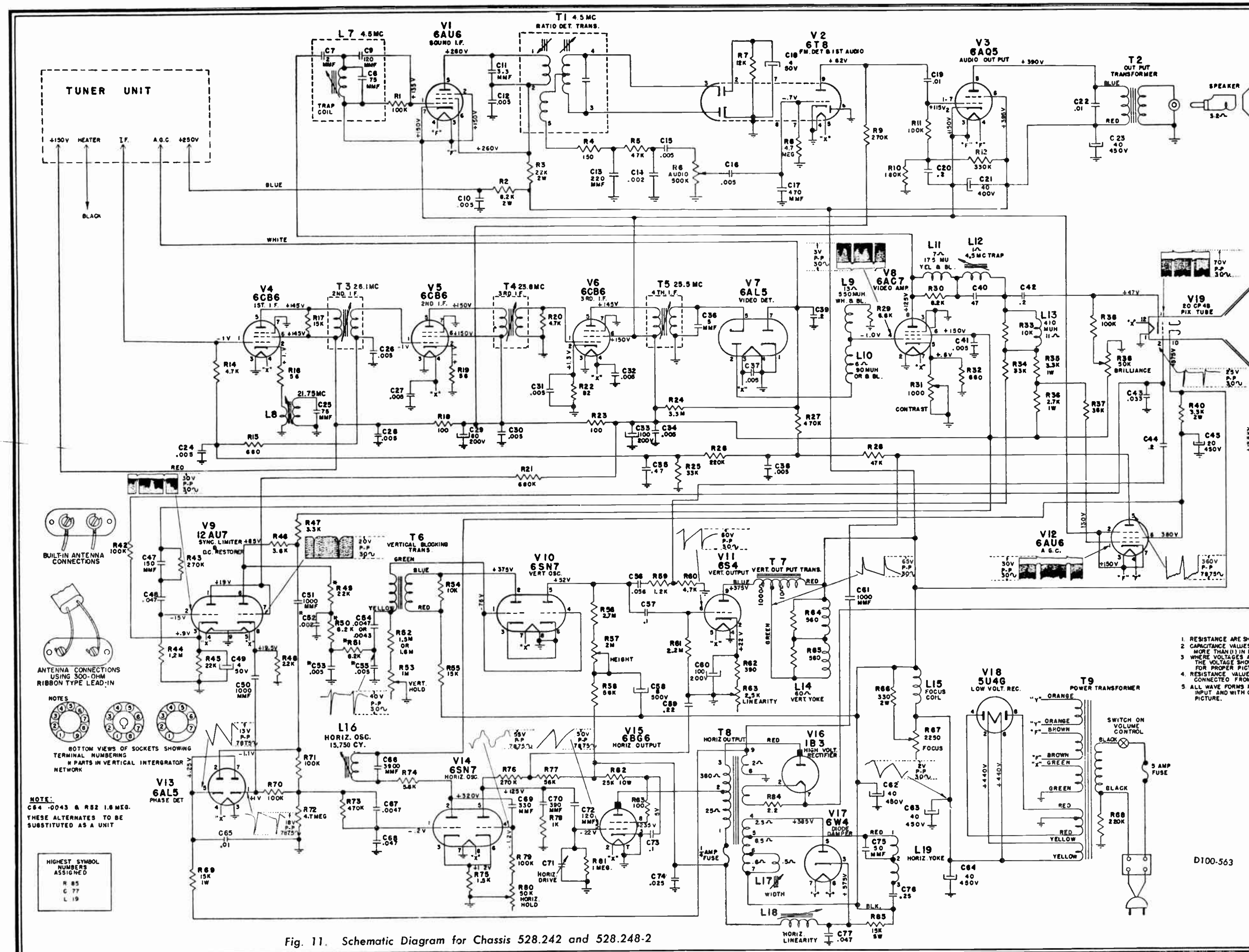


Fig. 10. Schematic Diagram of Chassis 528.248 and 528.248-1

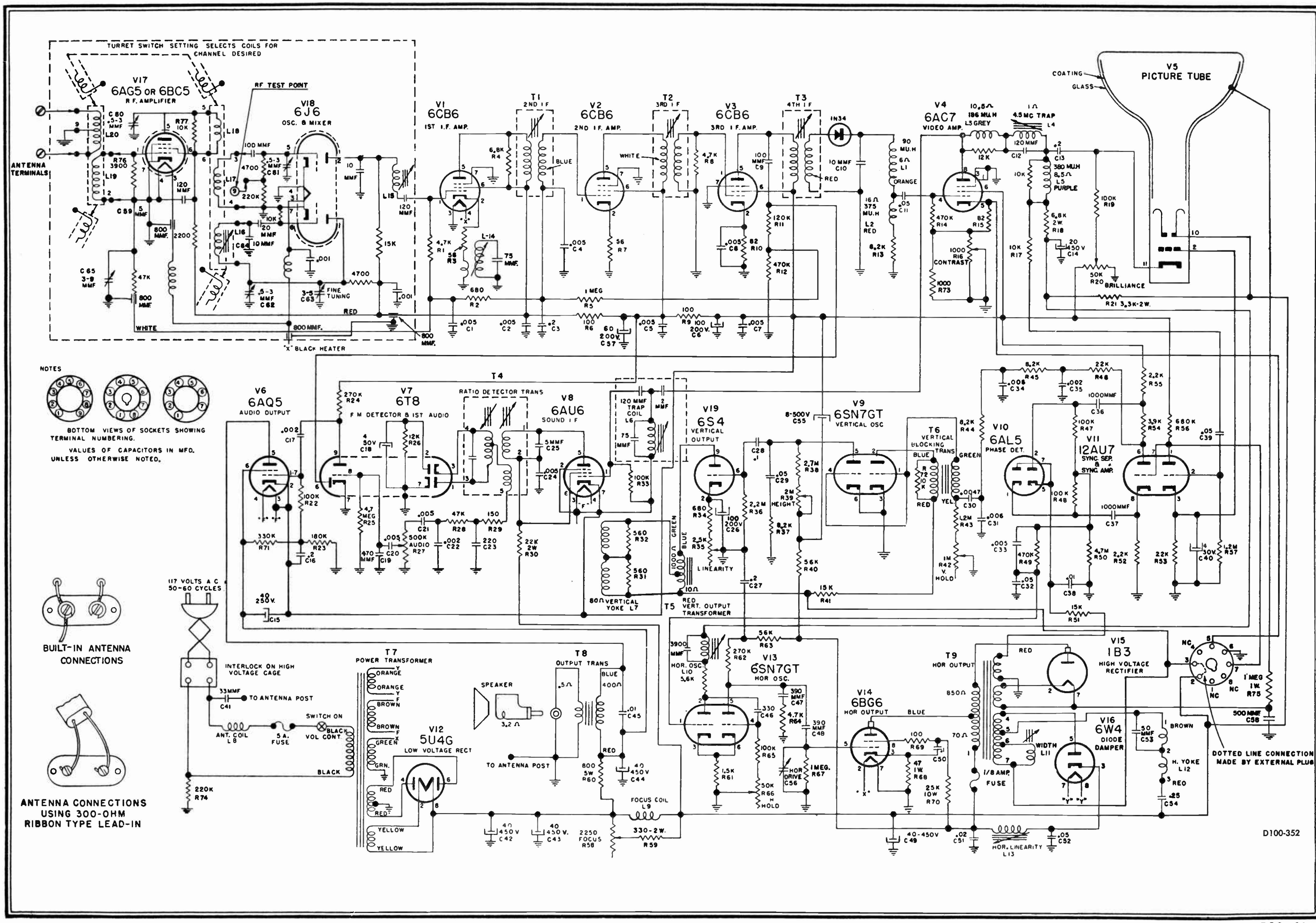


Note:

R13, 800 ohms, 5 w., has been omitted and should be added to schematic when diagram is used for Chassis 528.242

When using diagram for Chassis 528.248-2, these changes should be made: C34 should be changed to .0015 mfd. and R54 should become C78—Capacitor, ceramic, .005 mfd.

Fig. 11. Schematic Diagram for Chassis 528.242 and 528.248-2



SEARS, ROEBUCK TV PAGE 14-41

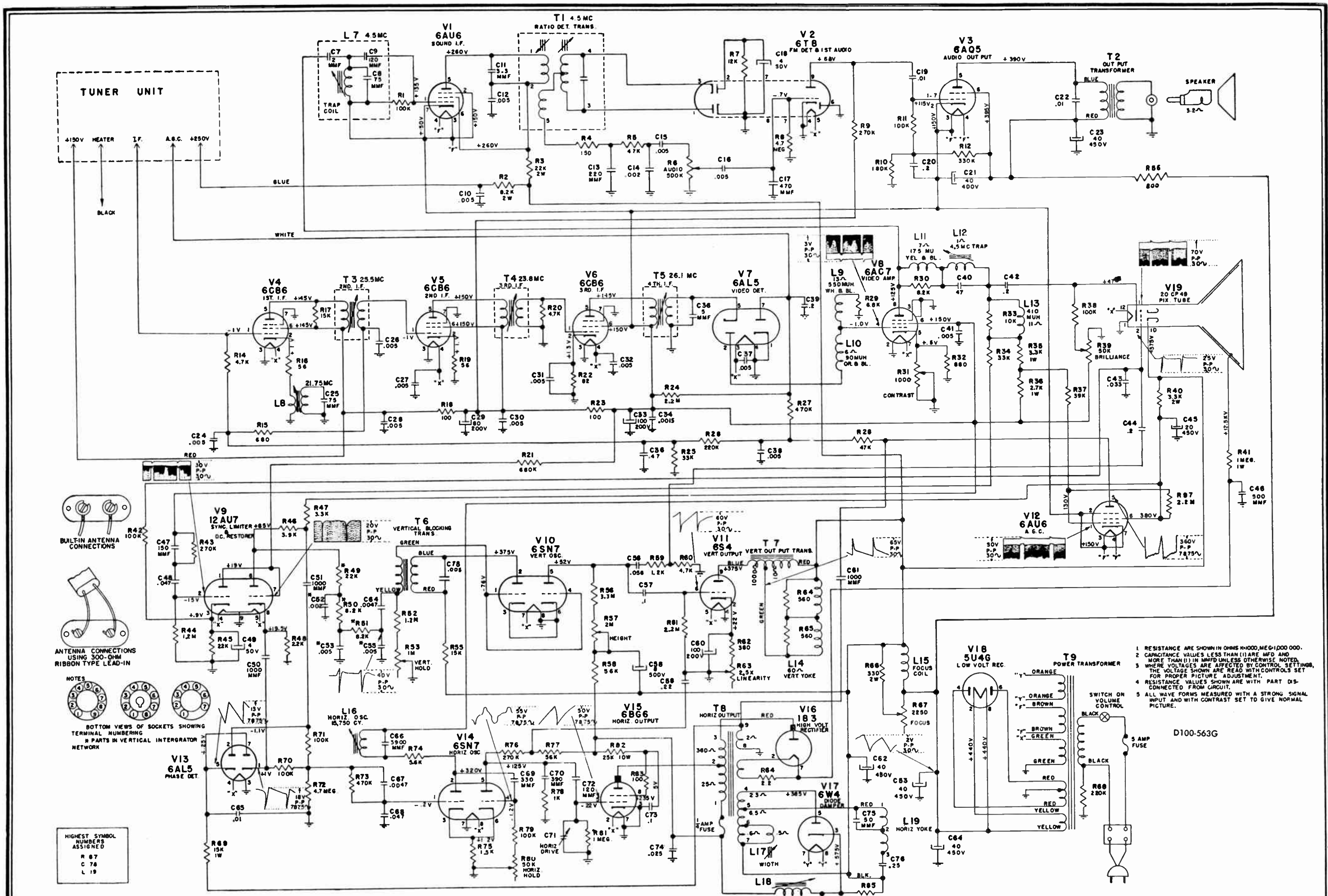


Fig. 13 Schematic diagram for chassis No. 528.242-2

CHASSIS REPAIR PARTS LIST

CAPACITORS

Schematic Location	Part Number	DESCRIPTION
C7, C8, C9		Part of Coil, 4.5 MC, Sound take off (T10-556)
C10, C12, C15, C16, C24, C26, C27, C28, C30, C31, C32, C34, C37, C38, C41	T16-177	Capacitor, ceramic, .005 mfd.
C11	T15-238	Capacitor, ceramic, 3.3 mmf.
C13	T15-230	Capacitor, mica, 220 mmf.
C14	T15-228	Capacitor, ceramic, .002 mfd.
C17	T15-200	Capacitor, mica, 470 mmf.
C18, C49	T18-292	Capacitor, electrolytic, 4 mfd., 50 v.
C19, C22, C65	T16-237	Capacitor, .01 mfd., 600 v. (molded, oil filled)
C20, C39, C44	T16-188	Capacitor, tubular, .2 mfd., 400 v.
C21	T18-308	Capacitor, 40 mfd., 400 v., electrolytic
C23, C33, C60, C62, C63, C64	T18-295	Capacitor, electrolytic, 40-40 mfd., 450 v., 100 mfd., 200 v.
C25		Part of Coil, 21.75 wave trap (T10-574)
C29	T18-302	Capacitor, electrolytic, 60 mfd., 200 v.
C35	T16-240	Capacitor, molded tubular, .47 mfd., 200 v.
C36	T15-222	Capacitor, ceramic, 5 mmf.
C40		Part of Coil, 4.5 MC trap (T10-581)
C42	T16-212	Capacitor, tubular, .2 mfd., 600 v.
C43	T16-234	Capacitor, tubular, .033 mfd., 600 v., oil filled
C45	T18-276	Capacitor, electrolytic, .20 mfd., 450 v.
C46	T15-239	Capacitor, ceramic, 500 mmf., 20,000 v.
C47	T15-235	Capacitor, mica, 150 mmf.
C48, C68	T16-235	Capacitor, .047 mfd., 600 v.
C50, C51, C61	T15-220	Capacitor, ceramic, .001 mfd., 1,000 v.
C52, C53, C55		Part of Vertical Integrator Network (T17-106)
*C54, C67	T16-233	Capacitor, .0047 mfd., 600 v., 10%
C56	T16-236	Capacitor, .056 mfd., 600 v., 10%
C57, C73	T16-238	Capacitor, .1 mfd., 600 v.
C58	T18-298	Capacitor, electrolytic, 8 mfd., 500 v.
C59	T16-218	Capacitor, tubular molded, .22 mfd., 600 v.
C66		Part of Coil, Horizontal Oscillator (T10-555)
C69	T15-226	Capacitor, silver mica, 330 mmf., 10%
C70	T15-231	Capacitor, mica, 390 mmf.
C71	T20-145	Capacitor, trimmer, horizontal drive
C72	T15-232	Capacitor, mica, 120 mmf., 10%
C74	T16-222	Capacitor, tubular, .025 mfd., 1,000 v., 10%
C75		Part of Coil, deflection yoke (T83-694)
C76	T16-226	Capacitor, tubular, .25 mfd., 400 v.
C77	T16-239	Capacitor, .047 mfd., 1,000 v.

RESISTORS

Schematic Location	Part Number	DESCRIPTION
R1	T60-727	Resistor, 100K ohm, ½ w.
R2	T60-878	Resistor, 8.2K ohm, 2 w., 10%
R3	T60-810	Resistor, 22K ohm, 2 w., 10%
R4	T60-767	Resistor, 150 ohm, ½ w., 10%
R5, R28	T60-730	Resistor, 47K ohm, ½ w.
R6	T24-197	Resistor, control, dual, ON-OFF VOLUME, 500K
R7	T60-811	Resistor, 12K ohm, ½ w., 10%
R8, R72	T60-779	Resistor, 4.7 megohm, ½ w.
R9, R43, R76	T60-747	Resistor, 270K ohm, ½ w., 10%
R10	T60-788	Resistor, 180K ohm, ½ w., 5%
R11, R38, R42, R70, R71, R79	T60-801	Resistor, 100K ohm, ½ w., 10%
R12	T60-787	Resistor, 330K ohm, ½ w., 5%
R13	T60-800	Resistor, wirewound, 800 ohm, 5 w.
R14, R20, R60	T60-759	Resistor, 4.7K ohm, ½ w., 10%
R15, R32	T60-708	Resistor, 680 ohm, ½ w., 10%
R16, R19	T60-806	Resistor, 56 ohm, ½ w., 10%
R17, R55	T60-783	Resistor, 15K ohm, ½ w.
R18, R23, R83	T60-752	Resistor, 100 ohm, ½ w., 10%
R21	T60-807	Resistor, 680K ohm, ½ w., 10%
R22	T60-776	Resistor, 82 ohm, ½ w., 10%
R24	T60-761	Resistor, 3.3 meg., ½ w.
R25, R34	T60-748	Resistor, 33K ohm, ½ w., 10%
R26	T60-672	Resistor, 220K ohm, ½ w., 10%
R27, R73	T60-731	Resistor, 470K ohm, ½ w.
R29	T60-786	Resistor, 6.8K ohm, ½ w., 10%
R30		Part of Coil, peaking 175 uh wound (T10-580)
R31		Control, CONTRAST, 1K (Part of T24-197)
R33		Part of Coil, peaking 410 uh wound (T10-578)
R35	T60-724	Resistor, 3.3K ohm, 1 w., 10%
R36	T60-892	Resistor, 2.7K ohm, 1 w.
R37	T60-893	Resistor, 39K ohm, ½ w., 10%
R39, R80	T25-21	Resistor, Control, BRIGHTNESS & HORIZ. HOLD, 50K
R40	T60-816	Resistor, 3300 ohm, 2 w., 10%
R41	T60-877	Resistor, 1 megohm, 1 w.
R44	T60-782	Resistor, 1.2 meg., ½ w., 10%
R45	T60-744	Resistor, 22K ohm, ½ w., 10%
R46	T60-710	Resistor, 3.9K ohm, ½ w., 10%
R47	T60-882	Resistor, 3.3K ohm, ½ w., 10%
R48	T60-714	Resistor, 2.2K ohm, ½ w., 10%
R49, R50, R51		Part of the Vertical Integrator Network (T17-106)
*R52	T60-880	Resistor, 1.5 megohm, ½ w., 10%
R53	T25-22	Resistor, control, VERTICAL HOLD, 1 meg.
R54	T60-760	Resistor, 10K ohm, ½ w., 10%
R56	T60-872	Resistor, 2.7 megohm, ½ w.
R57	T25-15	Resistor, Control, 2 meg., HEIGHT
R58, R77	T60-802	Resistor, 56K ohm, ½ w., 10%
R59	T60-756	Resistor, 1.2K ohm, ½ w., 10%
R61	T60-726	Resistor, 2.2 megohm, ½ w.
R62	T60-665	Resistor, 390 ohm, ½ w., 10%
R63	T25-13	Resistor, Control, VERTICAL LINEARITY 2.5 K
R64, R65		Part of Coil, deflection yoke (T83-694)
R66	T60-814	Resistor, 330 ohm, 2 w., 10%
R67	T25-14	Resistor, Control, 4 w., 2,250 ohm, FOCUS
R68	T60-667	Resistor, 220K ohm, ½ w.
R69	T60-887	Resistor, 15K ohm, 1 w., 10%
R74		Part of Coil, Horizontal Oscillator (T10-555)
R75	T60-729	Resistor, 1,500 ohm, ½ w., 10%
R78	T60-675	Resistor, 1,000 ohm, ½ w.
R81	T60-668	Resistor, 1 megohm, ½ w.
R82	T60-853	Resistor, 25K ohm, 10 w.
R84	T60-881	Resistor, 2.2 ohm, ½ w.
R85	T60-804	Resistor, 15K ohm, 5 w., 10%

TRANSFORMERS AND COILS

Schematic Location	Part Number	DESCRIPTION
T1	T10-552	Transformer, Ratio Detector, 4.5 MC
T2	T80-253	Transformer, output, (audio)
T3	T10-541	Transformer, 2nd I.F. (blue)
T4	T10-542	Transformer, 3rd I.F. (white)
T5	T10-577	Coil, 4th I.F. (shielded)
T6	T80-257	Transformer, vertical blocking
T7	T80-261	Transformer, vertical output
T8	T80-279	Transformer, horizontal output
T9	T80-264	Transformer, power
L7	T10-556	Coil, 4.5 MC Sound take off (includes C7, C8, C9)
L8	T10-574	Coil, 21.75 wave trap (includes C25)
L9	T10-579	Coil, peaking 550 uh (white and black)
L10	T10-557	Coil, peaking (orange) 90 uh
L11	T10-580	Coil, peaking 175 uh wound (includes R30) (yellow and black)
L12	T10-581	Coil, 4.5 MC trap (includes C40)
L13	T10-578	Coil, peaking 410 uh wound (includes R33) (yellow and red)
L14, L19	T83-694	Coil, deflection yoke (includes C75, R64, R65)
L15	T10-560	Coil, FOCUS
L16	T10-555	Coil, HORIZONTAL OSCILLATOR (includes C66, R74)
L17	T10-551	Coil, WIDTH CONTROL
L18	T10-561	Coil, LINEARITY CONTROL

MISCELLANEOUS CHASSIS PARTS

T22-165	Connector, high voltage
T84-447	Cover assembly
T21-161	Cover, high voltage cage
T43-13	Fuse, ¼ amp., 250 v.
T43-12	Fuse, 5 amp., 250 v. (3 AG type)
T47-115	Grommet, Rubber (3)
T83-684	Ion trap, single magnet
T37-139	Insulator, resistor support
T22-133	Jack, speaker
T23-161	Line cord (8 ft.) and plug
T95-30	R. F. Tuner (Cascode)
T87-43	Receptacle, AC line
T87-44	Receptacle, fuse holder
T83-661	Retainer, tube shield (2)
T71-42	Shield, tube (2)
T68-56	Socket, shell, Corona
T68-57	Socket, octal type
T68-18	Socket, octal molded (5)
T68-43	Socket, miniature, 7 pin (8)
T68-48	Socket, miniature, 9 pin (V11)
T68-44	Socket, miniature, 9 pin (V2 & V9) (2)
T68-50	Socket, picture tube
T68-55	Socket, Ring mounting (Corona Shell)
T70-167	Spring, Focus coil (3)
T70-153	Spring, tube grounding (2)
T27-24	Strap, picture tube support
T83-693	Yoke Mounting hood

ALTERNATE PARTS

(Alternate for C54)
*T16-232 CAP., Moulded tub., .0043 mfd., 600 v. 10%

(Alternate for R52)
*T60-895 RES., 1.8 megohm, ½ w. 5%

(Alternates must be used together)

CABINET PARTS

	PART NUMBER for Sears Cat. No. 3110A Table. Brown Leatherette	PART NUMBER for Sears Cat. No. 3115A Table. Mahogany	PART NUMBER for Sears Cat. No. 3160A Console. Mahogany
SPEAKER	T79-397 (5" P.M.)	T79-398 (6" P.M.)	T79-399 (8" P.M.)

Chassis 528.258 and 528.268 are 22 tube receivers providing for 82 channel reception by the use of a 13 position, turret type VHF tuner, and a continuous tuning UHF converter (see Fig. 1 for tubes and function).

These receivers employ a 41 Mc. Intermediate Frequency in place of the more common 21 Mc. IF. The higher IF is produced by increasing the frequency output of the local oscillator circuits in the VHF tuner and UHF converter, and is designed to eliminate harmonic interference in the IF strip. Proper amplification of the signal carrying IF is obtained by the addition of a 4th pentode stage to the stagger tuned, unity coupled IF circuit. In the video detector stage a 1N64 crystal is used, providing demodulation within the higher intermediate frequency range.

Chassis 528.258 and 528.268 are basically the same except that chassis 528.258 contains a tone control and phono circuit for hook-up with any standard phonograph. Other differences are outlined in the parts list and schematic diagram included with this RL.

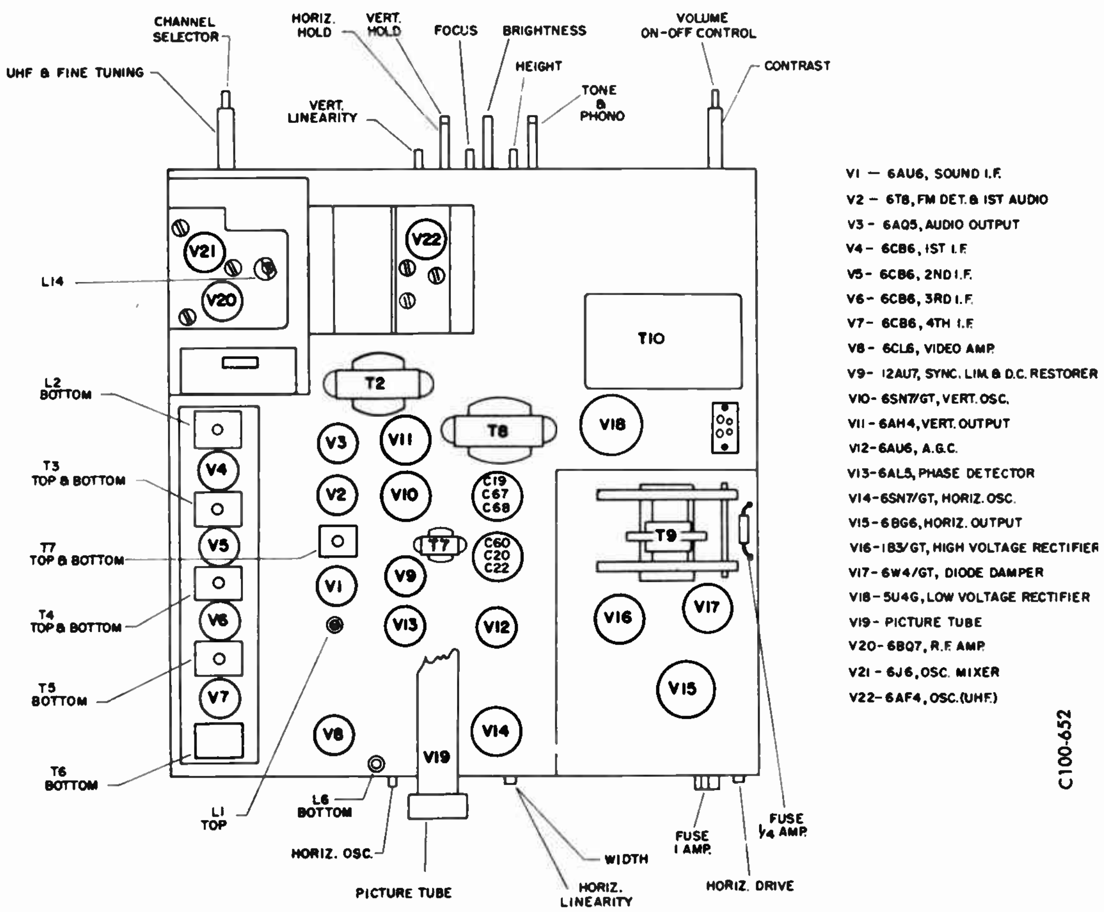


Fig. 2. Top View — Chassis 528.258

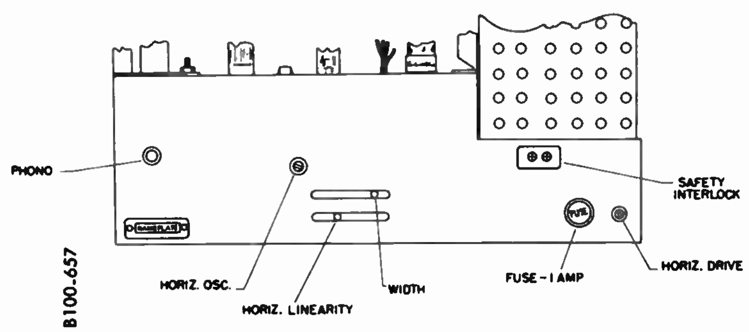


Fig. 4. Rear View Chassis Showing Controls (Chassis 528.268 does not contain Phono Jack)

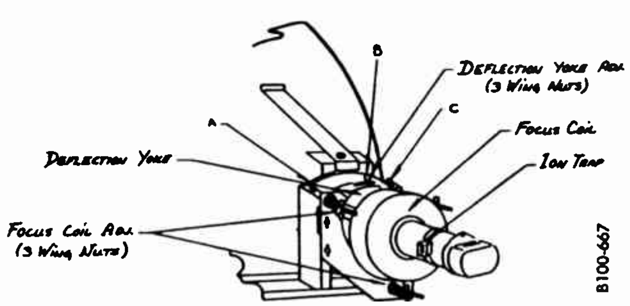


Fig. 5. Deflection and Focus Adjustments

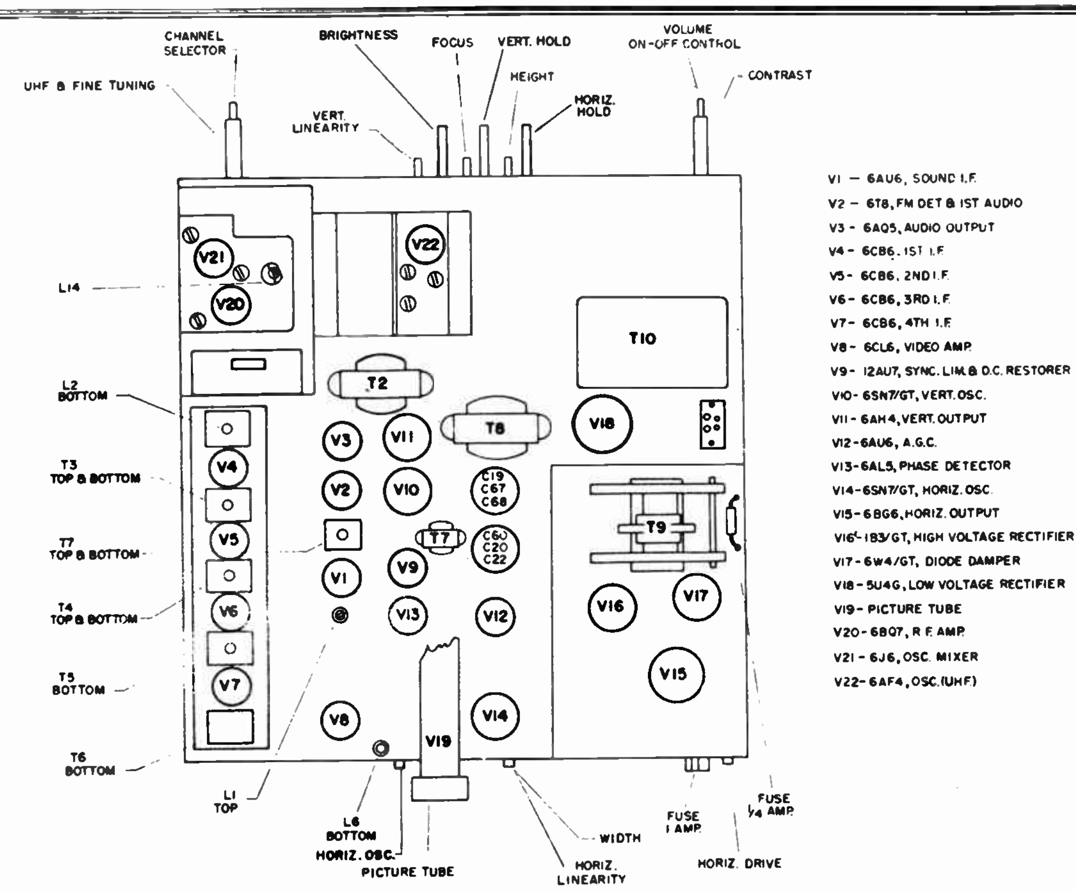


Fig. 3. Top View — Chassis 528.268

TELEVISION SERVICE ADJUSTMENTS

CAUTION HIGH VOLTAGES are used in the operation of this receiver. The back cover, while in place, prevents accidental contact with this voltage and therefore should not be removed by anyone except a qualified television serviceman.

THE HIGH VOLTAGE LEAD, which supplies 12 to 16 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves. Be sure to discharge the voltage developed across the capacitor formed by the inner and outer coating of the picture tube. This can be done by connecting the high voltage socket on the tube to the outer coating.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENTS:

Follow this procedure in adjusting the Deflection Yoke, Ion Trap and Focus Coil:

1. Turn the receiver on and disconnect the antenna.
2. Move the Deflection Yoke as far forward as possible on the neck of the picture tube by loosening wingnuts A and C, and by loosening wingnut B, rotate it so that the top and bottom edges of the raster are parallel to the chassis. See Fig. 5.
3. Turn the Brightness control to maximum (clockwise) and the contrast control to minimum (counterclockwise).
4. Rotate the Ion Trap while moving it forward and backward on the neck of the picture tube to find the position which produces the brightest raster.
5. Reduce the brightness to a point slightly above normal.
6. Center the raster within the opening of the mask and eliminate shaded corners by adjusting the three wing-nuts on the Focus Coil. Corner cutting or shadows at the corners may be caused by maladjustment of either the Focus Coil or the Ion Trap and the two may require simultaneous adjustment to obtain the brightest, yet evenly distributed light on the screen. Four self-tapping screws on the Focus Coil U-bracket are provided to permit vertical movement of the Focus Coil if necessary.

CAUTION: While adjusting the focus coil, make sure there is no strain exerted by the focus coil on the neck of the picture tube. The focus coil is supported by a U-shaped bracket held in place by four screws. Loosen these screws and raise or lower the bracket until focus coil is centered about neck of tube.

HORIZONTAL OSCILLATOR ADJUSTMENT

If the Horizontal Hold Control cannot be positioned to lock the picture in, the Horizontal Oscillator Coil may require adjustment. To reset this screwdriver adjustment, place the Horizontal Hold Control in the center of its range and lock the picture in with the Horizontal Oscillator Coil adjustment screw. Check the Horizontal Hold Control range on various channels and alter the screw adjustment as required to provide lock-in on all channels.

HORIZONTAL DRIVE, WIDTH AND LINEARITY ADJUSTMENTS

Set the Channel Selector on an unused channel and loosen the Horizontal Drive Control screw until a white vertical line appears approximately 1/3 from the left edge of the raster. Then slowly tighten the Horizontal Drive Control screw until the white line just disappears. This adjustment may necessitate readjustment of the Horizontal Oscillator. Adjust Width and Horizontal Linearity Controls for proper picture.

FINE TUNING

If the range of the Fine Tuning Control is not sufficient to tune the picture in clearly, set the Fine Tuning Control in the center of its range as shown in Fig. 15. Insert a screwdriver into the opening provided and tune the picture in clearly by adjusting the screw to the right or left. This procedure should be repeated on any channels with which difficulty is experienced.

SOUND ALIGNMENT

Step	Signal Generator Frequency	Signal Generator Connect to	Output Indicator	Connect to	Adjust	Remarks
1	4.5 Mc	Junction of R45 and L1	VTVM	See Note 1	L1 Bottom for maximum reading, T1 Bottom for maximum reading	Signal generator output below .1 volts, VTVM on low range (0-3 volts).
2	4.5 Mc	Same	Same	Junction of R6 and C9	T1 Top for zero (mid-scale)	
3	4.5 Mc	Junction of C45 and R45	Same	See Note 1	L6 for minimum reading	This adjusts the 4.5 Mc sound trap. For field adjustment see Note 2.

NOTE 1. Connect two 100K ohm matched resistors in series between Pin 2 of V2 (6T8) and ground. Connect negative lead of VTVM to the junction of the two resistors and the positive lead to junction of R6 and C9.

NOTE 2. As a field adjustment, the 4.5 Mc trap (L6) may be set on a signal by adjusting L6 for a minimum amount of graininess in the picture. This interference can be described as a moving, shadowy, bead-like appearance in the picture which is caused by a break-up at extremely close intervals of the horizontal lines. This is most easily seen in the neutral grey shades in the raster.

TELEVISION ALIGNMENT PROCEDURE

PRELIMINARY

Alignment is an exacting procedure and should be undertaken only when necessary. The following equipment is required for alignment work.

1. Signal generator, with an output of at least 1 volt maximum. Crystal controlled or calibrated markers for the sound (41.25 Mc) and picture (45.75 Mc) IF carriers are required in addition to the following variable frequencies.

4.5 Mc	Intercarrier Sound IF
41.25 Mc	Sound IF Trap (T-3, top)
42.9 Mc	1st & 3rd I.F. (T-3, bottom; T-5 bottom)
44.1 Mc	Converter and I.F. input (L-2 bottom; L-102 top)
45.2 Mc	2nd & 4th I.F. (T-4 bottom; T-6 bottom)
47.25 Mc	Adjacent Sound Trap (T-4 Top)

2. Electronic voltmeter (VTVM)
3. R.F. sweep generator with a frequency range of 40 to 220 Mc with a sweep width of at least 10 Mc, having an adjustable output of at least 0.1 volts.
4. Cathode ray oscilloscope, preferably with a wide band vertical amplifier and an input calibrating source.

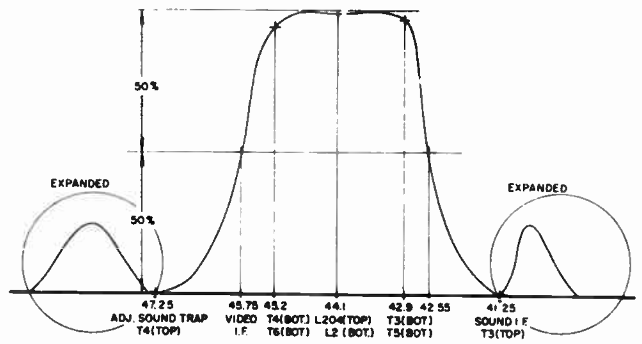


Fig. 6. 41 Mc I.F. Response

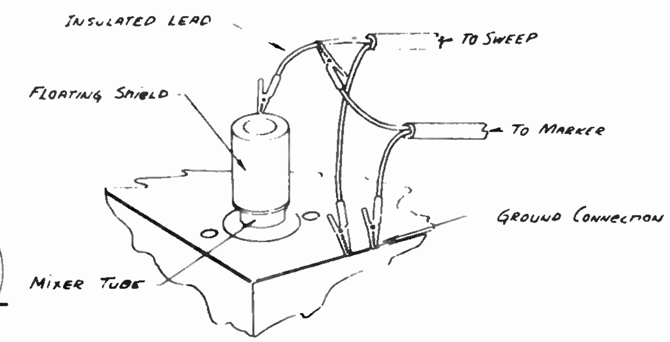


Fig. 7. I.F. Test Equipment Connections

VIDEO IF ALIGNMENT

Step	Signal Generator Frequency	Signal Generator Connect to	Output Indicator	Connect to	Adjust	Remarks
1	42.9 Mc	Floating shield on mixer tube, V-21	VTVM	Junction of R35 and L4	T3 Bottom for maximum reading	
2	42.9 Mc	Same	Same	Same	T5 Bottom for maximum reading	Apply —4.5 volt bias to AGC line, — side to C-24, + side to chassis. Short antenna terminals, set channel selector to unused channel free of harmonics or other interference. Adjust signal generator to give reading of approximately 2.5 volts on VTVM. On all "maximum" adjustments reduce generator output so that VTVM reading does not exceed 2.5 volts. On minimum adjustments increase generator output to provide definite dip on meter.
3	45.2 Mc	Same	Same	Same	T4 Bottom for maximum reading	
4	45.2 Mc	Same	Same	Same	T6 Bottom for maximum reading	
5	41.25 Mc	Same	Same	Same	T3 Top for minimum reading	
6	47.25 Mc	Same	Same	Same	T4 Top for minimum reading	
7	42.9 Mc	Same	Same	Same	T3 Bottom for maximum reading	
8	45.2 Mc	Same	Same	Same	T4 Bottom for maximum reading	
9	44.1 Mc	Same	Same	Same	L2 Bottom for maximum reading	
10	44.1 Mc	Same	Same	Same	L-102 Top for maximum reading	
11	Sweep 44 Mc, 10 Mc Sweep, Marker to freqs. in Fig. 4	See Fig. 7	Oscilloscope	Vertical terminals to junction of R35 and L4. Horizontal terminals to sweep Gen.	T6 for 45.75 Mc 50% position. L2 for correct tilt. See Fig. 6 for correct wave form	When sweeping overall pattern do not exceed 2 volts P-P (or approximately .3 volts D.C. at detector load resistor) to avoid overload and distortion of response curve.

ALIGNMENT PROCEDURE—VHF CASCODE TUNER NO. T95-33

Before attempting to align the VHF tuner it is necessary that the IF amplifier strip be correctly aligned. It is desirable that all adjustments of the trimmers be made first at channel No. 11. Where schematic locations are given in the following instructions, refer to tuner schematic diagram, Fig. 15. For adjustment points refer to detail illustration, schematic diagram and also to Fig. 8 below. To align the tuner proceed as follows:

(1) Connect an Rf sweep generator to the antenna terminals, and a 4.5 volt negative bias to AGC bus.
(2) If the generator is not provided with internal crystal controlled or crystal calibrated markers, loosely couple a marker generator to the antenna (be sure that coupling clip does not bite through antenna insulation).
(3) Connect a cathode ray oscilloscope to the test point indicated in Fig. 8.
(4) Adjust the RF generator for a 20 Mc. sweep width, with a center frequency at approximately 201 Mc.
(5) Set the channel selector to channel 11; turn the receiver on and allow it 15 minutes to warm up and stabilize.
(6) Align C101, C102, C103 for a curve similar to that shown in Fig. 9. Since there is some interaction between these adjustments, alignment should be repeated until a curve most nearly ideal is approached. Adjustments affect the curve as follows:
    C101—Greatest effect is on tilt of curve.
    C102—Greatest effect is on frequency of curve (will move it to right or left as viewed on scope).
    C103—Greatest effect is on gain (height) of curve.
(7) Change the station selector to the various channels and, using the correct setting of the RF sweep generator to center it in the channel and the correct marker frequency for the picture and sound carriers, test to see that response curve for each channel is correct. Note: The response curve may vary between higher and lower frequency channels. Alignment, in this case, may be made to favor those channels which the set actually receives.
(8) Change oscilloscope leads from RF test point to video detector load resistor.
(9) Set fine tuning control in middle of its range.
(10) Using correct picture carrier marker for each channel, adjust the individual cores (for each channel) in L101 to place picture carrier marker of 50% point on I.F. response curve (see Fig. 6).

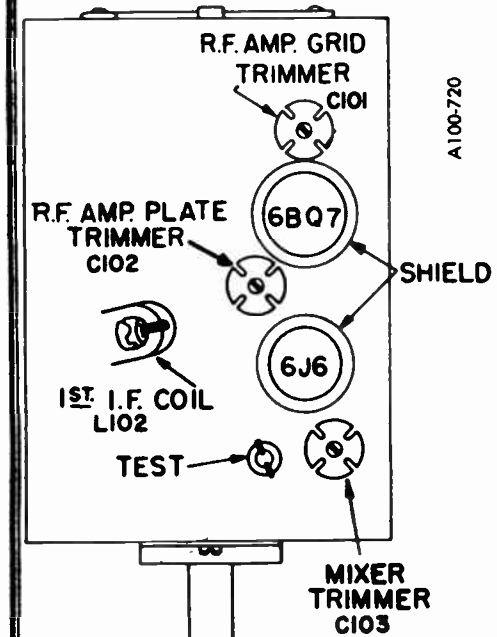
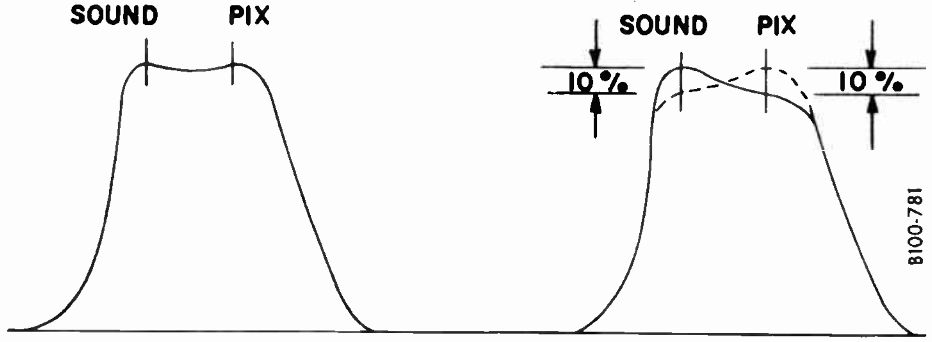


Fig. 8. Top View of VHF Cascode Tuner T95-33 Showing Adjustments



IDEAL *Fig. 9 VHF Tuner Response* ACCEPTABLE

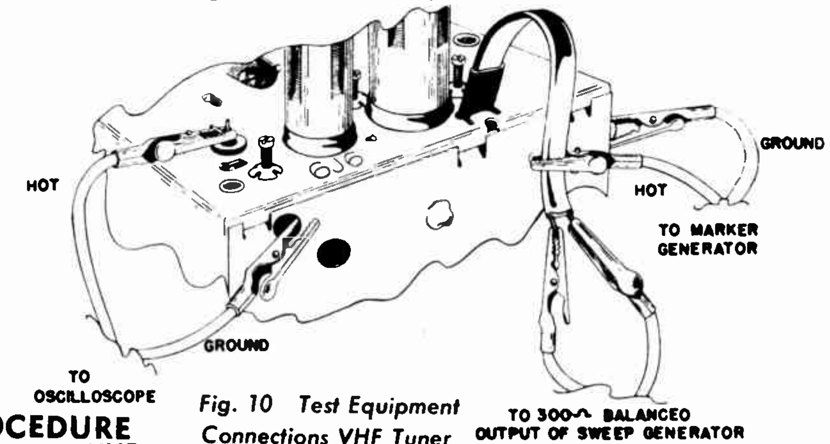


Fig. 10 Test Equipment Connections VHF Tuner

UHF CONVERTER ALIGNMENT PROCEDURE

1. VHF should be aligned properly before setting up UHF.

2. Turn channel knob to UHF position.

3. A UHF signal from a suitable UHF signal generator should be fed into the antenna terminal of the UHF converter; attach vacuum tube voltmeter or detector probe to TV set detector.

4. Adjust output transformer slug for maximum meter indications.

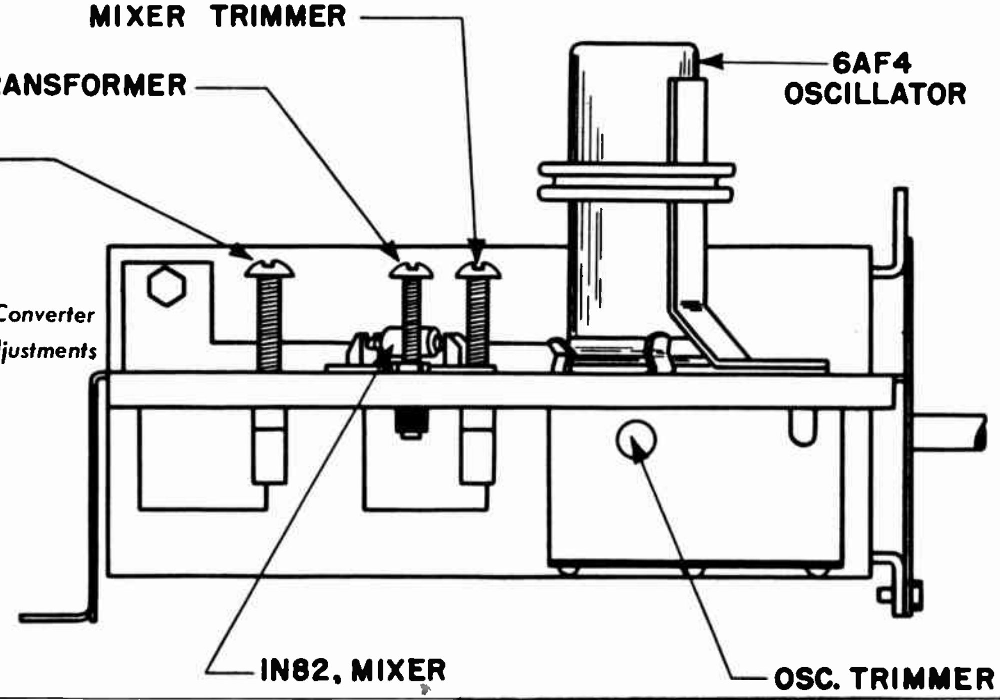


Fig. 11. Side View UHF Converter T95-34 Showing Adjustments

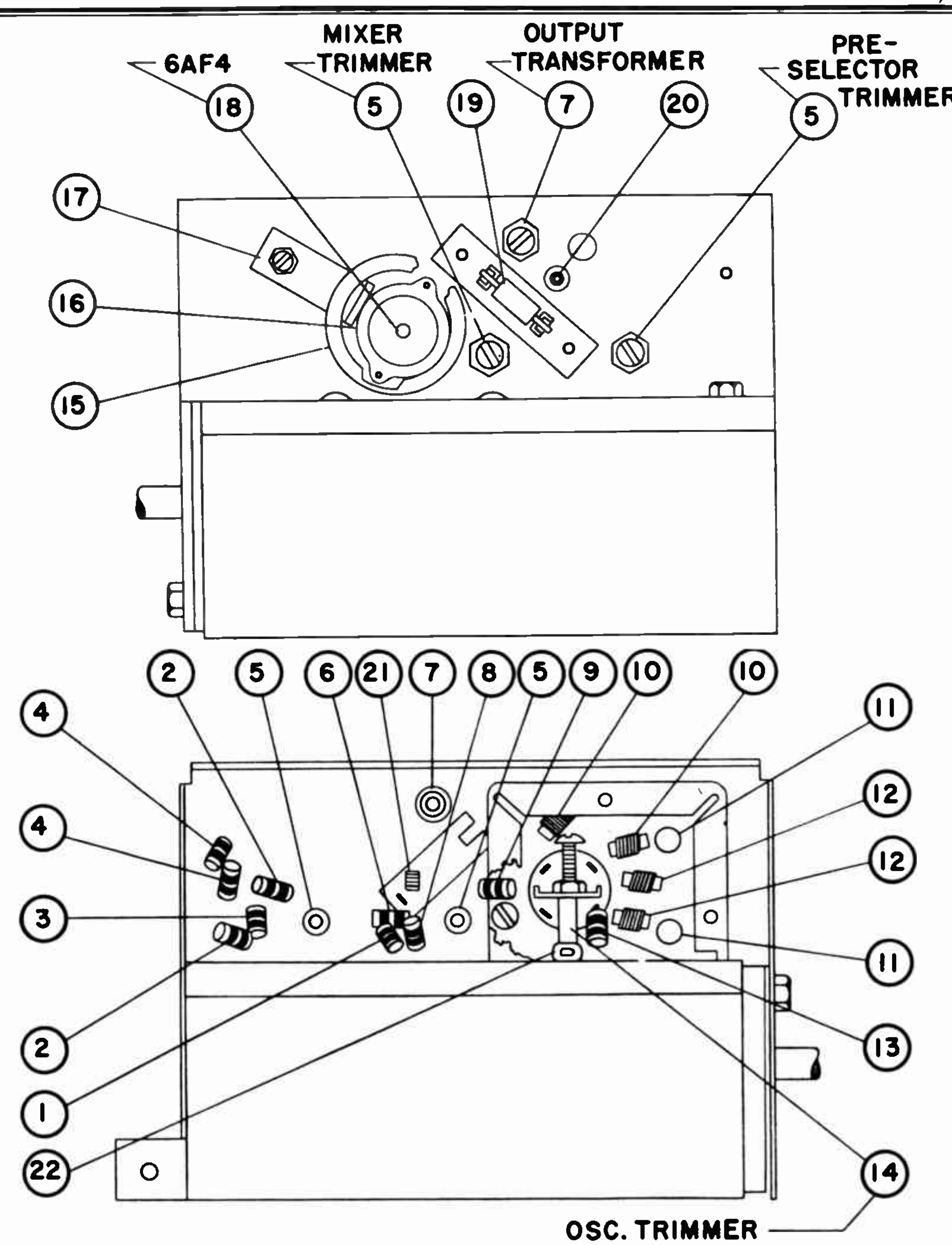


Fig. 13. Top and Bottom Views of UHF Converter T95-34 Showing Parts Locations

PARTS LIST — UHF CONVERTER
(See Fig. 13 above)

Location	Description	Part No.
1	Capacitor, 2.5 mmfd.	T600-025-17
2	Capacitor, 1.0 mmfd.	T600-025-6
3	Capacitor, 2.7 mmfd.	T600-389-7
4	Rsistor, 470K ohm	T600-029-9
5	Capacitor, Trimmer .8-6 mmfd.	T600-220-1
6	Capacitor, .25 mmfd.	T600-025-12
7	Transformer, Output	T630-268-1
8	Capacitor, 2.2 mmfd.	T600-025-10
9	Capacitor, .68 mmfd.	T600-025-13
10	Choke, 1.2 uh	T600-033-3
11	Capacitor, 68 mmfd.	T600-281-1
12	Choke, .38 uh	T600-240-3
13	Resistor, 12K ohm	T600-116-12
14	Capacitor, Trimmer 2.5-7.5 mmfd.	T600-282-4
15	Grommet, tube	T600-466-1
16	Shield, tube	T600-035-1
17	Bracket, tube clamp	T600-465-1
18	Tube, 6AF4	T630-235-1
19	Crystal, 1N82	T600-413-1
20	Capacitor, 250 mmfd.	T600-574-7
21	Choke, 1.7 uh	T600-407-1
22	Capacitor, 6 mmfd.	T600-463-2

ON AIR ADJUSTMENTS

1. Tune UHF receiver to a UHF station.

2. Adjust output transformer on UHF tuner for best sound and picture.

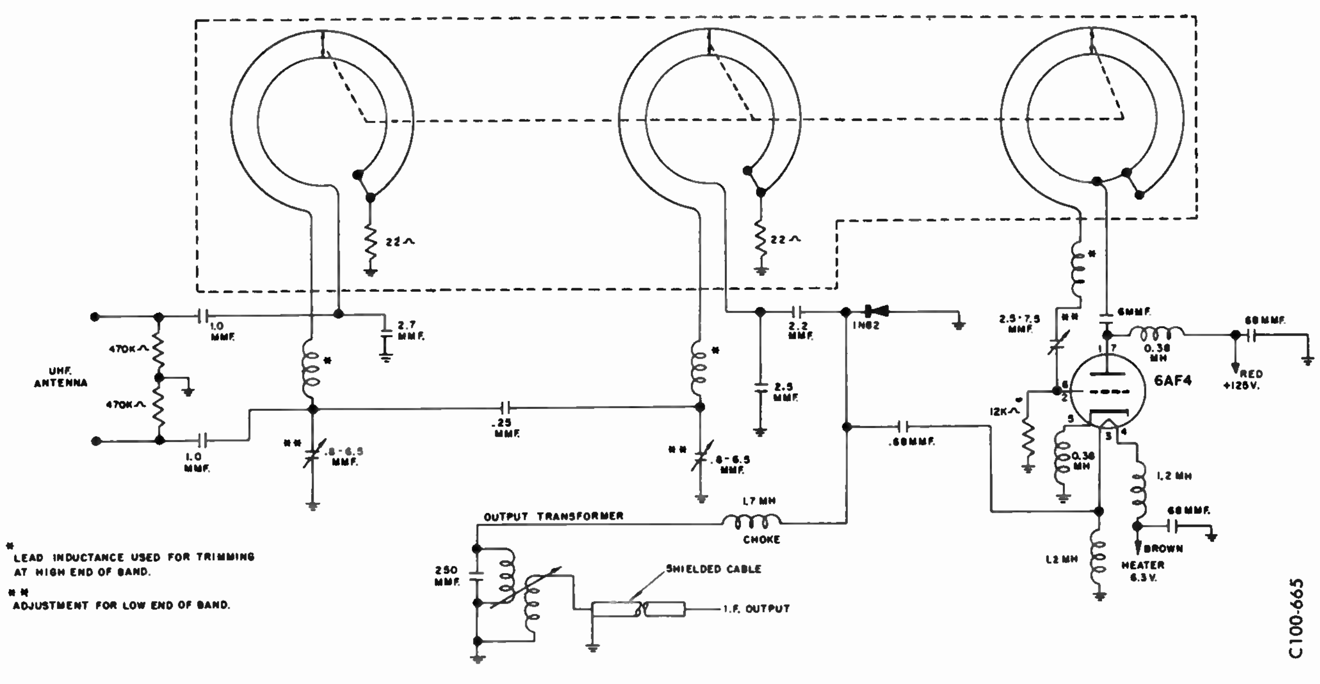


Fig. 14. Schematic Diagram of UHF Converter T95-34

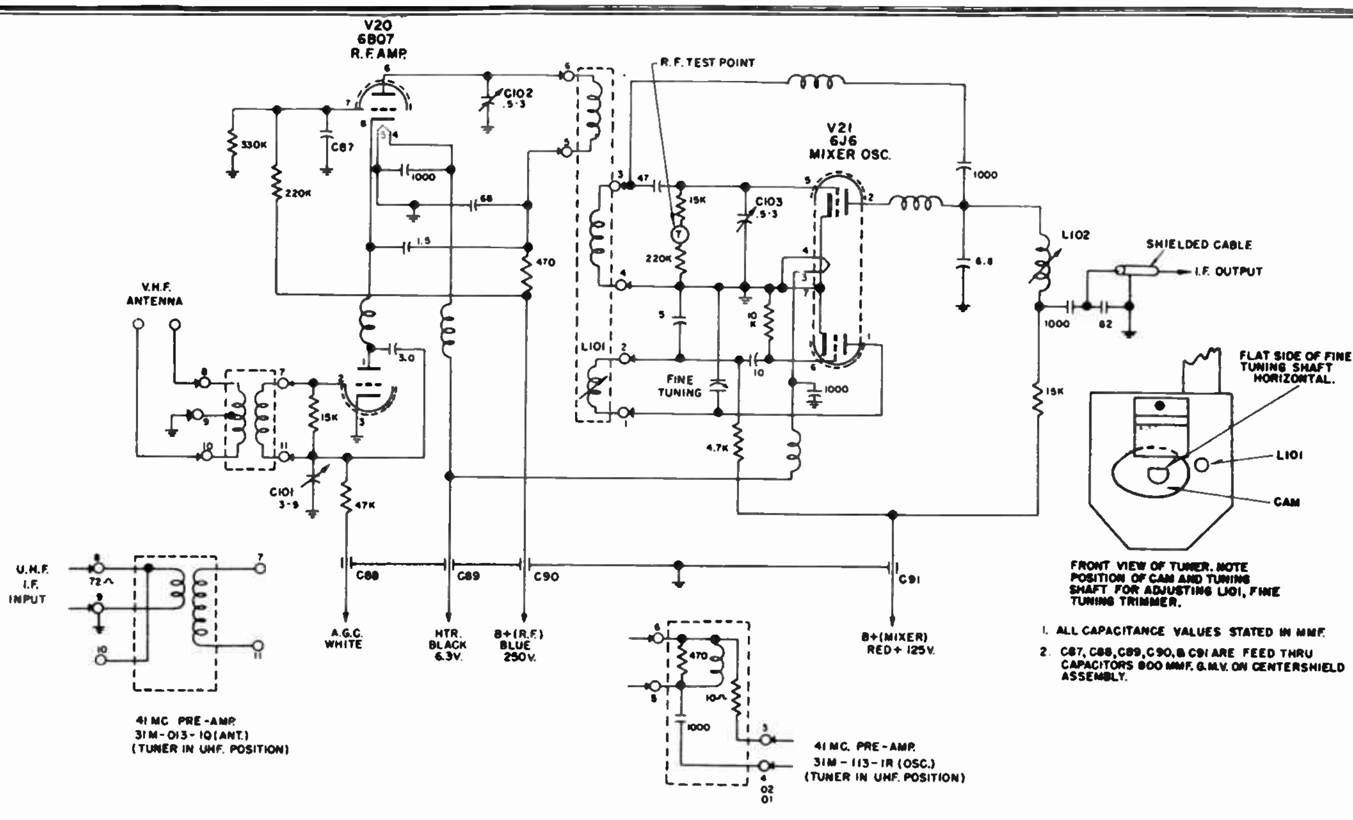
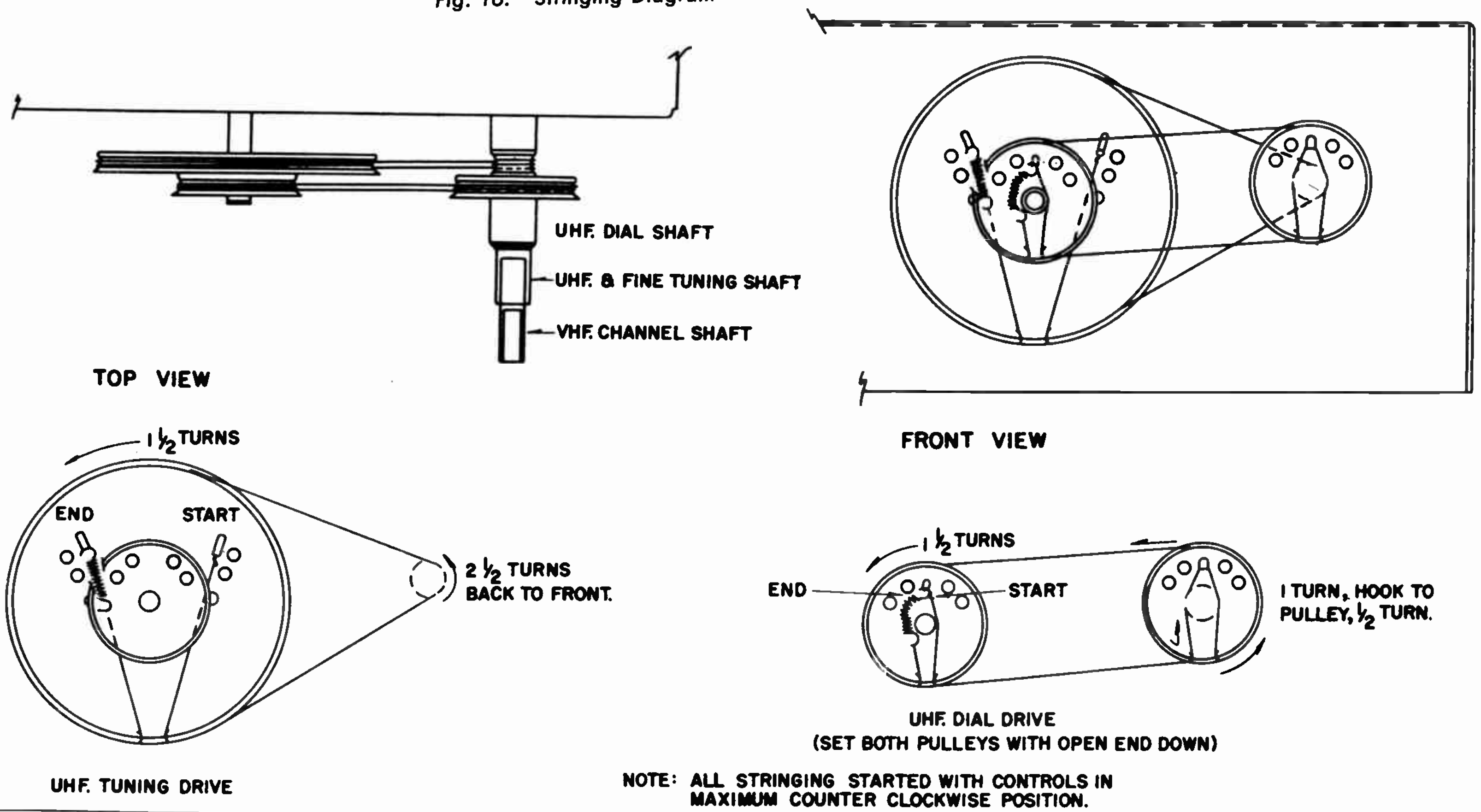


Fig. 15. Schematic Diagram of VHF Tuner T95-33

Fig. 16. Stringing Diagram



REPAIR PARTS LIST

Following is a combined parts list for chassis 528.258 and 528.268. Parts listed herein are used on both chassis except where otherwise specified. For explanatory notes see reverse side of schematic diagram.

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each
		CAPACITORS	
C1, C2		Part of Coil, 4.5 Mc Sound take-off (L1)	
C3, C5, C6, C11, C42, C56	T16-177	Capacitor, Ceramic .005 mfd.	$ .25
C4, C15†	T16-177	Capacitor, ceramic, .005 mfd. (used in chassis 528-258 only)	.25
C8*	T15-218	Capacitor, mica, 220 mmfd. (used in chassis 528-268 only)	.40
C8†	T15-258	Capacitor, mica, 270 mmfd., 5% (used in chassis 528-258 only)	.55
C9	T15-228	Capacitor, disc, .002 mfd.	.25
C10	T15-211	Capacitor, ceramic, .01 mfd.	.30
C12, C24, C49	T18-292	Capacitor, electrolytic, 4 mfd. 50 v.	1.25
C13†	T16-177	Capacitor, ceramic, .005 mfd. (not used in some 528-268 models)	.25
C14	T16-240	Capacitor, molded, .47 mfd. 200 v.	.70
C16, C21, C69, C83, C84	T16-237	Capacitor, molded, .01 mfd. 600 v.	.30
C17, C46, C50, C51	T15-220	Capacitor, ceramic, .001 mfd.	.25
C18, C45, C73	T16-218	Capacitor, molded, .22 mfd. 600 v.	.95
C19, C22, C60, C66, C67, C68	T18-295	Capacitor, electrolytic, 40-40 mfd. 450 v. 100 mfd. 200 v.	5.10
C20	T18-308	Capacitor, electrolytic, 40 mfd. 400 v.	2.20
C23, C25, C27, C29, C30, C31, C33, C34, C35, C36, C37	T15-247	Capacitor, disc, .001 mfd.	.20
C26, C38	T16-241	Capacitor, ceramic, .0015 mfd. 10%	.25
C28		Part of T3, 1st I. F.	
C32		Part of T4, 2nd I. F.	
C39, C40		Part of T6, 4th I. F.	
C41	T15-249	Capacitor, ceramic, 3 mmfd. + − .5 mfd.	.20
C43		Part of 4.5 Mc Trap (L6)	
C44	T16-246	Capacitor, molded, .47 mfd. 400 v.	.75
C47	T15-235	Capacitor, mica, 150 mmfd.	.25
C48, C81	T16-235	Capacitor, molded, .047 mfd. 600 v.	.40
C52, C53, C54		Parts of Vertical Integrator Network	
C55, C63, C70	T16-233	Capacitor, molded, .0047 mfd. 600 v.	.35
C57	T16-236	Capacitor, molded, .056 mfd. 600 v.	.45

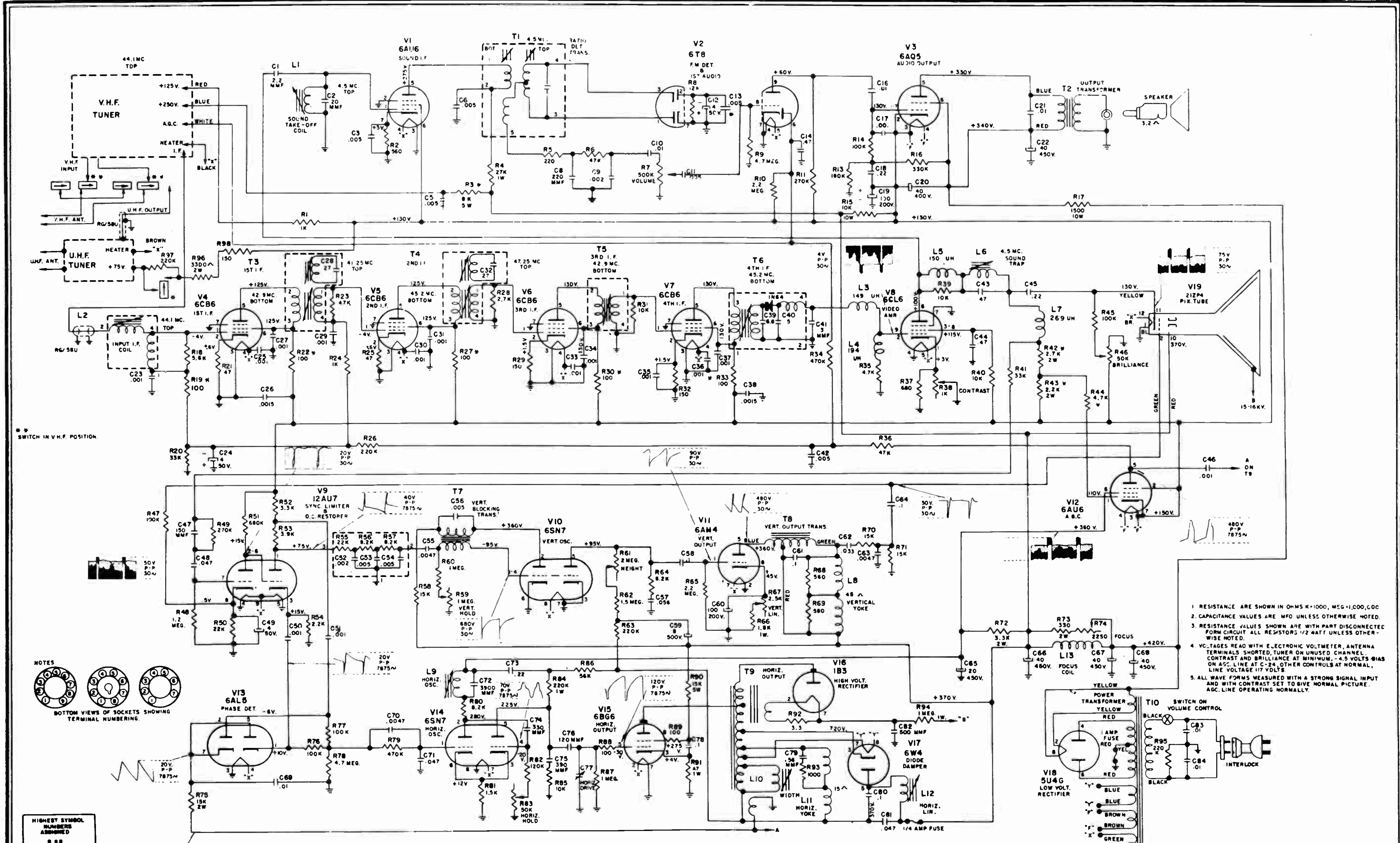


Fig. 17. Schematic Diagram of Chassis 528.258 and 528.268

**See production notes, reverse side of this diagram, for information on components marked "★"*

REPAIR PARTS PRICE LIST (Cont.)

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each
C58, C64, C78, C80	T16-238	Capacitor, molded, .1 mfd. 600 v.	.65
C59	T18-298	Capacitor, electrolytic, 8 mfd. 500 v.	1.65
C61	T16-187	Capacitor, tubular, .1 mfd. 400 v.	.35
C62	T16-234	Capacitor, molded, .033 mfd. 600 v.	.40
C65	T18-276	Capacitor, electrolytic, 20 mfd. 450 v.	2.15
C71	T16-245	Capacitor, molded, .047 mfd. 400 v.	.40
C72		Part of Horizontal Oscillator Coil (L9)	
C74	T15-226	Capacitor, mica, 330 mmfd. 10%	.45
C75	T15-231	Capacitor, mica, 390 mmfd.	.30
C76	T15-232	Capacitor, ceramic 120 mmfd.	.25
C77	T20-145	Capacitor, trimmer (Horizontal Drive)	.50
C82	T15-239	Capacitor, ceramic, 500 mmfd. 20 KV	1.50
R1, R24	T60-703	Resistor, 1K, ohm, ½ w. 10%	$ .20
R2	T60-758	Resistor, 560 ohm, ½ w. 10%	.20
R3†	T60-808	Resistor, 6.8K ohm, 2 w. 10% (used in chassis 528-258 only)	.30
R3*	T60-940	Resistor, 8K ohm, 5 w., wire wound, 5% (used in chassis 528.268 only)	1.35
R4	T60-692	Resistor, 27K ohm, 1 w. 10%	.20
R5	T60-753	Resistor, 220 ohm, ½ w. 10%	.20
R6	T60-730	Resistor, 47K ohm, ½ w.	.20
R7, R38	T24-206	Control ON/OFF — VOLUME (500K) & CONTRAST (1K)	2.15
R8	T60-811	Resistor, 12K ohm, ½ w. 10%	.20
R9, R78	T60-904	Resistor, 4.7 megohm, ½ w. 10%	.20
R10, R65	T60-898	Resistor, 2.2 megohm, ½ w. 10%	.20
R11, R49	T60-747	Resistor, 270K ohm, ½ w. 10%	.20
R12†	T25-23	TONE CONTROL and PHONO SWITCH, 500K (used in chassis 528-258 only)	3.25
R13	T60-788	Resistor, 180K ohm, ½ w. 5%	.20
R14, R45, R47, R76, R77	T60-801	Resistor, 100K ohm, ½ w. 10%	.20
R15	T60-916	Resistor, 10K ohm, 10 w. 10%	1.20
R16	T60-787	Resistor, 330K ohm, ½ w. 5%	.20
R17	T60-915	Resistor, 1.5K ohm, 10 w. 10%	1.00
R18	T60-910	Resistor, 5.6K ohm, ½ w. 10%	.20
R19, R22, R27, R30, R33	T60-703†	Resistor, 1K ohm, ½ w. 10% (used in chassis 528-258 only)	.20
R19, R22, R27, R30, R33	T60-752*	Resistor, 100 ohm, ½ w. 10% (used in chassis 528-268 only)	.20
R20, R41	T60-748	Resistor, 33K ohm, ½ w. 10%	.20
R21, R25	T60-798	Resistor, 47 ohm, ½ w. 10%	.20
R23, R35, R44	T60-759	Resistor, 4.7K ohm, ½ w. 10%	.20
R26, R63, R95, R97	T60-672	Resistor, 220K ohm, ½ w. 10%	.20
R28	T60-911	Resistor, 2.7K ohm, ½ w. 10%	.20
R29, R32, R98	T60-767	Resistor, 150 ohm, ½ w. 10%	.20
R31, R40, R85	T60-760	Resistor, 10K ohm, ½ w. 10%	.20
R34, R79	T60-902	Resistor, 470K ohm, ½ w. 10%	.20
R36	T60-903	Resistor, 47K ohm, ½ w. 10%	.20
R37	T60-708	Resistor, 680 ohm, ½ w. 10%	.20
R39		Part of Peaking Coil L5	
R42†	T60-905	Resistor, 2.2K ohm, 2 w. 10% (used in chassis 528-258 only)	.35
R42*	T60-914	Resistor, 2.7K ohm, 2 w. 10% (used in chassis 528-268 only)	.35
R43†	T60-914	Resistor, 2.7K ohm, 2 w. 10% (used in chassis 528-268 only	.35
R43*	T60-905	Resistor, 2.2K ohm, 2 w. 10% (used in chassis 528-258 only)	.35
R44†	T60-893	Resistor, 39K ohm, ½ w. 10% (used in chassis 528-258 only)	.20
R44*	T60-759	Resistor, 4.7K ohm, ½ w. 10% (used in chassis 528-268 only)	.20
R46	T25-21	Control, BRIGHTNESS (50K)	.90
R48	T60-782	Resistor, 1.2 megohm, ½ w. 10%	.20
R50	T60-744	Resistor, 22K ohm, ½ w. 10%	.20
R51	T60-807	Resistor, 680K ohm, ½ w. 10%	.20
R52	T60-882	Resistor, 3.3K ohm, ½ w. 10%	.20
R53	T60-710	Resistor, 3.9K ohm, ½ w. 10%	.20
R54	T60-714	Resistor, 2.2K ohm, ½ w. 10%	.20
R55, R56, R57		Parts of Vertical Integrator Network	
R58, R70, R71	T60-783	Resistor, 15K ohm, ½ w. 10%	.20
R59, R83†	T25-24	Control Dual, VERTICAL HOLD (1 meg.) and HORIZONTAL HOLD (50K) (used in chassis 528-258 only)	2.05
R59	T25-22	Control, VERTICAL HOLD (1 meg.) (used in chassis 528-268 only)	.95
R60, R87	T60-909	Resistor, 1 megohm, ½ w. 10%	.20
R61	T25-15	Control, HEIGHT, 2 megohm	.90
R62	T60-880	Resistor, 1.5 megohm, ½ w. 10%	.20
R64, R80	T60-778	Resistor, 8.2K ohm, ½ w. 10%	.20
R66	T60-899	Resistor, 1.8K ohm, 1 w. 10%	.20
R67	T25-13	Control, VERTICAL LINEARITY, 2.5K	.90
R68, R69, R93, C79		Part of Deflection Yoke (L8, L11)	
R72, R96	T60-816	Resistor, 3.3K ohm, 2 w. 10%	.30
R73	T60-814	Resistor, 330 ohm, 2 w. 10%	.30
R74	T25-14	Control, FOCUS (2250 ohm, 4 w.)	2.00
R75	T60-901	Resistor, 15K ohm, 2 w. 10%	.30
R81	T60-729	Resistor, 1.5K ohm, ½ w. 10%	.20
R82	T60-817	Resistor, 120K ohm, ½ w. 10%	.20
R83*	T25-21	Control, HORIZONTAL HOLD (50K) (used in chassis 528-268 only)	.90
R84	T60-886	Resistor, 220K ohm, 1 w. 10%	.20
R86	T60-802	Resistor, 56K ohm, ½ w. 10%	.20
R88, R89	T60-752	Resistor, 100 ohm, ½ w. 10%	.20
R90	T60-804	Resistor, 15K ohm, 5 w. wirewound, 10%	1.00
R91	T60-805	Resistor, 47 ohm, 1 w. 10%	.20
R92	T60-884	Resistor, 3.3 ohm, ½ w. 10%	.20
R94	T60-877	Resistor, 1 megohm, 1 w.	.20
R98*	T60-767	Resistor, 150 ohm, ½ w. 10% (used in chassis 528.268 only)	.20

TRANSFORMERS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each
T1	T10-552	Transformer, Ratio Detector, 4.5 Mc	$ 3.15
T2	T80-286	Transformer, Audio Output	2.45
T3	T10-594	Transformer, 1st I.F.	2.75
T4	T10-595	Transformer, 2nd I.F.	2.75
T5	T10-596	Transformer, 3rd I.F.	2.05
T6	T10-597	Transformer, 4th I.F.	3.70
T7	T80-288	Transformer, Vertical Blocking	2.15
T8	T80-287	Transformer, Vertical Output	3.60
T9	T80-289	Transformer, Horizontal Output	9.40
T10	T80-292	Transformer, Power	18.60

COILS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each
L1	T10-587	Coil, Sound take-off, 4.5 Mc	1.86
L2	T10-593	Coil, I.F. Input	2.00
L3	T10-600	Coil, Peaking (White & Red) 149 uh	.55
L4	T10-601	Coil, Peaking (White & Green) 194 uh	.55
L5	T10-591	Coil, Peaking (Black & Red) 150 uh (inc. R39)	.45
L6	T10-581	Coil, 4.5 Mc trap (inc. C43)	1.20
L7	T10-590	Coil, Peaking (Black & Green) 269 uh	.45
L8, L11	T83-776	Deflection Yoke (inc. R68, R69, R93, C79)	9.00
L9	T10-583	Coil, Horizontal Oscillator (inc. C72)	2.20
L10	T10-602	Coil, WIDTH Control	1.70
L12	T10-604	Coil, HORIZONTAL LINEARITY Control	1.60
L13	T10-603	Coil, Focus	8.70

MISCELLANEOUS CHASSIS PARTS

Schematic Location	Part Number	DESCRIPTION	Sears Selling Price Each
	T21-196	Cage, High Voltage	1.75
	T95-34	Converter, (UHF)	53.00
	T48-70	Crystal Diode 1N64	2.40
	T84-791	Drum and Shaft assembly	.85
	T43-15	Fuse, 1 amp. 250 v. (3AG)	.20
	T43-13	Fuse, ¼ amp. 250 v. with leads	.30
	T47-115	Grommet (3)	.10
	T83-684	Ion Trap magnet (single magnet)	.70
	T22-138	Jack, Speaker (2) (used in chassis 528.258 only)	.20
	T68-62	Jack, Speaker (1)	.20
	T89-7	Lamp, Pilot Light, #47 Bayonet	.20
	T22-180	Lead and Terminal (HV)	.80
	T87-43	Receptacle, A.C. Line	.20
	T87-44	Receptacle, Fuse Holder	.80
	T95-33	Tuner Cascode (13 position for UHF & VHF)	53.50
	T70-187	Retainer, UHF Tuning Shaft (2)	.05
	T68-56	Shell—Corona	.55
	T71-42	Shield, Tube (4)	.15
	T70-186	Sleeve, Neoprene, Corona	.15
	T70-162	Sleeve, Protective (rubber)	.35
	T68-18	Socket, Octal type (5)	.20
	T87-49	Socket, Pilot light	.30
	T68-43	Socket, 7 pin (7)	.20
	T68-51	Socket, 7 pin—W	.20
	T68-44	Socket, 9 pin (3)	.20
	T68-59	Socket, Picture Tube	1.00
	T68-55	Socket, Ring mounting	.30
	T68-58	Socket, Octal Type	.25
	T71-64	Spirashield	.60
	T70-167	Spring, Focus Coil (3)	.10
	T70-190	Spring, Grounding (Picture Tube)	.20
	T70-135	Spring, String Tension (3)	.10
	T51-105	String, Drive UHF, 66"	.20
	T69-194	Switch, UHF Antenna	2.75
	T17-106	Vertical Integrator Network (inc. C52, C53, C54, R55, R56, R57) (used in chassis 528-258 only)	.90
	T17-109	Vertical Integrator Network (inc. C52, C53, C54, R55, R56, R57) (used in chassis 528-268 only)	.90
	T83-775	Yoke Mounting Hood	1.30

528.258
CATALOG NO. 3112C
Leatherette Table Model

CABINET PARTS LIST

528.268
CATALOG NO. 4127A
Leatherette Console Model

Part Number	Sears Selling Price Each	MU Code	DESCRIPTION	Part Number	Sears Selling Price Each	MU Code
T79-397 5" PM	4.00		Speaker	T79-398 6" PM	4.80	

CHASSIS 110.817-10, -11, 110.821M-10, -35

FUNCTION	TYPE		FUNCTION	TYPE	
RF AMPLIFIER	V1	6BZ7	VERTICAL SWEEP OSCILLATOR	V14A	½ 12BH7
RF CONVERTER	V2	6X8	VERTICAL SWEEP OUTPUT	V14B	½ 12BH7
1ST IF AMPLIFIER	V3	6CB6	HORIZONTAL PHASE DETECTOR	V15	6AL5
2ND IF AMPLIFIER	V4	6CB6	HORIZONTAL SWEEP OSCILLATOR	V16	12BH7
3RD IF AMPLIFIER	V5	6CB6	HORIZONTAL SWEEP OUTPUT	V17	6BQ6GT
VIDEO DETECTOR	V6	6AL5	HI-VOLTAGE RECTIFIER	V18	1AX2
1ST VIDEO AMPLIFIER	V7A	½ 12BH7	HORIZONTAL DAMPER	V19	6W4GT
2ND VIDEO AMPLIFIER	V7B	½ 12BH7	POWER SUPPLY RECTIFIER	V20	5U4G
RATIO DETECTOR DRIVER	V8	6AU6	PICTURE TUBE	V21	
RATIO DETECTOR (AUDIO)	V9	6AL5	V21 For 110.817-10		17HP4
AUDIO AMPLIFIER	V10	6AV6	110.817-11		17HP4
AUDIO OUTPUT	V11	6V6GT	110.821M-10		21MP4
SYNC AMPLIFIER	V12A	½ 12BH7	110.821M-35		21MP4
PHASE INVERTER	V12B	½ 12BH7	UHF OSCILLATOR	V22	6AF4
SYNC SEPARATOR	V13	12BZ7			

GENERAL SPECIFICATIONS

MODEL	3102	3112	3131	3151	4103	4106
CHASSIS	110.817-11	110.821M-10	110.821M-35	110.821M-10	110.817-10	110.817-10
TYPE	Table	Table	Table	Open Face Console	Table	Table
PICTURE TUBE	17" Rect.	21" Metal Rect.	21" Metal Rect.	21" Metal Rect.	17" Rect.	17" Rect.
CABINET	Leatherette	Leatherette	Wood Mah.	Wood Mah.	Leatherette	Wood Mah.
BUILT-IN ANTENNA	Yes	Yes	Yes	Yes	Yes	Yes
ANTENNA IMPUT IMPEDANCE	300 ohm	300 ohm	300 ohm	300 ohm	300 ohm	300 ohm
SPEAKER	5" PM	6" PM	6" PM	6" PM	—	—
TOTAL POWER CONSUMPTION 117V 60 Cycle	210W	210W	210W	210W	210W	210W
AUDIO OUTPUT MAX. WATTS	2.5W	2.5W	2.5W	2.5W	2.5W	2.5W
PACKED WEIGHT	73 lbs.	95 lbs.	105 lbs.	115 lbs.	73 lbs.	81 lbs.
CABINET WIDTH	18"	23⅛"	23½"	24½"	18"	19"
CABINET DEPTH	18½"	19¾"	22⅛"	23"	18½"	19"
CABINET HEIGHT	16¹⁵⁄₁₆"	22³⁄₁₆"	22½"	36½"	16¹⁵⁄₁₆"	17¾"

CABINET PARTS LIST

	3102	3112	3131	3151	4103	4106
Cabinet	60192	60190-1S	60185	60186	60220	60224
Trap Door	—	44105	44105	44105	44105	44105
Safety Glass	62457-1	62457-21	62457-22	62457-21	62457-1	62457-24
Mask	62475	62608	62467	62476	62475	62473
Back Cover	62354	62472	62454-3	62454-3	62354	62474
Speaker	5866 5"PM	5866 5"PM	58130-2 6"PM	58130-2 6"PM	5866 5"PM	5866 5"PM
Knob Channel Sel.	39271	39271	39267	39271	39267	39267
Knob On-Off-Vol.	39273	39273	39269	39273	39269	39269
Knob Pix Control	39270 or 39274	39274	39270	39274	39274	39274
Knob Vernier	39268 or 39272	39272	39268	39272	39272	39272
Indicator Disc	40151	40151	40151	40151	40151	40151
Knob Phono/ TV Switch	—	—	39249	—	—	—

GENERAL INFORMATION

The information contained in this service RL Supplement covers the Catalog Nos. listed on the cover page.

The chassis used in these receivers are basically similar to the chassis covered in 57RL650, differing as described below:

1. Chassis 110.817-10, 110.817-11, 110-821M-10 similar to 110.817-1 except magnetic centering is used in place of electrical centering.

   If the picture requires centering;

   The angle between the vanes on the deflection yoke cover, moves any small area of the picture in a straight line along a radius. See Fig. 1.

   Rotating the vanes simultaneously, moves the same small area along the circumference of a circle. See Fig. 2.

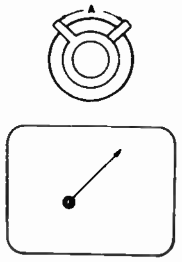


FIG. 1

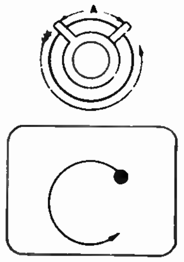
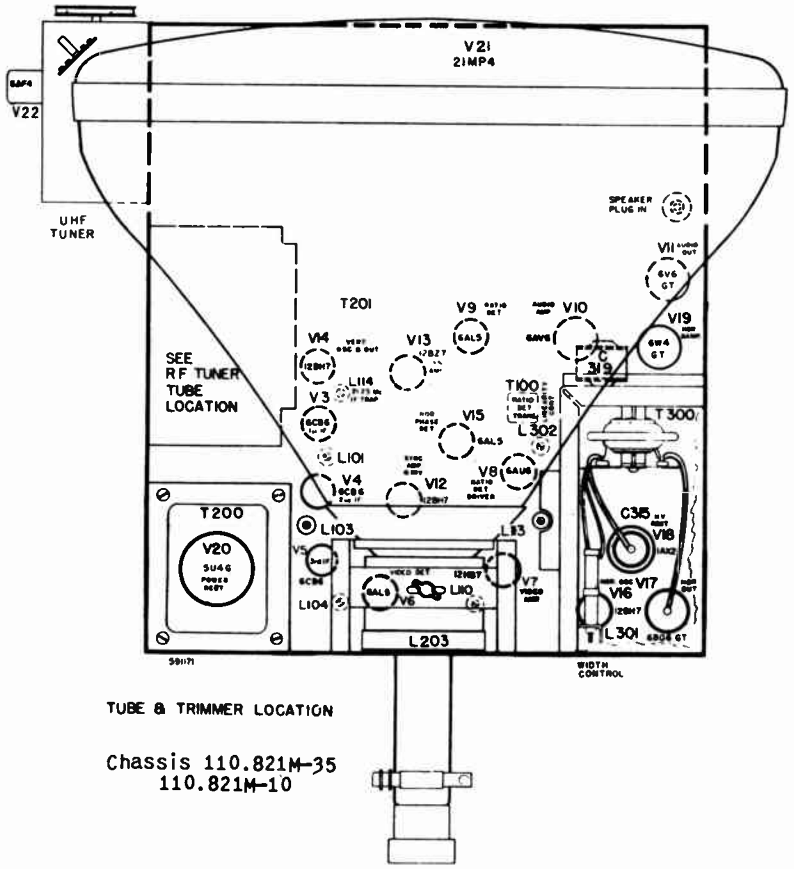


FIG. 2

2. All the chassis covered in this supplement use VHF Cascode Tuner PC541336 in conjunction with UHF Tuner PC541335 to provide complete VHF and UHF band coverage.

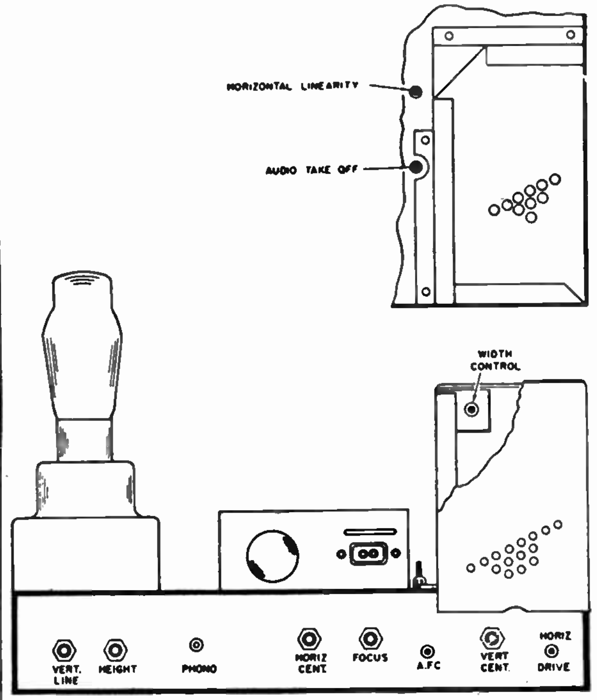
3. Chassis 110.817-10 and 110.821M-10 have Focus, Brightness, Vertical and Horizontal Hold Controls located on the front chassis apron.

4. Chassis 110.821M-35 has Brightness, Vertical and Horizontal Hold Controls and Phono TV switch in place of Focus Control on front chassis apron. Focus Control is on rear chassis apron.

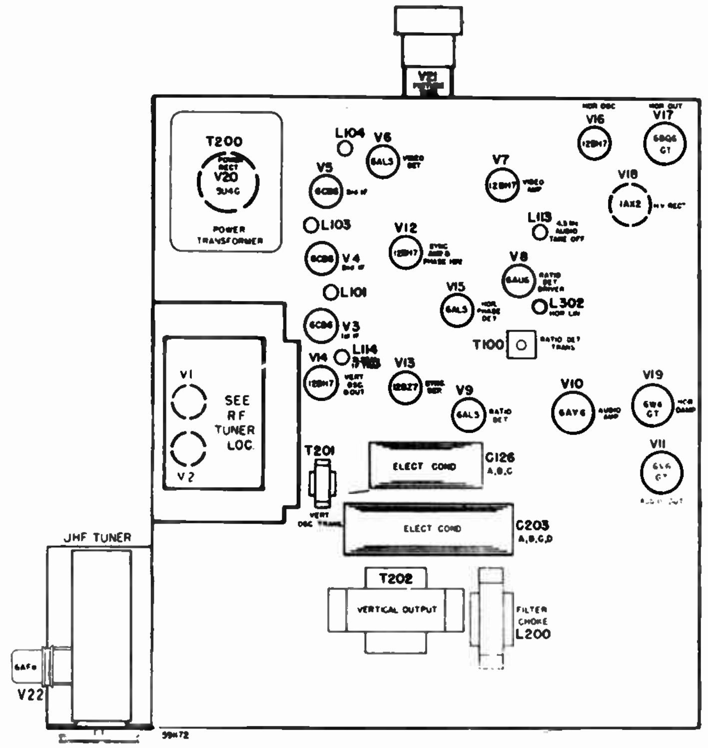


TUBE & TRIMMER LOCATION

Chassis 110.821M-35
110.821M-10



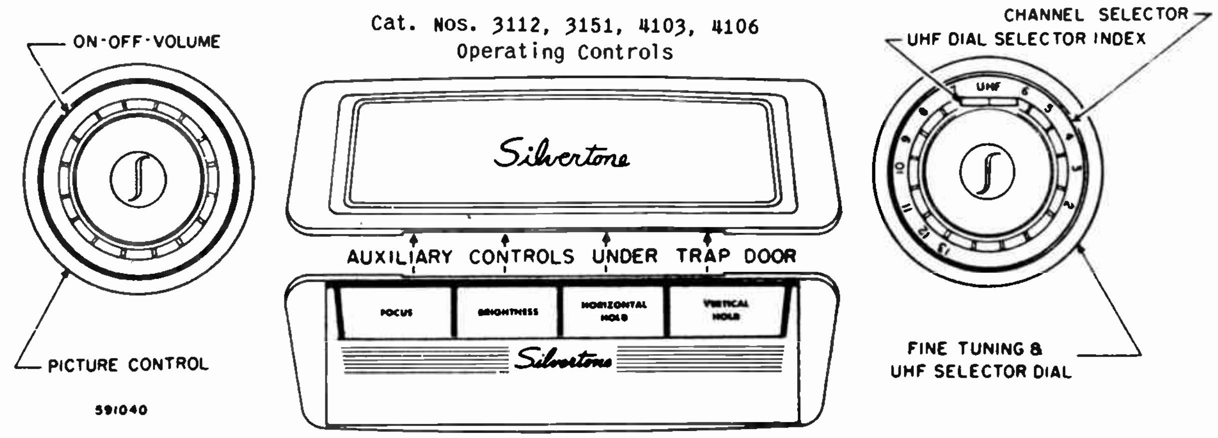
REAR OF CHASSIS
Chassis 110.821M-35

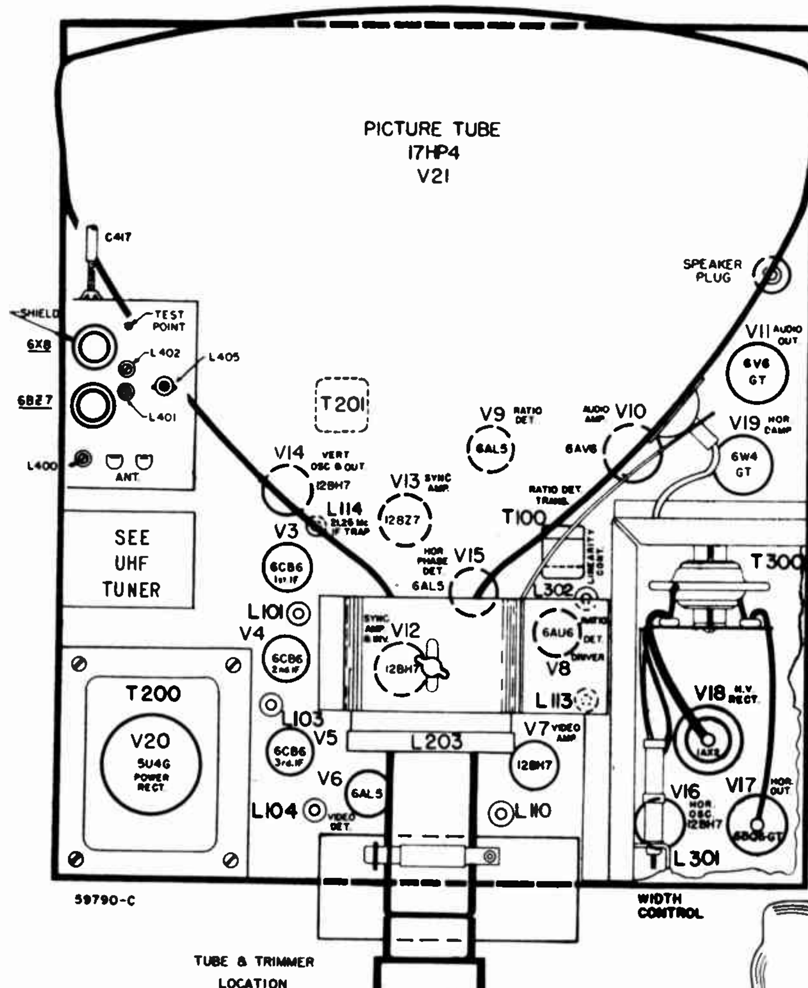


BOTTOM VIEW
821 M-35

Chassis 110.821M-35, 110.821M-10

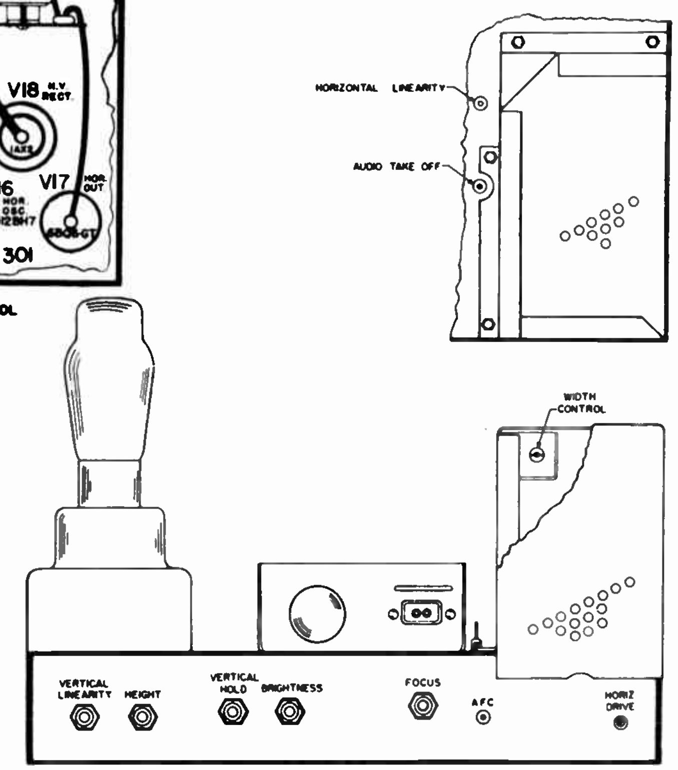
Cat. Nos. 3112, 3151, 4103, 4106
Operating Controls



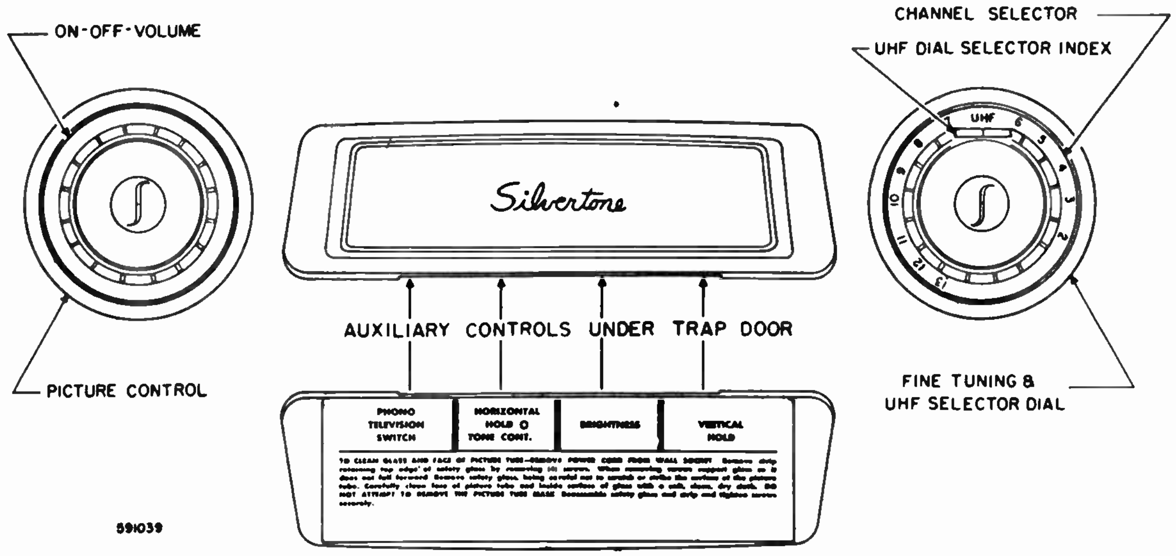


Chassis
110.817-10
110.817-11

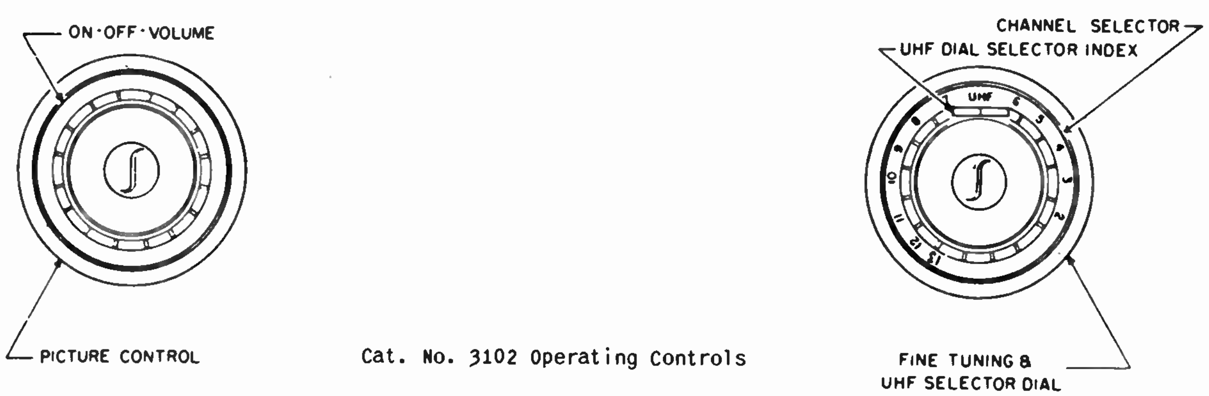
TOP VIEW



REAR CONTROLS
Chassis 110.817-11



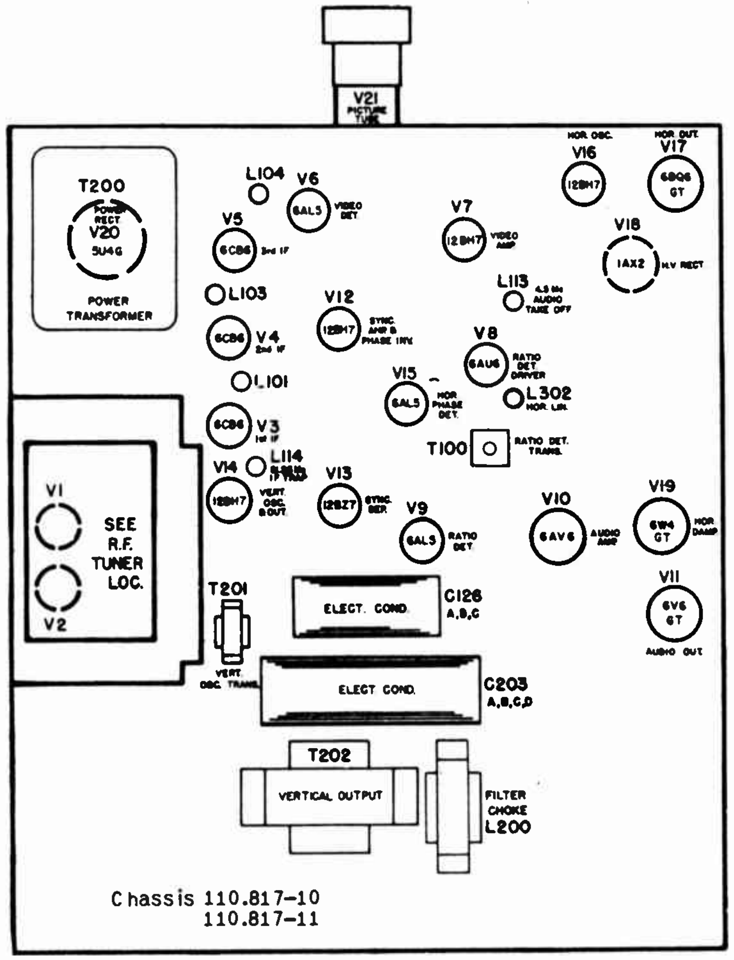
Cat. No. 3131 Operating Controls



Cat. No. 3102 Operating Controls

HORIZONTAL OSCILLATOR ALIGNMENT

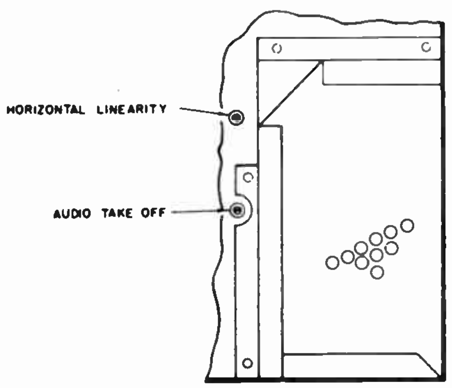
If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control, if one is provided, to the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

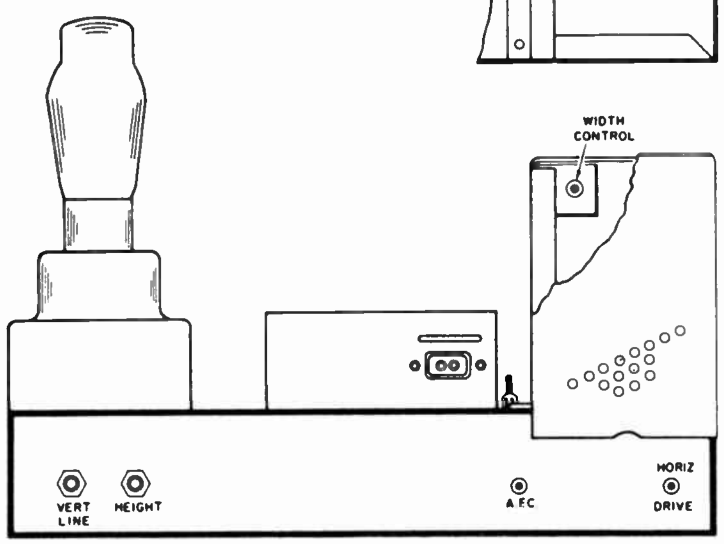


Chassis 110.817-10
110.817-11

REAR OF CHASSIS

Chassis 110.821M-10
110.817-10



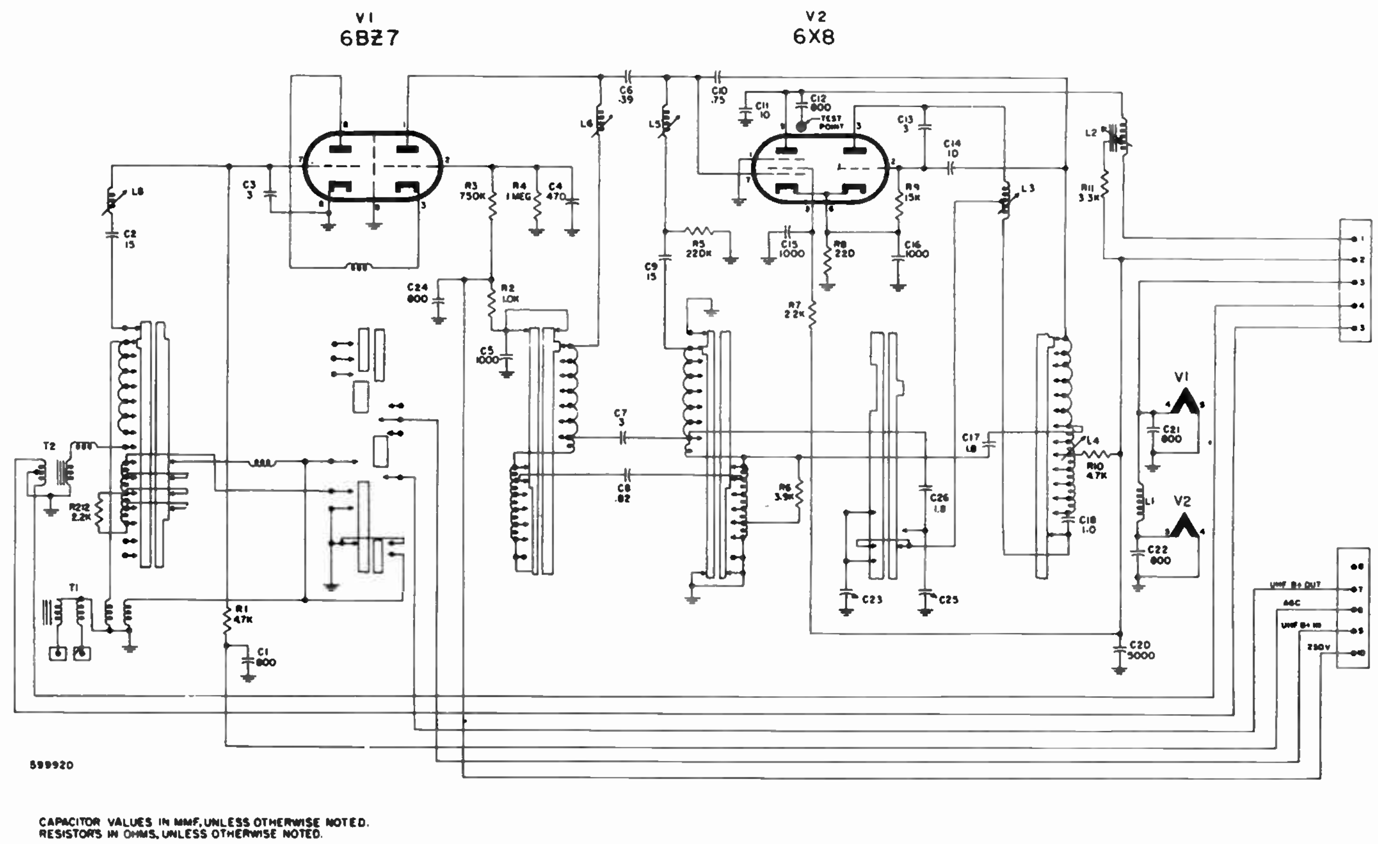


VHF CASCODE SWITCH TYPE TUNER

PART NO. PC541336

R. F. AMPLIFIER

The signal from the television receiving antenna is brought into the cascode R.F. amplifier through a coupling transformer which couples the balanced-to-ground twin-lead transmission line to the unbalanced single-ended grid drive of this stage. The channel switch picks out suitable lumped resonant elements in the circuits of this stage to permit selective amplification of the desired frequencies. A.G.C. is introduced at the grid of this stage also. The values of the shunt loading, the degree of the transformer coupling, and the values of the tuning inductances are chosen by the selector switch to provide uniform bandpass on all channels.



TUNER SCHEMATIC & TUBE LOCATION
CASCODE VHF TUNER PC-541336

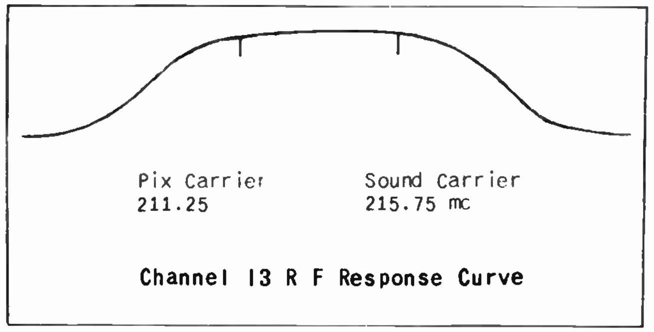
R. F. CONVERTER

The amplified signals from the previous R.F. stage are delivered to the input grid of V2. The 2nd section of the V2 is a modified Hartley oscillator, and the output of this local oscillator is heterodyned with the amplified R.F. in the mixer load. The channel selector functions in this circuit to select suitable fixed tank circuit elements so that the local oscillator frequency is always above the R.F. frequencies by an amount equal to the desired I.F. frequencies. The front panel "Fine Tuning" is mechanically connected to a variable capacitor in this oscillator tank circuit to provide vernier adjustment on the local oscillator frequency.

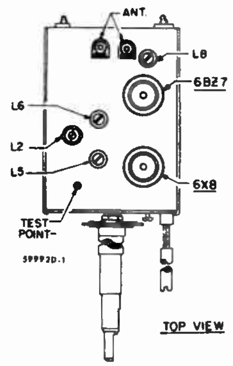
VHF TUNER RF BANDPASS ALIGNMENT

NOTE: DO NOT ATTEMPT RF BANDPASS ALIGNMENT UNTIL THE IF AMPLIFIERS ARE PROPERLY ALIGNED.

1. Connect the R.F. Sweep Generator, Marker Generator, and Oscilloscope as shown in Fig. 9a. Refer to Fig. 11 for instruments setting for each channel alignment. Put minus 3 volt bias between ground and AGC by means of the 3 volt battery. (Figs. refer to instruction manual 57RL650).
2. Set the RF sweep generator for 10mc. sweep width, and its center frequency at 213mc.
3. Set the CHANNEL SELECTOR to channel 13, and the fine tuning control at the middle of its rotation range.
4. Turn on the television receiver and test equipment and allow about 15 minutes for the set to warm up and stabilize.
5. Set the oscilloscope gain control for a maximum gain and the sweep attenuator for minimum output necessary to give a convenient size trace.
6. The response curve of the tuner should be flat over a 4.5mc band between the limits of 211.25mc and 215.75mc. If it is not L5, L6 and L8 (see Tuner Schematic and Tube Location) should be adjusted so the response is as near to this specification as possible. (See Sketch).



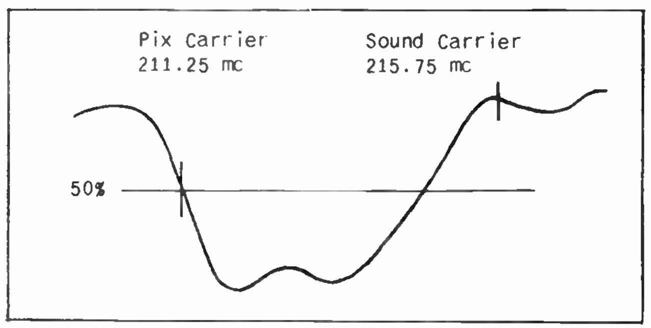
Channel 13 R F Response Curve

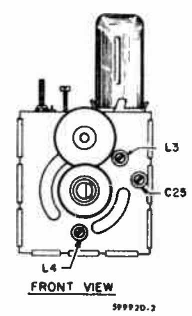


The RF Band pass alignment for all other channels is a factory adjustment.

VHF TUNER LOCAL OSCILLATOR ALIGNMENT

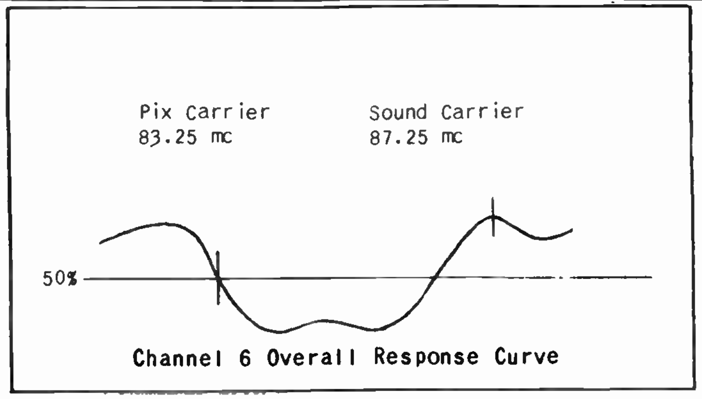
1. Connect the RF sweep generator to the antenna terminals as in figure 9A. Put minus 3 volt bias between ground and an AGC terminal by means of the 3 volt battery.
2. If the sweep generator is not provided with internal crystal-controlled or crystal-calibrated markers, connect a marker generator to the antenna terminals as in figure 9A.
3. Connect the cathode ray oscilloscope across the video detector load resistor R113. See figure 9B.
4. Adjust the R.F. sweep generator for 10mc. sweep width, with center frequency at approximately 213mc.
5. Adjust the marker generator for the picture carrier of channel 13 (211.25mc.)
6. Set the Channel Selector switch to channel 13, with the fine tuning control at the middle of its rotation range.
7. Turn on the receiver and test equipment and allow about 15 minutes for it to warm up and stabilize.
8. Set the oscilloscope gain control for a convenient size picture on the oscilloscope.
9. Adjust L3, the slug in Channel 13 oscillator coil, so the marker pip (211.25mc) is at the 50% point on the overall response curve. (See sketch)





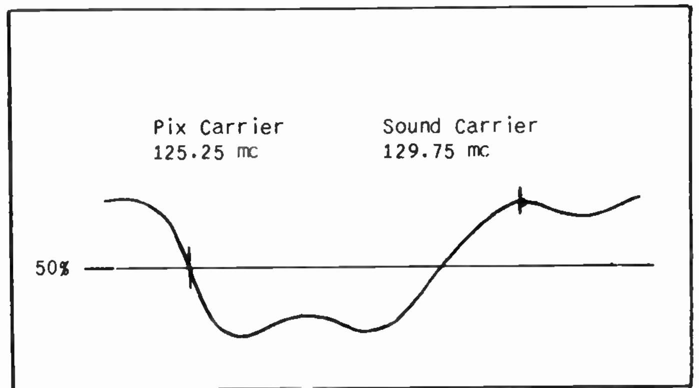
The oscillator alignment for all other high band channels is a factory adjustment.

10. Set the Channel Selector to Channel 6, the sweep generator frequency to approximately 85mc and the marker generator to the picture carrier (83.25mc) of Channel 6.
11. Adjust L4, the slug in Channel 6 oscillator coil so the marker pip (83.25mc) is at the 50% point on the slope of the overall response curve. (see sketch)



Channel 6 Overall Response Curve

The oscillator alignment for all other low band channels is a factory adjustment.



This completes the VHF tuner oscillator alignment.

12. Transfer the Sweep Signal Generator output terminals to the VHF tuner UHF input terminals on top of the UHF tuner. (Connecting to terminals 4 and 5 on the VHF tuner terminal strip – see schematic.)
13. Set the Channel Selector to UHF, and the sweep Generator to 127mc center frequency (or use the second harmonic of Channel 3 on selector switch type generators)
14. Adjust C25 so a marker generator 125.25mc pip is at the 50% response point on the overall response curve. (See sketch).

TELEVISION ALIGNMENT PROCEDURE, UHF

Alignment of the UHF Tuner is a simple procedure since its bandpass is essentially predetermined by the fixed characteristics of original component design, physical layout and associated circuitry. Except as stated otherwise in this procedure, band-pass is not subject to serious change during alignment, however, replacement of any component within the R-F or I-F curcuits may disturb the band-pass characteristics. Accordingly, whenever parts within these circuits are replaced, electrical and physical specifications of the original components must be duplicated as closely as possible. Wires, parts and other accessories must be replaced in their former positions.

Complicated or specially designed test equipment is not required for practical alignment of the UHF Tuner. Instruments used for testing VHF sets are usually satisfactory. However, the following instruments are needed;

1. VHF signal generator with AM output and a sweep modulation of at least 12 megacycles.
2. Oscilloscope or vacuum tube volt-ohmmeter for measurement of the relative signal.

The oscilloscope or VTVM should be connected to the TV set video detector load resistor R113.

The procedure for alignment consists of the following steps in the suggested sequence given:

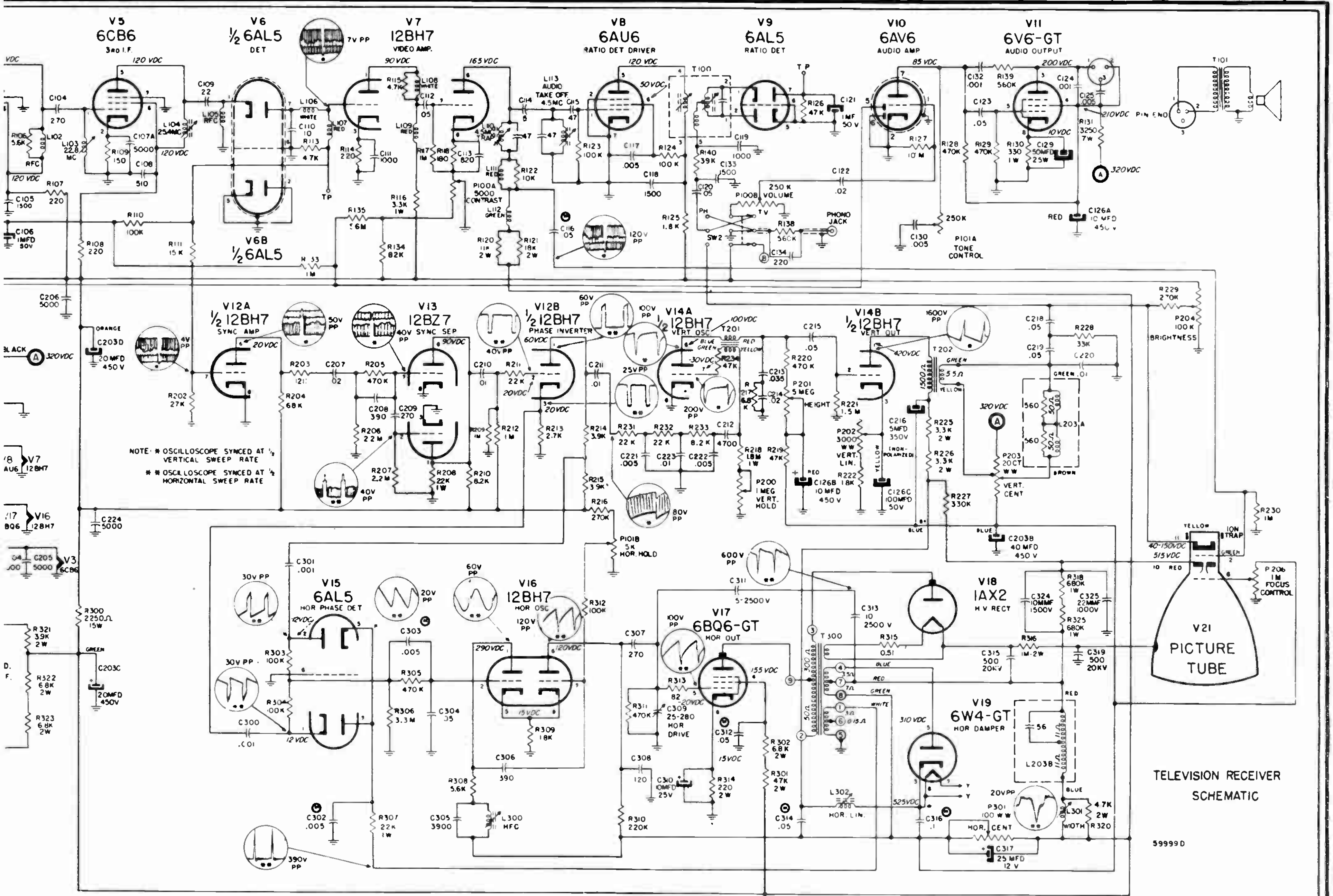
1. Adjustment of the oscillator for proper band coverage.
2. Alignment of R-F-circuits for maximum effectiveness.

OSCILLATOR ADJUSTMENT

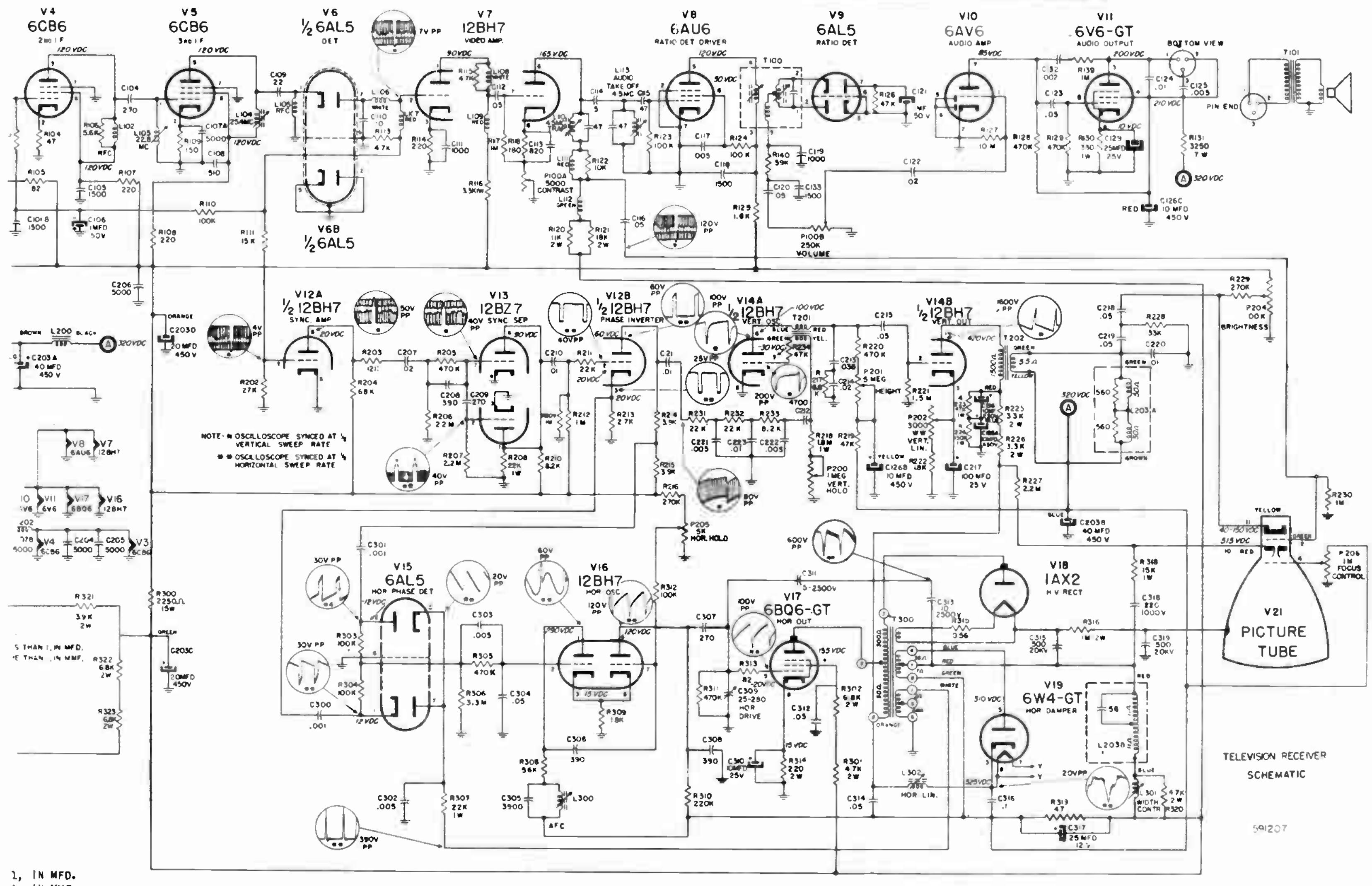
1. Adjust UHF channel tuning control to extreme counter-clockwise position.
2. Feed a 465-megacycle AM signal to the UHF Tuner antenna terminals through a resistive matching network, consisting of 50 ohms across the generator output with 120 ohms in one side of the line to the tuner and 150 ohms in the other. The input impedance of the tuner is 300 ohms balanced. Adjust oscillator trimmer (C3) for maximum signal. (Use non-metallic alignment tool.) (When using a VHF signal generator, a fundamental of 93 megacycles may be employed to produce the 5th harmonic energy of 465 megacycles.)
3. Adjust VHF channel to extreme clockwise position.
4. Set signal generator for a 900-megacycle output (5th harmonic of 180 megacycles). Carefully spread or pinch together the legs of the oscillator end-inductor (L3) for a maximum signal.
5. Repeat above steps until no further improvement in signal is apparent. (The oscillator alignment figures of 465 and 900 megacycles are only approximate, and may not fall precisely at the maximum dial settings; however, in every case the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the dial.)

R.F. ALIGNMENT

1. Adjust UHF channel tuning control to extreme counter-clockwise position.
2. Feed a 465-megacycle signal into the UHF tuner antenna terminals (as indicated above for oscillator alignment).
3. Adjust R-F trimmers (C1 & C2) for maximum signal.
4. Readjust tuning control to extreme clockwise position.
5. Set signal generator for 900-megacycle output.
6. Adjust end-inductors (L1 & L2) for maximum signal.
7. Repeat above steps until no further improvement in signal is apparent.



TELEVISION RECEIVER SCHEMATIC



TELEVISION RECEIVER SCHEMATIC

1, IN MFD.
1, IN MMF.

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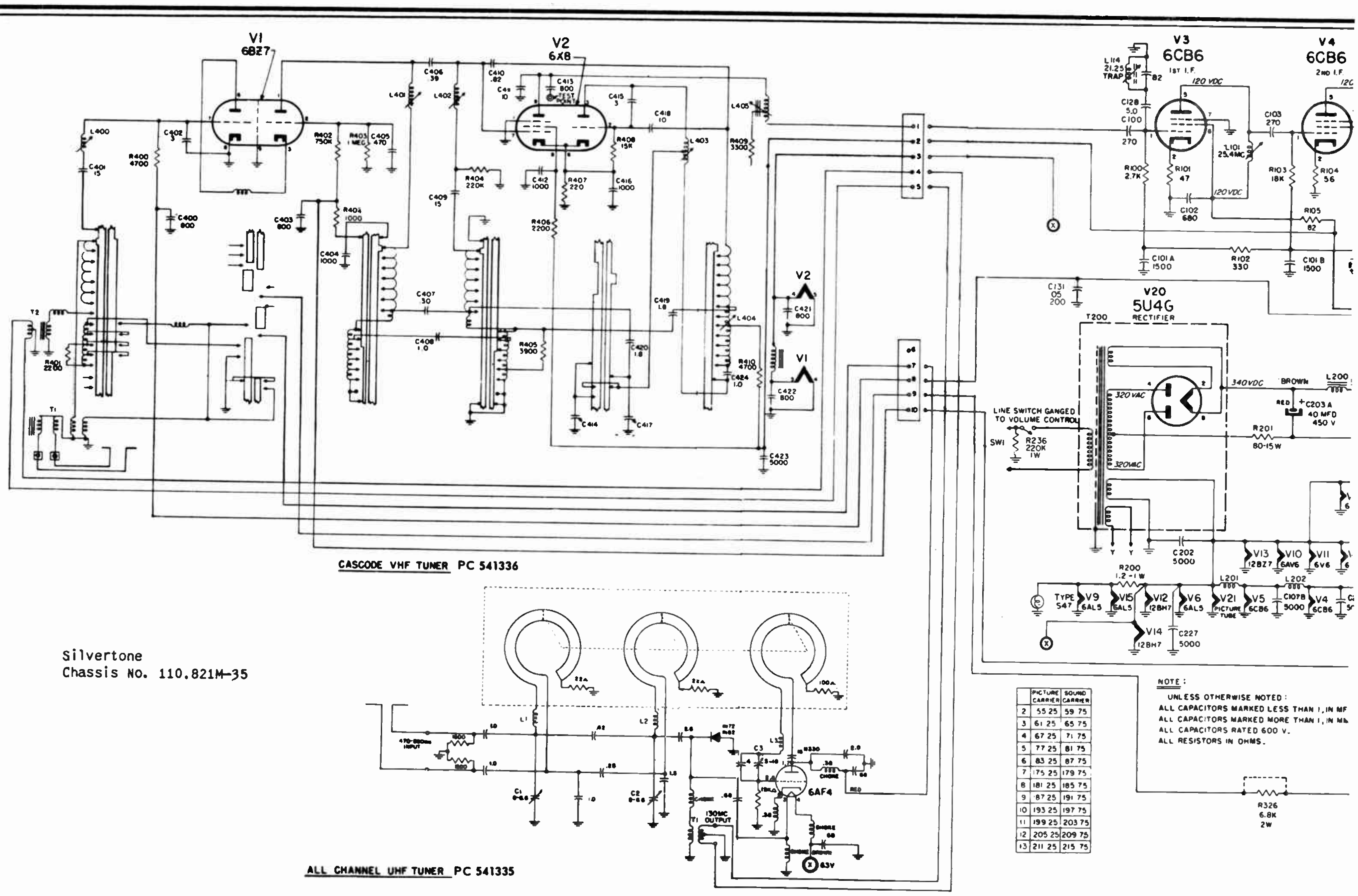
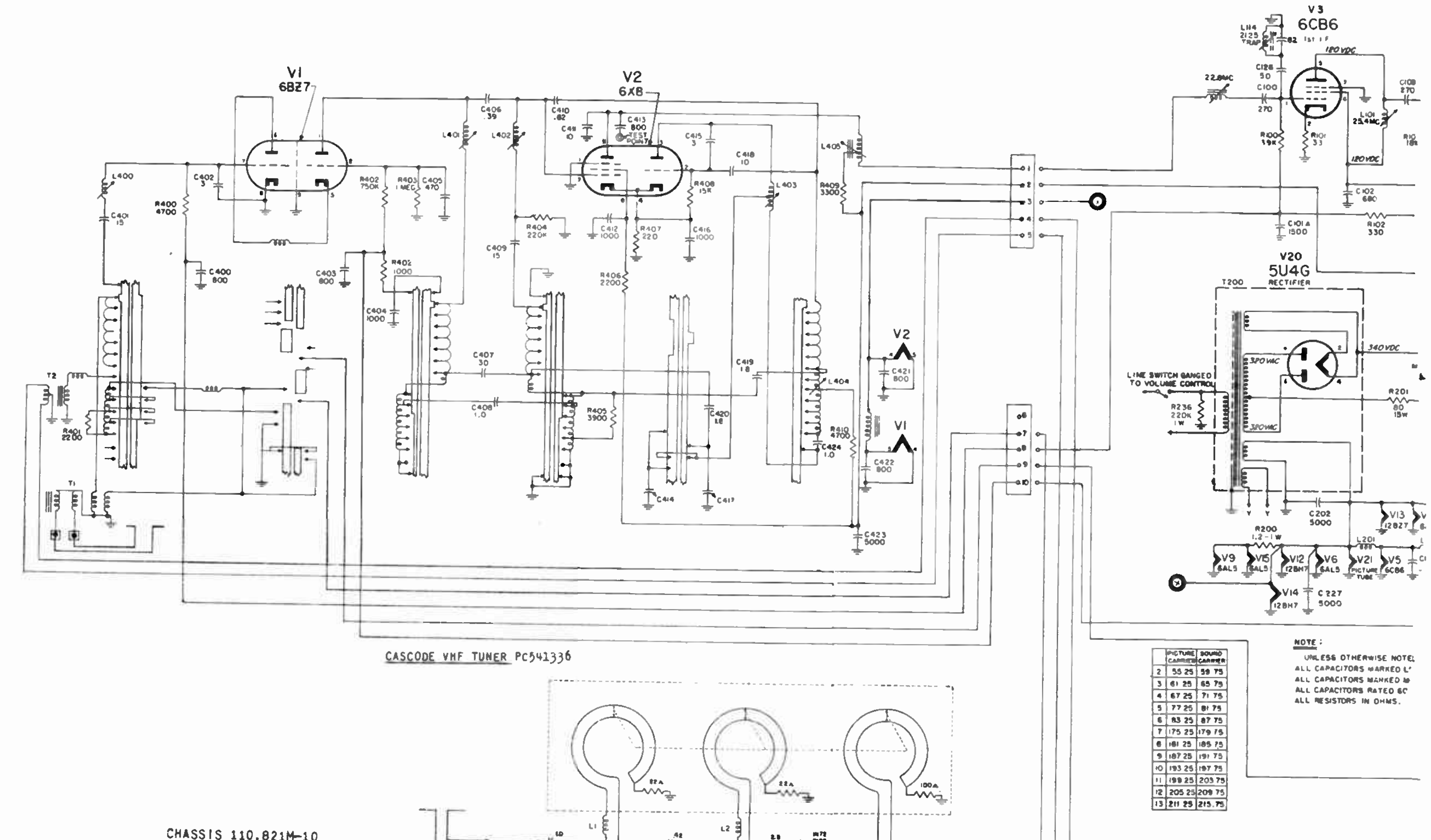


Silvertone
Chassis No. 110.821M-35

	PICTURE CARRIER	SOUND CARRIER
2	55 25	59 75
3	61 25	65 75
4	67 25	71 75
5	77 25	81 75
6	83 25	87 75
7	175 25	179 75
8	181 25	185 75
9	187 25	191 75
10	193 25	197 75
11	199 25	203 75
12	205 25	209 75
13	211 25	215 75

NOTE:

UNLESS OTHERWISE NOTED:
ALL CAPACITORS MARKED LESS THAN 1, IN MF
ALL CAPACITORS MARKED MORE THAN 1, IN MM
ALL CAPACITORS RATED 600 V.
ALL RESISTORS IN OHMS.



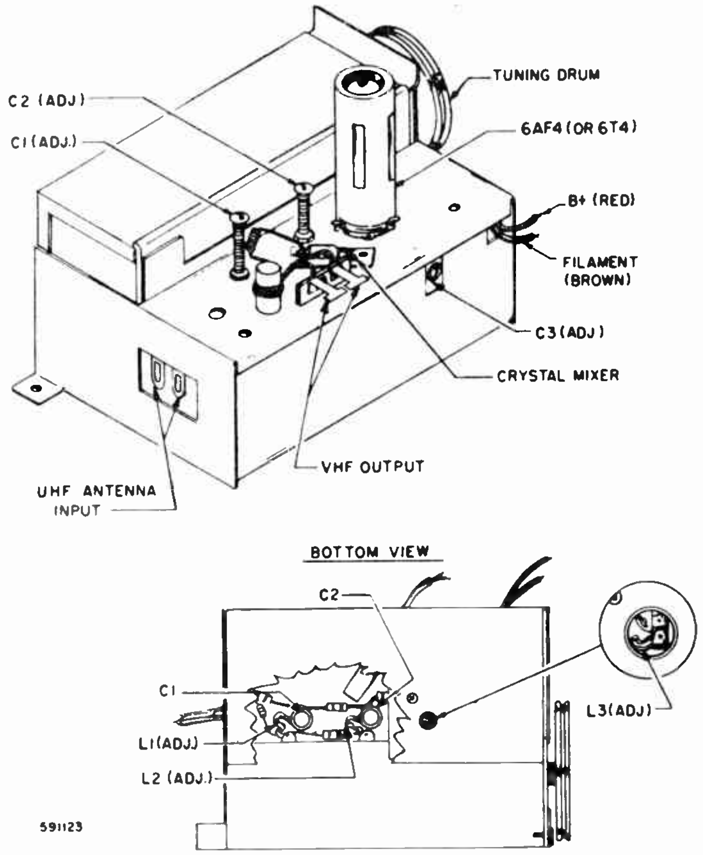
	PICTURE CARRIER	SOUND CARRIER
2	55 25	59 75
3	61 25	65 75
4	67 25	71 75
5	77 25	81 75
6	83 25	87 75
7	175 25	179 75
8	181 25	185 75
9	187 25	191 75
10	193 25	197 75
11	199 25	203 75
12	205 25	209 75
13	211 25	215.75

CHASSIS 110.821M-10
110.817-10, -11

NOTE:

UNLESS OTHERWISE NOTED:
1. ALL CAPACITORS MARKED LESS THA
2. ALL CAPACITORS MARKED MORE THAN
3. ALL CAPACITORS RATED 600V.
4. ALL RESISTORS IN OHMS.
5. ALL VOLTAGES MEASURED WITH VTVM SOCKET TERMINALS TO GROUND WI VOLTAGES OF 117VAC AND ANTENNA NALS SHORTED.
6. LL RESISTANCE VALUES OF TRANSFOR WINDINGS APPROXIMATE.
7. ON CHASSIS 817-11 P205 & R21 OMITTED AND R312 IS GROUNDE
8. ON CHASSIS 817-10, 817-11, C3 R316 & C319 ARE OMITTED.

CHASSIS	PIX TUBE
821M-10	21MP4
817-11, 817-10	17HP4

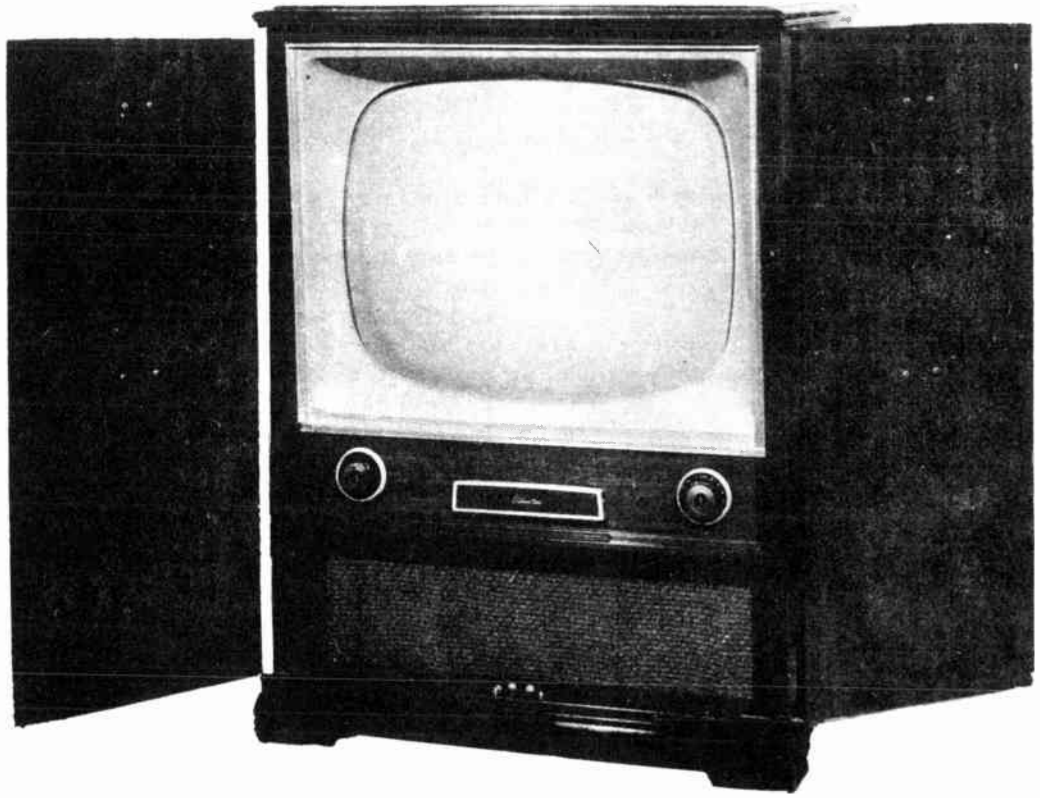


UHF TUNER PC-541335

TELEVISION REPAIR PARTS LIST

Schem. Loc.	Chassis	Part No.	Description	Selling Price	M.U. Code
			CAPACITORS		
C126		A20175	Electrolytic 10-10mfd 450V 100mmf 50V	4.20	B5
C128		A555-100	Ceramic 5.0mmf 500V ± 20% Unin.	.34	
C129		A20182	Electrolytic 50mfd 25V	1.30	AA5
C130		A194-151	Paper .005mfd 600V ± 20%	.34	
C131		A194-64	Paper .05mfd 200V ± 20%	.30	
C132		A194-145	Paper .001mfd 600V ± 20%	.30	
C133 C134	PA555-123	A556-238	Ceramic Tubular 1500mmf 350V ± 10% (Insul)	.34	
C200		Delete	Ceramic Tubular 220mmf 500V ± 20% (Insul)	.34	
C216		A20174	Electrolytic 5mmf 350V (non-polarized)	1.90	A5
C220		A194-160	Paper .05mfd 600V ± 20%	.34	
C224 C227		A19109	Ceramic Single Disc 5000mmf GMV	.34	
C302		A197-151	Paper Molded Tubular .005mmf 600V ± 20%	.34	
C308		A190-137	Mica 390mmf 500V ± 10%	.34	
C311		A19145	Mica 5mmf 2500V ± 20%	.40	
C312 C314		A197-160	Paper Molded Tubular .05mmf 600V ± 20%	.44	
C316		A197-162	Paper Molded Tubular .1mfd 600V ± 20%	.54	
C319	821-10, -35	A1998-3	Ceramic 500mmf 20K V	2.50	AO
C324		A19217	Mica 10mmf 1500V ± 10%	.40	
C325		A19218	Mica 22mmf 1000V ± 10%	.60	

Schem. Loc.	Chassis	Part No.	Description	Selling Price	M.U. Code
			RESISTORS		
R100		A231-1159	Carbon 2700 Ohm 1/2W ± 10%	.18	
R101 R104		A231-1117	Carbon 47 Ohm 1/2W ± 10%	.18	
R103		A231-1179	Carbon 18K Ohm 1/2W ± 10%	.18	
R106		A231-1167	Carbon 5600 Ohm 1/2W ± 10%	.18	
R133		A231-1221	Carbon 1.0 Megohm 1/2W ± 10%	.18	
R134		A231-1195	Carbon 82K Ohm 1/2W ± 10%	.18	
R135		A231-1239	Carbon 5.6 Megohm 1/2W ± 10%	.18	
R138 R139		A231-1215	Carbon 560K Ohm 1/2W ± 10%	.18	
R140		A231-1187	Carbon 39K Ohm 1/2W ± 10%	.18	
R201		A21134-22	Wirewound 80 Ohm 15W ± 10%	.90	
R216		A231-1207	Carbon 270K Ohm 1/2W ± 10%	.18	
R223	Delete				
R224	Delete				
R227		A232-1209	Carbon 330K Ohm 1W ± 20%	.24	
R236		A232-1205	Carbon 220K Ohm 1W ± 10%	.24	
R317		Delete			
R318 R325		A232-1217	Carbon 680 Ohm 1W ± 10%	.24	
R319		A231-1109	Carbon 22 Ohm 1/2W ± 10%	.18	
R320		A233-1165	Carbon 4700 Ohm 2W ± 10%	.34	
R321		A233-1163	Carbon 3900 Ohm 2W ± 10%	.34	
R322 R323		A233-1169	Carbon 6800 Ohm 2W ± 10%	.34	
R238					
			CHOKES & COILS		
L203	821M-10, -35	A28330	Coil, Deflection Yoke	12.50	B5
L301	821M-10, -35	A28318-1	Coil, Width Control	1.40	AAO
	817-10, -11 821M-10	A28331	Deflection Yoke Cover & Centering Device	1.60	A5
			TRANSFORMERS		
T202		A10152	Vertical Output	7.50	B5
			CONTROLS		
P101A,B	110.821M-35	A24145	Tone, Horiz. Hold 5K-250K	3.30	B5
P205		A24141B	Horizontal Hold 5000 Ohms	2.65	B5
			R.F. SECTION		
PC541336			Tuner, VHF (less Tubes)	43.50	B5
PC541335			Tuner, UHF (less Tubes)	48.20	B5
PB541436A			Mounting Bracket & Bearing Plate Assembly	.84	
PB541470			Compression Springs	.24	
PA591033			Stringing Diagram Label	.06	
			CRT CHASSIS ACCESSORIES		
		A541246	Bracket, Yoke Hood and CRT Grommet	2.30	
		A541250-1	Bracket, Yoke Hood Support (Left)	.60	
		A541250-2	Bracket, Yoke Hood Support (Right)	.60	
		A541243	Bracket, CRT Front Support and Stop	2.80	
		A541249	Bracket, Tie Rod	.30	
		A541254	CRT Strap Assembly	.60	
		A541261-1	Rubber Cushion (CRT Front Support and Stop Bkt.)	.18	
		A541261-2	Rubber Cushion (CRT Front Support and Stop Bkt.)	.18	
		A541102-6	Rubber Cushion (CRT Strap)	.90	



Catalog No. 4170 a 27" Console Model UHF-VHF Television Receiver with full doors. (Mahogany)

SPECIFICATIONS

Power Supply Rating	300 watts 105-120 volt 60 cycle AC
Audio Power Rating	3.5 watts maximum 1.5 watts undistorted
Antenna Input Impedance	300 ohm
Video Response	4 M.C.
Focus	Magnetic
Sweep Deflection	Magnetic
Picture Carrier	45.75 MC
Sound Carrier	41.25 MC
Adjacent Channel Sound Traps	47.25 MC
Adjacent Channel Picture Traps	39.75 MC

TUBE COMPLEMENT

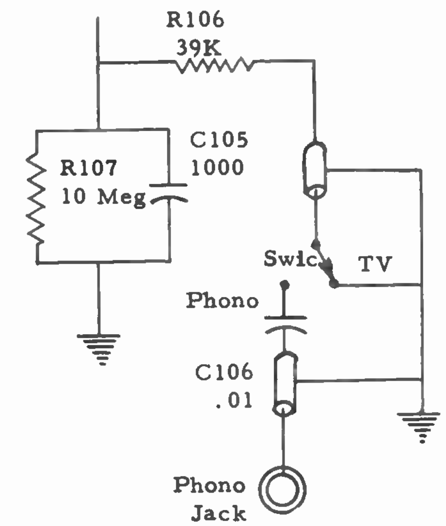
V1	6AU6	Intercarrier Sound Amp.	V13	6AL5	Horizontal Discr.
V2	6BN6	Sound Limiter Detector	V14	6SN7GTA	Horizontal Oscillator
V3	6BK5	Audio Output	V15	6CD6G	Horizontal Output
V4	6CB6	First Picture I.F.	V16	1B3GT	Hi-V Rectifier
V5	6CB6	Second Picture I.F.	V17	6AX4GT	Damper
V6	6CB6	Third Picture I.F.	V18	5U4G	Power Rectifier
V7	6CB6	Fourth Picture I.F.	V19	5U4G	Power Rectifier
V8	6CL6	Video Amplifier	V20	27EP4	Picture Tube
V9	6AU6	AGC Tube	V21	6BZ7	R. F. Amplifier
V10	6BE6	Sync Separator	V22	6J6 or	
V11A	6SN7GTA	Sync Splitter		6X8	R. F. Oscillator
V11B	6SN7GTA	Vertical Oscillator	V23	6AF4	UHF Oscillator
V12	6AH4GT	Vertical Output	V24	6BZ7	UHF I.F.

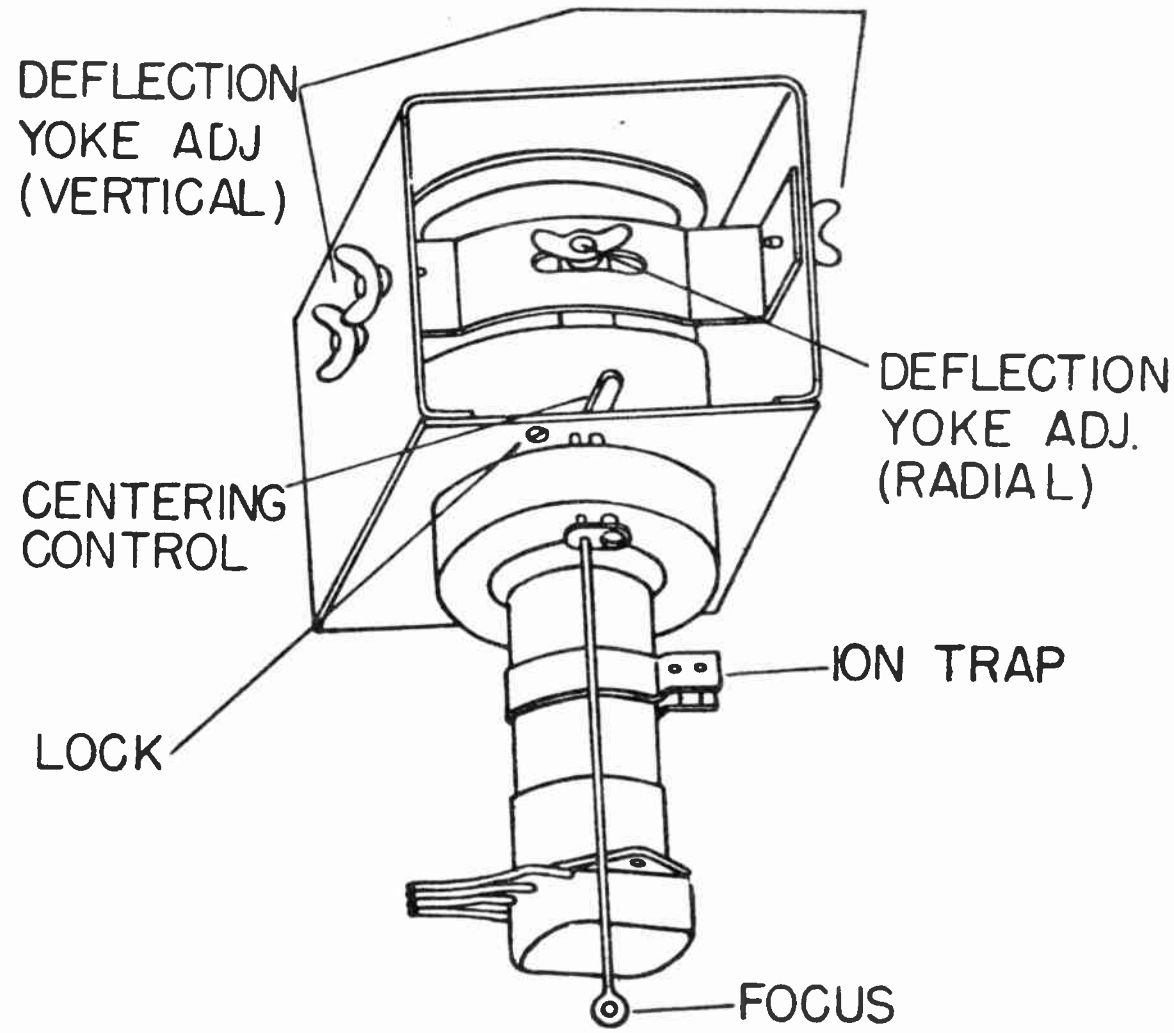
HIGH VOLTAGE WARNING

Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by personnel not thoroughly familiar with the precautions necessary when working on high-voltage equipment. Do not operate the television receiver with its compartment cover removed.

PRODUCTION CHANGES

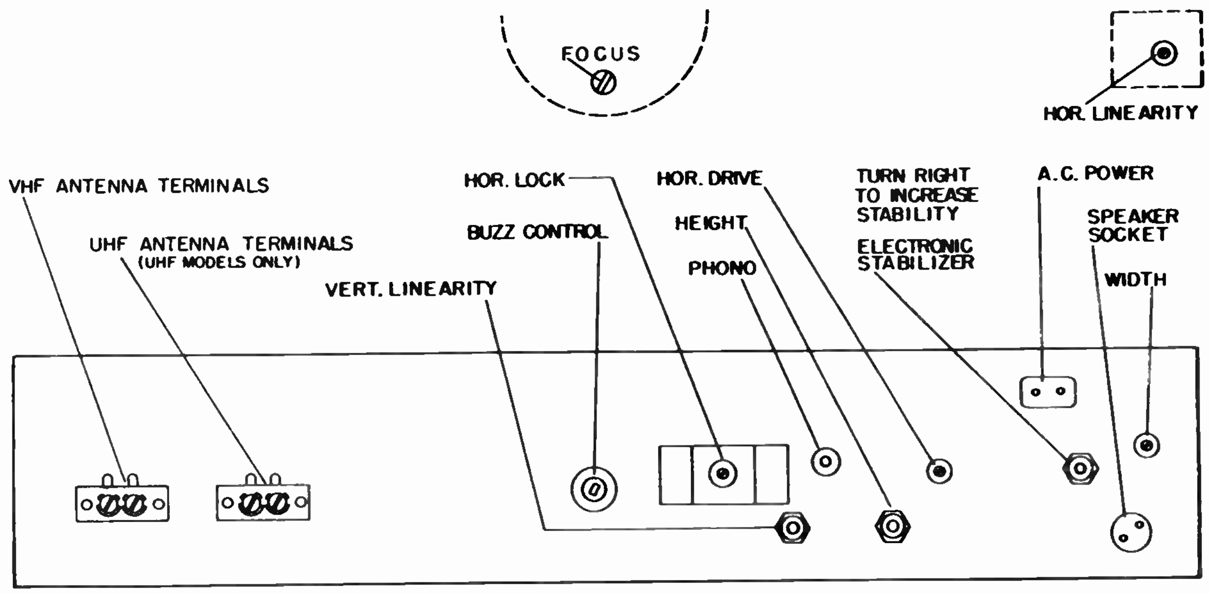
Schematic diagrams packed with Chassis 132.068, Model 4170, were in error in the connections to the Phono-TV switch (SW1C). The correct portion of this schematic is shown below.



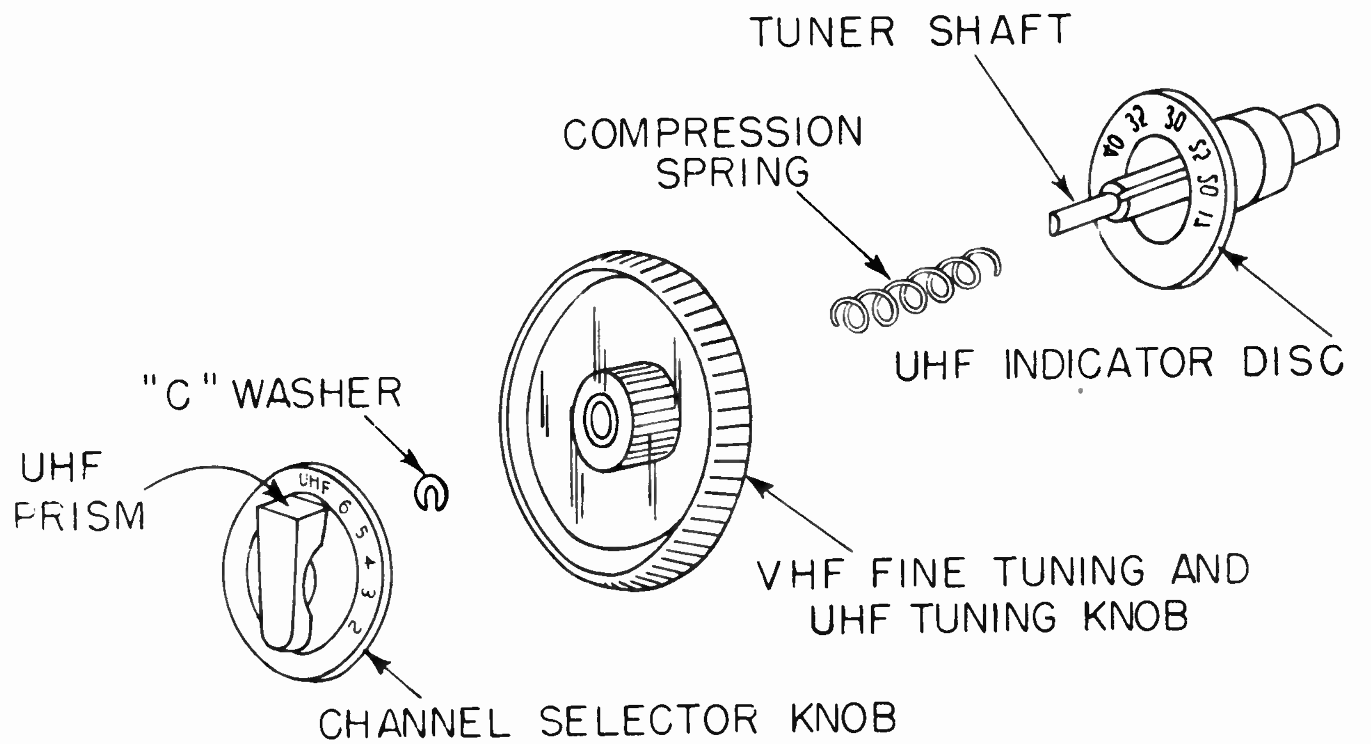


ION TRAP

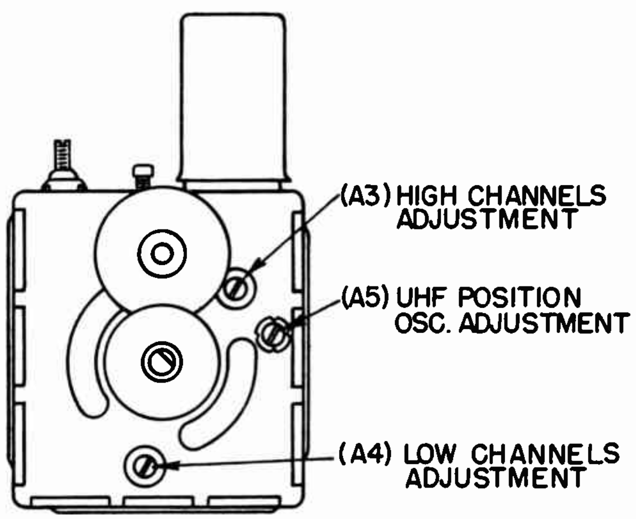
A single-magnet "beam bender" is used with the picture tube. Rotate the trap around the tube neck and slide it forward or back until a light appears on the screen. Adjust the trap for the point closest to the bakelite tube base which gives maximum light on the screen.



If the tuning knobs need to be pulled off, the Channel Selector knob must be removed first and the "C" washer must be taken out before the Fine Tuning knob can be removed (See Figure No. 1). The UHF indicator disc is held on by a compression spring and is not keyed to the shaft. Install the "C" washer in place before attempting to remove the UHF indicator disc, to prevent breakage of the VHF Fine Tuning drive wheel.



TUNER ADJUSTMENT



VHF TUNER (FRONT)

NOTE: The design purpose of A3 and A4 is for adjustment for channel 13 and channel 6--- for High and Low channels coverage. The above procedure gives optimum adjustment for any available stations.

The UHF position oscillator trimmer (C20 - A5) should not be adjusted unless some type of interference is present at the 127 megacycle frequency. This adjustment (C20 - A5) corresponds to the adjustments A3 and A4 for the VHF ranges.

ALIGNMENT

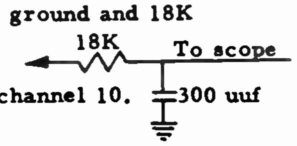
STAGGER-TUNED I.F. ALIGNMENT PROCEDURE

1. Set tuner to channel 9-10 or 11.
2. Pull AGC tube V9 out.
3. Connect -2.5 volts bias from junction R304 and R303 to ground with triple power switch in Suburban position.
4. Connect VTVM across R217 & R218. Isolate VTVM with 18K resistor. Use -5V scale.
5. Connect RF signal generator to ungrounded mixer tube sheild i.e. lift mixer tube sheild until it is just ungounded.
6. Good R.F. grounding between TV receiver on test and test equipment is necessary. A metal surface bench top should be used to insure proper RF grounding.

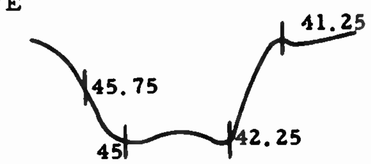
STEP	FREQUENCY	ADJUSTMENT	INSTRUCTIONS
1.	39.75 mc	Top T201 for min.	
2.	41.25 mc	Bottom T202 for min.	Outer peak
3.	47.25 mc.	Bottom T203 for min.	Outer peak
4.	43.2 mc UHF-VHF 42.8 mc VHF	Tuner coil for max.	Note: Turn bottom T201 completely out before making this adjustment.
5.	45.2 mc UHF-VHF 45.0 mc VHF	Bottom T201 for max.	
6.	44 mc	Top T202 for max.	Outer peak
7.	42.2 mc	Top T203 for max.	Outer peak-recheck steps 6 and 7
8.	40.3 mc	Bottom T204 for max.	
9.	45.2 mc	Bottom T205 for max.	
10.	43 mc	Bottom T206 for max.	Recheck steps 8-9 and 10

OVERALL SWEEP CHECK

1. Connect RF signal generator to chassis near V4 for marker generator. Push shield down on mixer tube.
2. Connect oscilloscope across R217 & R218. Isolate oscilloscope lead with 300 uuf to ground and 18K resistor in series.
3. Increase bias to -3.5 volts.
4. Connect sweep generator to antenna terminals. Adjust sweep generator & tuner to channel 10.



CURVE



ADJUSTMENT	INSTRUCTIONS
T205	T205 positions 45.75 marker
T206	T206 adjusts tilt of curve

Note: If desired curve cannot be obtained, slight adjustment of tuner coil and bottom T201 may be necessary.

SOUND AND 4.5 MC TRAP ALIGNMENT

1. Tune in available TV station and reduce signal into set until hiss is heard with sound. This can be done by inserting an attenuator in the antenna lead-in or by removing antenna lead-in from the set and stray feeding in signal by placing lead-in in close proximity of the set.

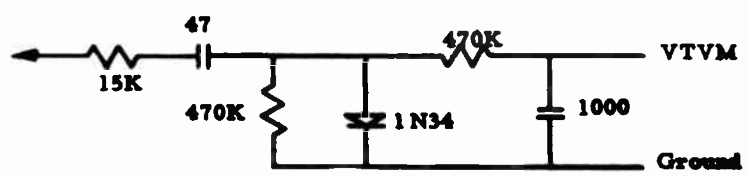
2. Set buzz control in the middle of its range. Adjust take off coil L201, top and bottom T101, Quadrature coil (L101) and buzz control for cleanest sound and minimum buzz. If any adjustment causes hiss to disappear reduce signal into set until hiss reappears and continue with adjustments.

Note: If difficulty is encountered either in reducing signal sufficiently or adjustments being very broad. The following proceedure may be used.

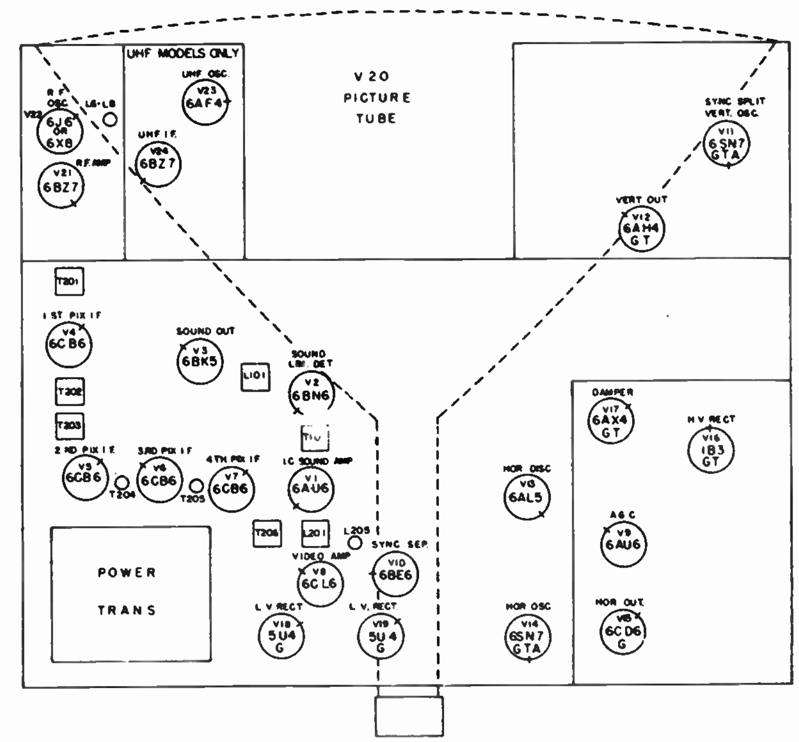
SOUND ALIGNMENT

STEP	EQUIPMENT	CONNECTION	FREQUENCY	ADJUSTMENT	INSTRUCTIONS
1.	Det. jig *	Input of jig to pin 2 of V2			Keep lead between 15K resistor and pin 2 as short as possible
2.	VTVM	out put of jig	Tune in available channel	L201-T101 (top and bottom) for max.	Adjust L201 on inner peak
3.		remove jig	Same	Quadrature coil (L101) for max. sound	Set buzz control in middle of its range before adjusting L101
4.			Same	Buzz control for minimum buzz	Correct adjustment of buzz control is approx. middle of its range
5.	Det. jig *	Junction L205 and L206			Connect VTVM to output of jig
6.	RF signal generator	Pin 9 (V8)	4.5 mc	Tune 4.5 mc trap (L205) for minimum	

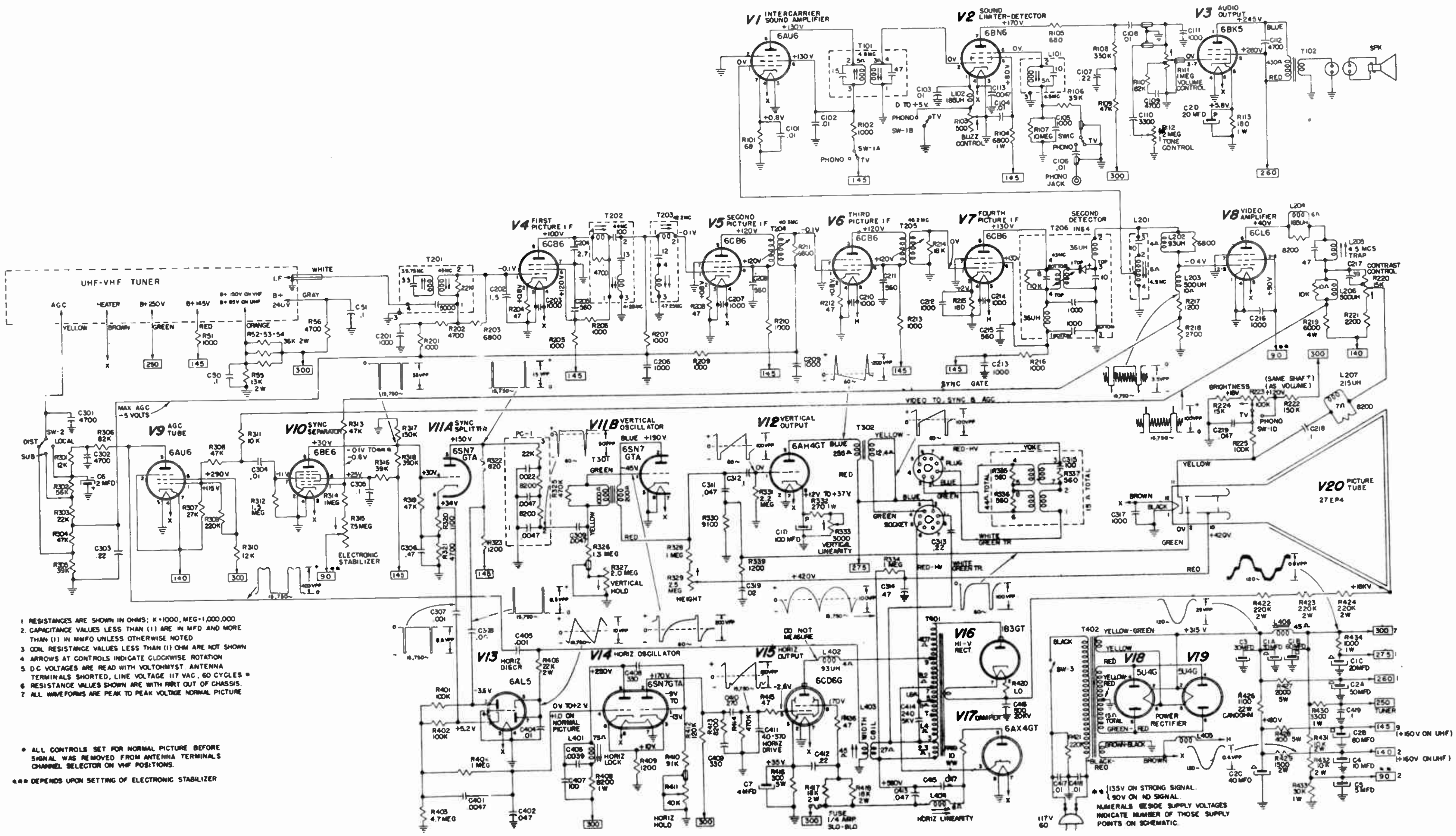
*Detector jig



TUBE LAYOUT



Schematic Location	Part No.	Description	List	M.U. Code
		CAPACITORS		
C202	N40355-1	Disc. 2.2 mmfd, 500 V.	.34	
C204	N41077-1	Disc. 2.7 uuf 0.5 uuf, P-100	.34	
C217	N20290-390	Mica. 39 uuf, 10%	.31	
C407	N20290-101	Mica. 100 uuf, 10%	.26	
C414	N40538-2	Disc. 260 uuf, 5 KV.	.32	
C410	N20290-271	Mica. 270 uuf, 10%	.26	
C408	N20331-331	Mica. 330 uuf, 5%, 500V.	.26	
C409	N20290-331	Mica. 330 uuf, 10%	.26	
C416	N24994	Hi Volt 500 uuf, 20 KV.	1.85	
C215	N41052-1	Disc. 560 uuf	.26	
C201, 203, 206, 207, 209, 210, 212, 213, 214, 216, 317	N40053-102	Disc. .001 mfd, G.M.V.	.23	
C111, 308, 307, 105	N40054-102	Disc. .001 mfd, 20%	.23	
C405	N40108-102	Disc. Heavy Duty, .001 mfd, 1000V.	.26	
C110	N40054-332	Disc. .0033 mfd, 20%	.23	
C406	N20433-392	Mica. 3900 uuf, 5% Class B.	1.25	
C301	N40053-472	Disc. .0047 uf, G.M.V.	.23	
C302, 401, 109	N40054-472	Disc. .0047 mfd, 20%	.23	
C112	N40108-472	Disc. Heavy Duty .0047 mfd, 1000V.	.26	
C309	N20324-472	.0047 mfd, 5%, 600V. Min. Oil Imp. Molded Paper	.46	
C101, 102, 103, 104, 106, 108	N40053-103	Disc. .01 mfd, G.M.V.	.23	
C417, 418	N41135-103	Disc. Heavy Duty, .01 mfd, 1500V.	.31	
C404, 304	N25455-103	.01 mfd, 20%, 200V. Paper Tubular	.23	
C319	N25455-223	.022 uf, .20%, 200V. Paper Tube	.23	



1 RESISTANCES ARE SHOWN IN OHMS; K=1000, MEG=1,000,000
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED
3 COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN
4 ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION
5. D C VOLTAGES ARE READ WITH VOLTOHMYST. ANTENNA TERMINALS SHORTED, LINE VOLTAGE 117 VAC, 60 CYCLES *
6 RESISTANCE VALUES SHOWN ARE WITH PART OUT OF CHASSIS.
7 ALL WAVEFORMS ARE PEAK TO PEAK VOLTAGE NORMAL PICTURE

* ALL CONTROLS SET FOR NORMAL PICTURE BEFORE SIGNAL WAS REMOVED FROM ANTENNA TERMINALS CHANNEL SELECTOR ON VHF POSITIONS.

*** DEPENDS UPON SETTING OF ELECTRONIC STABILIZER

Schematic Location	Part No.	Description	List
C314	N25461-474	.47 uf, 20% 600V Paper Tube	.51
C413,415	N20457-473	.047 mfd, 10%, 600V, Paper Tube	.31
C311	N25461-473	.047 mfd, 20%, 600V, Paper Tube	.26
C402,219	N25455-473	.047 mfd, 20%,200V, Paper Tube	.23
C312,314	N25461-104	.1 mfd, 20%, 600V, Paper Tube	.43
C303	N25455-224	.22 uf, 20%, 200V.	.29
C419,51	N25462-104	.1 mfd, 20%, 400V, Paper Tube	.31
C107,313, 412	N25462-224	.22 uf, 20% 400V.	.43
C306	N25455-474	.47 mfd, 20%, 200V, Paper Tube	.51
C6	N41534	Elect., 2 mfd, 150V.	.86
C7	N25453	Elect., 4 mfd, 150V.	1.15
C5	N40002	Elect., 5 mfd, 250V.	1.15
C4	N41429	Elect., 10 mfd, 350V.	1.30
C1	N22422-20	Elect., 30-400V., 60-20-350V., 100-50W.	3.90
C3	N22422-22	Elect., 30 mfd, 400V.	2.00
C2	N22422-21	Elect., 60-40-350V., 50-400V., 20-25V.	3.90
CP-1	N24166	Couplate	.85
C411	N24528	Trimmer 40-370	.43
C218,50, 305	N25455-104	.1 mfd, 20%, 200V, Paper Tube	.31

RESISTORS

Schematic Location	Part No.	Description	List
R420	N20309-39	3.9 ohm, 10%, 1/2W, W-W	.15
R419	N20308-100	10 ohm, 10%, 1/2W, W-W	.15
R425	N23970-26	10 ohm, 10%, 10W.	.86
R415	N20061-470	47 ohm, 20%, 1/2W.	.15
R208,204, 212	N22382-470	47 ohm, 5%, 1/2W.	.15
R101	N22381-680	68 ohm, 10%, 1/2W.	.15
R113	N20070-181	180 ohm, 10%, 1W.	.20
R215	N22381-181	180 ohm, 10%, 1/2W.	.15
R332	N20070-271	270 ohm, 10%, 1W.	.20
R416	N23970-23	300 ohm, 10%, 5W.	.36
R428	N23970-27	400 ohm, 10%, 5W.	.36
R105	N22382-681	680 ohm, 5%, 1/2W.	.15
R322	N22382-821	820 ohm, 5%, 1/2W.	.15
R205,206,207, 210,213, 216	N22381-102	1000 ohm, 10%, 1/2W.	.15
R434	N20070-102	1000 ohm, 10%, 1W.	.20
R102,201, 209	N20061-102	1000 ohm, 20%, 1/2W.	.15
R320	N22382-112	1100 ohm, 5%, 1/2W.	.15
R426	N41050	1100 ohm, 5%, 22W.	1.28
R409	N22381-122	1200 ohm, 10%, 1/2W.	.15
R217,323, 339	N22382-122	1200 ohm, 5%, 1/2W.	.15
R429	N25467-152	1500 ohm, 5%, 2W.	.36
R427	N23970-18	2000 ohm, 10%, 5W.	.36
R221	N22381-222	2200 ohm, 10%, 1/2W.	.15
R218	N22382-272	2700 ohm, 5%, 1/2W.	.15
R430	N20070-332	3300 ohm, 10%, 1W.	.20
R202,321	N22381-472	4700 ohm, 10%, 1/2W.	.15
R219	N41075-602	6000 ohm, 5%, 4W.	.36
R104	N20302-682	6800 ohm, 10%, 1W.	.15
R211,203	N22382-682	6800 ohm, 5%, 1/2W.	.15
R413	N22381-822	8200 ohm, 10%, 1/2W.	.15
R408	N20070-822	8200 ohm, 5%, 1/2W.	.15
R330	N22382-912	9100 ohm, 5%, 1/2W.	.15
R431,432	N25467-103	10K, 5%, 2W.	.15

RESISTORS

Schematic Location	Part No.	Description	List
R331	N22381-103	10K, 10%, 1/2W.	.15
R310	N22381-123	12K, 10%, 1/2W.	.15
R301	N22382-123	12K, 5%, 1/2W.	.15
R224	N22381-153	15K, 10%, 1/2W.	.15
R214	N22381-183	18K, 10%, 1/2W.	.15
R417,418	N20302-183	18K, 10%, 2W.	.36
R303	N22382-223	22K, 5%, 1/2W.	.15
R406	N20302-223	22K, 10%, 2W.	.15
R307	N22382-273	27K, 5%, 1/2W.	.15
R433	N22383-303	30K, 5%, 1W.	.15
R106	N22381-393	39K, 10%, 1/2W.	.15
R305,316	N22382-393	39K, 5%, 1.2W.	.15
R308,313, 319	N22381-473	47K, 10%, 1/2W.	.15
R304	N22382-473	47K, 5%, 1/2W.	.15
R109	N20061-473	47K, 20%, 1/2W.	.15
R302	N22382-563	56K, 5%, 1/2W.	.15
R306	N22382-823	82K, 5%, 1/2W.	.15
R110	N22381-823	82K, 10%, 1/2W.	.15
R410	N22382-913	91K, 5%, 1/2W.	.15
R225	N22381-104	100K, 10%, 1/2W.	.15
R401,402	N22382-104	100K, 5%, 1/2W.	.15
R412	N22381-124	120K, 10%, 1/2W.	.15
R317,222	N22381-154	150K, 10%, 1/2W.	.15
R421	N20061-224	220K, 20%, 1/2W.	.15
R108	N22381-334	330K, 10%, 1/2W.	.15
R309	N22382-224	220K, 5%, 1/2W.	.15
R318	N22381-394	390K, 10%, 1/2W.	.15
R325,414	N22381-474	470K, 10%, 1/2W.	.15
R404,314, 334,328	N22381-105	1meg, 10%, 1/2W.	.15
R226	N22382-155	1.5meg, 5%, 1/2W.	.15
R312	N22381-155	1.5meg, 10%, 1/2W	.15
R331	N22381-225	2.2meg, 10%, 1/2W	.15
R403	N22381-475	4.7meg, 10%, 1/2W	.15
R107	N20001-106	10meg. 20%, 1/2W.	.15

MISCELLANEOUS

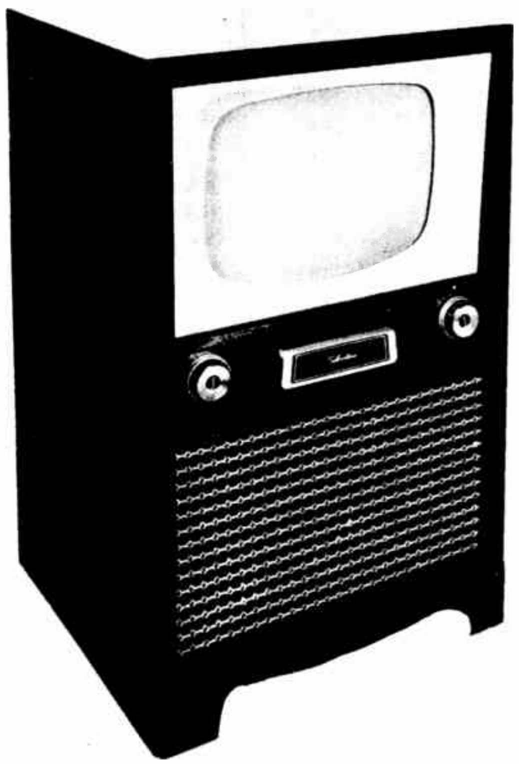
Schematic Location	Part No.	Description	List	M.U. Code
	N41439-1	Control Door & Escutcheon	3.55	A5
	N40711-1	Knob, Channel Indicator	2.65	AAO
	N40579-1	Knob, Fine Tuning & UHF	1.30	
	N40712-1	Knob, Volume	1.30	
	N41578-1	Knob, Brightness	.60	
	N40517	Top Retainer Rail	2.00	
	N40518	Bottom Retainer Rail	2.70	
	N40488	Safety Glass	18.00	B5
	N40204-1	Plastic Mask	5.30	B5
	N41615	Speaker 10" P.M.	5.70	B5
	N23538	Speaker Plug	.17	
	N19579	Speaker Socket	.11	
	N24699-7	Knob, Behind Control Door	.17	
	N25095	UHF Indicator Disc.	*.65	
	N25267-16	Tuner Assy.	65.00	B5

COILS, CHOKES & TRANSFORMERS

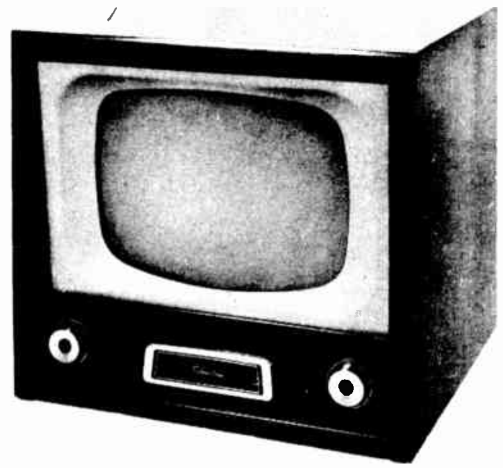
L102	N25468-1	Coil, Peaking 185 uh	2.00	AA5
L101	N40937	Coil, Quadrature	.60	
L202	N25468-18	Coil, Peaking 93 uh on 6800 ohm	.60	
L206	N25468-16	Coil, Peaking 500 uh on 10K	.60	
L203	N25468-15	Coil, Peaking 500 uh on Dummy	.60	
L204	N25468-19	Coil, Peaking 185 uh on 8200 ohm	.60	
L207	N25468-20	Coil, Peaking 215 uh on 8.2K	.60	
L402	N25468-10	Coil, Peaking 93 uh	.60	
L401	N23449	Coil, Horizontal Osc.	1.15	
L403	N40532	Coil, Width Control	2.00	
L205	N25609	Coil, Video Trap	1.00	
L404	N40533	Coil, Horizontal Linearity	1.30	
L406	N22561-5	Filter Choke	1.83	
L405	N23095	Filament Choke	.17	
	N40537	Yoke, Deflection	17.20	B5
	N22381-561	R335,336 Resistor 560 ohm, 10%, 1/2W	.15	
	N40539	C315, Capacitor Disc. 100 uuf, 3KV.	.60	
T202	N41171	Transformer, 1st Pix I.F. Assy. (M1)	2.85	
T203	N41172	Transformer, 1st Pix I.F. Assy. (M2)	2.00	
T204, 205	N41173	Transformer, 2nd & 3rd I.F. Assy.	1.00	
T206	N41174	Transformer, 4th Pix I.F. Assy.	4.00	A5
T301	N22446-1	Transformer, Vert. Osc. Assy.	2.85	AAO
T402	N40926	Transformer, Power	17.00	B5
T401	N40513	Transformer, Horiz. Output Assy.	8.65	B5
T102	N24776-5	Transformer, Audio Output	2.65	
L201	N41176	Transformer, Sound Take Off	1.65	
T101	N41177	Transformer, 1st Sound I.F.	2.25	
T302	N41092-1	Vertical Output Choke Assy.	3.25	AAO
T201	N41175	Converter I.F.	2.75	AAO

MISCELLANEOUS

Schematic Location	Part No.	Description	List	M.U. Code
	N41498	Instruction Leaflet		
	N19351	Dial Light Bulb	.26	
	N25265-2	Panel Light Socket Assy.	.23	
	N40663	High Voltage Fuse	.43	
	N22871	Tube Top Cap (6CD6G)	.17	
	N40959	Plug Interlock Assy.	.17	
	N40512	Socket & Corona Ring Assy.	.85	
	N24911-9	Kinescope Socket Assy.	.41	
	N25662-2	Ion Trap	.77	
	N41123-1	Anode Connector Assy.	1.55	
	N25511-1	Hi Volt Top & Rear Cover Assy.	.65	
	N41464	41 mc Trap	3.25	AAO
R111,223, SW-3	N22464-50	Control, Volume, Brightness	2.25	
R220	N22464-52	Control, Contrast	.85	
R333	N22464-41	Control, Vertical Linearity	.85	
R327	N22464-58	Control, Vertical Hold	.85	
R411	N22464-53	Control, Horizontal Hold	.85	
R112, SW-1	N22464-56	Control, Tone-Phono-TV Switch	2.25	
R329	N22464-43	Control, Height	.85	
R315	N22464-57	Control, Fringe Lock	.85	
R103	N41038	Control, Buzz	.55	
	N41072	Control, Shaft Contrast	.60	
	N41073-1	Coupling, Contrast Control	.29	
SW-2	N41039	Local Distance Switch	1.00	
	N40991-2	Control Magnetic Focus	5.00	B5
	N24458-4	Antenna Loop Assy.	.92	



Catalog No. 3146 is a 17" Console Model UHF-VHF Television Receiver.



Catalog No. 3106 is a 17" Table Model Television Receiver.

TUBE COMPLEMENT

V21	6X8	Oscillator-Mixer
V20	6AK5	RF Amplifier
V1	6AU6	Limiter
V2	6AL5	Ratio Detector
V3	6AV6	1st Audio Amplifier
V4	6V6GT	Audio Output
V5	6CB6	1st Pix IF Amplifier
V6	6CB6	2nd Pix IF Amplifier
V7	6CB6	3rd Pix IF Amplifier
V8	6BA6	4th Pix IF Amplifier
V9A	12AU7	2nd Detector and A.G.C.
V9B		1st Sound IF Amplifier
V23	6AF4	UHF Oscillator
V10	6AC7	Video Amplifier
V11	12AU7	Sync Amplifier & Sync Separator
V12A	6SN7GT	Sync Splitter
V12B		Vertical Oscillator
V13	6S4	Vertical Output
V14	6AL5	Horizontal Discriminator
V15	6SN7GT	Horizontal Oscillator
V16	6BQ6GT	Horizontal Output
V17	1B3GT	Hi-Volt Rectifier
V18	6W4GT	Damper
V19	5U4G	Power Rectifier
V22	17LP4	Picture Tube
V24	6BQ7 or 6BZ7	UHF IF Amplifier

SPECIFICATIONS

Power Supply Rating	105-120 Volt, 270 Watts, 60 Cycle AC
Audio Power Rating	3.2 Watts
Antenna Input Impedance	300 Ohms.
Video Response	4 M.C.
Focus	Electrostatic
Sweep Deflection	Magnetic
Picture Carrier	45.75 M.C.
Sound Carrier	41.25 M.C.
Adjacent Channel Sound Traps	47.25 M.C.
Adjacent Channel Picture Traps	39.75 M.C.
Accompanying Sound Trap Shelf	41.6 M.C.
Rejection Trap	4.5 M.C.

PRODUCTION CHANGES IN CHASSIS 132.045

(NOTE: SEE PARTS LIST FOR PART NUMBER AND DESCRIPTION OF PARTS DELETED & ADDED.)

I. Chassis TE 132.045-1 differs from 132.045 as follows:

1. VHF tuner changed from pentode to cascode circuit.
2. Horizontal and vertical hold controls and circuits changed to provide a wider operating range.
3. A dissapation change made in low voltage power supply to limit peak current in 5U4 tube.

II. Chassis 132.045-2 differs from 132.045-1 as follows:

1. Combination tuner connection changed to minimize regeneration.
2. New design volume and channel selector knobs.
3. C28 changed on VHF tuner to decrease Band width.

III. Chassis 132.045-3 differs from 132.045-2 as follows:

1. L110 and L112 peaking coils revisedto reduce smear and ringing.
2. 6C4 tube (V25) and associated circuit added to improve vertical noise immunity.

IV. Chassis 132.045-4 differsfrom 132.045-3 as follows:

1. B plus voltage to VHF tuner is changed from 100 volts to 135 volts to improve sensitivity.
2. Band elimination filter redesigned to improve sensitivity.

PARTS LIST CHANGE CHASSIS 132.045-1

PARTS DELETED

	N25267-5	Combination Tuner		
	N25236-1	VHF Tuner		
R204-1		Resistor, 300 ohm.		
R176		Resistor 10K.		
C165		Capacitor, .033 mfd.		
R213		Resistor 15K		
R214		Resistor 2200 ohm.		

PARTS ADDED

	N25267-7	Combination Tuner	$65.00	B5
	N40547-1	VHF Tuner (Cascode)	35.00	B5
R204-2		Resistor, 50 ohm, 5W, 10%	.15	
R178-1		Resistor, 12K, 5%, 1/2W	.15	
C165-1		Capacitor, .022 ufd, 20%, 200V	.23	
R213-1		Resistor, 6.8K, 10%, 1/2W	.15	
R214-1		Resistor, 1800 ohms, 10%, 20W	1.08	
R224		Resistor, 100 ohm, 30W	1.08	
C189		Capacitor, .22 ufd, 20%, 400V	.43	
R101		Resistor, 470 ohm, 10%, 1W	.15	

PARTS LIST CHANGE CHASSIS 132.045-2

PARTS DELETED

	N40543-1	Knob, Channel Indicator	3.40	A5
	N40543-1	Knob, Volume	1.30	

PARTS ADDED

C195, C196, C197		Capacitor, 1000 uuf, 500V	.23	
	N40711-1	Knob, Channel Indicator	3.40	A5
	N40712-1	Knob, Volume	1.30	

PARTS LIST CHANGE CHASSIS 132.045-3

PARTS DELETED

L110	N25468-8	Peaking coil	
L112	N25468-1	Peaking coil	
R157		Resistor, 2.2 meg.	

PARTS ADDED

L110	N25468-17	Peaking coil	.66
L112	N25468-16	Peaking coil	.66
V25		6C4 tube	
R222		Resistor, 560 K, 10%, 1/2W	.15
R221		Resistor, 68K, 5%, 1W	.15
C196		Capacitor, .22uf, 200V	.37
C194, C195		Capacitor, 1000 uuf, 500V	.23
C197		Capacitor, .47 uf, 200V	.51
R157-1		Resistor, 4.7 meg, 10%, 1/2W	.15

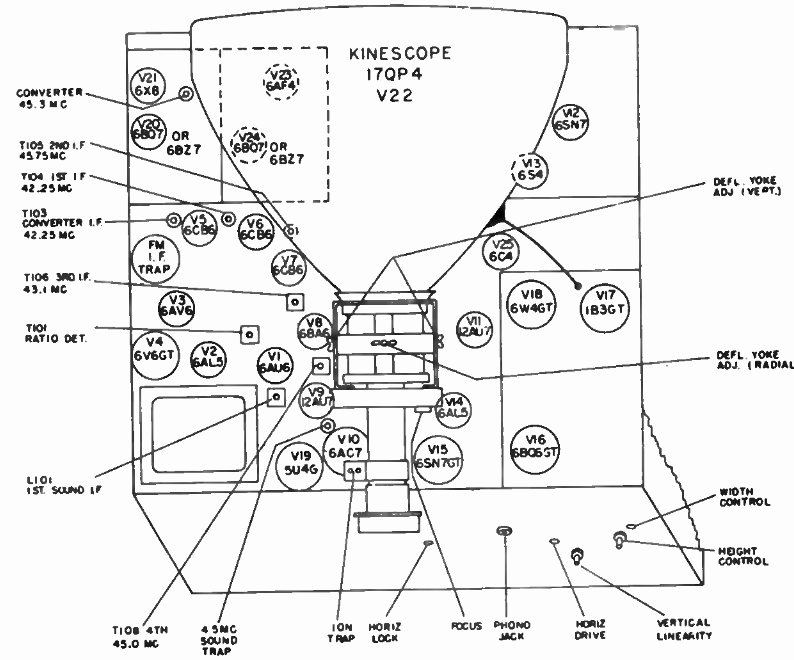
PARTS LIST CHANGE CHASSIS 132.045-4

PARTS DELETED

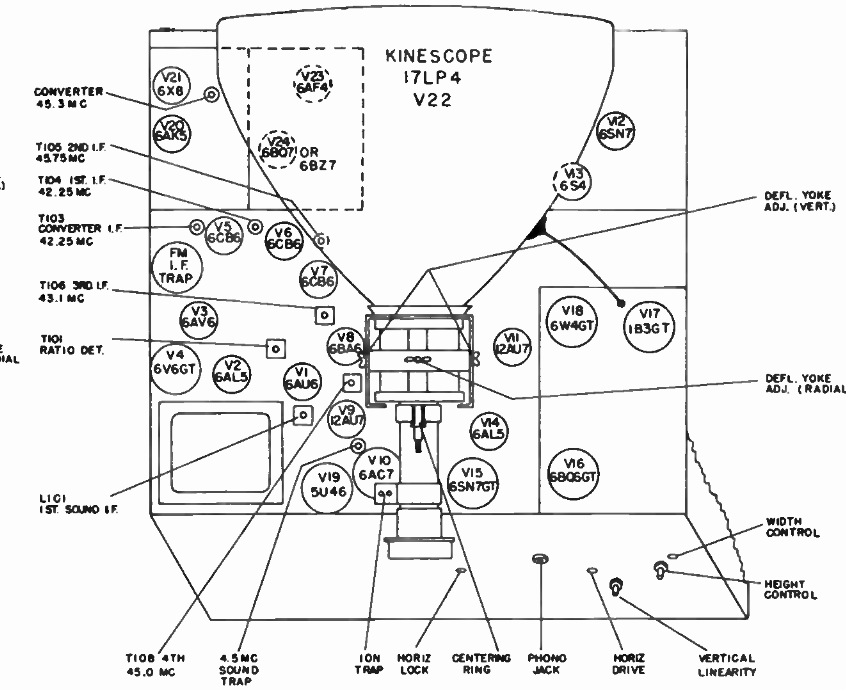
	N40364	Band Elimination Filter	

PARTS ADDED

R228		Resistor 10K, 2W, 10%	.15	
C202		Capacitor, 4700 uuf	.23	
	N40917	IF-FM Trap	3.50	AA0



TOP VIEW — CHASSIS 132.045 -4



TOP VIEW — CHASSIS 132.045

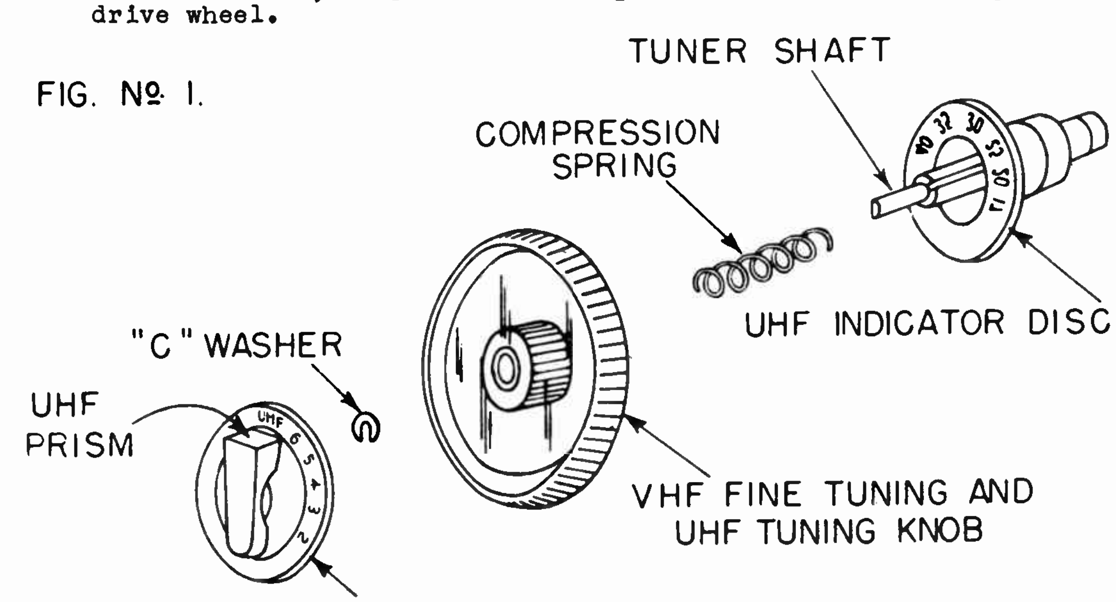
THE ALL CHANNEL VHF-UHF COMBINATION

TUNER SYSTEM

The combination tuner employs individual UHF and VHF tuners mechanically ganged together to be operated by one set of control knobs. UHF tuning is accomplished by a two-speed pulley system. The prism (UHF position) indicates the UHF channels which are tuned by the VHF Fine Tuning knob. Rapid UHF tuning is achieved by pressing in the VHF Fine Tuning knob to engage a direct-drive mechanism. When this Fine Tuning knob is released, the UHF tuning ratio is approximately 12 to 1.

If the tuning knobs need to be pulled off, the Channel Selector knob must be removed first and the "C" washer must be taken out before the Fine Tuning knob can be removed (See Figure No. 1). The UHF indicator disc is held on by a compression spring and is not keyed to the shaft. Install the "C" washer in place before attempting to remove the UHF indicator disc, to prevent breakage of the VHF Fine Tuning drive wheel.

FIG. Nº. 1.



SUBJECT: Addition of suffix -5, to Chassis No. 132.045. Catalog No. 3106 & 3146 This supplement covers parts changes and the UHF schematic diagram. For all other service information or repair parts refer to 57 RL 667 dated May, 1953

PARTS LIST CHANGE IN CHASSIS 132.045-5

PARTS DELETED

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SELLING PRICE	M.U. CODE
	N25267-7	Combination Tuner	65.00	B5

PARTS ADDED

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	SELLING PRICE	M.U. CODE
	N25267-11	Combination Tuner	65.00	B5

NOTE: Pre-selector circuit of the UHF tuner was revised to improve the noise figure.

I. VHF OPERATION

A. GENERAL

The VHF tuner is a conventional 12-position switch type where the Fine Tuning is accomplished with a variable capacitor in the R.F. oscillator tuning circuit. This variable capacitor is mechanically connected to the Fine Tuning shaft.

There is an additional position on the VHF tuner (between Channels 6 and 7) which is used during UHF operation. Filament voltage is applied to the UHF tuner tubes during VHF operation; however, the B plus voltage is applied to the UHF tuner only during UHF operation.

B. ADJUSTMENT

The frequency of the VHF R.F. oscillator may be adjusted as follows: A High-Channels adjustment (A3), and a Low-Channels adjustment (A4), of the R.F. oscillator is accessible when the channel tuning knobs are removed. (See Figure 2).

1. High-Channels.

   a. Set the Channel Selector Switch to the highest available station between channels 7 and 13.

   b. Adjust (A3) so that the picture will just disappear at one point when turning the Fine-Tuning control clockwise.

   c. The remaining lower "High-Channels" should be within the range of the Fine-Tuning.

2. Low Channels

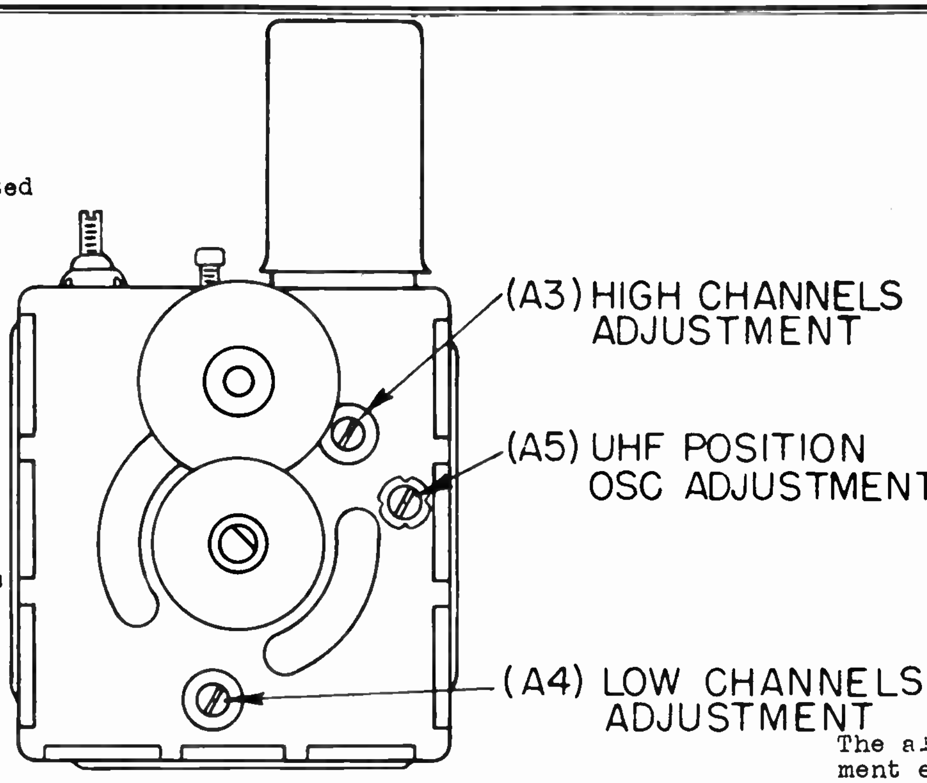
   a. Set the Channel Selector Switch to the highest available station between channels 2 and 6.

   b. Adjust (A4) so that the picture will just disappear at one point when turning the Fine-Tuning control clockwise.

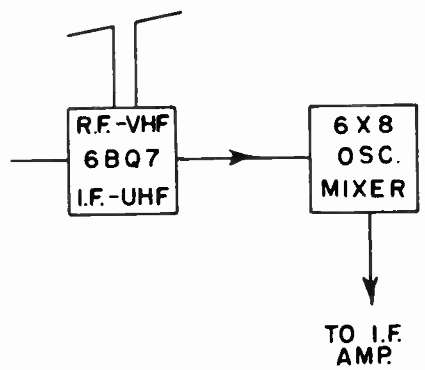
   c. The remaining lower "Low-Channels" should be within the range of the Fine-Tuning.

NOTE: - The design purpose of A3 and A4 is for adjustment for channel 13 and channel 6 --- for High and Low channels coverage. The above procedure gives optimum adjustment for any available stations.

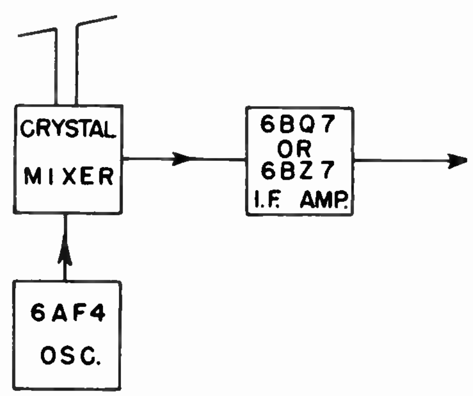
The UHF position oscillator trimmer (C20 - A5) (See Figures 2 and 4) should not be adjusted unless some type of interference is present at the 127 megacycle (1st I.F.) frequency. This adjustment (C20 - A5) corresponds to the adjustments A3 and A4 for the VHF ranges.



VHF SECTION



UHF SECTION



II. UHF OPERATION

A. GENERAL

A double conversion superheterodyne system is employed when the receiver is operating in a UHF position. The UHF tuner consists of a three-element concentric line tuning element which is used as two preselector circuits and a UHF oscillator tuning circuit. A crystal diode serves as a mixer and from it a 127 megacycle signal is applied to the UHF I.F. amplifier. The R.F. tube in the VHF tuner is used as an extra 127 megacycle I.F. amplifier for UHF operation. The oscillator mixer tube in the VHF tuner converts this 127 megacycle signal to the 41 megacycle I.F. frequency of the television chassis. See Block diagram (Figure No. 3). As the channel selector knob is turned to UHF, the following connections are made:

1. The B plus voltage is applied to the UHF tuner unit.
2. The UHF output circuit is applied to the matching transformer which is switched into the input circuit of the VHF tuner.
3. The conventional VHF tuner input circuit is isolated and grounded by this switching operation.

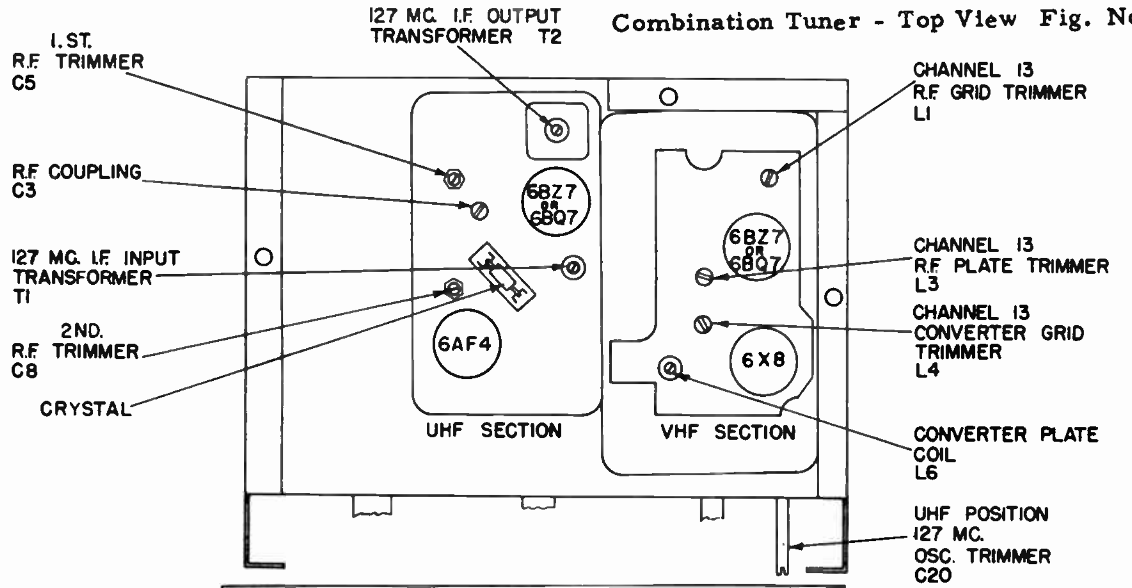
B. ADJUSTMENT

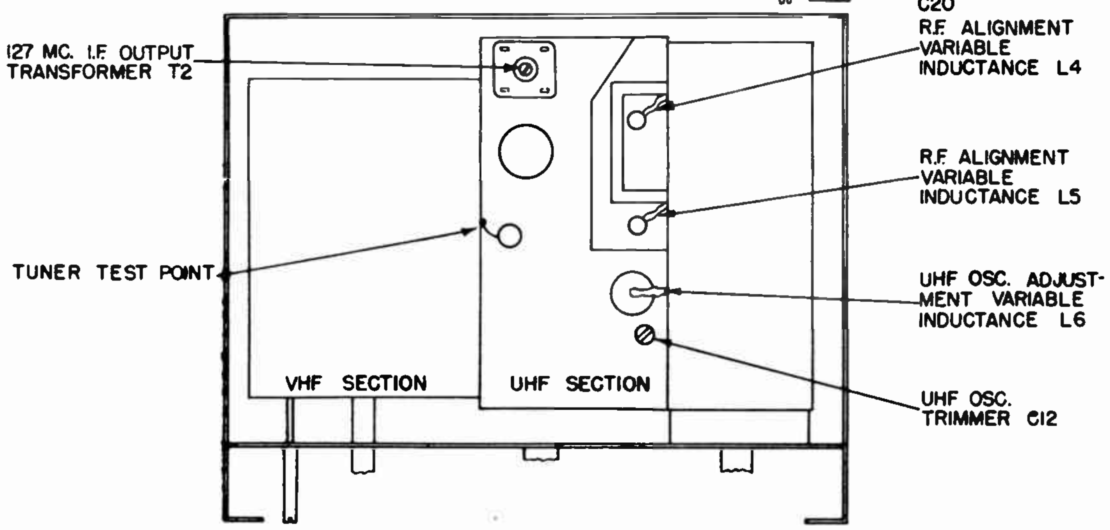
The alignment of a UHF tuner is quite similar to the alignment encountered in a VHF tuner. The most noticeable difference is the frequencies covered. The most important problem when using these high frequencies is that of obtaining a suitable test signal. If suitable UHF test equipment is not available, it is suggested that harmonics from a VHF signal generator be used to obtain these signals. It is well to bring out at this point that the harmonics will be so small in magnitude that it will probably be necessary to use the entire television chassis in order to get enough amplification to see the response curve on an oscilloscope. When using the television chassis to obtain a complete response curve, it would be well to mark the VHF only response curve on the face of the oscilloscope tube before attempting UHF alignment. The VHF adjustments should not be changed after UHF alignment is undertaken as it would be possible to misalign the VHF circuits making complete realignment necessary. It is well to point out that each UHF tuner has been carefully tracked over the entire UHF range and that major realignment should not be necessary. In general the two tubes or the crystal detector can be replaced with little or no change noticed in the alignment of the tuner. Note: For best overall performance (tracking) replace crystal with same type; i.e., 1N72, 1N82, 1N110.

CAUTION: - In attempting to service a tuner, (UHF or VHF) do not move or rearrange any of the components as this would easily change the distributed capacity enough to cause serious misalignment. If it is necessary to replace a component, make sure that the exact lead length and physical characteristics are obtained with the new component. The following checks can be made:

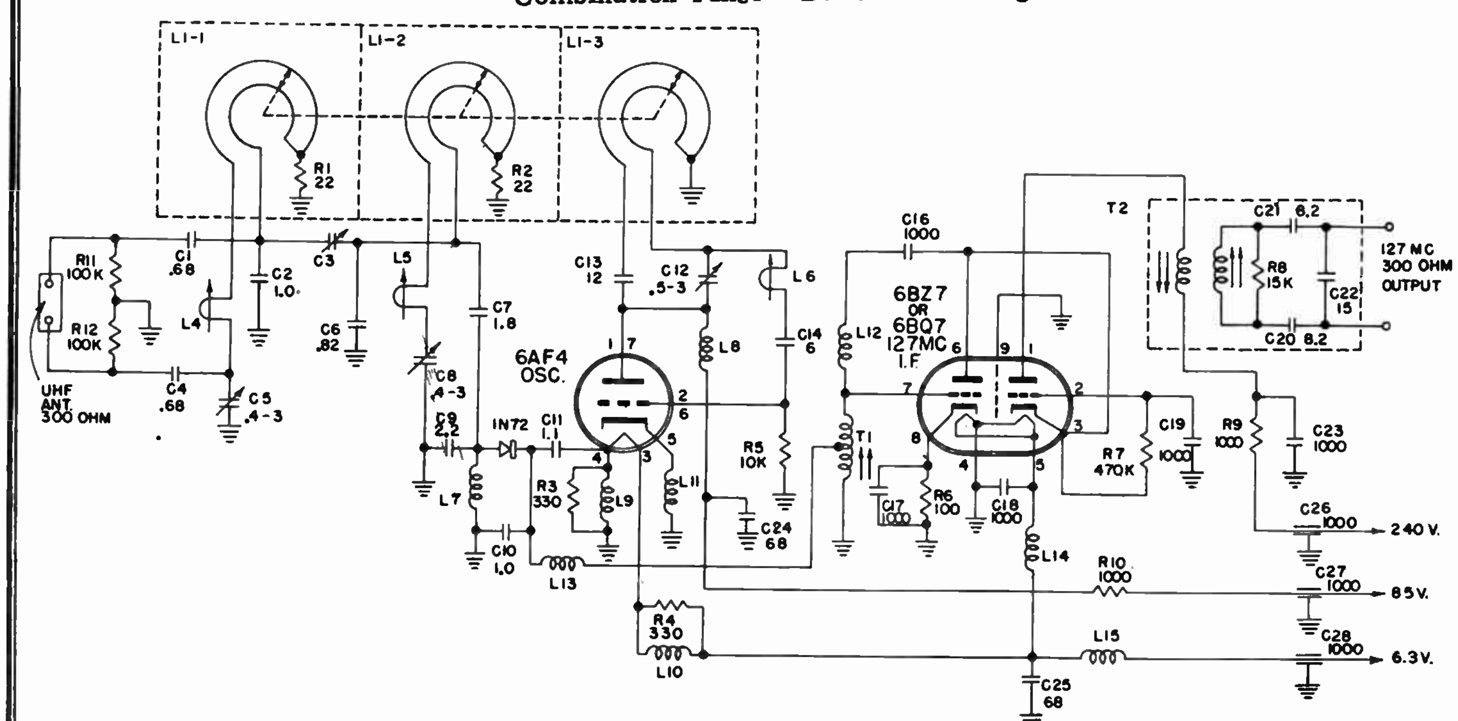
1. Oscillator section and crystal detection --- the grounding wire from the tuner test point (See Figure No. 5) can be unsoldered and a 0 to 5 milliampere meter inserted from this tuner test point to the chassis. A .001 capacitor should be connected from the tuner test point to chassis to keep R.F. from the meter leads. With the meter in this position, a reading from 0.5 to 2.5 millamperes should be indicated over the tuning range. (Indicates diode current resulting from oscillator injection.) If no reading or incorrect reading is indicated, replace either oscillator tube or crystal detector. If trouble is still evident, replace both items. (Note: Be sure to resolder grounding wire from tuner test point to chassis.)

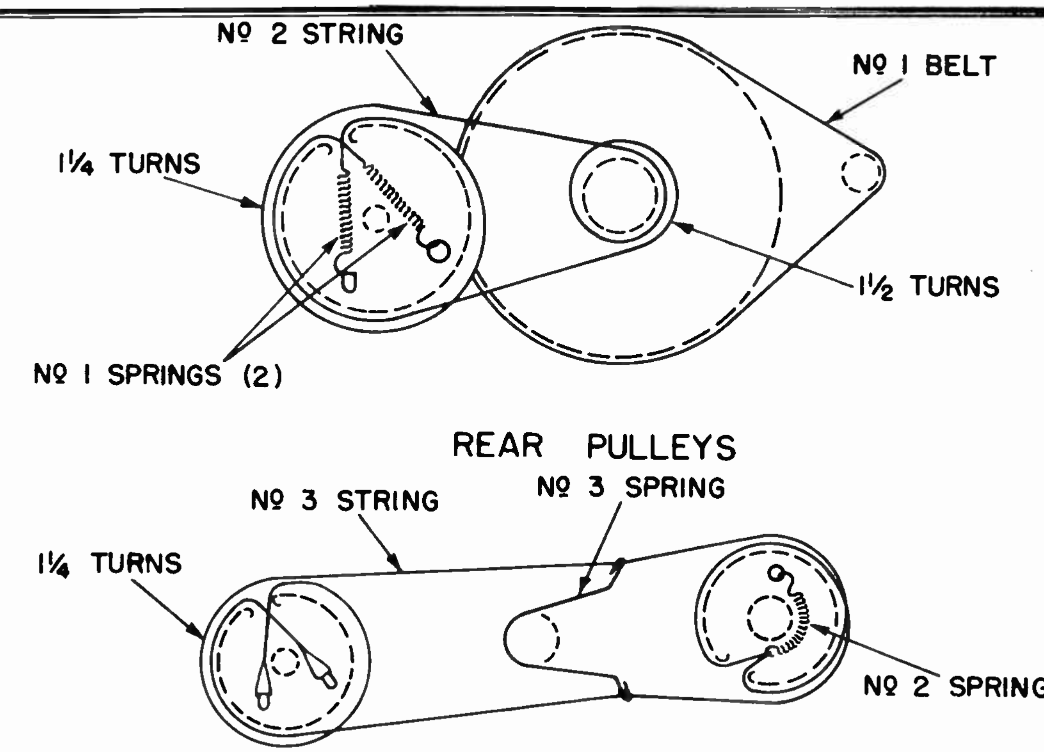
Combination Tuner - Top View Fig. No. 4





Combination Tuner - Bottom View Fig. No. 5





REAR PULLEYS

FRONT PULLEYS

Combination Tuner - Stringing Diagram Fig No. 6

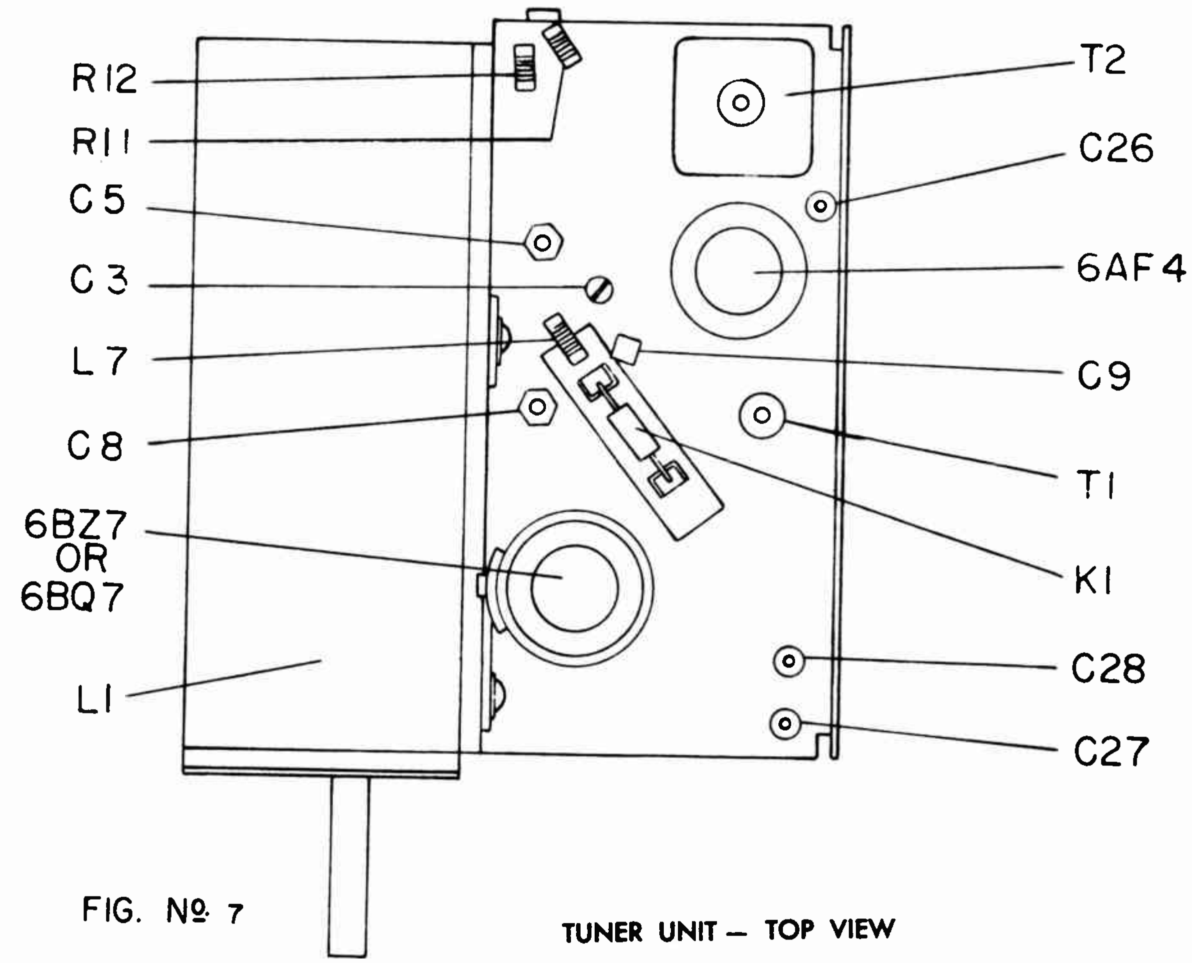


FIG. NO 7

TUNER UNIT — TOP VIEW

TUNER UNIT - BOTTOM VIEW

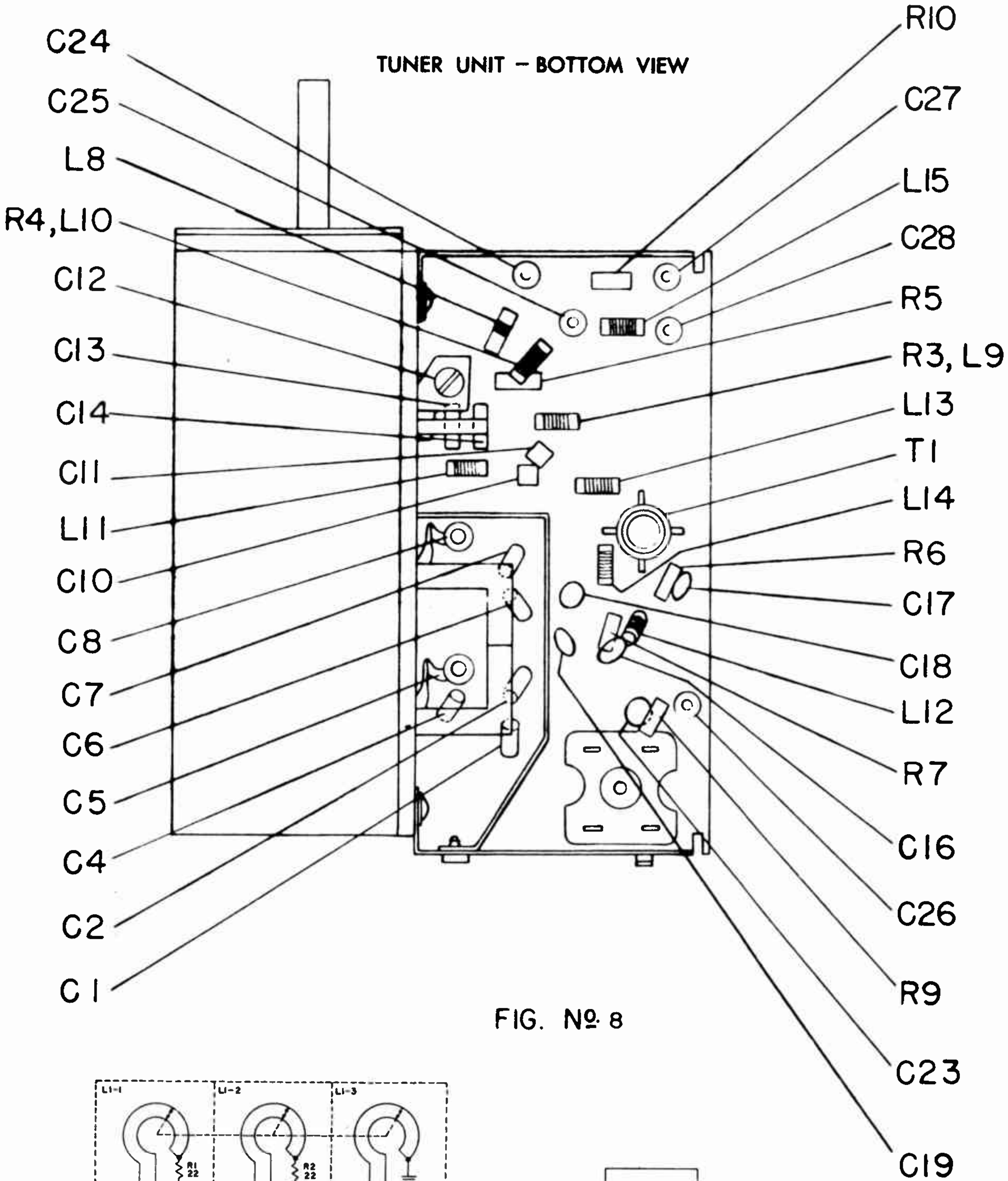
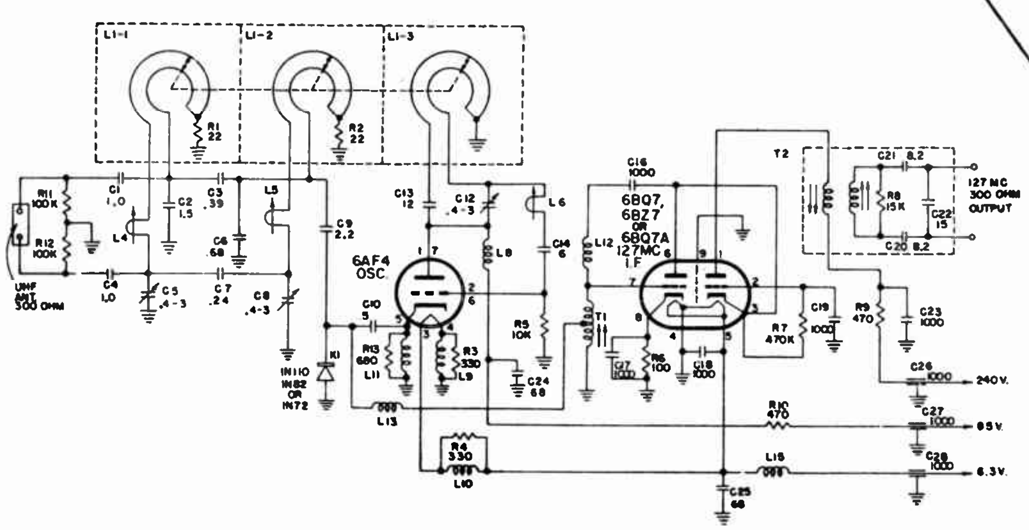


FIG. No. 8



TUNER UNIT — UHF

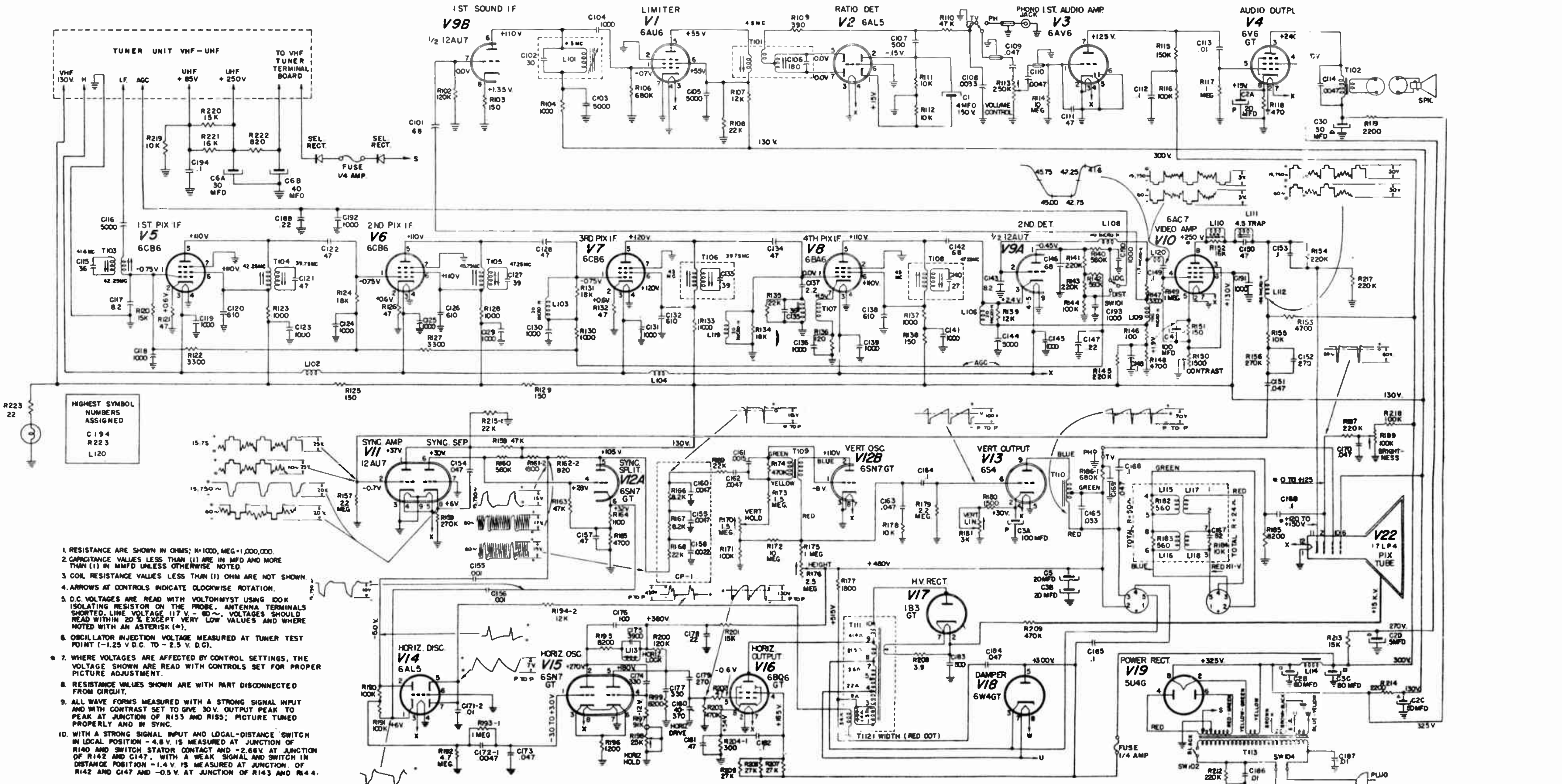
COMBINATION TUNER PARTS LIST (ELECTRICAL)

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	PRICE	MU CODE
		CAPACITORS		
C7	N25675-8	Capacitor 1.8uuf, 10%	.15	
C16, C17, C18, C19, C23	N23078	Capacitor, Disc. 100uuf	.20	
C24, C25	N25675-7	Capacitor, Gimmick 68uuf, 20%	.20	
C2, C10	N25675-2	Capacitor, Gimmick 1uuf, 10%	.20	
C1, C4	N25675-1	Capacitor, Gimmick 0.68uuf, 10%	.20	
C11	N25675-9	Capacitor, Gimmick 1.1uuf, 10%	.20	
C9	N25675-4	Capacitor, Gimmick 2.2uuf, 10%	.20	
C6	N25675-6	Capacitor, Gimmick 0.82uuf, 10%	.20	
C26, C27, C28	N25671	Capacitor, Feed-Thru Ceramic 1000uuf	.25	
C13	N25678-1	Capacitor, Feed-Thru Ceramic 12uuf, 5%	.85	
C14	N25718-1	Capacitor, Feed-Thru Ceramic 6uuf, 5%	.85	
C12	N25690-1	Capacitor, Trimmer Assy., Osc.	.75	
C5, C8	N25719-1	Capacitor, Trimmer, Ceramic 0.4-3.0uuf	.60	
		CHOKES AND COILS		
L14, L15	N25249-1	Choke, R. F. (White Dot)	.45	
L8, L11	N25249-2	Choke, R. F. (Red Dot)	.45	
L9, L10	N25672	Choke, Filament	.48	
L12	N25249-4	Choke, Neutralizing (Yellow Dot)	.45	
L7, L13	N25249-3	Choke, Crystal Return (Orange Dot)	.45	
T1	N25669	Coil, I. F. Input	.75	
T2	N25670	Coil, I. F. Output	2.40	
		MISCELLANEOUS		
K1	N25209	Crystal Diode	3.30	A5
	N25920	Crystal Diode Socket	.35	
		Tuner Unit VHF (see parts list)		
		RESISTORS		
R6	N22381-101	Resistor 100ohm, 10% 1/2 W	.15	
R9, R10	N22381-102	Resistor 1000ohm, 10% 1/2 W	.15	
R5	N22381-103	Resistor 10K, 10%, 1/2 W	.15	
R11, R12	N20061-104	Resistor 100K, 20% 1/2 W	.15	
R7	N22381-474	Resistor 47K, 10% 1/2 W	.15	

COMBINATION TUNER PARTS LIST (MECHANICAL)

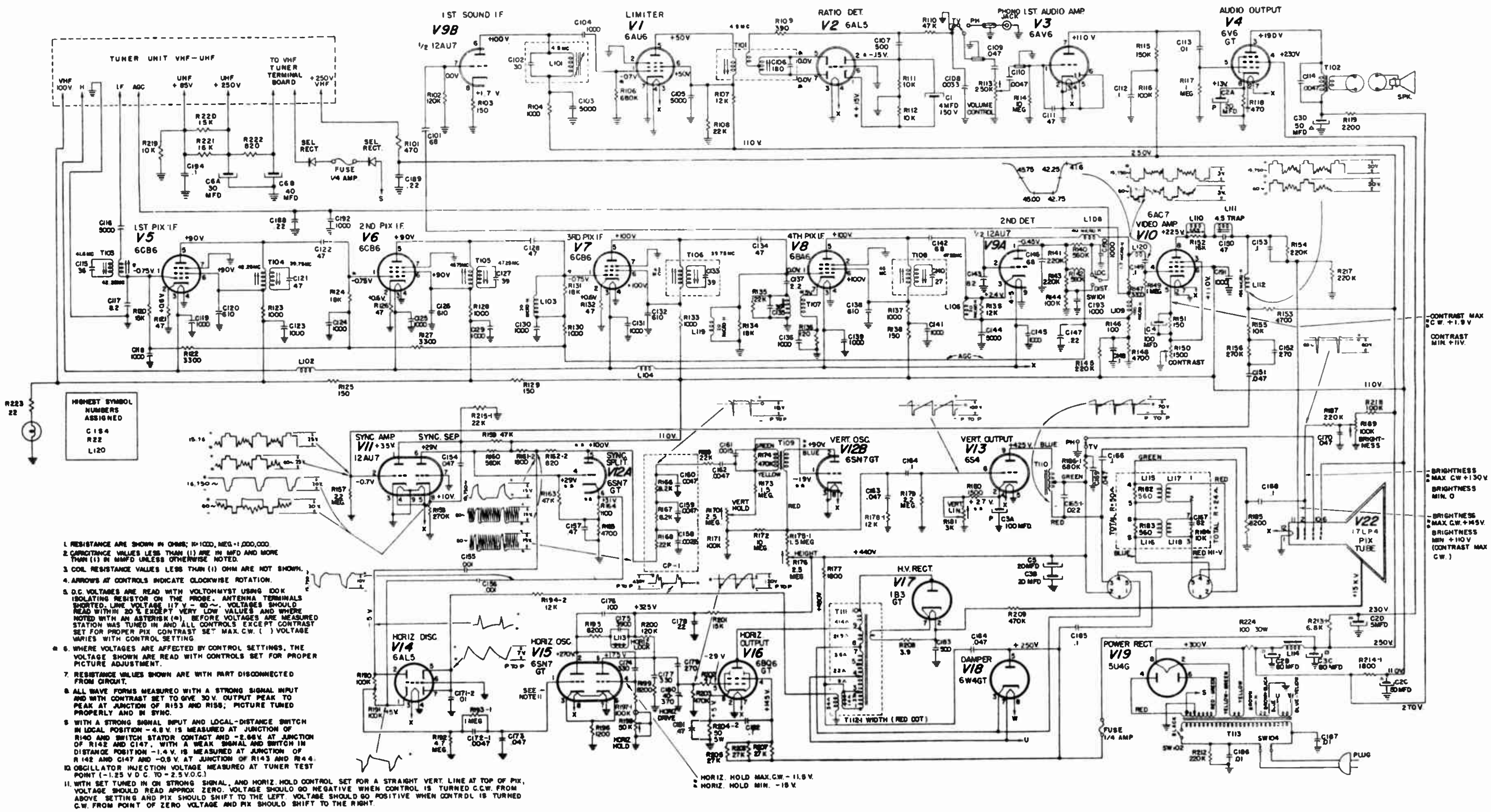
Schematic Location	Part No.	Description	Price List	MU Code
	N25501-1	Center Pully Assy.	.35	
	N20403	"C" Washer	.15	
	N20404	Drive Cord (#2)	.15	
	N20445	Drive Cord (#3)	.15	
	N25026	Dial Belt (#1)	.85	
	N25021	Idler Pulley Spring	.15	
	N25275-1	Pully Assy. & Vernier Shaft	.20	
	N20409-1	Ring "E" Retainer	.15	
	N25248	Screw, Nylon	.15	
	N25223	Spring Compression	.15	
	N25313-4	Spring, Tension (#2)	.15	
	N25313-1	Spring, Tension (#1)	.15	
	N25219	Spring, Torison (#3)	.15	
	N25134	Torque, Bearing	.15	
	N25274-1	VHF Pulley Assy.	.75	

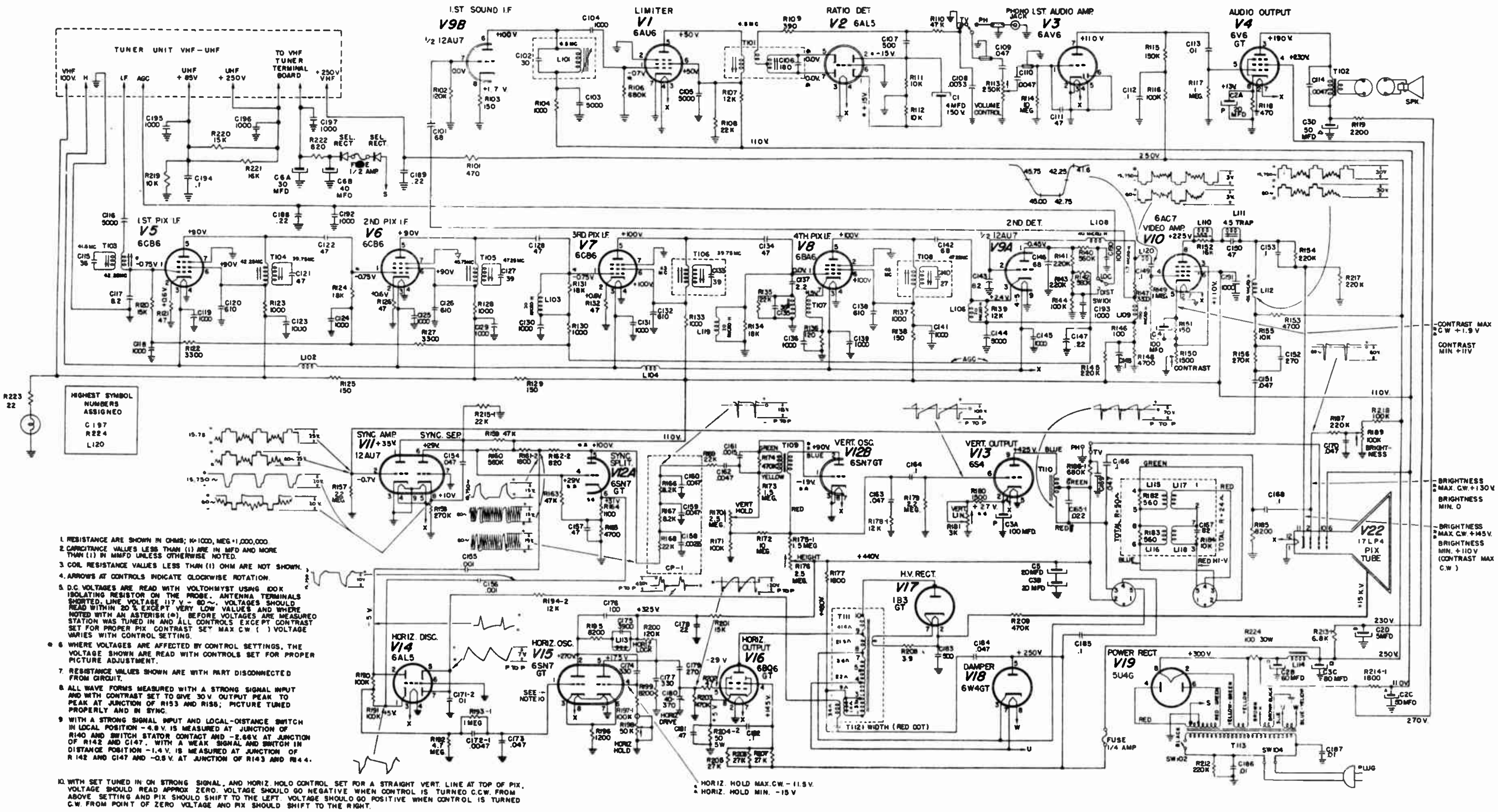
SCHEMATIC DIAGRAM 132.045



1. RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000.
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED.
3. COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5. D.C. VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V. - 60~. VOLTAGES SHOULD READ WITHIN 20% EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*).
6. OSCILLATOR INJECTION VOLTAGE MEASURED AT TUNER TEST POINT (-1.25 V D.C. TO - 2.5 V. D.C).
* 7. WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGE SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT.
8. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
9. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V. OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.
10. WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND -0.5 V. AT JUNCTION OF R143 AND R144.

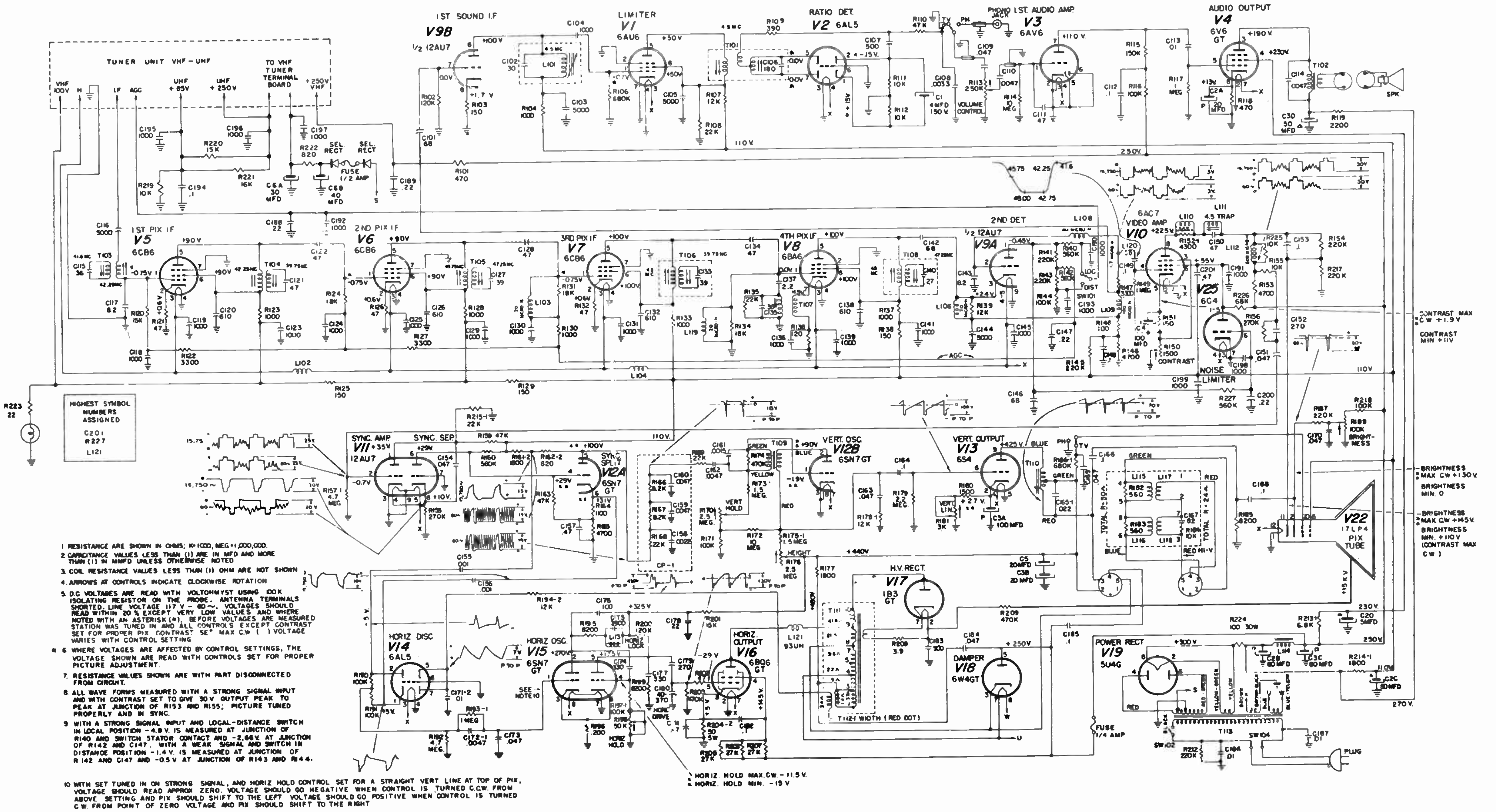
SCHEMATIC DIAGRAM 132.045- 1





1. RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000.
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED.
3. COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5. D.C. VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V - 60 ~. VOLTAGES SHOULD READ WITHIN 20 % EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*). BEFORE VOLTAGES ARE MEASURED STATION WAS TUNED IN AND ALL CONTROLS EXCEPT CONTRAST SET FOR PROPER PIX CONTRAST SET MAX C.W. ( ) VOLTAGE VARIES WITH CONTROL SETTING.
6. * WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGE SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT.
7. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
8. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V. OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.
9. WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66 V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND -0.8 V. AT JUNCTION OF R143 AND R144.
10. WITH SET TUNED IN ON STRONG SIGNAL, AND HORIZ. HOLD CONTROL SET FOR A STRAIGHT VERT. LINE AT TOP OF PIX, VOLTAGE SHOULD READ APPROX ZERO. VOLTAGE SHOULD GO NEGATIVE WHEN CONTROL IS TURNED C.C.W. FROM ABOVE SETTING AND PIX SHOULD SHIFT TO THE LEFT. VOLTAGE SHOULD GO POSITIVE WHEN CONTROL IS TURNED C.W. FROM POINT OF ZERO VOLTAGE AND PIX SHOULD SHIFT TO THE RIGHT.

SCHEMATIC DIAGRAM 132.045 - 2



1 RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000.

2 CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED

3 COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN

4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION

5 D.C VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V - 60 ~. VOLTAGES SHOULD READ WITHIN 20 % EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*). BEFORE VOLTAGES ARE MEASURED STATION WAS TUNED IN AND ALL CONTROLS EXCEPT CONTRAST SET FOR PROPER PIX CONTRAST SET MAX C.W ( ) VOLTAGE VARIES WITH CONTROL SETTING

* 6 WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGE SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT.

7. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.

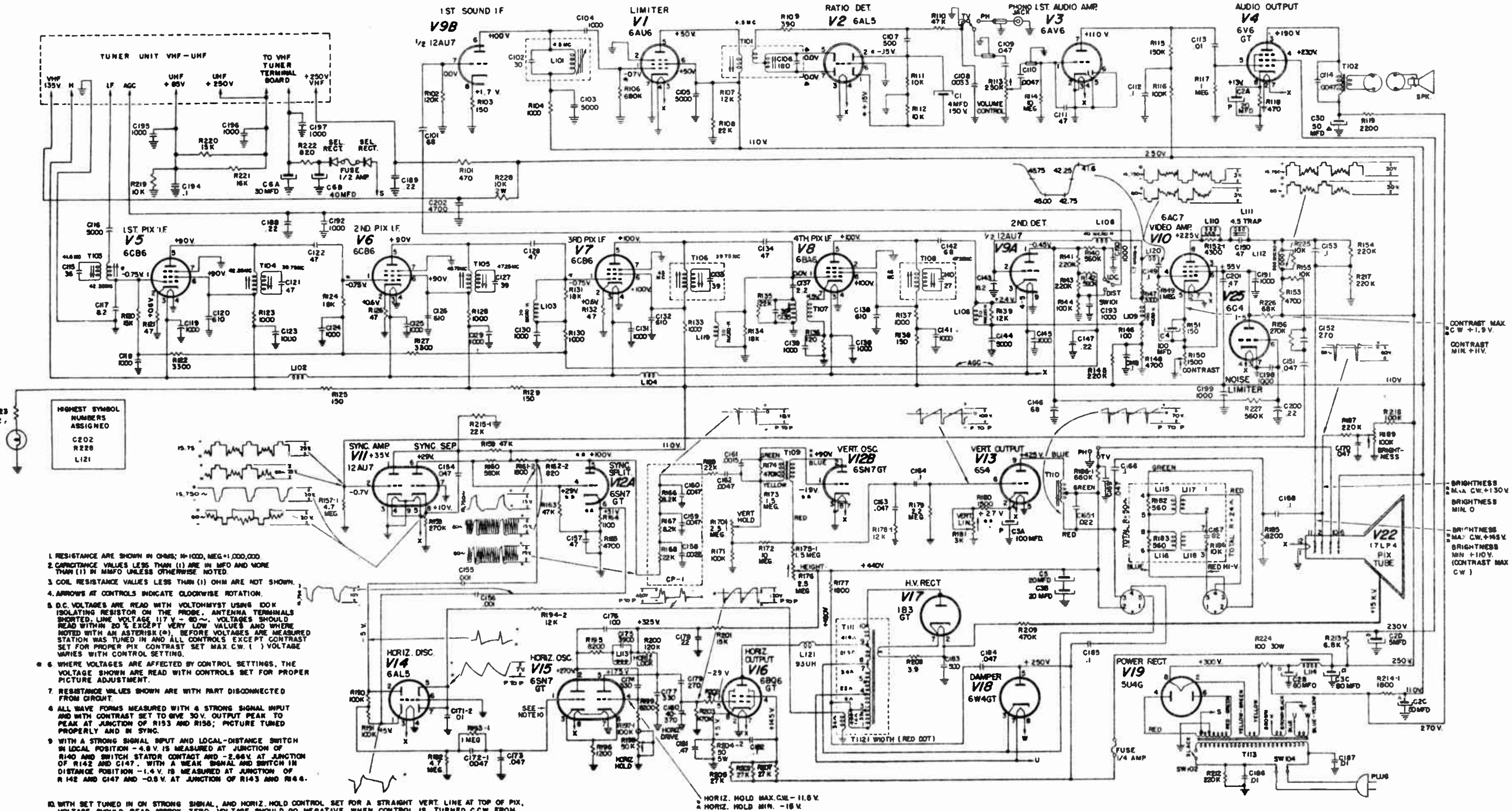
8. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.

9 WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R 142 AND C147 AND -0.5 V AT JUNCTION OF R143 AND R144.

10 WITH SET TUNED IN ON STRONG SIGNAL, AND HORIZ HOLD CONTROL SET FOR A STRAIGHT VERT LINE AT TOP OF PIX, VOLTAGE SHOULD READ APPROX ZERO. VOLTAGE SHOULD GO NEGATIVE WHEN CONTROL IS TURNED C.C.W. FROM ABOVE SETTING AND PIX SHOULD SHIFT TO THE LEFT. VOLTAGE SHOULD GO POSITIVE WHEN CONTROL IS TURNED C.W. FROM POINT OF ZERO VOLTAGE AND PIX SHOULD SHIFT TO THE RIGHT

SCHEMATIC DIAGRAM 132.045 - 3

SCHEMATIC DIAGRAM 132.045-4



1. RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED.
3. COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5. D.C. VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V - 60~. VOLTAGES SHOULD READ WITHIN 20 % EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*). BEFORE VOLTAGES ARE MEASURED STATION WAS TUNED IN AND ALL CONTROLS EXCEPT CONTRAST SET FOR PROPER PIX CONTRAST SET MAX C.W. ( ) VOLTAGE VARIES WITH CONTROL SETTING.

* 6. WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGE SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT.

7. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
8. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V. OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R156; PICTURE TUNED PROPERLY AND IN SYNC.
9. WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND -0.8 V. AT JUNCTION OF R143 AND R144.
10. WITH SET TUNED IN ON STRONG SIGNAL, AND HORIZ. HOLD CONTROL SET FOR A STRAIGHT VERT. LINE AT TOP OF PIX, VOLTAGE SHOULD READ APPROX ZERO. VOLTAGE SHOULD GO NEGATIVE WHEN CONTROL IS TURNED C.C.W. FROM ABOVE SETTING AND PIX SHOULD SHIFT TO THE LEFT. VOLTAGE SHOULD GO POSITIVE WHEN CONTROL IS TURNED C.W. FROM POINT OF ZERO VOLTAGE AND PIX SHOULD SHIFT TO THE RIGHT.

HOW TO ORDER PARTS

1. Use correct form.
2. On the Purchase Order always give the following information:
   (1) PART NUMBER (number printed on the part if different from that shown in this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).
   (2) The CHASSIS NUMBER, which is 132.045. See "DIV. 57 STANDARD NOMENCLATURE INDEX" for source, name and address.
3. ORDERING INSTRUCTIONS:
   Send Purchase Orders DIRECT to SOURCE No. 132. See "DIV. 57 STANDARD NOMENCLATURE INDEX" for source, name and address.
4. MARK-UP: Selling prices in the following list produce a MARK-UP of AA5, unless otherwise noted in the M.U. Code Column.
5. In all correspondence relating to cabinets, always mention the source code letter stamped in the upper rear rail of consoles or on sticker on the back, bottom or inside of cabinet.

Schematic Location	Part No.	Description	Price List	MU Code
	N25520	Antenna Term. Board	.15	
	N40364	Band Elimination Trap	3.10	AAO
	N25626	Beam Centering Control	1.25	
C130	N24528	Capacitor, 370 uuf, Trimmer	.43	
C137		Capacitor, 2.2 uuf, 0.5 uuf, 500V Ceramic	.34	
C117, C134		Capacitor, 8.2 uuf, 10%, Ceramic	.26	
C122, C128, C134		Capacitor, 47 uuf, 10%, Ceramic	.31	
C142, C146, C101	N25530-13	Capacitor, 68 uuf, 10%, Disc	.23	
C167	N24123-820	Capacitor, 82 uuf, 10%, 1500V	.23	
C183	N24994	Capacitor, 500 uuf, Hi-Volt	2.00	
C104, C118, C119, C123, C124, C125, C129, C130, C131, C136, C139, C141, C145, C190, C191, C192, C193		Capacitor, 1000 uuf, Min 500 D.S. W.V. Disc	.23	
C105, C103, C116, C144		Capacitor, 5000 uuf, Min. 500 D.C.W.B. Disc	.23	
C111		Capacitor, 47 uuf, 20%, 500V Mica	.23	
C176		Capacitor, 100 uuf, 10%, 500V, Mica	.26	
C152, C179		Capacitor, 270 uuf, 10%, 500V, Mica	.26	
C174		Capacitor, 330 uuf, 5%, 500V, Mica	.31	
C177		Capacitor, 330 uuf, 10%, 500V, Mica	.26	
C107		Capacitor, 500 uuf, 10%, 500V, Mica	.26	
C175		Capacitor, 3900 uuf, 5%, Class "B", Mica	1.25	
C155, C156		Capacitor, .001 ufd, 20%, 600V, Molded Paper	.23	
C161		Capacitor, .0015 ufd, 20%, 600V, Molded Paper	.23	
C108		Capacitor, .0033 ufd, 20%, 600V, Paper Tubular	.23	
C110, C114		Capacitor, .0047 ufd, 20%, 600V, Molded Paper	.23	
C162		Capacitor, .0047 ufd, 5%, 600V, Molded Paper Min. Oil. Imp.	.46	
C172-1		Capacitor, .0047 ufd, 20%, 200V, Paper Tubular	.23	
C113, C171-2		Capacitor, .01 ufd, 20%, 400V, Molded Paper	.23	
C186, C187		Capacitor, .01 ufd, 20%, 600V, Molded Paper	.31	
C165		Capacitor, .033 ufd, 20%, 200V, Paper Tubular	.23	
C163, C169, C184		Capacitor, .047 ufd, 20%, 600V, Molded Paper	.26	
C109		Capacitor, .047 ufd, 20%, 200V, Molded Paper	.23	
C151, C170		Capacitor, .047 ufd, 5%, 400V, Molded Paper	.26	
C166		Capacitor, .1 ufd, 20%, 1000V, Paper Tubular	.34	
C164, C182		Capacitor, .1 ufd, 20%, 600V, Molded Paper	.43	
C148, C149		Capacitor, .1 ufd, 20%, 200V, Molded Paper	.29	
C112, C153, C168, C185		Capacitor, .1 ufd, 20%, 400V, Molded Paper	.31	
C188		Capacitor, .22 ufd, 20%, 200V, Molded Paper	.37	
C178		Capacitor, .22 ufd, 20%, 600V, Paper Tubular	.51	
C157, C181		Capacitor, .47 ufd, 20%, 200V, Molded Paper	.51	
C120, C126, C132, C138		Capacitor, 610 uuf, 10%, 500V, Ceramic	.31	
C194		Capacitor, .1 ufd, 20%, 400V, Molded Paper	.31	
C1	N25453	Capacitor, 4 ufd, 150V, Electrolytic	1.05	
C2	N22422-13	Capacitor, 20 ufd, 25V, Electrolytic 50 ufd, 350V 60 ufd, 400V 5 ufd, 450V	3.45	A5

Schematic Location	Part No.	Description	Price List	MU Code
C3	N22422-14	Capacitor, 100 ufd, 50V, Electrolytic 20 ufd, 450V 80 ufd, 350V 50 ufd, 350V	3.35	A5
C4	N25454	Capacitor, 100 ufd, 25V Electrolytic	1.43	
C5	N25452	Capacitor, 20 ufd, 450V, Electrolytic	1.65	
C6	N22422-15	Capacitor, 40 ufd, 300V, Electrolytic 30 ufd. 300V.	2.55	
L101	N25543	Sound Pick Off	1.50	
L113	N23449	Coil, Horizontal Oscillator	.94	
L111	N25609	Coil, Video Trap	1.14	
L119, L103, L134, L124	N22500-19	Coil, Video Peaking 20 uh on 18K	.66	
L106, R139	N22500-8	Coil, Video Peaking 20 uh on 12K	.66	
L112	N25468-1	Coil, Video Peaking, 185 uh on dummy	.66	
L109	N25468-5	Coil, Video Peaking, 100uh	.66	
L110, R152	N25468-8	Coil, Video Peaking, 250 uh on 16 K	.66	
L108	N25468-6	Coil, Video Peaking, 40 uh	.66	
L120	N25916	Coil, Video Peaking 1.7 uh	.66	
R113, R150, SW102	N22464-27	Control, Vol, Contrast, On-Off	2.56	
R189	N22464-40	Control, Brightness	.74	
R181	N22464-41	Control, Vert. Linearity	.74	
R170, R198	N22464-42	Control, Vert. Hold & Horizontal Hold	1.62	
R176	N22464-43	Control, Height	.74	
CP-1	N24166	Couplate, Vert. Int. Circuit	.85	
	N19351	Dial Light Bulb	.23	
	N25265-1	Dial Light Socket	.26	
	N40210-1	Control Door Assy.	2.50	
	N25537	Glass	4.65	B5
	N24227-4	Rubber Grommet	.06	
	N22493	Fuse 1/4 Amp.	.29	
	N40656	Fuse 1/2 Amp. (Tuner Supply)	.29	
L114	N23087-1	Filter Choke	.20	
L102, L104	N23095	Filament Choke	.17	
N40543-1 use	N40711-1	Knob, Channel Indicator	3.40	A5
N40542-1 use	N40712-1	Knob, Volume	1.30	
	N25735-1	Knob, Contrast	.60	
	N25094-1	Knob, Fine Tuning & UHF	1.30	
	N24699-2	Knob, PH-TV Switch	.17	
	N25095	UHF Indicator, Disc	.65	
SW101	N25525	Local Distance Switch	.23	
	N40079-1	Pin Cushion Magnets, 35 gauss	.85	
	N40412	Plastic Mask	4.60	AO
SW101	N22489	Plug Interlock	.23	
R208		Resistor, 3.9 ohm, 10%, 1/2W, W-W	.15	
R223		Resistor, 22ohm, 10%, 1/2W	.15	
R202		Resistor, 47 ohm, 20%, 1/2W	.15	
R121, R126, R132		Resistor, 47 ohm, 10%, 1/2W	.15	
R204, R204-1		Resistor, 300 ohm, 10%, 5W	.15	
R146		Resistor, 100 ohm, 10%, 1/2W	.15	
R136		Resistor, 120 ohm, 10%, 1/2W	.15	
R103, R125, R129, R138		Resistor, 150 ohm, 20%, 1/2W	.15	
R151		Resistor, 150 ohm, 10%, 1/2W	.15	
R109		Resistor, 390 ohm, 5%, 1/2W	.15	
R118		Resistor, 470 ohm, 10%, 1W	.15	
R182, R183		Resistor, 560 ohm, 10%, 1/2W	.15	
R162-2		Resistor, 820 ohm, 10%, 1/2W	.15	
R122		Resistor, 820 ohm, 10%, 1W	.15	
R123, R128, R130, R133, R137		Resistor, 1000 ohm, 20%, 1/2W	.15	
R104		Resistor, 1000 ohm, 10%, 1/2W	.15	
R164		Resistor, 1100 ohm, 5%, 1/2W	.15	
R196		Resistor, 1200 ohm, 10%, 1/2W	.15	
R180		Resistor, 1500 ohm, 20%, 1/2W	.15	
R161-2		Resistor, 1800 ohm, 10%, 1/2W	.15	
R214		Resistor, 2200 ohm, 10%, 20W	.15	
R177		Resistor, 1800 ohm, 10%, 2W	.15	
R119		Resistor, 2200 ohm, 20%, 2W	.15	
R147		Resistor, 330 ohm, 5%, 1/2W	.15	
R122, R127		Resistor, 330 ohm, 20%, 1/2W	.15	
R148, R165		Resistor, 4700 ohm, 10%, 1/2W	.15	

Schematic Location	Part No.	Description	Price List	MU Code
R153		Resistor, 4700 ohm, 5%, 2W	.15	
R185, R199		Resistor, 8200 ohm, 10%, 1/2W	.15	
R195		Resistor, 8200 ohm, 10%, 1W	.15	
R184		Resistor, 10K, 10%, 1/2W	.15	
R155		Resistor, 10K, 20%, 1/2W	.15	
R219		Resistor, 10K, 5%, 2W	.15	
R111, R112, R178		Resistor, 10K, 5%, 1/2W	.15	
R107		Resistor, 12K, 10%, 1W	.15	
R194-2		Resistor, 12K, 10%, 2W	.15	
R220		Resistor, 15K, 5%, 2W	.15	
R213		Resistor, 15K, 10%, 1/2W	.15	
R201		Resistor, 15K, 10%, 1W	.15	
R221		Resistor, 16K, 5%, 2W	.15	
R124		Resistor, 18K, 5%, 1/2W	.15	
R108		Resistor, 22K, 10%, 1W	.15	
R135, R169		Resistor, 22K, 10%, 1/2W	.15	
R215-1				
R205, R206, R207		Resistor, 27K, 10%, 2W	.15	
R159		Resistor, 47K, 10%, 1W	.15	
R110, R163		Resistor, 47K, 10%, 1/2W	.15	
R144, R171		Resistor, 100K, 10%, 1/2W	.15	
R218, R116				
R190, R151, R197-1		Resistor, 100K, 5%, 1/2W	.15	
R102, R200		Resistor, 120K, 10%, 1/2W	.15	
R115		Resistor, 150K, 10%, 1/2W	.15	
R145, R212		Resistor, 220K, 20%, 1/2W	.15	
R141, R143, R154		Resistor, 220K, 10%, 1/2W	.15	
R187, R217				
R158, R156		Resistor, 270K, 10%, 1/2W	.15	
R209		Resistor, 470K, 20%, 1W	.15	
R174, R203		Resistor, 470K, 10%, 1/2W	.15	
R160, R140, R142		Resistor, 560K, 10%, 1/2W	.15	
R106, R186-1		Resistor, 680K, 20%, 1/2W	.15	
R117, R149		Resistor, 1 meg., 20%, 1/2W	.15	
R193-1				
R173, R175-1		Resistor, 1.5 mg., 5%, 1/2W	.15	
R157, R179		Resistor, 2.2 meg. 10%, 1/2W	.15	
R192		Resistor 4.7 meg., 10%, 1/2W	.15	
R114		Resistor, 10 meg. 20%, 1/2W	.15	
R172		Resistor, 10 meg. 10%. 1W	.15	
	N25697	Selenium Rectifier	2.55	
1B3GT	N25002	Socket & Corona Ring Assy.	.60	
	N24911-6	Kinescope Socket Assy.	.41	
	N25597-1	Speaker 8" P. M. & Plug	5.00	A0
	N25607-1	Speaker 5" P.M. & Plug	3.90	A5
	N23538	Speaker Plug	.17	
	N19579	Speaker, Socket	.11	
T111	N24989	Transformer, Horizontal Output Assy.	6.20	B5
T110	N24990-1	Transformer, Vert. Output Assy.	3.35	A5
T102	N24776-1	Transformer, Audio Output Assy.	2.65	
T113	N25696	Transformer, Power	17.00	B5
T104	N25411	Transformer, Lst Pix. I.F.	1.54	
T105	N25412	Transformer, 2nd pix. I.F.	1.54	
T106	N25413	Transformer, 3rd Pix. I.F.	1.68	
T108	N25474	Transformer, 4th Pix. I. F.	1.68	
T103	N25410	Transformer, Coverter I.F.	1.40	
T109	N22446-1	Transformer, Vert. Osc. Assy.	2.52	AA0
T101	N25322	Transformer, Ratio Detector	2.88	AA0
T107	N25415	Transformer, Cathode Trap	1.31	
	N25662-1	Ion Trap	.77	
	N25963	I.F. & F.M. Trap Assy.*	4.00	A0
	N25267-5	Tuner Assembly Combination	65.00	B5
	N25236-1	Tuner Unit VHF	35.00	B5
	N25471	Tube Top Cap	.06	
T112	N40027	Width Control	1.35	
	N24807	Deflection Yoke	6.75	B5

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST	M. U. CODE
		CAPACITORS		
C1, C4	N25675-2	Capacitor, 1uuf, 10%, Gimmick	.20	
C2	N25675-3	Capacitor, 1.5uuf, 10%, Gimmick	.20	
C3	N25675-11	Capacitor, .39uuf, 5%, Gimmick	.20	
C5	N25719-1	Capacitor, 0.4-3.0uuf, Ceramic	.60	
C6	N25675-1	Capacitor, 0.68uuf, 10%, Gimmick	.20	
C7	N25675-10	Capacitor, .24uuf, 5%, Gimmick	.20	
C8	N25719-2	Capacitor, 0.4-3.0uuf, Ceramic	.60	
C9	N25675-4	Capacitor, 2.2uuf, 10%, Gimmick	.20	
C10	N25675-12	Capacitor, 0.5uuf, 5%, Gimmick	.20	
C12	N25690-1	Capacitor, Osc. Trimmer Assy.	.75	
C13	N25678-1	Capacitor, 12uuf, 5%, N220, Ceramic	.85	
C14	N25718-1	Capacitor, 6uuf, 5%, N220, Ceramic	.85	
C16, C17, C18	N23078	Capacitor, 1000uuf, Ceramic	.20	
C19, C23				
C24, C25	N25675-7	Capacitor, 68uuf, 20%, Gimmick	.20	
C26, C27, C28	N25671	Capacitor, 1000uuf, GMV, Ceramic	.25	
		RESISTORS		
R5	N22381-103	Resistor, 10K, 10%, 1/2W.	.15	
R6	N22381-101	Resistor, 100ohm, 10%, 1/2W.	.15	
R7	N22381-474	Resistor, 470K, 10%, 1/2W	.15	
R9, R10	N22381-471	Resistor, 470ohm, 10%, 1/2W.	.15	
R11, R12	N20061-104	Resistor, 100K, 20%, 1/2W.	.15	
		CHOKES, COILS, & TRANSFORMERS		
L9, L10, R3, R4	N25672	Choke, Filament, .65uh	.48	
L11, R13	N41183	Choke, R.F., .35uh	.48	
L12, L15	N25249-5	Choke, R.F., .65uh	.45	
L13, L8	N25249-2	Choke, R.F., .65uh	.45	
T1	N41182	Coil, I.F. Input	.83	
T2	N25670	Coil, I.F. Output	2.40	
		MISCELLANEOUS		
K1	N41292	Crystal Diode (1N82)	4.85	
K1	N41293 or	Crystal Diode (1N110)	4.85	
	N25920	Crystal Diode Socket	.35	

GENERAL DESCRIPTION

The information contained in this service R.I. covers catalog numbers 3177-A and 3187-A. Both receivers utilize chassis 100.400 and differ only as to cabinet design.

Seventeen tubes are used solely for reproduction of the visual and aural portions of the television broadcast. In addition, a heavy duty transformer and two rectifier tubes provide power for operation of all stages.

Outstanding circuit features of the receivers include a high gain R.F. tuner which is noted for its stability and rugged mechanical construction, an inter-carrier sound system which is free from distortion normally caused by oscillator drift, automatic frequency control of horizontal sync system, automatic gain control, and retrace line suppression.

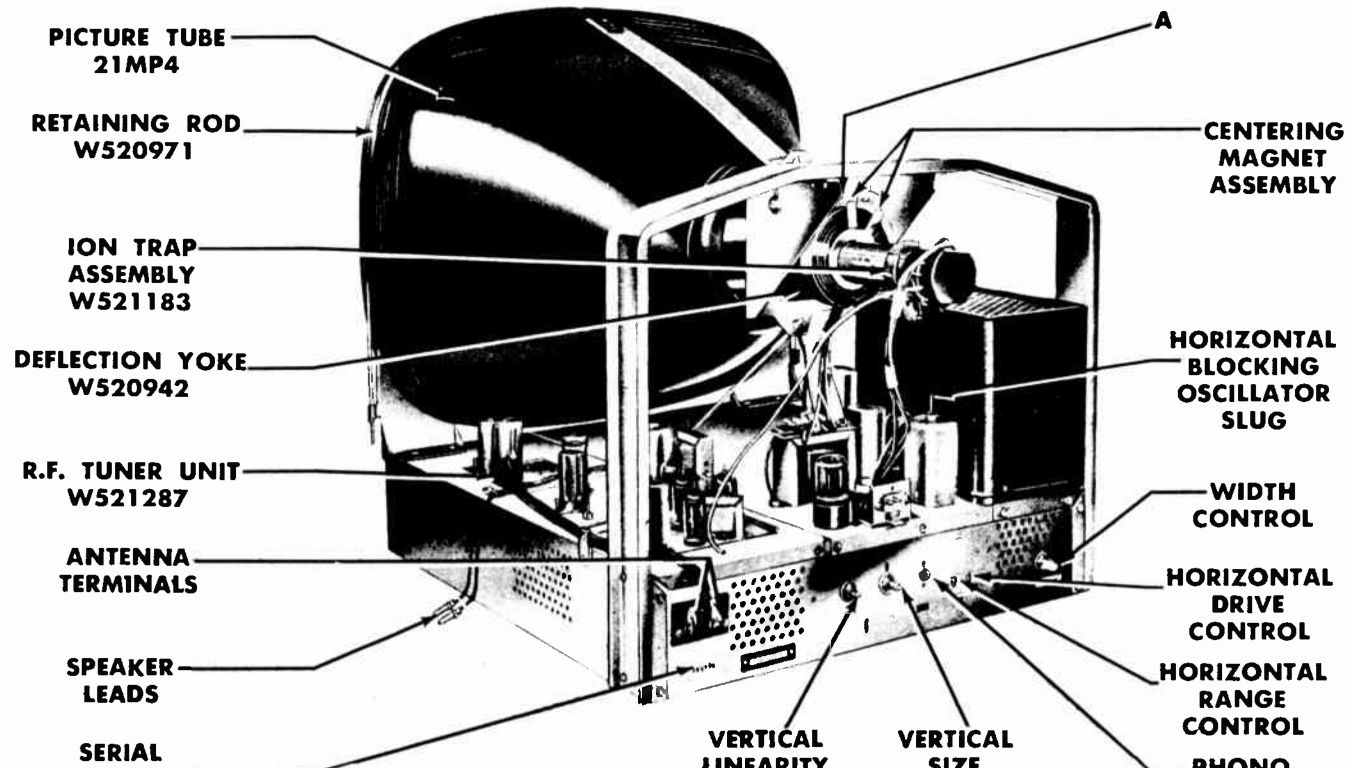
The R.F. tuner is of a turret type construction with individual coils easily replaceable. The circuit uses a cascode R.F. amplifier which provides good gain on both high and low television channels, while keeping inherent tube noise to a minimum.

A three stage I.F. amplifier is used with the first two stages connected as a cascode amplifier. Good overall sensitivity is achieved by a stable R.F. and I.F. amplifier which is controlled by an excellent A.G.C. system and A.G.C. controlled R.F. amplifier, and I.F. system.

These stages are followed by a video amplifier. Also keyed A.G.C. and Gated Sync. Amplifier provides the receiver with good immunity to noise and other interference.

Suppression of retrace lines by an ingenious circuit arrangement contributes to ease of operation of the receiver. This highly desirable performance feature permits a wide variety of picture brightness and contrast control settings without appearance of retrace lines.

Orderly and well spaced arrangement of all components on a generously proportioned chassis pan permits easy access to all tube and circuits for analysis and measurement. In addition, some of the major components such as the yoke and horizontal output transformer, are easily replaced because electrical connection is made by "snap-on" or "plug-in" connectors.



CHASSIS AND PICTURE TUBE ASSEMBLY

SPECIFICATIONS

SPEAKER

Catalog	Type	Size	V.C. Imped.
3177-A	P.M. Dynamic	10"	3.2 Ohms
3187-A	P.M. Dynamic	10"	3.2 Ohms

DIMENSIONS

Model	Height	Width	Depth
3177-A	38"	25"	20¾"
3187-A	37⅝"	23⅛"	23⅜"

INTERMEDIATE FREQUENCIES

Sound Carrier—22.1 Mc.
Picture Carrier—26.6 Mc.

I.F. SYSTEM

Three Stages—stagger tuned—for composite signal.
One additional stage for sound channel.

DETECTOR

Sound—Ratio Type
Picture—Germanium Crystal Type

RETRACE LINE SUPPRESSOR

Eliminates retrace lines thruout the normal range of picture brightness and contrast.

DEFLECTION

Magnetic

POWER REQUIREMENTS

117 volts 60 cycles 200 watts

ANTENNA INPUT IMPEDANCE

300 ohms—balanced to ground.

PICTURE SIZE

21" Rectangular

R. F. TUNER

Turret type construction; individually removable coil assemblies for all channels. All components are easily accessible for servicing.

FOCUS

Electrostatic

HORIZONTAL SYNCHRONIZATION

Automatic frequency control provides excellent picture stability.

HIGH VOLTAGE POWER SUPPLY

"Fly-back" type. Completely enclosed in a shielded compartment.

BUILT-IN ANTENNA

Broad band dipole.

TUBE COMPLEMENT

Tube No.	Tube Type	Function
V1	6CB6	1st I.F. Amplifier
V2	6CB6	2nd I.F. Amplifier
V3	6CB6	3rd I.F. Amplifier
V4	6CL6	Video Amplifier
V5	6AU6	Keyer—A.G.C.
V6	6BE6	Gated Sync. Separator
V7 A&B	12AT7	Sync. Amplifier—Vertical Blocking Oscillator
V8 A&B	6SN7GT	Horiz. A.F.C.—Horiz. Blocking Osc.
V9	6BQ6GT	Horiz. Scanning Output
V10	1B3GT	High Voltage Rectifier
V11	6AX4GT	Horizontal Damping
V12	5U4G	Rectifier
V13	6AU6	Sound I.F. Amp.—Limiter
V14	6T8	Sound Discriminator—Sound Amplifier
V15	6AQ5	Sound Output
V16	6AH4GT	Vertical Scanning Output
V17	21MP4	Picture Tube
V18	6BQ7, or 6BZ7	R.F. Amplifier
V19	6J6	Mixer—Oscillator

PHONOGRAPH CONNECTIONS

This receiver may be used in conjunction with a separate record player to play your favorite records. When a record player utilizing a high impedance pick-up unit is connected as described in the following paragraphs, the television receiver serves to faithfully reproduce the recorded sound. A pin-jack type phono-socket, located at the back of the television chassis is used for the connection of the phonograph unit. Record players have a cable for connection to an amplifying device which contains two wires (or one wire and a braided shield). The end of this cable which is to be connected to the television chassis must be equipped with a pin type Phono Plug which fits the socket on the chassis and one may be ordered from any Sears Store by requesting a Phono Plug W500966.

After properly connecting the record player to the television receiver, connect the 117 Volt power cord from the record player to a convenient wall outlet. Slide the "PHONO TELEV" switch (located under the name plate) to the up position, then turn on the television receiver. Operate the record player in the prescribed manner. If the phonograph has a separate volume control, that control should be set to nearly the maximum volume position. Volume can then be controlled by adjusting the "VOLUME" knob on the television receiver.

When it is desired to again use the receiver for regular television reception it is not necessary to disconnect the record player; merely slide the "PHONO TELEV" switch to the down position and turn the record player's "ON-OFF" switch to the "OFF" position.

CLEANING GLASS WINDOW AND PICTURE TUBE FACE

These receivers are equipped with removable glass windows for easy cleaning. Removal can be accomplished by following the procedure below.

1. Remove power cord from wall outlet.
2. Take off the gold colored picture frame or escutcheon that retains glass window by taking out the cross-slotted screws in this frame while at the same time supporting the glass window to keep it from falling forward.
3. Carefully remove the glass window avoiding any possibility of scratching or chipping it.
4. Using a slightly dampened lint free soft cloth, carefully wipe the inside of the glass window and the face of the picture tube. Avoid any scratching, scraping or chipping that might impair the glass surface.
5. When replacing the glass window be sure that screws are securely tightened.

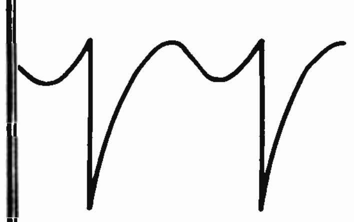
SYNCROGUIDE TRANSFORMER ALIGNMENT

Alignment of the Syncroguide transformer, circuit diagram #128, which is used in the Horizontal Oscillator circuit, can be accomplished by utilizing the procedure outlined below. To perform this alignment, it will be necessary to use an oscilloscope, preferably one that has a 2 megacycle response and a low input capacity probe—under 100 mmfd. to ground.

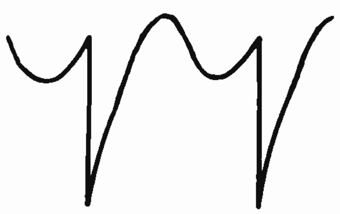
1. Set the "Top Slug" and "Bottom Slug" of the Syncroguide transformer to their maximum counter-clockwise positions.
2. Short together terminals C and D of the Syncroguide transformer.
3. Set "Horizontal Range" control, located on rear of chassis pan, to its maximum clockwise position.
4. Set "Horizontal Hold" control, located at front of chassis to its maximum counter-clockwise position.
5. Turn on receiver and tune in any local TV channel.
6. Adjust "Top Slug" clockwise until picture just locks in horizontally.
7. Remove short from terminals C and D. If picture does not hold sync when short is removed, adjust "Bottom Slug" clockwise until picture locks in.
8. Connect 'scope to terminal C of Syncroguide transformer and adjust sweep rate of 'scope until two cycles of oscillogram remain stationary. Turn "Bottom Slug" clockwise until wave form peaks are equal in height as shown in Fig. 21.

IMPORTANT: The first peak of the wave form should never be higher than the second peak nor should the first peak be lower than the second peak by more than 3%. Also when adjusting the "Bottom Slug," the picture must be in sync, therefore it may be necessary to turn the "Horizontal Hold" control clockwise when performing this step. After this adjustment has been completed, disconnect 'scope from receiver.

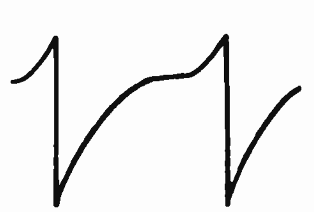
9. Set "Horizontal Hold" control counter-clockwise and adjust "Top Slug" until picture is locked in and does not lose sync when switching "Channel Selector" knob. Then, turn "Top Slug" slowly counter-clockwise until picture is just ready to lose sync as shown in Fig. 24.
10. Horizontal holding action of receiver should now be as follows:
    a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 24 or be out of sync.
    b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.
    c. When "Horizontal Hold" control is in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.
11. If the foregoing steps fail to correct for loss of horizontal holding action under normal receiver operation, be sure that condenser 130 (.01 mfd.) connected across terminals C and D of the Syncroguide transformer is part W512311, tubular, .01 mfd., 400 V. Do not use a substitute part.



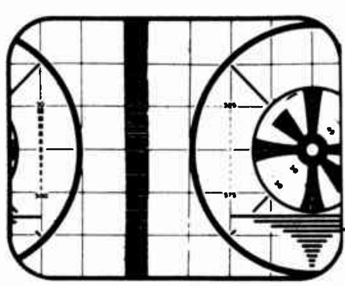
CORRECT
Fig. 21



INCORRECT
Fig. 22



INCORRECT
Fig. 23



ALIGNMENT PROCEDURE

The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits.

Alignment of all RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts. These procedures should preferably be applied in the order in which they are presented. Alignment of Sound Channel or IF Channel may be accomplished individually if desired.

The RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned.

CAUTION

The picture tube is highly evacuated and if broken fragments will be violently expelled. Handle with care. Avoid contact with metal shell of picture tube as this is part of the high voltage circuit.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated.
   a. IF Frequencies:
      4.5 Mc. Sound Channel
      22.1 Mc. to 26.6 Mc. IF Channel
   b. RF Frequencies:
      54 to 88 Mc.
      174 to 216 Mc.
2. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.
3. **RF SWEEP GENERATOR** to provide frequency modulated signal for observing the over-all bandpass characteristic and RF Channel alignment at the following frequencies:
   20 to 30 Mc. with 10 Mc. sweep width.
   54 to 88 Mc. with 10 Mc. sweep width.
   174 to 216 Mc. with 10 Mc. sweep width.
4. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe. This instrument is used for observing the over-all bandpass characteristic and for RF Channel alignment.

SOUND CHANNEL ALIGNMENT PROCEDURE

Short antenna terminals together with a jumper wire.

Set receiver Channel Selector to any inactive television channel and Picture control to its maximum counter-clockwise position; other controls may be left at any desired setting.

3. A small screwdriver (preferably non-metallic) can be used for alignment of Sound IF. The blade of this tool will fit the slot in the core of the transformer.

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Picture control to its maximum counter-clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in Fig. 3. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2. 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V1, V2 or V3). This will prevent noise in the RF stages from affecting the voltage reading while adjusting the sound trap.	#1 4.5 MC Sound Trap (See Fig. 10)	Adjust for minimum reading on VTVM.
Same as above	Same as above.	Connect as shown in Fig. 4.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	#2 Discriminator Secondary (See Fig. 10)	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary (See Fig. 11)	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 5.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 5.	#2 Discriminator Secondary (See Fig. 10)	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.

Replace the type 6CB6 tube previously removed in the above procedure and turn set on. Tune in to a local channel and should there be an unusual amount of "Intercarrier Buzz" refer to procedure on adjoining page to remove this aforementioned fault.

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

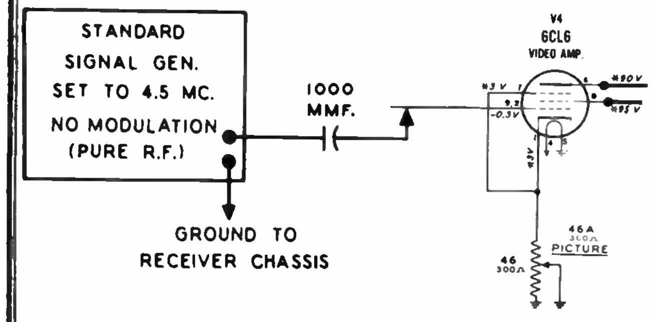


FIG. 1
Generator Connections
for Sound Channel and 4.5 Mc. Sound Trap
Alignment

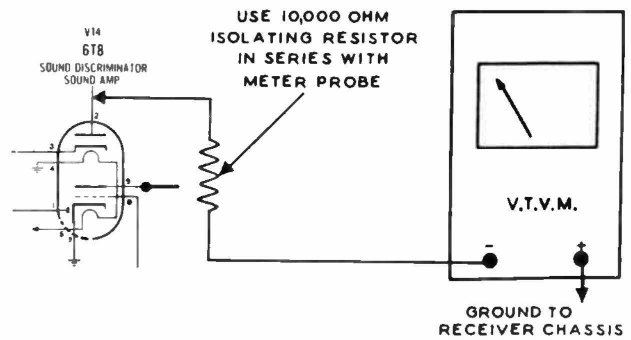


FIG. 4
VTVM Connections
for Sound IF Alignment

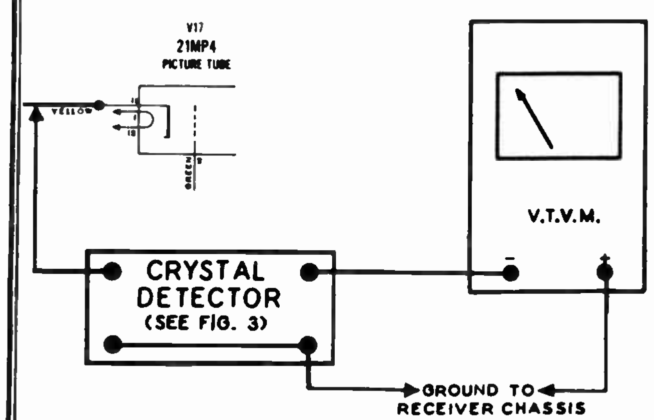


FIG. 2
Crystal Detector and VTVM Connections
for 4.5 Mc. Sound Trap
Alignment

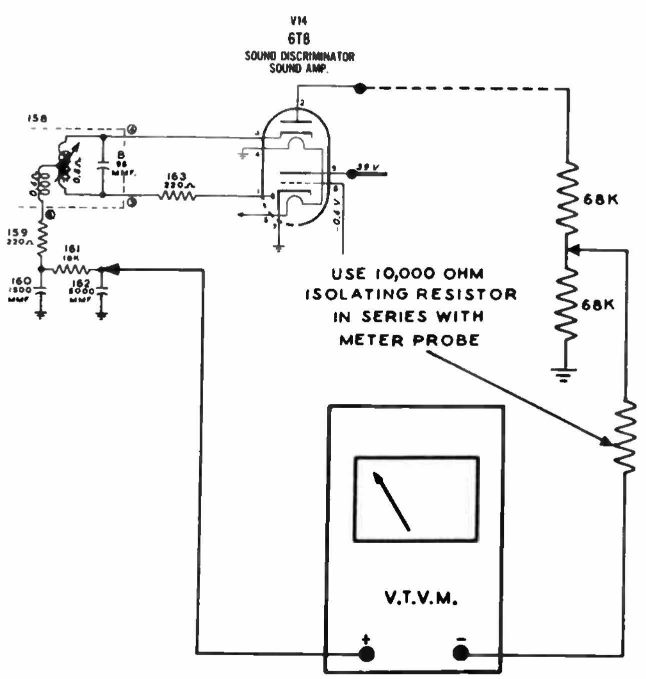


FIG. 5
VTVM Connections
for Sound Discriminator
Alignment

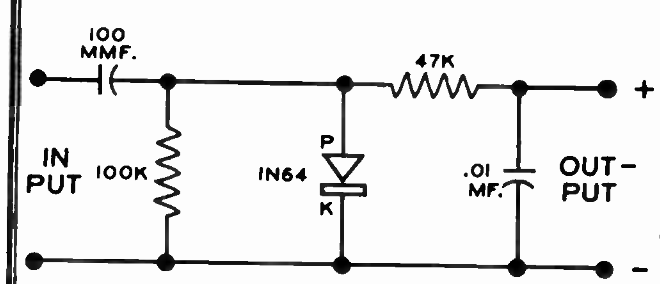


FIG. 3
Circuit Diagram for
Crystal Detector shown in Fig. 2

REDUCTION OF INTERCARRIER BUZZ

Under actual reception conditions slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under these conditions.

Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

IF CHANNEL ALIGNMENT PROCEDURE

1. In order to eliminate the possibility of spurious oscillations, it is desirable to render the RF oscillator inoperative. This may be readily accomplished by insulating oscillator terminals of tuner. Remove tuner bottom shield and place a piece of transparent cellulose tape on the first two contacts (from front) of drum assembly. Use any inoperative channel and rotate drum to this insulated position.
2. Short antenna terminals together with a jumper wire.
3. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to the AGC line and positive terminal of battery connects to receiver chassis. See Fig. 11 for convenient point of connection.
4. If the IF channel is badly misaligned and two or more immediately adjoining IF stages are tuned to the same frequency, oscillation may occur. Such oscillation shows up as an excessive voltage across the video detector load, circuit reference number 42 and 43, and is indicated by the VTVM that is connected to this point during alignment. It should be noted that voltage due to IF oscillation is unaffected by strength of signal from the generator.

Where IF oscillation is encountered, it is generally possible to correct the condition by detuning the IF coils in different directions. If that does not have the desired effect, increase fixed bias on AGC line by using a 4½ volt battery instead of the 3 volt battery referred to in instruction #3. After stopping the oscillation in this manner it will then be possible to align all IF stages using the following procedure, however, the AGC bias battery must be changed back to 3 volts when using the oscilloscope to observe band pass characteristics. Once all stages have been aligned using the 4½ volt bias, the IF channel should be stable with reduced bias.

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	'SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Connect as shown in Fig. 7.	23.4 MC.	Not used.	—	Connect as shown in Fig. 9.	Not used.	Be sure that RF oscillator has been rendered inoperative as outlined in instruction #1 at the head of this chart.	#5 Converter plate coil (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	24.2 MC.	Not used.	—	Same as above.	Not used.	Same as above.	#6 1st I.F. (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	26.2 MC.	Not used.	—	Same as above.	Not used.	Same as above.	#7 2nd I.F. (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	25.4 MC.	Not used.	—	Same as above.	Not used.	Same as above.	#8 3rd I.F. (See Fig. 10)	Adjust for maximum reading on VTVM.
Connect as shown in Fig. 8.	26.6	Connect as shown in Fig. 8.	25 MC. Sweep Width 10 Mc.	Same as above.	Connect as shown in Fig. 9	IMPORTANT: 1. Adjust output attenuator on sweep generator so that reading on VTVM is approximately one-half volt. 2. Set attenuator on standard signal generator so that marker signal does not distort the pattern on the oscilloscope. 3. Be sure that a 3 volt battery is connected to AGC line as specified in instruction #3 at the head of this chart. Do not use a battery of any other voltage.	The I.F. bandpass characteristic can now be observed by the use of a 'scope. Its general shape and contour should compare with the curve shown in Fig. 6. The picture carrier marker (26.6 Mc.) should appear at the 50% (±10%) amplitude position of the curve as shown in Fig. 6. (see Fig. 6 below) Should this observation fail to meet the above requirements, the complete I.F. alignment procedure must be repeated, exercising greater care in frequency setting of the marker generator and adjusting the I.F. transformer slugs for maximum output at the prescribed frequencies.	
Same as above.	22.1	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.	The sound carrier marker (22.1 Mc.) can be observed by the use of a 'scope and should be compared with that shown in Fig. 6. Increase the vertical gain control on 'scope in order to magnify the sound portion of the response curve. This marker should appear at the position indicated in Fig. 6. Should the sound marker not be properly positioned, check the setting of the picture carrier marker as indicated in the previous step.	

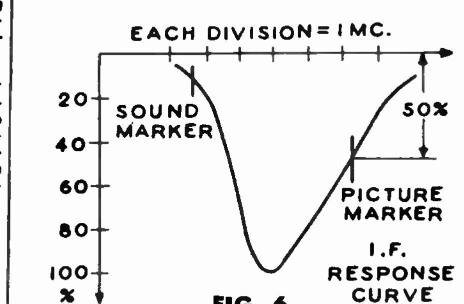


FIG. 6

RF CHANNEL ALIGNMENT PROCEDURE

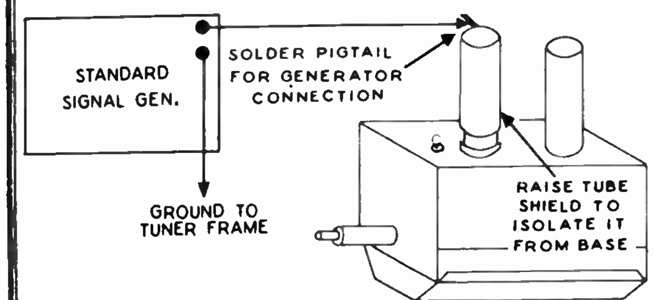


FIG. 7
Generator Connections for IF Channel Alignment

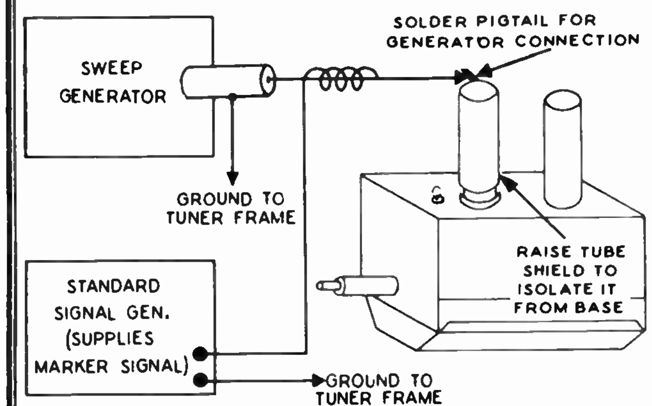


FIG. 8
Generator Connections for IF Channel Alignment

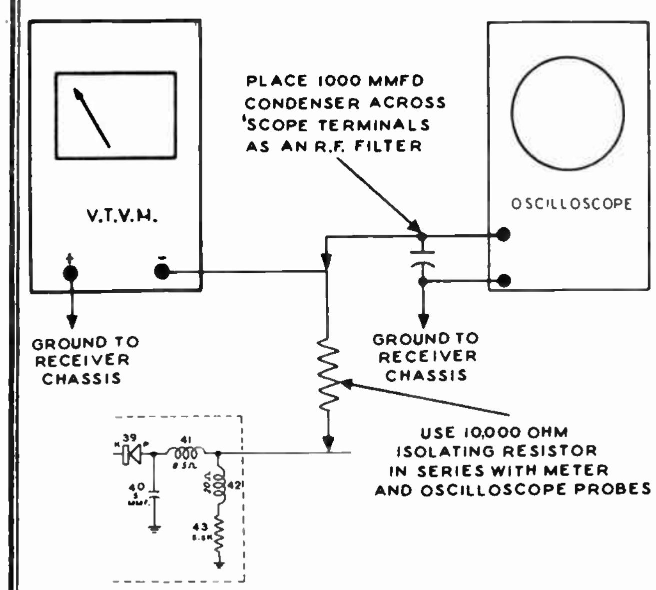


FIG. 9
VTVM and Oscilloscope Connections for IF Channel Alignment

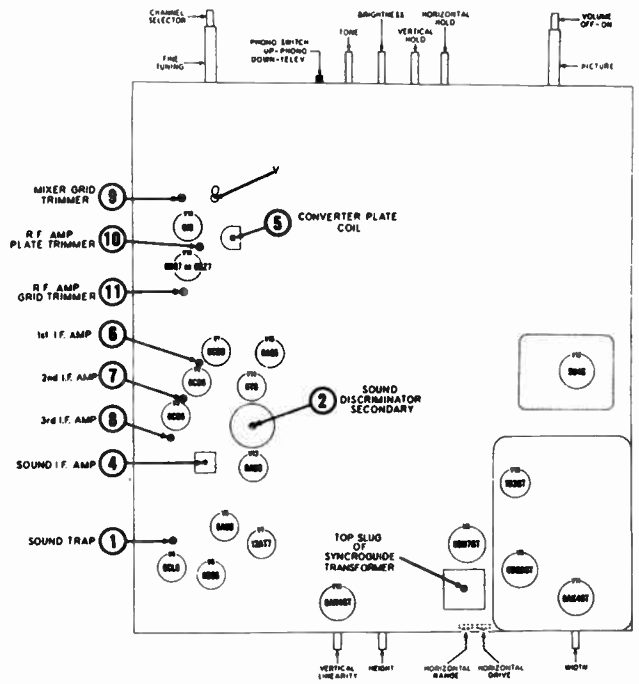


FIG. 10
Top View of Chassis

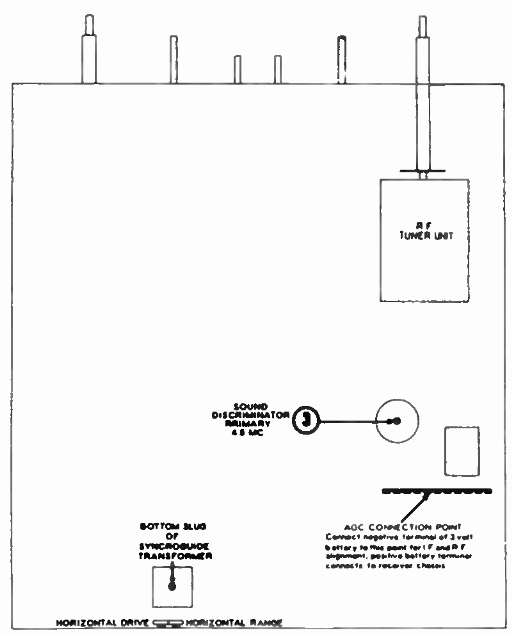


FIG. 11
Bottom View of Chassis

RF CHANNEL ALIGNMENT PROCEDURE

1. **CAUTION:** The shell of the picture tube has a high voltage potential, approximately 14,000 volts, and contact should be avoided. As the adjustment screws are in relatively close proximity to this shell, some means of insulation from accidental contact should be provided.
2. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 11 for convenient point of connection.)

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNEC-TIONS	SCOPE CONNEC-TIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUST-MENT AND OUTPUT INDICATION
CONNEC-TIONS	FREQUENCY	CONNEC-TIONS	FREQ.					
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 12.	**209.75 MC.** Sound Carrier **205.25 MC.** Picture Carrier Marker.	Connect as shown in Fig. 12 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	**CHANNEL #12**	Not used.	Connect as shown in Fig. 13.	Set Channel Selector to #12. IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	**#9** Mixer Grid. (See Fig. 19) **#10** RF Amp. Plate. (See Fig. 19) **#11** RF Amp. Grid. (See Fig. 19)	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 16. Use Mixer Grid trimmer #9; and RF Amplifier Plate trimmer #10 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #11 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. **IMPORTANT:** When adjusting trimmers #9, 10 and 11 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that wauld result in a loss of sensitivity.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 15.	Same as above.	Set sweep generator to channel frequencies being observed.	Not used.	Same as above.	Set channel selectar to channel being observed.		The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #9, 10 and 11. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. Band pass characteristic of these channels should conform close ta the RF response curve in Fig. 16. If necessary, a compromise may be obtained ta compensate for large variations in channel response by returning to channel #12 and moking slight changes in the settings of trimmers #9, 10 and 11.

OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in Fig. 6.
2. During oscillator alignment, it is necessary to set the Fine Tuning control so that the tooth on the fiber fine tuning cam points downward (correct position for this control is shown in Fig. 18).
3. During this step and thru-out all succeeding steps it is necessary to: keep output of sweep generator at a level that does nat allow reading an VTVM to exceed one-half valt.
4. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.

Connect as shown in Fig. 12.	**209.75 MC.** Saund Carrier Marker. **205.25 MC.** Picture Carrier Marker.	Connect as shown in Fig. 12 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	**CHANNEL #12**	Cannect as shown in Fig. 14.	Connect as shown in Fig. 14.	Set Channel Selector to #12 Be sure that generator's output does not exceed voltage specified in instructions #3 and 4 above.	Using a nan-metallic screwdriver to adjust channel #12 oscillator slug (accessible thru hole on front of RF Tuner Unit—see Fig. 18) shift response curve so that picture carrier marker is located at the position indicated in Fig. 17. Position of sound carrier marker should appear as indicated in Fig. 17.
Some as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 15.	Same as above.	Set sweep generator to channel frequencies being observed.	Same as above.	Same as above.	Set channel selector to channel being observed.	Adjust the RF sweep generator and marker generator for operation on the other television channels. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of RF Tuner Unit (see Fig. 18). This permits response curve to be shifted so that picture and sound carrier markers will appear at the position indicated in Fig. 17. **NOTE:** Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 18).

If an oscillator slug "falls into" its coil farm during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it shauld be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position. (See Fig. 20.)

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel. If characteristic does not conform reasonably well within the typical curve shown in Fig. 16, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

CIRCUIT DESCRIPTION FOR W521287 RF TUNER — CIRCUIT DESCRIPTION FOR W521287 RF TUNER

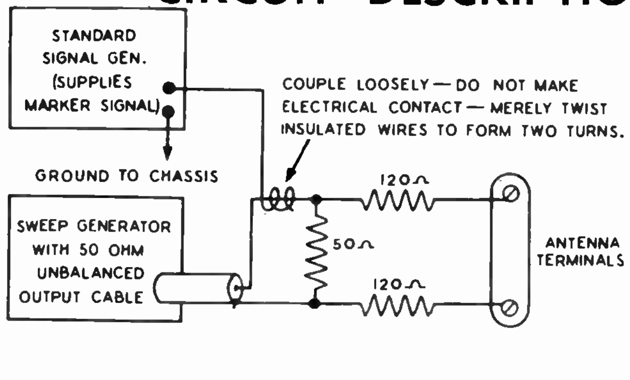


FIG. 12
Generator Connections for RF Channel Alignment

CHANNEL NUMBER	PICTURE CARRIER MARKER FREQ.	SOUND CARRIER MARKER FREQ.
13	211.25 MC.	215.75 MC.
12	205.25 MC.	209.75 MC.
11	199.25 MC.	203.75 MC.
10	193.25 MC.	197.75 MC.
9	187.25 MC.	191.75 MC.
8	181.25 MC.	185.75 MC.
7	175.25 MC.	179.75 MC.
6	83.25 MC.	87.75 MC.
5	77.25 MC.	81.75 MC.
4	67.25 MC.	71.75 MC.
3	61.25 MC.	65.75 MC.
2	55.25 MC.	59.75 MC.

Fig. 15

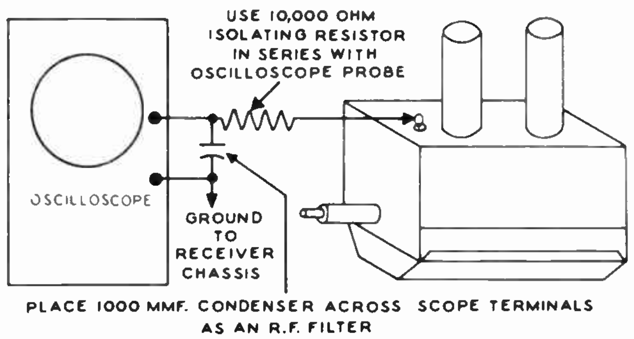


FIG. 13
Oscilloscope Connections for RF Amp. and Mixer Alignment

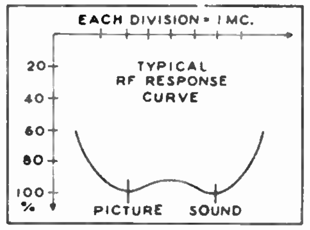


FIG. 16

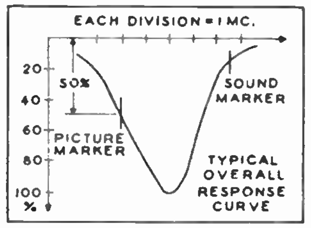


FIG. 17

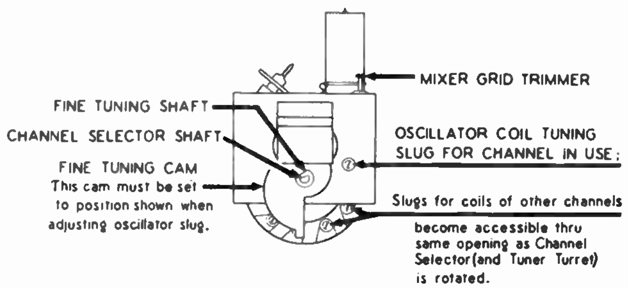


FIG. 18
Front View of RF Tuner Unit

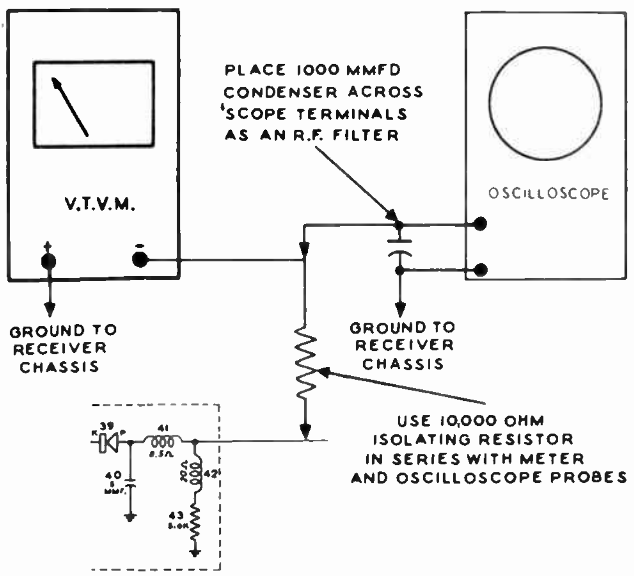


FIG. 14
VTVM and Oscilloscope Connections for Oscillator Alignment

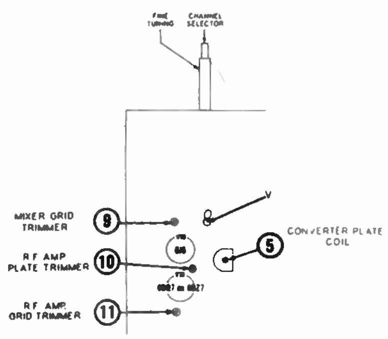


FIG. 19
Trimmer Location of R.F. Tuner

The turret type tuner incorporated in this chassis is of the latest design and utilizes a 6BQ7 or 6BZ7 tube as the R.F. amplifier (V5) and a 6J6 tube (V6) as the Mixer-Oscillator.

Channel selection is accomplished by rotation of the turret containing two sets of easily removable coil assemblies for each channel. The individual antenna coil sections consist of a balanced primary to minimize noise pick-up on the transmission line and an R.F. grid coil which couples the incoming signal to the grid of the first section of the R.F. Amplifier tube (V5). The inductance and amount of coupling of the tuned antenna input circuit are changed for each channel so that a constant input impedance of 300 ohms is maintained. This provides maximum transfer of energy to the R.F. Amplifier stage, particularly when interconnection between an outdoor antenna and the receiver is made with 300 ohm transmission line.

The R.F. Amplifier tube is a dual-triode tube and is connected in the circuit as a direct coupled grounded-grid type amplifier. This circuit was developed to meet the demand for an R.F. Amplifier that would provide more nearly equal gain on both the low and high Television Channels, while keeping inherent tube noise to a minimum. The circuit can be thought of very simply as two triode tubes in series, the first or driver unit acting not as an amplifier, but rather as an antenna impedance matching device and also as a variable cathode impedance, or bias source, for the second, or grounded-grid unit. In addition the first unit of the R.F. Amp. acts as a power amplifier due to its extremely low plate impedance, which is in reality the cathode circuit of unit two, and converts the weak signal voltage from the antenna to a low voltage-high current signal which is then applied to the cathode of unit number two. The signal coupling unit between the first and second units is a series peaking coil, symbol 406, similar to that found in a video amplifier circuit. Its purpose is to form a series resonant circuit with the input capacity of the second unit. The coil is so made as to resonate at a frequency slightly higher than channel 13. In a standard pentode type amplifier, the gain falls off rapidly as progressively higher channels are selected. With the use of the plate to cathode peaking coil an almost equal gain can be realized for all channels.

The R.F. Amp. tube has inherently low interelectrode capacity due to physical design and this factor in conjunction with the low output impedance of the first section is responsible for the low noise factor at this stage. While neutralization of the first unit is not necessarily due to its low plate to grid capacity, additional noise reduction has been realized, with only a slight decrease in gain, by the addition of a neutralizing condenser, item 405. Due to the low output impedance of the stage, it is not necessary that the neutralizing condenser be turnable.

Because of the circuits' excellent internal shielding, low input impedance and radiation rejection, the second section of the R.F. Amp. is connected as a driven grounded-grid amplifier. While this might not be apparent at first glance due to the fact that grid has no direct D.C. return, it will be found upon further examination that any high frequency A.C. potentials are by-passed to ground through condenser 407.

The second section of turret coils includes the tuned R.F. amplifier plate coil, tuned mixer grid coil, and oscillator coil. The output of the R.F. amplifier stage is coupled to the grid of the mixer stage, which utilizes one triode section of a 6J6 tube (V6). The other half of the 6J6 is connected as a modified Colpitts oscillator which injects oscillator voltage into the mixer stage through coupling between the oscillator coil and the mixer grid coil. Course oscillator tuning is accomplished by adjusting the positions of the slugs in the individual oscillator coils, while Fine Tuning is obtained when using condenser #417 in the oscillator plate circuit. This Fine Tuning condenser is composed of two fixed plates, and its capacitance is changed by the insertion of a bakelite com between these plates.

Signal output from the mixer stage is coupled to the IF amplifiers through the converter plate I.F. coil, diagram #427, located on the tuner unit.

REPAIR DATA FOR W521287 RF TUNER

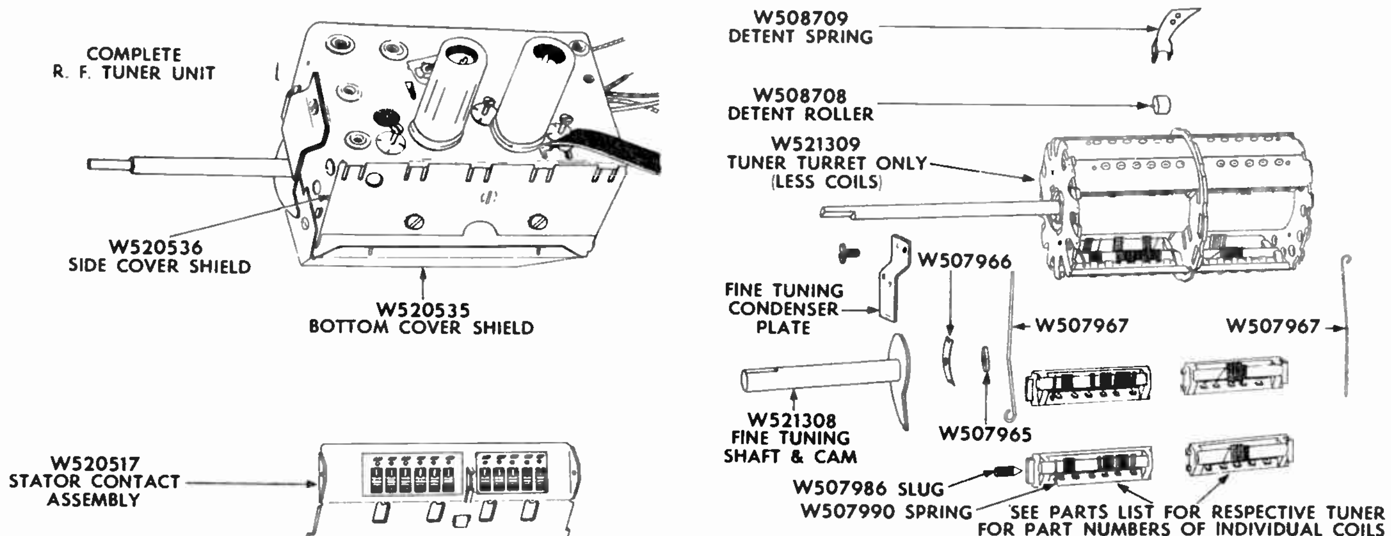


FIG. 20

SERVICE PRECAUTIONS

SUBJECT	PRECAUTIONS
ELECTRICAL COMPONENTS	The high frequencies used in the RF section of a television receiver make it necessary that considerable care be exercised in servicing the tuner. Lead dress and location of components are very critical at these frequencies. When replacing parts, it is important to use components of identical electrical characteristics and physical size. Always reconnect the replacement item in the same location and position in the tuner as the original component.
TUBES	Replacement of tubes in the Tuner Unit may cause slight detuning of RF circuits due to inherent differences in inter-electrode capacitances. When replacing tubes (especially 6J6 mixer-oscillator tube) make sure that Fine Tuning control will tune in television stations at approximately the middle of its range. It may be necessary to change the setting of the individual oscillator coil slugs for some channels to accomplish this.

PARTS LIST

CONDENSERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
11	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	$ .36
12	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
17	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
19	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
20	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
26	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
29	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
31	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
35	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
36	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
40	W513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
45	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
47	W512238	Condenser—.22 Mfd. 200 volt	.50
50	W513438	Condenser—ceramic 47 Mmfd. ±5% 500 v. (Temperature compensating)	.45
58	W512239	Condenser—.47 Mfd. 200 volt	.75
61	W513032	Condenser—ceramic 220 Mmfd. 1000 volt	.40
62	W512216	Condenser—.1 Mfd. 200 volt	.30
65	W512235	Condenser—.047 Mfd. 200 volt	.30
71	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
73	W512206	Condenser—.01 Mfd. 600 volt	.30
74	W512206	Condenser—.01 Mfd. 600 volt	.30
77	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
79	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
81	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
82	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
85-A,B,C	W508072	Condenser—electrolytic A—40 Mfd. 450 volt; B—40 Mfd. 450 volt; C—40 Mfd. 450 volt	4.50
89	W160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
90-A,B	W509002	Condenser—electrolytic A—80 Mfd. 250 volt; B—100 Mfd. 50 volt	3.00
91	W504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
95	W512235	Condenser—.047 Mfd. 200 volt	.30
98	W512239	Condenser—.47 Mfd. 200 volt	.75
103	W512205	Condenser—.01 Mfd. 400 volt	.25
107	W512502	Condenser—mica 100 Mmfd. ±10% 500 volt	.25
108-A,B	W520991	Condenser—trimmer assembly A—10-160 Mmfd. (Horizontal Range); B—10-160 Mmfd. (Horizontal Drive)	.90
109	W513030	Condenser—ceramic 47 Mmfd. 1000 volt	.40
110	W512232	Condenser—.0022 Mfd. 400 volt	.25
115	W512235	Condenser—.047 Mfd. 200 volt	.30
119	W512239	Condenser—.47 Mfd. 200 volt	.75
121	W512236	Condenser—.047 Mfd. 400 volt	.30
122	W512233	Condenser—.022 Mfd. 400 volt	.30
127	W513427	Condenser—ceramic 200 Mmfd. ±2% (Temperature compensating)	.65
130	W512311	Condenser—.01 Mfd. 400 volt (Special)	.25
131	W512547	Condenser—mica 820 Mmfd. ±5% 500 v.	.50
132	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
135	W512238	Condenser—.22 Mfd. 200 volt	.50
137	W512218	Condenser—.1 Mfd. 600 volt	.55
141	W512237	Condenser—.047 Mfd. 600 volt	.40
142	W512234	Condenser—.022 Mfd. 600 volt	.35
144	W520990	Condenser—ceramic 500 Mmfd. 20,000 volt	1.75
147	W512235	Condenser—.047 Mfd. 200 volt	.30
150	W513027	Condenser—ceramic 56 Mmfd. ±10% 1500 v.	.45
152	W513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
155	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
156	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
158-A	W509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
158-B	W509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
160	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
162	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
165	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
166	W512235	Condenser—.047 Mfd. 200 volt	.30
167	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
170	W505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
171	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
173	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
174	W512205	Condenser—.01 Mfd. 400 volt	.25
175	W512204	Condenser—.01 Mfd. 200 volt	.25
179	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
183-A	W508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
183-C	W508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-E	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-G	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
185	W512533	Condenser—mica 4700 Mmfd. ±5% 1000 v.	1.40
190	W512236	Condenser—.047 Mfd. 400 volt	.30
192	W504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
194	W512218	Condenser—.1 Mfd. 600 volt	.55
402	W509064	Condenser—trimmer 3-9 Mmfd.	.50
405	W520721	Condenser—ceramic 3.6 Mmfd. ±10% 500 v.	.35
407	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
410	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	W520719	Condenser—ceramic 47 Mmfd. ±10% 500 v. (Temperature compensating)	.40
414	W520717	Condenser—ceramic 5 Mmfd. ±5% 500 v. (Temperature compensating)	.35
416	W520719	Condenser—ceramic 47 Mmfd. 10% 500 v. (Temperature compensating)	.40
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	W520718	Condenser—ceramic 10 Mmfd. ±10% 500 v. (Temperature compensating)	.30
421	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	W520716	Condenser—ceramic 6.8 Mmfd. ±5% 500 v. (Temperature compensating)	.35
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	W513029	Condenser—ceramic 120 Mmfd. ±10% 500 v.	.35
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	W520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
435	W520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
437	W520720	Condenser—ceramic 1.5 Mmfd. 500 volt	.35

RESISTORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
13	W510348	Resistor—carbon 4,700 Ohms ±10% 2 watt	.25
14	W510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
15	W510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
16	W510116	Resistor—carbon 68 Ohms ½ watt	.12
18	W510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
21	W510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
23	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
24	W510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
25	W510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
27	W510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
28	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
30	W510157	Resistor—carbon 15,000 Ohms ±10% ½ w.	.12
32	W510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
34	W510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
37	W510118	Resistor—carbon 100 Ohms ± 10% ½ watt	.12
43	W510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
44	W510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
48	W510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
52	W510744	Resistor—carbon 15,000 Ohms ±5% ½ watt	.16
54	W510247	Resistor—carbon 3900 Ohms ±10% 1 watt	.12
55	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
56	W510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
57	W510701	Resistor—carbon 3.3 Meg. ±10% ½ watt	.12
59	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
60	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
63	W510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
64	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
68	W510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
70	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
83	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
84	W510782	Resistor—wire wound 50 Ohms ±10% 5 w.	.40
87	W510741	Resistor—wire wound 600 Ohms ±10% 10 w.	.90
88	W510779	Resistor—wire wound 400 Ohms ±10% 10 w.	.75
92	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
93	W510357	Resistor—carbon 15,000 Ohms ±10% 2 watt	.35
94	W510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
96	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
97	W510189	Resistor—carbon 820,000 Ohms ±10% ½ w.	.12
99	W510171	Resistor—carbon 82,000 Ohms ±10% ½ w.	.12
100	W510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
101	W510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
102	W510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
104	W510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
106	W510151	Resistor—carbon 6800 Ohms ± 10% ½ watt	.12
111	W510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
112	W510189	Resistor—carbon 820,000 Ohms ±10% ½ w.	.12
113	W510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
114	W510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
116	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
117	W510281	Resistor—carbon 330,000 Ohms ±10% 1 w.	.12
118	W510148	Resistor—carbon 4700 Ohms ±10% ½ watt	.12
120	W510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
124	W510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
125	W510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
126	W510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
129	W510269	Resistor—carbon 68,000 Ohms ±10% 1 w.	.12
133	W510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
134	W510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
136	W510318	Resistor—carbon 100 Ohms ±10% 2 watt	.25
138	W510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
139	W510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
143	W510725	Resistor—carbon 3.3 Ohms ±10% ½ watt	.16
145	W510190	Resistor—carbon 1 Meg. ± 10% ½ watt	.12
146	W510134	Resistor—carbon 680 Ohms ½ watt	.12
154	W510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
157	W510249	Resistor—carbon 4700 Ohms 1 watt	.16
159	W510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
161	W510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
163	W510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
164	W510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
168	W510197	Resistor—carbon 10 Meg. ½ watt	.12
169	W510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
172	W510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
177	W510778	Resistor—carbon 560,000 Ohms ±5% ½ w.	.16
178	W510747	Resistor—carbon 820,000 Ohms ±5% ½ w.	.20
182	W510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
183-B	W508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
183-D	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
183-F	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
186	W510777	Resistor—carbon 1.2 Meg. ±5% ½ watt	.12
188	W510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
191	W510153	Resistor—carbon 8200 Ohms ±10% ½ w.	.12
193	W510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
195	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
197	W510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
199	W510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
200	W510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
403	W510157	Resistor—carbon 15,000 Ohms ±10% ½ w.	.12
404	W510167	Resistor—carbon 47,000 Ohms ½ w.	.12
408	W510774	Resistor—carbon 160,000 Ohms ±5% ½ w.	.16
409	W510751	Resistor—carbon 100,000 Ohms ±5% ½ w.	.20
411	W510139	Resistor—carbon 1500 Ohms ±10% ½ w.	.12
418	W510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
419	W510179	Resistor—carbon 220,000 Ohms ½ w.	.12
422, 423	W510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
438	W510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12

CABINET PARTS

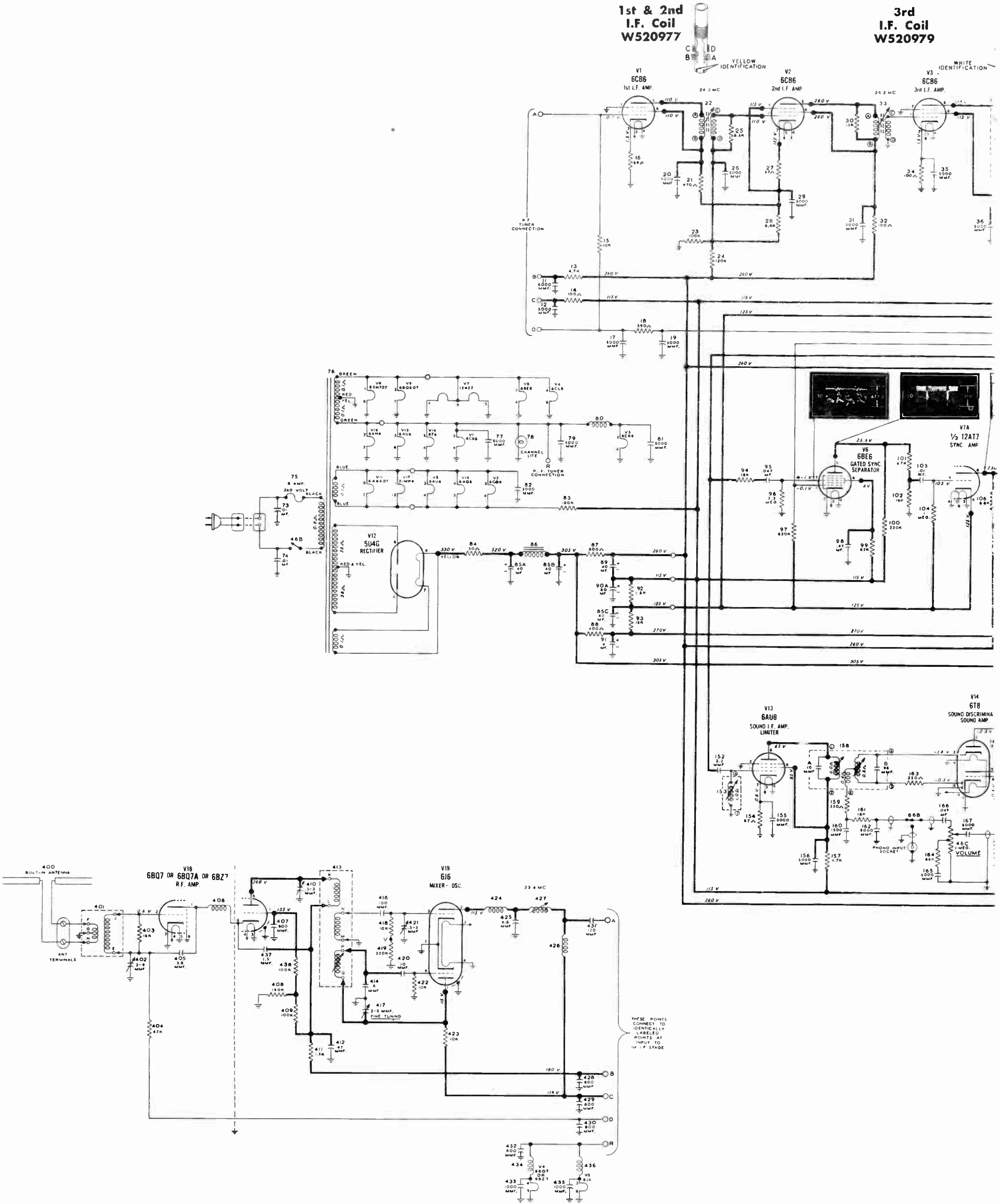
PART NO.	DESCRIPTION	LIST PRICE
W115324	Back for cabinet; (includes power cord)	3.50
W521341-A	Cabinet for Catalog #3177-A	90.00
W521340-A	Cabinet for Catalog #3187-A	120.00
W520492	Caster for console cabinet ea.	.50
W520814	Door for cabinet (left hand); Catalog #3187-A	10.00
W520815	Door for cabinet (right hand); Catalog #3187-A	10.00
W520437	Escutcheon for glass window (gold metal frame)	10.00

CABINET PARTS—Continued

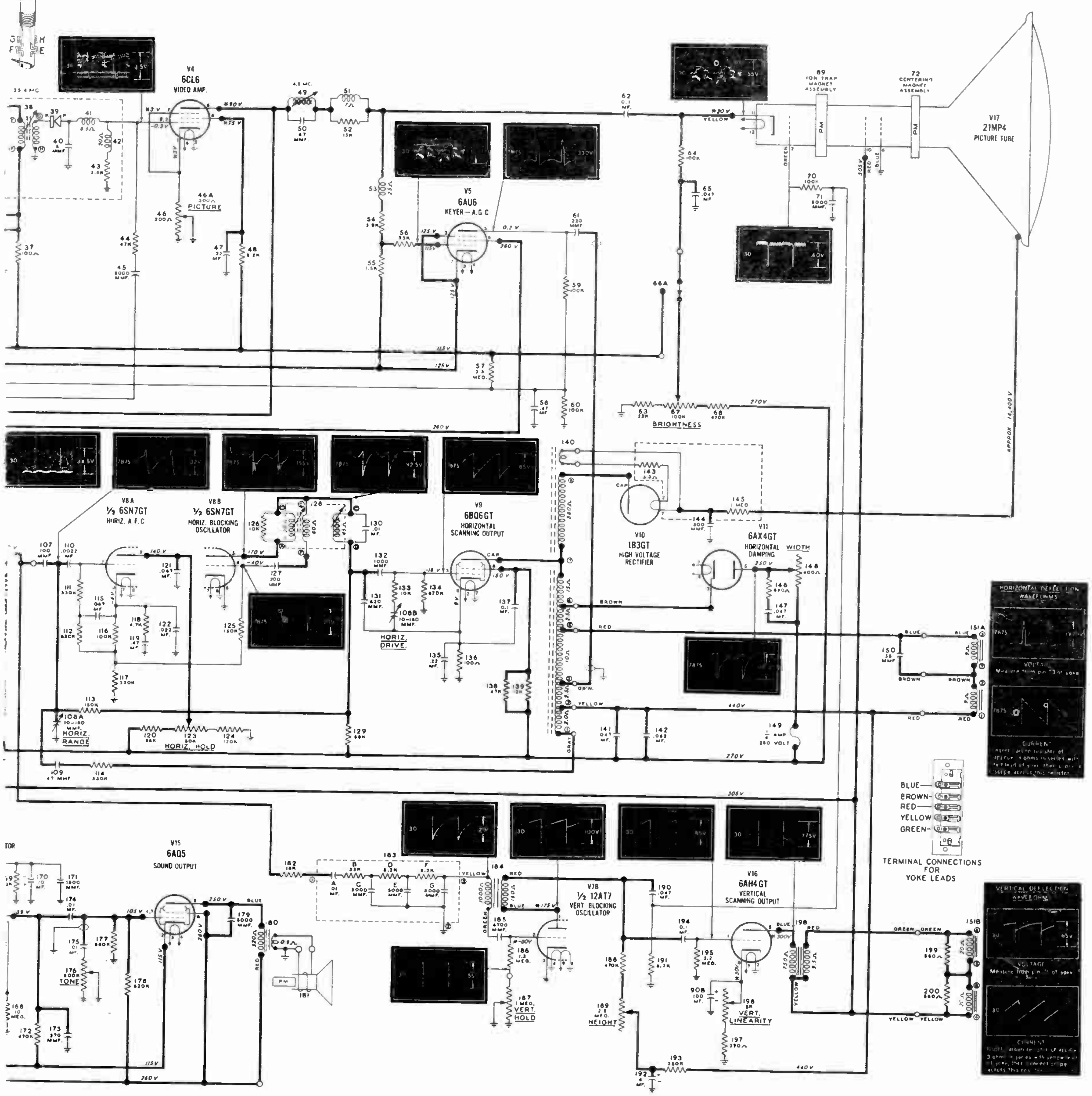
PART NO.	DESCRIPTION	LIST PRICE
W520435	Glass window; Catalog #3177-A, #3187-A	$10.00
W520816	Handle for door; Catalog #3187-A	1.50
W520812	Hinge for door; Catalog #3187-A per pair	.65
W520684-B	Knob, Channel Selector (Green)	.85
W520686-A	Knob, Fine Tuning (Beige)	.75
W520685-B	Knob, Off-On-Volume (Green)	.70
W520687-A	Knob, Picture (Beige)	.45
W520436	Mask for picture tube	8.00
W520678-B	Nameplate (Green) (includes spring and hinge)	3.00
W170986	Screw—#6—32, Phillips oval brass head; retain escutcheon	.02
W18807	Screw—#14 x 1"; mounts TV chassis	.02
W520754-A	Tab U.H.F., for Selector knob	.15
W520993	Terminal strip for TV antenna connection	.25

COILS AND TRANSFORMERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
22	W520977	Transformer—1st video I.F. (less slug)	.75
22	W507357	Slug core for 1st video I.F. coil	.20
33	W520977	Transformer—2nd video I.F. (less slug)	.75
33	W507357	Slug core for 2nd video I.F. coil	.20
38	W520979	Transformer—3rd video I.F. (less slug)	.75
38	W507357	Slug core for 3rd video I.F. coil	.20
41	W520620	Coil—peaking	.65
42	W520985	Coil—peaking	.65
49	W509603	Coil—4.5 Mc. trap (includes slug and condenser #50)	1.20
49	W507357	Slug core for 4.5 Mc. trap coil	.20
51	W520984	Coil—peaking	.50
53	W520986	Coil—peaking	.60
76	W520951	Transformer—power	17.50
80	W507584	Coil—choke	.28
86	W508341	Choke—filter	3.60
128	W520943	Transformer—syncroguide	2.50
128	W521064	Slug core for syncroguide transformer	.70
140	W521066	Transformer—horizontal output	8.50
151-A,B	W520942	Yoke—picture tube deflection (includes leads, connectors and resistors #199 and #200)	7.50
153	W509378	Transformer—audio take-off	1.50
158	W509706	Transformer—TV sound discriminator (includes condensers 158A and 158B)	3.00
180	W509376	Transformer—audio output	1.85
184	W520980	Transformer—vertical blocking oscillator	1.90
198	W520975	Transformer—vertical output (includes connectors for deflection yoke leads)	4.00
401	W520702	Coil-antenna; channel #2 (coded "2Q")	1.40
401	W520703	Coil-antenna; channel #3 (coded "3Q")	1.40
401	W520704	Coil-antenna; channel #4 (coded "4Q")	1.40
401	W520705	Coil-antenna; channel #5 (coded "5Q")	1.40
401	W520706	Coil-antenna; channel #6 (coded "6Q")	1.40
401	W520707	Coil-antenna; channel #7 (coded "7Q")	1.15
401	W520708	Coil-antenna; channel #8 (coded "8Q")	1.15
401	W520709	Coil-antenna; channel #9 (coded "9Q")	1.15
401	W520710	Coil-antenna; channel #10 (coded "10Q")	1.15
401	W520711	Coil-antenna; channel #11 (coded "11Q")	1.15
401	W520712	Coil-antenna; channel #12 (coded "12Q")	1.15
401	W520713	Coil-antenna; channel #13 (coded "13Q")	1.15
406	W520701	Coil-cathode coupling	.15
413	W520722	Coil-R.F. and osc; channel #2 (coded "2Q")	1.85
413	W520723	Coil-R.F. and osc; channel #3 (coded "3Q")	1.85
413	W520724	Coil-R.F. and osc; channel #4 (coded "4Q")	1.85
413	W520725	Coil-R.F. and osc; channel #5 (coded "5Q")	1.85
413	W520726	Coil-R.F. and osc; channel #6 (coded "6Q")	1.85
413	W520727	Coil-R.F. and osc; channel #7 (coded "7Q")	1.70
413	W520728	Coil-R.F. and osc; channel #8 (coded "8Q")	1.70
413	W520729	Coil-R.F. and osc; channel #9 (coded "9Q")	1.70
413	W520730	Coil-R.F. and osc; chan. #10 (coded "10Q")	1.70
413	W520731	Coil-R.F. and osc; chan. #11 (coded "11Q")	1.70
413	W520732	Coil-R.F. and osc; chan. #12 (coded "12Q")	1.70
413	W520733	Coil-R.F. and osc; chan. #13 (coded "13Q")	1.70
413	W507986	Slug for osc coil; auxiliary fine tuning adj.	.05
424	W520714	Coil-choke	.15
426	W520715	Coil-choke	.45
427	W520734	Coil—converter plate I.F. (includes slug and clip)	.75
427	W509062	Slug core for converter plate coil	.12
434	W520518	Coil-choke	.10
436	W520520	Coil-choke	.10


1st & 2nd I.F. Coil W520977
YELLOW IDENTIFICATION
3rd I.F. Coil W520979
WHITE IDENTIFICATION
V1 6CB6 1st I.F. AMP.
V2 6CB6 2nd I.F. AMP
V3 6CB6 3rd I.F. AMP.
R.F. TUNER CONNECTION
V12 5U4G RECTIFIER
CHANNEL LITE
V6 6BE6 GATED SYNC SEPARATOR
V7A ½ 12AT7 SYNC AMP
V13 6AU8 SOUND I.F. AMP. LIMITER
V14 6T8 SOUND DISCRIMINA SOUND AMP
PHONO INPUT SOCKET
VOLUME
BUILT-IN ANTENNA
ANT TERMINALS
V18 6BQ7 OR 6BQ7A OR 6BZ7 R.F. AMP.
V19 6J6 MIXER- OSC.
FINE TUNING
THESE POINTS CONNECT TO IDENTICALLY LABELED POINTS AT INPUT TO 1st I.F. STAGE

SCHEMATIC AND PARTS LIST DIAGRAM FOR CHASSIS 100.400

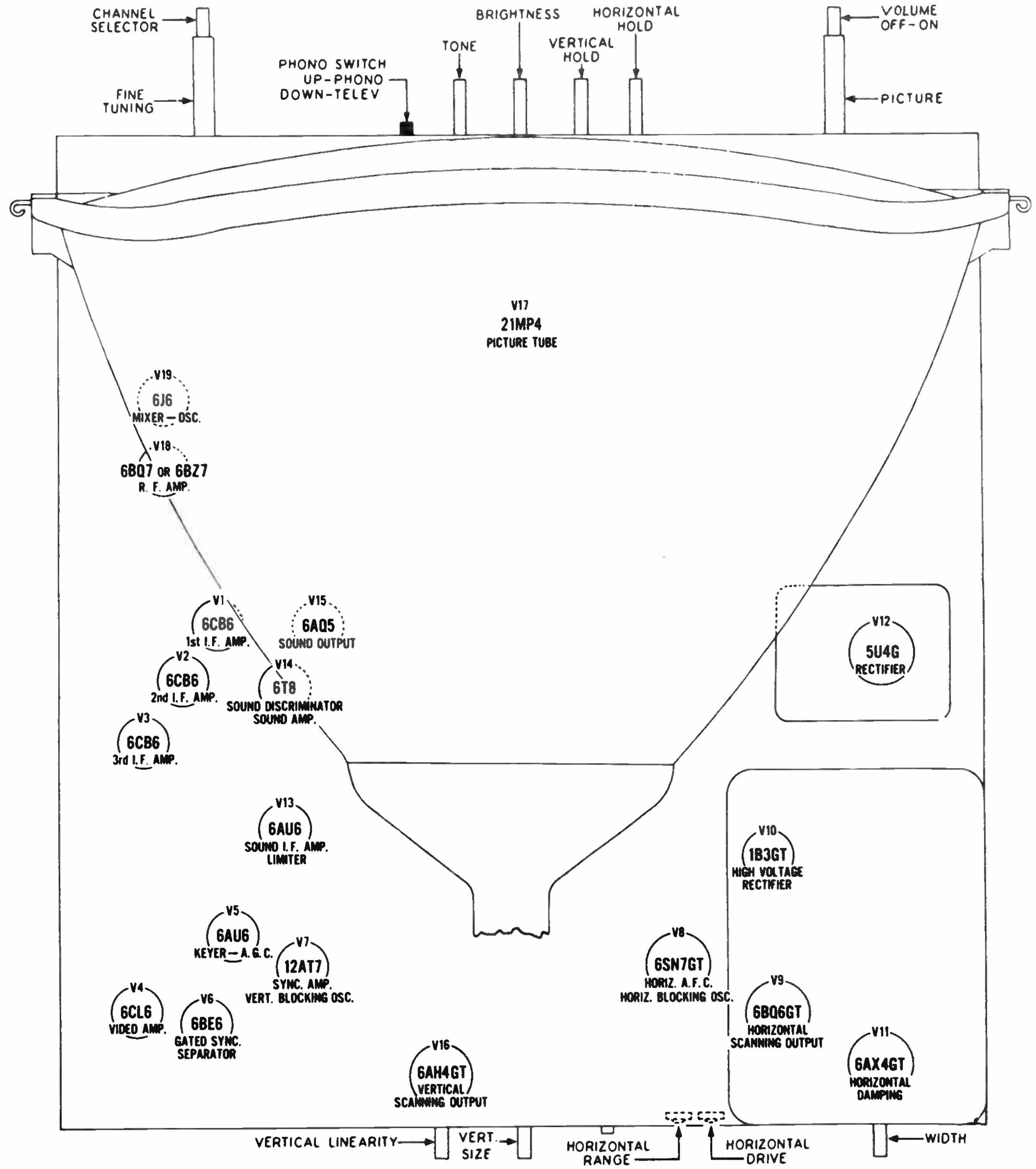


SUBJECT	PRECAUTIONS
CHANNEL COILS AND SLUGS	Channel Coils must be handled with care. **Do not disturb coil windings.** If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.
FINE TUNING CONTROL	Rubbing of the bakelite Fine Tuning Cam against the Fine Tuning Condenser Plate is intentional in order to avoid vibration with resulting microphonics. However, the Fine Tuning Cam should **not** rub or contact the small circular plate located on the body of the tuner.

REMOVAL AND REPLACEMENT OF PARTS

ITEM	PROCEDURE
RF TUNER UNIT	To remove the Tuner Unit from receiver chassis, proceed as follows: 1. Remove channel selector dial lamp socket. 2. Remove front and rear tuner mounting screws. 3. Disconnect the leads from the tuner to the main chassis. See illustration on circuit diagram page showing tuner connections. 4. Tuner unit may now be withdrawn from underside of chassis.
CHANNELS COILS	It is not necessary to remove entire tuner unit to replace a snap-in channel coil but removal of bottom shield will be required. This may be accomplished by grasping the front end of the shield and pulling downward and unhooking it from rear of tuner frame. Insert a screwdriver blade between Coil Retainer Spring and the end of the Tuner Turret. Twist the blade to pull spring away from the molded body of Channel Coil. Lift this end of coil body upward and remove individual coil assembly from tuner. When replacing Channel Coils, be sure they are reinstalled in their correct positions. Coil numbers should increase consecutively in a counter-clockwise direction when tuner is viewed from the front. If all the Channel Coils have been removed from the Tuner Turret, rotate turret until flat surface on end of tuner shaft points down. Install #3 Channel Coils into bottom position on turret. Then follow the correct sequence indicated above to replace other coils.
TUNER TURRET ASSEMBLY	To remove turret from RF Tuner Unit, remove complete tuner and bottom shield as described in previous sections and proceed as follows: 1. Remove rear Turret Shaft Retaining Spring by disengaging straight end of spring from projection on tuner frame. 2. Remove Fine Tuning Condenser Plate from front of Tuner Unit. This plate forms one side of Fine Tuning control condenser and is held in place by one screw. 3. Slide Fine Tuning Cam and Shaft off of main Channel Selector Shaft. 4. Remove Spring Contactor Washer and Fiber Spacer Washer from Channel Selector Shaft. 5. Remove Shaft Retaining Spring at front of tuner by disengaging straight end of spring from projection on frame. 6. Remove turret assembly from frame. To replace turret, reverse the above procedure. Tooth on bakelite Fine Tuning Cam should point downward during assembly so that it does not become locked between the stops on the Fine Tuning Condenser Plate. Also be sure to replace bottom shield.
STATOR CONTACT ASSEMBLY	To remove this assembly, remove complete tuner as described in previous sections and proceed as follows: 1. Remove side shield by taking out the two retaining screws and unsolder shield at one point. Now, disengage shield from upper edge of tuner frame. 2. Remove the two screws at the front and rear of the Stator Contact Assembly. 3. Unsolder all electrical connections to contact plate. 4. Unsolder five soldered joints between Stator Contact Assembly and Tuner Unit. 5. Contact Assembly may now be withdrawn from frame. To reinstall this assembly: 1. Place Stator Contact Assembly in position and replace, but do not tighten, the two screws at the front and rear of the assembly. 2. Remove 3 consecutive pairs of Channel Coils from the turret (for example, the antenna and rf-osc. coils for channels #5, 6 and 7). 3. Position Tuner Turret so that the edges of the next highest Channel Coils (in this case, the coils for channel #8) just pass the row of 11 contacts on the Stator Contact Assembly. 4. Adjust position of the Stator Contact Assembly so that there are a few thousandths of an inch spacing between the contacts on the contact plate and the molded body of the Channel Coils. 5. The Contact Assembly is now correctly positioned and screws at front and rear may be tightened. 6. Solder Stator Contact Assembly to tuner frame at same points that were used previously. 7. Make all electrical connections to contact plate. 8. Replace Channel Coils. 9. Replace side shield.

TUBE AND CONTROL LOCATIONS



SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		CONTROLS	
46-A,B,C	W521288	Picture and Volume potentiometers (includes ON-OFF switch)	
		A—Picture (300 Ohms ½ watt)	
		B—On-Off Switch	2.50
		C—Volume (1 Meg. ¼ watt)	
66-A,B	W520563	Switch, "PHONO-TELEV."	.55
67	W509893	Brightness potentiometer (100,000 Ohms ¼ watt)	1.00
108-A,B	W520991	Horizontal Range and Horizontal Drive trimmer condenser assembly	
		A—Horizontal Range (10-160 Mmfd.)	.90
		B—Horizontal Drive (10-160 Mmfd.)	
123	W521059	Horizontal Hold potentiometer (50,000 Ohms ¼ watt)	2.00
148	W520996	Width potentiometer (400 Ohms ±10% 4 w.)	1.50
176	W520651	Tone potentiometer (500,000 Ohms ¼ watt)	.85
187	W521058	Vertical Hold Potentiometer (1 Meg. ¼ w.)	1.00
189	W520944	Vertical Size potentiometer (2.5 Meg. ¼ w.)	.80
196	W520945	Vertical Linearity potentiometer (5000 Ohms ½ watt)	.90
417	*	Fine Tuning condenser (3.5 Mmfd.)	—
		OTHER ELECTRICAL PARTS	
39	W509386	Crystal detector	2.00
69	W521183	Ion trap	1.00
72	W521267	Centering magnets (included with back cover of yoke)	1.10
75	W520988	Fuse; 5 amp. 250 volt	.15
78	W118921	Channel lite (Mazda #47) 6-8V. 150 Ma.	.15
149	W508713	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt	.20
181	W506464	Speaker—P.M. Dynamic (10")	11.30
183-A to G	W508062	Integrator coupling unit	
		A—Condenser—ceramic .01 Mfd. 450 v.	
		B—Resistor—carbon 22,000 Ohms ⅕ w.	
		C—Condenser—ceramic 2000 Mmfd. 450 v.	
		D—Resistor—carbon 8200 Ohms ⅕ w.	1.40
		E—Condenser—ceramic 5000 Mmfd. 450 v.	
		F—Resistor—carbon 8200 Ohms ⅕ w.	
		G—Condenser—ceramic 5000 Mmfd. 450 v.	
400	W509695	Built-in antenna	1.00

MECHANICAL PARTS OF R.F. TUNER

(for electrical parts see preceding classified listings of condensers, resistars and coils)

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
	W521287	R.F. Tuner complete with coils and tubes	37.50
	W507339	Clip for mounting video converter plate coil	.10
	W521308	Fine Tuningc cam and shaft	.70
	W508708	Roller—detent	.10
	W520535	Shield, bottom cover	.50
	W520536	Shield, side cover	.35
	W520354	Shield—tube; miniature for 6J6 tube	.15
	W520519	Shield—tube; miniature for 6BQ7 or 6BZ7 tube	.20
	W509062	Slug core for converter plate coil	.12
	W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05
	W507987	Socket—miniature for 6J6 tube (includes base for maunting shield)	.45
	W520521	Socket—miniature (9 pin) far 6BQ7 or 6BZ7 tube (includes base for mounting shield)	.50
	W507966	Spring—contactor washer (on front turret shaft)	.08
	W508709	Spring—detent	.08
	W507990	Spring—retains osc. fine tuning slug	.10
	W507967	Spring—turret shaft retaining	.03
	W520517	Stator contact assembly (includes 11 contacts and metal frame)	3.75
	W521309	Tuner turret and shaft assembly (less coils)	4.00
	W507965	Washer, fiber spacer (on turret shaft)	01

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		MISCELLANEOUS PARTS	
	W520983	Base for mounting tube shield (7 pin)	.05
	W521120	Base for mounting tube shield (9 pin)	.10
	W509673	Bracket, mounts yoke	.20
	W520950	Bracket, bridge, supports rear of picture tube	2.40
	W520952	Bracket; mounts rubber ring and supports flared neck of picture tube	1.00
	W520953	Bracket for mounting picture tube (front right hand)	.75
	W520954	Bracket for mounting picture tube (front left hand)	.75
	W521122	H.V. connector with insulated lead	1.00
	W521123	H.V. cannector with braided lead	.60
	W521183	Ion trap	1.00
	W521054	Clamp, (plostic) for antenna lead	.15
	W521267	Centering magnet (included with back cover of yoke)	1.10
	W508149	Clip for mounting antenna terminal strip	.02
	W505101	Clip for mounting sound take-off transformer	.05
	W507592	Clip for mounting 1st video I.F., 2nd video I.F. or 3rd video I.F. coil	.04
	W507339	Clip—for mounting trap coil	.10
	W521065	Clip—retoins horizontal output transformer	.05
	W521184	Connector for filament lead of 1B3GT tube (includes cap and lead)	.65
	W520989	Fuse holder	.60
	W521382	Plug (5 pin) for interconnection of chassis	.15
	W520313	Ring, insulating; for mounting picture tube	3.50
	W115327	Rod, anchor; lower (insulated)	.25
	W520971	Rod, picture tube retaining	.60
	W520966	Rubber ring; supports flared neck of picture tube	.60
	W18807	Screw—#14 x 1"; mounts chassis	.02
	W115284	Shield—H.V. compartment	1.30
	W162324	Shield for TV channel lite	.20
	W162353	Shield for 3rd I.F. coil and crystal detector	.30
	W521052	Shield for 1B3GT socket	.40
	W520982	Shield—tube (7 pin)	.10
	W521121	Shield—tube (9 pin)	.18
	W507357	Slug core for 1st, 2nd or 3rd video I.F. coil or trap coil	.20
	W521064	Slug core for syncroguide transformer	.20
	W521304	Socket and mounting bracket for TV channel lite	.50
	W115267	Socket—male, power cord interlock (includes mounting bracket)	.60
	W160039	Socket (1 pin) for phono. pick-up cable	.12
	W521383	Socket (5 pin) for interconnection of chassis	.15
	W507364	Socket—tube (7 pin)	.24
	W506220	Socket—tube (octal)	.18
	W521053	Socket—(octal) for 1B3GT tube	.30
	W508044	Socket—tube (9 pin)	.35
	W520978	Socket and cable assembly for picture tube	.90
	W115326	Strap, anchor; upper (insulated)	.95
	W521063	Strip, retains H.V. lead	.10
	W520981	Support for tuner shaft (plastic)	.03
	W520754-A	Tab, U.H.F.	.15
	W520993	Terminal strip for TV antenna connections	.25
	W521095	Terminal strip for deflection yoke connections (fits on vertical output transformer)	.25
	W170741	Wing screw #8-32; far maunting or forward adj. of yoke	.10

VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception — Power Booster control completely counterclockwise.

Voltages marked with an asterisk (*) will vary widely with control settings.

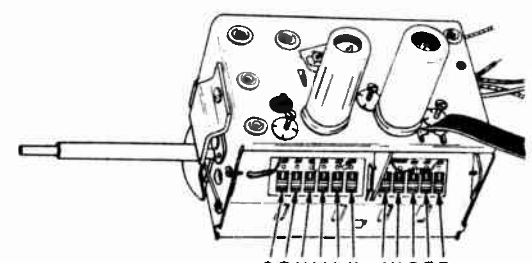
R.F. tuner voltages were measured with tubes removed from sockets.

No voltage reading at a tube element indicates zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.

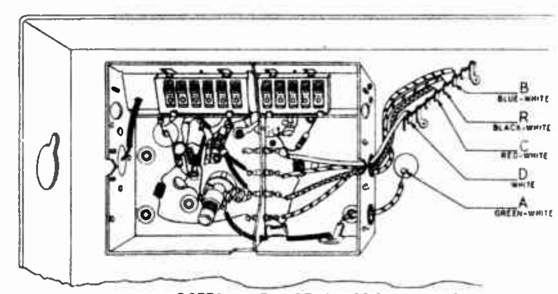
OSCILLOGRAMS

All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Power Booster control adjusted to give 55 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within 20% at 2 MC.

Number appearing to the left of oscillogram specifies setting of horizontal sweep frequency control on 'Scope.



W521287 R.F. TUNER UNIT
(SHOWN WITH SIDE SHIELD REMOVED)



BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNIT

Fundamentally, the Sears Model 6950 UHF Converter operates in the same manner as the superheterodyne "front end" and the first I-F stage employed in many makes of VHF television sets. The primary difference is the operation of the Model 6950 on a higher frequency band--- 470 mc. to 890 mc. Allowing for this difference in operating frequency, the converter can be aligned as quickly and effectively as its VHF counterpart.

Alignment of the Model 6950 is a simple procedure since its bandpass is essentially predetermined by the fixed characteristics of original component design, physical layout and associated circuitry. Except as stated otherwise in this bulletin, band-pass is not subject to serious change during alignment adjustment; however, replacement of any component within the R-F or I-F circuits may disturb the band-pass characteristics of the instrument. Accordingly, whenever parts within these circuits are replaced, electrical and physical specifications of the original components must be duplicated as closely as possible. Wires, parts and other accessories must be replaced in their former positions.

Complicated or specially-designed test equipment is not required for practical alignment of the Model 6950. Instruments used in most TV service shops for testing VHF sets usually are satisfactory for aligning the converter. In addition to these tools, the following instruments are needed: a VHF signal generator with AM output and a sweep modulation of at least 12 megacycles; an oscilloscope or vacuum tube volt-ohmmeter for measurement of the relative signal; and an operating VHF television set. The latter is suggested as a practical amplifier for raising the output signal of the Converter to a level which permits convenient observation.

Before attempting to align the Model 6950, acceptability of the resistance and voltage values, which are found at each tube socket, should be determined by comparison with typical values listed below. The 6AF4 oscillator voltages, in particular, should be examined carefully. When tuning from one end of the dial to the other, plate and grid voltages should remain within the limits prescribed. Separate charts have been prepared for early and late 1952 models.

ALIGNMENT

The Sears UHF Converter to be tested should be connected to the VHF television set in the usual manner. The oscilloscope or VTVM should then be connected to the TV set at a point which permits satisfactory observation of the relative intensity and character of the AM (or sweep-modulated) signal introduced into the converter. The procedure for alignment consists of the following steps in the suggested sequence shown: (1) alignment of the I-F stage; (2) positioning of the oscillator for proper band coverage; and (3) alignment of R-F circuits for maximum effectiveness.

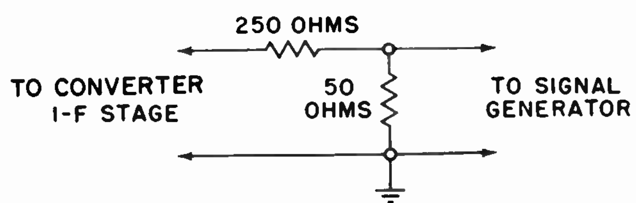


Figure 1

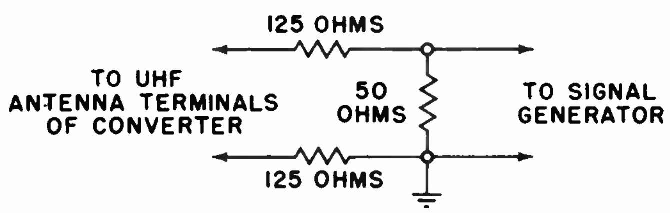


Figure 2

I-F ALIGNMENT

Chassis 725.101

1. Connect the VHF signal generator, through a suitable resistor-matching network (Fig. 1), to the crystal mixer of the Converter at the junction of Items 21, 29, 45 and 51 (Fig. 3). Apply an AM signal centered at 82 megacycles.
2. Align input and output I-F transformers (Items 5 and 6, Fig. 3) to obtain the maximum signal. Location of I-F alignment points is shown in Figures 5 and 6.
3. Replace AM signal with a sweep of at least 12 megacycles centered at 82 megacycles.
4. Readjust slugs of double-tuned, I-F output transformer (Item 6, Fig. 3) for equal signal response at VHF channels 5 and 6. The I-F amplifier must be aligned for a minimum 12-megacycle band-width, and the maximum gain possible with this band-width.

Chassis 725.101-1

1. Connect the VHF signal generator, through a suitable resistor-matching network (Fig. 1), to the crystal mixer of the Converter at the junction of Items 13, 14, 37 and 68 (Fig. 4). Apply an AM signal centered at 82 megacycles.
2. Align input and output I-F transformers (Items 5 and 6, Fig. 4) to obtain the maximum signal. Location of I-F alignment points is shown in Figures 7 and 8.
3. Replace AM signal with a sweep of at least 12 megacycles centered at 82 megacycles.
4. Readjust slugs of double-tuned, I-F output transformer (Item 6, Fig. 4) for equal signal response at VHF channels 5 or 6. The I-F amplifier must be aligned for a minimum 12-megacycle band-width, and the maximum gain possible with this band-width.

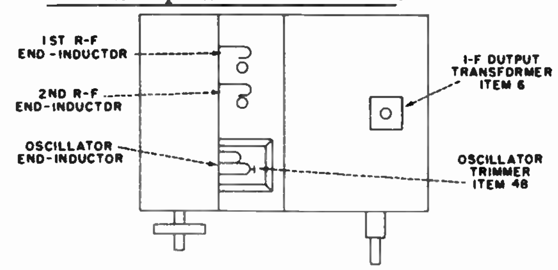
OSCILLATOR ADJUSTMENT

Chassis 725.101

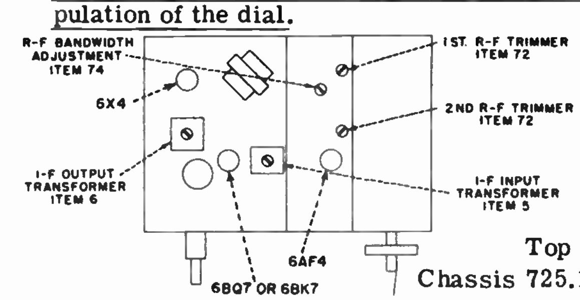
1. Adjust tuning control so that indicating pointer is positioned at extreme left-hand edge of dial.
2. Feed a 465-megacycle AM signal into converter antenna terminals through a matching network described in Figure 2. Adjust oscillator trimmer (Item 48, Fig. 5) for maximum signal. (Use non-metallic alignment tool). When using a VHF signal generator, a fundamental of 93 megacycles may be employed to produce the 5th harmonic energy of 465 megacycles.
3. Adjust the Converter tuning control so that indicator is positioned at extreme right-hand edge of dial.
4. Set signal generator for 900-megacycle output (5th harmonic of 180 megacycles). Carefully spread or pinch together the legs of the oscillator end-inductor (Fig. 5) for maximum signal.
5. Repeat above steps until no further improvement in signal is apparent. The oscillator alignment figures of 465 and 900 megacycles are approximate only, and may not fall precisely at the maximum and minimum dial settings; however, in every case, the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the dial.

Chassis 725.101-1

1. Adjust tuning control so that indicating point is positioned at extreme left-hand edge of dial.
2. Feed a 465-megacycle AM signal into the converter antenna terminals through a matching network (described in Fig. 2). Adjust oscillator trimmer (Item 21, Fig. 6) for maximum signal. When using a VHF signal generator, a fundamental of 93 megacycles may be employed to produce the 5th harmonic energy of 465 megacycles.
3. Adjust the Converter tuning control so that indicator is positioned at extreme right-hand edge of dial.
4. Set signal generator for 900-megacycle output (5th harmonic of 180 megacycles). Carefully spread or pinch together the legs of the oscillator end-inductor (Fig. 6) for maximum signal.
5. Repeat above steps until no further improvement in signal is apparent. The oscillator alignment figures of 465 and 900 megacycles are approximate only, and may not fall precisely at the maximum and minimum dial settings; in every case, however, the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the dial.



Bottom View



Top View
Chassis 725.101

R-F ALIGNMENT

Chassis 725.101

1. Adjust tuning control so that indicator is positioned at extreme left-hand edge of dial.
2. Feed a 465-megacycle signal into the Converter antenna terminals (as indicated above for oscillator alignment).
3. Adjust R-F trimmers (Item 72, Fig. 5) for maximum signal. Physical location of R-F alignment points is shown in Figures 5 and 6.
4. Readjust tuning control so that indicator rests at extreme right-hand edge of dial.
5. Set signal generator for 900 megacycles output.
6. Adjust end-inductors (Fig. 5) for maximum signal.
7. Repeat above steps until no further improvement in signal is apparent.
8. Readjust tuning control so that indicator is positioned at extreme left-hand edge of dial.
9. Adjust coupling trimmer (Item 74, Fig. 6) for maximum signal.

Chassis 725.101-1

1. Adjust tuning control so that indicator is positioned at extreme left-hand edge of dial.
2. Feed a 465-megacycle signal into the Converter antenna terminals (as indicated above for oscillator alignment).
3. Adjust R-F trimmers (Item 5, Fig. 8) for maximum signal. Physical location of R-F alignment points is shown in Figures 7 and 8.
4. Readjust tuning control so that indicator rests at extreme right-hand edge of dial.
5. Set signal generator for 900-megacycle output.
6. Adjust end-inductors (Fig. 7) for maximum signal.
7. Repeat above steps until no further improvement in signal is apparent.

VOLTAGE MEASUREMENTS

Note: -- Voltage measurements, made by means of an electronic voltmeter (VTVM), should be taken between tube socket terminals and the chassis. Measurements within 20 per cent of the specified value usually will assure satisfactory performance of the Converter.

Chassis 725.101

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6X4	Rect.	170VAC	NC	0	6.3VAC	NC	170VAC	190VDC	---	---
6BK7 or 6BQ7	I-F AMP	120VDC	0	.85VDC	6.3VAC	0	125VDC	0	1 VDC	0
6AF4	OSC.	85VDC*	5.7VDC*	0	6.3VAC	0	5.7VDC*	85VDC*	---	---

Chassis 725.101-1

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6CB6	I-F AMP	0	1.3VDC	6.3VAC	0	98VDC	98VDC	1.3VDC	---	---
6AF4	OSC.	85VDC*	5.7VDC*	0	6.3VAC	0	5.7VDC*	85VDC*	---	---

Selenium Rectifier "K" Terminal 125VDC

*Measurement made with 15K isolating resistor in series with voltmeter probe.

RESISTANCE MEASUREMENTS

Note: -- Resistance measurements, made by means of an electronic ohmmeter (VTVM), should be taken between tube socket terminals and the chassis. Measurements within 20 per cent of the specified value usually will assure satisfactory performance of the Converter. When taking these measurements, the Converter switch must be turned to the "UHF" position and the line cord detached from the house circuit.

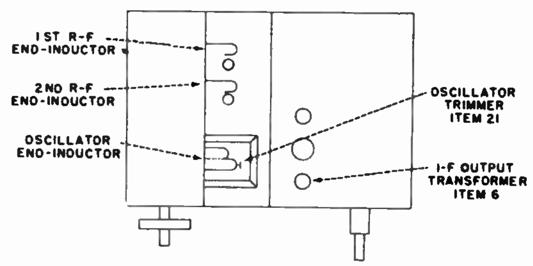
Chassis 725.101

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6X4	Rect.	130	NC	0	.3	NC	130	50K or More	---	---
6BK7 or 6BQ7	I-F AMP	50K or More	0	56	.3	0	50K or More	0	56	0
6AF4	OSC.	50K or More	12K	0	.3	0	12K	50K or More	---	---

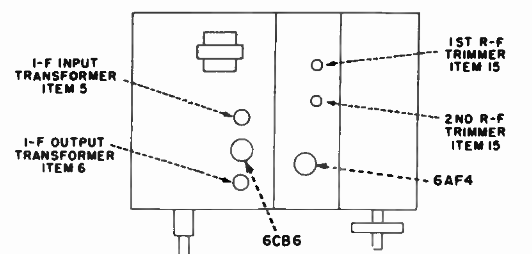
Chassis 725.101-1

TUBE	USE	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
6CB6	I-F AMP	0	150	0.6	0	50K or More	50K or More	150	---	---
6AF4	OSC.	50K or More	12K	0	0.3	0	12K	50K or More	---	---

Selenium Rectifier "K" Terminal to Chassis 50K or More.



Bottom View
Chassis 725.101-1



Top View
Chassis 725.101-1

HOW TO ORDER PARTS

1. Use the Correct Order Form.
2. On the Purchase Order always give the following information:
   (1) PART NUMBER (number printed on the part if different from that shown in this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).
   (2) The CHASSIS NUMBER, which is 725.101. This number is found on a metal plate (picture on page 1) at the rear of the chassis.
3. ORDERING INSTRUCTIONS:
   Send Purchase Orders DIRECT to SOURCE No. 725. See "DIV. 57 STANDARD NOMENCLATURE INDEX", for source name and address.
4. MARK-UP: Selling prices in the following produce a MARK-UP of AA5 unless otherwise noted.

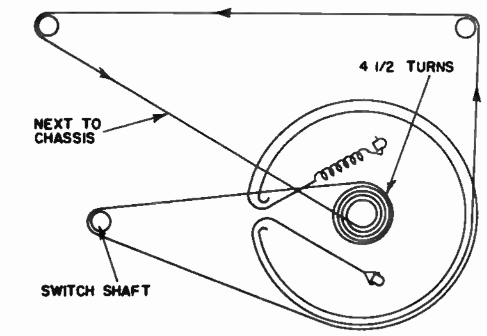
There will be a minimum charge of 50¢ made by the source on each parts order totaling less than 50¢ (cost to Sears). The customer is to be charged only the actual selling price shown in this RL.

ELECTRONIC PARTS LIST FOR UHF CONVERTER (CHASSIS 725.101)

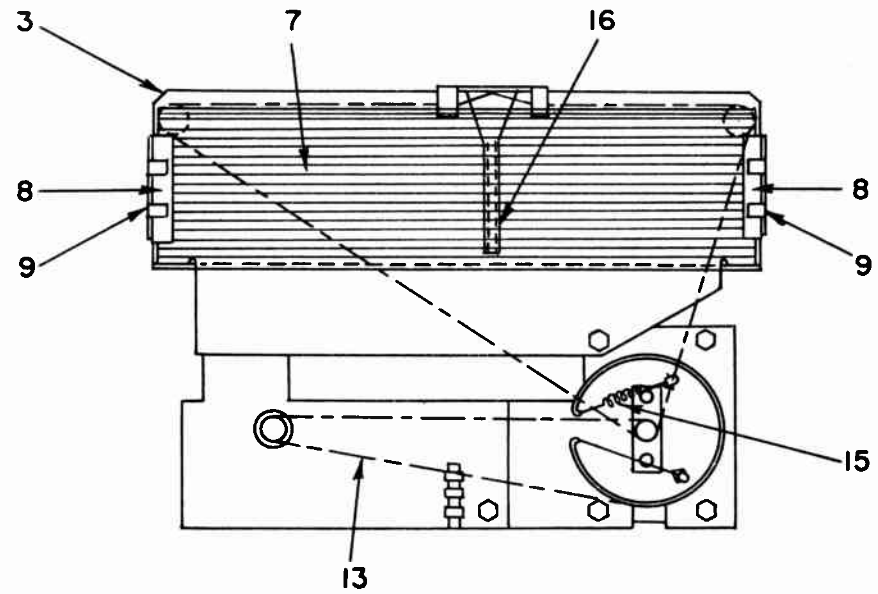
Item No.	Part No.	Description	Selling Price	M.U. Code
25	A-600295-3	Capacitor, Fixed ceramic tubular, 10 uufd	.26	
29	A-600025-13	" " " " .68 uufd, ±10%	.77	
35	FP318.5	" Electrolytic filter, 20-20-20/200-175-150	3.13	AAO
40	A-600281-1	" Fixed ceramic tubular, 68 uufd	.26	
42	A-600027-1	" Fixed ceramic disc, 1000 uufd	.37	
44	A-600025-10	" Fixed ceramic tubular, 2.2 uufd	.51	
45	A-600025-6	" " " " 1.0 uufd	.51	
46	A-600025-15	" " " " 1.2 uufd	.80	
48	A-600282-3	" Trimmer ceramic tubular 3-10 uufd	.74	
72	A-600220-1	" " " " .8-6.5 uufd	.74	
36	A-600111-19	Resistor, Carbon, 56 ohm, ±10%	.40	
38	A-600029-1	" " 470 ohm	.37	
39	A-600116-11	" " 680 ohm	.40	
41	A-600116-12	" " 12k ohm	.37	
47	A-600116-13	" " 3300 ohm, 2 watt	.51	
24	A-600240-1	Choke, neutralizing	.71	
27	A-600240-2	" I-F plate	.74	
50	A-600240-3	" Oscillator	.71	
51	A-600285-1	" "	.77	
53	A-600033-2	" " and RF	.83	
4	B-630052-1	Transformer, power	3.89	A5
5	B-630070-1	" I-F input	3.13	AAO
6	B-630121-1	" I-F output	4.60	AO
9	B-630069-1	Switch, AC and antenna changeover	2.37	
74	A-600219	Nylon adjustment screw	.17	
18		Vacuum tube, oscillator, 6AF4	3.77	A5
19		" " I-F amplifier, 6BK7 or 6BQ7	3.06	AAO
20		" " power rectifier, 6X4	2.05	
21		Crystal, diode, 1N72	2.57	
13	A-600025-13	Capacitor, Fixed ceramic tubular, .68 uufd ±10%	.77	
14	A-600025-10	Capacitor, Fixed ceramic tubular, 2.2 uufd ±10%	.51	
15	A-600220-1	" Trimmer ceramic tubular, .8-6.5 uufd	.74	
16	A-600025-2	" Fixed ceramic tubular, 1.5 uufd ±10%	.51	
18	A-600025-6	" " " " 1.0 uufd ±10%	.51	
21	A-600282-3	" Trimmer ceramic tubular, 3-10 uufd	.74	
22	A-600295-3	" Fixed ceramic tubular, 10 uufd	.26	
23	A-600281-1	" " " " 68 uufd	.26	
24	A-600027-1	" " disc 1000 uufd	.37	
39	FP211	" Electrolytic filter 30-30/150	2.71	
64	A-600025-12	" Fixed ceramic tubular, 0.25 uufd ±10%	.77	
67	A-600389-2	" " " " 0.42 uufd ±10%	.77	
20	A-600116-12	Resistor, Carbon, 12k ohm	.37	
25	A-600111-2	" " 150 ohm	.37	
27	A-600116-14	" " 820 ohm, 1 watt	.51	
33	A-600029-1	" " 470 ohm	.37	
63	A-600029-17	" " 1500 ohm	.37	
12	A-600384-1	Choke	.51	
17	A-600383-1	"	.51	
19	A-600240-3	"	.71	
68	A-600407-1	"	.51	
4	B-630124	Transformer, power	3.15	AAO
5	B-630130-1	" I-F input	.74	
6	B-630131-1	" I-F output	2.42	
9	B-630069-1	Switch, AC and antenna changeover	2.37	
28		Vacuum tube, 6CB6 I-F amplifier	2.28	
29		" " 6AF4 or 6T4, oscillator	3.77	A5
37		Crystal, diode, 1N72	2.57	
48		Rectifier, selenium	2.05	

LIST OF REPLACEMENT PARTS FOR DIAL ASSEMBLY

Item No.	Part No.	Description	Selling Price	M.U. Code
3	B-630067	Riveted Dial Background	3.13	AAO
7	B-630062	Dial Glass	1.14	
8	A-600250	Dial Glass Cushion	.14	
9	A-600216	Dial Glass Clamp	.28	
13	A-600255	Drive Cord	.14	
15	A-600225	Dial Cord Spring	.14	
16	A-630061	Pointer	.86	



PLACEMENT OF DIAL DRIVE CORD

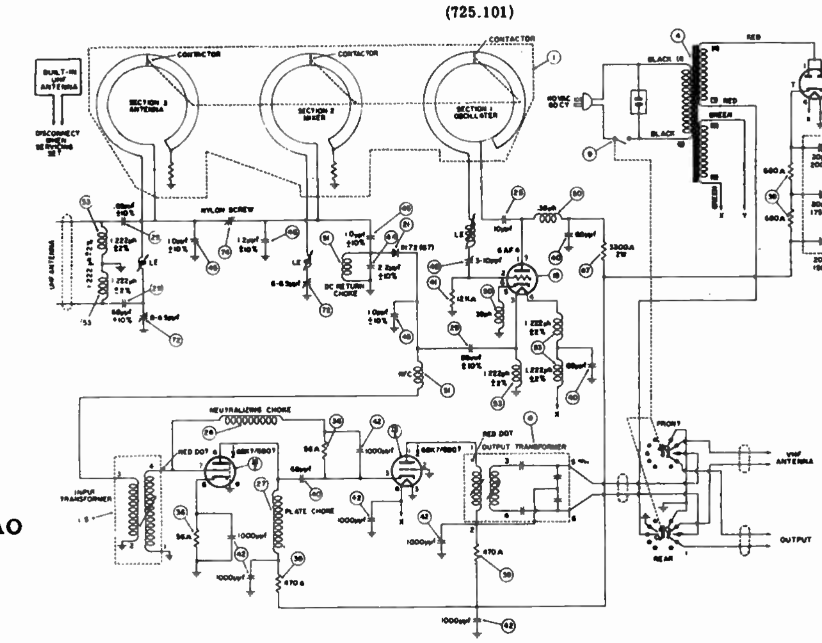


MISCELLANEOUS COMPONENTS

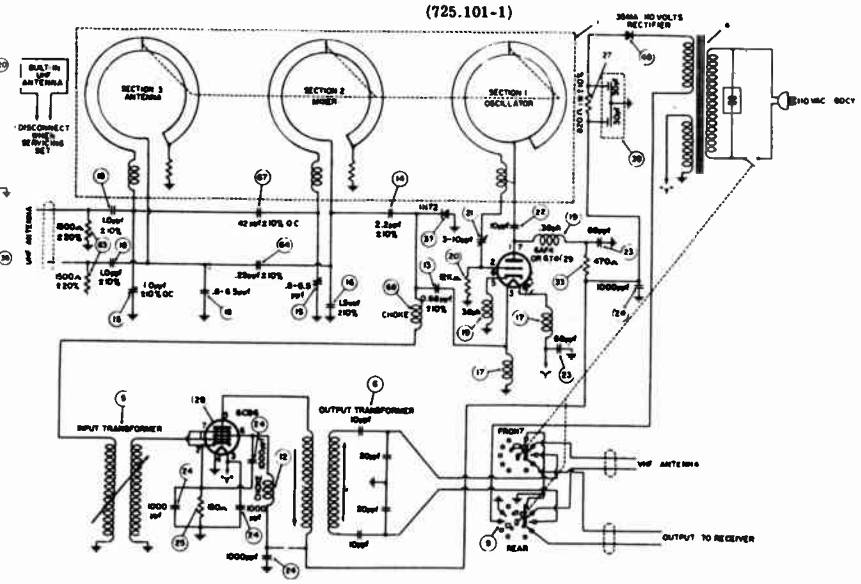
Part No.	Description	Selling Price	M.U. Code
B-630065-1	Mahoghany Plastic Cabinet	5.00	B5
C-646074-1	Knob (Tuning)	1.42	
C-646074-2	Knob (Switching)	1.14	
A-600256-1	Knob Spring	.03	
B-630094-1	Built-in Antenna	.57	

* 1 Knob Spring required for each knob.

CIRCUIT DIAGRAM (725.101)



CIRCUIT DIAGRAM (725.101-1)



NO. 144

SPECIFICATIONS

POWER SUPPLY
105 to 125 Volts — 60 Cycle AC

POWER CONSUMPTION
290 Watts

POWER OUTPUT (AUDIO)
2 Watts (undistorted)

INPUT IMPEDANCE
72 Ohms. or 300 Ohms.

PICTURE SIZE
10⅛" x 13¾"

PICTURE TUBE
16" Rectangular

585

SPEAKER
4"x 6"Oval P.M.–Voice Coil–3 Ohms.

VERTICAL SCANNING FREQ.
60 cycles per second

HORIZONTAL SCANNING FREQ.
15,750 cycles per second

GENERAL DESCRIPTION

This Silvertone console receiver consists of a combination television, standard broadcast and frequency modulation broadcast receiver and a record changer. A BUILT-IN-ANTENNA system permits reception of local television, FM or AM broadcasting facilities directly without external antenna equipment. Where required, external antennas may be readily connected to the receiver.

Features of the television receiver include full twelve channel coverage, an intercarrier sound system, automatic frequency control horizontal hold, and stabilized vertical hold.

The high sensitivity AM-FM broadcast receiver is also used to furnish the audio power for the television sound output.

The record changer will automatically play standard 78 RPM, fine-groove 45 RPM and long-play 33-1/3 RPM records of standard commercial dimensions.

FREQUENCY RANGE

Radio —
Standard Broadcast (A.M.) — 535-1600 K.C.
Frequency Modulation (F.M.) — 88-108 M.C.

Television —
Channels 2 through 13.
For channel frequencies, see table

TUBE COMPLEMENT

Television Chassis

1.	6J6	V 16	RF Amplifier
2.	6AG5	V 17	Mixer
3.	6J6	V 18	R.F. Oscillator
4.	6CB6	V 1	1st Video I.F. Amplifier
5.	6CB6	V 2	2nd Video I.F. Amplifier
6.	6CB6	V 3	3rd Video I.F. Amplifier
7.	6AL5	V 4A	Video Detector
		V 4B	A.G.C. Detector
8.	12AU7	V 5	1st & 2nd Video Amplifier
9.	6AU6	V 14	4.5 M.C. Amplifier
10.	6AL5	V 15	Ratio Detector
11.	6SN7 or 7N7	V 7	Sync Separator
12.	6SR7 or 6BF6	V 6A	Sync Limiter
		V 6B	Vertical Sweep Oscillator
13.	6S4	V 8	Vertical Sweep Amplifier
14.	6SN7 or 7N7	V 9	Horizontal Sweep Oscillator Sync Guide
15.	6BG6	V 10	Horizontal Sweep Output
16.	6W4	V 12	Damper
17.	1B3	V 11	High Voltage Rectifier
18.	5U4	V 13	Power Rectifier
19.	16TP4 or 16RP or 16XP4	V 19	Picture Tube

A.M.-F.M. Radio Chassis

1.	6BJ6	V 20	R.F. Amplifier (F.M.)
2.	12AT7	V 21	Mixer and Oscillator (F.M.)
3.	6BE6	V 25	Mixer and Oscillator (A.M.)
4.	6BJ6	V 22	1st I.F. Amplifier (A.M.-F.M.)
5.	6BA6	V 23	2nd I.F. Amplifier (F.M.)
6.	6T8	V 24	Detector, A.V.C. and 1st Audio Amplifier
7.	6AS5	V 27	Audio Output
8.	6X4	V 26	Power Rectifier

OUTDOOR TELEVISION ANTENNA INSTALLATION

(Note: Disconnect Built-in-Antenna)

CONNECT
72 OHM COAXIAL LEAD-IN
TO TERMINALS 1-2
(CENTER LEAD TO TERMINAL 1)
AS SHOWN ABOVE.
LINK MUST BE CLOSED.

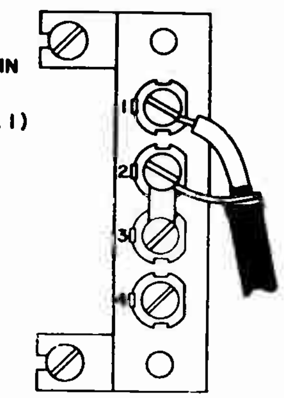
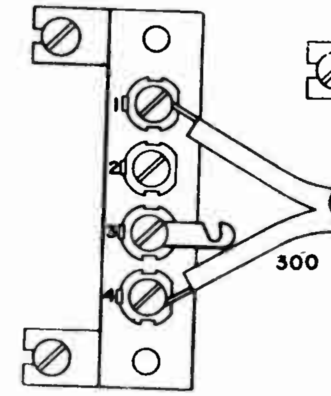


FIG. 3A



CONNECT
300 OHM FLAT TWIN LEAD-IN
TO TERMINALS 1-4
AS SHOWN ABOVE.
LINK MUST BE OPEN.

FIG. 3B

TELEVISION ALIGNMENT PROCEDURE

The alignment of this Receiver can be broken down into three basic parts.

1 — Video IF Alignment
2 — RF Alignment
3 — Sound Alignment

TEST EQUIPMENT

CATHODE RAY OSCILLOSCOPE — The tube size is relatively unimportant, however, anything under 5" usually makes fine adjustment quite difficult.

SWEEP GENERATOR—The sweep generator used should have linear coverage of a center range from 30 to 220 megacycles. The output should be fairly flat over wide frequency variation of the sweep. It should be capable of an output of about 0.1 volt with attenuation. It is preferable that the generator have a deflection output for the test oscilloscope.

TELEVISION RECEIVER REAR CHASSIS CONTROLS

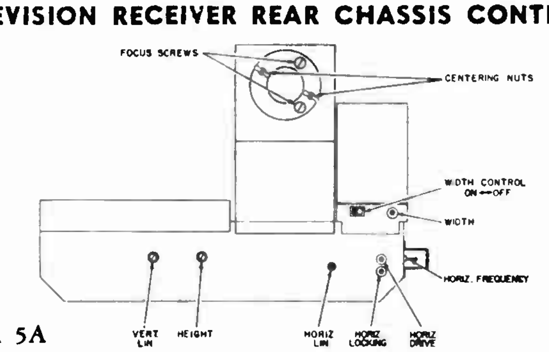


FIG. 5A

AM SIGNAL GENERATOR — This generator should have a frequency range of from 4.5 to 220 megacycles. As this generator is used occasionally as a marker generator, accuracy is an important factor. It should be capable of 0.1 volt output with attenuation and should be linear through the range.

VACUUM TUBE VOLTMETER — Any standard make VTVM will do. It should preferably have a reversible polarity switch.

WAVE TRAP — 32.8 M.C.

TEST SOCKET

In this model a Test Socket is provided which gives convenient access to the various points where either a vacuum tube voltmeter or an oscilloscope must be inserted for proper alignment. A letter diagram in the margin of the schematic will locate these points by means of corresponding letters in the schematic proper. A typical Octal socket is used and it should be noted that the diagram shows a TOP VIEW. Two ground points are supplied on separate pins of the test socket for easy metering. Reference is made, in the following Alignment Procedures, to the pins on this Test Socket.

R.F. OSCILLATOR ALIGNMENT

To align the R.F. oscillator it is first necessary to connect a working antenna to the set. Turn the selector switch to the channel to be aligned. With the fine tuning control set at the center of its range, adjust the correct brass slug (see Fig. 8) until the best picture is obtained. Adjusting channel 2 will affect all other channel adjustments, therefore, channel 2 should not be disturbed after aligning channels 3 to 13.

VIDEO IF ALIGNMENT

An adequate signal can be fed through the video IF string by feeding the output of the signal generator into a tube shield placed over the mixer tube (6AG5) (V-17). Care should be taken that this shield is NOT grounded. The ground side of the Generator output can be conveniently grounded to the shield of the adjacent oscillator tube.

The vacuum tube voltmeter should be connected across the 8200 ohm detector load resistor (Pin B Test Socket) and should be set on the minus 3 Volt scale. Set channel selector to an unused low band channel.

The Signal generator should be set to a frequency of 36.9 MC. The output of the generator should be adjusted to the point where the reading on the VTVM is between minus 1 to minus 1.5 volts.

The First and Third I.F. coils should be peaked for a maximum reading on the VTVM. As the voltage reading increases with tuning, the generator should be attenuated to maintain a maximum of minus 1.5 volts.

Set the Signal Generator to a Frequency of 34.8 MC and tune the Second and Fourth I.F. coils in the same manner as above:

The Generator should now be shut off (or tuned to different band) and the VTVM should read no more than minus .5 volt. If there is a higher voltage reading, check for regeneration in the I.F. stages.

To look at the actual response curve of the I.F. Amplifier connect the Sweep Generator and the A.M. Signal Generator to the antenna. Then connect "hot" or "high" side of the Oscilloscope to Pin B of the Test Socket. The "low" or ground side should be connected to the nearest convenient ground point. Care should be taken to separate the Oscilloscope leads from the Generator leads.

The Sweep Generator is set at the approximate mid-frequency of an unused low channel and the Signal Generator is set at the sound carrier frequency of the channel used. The Sweep Generator Amplitude is set so that a VTVM will read — 1.5 volts D.C. at test point B. Loosely couple a wave trap tuned to 32.8 MC into one of the I.F. coils until a small dip is noticed on the trace (see Fig. 9). The fine tuning control on the tuner should now be adjusted to make the Signal Generator marker coincide with the trap valley. The Signal Generator can now be tuned to the R.F. Picture Carrier frequency and the position of the Picture Carrier on the response curve noted. It should be between the 40% and 60% points on the slope of the curve. The band width between 50% points should be approximately 3.2 MC. Slight readjustment of the I.F. transformers may be necessary to obtain the desired response. Small variations from the ideal are acceptable as shown in Fig. 9.

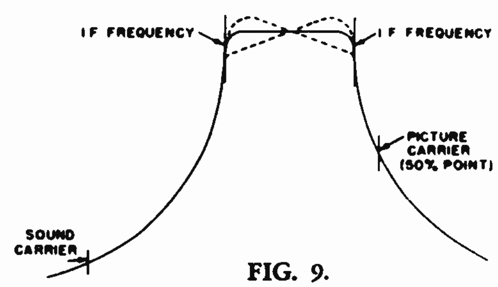


FIG. 9.

SOUND ALIGNMENT

Sound alignment on these receivers is best accomplished by using an actual transmission received on an antenna and fed in the normal manner to the antenna terminals. A Vacuum Tube Voltmeter should first be inserted between the output plate of the Ratio Detector Diode (pin 2 V15) and ground. This point may be reached through pin C of the Test Socket. The meter should be set on the *minus* 10 volt scale. With the equipment so placed the 4.5 MC pick-off coil (T8) and the primary of the Ratio Detector Transformer (bottom adjustment, T9) should be adjusted for a maximum deflection of the meter. The hot lead of the meter should now be moved to the junction point of R71, C60 and C61 (Pin A Test Socket), and the secondary of the Ratio Detector Transformer should be adjusted for a *ZERO* reading. (Note: There are 3 points at which the meter will zero. Only one of these is correct. At the proper setting the meter should swing negative on one side and positive on the other side of zero). In cases where it is necessary to align the sound section when no station transmission is available a single frequency signal generator tuned to 4.5 megacycles may be fed into the output circuit of the Video Detector (Pin B Test Socket). The receiver should then be aligned in the same manner as described above. The disadvantage of this method is that any inaccuracy in your signal generator will show up as misalignment when the set is in actual operation, since proper adjustment is very critical.

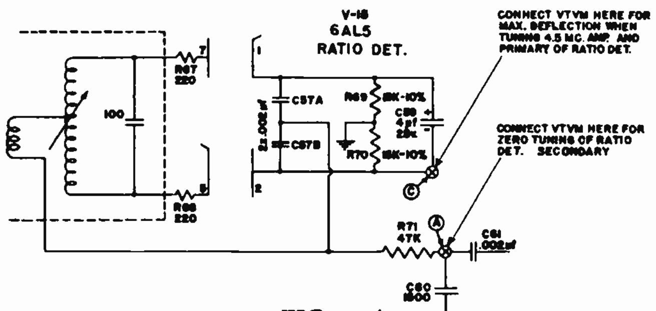


FIG. 10A

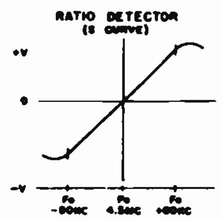
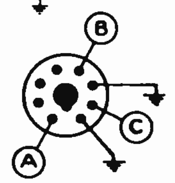


FIG. 10B



TEST SOCKET
(BOTTOM VIEW)
FIG. 10C

PICTURE ADJUSTMENTS

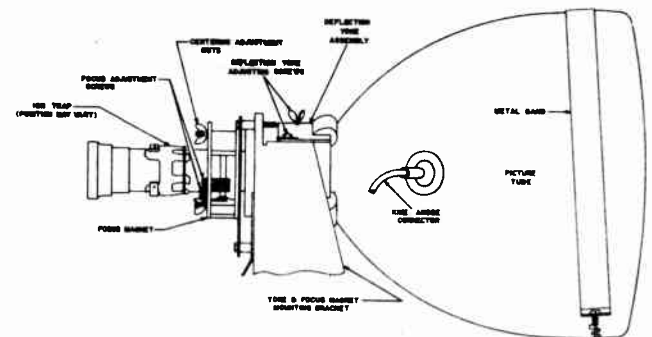


FIG. 11

ION TRAP MAGNET ADJUSTMENT

Position the ion trap so that the arrow points toward the second anode contact.

The ion trap rear magnet poles should be aproximately over the ion trap flags in the picture tube. The ion trap flags are small, rectangular plates in the neck of the picture tube about 1 inch from the black base of the tube. Starting from this position, adjust the magnet by moving it forward or backward until the raster (illuminated area of picture tube within the mask)is observed. Rotate it slightly around the neck of the picture tube for the brightest raster on the screen, and at the same time reduce the brightness control setting until the raster is slightly above average brilliance. Adjust the focus adjustment screws (see Fig. 11) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment screws

NOTE: Be sure the deflection yoke as well as the picture tube mounting is positioned forward as far as possible against the flare of the picture tube.

It will now be necessary to obtain a test pattern picture in order to obtain further adjustments.

FOCUS MAGNET ADJUSTMENT

A permanent magnet type focus control is used in some receivers.The two focus adjustment screws shown in Fig.11 should be adjusted for sharpest focus. It is recommended that a brass screw-driver be used for this operation, otherwise the focus will change slightly when the screw-driver is removed.

Centering is accomplished by loosening the two wing nuts on the back of the focus control and shifting the control both vertically and horizontally in a vertical plane until proper centering is obtained. Rotation of the focus magnet about its axis will result in an optimum position for the removal of any remaining shadows in the corners of the picture. The wing nuts should then be tightened.

The ion trap magnet should now be rechecked for maximum brilliance.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT

Turn the horizontal control (on the front panel) to the extreme counter-clockwise position. The picture should remain in sync. Momentarily remove the signal by switching to another channel and then switching back again. The picture should break horizontal sync and the picture will be resolved into a series of black bars sloping down to the left.

Turn the horizontal control clockwise slowly bringing the picture into sync again. At the extreme clockwise position the picture will again show a tendency to break sync as indicated by anything from a shimmy to 2½ black diagonal bars sloping down to the right.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is adjusted and need not be aligned.

HORIZONTAL OSCILLATOR ALIGNMENT

1. The HORIZONTAL HOLD CONTROL should be set at approximately the center of its mechanical range. The HORIZONTAL LOCKING RANGE and the HORIZONTAL DRIVE trimmers should be set at two full turns counter-clockwise from maximum capacity.

2. Turn the HORIZONTAL DRIVE trimmer clockwise until the bright, vertical bars running through the picture are eliminated. If, in so doing, the picture should fall out of sync it should be brought back by re-adjusting the Horizontal Oscillator Transformer. This is the long screw adjustment which extends through the side of the chassis (see Fig. 12). (SEE NOTE).

3. Rotate the HORIZONTAL HOLD CONTROL (front panel auxiliary control) to the maximum clockwise position. The Horizontal Oscillator Transformer should now be adjusted to a point where the black horizontal blanking bar starts to come into the picture from the left side.

4. The HORIZONTAL HOLD CONTROL should now be rotated to its maximum counter-clockwise position. The picture should stay in sync. However, shorting the antenna terminals or rapidly switching to an unused channel and back should cause the picture to fall out of sync. If this condition does not exist readjust in accordance with step 3 above.

5. When the HORIZONTAL HOLD CONTROL is rotated to maximum clockwise position it is acceptable for the picture to vary in sync from a shimmy to 2½ bars sloping downward to the right. The picture should stay locked, however, through approximately ¾ of the mechanical rotation of the HORIZONTAL HOLD CONTROL.

6. If the HORIZONTAL DRIVE Trimmer must be readjusted at this time for improved width or linearity, steps 3, 4 and 5 should be rechecked.

NOTE: In the above procedure adjustment of the Horizontal Oscillator Transformer is mentioned a number of times. The adjustment referred to is the long screw which extends from the Horizontal Oscillator Transformer (T6) through the chassis and which would be adjusted from the outside of the chassis. There is an adjustment at the other (inside) end of this same coil can. This is the HORIZONTAL PHASE CONTROL adjustment. *IT IS IMPORTANT TO NOTE THAT THIS LATTER ADJUSTMENT SHOULD NOT BE TOUCHED IN THE FIELD.* This is a Factory adjustment and should not be attempted in the service shop. If this circuit is suspected of being defective or mistuned the entire assembly including the .01 mfd. — 600 volt Molded Paper condenser (C-43) should be removed and returned to the factory as a defective part.

HEIGHT, WIDTH AND LINEARITY

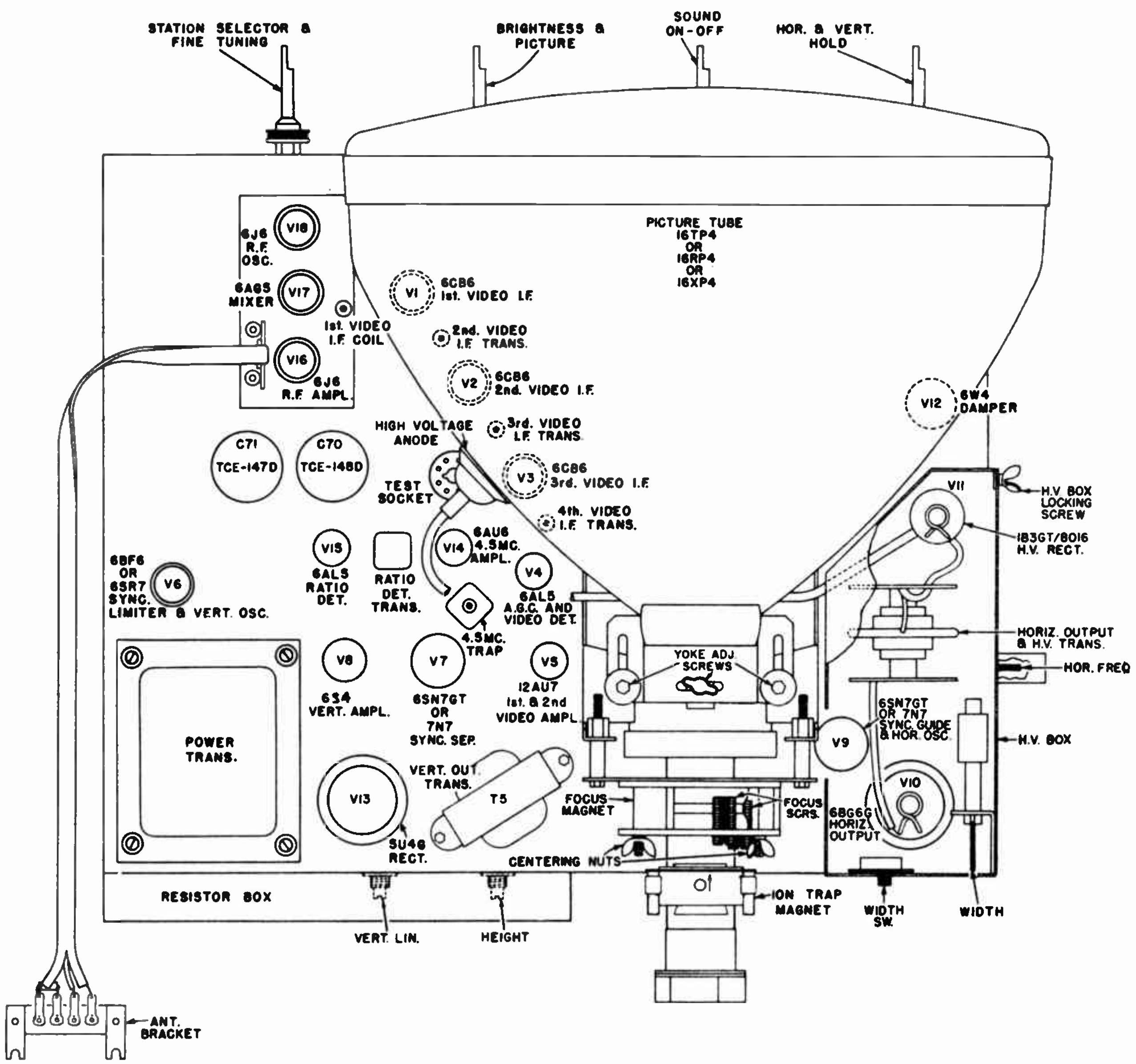
To adjust the overall size and linearity of the picture it is almost mandatory that a pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be accurately made on moving transmissions. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area delineated by the mask.

The first step in linearity and size adjustment is to turn the WIDTH control (rear of chassis) all the way in (clockwise).

The HORIZONTAL DRIVE trimmer should then be adjusted for the best compromise between maximum brightness and good horizontal linearity. This control will affect the left side of the picture primarily. The HORIZONTAL LINEARITY control (rear of chassis) should then be adjusted for linearity of the right side of the picture. If it has been found necessary to adjust the HORIZONTAL DRIVE trimmer, steps 3, 4 and 5 of Horizontal Oscillator Alignment must be repeated.

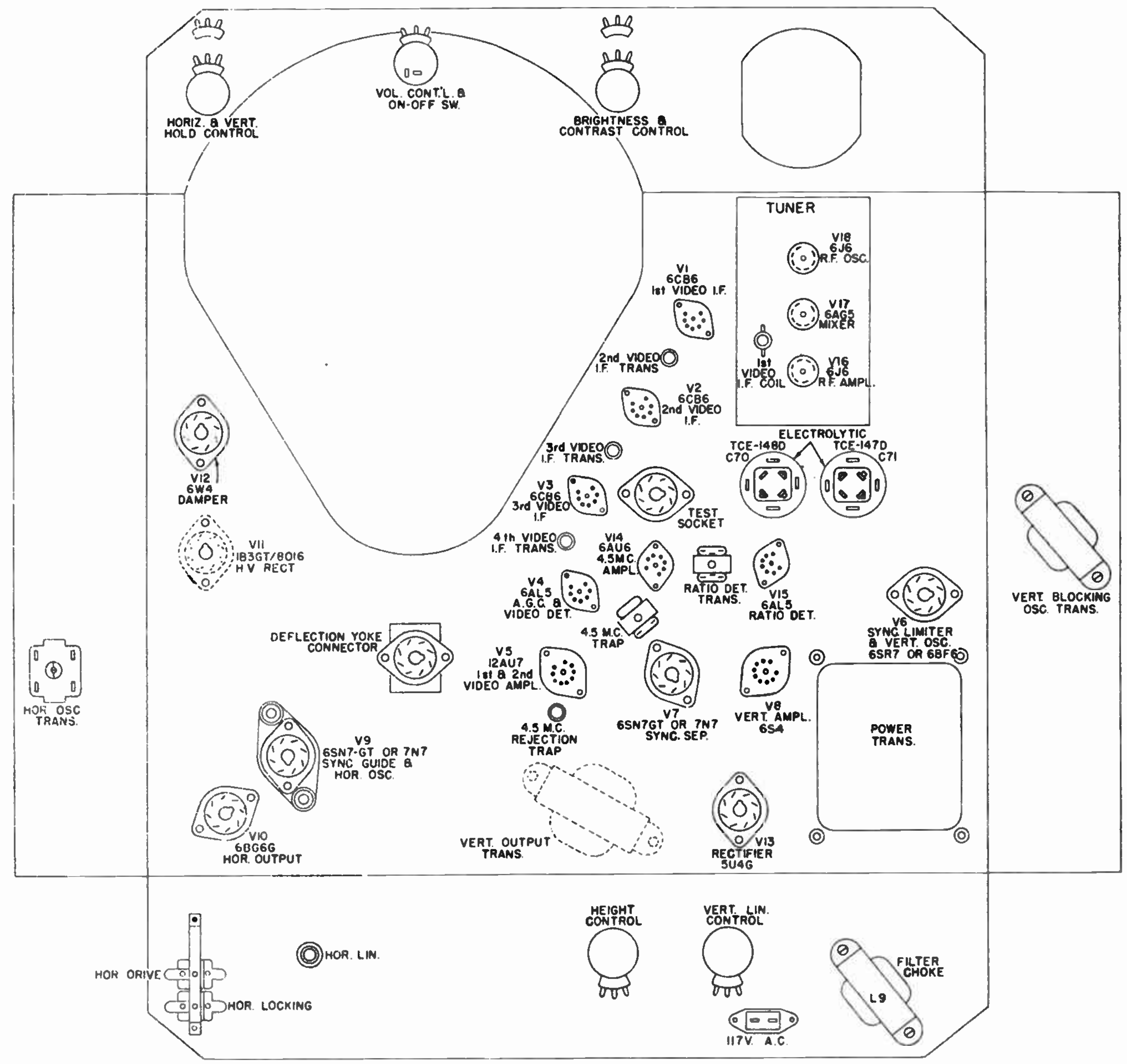
The WIDTH Control should now be readjusted to achieve a picture that will fill the mask horizontally. If necessary the width coil may be entirely removed from the circuit of the WIDTH SWITCH on rear of chassis.

The HEIGHT and VERTICAL LINEARITY controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically. At this point the FOCUS ADJUSTMENT screw previously set, should be retouched for maximum definition of the lines in the vertical wedge of the test pattern. Proper adjustment and alignment of the receiver should result in clear and sharp definition.



PARTS LOCATION - TELEVISION CHASSIS - TOP VIEW

Fig. 12



PARTS LOCATION - TELEVISION CHASSIS - BOTTOM VIEW

Fig. 13

RESISTANCE CHECK CHART
TELEVISION CHASSIS

SCHEMATIC LOCATION	TUBE FUNCTION	TUBE	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V 1	1st Vid. I.F.	6CB6	700K	47	0	Fil.	10K	10K	0		
V 2	2nd Vid. I.F.	6CB6	700K	47	0	Fil.	10K	10K	0		
V 3	3rd Vid. I.F.	6CB6	0	100	0	Fil.	10K	10K	0		
V 4	Vid. Detector & A.G.C.	6AL5	0	120K	Fil.	0	1.1K		3.9K		
V 5	1st & 2nd Vid. Ampl.	12AU7	12K	1 Meg.	5K	Fil.	Fil.	13K	1 Meg.	47	0
V 14	4.5 M.C. Ampl.	6AU6	1.5	0	0	Fil.	10K	10K	180		
V 15	Ratio Detector	6AL5	15K	15K	5.1	Fil.	Inf.	0	Inf.		
V 7	Sync. Separator	6SN7	1.2 Meg.	27K	0	5 Meg.	10K	6.8K	Fil.	0	
		or									
		7N7	Fil.	0	27K	1.2 Meg.	5 Meg.	10K	6.8K	0	
V 6	Sync. Limiter	6BF6	1.8 Meg.	0	0	Fil.	4 Meg.	4 Meg.	1.8 Meg.		
	and	or									
	Vertical Oscillator	6SR7	0	1.8 Meg.	0	4 Meg.	4 Meg.	1.8 Meg.	Fil.	0	
V 8	Vertical Amplifier	6S4		3K		Fil.	0	2.2 Meg.			120K
V 9	Hor. Oscillator	6SN7	1.6 Meg.	60K	450K	500K	100K	800	Fil.	0	
	and	or									
	Sync. Guide	7N7	0	450K	60K	1.6 Meg.	500K	100K	800	Fil.	
V 10	Horizontal Output	6BG6		Fil.	950		1 Meg.		0	16K	
V 12	Damper	6W4			330K		10K		8K	8K	
V 13	Power Rectifier	5U4		10K		850		850		10K	

CONDITIONS:

1. All readings taken with RCA Volt-Ohmist.
2. All controls at "Normal Setting".
3. Switch off-line cord disconnected.
4. All tubes left in sockets.

Note: Filament resistance too low to read.

VOLTAGE CHECK CHART
TELEVISION CHASSIS

SCHEMATIC LOCATION	TUBE FUNCTION	TUBE	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V 1	1st Vid. I.F.	6CB6	-.5	1	0	6.3 A.C.	110	110	0		
V 2	2nd Vid. I.F.	6CB6	-.5	1	0	6.3 A.C.	110	110	0		
V 3	3rd Vid. I.F.	6CB6	0	1.2	0	6.3 A.C.	110	110	0		
V 4	Vid. Detector & A.G.C.	6AL5	0	-.2	6.3 A.C.	0	1.2		-.5		
V 5	1st & 2nd Vid. Ampl.	12AU7	120*	-3.5	3.5*	6.3 A.C.	6.3 A.C.	160	-1*	.8	0
V 14	4.5 M.C. Ampl.	6AU6	0	0	0	6.3 A.C.	110	110	1.2		
V 15	Ratio Detector	6AL5	.4	-.4	1 A.C.	6.3 A.C.	0	0	0		
V 7	Sync. Separator	6SN7	-3.5	0	0	-15*	235	4	6.3 A.C.	0	
		or									
		7N7	6.3 A.C.	0	0	-3.5	-15*	235	4	0	
V 6	Sync. Limiter	6BF6	-25+	0	0	6.3 A.C.	-15*	-15*	100++		
	and	or									
	Vertical Oscillator	6SR7	0	-25+	0	-15*	-15*	100++	6.3 A.C.	0	
V 8	Vertical Amplifier	6S4		-90		6.3 A.C.	0	-90		270	
V 9	Hor. Oscillator	6SN7	-100	35**	-125	-180	110	-105	6.3 A.C.	0	
	and	or									
	Sync. Guide	7N7	0	-105	35**	-100	-180	110	-125	6.3 A.C.	
V 10	Hor. Output	6BG6		6.3 A.C.	-95		-110		0	190	
V 12	Damper	6W4			475		280		120	120	
V 13	Power Rectifier	5U4		300		-90		-90		300	

CONDITIONS:

1. Switch on - set connected to 117 Volt 60 cycle AC.
2. No antenna connected and set tuned to unused channel.
3. All controls at "Normal" setting.
4. Measurements taken with RCA volt-Ohmist.

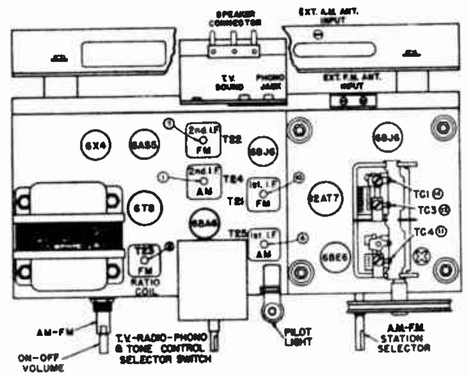
Notes:

* Reading will vary with setting of Picture Control.
** Reading will vary with setting of Horizontal Hold Control.
\+ Reading will vary with setting of Vertical Hold Control.
\+\+ Reading will vary with setting of Height Control.

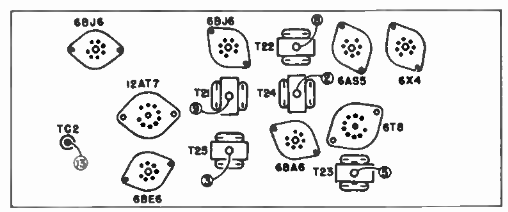
AM-FM RADIO ALIGNMENT PROCEDURE

PRELIMINARY:

Output meter connection .... Across speaker voice coil
Output meter reading to indicate 500 MW (Standard Output) .... 1.27 volt
Generator modulation .... 30% 400 cycles
Position of volume control .... Fully clockwise
Set Dial Pointer .... 1-3/32" from center of right shaft, variable condenser closed
Set band switch .... To left for AM alignment; to right for FM alignment



TOP VIEW OF RADIO CHASSIS
FIG. 14



BOTTOM VIEW OF RADIO CHASSIS
FIG. 15

AM ALIGNMENT

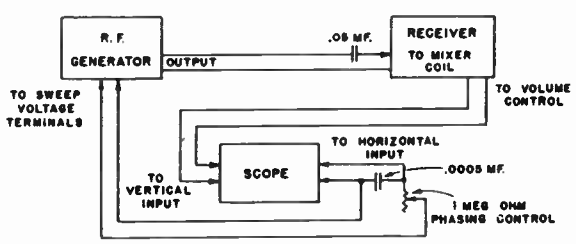
POSITION OF VARIABLE	GENERATOR FREQUENCY	DUMMY ANTENNA	GENERATOR CONNECTION HIGH SIDE	GENERATOR CONNECTION GROUND LEAD	ADJUST TRIMMERS IN ORDER SHOWN FOR MAX. OUTPUT	TRIMMER FUNCTION
Open	455 Kc	.05 Mfd	Mixer grid	Chassis	1, 2, 3, 4	I.F.
1620 Kc	1620 Kc		*Test loop	Test loop	11	Oscillator
1400 Kc	1400 Kc		*Test loop	Test loop	12	Antenna
**600 Kc	600 Kc		*Test loop	Test loop	Check-point	Antenna

*Connect generator lead to a Standard Hazeltine Test Loop, Model 1150, placed two feet from the set loop, or three turns of wire about six inches in diameter, placed about one foot from the set loop.

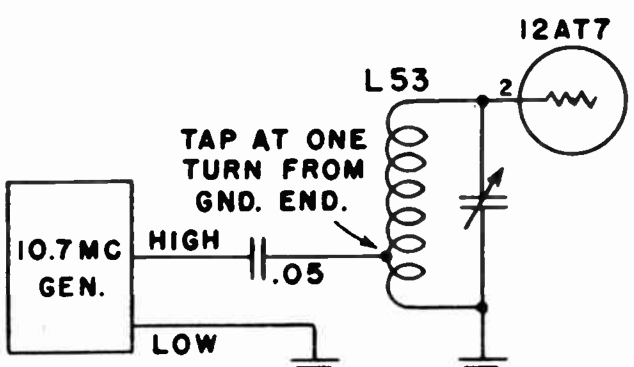
**With a generator signal of 600 Kc, tune the set to the point where maximum output is obtained, which should be approximately 600 Kc on the dial. Adjust antenna section plates of variable for maximum output.

The alignment procedure should be repeated in the original order for greatest accuracy.

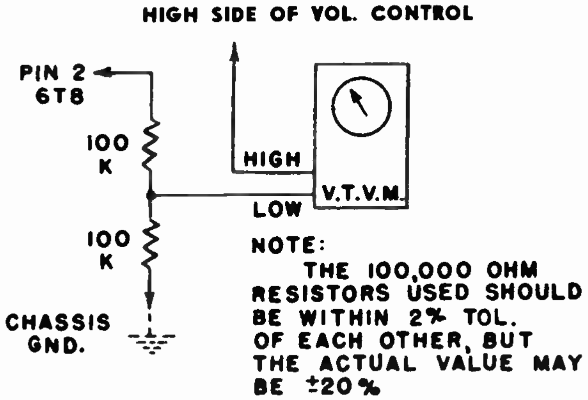
Always keep the output from the signal generator at its lowest possible value to make the A. V. C. action of the receiver ineffective.



BLOCK DIAGRAM FOR I.F. AND DETECTOR ALIGNMENT USING SIGNAL GENERATOR AND OSCILLOSCOPE.
FIG. 16



RF ALIGNMENT CONNECTIONS
FIG. 17



DETECTOR ALIGNMENT CONNECTIONS
FIG. 18

FM ALIGNMENT

DETECTOR AND IF ALIGNMENT USING SIGNAL GENERATOR AND OSCILLOSCOPE

1. Connect vertical input of scope across volume control of receiver (Grounded terminal to chassis, ungrounded terminal to high side of the control).
2. Connect FM Generator, High Side, to grid of 2nd IF tube through .01 mfd. dummy, Low Side, to chassis.
3. Connect sweep voltage of generator to horizontal terminals of scope.
4. Set generator frequency to 10.7 Mc modulated either 60 cycles or 400 cycles, 250 Kc sweep (125 Kc deviation).
5. Set volume control to maximum, variable condenser fully open, band switch to right (FM).
6. Adjust detector primary slug #5 for maximum vertical sweep of the scope pattern.
7. Adjust detector secondary slug #6 for symmetry of the pattern. Pattern should look like Fig.19, with the same amount of curve on both ends.
8. Connect generator, high side, to mixer coil as in Fig.17, low side to chassis.
9. Short A. V. C. to chassis at junction of R125 and R129.
10. Disconnect the negative lead of C132 from pin #2 of 6T8.
11. Connect vertical input of scope across R124. (Grounded terminal to chassis, ungrounded terminal to high side of resistor.)
12. Adjust IF slugs 7, 8, 9, 10 for greatest vertical sweep of the pattern. Stagger tune (detune) slightly so that pattern looks like Fig.22.
13. Resolder the negative lead of condenser disconnected after alignment is completed.

NOTE: A double trace pattern, as in Fig.20 or Fig.21 for detector alignment, or Fig.23 for IF alignment, may be caused by a slight out of phase condition between the sweep voltage to the horizontal terminals of the scope and the modulation on the generator signal. To correct this condition, connect a condenser of about .0005 mf. across the horizontal input terminals of the scope and a 1 megohm variable resistance in series with the lead to the ungrounded terminal. Adjust the resistance until the two traces coincide.

OSCILLOSCOPE PATTERNS

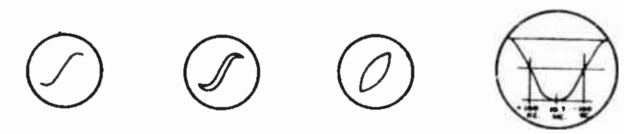


FIG. 19 **FIG. 20** **FIG. 21** **FIG. 22** **FIG. 23**

DETECTOR ALIGNMENT USING SIGNAL GENERATOR AND VTVM

POSITION OF VARIABLE	GENERATOR FREQUENCY	DUMMY ANTENNA	GENERATOR CONNECTION HIGH SIDE	GENERATOR CONNECTION GROUND LEAD	ADJUST TRIMMERS IN ORDER SHOWN	TRIMMER FUNCTION
Open	10.7 Mc	.01 Mfd.	2d IF grid	Chassis	#*5, #*6	Detector

#*5 is adjusted for maximum A. V. C. voltage. A vacuum tube voltmeter or a 20,000 ohm per volt voltmeter with a low V. range can be used to measure the A. V. C. voltage. Connect negative lead to junction of R125 and R129 on band switch and positive lead to the chassis.

#*6 is adjusted for zero reading of a vacuum tube voltmeter or a 20,000 ohm per volt voltmeter, connected as shown in Fig.18. Rock this adjustment through the zero point to see that the voltage is positive on one side of the zero point and negative on the other.

NOTE: If a 10.7 Mc FM generator is not available for alignment of detector, an unmodulated signal of 10.7 Mc from an accurately calibrated conventional AM type generator can be used. (Voltmeter alignment only).

I.F. alignment using signal generator and V.T.V.M. not recommended.

RF ALIGNMENT

POSITION OF VARIABLE	GENERATOR FREQUENCY	DUMMY ANTENNA	GENERATOR CONNECTION HIGH SIDE	GENERATOR CONNECTION GROUND LEAD	ADJUST TRIMMERS IN ORDER SHOWN	TRIMMER FUNCTION
Open	109 Mc	300 Ohm	Ant. Term.	Ant. Term.	#13	Oscillator
Closed	87.5 Mc	300 Ohm	Ant. Term.	Ant. Term.	Spacing of L-55	Oscillator

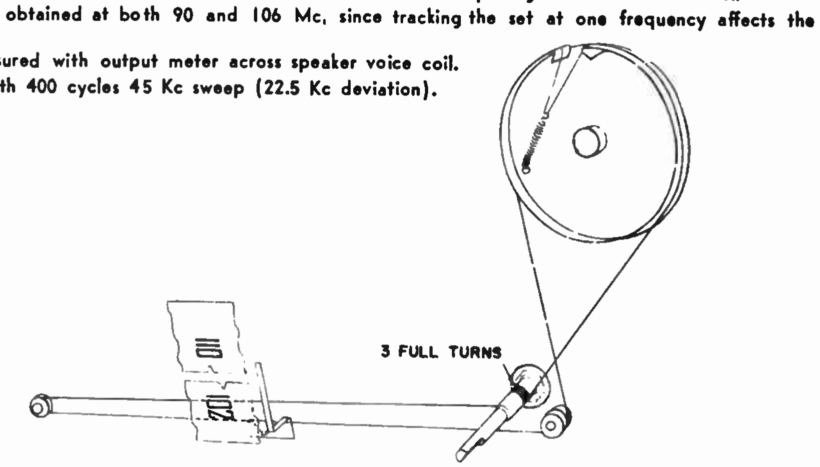
Repeat the above oscillator adjustments until proper coverage is obtained on both ends of band since the two adjustments effect each other.

106 Mc	106 Mc	300 Ohm	Ant. Term.	Ant. Term.	#14	RF
90 Mc	90 Mc	300 Ohm	Ant. Term.	Ant. Term.	Spacing of L-53	RF

Repeat "RF and Ant." adjustments until proper tracking is obtained at both 90 and 106 Mc, since tracking the set at one frequency affects the tracking at the other frequency.

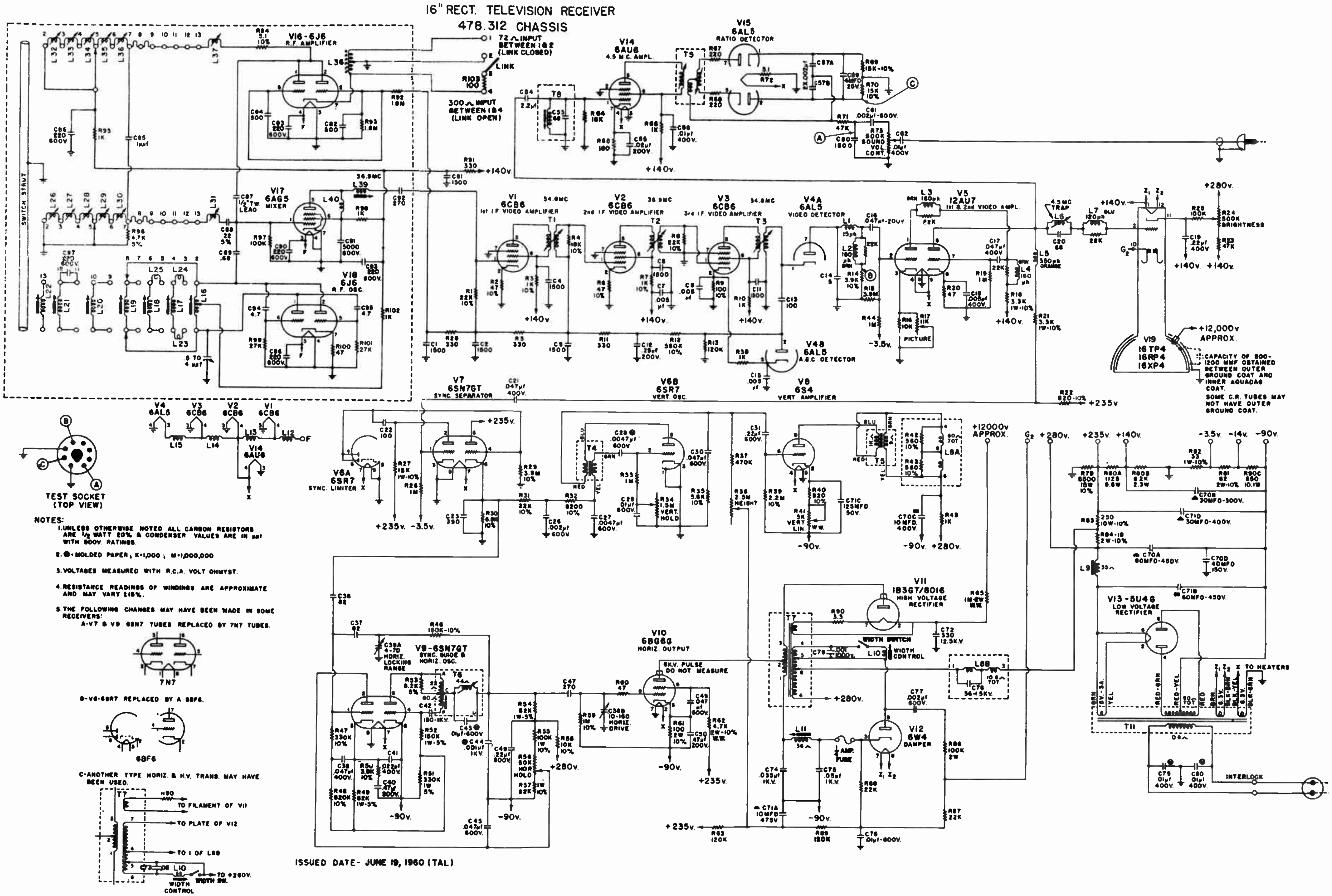
All RF trimmers are adjusted for maximum output, measured with output meter across speaker voice coil.

For RF alignment, use FM generator signal modulated with 400 cycles 45 Kc sweep (22.5 Kc deviation).



DIAL STRINGING ARRANGEMENT
FIG. 24

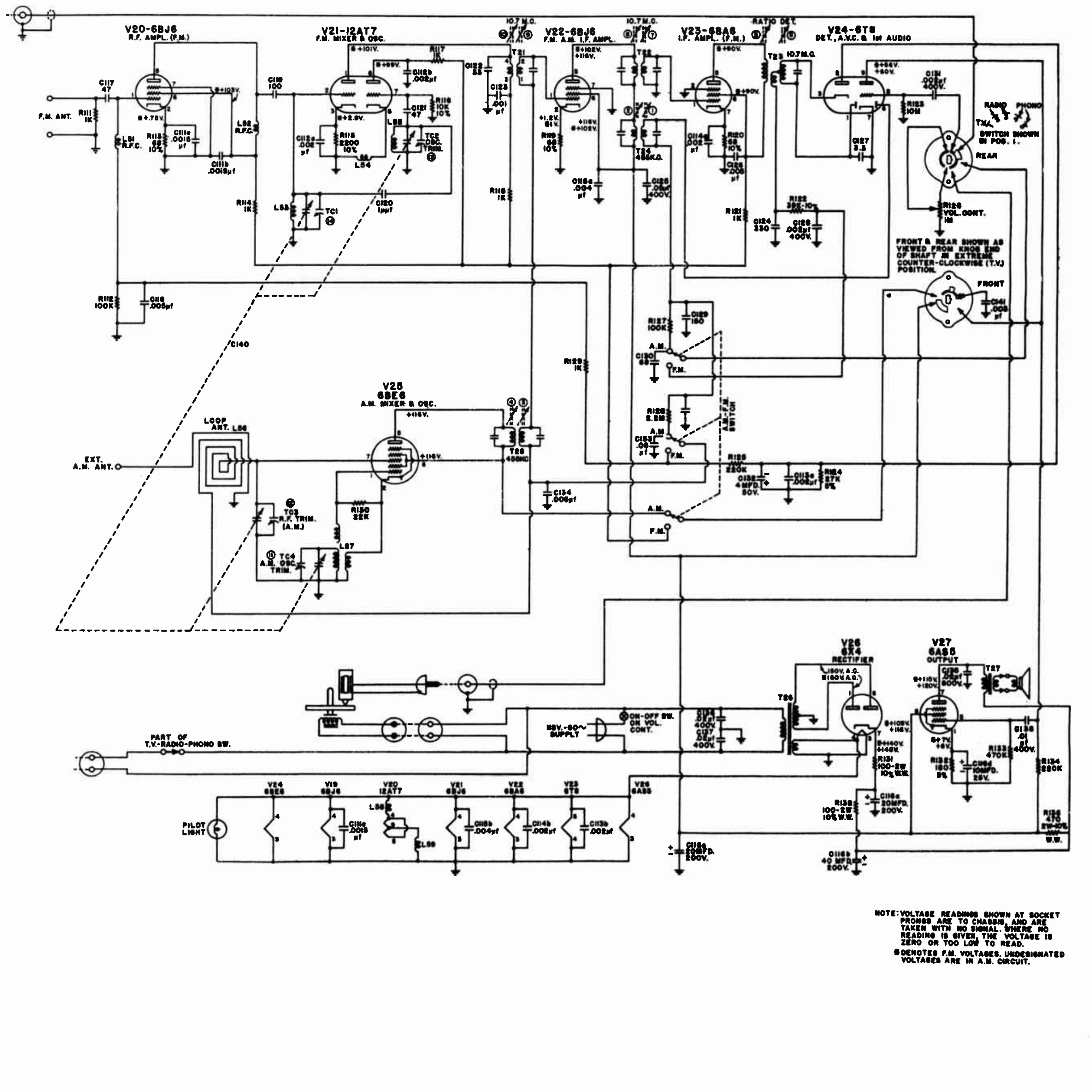
16" RECT. TELEVISION RECEIVER
478.312 CHASSIS



NOTES:
1. UNLESS OTHERWISE NOTED ALL CARBON RESISTORS ARE 1/2 WATT 20% & CONDENSER VALUES ARE IN µµf WITH 500V. RATINGS.
2. ● - MOLDED PAPER ; K=1,000 ; M=1,000,000
3. VOLTAGES MEASURED WITH R.C.A. VOLT OHMYST.
4. RESISTANCE READINGS OF WINDINGS ARE APPROXIMATE AND MAY VARY ±15%.
5. THE FOLLOWING CHANGES MAY HAVE BEEN MADE IN SOME RECEIVERS:
A - V7 & V9 6SN7 TUBES REPLACED BY 7N7 TUBES.
B - V6 - 6SR7 REPLACED BY A 6BF6.
C - ANOTHER TYPE HORIZ. & H.V. TRANS. MAY HAVE BEEN USED.

ISSUED DATE - JUNE 19, 1950 (TAL)

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
		RESISTORS (A.M. - F.M. CHASSIS) Carbon -20% Unless Noted
RC-680-2,	R 113,119,120	68 Ohms 1/2 Watt 10%
RW-101-8	R 131,135	100 Ohms 2 Watt 10% W.W.
RC-181-2	R 132	180 Ohms 1/2 Watt 5%
RW-471-8	R 136	470 Ohms 2 Watt 10% W.W.
RC-102-1	R 111,114,117,118, 121,129	1,000 Ohms 1/2 Watt
RC-222-2	R 115	2,200 Ohms 1/2 Watt 10%
RC-103-2	R 116	10,000 Ohms 1/2 Watt 10%
RC-223-1	R 130	22,000 Ohms 1/2 Watt
RC-273-3	R 124	27,000 Ohms 1/2 Watt 5%
RC-393-2	R 122	39,000 Ohms 1/2 Watt 10%
RC-104-1	R 112,127	100,000 Ohms 1/2 Watt
RC-224-1	R 125,134	220,000 Ohms 1/2 Watt
RC-474-1	R 133	470,000 Ohms 1/2 Watt
RC-225-1	R 128	2.2 Megohm 1/2 Watt
RC-106-1	R 123	10 Megohm 1/2 Watt
VC-17	R 126	Volume Control (1 Meg) & on-off switch
		CONDENSERS (A.M - F.M. CHASSIS)
CSP-1	C 120	1 Mmf. Ceramic
CC-33-11	C 127	3.3 Mmf. Ceramic
CMS-033-9	C 122	33 Mmf. Silver Mica
CC-47-7	C 117,121	47 Mmf. Ceramic
CM-068-7	C 130	68 Mmf. Mica
CC-101-7	C 119	100 Mmf. Ceramic
CM-151-1	C 129	150 Mmfd. Mica
CM-331-8	C 124	330 Mmfd. Mica
CM-102	C 123	.001 Mfd. Mica
CC-3-0	C111a,b,c	3 x .0015 Mfd. Ceramic
CC-2-1	C112 a,b.;C 113a,b, C114a,b,	2 x .002 Mfd. Ceramic
CP-202-2	C 128,131	.002 Mfd. 400 Volts Paper Tubular
CP-302-2	C 141	.003 Mfd. 600 Volts Paper Tubular
CC-2-2	C 115a.b	2 x .004 Mfd. Ceramic
		CONDENSERS (A.M. - F.M. CHASSIS)
CC-1-1	C 118,126,134	.005 Mfd. Ceramic Herlec
CP-103-1	C 138	.01 Mfd. 400 Volts Paper Tubular
CPM-203-1	C 136,137	.02 Mfd. 400 Volts Molded Paper Tubular
CP-203-20	C 135	.02 Mfd. 800 Volts Paper Tubular
CP-503-1	C 125,133	.05 Mfd. 400 Volts Paper Tubular
CE-19	C 132	4 Mfd. 50 Volts Electrolytic
CE-22	C 116a,	20 Mfd. 150 Volts (4 Section Electrolytic)
	C 116b	40 Mfd. 150 Volts
	C 116c	20 Mfd. 150 Volts
	C 116d	10 Mfd. 150 Volts
CV-17	C 140	Variable Condenser (A.M.-F.M.)
TA-3	TC 2	Trimmer Assembly
		INDUCTANCES (A.M. - F.M. CHASSIS)
LF-33	T 23	Ratio Detector Transformer
LF-30	T 21	F.M. I.F. Transformer
LF-34	T 22	F.M. I.F. Transformer
LF-32	T 25	A.M. I.F. Transformer
LF-35	T 24	A.M. I.F. Transformer
LC-12	L 53	R.F. Coil (3 turns bus wire)
LC-11	L 55	Osc. Coil (3 turns bus wire)
LC-13	L 58,59	Filament Choke
LC-14	L 52	Plate Choke
LC-15	L 51	Grid Choke
LC-16	L 54	Cathode Choke
LC-9	L 57	Broadcast Osc. Coil
TR-21	T 26	Power Transformer
LP-21	L 56	Loop Antenna
TTR-179-D	T 27	Audio Output Transformer



A.M.-F.M. RADIO RECEIVER
478.240 CHASSIS

REPAIR PARTS LIST

RESISTORS (T.V. CHASSIS)
Carbon - 20% Unless Noted

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TRC-33A-1	R 90	3.3 Ohms 1/2 Watt
TRC-51A-1	R 72	5.1 Ohms 1/2 Watt
TRC-180-8	R 84	18 Ohms 2 Watt 10%
TRC-330-5	R 82	33 Ohms 1 Watt 10%
TRC-470-1	R 20,60	47 Ohms 1/2 Watt
TRC-470-2	R 2,6	47 Ohms 1/2 Watt 10%
TRC-820-8	R 81	82 Ohms 2 Watt 10%
TRC-101-2	R 9	100 Ohms 1/2 Watt 10%
TRC-101-8	R 61	100 Ohms 2 Watt 10%
TRC-181-1	R 65	180 Ohms 1/2 Watt
TRC-221-1	R 67,68	220 Ohms 1/2 Watt
TRW-251-SP	R 83	250 Ohms 10 Watt 10% W.W.
TRC-331-1	R 5,11,28,91	330 Ohms 1/2 Watt
TRC-821-2	R 22,40	820 Ohms 1/2 Watt 10%
TRC-102-1	R 10,38,45,66	1,000 Ohms 1/2 Watt
TRC-102-2	R 3,7	1,000 Ohms 1/2 Watt 10%
TRC-332-5	R 18,21	3,300 Ohms 1 Watt 10%
TRC-392-2	R 14,50	3,900 Ohms 1/2 Watt 10%
TRW-472-7	R 62	4,700 Ohms 2 Watt W.W.
TRP-21	R 79	5,500 Ohms 15 Watt 10%
TRC-562-2	R 35	5,600 Ohms 1/2 Watt 10%
TRC-682-2	R 30	6,800 Ohms 1/2 Watt 10%
TRC-822-2	R 32	8,200 Ohms 1/2 Watt 10 %
TRC-822-3	R 53	8,200 Ohms 1/2 Watt 5%
TRC-103-1	R 16	10,000 Ohms 1/2 Watt
TRC-103-2	R 58	10,000 Ohms 1/2 Watt 10%
TRC-153-2	R 64,69,70	15,000 Ohms 1/2 Watt 10%
TRC-153-5	R 27	15,000 Ohms 1 Watt 10%
TRC-183-2	R 4	18,000 Ohms 1/2 Watt 10%
TRC-223-1	R 87,88	22,000 Ohms 1/2 Watt
TRC-223-2	R 1,8,31	22,000 Ohms 1/2 Watt 10%
TRC-473-1	R 23,71	47,000 Ohms 1/2 Watt
TRC-823-5	R 57	82,000 Ohms 1 Watt 10%
TRC-823-6	R 49,54	82,000 Ohms 1 Watt 5%
TRC-104-1	R 25	100,000 Ohms 1/2 Watt
TRC-104-5	R 55	100,000 Ohms 1 Watt 10%
TRC-104-7	R 86	100,000 Ohms 2 Watt
TRC-124-1	R 13,63,89	120,000 Ohms 1/2 Watt
TRC-154-2	R 46	150,000 Ohms 1/2 Watt 10%
TRC-154-6	R 52	150,000 Ohms 1 Watt 5%
TRC-334-2	R 47	330,000 Ohms 1/2 Watt 10%
TRC-334-6	R 51	330,000 Ohms 1 Watt 5%

RESISTORS (T.V. CHASSIS)
Carbon -20% Unless Noted

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TRC-474-1	R 37	470,000 Ohms 1/2 Watt
TRC-564-2	R 12	560,000 Ohms 1/2 Watt 10%
TRC-824-2	R 48	820,000 Ohms 1/2 Watt 10%
TRC-105-1	R 19,26,33,44	1 Megohm 1/2 Watt
TRC-105-2	R 59	1 Megohm 1/2 Watt 10%
TRC-105-7	R 85	1 Megohm 2 Watt
TRC-225-2	R 39	2.2 Megohms 1/2 Watt 10%
TRC-395-1	R 15	3.9 Megohms 1/2 Watt
TRC-395-2	R 29	3.9 Megohms 1/2 Watt 10%

SPECIAL RESISTORS

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
	R 80A	1,125 Ohms 9.8 Watts
TRP-17-DA	R 80B	8,200 Ohms 2.3 Watts
	R 80C	650 Ohms 10.1 Watts

VARIABLE RESISTORS

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TVC-504-1-D	R 36	Height Control (2.5 Meg)
TVC-523-D	R 34	Dual Control-Hold-Vertical (1.5 Meg)
	R 56	Hor. (50K)
TVC-524-D	R 24	Dual Control- Brightness (500K)
	R 17	Picture (11.5K)
TVC-503-1-D	R 41	Vertical Linearity (5K) W.W.
TVC-520-D	R 73	T.V. Sound Volume Control (500K)

CONDENSERS (T.V. CHASSIS)
Electrolytic

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TCE-104-D	C 59	4 Mfd. 25 Volts
	C 71A	10 Mfd. 475 Volts
TCE-147-D	C 71D	30 Mfd. 400 Volts — 4 Section
	C 71B	60 Mfd. 450 Volts
	C 71C	125 Mfd. 50 Volts
	C 70A	80 Mfd. 450 Volts
	C 70D	40 Mfd. 150 Volts
TCE-148-D	C 70B	30 Mfd. 300 Volts — 4 Section
	C 70C	10 Mfd. 400 Volts

PAPER TUBULAR

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TCP-102-14	C 73	.001 Mfd. 1,000 Volts
TCP-202-10	C 61	.002 Mfd. 600 Volts
TCP-502-4	C 18	.005 Mfd. 400 Volts
TCP-103-4	C 56,62	.01 Mfd. 400 Volts
TCP-203-1	C 55	.02 Mfd. 200 Volts
TCP-353-13	C 74	.035 Mfd. 1,000 Volts Oil Impregnated
TCP-503-13	C 75	.05 Mfd. 1,000 Volts, Oil Impregnated
TCP-254-1	C 12	.25 Mfd. 200 Volts,

MOLDED PAPER TUBULAR

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TCPM-331-SP	C 72	330 Mmfd. 12,500 Volts
TCPM-102-14-SP	C 44	.001 Mfd. 1,000 Volts
TCPM-202-10	C 26,77	.002 Mfd. 600 Volts
TCPM-502-10	C 27	.0047 Mfd. 600 Volts
TCPM-502-11-SP	C 28	.0047 Mfd. 600 Volts
TCPM-103-4-SP	C 79,80	.01 Mfd. 400 Volts
TCPM-103-10	C 29,76	.01 Mfd. 600 Volts
TCPM-103-10-SP	C 43	.01 Mfd. 600 Volts
TCPM-203-4	C 41	.022 Mfd. 400 Volts
TCPM-503-1	C 16	.047 Mfd. 200 Volts
TCPM-503-4	C 17,21,39	.047 Mfd. 400 Volts
TCPM-503-10	C 30,45	.047 Mfd. 600 Volts
TCPM-503-11	C 49	.047 Mfd. 600 Volts
TCPM-254-4	C 19	.22 Mfd. 400 Volts
TCPM-254-10	C 31,46	.22 Mfd. 600 Volts
TCPM-474-1	C 40,50	.47 Mfd. 200 Volts

MICA & CERAMIC

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TCC-2.2-7	C 54	2.2 Mmfd. 500 Volts Ceramic
TCC-050-8	C 14	5 Mmfd. 500 Volts Ceramic

MICA & CERAMIC (Continued)

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TCM-082-8	C 36,37	82 Mmfd. 500 Volts Mica
TCSM-101-7	C 13	100 Mmfd. 500 Volts Silver Mica
TCM-101-8	C 22	100 Mmfd. 500 Volts Mica
TCSM-181-29	C 42	180 Mmfd. 1,000 Volts Silver Mica
TCM-271-7	C 47	270 Mmfd. 500 Volts Mica
TCM-391-7	C 23	390 Mmfd. 500 Volts Mica
TCC-152-SP	C 1,2,4,6,9,11,60,81	1,500 Mmfd. 500 Volts Ceramic
TCC-2-1	C 57A,B	2 x .002 Mfd. 500 Volts Ceramic Herlec
TCC-502-SP	C 7,8,15	.005 Mfd. 500 Volts Ceramic

TRIMMERS

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TAS-541-D	C 38A,B	Trimmer Strip Assembly (Hor. Locking, Hor. Drive)

INDUCTANCES (T.V. Chassis)

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TLF-502-D	L 7	Peaking Coil (on 22 K Resistor)
TLF-114-D	T 8	Sound Take-off Trap
TLF-568-D	T 2	I.F. Coil
TLF-567-D	T 1	I.F. Coil
TLF-567-1-D	T 3	I.F. Coil
TLF-506-DA	L 11	Horizontal Linearity Coil
TLF-570-D	L 6	4.5 M.C. Rejection Trap
TLF-520-D	L 12,13,14,15	Filament Choke
TLF-531-D	T 9	Ratio Detector Trans.
TLF-135-D	L 2,3,4	Peaking Coil
TLF-562-D	L 5	Peaking Coil
TLF-146-D	L 1	I.F. Choke
TLF-566-D	T 6	Synchro Guide Transformer
TTR-106-2-D	L 9	Filter Choke
TTR-185-D	T 5	Vertical Output Transformer
TTR-188-D	T 11	Power Transformer
TTR-209-D	T 7	Horizontal Output Transformer
TTR-201-D	L 8A,B	Deflection Yoke
TLF-553-D	L 10	Width Control Coil
TTR-161-2-D	T 4	Blocking Osc. Transformer (Vert.)

HARDWARE (T.V. Chassis)

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TPL-150		Interlock Plug
TFA-510-D		C.R.T. Anode Connector, & Lead
TMS-127		Miniature Tube Shield
TFU-1		Fuse, 1/4 Amp. 250 Volts, 3 AG.
TSW-201		Width Switch
TLF-554-D		Ion Trap Assembly (Use with 16 TP4) or
TLF-546		Ion Trap Assembly (Use with 16XP4 & 16RP4)
TPM-101-DA		Focus Magnet

RESISTORS (TUNER)
Carbon - 20% Unless Noted

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TRC-51A-2	R 94	5.1 Ohms 1/2 W. 10%
TRC-470-1	R 100	47 Ohms 1/2 W.
TRC-101-1	R 103	100 Ohms 1/2 Watt
TRC-102-1	R 95,98,102	1,000 Ohms 1/2 W.
TRC-472-3	R 96	4,700 Ohms 1/2 W. 5%
TRC-273-1	R 99,101	27,000 Ohms 1/2 W.
TRC-104-1	R 97	100,000 Ohms 1/2 W.
TRC-185-1	R 92,93	1.8 Megohm 1/2 W.

CONDENSERS (TUNER)

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TCC-068-8	C 89	.68 Mmfd. 500 Volts Ceramic
TCC-010-11	C 85	1.0 Mmfd. Ceramic
TCC-47-11	C 94,95	4.7 Mmfd. Tubular Ceramic
TCC-22-12	C 88	22 Mmfd. 5% Ceramic
TCC-221-7	C 83,86,90,93,96,97	220 Mmfd. 500 Volts Ceramic
TCM-271-7	C 92	270 Mmfd. 500 Volts Mica
TCC-501-GM	C 82,84	500 Mmfd. G.M.V
TCC-502-SP	C 91	5,000 Mmfd. 600 Volts Disc. Ceramic

COILS (TUNER)

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TLF-565-D	L 38	Matching Transformer
TLF-120-1	L 16	Oscillator Coil
TLF-120-3	L 17	Oscillator Coil
TLF-120-5	L 18	Oscillator Coil
TLF-120-6	L 19	Oscillator Coil
TLF-120-9	L 20	Oscillator Coil
TLF-120-10	L 21,22	Oscillator Coil
TLF-128-D	L 26,32	R.F. Coil
TLF-138-D	L 31,37	R.F. Strap Inductance
TLF-143-D	L 30,36	R.F. End Inductance
TLF-129-D	L 27,28,33,34	R.F. Coil
TLF-130-D	L 29,35	R.F. Coil
TLF-541-D	L 25	R.F. Coil
TLF-542-D	L 23,24	R.F. Coil
TLF-146-D	L 40	I.F. Choke
TLF-551-D	L 39	I.F. Coil

HARDWARE (TUNER)

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
TAS-524-D		Trimmer Bushing Assembly
TAS-525-D		Trimmer Shaft Assembly
TMS-849		Taper pin 7/0 x 1/4"
TSG-112-D		Spring, Drive Cord
CR-2		Drive Cord
TAS-542-D		Tuning Shaft and Detent Assembly
TMS-829-D		Spring Washer
TSG-115-D		Shaft Spring
TMS-813-D		Shield
TMS-816-D		Shield Mtg. Spring
TSP-80		8" P.M. Speaker

MODEL 711-721 MODEL 714-724 MODEL 755-765 MODEL 758-768

ELECTRICAL SPECIFICATIONS

Power Supply	110 to 120 volts 60 cycle AC
Power Consumption	225 Watts
Power Output	Undistorted 2.2 Watts Maximum 4.0 Watts
Antenna Input Imp.	300 Ohm Balanced
Tuning Range	12 Channel MODELS, 701, 711, 714, 752, 755, 758
Tuning Range	82 Channel MODELS 721, 724, 762, 765, 768, 791
Loud Speaker	5" PM Models 701, 711, 721, 791 8" PM Models 714, 724 2-6" PM Models 752, 762 1-10" PM and 1-6" PM Models 755, 758, 765, 768
Voice Coil Impedance	3.2 Ohm at 400 Cycles
I.F. CIRCUIT	Inter-Carrier Sound
R.F. STAGE	One
I.F. STAGES	Three "Combined Picture and Sound" and one Sound 41.25 M.C. Sound Carrier 45.75 M.C. Video Carrier 4.5 M.C. Inter-Carrier Sound

TUBE COMPLEMENT

V-1	6CB6	1st Video IF Amplifier
V-2	6CB6	2nd Video IF Amplifier
V-3	6CB6	3rd Video IF Amplifier
V-4	6CL6	Video Amplifier
V-5	6AU6	Sound IF Amplifier
V-6	6AL5	Sound Detector
V-7	6SN7GT	A.F. Amplifier, Horizontal AFC Control
V-8	6W6GT	Audio Output
V-9	6SN7GT	SYNC Separator, Phase Splitter
V-10	6SN7GT	Horizontal Oscillator
V-11	6BQ6GT or 6CU6	Horizontal Output
V-12	1B3GT	H. V. Rectifier
V-13	5U4G	Power Rectifier
V-14	6W4GT	Horizontal Damper
V-15	12BH7	Vertical Oscillator Vertical Output
V-16	6BZ7	R. F. Amplifier
V-17	6U8	VHF Oscillator, Modulator
	1N60	Video Detector
V-18	17HP4	17" Electrostatic Focus Picture Tube, Models 701, 791
V-18	21ZP4A or	21" Magnetic Focus Picture Tube Models 711, 714, 721, 724
	21YP4	21" Electrostatic Focus Picture Tube Models 711, 714, 721, 724
V-18	21ZP4B	21" Magnetic Focus Picture Tube, Aluminized, Models 752, 755, 758, 762, 765, 768
	or 21YP4A	21" Electrostatic Focus Picture Tube, Aluminized, Models 752, 755, 758, 762, 765, 768
V-19	6T4	UHF Oscillator Models 721, 724, 762, 765, 768, 791
	IN82A	UHF Crystal Converter Models 721, 724, 762, 765, 768, 791

GENERAL INSTALLATION INSTRUCTIONS

While each receiver is correctly aligned at the factory rough handling in transit, ageing, drift, etc., may throw the receiver off, so we suggest that the proper oscillator trimmers, ratio detector, and rear panel controls be checked for correct adjustment with a transmitted television pattern, in the customer's home at the time of installation. Be sure to have the receiver operating for one-quarter hour before making these adjustments. Listed below is the correct procedure to follow in making these adjustments.

(A) Check all operating channels, using FINE TUNING CONTROL for best picture detail. (See paragraph PEAKING THE INDIVIDUAL OSCILLATOR TRIMMERS.)

(B) Check LOCALITY ADJUSTER CONTROL located on back of chassis for proper setting.

NOTE: The signal strength (too strong or too weak) will be affected by location and distance from the station, type of antenna used, terrain obstructions such as tall buildings, electrical disturbances.

PEAKING THE INDIVIDUAL VHF OSCILLATOR TRIMMERS

(A) Set channel selector knob to the desired channel.

(B) Remove the channel and fine tuning knobs. This will expose the individual channel adjustment screw opening located above the channel shaft.

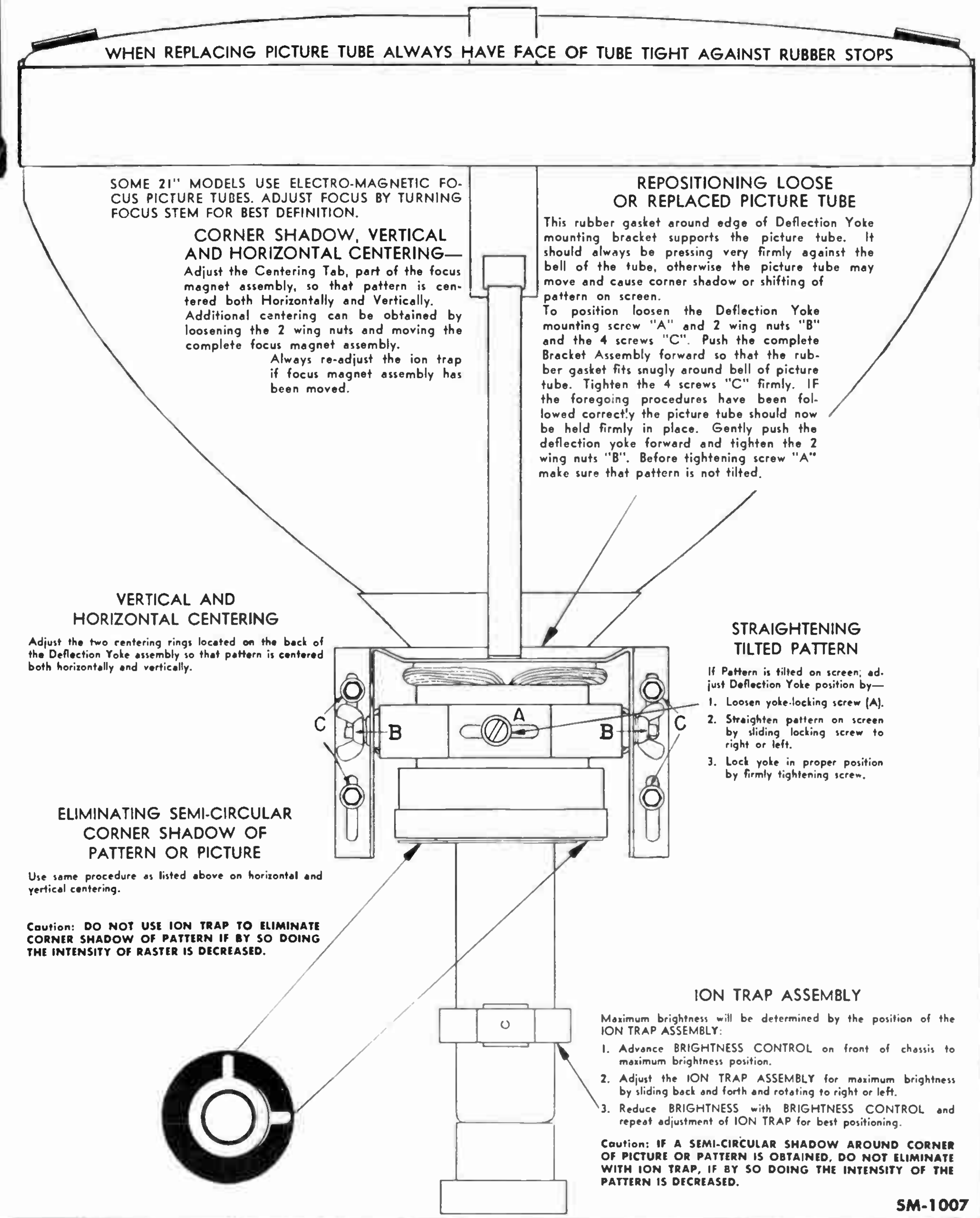
(C) Set the FINE TUNING CONTROL to the center position. Flat of fine tuning shaft facing up.

(D) Use a non-metallic screwdriver such as polystyrene or nylon.

Adjust the individual oscillator screw for best picture detail. A slight adjustment in either direction is all that is necessary. CAUTION: DO NOT ADJUST INDISCRIMINATELY, this may cause the adjustment screw to fall from its locking position.

ADJUSTMENT FOR STATION BUZZ

If station buzz is excessive and is NOT DUE to "contrast control" being advanced too far in a clockwise direction or the locality adjuster control in the incorrect position, adjust the ratio detector secondary adjustment screw located on top of the ratio detector for minimum buzz. MAKE SURE THAT THIS POSITION IS BETWEEN the two MAXIMUM buzz peaks that will be noticed when adjustment screw is turned to the right or left of the m'n'mum buzz position.



SOME 21" MODELS USE ELECTRO-MAGNETIC FOCUS PICTURE TUBES. ADJUST FOCUS BY TURNING FOCUS STEM FOR BEST DEFINITION.

CORNER SHADOW, VERTICAL AND HORIZONTAL CENTERING—

Adjust the Centering Tab, part of the focus magnet assembly, so that pattern is centered both Horizontally and Vertically. Additional centering can be obtained by loosening the 2 wing nuts and moving the complete focus magnet assembly.

Always re-adjust the ion trap if focus magnet assembly has been moved.

REPOSITIONING LOOSE OR REPLACED PICTURE TUBE

This rubber gasket around edge of Deflection Yoke mounting bracket supports the picture tube. It should always be pressing very firmly against the bell of the tube, otherwise the picture tube may move and cause corner shadow or shifting of pattern on screen.

To position loosen the Deflection Yoke mounting screw "A" and 2 wing nuts "B" and the 4 screws "C". Push the complete Bracket Assembly forward so that the rubber gasket fits snugly around bell of picture tube. Tighten the 4 screws "C" firmly. IF the foregoing procedures have been followed correct!y the picture tube should now be held firmly in place. Gently push the deflection yoke forward and tighten the 2 wing nuts "B". Before tightening screw "A" make sure that pattern is not tilted.

VERTICAL AND HORIZONTAL CENTERING

Adjust the two centering rings located on the back of the Deflection Yoke assembly so that pattern is centered both horizontally and vertically.

STRAIGHTENING TILTED PATTERN

If Pattern is tilted on screen; adjust Deflection Yoke position by—

1. Loosen yoke-locking screw (A).
2. Straighten pattern on screen by sliding locking screw to right or left.
3. Lock yoke in proper position by firmly tightening screw.

ELIMINATING SEMI-CIRCULAR CORNER SHADOW OF PATTERN OR PICTURE

Use same procedure as listed above on horizontal and yertical centering.

Caution: DO NOT USE ION TRAP TO ELIMINATE CORNER SHADOW OF PATTERN IF BY SO DOING THE INTENSITY OF RASTER IS DECREASED.

ION TRAP ASSEMBLY

Maximum brightness will be determined by the position of the ION TRAP ASSEMBLY:

1. Advance BRIGHTNESS CONTROL on front of chassis to maximum brightness position.
2. Adjust the ION TRAP ASSEMBLY for maximum brightness by sliding back and forth and rotating to right or left.
3. Reduce BRIGHTNESS with BRIGHTNESS CONTROL and repeat adjustment of ION TRAP for best positioning.

Caution: IF A SEMI-CIRCULAR SHADOW AROUND CORNER OF PICTURE OR PATTERN IS OBTAINED, DO NOT ELIMINATE WITH ION TRAP, IF BY SO DOING THE INTENSITY OF THE PATTERN IS DECREASED.

SM-1007

UHF TUNER DATA

The UHF TUNER has been aligned for optimum operation by special factory equipment and should not require alignment.

The 6T4 OSCILLATOR TUBE and 1N82 CRYSTAL are parts that may require replacement. The 1N82 crystal, located on top of UHF TUNER under square metal cover, is a snap-in type and no soldering is required.

In the UHF position, the 6BZ7 and 6U8 are used as additional IF stages.

Great care should be taken that parts location and lead dress are not altered in UHF TUNER.

UHF ALIGNMENT SHOULD NOT BE ATTEMPTED UNLESS ABSOLUTELY NECESSARY.

UHF TUNER ALIGNMENT

EQUIPMENT REQUIRED
UHF MARKER GENERATOR
PROCEDURE
UHF SWEEP GENERATOR
CATHODE RAY OSCILLOSCOPE

Set VHF tuner to UHF position.
Connect sweep generator to UHF antenna terminals.

NOTE: Sweep generator must match the 300 Ohm input impedance.
Loosely couple UHF marker generator to UHF sweep generator leads.
Connect oscilloscope to test point on VHF tuner.
Locality adjuster switch in weak position.
Carefully detune TU-2 mixer IF coil located on VHF tuner by turning core OUT exactly 10 turns.

NOTE: Radiated horizontal pulses may appear on the response curve. This will not affect the response or tilt of curve. DO NOT disable the horizontal sweep circuit; damage to the horizontal output tube may result.

ALIGNMENT

(1) Set sweep and marker generator to 460 MC.
Set UHF tuner to maximum counter-clockwise position.

Adjust CU-26 until marker is in the center of response curve.

If marker cannot be centered on response curve: carefully bend and move oscillator inductor tab Fig. 1 and re-adjust CU-26 until marker is in center of response curve.

(2) Leave marker and sweep generator at 460 MC.
Leave UHF tuner at maximum counter-clockwise position.

Carefully bend and move PRESELECTOR INDUCTOR TAB Fig. 1 for maximum response and minimum tilt. See response curve Fig. 2.
Repeat steps 1 and 2.

(3) Turn TU-2 mixer IF coil located on VHF tuner IN 10 turns until exact position is reached as before alignment.

DO NOT BEND OR MOVE INDUCTOR TABS INDISCRIMINATELY OR EXCESSIVELY.

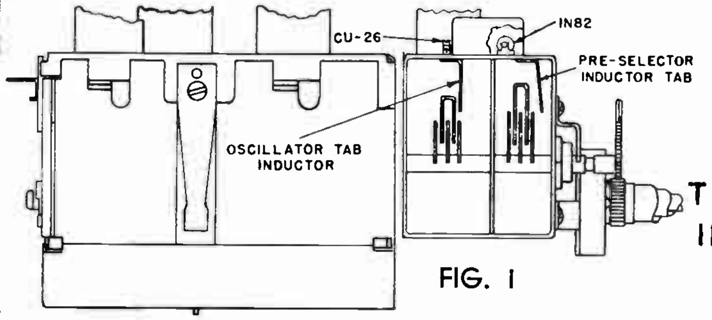
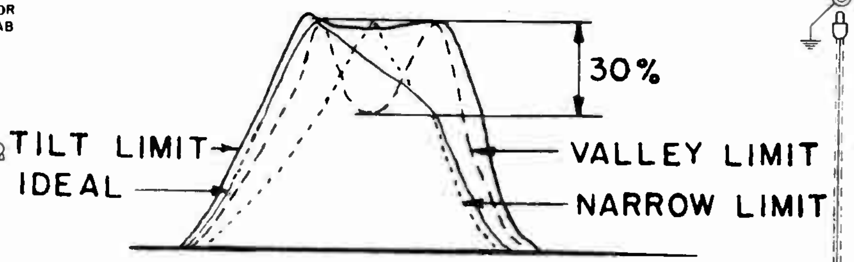
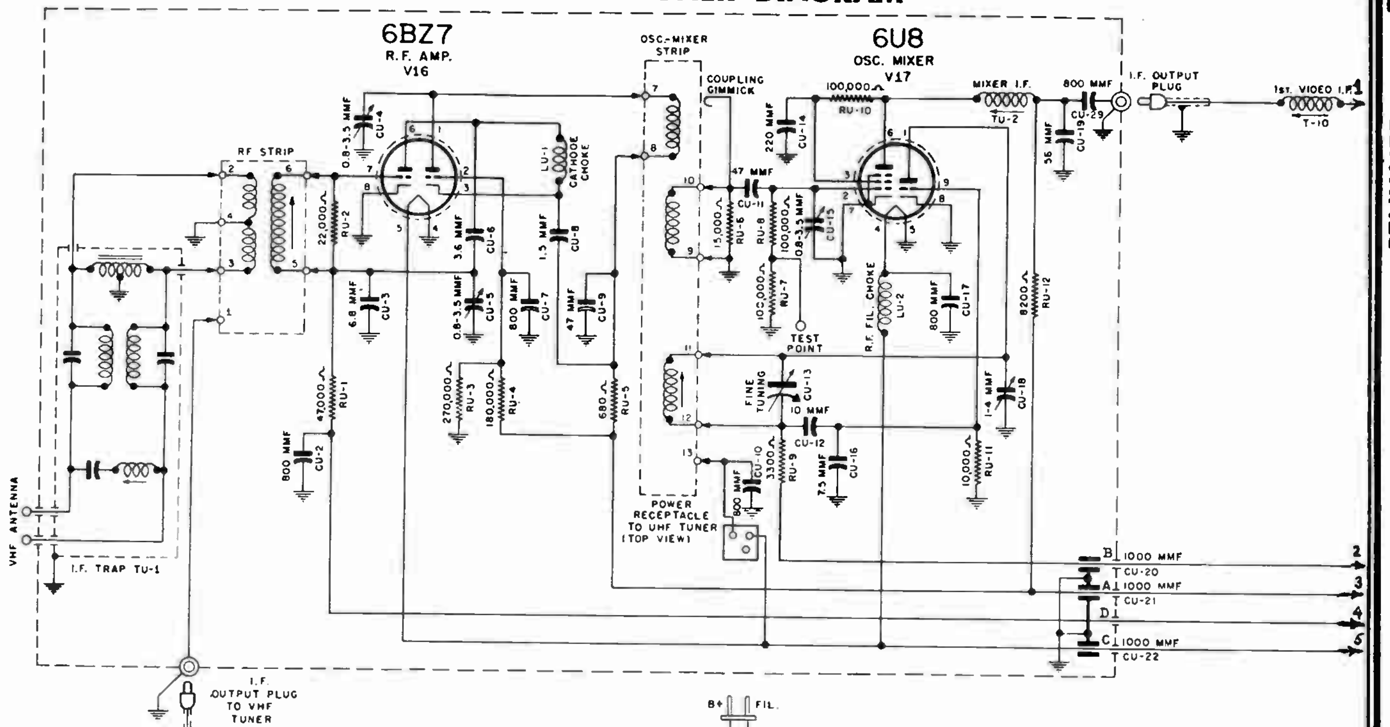
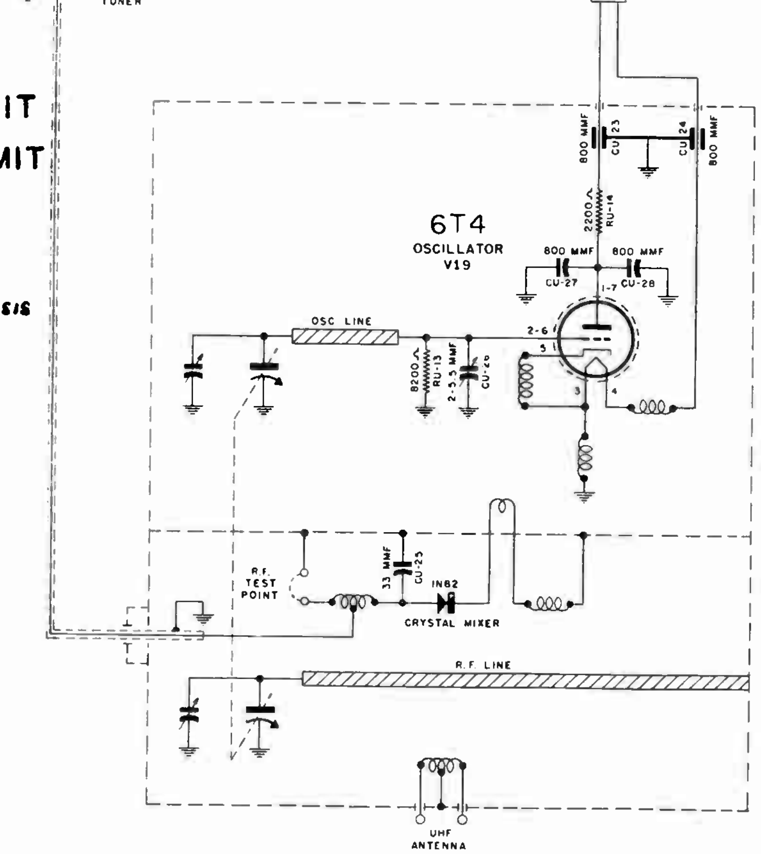


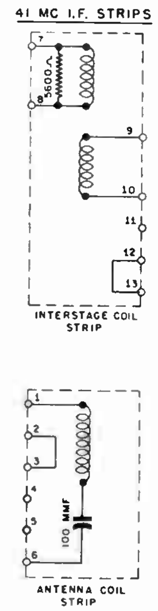
FIG. 1



UHF – VHF TUNER DIAGRAM

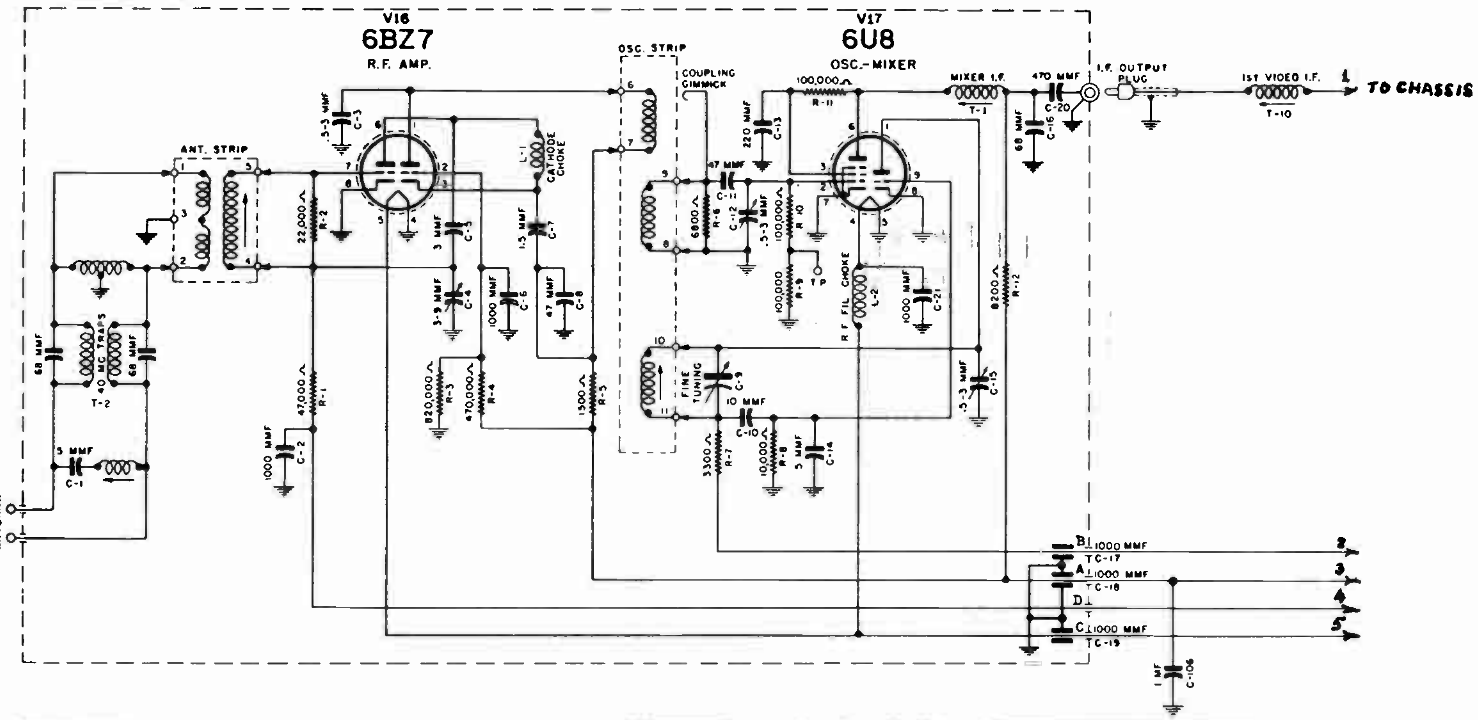






NOTE:

To complete circuit for models 721, 724, 762, 765 768 and 791 open page 11 and fold page 6 over page 8.



COMBINATION VHF—UHF TUNER PARTS LIST

VHF TUNER

CAPACITORS

Illus. No.	Part No.	Description
CU-2	G-200	Fixed Ceramic 800 MMF GMV
CU-3	G-201	Fixed Ceramic 6.8 MMF ± 10% NPO
CU-4	G-202	Trimmer .8-3.5 MMF
CU-5	G-202	Trimmer .8-3.5 MMF
CU-6	G-203	Fixed Ceramic 3.6 MMF ± .25 MMF NPO P100
CU-7	G-204	Feed Thru 800 MMF
CU-8	G-205	Fixed Ceramic 1.5 MMF ± 10% NPO P100
CU-9	G-206	Fixed Ceramic 47 MMF ± 10% GP
CU-10	G-200	Fixed Ceramic 800 MMF GMV
CU-11	G-207	Feed Thru 47 MMF ± 10%
CU-12	G-208	Fixed Ceramic 10 MMF ± 10% N470
CU-14	G-209	Fixed Ceramic 220 MMF ± 10%
CU-15	G-202	Trimmer .8-3.5 MMF
CU-16	G-210	Fixed Ceramic 7.5 MMF ± 10% N330
CU-17	G-200	Fixed Ceramic 800 MMF GMV
CU-18	G-211	Trimmer 1-4 MMF
CU-19	G-212	Fixed Ceramic 68 MMF ± 5% N 750
CU-20	G-213	Feed Thru 1000 MMF
CU-21	G-213	Feed Thru 1000 MMF
CU-22	G-213	Feed Thru 1000 MMF
CU-29	G-214	Fixed Ceramic 800 MMF

RESISTORS

Illus. No.	Part No.	Description
RU-1	27E473K-½	Carbon 47,000 Ohm ½ W. ± 10%
RU-2	27E223K-½	Carbon 22,800 Ohm ½ W. ± 10%
RU-3	27E274K-½	Carbon 270,000 Ohm ½ W. ± 10%
RU-4	27E184K-½	Carbon 180,000 Ohm ½ W. ± 10%
RU-5	27E681K-½	Carbon 680 Ohm ½ W. ± 10%
RU-6	27E153K-½	Carbon 15,000 Ohm ½ W. ± 10%
RU-7	27E104K-½	Carbon 100,000 Ohm ½ W. ± 10%
RU-8	27E104K-½	Carbon 100,000 Ohm ½ W. ± 10%
RU-9	27E332K-1	Carbon 3300 Ohm 1 W. ± 10%
RU-10	27E104K-½	Carbon 100,000 Ohm ½ W. ± 10%
RU-11	27E103K-½	Carbon 10,000 Ohm ½ W. ± 10%
RU-12	27E822K-½	Carbon 8200 Ohm ½ W. ± 10%
LU-1	G-215	Cathode Choke
LU-2	G-216	Choke Filament
TU-1	G-217	Transformer if Output
		When ordering channel strips specify required channel and code number. For example part number for channel 2 strips would be G218-2A for the antenna strip and G-219-2A for RF and oscillator strip.
	G-218	Antenna Strips
	G-219	RF. and Oscillator Strips

UHF TUNER

CAPACITORS

Illus. No.	Part No.	Description
CU-23	G-220	Feed Thru 800 MMF
CU-24	G-220	Feed Thru 800 MMF
CU-25	G-221	Fixed Ceramic 33 MMF
CU-26	G-222	Trimmer 2—5.5 MMF
CU-27	G-223	Fixed Ceramic 800 MMF
CU-28	G-223	Fixed Ceramic 800 MMF

RESISTORS

Illus. No.	Part No.	Description
RU-13	27E822K-½	Carbon 8200 Ohm ½ W. ± 10%
RU-14	27E22K-½	Carbon 2200 Ohm ½ W. ± 10%

MISCELLANEOUS PARTS

1N82A	Crystal

VHF ALIGNMENT DATA

ALIGNMENT PROCEDURE

All circuits are very stable and will seldom require adjustment. Only when major parts of the tuner or the video I-F strip have been replaced or tampered with will it be necessary to realign the receiver.

Generally under normal conditions only the INDIVIDUAL CHANNEL TRIMMERS in the tuner unit may require adjustment by the service technician.

RATIO DETECTOR AND SOUND I-F ALIGNMENT

In most cases only the secondary of the ratio detector coil will require adjustment. This can be done simply by adjusting the top adjustment screw of the ratio detector for minimum buzz with the sound carrier of a TV station. For complete alignment use steps 1, 2, and 3 in the alignment table.

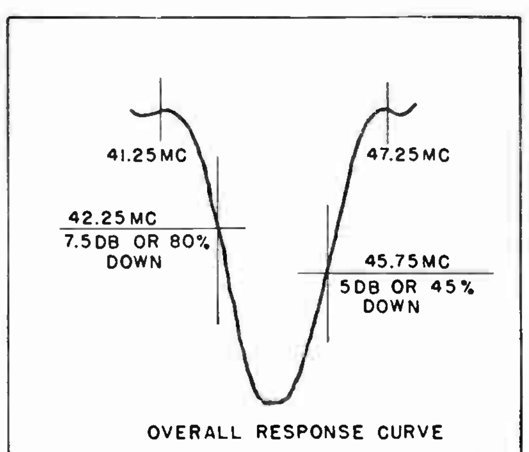


FIG. 3

PICTURE I-F ALIGNMENT

Receiver should be run for at least ¼ hour before proceeding with alignment.

EQUIPMENT REQUIRED

VACUUM TUBE VOLTMETER
For video I-F alignment maintain readings in middle of low volt scale.

SIGNAL GENERATOR supplying a 4.5 MC. (within .25%) 40 to 216 MC. (within 1%) signal. With output adjustable to at least .1 volt maximum.

CATHODE-RAY OSCILLOSCOPE. Must have good frequency and phase response from 10 cycles to at least 2 MC.

SWEEP GENERATOR. Capable of covering 40 to 270 MC. with a 10 MC. sweep with output adjustable to at least .1 volt maximum.

3 VOLT "A" BATTERY to provide fixed bias during video I-F and R-F alignment.

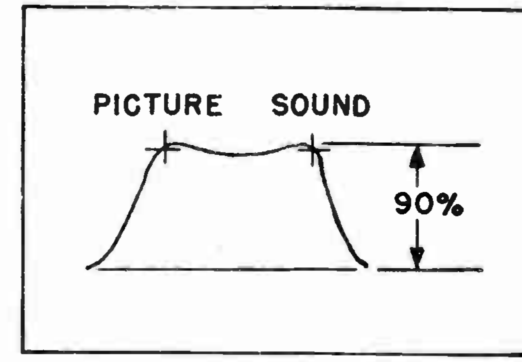


FIG. 4

VHF ALIGNMENT TABLE

RATIO DETECTOR AND SOUND ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
1	In series with .001 Mfd. Cond. to junction of L-15 and L-16. See fig. 6	4.5 MC.	In series with 47,000 ohm res. across C-66 a 10 Mfd. cond. See fig. 6	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-15 (top) and T-16 (bottom) for max. reading. See fig. 5 & 6
2	In series with .001 Mfd. Cond. to junction of L-15 and L-16. See fig. 6	4.5 MC.	In series with 47,000 ohm res. to junction of R-60 and C-69 See fig. 6	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-16 (top) for zero reading. See fig. 5
3	In series with .001 Mfd. Cond. to cathode of picture tube yellow lead. See fig. 6	4.5 MC.	In series with 47,000 ohm res. across C-66 a 10 Mfd. cond. See fig. 6	Maintain reading on low volt scale. Remove 3rd video IF tube 6CB6.	T-14 (top) for minimum reading. See fig. 5

NOTE 1: For **minimum buzz** always adjust T-16 (top) with the sound carrier of a TV station.
NOTE 2: Alternate 4.5 MC. trap alignment: Adjust T-14 (top) for minimum 4.5 MC. beat on picture with a strong station signal.

PICTURE I-F ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
4	Ungrounded converter tube (6U8) shield	44.0 MC.	In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6	Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6	T-13 (top) for maximum reading. See fig. 5
5	Ungrounded converter tube (6U8) shield	43.2 MC.	In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6	Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6	T-12 (top) for maximum reading. See fig. 5
6	Ungrounded converter tube (6U8) shield	41.25 MC.	In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6	Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 Repeat Steps 5 & 6	T-12 (bottom) for minimum reading. See fig. 6
7	Ungrounded converter tube (6U8) shield	45.4 MC.	In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6	Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6	T-11 (top) for maximum reading. See fig. 5
8	Ungrounded converter tube (6U8) shield	47.25 MC.	In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6	Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 Repeat Steps 7 & 8	T-11 (bottom) for minimum reading. See fig. 6

9	Ungrounded converter tube (6U8) shield	44.5 MC.	In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6	Tuner on channel 3, 3 volts bias across C-49 positive side to ground. Locality switch in strong position. See fig. 6 **NOTE:** Detune T-10 by turning slug out as far as possible.	T-1 (top) for maximum reading. See fig. 5
10	Ungrounded converter tube (6U8) shield	45.75 MC.	In series with 47,000 ohm res. to junction of R-46 and L-16. See fig. 6	Tuner on channel 3, 3 volts bias across C-49 positive side to position. See fig. 6	T-10 (top) for maximum reading. See fig. 5

NOTE 3: For visual check of IF response curve (see fig. 3) connect signal and sweep generator to ungrounded converter tube shield (6J6). Connect oscilloscope in series with 47,000 ohm resistor to junction of R-46 and L-16.

TUNER R-F ALIGNMENT

NOTE 4: NEVER ADJUST C-3, C-4 and C-12 UNLESS ABSOLUTELY NECESSARY. (CU-4, CU-5 and CU-15 on VHF-UHF Tuner). THEY ARE FACTORY PRESET BY SPECIAL EQUIPMENT.

Step No.	Connect Marker Generator to	Marker Gen. Freq.	Connect Sweep Gen. to	Sweep Gen. Chan.	Connect Oscilloscope to	Miscellaneous Connections	Adjust
11	Loosely couple to sweep gen. leads.	205.25 MC. and 209.75 MC.	300 ohm antenna terminals.	12	Lead extending from top of tuner. See fig. 5	Tuner on channel 12 3 volt bias to junction of C-49 locality switch in strong position.	C-3, C-4 and C-12 for max. response having linear peaks with picture and sound markers at 90% maximum response. See fig. 4
12	OBSERVE RESPONSE CURVE FOR ALL CHANNELS USING CORRECT FREQUENCIES AND CHANNELS. A SLIGHT COMPROMISE SHOULD BE MADE WITH C-3, C-4 and C-12 IF MARKERS ARE BELOW 70%.						

NOTE 5: FOR RF OSCILLATOR ALIGNMENT, SET VHF TUNER TO HIGHEST VHF OPERATING CHANNEL IN YOUR AREA. SET FINE TUNING CONTROL TO CENTER POSITION (FLAT OF SHAFT FACING UP.) ADJUST C-15 (CU-18 ON VHF—UHF TUNER) FOR BEST PICTURE DETAIL ON A TEST PATTERN OF A TV STATION.
ADJUST INDIVIDUAL CHANNEL SLUGS FOR BEST PICTURE DETAIL ON ALL OPERATING CHANNELS WITH A TEST PATTERN OF A TV STATION. NOTE: USE A NON-METALLIC SCREWDRIVER.

NOTE 6: T-2 (TU-1 in VHF-UHF Tuner, see fig. 5) part of a 40 MC. tuned trap need only be adjusted when local interferences from 40 thru 45 MC. affect the picture. Adjust T-2 for minimum 40 MC. beat on picture with a station signal.

TRIMMER LOCATION AND ALIGNMENT CONNECTION POINTS

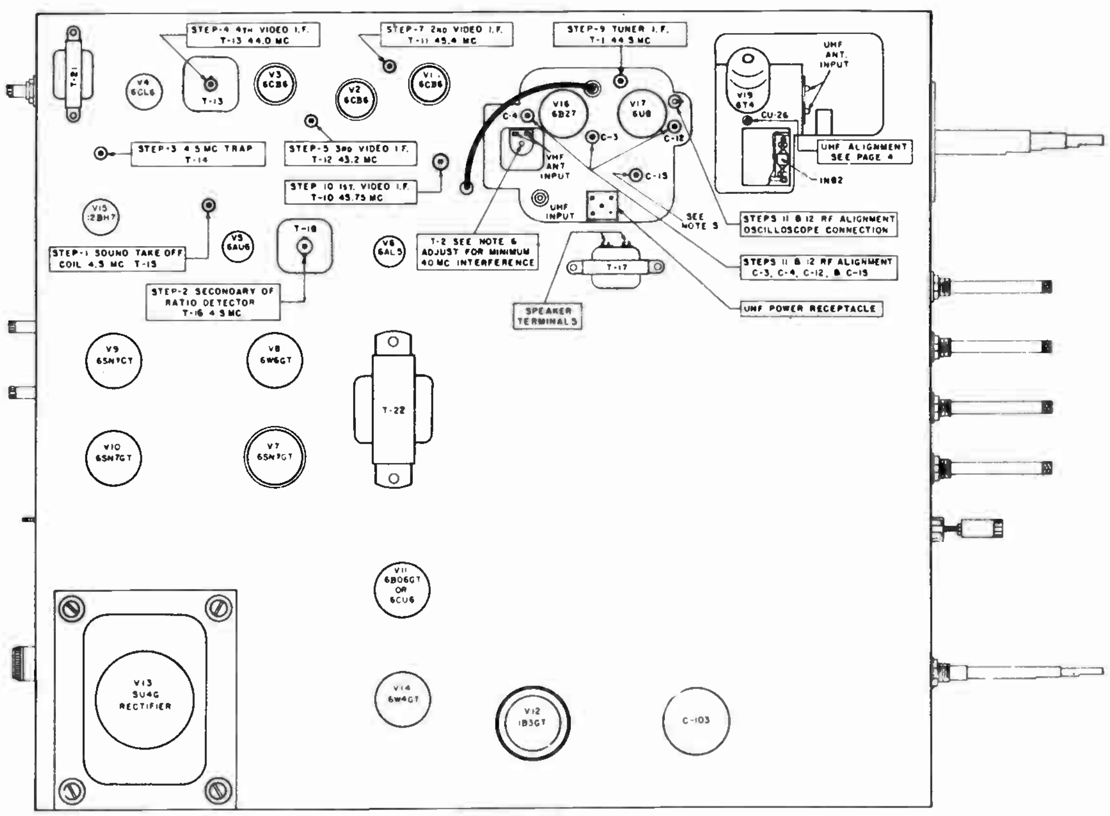


FIG. 5

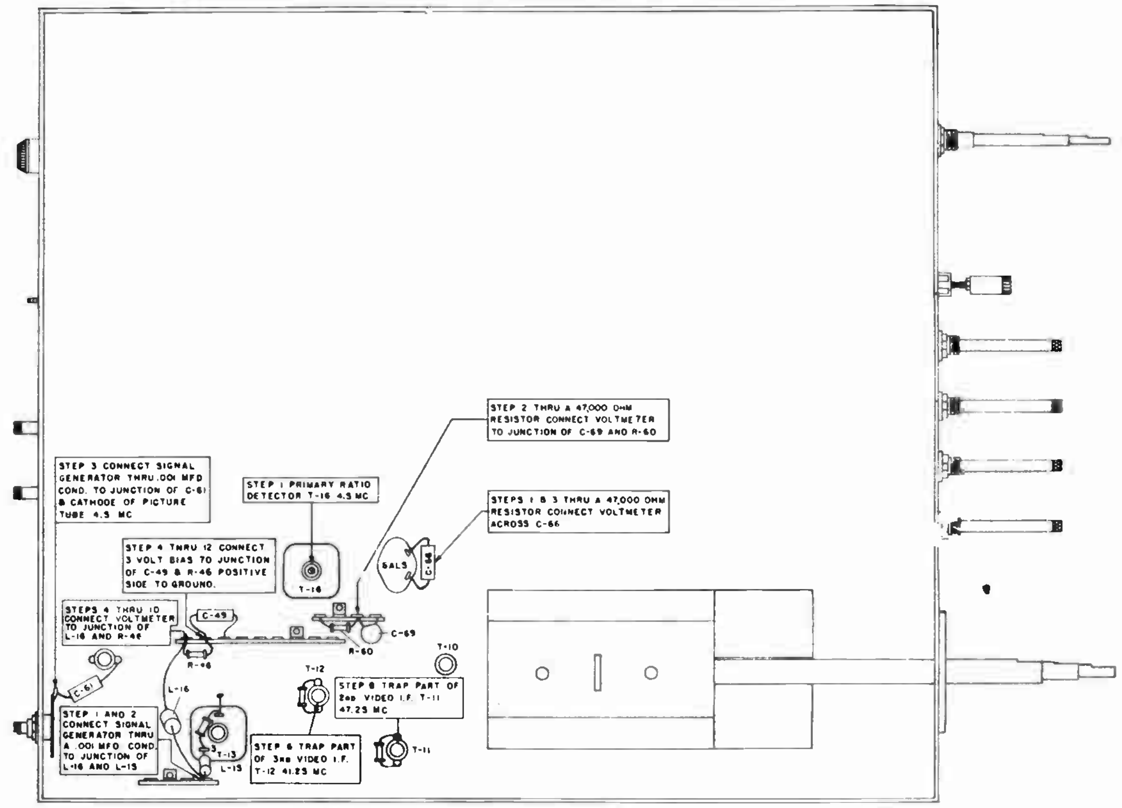
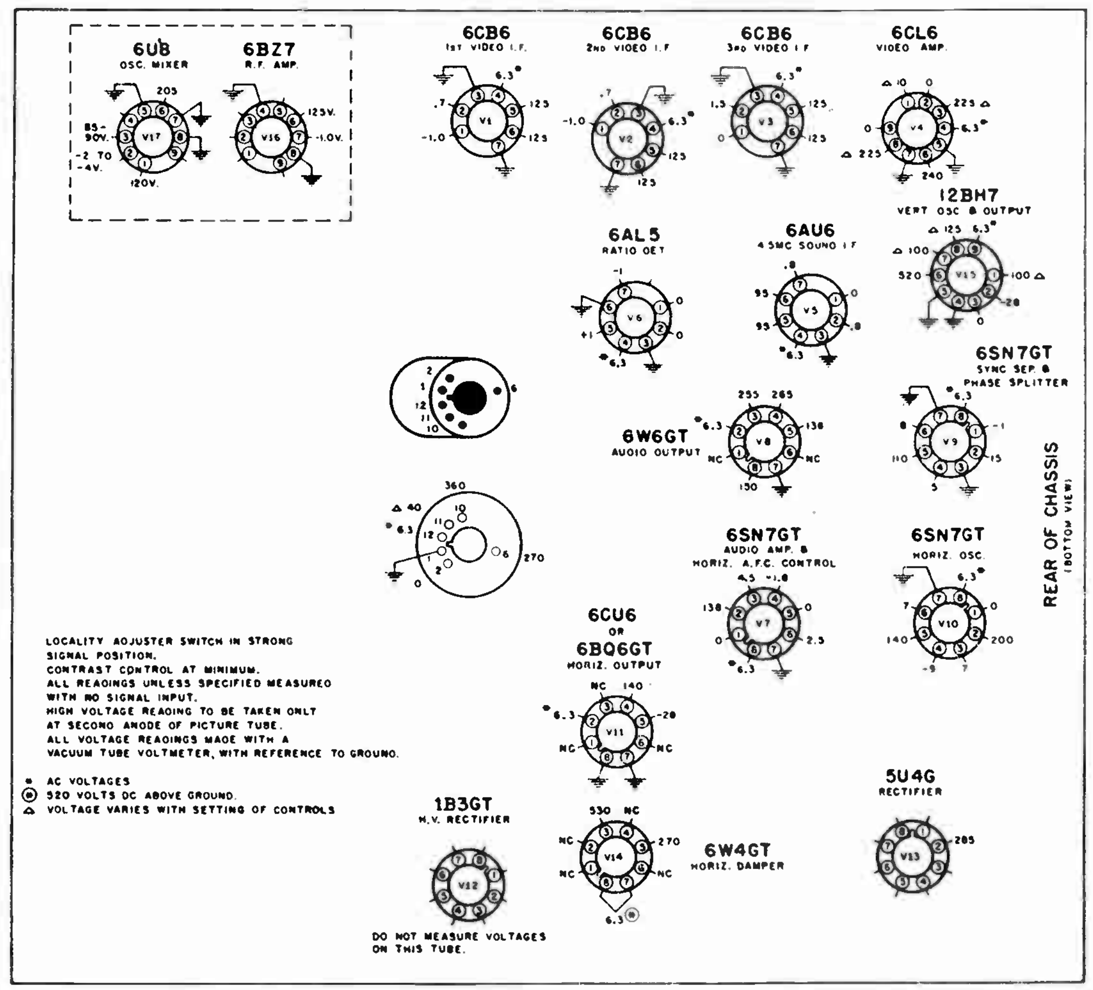
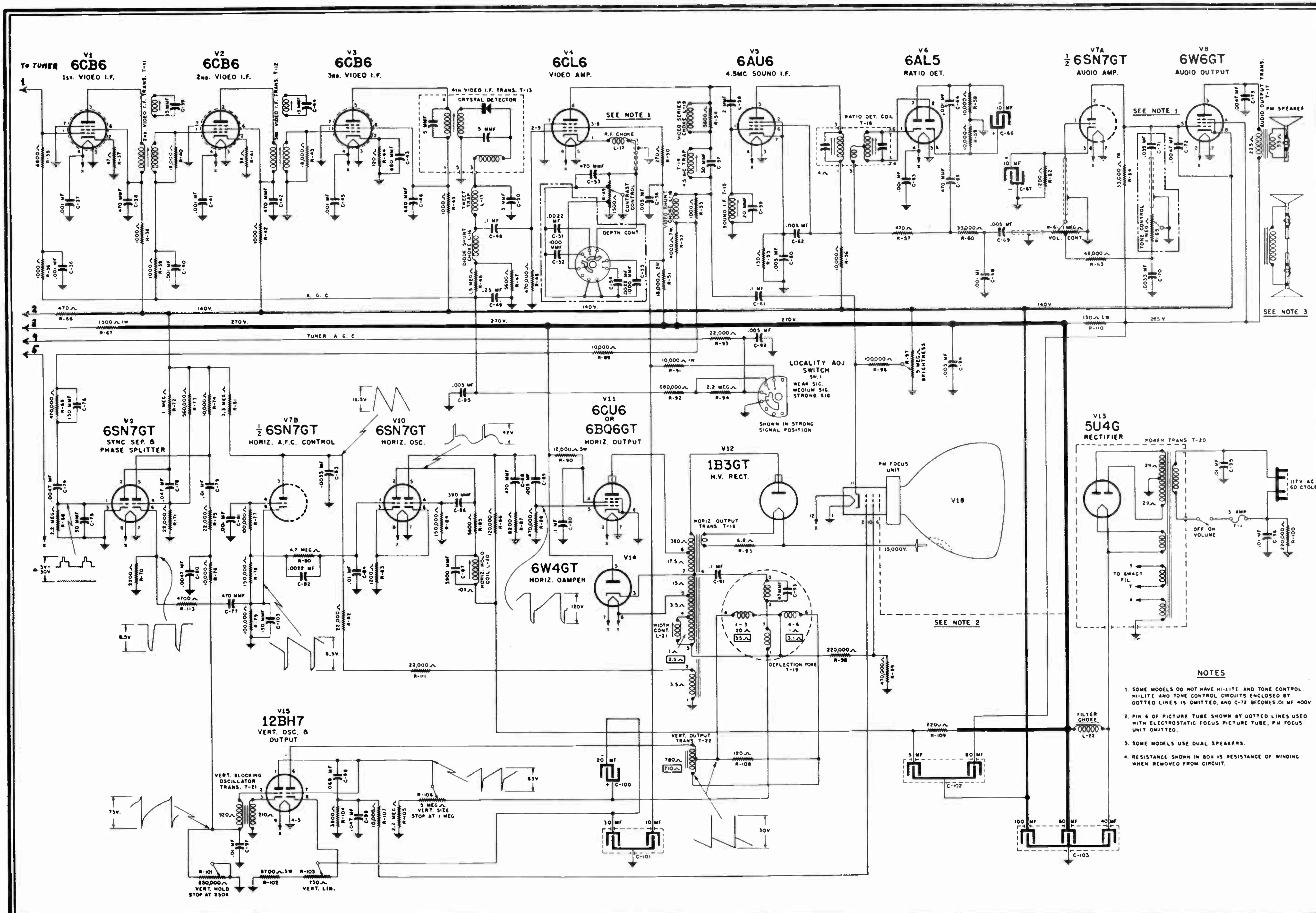


FIG. 6




TO TUNER
V1 6CB6 1ST. VIDEO I.F.
V2 6CB6 2ND. VIDEO I.F.
V3 6CB6 3RD. VIDEO I.F.
4TH VIDEO I.F. TRANS. T-13
CRYSTAL DETECTOR
V4 6CL6 VIDEO AMP.
SEE NOTE 1
V5 6AU6 4.5MC SOUND I.F.
V6 6AL5 RATIO DET.
RATIO DET. COIL T-16
V7A 1/2 6SN7GT AUDIO AMP.
V8 6W6GT AUDIO OUTPUT
PM SPEAKER
SEE NOTE 3
CONTRAST CONTROL
DEPTH CONT
VOL. CONT
TONE CONTROL
A. G. C.
TUNER A. G. C.
140V.
270V.
265V
LOCALITY ADJ SWITCH SW.1
WEAK SIG.
MEDIUM SIG.
STRONG SIG.
SHOWN IN STRONG SIGNAL POSITION
BRIGHTNESS
V9 6SN7GT SYNC SEP. & PHASE SPLITTER
V7B 1/2 6SN7GT HORIZ. A.F.C. CONTROL
V10 6SN7GT HORIZ. OSC.
V11 6CU6 OR 6BQ6GT HORIZ. OUTPUT
V12 1B3GT H.V. RECT.
PM FOCUS UNIT
V16
V13 5U4G RECTIFIER
POWER TRANS T-20
117 V AC 60 CYCLE
OFF ON VOLUME
3 AMP F-1
TO 6W4GT FIL.
V14 6W4GT HORIZ. DAMPER
HORIZ. HOLD COIL L-20
HORIZ OUTPUT TRANS. T-18
15,000V.
WIDTH CONT. L-21
DEFLECTION YOKE T-19
SEE NOTE 2
FILTER CHOKE L-22
V15 12BH7 VERT. OSC. & OUTPUT
VERT. BLOCKING OSCILLATOR TRANS. T-21
VERT. OUTPUT TRANS. T-22
VERT. SIZE STOP AT 1 MEG
850,000 VERT. HOLD STOP AT 250K
750 VERT. LIN.
NOTES
1. SOME MODELS DO NOT HAVE HI-LITE AND TONE CONTROL. HI-LITE AND TONE CONTROL CIRCUITS ENCLOSED BY DOTTED LINES IS OMITTED, AND C-72 BECOMES .01 MF 400V
2. PIN 6 OF PICTURE TUBE SHOWN BY DOTTED LINES USED WITH ELECTROSTATIC FOCUS PICTURE TUBE, PM FOCUS UNIT OMITTED.
3. SOME MODELS USE DUAL SPEAKERS.
4. RESISTANCE SHOWN IN BOX IS RESISTANCE OF WINDING WHEN REMOVED FROM CIRCUIT.

PARTS LIST

MISCELLANEOUS PARTS

Illus. No.	Part No.	Description	List Price
	16S-011	Tubo Shield	.22
	31K-525	Spring Rocker (Rear)	.11
	31K-118-02	Spring Drum Shaft Retainer	.11
	31K-801	Rocker Plastic	1.08
	31B-005	Spring Detent	.22
	31B-016	Roller Detent	.22
	31K-108	Spring, Fine Tuning and Rocker	.11
	31B-203-A	Drum Assembly Less Coils	4.60
	31K-163	Blade Fine Tuning	.30
	31K-886	Fine Tuning Link and Shaft Assembly	.41
	31K-826	Cam Fine Tuning	.54
	23A-056	Spring Compression For Fine Tuning Cam	.11
	31B-162-A	Shaft Fine Tuning	.81
	31A-152	Washer C Retainer For Fine Tuning Shaft	.11
	31K-800	Shield Cover	1.20
SW-1	29E30-2	Switch, Locality Adjuster	1.05
SW-2	29E33	Switch, Depth Control	1.46
F-1	40E8-10	Fuse, 3 Ampere (Slo-Blo)	.29
	17E32	Receptacle AC 2 Contact, Male	.30
	17E1-46	Socket, Miniature, 7 pin	.20
	17E1-41	Socket, Miniature, 9pin	.18
	17E1-39	Socket, Miniature, 9 pin Nova Mica	.50
	17E1-27	Socket, Octal Mica Flled	.24
	17E1-18	Socket, Octal	.15
	17E44	Socket, HV With Corona Ring	1.06
	55E57	Fuse Holder with Cap	.78
	20E950	Tuner Assembly VHF (Models 701, 711, 714, 752, 755, 758)	
	20E976	Tuner Assembly VHF-UHF (Models 721, 724, 762, 765, 768, 791)	

VHF TUNER

CAPACITORS

Illus. No.	Part No.	Description	List Price
C-1		Fixed Ceramic, 5 MMF (Part of T-2)	$
C-2	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	.27
C-3	31A-056-1	Trimmer, .5-3 MMF with Screw and Nut	.75
C-4	31A-056-2	Trimmer, 3-9 MMF with Screw and Nut	.75
C-5	13L8C030K	Fixed Ceramic, 3 MMF ± 10%	.27
C-6	13M28N1027-03	Feed Thru 1000 MMF GMV. (Part of Center Shield Assem.)	.29
C-7	13L8C1R5C	Fixed Ceramic, 1.5 MMF ± .25 MMF NPO	.32
C-8	13L8Q470K	Fixed Ceramic, 47 MMF ± 10%	.32
C-10	13L8T100A	Fixed Ceramic, 10 MMF ± 1 MMF N470	.27
C-11	13M20U470K-R	Feed Thru 47 MMF ± 10% N750	.41
C-12	31A-056-1	Trimmer .5-3 MMF with screw and nut	.75
C-13	13L12D221K	Fixed Ceramic, 220 MMF ± 10%	.32
C-14	13L8UA050C	Fixed Ceramic, 5 MMF ± .25 MMF N-900	.46
C-15	31A-056-1	Trimmer .5-3 MMF with screw and nut	.75
C-16	13L12U680H	Fixed MICA, 68 MMF ± 3%	.41
C-17	13M-28N1027-03	Feed Thru 1000 MMF GMV (Part of Center Shield Assembly)	.29
C-18	13M-28N1027-03	Feed Thru 1000 MMF GMV (Part of Center Shield Assembly)	.29
C-19	13M-28N1027-03	Feed Thru 1000 MMF GMV (Part of Center Shield Assembly)	.29
C-20	23E2027-14	Fixed Ceramic, 470 MMF 500 V	.21

RESISTORS

Illus. No.	Part No.	Description	List Price
R-1	27E473K-½	Carbon, 47,000 Ohm ½ W. ± 10%	.10
R-2	27E223K-½	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-3	27E824K-½	Carbon, 820,000 Ohm ½ W. ± 10%	.10
R-4	27E474K-½	Carbon, 470,000 Ohm ½ W. ± 10%	.10
R-5	27E152K-1	Carbon, 1500 Ohm 1 W. ± 10%	.14
R-6	27E682K-½	Carbon, 6800 Ohm ½ W. ± 10%	.10
R-7	27E332K-1	Carbon, 3300 Ohm 1 W. ± 10%	.14
R-8	27E103K-½	Carbon, 10,000 Ohm ½ W. ± 10%	.10
R-9	27E104K-½	Carbon, 100,000 Ohm ½ W. ± 10%	.10
R-10	27E104K-½	Carbon, 100,000 Ohm ½ W. ± 10%	.10
R-11	27E104K-½	Carbon, 100,000 Ohm ½ W. ± 10%	.10
R-12	27E822K-½	Carbon, 8200 Ohm ½ W. ± 10%	.10

COILS AND CHOKES

Illus. No.	Part No.	Description	List Price
T-1	31K-109	Mixer IF	.81
T-2	31K-225-01	40 MC. Trap Assembly Antenna Input	6.75
L-1	31B-629	Choke Cathode	.27
L-2	34A-704	RF Filament Choke	.10
		When ordering channel strips specify required channel and code number. For example: part number for channel 2 strips would be 31M-012-2U for the antenna strip and 31M-112-2U for RF and oscillator strip.	
	31M-012	Antenna Strips Channels 2 Thru 6 Code U. Green	1.20
	31M-012	Antenna Strips Channels 7 Thru 13 Code U, Green	1.00
	31M-112	RF and Oscillator Strips Channels 2 Thru 6 Code U, Green	1.60
	31M-112	RF and Oscillator Strips Channels 7 Thru 13 Code U. Green	1.50
		Kits containing the necessary strips to convert to any UHF channel are available. When ordering please be sure to: Specify required UHF channel number, and code letter U.	

MAIN CHASSIS

CAPACITORS

Illus. No.	Part No.	Description	List Price
C-36	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	.17
C-37	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	.17
C-38	23E4000-26	Fixed Ceramic, 470 MMF 500 V.	.21
C-40	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	.17
C-41	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	.17
C-42	23E4000-26	Fixed Ceramic, 470 MMF 500 V.	.21
C-43	23E4000-28	Fixed Ceramic, 680 MMF 500 V.	.21
C-45	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	.17
C-46	23E4000-28	Mixed Ceramic, 680 MMF 500 V.	.21
C-48	23E3216	Molded Tubular, .1 MFD 200 V.	.34
C-49	23E122	Fixed Paper, .25 MFD 100 V.	.42
C-50	23E4001-6	Fixed Ceramic, 3 MMF 500 V.	.17
C-51	23E3406	Molded Tubular, .0022 MFD 400 V. (not used in models 701, 711, 714, 721, 724, 791)	.28
C-52	23E4000-30	Fixed Ceramic, .001 MFD 500 V. (not used in models 701, 711, 714, 721, 724, 791)	.22
C-53	23E4000-26	Fixed Ceramic, 470 MMF 500 V.	.21
C-54	23E3406	Molded Tubular, .0022 MFD 400 V. (not used in models 701, 711, 714, 721, 724, 791)	.28
C-55	23E4000-30	Fixed Ceramic, .001 MFD 500 V. (not used in models 701, 711, 714, 721, 724, 791)	.22
C-56	23E4004-15	Fixed Ceramic, .005 MFD 500 V.	.31
C-57	23E4001-9	Fixed Ceramic 30 MMF 500 V.	.23
C-58	23E4001-7	Fixed Ceramic, 2 MMF 500 V.	.19
C-59	23E4001-8	Fixed Ceramic, 20 MMF 500 V.	.19
C-60	23E4004-15	Fixed Ceramic. .005 MFD 500 V.	.31
C-61	23E3416	Molded Tubular, .1 MFD 400 V.	.38
C-62	23E4004-15	Fixed Ceramic, .005 MFD 500 V.	.31
C-63	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	.17
C-64	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	.17
C-65	23E3500-40	Fixed Mica, 470 MMF 500 V.	.32
C-66	25E66	Dry Electrolytic, 10 MFD 50 V.	1.14
C-67	25E66	Dry Electrolytic, 10 MFD 50 V.	1.14
C-68	23E4000-30	Fixed Ceramic, .001 MFD 500 V.	.22
C-69	23E4004-15	Fixed Ceramic, .005 MFD 500 V.	.31
C-70	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-71	23E3423	Molded Tubular, .039 MFD 400 V. (not used in models 701, 711, 714, 721, 724, 791)	.34
C-72	23E3408	Molded Tubular, .0047 MFD 400 V. (not used in models 701(711, 714, 721, 724, 791)	.27
C-72	23E3410	Molded Tubular, .01 MFD 400 V. (not used in models 752, 755, 758, 762, 765, 768)	.28
C-73	23E3608	Molded Tubular, .0047 MFD 600 V.	.29
C-74	23E3608	Molded Tubular, .0047 MFD 600 V.	.29
C-75	23E4001-9	Fixed Ceramic, 30 MMF 500 V.	.23
C-76	23E4000-20	Fixed Ceramic, 150 MMF 500 V.	.17
C-77	23E3500-40	Fixed Mica, 470 MMF 500 V.	.32
C-78	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-79	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-80	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-81	23E4004-5	Fixed Ceramic, .001 MFD 500 V.	
C-82	23E3406	Molded Tubular, .0022 MFD 400 V.	.28
C-83	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-84	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-85	23E4004-15	Fixed Ceramic, .005 MFD 500 V.	.31
C-86	23E3500-39	Fixed Mica, 390 MMF 500 V.	.29
C-87	23E4005-64	Fixed Mica, 3900 MMF 500 V. ± 5%	1.35
C-88	23E3500-40	Fixed Mica, 470 MMF 500 V.	.32
C-89	23E4004-15	Fixed Ceramic, .005 MFD 500 V.	.31
C-90	23E3416	Molded Tubular, .1 MFD 400 V.	.38
C-91	23E3616	Molded Tubular, .1 MFD 600 V.	.52
C-92	23E4004-15	Fixed Ceramic, .005 MFD 500 V.	.31
C-93	23E2025-5	Fixed Ceramic, 47 MMF 2000 V.	.32
C-94	23E4004-15	Fixed Ceramic, .005 MFD 500 V.	.31
C-95	23E3610	Molded Tubular, .01 MFD 600 V.	.30
C-96	23E3610	Molded Tubular, .01 MFD 600 V.	.30
C-97	23E3424	Molded Tubular, .01 MFD 400 V. ± 10%	.42
C-98	23E3415	Molded Tubular, .068 MFD 400 V.	.39
C-99	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-100	25E64	Dry Electrolytic, 20 MFD 450 V.	1.88
C-101	25E63	Dry Electrolytic, 30 MFD 200 V., 10 MFD 350 Volts	2.07
C-102	25E62	Dry Electrolytic, 5-60 MFD 250 V.	2.19
C-103	25E78	Dry Electrolytic, 40-80 MFD 350 V. 100 MFD 200 V.	4.89
C-105	23E4000-20	Fixed Ceramic, 150 MMF 500 V.	.17
C-106	23E3416	Molded Tubular, .1 MFD 400 V.	.38

RESISTORS

Illus. No.	Part No.	Description	List Price
R-35	27E682K-½	Carbon, 6800 Ohm ½ W. ± 10%	.10
R-36	27E102K-½	Carbon, 1000 Ohm ½ W. ± 10%	.10
R-37	27E470K-½	Carbon, 47 Ohm ½ W. ± 10%	.10
R-38	27E102K-½	Carbon, 1000 Ohm ½ W. ± 10%	.10
R-39	27E102K-½	Carbon, 1000 Ohm ½ W. ± 10%	.10
R-40	27E183K-½	Carbon, 18,000 Ohm ½ W. ± 10%	.10
R-41	27E560K-½	Carbon, 56 Ohm ½ W. ± 10%	.10
R-42	27E102K-½	Carbon, 1000 Ohm ½ W. ± 10%	.10
R-43	27E183K-½	Carbon, 18,000 Ohm ½ W. ± 10%	.10
R-44	27E121K-½	Carbon, 120 Ohm ½ W. ± 10%	.10
R-45	27E102K-½	Carbon, 1000 Ohm ½ W. ± 10%	.10
R-46	27E155M-½	Carbon, 1.5 Megohm ½ W. ± 20%	.10
R-47	27E562J-½	Carbon, 5600 Ohm ½ W. ± 5%	.18
R-48	27E474M-½	Carbon, 470,000 Ohm, ½ W. ± 20%	.10
R-49	28E99-2	Control Contrast 1500 Ohm (Part of R-61)	2.70
R-50	27E271K-½	Carbon, 270 Ohm ½ W. ± 10%	.10
R-51	27E183K-2	Carbon, 18,000 Ohm 2 W. ± 10%	.24
R-52	27E1016-14	Wirewound, 4000 Ohm 7 W. ± 10%	.53
R-53	27E102K-½	Carbon, 1000 Ohm ½ W. ± 10%	.10
R-54	27E562J-½	Carbon, 5600 Ohm ½ W. ± 5%	.18
R-55	27E151K-½	Carbon, 150 Ohm ½ W. ± 10%	.10
R-56	27E103K-½	Carbon, 10,000 Ohm ½ W. ± 10%	.10
R-57	27E471K-½	Carbon, 470 Ohm ½ W. ± 10%	.10
R-58	27E103J-½	Carbon, 10,000 Ohm ½ W. ± 5%	.18
R-59	27E103J-½	Carbon, 10,000 Ohm ½ W. ± 5%	.18
R-60	27E333K-½	Carbon, 33,000 Ohm ½ W. ± 10%	.10
R-61	28E99-2	Control Off-On-Vol. 1 megohm (Part of R-49)	2.70
R-62	27E122K-½	Carbon, 1200 Ohm ½ W. ± 10%	.10
R-63	27E683K-½	Carbon, 68,000 Ohm ½ W. ± 10%	.10
R-64	27E333K-1	Carbon, 33,000 Ohm 1 W ± 10%	.14
R-65	28E113	Control Tone, 1 Megohm (not used in models 701, 711, 714, 721, 724, 791)	.84
R-66	27E471K-½	Carbon, 470 Ohm ½ W. ± 10%	.10
R-67	27E152K-1	Carbon, 1500 Ohm 1 W ± 10%	.14
R-68	27E225M-½	Carbon, 2.2 Megohm ½ W. ± 20%	.10
R-69	27E474M-½	Carbon, 470,000 Ohm ½ W. ± 20%	.10
R-70	27E222K-½	Carbon, 2200 Ohm ½ ± 10%	.10
R-71	27E223K-½	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-72	27E105M-½	Carbon, 1 Megohm ½ W. ± 20%	.10
R-73	27E564K-½	Carbon, 560,000 Ohm ½ W. ± 10%	.10
R-74	27E103K-½	Carbon, 10,000 Ohm ½ W. ± 10%	.10
R-75	27E223K-½	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-76	27E103K-½	Carbon, 10,000 Ohm ½ W. ± 10%	.10
R-77	27E104K-½	Carbon, 100,000 Ohm ½ W. ± 10%	.10
R-78	27E154K-½	Carbon, 150,000 Ohm ½ W. ± 10%	.10
R-79	27E104K-½	Carbon, 100,000 Ohm ½ W. ± 10%	.10
R-80	27E475M-½	Carbon, 4.7 Megohm ½ W. ± 20%	.10
R-81	27E335M-½	Carbon, 3.3 Megohm ½ W. ± 20%	.10
R-82	27E223K-½	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-83	27E122K-½	Carbon, 1,200 Ohm ½ W. ± 10%	.10
R-84	27E154K-½	Carbon, 150,000 Ohm ½ W. ± 10%	.10
R-85	27E562J-½	Carbon, 5,600 Ohm ½ W. ± 5%	.18
R-86	27E124K-½	Carbon, 120,000 Ohm ½ W. ± 10%	.10
R-87	27E822J-½	Carbon, 8,200 Ohm ½ W. ± 5%	.18
R-88	27E474M-½	Carbon, 470,000 Ohm ½ W. ± 20%	.10
R-89	27E103K-½	Carbon, 10,000 Ohm ½ W. ± 10%	.10
R-90	27E1016-25	Wirewound, 12,000 Ohm 5 W. ± 10%	.76
R-91	27E103K-1	Carbon, 10,000 Ohm 1 W. ± 10%	.14
R-92	27E684M-½	Carbon, 680,000 Ohm ½ W. ± 20%	.10
R-93	27E223K-½	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-94	27E225M-½	Carbon, 2.2 Megohm ½ W. ± 20%	.10
R-95	27E1015-9	Wirewound, 6.8 Ohm ½ W. ± 5%	.18
R-96	27E104M-½	Carbon, 100,000 Ohm ½ W. ± 20%	.10
R-97	28E109	Control Brightness, 5 Megohm	.85
R-98	27E224M-½	Carbon, 220,000 Ohm ½ W. ± 20%	.10
R-99	27E474M-½	Carbon, 470,000 Ohm ½ W. ± 20%	.10
R-100	27E224M-½	Carbon, 220,000 Ohm ½ W. ± 20%	.10
R-101	28E111	Control Vertical Hold, 850,000 Ohm stop at 250,000 Ohm	.91
R-102	27E1016-3	Wirewound, 6000 Ohm 4 W. ± 10% (Used with 28E108 Control)	.52
R-102A	27E332K-2	Carbon, 3300 Ohm 2 W. ± 10% (Used with 28E108 Control) (Connected in series with R-102)	.24
R-102B	27E1016-20	Wirewound, 8700 Ohm 5 W. (Used with 28E117 Control)	.51
R-103	28E108	Control Vertical Linearity, 5000 Ohm	.65
R-103A	27E102K-½	Carbon, 1000 Ohm ½ W. ± 10% (Used with 28E108 Control) (Parallels R-103)	.10
R-103B	28E117	Control Vertical Linearity, 750 Ohm	.63
R-104	27E392K-½	Carbon, 3900 Ohm ½ W. ± 10%	.10
R-105	27E225M-½	Carbon, 2.2 Megohm ½ W. ± 20%	.10
R-106	28E110	Control Vertical Size, 5 Megohm stop at 1 Megohm	.70
R-107	27E103K-½	Carbon, 10,000 Ohm ½ W. ± 10%	.10
R-108	27E121K-½	Carbon, 120 Ohm ½ W. ± 10%	.10
R-109	27E222K-½	Carbon, 2200 Ohm ½ W. ± 10%	.10
R-110	27E151K-1	Carbon, 150 Ohm 1 W. ± 10%	.14
R-111	27E223K-½	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-113	27E472K-½	Carbon, 4,700 Ohm ½ W. ± 10%	.10

COILS AND TRANSFORMERS

Illus. No.	Part No.	Description	List Price
L-15	20E883	Tweet Trap	.19
L-16	20E363-19	Choke Diode Shunt	.78
L-17	2E92	Choke R. F.	.40
L-18	20E363-26	Choke Video Shunt	.78
L-19	20E363-25	Choke Video Series	.78
L-20	20E831	Coil, Horizontal Hold	1.95
L-21	20E952	Coil, Horizontal Width	1.50
L-22	22E73-2	Choke Filter	1.97
T-10	20E857	Transformer, 1st Video IF	.84
T-11	20E858	Transformer, 2nd Video IF	1.94
T-12	20E859	Transformer, 3rd Video IF	1.92
T-13	20E860	Transformer, 4th Video IF	3.20
T-14	20E785	Trap, 4.5 MC	1.25
T-15	20E785	Transformer, Sound IF	1.25
T-16	20E783	Transformer, Ratio Detector	3.73
T-17	22E91	Transformer, Audio Output	1.97
T-17	22E92	Transformer, Audio Output (Used with Dual Speaker)	2.34
T-18	20E947	Transformer, Horizontal Output	11.07
T-19	20E788-5	Yoke Deflection for Electro-Static Focus Picture Tubes	11.72
	20E788-3	Yoke Deflection for Electromagnetic Focus Picture Tubes	11.72
T-20	22E94	Tranformer, Power	22.84
T-21	22E89	Transformer, Vertical Blocking Oscillator	2.05
T-22	22E72-2	Transformer, Vertical Output	3.78
	62E9	Focus Magnet for Electro-Magnetic Focus Picture Tubes	9.18
	15E174-4 or 15E174-6	Ion Trap	1.55
	95E1	Crystal, 2nd Detector (1N60)	1.00
	41E16	Line Cord with Female Plug	1.27
	1E58	Speaker, 5" PM Models 701, 711, 721, 791	5.26
	1E34-2	Speaker, 8" PM Models 714, 724	10.27
	1E49	Speaker, 6" PM Models 752, 755, 758, 762, 765, 768	7.13
	1E43-2	Speaker, 10" PM Models 755, 758, 765, 768	11.03

ELECTRICAL SPECIFICATIONS

Power Supply................110 to 120 Volts 60 Cycle AC

Power Consumption..130 Watts

Antenna Input..................................300 Ohms Balanced

Tuning Range..........12 Channel Models 901, 911, 914

Tuning Range..........82 Channel Models 921, 924, 991

Loud Speaker...........4" PM Models 901, 911, 921, 991
8" PM Models 914, 924

Voice Coil Impedance...........3.2 Ohm at 400 Cycles

I.F. CIRCUIT Inter-Carrier Sound

R.F. STAGE One

I.F. STAGES Three "Combined Picture and Sound" and one "Sound"
21.9 M.C. Sound Carrier
26.4 M.C. Video Carrier
4.5 M.C. Inter-Carrier Sound

CABINET AND CHASSIS REMOVAL INSTRUCTIONS

IMPORTANT: The cabinet of the table model receivers can be removed from cabinet base for service adjustments. Care should be taken that only the proper screws are removed when separating cabinet from cabinet base.

REMOVING CABINET FROM CABINET BASE (TABLE MODELS ONLY)

1. Remove all control knobs and cabinet back.
2. Remove antenna terminal plate from cabinet and disconnect speaker leads.
3. Place cabinet face down on a soft clean cloth.
4. Remove ONLY the cabinet mounting screws located under and on the outer edges of cabinet base. DO NOT REMOVE CHASSIS MOUNTING SCREWS. Remove the 2 wood screws from the lower rear corner support braces of cabinet.
5. Carefully guide cabinet and cabinet base to its normal upright position. Remove cabinet by lifting straight up.

REMOVING CHASSIS BASE FROM CONSOLE CABINETS

1. Remove all knobs and cabinet back.
2. Remove antenna terminal plate from cabinet and disconnect speaker leads.
3. Remove the screws under guide rails of chassis base and the one screw under center support bridge.
4. Slide chassis base out.

HEIGHT CONTROL

This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the VERTICAL LINEARITY to obtain a picture that is correctly proportioned.

VERTICAL LINEARITY CONTROL

This control increases or decreases the height of the upper portion of the picture.

BRIGHTNESS CONTROL

This control is used in adjusting for brilliance or light intensity of the screen. When picture is too light adjust Brightness Control.

NOTE: The Brightness Control has an extended shaft that permits adjustment from the rear of the cabinet without removing the cabinet back.

ION TRAP ASSEMBLY

Maximum brightness will be determined by the position of the ION TRAP ASSEMBLY:

1. Advance BRIGHTNESS CONTROL on rear of chassis to maximum brightness position.
2. Adjust the ION TRAP ASSEMBLY for maximum brightness by sliding back and forth and rotating to right or left.
3. Reduce BRIGHTNESS with BRIGHTNESS CONTROL and repeat adjustment of ION TRAP for best positioning.

CAUTION: IF A SEMI-CIRCULAR SHADOW AROUND CORNER OF PICTURE OR PATTERN IS OBTAINED, DO NOT ELIMINATE WITH ION TRAP, IF BY SO DOING THE INTENSITY OF THE PATTERN IS DECREASED.

BUZZ CONTROL See "Sound Alignment"

SERVICING FRONT OF CHASSIS

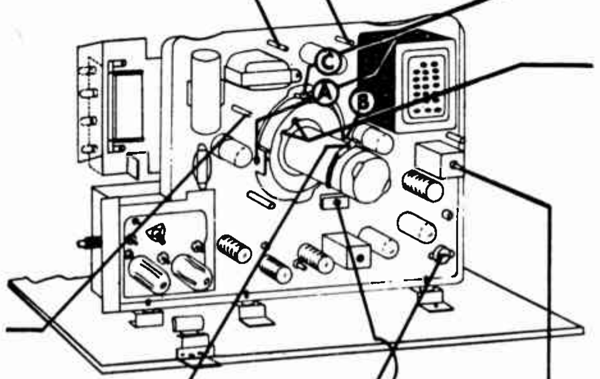
Picture tube and chassis are self supported and servicing on front of chassis can be accomplished by removing chassis only.

Disconnect picture tube socket, ion trap, HV connector, and AC receptacle before removing chassis from chassis base.

If picture tube is required while servicing front of chassis, proceed as follows:

1. Remove yoke wingnut, and turn yoke around to face rear of chassis.
2. Turn chassis around and carefully slide yoke around neck of picture tube.
3. Tape yoke to bell of picture tube.
4. Add a jumper wire between HV connector and second anode of picture tube.
5. Replace ion trap and picture tube socket.

REAR VIEW



DEFLECTION YOKE ADJUSTMENT

The deflection yoke must be positioned as far forward as possible on the neck of the picture tube and centered around the picture tube neck at the same time. To make this adjustment, loosen screws "A" and "B" enough to permit the yoke bracket to be pushed forward. While holding the bracket in this position, tighten screws "A" and "B." If the picture is tilted, loosen wing nut "C" on the top side of the yoke. Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.

CENTERING MAGNET ADJUSTMENT

If the picture is off center and or has neck shadow rotate either or both centering magnet levers to the right or left until the picture is centered on the screen and the picture is free of all neck shadow. Then readjust the Ion Trap.

HORIZONTAL FREQUENCY ADJUSTMENT

If the Horizontal Hold Control is insufficient to lock in a single stationary picture, the Horizontal Frequency Adjustment will require adjustment. See "Horizontal Blocking Oscillator Alignment"

HORIZONTAL LOCK

If the range of the Horizontal Hold Control is insufficient to lock in a single stationary picture the Horizontal Lock trimmer will require adjustment. See "Horizontal Blocking Oscillator Alignment"

FOCUS

It may be possible to obtain better focus with replacement picture tubes, if the electronic focus anode is connected to a point other than the +150 volt line.

Suggested points to try are: chassis ground, +260 volts, +285 volts (picture tube pin 10) and +480 volt line.

SERVICING HINTS FOR LOCATING FAULTY TUBES

This receiver employs a series-parallel filament circuit.
Receiver should never be operated with any tube removed.

1. **VISUAL INSPECTION:** Turn receiver "ON" and make a visual inspection of all tubes to see if they light up. All tubes except 1X2B will have an apparent glow.
2. **IF ALL TUBES DO NOT LIGHT UP:** Replace the 12AX4 (V-111), 12BH7 (V-110), 6SN7 (V-107). Check continuity across pins 1 and 12 of picture tube. Check resistance of R-153 (tube life extender)—125 ohms (cold).

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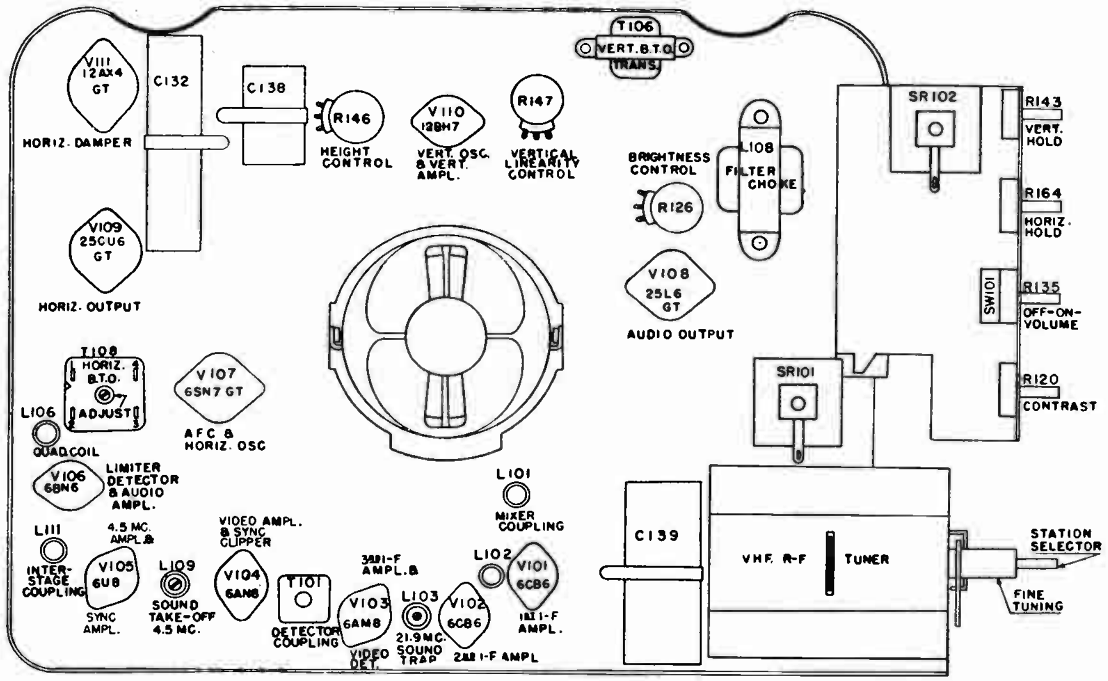
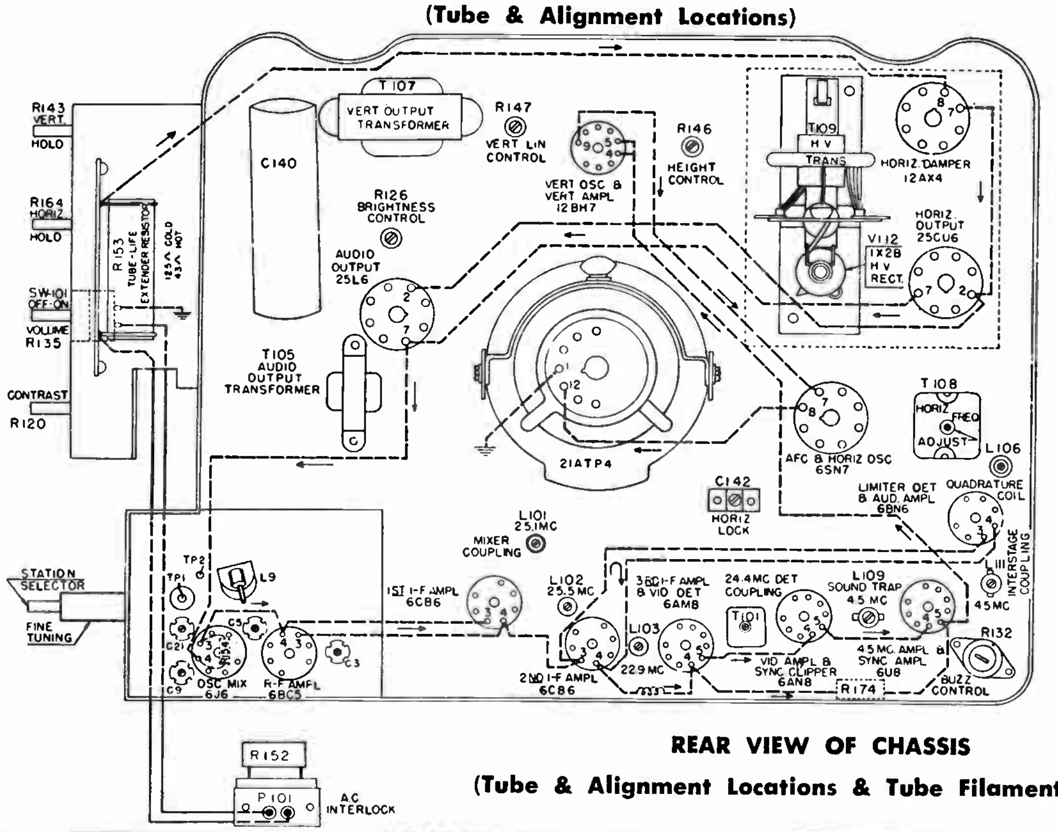
3. **IF TUBES LIGHT UP:**

Sound but no raster........replace 25CU6 (V-109), 1X2B (V-112)
Picture but no sound........replace 25L6 (V-108), 6BN6 (V-106)
No sound or picture with raster......replace 6BC5 (V-1), 6J6 (V-2), 6CB6 (V-101), 6CB6 (V-102) 6AM8 (V-103), 6AN8 (V-104)
Picture, but no sync. or Sound........replace 6U8 (V-105)
Sound, no vertical deflection or sync........replace 12BH7 (V-110)



FRONT VIEW OF CHASSIS

(Tube & Alignment Locations)



REAR VIEW OF CHASSIS

(Tube & Alignment Locations & Tube Filament Wiring)

VHF TUNER

(Tube & Alignment Locations)

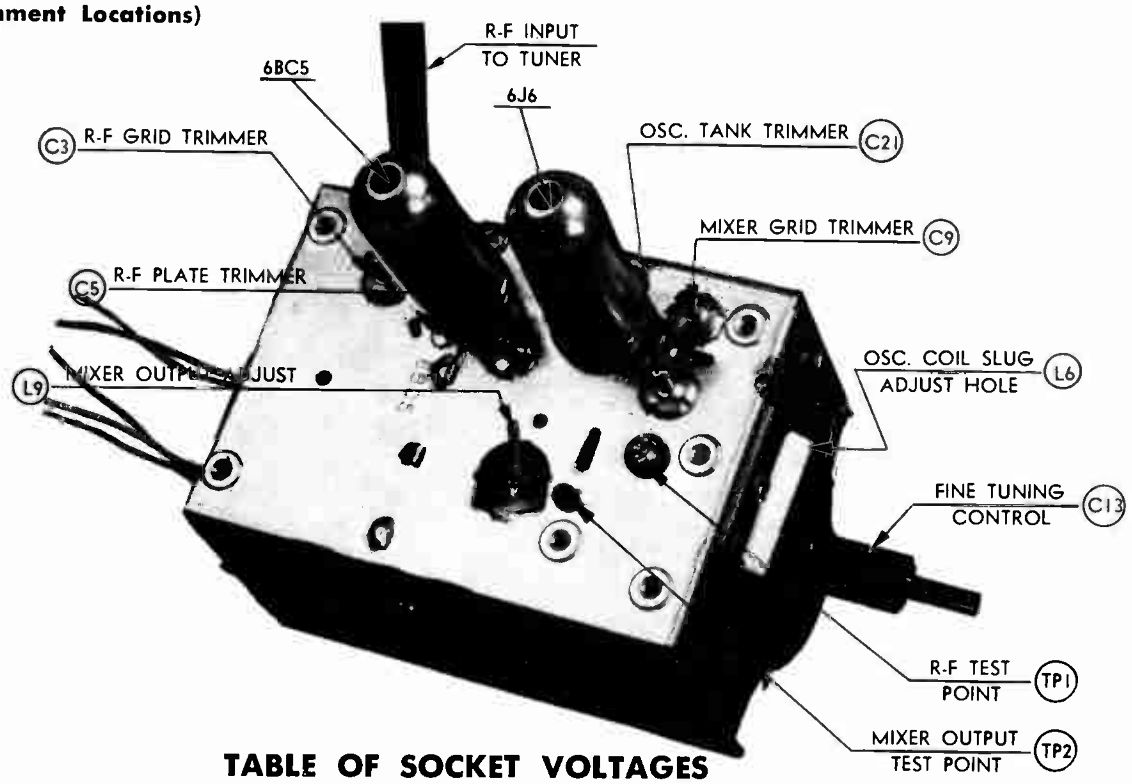


TABLE OF SOCKET VOLTAGES

The following voltages were measured with an electronic voltmeter while the set was operating on 117 volts, 60 cycle a.c. with no signal input, antenna terminals shorted, Station Selector set to channel 3, and the Brightness and Contrast Controls at minimum setting. Electronic voltmeter connected between socket lug and chassis. * = AC. voltages. Voltages may vary depending upon the setting of other controls.

D. C. current at junction of L108 and C132B, with contrast control in the maximum counter-clockwise position, 190 ma. With contrast set at maximum clockwise position, D.C. current at this point is 200 ma.

Symbol	Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101	6CB6	—0.8	+0.6	*50.4	*44.1	+135	+131	0	....	....
V102	6CB6	—0.6	+0.7	*44.1	*37.8	+137	+143	0	....	....
V103	6AM8	+1.0	....	+137	*37.8	*31.5	+145	0	—1.1	0
V104	6AN8	+10.5	—0.9	0	*31.5	*25.2	+250	+230	+1.7	+7.3
V105	6U8	+53.5	....	+59	*25.2	*18.9	+59	+0.8	0	—0.5
V106	6BN6	+2.5	....	*44.1	*37.8	+100	....	+100	....	....
V107	6SN7GT	+16	+74 to +150	+2.1	—90	+210	0	*12.6	*6.3	....
V108	25L6GT	....	*81.7	+250	+270	+145	....	*56.7	+150	....
V109	25CU6	....	*81.7	....	+130	—30	....	*56.7	0	Cap—High Voltage *12.6
V110	12BH7	+72	—19	0	*18.9	*18.9	● +490	+72	+95	
V111	12AX4	....	....	● +515	....	+265	....	*81.7	*94	....
V112	1X2B	....	....	....	....	....	....	....	H. V. 13KV	....
V113	21ATP4 or 17AVP4	*0	....	....	....	....	Gnd or +150	(Pin 10) +300	(Pin 11) +150	(Pin 12) *6.3
V1	6BC5	....	0	*44.1	*50.4	+125	+125	0	....	....
V2	6J6	+80	+78	*50.4	*56.4	....	—7.4	0	....	....

● Do not measure. High voltage pulse over 2 kv. on cathode of Damper Tube and over 1 kv. on pin 6 of V110.

UHF TUNER ALIGNMENT

EQUIPMENT REQUIRED

UHF SWEEP GENERATOR

UHF MARKER GENERATOR

CATHODE RAY OSCILLOSCOPE

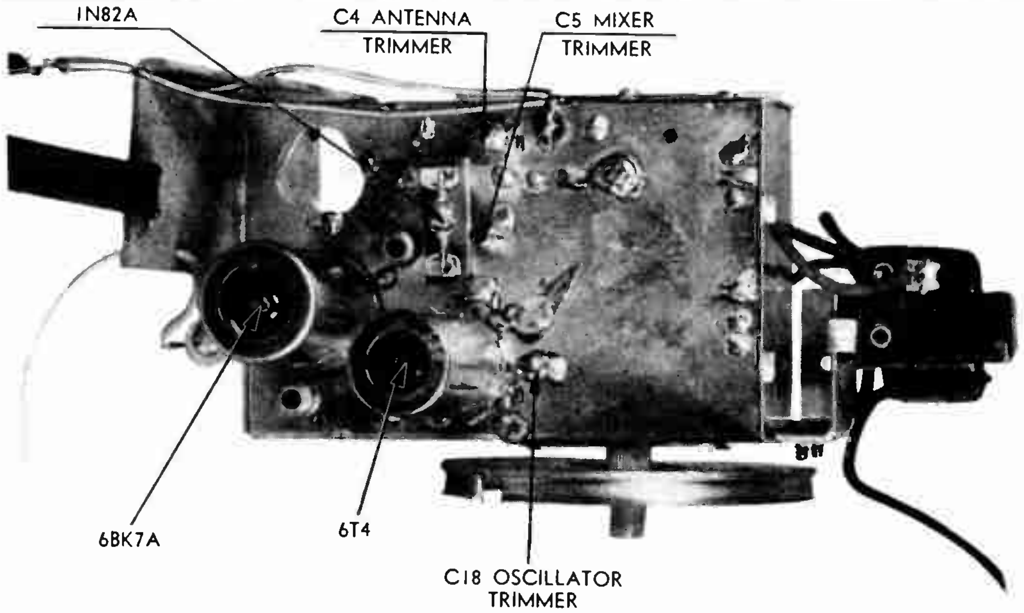
PROCEDURE

Set VHF tuner to channel 5 or 6.
Turn VHF-UHF Switch to UHF Position.
Remove dial cord and 3 UHF Tuner mounting screws.
Connect sweep generator to UHF antenna terminals.
NOTE: Sweep generator must match the 300 ohm input impedance.

Loosely couple UHF marker generator to UHF sweep generator leads.

Connect oscilloscope to test point on VHF tuner.

Carefully detune L-9 mixer IF coil located on VHF tuner by turning core OUT exactly 7 turns.



ALIGNMENT

(1) Set sweep and marker generator to 460 mc.

Set UHF tuner to maximum counter-clockwise position. Adjust C-18 until marker is in the center of response curve.

(2) Set sweep and marker generator to 910 mc.

Set UHF tuner to maximum clockwise position.

CAREFULLY bend and move oscillator end inductor ribbon connected to C-18 until marker is in center of response curve.

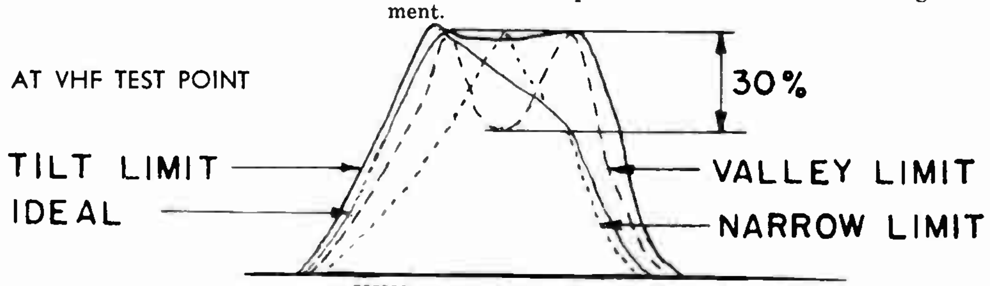
Repeat steps 1 and 2.

(3) Set marker and sweep generator to 460 mc. Set UHF tuner to maximum counter-clockwise position. Adjust C-4 and C-5 for maximum response with minimum tilt.

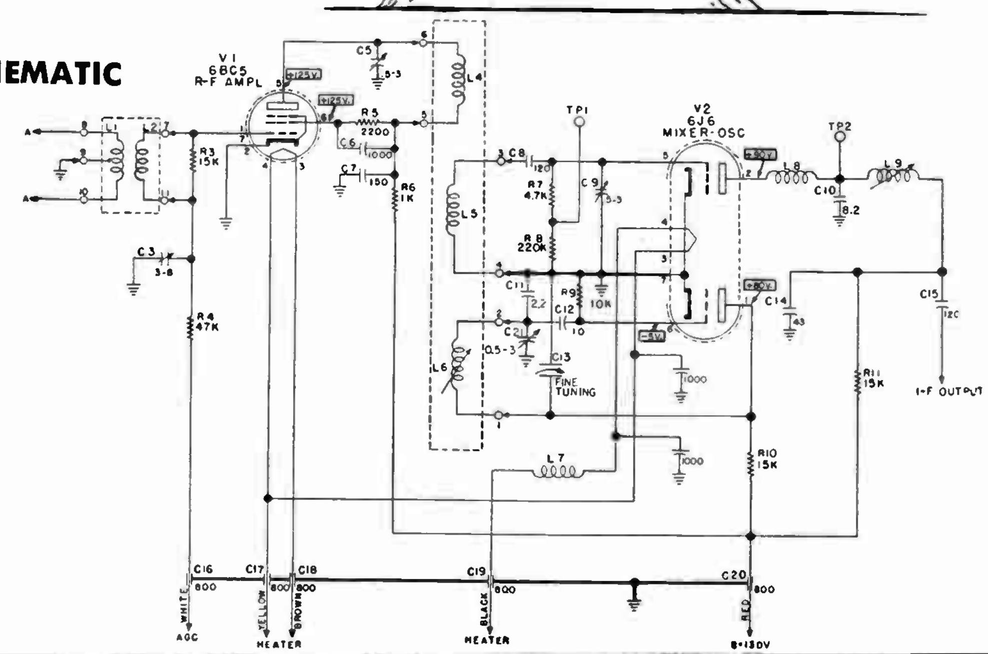
(4) Set marker and sweep generator to 910 mc. Set UHF tuner to maximum clockwise position. CAREFULLY bend and move the antenna and mixer end inductor ribbons connected to C-4 and C-5 respectively for maximum response and for minimum tilt. (See response curve below.) Repeat steps 3 and 4.

(5) Turn L-9 mixer IF coil located on VHF tuner IN 7 turns until exact position is reached as before alignment.

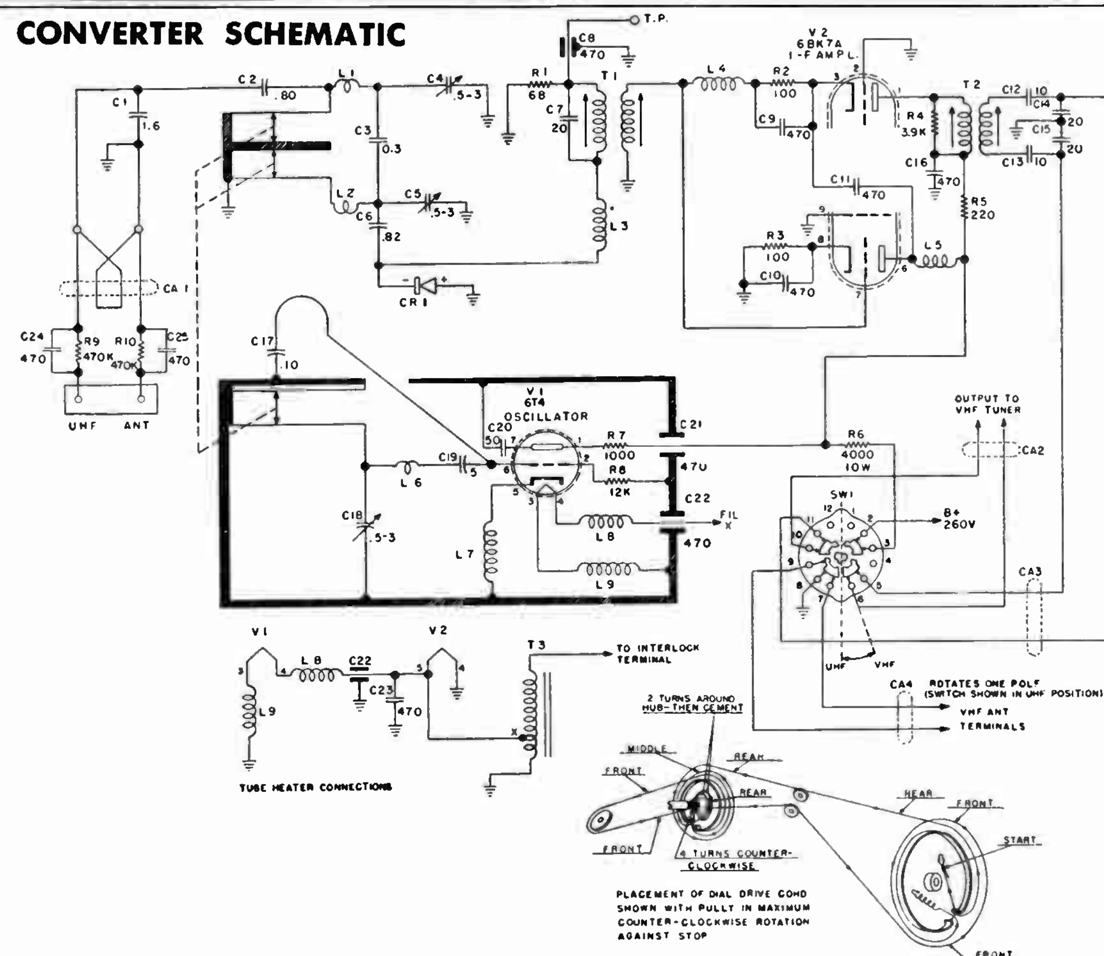
UHF CONVERTER RESPONSE AT VHF TEST POINT



VHF TUNER SCHEMATIC



UHF CONVERTER SCHEMATIC



ALIGNMENT DATA

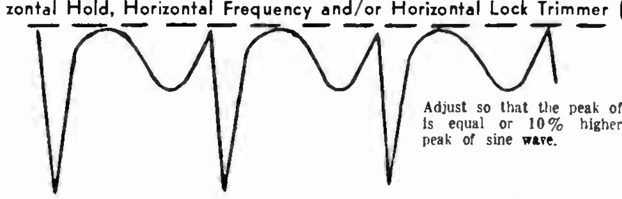
CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes.

The rear side of the chassis means the side on which the tubes are mounted.

HORIZONTAL BLOCKING OSCILLATOR ALIGNMENT

Tune Receiver to TV signal, adjust contrast control for normal picture below limiting in the Video Amplifier, and proceed as follows:

Step No.	Contrast Control Set For	Miscellaneous	Adjust
1	Normal Picture	....	Horizontal Hold Control (R164) and Horizontal Frequency Adjustment (rear slug of T108) until picture is in sync.
2	Normal Picture	Connect scope in series with 10 mmf. to lug 4 of T108.	Adjust Horizontal BTO Trap (front slug of T108) to obtain the wave-form shown below. Keep the picture in sync at all times by readjusting the Horizontal Hold, Horizontal Frequency and/or Horizontal Lock Trimmer (C142).  Adjust so that the peak of pulse is equal or 10% higher than peak of sine wave.
3	Normal Picture	Horizontal Hold set fully clockwise.	Adjust Horizontal Frequency (rear slug of T108) by turning out until the picture is just out of sync. Then turn the control slowly in until the picture is just ready to fall into sync (indicated by a wide black vertical or diagonal horizontal blanking bar).
4	Normal Picture	Horizontal Hold set fully counter-clockwise.	Picture should normally be in sync. Remove the signal by tuning off and then re-tuning to the station. If more than seven bars are present, adjust the Horizontal Lock Trimmer slightly counter-clockwise until three or four bars appear when the receiver is tuned off and then re-tuned to the station (Horizontal Hold Control still set fully counter-clockwise). If less than three bars are present, adjust the Horizontal Lock Trimmer clockwise to obtain the three or four bars as described above.

				Since the Horizontal Lock Trimmer adjustment affects the horizontal frequency, the adjustment of both the Horizontal Frequency Adjustment and the Horizontal Lock Trimmer must be repeated until the conditions outlined in steps 3 and 4 exist simultaneously at the extreme positions of the Horizontal Hold control. Check pull-in range, which should be normally 60° to 120°.
5	Weak Picture		....	Set the Horizontal Hold Control so that when the receiver is tuned off and then re-tuned to the station, the picture returns completely in sync.

SOUND ALIGNMENT

Step No.	Connect Signal Generator Through a .01 Capacitor	Signal Gen. Freq. MC.	Connect VTVM	Miscellaneous Connections and Instructions	Adjust
1	Cathode of Picture Tube	4.5 mc.	Across secondary of output trans. T105.	Use a high input level on signal generator.	Adjust L109 (rear slug) for minimum reading.
2	Pin 8 of V104.	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation	Across secondary of output trans. T105.	Set Buzz Control (R132) to approximately 90° from clockwise stop. Set the Volume Control (R135) at a low level.	L106 for maximum reading.
3	Pin 8 of V104.	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation	Across secondary of output trans. T105.	Set Buzz Control (R132) to approximately 90° from clockwise stop. Set the Volume Control (R135) at a low level.	L111 for maximum reading keeping input signal at a low level (below limiting).
4	Pin 8 of V104.	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation	Across secondary of output trans. T105.	Set Buzz Control (R132) to approximately 90° from clockwise stop. Set the Volume Control (R135) at a low level.	L109 (front slug) for maximum reading keeping input signal at a low level.
5	Pin 8 of V104.	4.5 mc. AM modulated 400 c.p.s.	Across secondary of output trans. T105.	Use a high input level on signal generator.	Buzz Control (R132) for null (minimum reading).
6	Pin 8 of V104.	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation	Across secondary of output trans. T105.	Set the Volume Control (R135) at a low level.	Re-peak L106 for maximum reading.

I.F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

VIDEO I. F. ALIGNMENT (with VTVM)

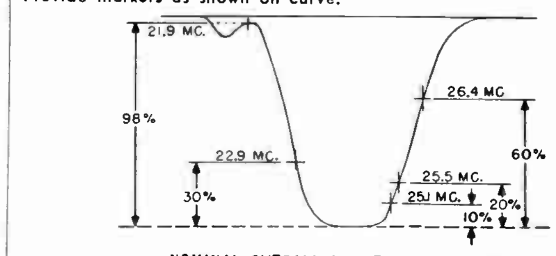
In the I.F. Alignment, limit input of signal generator so that reading on VTVM does not exceed —2 volts.

Step No.	Connect Signal Generator Through a .01 Capacitor	Signal Gen. Freq. MC.	Connect VTVM	Miscellaneous Connections and Instructions	Adjust
1	Test Point No. 2 on Tuner (closest to L9 slug adjustment).	24.4 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	T101 for maximum indication on meter, limit input to make peak less than —2 volts D.C. on VTVM.
2	Test Point No. 2 on Tuner (closest to L9 slug adjustment).	22.9 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.
3	Test Point No. 2 on Tuner (closest to L9 slug adjustment).	21.9 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	L103 (front slug) for minimum. Input level should be high enough to produce at least .5 volts at null on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
4	Repeat steps 2 and 3.				
5	Test Point No. 2 on Tuner (closest to L9 slug adjustment).	25.5 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	L102 for maximum.
6	Test Point No. 2 on Tuner (closest to L9 slug adjustment).	25.1 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	L101 (front slug), for maximum. Use first peak from tinnerman clip end of coil.
7	Test Point No. 1 on Tuner (closest to C21 trimmer screw).	25.1 mc.	Junction of R118 and C113 and chassis.	Connect a 100 ohm resistor in series with a 1000 mmf. cap. across L101.	L9 (brass screw) on the Tuner for maximum.

TO CHECK I. F. ALIGNMENT (with scope)

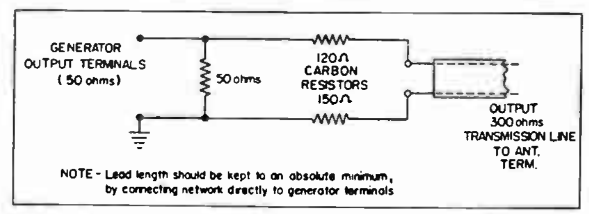
Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form.

Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

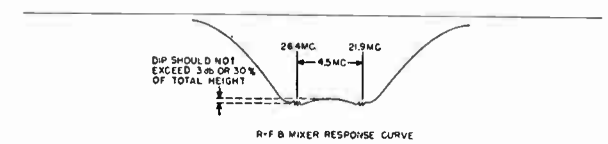
Sweep Gen. Connected to	Scope Connected to	Bias	Sweep Gen. Set to	Remarks
Ungrounded shield of V2 and chassis.	High side of contrast control R120 and chassis. Contrast control at minimum contrast.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	Sweep from 20 to 30 mega-cycles.	Provide markers as shown on curve.  NOMINAL OVERALL I-F RESPONSE CURVE A slight deviation in response curve is tolerable, but if any great deviation is noted, the I. F. stages will have to be realigned.

R.F. AND MIXER ALIGNMENT

Step No.	Station Selector	Oscilloscope	Bias	Signal Generator To	Adjust
1.	Chan. #10	High side through a 10,000 ohm resistor to TP1 on Tuner. Ground lead to Tuner Case.	-1.5 volts to white lead on tuner.	Signal Generator set to 195.5 MC., 400 cycle 30% AM modulated. Through Dummy Antenna to the Antenna lead-in.	C-3 for maximum 400 cycle response on scope. Remove signal Generator.
2.	Chan. #10	High side through a 10,000 ohm resistor to TP1 on Tuner. Ground lead to Tuner Case.	-1.5 volts to white lead on tuner.	Sweep Generator to Antenna lead-in through dummy antenna. Set Generator to sweep Channel 10 freq. Loosely couple Marker Generator to sweep output cable. Set marker to either 21.9 or 26.4 mc.	Adjust C5 & C9, to produce a response curve similar to R.F. and Mixer Response Curve.



DUMMY ANTENNA



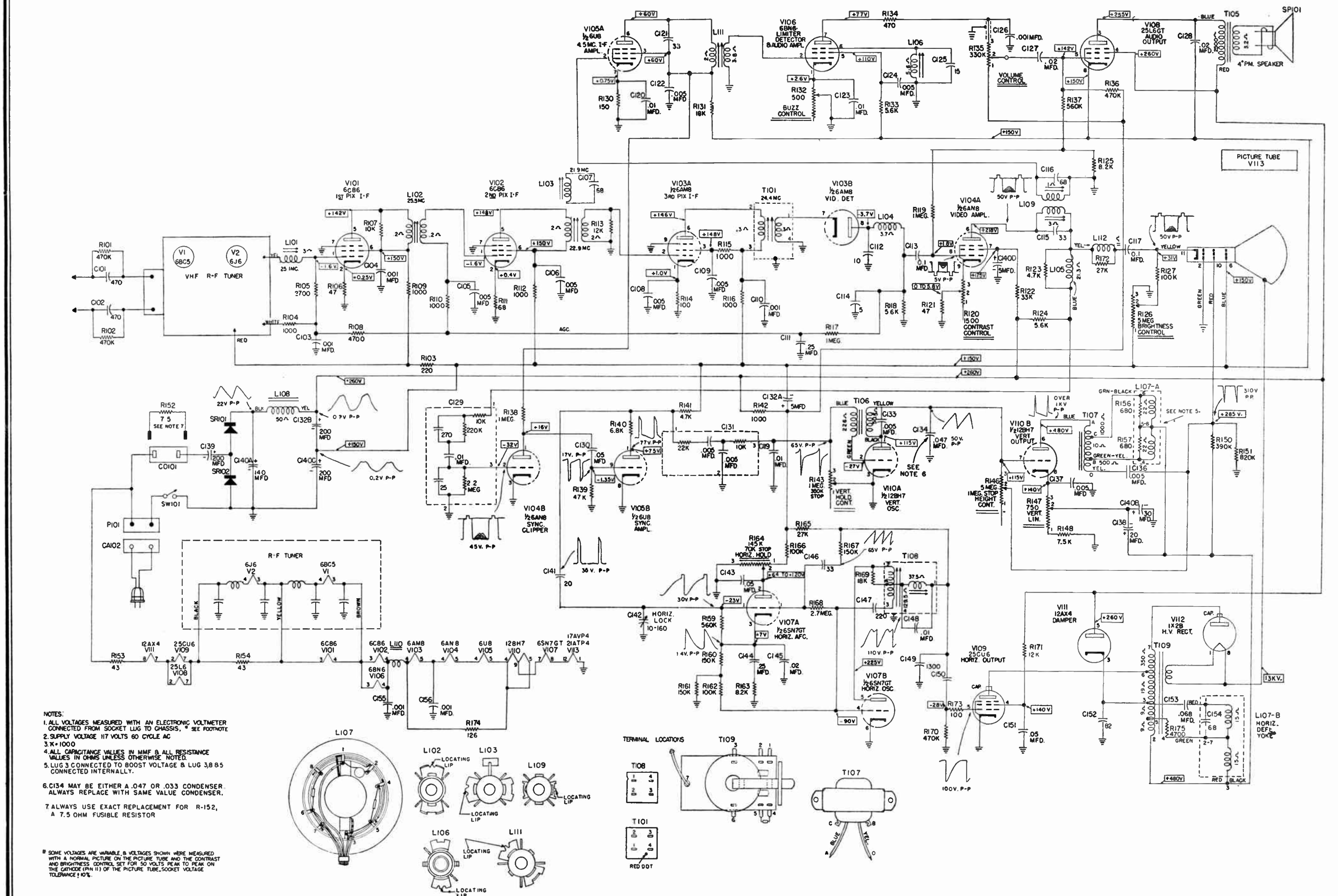
R. F. & MIXER RESPONSE CURVE

Without disturbing the R.F. grid, R.F. plate, and mixer-grid trimmer, check the response on the other VHF TV channels by setting the station selector to the desired channel and changing the frequency of the sweep generator to correspond to the channel being checked. The response curve should be essentially the same on all channels and the markers should fall in similar positions on the response curve. A slight amount of tilt can be tolerated. The amount of tilt indicated by the relative amplitudes of the response curves where the picture and sound I.F. Markers rest should not exceed 30% of the over-all response curve amplitude.

VHF OSCILLATOR ALIGNMENT

FOR RF OSCILLATOR ALIGNMENT, SET VHF TUNER TO HIGHEST VHF OPERATING CHANNEL IN YOUR AREA. SET FINE TUNING CONTROL TO CENTER POSITION (FLAT OF SHAFT FACING UP.) ADJUST C-21 OSCILLATOR TANK TRIMMER FOR BEST PICTURE DETAIL ON A TEST PATTERN OF A TV STATION.

ADJUST INDIVIDUAL CHANNEL SLUGS FOR BEST PICTURE DETAIL ON ALL OPERATING CHANNELS WITH A TEST PATTERN OF A TV STATION. NOTE: USE A NON-METALLIC SCREWDRIVER.



NOTES:

1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS, * SEE FOOTNOTE
2. SUPPLY VOLTAGE 117 VOLTS 60 CYCLE AC
3. K=1000
4. ALL CAPACITANCE VALUES IN MMF & ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. LUG 3 CONNECTED TO BOOST VOLTAGE & LUG 3,8 & 5 CONNECTED INTERNALLY.
6. C134 MAY BE EITHER A .047 OR .033 CONDENSER. ALWAYS REPLACE WITH SAME VALUE CONDENSER.
7. ALWAYS USE EXACT REPLACEMENT FOR R-152, A 7.5 OHM FUSIBLE RESISTOR

* SOME VOLTAGES ARE VARIABLE, & VOLTAGES SHOWN WERE MEASURED WITH A NORMAL PICTURE ON THE PICTURE TUBE AND THE CONTRAST AND BRIGHTNESS CONTROL SET FOR 50 VOLTS PEAK TO PEAK ON THE CATHODE (PIN 11) OF THE PICTURE TUBE. SOCKET VOLTAGE TOLERANCE ± 10%.

PARTS LIST

VHF TUNER

Symbol No.	Part No.	Description
C3	156906-16	Capacitor, 3-8 mmf., Antenna Trimmer and Lead Assembly
C4	158106-1	Capacitor, 1000 mmf., disc Ceramic
C5	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly
C6	158106-1	Capacitor, 1000 mmf., Disc Ceramic
C7	158106-2	Capacitor, 150 mmf., 10% Disc Ceramic
C8	158106-3	Capacitor, 120 mmf., 10%, N750, Disc Ceramic
C9	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly
C10	158106-15	Capacitor, 8.2 mmf.
C11	158106-5	Capacitor, 2.2 mmf., ± .25 mmf., N750, Ceramic
C12	158106-6	Capacitor, 10 mmf., 10%, N1400, Disc Ceramic
C13		Fine Tuning
C14	158106-16	Capacitor, 43 mmf.
C15	158106-3	Capacitor, 120 mmf., 10%, N750, Disc Ceramic
C16	158106-8	Capacitor, 1000 mmf., minimum, Feed Thru
C17	158106-8	Capacitor, 1000 mmf., minimum, Feed Thru
C18	158106-8	Capacitor, 1000 mmf., minimum, Feed Thru
C19	158106-8	Capacitor, 1000 mmf., minimum, Feed Thru
C20	158106-8	Capacitor, 1000 mmf., minimum, Feed Thru
C21	156906-5	Capacitor, 0.5-3 mmf., Trimmer and Lead Assembly
R3	158106-9	Resistor, 15,000 ohm, 20%, 1/2 w. (IRC Type BTS)
R4		Resistor, 47,000 ohm, 10%, 1/2 w.
R5		Resistor, 2200 ohm, 10%, 1/2 w.
R6		Resistor, 1000 ohm, 10%, 1/2 w.
R7		Resistor, 4700 ohm, 10%, 1/2 w. (IRC Type BTS)
R8		Resistor, 220,000 ohm, 10%, 1/2 w.

Symbol No.	Part No.	Description
R9		Resistor, 10,000 ohm, 10%, 1/2 w.
R10		Resistor, 15,000 ohm, 10%, 1/2 w.
R11		Resistor, 15,000 ohm, 10%, 1/2 w.
L1, L2	158021- State Channel Number Required	Antenna Coil Assembly (VHF channels)
L3	156906-50	Choke, RF Filament
L4, L5, L6	158022- State Channel Number Required	RF and Oscillator Coil Assembly (VHF channels)
L7	156906-51	Choke, Oscillator Filament
L8	156906-52	Choke, Mixer Plate
L9	158106-11	I.F. Coil Assembly
	156906-24	Shield (V1, V2)
	156906-40	Screw, Trimmer
	156906-39	Nut (Spring), Trimmer
	C3, C5, C9, C21	Capacitor, Ceramic Tube
	158106-11	I.F. Assembly
	156906-27	Roller, Detent
	156906-28	Spring, Detent
	156906-35	Ceramic Bushing and Lead Assembly (Fine Tuning)
	156906-33	Mounting Strip, Ceramic Bushing
	158106-12	Plate, Fine Tuning Ground
	158106-13	Drum and Insulated Shaft Assembly, without Coils
	156906-29	Spring, Shaft Retaining
	156906-34	Washer, Fiber
	156906-31	Spring, Fine Tuning
	158106-14	Fine Tuning Cam
	156906-44	Spring, Slug Retaining
	156906-26	Shield (Bottom Cover)
	156906-25	Shield (Side)
	156906-41	Contact Bracket Assembly
	157282	VHF Tuner Complete

UHF CONVERTER

CAPACITORS

Illus. No.	Part No.	Description
C-1, C-2	B158186-1	Composite (Dual Plate) 1.6 MMF — .80 MMF
C-3	B158186-2	Fixed Ceramic, .30 MMF ± 10%
C-4	B158186-3	Trimmer, .5-3 MMF
C-5	B158186-3	Trimmer, .5-3 MMF
C-6	B158186-4	Fixed Ceramic, .82 MMF ± 10%
C-7	B158186-5	Fixed Ceramic, .20 MMF ± 10%
C-8	B158186-6	Feed Thru, 470 MMF
C-9	B158186-7	Fixed Ceramic, 470 MMF
C-10	B158186-7	Fixed Ceramic, 470 MMF
C-11	B158186-7	Fixed Ceramic, 470 MMF
C-12		Part of T-2, 10 MMF
C-13		Part of T-2, 10 MMF
C-14		Part of T-2, 20 MMF
C-15		Part of T-2, 20 MMF
C-16	B158186-7	Fixed Ceramic, 470 MMF
C-17	B158186-8	Fixed Ceramic, .1 MMF ± 10%
C-18	B158186-9	Trimmer, .5-3 MMF
C-19	B158186-10	Tubular, 5 MMF ± 10%
C-20	B158186-11	Disc., 50 MMF ± 10%
C-21	B158186-6	Feed Thru, 470 MMF
C-22	B158186-6	Feed Thru, 470 MMF
C-23	B158186-7	Fixed Ceramic, 470 MMF
C-24	B143223-14	Mica, 470 MMF
C-25	B143223-14	Mica, 470 MMF

RESISTORS

Illus. No.	Part No.	Description
R-1	27E680K-1/2	Carbon, 68 Ohm 1/2 W. ± 10%
R-2	27E101K-1/2	Carbon, 100 Ohm 1/2 W. ± 10%
R-3	27E101K-1/2	Carbon, 100 Ohm 1/2 W. ± 10%
R-4	27E392K-1/2	Carbon, 3900 Ohm 1/2 W. ± 10%
R-5	27E221K-1/2	Carbon, 220 Ohm 1/2 W. ± 10%
R-6	B158186-12	Wirewound, 4000 Ohm 10 W.
R-7	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-8	27E123K-1/2	Carbon, 12,000 Ohm 1/2 W. ± 10%
R-9	27E474K-1/2	Carbon, 470,000 Ohm 1/2 W. ± 10%
R-10	27E474K-1/2	Carbon, 470,000 Ohm 1/2 W. ± 10%

TRANSFORMERS

Illus. No.	Part No.	Description
T-1	B158186-19	Transformer, IF Input
T-2	B158186-20	Transformer, IF Output
T-3	C-157915-1	Transformer, Filament

MISCELLANEOUS PARTS

Illus. No.	Part No.	Description
CR-1	1N82A	Crystal
SW-1	B157867-1-2	Switch, VHF-UHF
	D157917-1-6	Tuner, UHF
	20E993	UHF Bracket and Drive Assembly, Models 921, 924
	20E993-2	UHF Bracket and Drive Assembly, Model 991
	30E188	Pulley and Hub Assembly
	A157888-1-1	Shaft, Knob
	A157887-1-2	Pulley, Fine Tuning
	AD132167-144-1	Drive Cord Assembly, Models 921, 924
	AD132167-143-1	Drive Cord Assembly, Model 991
	B-157783-1-1	Tap Nut, Nylon, UHF Mounting

MAIN CHASSIS

CAPACITORS

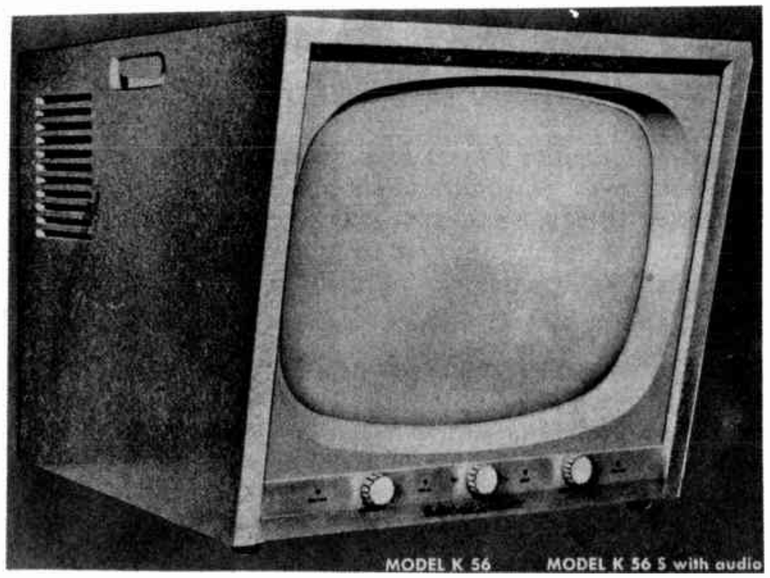
Illus. No.	Part No.	Description
C-101	B156201-1-1	Fixed Ceramic, 470 MMF 2000 V.
C-102	B156201-1-1	Fixed Ceramic, 470 MMF 2000 V.
C-103	23E4004-5	Fixed Ceramic, .001 MFD 500 V.
C-104	23E4004-5	Fixed Ceramic, .001 MFD 500 V.
C-105	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-106	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-107	C137499-33	Fixed Mica (Silver), 68 MMFD 500 V. (Part of L-103)
C-108	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-109	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-110	23E4004-5	Fixed Ceramic, .001 MFD 500 V.
C-111	A157810-1-1	Tubular, .25 MFD 25 V.
C-112	D137727-135-1	Fixed Ceramic, 10 MMF 500 V.
C-113	A157906-1-1	Tubular, .1 MFD 150 V.
C-114	D137727-103	Fixed Ceramic, 5 MMF 500 V.
C-115	D137727-126	Fixed Ceramic, 33 MMF 500 V.
C-116	D137727-133	Fixed Ceramic, 68 MMF 500 V.
C-117	23E3416	Molded Tubular, .1 MFD 400 V.
C-119	23E3424	Molded Tubular, .01 MFD 400 V. ± 10%
C-120	23E3410	Molded Tubular, .01 MFD 400 V.
C-121	D137727-126	Fixed Ceramic, 33 MMF 500 V.
C-122	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-123	23E3410	Molded Tubular, .01 MFD 400 V.
C-124	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-125	D137727-43	Fixed Ceramic, 15 MMF 500 V.
C-126	23E4004-5	Fixed Ceramic, .001 MFD 500 V.
C-127	23E3412	Molded Tubular, .02 MFD 400 V.
C-128	23E3412	Molded Tubular, .02 MFD 400 V.
C-129	A157813-1-3	Couplate, Sync.
C-130	23E3414	Molded Tubular, .047 MFD 400 V.
C-131	A157812-1-2	Vertical Integrating Unit
C-132A, C-132B	B157836-1-3	Dry Electrolytic, 200-5 MFD 150 V.
C-133	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-134	23E3414	Molded Tubular, .047 MFD 400 V.
C-136	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-137	23E4004-15	Fixed Ceramic, .005 MFD 500 V.
C-138	B157903-1-2	Dry Electrolytic, 20 MFD 450 V.
C-139	B158557-1-1	Dry Electrolytic, 200 MFD 300 V.
C-140A, C-140B, C-140C, C-140D	B157838-3-1	Dry Electrolytic, 140-5 MFD 300 V., 200-30 MFD 150 V.
C-141	B137727-61	Fixed Ceramic, 20 MMF 500 V.
C-142	A157870-1-1	Trimmer Horizontal Lock, 10-160 MMF
C-143	23E3414	Molded Tubular, .047 MFD 400 V.
C-144	A157810-1-1	Tubular, .25 MFD 25 V.
C-145	23E3412	Molded Tubular, .02 MFD 400 V.
C-146	D137727-126	Fixed Ceramic, 33 MMF 500 V.
C-147	C137498-22-1	Fixed Mica, 220 MMF 500 V.
C-148	23E3424	Molded Tubular, .01 MFD 400 V. ± 10%
C-149	C144675-33-1	Fixed Ceramic, 1300 MMF 500 V.
C-150	C144675-32-1	Fixed Ceramic, 560 MMF 500 V.
C-151	23E3414	Molded Tubular, .047 MFD 400 V.
C-152	C158215-32-1	Fixed Ceramic, 82 MMF 3000 V.
C-153	23E3415	Molded Tubular, .068 MFD 400 V.
C-154	C158215-3	Fixed Ceramic, 68 MMF 3000 V.
C-155	23E4004-5	Fixed Ceramic, .001 MFD 500 V.
C-156	23E4004-5	Fixed Ceramic, .001 MFD 500 V.

RESISTORS

Illus. No.	Part No.	Description
R-101	27E474M-1/2	Carbon, 470,000 Ohm 1/2 W. ± 20%
R-102	27E474M-1/2	Carbon, 470,000 Ohm 1/2 W. ± 20%
R-103	27E221K-1/2	Carbon, 220 Ohm 1/2 W. ± 10%
R-104	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-105	27E272K-1/2	Carbon, 2700 Ohm 1/2 W. ± 10%
R-106	27E470K-1/2	Carbon, 47 Ohm 1/2 W. ± 10%
R-107	27E103K-1/2	Carbon, 10,000 Ohm 1/2 W. ± 10%
R-108	27E472K-1/2	Carbon, 4700 Ohm 1/2 W. ± 10%
R-109	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-110	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-111	27E680K-1/2	Carbon, 68 Ohm 1/2 W. ± 10%
R-112	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-113	27E123K-1/2	Carbon, 12,000 Ohm 1/2 W. ± 10%
R-114	27E101K-1/2	Carbon, 100 Ohm 1/2 W. ± 10%
R-115	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-116	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-117	27E105M-1/2	Carbon, 1 Megohm 1/2 W. ± 20%
R-118	27E562K-1/2	Carbon, 5600 Ohm 1/2 W. ± 10%
R-119	27E105K-1/2	Carbon, 1 Megohm 1/2 W. ± 10%
R-120	B157804-1-2	Control Contrast, 1500 Ohm
R-121	27E470K-1/2	Carbon, 47 Ohm 1/2 W. ± 10%
R-122	27E333K-1	Carbon, 33,000 Ohm 1 W. ± 10%
R-123		Part of L-105
R-124	A156911-2-2	Carbon, 5600 Ohm 2 W. ± 10%
R-125	27E822K-1/2	Carbon, 8200 Ohm 1/2 W. ± 10%
R-126	B157801-1-3	Control Brightness, 5 Megohm
R-127	27E104K-1/2	Carbon, 100,000 Ohm 1/2 W. ± 10%
R-130	27E151K-1/2	Carbon, 150 Ohm 1/2 W. ± 10%
R-131	27E183K-1/2	Carbon, 18,000 Ohm 1/2 W. ± 10%
R-132	A157955-2-1	Control Buzz, 500 Ohm
R-133	27E562K-1	Carbon, 5600 Ohm 1 W. ± 10%
R-134	27E471K-1/2	Carbon, 470 Ohm 1/2 W. ± 10%
R-135	B157803-1-2	Control Volume, 330,000 Ohm, With S.P.S.T. Switch
R-136	27E474K-1/2	Carbon, 470,000 Ohm 1/2 W. ± 10%
R-137	27E564K-1/2	Carbon, 560,000 Ohm 1/2 W. ± 10%
R-138	27E105K-1/2	Carbon, 1 Megohm 1/2 W. ± 10%
R-139	27E473K-1/2	Carbon, 47,000 Ohm 1/2 W. ± 10%
R-140	27E682K-1/2	Carbon, 6800 Ohm 1/2 W. ± 10%
R-141	27E472K-1/2	Carbon, 4700 Ohm 1/2 W. ± 10%
R-142	27E102K-1/2	Carbon, 1000 Ohm 1/2 W. ± 10%
R-143	B157805-1-3	Control Vertical Hold, 1 Megohm, Stop at 350,000 Ohm
R-146	B157806-1-1	Control Vertical Size, 5 Megohm, Stop at 1 Megohm
R-147	B157800-1-1	Control Vertical Linearity, 750 Ohm
R-148	A156911-4-1	Carbon, 7500 Ohm 2 W. ± 10%
R-150	27E394K-1/2	Carbon, 390,000 Ohm 1/2 W. ± 10%
R-151	27E824K-1/2	Carbon, 820,000 Ohm 1/2 W. ± 10%
R-152	B154089-1-6	Fusible, 7.5 Ohm 5 W.
R-153	A157949-1-1	Globar, 43 Ohm Hot, 125 Ohm Cold
R-154	A158230-2-1	Wirewound, 43 Ohm 5 W. ± 10%
R-156	27E681K-1/2	Carbon, 680 Ohm 1/2 W. ± 10%
R-157	27E681K-1/2	Carbon, 680 Ohm 1/2 W. ± 10%
R-159	27E564K-1/2	Carbon, 560,000 Ohm 1/2 W. ± 10%
R-160	27E154K-1/2	Carbon, 150,000 Ohm 1/2 W. ± 10%
R-161	27E154K-1/2	Carbon, 150,000 Ohm 1/2 W. ± 10%
R-162	27E104K-1/2	Carbon, 100,000 Ohm 1/2 W. ± 10%
R-163	27E822K-1/2	Carbon, 8200 Ohm 1/2 W. ± 10%
R-164	B157802-1-3	Control Horizontal Hold, 145,000 Ohm, Stop at 70,000 Ohm
R-165	27E273K-1/2	Carbon, 27,000 Ohm 1/2 W. ± 10%
R-166	27E104K-1/2	Carbon, 100,000 Ohm 1/2 W. ± 10%
R-167	27E154K-1/2	Carbon, 150,000 Ohm 1/2 W. ± 10%
R-168	27E275K-1/2	Carbon, 2.7-Megohm 1/2 W. ± 10%
R-169	27E183K-1/2	Carbon, 18,000 Ohm 1/2 W. ± 10%
R-170	27E474K-1/2	Carbon, 470,000 Ohm 1/2 W. ± 10%
R-171	A156911-5-1	Carbon, 12,000 Ohm 2 W. ± 10%
R-172		Part of L-112
R-173	27E101K-1/2	Carbon, 100 Ohm 1/2 W. ± 10%
R-174	A158230-1-1	Wirewound, 126 Ohm 10 W. ± 10%
R-175	27E472K-1/2	Carbon, 4700 Ohm 1/2 W. ± 10%

COILS AND TRANSFORMERS

Illus. No.	Part No.	Description
L-101	AA157787-1-5	Coil, IF Input
L-102	20E994	Coil, Interstage IF
L-103	B158224-1-3	Coil, 2nd IF
L-104	B158352-1-1	Choke, Diode
L-105	B158222-1-1	Coil, Peaking
L-106	B158351-1-2	Coil, Quadrature Grid
L-107	AD158426-1-2	Yoke, Deflection
L-108	B155529-1-1	Choke, Filter
L-109	B158353-1-2	Coil, Sound Take-off
L-110	AB155256-1-1	Choke, Filament
L-111	B158354-1-2	Coil, Sound Coupling
L-112	B158223-1-1	Coil, Video Peaking
T-101	B158355-1-4	Coil, IF Output
T-105	B157919-1-1	Transformer, Audio Output
T-106	B155255-3-1	Transformer, Vertical Blocking Oscillator
T-107	22E97	Transformer, Vertical Output
T-108	C158225-1-2	Transformer, Horizontal Blocking
T-109	20E995	Transformer, Horizontal Output
SR-101	C1555575-2-1	Selenium Rectifier
SR-102	C1555575-2-1	Selenium Rectifier
	AD158327-1-1	Speaker, 4" PM, Models 901, 991, 911, 921
	1E34-3	Speaker, 8" PM, Models 914, 924



Models 553 and 5503 are equiped with "slide out" compartments to accommodate an automatic 3-speed VM Record Changer with a High Fidelity tone arm that opens a new world of listening pleasure when records are played through SETCHELL CARLSON'S HI-FI sound system.

SPECIFICATIONS

CABINET

- Finest Dark Mahogany veneers and Blonde Oak cabinets in all models.
- Filter-Ray tinted glass is removable from front by removing screws and moulding under "Top-Tuning" Panel.
- Access to chassis is accomplished by removing 2 screws under front of hinged lid of cabinet.
- Luma-Dials provide soft indirect lighting of channel selector and radio dial.
- Picture tube guaranteed for one full year.

Model 551—21" Console TV.
Model 552—21" Console TV with super-powered 3 gang AM radio.
Model 553—21" Console TV with super-powered 3 gang AM radio and slide out phono compartment (for VM 3-speed Record Changer with Hi-Fi Tone Arm and 45 RPM spindle).
DIMENSIONS: 21" MODELS 24$\frac{9}{16}$" wide, 22½" deep, 35¾" high.
SHIPPING WEIGHT 140 lbs.

Model 5501—27" Console TV.
Model 5502—27" Console TV with super powered 3 gang AM radio.
Model 5503—27" Console TV with super powered 3 gang AM radio and slide out phone compartment (for VM 3-speed Record Changer with Hi-Fi Tone Arm and 45 RPM spindle).
DIMENSIONS: 27" MODELS 29$\frac{1}{16}$" wide, 22½" deep, 41" high.
SHIPPING WEIGHT 167 lbs.

Model VM 950-271 Record Changer: 9½ lbs. (packed separately).

CHASSIS

- Chassis has ample power to produce a brilliant picture on tube sizes ranging from 17" to 27". Ideal for use in custom installations.
- Improved Automatic Self-Focusing ALUMINIZED Picture Tube for finest picture detail.
- Cascode tuner with dial controlled vernier.
- VHF and UHF pre-tuned strips assure instant accurate "snap-in" channel selection.
- Lifetime aluminum chassis—excellent conductor—rust-proof—lighter—durable.
- 4 double tuned stages of IF and crystal video detector.
- 44.25 M.C. Sound, 48.75 M.C. Pix, I.F. Pass Band.
- Horizontal output tube protected by automatic bias.
- Simplified picture centering. • Simple, efficient width control sleeve.
- Shielded horizontal deflection and hi-voltage supply.
- Push-pull audio for high level wide range sound output 30 CPS to 20,000 CPS.
- Individual bass and treble tone controls permit full adjustment of audio range.
- Improved keyed A. G. C. circuit minimizes interference and increases locking stability.
- Fused power input circuit 105 to 125 volts AC—220 watts.
- 25 tubes plus 2 crystals and 2 rectifier tubes and picture tube (with radio).
- Filaments of TV tubes turn off when radio or phonograph is in use.
- High gain, selective superheterodyne (535-1700 KC) AM radio with tuned RF Stage, 3 gang condenser.
- New coupling utilizes T.V. antenna for radio reception.
- All models with radio include phono jack and AC phono outlet.
- Shipping weight—approximately 40 lbs.

INSTRUCTIONS AND INFORMATION

The Model K-56 black and white Television Monitor is a high quality low priced instrument for television broadcasting stations and other places where it is important to know the quality of picture, information which is being transmitted. Special care has been taken to insure a brilliant image acceptable for studio use, and a wide band video amplifier suitable for control room use. The "unitized" construction offers simplicity and speed of maintenance. It can be supplied to include audio amplifier and twin 6" speakers.

The video amplifier has internal-external sync provisions where composite and non-composite video signals may be encountered, and, rear chassis plug for wiring to permit remote switching. Local sync input is negative from .5 to 4 volts peak to peak.

The 17" kinescope is of the self or electrostatic focus type. This type of tube was chosen to insure finest full face focus regardless of line voltage changes and/or high voltage variation. The type 17KP4 as made by Dumont will be used as standard equipment unless otherwise specified. For replacement purposes any spherical face 17" tube can be used, such as the 17HP4 made by RCA, Sylvania and other tube manufacturers. The type 17KP4, however, as made by Dumont produces a very small spot size which is far superior to older type self-focus tubes.

Care should be taken to adjust the ion trap for best brilliance and focus after the centering magnets have been positioned.

Secondary controls are located in the front panel and are clearly identified. Instructions as to the adjustment of the yoke, centering and ion trap are located inside of the back cover.

The main power transformer is located on the chassis proper and all other units are removable. It was desirable to place the power transformer as far from the neck of the tube as possible to prevent sweep distortion.

The "E" unit, which is plug-in and removable, incorporated the vertical oscillator and output tube and is available with or without audio. All main chassis are wired to use either unit--with or without audio. The audio power output is 1.7 watts at 400 cps. at less than 10% distortion.

The "D" unit, which is plug-in and removable, incorporates two stages of video amplification, DC restorer, wync separator, sync amplifier, AFC detector and internal-external sync control amplifier.

The "F" unit, which is plug-in and removable, incorporates the horizontal oscillator, horizontal output, damper, high voltage rectifier, flyback transformer, etc.
Type designations of the units are as follows:

"D" Unit	Series M2S	Video Amplifier with internal-external sync.
"E" Unit	Series M2	Vertical Deflection. (Without audio amplifier.)
"E" Unit	Series M2S	Vertical Deflection, (With audio amplifier.)
"F" Unit	Series M2	H. V. and Horizontal Deflection.

Speakers - 6" round, 312 ohm V. C.
Ion Trap - 55 gausses.
Kinescope - 17KP4 (preferred).

It is advantageous to have an extra unit or part as listed above to facilitate immediate service or repair of monitor, thus avoiding "time out."

The Model K-56 Monitor is covered by the standard RTMA warranty, which includes one year guarantee on the kinescope.

SERVICE HINTS

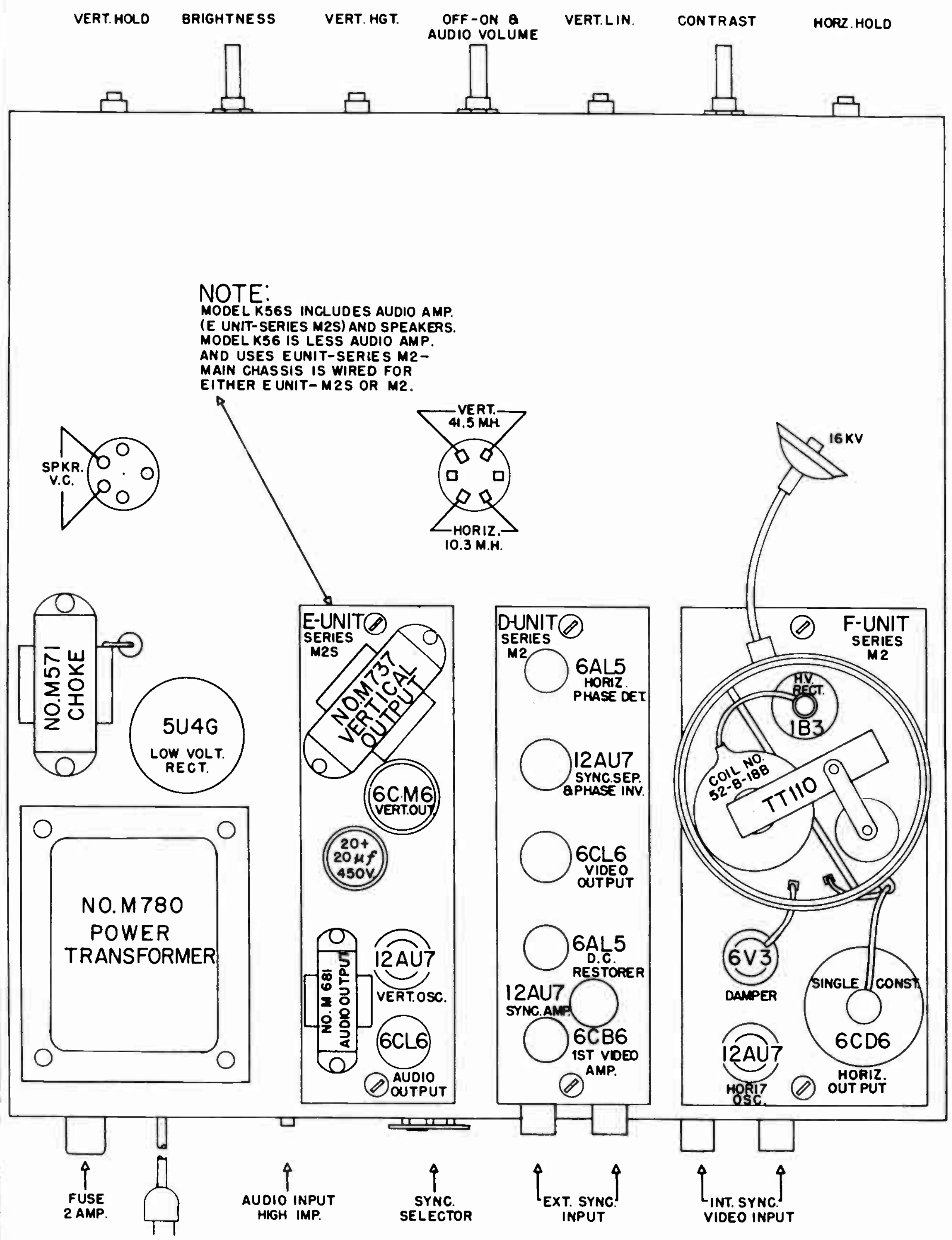
It is recommended that a chassis having all units in good working order be used for checking units that are doubtful or after repair has been made. The resistance values as shown on the schematic were all taken with units removed from main chassis, therefore, an "ohm meter" is all that is necessary for locating 90% of unit trouble.

1. If television reveiver is completely dead, no picture tube illumination and no sound, check the power fuse located at the rear of the chassis. If all tubes (except picture tube) light up, check the B voltage as supplied by the G Unit. Check the focus coil continuity. Check voltages to each unit as shown on schematic to locate open or short circuit.
2. If picture tube face illuminates but no picture or sound, check first video amplifier 6AU6 tube in D Unit. Check all tubes of the A and B Units. Check A, B and C Units. Check 2 K ohm 10 watt resistor supplying B voltage to terminal D-11 of the D Unit.
3. If there is picture information and no sound, check the tubes in the C Unit. Check the C Unit. Check the speaker voice coil. Check 2 K ohm 10 watt resistor connected to terminal C-10.
4. If there is sound but not picture information, and picture tube face is illuminated, check the 3 ohm filament resistor on the 6AU6 tube (V-15) of the D Unit. Check all of the tubes of the D Unit. Check the D Unit. Check the 1N60 germanium crystal connected to terminal B-12 of the B Unit. Check the picture tube socket connections. Check the contrast control.
5. If there is sound and picture tube face does not illuminate, check the ion trap on the neck of the picture tube. Check the brightness control. Check all of the tubes in the F Unit. Check the F Unit. Check for continuity the horizontal coils of the yoke. Check the cathode voltage of the picture tube as shown on schematic pin #11. Check the picture tube.
6. Excessive interference or sync buzz in the sound. This is usually remedied by adjusting the top slug of the ratio detector coil B13M19257, or replacing 6AL5 (V-9) tube in the C Unit.

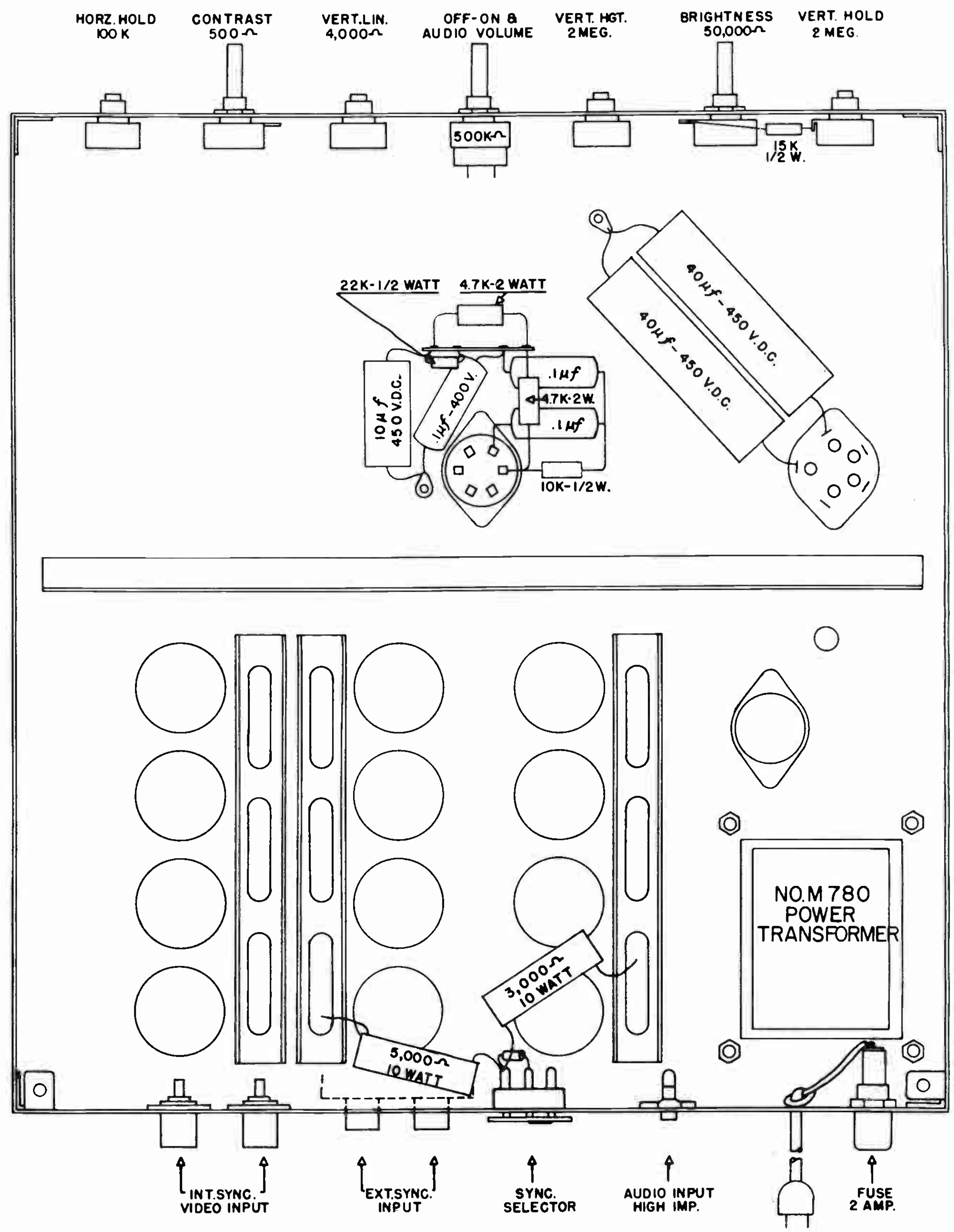
Be careful when adjusting C-4501, which is the sound take-off coil located in the C Unit. This should be adjusted to exactly 4.5 mc. and not necessarily maximum sound. Adjustment of this coil may be made on station by noting the removal of 4.5 mc. sound frequencies from appearing on the picture tube. Correct adjustment of this coil will eliminate the jagged vertical lines between the horizontal trace lines. The adjustment of this coil is critical as it not only is a sound frequency take-off coil, but is a 4.5 mc. trap to reduce or eliminate unwanted frequencies from appearing on picture tube.

7. Poor vertical linearity can usually be traced to the 6V6GT tube or the output transformer of the vertical or E Unit.
8. Insufficient contrast may be caused by a weak 6AU6 first video amplifier (V-16) or 6K6 (V-14) second video amplifier. Too much contrast causing picture bending and/or pulling may also be traced to the first video amplifier 6AU6 tube located in the D Unit.
9. If poor picture information, check the D-2000 coils in the D Unit. Check the 1N60 germanium crystal in the B Unit. Check all resistors and condensers associated with V-14 and V-16 tubes located in the D Unit. Check the alignment of the I.F. coils. Check the picture tube.
10. For poor vertical locking, check the resistors and condensers on terminals E-1, E-2, E-3 and E-4 of the E Unit. Check the resistor connected to terminal D-3 of the D Unit. Check the 12BH7 tube of the D Unit. Check the 6AU6 tube (V-15) of the D Unit and its 3 ohm filament resistor. Check the E Unit. Check the D Unit.
11. For poor horizontal locking, check the 12BH7 tube (V-19) in the F Unit. Try more than one tube before determining that it is not tube trouble. Check the 3.9 K resistor which connects the plate of the 12BH7 tube to the horizontal frequency coil. Check the 1500 ohm cathode resistor on the 12BH7 tube. Check the two 270 mmfd. silver mica condensers--use only 5% 500 Volt DC silver mica condensers for replacement. Check the 6AL5 (V-12) and the 12BH7 (V-13) of the D Unit. Check the F Unit. Check the D Unit.
12. Insufficient width--check the 5U4 tube (V- 23) in the G Unit. Check the 6BQ6 tube (V-20) in the F Unit. Check the 6W4 tube (V-22) in the F Unit. Check the horizontal drive condenser. Check the position of the yoke on the neck of the tube as it must be as far forward as possible. Check the F Unit. Check the G Unit. It is satisfactory to use a 24 ohm resistor in series with the selenium rectifier, however, the D-2002 choke provides for higher second anode voltage. The use of a 24 ohm resistor in place of this choke provides for additional sweep with about 1000 volts decrease in second anode voltage.
13. Blooming or loss of picture when attempting to increase brightness is usually caused by a poor 1X2A high voltage rectifier tube located in the F Unit. It is possible, however, for a poor 6BQ6 or 6W4 tube to be responsible for such trouble.
14. To eliminate high voltage arcing around the #2 anode terminal of the picture tube, it is recommended that at least a 6" area around the terminal be cleaned periodically with carbon tetrachloride.
15. High frequency ''sing'' or noise coming from the F Unit is usually traced to the 6W4 tube (V-22) or bracket of flyback transformer.
16. All units should be secured fairly tight to the main chassis by their mounting bolts for good grounding reasons.
17. On TV #151 series, the yoke and focus coil housing should be grounded to the top of the F Unit by means of a metal strap at least 1/2" wide and no longer than necessary. This eliminates or reduces barkhausen.
18. Excessive vertical lines or shading on the left side of the picture tube can usually be traced to the yoke coil itself or the flyback transformer. The horizontal drive condenser, note 3 on schematic, should be properly adjusted before looking for this trouble elsewhere.
19. Parts that have given some trouble in the field are as follows:

(a) The 3 ohm filament resistor on 6AU6 tube (V-15) of the D Unit. Do not eliminate but replace with new resistor.
(b) The 270 mmfd. 5% silver mica condenser located in the F Unit may test okay, but may cause an unstable horizontal oscillator condition.
(c) The 25 ma. selenium rectifier in the F Unit should be replaced with a 65 ma. selenium rectifier as the actual running load is 20 to 25 ma.
(d) The .00047-20 KV condenser located in the F Unit has in some cases developed a partial short, thereby, causing arcing under 1X2A tube socket or loss of high voltage.
(e) The .25 mfd. 400 volt coupling condenser connected to the grid of the 6V6 tube (V-18) of the E Unit, in some cases has developed a leakage, thereby, causing poor vertical linearity.
(f) The 120 mmfd. condenser connected from terminal #5 of the coil strip to ground of the A Unit has shorted out occasionally, which in turn burns out the 1 K ohm resistor. This refers to the pentode unit as well as the cascode unit.
(g) The 2000 ohm 4 watt focus control can be damaged if the set is turned on with the focus coil and yoke assembly plug disconnected.
(h) The use of the 3.9 K ohm resistor connecting the plate of the 12BH7 tube (V-19) to the horizontal frequency coil located in the F Unit provides a less critical circuit for 12BH7 tubes.
(i) 12AU7 tubes may be used as substitutes for 12BH7 tubes in the F and D Units.

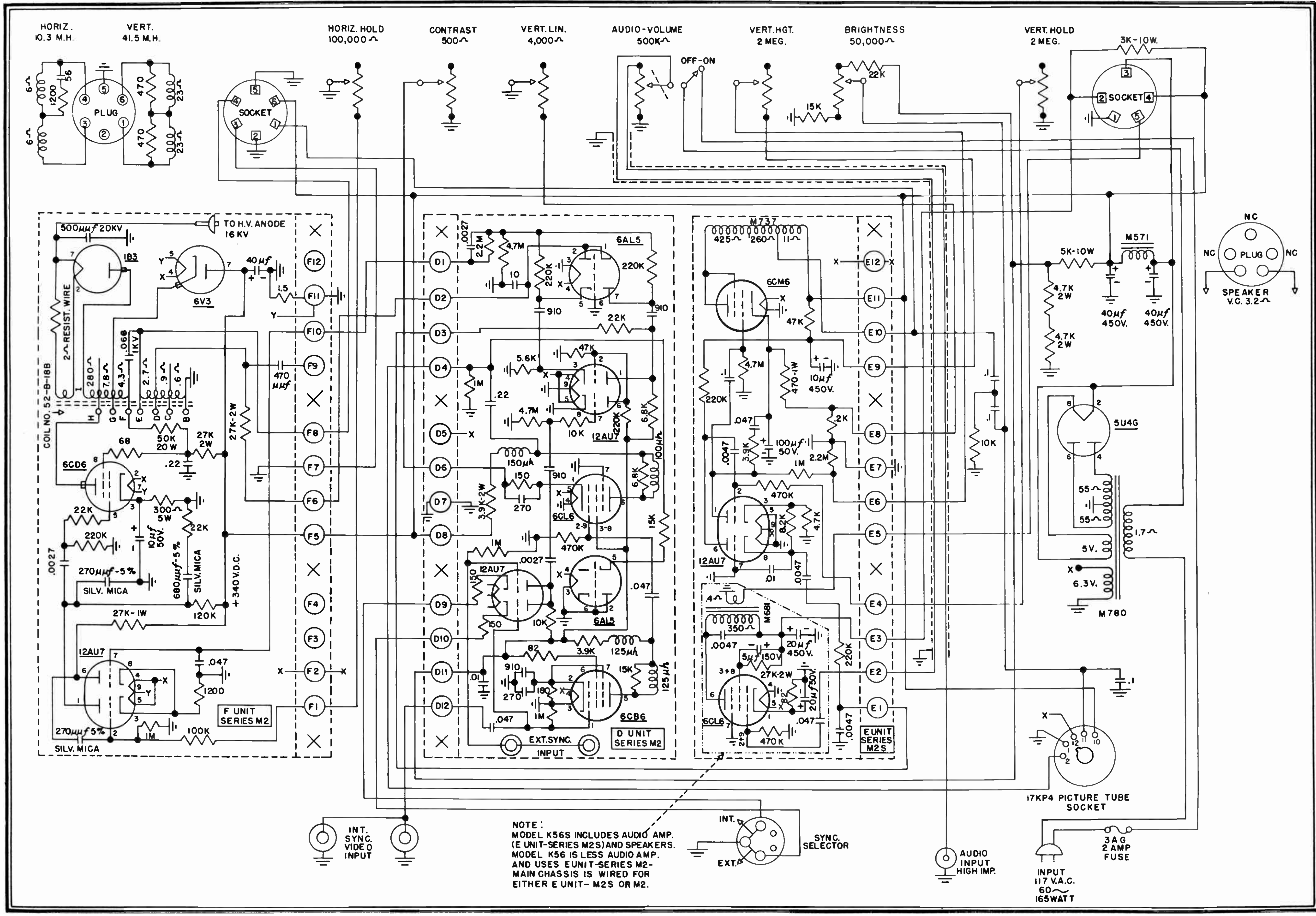


TOP VIEW



BOTTOM VIEW

TOP AND BOTTOM VIEWS


HORIZ. 10.3 M.H.
VERT. 41.5 M.H.
PLUG
SOCKET
HORIZ. HOLD 100,000 Ω
CONTRAST 500 Ω
VERT. LIN. 4,000 Ω
AUDIO-VOLUME 500K Ω
OFF-ON
VERT. HGT. 2 MEG.
BRIGHTNESS 50,000 Ω
VERT. HOLD 2 MEG.
3K-10W.
TO H.V. ANODE 16 KV
500 μμf 20KV
1B3
6V3
40 μf
COIL NO. 52-B-188
2 Ω RESIST. WIRE
6CD6
+340 V.D.C.
SILV. MICA
12AU7
F UNIT SERIES M2
6AL5
12AU7
6CL6
6AL5
6CB6
EXT. SYNC. INPUT
D UNIT SERIES M2
M737
6CM6
12AU7
M681
6CL6
E UNIT SERIES M2S
5K-10W
M571
40 μf 450V.
40 μf 450V.
5U4G
M780
PLUG
NC
SPEAKER V.C. 3.2 Ω
17KP4 PICTURE TUBE SOCKET
INT. SYNC. VIDEO INPUT
NOTE: MODEL K56S INCLUDES AUDIO AMP. (E UNIT-SERIES M2S) AND SPEAKERS. MODEL K56 IS LESS AUDIO AMP. AND USES E UNIT-SERIES M2- MAIN CHASSIS IS WIRED FOR EITHER E UNIT- M2S OR M2.
INT.
EXT.
SYNC. SELECTOR
AUDIO INPUT HIGH IMP.
INPUT 117 V.A.C. 60 ~ 165 WATT
3AG 2 AMP FUSE

UNIT "A"

Part No.	Description	Unit Series	List Price
TA-101	Coil strip, oscillator (Channel 2-13) specify channel and series	1-2-3	$2.00
TA-102	Coil strip, antenna (Channel 2-13) specify channel and series	1-2-3	2.00
TA-103	Fine tuning shaft and blade, #31A-066-2	1-2-3	.75
TA-104	Drum and shaft—less coil strips, #31B-203-57	1-2-3	3.50
TA-105	Contact bracket assembly, 11 contact #31B-278	1-2-3	3.50
TA-106	Coil, I.F. 20-25 MC #31A-078	1-2-3	.90
TA-107	Coil, choke (+B to I.F coil) #31B-638	3	.40
TA-108	Condenser—Feed thru. 800 UUF #130-153	1-2-3	.40
TA-109	Roller, detent #31B-016	1-2-3	.25
TS-111	Socket strip, 5-contact TV1-13	1-2-3	.35
TS-115	Socket, pilot light #420-90	3	.35
TZ-103	Hold-down bolt 8-32 x 3"	1-2-3	.08
TZ-104	Hold-down bar—front	1-2-3	.20
TZ-105	Hold-down bar—rear	1-2-3	.20

UNIT "B"

Part No.	Description	Unit Series	List Price
TC-101	Coil, I.F., 20-25 MC slug tuned B-72A83-3	1	$ .90
TC-201	Condenser, .01 uf — 500 V ceramic disc	1	.25
TC-215	Condenser, .5 uf — 200 V paper tubular molded	1	.55
TC-301	Crystal, germanium diode #1N60	1	1.50
TR-101	Resistor — 270 ohm 1 watt, tolerance 10%	1	.15
	Resistors — ½ watt, 10% tol. any value used	1	.10
TS-101	Socket, 7-contact min. with center pin 1" M.C.	1	.20
TS-112	Socket, strip, 12-contact #TV1-11	1	.75
TZ-106	Hold-down bolt 8-32x1¾"	1	.05

UNIT "C"

Part No.	Description	Unit Series	List Price
TC-102	Coil, I.F., 4.5 MC. Sound input trap #C-4501	2	$1.70
TC-103	Coil, I.F., 4.5 MC. Sound interstage #C-4502	2	1.70
TC-104	Coil, ratio detector, 4.5 MC. #B13M19643	1-2	3.00
TC-112	Coil, I.F., 4.5 MC. Sound input trap #C-45	1	.80
TC-201	Condenser, .01 uf — 500 V ceramic disc	1-2	.25
TC-202	Condenser, 20 uuf — 500 V reg. mica, tol. 10%	1	.25
TC-203	Condenser, .0027 uf — 400 V paper tubular molded	1-2	.25
TC-204	Condenser, .0047 uf — 400 V paper tubular molded	1-2	.25
TC-205	Condenser, 4 uf — 50 WVDC elect. tubular	1-2	1.00
TC-206	Condenser, 10 uf — 450 WVDC elect. tubular	1-2	1.30
TC-302	Control, pot., tone, .5 meg. #TX-15-1	2	1.00
TR-102	Resistor, 470 ohm 1 watt, tol. 10%	1-2	.15
	Resistors—½ watt, tol. 10%, any value used	1-2	.10
TS-101	Socket, 7-contact, min. with center pin 1" MC.	1-2	.20
TS-102	Socket, 7-contact, min. no center pin 1" MC.	1-2	.20
TS-105	Socket, 8-contact, octal, molded #9905	1-2	.25
TS-112	Socket strip, 12-contact, #TV1-11	1-2	.75
TT-101	Transformer, audio output, #M-681	1-2	2.00
TZ-106	Hold-down bolt 8-32x1¾"	1-2	.05

UNIT "D"

Part No.	Description	Unit Series	List Price
TC-105	Coil, video peaking #D-2000	1-2-3-4	$ .30
TC-106	Coil, video peaking dual winding, output #TV121-3	1-2-3-4	.70
TC-107	Coil, video peaking dual winding, interstage	1	.70
TC-202	Condenser, 20 uuf — 500 V reg. mica, tol. 10%	4	.25
TC-203	Condenser, .0027 uf — 400 V paper tubular molded	2-3-4	.25
TC-204	Condenser, .0047 uf — 400 V paper tubular molded	1-2-3-4	.25
TC-206	Condenser, 10 uf — 450 WVDC elect. tubular	1-2-3-4	1.30
TC-207	Condenser, 270 uuf — 500 V reg. mica tol. 10%	2-3-4	.35
TC-208	Condenser, 910 uuf — 500 V reg. mica tol. 10%	1-2-3-4	.50
TC-209	Condenser, .01 uf — 400 V paper tubular molded	1-2-3-4	.25
TC-210	Condenser, .047 uf — 400 V paper tubular molded	1-2-3-4	.30
TC-211	Condenser, .1 uf — 600 V paper tubular molded	1	.45
TR-103	Resistor, 3300 ohm 1 watt tol. 10%	1-2-3-4	.15
	Resistors — ½ watt, 10% tol., any value used	1-2-3-4	.10
TS-102	Socket, 7-contact, min. no center pin 1" MC.	1-2-3-4	.20
TS-103	Socket, 9-contact, min. no center pin 1⅛" MC.	1-2-3-4	.25
TS-105	Socket, 8-contact, octal, molded #9905	1-2-3-4	.25
TS-112	Socket strip, 12-contact TV1-11	1-2-3-4	.75
TT-231	Terminal strip, 1 lug	3	.10
TT-202	Terminal strip, 2 lug	4	.12
TZ-106	Hold-down bolt 8-32x1¾"	1-2-3-4	.05

UNIT "E"

Part No.	Description	Unit Series	List Price
TC-203	Condenser, .0027 uf — 400 V paper tubular molded	1-2-3-4	$ .25
TC-204	Condenser, .0047 uf — 400 V paper tubular molded	1-2-3-4	.25
TC-206	Condenser, 10 uf — 450 WVDC elect. tubular	1-2-3-4	1.30
TC-209	Condenser, .01 uf — 400 V paper tubular molded	4	.25
TC-210	Condenser, .047 uf — 400 V paper tubular molded	1-2-3-4	.30
TC-211	Condenser, .1 uf — 600 V paper tub. molded	1-2-3	.45
TC-212	Condenser, .22 uf — 400 V paper tubular molded	4	.40
TC-213	Condenser, 100 uf — 50 WVDC elect. tubular	1-2-3-4	1.40
	Resistor — ½ watt, 10% tol., any value used	1-2-3-4	.10
TS-102	Socket, 7-contact, min. no center pin 1" MC.	1-2-3-4	.20
TS-105	Socket, 8-contact, octal, molded #9905	1-2-3-4	.25
TS-112	Socket strip, 12-contact #TV1-11	1-2-3-4	.75
TT-102	Transformer, vertical osc. #M-682	1-2-3-4	2.00
TT-103	Transformer, vertical output #M-685	1-2-3-4	4.00
TT-201	Terminal strip, 1 lug	1-2-3-4	.10
TZ-106	Hold-down bolt 8-32x1¾"	1-2-3-4	.05

UNIT "F"

Part No.	Description	Unit Series	List Price
TC-113	Coil, for flyback transformer #52-B-14A	5-6	$4.00
TC-202	Condenser, 20 uuf — 500 V reg. mica, tol. 10%	2-3-4	.25
TC-203	Condenser, .0027 uf — 400 V paper tubular molded	6	.25
TC-207	Condenser, 270 uuf — 500 V reg. mica, tol. 10%	4-5-6	.30
TC-210	Condenser, .047 uf — 400 V paper tubular molded	1-2-3-4-5-6	.30
TC-211	Condenser, .1 uf — 600 V paper tubular molded	2-3-4-5-6	.45
TC-212	Condenser, .22 uf — 400 V paper tubular molded	1-2-3-4-5-6	.40
TC-214	Condenser, 40 uf — 450 WVDC elect. tubular	1-2-3-4-5-6	1.80
TC-216	Condenser, 270 uuf — 500 V silver mica, tol. 5%	1-2-3-4-5-6	.50
TC-217	Condenser, 680 uuf — 500 V silver mica, tol. 5%	5-6	.70
TC-218	Condenser, 50 uuf — 500 V reg. mica, tol. 10%	2-3-4	.25
TC-219	Condenser, 470 uuf — 500 V ceramic disc	6	.25
TC-220	Condenser, 500 uuf — 20 KV ceramic molded	4-5-6	1.85
TC-221	Condenser, 470 uuf — 10 KV tubular molded	1-2-3	1.30
TC-222	Condenser, trimmer, drive control, 100 to 580 uuf	1-2-3-4-5	.75
TC-401	Core, for flyback transformer (½ only)	5-6	.90
TG-101	Gel. silica, 10-unit replacement bottle	5-6	2.25
TH-101	HermAdome, base, with terminals #52B11C	5-6	2.50
TH-102	HermAdome, cover, less silica-gel #52B12D	5-6	2.00
TR-104	Resistor, 68 ohm 1 watt, tol. 10%	6	.15
TR-105	Resistor, 10,000 ohm 1 watt, tol. 10%	2-3-4	.15
TR-106	Resistor, 27,000 ohm 2 watt, tol. 10%	5-6	.20
TR-107	Resistor, 100 ohm 5 watt, wire wound	1-2-3-4	.50
TR-108	Resistor wire, 1.2 ohm with insulation 6"	5-6	$ .25
TR-109	Resistor wire, 5 ohm with insulation 8"	2-3-4	.25
	Resistors, ½ watt, 10% tol., any value used	1-2-3-4-5-6	.10
TR-201	Rectifier, selenium, 65 MA. 150 V #8J1	1-2-3-4-5-6	1.35
TS-103	Socket, 9-contact min. 1⅛" MC.	1-2-3-4-5-6	.25
TS-104	Socket, 6-contact min. molded for #1AX2 tube	5-6	.35
TS-105	Socket, 8-contact octal molded #9905	1-2-3-4-5-6	.25
TS-112	Socket strip, 12-contact #TV1-11	1-2-3-4-5-6	.75
TS-113	Socket, 4-contact min. wafer 1" MC. for 1x2A tube	1-2-3-4	.20
TT-105	Transformer, flyback, for 12½" CRT #X100	1	7.50
TT-106	Transformer, flyback, for 17" & 20" CRT #30-6145	2-3-4	10.00
	See coil and core for F-5 and F-6 transformer.		
TW-101	Wire, high voltage lead with button 16" long	1-2-3-4-5-6	.50
TW-102	Wire, #6BQ6 plate lead with connector 5½" long	1-2-3-4-5-6	.35
TZ-106	Hold-down bolt 8-32x1¾"	2-3-4-5-6	.05
TZ-107	Core clamp for flyback transformer top	5-6	.15
TZ-108	Core clamp for flyback transformer bottom	5-6	.15
TZ-109	Shoulder stud for core clamps	5-6	.05
TZ-110	Screw, polystyrene for #1AX2 socket mtg.	5-6	.03
TZ-111	Gasket for HermAdome sealing	5-6	.55

UNIT "G"

Part No.	Description	Unit Series	List Price
TC-201	Condenser, .01 uf — 500 V ceramic disc	2	$ .25
TC-210	Condenser, .047 uf — 400 V paper tubular molded	1-2	.30
TC-214	Condenser, 40 uf — 450 WVDC elect. tubular	1-2	1.80
TS-105	Socket, 8-contact molded #9905	1-2	.25
TS-112	Socket strip, 12-contact #TV1-11	1-2	.75
TT-104	Transformer, main power, 115 V prim. #M-575C	1-2	20.00
TT-107	Filter choke, 200 MA. DC. #M-571	1-2	4.00
TZ-106	Hold-down bolt 8-32 x 1¾"	1-2	.05

UNIT "H"

Part No.	Description	Unit Series	List Price
TC-108	Coil, I.F. 456 K.C., slug tuned #570-455	1-2-3	$2.00
TC-109	Coil, oscillator, ceramic form 3-lug #416C	1-2-3	.80
TC-110	Coil, loop antenna, ferrite core "Hot-Rod" 6" long	1-2-3	1.20
TC-111	Coil, R.F., untuned, double peaking #BC-416	2	1.00
TC-207	Condenser, 270 uuf — 500 V reg. mica	1-2-3	.30
TC-210	Condenser, .047 uf — 400 V paper tubular molded	1-2-3	.30
TC-223	Condenser, 100 uuf — 500 V reg. mica, tol. 10%	1-2-3	.30
TC-224	Condenser, variable, 2-gang tuning	1-2-3	3.20
TC-301	Crystal, germanium, diode #1N60	2	1.50
TR-106	Resistor, 27,000 ohms 2 watt, tol. 10%	1-2-3	.20
	Resistors, ½ watt, 10% tol., any value used	1-2-3	.10
TS-101	Socket, 7-contact min. with center pin 1" MC.	1-2-3	.20
TS-102	Socket, 7-contact min. no center pin 1" MC.	1-2-3	.20
TS-111	Socket strip, 5-contact #TV1-13	1-2-3	.35
TS-115	Socket, pilot lite with 6" leads #420-90	3	.35
TZ-103	Hold-down bolt 8-32 x 3"	1-2-3	.08

MAIN CHASSIS

Part No.	Description	Where Used	List Price
TC-203	Condenser, .0027 uf — 400 V paper tubular molded		$ .25
TC-210	Condenser, .047 uf — 400 V paper tubular molded		.30
TC-212	Condenser, .22 uf — 400 V paper tubular molded		.40
TC-303	Control, pot. .5 meg. ohm, with switch #TV1-60 off-on-vol.		1.25
TC-304	Control, pot. 4000 ohm contrast #TV1-61		1.00
TC-305	Control, pot. 4000 ohm vert. lin. #TV1-61-62A		1.00
TC-306	Control, pot. 100,000 ohm hor. hold #TV1-62A		$1.00
TC-307	Control, pot. 2 meg ohm brt., hgt., vert. hold TV1-51-5		1.00
TC-309	Control variable, 2000 ohm 4 watt focus		2.00
TF-101	Fuse holder, type HCM		1.00
TF-102	Fuse holder, #342003		1.00
TF-103	Fuse, 3 amp. type 3 AG		.10
TP-101	Plug strip, 5-pin for Units A and H TV1-14		.15
TP-102	Plug strip, 12-pin for Units B, C, D, E, F and G #TV1-12		.35
TR-107	Resistor, 100 ohm 5 watt wire wound		.50
TR-110	Resistor, 175 ohm 5 watt wire wound		.50
TR-111	Resistor, 500 ohm 5 watt wire wound		.50
TR-112	Resistor, 750 ohm 10 watt wire wound		.75
TR-113	Resistor, 1500 ohm 12 watt wire wound		.80
TR-114	Resistor, 2000 ohm 10 watt wire wound		.75
TR-115	Resistor, 3000 ohm 10 watt wire wound		.75
TR-202	Receptacle, phono motor, convenience outlet #402		.40
TS-106	Socket, 5-contact, wafer 1½" MC		.20
TS-107	Socket, 6-contact, wafer 1½" MC		.20
TS-108	Socket, single contact, for phono and tuner		.15
TS-109	Socket, 1-contact, molded for A unit conn.		.15
TS-114	Socket, for picture tube, 6 leads 18" long #99-10-C		1.00
TS-115	Socket, pilot lite #420-90		.35
TT-201	Terminal strip, 1 lug		.10
TT-202	Terminal strip, 2 lug		.10
TT-203	Terminal strip, 4 lug		.12
TW-103	Wire, AC cord with plug, 11 ft.		.90
TZ-101	Nut and housing for "A" Unit hold-down bolt		.10
TZ-102	Nut and housing for B, C, D, E, F, G, H unit hold-down bolts		.10

FINAL ASSEMBLY

Part No.	Description	Where Used	List Price
FA53-101	Speaker, 10" P.M., 3.15 oz. AL V		$9.00
FA53-102	Yoke, with res., cond., leads and plug		10.00
FA53-103	Ion trap, for 12½", 17", 20" and 21" CRT		.75
FA53-104	Width sleeve		.60
FA53-105	Knob assembly, TV channel selector		2.50
FA53-106	Knob assembly, Radio selector		2.50
FA53-107	Knob assembly, Off-on-volume		2.00
FA53-108	Knob, small size, contrast, etc.		.50
FA53-109	Glass, safety, 16" x 22" for #53, #531, #5301		6.00
	Crating charge 1 to 8 pieces		3.00
FA53-110	Mask, picture tube, for #53, #531, #5301, #5302		4.50
FA53-111	Mounting band for picture tube, 21"		3.50
FA53-112	Mounting bracket for yoke		.70
FA53-113	Glass, safety, 16" x 21⅛" for #5302		6.00
	Crating charge 1 to 8 pieces		3.00
FA53-114	Centering magnets and cap for yolk		1.00
FA-201	Speaker, 6" P.M., 1 oz AL V		5.00
FA-202	Speaker, 5" P.M., 1 oz AV V		4.00
FA-203	Knob, TV channel selector #A52A-39-1		3.00
FA-204	Knob, radio selector, off-on-volume, #A52A-39-2		2.55
FA-206	Knob, small size, black plastic, metal trim TV-151-6, for TV—Radio—Phono. contr., off-on-vol.		.60
FA-207	Lever, for TV fine tuning and radio pointer TV1-38		.25
FA-208	Plate, channel selector TV1-43		.60
FA-209	Plate, radio selector TV1-44		.60
FA-210	Plate, adjustment and name TV1-12		.60
FA-211	Plate, channel selector TV1-66		.60
FA-212	Plate, radio selector TV1-67		.60
FA-213	Plate, adjustment and name TV1-65		.60
FA-214	Plate, channel selector TV-65A		.60
FA-216	Plate, radio selector TV-66		.60
FA-216	Plate, adjustment and name TV-151-2		.60
FA-217	Plate, off-on-volume		.60
FA-220	Focus coil with leads		5.00

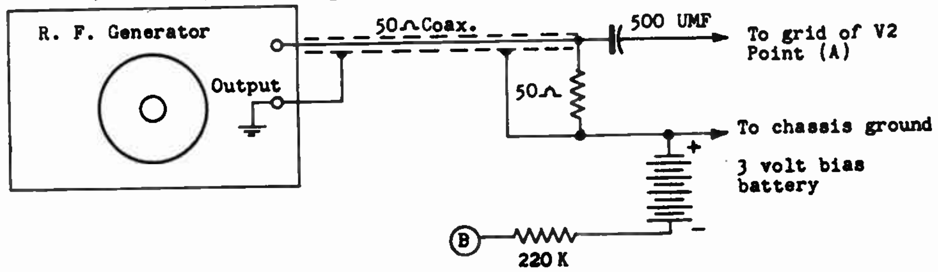
PARTS LIST NUMERICALLY

Part No.	Description	Where Used	List Price
FA53-101	Speaker, 10" P.M. 3.15 oz AL V		9.00
FA53-102	Yoke, with res., cond., leads and plug		10.00
FA53-103	Ion trap, for 12½", 17", 20", 21", CRT		.75
FA-201	Speaker, 6" PM. 1 oz AL V		5.00
FA-220	Focus coil with leads		5.00
TA-101	Coil strip, oscillator (Channel 2 - 13) specify channel and series	A	$2.00
TA-102	Coil strip, antenna (Channel 2 - 13) specify channel and series	A	2.00
TA-103	Fine tuning shaft & blade #31A-066-2	A	.75
TA-104	Drum and shaft, less coil strips 31B-203-57	A	3.50
TA-105	Contact bracket assembly, 11 contact #31B-278	A	3.50
TA-106	Coil, I.F. 20-25 M.C #31A-078	A	.90
TA-107	Coil, choke (+B to I.F. coil) 31B-638	A	.40
TA-108	Condenser, feed thru 800 uuf #130-153	A	.40
TA-109	Roller, detent #31B-016	A	.25
TC-101	Coil, I.F. 20-25 M.C slug tuned #B-72A83-3	B	.90
TC-102	Coil, I.F. 4.5 M.C sound input trap #C-4501	C	1.70
TC-103	Coil, I.F. 4.5 M.C Sound interstage #C-4502	C	1.70
TC-104	Coil, ratio detector 4.5 M.C. B13M19643	C	3.00
TC-105	Coil, video peaking #D-2000	D	.30
TC-106	Coil, video peaking dual winding, output TV121-3	D	.70
TC-107	Coil, video peaking dual winding interstage	D-1	.70
TC-108	Coil, I.F. 456KC slug tuned #570-455	H	2.00
TC-109	Coil, oscillator, ceramic form 3 lug #416C	H	.80
TC-110	Coil, loop antenna ferrite core "Hot Rod" 6" long	H	1.20
TC-111	Coil, R.F., untuned, double peaking #BC-416	H	1.00
TC-112	Coil, I.F. 4.5 M.C. sound input trap C-45	C-1	.80
TC-113	Coil, for flyback transformer #52-B-14A	F5,6	4.00
TC-201	Condenser, .01 uf — 500 V ceramic disc		.25
TC-202	Condenser, 20 uuf — 500 V reg. mica 10% tol.		.25
TC-203	Condenser, .0027 uf — 400 V paper tubular molded		.25
TC-204	Condenser, .0047 uf — 400 V paper tubular molded		.25
TC-205	Condenser, 4 uf — 50 WVDC elect. tubular		1.00
TC-206	Condenser, 10 uf — 450 WVDC elect. tubular		1.30
TC-207	Condenser, 270 uuf — 500 V reg. mica tol. 10%		.35
TC-208	Condenser, 910 uuf — 500 V reg. mica tol. 10%		.50
TC-209	Condenser, .01 uf — 400 V paper tubular molded		.25
TC-210	Condenser, .047 uf — 400 V paper tubular molded		.30
TC-211	Condenser, .1 uf — 600 V paper tubular molded		.45
TC-212	Condenser, .22 uf — 400 V paper tubular molded		.40
TC-213	Condenser, 100 uf — 50 WVDC elect. tubular		1.40
TC-214	Condenser, 40 uf — 450 WVDC elect. tubular		1.80
TC-215	Condenser, .5 uf — 200 V paper tabular molded		.55
TC-216	Condenser, 270 uuf — 500 V silver mica tol. 5%		.50
TC-217	Condenser, 680 uuf — 500 V silver mica tol. 5%		.70
TC-218	Condenser, 50 uuf — 500 V reg. mica tol. 10%		.25
TC-219	Condenser, 470 uuf — 500 V ceramic disc		.25
TC-220	Condenser, 500 uuf — 20 KV ceramic molded		1.85
TC-221	Condenser, 470 uuf — 10 KV tubular molded		1.30
TC-222	Condenser, trimmer, drive control 100-580 uuf	F	.75
TC-223	Condenser, 100 uuf — 500 V reg. mica tol. 10%		.30
TC-224	Condenser, variable, 2-gang tuning	H	3.20
TC-301	Crystal, germanium, diode #1N60	B, H-2	1.50
TC-302	Control, pot, tone, .5 meg #TX-15-1	C	1.00
TC-303	Control, pot, .5 meg ohm, with switch #TV1-60, off-on-vol.		1.25
TC-304	Control, pot, 4000 ohm contrast TV1-61		1.00
TC-305	Control, pot. 4000 ohm vert. lin. #TV1-61-62A		1.00
TC-306	Control, pot, 100,000 ohm hor. hold TV1-62A		1.00
TC-307	Control, pot. 2 meg ohm bright, hgt., vert. hold TV1-51-5		1.00
TC-308	Control, pot. 2 meg ohm bright, long shaft		1.00
TC-309	Control variable, 2000 ohm 4 watt focus		2.00
TC-401	Core, for flyback transformer (½ only)	F5,6	.93
TF-101	Fuse holder, type HCM		1.00
TF-102	Fuse holder, #342003		1.00
TF-103	Fuse, 3 amp. type 3 AG		.10
	Resistors—½ watt, tol. 10% any values used		.10
TR-101	Resistor — 270 ohm 1 watt, tolerance 10%	B	.15
TR-102	Resistor, 470 ohm 1 watt tol. 10%	C	.15
TR-103	Resistor, 3300 ohm 1 watt tol. 10%	D	.15
TR-104	Resistor, 68 ohm 1 watt tol. 10%	F	.15
TR-105	Resistor, 10,000 ohm 1 watt tol. 10%	F	.15
TR-106	Resistor, 27,000 ohm 2 watt tol. 10%	F	.20
TR-107	Resistor, 100 ohm 5 watt wire wound	F	.50
TR-108	Resistor wire, 1.2 ohm with insulation 6"	F5,6	.25
TR-109	Resistor wire, 5 ohm with insulation 8"	F2,3,4	.25
TR-110	Resistor, 175 ohm 5 watt wire wound		.50
TR-111	Resistor, 500 ohm 5 watt wire wound		.50
TR-112	Resistor, 750 ohm 10 watt wire wound		.75
TR-113	Resistor, 1500 ohm 12 watt wire wound		.80
TR-114	Resistor, 2000 ohm 10 watt wire wound		.75
TR-115	Resistor, 3000 ohm 10 watt wire wound		.75
TR-201	Rectifier, selenium, 65MA-150V #8J1	F	1.35
TT-101	Transformer, Audio Output M-681	C	$ 2.00
TT-102	Transformer, vertical ocs. #M-682	E	2.00
TT-103	Transformer, vertical output #M-685	E	4.00
TT-104	Transformer, main power, 115 V prim. #M-575C	G	20.00
TT-105	Transformer, flyback, for 12½" CRT #X100	F1	7.50
TT-106	Transformer, Flyback for 17", 20" CRT 30-6145	F2, 3, 4	10.00
TT-107	Transformer, Filter Choke 200 M.A. #M-571	G	4.00

ALIGNMENT PROCEDURE UNMODULATED (CW) GENERATOR METHOD

Step One: SOUND TRAP ALIGNMENT

A. Adjust all controls to normal operating position. Connect the R. F. Signal Generator to the grid of V-2 (Point A.) I. F. input adapter, as shown below.



B. Connect VTVM across R56 (Point C.) Use low volts D. C. Scale.
C. Connect a 4.5 volt bias battery between Point G and ground. (Positive terminal of battery to chassis ground.) Remove 6AU6 (V8).
D. Set R. F. Tuner to channel which gives minimum indication of voltmeter.
E. Adjust L25 and L26 for minimum indication on voltmeter at the specified frequency:

L25	=	27.75 mc
L26	=	21.75 mc

Step Two: PIX I F ALIGNMENT

A. Adjust L10, L27, L28, L29, L30, for maximum indication on voltmeter at the specified frequency.

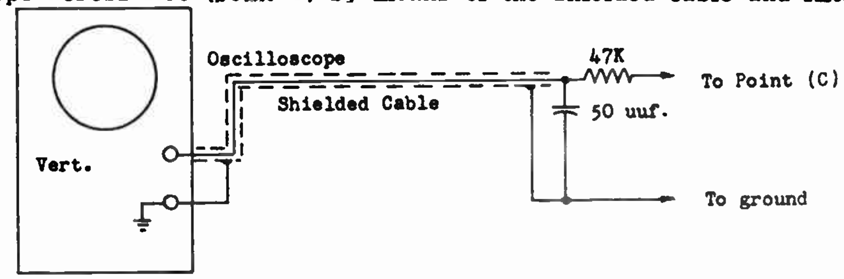
L10	22.5 mc
L27	25.25 mc
L28	24.25 mc
L29	23.25 mc
L30	26.0 mc

Step Three: SOUND IF ALIGNMENT

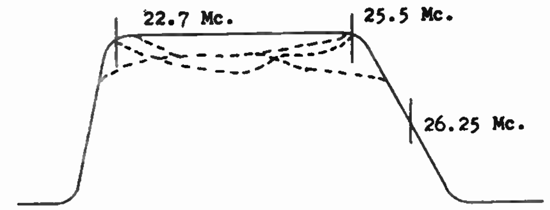
A. Connect the R. F. Signal Generator to Point C.
B. Inject the 4.5 mc signal. (Frequency accuracy important.)
C. Connect VTVM from Point E to ground. Use - 10 volt DC Scale.
D. Adjust L33, T1, and T2 primary for maximum indication of voltmeter.
E. Connect VTVM from Point F to ground. Use lowest D. C. Scale. Adjust secondary of T2 for zero output, as indicated by voltmeter. Note: It is possible to produce a positive or negative voltage indicated by varying this adjustment. The point where the voltage swings from positive to negative is zero output and indicates correct alignment. (If Ratio Detector is seriously misaligned repeat alignment of primary and secondary until no improvement can be made.)
F. Connect VTVM with detector probe from Point D to ground. Use lowest DC Scale
G. Adjust L37 for minimum indication on voltmeter.

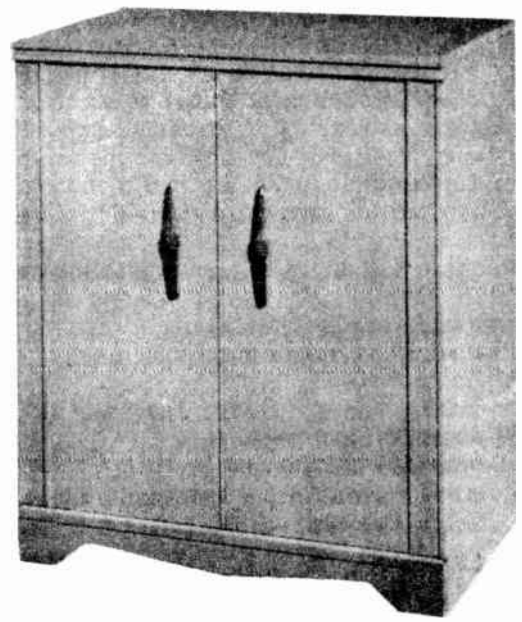
VISUAL ALIGNMENT CHECK USING SWEEP GENERATOR, MARKER GENERATOR, AND OSCILLOSCOPE.

A. Adjust all controls to normal operating position. Connect the sweep generator to the grid of V2 (point A). Connect a 4.5 volt bias battery between point G and ground. (Positive terminal of battery to chassis ground).
B. Connect the oscilloscope across R56 (point C) by means of the shielded cable and filter system shown below.



C. Adjust the R. F. sweep generator so that it sweeps from approximately 20 to 30 mc.
D. Adjust the oscilloscope so that the I.F. response is visible. (Set tuner to channel where rotation of Fine Tuning does not change observed response.)
E. Inject proper marker signals as recommended by manufacturer of R. F. sweep generator used.
F. Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary, slightly vary the tuning of the picture I.F. coils L10, L27, L28, L29, L30 until the picture I.F. response shown is obtained The solid curve depicts the ideal I.F. response while the dotted curves show permissable variations.





ELECTRICAL SPECIFICATIONS

Power supply	105-125 Volts AC 60 Cycle only
Power Consumption	325 Watts
Audio Power Output	Maximum Undistorted 2.5 Watts
Tuning Range	T. V. Channels 2 thru 83
Antenna Input Impedance	300 Ohms Balanced
Intermediate Frequencies	Picture 26.25 Mc.
Intercarrier Sound System	4.5 Mc.
Voice Coil Impedance	3.2 Ohms at 400 Cycles

MISCELLANEOUS SERVICE HINTS

VHF R.F. AND MIXER ALIGNMENT

1. Set station selector to Channel 12.
2. Connect oscilloscope thru 10,000 ohms to test point T (Wire loop on top of tuner.)
3. For negative bias connect -3volts DC to A.G.C. lead (white covered wire) from tuner.
4. Feed sweep generator into antenna terminals, sweeping Channel 12.
5. Adjust C3, C6 and C13 (upright screws on top of tuner) for flat top response curve and maximum gain. Check markers on all channels. They should fall in automatically on all channels.

VHF OSCILLATOR ALIGNMENT

1. Turn on set and select channel to be viewed.
2. Center fine tuning control.
3. Place a non inductive screwdriver through opening, and adjust oscillator coil for best picture and sound.
4. Repeat this adjustment for each channel that can be viewed in the area.

ADJUSTMENT SUGGESTIONS FOR PM FOCUS UNIT

UNDER NORMAL CONDITIONS, ALL FOCUS ADJUSTMENTS CAN BE MADE BY INSERTING A SCREWDRIVER THRU THE HOLE IN THE BACK OF THE CABINET AND INTO THE SLOTTED END OF THE FOCUS CONTROL SHAFT. ROTATE THE SHAFT EITHER CLOCKWISE OR COUNTER-CLOCKWISE UNTIL BEST OVERALL FOCUS IS OBTAINED.

1. IT IS RECOMMENDED THAT THE PHYSICAL POSITIONING OF THE PM FOCUS UNIT BE PLACED SO THAT THE MOUNTING BRACKET HAS THE TWO SELF-TAPPING SCREWS IN THE CENTER OF THE SLOT.

2. IN THE EVENT THE BRIGHTNESS VARIES WHILE ADJUSTING THE FOCUS UNIT FOR BEST OVERALL FOCUS, MOVE THE FOCUS UNIT ASSEMBLY FORWARD (TOWARD THE YOKE) APPROXIMATELY 3/8" AND RESET THE ION TRAP FOR MAXIMUM BRIGHTNESS THEN REFOCUS (PM) UNIT.

3. FOR BEST COMPROMISE, TO OFFSET VARIATIONS IN FOCUS WITH DIFFERENT BRIGHTNESS SETTINGS, MAKE ALL FINAL FOCUS ADJUSTMENTS AT A HIGH BRIGHTNESS CONTROL SETTING.

MISCELLANEOUS SERVICE HINTS

Horizontal Drive Adjustments:

With 125V.A.C. line adjust vertical deflection for 10% over-scan with best linearity then adjust horizontal linearity control for best linearity and follow with adjustment of horizontal width control for maximum width. Adjust horizontal hold control to its maximum counter-clockwise position. Decrease horizontal drive control resistance until the compression near the center of the picture disappears. Reset horizontal hold control to its mid-position.

With 117 A. C. line volts, the cathode current of the 6CD6 must not exceed 140 Ma. with zero beam current.

Hor. Oscillator Adjustment:

With 117 A. C. line volts and the horizontal hold control set at the mid-point of its range, adjust L-41 for synchronization with approx. zero volts from Pin #1 of V20 to ground as measured with a vacuum tube or other high impedance voltmeter.

Vertical Peaking Control R130 (Part No. PA4465-1)

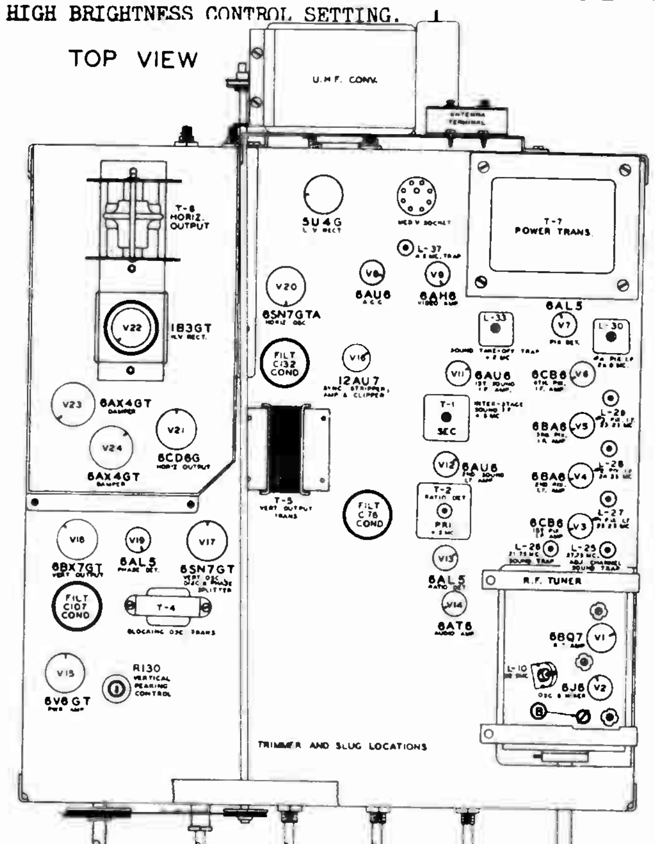
This control has been added on later models due to variation in 6BX7GT tubes. The control is adjusted for best vertical linearity at the top of the raster.

Adjustment of Anti-Pin Cushion Corrector Magnets:

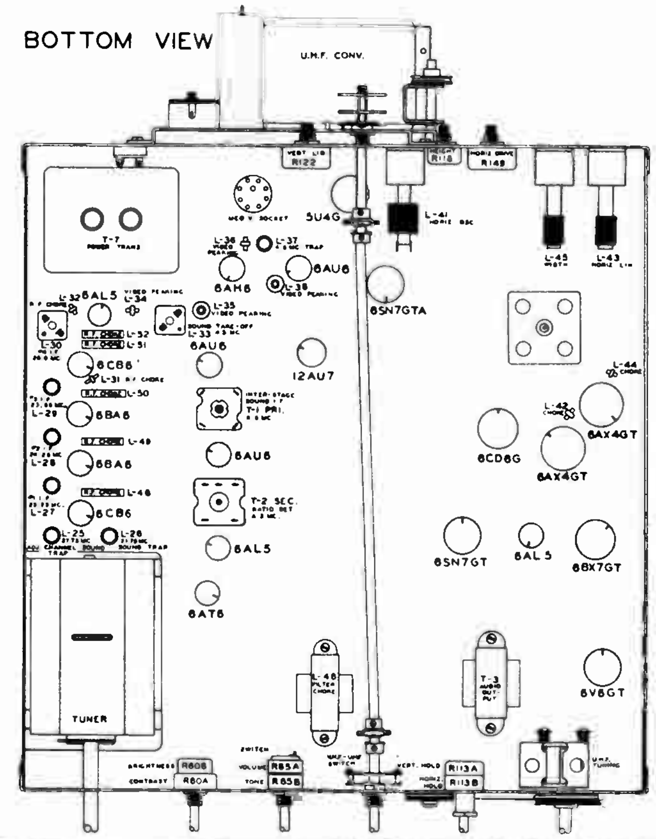
These magnets are mounted on the deflection coil mounting bracket and can be moved in and out by first loosening the mounting screws. Under certain conditions it may be necessary to form, or bend the flexible arms which support the magnets. The above adjustment is made at the factory and should not require re-adjustment unless the original position of the magnets is accidently disturbed. Adjustment can be made in the following manner:

1. With the size controls reduce the size of the raster until the sides are visible.
2. Adjust the corrector magnets for straightest possible raster edges. Restore the picture to normal size.

TOP VIEW



BOTTOM VIEW



VOLTAGE TEST SPECIFICATIONS:

1. All Voltages & Current measured with VHF - UHF Switch in VHF Position.
2. Channel Switch Position - Channel #2.
3. Line Voltage - 117 Volts A.C. No signal input applied to set.
4. Brightness & Contrast Control Position - Maximum Clockwise.
5. Horizontal & Vertical Hold Control Positions - Set correct position to lock in picture.
6. Width Control Position - Set for normal size.
7. Vertical Size & Linearity Control Position - Set for normal size best linearity.
8. Focus Control Position - Properly focused.
9. Volume Control & Tone Control Position - Maximum Counter - Clockwise.
10. Instrument (Meter) Used - (VTVM) Vacuum Tube Volt Meter.
11. Unless otherwise designated all voltages measured in respect to Chassis Ground.

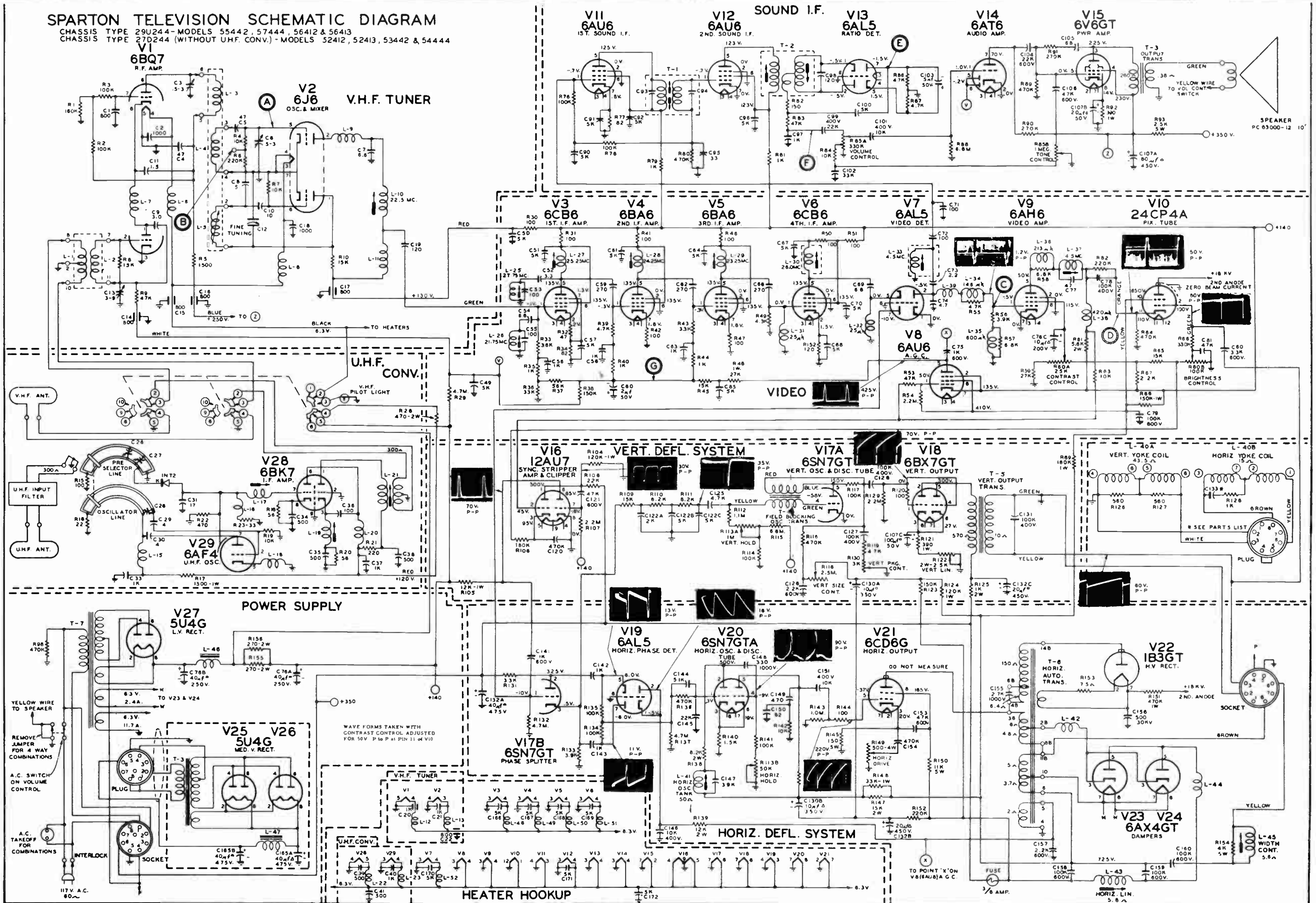
PARTS LIST

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	CAPACITORS	
C1 thru 25	IN VHF TUNER UNIT	
C26 thru 41	IN UHF CONVERTER	
C49	5K CERAMIC DISK	PA4334-1
C50	5K CERAMIC DISK	PA4334-1
C51	5K CERAMIC DISK	PA4334-1
C52	3.3 CERAMIC	PA4326-4
C53	100 CERAMIC	PA4332-3
C54	6.8 CERAMIC	PA4328-13
C55	100 CERAMIC	PA4332-3
C56	1K CERAMIC	HK36M-102
C57	5K CERAMIC DISK	PA4334-1
C58	1K CERAMIC	HK36M-102
C59	270 CERAMIC	HK36M-271
C60	2 mf. 50V. ELECTROLYTIC	PA4303-14
C61	5K CERAMIC DISK	PA4334-1
C62	270 CERAMIC	HK36M-271
C63	1K CERAMIC	HK36M-102
C64	5K CERAMIC DISK	PA4334-1
C65	5K CERAMIC DISK	PA4334-1
C66	270 CERAMIC	HK36M-271
C67	5K CERAMIC DISK	PA4334-1
C68	5K CERAMIC DISK	PA4334-1
C69	6.8 CERAMIC	PA4328-13
C70	5K CERAMIC DISK	PA4334-1
C71	100 CERAMIC	PA4332-3
C72	100 CERAMIC	PA4332-3
C73	2.2 CERAMIC	PA4326-1
C74	4.7 CERAMIC	PA4328-11
C75	1K 600V. TUBULAR	PC42GM-102
C76A	40 mf. 250V. ELECTROLYTIC	PA4307-21
C76B	40 mf. 250V. ELECTROLYTIC	PA4307-21
C76C	10 mf. 200V. ELECTROLYTIC	PA4307-21
C77	47 CERAMIC	CC30A-470F
C78	100K 400V. TUBULAR	PC42GL-104
C79	100K 600V. TUBULAR	PC42GM-104
C80	3.3K 600V. TUBULAR	PC42GM-332
C81	47K 400V. TUBULAR	PC42GL-473
C90	5K CERAMIC DISK	PA4334-1
C91	5K CERAMIC DISK	PA4334-1
C92	5K CERAMIC DISK	PA4334-1
C95	33 MICA	MC60E-330
C96	5K CERAMIC DISK	PA4334-1
C97	1K CERAMIC	HK36M-102
C98	120 CERAMIC	PA4332-4
C99	22K 400V. TUBULAR	PC42CL-223
C100	5K CERAMIC DISK	PA4334-1
C101	10K 400V. TUBULAR	PC42GL-103
C102	33K 200V. TUBULAR	PC42GK-333
C103	5 mf. 50V. ELECTROLYTIC	PA4308-2
C104	22K 600V. TUBULAR	PC42CM-223
C105	68 MICA	MC60E-680
C106	4.7K 600V. TUBULAR	PC42GM-472
C107A	80 mf. 450V. ELECTROLYTIC	PA4307-23
C107B	20 mf. 50V. ELECTROLYTIC	PA4307-23
C107C	100 mf. 50V. ELECTROLYTIC	PA4307-23
C120	470K 200V. TUBULAR	PC42DK-474
C121	47K 600V. TUBULAR	PC42GM-473
C122A	2K CERAMIC	PA4339-4
C122B	5K CERAMIC	PA4339-4
C122C	5K CERAMIC	PA4339-4
C125	4.7K MICA	MC61F-472
C126	2.2K 600V. TUBULAR	PC42GM-222
C127	100K 400V. TUBULAR	PC42FL-104
C128	100K 400V. TUBULAR	PC42GL-104
C130A	10 mf. 350V. ELECTROLYTIC	PA4304-3
C130B	10 mf. 350V. ELECTROLYTIC	PA4304-3
C131	100K 400V. TUBULAR	PC42GL-104
C132A	40 mf. 475V. ELECTROLYTIC	PA4307-22
C132B	20 mf. 450V. ELECTROLYTIC	PA4307-22
C132C	20 mf. 450V. ELECTROLYTIC	PA4307-22
C133	130 2KV CERAMIC DISK	Pur. with Defl. Yoke
C141	1K 600V. TUBULAR	PC42GM-102
C142	1K MICA	MC61E-102
C143	1K MICA	MC61E-102
C144	5.1K MICA	MC61E-512
C145	22K 200V. TUBULAR	PC42GK-223
C146	10K 400V. TUBULAR	PC42FL-103
C147	3.9K SILVER MICA	MC63F-392
C148	330 1KV MICA	PA4340-12
C149	470 MICA	MC60E-471
C150	82 MICA	MC60G-820
C151	10K 400V. TUBULAR	PC42GL-103
C153	47K 600V. TUBULAR	PC42GM-473
C154	470K 200V. TUBULAR	PC42GK-474
C155	2.7K 1000V. TUBULAR	PC42FN-272
C156	500 30KV CERAMIC	PA4348
C157	2.2K 600V. TUBULAR	PC42GM-222
C158	100K 600V. TUBULAR	PC42FM-104
C159	100K 600V. TUBULAR	PC42GM-104
C160	100K 600V. TUBULAR	PC42GM-104
C165A*	40 mf. 475V. ELECTROLYTIC	PA4307-13
C165B*	40 mf. 475V. ELECTROLYTIC	PA4307-13

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	CAPACITORS	
C166	5K CERAMIC DISK	PA4334-1
C167	5K CERAMIC DISK	PA4334-1
C168	5K CERAMIC DISK	PA4334-1
C169	5K CERAMIC DISK	PA4334-1
C170	5K CERAMIC DISK	PA4334-1
C171	5K CERAMIC DISK	PA4334-1
C172	5K CERAMIC DISK	PA4334-1
	RESISTORS	
R1 thru 10	IN VHF TUNER UNIT	
R15 thru 23	IN UHF CONVERTER	
R28	470 2 WATT	DR12S-471
R29	4.7 Meg. 1/2 WATT	BR12S-475
R30	100 1/2 WATT	BR12N-101
R31	100 1/2 WATT	BR12N-101
R32	47 1/2 WATT	BR12G-470
R33	3.6K 1/2 WATT	BR12G-362
R34	82 1/2 WATT	BR12G-820
R35	1K 1/2 WATT	BR12N-102
R36	33K 1/2 WATT	BR12S-333
R37	56K 1/2 WATT	BR12S-563
R38	150K 1/2 WATT	BR12S-154
R39	4.7K 1/2 WATT	BR12G-472
R40	1K 1/2 WATT	BR12N-102
R41	100 1/2 WATT	BR12N-101
R42	100 1/2 WATT	BR12G-101
R43	3.3K 1/2 WATT	BR12G-332
R44	1K 1/2 WATT	BR12N-102
R45	15K 1/2 WATT	BR12G-103
R46	100 1/2 WATT	BR12N-101
R47	100 1/2 WATT	BR12G-101
R48	27K 1 WATT	CR12S-273
R49	4.3K 1/2 WATT	BR12G-432
R50	100 1/2 WATT	BR12N-101
R51	100 1/2 WATT	BR12N-101
R52	120 1/2 WATT	BR12S-121
R53	47K 1/2 WATT	BR12S-473
R54	2.2 Meg. 1/2 WATT	BR12S-225
R55	4.7K 1/2 WATT	PA4203-9
R56	3.9K 1/2 WATT	BR12G-392
R57	6.8K 1/2 WATT	BR12S-682
R58	6.8K 1/2 WATT	PA4203-10
R59	27K 1/2 WATT	BR12S-273
R60A	25K CONTRAST CONTROL	PA4457
R60B	100K BRIGHTNESS CONTROL	PA4457
R61	5.6K 2 WATT	DR12G-562
R62	220K 1/2 WATT	BR12S-224
R63	10K 1/2 WATT	BR12S-103
R64	470K 1/2 WATT	BR12S-474
R65	15K 1/2 WATT	BR12S-153
R66	330K 1/2 WATT	BR12N-334
R67	2.2K 1/2 WATT	BR12G-222
R68	150K 1 WATT	CR12S-154
R69	180K 1 WATT	CR12S-184
R76	100K 1/2 WATT	BR12S-104
R77	82 1/2 WATT	BR12G-820
R78	100K 1/2 WATT	BR12N-104
R79	1K 1/2 WATT	BR12N-102
R80	470K 1/2 WATT	BR12S-474
R81	1K 1/2 WATT	BR12N-102
R82	150 1/2 WATT	BR12G-151
R83	47K 1/2 WATT	BR12S-473
R84	10K 1/2 WATT	BR12S-103
R85A	330K VOLUME CONTROL	PA4450-2
R85B	1 Meg. TONE CONTROL	PA4450-2
R85A	330K VOLUME CONTROL	PA4450-4
R85B	1 Meg. TONE CONTROL	PA4450-4
R86	4.7K 1/2 WATT	BR12G-472
R87	4.7K 1/2 WATT	BR12G-472
R88	6.8 Meg. 1/2 WATT	BR12N-685
R89	470K 1/2 WATT	BR12N-474
R90	270K 1/2 WATT	BR12S-274
R91	270K 1/2 WATT	BR12S-274
R92	390 1 WATT	CR12S-391
R93	2.5K 5 WATT	PA4200-24
R104	120K 1 WATT	CR12S-124
R105	12K 1 WATT	CR12S-123
R106	180K 1/2 WATT	BR12S-184
R107	2.2 Meg. 1/2 WATT	BR12N-225
R108	22K 1/2 WATT	BR12S-223
R109	15K 1/2 WATT	BR12S-153
R110	8.2K 1/2 WATT	BR12S-822
R111	8.2K 1/2 WATT	BR12S-822
R112	1.1 Meg. 1/2 WATT	BR12G-115
R113A	1.0 Meg. VERTICAL HOLD CONTROL	PA4456
	DEFLECTION YOKE ASSEMBLY	AC68088-1
	MAGNETIC FOCUSING UNIT	PB40387
	ION TRAP	PA1248
	RF TUNER ASSEMBLY UHF	PC70021
	RF TUNER ASSEMBLY VHF	PD93174-5
	FUSE 3/8 AMP	PA1248

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	RESISTORS	
R113B	50K HORIZONTAL HOLD CONTROL	PA4456
R114	100K 1/2 WATT	BR12S-104
R115	6.8 Meg. 1/2 WATT	BR12S-685
R116	470K 1/2 WATT	BR12N-474
R117	100K 1/2 WATT	BR12S-104
R118	2.5 Meg. VERTICAL SIZE CONTROL	PA4431
R119	4.7K 1/2 WATT	BR12S-472
R120	100 1/2 WATT	BR12N-101
R121	390 1 WATT	CR12S-391
R122	2.5K VERTICAL LINEARITY CONTROL	PA4464
R123	150K 1/2 WATT	BR12S-154
R124	120K 1 WATT	CR12S-124
R125	1K 2 WATT	DR12S-102
R126	560 1/2 WATT	Part of Defl. Yoke
R127	560 1/2 WATT	Part of Defl. Yoke
R128	1K 1/2 WATT	Part of Defl. Yoke
R129	2.2 Meg. 1/2 WATT	BR12S-225
R130	3K VERTICAL PEAKING CONTROL	PA4465-1
R131	3.3K 1/2 WATT	BR12G-332
R132	4.7 Meg. 1/2 WATT	BR12S-475
R133	3.9K 1/2 WATT	BR12G-392
R134	100K 1/2 WATT	BR12G-104
R135	100K 1/2 WATT	BR12G-104
R136	470K 1/2 WATT	BR12S-474
R137	4.7 Meg. 1/2 WATT	BR12N-475
R138	8.2K 2 WATT	DR12G-822
R139	12K 2 WATT	DR12S-123
R140	1.5K 1/2 WATT	BR12G-152
R141	100K 1/2 WATT	BR12S-104
R142	10K 1/2 WATT	BR12S-103
R143	1 Meg. 1/2 WATT	BR12S-105
R144	100 1/2 WATT	BR12N-101
R145	150 5 WATT	PA4200-22
R146	180K 1 WATT	CR12G-184
R147	15K 2 WATT	DR12S-153
R148	33K 1 WATT	CR12S-333
R149	500 HORIZONTAL DRIVE CONTROL	PA4448
R150	11K 5 WATT	PA4200-27
R152	220K 1/2 WATT	BR12N-224
R153	7.5 1/2 WIREWOUND	BRW12S-75
R154	4K 5 WATT	PA4200-25
R155	270 2 WATT	DR12S-271
R156	270 2 WATT	DR12S-271

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	COILS	
L1 thru 13	IN VHF TUNER	
L15 thru L33	IN UHF CONVERTER	
L25	27.75 MC TRAP	AB43523-13
L26	21.75 MC TRAP	AB43523-12
L27	25.25 MC P. I. F. (1)	AA6408-1
L28	24.25 MC P. I. F. (2)	AA6408-1
L29	23.25 MC P. I. F. (3)	AA6408-1
L30	26.0 MC P. I. F.	AA6364-1
L31	25 UH CHOKE	AA6650-1
L32	25 UH CHOKE	AA6650-1
L33	4.5 MC TRAP	AA6364-2
L34	146 UH CHOKE	AA6402-6
L35	600 UH CHOKE	AA6613-8
L36	213 UH CHOKE	AA6402-7
L37	4.5 MC TRAP	AA6407-1
L38	420 UH CHOKE	AA6613-10
L40A	DEFLECTION YOKE ASSEMBLY	AC6088-1
L40B	DEFLECTION YOKE ASSEMBLY	AC6088-1
L41	HORIZONTAL OSCILLATOR	AA6403-2
L42	CHOKE	AA6650-9
L43	HORIZONTAL LINEARITY	AA6400-3
L44	CHOKE	AA6650-9
L45	WIDTH CONTROL	AA6400-3
L46	FILTER CHOKE	AB47009-1
L47*	FILTER CHOKE	AB47012-1
L48	HEATER CHOKE	AA6651-1
L49	HEATER CHOKE	AA6651-1
L50	HEATER CHOKE	AA6651-1
L51	HEATER CHOKE	AA6651-1
L52	HEATER CHOKE	AA6651-1
	TRANSFORMERS	
T1	SOUND I. F.	AA6667-5
T2	RATIO DETECTOR	AA6684-4
T3	AUDIO OUTPUT	AB44066-3
T4	FIELD BLOCK OSC.	AB47006-4
T5	VERTICAL OUTPUT	AB44070-1
T6	HORIZONTAL OUTPUT	PC70019
T7	POWER	AB44033-1
T8*	POWER	AB44034-1



NOTE:
The points indicated by the letters A,B,C,D,E,F & G are the alignment test points referred to in the alignment procedure.

(A) Pin #6 of V2 (6J6) Osc. & Mixer Tube.
Apply signals here for spot I.F. Alignment or I.F. Sweep.

(B) Apply minus 3 volts through 220K Ohms to test terminal, located between the tubes on top of R.F. Tuner (See Suggested input adapter.)

(C) Diode Load Resistor
Read D.C. output here for spot I.F. Alignment.
Connect scope here for visual I.F. Alignment.

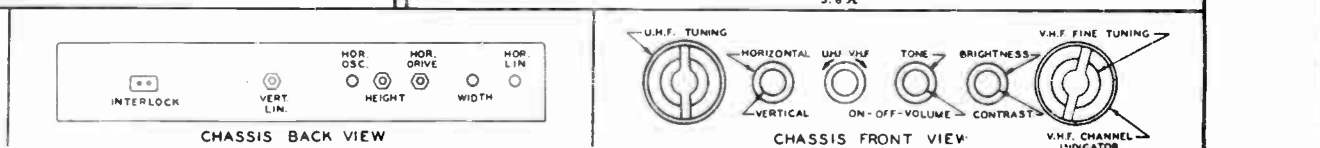
(D) Cathode of Picture Tube
Read A.C. output here for overall sensitivity.
Read 4.5Mc output here for aligning 4.5 Mc. Trap.

(E) Ratio Detector Output
Read D.C. here for alignment of sound take-off trap, inter-stage sound I.F. trans. and primary of ratio det. trans.

(F) Ratio Detector Balanced Output
Read D.C. here for alignment of secondary of ratio det. trans.

(G) A.G.C. Line
apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

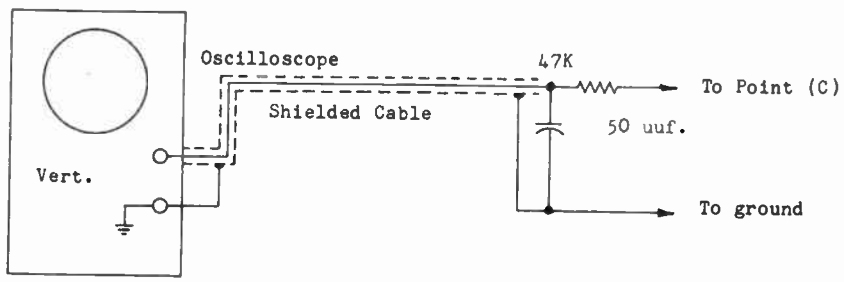
Note: Adjustment of Contrast, Brightness, Focus, Vertical Size, Horizontal Hold and Horizontal Drive Controls will change voltages from those indicated in their respective associated circuits.



VISUAL ALIGNMENT CHECK USING SWEEP GENERATOR, MARKER GENERATOR, AND OSCILLOSCOPE.

A. Adjust all controls to normal operating position. Connect the sweep generator to the grid of V2 (point A.) Connect a 4.5 volt bias battery between point G and ground. (Positive terminal of battery to chassis ground.)

B. Connect the oscilloscope across R32 (point C) by means of the shielded cable and filter system shown below.

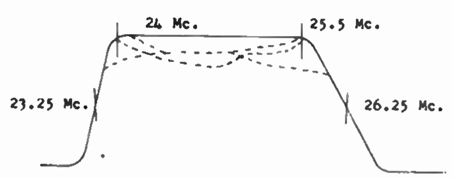


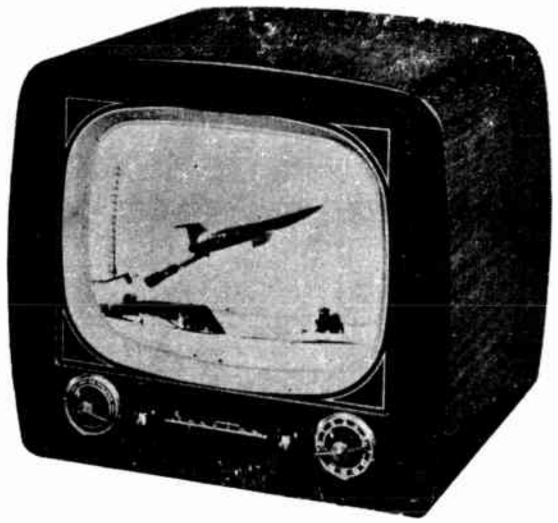
C. Adjust the R. F. sweep generator so that it sweeps from approximately 20 to 30 mc.

D. Adjust the oscilloscope so that the I.F. response is visible. (Set tuner to channel where rotation of Fine Tuning does not change observed response.)

E. Inject proper marker signals as recommended by manufacturer of R.F. sweep generator used.

F. Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary, slightly vary the tuning of the picture I.F. coils L11, L13, L14, L15, until the picture I.F. response shown is obtained. The solid curve depicts the ideal I.F. response while the dotted curves show permissable variations.

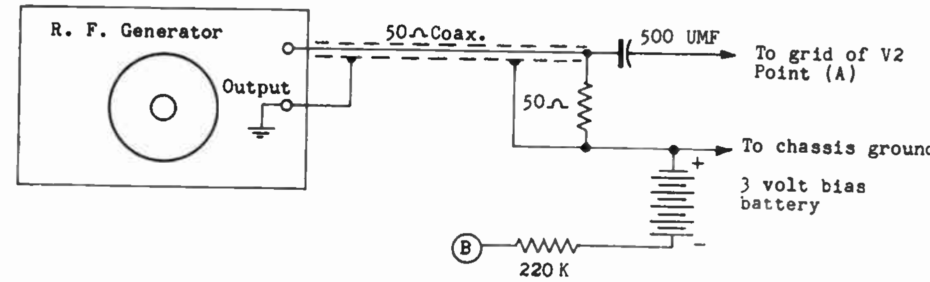




ALIGNMENT PROCEDURE UNMODULATED (CW) GENERATOR METHOD

Step One: SOUND TRAP ALIGNMENT

A. Adjust all controls to normal operating position. Connect the R.F. Signal Generator to the grid of V-2 (Point A.) I.F. input adapter, as shown below.



B. Connect VTVM across R32 (Point C.) Use low volts D. C. Scale.
C. Connect a 4.5 volt bias battery between Point G and ground. (Positive terminal of battery to chassis ground.)
D. Set R.F. Tuner to channel which gives minimum indication on voltmeter.
E. Adjust L12 for minimum indication on voltmeter at the specified frequency:

L12 = 21.75 mc

Step Two: PIX IF ALIGNMENT

A. Adjust L11, L13, L14, L15, for maximum indication on voltmeter at the specified frequency:

L11	22.5 mc
L13	25.0 mc
L14	23.8 mc
L15	26.0 mc

Step Three: SOUND IF ALIGNMENT

A. Connect the R.F. Signal Generator to Point C.
B. Inject the 4.5 mc signal. (Frequency accuracy important.)
C. Connect VTVM from Point E to ground. Use — 10 volt DC Scale.
D. Adjust L25 and T1 primary for maximum indication on voltmeter.
E. Connect VTVM from Point F to ground. Use lowest D. C. Scale. Adjust secondary of T1 for zero output, as indicated by voltmeter. Note: It is possible to produce a positive or negative voltage indicated by varying this adjustment. The point where the voltage swings from positive to negative is zero output and indicates correct alignment.(If Ratio Detector is seriously misaligned repeat alignment of primary and secondary until no improvement can be made.)
F. Connect VTVM with detector probe from Point D to ground. Use lowest DC Scale.
G. Adjust L19 for minimum indication on voltmeter.

ELECTRICAL SPECIFICATIONS

POWER SUPPLY	105-125 VOLTS AC 60 CYCLE ONLY
POWER CONSUMPTION	235-210 WATTS
AUDIO POWER OUTPUT	MAXIMUM UNDISTORTED 2.5 WATTS
TUNING RANGE	T.V. CHANNELS 2 THRU 83 *
ANTENNA INPUT IMPEDANCE	300 OHMS BALANCED.
INTERMEDIATE FREQUENCIES	PICTURE 26.25 MC.
INTERCARRIER SOUND SYSTEM	4.5 MC.
VOICE COIL IMPEDANCE	3.2 OHMS AT 400 CYCLES

* CONVERSION "STRIPS AND CONVERTERS" ARE AVAILABLE FOR STANDARD TUNER TO CONVERT REGULAR VHF TUNERS FOR RECEPTION OF SIGNALS IN ANY UHF TELEVISION BAND.

MISCELLANEOUS SERVICE HINTS

VHF R.F. AND MIXER ALIGNMENT

1. Set station selector to Channel 12.
2. Connect oscilloscope through 10,000 ohms to test point T (Wire loop on top of tuner.)
3. For negative bias connect -3 volts DC to A.G.C. lead (white covered wire) from tuner.
4. Feed sweep generator into antenna terminals, sweeping Channel 12.
5. Adjust C3, C6 and C13 (upright screws on top of tuner) for flat top response curve and maximum gain. Check markers on all channels. They should fall in automatically on all channels.

VHF OSCILLATOR ALIGNMENT

1. Turn on set and select channel to be viewed.
2. Center fine tuning control.
3. Place a non inductive screwdriver through opening, and adjust oscillator coil for best picture and sound.
4. Repeat this adjustment for each channel that can be viewed in the area.

MISCELLANEOUS SERVICE HINTS

Horizontal Drive Adjustments:

With 125V.A.C. line adjust vertical deflection for 10% over-scan with best linearity then adjust horizontal linearity control for best linearity and follow with adjustment of horizontal width control for maximum width. Adjust horizontal hold control to its maximum counter-clockwise position. Decrease horizontal drive control resistance until the compression near the center of the picture disappears. Reset horizontal hold control to its mid-position.

With 117 A.C. line volts, the cathode current of the 6BQ6 must not exceed 110 Ma. with zero beam current.

Horizontal Oscillator Adjustment:

With 117 A.C. line volts and the horizontal hold control set at the mid-point of its range, adjust L-36 for synchronization with approx. zero volts from Pin #1 of V-17 to ground as measured with a vacuum tube or other high impedance voltmeter.

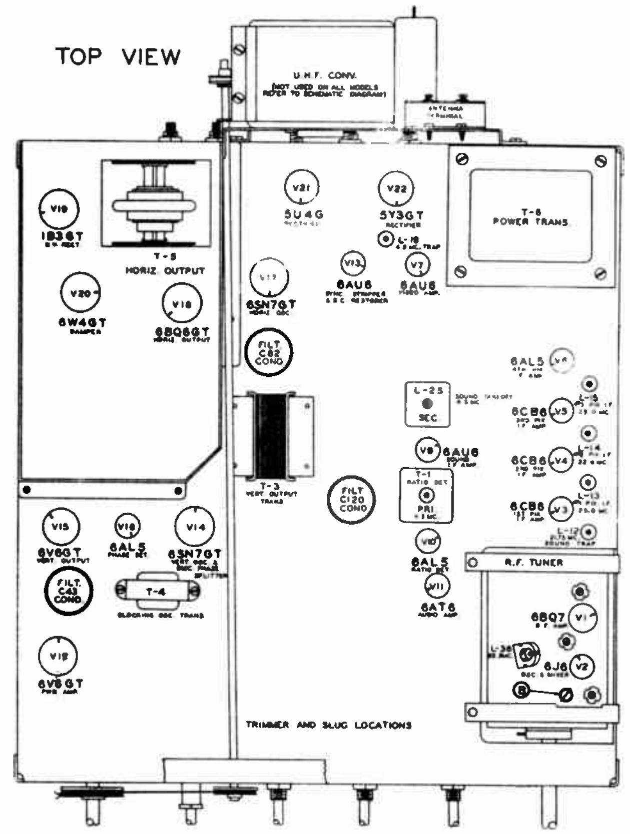
INSTRUCTIONS FOR INSTALLATION OF UHF CHANNEL IDENTIFICATION NUMBERS.

UPON INSTALLATION OF THE UHF CONVERTER STRIPS, YOU MAY CHANGE THE ORIGINAL VHF IDENTIFICATION NUMBER ON THE CHANNEL SELECTOR KNOB TO THE DESIRED UHF CHANNEL NUMBER. THE FOLLOWING INSTALLATION PROCEDURE IS SUGGESTED:

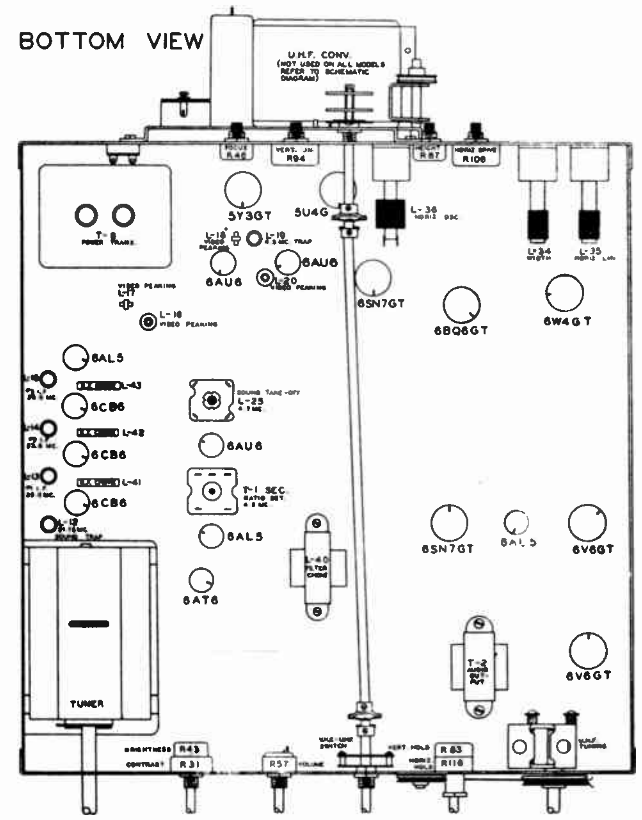
1. REMOVE CHANNEL SELECTOR KNOB
2. REMOVE THE TWO SCREWS HOLDING CHANNEL INDICATOR INSERT.
3. WITH A SHARP KNIFE OR SIMILAR INSTRUMENT, SCRAPE THE UNDESIRED VHF CHANNEL NUMBER FROM FRONT OF INDICATOR INSERT. CAUTION: DO NOT SCRAPE BEYOND THE EDGE LIMITS OF NEW UHF NUMBER.
4. MOISTEN ADHESIVE ON UHF STICKER AND PLACE IN POSITION.
5. ASSEMBLE INDICATOR INSERT TO KNOB, USING CAUTION NOT TO STRIP SCREWS.
6. REPLACE KNOB.

SELECTOR IDENTIFICATION NUMBERS ARE SUPPLIED IN GREEN AND MAROON TO MATCH BOTH BLOND AND MAHOGANY MODELS, AND WILL BE SHIPPED WITH YOUR SPARTON TV RECEIVER. THEY MAY BE FOUND IN THE CUSTOMER INSTRUCTION ENVELOPE ATTACHED TO THE BACK OF THE SET.

TOP VIEW



BOTTOM VIEW

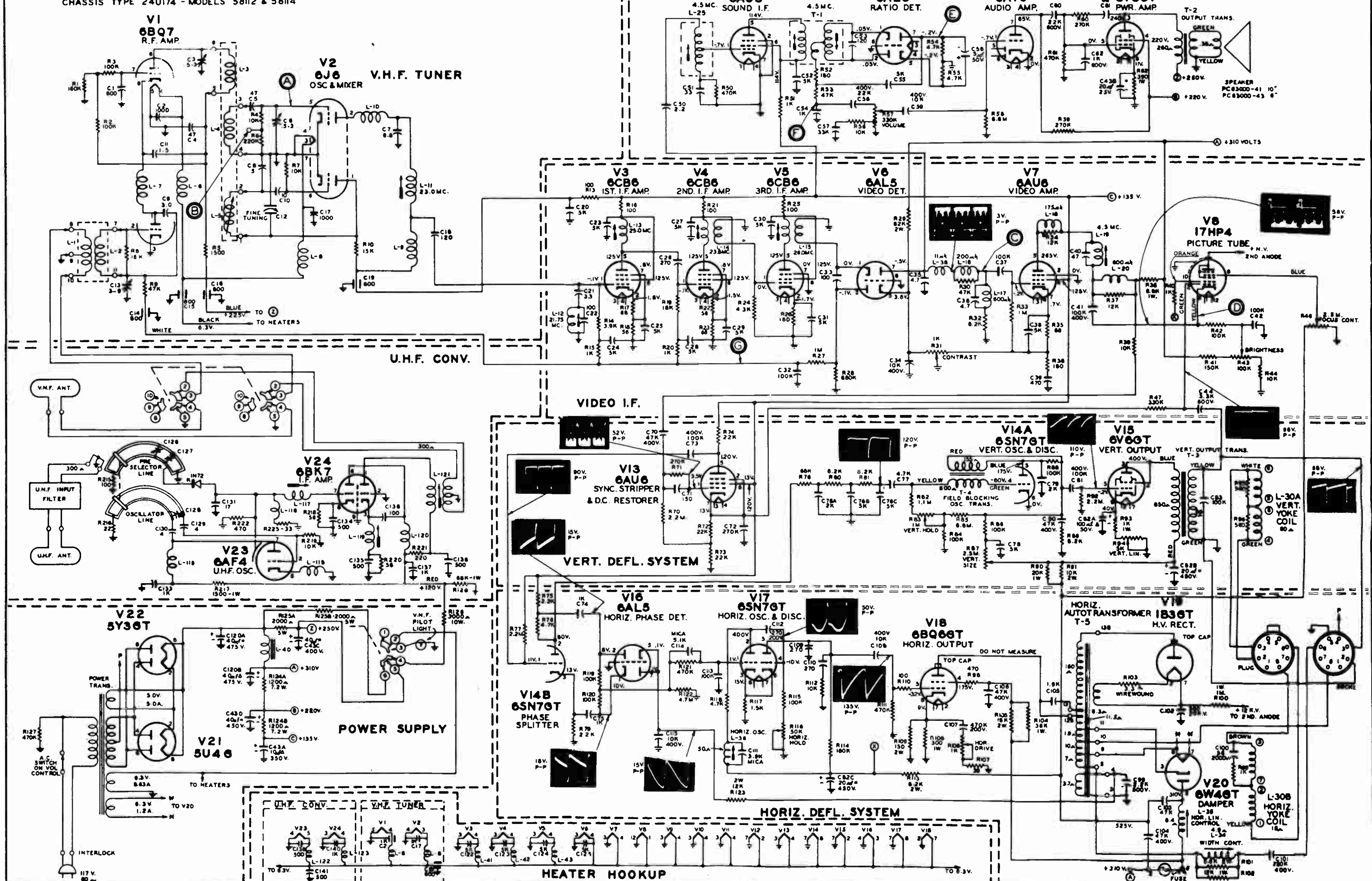


VOLTAGE TEST SPECIFICATIONS:

1. All Voltages & Current measured with VHF - UHF Switch in VHF position.
2. Channel Switch Position - Channel 2-
3. Line Voltage - 117 Volts A.C. No signal input applied to set.
4. Brightness & Contrast Control Position - Maximum Clockwise.
5. Horizontal & Vertical Hold Control Positions - Set correct position to lock in picture.
6. Width Control Position - Set for normal size.
7. Vertical Size & Linearity Control Position - Set for normal size best linearity.
8. Focus Control Position - Properly focused.
9. Volume Control & Tone Control Position - Maximum Counter-Clockwise.
10. Instrument (Meter) Used - (VTVM) Vacuum Tube Volt Meter.
11. Unless otherwise designated all voltages measured in respect to Chassis Ground.

SPARTON TELEVISION SCHEMATIC DIAGRAM

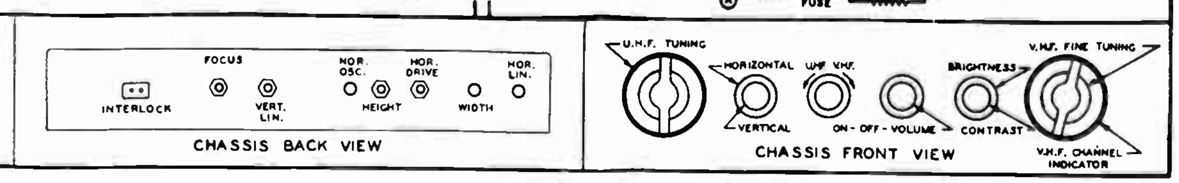
CHASSIS TYPE 24U174 - MODELS 5812 & 58114



NOTE:
The points indicated by the letters A,B,C,D,E,F, & G are the alignment test points referred to in the alignment procedure.

(A) Pin 5 of V2 (6J6) Osc. & Mixer Tube. Apply signals here for spot I.F. Alignment or I.F. Sweep.
(B) Apply minus 3 volts through 220K Ohms to test terminal, located between the tubes on top of R. F. Tuner. (See Suggested input adapter.)
(C) Diode Load Resistor. Read D.C. output here for spot I.F. Alignment. Connect scope here for visual I.F. Alignment.
(D) Cathode of Picture Tube. Read A.C. output here for overall sensitivity. Read 4.5 Mc output here for overall sensitivity.
(E) Ratio Detector Output. Read D.C. here for alignment of sound take-off trap, inter-stage sound. I.F. trans. and primary of ratio det. trans.
(F) Ratio Detector Balanced output. Read D.C. here for alignment of secondary of ratio det. trans.
(G) A.G.C. Line. apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

Note: Adjustment of Contrast, Brightness, Focus, Vertical Size, Horizontal Hold and Horizontal Drive Controls will change voltages from those indicated in their respective associated circuits.



SPARTON TV PAGE 14-7

PARTS LIST

REF. SYMBOL	DESCRIPTION	
"C"		
1 thru 19	IN VHF TUNER UNIT	
20	CERAMIC DISK 5K	PA4334-1
21	CERAMIC -3.3 MMF	PA4326-4
22	CERAMIC -100 MMF	PA4332-3
23	CERAMIC DISK 5K	PA4334-1
24	CERAMIC DISK 5K	PA4334-1
25	CERAMIC DISK 5K	PA4334-1
26	CERAMIC -270 MMF	HK36M-271
27	CERAMIC DISK 5K	PA4334-1
26	CERAMIC DISK 5K	PA4334-1
29	CERAMIC DISK 5K	PA4334-1
30	CERAMIC DISK 5K	PA4334-1
31	CERAMIC DISK 5K	PA4334-1
32	TUBULAR -100K MMF. 200V	PC42GK-104
33	CERAMIC -100 MMF.	HK36M-101
34	TUBULAR -10K MMF. 400V.	PC42GL-103
35	CERAMIC -4.7 MMF.	PA4328-11
36	CERAMIC -4.7 MMF.	PA4326-11
37	TUBULAR -100K MMF. 200V.	PC42GK-104
36	CERAMIC DISK 5K	PA4334-1
39	MICA -470 MMF.	MC60F-471
40	CERAMIC -47 MMF.	CC30A-470
41	TUBULAR -100K MMF. 400V.	PC42GL-104
42	TUBULAR -100K MMF. 200V.	PC42GK-104
43	ELECTROLYTIC -40-20-10-20 MFD.	PA4307-29
44	TUBULAR -3.3K MMF. 600V.	PC42GM-332
50	CERAMIC -2.2 MMF.	PA4326-1
52	CERAMIC DISK 5K	PA4334-1
53	CERAMIC -120 MMF.	PA4332-4
54	CERAMIC -1K MMF.	HK36M-102
55	CERAMIC DISK -5K	PA4334-1
56	TUBULAR -22K MMF. 400V.	PC42GL-223
57	TUBULAR 33K MMF. 200V.	PC42GK-333
58	ELECTOLYTIC -5 MFD. 50V.	PA4308-2
59	TUBULAR -10K MMF. 400V.	PC42GL-103
60	TUBULAR -22K MMF. 600V.	PC42GM-223
61	MICA -68 MMF.	MC60E-680
62	TUBULAR -1K MMF. 600V.	PC42GM-102
70	TUBULAR -47K MMF. 400V.	PC42GL-473
72	TUBULAR -270K MMF. 200V.	PC42GK-274
73	TUBULAR -100K MMF. 400V.	PC42GL-104
74	MICA -1K MMF.	MC61E-102
75	MICA -1K MMF.	MC61E-102
76	CERAMIC -2K -5K -5K MMF.	PA4339-4
77	MICA -4.7K MMF.	MC61F-472
78	CERAMIC DISK -5K	PA4334-1
79	MICA -2K MMF.	MC61E-202
80	TUBULAR -47K MMF. 400V.	PC42GL-473
81	TUBULAR -100K MMF. 400V.	PC42GL-104
82	ELECTROLYTIC -20 -20 -100 MFD.	PA4307-30
83	TUBULAR -100K MMF. 200V.	PC42GK-104
99	TUBULAR -2.2K MMF. 600V.	PC42GM-222
101	TUBULAR -220K MMF. 400V.	PC42GL-224
103	TUBULAR -47K MMF. 400V.	PC42GL-473
104	TUBULAR -47K MMF. 400V.	PC42GL-473
106	TUBULAR -47K MMF. 600V.	PC42GM-473
107	TUBULAR -470K MMF. 200V.	PC42GK-474
108	TUBULAR -10K MMF. 400V.	PC42GL-103
109	MICA -270 MMF.	MC60E-271
110	MICA -270 MMF.	MC60E-271
111	MICA -3.9K MMF.	MC63F-392
112	MICA -270 MMF.	MC60E-271
113	TUBULAR -100K MMF. 200V.	PC42GK-104
114	MICA -5.1K MMF.	MC61E-512
115	TUBULAR -10K MMF. 400V.	PC42GL-103
120	ELECTROYLTIC -40 -40 MFD.	PA4307-13
122	CERAMIC DISK -5K	PA4334-1
123	CERAMIC DISK -5K	PA4334-1
124	CERAMIC DISK -5K	PA4334-1
125	CERAMIC DISK -5K	PA4334-1

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
"R"		
13	100 OHM 1/2 WATT	BR12N-101
14	3.9K OHM 1/2 WATT	BR12G-392
15	1K OHM 1/2 WATT	BR12N-102
17	68 OHM 1/2 WATT	BR12G-680
18	560 OHM 1/2 WATT	BR12G-560
19	181 OHM 1/2 WATT	BR12G-183
22	560 OHM 1/2 WATT	BR12G-560
23	68 OHM 1/2 WATT	BR12G-680
24	4.3K OHM 1/2 WATT	BR12G-432
26	180 OHM 1/2 WATT	BR12S-181
28.	680K OHM 1/2 Watt	BR12N-684
29	2 WATT	DR12S-823
30	47K OHM 1/2 WATT	BR12G-473
31	CONTROL-CONTRAST & BRIGHTNESS	PA4458-1
32	8.2K OHM 1/2 WATT	BR12G-822
33	1 MEGOHM 1/2 WATT	BR12S-105
34	12K OHM 1/2 Watt	BR12G-123
35	68 OHM 1/2 WATT	BR12S-680
36	180 OHM 1/2 WATT	BR12G-181
38	6.8K OHM 1/2 WATT	CR12G-682
39	10K OHM 1/2 WATT	BR12S-103
40	1K OHM 1/2 WATT	BR12M-102
41	150K OHM 1/2 WATT	BR12S-154
42	100K OHM 1/2 WATT	BR12S-104
43	CONTROL-CONTRAST & BRIGHTNESS	PA4458-1
44	10K OHM 1/2 WATT	BR12S-103
45	2K OHM 10 WATT WIREWOUND	PA4200-23
46	CONTROL-FOCUS & HEIGHT	PA4454
47	300K OHM 1/2 WATT	BR12N-334
51	1K OHM 1/2 WATT	BR12N=102
52	180 OHM 1/2 WATT	BR12G-181
53	47K OHM 1/2 WATT	BR12S-390
54	4.7K OHM 1/2 WATT	BR12G-472
55	4.7K OHM 1/2 WATT	BR12G-472
56	10K OHM 1/2 WATT	BR12S-103
57	CONTROL-VOLUME	PA4436-3
58	6.6 MEGOHM 1/2 WATT	BR12N-665
59	270K OHM 1/2 WATT	BR12S-274
60	270K OHM 1/2 WATT	BR12S-274
61	470K OHM 1/2 WATT	BR12N-474
62	390 OHM 1 WATT	CR12S-391
63	1K OHM 10 WATT WIREWOUND	PA4200-20
70	2.2 MEGOHM 1/2 WATT	BR12N-225
72	22K OHM 1/2 WATT	BR12S-223
73	22K OHM 1/2 WATT	BR12S-223
74	22K OHM 1/2 WATT	BR12S-223
75	2.2K OHM 1/2 WATT	BR12G-222
76	4.7K OHM 1/2 WATT	BR12G-472
77	2.2 MEGHOM 1/2 WATT	BR12N-225
78	68K OHM 1/2 WATT	BR12S-683
79	2.2K OHM 1/2 WATT	BR12G-222
80	8.2K OHM 1/2 WATT	BR12S-822
81	8.2K OHM 1/2 WATT	BR12S-622
82	1.1 MEGOHM 1/2 WATT	BR12G-115
83	CONTROL-HORIZ. & VERT. HOLD	PA4456-1
84	100K OHM 1/2 WATT	BR12S-104
85	6.8 MEGOHM 1/2 WATT	BR12S-685
86	100K OHM 1/2 WATT	BR12S-104
87	CONTROL FOCUS & HEIGHT	PA4454
88	100K OHM 1/2 WATT	BR12S-104
89	6.2K OHM 1/2 WATT	BR12S-822
92	2.2 MEGOHM 1/2 WATT	BR12N-225
93	1K OHM 1 WATT	CR12S-102
94	CONTROL-VERTICAL LINEARITY	PA4411
98	470 OHM 1/2 WATT	BR12N-471
106	CONTROL-HORIZ. SRIVE	PA4446
107	39 OHM 1/2 WATT	BR12S-390
110	100 OHM 1/2 WATT	BR12N-101
111	470K OHM 1/2 WATT	BR12S-474
112	10K OHM 1/2 WATT	BR12S-103
113	8.2 OHM 2 WATT	DR12S-822
114	180K OHM 1/2 WATT	BR12G-184
115	100K OHM 1/2 WATT	BR12S-104
116	CONTROL-HORIZ. & VERT. HOLD	PA4456-1
117	1.5K OHM 1/2 WATT	BR12G-152
118	4.7K OHM 1/2 WATT	BR12G-472
119	100K OHM 1/2 WATT	BR12S-104
120	100K OHM 1/2 WATT	BR12S-104
121	470K OHM 1/2 WATT	BR12S-474
122	4.7 MEGOHM 1/2 WATT	BR12N-475
123	12K OHM 2 WATT	DR12S-123
127	470K OHM 1/2 WATT	BR12N-474

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
"L"		
12	TRAP -21.75 MC.	AB43523-14
13	P.I.F. AMP. -25.0 MC,	AA6408-1
14	P.I.F. AMP. -23.6 & 26.0 MC.	AA6409-1
15	P.I.F. AMP. -23.8 & 26.0 MC.	AA6409-1
16	VIDEO PEAKING -200 MH.	AA6613-4
17	VIDEO PEAKING -600 MH	AA6613-8
18	VIDEO PEAKING -175 MH	AA6613-9
19	TRAP -4.5 MC	AA6407-1
20	VIDEO PEAKING COIL & RESISTOR ASSY.	AA6391-1
25	SOUND TAKE OFF TRAP COIL ASSY.	AA6667-6
34	WIDTH CONTROL	AA6400-4
35	HORIZ. LIN. CONTROL	AA6400-5
36	HORIZ. OSCILLATOR	AA6403-2
37	VIDEO PEAKING COIL & RESISTOR ASSY.	AA6391-1
36	FILTER CHOKE	AA6830-1
41	R.F. CHOKE & TUBING ASSY.	AA6376-2
42	R.F. CHOKE & TUBING ASSY.	AA6376-2
43	R.F. CHOKE & TUBING ASSY.	AA6376-2

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
"T"		
1	RADIO DETECTOR COMPLETE ASSY.	AA6684-4
2	AUDIO OUTPUT TRANSFORMER	AB44066-3
3	VERTICAL OUTPUT TRANSFORMER	AA44062-7
4	VERTICAL BLOCKING OSC.	AB47006-4
5	AUTOTRANSFORMER ASSY.	PC70015
6	POWER TRANSFORMER	AB44027-1

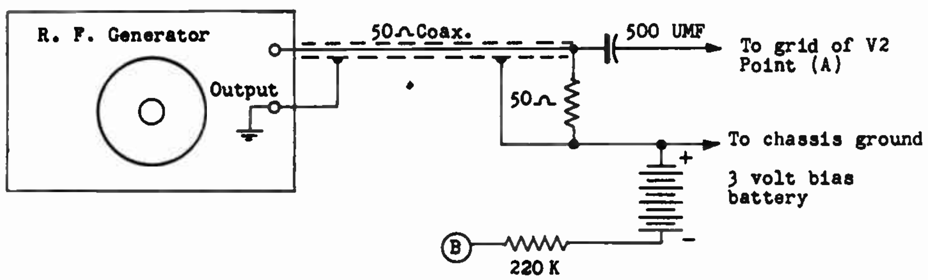
MISCELLANEOUS CHASSIS TYPE 21S173A

SPEAKER - 6 INCH ROUND (MODEL 5301A, 5302A, 30112, 30114)	PC63000-43
FOLDED DIPOLE ASSEMBLY (MODEL 5302A, 5302A, 30112, 30114)	AB41923-6
DIAL LIGHT BRACKET & GROMMET ASSY. (MODEL 5301A, 5302A, 30112, 30114)	AA6819-1
DIAL LIGHT SOCKET EXTENSION (MODEL 5301A, 5302A, 30112, 30114)	PA6117
DIAL LIGHT FILTER (MODEL 5301A, 5302A, 30112, 30114)	PA1294
DIAL LIGHT COVER (MODEL 5301A, 5302A, 30112, 30114)	PA1295
DIAL LIGHT BULB (MODEL 5301A, 5302A, 30112, 30114)	PA4100-2
CABINET-TABLE MODEL-DURON MAHOGANY (MODEL 5301A, 30112)	PD90112-2
CABINET-TABLE MODEL-DURON BLOND (MODEL 5302A,)	PD90112-3
CABINET-TABLE MODEL-DURON LIMED OAK (MODEL 30114)	PD90112-4
KNOB-INFREQUENT CONTROL-INNER (MAROON) (MODEL 5301A, 5302A)	PA5659-1
KNOB-INFREQUENT CONTROL-OUTER (MAROON) (MODEL 5301A, 5302A, 30112, 30114)	PA5660-1
KNOB-HORIZ. & VERT. HOLD (MAROON) (MODEL 30112, 30114)	PA5669-1
KNOB-CONTROL & BRIGHTNESS (MAROON) (MODEL 30112, 30114)	PA5670-1
TUNER KNOB ASSEMBLY (MAROON) (MODEL 5301A, 5302A, 30112, 30114)	AB43593-1
CONTROL KNOB (MAROON) (MODEL 5301A, 5302A, 30112, 30114)	PB40363-1
OFF/ON/VOLUME KNOB ASSEMBLY (MAROON) (MODEL 5301A, 5302A, 30112, 30114)	AB43596-1
CONTROL-KNOB (MAROON) (MODEL 5301A, 5302A, 30112, 30114)	PB40366-1
POWER CORD & PLATES ASSEMBLY (MODEL 5301A, 5302A, 30112, 30114)	AA6361-1
TUBE END SHIELD (MODEL 5301A, 5302A, 30112, 39114)	PB40353-1
SAFETY BACK & LABELS ASSEMBLY (MODEL 5301A, 5302A, 30112, 30114)	AA6363-99
DIAL LIGHT SOCKET EXTENSION (MODEL 5302A, 5301A, 30112, 30114)	PA6117
SPARTON EMBLEM NAME PLATE (MODEL 5301A, 5302A, 30112, 30114)	PB40359
BRACKET-DIAL EIGHT MOUNTING (MODEL 5301A, 5302A, 30112, 30114)	PB41996
MASK (MODEL 5301A, 5302A, 30112, 30114)	PD93035-2
SAFETY GLASS (MODEL 5301A, 5302A, 30112, 30114)	PD93026-1
SAFETY BACK (MODEL 5301A, 5302A, 30112, 30114)	PD93071
TUNER UNIT	PD93174-4
HIGH VOLTAGE TUBE SOCKET ASSY.	AB43570-2
DUODECAL SOCKET	PB40345-1
DIAL LIGHT SOCKET	PB40379
ANTENNA TERMINAL STRIP & BRKT. ASSY.	AA6818-1
EXTENSION SPRING (LEAD SUPPORT)	PA4146
ION TRAP	PA1270
ION TRAP	PA1246-4
MAGNETIC CENTERING RING	PA1270
PICTURE TUBE -TYPE 21FP4A	PD93172-2
SPEAKER -6 INCH ROUND (MODEL 58112, 58114)	PC63000-43

ALIGNMENT PROCEDURE UNMODULATED (CW) GENERATOR METHOD

Step One: SOUND TRAP ALIGNMENT

A. Adjust all controls to normal operating position. Connect the R.F. Signal Generator to the grid of V-2 (Point A.) I.F. input adapter, as shown below.



B. Connect VTVM across R32 (Point C.) Use low volts D. C. Scale.
C. Connect a 4.5 volt bias battery between Point G and ground. (Positive terminal of battery to chassis ground.)
D. Set R.F. Tuner to channel which gives minimum indication on voltmeter.
E. Adjust L12 for minimum indication on voltmeter at the specified frequency:

L12 = 21.75 mc

Step Two: PIX IF ALIGNMENT

A. Adjust L11, L13, L14, L15, for maximum indication on voltmeter at the specified frequency:

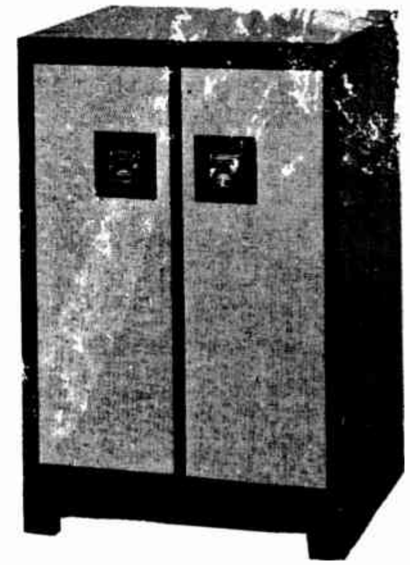
L11	22.5 mc
L13	25.0 mc
L14	23.8 mc
L15	26.0 mc

Step Three: SOUND IF ALIGNMENT

A. Connect the R.F. Signal Generator to Point C.
B. Inject the 4.5 mc signal. (Frequency accuracy important.)
C. Connect VTVM from Point E to ground. Use — 10 volt DC Scale.
D. Adjust L25 and T1 primary for maximum indication on voltmeter.
E. Connect VTVM from Point F to ground. Use lowest D. C. Scale. Adjust secondary of T1 for zero output, as indicated by voltmeter. Note: It is possible to produce a positive or negative voltage indicated by varying this adjustment. The point where the voltage swings from positive to negative is zero output and indicates correct alignment.(If Ratio Detector is seriously misaligned repeat alignment of primary and secondary until no improvement can be made.)
F. Connect VTVM with detector probe from Point D to ground. Use lowest DC Scale.
G. Adjust L19 for minimum indication on voltmeter.

ELECTRICAL SPECIFICATIONS

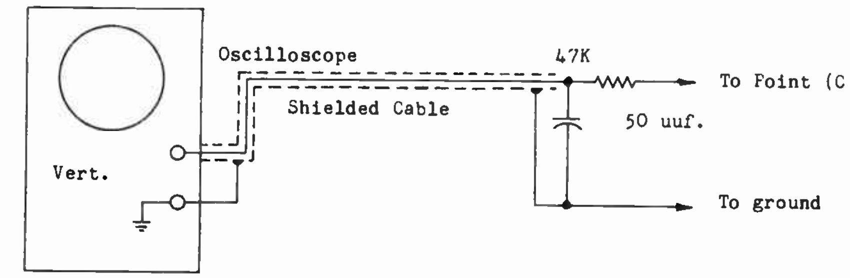
Power Supply	105-125 Volts AC 60 Cycle only
Power Consumption	235 Watts
Audio Power Output	Maximum Undistorted 2.5 Watts
Tuning Range	T.V. Channels 2 thru 83
Antenna Input Impedance	300 Ohms Balanced
Intermediate Frequencies	Picture 26.25 Mc.
Intercarrier Sound System	4.5 Mc.
Voice Coil Impedance	3.2 Ohms at 400 Cycles



VISUAL ALIGNMENT CHECK USING SWEEP GENERATOR, MARKER GENERATOR, AND OSCILLOSCOPE.

A. Adjust all controls to normal operating position. Connect the sweep generator to the grid of V2 (point A.) Connect a 4.5 volt bias battery between point G and ground. (Positive terminal of battery to chassis ground.)

B. Connect the oscilloscope across R32 (point C) by means of the shielded cable and filter system shown below.

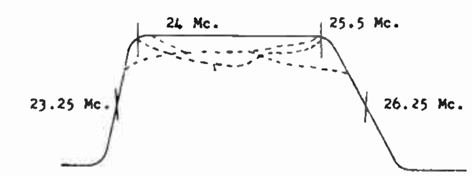


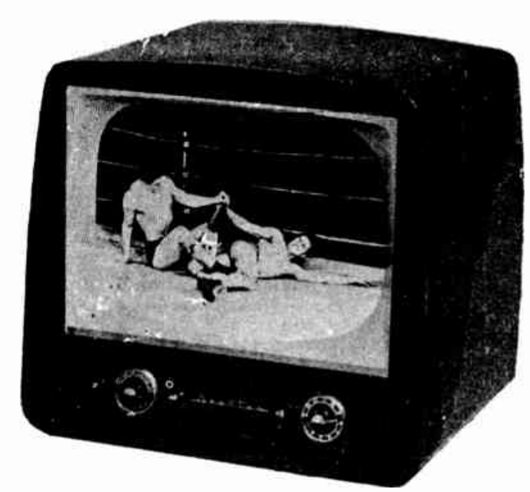
C. Adjust the R. F. sweep generator so that it sweeps from approximately 20 to 30 mc.

D. Adjust the oscilloscope so that the I.F. response is visible. (Set tuner to channel where rotation of Fine Tuning does not change observed response.)

E. Inject proper marker signals as recommended by manufacturer of R.F. sweep generator used.

F. Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary, slightly vary the tuning of the picture I.F. coils L11, L13, L14, L15, until the picture I.F. response shown is obtained. The solid curve depicts the ideal I.F. response while the dotted curves show permissable variations.





MISCELLANEOUS SERVICE HINTS

VHF R.F. AND MIXER ALIGNMENT

1. Set station selector to Channel 12.
2. Connect oscilloscope through 10,000 ohms to test point T (Wire loop on top of tuner.)
3. For negative bias connect -3 volts DC to A.G.C. lead (white covered wire) from tuner.
4. Feed sweep generator into antenna terminals, sweeping Channel 12.
5. Adjust C3, C6 and C13 (upright screws on top of tuner) for flat top response curve and maximum gain. Check markers on all channels. They should fall in automatically on all channels.

VHF OSCILLATOR ALIGNMENT

1. Turn on set and select channel to be viewed.
2. Center fine tuning control.
3. Place a non inductive screwdriver through opening, and adjust oscillator coil for best picture and sound.
4. Repeat this adjustment for each channel that can be viewed in the area.

ADJUSTMENT SUGGESTIONS FOR PM FOCUS UNIT

UNDER NORMAL CONDITIONS, ALL FOCUS ADJUSTMENTS CAN BE MADE BY INSERTING A SCREWDRIVER THRU THE HOLE IN THE BACK OF THE CABINET AND INTO THE SLOTTED END OF THE FOCUS CONTROL SHAFT. ROTATE THE SHAFT EITHER CLOCKWISE OR COUNTER-CLOCKWISE UNTIL BEST OVERALL FOCUS IS OBTAINED.

1. IT IS RECOMMENDED THAT THE PHYSICAL POSITIONING OF THE PM FOCUS UNIT BE PLACED SO THAT THE MOUNTING BRACKET HAS THE TWO SELF-TAPPING SCREWS IN THE CENTER OF THE SLOT.

2. IN THE EVENT THE BRIGHTNESS VARIES WHILE ADJUSTING THE FOCUS UNIT FOR BEST OVERALL FOCUS, MOVE THE FOCUS UNIT ASSEMBLY FORWARD (TOWARD THE YOKE) APPROXIMATELY 3/8" AND RESET THE ION TRAP FOR MAXIMUM BRIGHTNESS THEN RE-FOCUS (PM) UNIT.

3. FOR BEST COMPROMISE, TO OFFSET VARIATIONS IN FOCUS WITH DIFFERENT BRIGHTNESS SETTINGS, MAKE ALL FINAL FOCUS ADJUSTMENTS AT A HIGH BRIGHTNESS CONTROL SETTING.

MISCELLANEOUS SERVICE HINTS

Horizontal Drive Adjustments:

With 125V.A.C. line adjust vertical deflection for 10% over-scan with best linearity then adjust horizontal linearity control for best linearity and follow with adjustment of horizontal width control for maximum width. Adjust horizontal hold control to its maximum counter-clockwise position. Decrease horizontal drive control resistance until the compression near the center of the picture disappears. Reset horizontal hold control to its mid-position.

With 117 A.C. line volts, the cathode current of the 6BQ6 must not exceed 110 Ma. with zero beam current.

Horizontal Oscillator Adjustment:

With 117 A.C. line volts and the horizontal hold control set at the mid-point of its range, adjust L-36 for synchronization with approx. zero volts from Pin #1 of V-17 to ground as measured with a vacuum tube or other high impedance voltmeter.

Adjustment of Anti-Pin Cushion Corrector Magnets:

These magnets are mounted on the deflection coil mounting bracket and can be moved in and out by first loosening the mounting screws. Under certain conditions it may be necessary to form, or bend the flexible arms which support the magnets. The above adjustment is made at the factory and should not require re-adjustment unless the original position of the magnets is accidently disturbed. Adjustment can be made in the following manner:

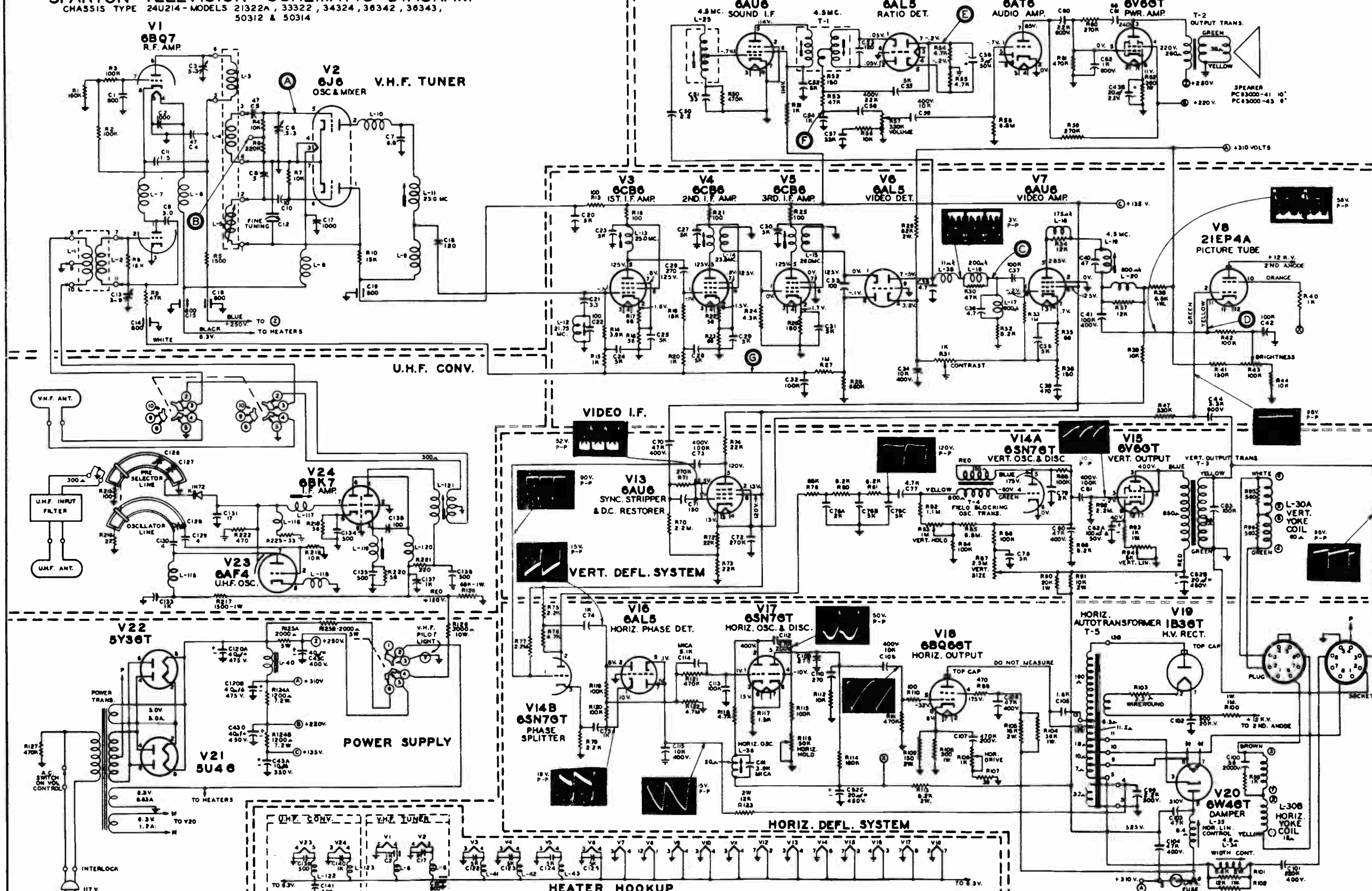
1. With the size controls reduce the size of the raster until the sides are visible.

2. Adjust the corrector magnets for straightest possible raster edges. Restore the picture to normal size.

Misadjustment of the corrector magnets may cause barreling, keystoning and/or poor linearity.

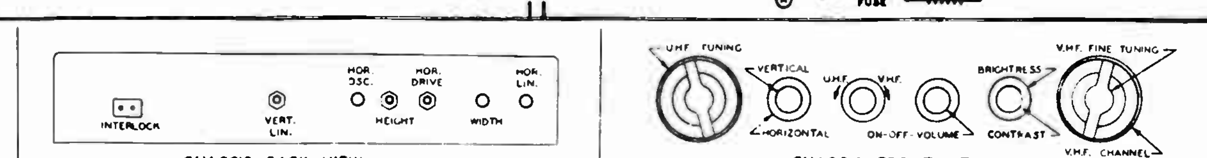
SPARTON TELEVISION SCHEMATIC DIAGRAM

CHASSIS TYPE 24U214 - MODELS 21322A, 33322, 34324, 36342, 36343, 50312 & 50314



NOTE:
The points indicated by the letters A,B,C,D,E,F, & G are the alignment test points referred to in the alignment procedure.
(A) Pin 5 of V2 (6J6) Osc. & Mixer Tube.
Apply signals here for spot I.F. Alignment or I.F. Sweep
(B) Apply minus 3 volts through 220K Ohms to test terminal, located between the tubes on top of R.F. Tuner. (See Suggested input adapter.)
(C) Diode Load Resistor
Read D.C. output here for spot I.F. Alignment
Connect scope here for visual I.F. Alignment.
(D) Cathode of Picture tube
Read A.C. output here for overall sensitivity
Read 4.5 Mc output here for overall sensitivity.
(E) Ratio Detector Output
Read D.C. here for alignment of sound take-off trap, inter-stage sound.
(F) Ratio Detector Balanced output
Read D.C. here for alignement of secondary of ratio det. trans.
(G) A.G.C. line
Apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

Note: Adjustment of Contrast, Brightness, Focus, Vertical Size, Horizontal Hold and Horizontal Drive Controls will change voltages from those indicated in their respective associated circuits.



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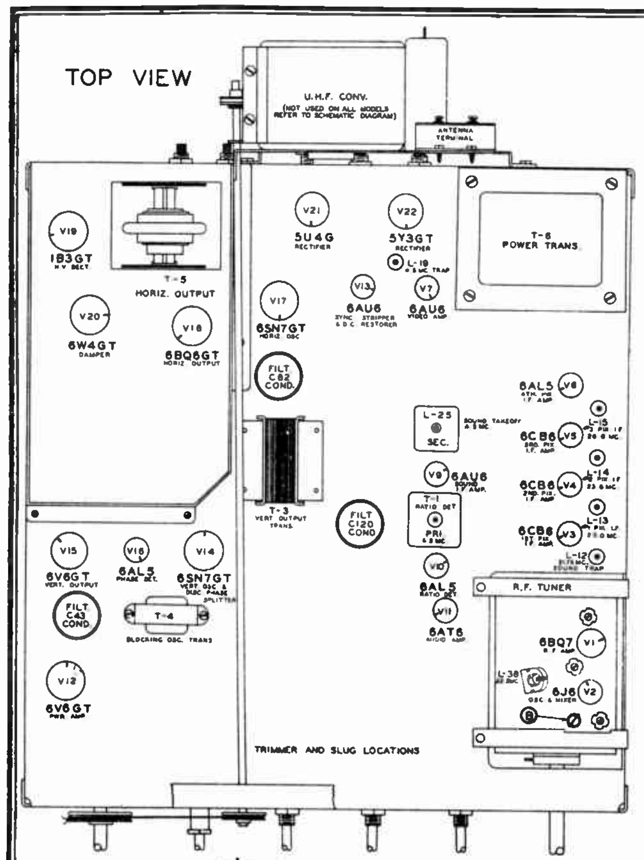
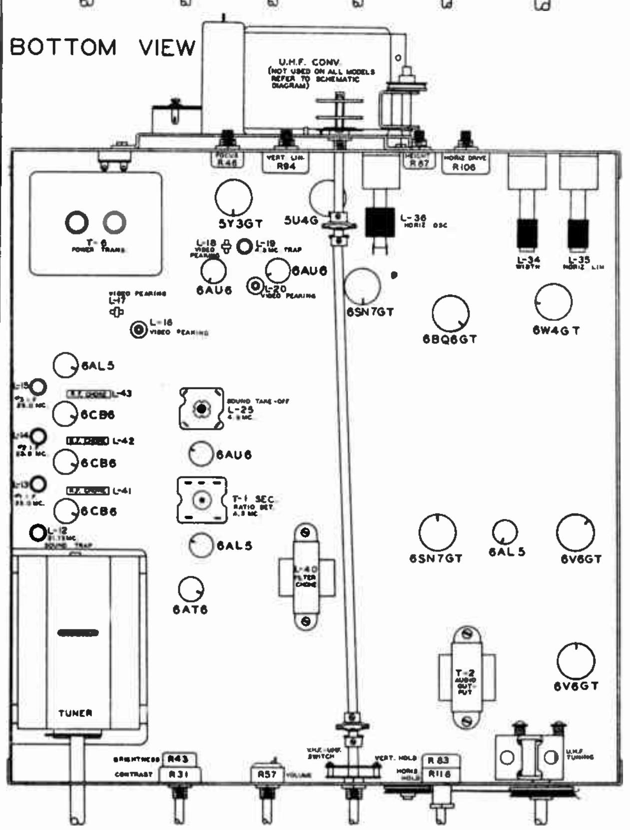
TOP VIEW



BOTTOM VIEW



PARTS LIST

REF.SYMBOL	DESCRIPTION	SPARTON PART NO.
"C"	CAPACITORS	
1 thru 19	IN VHF TUNER UNIT	
20	5K CERAMIC DISK	PA4334-1
21	3.3 CERAMIC	PA4326-4
22	100 CERAMIC	PA4332-3
23	5K CERAMIC DISK	PA4334-1
24	5K CERAMIC DISK	PA4334-1
25	5K CERAMIC DISK	PA4334-1
26	270 CERAMIC	HK36M-271
27	5K CERAMIC DISK	PA4334-1
28	5K CERAMIC DISK	PA4334-1
29	5K CERAMIC DISK	PA4334-1
30	5K CERAMIC DISK	PA4334-1
31	5K CERAMIC DISK	PA4334-1
32	.1 MF.200V TUBULAR	PC42GK-104
33	100 CERAMIC	HK36M-101
34	.01 MF.400V TUBULAR	PC42G L-103
35	4.7 CERAMIC	PA4328-11
36	4.7 CERAMIC	PA4328-11
37	.1 MF.200V TUBULAR	PC42GK-104
38	5K CERAMIC DISK	PA4334-1
39	470 CERAMIC	MC60F-471
40	47 CERAMIC	CC30A-470F
41	.1 MF .400V TUBULAR	PC42GL-104
42	.1 MF.200V TUBULAR	PC42GK-104
43A	10 MF.350V ELECTROLYTIC	PA4307-29
43B	20 MF.25V ELECTROLYTIC	PA4307-29
43C	40 MF.400V ELECTROLYTIC	PA4307-29
43D	40 MF.450V ELECTROLYTIC	PA4307-29
44	3.3K CERAMIC	PC42GM-332
50	2.2 CERAMIC	PA4326-1
51	33 CERAMIC	CC30A330F
52	5K CERAMIC DISK	PA4334-1
53	120 CERAMIC	PA4332-4
54	1K CERAMIC	HK36M-102
55	5K CERAMIC DISK	PA4334-1
56	.022 MF.400V TUBULAR	PC42CL-223
57	.033 MF.200V TUBULAR	PC42GK-333
58	5 MF.50V ELECTROLYTIC	PA4308-2
59	.01 MF.400V TUBULAR	PC42GL-103
60	.022 MF.600V TUBULAR	PC42CM-223
61	68 CERAMIC	MC60E-680
62	.001 MF.600V TUBULAR	PC42GM-102
70	.047 MF.400V. TUBULAR	PC42FL-473
71	150 CERAMIC	MC60F-151
72	.027 MF.200V	PC42GK-274
73	.1 MF .400V TUBULAR	PC42GL-104
74	1K MICA	MC61E-102
75	1K MICA	MC61E-102
76	2K/5K/5K HERLEC	PA4339-4
77	4.7 MICA	MC61F-472
76	5K CERAMIC	PA4334-1
79	2K MICA	MC61E-202
80	.047 MF.400V TUBULAR	PC42FL-473
81	.1 MF.400V TUBULAR	PC42GL-104
82A	100 MF.50V ELECTROLYTIC	PA4307-30
82B	20 MF.450V ELECTROLYTIC	PA4307-30
82C	20 MF.450V ELECTROLYTIC	PA4307-30
83	.1 MF.200V TUBULAR	PC42GK-104
99	.022 MF.600V TUBULAR	PC42GM-222
100	56 CERAMIC	IN YOKE ASS'Y.
101	.22 MF.400V TUBULAR	PC42GL-224
102	500 CERAMIC	PA4342-2
103	.047 MF.400V TUBULAR	PC42GL-473
104	.047 MF.400V TUBULAR	PC42GL-473
105	1.8K CERMIC	MC61E-182
106	.047 MF.400V TUBULAR	PC42GL-473
107	.47 MF.200V TUBULAR	PC42GK-474
108	.01 MF.400V TUBULAR	PC42GL-103
109	270 CERAMIC	MC60E-271
110	270 CERAMIC	MC60E-271
111	3.9K MICA	MC63F.392
112	270 CERAMIC	MC60E-271
113	.1 MF.200V TUBULAR	PC42FK-104
114	5.1K MICA	MC61E-512
115	.01 MF.400V TUBULAR	PC42FL-103

REF.SYMBOL	DESCRIPTION	SPARTON PART NO.
"C"	CAPACITORS	
120A	40 MF.475V ELECTROLYTIC	PA4307-13
120B	40 MF.475V ELECTROLYTIC	PA4307-13
122	5K CERAMIC	PA4334-1
123	5K CERAMIC	PA4334-1
124	5K CERAMIC	PA4334-1
125	5K CERAMIC	PA4334-1

REF.SYMBOL	DESCRIPTION	SPARTON PART NO.
"R"	RESISTORS	
1 thru 12	IN VHF TUNER UNIT	
13	100 1/2 WATT	BR12N101
14	3.9K 1/2 WATT	BR12G392
15	1K 1/2 WATT	BR12N102
16	100 1/2 WATT	BR12N101
17	68 1/2 WATT	BR12N680
18	56 1/2 WATT	BR12n560
19	18K 1/2 WATT	BR12G183
20	1K 1/2 WATT	BR12S102
21	100 1/2 WATT	BR12N101
22	56 1/2 WATT	BR12N560
23	68 1/2 WATT	BR12N680
24	4.3K 1/2 WATT	BR12G432
25	100 1/2 WATT	BR12N101
26	180 1/2 WATT	BR12S181
27	1 MEG. 1/2 WATT	BR12S105
28	680K 1/2 WATT	BR12N684
29	82K 2 WATT	DR12S823
30	47K 1/2 WATT	BR12G473
31	1K Contrast & Brightness	PA4458
32	8.2K 1/2 WATT	BR12G822
33	1 MEG. 1/2 WATT	BR12S105
34	12K 1/2 WATT (PART of L-18)	BR12S123
35	68 1/2 WATT	BR12S680
36	180 1/2 WATT	BR12G181
37	12K 1/2 WATT(Part of L-20)	BR12S123
38	6.8K 1 WATT	CR12G682
39	10K 1/2 WATT	BR12S103
40	1K 1/2 WATT	BR12N102
41	150K 1/2 WATT	BR12S154
42	100K 1/2 WATT	BR12S104
43	100K Brightness & Contrast	PA4458
44	10K 1/2 WATT	BR12S103
45	2K 10 WATT (W.W.)	PA4200-23
47	330K 1/2 WATT	BR12N334
50	470K 1/2 WATT	BR12N474
51	1K 1/2 WATT	BR12N102
52	180 1/2 WATT	BR12S181
53	47K 1/2 WATT	BR12S473
54	4.7K 1/2 WATT	BR12G472
55	4.7K 1/2 WATT	BR12G472
56	10K 1/2 WATT	BR12S103
57	330K VOLUME CONTROL & SW.	PA4461-2
58	6.8 MEG. 1/2 WATT	BR12S685
59	270K 1/2 WATT	BR12S274
60	270K 1/2 WATT	BR12S274
61	470K 1/2 WATT	BR12S474
62	390 1 WATT	CR12S391
63	1K 10 WATT (W.W.)	PA4200-20
70	2.2 MEG. 1/2 WATT	BR12N225
71	270K 1/2 WATT	BR12S274
72	22K 1/2 WATT	BR12S223
73	22K 1/2 WATT	BR12S223
74	22K 1/2 WATT	BR12S223
75	2.2K 1/2 WATT	BR12G222
76	4.7K 1/2 WATT	BR12G472
77	2.2 MEG.1/2 WATT	BR12N225

REF.SYMBOL	DESCRIPTION	SPARTON PART NO.
"R"	RESISTORS	
78	68K 1/2 WATT	BR12S683
79	2.2K 1/2 WATT	BR12G 222
80	8.2K 1/2 WATT	BR12S822
81	8.2K 1/2 WATT	BR12S822
82	1.1 MEG. 1/2 WATT	BR12G115
83	1 MEG.VERT.& HORIZ;HOLD	PA4456
84	100K 1/2 WATT	BR12G104
85	6.8 MEG. 1/2 WATT	BR12S635
86	100K 1/2 WATT	BR12G104
87	2.5 MEG.VERT.SIZE CONTROL	PA4454
88	100K 1/2 WATT	BR12G104
89	8.2K 1/2 WATT	BR12G822
90	20K 1 WATT	CR12S203
91	10K 2 WATT	DR12S103
92	2.2 MEG. 1/2 WATT	BR12N225
93	1K 1 WATT	CR12S102
94	5K VERT.LINEARITY CONTROL	PA4411
95	560 1/2 Watt(In Vert.Yoke Coil)	BR12S561
96	560 1/2 WATT (In Vert.Yoke Coil)	BR12S561
98	470 1/2 WATT	BR12S471
99	1K 1/2 WATT (In Yoke Ass'y)	BR12S102
100	1 MEG. 1 WATT	CR12S105
101	5.6K 2 WATT	DR12S562
102	12K 1 WATT	CR12S123
103	3.3 1 WATT (W.W.)	CR12S33
104	36K 1 WATT	CR12S363
105	18K 2 WATT	DR12S183
106	1K HORIZ.DRIVE CONTROL	PA4446
107	39 1/2 WATT	BR12S390
108	300 1 WATT	CR12S301
109	150 2 WATT	DR12S151
110	100 1/2 WATT	BR12N101
111	470K 1/2 WATT	BR12S 474
112	10K 1/2 WATT	BR12S103
113	8.2K 1/2 WATT	BR12S822
114	180K 1/2 WATT	BR12S184
115	100K 1/2 WATT	BR12S104
116	50K HORIZ.&Vert.HOLD CONTROL	PA4456
117	1.5K 1/2 WATT	BR12S152
118	4.7K 1/2 WATT	BR12G472
119	100K 1/2 WATT	BR12S104
120	100K 1/2 WATT	BR12S104
121	470K 1/2 WATT	BR12S474
122	4.7 MEG. 1/2 WATT	BR12S475
123	12K 2 WATT	DR12S123
124		
126	3K 10 WATT (W.W.)	PA4200-26
127	470K 1/2 WATT	BR12S474
128	68K 1 WATT	CR12S683

REF.SYMBOL	DESCRIPTION	SPARTON PART NO.
"L"	"COILS"	
1 thru 11	IN VHF TUNER UNIT	
12	21.75 MC TRAP	AB43523-14
13	25.0 MC P.I:F.	AA6408-1
14	23.8 MC P.I.F.	AA6409-1
15	26.0 MC P.I.F.	AA6409-1
16	200 UH PEAKING COIL	AA6613-4
17	600 UH PEAKING COIL	AA6613-8
18	175 UH PEAKING COIL	AA6613-9
19	4.5 MC TRAP	AA6407-1
20	R.F.CHOKE	AA6376-3
34	WIDTH COIL	AA6400-4
35	HORIZ.LINEARITY COIL	AA6400-5

MISCELLANEOUS

COMPLETE RECEIVER ASSEMBLY	AD2-24U214
UNIVERSAL COUPLING	PA1349
RESISTOR-3K OHM 10W WIREWOUND	PA4200-26
RESISTOR-1.2K OHM WIREWOUND	PA4218
RESISTOR-2K OHM WIREWOUND	PA4219
CONTROL-VOLUME	PA4461-2
UHF ANTENNA FILTER UNIT	PA5353
SWITCH-UHF (FRONT)	PB42013
SWITCH-UHF (REAR)	PB42014
POWER TRANSFORMER	AB44036-1
KINGSTON UHF-CONVERTER UNIT	PC70021
CABINET-TABLE MODEL MAHOGANY (MODEL 50312, 21322, 33322, 36342)	PD90159-2
CABINET-TABLE MODEL-LIMED OAK (MODEL 50414, 34324, 36343)	PD90159-4
SPEAKER-6 INCH ROUND (MODEL 50312, 50314)	PC63000-43

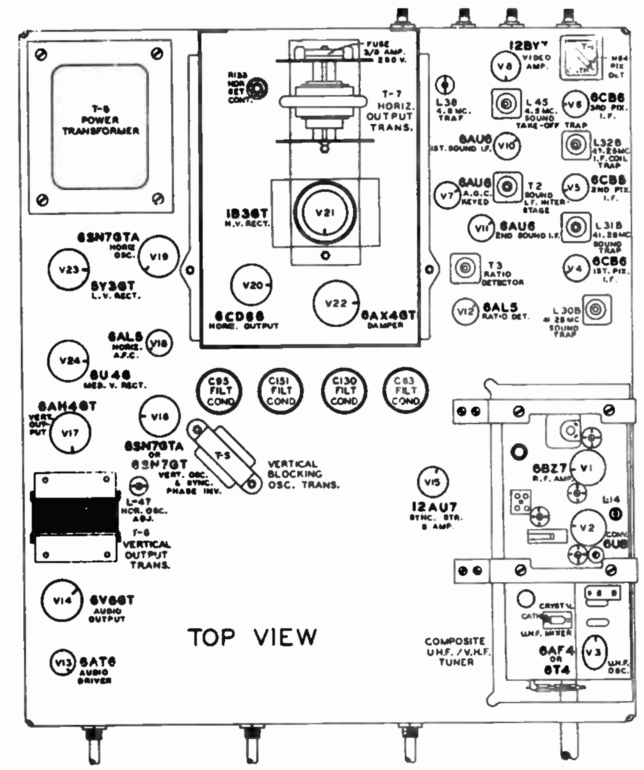
VOLTAGE TEST SPECIFICATIONS:
1. All Voltages & Current measured with VHF - UHF Switch in VHF position.
2. Channel Switch Position - Channel 2-
3. Line Voltage - 117 Volts A.C. No signal input applied to set.
4. Brightness & Contrast Control Position - Maximum Clockwise.
5. Horizontal & Vertical Hold Control Positions - Set correct position to lock in picture.
6. Width Control Position - Set for normal size.
7. Vertical Size & Linearity Control Position - Set for normal size best linearity.
8. Focus Control Position - Properly focused.
9. Volume Control & Tone Control Position - Maximum Counter-Clockwise.
10. Instrument (Meter) Used - (VTVM) Vacuum Tube Volt Meter.
11. Unless otherwise designated all voltages measured in respect to Chassis Ground.

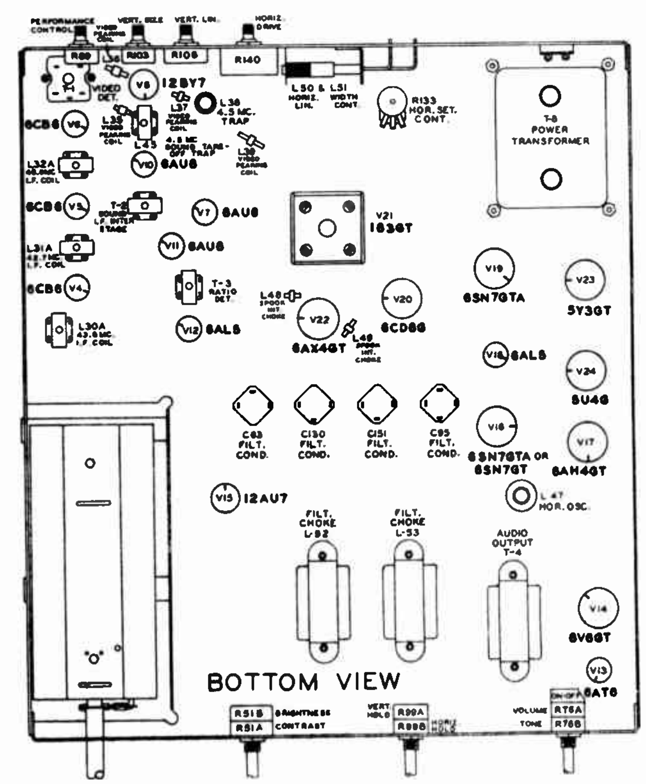
Sparton 21 Inch Cornell
Mahogany Console
Model 14A204 *

Sparton 21 Inch Princeton
Mahogany Console
Model 12A204 *
Model 12A210

Sparton 21 Inch Stanford
Mahogany Table Model
Model 11T210

* Aluminized





BRIEF ELECTRICAL SPECIFICATIONS

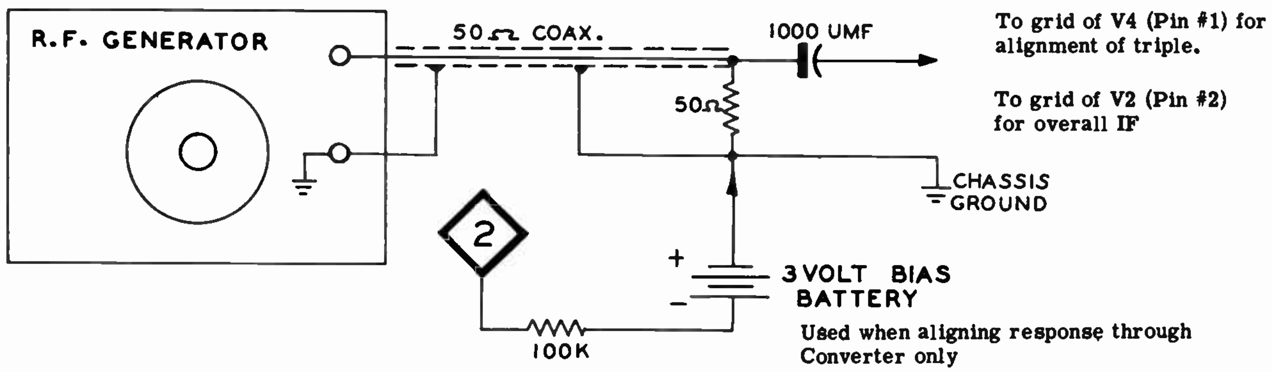
Power Supply	105-125 Volts AC 60 Cycle only
Power Consumption	230 Watts
Audio Power Output	Maximum 2.5 Watts *
Tuning Range	T. V. Channels 2 thru 83
Antenna Input Impedance	300 Ohms Balanced
Intermediate Frequencies	Picture 45.75 Mc.
Intercarrier Sound System	4.5 Mc.
Voice Coil Impedance	3.2 Ohms at 400 Cycles

*Total harmonic distortion 8% at 400 cycles.

SUGGESTED ALIGNMENT PROCEDURE

Since the picture I. F. system in the receiver consists of a flat staggered triple (V4, V5, &V6) preceded by a double tuned, over coupled converter stage, it is necessary to align the picture I. F. in two steps. First, the triple is aligned for a flat overall response from the first picture I. F. grid. Second, the over coupled converter stage is aligned against the flat response of the triple to produce the desired I. F. response characteristic.

Picture I. F. Alignment -
Conditions:
- A. V7 (6AU6) tube removed from socket
- B. -4.5 volts applied across C48, Test Point #7
- C. Tuner set to Channel #12 or some other high channel
- D. Adjust all other controls for normal picture
- E. Signals applied to grid of V4 (1st Pix I. F.) thru suitable adapter (Fig. #1).
- F. Connect V.T.V.M. across diode load R48 using low volts DC scale, Test Point #3



Note: When applying signal to V2, remove 6U8 (converter) and wrap small insulated wire around Pin #2. Strip enough to go around and make contact on Pin #2. Replace tube.

FIG. #1

ALIGNMENT OF TRIPLE

Step 1. Unmodulated generator set at 43.8 Mc then adjust T1 for maximum meter indication on V.T.V.M.

2. Unmodulated generator set at 45 Mc adjust L32A (bottom) for maximum meter indication on V.T.V.M.

3. Unmodulated generator set at 42.7 Mc adjust L31A (bottom) for maximum meter indication on V.T.V.M.

4. Unmodulated generator set at 47.25 Mc adjust L32B (top) for minimum dip indication on V.T.V.M.

5. Unmodulated generator set at 41.25 Mc adjust L31B (top) for minimum dip indication on V.T.V.M.

6. Remove V.T.V.M. and connect scope to Test Point #3. Adjust generator to sweep 40 to 50 Mc. Touch up T1, L32A, L31A for flat response from 42.7 Mc to 45.0 Mc. Fig. #3.

7. Inject marker signal at 41.25 Mc and 47.25 Mc as recommended by manufacturer of R. F. Sweep generator used. Check alignment of traps L31B and L32B. This completes alignment of triple.

OVERALL ALIGNMENT

Step 1. Apply signal to grid of V2 (converter) thru suitable adapter. Fig. #1. (For overall response curve check).

2. Apply -3 volts bias to tuner, Test Point #2 thru 100K resistor (see Fig. #1). (-4.5 volts remains connected to Point #7).

3. Remove scope and connect V.T.V.M. to Test Point #3.

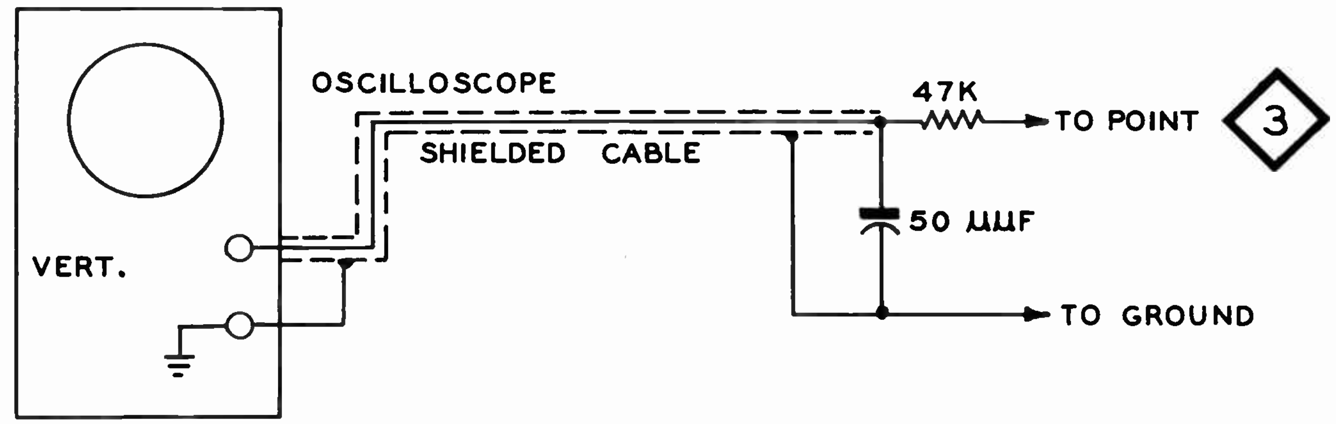


FIG. #2

4. Unmodulated generator set at 41.25 Mc adjust L30B for minimum dip indication of V.T.V.M.

5. Detune L14 on tuner to high frequency limit. (Core out of coil-maximum counter-clockwise)

6. Unmodulated generator set at 43.8 Mc align L30A (bottom) for maximum meter indication on V.T.V.M.

7. Shunt L30A with 1 K resistor.

8. Unmodulated generator set at 43.8 Mc align L14 (Tuner output) for maximum meter indication on V.T.V.M.

9. Adjust generator to sweep from 40 to 50 Mc. Observe the bandwidth, relative position of pix carrier, and flatness of the overall I. F. response curve. Fig. #3. If necessary, slightly vary the tuning of L14 and L30A for flat response between 42.7 Mc and 45.0 Mc. Picture carrier (45.75 Mc) should be down 50%.

10. Inject markers at 41.25 Mc and 47.25 Mc, check alignment of traps (over swept curve) L31B (top) and L32B (top).

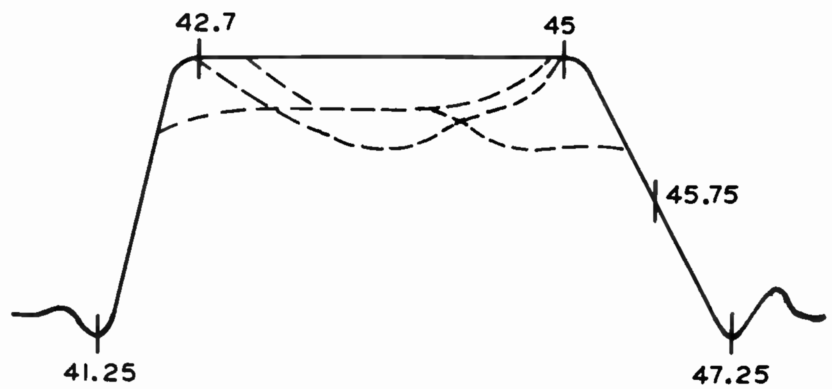


FIG. #3 IDEAL I. F. RESPONSE WITH PERMISSABLE VARIATIONS

Sound I.F. Alignment:

A. Connect R. F. Signal Generator set at 4.5 Mc between the anode of the crystal video detector and chassis ground.

B. Connect V.T.V.M. across R77, Test Point #5 (use -10V scale).

C. Adjust L45 for maximum indication.

D. Align T2 primary (bottom) and secondary (top) for maximum indication.

E. Align T3 (bottom only) primary for maximum indication.

F. Connect V.T.V.M. across C85, Test Point #6.

G. Using lowest DC scale, adjust T3 Ratio Detector secondary (top) to zero output, as indicated by V.T.V.M.

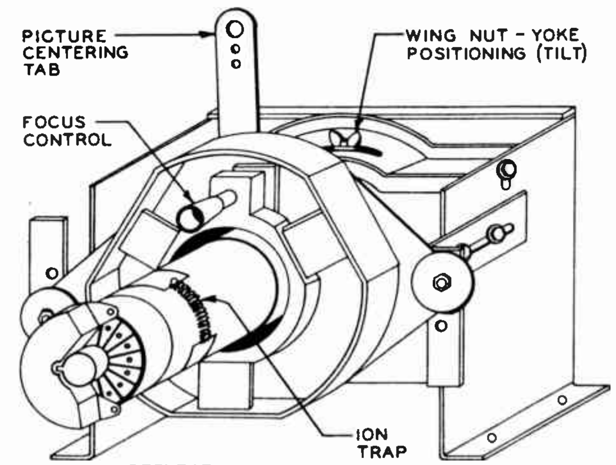
Note: It is possible to produce a positive or negative indication by varying this adjustment. The point where the voltage swings from positive to negative is zero output and indicates correct alignment. (If Ratio Detector is seriously misaligned, repeat alignment of primary and secondary until no improvement can be made).

H. Using an R. F. Probe, connect V.T.V.M. across R57, Test Point #4.

I. Adjust L38 (4.5 trap) for minimum dip indication.

General Note: It may be possible to find two positions at which tuning slugs resonate coils being aligned. In the case of all multiple winding coils only one position, the one with the tuning slug nearest the end of the coil form, is correct. The other slug position will change coupling between windings and cause improper circuit operation.

INSTALLATION INSTRUCTIONS



DEFLECTION YOKE AND FOCUS UNIT ASSEMBLY

Ion Trap and Focus

THIS ADJUSTMENT IS IMPORTANT TO LIFE OF PICTURE TUBE AND SHOULD BE MADE ON EVERY SET AS FOLLOWS:

1. With brightness control set for low brilliance, move trap forward or backward and at the same time rotate until maximum brightness of raster is obtained.
2. Readjust raster brilliance to normal.
3. Adjust focus control until best picture detail is observed over entire face of picture tube.
4. Readjust ion trap once more for maximum brilliance.

THERE MAY BE TWO LOCATIONS WHERE ION TRAP WILL PRODUCE BRILLIANCE ON CRT; USE ONLY THE POSITION NEAR THE CRT BASE SOCKET; NEVER USE THE FORWARD POSITION

Deflection Yoke

1. The yoke must be held firmly against the flare of CRT.
2. To level picture, loosen and adjust wing nut on yoke.

Centering Raster

1. Center with magnet control tab on focus unit.
2. Readjust ion trap for maximum brilliance.

Picture Symmetry

Sometimes linearity and corresponding size controls may have to be re-adjusted. A test pattern is most practical for these adjustments which consist of HEIGHT, VERT LIN., WIDTH, and HOR LIN.

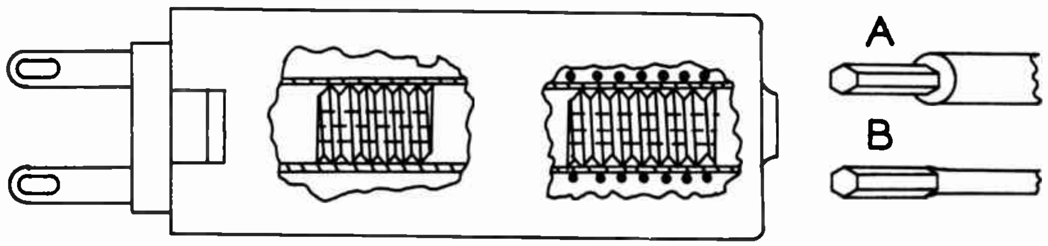
Peak Performance Control

1. With receiver operating, set the peak performance control to extreme counter-clockwise position (fringe area).
2. Tune in strongest signal in your area.
3. Set contrast to maximum (extreme clockwise position).
4. If picture appears normal leave control set in fringe position.
5. If picture shows any signs ov overload, rotate control clockwise towards local position until picture becomes normal.
6. Do not turn control toward local position any more than necessary.

Horizontal Oscillator (Make only when necessary)

1. Pull 6AL5 (phase detector).
2. Set hor. hold to center of range.
3. Shunt L47 with .1 MFD 400V condenser from test point on high voltage transformer to ground.
4. Adjust R133 until picture floats in horizontal sync.
5. Remove .1 condenser and adjust L47 until picture floats in horizontal sync.
6. Replace 6AL5.
7. Pull-in should occur when 2 or 3 diagonal bars are observed as hor. hold is rotated towards center of range.

MISCELLANEOUS SERVICE HINTS



CAUTION: DOUBLE TUNED I. F. COIL ASSEMBLY PERMITS ADJ. OF BOTH SLUGS FROM TOP OR BOTTOM OF CAN.

A. This tool end permits adj. of top slug (from top) and bottom slug (from bottom).
B. This tool end permits adj. of both from either end since it will pass on thru the tuning slug.

I.F. Tube Replacement
Due to the fundamental characteristics of 45Mc I.F. circuits we would like to express a word of caution. To minimize any detuning effects caused by differences in interelectrode capacities it is suggested that several tubes of same type and make are tried to obtain original quality picture.

Spooks.
The damper-tube current rises from zero to a maximum of 300 to 400 milliamperes in 1/10 microsecond or less. A wave form with such a short rise time is certain to contain many harmonics (of 15,750 cycles). If these harmonics are allowed to radiate and be picked up by the RF and IF circuits they will there be amplified, detected, and applied to picture tube, resulting in a narrow vertical line very close to the left edge of raster. Since the damper is the principal offender, the SPARTON "Dyna-Volt" chassis incorporates RF chokes in cathode and plate to minimize the "spook". Since the energy in each higher harmonic becomes progressively less, the spook is most noticable in the lower VHF channels.

TUNER DISASSEMBLY:

CAUTION: TUNER MUST BE IN THE VHF POSITION WHEN REMOVING TURRET TO PREVENT DAMAGE TO UHF DECADE STRIPS. WHEN REPLACING COVER, NOTE POSITION OF PIGTAIL LEADS TO ROCKER BAR SO AS NOT TO PINCH OR SHEAR WIRES UNDER COVER.

FOCUS ADJUSTMENTS:

Under certain conditions the focus may be improved by adjusting focus unit mounting brackets to locate the focus unit approximately 4-1/4 to 4-3/8 inches from the base of the picture tube (measured from the end of center locating key of duodecal base). With the ion trap set as previously described, adjust the focus control for best overall picture detail.

CAUTION: READJUST ION TRAP AFTER ALL ADJUSTMENTS OF FOCUS.

Replacing Crystal Video Detector:

If replacement of crystal becomes necessary, be sure to prevent exposing crystal to excessive heat. Holding crystal lead with long nose pliers placed between crystal and soldering lug will help conduct heat away from crystal.

Horizontal Drive Adjustments:

With 125V A.C. line adjust vertical deflection for 10% over-scan with best linearity, then adjust horizontal linearity control for best linearity and follow with adjustment of horizontal width control for maximum width. Adjust horizontal hold control to its maximum counter-clockwise position. Decrease horizontal drive control resistance until the compression near the center of the picture disappears. Reset horizontal hold control to its mid-position.

Adjustment of Anti-Pin Cushion Corrector Magnets:

These magnets are mounted on the deflection coil mounting bracket and can be moved in and out by first loosening the mounting screws. Under certain conditions it may be necessary to form, or bend, the flexible arms which support the magnets. The above adjustment is made at the factory and should not require re-adjustment unless the original position of the magnets is accidently disturbed. Adjustment can be made in the following manner:

1. With the size controls, reduce the size of the raster until the sides are visible.
2. Adjust the corrector magnets for straightest possible raster edges. Restore the picture to normal size.

Cleaning Picture Tube Face:

Remove three screws in the decorative bottom rail and carefully lower safety glass from cabinet. Observe great care while cleaning picture tube face, especially when replacing safety glass. A sharp blow on face of exposed tube could result in personal injury.

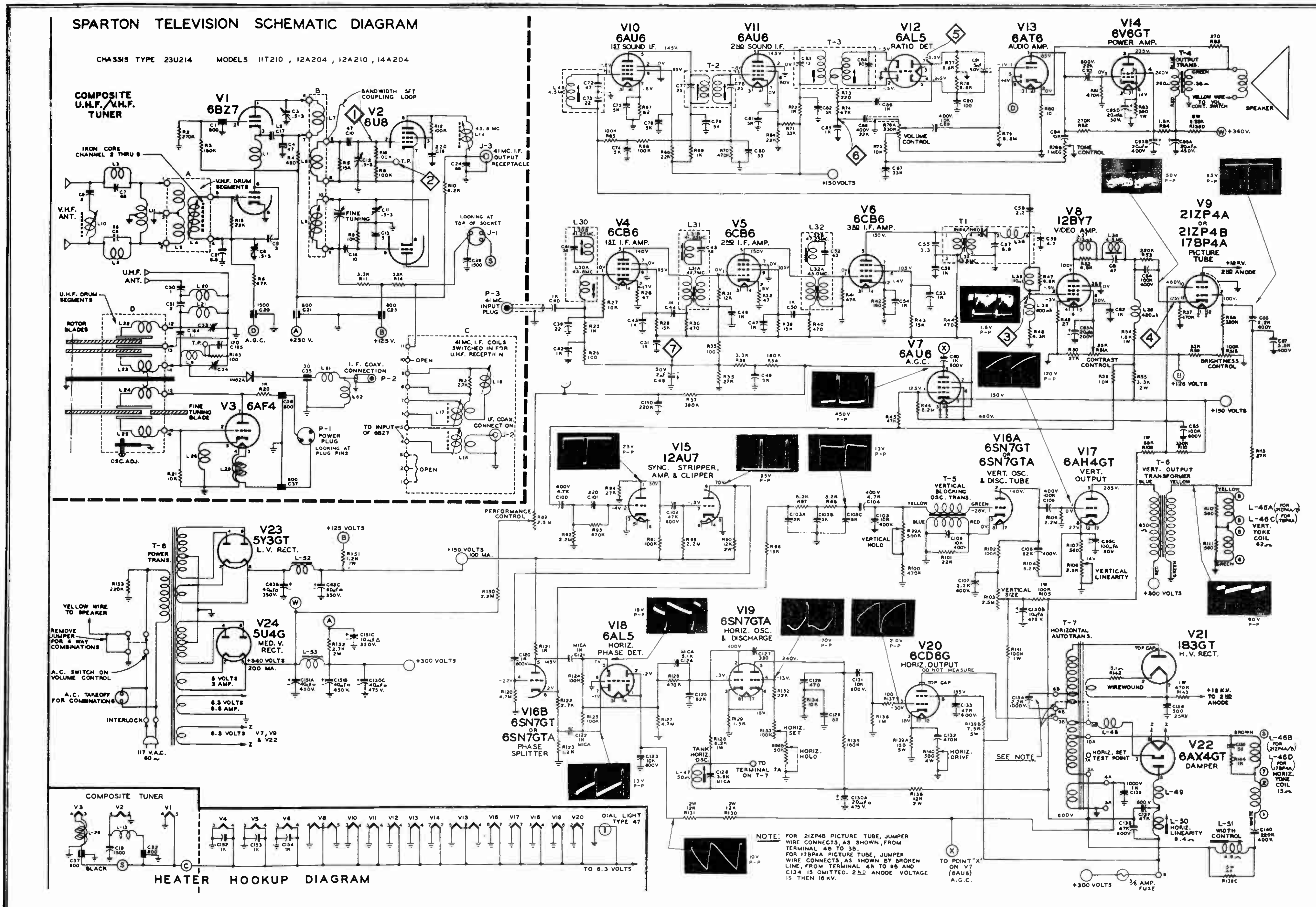
NOTE: Relocation of Horizontal Oscillator Tank Coil, L-47.

The accessibility of the adjustment for the L47 has been sacrificed in favor of improved set performance by relocating the L47. The new position is indicated on chassis top and bottom view diagrams.

NOTE:
The points indicated by the numbers 1 2 3 4 5 6 & 7 are the alignment test points referred to in the alignment procedure.
1. Pin #2 of V2 (6U8) Osc. & Mixer Tube.
   Apply signals for spot and sweep alignment of converter stage.
2. For Tuner alignment only.
3. Diode load resistor
   Read D.C. output here for spot I.F. alignment
   Connect scope here for visual I.F. alignment
4. Cathode of Picture Tube
   Read A.C. output here for overall sensitivity
   Connect VTVM for 4.5 Mc trap alignment
5. Ratio Detector Output
   Read D.C. here for alignment of sound take-off trap, inter-stage sound I.F. transformer and primary of ratio detector transformer
6. Ratio Detector Balanced Output
   Read D.C. here for alignment of secondary of ratio detector trans.
7. A.G.C. Line
   Apply 4.5 volts bias here for visual check of I.F. overall with oscilloscope

NOTE: ADJUSTMENT OF CONTRAST, BRIGHTNESS, VERTICAL SIZE, HORIZONTAL HOLD AND HORIZONTAL DRIVE CONTROLS WILL CHANGE VOLTAGES FROM THOSE INDICATED IN THEIR RESPECTIVE ASSOCIATED CIRCUITS.

WAVE FORMS TAKEN WITH CONTRAST CONTROL ADJUSTED FOR 80V. P to P at PIN 11 of V9.


SPARTON TELEVISION SCHEMATIC DIAGRAM
CHASSIS TYPE 23U214 MODELS 11T210, 12A204, 12A210, 14A204
COMPOSITE U.H.F./V.H.F. TUNER
HEATER HOOKUP DIAGRAM
SPARTON TV PAGE 14-17
NOTE: FOR 21ZP4B PICTURE TUBE, JUMPER WIRE CONNECTS, AS SHOWN, FROM TERMINAL 4B TO 3B. FOR 17BP4A PICTURE TUBE, JUMPER WIRE CONNECTS AS SHOWN BY BROKEN LINE, FROM TERMINAL 4B TO 9B AND C134 IS OMITTED. 2ND ANODE VOLTAGE IS THEN 16 KV.

PARTS LIST

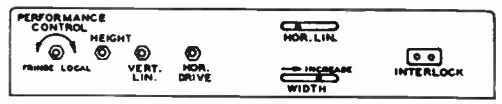
REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	CAPACITORS	
C1 thru C39	IN TUNER UNIT	
C39	22 CERAMIC DISK (.000022)	CC34A-220F
C40	1K CERAMIC DISK (.001)	PA4334-6
C41	56 PART OF L30 (.000056)	PA4349-1
C42	1K CERAMIC DISK (.001)	PA4334-6
C43	1K CERAMIC DISK (.001)	PA4334-6
C44	1K CERAMIC DISK (.001)	PA4334-6
C45	56 PART OF L31 (.000056)	PA4349-1
C46	1K CERAMIC DISK (.001)	PA4334-6
C47	1K CERAMIC DISK (.001)	PA4334-6
C48	2 MFD. 50V. ELECTROLYTIC	PA4303-14
C49	5K CERAMIC DISK (.005)	PA4334-1
C50	1K CERAMIC DISK (.001)	PA4334-6
C51	1K CERAMIC DISK (.001)	PA4334-6
C52	43 PART OF L32 (.000043)	PA4349-2
C53	1K CERAMIC DISK (.001)	PA4334-6
C54	1K CERAMIC DISK (.001)	PA4334-6
C55	3.3 CERAMIC (GIMIC) (.0000033)	PA4326-4
C56	1K CERAMIC DISK (.001)	PA4334-6
C57	6.8 CERAMIC (IN T1) (.0000068)	PA4328-13
C58	2.2 CERAMIC (GIMIC) (.0000022)	PA4326-1
C59	4.7 CERAMIC (.0000047)	PA4328-11
C60	1K 600V. TUBULAR (.001)	PC42GM-102
C61	47 CERAMIC (.000047)	CC30A-470F
C62	1K CERAMIC DISK (.001)	PA4334-6
C63A	20 MFD. 200V. ELECTROLYTIC	PA4307-34
C63B	40 MFD. 350V. ELECTROLYTIC	PA4307-34
C63C	60 MFD. 350V. ELECTROLYTIC	PA 4307-34
C64	100K 400V. TUBULAR (.1)	PC42GL-104
C65	100K 600V. TUBULAR (.1)	PC42GM-104
C66	2.2K 400V. TUBULAR (.022)	PC42GL-222
C67	3.3K 400V. TUBULAR (.033)	PC42GL-332
C72	47 (.000047)	PART OF L45
C73	22 (.000022)	PART OF L45
C74	5K CERAMIC DISK (.005)	PA4334-1
C75	5K CERAMIC DISK (.005)	PA4334-1
C76	5K CERAMIC DISK (.005)	PA4334-1
C77	25 (.000025)	PART OF T2
C78	25 (.000025)	PART OF T2
C79	5K CERAMIC DISK (.005)	PA4334-1
C80	33 MICA (.000033)	MC60E-330
C81	5K CERAMIC DISK (.005)	PA4334-1
C82	5K CERAMIC DISK (.005)	PA4334-1
C83	13 (.000013)	PART OF T3
C84	90 (.00009)	PART OF T3
C85	1K CERAMIC (.001)	HK36M-102
C86	22K 400V. TUBULAR (.022)	PC42CL-223
C87	33K 200V. TUBULAR (.033)	PC42GK-333
C88	1K CERAMIC (.001)	PA4334-6
C89	10K 400V. TUBULAR (.01)	PC42CL-103
C90	100 CERAMIC (.0001)	HK36M-101
C91	5 MFD. 50V. ELECTROLYTIC	PA4308-2
C92	22K 600V. TUBULAR (.022)	PC42CM-223
C94	10K 600V. TUBULAR (.01)	PC42GM-103
C95A	20 MFD. 450V. ELECTROLYTIC	PA4307-36
C95B	20 MFD. 400V. ELECTROLYTIC	PA4307-36
C95C	100 MFD. 50V. ELECTROLYTIC	PA4307-36
C95D	20 MFD. 50V. ELECTROLYTIC	PA4307-36
C100	4.7K 400V. TUBULAR (.0047)	PC42GL-472
C101	220 MICA (.00022)	MC60E-221
C102	47K 600V. TUBULAR (.047)	PC42GM-473
C103A	2K (.002)	PA4339-4
C103B	5K CERAMIC-HERLEC (.005)	PA4339-4
C103C	5K (.005)	PA4339-4
C104	4.7K 400V. TUBULAR (.0047)	PC42GL-472
C105	10K 400V. TUBULAR (.01)	PC42GL-103
C106	10K 400V. TUBULAR (.01)	PC42GL-103
C107	2.2K 600V. TUBULAR (.0022)	PC42GM-222
C108	82K 400V. TUBULAR (.082)	PC42FL-823
C109	100K 400V. TUBULAR (.1)	PC42GL-104
C120	1K 600V. TUBULAR (.001)	PC42GM-102
C121	1K MICA (.001)	MC61E-102
C122	1K MICA (.001)	MC61E-102
C123	10K 600V. TUBULAR (.01)	PC42FM-103
C124	5.1K MICA (.0051)	MC61E-512
C125	82K 200V. TUBULAR (.082)	PC42FK-823
C126	3.9K MICA (SILVER) (.0039)	MC63F-392
C127	330 MICA (.00033)	MC60F-331
C128	470 MICA (.00047)	MC60E-471
C129	82 MICA (.000082)	MC60G-820
C130A	20 MFD. 450V. ELECTROLYTIC	PA4307-33
C130B	10 MFD. 450V. ELECTROLYTIC	PA4307-33
C130C	40 MFD. 450V. ELECTROLYTIC	PA4307-33
C131	10K 600V. TUBULAR (.01)	PC42GM-103
C132	470K 200V. TUBULAR (.47)	PC42GK-474
C133	47K 600V. TUBULAR (.047)	PC42GM-473
C134	2.2K 1 KV. MICA (.0022)	PC42FN-222
C135	1K 1 KV. TUBULAR (.001)	PC42GN-102
C136	47K 600V. TUBULAR (.047)	PC42FM-473
C137	47K 600V. TUBULAR (.047)	PC42FM-473
C138	500 30 KV. CERAMIC (.0005)	PA4348
C139	56 CERAMIC DISK (.000056)	PA4334-5
C140	220K 400V. TUBULAR (.22)	PC42GL-224
C150	220K 200V. TUBULAR (.22)	PC42GK-224
C151A	40 MFD 450V. ELECTROLYTIC	PA4307-35
C151B	40 MFD 450V. ELECTROLYTIC	PA4307-35
C151C	10 MFD 350V. ELECTROLYTIC	PA4307-35
C152	1K CERAMIC DISK (.001)	PA4334-5
C153	1K CERAMIC DISK (.001)	PA4334-6
C154	1K CERAMIC DISK (.001)	PA4334-6

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	RESISTORS	
R1 thru R24	IN TUNER UNIT	
R25	1K 1/2 WATT	BR12N-102
R26	100 1/2 WATT	BR12N-101
R27	10K 1/2 WATT	BR12G-103
R28	47 1/2 WATT	BR12S-470
R29	15K 1/2 WATT	BR12S-153
R30	470 1/2 WATT	BR12N-471
R31	12K 1/2WATT	BR12G-123
R32	47 1/2 WATT	BR12S-470
R33	100 1/2 WATT	BR12N-101
R34	180K 1/2 WATT	BR12S-184
R35	27K 1/2 WATT	BR12G-273
R36	3.3K 1/2 WATT	BR12N-332
R37	390K 1/2 WATT	BR12S-394
R39	15K 1/2 WATT	BR12S-153
R40	470 1/2 WATT	BR12N-471
R41	47K 1/2 WATT	BR12G-473
R42	180 1/2 WATT	BR12S-181
R43	15K 1/2 WATT	BR12S-153
R44	470 1/2 WATT	BR12N-471
R45	47K 1/2 WATT	BR12S-473
R46	2.2 Meg. 1/2 WATT	BR12S-225
R47	6.8K 1/2 WATT (IN L35)	PA4203-10
R48	4.3K 1/2 WATT	BR12G-432
R49	27 1/2 WATT	BR12S-270
R50	27K 1/2 WATT	BR12S-273
R51A	25K 1/2 WATT CONTRAST CONTROL	PA4457-2
R51B	100K 1/4 WATT BRIGHTNESS CONTROL	PA4457-2
R52	6.8K 1/2 WATT (IN L37)	PA4203-10
R53	220K 1/2 WATT	BR12S-224
R54	1.8K 1 WATT	CR12G-182
R55	3.3K 2 WATT	DR12G-332
R56	10K 1/2 WATT	BR12S-103
R57	470K 1/2 WATT	BR12S-474
R58	330K 1/2 WATT	BR12S-334
R59	33K 1/2 WATT	BR12S-333
R64	22K 1/2 WATT	BR12N-223
R65	100K 1/2 WATT	BR12N-104
R66	100K 1/2 WATT	BR12N-104
R67	82 1/2 WATT	BR12G-820
R68	22K 1/2 WATT	BR12N-223
R69	1K 1/2 WATT	BR12N-102
R70	470K 1/2 WATT	BR12S-474
R71	33K 1/2 WATT	BR12S-333
R72	1K 1/2 WATT	BR12N-102
R73	220 1/2 WATT	BR12G-221
R74	47K 1/2 WATT	BR12S-473
R75	10K 1/2 WATT	BR12S-103
R76A	330K VOLUME CONTROL	PA4450-5
R76B	1 Meg. TONE CONTROL	PA4450-5
R77	6.8K 1/2 WATT	BR12G-682
R78	6.8K 1/2 WATT	BR12G-682
R79	6.8 Meg. 1/2 WATT	BR12N-685
R80	10 1/2 WATT	BR12S-100
R81	470K 1/2 WATT	BR12N-474
R82	270K 1/2 WATT	BR12S-274
R83	390 1 WATT	CR12S-391
R84	1.8K 1/2 WATT	BR12S-182
R85	270 1/2 WATT	BR12S-271
R89	2.5 Meg. PERFORMANCE CONTROL	PA4454
R90	12K 2 WATT	DR12S-123
R91	100K 1/2 WATT	BR12S-104
R92	2.2 Meg. 1/2 WATT	BR12N-225
R93	470K 1/2 WATT	BR12S-474
R94	27K 1/2 WATT	BR12S-273
R95	2.2 Meg. 1/2 WATT	BR12N-225
R96	15K 1/2 WATT	BR12S-153
R97	8.2K 1/2 WATT	BR12S-822
R98	6.2K 1/2 WATT	BR12S-822
R99A	500K VERTICAL HOLD	PA4467-1
R99B	50K HORIZONTAL HOLD	PA4467-1
R100	330K 1/2 WATT	BR12S-334
R101	22K 1/2 WATT	BR12S-223
R102	100K 1/2 WATT	BR12S-104
R103	2.5 Meg. VERTICAL SIZE	PA4454
R104	6.2K 1/2 WATT	BR12G-622
R105	100K 1 WATT	CR12S-104
R106	2.2 Meg. 1/2 WATT	BR12N-225
R107	560 1/2 WATT	BR12S-561
R108	2.5K VERTICAL LINEARITY	PA4466
R109	68K 1 WATT	CR12S-683
R110	330K 1/2 WATT	BR12S-334
R111	560 1/2 WATT	BR12S-561
R112	560 1/2 WATT	BR12S-561
R113	27K 1/2 WATT	BR12S-273
R120	4.7 Meg. 1/2 WATT	BR12S-475
R121	1K 1/2 WATT	BR12G-102
R122	2.7K 1/2 WATT	BR12G-272
R123	1.2K 1/2 WATT	BR12G-122
R124	100K 1/2 WATT	BR12G-104
R125	100K 1/2 WATT	BR12G-104
R126	470K 1/2 WATT	BR12S-474
R127	4.7 Meg. 1/2 WATT	BR12N-475
R128	8.2K 1 WATT	CR12G-822
R129	1.5K 1/2 WATT	BR12G-152
R130	12K 2 WATT	DR12S-123
R131	12K 2 WATT	DR12S-123
R132	22K 1/2 WATT	BR12S-223
R133	100K HORIZONTAL SET	PA4470
R134	10K 1/2 WATT	BR12S-103

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	RESISTORS	
R135	180K 1/2 WATT	BR12G-184
R136	1 Meg. 1/2 WATT	BR12S-105
R137	100 1/2 WATT	BR12N-101
R138	12K 2 WATT	DR12S-123
R139A	150 5 CANDOHM	PB40623-2
R139B	7.5K 5 CANDOHM	PB40623-2
R139C	4K 5 CANDOHM	PB40623-2
R139D	2.25K 5 CANDOHM	PB40623-2
R140	500 4 HORIZONTAL DRIVE	PC70023-1
R141	100K 1WATT	CR12S-104
R142	5.1 WIREWOUND	BRW12S-51
R143	470K 1 WATT	CR11N-474
R144	1K 1/2 WATT	BR12N-102
R150	2.2 Meg. 1/2 WATT	BR12S-225
R151	1.2K 1 WATT	CR12S-122
R152	2.7K 2 WATT	DR12S-272
R153	470K 1/2 WATT	BR12N-474

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	TRANSFORMERS	
T1	VIDEO DETECTOR	AA6833-1
T2	SOUND I. F. INTERSTAGE	AB43080-5
T3	RATIO DETECTOR	AB43080-6
T4	AUDIO OUTPUT	AB44066-4
T5	VERTICAL BLOCK OSCILLATOR	AB47014-1
T6	VERTICAL OUTPUT	AB44071-1
T7	HORIZONTAL AUTO TRANSFORMER	PC70025
T8	POWER	AB4[illegible]
	COILS	
L1 thru L29	IN TUNER UNIT	
L30A	42.8 MC I. F. COIL	AB43095-1
L30B	41.25 MC SOUND TRAP	AB43095-1
L31A	45.4 MC I. F. COIL	AB43095-2
L31B	41.25 MC SOUND TRAP	AB43095-2
L32A	45.4 MC I. F. COIL	AB43095-3
L32B	47.25 MC I. F. COIL TRAP	AB43095-3
L33		PART OF T1
L34		PART OF T1
L35	110 MH CHOKE	AA6402-8
L36	600 MH CHOKE	AA6613-8
L37	213 MH CHOKE	AA6402-7
L38	4.5 MC TRAP	AA6407-1
L39	420 MH CHOKE	AA6613-[illegible]
L45	4.5 MC SOUND TAKE-OFF TRAP	AB43080-[illegible]
L46A	VERTICAL DEFLECTION YOKE	AB43070-8
L46B	HORIZONTAL DEFLECTION YOKE	AB43070-[illegible]
L47	HORIZONTAL OSCILLATOR	AA6403-2
L48	SPOOK INTERFERENCE CHOKE	AA6650-8
L49	SPOOK INTERFERENCE CHOKE	AA6650-8
L50	HORIZONTAL LINEARITY	AA6400-6
L51	WIDTH CONTROL	AA6400-7
L52	L. V. FILTER CHOKE	AB47009-3
L53	M. V. FILTER CHOKE	AB47009-3

DEFECTIVE MATERIAL WILL NOT BE ACCEPTED FOR REPLACEMENT NO CHARGE UNLESS WITHIN WARRANTY. SPARTON WILL NOT CREDIT ANY PARTS NOT OUR MAKE, ORIGIN, OR PURCHASED LOCALLY FROM AN OUTSIDE SOURCE. CREDIT WILL ONLY BE ISSUED ON PARTS ORDERED AS ADVANCE REPLACEMENT. ALL OTHER IN WARRANTY PARTS RETURNED TO THE FACTORY WILL BE REPLACED. ALL MATERIAL SUBJECT TO FACTORY COUNT AND INSPECTION. TRANSPORTATION CHARGES MUST BE FULLY PREPAID IN ALL CASES.



CHASSIS BACK VIEW

VOLTAGE TEST SPECIFICATIONS:
1. ALL VOLTAGES & CURRENT MEASURED IN VHF POSITION - CHANNEL 2.
2. LINE VOLTAGE - 117 VOLTS A.C. NO SIGNAL INPUT APPLIED TO SET.
3. BRIGHTNESS & CONTRAST CONTROL POSITION - MAXIMUM CLOCKWISE.
4. HORIZONTAL & VERTICAL HOLD CONTROL POSITIONS - SET CORRECT POSITION TO LO PICTURE.
5. WIDTH CONTROL POSITION - SET FOR NORMAL SIZE.
6. VERTICAL SIZE & LINEARITY CONTROL POSITION - SET FOR NORMAL SIZE BEST LINE.
7. VOLUME CONTROL & TONE CONTROL POSITION - MAXIMUM COUNTER-CLOCKWISE.
8. INSTRUMENT (METER) USED - (VTVM) VACUUM TUBE VOLT METER.
9. UNLESS OTHERWISE DESIGNATED ALL VOLTAGES MEASURED IN RESPECT TO CHASSIS GROUND.

GENERAL

The *Standard Tuner* is the "front-end" in millions of television receivers. It is a vacuum-tube frequency selecting device whereby the television receiver may be selectively "tuned" to any one of twelve available television channels.

Electrically, the tuner consists of a tuned r-f amplifier stage with resonant grid and plate circuits, a tuned mixer stage, and a variable frequency oscillator. The input circuit of the tuner accepts the modulated picture and sound carriers; the output circuit delivers individual or common sound and picture i-f output for further processing in the receiver. The input circuit of the tuner is designed for use with balanced 300-ohm transmission lines. The mixer output circuits are designed to supply i-f signals between 19 and 26 mc in one group of tuners, and from 40 to 46 mc in the remaining group of tuners. Both sets of signal frequencies are subject to specific selection to suit different designs of receivers.

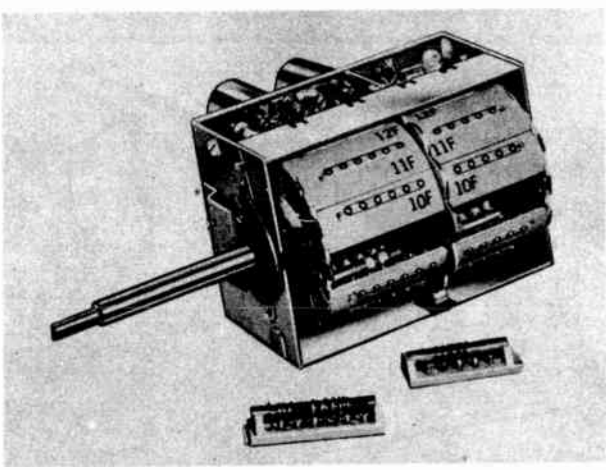


Fig. 1. A view of the turret and a matched pair of channel-9 coil strips.

Selection of television channel frequencies is accomplished by changing the position of a rotatable turret which carries the coils for the tuned circuits. The resonant coils for each television channel are divided between two mounting strips which are spring attached to the turret. One strip carries the antenna coils and grid coil for the r-f stage; the other strip mounts the tuned plate coil for the r-f stage, the grid coil for the mixer, and the oscillator coil. The remaining circuit components are fixed in position on the tuner chassis. A view showing the turret and a "matched-pair" of coil strips for television channel 9, removed from their places on the turret, appears in Fig. 1. The entire mechanical arrangement gives rise to the term "turret tuner" as identification of the *Standard Tuner.*

Rotating the turret by means of the station selector shaft connects the appropriate coils to the tubes and associated circuitry, by placing the coil contacts in electrical junction with a set of fixed position contact fingers which are connected to the tubes and other circuit elements. The contact finger mounting is illustrated in Fig. 2.

Eight basic types of the *Standard Tuner* have been supplied to the TV receiver manufacturing industry. Each bears a type number indicative of the basic tuner design series. These tuners differ in a number of ways, among these being the type of tube used for the r-f amplifier and the circuitry. The first four types use a pentode r-f amplifier, hence they bear the *general* identification of "pentode" tuners. The remaining four types of tuners bear the *general* classification of "cascode" tuners because of the circuit arrangement used in their r-f amplifier stage. These four use a dual-triode r-f stage, described in complete detail under the heading of The Cascode Series of Tuners (as is the circuitry used in the pentode group).

Regardless of differences in tubes and circuitry, a general order of identifying features has been retained. Being distinctive and unique, these features enable immediate recognition of the *Standard Tuner* when encountered in commercial television receivers.

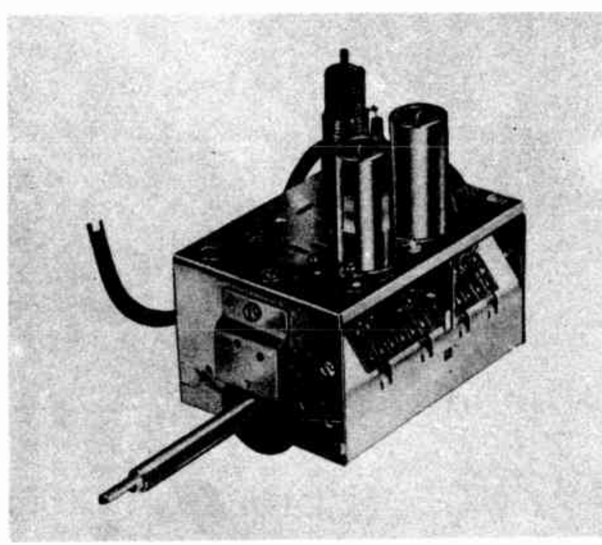


Fig. 2. Photograph showing the contact-finger mounting in an early version of the *Standard Tuner* (TV 200 series).

Identifying Features

An early version of the *Standard Tuner* is shown in Fig. 2. Specifically this is the second production (Type TV 200 series), but with few exceptions, its general physical features are identical to its predecessor, and those which followed.

The general physical outline of the device is a rectangular box, with two shielded tubes mounted on the top. Two tubes with shields of *like diameter and height* identify the entire *pentode* series of tuners. Adjacent to the tube farthest from the front wall of the tuner is the antenna input. This location is consistent in *all* models of the *Standard Tuner* and is another identification. Also mounted on top of the tuner are three, four, or five variable adjustments, as the case may be. In addition, the top of the tuner is the location for the r-f "test" point used for tuner response curve determination.

Another identifying feature is the rotatable, cam shaped, dielectric disc attached to the outer drive shaft, more appropriately identified as the "fine tuning" shaft. This disc tunes the oscillator. All versions of the *Standard Tuner,* except the very first, mount the fine tuning dielectric disc on the *outside* of the front wall. The early production of TV 100 series tuners used a circular dielectric disc for the same purpose, except that it was located *inside* the tuner, behind the front wall. In all instances, the dielectric disc moves between a "hot" stator plate and a grounded plate. This is clearly visible in the illustration.

The TV 100 series used rivet shaped contacts for the stator as well as drum contacts. The stator contacts were staked to flat, dual, cantilever springs which were in turn riveted to molded strips in the stator bracket. All other series of the *Standard Tuner* use stator contacts of flat spring stock, folded into a "kidney shaped" loop. In conjunction with the change to this "kidney spring" contact, the rivet contacts on the coil drum were raised above the greater portion of the drum circumference by small ribs along the plastic segments.

A later version of the *Standard Tuner* is shown in Fig. 3. It is representative of the entire *cascode* group. One distinctive feature added to the others enables immediate recognition of the cascode series: a *wider* and *higher* tube shield for the r-f stage is used on the tube nearest the antenna input than for the mixer-oscillator tube. When the *Standard Tuner* uses differently dimensioned tubes (and shields) it is a cascode tuner; when it uses similarly dimensioned tubes and shields it is a pentode tuner.

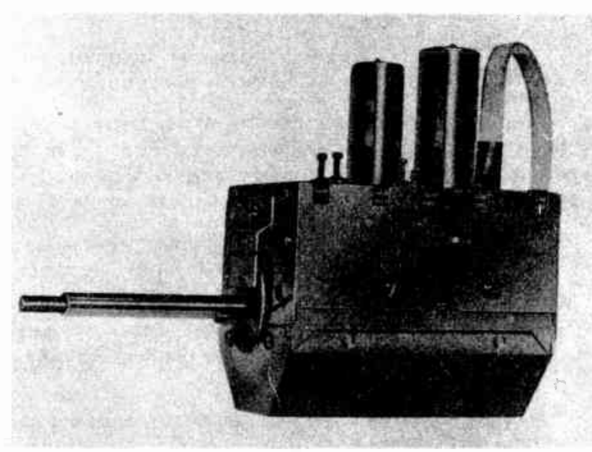


Fig. 3. Later version of the *Standard Tuner* which is representative of the cascode group.

A feature common to all cascode tuners and pentode tuners after the TV 200 series, is complete shielding. Shielding the bottom as well as the contact finger strip minimizes radiation from the tuner. The other identifying features are the same as previously described in connection with Fig. 2.

Attention is called to possible departures from the appearance of the top of the *Standard Tuners* shown in Figs. 2 and 3. These may be encountered in television receivers. Frequently the set manufacturers elect to include special traps or even the first video i-f transformer in the tuner. These components are usually, though not always, mounted on the top of the tuner, consequently modifying its physical outline. They do not, however, alter the general identifying features as described here. Hence ease of recognition of the Standard Coil product is not reduced.

An exploded view of a typical *Standard Tuner* is shown in Fig. 4. The numbers refer to the part's nomenclature. The mechanical design contributes to the attainment of a number of desirable electrical features, as well as convenient accessibility and disassembly. The underside of the chassis is divided into two compartments by the shield (22). The turret is removable as a unit. When set to a specific television channel, the turret is held firmly in place by means of the spring (8) pressure exerted on a detent roller (7), which is in firm contact with the scalloped-edged detent disc. This disc is seen protruding from the center of the turret. The detent roller spring is another positive identification of the *Standard Tuner.*

The contact finger bracket (21) is shown in position, and also removed from the unit. The lugs at the top of the contact bracket are the connecting points for the circuit components (the capacitors and resistors). Removing the side wall shield affords access to some of the components and also to the pins on the tube socket.

The coil mounting strips (41 through 52 and 53 through 64) are shown in position on the turret, and removed from the turret. These snap into position (on the turret) and are held firmly in place by spring tension. The fingers of the spring can be seen on the front side of the turret, similar spring fingers are located on the opposite end. The smaller coil strips mount the antenna transformer primary and secondary windings; the larger strips mount the r-f tube plate winding, the mixer grid winding, and the oscillator tank coil. The coils for each channel come in *matched* pairs for each television channel. They can be removed instantly from the turret by lifting the appropriate spring fingers.

The oscillator coils (one for each channel) have individual tuning slugs (25). This adjustment is accessible through the hole shown directly above the fine-tuner ground retainer spring (11) on the front wall of the tuner.

The complete listing of the parts' numbers for these mechanical items for each type of tuner is given elsewhere in this manual.

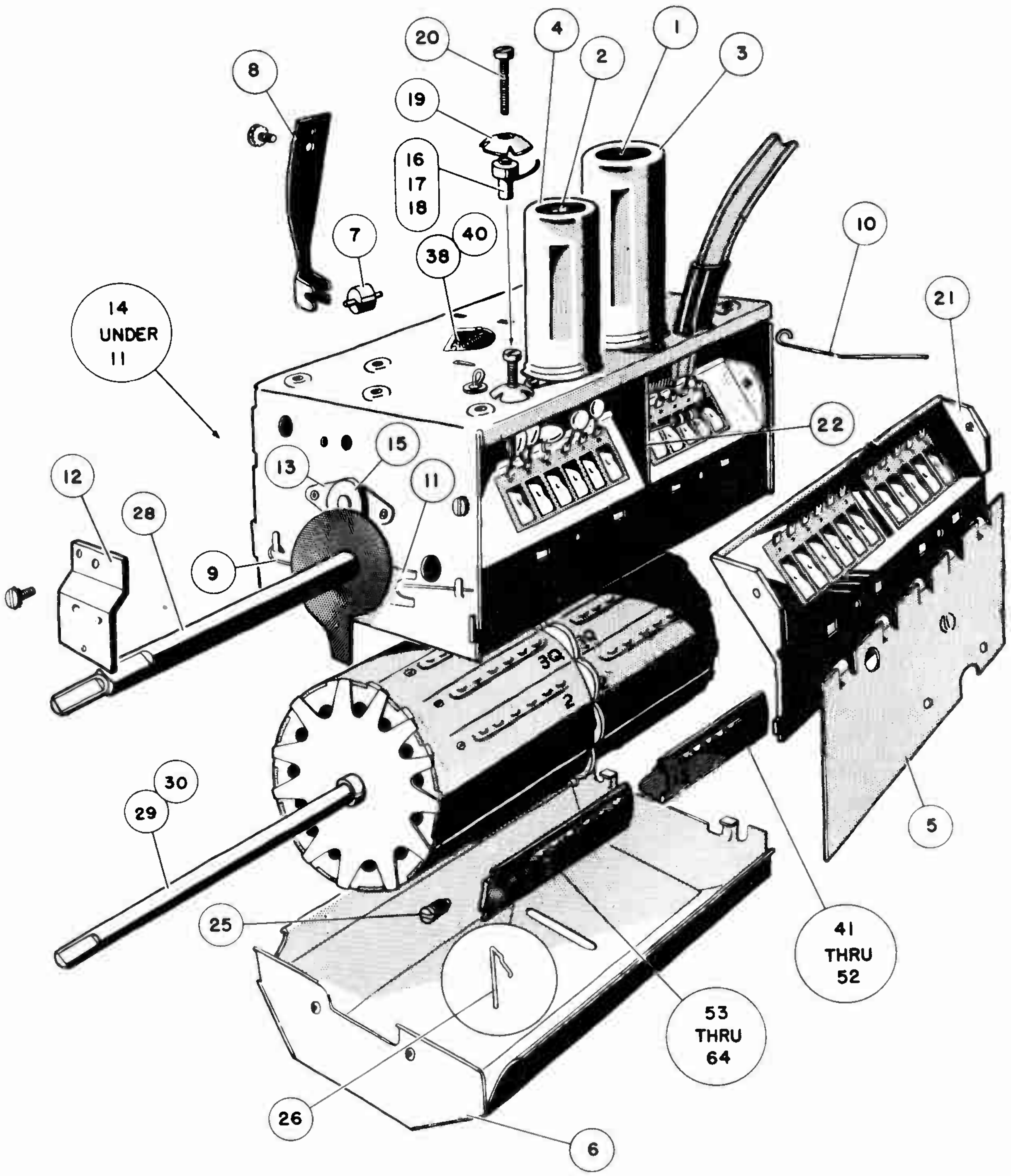


Fig. 4. Exploded view of a typical *Standard Tuner.*

Basic Type Identification Numbers

While the series numbers of the *Standard Tuner* using the pentode r-f amplifier are below 2000, the chronological sequence in which the series were introduced is as follows:

TV 100, the original turret tuner. This series ran through TV 134.

TV 200, introducing mechanical improvements in contact structure and lower torque positive detent action. This series ran through TV 353.

TV 1000, electrically the same as TV 200 but with additional shielding to make possible compliance with the oscillator radiation recommendations of the RTMA and the FCC. This series ran through TV 1357.

TV 2000, improved performance by the use of the cascode r-f amplifier. This series ran through TV 2047.

TV 3000, adaption of the TV 2000 circuitry for use with 42 mc. i-f amplifier. This series ran through TV 3005.

TV 2200, improved performance over TV 2000.

TV 3100, improved performance over TV 3000.

TV 1500, an improved performance tuner over TV 1000 but at lower cost than the cascode group.

The TV 1500, TV 2200 and TV 3100 are current models, the others having been discontinued.

Frequently the receiver manufacturer assigns his own type number to the tuner, but retains the series identification; for example 101, etc., for the basic 100 series, or 201, 230, 241, etc., for the basic 200 series, etc. It is to be noted, however, that some other manufacturers of receivers assign their own distinctive part numbers which bear no relation to the basic series numbers as used by Standard Coil. In this event recognition of the specific type is possible only by comparison of the circuitry, exclusive of output circuit components, which may have been added to the mixer-output system.

DESCRIPTION OF "PENTODE" TUNER CIRCUITS

The schematic wiring diagrams of the four pentode tuners appear in Figs. 5, 6, and 7. The circuit description given here is for the TV 100 and TV 200 series. Significant variations between this design and those which followed using a pentode for the r-f amplifier, will be stated individually in connection with the respective schematics.

Referring to Fig. 5, the antenna transformer primary (*L1*) is designed for a balanced input. The inductively-coupled secondary (*L2*) is connected to the control-grid circuit of the r-f amplifier tube. Resistor *R1* is the grid circuit loading resistor for proper bandwidth, and *C1* is the pre-set general coverage trimmer which tunes the r-f grid coil. Resistor *R2* is the decoupling resistor in the agc bus; the bus is stated as being a white lead but in some of the very early TV 100 series tuners it was a green lead. The antenna transformer coils, *L1* and *L2*, are mounted on the smaller coil strip which is located on the rear half of the turret.

The plate circuit of the r-f amplifier is tuned. The related circuit elements are the plate coil *L3*, the plate tank loading resistor *R3*, and the general coverage tuning trimmer *C3*. Resistor *R3* loads the plate coil to produce the required bandwidth on each channel; resistor *R5* and capacitor *C4* are the decoupling elements for the B+ supply. In turn, *L6* and *C17* are the r-f isolating and by-pass elements in the r-f tube heater circuit.

The r-f tube plate coil, *L3*, is inductively coupled to the mixer coil, *L4*. The mixer tube is one half of a 6J6. The mixer grid coil is tuned by the pre-set general coverage trimmer *C6*. The grid blocking and resonating capacitor is *C5* and the grid leak and grid coil loading for the mixer is the series network of *R4* and *R6*. These resistors develop the grid bias for the mixer, and the junction between them is the r-f *test* point for use in determining the response curve of the tuned r-f and mixer stages.

The oscillator is the second half of the 6J6. Coil *L5* is the tank coil and is permeability tuned by a slug and by the general coverage pre-set trimmer *C2*. The oscillator fine-tuning capacitor using the dielectric disc previously mentioned is labeled "fine tuning." The operation of this capacitor is as follows: Using two fixed plates, one "hot" and the other grounded, changing the position of the dielectric disc in relation to the two plates changes the dielectric constant of the capacitor, and so varies the capacitance. The exact amount of frequency change is about 3 mc on the high-frequency channels and about .7 mc on the low-frequency channels.

The oscillator-blocking capacitor is *C10* and the related grid leak is *R7*. The coupling from the oscillator to the mixer is through the mutual inductance between *L4* and *L5*. Capacitor *C8* is a part of the oscillator feed-back system. The heater circuit of the oscillator is isolated from the remainder of the tube system with respect to r-f coupling by the r-f choke *L8* and the bypass capacitor *C21*.

The plate circuit of the mixer may contain a variety of devices, but in the basic unit it is as shown. The r-f bypass capacitor is *C7*, the permeability tuned first i-f stage picture i-f coil is *L11*, which is in series with the fixed resonating capacitor, *C18*. The plate circuit of the mixer also contains the sound i-f trap and transformer, consisting of windings *L10* and *L12*, as well as the fixed tuning capacitor, *C14*. The secondary of this transformer, *L12*, is permeability tuned. The sound i-f transformer, which is the upright unit shown in back of the tubes in Fig. 1, is deleted from tuners used in intercarrier systems.

Summarizing the TV 100 and 200 series, the circuitry is the same; the difference between them is the contact structure.

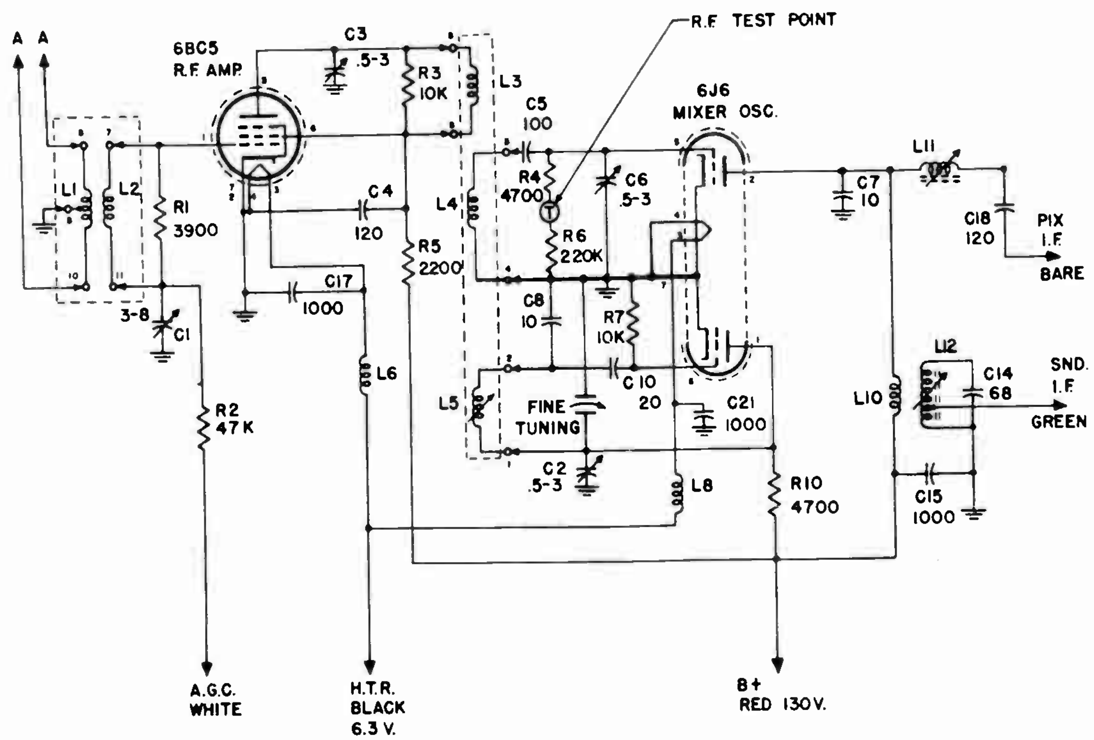


Fig. 5. Schematic diagram of the TV 100 and TV 200 series pentode tuner.

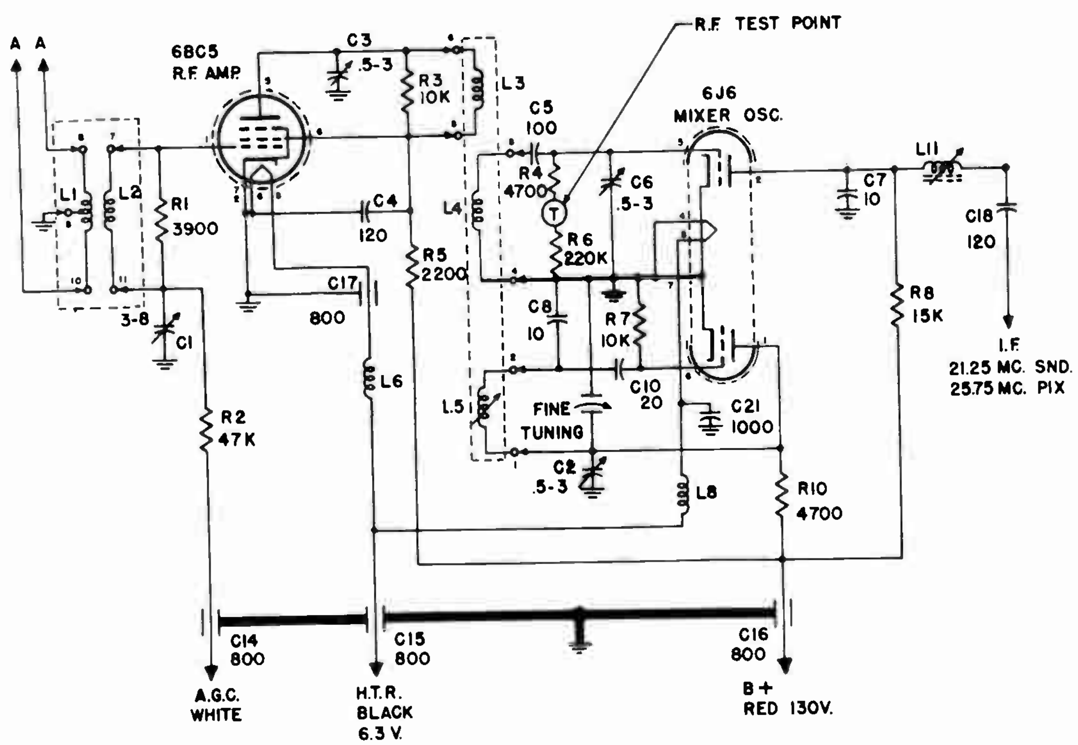


Fig. 6. Schematic diagram of the TV 1000 series pentode tuner.

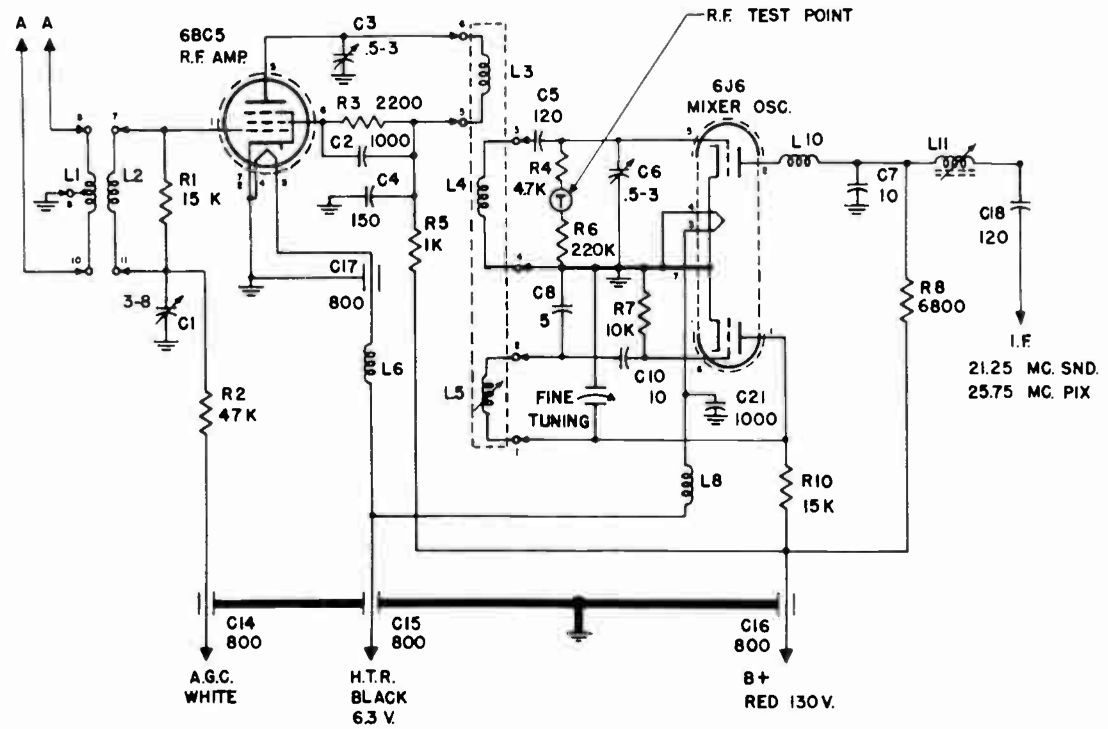


Fig. 7. Schematic diagram of the TV 1500 series pentode tuner.

TV 1000 Series. The TV 1000 series tuner schematic appears in Fig. 6. It is very much like the TV 100 and 200 series except for the sound i-f trap and transformer which has been removed, and a side and bottom cover shield have been added. These changes were made to lower the oscillator radiation to comply with the FCC-RTMA proposed limits.

The mixer plate load resistor is *R8*. The 130 volt B+ bypass capacitor was changed from 1000 $\mu\mu f$ to a low inductive feed-through type of 800 $\mu\mu f$. In addition, feed-through bypass capacitors of 800 $\mu\mu f$ each, were added to the agc bus and to the live heater wire.

TV 1500 Series. The TV 1500 series schematic appears in Fig. 7. It is like the circuit used in the TV 1000 series with a few changes in circuit constants. The r-f stage plate coil-loading resistor, *R3*, used in earlier models, was removed from across the plate coil, changed to 2200 ohms (*R3*) and placed in series with the r-f tube screen and the B+ end of the r-f plate coil. The antenna coil load resistor *R1* was also increased in value. This increased gain and reduced the noise.

The plate load resistor (*R8*) serving the mixer tube was lowered from 15000 ohms to 6800 ohms, thus increasing the plate voltage on that tube. A peaking coil, *L10*, was added in series with the output of the mixer plate system. This coil raises the gain on the higher channels by providing an inductive plate load for the mixer on channels 7 through 13. The pre-set general coverage trimmer, *C2*, was removed from the oscillator system. This reduced the number of pre-set trimmers located on top of the tuner from four to three.

THE CASCODE SERIES OF TUNERS

The cascode series of tuners introduced a new design. The four versions are shown schematically in Figs. 8, 9, 10, and 11. The major differences between these and those which preceded them is to be found in the r-f amplifier tube and circuitry.

The TV 2000 Series. The TV 2000 was the first to use dual triodes as r-f amplifiers. Later tuners are modifications of this design. The circuit change resulted in a tuner with higher gain and a lower noise factor than ever achieved before.

With reference to Fig. 8, the two halves of the dual triode (either 6BK7 or 6BQ7) comprise the two r-f amplifying stages connected in series. The antenna transformer consists of two inductively coupled windings *L1* and *L2*. The primary, *L1*, is designed for a balanced input. The inductively coupled secondary, *L2*, is connected into the grid circuit of one half (V1A) of the dual triode. The shunt resistor *R8*, 22,000 ohms, is the grid loading resistor used to provide a specific bandwidth for the antenna transformer. The trimmer *C13* is the pre-set general coverage trimmer for the antenna transformer. The resistor *R9* is the decoupling resistor in the agc line.

The capacitor *C9* of 2.2 μf, is used to neutralize the tuned r-f stage; also to offset to some degree the loading effect of the tube grid on the tuned circuit at the high frequencies.

The V1B section of the dual-triode functions as a grounded-grid amplifier. As far as signal voltages are concerned, the control grid is effectively grounded by the 800 $\mu\mu$f feed-through capacitor *C1*. The cathode (8) of the grounded grid stage is connected to the plate of the other half-triode through the coil *L7*. In effect this is series connection of the two amplifiers, and whatever signal voltage is delivered from the V1A section is applied between the cathode and control grid of the V1B section. This circuit arrangement places the cathode of V1B above the chassis by a voltage equal to the plate voltage applied to the V1A triode plate.

The coupling choke, *L7*, performs two functions in the circuit.

1. It provides an inductive load for the plate of the grounded cathode section of the cascode amplifier, thus reducing the loading of the grid circuit at higher frequencies.
2. *L7*, the plate to ground capacitance of the grounded cathode section, and the cathode to ground capacitance of the grounded-grid section form a π type impedance transforming network, resonating above the operating frequency of the amplifier. This presents the plate with a higher impedance load at the higher frequencies.

The bias for the grounded grid half-section is obtained from the voltage divider *R1-R2* which is seen connected across the high voltage B circuit. With the cathode of V1B positive because of its junction to the plate of V1A, the control grid of V1B must receive a slightly less positive potential than its cathode. The tuned plate coil *L3* is resonated by the pre-set general purpose trimmer *C3*. This is the same as in all of the previous tuners. The B+ plate supply dropping resistor is *R5* and its related bypass capacitor is *C4*. The heater bypass capacitor is *C2*, and the r-f isolating coil in the heater system of the r-f amplifiers is *L6*.

The transfer of the signal from the V1A section to the V1B section occurs in the following manner: With the cathode of the V1B section directly coupled to the plate of the V1A section, a change in effective voltage at the plate of the latter, due to the signal voltage applied to the V1A control grid, results in a corresponding change in voltage at the cathode of the former, and an opposite polarity change in voltage at the grid of V1B. Thus the swing in voltage at the plate of V1A appears as a changing signal voltage between cathode and control grid of V1B. From this point on V1B behaves as a conventional amplifier.

The general design of the mixer-oscillator section of the tuner is the same as has been described for the TV 100 through the TV 1500 pentode series tuners; hence will not be repeated here. However, some changes in the circuit constants warrant comment. The grid capacitor *C5* in the mixer circuit is 100 $\mu\mu$f. The oscillator tank capacitor *C8* is changed to 10 $\mu\mu$f because the general purpose oscillator, pre-set trimmer *C11*, is restored to the circuit. The TV 2000 series tuners, therefore, mount four trimmers on the top of the chassis.

Because individual B+ voltages are required by the r-f and mixer-oscillator stages, two B+ supply lines are used in all cascode tuners. This required the addition of an other feed-through type bypass-capacitor of 800 $\mu\mu$f; the four of them being *C14*, *C15*, *C16*, and *C17*.

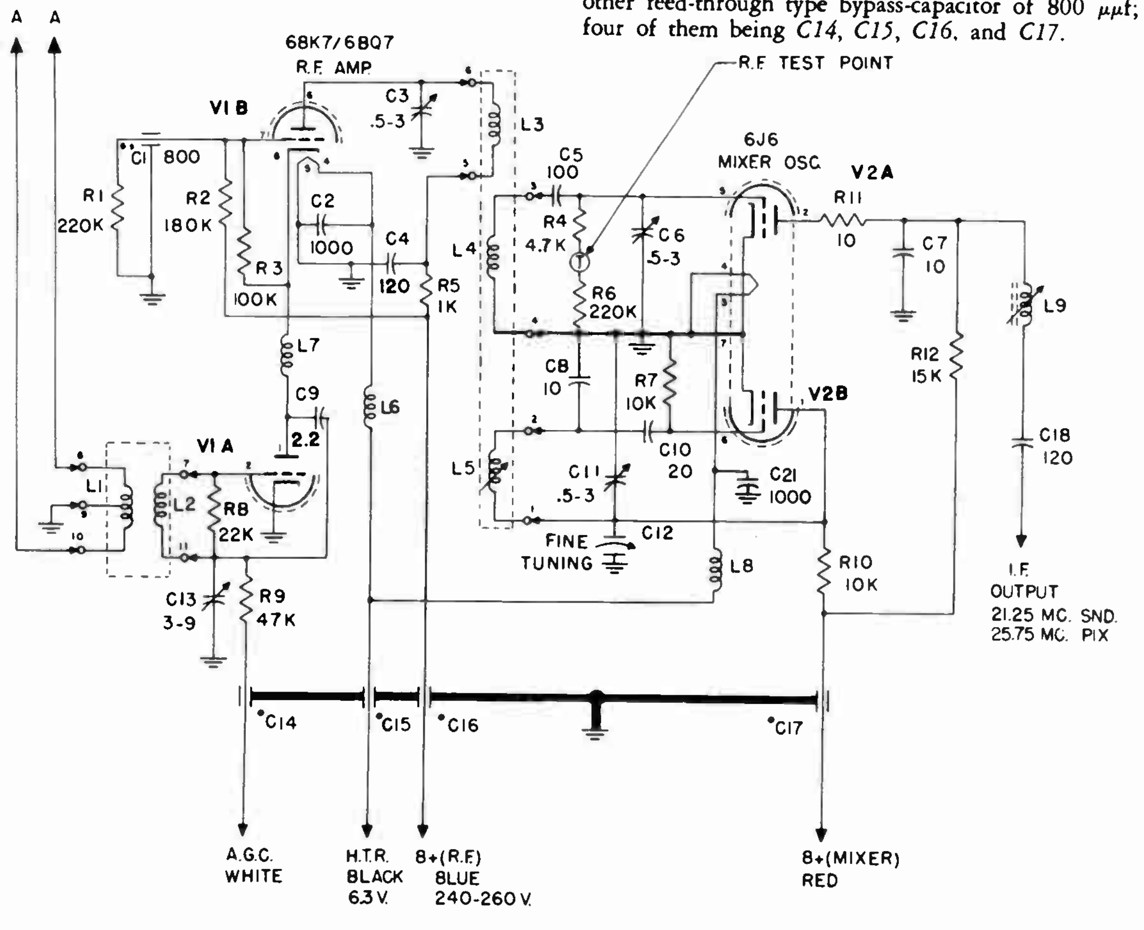


Fig. 8. Schematic diagram of the TV 2000 series cascode tuner.

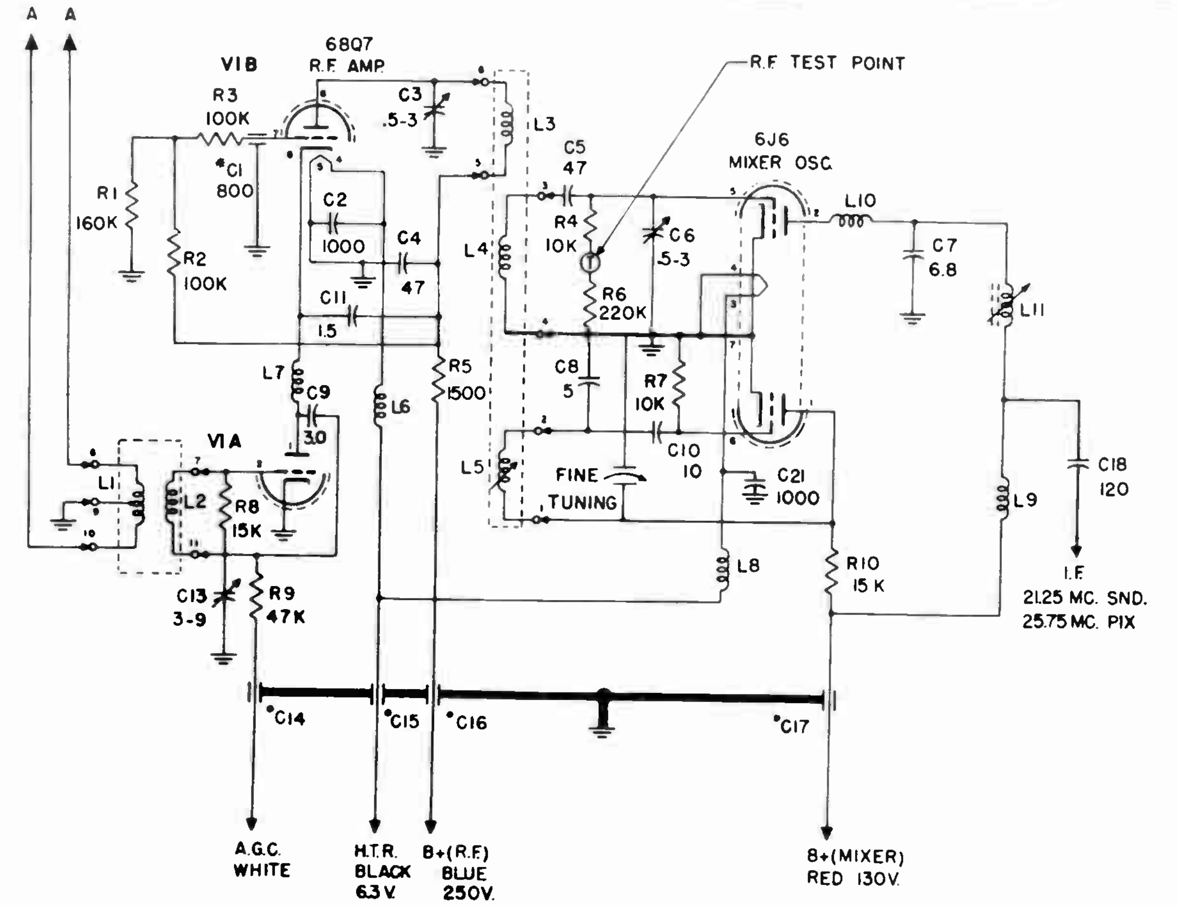


Fig. 9. Schematic diagram of the TV 2200 series cascode tuner.

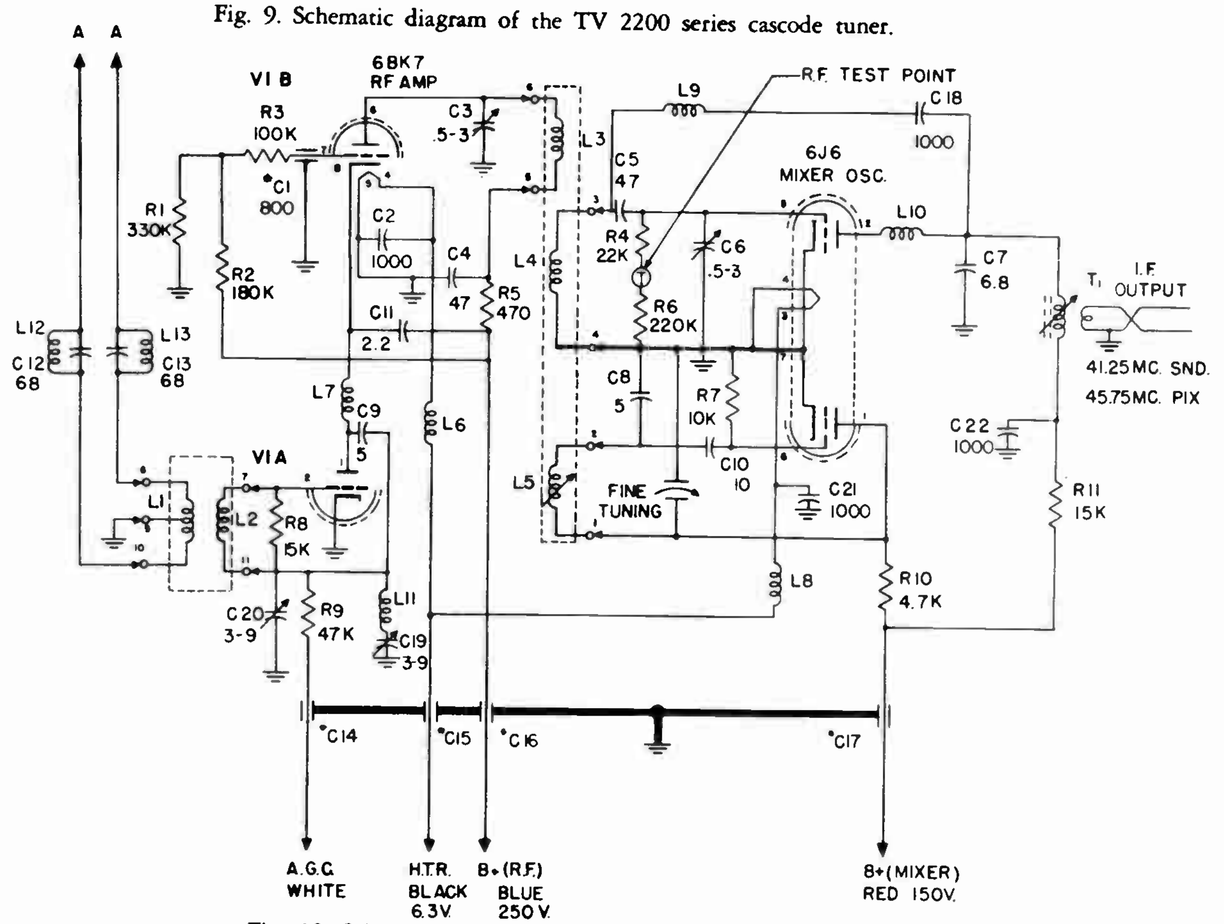


Fig. 10. Schematic diagram of the TV 3000 series cascode tuner.

The plate circuits of the mixer and oscillator systems are the same as the TV 1000 series with two exceptions: One is the addition of a resistor *R11* in series with the converter plate for i-f isolation purposes, the other is the increase in value of the oscillator plate resistor *R10* to 10,000 ohms.

TV 2200 Series. The TV 2200 series tuner schematic appears in Fig. 9. It is like the TV 2000 except for changes in circuit constants. To improve the neutralization of the r-f system, another neutralizing capacitor, *C11*, is added between the cathode of the grounded-grid amplifier and the low end of its tuned plate coil.

The plate circuit of the mixer tube is altered by the addition of a peaking coil *L10* and by the reduction in value of the resonating capacitor *C7* to 6.8 $\mu\mu$f. The mixer plate voltage is increased by replacing the plate-load resistor with an r-f choke *L9*. This change increased the mixer gain. The remainder of the mixer-output system remained as before in the TV 2000 series.

The oscillator stage was subjected to several changes. The pre-set trimmer is removed and the oscillator-tank capacitor decreased to 5.0 $\mu\mu$f. The oscillator grid capacitor is reduced in value from the previously used 20 $\mu\mu$f to 10 $\mu\mu$f.

The TV 3000 Series. This series, shown schematically in Fig. 10, heralded a new set of output-intermediate-frequencies. The basic r-f, mixer, and oscillator circuitry resembles the earlier cascode tuners although it contains a number of circuit changes. The r-f tube is a dual-triode 6BK7. The i-f signal-output frequencies are 41.25 mc sound, and 45.75 mc picture.

The antenna input circuit contains two i-f traps, *L12-C12* and *L13-C13*, one trap in each leg of the antenna feeder. Each is tuned between 43 and 44 mc. An adjustable series-resonant trap, *L11-C19*, in the input circuit of the grid-tuned r-f stage is intended for the elimination of local interference, which might otherwise pass through the r-f stystem and appear in the output of the mixer. Slight changes appear in the grid circuit of the grounded-grid amplifier in the form of reduced constants for the divider network *R1* and *R2*, thus altering the grid bias.

A feedback control circuit *L9* and *C18* is added between the input and output circuits of the mixer. This is used to reduce i-f reflections and to prevent regeneration. The i-f output is via the transformer *T1*. In series with the primary of the output i-f transformer is a voltage-dropping resistor *R11*. This is a change from the plate coil used in the TV 2200 series.

IDENTIFICATION OF COILS IN TUNERS

To aid recognition and replacement of coils used in the different series of tuners, each set of coils required for a channel is supplied in matched pairs. The identification consists of two labels, a number followed by a letter. The number indicates the channel; for instance coils numbered 2 are intended for channel 2; coils numbered 3 are intended for channel 3, etc. Since the tuners of all series are designed for use on the same television channels, like numbers will be encountered on the coil strips in each series of tuners.

The number designating the coils intended for a channel is duplicated on each coil strip of the two used for each channel. Thus if the channel is number 3, the antenna coil mounting strip will bear the number 3, and so will the mounting strip which carries the r-f plate coil, the mixer-grid coil, and the oscillator coil for the same channel. This can be seen in any of the illustrations which show the turret.

The letter designation also is duplicated on both mounting strips of a pair, but in this case the letter differs according to the *series* tuner for which they were designed. The following is the list of letter identifications relative to the different tuner series:

TV 100 series
Channel number only. No suffix letter.

TV 200 series
Channel number suffixed by "F" in green.

TV 1000 series
Channel number 2 through 9 suffixed by "G" in green.
Channel number 10 through 13 suffixed by "F" in green.
All antenna segment numbers suffixed by "F" in green.

TV 1500 series
Channel number suffixed by "H" in black.

TV 2000 series
Channel number suffixed by "K" in black.

TV 2200 series
Channel number suffixed by "Q" in red.

TV 3000 series
Channel number suffixed by "M" in black.

TV 3100 series
Channel number suffixed by "R" in red.

Interchangeability of coils is limited to coils of like channel number ***and*** like suffix letter. No other combination will work properly; adjustments of coils of unlike suffix letter to make them function in a tuner should ***not*** be attempted. When replacing a set of coils removed from a tuner, the replacement must bear the same suffix letter.

Many manufacturers of receivers assign their own distinctive part numbers to the different coil strips. This situation does not modify the conditions set forth above. Even these coils bear the aforementioned channel numbers and suffix letters pursuant to the series tuner involved.

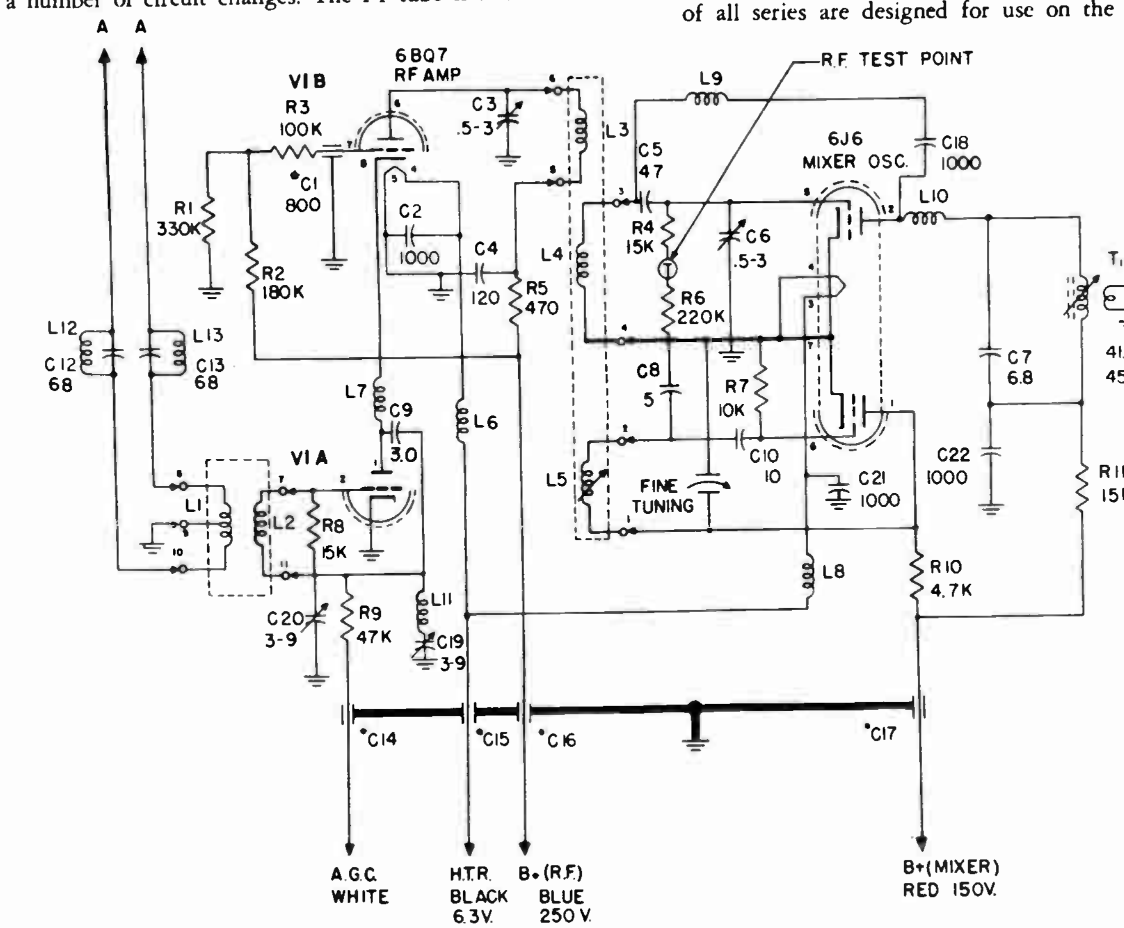


Fig. 11. Schematic diagram of the TV 3100 series cascode tuner.

The TV 3100 series is shown in schematic form in Fig. 11. The organization of the circuitry is like that of the TV 3000 except that some of the constants are changed.

MAINTENANCE AND REPAIR

Alignment

Proper alignment of the Standard Coil tuner in every television receiver determines the kind of performance which the receiver will deliver. Improper alignment will not only degrade the quality of the picture, but it can very easily defeat the usefulness of the receiver completely.

Four sections of the tuner are related to alignment operations. These are the r-f stage (two trimmers), the mixer stage (one trimmer), the oscillator stage (possibly one trimmer and always a slug), and the i-f system in the output of the mixer. The frequencies at which all adjustments, other than the i-f system are to be made, are prescribed for all Standard Coil tuners. The frequency at which the i-f components contained in the tuner are adjusted is a variable; it is determined by the specific picture and sound intermediate frequencies used in the receiver and the i-f amplifier design. Since these vary greatly, the data given here are based on the basic procedure rather than specific frequencies, with the exception of an example which assumes a specific set of conditions.

The alignment of all Standard Coil tuners follows substantially the same method with but few exceptions. The variables appear in the amount of grid bias which must be applied to the agc bus. This is critical and the information given here should be followed. If this is in conflict with data contained in a receiver manufacturer's service manual, the *latter* should be followed. In the absence of such information, the instructions contained herein should be observed.

Because of the general similarity between all pentode type tuners, and because of the general similarity between all cascode type tuners, complete instructions will be given for the first type in each group. Reference to these instructions is made under the alignment instructions for each specific type, and variations from the basic procedures are indicated. The location of the adjustment elements for each tuner series is shown in small sketches under the appropriate tuner headings.

The adjustment of the oscillator-coil slug for each channel is the same on all tuners. In order to obtain access to this slug through the hole in the front wall of the tuner, it is necessary to position the fine-tuning dielectric disc correctly. It is set to its mid-range position as shown in Fig. 12. Since this practice is standard in all instances, no further reference to positioning of the fine-tuning disc will be made; simple reference to adjustment of the oscillator slug is deemed sufficient.

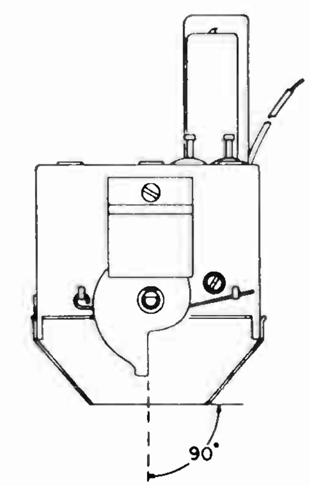


Fig. 12. Front view of tuner showing fine-tuning control set to its mid-range position.

All shields must be in place before and during alignment.

Test Equipment Required

The test equipment required for proper alignment is the following:

1. A sweep generator affording frequency-modulated test signals on all twelve VHF television channels, and at intermediate frequencies from 20 to 45 mc. The frequency setting should be adjustable according to frequency calibrations secured from an internal crystal calibrator or marker or from an external device.
2. A cathode-ray oscilloscope with at least from 10 to 50 millivolt sensitivity in the vertical amplifiers and with good low-frequency response and low-phase distortion. A scope which passes 60-cps square wave properly is satisfactory.
3. An electronic voltmeter.
4. An a-m signal generator which affords accurately set frequencies from 20 to 45 mc.

5. Suitable non-metallic alignment tools with 1/8 inch heads.
6. Proper means for matching the output of the sweep generator to the balanced 300-ohm input of the tuners.

Alignment of TV 100 and TV 200 Series

Some of these series tuners contain a sound i-f trap and sound take-off point as well as a resonant picture i-f system corresponding to the first video i-f input. Adjustment described here should be made at the frequencies prescribed for the sound i-f and for the first picture i-f stage in the receiver. As a typical case we are *assuming* that the tuners are used in a split-sound receiver which uses a stagger-tuned picture i-f system, wherein the sound i-f is 21.25 mc and the first picture i-f stage is tuned to 21.8 mc. If the sound i-f and the first picture i-f stage use other frequencies, the instructions given herein apply, except for the specific frequencies stated. The locations of the alignment adjustments are shown in Fig. 13.

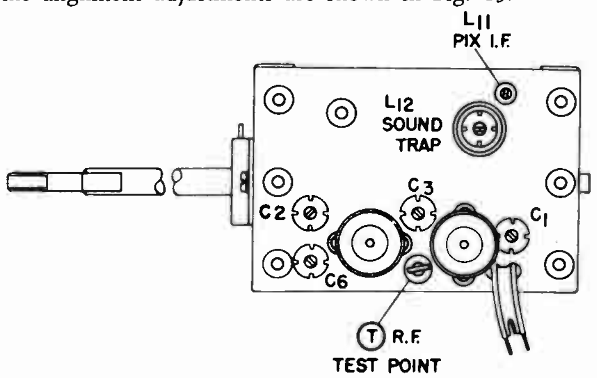


Fig. 13. Location of alignment adjustments in TV 100 and TV 200 series tuners.

It is further assumed that, regardless of the nature of the sound and picture i-f systems used in the receiver, their electrical condition is satisfactory. Finally, it is stressed that these instructions apply to the basic Standard Coil tuners listed herein, whether found in a receiver or to be used as a replacement in the receiver.

I-F and Trap Alignment

1. Connect a VTVM through a 10,000-ohm isolating resistor across the video-detector load resistor.
2. Remove the mixer-tube shield on the tuner.
3. Feed an unmodulated signal, corresponding to the *sound i-f,* to the mixer tube in the tuner by any one of a number of possible methods. The use of capacity coupling, via a tightly fitting ungrounded shield placed around the outside of a mixer tube, is satisfactory. Feed a substantial signal to the ungrounded shield. Tune *L12* for *minimum* indication on the VTVM.
4. Tune the unmodulated signal source to the frequency of the first picture i-f stage. Tune *L11* for *maximum* indication on the VTVM. Use the lowest possible signal output from the unmodulated generator consistent with a usable indication on the VTVM.

Note: Assuming a sound i-f of 21.25 mc, and the first picture i-f stage frequency in a stagger-tuned receiver being 21.8 mc, step 3 refers to a 21.25-mc setting of the unmodulated oscillator, and step 4 refers to a 21.8-mc setting of the unmodulated oscillator. Assuming use of the tuner in an intercarrier receiver, step 3 would be eliminated, and step 4 would involve the frequency stipulated for the first stage of the common video-sound i-f amplifier.

R-F and Mixer Alignment

1. Set station selector dial to channel 12.
2. Connect test oscilloscope vertical input through 10,000-ohm isolating resistor to r-f test point (wire loop) on top of tuner, and ground close by.
3. Apply a fixed negative bias of —1.5 volts to agc feed to tuner. This is white or green lead. Value of bias must be exact, otherwise distortion of the response curve may result.
4. Connect sweep generator to antenna terminals. Make certain that proper impedance match exists and that termination is correct.
5. Set sweep generator to sweep channel 12 frequencies. Use minimum output from sweep generator consistent with readable trace on oscilloscope screen.
6. Loosely couple marker generator to sweep-output cable at antenna terminals. Set marker generator to sound or picture i-f. Feed minimum signal from marker, consistent with seeing marker on response curve on scope screen.
7. Adjust antenna (r-f grid) trimmer; then the r-f plate circuit trimmer, and finally the mixer-grid circuit trimmer, to produce a response curve similar to that shown in Fig. 14. The response curve should be symmetrical, the depth of the valley between the peaks should not exceed 30 percent in over-all amplitude. In production, tolerances of 30 percent differences in

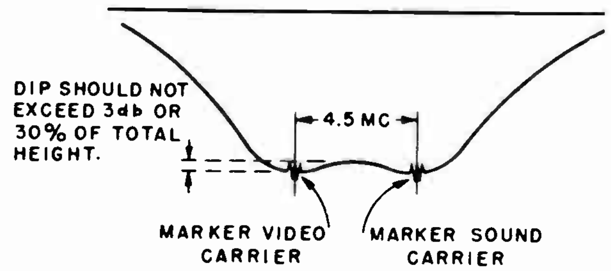


Fig. 14. R-f and mixer response curve of the tuner.

pattern height at or between the carrier frequencies are permissible. In the alignment, care should be taken not to "stagger tune" these circuits. This can best be accomplished by tuning for maximum pattern height at the point midway between the two carrier frequencies. The skirts of the curve will not fall to zero if the sweep width is less than 12 mc. The adjustments should result in the maximum amplitude of the response curve, proper positioning of the two marker frequencies, the closest possible approach to like amplitudes for each of the two humps, and minimum valley in between. Figure 14 is the r-f and mixer response curve of the tuner and should not be confused with the overall r-f and i-f response curve.

8. Without disturbing the r-f grid, r-f plate, and mixer-grid trimmer, check the response curves on the other TV channels by setting the station selector switch to the desired channel and changing the frequency of the sweep generator to correspond to the channel being checked. The response curves should be substantially the same on all channels and the two marker frequencies should fall in similar positions on the response curves. A slight amount of tilt can be tolerated. The amount of tilt indicated by the relative amplitudes of the response curves where the picture and sound i-f markers rest should not exceed 30 percent of the overall response curve amplitude. The ideal response curve is a flat-top.

Oscillator Alignment for Split Sound I-F Circuits

1. Set the station selector to channel 12.
2. Connect the a-m signal generator, or a marker calibrator, or whatever other type of signal capable of supplying an *accurately* calibrated unmodulated signal over the television channel frequencies is available, to the antenna terminals. (Remove the sweep generator connection to the antenna terminals, unless that device also is the source of the unmodulated test signal for oscillator adjustment.)
3. Set the unmodulated signal source precisely to that frequency which, when mixed with the local oscillator for channel 12, will produce the sound i-f required by the receiver. For example, if the sound i-f is 21.25 mc, set the signal generator to exactly 209.75 mc, which is the sound-carrier frequency for channel 12.
4. Connect the VTVM to the output of the sound discriminator (or ratio detector).
5. Adjust the oscillator tank trimmer for zero indication on the VTVM *between* positive and negative peaks. If zero cannot be attained proceed as described in step 6.
6. Check all channels by setting the station selector dial to the desired channel, and changing the frequency of the signal generator to correspond with the sound-carrier frequency for each channel as described in step 3. If it is found necessary to further adjust the oscillator coils on channel 12, or on any channel, this is done by means of the individual oscillator-coil slugs as described in steps 7 and 8.
7. Center the oscillator fine-tuning-control dielectric disc as shown in Fig. 12.
8. With the turret set for the desired channel, and with the appropriate generator frequency as indicated in step 3 applied to the antenna, insert a non-metallic screw driver through the hole in the front face of the tuner and adjust the slug until the VTVM connected to the sound-discriminator output indicates zero *between* the positive and negative peaks. Only a small movement of the slug will generally be necessary. (See below.)

Note: Be careful when adjusting the oscillator-coil slug. If turned too far the slug will fall into the coil. If this happens, remove the coil mounting strip from the turret. Remove the retaining spring which normally holds the slug in place. Upend the coil so that the hole is facing downwards and lightly tap the coil until the slug falls out. Replace the slug and the retaining spring; replace the coil strip in the turret and adjust as described.

Oscillator Alignment for Intercarrier Sound I-F Circuits

1. Set the station selector to the alignment channel.
2. Connect the oscilloscope across the load resistor of the video detector.
3. With the sweep generator fed into the antenna and the marker generator set at the frequency of the *video* carrier of the channel, adjust the oscillator tank trimmer until the marker is at the 6db point (half amplitude) on the high-frequency slope of the i-f response curve.
4. Adjust the oscillator coil slug for each of the other channels with the generators set to the proper frequencies for each channel.

Note: Types TV 1500, TV 2200, TV 3000 and TV 3100 do not use a common oscillator tank trimmer and the oscillator-coil slug must be individually adjusted on all channels.

TV 1000 Series Alignment

The reference alignment instructions are those stated for the TV 100 and 200 series tuners. The adjustment locations are shown in Fig. 15.

I-F Alignment
Complete steps 1, 2, and 4.
R-F and Mixer Alignment
Complete steps 1 through 8.
Oscillator Alignment
Complete alignment as shown under intercarrier i-f.

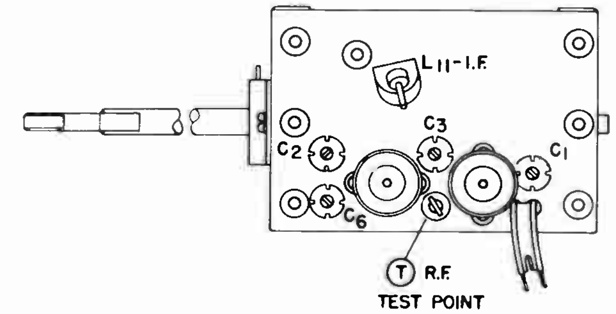


Fig. 15. Location of alignment adjustments in TV 1000 series tuners.

TV 1500 Series Alignment

The reference alignment instructions are those for TV 100 and TV 200 series. The adjustment locations are shown in Fig. 16.

I-F Alignment
Complete steps 1, 2, and 4.

R-F and Mixer Alignment
Complete steps 1 through 8. The alignment channel is *number 10.*

Oscillator Alignment
Complete alignment as shown under intercarrier i-f using slugs only as the oscillator trimmer is omitted.

Note: The adjustment of the TV 1500 series tuner requires extreme care.

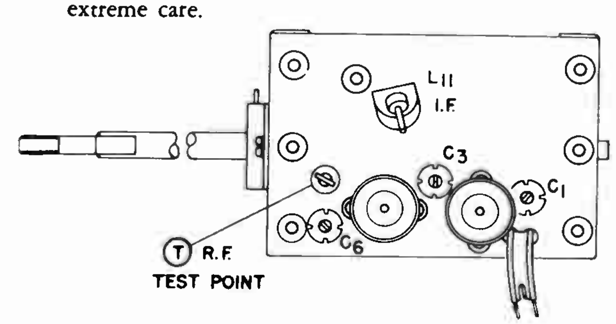


Fig. 16. Location of alignment adjustments in TV 1500 series tuners.

TV 2000 Series Alignment

The reference alignment instructions are those given for the TV 100 and TV 200 series. The TV 2000 series tuners were designed for 21.25-mc sound i-f and 25.75-picture i-f. The tuner is set nominally for 22.3 mc but can be tuned to any desired i-f between 19 and 26 mc. The adjustment locations of the TV 2000 series tuners are given in Fig. 17.

I-F Alignment
Complete steps 1, 2, and 4.

R-F and Mixer Alignment
Complete steps 1 through 8. The alignment channel is *number 12*. The fixed bias required for the agc lead is exactly —3 volts.

Oscillator Alignment
Complete alignment as shown under intercarrier i-f.

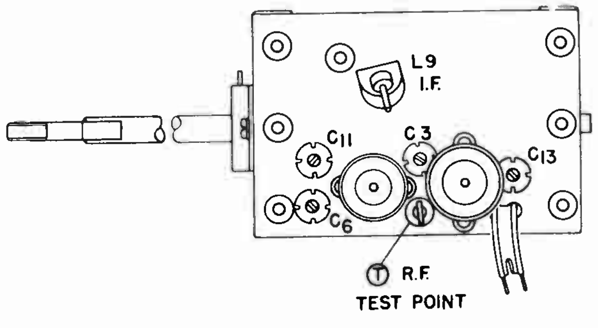


Fig. 17. Location of alignment adjustments in TV 2000 series tuners.

TV 2200 Series Alignment

The reference alignment instructions are those given for TV 100 and 200 series tuners. Adjustment locations are given in Fig. 18.

I-F Alignment
Complete steps 1, 2, and 4.

R-F and Mixer Alignment
Complete steps 1 through 8. The alignment channel is *10*. The fixed-bias voltage for the agc is exactly —3 volts. It is possible that adjusting the r-f grid (or antenna) trimmer may have little effect. In that event channel 6 should be used for readjustment of this trimmer (*C13*) only.

Oscillator Alignment
Complete alignment as shown under intercarrier i-f using slugs only as oscillator trimmer is omitted.

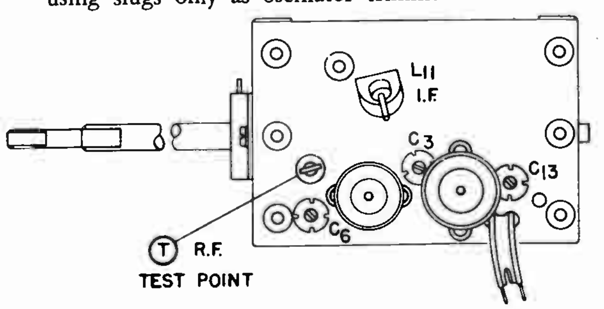


Fig. 18. Location of alignment adjustments in TV 2200 series tuners.

TV 3000 and 3100 Series Alignment

The reference alignment instructions are those given for the TV 100 and TV 200 series tuners, except that the TV 3000 and 3100 series are designed for 41.25-mc sound i-f, and 45.75-mc picture i-f. Also that the tuners incorporate the first stage i-f transformer, *T1* in the schematics of Figs. *10* and *11*. The locations of the adjustments referred to in the alignment instructions are shown in Fig. 19.

I-F Alignment
Complete steps 1, 2, and 4. The reference to *L11* in the alignment instructions is the primary of the i-f transformer in the TV 3000 and 3100 series tuners.

R-F and Mixer Alignment
Complete steps 1 through 8. The alignment channel is *10*. The fixed bias required for the agc is exactly —2 volts. Reference to the r-f grid trimmer under TV2200 also applies.

Oscillator Alignment
Complete alignment as shown under intercarrier i-f using slugs only as oscillator trimmer is omitted.

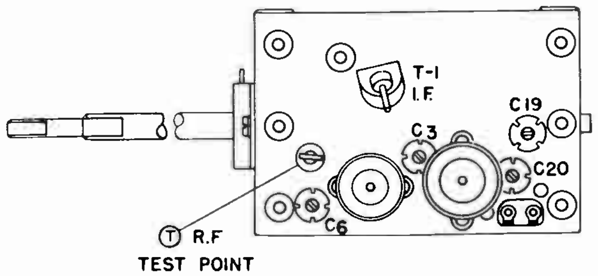


Fig. 19. Location of alignment adjustments in TV 3000 and TV 3100 series tuners.

Servicing

In the event servicing of the tuner is necessary, the following disassembly instructions should be followed.

Removing Tuner Turret

When removal of the turret is necessary, proceed as follows, using the parts identifications in Fig. 4 for guidance.

1. Remove bottom cover shield.
2. Remove the fine tuning ground plate (12)
3. Remove the fine tuning control shaft (28) and dielectric disc. Also remove the fine tuner ground spring (11) and the fibre washer (14). *For reassembly note reverse order of disassembly.*
4. Remove front and rear shaft retaining spring, (9) and (10), by pressing straight away from tab on tuner chassis.
5. Grasp tuner drum and slip out of end bearings by a slight rolling action.

Adjusting Contact Finger Springs

In the event that the stationary contact fingers make poor contact with the studs on the coil strips, the tension of the springs can be increased.

1. Remove the shield on the contact bracket side and the bottom shield.
2. Remove a number of coil strips and rotate the turret so that the fingers on the contact mounting bracket (21) are accessible. With a thin, narrow blade screwdriver, adjust the contact finger spring tension by carefully bending the spring inward until the highest point on the spring contact is about 9/64th of an inch above the surface of the plastic mounting plate. Adjust each spring separately. With correct tension, the contact finger will clear the flat service of the mounted coil strip by about 1/64th of an inch.

Removing Coil Strips

1. Remove bottom cover shield of tuner.
2. Insert thin screwdriver between end plate of turret and appropriate coil retainer spring. Twist the blade away from the turret and raise end of coil. Front retainer spring holds r-f and oscillator coil strips and rear retainer spring holds antenna coil strips.

Cleaning and Lubrication

When it becomes necessary to clean the contacts and springs, proceed as follows. Contacts on coil strips can be cleaned without removing the coils from the turret by using a toothbrush dipped in carbon tetrachloride; do not douse coils. Allow a few minutes for evaporation and then wipe the coil contacts with a lint-free cloth to remove any film deposit.

To clean the stationary contacts, remove several coil strips so as to expose them. Clean with stiff brush dipped into carbon tetrachloride and remove film deposit with clean lint-free cloth. Remove any accumulation of dirt and grease from contact plate surface in the same manner. After cleaning contacts it may be necessary to reset them; see procedure for adjusting contact finger springs.

In the event that lubrication of tuner contacts is necessary, which is generally so after cleaning, use a sulphur and acid-free, non-drying lubricant such as *Viscosity Oil Company #7069*. Do not use any so-called noise-eliminating lubricants or cleaning substances. Lubricate all moving parts including the stationary and moving coil contacts, the inner side of the outer shaft, and all bearings and springs. For lubricating bearings use *Viscosity Oil Company #8857* lubricant or light vaseline.

Parts Replacement

When it becomes necessary to replace electrical parts in the tuner, extreme care must be exercised. The constants of the different electrical components are given in the parts lists elsewhere in this manual. The replacement part must be exactly the same as the original. This applies to its electrical value, tolerance and temperature coefficient if applicable, physical dimension, location, and lead length. The lead dress is extremely important. Observe the lead dress arrangement before making parts changes.

In the case of fixed resistors which must be replaced, make certain that the type used is that originally used in the tuner.

UHF ADAPTABILITY

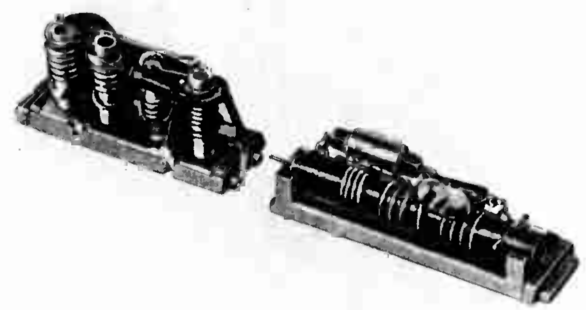


Fig. 20. Photograph of uhf strips for *Standard Tuners*.

Conversion "strips" are available for the Standard Tuner to convert regular VHF tuners for reception of signals in the UHF television band. Fig. 20 shows such a strip which can be inserted in the coil drum in place of any of the normal VHF channel strips.

These UHF strips operate by double conversion of the signal, using a harmonic frequency of the local oscillator in the first conversion and the fundamental frequency for the second conversion as shown in the circuit of Fig. 21.

Since the width of the structure extends well toward the center of the drum, only six UHF strips may be inserted in the coil drum.

Different series of these converter strips are supplied for each series of tuners and are identified by the same letter as marked on the VHF coil assemblies.

While production tolerances may make it possible for strips of one series to work in a tuner of another series, optimum performance can be obtained only with strips of the proper series.

UHF strips should be ordered by channel number and coil series letter. Presently available are:

F/G	Series for TV 200 and TV 1000
H	Series for TV 1500
K	Series for TV 2000
Q	Series for TV 2200
R	Series for TV 3100 and TV 3000

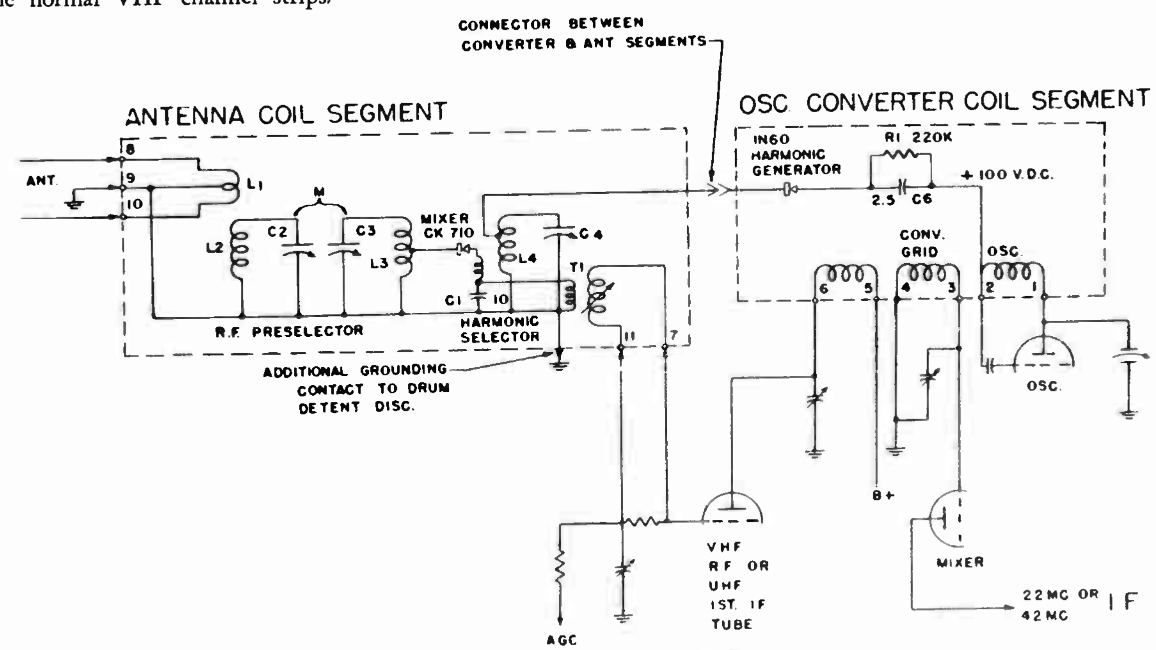


Fig. 21. Circuit arrangement of the *Standard Tuner* uhf strip.

General Parts List

For

Standard Tuners

STANDARD TUNERS - GENERAL PARTS LIST

Item	Intermediate Frequency			21.25 mc. Sound - 25.75 mc. Picture					41.25 mc. - 45.75 mc. Pix.	
	Circuit Description			Pentode R. F. Amplifiers					Cascode R. F. Amplifiers	
Item	Tuner Series	TV-100	TV-100C	TV-200	TV-1000	TV-1500	TV-2000	TV-2200	TV-3000	TV-3100
	Coding of Drum Segments	No Letter**	No Letter**	F in Green	F or G Grn.	H - Blk.	K - Blk.	O - Red	M - Blk.	R - Red
1	Tube, R. F.	6AG5	6AG5	6AG5/6BC5	6AG5/6BC5	6BC5	6BK7/6BQ7	6BZ7/6BQ7	6BK7	6BQ7/6BZ7
2	Tube, Mixer - Oscillator	6J6	6J6	6J6	6J6	6J6	6J6	6J6	6J6	6J6
3	Shield, Tube - R. F.	16S-006	16S-006	16S-006	16S-006	16S-006	16S-004	16S-004	16S-004	16S-004
4	Shield, Tube - Mixer Osc.	16S-006	16S-006	16S-006	16S-006	16S-006	16S-006	16S-006	16S-006	16S-006
5	Shield, Side				31B-143	31B-143	31B-143	31B-143	31B-143	31B-143
6	Shield, Bottom Cover				31B-103	31B-103	31B-103	31B-103	31B-103	31B-103
7	Roller, Detent	31A-002	31A-111	31B-016	31B-016	31B-016	31B-016	31B-016	31B-016	31B-016
8	Spring, Detent	31A-009	31A-110	31B-005	31B-005	31B-005	31B-005	31B-005	31B-005	31B-005
9	Spring, Shaft Retaining Front	31A-035	31A-109	31B-030	31B-030	31B-030	31B-030	31B-030	31B-030	31B-030
10	Spring, Shaft Retaining Rear	31A-032	31A-109	31A-109	31A-109	31A-109	31A-109	31A-109	31A-109	31A-109
11	Spring, Fine Tuner Ground		31B-008	31B-008	31B-008	31B-008	31B-008	31B-008	31B-008	31B-008
12	Plate, Fine Tuner Ground		31B-012	31B-012	31B-012	31B-012	31B-012	31B-012	31B-012	31B-012
13	Strap, Fine Tuner Mtg.		31B-021	31B-021	31B-021	31B-021	31B-021	31B-021	31B-021	31B-021
14	Washer, Fibre		11D-022	11D-022	11D-022	11D-022	11D-022	11D-022	11D-022	11D-022
15	Fine Tuner Hot Plate & Lead	31A-001	31B-252	31B-252	31B-252	31B-252	31B-252	31B-252	31B-252	31B-252
16	Trimmer, Ceramic & Lead-Ant.	31A-079	31A-079	31A-079	31A-079	31A-079	31A-079	31A-079	31A-079	31A-079
17	Trimmer, Ceramic & Lead-R. F.	31A-056	31A-056	31A-056	31A-056	31A-056	31A-056	31A-056	31A-056	31A-056
18	Trimmer, Ceramic & Lead-Osc.	31A-069	31A-069	31A-069	31A-069		31A-069		31A-069	
19	Nut, Trimmer Spring	10E-401	10E-401	10E-401	10E-401	10E-401	10E-401	10E-401	10E-401	10E-401
20	Screw, Trimmer	9A-410-7	9A-410-7	9A-410-7	9A-410-7	9A-410-7	9A-410-7	9A-410-7	9A-410-7	9A-410-7
21	Contact Bracket Assembly	31A-055	31A-055	31B-278	31B-278	31B-278	31B-278	31B-278	31B-278	31B-278
22	Shield, Center Assembly				31B-264	31B-663	31B-611	31B-611	31B-611	31B-611
23	Lubricant, Contact	29A-005	29A-005	29A-005	29A-005	29A-005	29A-005	29A-005	29A-005	29A-005
24	Lubricant, Bearing	29A-014	29A-014	29A-014	29A-014	29A-014	29A-014	29A-014	29A-014	29A-014
25	Slug, Oscillator Tuning	31B-015	31B-015	31B-015	31B-015	31B-015	31B-015	31B-015	31B-015	31B-015
26	Spring, Slug Retaining	31A-010	31A-010	31A-010	31A-010	31A-010	31A-010	31A-010	31A-010	31A-010
27	Choke, R. F. Heater	34A-546	34A-546	34A-546	34A-546	34A-546	34A-546	34A-546	34A-546	34A-546
28*	Fine Tuner Shaft & Blade	31A-051-**	31A-066-**	31A-066-**	31A-066-**	31A-066-**	31A-066-**	31A-066-**	31A-066-**	31A-066-**
29*	Drum Assembly Without Coils	31A-065-**	31A-065-**	31B-203-**	31B-203-**	31B-203-**	31B-203-**	31B-203-**	31B-203-**	31B-203-**
30*	Drum Assembly with Coils	31A-063-**	31A-063-**	31B-202-**	31B-1202-**	31B-1502-**	31B-2202-**	31B-2302-**	31B-3202-**	31B-3102-**
31	Choke, Osc. Heater	34A-575	34A-575	34A-575	34A-575	34A-575	34A-575	34A-575	34A-575	34A-575
32	Choke, Cascode Coupling -L7						31B-629	31B-629	31B-621	31B-629
33	Choke, Mixer Plate -L10					31B-638		31B-638	31B-295	31B-295
34	Choke, Neutralizing -L9								34A-660	34A-660
35	Trap, Pretuned 45 mc. -L12, C12								31B-299	31B-649
36	Trap, Pretuned 44 mc.								31B-601	31B-601
37	Terminal Board, Antenna								31B-607	31B-607
38	Core, I. F. Tuning	20C-055	20C-055	20C-055	20C-055	20C-055	20C-055	20C-055	20C-055	20C-055
39	Choke, Mixer Plate Feed -L9							31B-230		
40	I. F. Coil & Core Assembly - -	Because of Tuning Range this varies - Specific part numbers are given for each tuner.								

* Shaft length of Items 27, 28 and 29 are indicated by digits in place of the asterisks after the part number.
Example: #31B-202-22 is the complete drum assembly for TV-250 tuner.

Item 27 on some tuners may be #31B-613-** which gives greater fine tuning range. With this, item 12 is 31B-124.

**Use letter B as channel no. suffix for UHF strips.

Resistance and capacitance values and part numbers are given below by circuit symbol number for "R" or "C" in the schematics on preceeding pages. All components from the antenna trimmers to and including the mixer plate by-pass (C-7) are common to all tuners of each series. Components peculiar to the different I. F. circuits of various receivers are identified separately with reference to individual tuner schematics.

RESISTORS - All 1/2 watt insulated composition resistors are suitable replacements, except those marked with asterisk which should be IRC type BTS.

PART NO.	VALUE	TV-100/200	TV-1000	TV-1500	TV-2000	TV-2200	TV-3000	TV-3100
12TAE100M	10Ω ± 20%				R-11			
12TAE471M	470Ω ± 20%						R-5	R-5
12TAE102M	1000Ω ± 20%			R-5	R-5			
12TAE152K	1500Ω ± 10%					R-5		
12TAE222M	2200Ω ± 20%	R-5	R-5	R-3				
12TAE392K	3900Ω ± 10%	R-1	R-1					
12TAE472K	4700Ω ± 10%	R-4*, 10	R-4*, 10	R-4*	R-4*		R-10	R-10
12TAE682J	6800Ω ± 5%			R-8				
12TAE103K	10KΩ ± 10%	R-3, 7	R-3, 7	R-7	R-7, 10	R-4*, 7	R-7	R-7
12TAE153K	15KΩ ± 10%		R-8	R-1*, 10	R-12	R-8*, 10	R-8*, 11	R-8*, 11, 4
12TAE223M	22KΩ ± 20%				R-8*		R-4*	
12TAE473M	47KΩ ± 20%	R-2	R-2	R-2	R-9	R-9	R-9	R-9
12TAE104K	100KΩ ± 10%					R-3, 2	R-3	R-3
12TAE164J	160KΩ ± 5%					R-1		
12TAE184K	180KΩ ± 10%				R-2		R-2	R-2
12TAE224K	220KΩ ± 10%				R-1			
12TAE224M	220KΩ ± 20%	R-6	R-6	R-6	R-6	R-6	R-6	R-6
12TAE334K	330KΩ ± 10%						R-1	R-1

CAPACITORS - Since small disc capacitors are now available, it is recommended that they be used for service in the earlier models except in critical circuits. Care must be taken to keep the leads as close to the same as the capacitor replaced.

PART NO.	CAPACITANCE	TV-100/200	TV-1000	TV-1500	TV-2000	TV-2200	TV-3000	TV-3100
13L8C-1R5M	1.5 μμf NPO					C11		
13L8GP-2R2C	2.2 μμf				C9		C11	
13L8C-030C	3.0 μμf NPO					C9		C9
13L8C-050C	5.0 μμf NPO							
13L8U-050C	5.0 μμf N750			C8		C8	C8, 9	C8
13L8C-6R8C	6.8 μμf NPO					C7	C7	C7
13L10C-100K	10 μμf NPO	C7	C7	C7, 10	C7	C10	C10	C10
13XR1-20UK100J	10 μμf N750	C8	C8		C8			
13XR1-20CH200K	20 μμf NPO	C10	C10		C10			
13L8Q-470K	47 μμf N1400					C5, 4	C4, 5	C5
13L8Q-510J	51 μμf							
13XR1-30UK101K	100 μμf N750	C5	C5		C5			
13XR1-30UK121J	120 μμf N750	C4	C4					
13L8D-121K	120 μμf	C18	C18		C4, 18	C18		C4
13D-153	800 μμf GMV		C14, 15, 16, 17	C14, 15, 16, 17	C1, 14, 15, 16, 17	C1, 14, 15, 16, 17	C1, 14, 15, 16, 17	C1, 14, 15, 16, 17
13L8X-102Z	1000 μμf GMV	C15, 17, 21	C21	C2, 21	C2, 21	C2, 21	C2, 18, 21, 22	C2, 18, 21, 22
13B-052	60 μμf NPO	C14						
13L8T2-151K	150 μμf			C4				

24" Rectangular Picture Tube
Model 24C-9360A (Mahogany)
Model 24C-9360AB (Blond)

GENERAL SPECIFICATIONS

DIMENSIONS

Model	Height	Width	Depth
24C-9360A	40¼"	26"	23"
24C-9360AB	40¼"	26"	23"

WEIGHT (packed)

Model	Weight
24C-9360A	172 lbs.
24C-9360AB	172 lbs.

POWER REQUIREMENTS

117 volts 60 cycles 275 watts

PICTURE SIZE	DEFLECTION	FOCUS
24" Rectangular	Magnetic	Magnetic

INTERMEDIATE FREQUENCIES

Sound Carrier—41.25 Mc.
Picture Carrier—45.75 Mc.

I.F. SYSTEM

Three Stages—overcoupled—for composite signal.
One additional stage for sound channel.

SPEAKER

Model	Type	Size	V.C. Imped.
24C-9360A	P.M. Dynamic	6" x 9"	3.2 ohms
24C-9360AB	P.M. Dynamic	6" x 9"	3.2 ohms

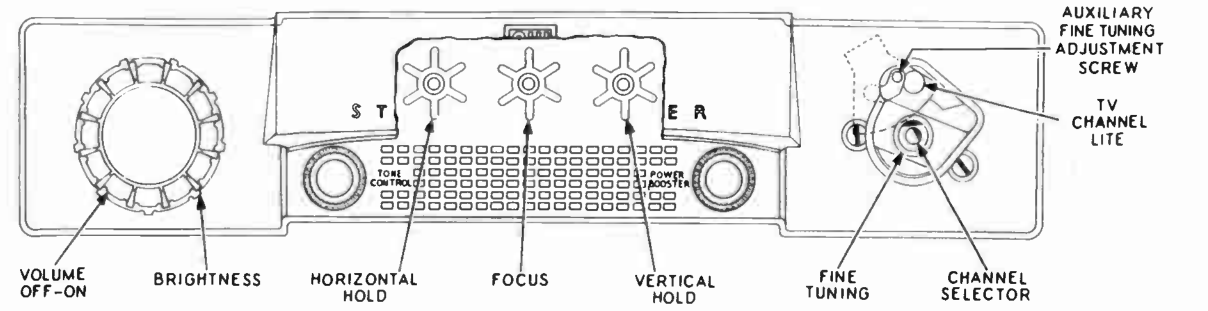


Fig. 14—LOCATIONS OF PRE-SET CONTROLS

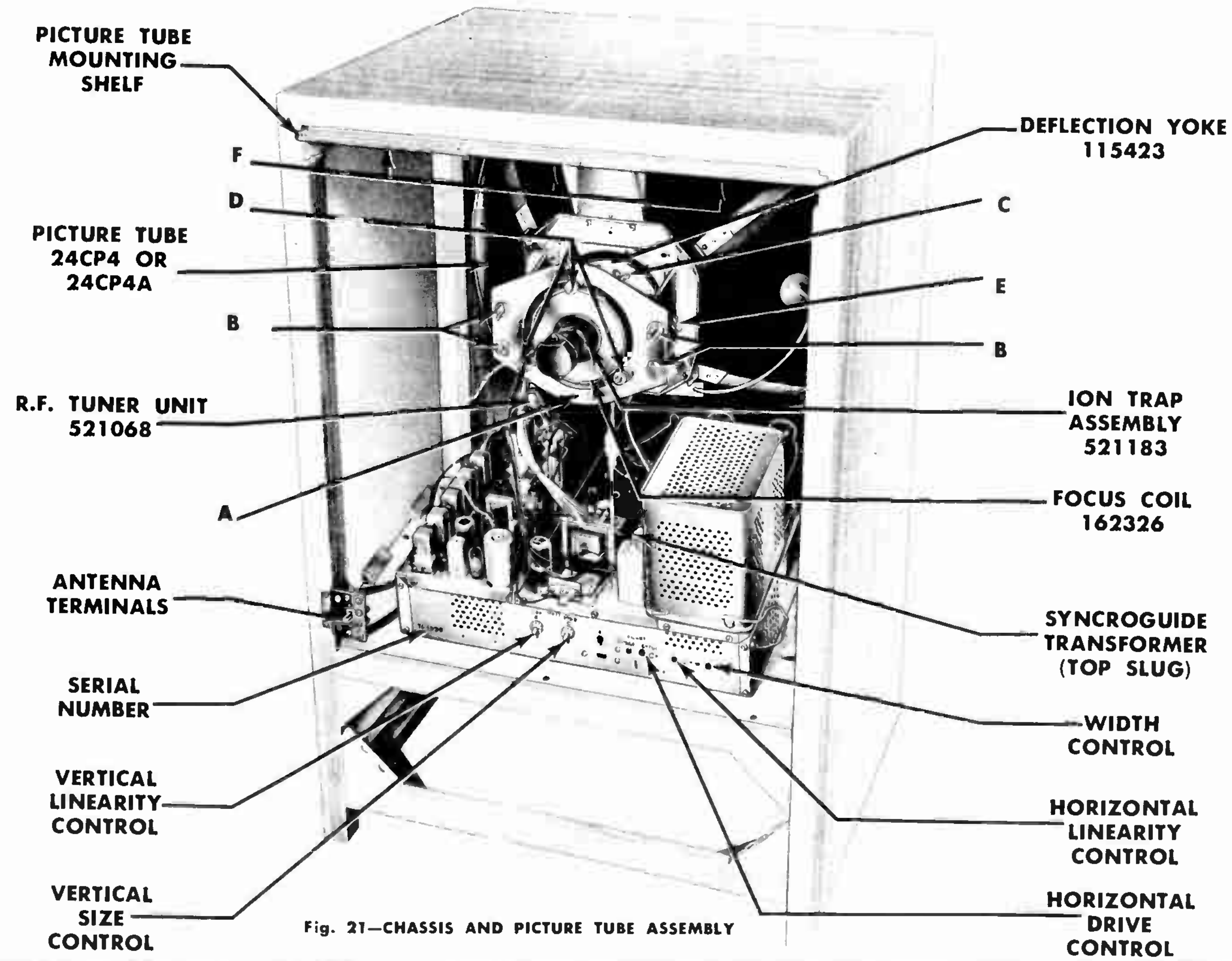


Fig. 21—CHASSIS AND PICTURE TUBE ASSEMBLY

ALIGNMENT PROCEDURE

The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits.

Alignment of all VHF RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts.

These procedures should preferably be applied in the order in which they are presented. Alignment of Sound Channel or IF Channel may be accomplished individually if desired.

The VHF RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned.

CAUTION

The picture tube is highly evacuated and if broken fragments will be violently expelled. Handle with care.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated.
   a. IF Frequencies:
      4.5 Mc. Sound Channel
      39.75 Mc. to 47.25 Mc. IF Channel
   b. RF Frequencies:
      54 to 88 Mc.
      174 to 216 Mc.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the RF Tuner, part 521150, must be returned to the factory.
2. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.
3. **RF SWEEP GENERATOR** to provide frequency modulated signal for observing the over-all bandpass characteristic and RF Channel alignment at the following frequencies:

   40 to 50 Mc. with 10 Mc. sweep width.
   54 to 88 Mc. with 10 Mc. sweep width.
   174 to 216 Mc. with 10 Mc. sweep width.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the RF Tuner, part 521150, must be returned to the factory.
4. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe. This instrument is used for IF and RF Channel alignment and for observing the over-all band-pass characteristic.

SOUND CHANNEL ALIGNMENT PROCEDURE

1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and Power Booster control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. A small screwdriver (preferably non-metallic) can be used for alignment of Sound IF. The blade of this tool will fit the slot in the core of the transformer.

STANDARD SIGNAL GENERATOR		VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY				
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Power Booster control to its maximum counter-clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in Fig. 3. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2. 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V1, V2 or V3). This will prevent noise in the RF stages from affecting the voltage reading while adjusting the sound trap.	**#1** 4.5 MC Sound Trap (See Fig. 10)	Adjust for minimum reading on VTVM.

Same as above	Same as above.	Connect as shown in Fig. 4.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This sourious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	#2 Discriminator Secondary (See Fig. 10)	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary (See Fig. 8)	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 5.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 5.	#2 Discriminator Secondary (See Fig. 10)	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.
Replace the type 6CB6 tube previously removed in the above procedure and turn set on. Tune in to a local channel and should there be an unusual amount of "Intercarrier Buzz" refer to procedure on adjoining page to remove this aforementioned fault.					

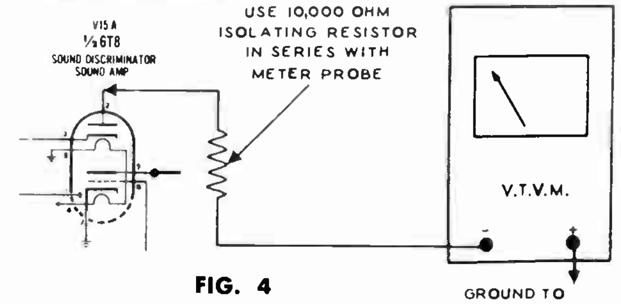


FIG. 4
VTVM Connections for Sound IF Alignment

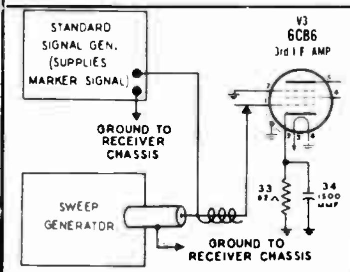
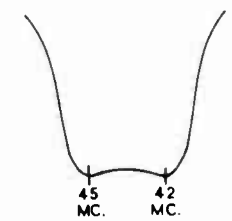
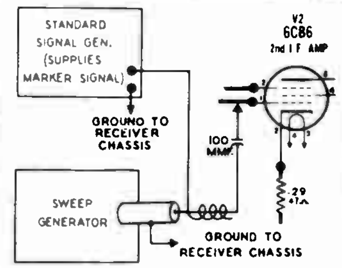
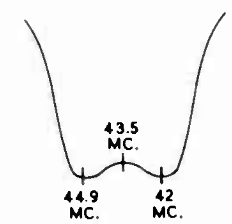
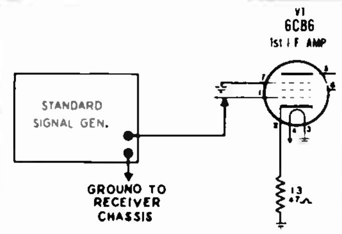
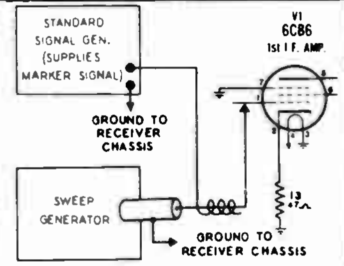
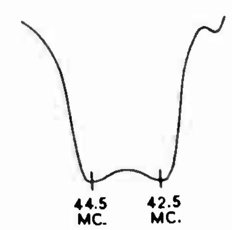
REDUCTION OF INTERCARRIER BUZZ

Under actual reception conditions slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under these conditions.

Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

IF CHANNEL ALIGNMENT PROCEDURE

1. A non-metallic screw driver must be used when adjusting the trimmers of the IF transformers to prevent a false indication.
2. In order to eliminate the possibility of spurious oscillation, it is desirable to render the VHF RF oscillator inoperative. This may be accomplished by insulating oscillator contacts on the tuner strips. Remove tuner bottom shield and place a piece of transparent cellulose tape on the first two contacts (from front) of drum assembly. Use any inoperative channel and rotate drum to this insulated position.
3. Short antenna terminals together with a jumper wire.
4. Connect a V.T.V.M. and oscilloscope as shown in Fig. 7.
5. Adjust output attenuator on sweep generator so that reading on V.T.V.M. is not in excess of one volt.
6. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.
7. Certain alignment steps will require a fixed 3 volt A.G.C. bias. When necessary, connect negative terminal of battery to the receiver A.G.C. line and positive terminal to receiver chassis. See Fig. 8 for convenient point of connection.

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR 42 Mc. & 45 Mc. — SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Detune 2nd IF transformer by soldering a short piece of wire or connecting a clip to pin 5 of V2 (6CB6, 2nd IF Amp.) Other end of wire or clip is left unconnected.	# 5 and # 6 3rd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 42 Mc., 43.5 Mc. & 44.9 Mc. — SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Remove detuning clip discussed in previous step. — Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 7 and # 8 2nd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 41.25 Mc. — SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 9 Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 47.25 Mc. — SWEEP GENERATOR Not Used	Same as above.	# 10 Adjacent Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 42.5 Mc. & 44.5 Mc. — SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 11 2nd IF Grid Coil and # 12 1st IF Plate Coil (See Fig. 9)	Adjust trimmers for maximum amplitude bandwidth and correct positioning of markers as shown. 

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

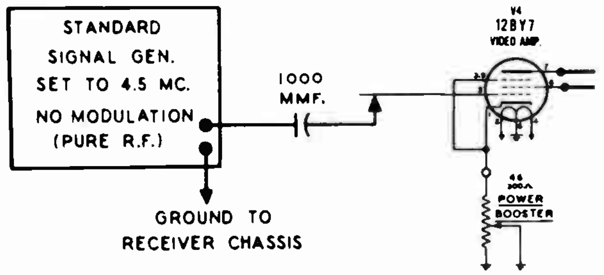


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

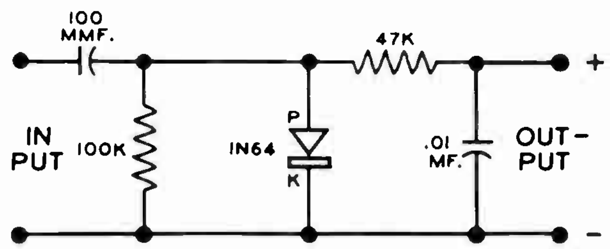


FIG. 3
Circuit Diagram for Crystal Detector shown in Fig. 2

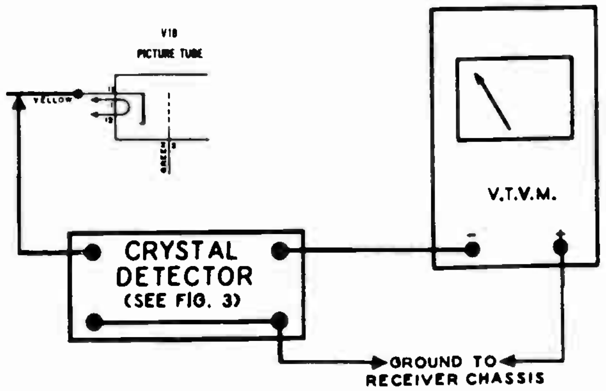


FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

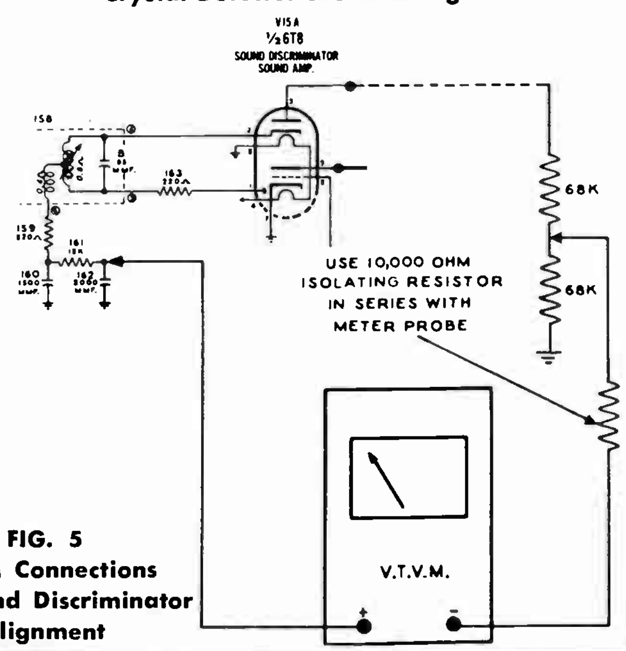
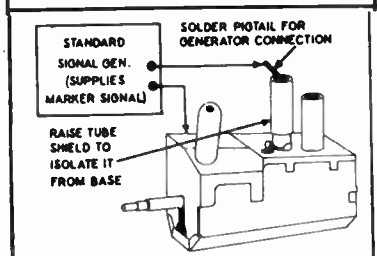
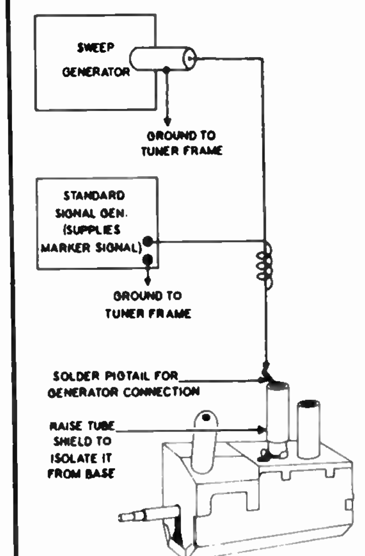
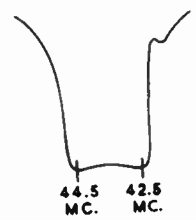
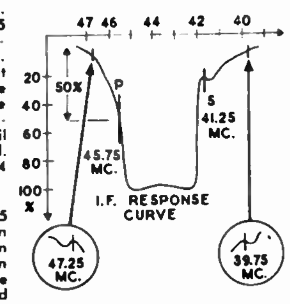


FIG. 5
VTVM Connections for Sound Discriminator Alignment

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR **39.75 Mc.** SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 13 Adjacent Picture IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR **42.5 Mc. & 44.5 Mc.** SWEEP GENERATOR **45 Mc.** Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 14 1st IF Grid Coil (See Fig. 9) #15 Converter Plate Coil (See Fig. 10)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR **39.75 Mc., 41.25 Mc., 45.75 Mc. & 47.25 Mc.** SWEEP GENERATOR **45 Mc.** Sweep Width 10 Mc.	Same as above.	The general shape of the overall IF response curve and position of markers should compare with that shown. The picture carrier marker (45.75 Mc.) should appear at approximately the 50% amplitude position. Should this observation fail to meet the above requirement, it will be necessary to make a small change in the setting of one or a combination of the following trimmers until the desired results are achieved. Trimmers, # 5, 6, 7, 8, 11, 12, 14 and slug 15. The sound carrier marker (41.25 Mc.) should appear at the position shown on the curve. If the position of this marker is not correct, then it will be necessary to readjust the setting of trimmer # 9 as explained previously in this procedure.	

To properly observe the position of the adjacent channel picture carrier (39.75 Mc.) and the adjacent channel sound carrier (47.25 Mc.), it will be necessary to increase the vertical gain control on the 'scope and the output of the sweep and standard signal generators. Also, be sure to disconnect the 3 volt AGC battery from receiver. If these markers do not compare favorably with that shown, repeat the adjustment of trimmers # 10 and 13 as explained previously in this procedure, exercising greater care in obtaining a minimum reading on the VTVM.

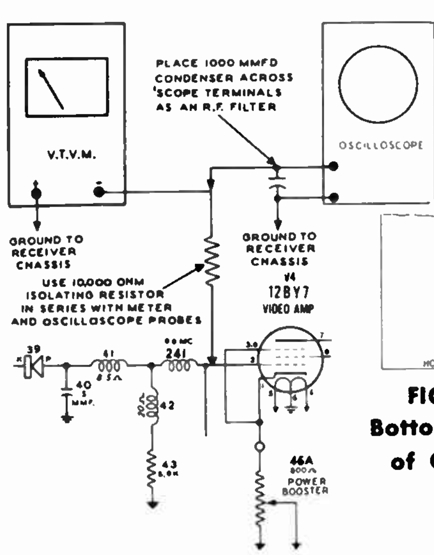


FIG. 7
VTVM and Oscilloscope Connections for IF Channel Alignment

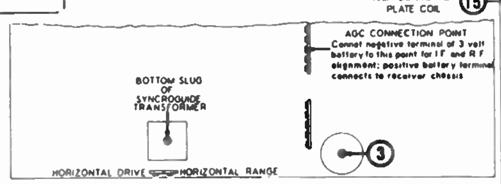


FIG. 8
Bottom View of Chassis

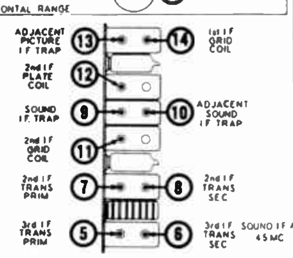


FIG. 9
View of IF Strip

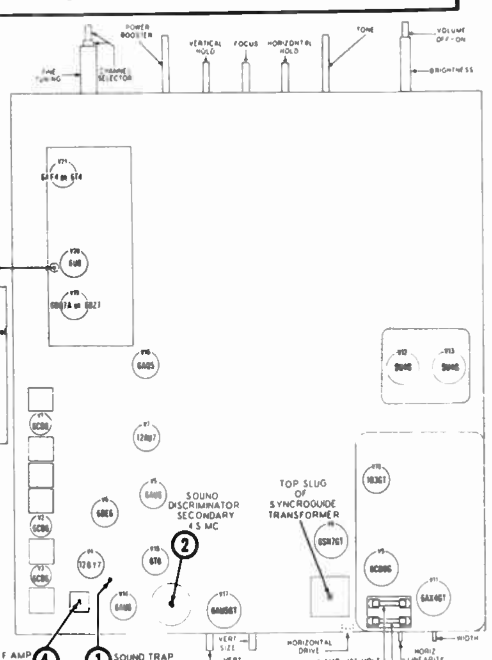


FIG. 10
Top View of Chassis

VHF RF CHANNEL ALIGNMENT PROCEDURE

The procedure listed is only for the VHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the RF Tuner, part 521150, must be returned to the factory.

1. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 8 for convenient point of connection.)
2. During alignment, it is necessary to set the Fine Tuning control so that Fine Tuning Quadrant is in the center of its range (correct position shown in Fig. 17).

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR CONNECTIONS	SWEEP GENERATOR FREQ.	VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 11.	197.75 MC. Sound Carrier 193.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #10	Not used.	Connect as shown in Fig. 12.	Set tuner to receive channel #10 by rotating center shaft to the V.H.F. position and inner shaft to channel #10. (See flat position on shafts in Fig. 17) IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	#16 Mixer Grid. (See Fig. 18) #17 RF Amp. Plate. (See Fig. 18) #18 RF Amp. Grid. (See Fig. 18)	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 15. Use Mixer Grid trimmer #16 and RF Amplifier Plate trimmer #17 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #18 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. IMPORTANT: When adjusting trimmers #16, 17 and 18 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Not used.	Same as above.	Set channel selector to channel being observed.	The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #16, 17 and 18. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. Band pass characteristic of these channels should conform close to the RF response curve in Fig. 15. If necessary, a compromise may be obtained to compensate for large variations in channel response by returning to channel #10 and making slight changes in the settings of trimmers #16, 17 and 18.	
OSCILLATOR ALIGNMENT								

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in IF alignment procedure.
2. During this step and thru-out all succeeding steps it is necessary to keep output of sweep generator at a level that does not allow reading on VTVM to exceed one volt.
3. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR CONNECTIONS	SWEEP GENERATOR FREQ.	VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 11.	197.75 MC. Sound Carrier Marker. 193.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #10	Connect as shown in Fig. 13.	Connect as shown in Fig. 13.	Set tuner to receive channel #10 by rotating center shaft to the V.H.F. position and inner shaft to channel #10. (See flat position on shafts in Fig 17) Be sure that generator's output does not exceed voltage specified in instructions #2 and 3 above.	#19 Oscillator Trimmer (See Fig. 18)	Before undertaking this adjustment, position oscillator slug, located in channel #10 R.F. and Mixer and Oscillator Strip, to the center of its range. Also set Fine Tuning Quadrant to the center of its range as shown in Fig. 17. Adjust Oscillator Trimmer #19 to shift response curve so that picture carrier marker is located at the position indicated in Fig. 16. Position of sound carrier marker should appear as indicated in Fig. 16.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Same as above.	Same as above.	Set channel selector to channel being observed.		Adjust the R.F. sweep generator and marker generator for operation on the other television channels and set Channel Selector to corresponding channel. Using a long, non-metallic screwdriver (approx. 12"), adjust oscillator slug thru hole on front of R.F. Tuner Unit (see Fig. 17). This permits response curve to be shifted so that picture and sound carrier markers will appear at the position indicated in Fig. 16. NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 17).

If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel. If characteristic does not conform reasonably well within the typical curve shown in Fig. 15, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

INSTRUMENT CONNECTIONS FOR R.F. CHANNEL ALIGNMENT

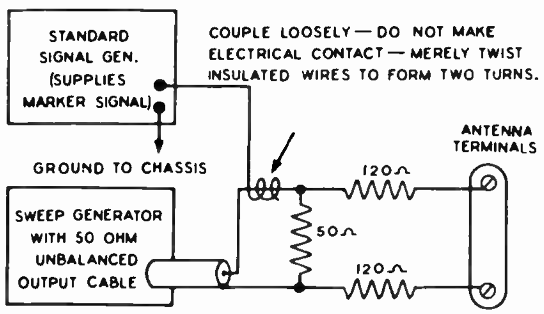


FIG. 11
Generator Connections for RF Channel Alignment

CHANNEL NUMBER	PICTURE CARRIER MARKER FREQ.	SOUND CARRIER MARKER FREQ.
13	211.25 MC.	215.75 MC.
12	205.25 MC.	209.75 MC.
11	199.25 MC.	203.75 MC.
10	193.25 MC.	197.75 MC.
9	187.25 MC.	191.75 MC.
8	181.25 MC.	185.75 MC.
7	175.25 MC.	179.75 MC.
6	83.25 MC.	87.75 MC.
5	77.25 MC.	81.75 MC.
4	67.25 MC.	71.75 MC.
3	61.25 MC.	65.75 MC.
2	55.25 MC.	59.75 MC.

FIG. 14

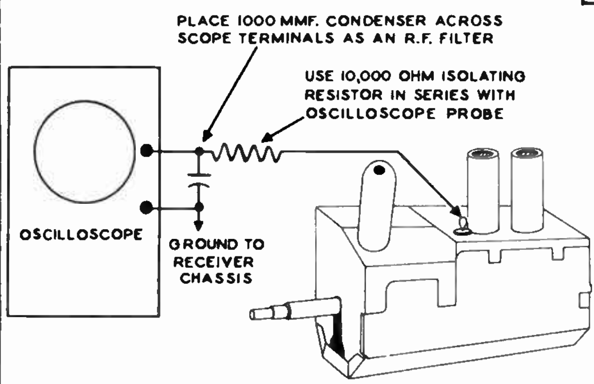


FIG. 12
Oscilloscope Connections for RF Amp. and Mixer Alignment

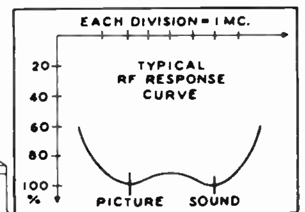


FIG. 15

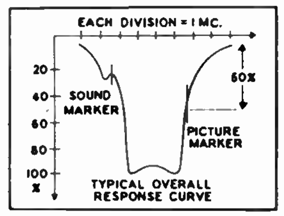


FIG. 16

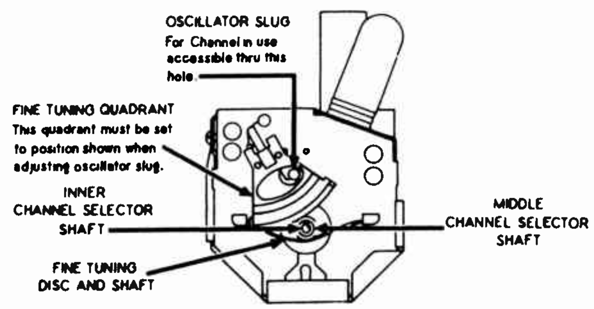


FIG. 17
Front View of RF Tuner Unit

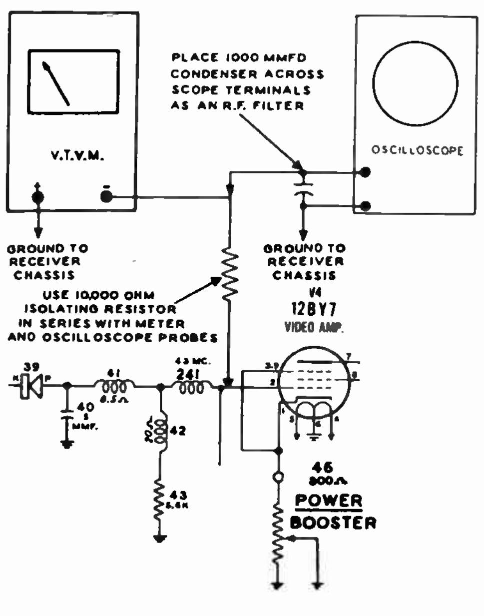


FIG. 13
VTVM and Oscilloscope Connections for Oscillator Alignment

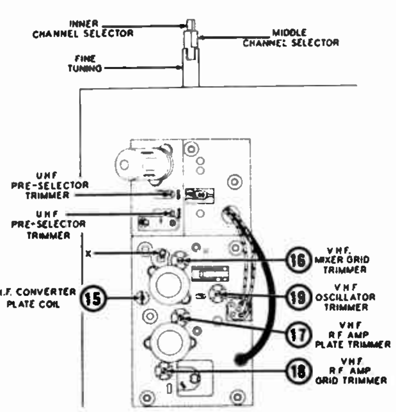


FIG. 18
Trimmer Location of RF Tuner

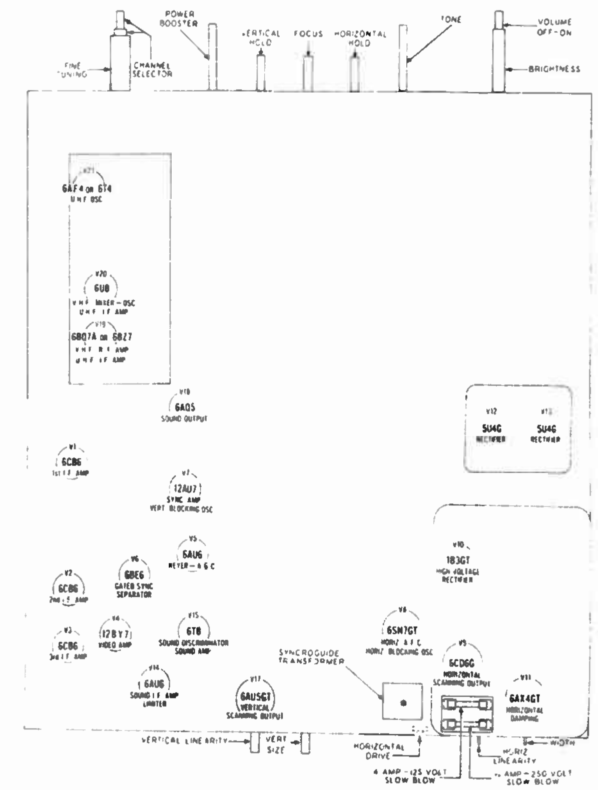
PRODUCTION CHANGES

The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. The coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D".

The circuit shown on this page applies to "SERIES ABCDEF" chassis

A letter following the component circuit diagram number thus—201A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
UNCODED	INITIAL PRODUCTION
"A"	The following change was incorporated to facilitate the inclusion of condenser 240 within the 1st I.F. coil can. When this modification is made, the complete I.F. strip, part 521816, is changed to part 522088. 1. Relocate condenser 240 from the junction of 1st I.F. Coil and Adjacent Picture I.F. Trap to the grid side of the 1st I.F. Coil and change its value from 470 Mmfd. to 680 Mmfd.
"B"	The following change was incorporated to improve sync. stability in the presence of electrical interference or weak signal. 1. Disconnect resistor 94 (18,000 Ohms) from the plate of tube V4-12BY7 (Video Amp.), and reconnect it to the junction of resistors 54 (2200 Ohms) and 55 (1800 Ohms) located in plate load circuit of tube V4. Note: The sound take-off for tube V14 (Sound I.F. Amp.) remains connected to the plate of tube V4 (Video Amp.) The following change was incorporated to provide for adequate width of the picture under the condition of low line voltage. 1. Change resistor 88 in 270 volt supply from 400 Ohms to 200 Ohms. The following change was incorporated to provide a greater margin of safety for the plate load resistor of tube V7A (12AU7). 1. Change resistor 105 located in plate circuit of tube V7A (Sync. Amp.) from 4700 Ohms 1/2 watt to 4700 Ohms 1 watt.
"C"	The following change was incorporated to protect resistor 88, located in the 270 volt supply, in the event of abnormal current drain in the high voltage system. 1. Change fuse 149 in the horizontal sweep circuit from a 1/2 Amp. 250 volt to a 1/4 Amp. "Slow Blow" 250 volt.
"D"	The following changes were incorporated to improve the range of the horizontal hold control. 1. Change resistor 120, located in the plate circuit of tube V7A (Horiz. A.F.C.) from 22,000 Ohms to 68,000 Ohms. 2. Change resistor 124 located in the plate circuit of tube V7A (Horiz. A.F.C.) from 68,000 Ohms to 120,000 Ohms. The above change should only be undertaken when the letter "B" is included in the SERIES designation at rear of chassis.
"E"	The following change was incorporated to protect the filament winding of power transformer 76 that connects to the 6AX4GT (Horiz. Damping) in the event this tube develops a cathode to filament short. 1. Change resistor 83, located in filament supply, from 100,000 Ohms to 18,000 Ohms, 2 watt.
"F"	The following changes were incorporated to improve picture quality by reducing the noise level (snow) in Video Amp. system. 1. Add resistor 242 (6800 Ohms) in parallel with peaking coil 41 located in grid circuit of V4 (Video Amp.) 2. Change peaking coil 42 located in grid circuit of tube V4 (Video Amp.) from part 520985 (double pi, coded with green dot) to part 509341 (single pi, coded with green dot). 3. Change peaking coil 51 located in plate circuit of tube V4 (Video Amp.) from part 520689 (single pi, coded with purple dot) to part 520984 (single pi, coded with red dot). 4. Change resistor 52 located across peaking coil 51 in plate circuit of V4 (Video Amp.) from 12,000 Ohms to 15,000 Ohms. 5. Change peaking coil 53 located in plate circuit of tube V4 (Video Amp.) from part 509342 (single pi, coded with yellow dot) to part 509340 (single pi, coded with white dot).



TUBE AND CONTROL LOCATIONS

VOLTAGE MEASUREMENTS

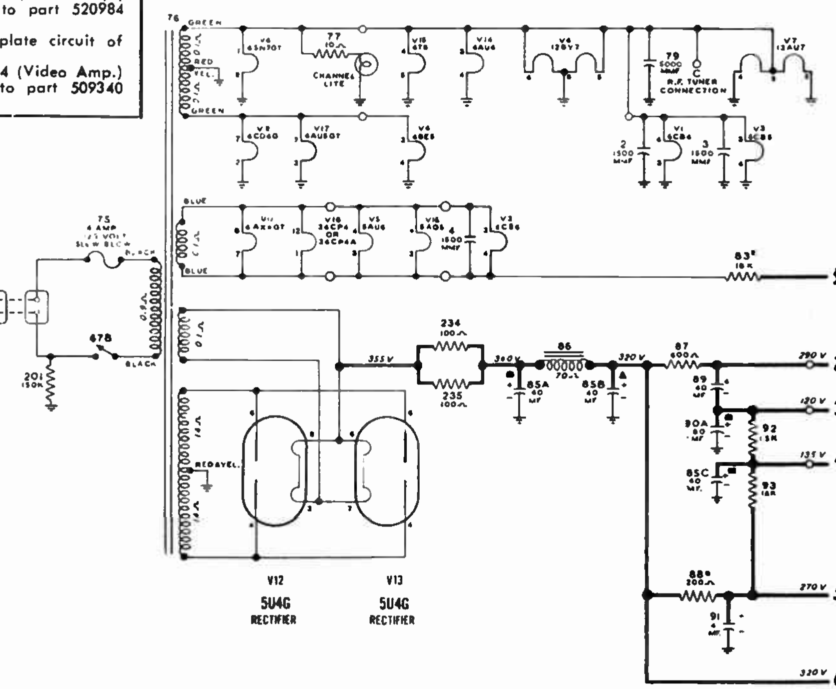
All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

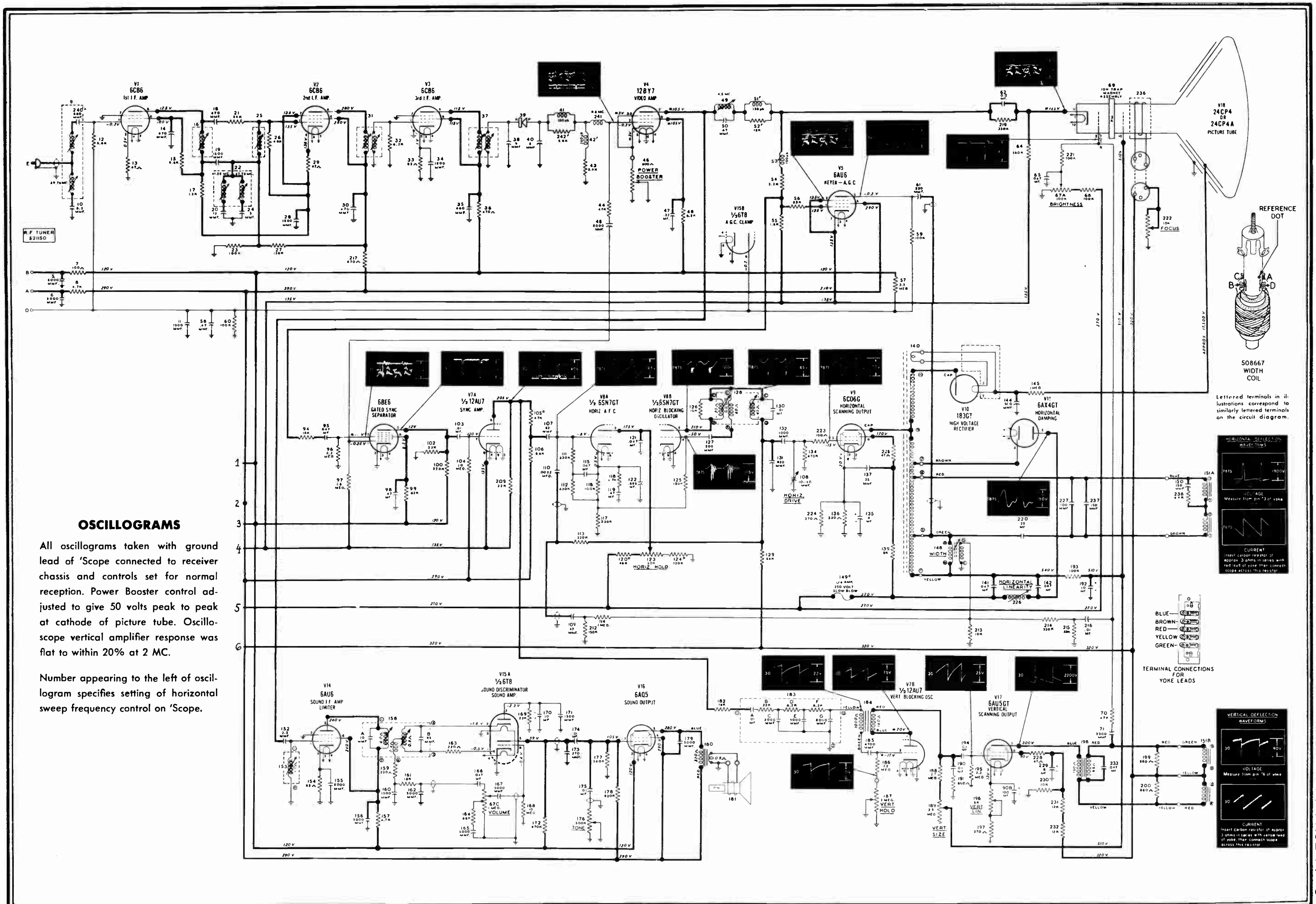
Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception—Power Booster control completely counterclockwise.

Voltages marked with an asterisk (*) will vary widely with control settings.

No voltage reading at a tube element indicate zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.





OSCILLOGRAMS

All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Power Booster control adjusted to give 50 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within 20% at 2 MC.

Number appearing to the left of oscillogram specifies setting of horizontal sweep frequency control on 'Scope.

PARTS LIST

DIA-GRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
		CONDENSERS	
2	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
3	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
4	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
5	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
6	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
10	513455	Condenser—ceramic 8.2 Mmfd. ±5% 400 volt (Temperature compensating)	.25
11	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
14	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
18	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
19	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.45
20	513448	Condenser—ceramic 12 Mmfd. ±5% 500 volt (Temperature compensating)	1.05
24	513449	Condenser—ceramic 5 Mmfd. ±1% 500 volt (Temperature compensating)	1.05
28	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
30	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
34	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
35	513044	Condenser—ceramic 680 Mmfd. 400 volt	.25
38	513454	Condenser—ceramic 4 Mmfd. ±1% 500 volt (Temperature compensating)	.25
40	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
45	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
47	512238	Condenser—.22 Mfd. 200 volt	.50
50	513438	Condenser—ceramic 47 Mmfd. ±5% 500 v. (Temperature compensating)	.45
58	512239	Condenser—.47 Mfd. 200 volt	.75
61	513032	Condenser—ceramic 220 Mmfd. 1000 volt	.40
62	512216	Condenser—.1 Mfd. 200 volt	.30
65	512235	Condenser—.047 Mfd. 200 volt	.30
71	512520	Condenser—mica 3300 Mmfd. ±2% 500 volt	1.30
79	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
85-A,B,C	508072	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—40 Mfd. 450 volt	4.50
89	160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
90-A,B	509002	Condenser—electrolytic A—80 Mfd. 250 volt B—100 Mfd. 50 volt	3.00
91	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
95	512235	Condenser—.047 Mfd. 200 volt	.30
98	512239	Condenser—.47 Mfd. 200 volt	.75
103	512205	Condenser—.01 Mfd. 400 volt	.25
107	513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
108	508071	Condenser—trimmer 10-160 Mmfd. (Horizontal Drive)	.40
109	513030	Condenser—ceramic 47 Mmfd. 1000 volt	.40
110	512232	Condenser—.0022 Mfd. 400 volt	.25
115	512235	Condenser—.047 Mfd. 200 volt	.30
119	512239	Condenser—.47 Mfd. 200 volt	.75
121	512236	Condenser—.047 Mfd. 400 volt	.30
122	512233	Condenser—.022 Mfd. 400 volt	.30
127	513427	Condenser—ceramic 200 Mmfd. ±2% 500 v. (Temperature compensating)	.65
130	512311	Condenser—.01 Mfd. 400 volt (Special Characteristic)	.30
131	512547	Condenser—mica 820 Mmfd. ±5% 500 volt	.50
132	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
135	520921	Condenser—electrolytic 4 Mfd. 150 volt	1.20
137	512223	Condenser—.25 Mfd. 400 volt	.60
141	512236	Condenser—.047 Mfd. 400 volt	.30
142	512236	Condenser—.047 Mfd. 400 volt	.30
144	521737	Condenser—ceramic 500 Mmfd. 30,000 volt	4.00
150	513042	Condenser—ceramic 150 Mmfd. ±5% 2000 v.	.30
152	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
155	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
156	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
158-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
158-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
160	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30

DIA-GRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
162	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
165	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
166	512235	Condenser—.047 Mfd. 200 volt	.30
167	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
170	505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
171	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
173	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
174	512205	Condenser—.01 Mfd. 400 volt	.25
175	512204	Condenser—.01 Mfd. 200 volt	.25
179	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
183-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
183-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
185	512533	Condenser—mica 4700 Mmfd. ±5% 1000 v.	1.40
190	512218	Condenser—.1 Mfd. 600 volt	.55
192	508680	Condenser—electrolytic 10 Mfd. 600 volt	2.55
194	512218	Condenser—.1 Mfd. 600 volt	.55
216	512204	Condenser—.01 Mfd. 200 volt	.25
220	512223	Condenser—.25 Mfd. 400 volt	.60
227	513043	Condenser—ceramic 100 Mmfd. ±10% 3000 volt	.30
229	507386	Condenser—electrolytic 8 Mfd. 300 volt	1.25
233	512237	Condenser—.047 Mfd. 600 volt	.40
237	513042	Condenser—ceramic 150 Mmfd. ±5% 2000 v.	.30
240	513044	Condenser—ceramic 680 Mmfd. 350 volt (used when letter "A" is included in series designation at rear of chassis)	.25
	513008	Condenser—ceramic 470 Mmfd. 350 volt (used when letter "A" is not included in series designation at rear of chassis)	.30
		RESISTORS	
7	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
8	510348	Resistor—carbon 4700 Ohms ±10% 2 watt	.25
12	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
13	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
15	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
17	510138	Resistor—carbon 1200 Ohms ±10% ½ watt	.12
21	510783	Resistor—carbon 24,000 Ohms ±5% ½ watt	.30
23	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
26	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
27	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
29	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
32	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
33	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
36	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
43	510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
44	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
48	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
52	510744	Resistor—carbon 15,000 Ohms ±5% ½ watt (used when letter "F" is included in series designation at rear of chassis)	.16
	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt (used when letter "F" is not included in series designation at rear of chassis)	.16
54	510242	Resistor—carbon 2200 Ohms ±10% 1 watt	.16
55	510141	Resistor—carbon 1800 Ohms ±10% ½ watt	.12
56	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
57	510701	Resistor—carbon 3.3 Meg. ±10% ½ watt	.12
59	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
60	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
64	510186	Resistor—carbon 560,000 Ohms ±10% ½ w.	.12
68	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
70	510167	Resistor—carbon 47,000 Ohms ±10% ½ watt	.12
77	510101	Resistor—carbon 10 Ohms ±10% ½ w.	.12
83	510359	Resistor—carbon 18,000 Ohms ±10% 2 watt (used when letter "E" is included in series designation at rear of chassis)	.25
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "E" is not included in series designation at rear of chassis)	.12
87	510741	Resistor—wire wound 600 Ohms ±10% 10 w.	.90
88	510792	Resistor—wire wound 200 Ohms ±10% 10 watt (used when letter "B" is included in series designation at rear of chassis)	.90
	510779	Resistor—wire wound 400 Ohms ±10% 10 watt (used when letter "B" is not included in series designation at rear of chassis)	.75
92	510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
93	510357	Resistor—carbon 15,000 Ohms ±10% 2 w.	.35
94	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
96	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
97	510752	Resistor—carbon 1.5 Meg. ±10% ½ watt	.12
99	510171	Resistor—carbon 82,000 Ohms ±10% ½ w.	.12
100	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
102	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
104	510197	Resistor—carbon 10 Meg. ½ watt	.12

DIA-GRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
105	510248	Resistor—carbon 4700 Ohms ±10% 1 watt (used when letter "B" is included in series designation at rear of chassis)	.16
	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "B" is not included in series designation at rear of chassis)	.12
106	510251	Resistor—carbon 6800 Ohms ±10% 1 watt	.16
111	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
112	510189	Resistor—carbon 820,000 Ohms ±10% ½ w.	.12
113	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
114	510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
116	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
117	510281	Resistor—carbon 330,000 Ohms ±10% 1 w.	.16
118	510148	Resistor—carbon 4700 Ohms ±10% ½ watt	.12
120	510169	Resistor—carbon 68,000 Ohms ±10% ½ w. (used when letter "D" is included in series designation at rear of chassis)	.12
	510160	Resistor—carbon 22,000 Ohms ±10% ½ w. (used when letter "D" is not included in series designation at rear of chassis)	.12
124	510174	Resistor—carbon 120,000 Ohms ±10% ½ w. (used when letter "D" is included in series designation at rear of chassis)	.12
	510169	Resistor—carbon 68,000 Ohms ±10% ½ w. (used when letter "D" is not included in series designation at rear of chassis)	.12
125	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
126	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
129	510269	Resistor—carbon 68,000 Ohms ±10% 1 w.	.16
134	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
136	510327	Resistor—carbon 330 Ohms ±10% 2 watt	.25
139	510789	Resistor—wire wound 8000 Ohms ±10% 5 w.	.95
145	510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
154	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
157	510249	Resistor—carbon 4700 Ohms 1 watt	.16
159	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
161	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
163	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
164	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
168	510197	Resistor—carbon 10 Meg. ½ watt	.12
169	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
172	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
177	510778	Resistor—carbon 560,000 Ohms ±5% ½ w.	.16
178	510747	Resistor—carbon 820,000 Ohms ±5% ½ w.	.20
182	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
183-B	508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
183-D	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
183-F	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
186	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt	.12
188	510772	Resistor—carbon 2.7 Meg. ±5% ½ watt	.12
191	510134	Resistor—carbon 680 Ohms ½ watt	.12
193	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
195	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
197	510126	Resistor—carbon 270 Ohms ±10% ½ watt	.12
199	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
200	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
201	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
209	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
212	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
213	510254	Resistor—carbon 10,000 Ohms ±10% 1 watt	.16
214	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
215	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
217	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
219	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
221	510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
223	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
224	510326	Resistor—carbon 270 Ohms ±10% 2 watt	.25
225	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
228	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
230	510254	Resistor—carbon 10,000 Ohms ±10% 1 watt	.16
231	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
232	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
234	510781	Resistor—wire wound 100 Ohms ±10% 5 w.	.75
235	510781	Resistor—wire wound 100 Ohms ±10% 5 w.	.75
238	510248	Resistor—carbon 4700 Ohms ±10% 1 watt	.16
242	510151	Resistor—carbon 6800 Ohms ±10% ½ watt (used when letter "F" is included in series designation at rear of chassis)	.12
		COILS AND TRANSFORMERS	
9	*	Coil—1st I.F. grid and Adjacent Picture I.F. Trap	—
16	*	Coil—1st I.F. plate	—
22	*	Trap—sound I.F. and Adjacent Sound I.F.	—
25	*	Coil—2nd I.F. Grid	—
31	*	Transformer—2nd I.F.	—
37	*	Transformer—3rd I.F.	—
41	520620	Coil—peaking (single pi, coded with black dot)	.65

DIA-GRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
42	509341	Coil—peaking (single pi, coded with green dot) (used when letter "F" is included in series designation at rear of chassis)	.60
	520985	Coil—peaking (double pi, coded with green dot) (used when letter "F" is not included in series designation at rear of chassis)	.65
49	509603	Coil—4.5 Mc. trap (includes slug and condenser #50)	1.20
	507357	Slug core for 4.5 Mc. trap coil	.20
51	520984	Coil—peaking (single pi, coded with red dot) (used when letter "F" is included in series designation at rear of chassis)	.50
	520689	Coil—peaking (single pi, coded with purple dot) (used when letter "F" is not included in series designation at rear of chassis)	.65
53	509340	Coil—peaking (single pi, coded with white dot) (used when letter "F" is included in series designation at rear of chassis)	.55
	509342	Coil—peaking (single pi, coded with yellow dot) (used when letter "F" is not included in series designation at rear of chassis)	.60
76	521725	Transformer—power	20.00
86	508341	Choke—filter	3.60
128	520943	Transformer—syncroguide	2.50
	521064	Slug core for syncroguide transformer	.70
140	521735	Transformer—horizontal output (includes resistor 145)	14.00
148	508667	Coil—Width (includes slug and clip)	1.75
	508784	Slug core for Width coil (includes mtg. clip)	.65
151-A,B	115423	Yoke—picture tube deflection (includes leads, connectors, resistor 238 and condenser 150)	21.00
153	509378	Transformer—audio take-off	1.50
158	509706	Transformer—TV sound discriminator (includes condensers 158A and 158B)	3.00
180	509376	Transformer—audio output	1.85
184	520980	Transformer—vertical blocking oscillator	1.90
198	520975	Transformer—vertical output (includes connectors for deflection yoke leads)	4.00
226	520911	Coil—Horizontal Linearity (includes slug and clip	1.50
236	162326	Coil—focus (includes cable and plug)	14.00
241	522020	Coil—43 Mc. trap	.50
		CONTROLS	
46	521057	Power Booster (Contrast) potentiometer (300 Ohms ½ watt)	1.00
67-A,B,C	521989	Volume and Brightness potentiometers (includes On-Off switch) A—Brightness (100,000 Ohms ¼ watt) B—On-Off Switch C—Volume (1 Meg. ¼ watt)	2.50
108	508071	Horizontal Drive Condenser (10-160 Mmfd.)	.40
123	521059	Horizontal Hold potentiometer (50,000 Ohms ¼ watt)	2.00
148	508667	Width coil (includes slug and clip)	1.75
	508784	Slug for width coil (includes mtg. clip)	.65
176	520746	Tone potentiometer (500,000 Ohms ¼ watt)	1.00
187	521058	Vertical Hold potentiometer (1 Meg. ¼ w.)	1.00
189	520944	Vertical Size potentiometer (2.5 Meg. ¼ w.)	.80
196	520945	Vertical Linearity potentiometer (5000 Ohms ½ watt)	.90
222	521727	Focus potentiometer (10,000 Ohms 4 watt)	2.00
226	520911	Horizontal Linearity coil (includes slug and clip)	1.50
	115444	Switch-antenna (includes terminal board)	2.50
		OTHER ELECTRICAL PARTS	
39	509386	Crystal detector	1.00
69	521183	Ion trap	1.00
75	521803	Fuse; 4 amp. 125 volt "Slow Blow"	.25
78	118921	Channel lite (Mazda #47) 6-8V. 150 Ma.	.15
149	522320	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt "Slow Blow" (used when letter "C" is included in series designation at rear of chassis)	.25
	521752	Fuse for horizontal sweep circuit; ½ Amp. 250 volt (used when letter "C" is not included in series designation at rear of chassis)	.20
181	508174	Speaker—P.M. Dynamic (6"x9")	8.40
183-A to G	508062	Integrator unit (includes all condensers and resistors from 183-A to 183-G)	1.40
	522088	I.F. printed circuit complete with tubes, transformers, condensers and resistors (used when letter "A" is included in series designation at rear of chassis)	20.00
	521816	I.F. printed circuit complete with tubes, transformers, condensers and resistors (used when letter "A" is not included in series designation at rear of chassis)	20.00
	521150	R.F. Tuner; V.H.F. channels 2-13 and U.H.F. channels 14-83 (includes tubes and tuning coils)	85.00

*—This part is not supplied as a Service replacement item.

ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

27" Rectangular Picture Tube
Model 27C-9350A (Mahogany)
Model 27C-9350AB (Blond)

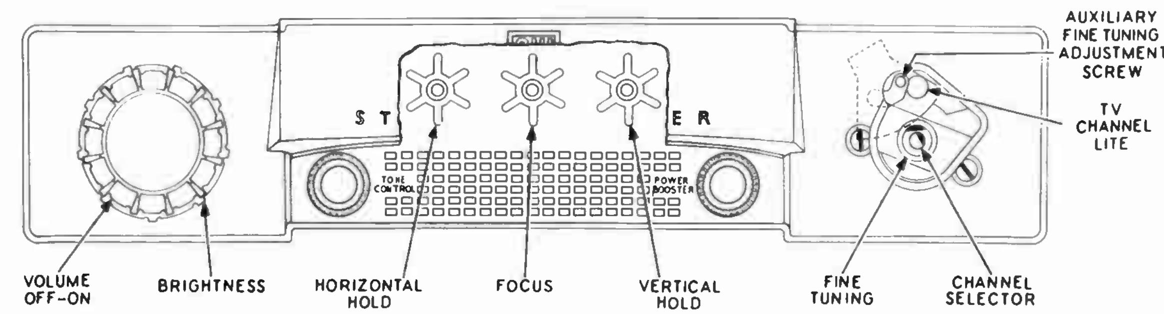


Fig. 14—LOCATIONS OF PRE-SET CONTROLS

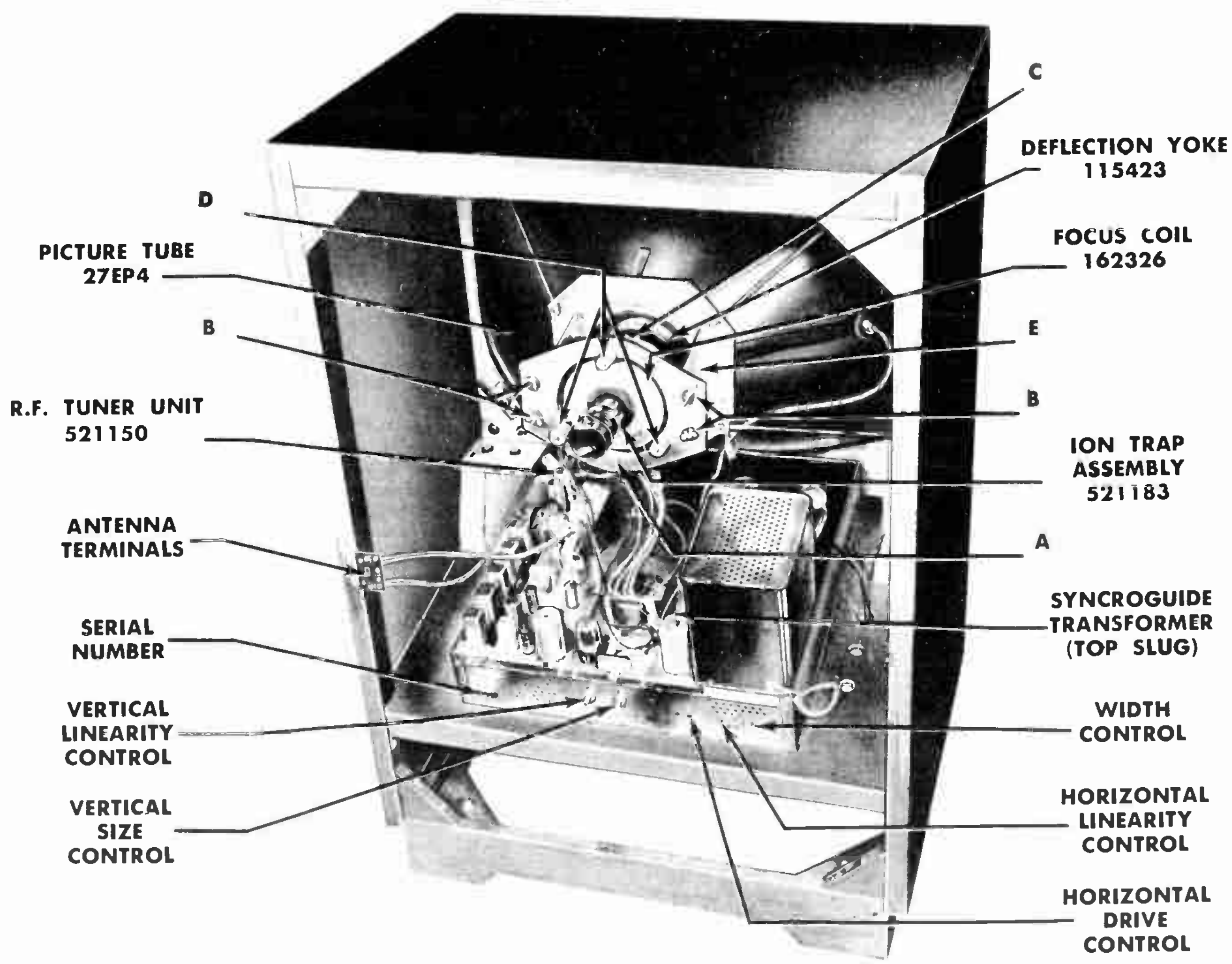


Fig. 21—CHASSIS AND PICTURE TUBE ASSEMBLY

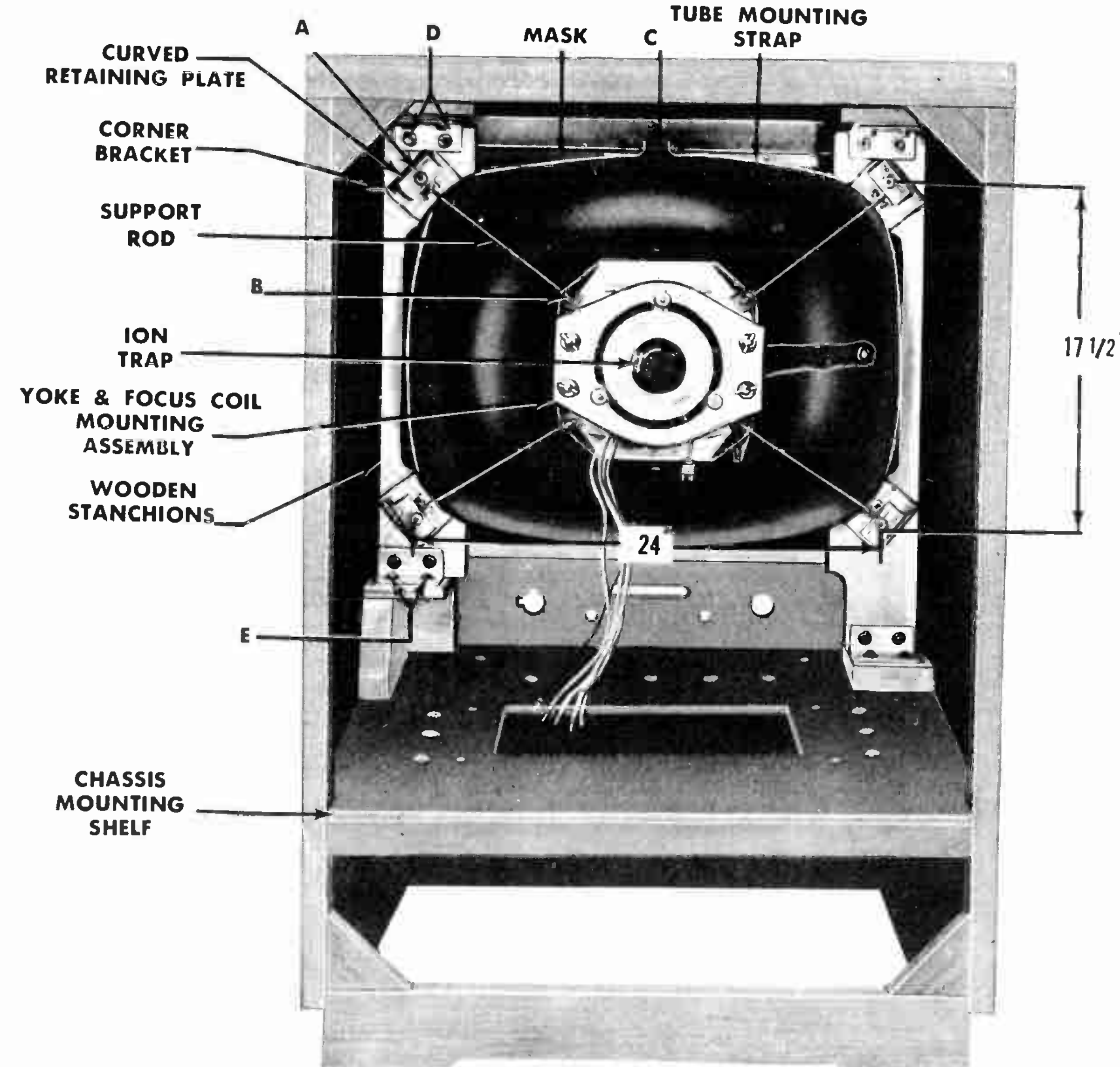


Fig. 24—PICTURE TUBE MOUNTING

GENERAL SPECIFICATIONS

DIMENSIONS

Model	Height	Width	Depth
27C-9350A	42¾"	29¼"	23¼"
27C-9350AB	42¾"	29¼"	23¼"

WEIGHT (packed)

Model	Weight
27C-9350A	210 lbs.
27C-9350AB	210 lbs.

POWER REQUIREMENTS

117 volts 60 cycles 275 watts

SPEAKER

Model	Type	Size	V.C. Imped.
27C-9350A	P.M. Dynamic	6" x 9"	3.2 ohms
27C-9350AB	P.M. Dynamic	6" x 9"	3.2 ohms

INTERMEDIATE FREQUENCIES

Sound Carrier—41.25 Mc.
Picture Carrier—45.75 Mc.

I.F. SYSTEM

Three Stages—overcoupled—for composite signal.
One additional stage for sound channel.

DEFLECTION

Magnetic

FOCUS

Magnetic

R.F. TUNER

Turret type construction; individually removable coil assemblies for 83 channels.

ALIGNMENT PROCEDURE

The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits.

Alignment of all VHF RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts.

These procedures should preferably be applied in the order in which they are presented. Alignment of Sound Channel or IF Channel may be accomplished individually if desired.

The VHF RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned.

CAUTION

The picture tube is highly evacuated and if broken fragments will be violently expelled. Handle with care.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated.

   a. IF Frequencies:
   4.5 Mc. Sound Channel
   39.75 Mc. to 47.25 Mc. IF Channel

   b. RF Frequencies:
   54 to 88 Mc.
   174 to 216 Mc.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the RF Tuner, part 521150, must be returned to the factory.

2. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.

3. **RF SWEEP GENERATOR** to provide frequency modulated signal for observing the over-all bandpass characteristic and RF Channel alignment at the following frequencies:

   40 to 50 Mc. with 10 Mc. sweep width.
   54 to 88 Mc. with 10 Mc. sweep width.
   174 to 216 Mc. with 10 Mc. sweep width.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the RF Tuner, part 521150, must be returned to the factory.

4. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe. This instrument is used for IF and RF Channel alignment and for observing the over-all band-pass characteristic.

SOUND CHANNEL ALIGNMENT PROCEDURE

1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and Power Booster control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. A small screwdriver (preferably non-metallic) can be used for alignment of Sound IF. The blade of this tool will fit the slot in the core of the transformer.

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Power Booster control to its maximum counter-clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in Fig. 3. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2. 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V1, V2 or V3). This will prevent noise in the RF stages from affecting the voltage reading while adjusting the sound trap.	**#1** 4.5 MC Sound Trap (See Fig. 10)	Adjust for minimum reading on VTVM.
Same as above	Same as above.	Connect as shown in Fig. 4.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This sourious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment af the sound channel.	**#2** Discriminatar Secondary (See Fig. 10)	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary (See Fig. 8)	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 5.	To obtain zero bolance af the discriminotar circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is nat critical. Connect the two resistars in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 5.	**#2** Discriminatar Secandary (See Fig. 10)	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from o positive to a negative reading or vice versa. The correct setting af slug #2 is abtained when the meter reads zero as the slug is moved thru this point.

Replace the type 6CB6 tube previously removed in the above procedure and turn set on. Tune in ta a local channel and should there be an unusual amount of "Intercarrier Buzz" refer to procedure on adjoining page to remove this aforementioned fault.

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

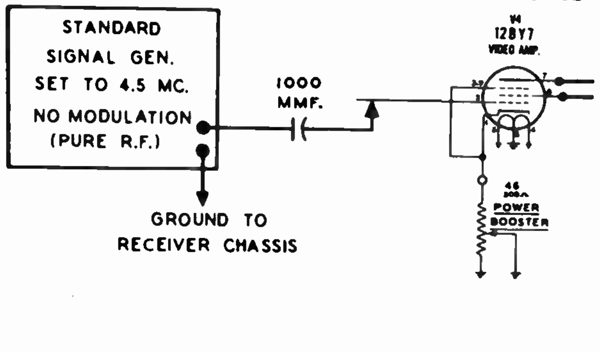


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

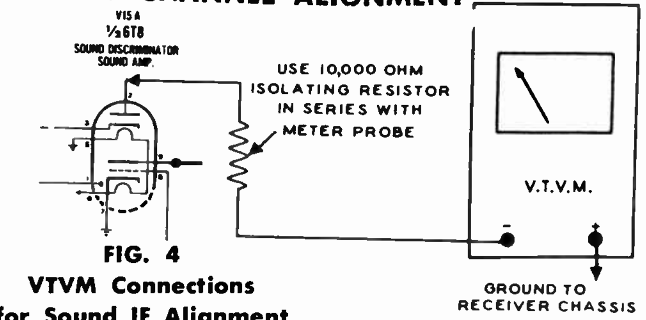


FIG. 4
VTVM Connections for Sound IF Alignment

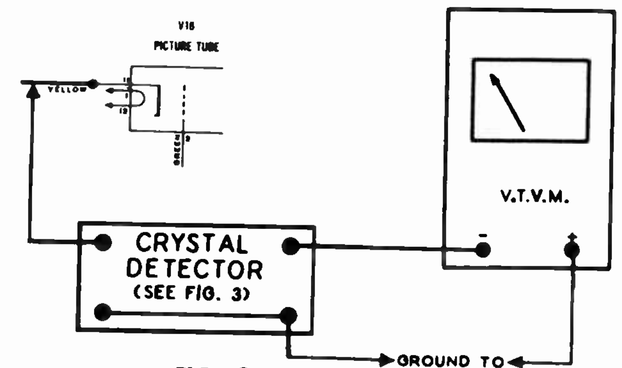


FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

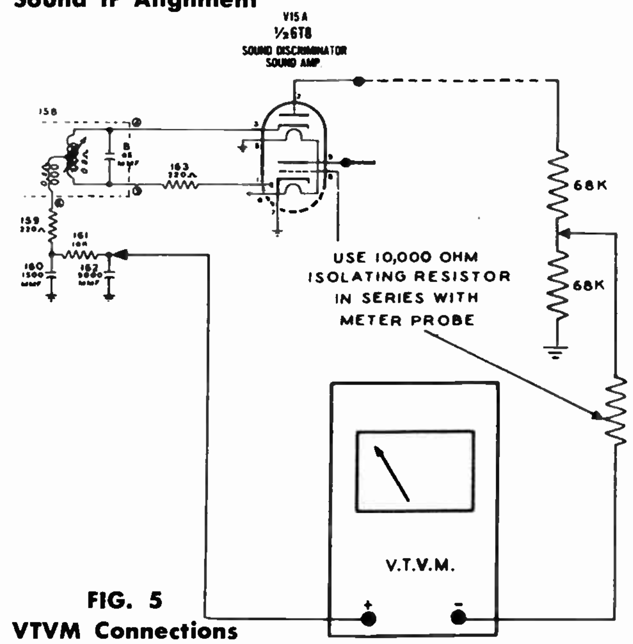


FIG. 5
VTVM Connections for Sound Discriminator Alignment

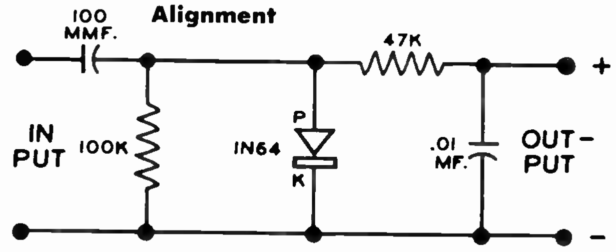


FIG. 3
Circuit Diagram for Crystal Detector shown in Fig. 2

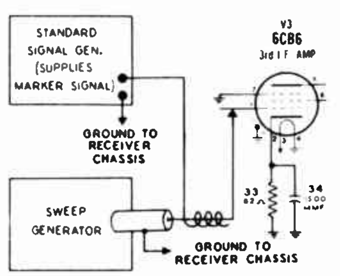
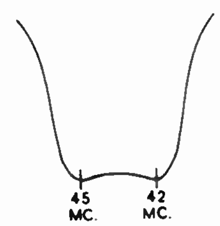
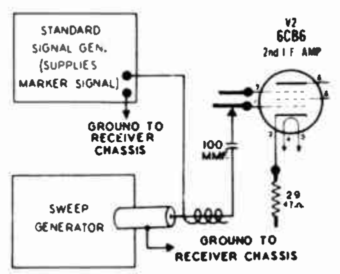
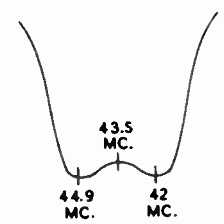
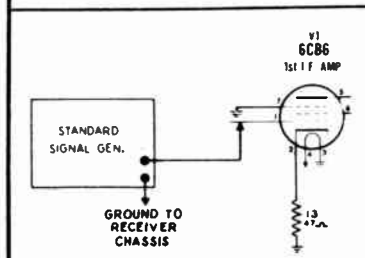
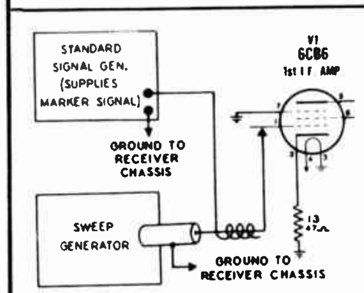
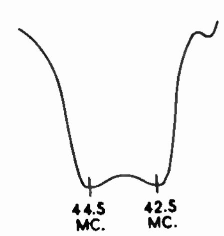
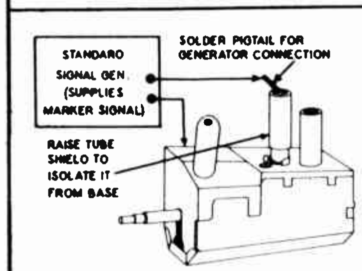
REDUCTION OF INTERCARRIER BUZZ

Under actual reception conditions slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under these conditions.

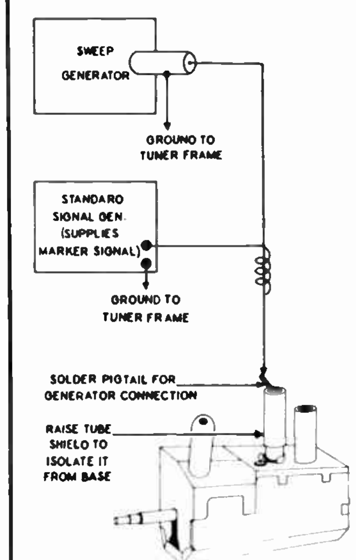
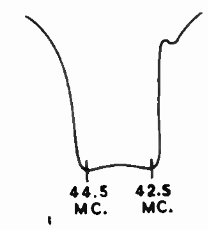
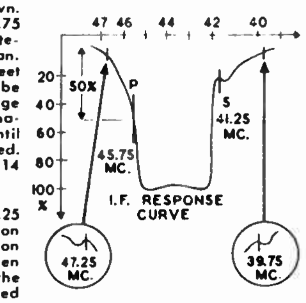
Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

IF CHANNEL ALIGNMENT PROCEDURE

1. A non-metallic screw driver must be used when adjusting the trimmers of the IF transformers to prevent a false indication.
2. In order to eliminate the possibility of spurious oscillation, it is desirable to render the VHF RF oscillator inoperative. This may be accomplished by insulating oscillator contacts on the tuner strips. Remove tuner bottom shield and place a piece of transparent cellulose tape on the first two contacts (from front) of drum assembly. Use any inoperative channel and rotate drum to this insulated position.
3. Short antenna terminals together with a jumper wire.
4. Connect a V.T.V.M. and oscilloscope as shown in Fig. 7.
5. Adjust output attenuator on sweep generator so that reading on V.T.V.M. is not in excess of one volt.
6. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.
7. Certain alignment steps will require a fixed 3 volt A.G.C. bias. When necessary, connect negative terminal of battery to the receiver A.G.C. line and positive terminal to receiver chassis. See Fig. 8 for convenient point of connection.

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR 42 Mc. & 45 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Detune 2nd IF transformer by soldering a short piece of wire or connecting a clip to pin 5 of V2 (6CB6, 2nd IF Amp.) Other end of wire or clip is left unconnected.	# 5 and # 6 3rd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 42 Mc., 43.5 Mc. & 44.9 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Remove detuning clip discussed in previous step. Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 7 and # 8 2nd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 41.25 Mc. SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 9 Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 47.25 Mc. SWEEP GENERATOR Not Used	Same as above.	# 10 Adjacent Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 42.5 Mc. & 44.5 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 11 2nd IF Grid Coil and # 12 1st IF Plate Coil (See Fig. 9)	Adjust trimmers for maximum amplitude bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 39.75 Mc. SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 13 Adjacent Picture IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.

IF CHANNEL ALIGNMENT PROCEDURE—Continued

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR 42.5 Mc. & 44.5 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 14 1st IF Grid Coil (See Fig. 9) #15 Converter Plate Coil (See Fig. 10)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 39.75 Mc., 41.25 Mc., 45.75 Mc. & 47.25 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Same as above.		The general shape of the overall IF response curve and position of markers should compare with that shown. The picture carrier marker (45.75 Mc.) should appear at approximately the 50% amplitude position. Should this observation fail to meet the above requirement, it will be necessary to make a small change in the setting of one or a combination of the following trimmers until the desired results are achieved. Trimmers, # 5, 6, 7, 8, 11, 12, 14 and slug 15.  The sound carrier marker (41.25 Mc.) should appear at the position shown on the curve. If the position of this marker is not correct, then it will be necessary to readjust the setting of trimmer # 9 as explained previously in this procedure. To properly observe the position of the adjacent channel picture carrier (39.75 Mc.) and the adjacent channel sound carrier (47.25 Mc.), it will be necessary to increase the vertical gain control on the 'scope and the output of the sweep and standard signal generators. Also, be sure to disconnect the 3 volt AGC battery from receiver. If these markers do not compare favorably with that shown, repeat the adjustment of trimmers # 10 and 13 as explained previously in this procedure, exercising greater care in obtaining a minimum reading on the VTVM.

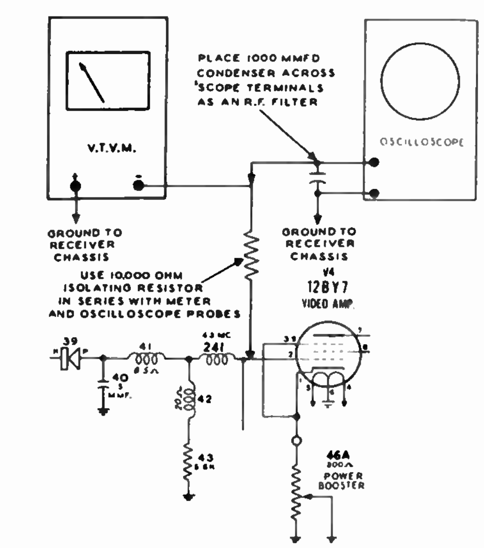


FIG. 7
VTVM and Oscilloscope Connections for IF Channel Alignment

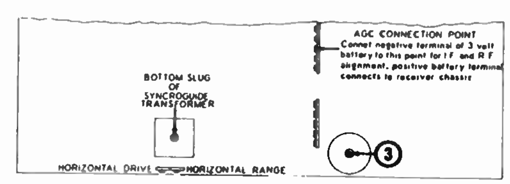


FIG. 8
Bottom View of Chassis

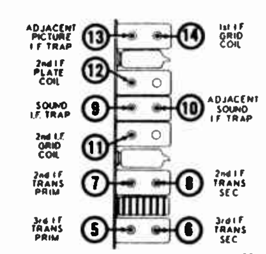


FIG. 9
View of IF Strip

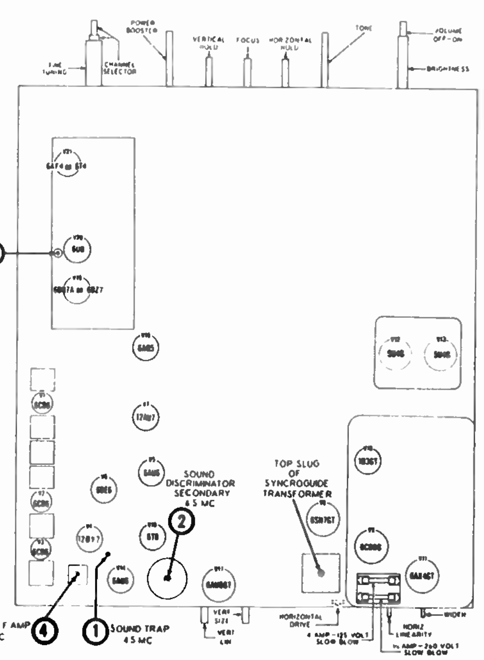


FIG. 10
Top View of Chassis

VHF RF CHANNEL ALIGNMENT PROCEDURE

The procedure listed is only for the VHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the RF Tuner, part 521150, must be returned to the factory.

1. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 8 for convenient point of connection.)
2. During alignment, it is necessary to set the Fine Tuning control so that Fine Tuning Quadrant is in the center of its range (correct position shown in Fig. 17).

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 11.	197.75 MC. Sound Carrier 193.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #10	Not used.	Connect as shown in Fig. 12.	Set tuner to receive channel #10 by rotating center shaft to the V.H.F. position and inner shaft to channel #10. (See flat position on shafts in Fig. 17) IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	#16 Mixer Grid. (See Fig. 18) #17 RF Amp. Plate. (See Fig. 18) #18 RF Amp. Grid. (See Fig. 18)	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 15. Use Mixer Grid trimmer #16 and RF Amplifier Plate trimmer #17 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #18 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. IMPORTANT: When adjusting trimmers #16, 17 and 18 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Not used.	Same as above.	Set channel selector to channel being observed.		The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #16, 17 and 18. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. Band pass characteristic of these channels should conform close to the RF response curve in Fig. 15. If necessary, a compromise may be obtained to compensate for large variations in channel response by returning to channel #10 and making slight changes in the settings of trimmers #16, 17 and 18.

OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in IF alignment procedure.
2. During this step and thru-out all succeeding steps it is necessary to keep output of sweep generator at a level that does not allow reading on VTVM to exceed one volt.
3. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.

STANDARD SIGNAL GENERATOR CONNECTIONS	FREQUENCY	SWEEP GENERATOR CONNECTIONS	FREQ.	VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 11.	197.75 MC. Sound Carrier Marker. 193.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #10	Connect as shown in Fig. 13.	Connect as shown in Fig. 13.	Set tuner to receive channel #10 by rotating center shaft to the V.H.F. position and inner shaft to channel #10. (See flat position on shafts in Fig. 17) Be sure that generator's output does not exceed voltage specified in instructions #2 and 3 above.	#19 Oscillator Trimmer (See Fig. 18)	Before undertaking this adjustment, position oscillator slug, located in channel #10 R.F. and Mixer and Oscillator Strip, to the center of its range. Also set Fine Tuning Quadrant to the center of its range as shown in Fig. 17. Adjust Oscillator Trimmer #19 to shift response curve so that picture carrier marker is located at the position indicated in Fig. 16. Position of sound carrier marker should appear as indicated in Fig. 16.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Same as above.	Same as above.	Set channel selector to channel being observed.		Adjust the R.F. sweep generator and marker generator for operation on the other television channels and set Channel Selector to corresponding channel. Using a long, non-metallic screwdriver (approx. 12"), adjust oscillator slug thru hole on front of R.F. Tuner Unit (see Fig. 17). This permits response curve to be shifted so that picture and sound carrier markers will appear at the position indicated in Fig. 16. NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 17).

If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel. If characteristic does not conform reasonably well within the typical curve shown in Fig. 15, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

INSTRUMENT CONNECTIONS FOR R.F. CHANNEL ALIGNMENT

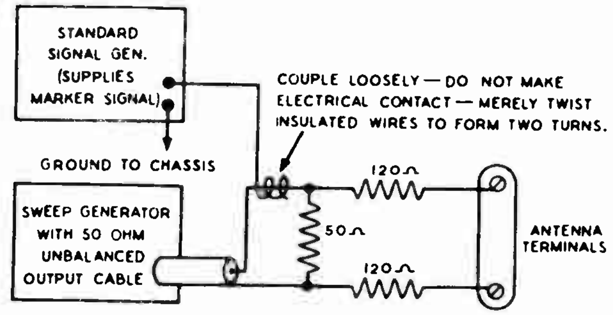


FIG. 11
Generator Connections for RF Channel Alignment

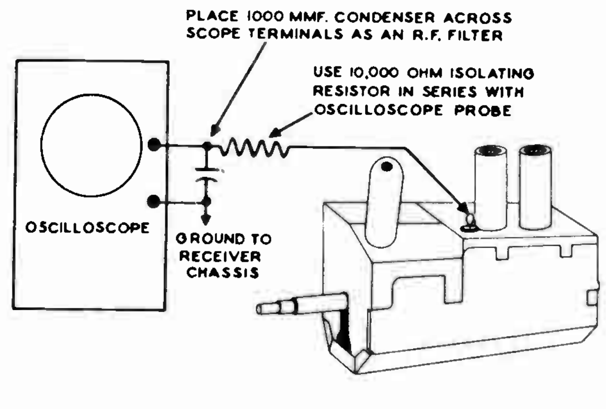


FIG. 12
Oscilloscope Connections for RF Amp. and Mixer Alignment

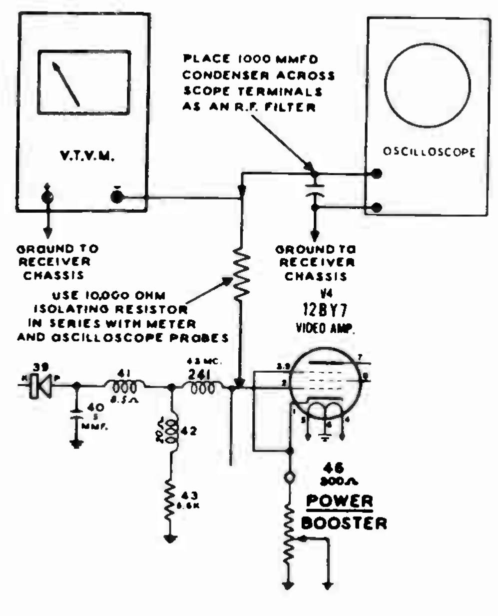


FIG. 13
VTVM and Oscilloscope Connections for Oscillator Alignment

CHANNEL NUMBER	PICTURE CARRIER MARKER FREQ.	SOUND CARRIER MARKER FREQ.
13	211.25 MC.	215.75 MC.
12	205.25 MC.	209.75 MC.
11	199.25 MC.	203.75 MC.
10	193.25 MC.	197.75 MC.
9	187.25 MC.	191.75 MC.
8	181.25 MC.	185.75 MC.
7	175.25 MC.	179.75 MC.
6	83.25 MC.	87.75 MC.
5	77.25 MC.	81.75 MC.
4	67.25 MC.	71.75 MC.
3	61.25 MC.	65.75 MC.
2	55.25 MC.	59.75 MC.

FIG. 14

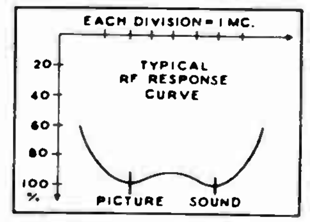


FIG. 15

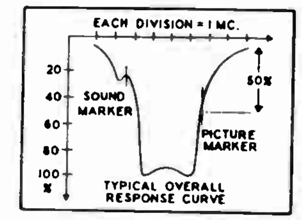


FIG. 16

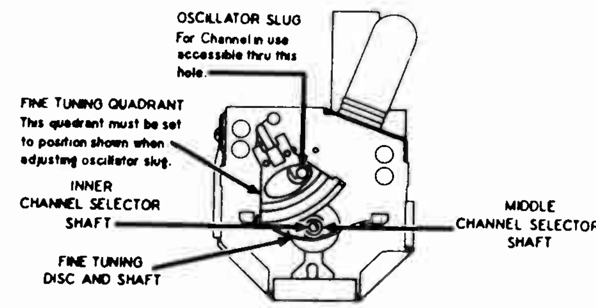


FIG. 17
Front View of RF Tuner Unit

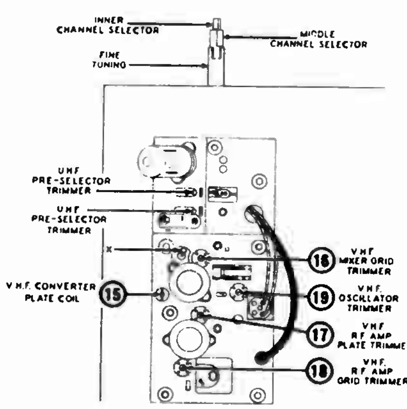


FIG. 18
Trimmer Location of RF Tuner

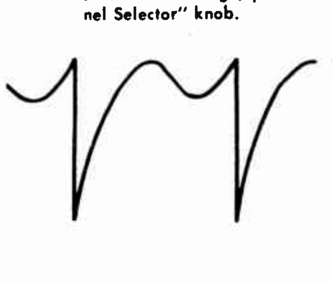
SYNCROGUIDE TRANSFORMER ALIGNMENT

Alignment of the Syncroguide transformer, circuit diagram #128, which is used in the Horizontal Oscillator circuit can be accomplished by utilizing the procedure outlined below. To perform this alignment, it will be necessary to use an oscillascope, preferably one that has a 2 megacycle response and a low input capacity probe—under 100 mmfd. to ground.

1. Set the "Top Slug" and "Bottom Slug" of the Syncroguide transformer to their maximum counter-clockwise positions.
2. Short together terminals C and D of the Syncroguide transformer.
3. Adjust "Horizontal Drive" control, located on rear of chassis pan, one-half turn out from its maximum clockwise position.
4. Set "Horizontal Hold" control, located at front of chassis, to its maximum clockwise position.
5. Turn on receiver and tune in any local TV channel.
6. Adjust "Top Slug" clockwise until picture just locks in horizontally.
7. Remove short from terminals C and D. If picture does not hold sync when short is removed, adjust "Bottom Slug" clockwise until picture locks in.
8. Connect 'scope to terminal C of Syncroguide transformer and adjust sweep rate of 'scope until two cycles of oscillogram remain stationary. Turn "Bottom Slug" clockwise until wave form peaks are equal in height as shown in Fig. 19.

IMPORTANT: The first peak of the wave form should never be higher than the second peak nor should the first peak be lower than the second peak by more than 3%. Also, when adjusting the "Bottom Slug," the picture must be in sync, therefore, it may be necessary to turn the "Horizontal Hold" control counter-clockwise when performing this step. After this adjustment has been completed, disconnect 'scope from receiver.

9. Set "Horizontal Hold" control counter-clockwise and adjust "Top Slug" until picture is locked in and does not lose sync when switching "Channel Selector" knob. Then, turn "Top Slug" slowly counter-clockwise until picture is just ready to lose sync as shown in Fig. 22.
10. Horizontal Holding action of receiver should now be as follows:
    a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 22 or be out of sync.
    b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.
    c. When "Horizontal Hold" control is in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.


CORRECT
Fig 19


INCORRECT
Fig. 20


INCORRECT
Fig 21

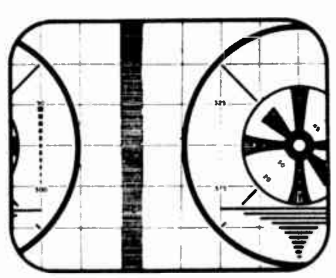


Fig. 22

PRODUCTION CHANGES

The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. The coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D".

The circuit shown on this page applies to "SERIES ABCDEF" chassis

A letter following the component circuit diagram number thus—201A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
UNCODED	**INITIAL PRODUCTION**
"A"	The following change was incorporated to facilitate the inclusion of condenser 240 within the 1st I.F. coil can. When this modification is made, the complete I.F. strip, part 521816, is changed to part 522088. 1. Relocate condenser 240 from the junction of 1st I.F. Coil and Adjacent Picture I.F. Trap to the grid side of the 1st I.F. Coil and change its value from 470 Mmfd. to 680 Mmfd.
"B"	The following change was incorporated to improve sync. stability in the presence of electrical interference or weak signal. 1. Disconnect resistor 94 (18,000 Ohms) from the plate of tube V4-12BY7 (Video Amp.) and reconnect it to the junction of resistors 54 (2200 Ohms) and 55 (1800 Ohms) located in plate load circuit of tube V4. Note: The sound take-off for tube V14 (Sound I.F. Amp.) remains connected to the plate of tube V4 (Video Amp.) The following change was incorporated to provide for adequate width of the picture under the condition of low line voltage. 1. Change resistor 88 in 270 volt supply from 400 Ohms to 200 Ohms. The following change was incorporated to provide a greater margin of safety for the plate load resistor of tube V7A (12AU7). 1. Change resistor 105 located in plate circuit of tube V7A (Sync. Amp.) from 4700 Ohms ½ watt to 4700 Ohms 1 watt.
"C"	The following change was incorporated to protect resistor 88, located in the 270 volt supply, in the event of abnormal current drain in the high voltage system. 1. Change fuse 149 in the horizontal sweep circuit from a ½ Amp. 250 volt to a ¼ Amp. "Slow Blow" 250 volt.
"D"	The following changes were incorporated to improve the range of the horizontal hold control. 1. Change resistor 120, located in the plate circuit of tube V7A (Horiz. A.F.C.) from 22,000 Ohms to 68,000 Ohms. 2. Change resistor 124 located in the plate circuit of tube V7A (Horiz. A.F.C.) from 68,000 Ohms to 120,000 Ohms. The above change should only be undertaken when the letter "8" is included in the SERIES designation at rear of chassis.
"E"	The following change was incorporated to protect the filament winding of power transformer 76 that connects to the 6AX4GT (Horiz. Damping) in the event this tube develops a cathode to filament short. 1. Change resistor 83, located in filament supply, from 100,000 Ohms to 18,000 Ohms, 2 watt.
"F"	The following changes were incorporated to improve picture quality by reducing the noise level (snow) in Video Amp. system. 1. Add resistor 242 (6800 Ohms) in parallel with peaking coil 41 located in grid circuit of V4 (Video Amp.) 2. Change peaking coil 42 located in grid circuit of tube V4 (Video Amp.) from part 520985 (double pi, coded with green dot) to part 509341 (single pi, coded with green dot). 3. Change peaking coil 51 located in plate circuit of tube V4 (Video Amp.) from part 520689 (single pi, coded with purple dot) to part 520984 (single pi, coded with red dot). 4. Change resistor 52 located across peaking coil 51 in plate circuit of V4 (Video Amp.) from 12,000 Ohms to 15,000 Ohms. 5. Change peaking coil 53 located in plate circuit of tube V4 (Video Amp.) from part 509342 (single pi, coded with yellow dot) to part 509340 (single pi, coded with white dot).

VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception—Power Booster control completely counterclockwise.

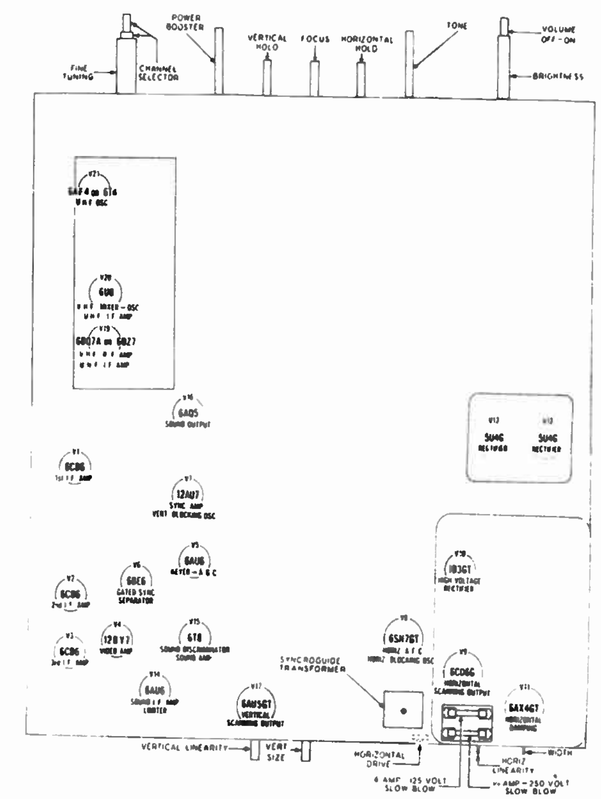
Voltages marked with an asterisk (*) will vary widely with control settings.

No voltage reading at a tube element indicate zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.

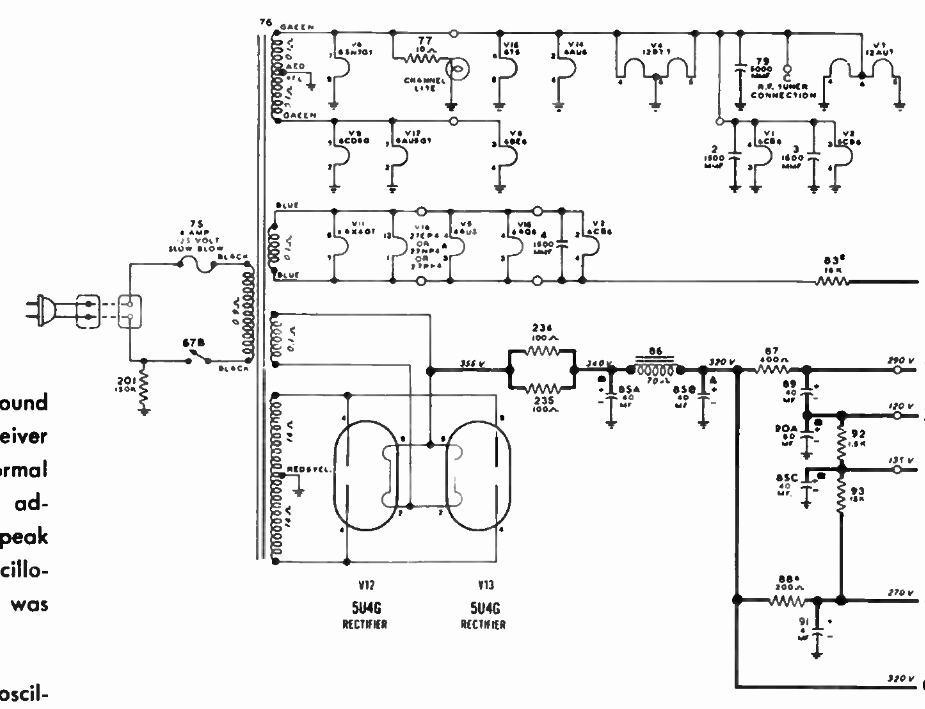
OSCILLOGRAMS

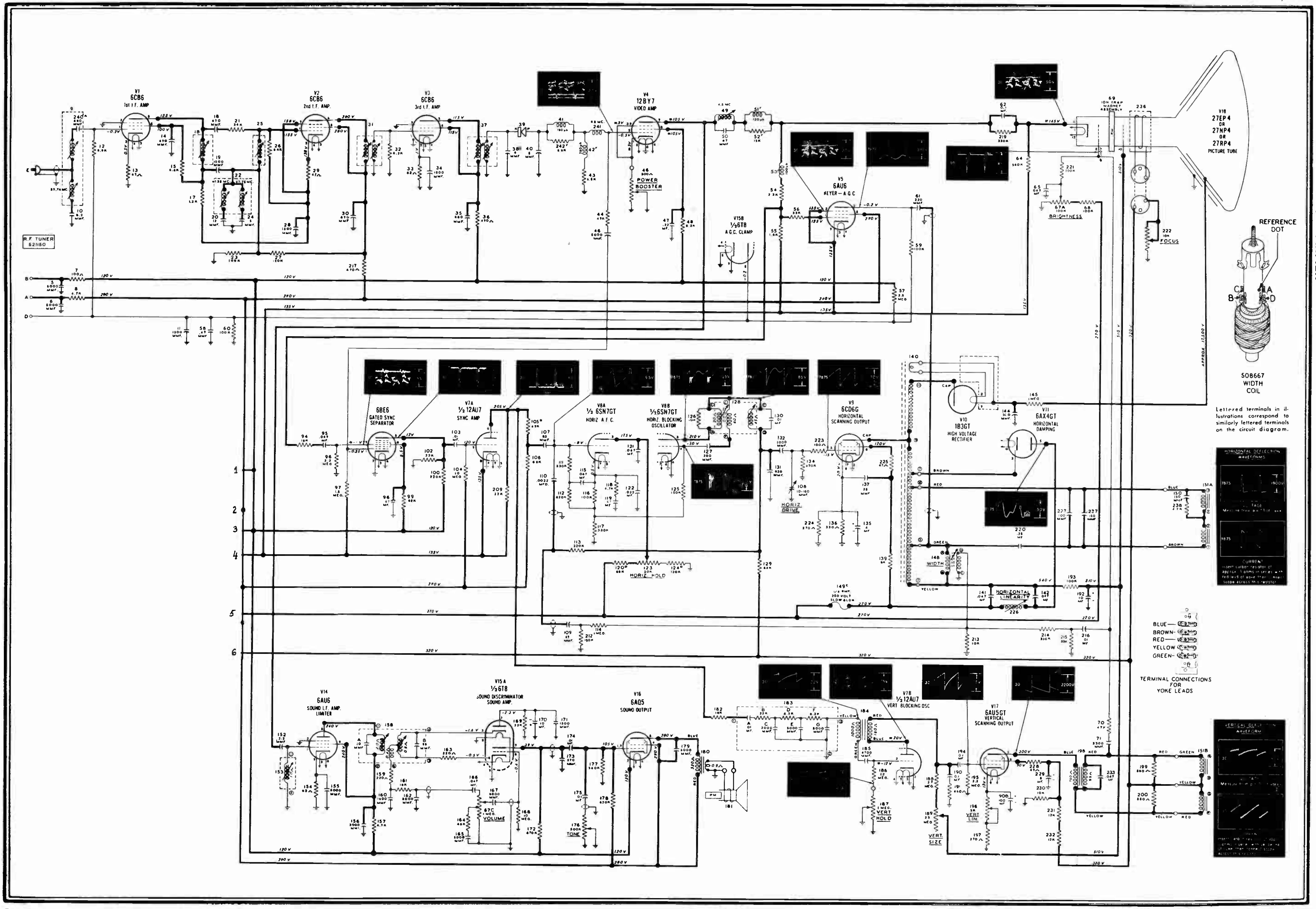
All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Power Booster control adjusted to give 50 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within 20% at 2 MC.

Number appearing to the left of oscillogram specifies setting of horizontal sweep frequency control on 'Scope.



TUBE AND CONTROL LOCATIONS




V1
6CB6
1st I.F. AMP
V2
6CB6
2nd I.F. AMP
V3
6CB6
3rd I.F. AMP
V4
12BY7
VIDEO AMP
POWER BOOSTER
V5
6AU6
KEYER - A G C
V15B
½6T8
A.G.C. CLAMP
R.F. TUNER
52H50
V18
27EP4
OR
27NP4
OR
27RP4
PICTURE TUBE
BRIGHTNESS
FOCUS
REFERENCE DOT
S08667
WIDTH
COIL
Lettered terminals in illustrations correspond to similarly lettered terminals on the circuit diagram.
6BE6
GATED SYNC SEPARATOR
V7A
½ 12AU7
SYNC AMP
V8A
½ 6SN7GT
HORIZ A.F.C.
V8B
½6SN7GT
HORIZ. BLOCKING OSCILLATOR
V9
6CD6G
HORIZONTAL SCANNING OUTPUT
V10
1B3GT
HIGH VOLTAGE RECTIFIER
V11
6AX4GT
HORIZONTAL DAMPING
HORIZ. DRIVE
HORIZ. HOLD
WIDTH
HORIZONTAL LINEARITY
HORIZONTAL DEFLECTION WAVEFORMS
BLUE
BROWN
RED
YELLOW
GREEN
TERMINAL CONNECTIONS FOR YOKE LEADS
V14
6AU6
SOUND I.F. AMP. LIMITER
V15A
½6T8
SOUND DISCRIMINATOR SOUND AMP.
V16
6AQ5
SOUND OUTPUT
VOLUME
TONE
V7B
½ 12AU7
VERT. BLOCKING OSC
V17
6AU5GT
VERTICAL SCANNING OUTPUT
VERT. HOLD
VERT. SIZE
VERT. LIN.
VERTICAL DEFLECTION WAVEFORM

PARTS LIST

Notice: Some parts listed below have special characteristics.

Do not use substitutes for replacement purposes.

CONDENSERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
2	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
3	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
4	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
5	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
6	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
10	513455	Condenser—ceramic 8.2 Mmfd. ±5% 400 volt (Temperature compensating)	.25
11	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
14	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
18	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
19	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.45
20	513448	Condenser—ceramic 12 Mmfd. ±5% 500 volt (Temperature compensating)	1.05
24	513449	Condenser—ceramic 5 Mmfd. ±1% 500 volt (Temperature compensating)	1.05
28	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
30	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
34	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
35	513044	Condenser—ceramic 680 Mmfd. 400 volt	.25
38	513454	Condenser—ceramic 4 Mmfd. ±1% 500 volt (Temperature compensating)	.25
40	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
45	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
47	512238	Condenser—.22 Mfd. 200 volt	.50
50	513438	Condenser—ceramic 47 Mmfd. ±5% 500 v. (Temperature compensating)	.45
58	512239	Condenser—.47 Mfd. 200 volt	.75
61	513032	Condenser—ceramic 220 Mmfd. 1000 volt	.40
62	512216	Condenser—.1 Mfd. 200 volt	.30
65	512235	Condenser—.047 Mfd. 200 volt	.30
71	512520	Condenser—mica 3300 Mmfd. ±2% 500 volt	1.30
79	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
85-A,B,C	508072	Condenser—electrolytic A—40 Mfd. 450 volt, B—40 Mfd. 450 volt, C—40 Mfd. 450 volt	4.50
89	160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
90-A,B	509002	Condenser—electrolytic A—80 Mfd. 250 volt, B—100 Mfd. 50 volt	3.00
91	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
95	512235	Condenser—.047 Mfd. 200 volt	.30
98	512239	Condenser—.47 Mfd. 200 volt	.75
103	512205	Condenser—.01 Mfd. 400 volt	.25
107	513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
108	508071	Condenser—trimmer 10-160 Mmfd. (Horizontal Drive)	.40
109	513030	Condenser—ceramic 47 Mmfd. 1000 volt	.40
110	512232	Condenser—.0022 Mfd. 400 volt	.25
115	512235	Condenser—.047 Mfd. 200 volt	.30
119	512239	Condenser—.47 Mfd. 200 volt	.75
121	512236	Condenser—.047 Mfd. 400 volt	.30
122	512233	Condenser—.022 Mfd. 400 volt	.30
127	513427	Condenser—ceramic 200 Mmfd. ±2% 500 v. (Temperature compensating)	.65
130	512311	Condenser—.01 Mfd. 400 volt (Special Characteristic)	.30
131	512547	Condenser—mica 820 Mmfd. ±5% 500 volt	.50
132	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
135	520921	Condenser—electrolytic 4 Mfd. 150 volt	1.20
137	512223	Condenser—.25 Mfd. 400 volt	.60
141	512236	Condenser—.047 Mfd. 400 volt	.30
142	512236	Condenser—.047 Mfd. 400 volt	.30
144	521737	Condenser—ceramic 500 Mmfd. 30,000 volt	4.00
150	513042	Condenser—ceramic 1500 Mmfd. ±5% 2000 v.	.30
152	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
155	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
156	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
158-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
158-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
160	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
162	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
165	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
166	512235	Condenser—.047 Mfd. 200 volt	.30
167	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
170	505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
171	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
173	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
174	512205	Condenser—.01 Mfd. 400 volt	.25
175	512204	Condenser—.01 Mfd. 200 volt	.25
179	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
183-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
183-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
185	512533	Condenser—mica 4700 Mmfd. ±5% 1000 v.	1.40
190	512218	Condenser—.1 Mfd. 600 volt	.55
192	508680	Condenser—electrolytic 10 Mfd. 600 volt	2.55
194	512218	Condenser—.1 Mfd. 600 volt	.55
216	512204	Condenser—.01 Mfd. 200 volt	.25
220	512223	Condenser—.25 Mfd. 400 volt	.60
227	513043	Condenser—ceramic 100 Mmfd. ±10% 3000 volt	.30
229	507386	Condenser—electrolytic 8 Mfd. 300 volt	1.25
233	512237	Condenser—.047 Mfd. 600 volt	.40
237	513027	Condenser—ceramic 150 Mmfd. ±5% 2000 v.	.30
240	513044	Condenser—ceramic 680 Mmfd. 350 volt (used when letter "A" is included in series designation at rear of chassis)	.25
	513008	Condenser—ceramic 470 Mmfd. 350 volt (used when letter "A" is not included in series designation at rear of chassis)	.30

RESISTORS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
7	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
8	510348	Resistor—carbon 4700 Ohms ±10% 2 watt	.25
12	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
13	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
15	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
17	510138	Resistor—carbon 1200 Ohms ±10% ½ watt	.12
21	510783	Resistor—carbon 24,000 Ohms ±5% ½ watt	.30
23	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
26	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
27	510174	Resistor—carbon 120,000 Ohms ±10% ½ watt	.12
29	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
32	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
33	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
36	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
43	510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
44	510166	Resistor—carbon 47,000 Ohms ±10% ½ watt	.12
48	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
52	510744	Resistor—carbon 15,000 Ohms ±5% ½ watt (used when letter "F" is included in series designation at rear of chassis)	.16
	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt (used when letter "F" is not included in series designation at rear of chassis)	.16
54	510242	Resistor—carbon 2200 Ohms ±10% 1 watt	.16
55	510141	Resistor—carbon 1800 Ohms ±10% ½ watt	.12
56	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
57	510701	Resistor—carbon 3.3 Meg. ±10% ½ watt	.12
59	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
60	510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
64	510186	Resistor—carbon 560,000 Ohms ±10% ½ watt	.12
68	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
70	510167	Resistor—carbon 47,000 Ohms ±10% ½ watt	.12
77	510101	Resistor—carbon 10 Ohms ±10% ½ w.	.12
83	510359	Resistor—carbon 18,000 Ohms ±10% 2 watt (used when letter "E" is included in series designation at rear of chassis)	.25
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "E" is not included in series designation at rear of chassis)	.12
87	510741	Resistor—wire wound 600 Ohms ±10% 10 w.	.90
88	510792	Resistor—wire wound 200 Ohms ±10% 10 watt (used when letter "B" is included in series designation at rear of chassis)	.90
	510779	Resistor—wire wound 400 Ohms ±10% 10 watt (used when letter "B" is not included in series designation at rear of chassis)	.75
92	510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
93	510357	Resistor—carbon 15,000 Ohms ±10% 2 w.	.35
94	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
96	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
97	510752	Resistor—carbon 1.5 Meg. ±10% ½ watt	.12
99	510171	Resistor—carbon 82,000 Ohms ±10% ½ w.	.12
100	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
102	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
104	510197	Resistor—carbon 10 Meg. ½ watt	.12
105	510248	Resistor—carbon 4700 Ohms ±10% 1 watt (used when letter "B" is included in series designation at rear of chassis)	.16
	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "B" is not included in series designation at rear of chassis)	.12
106	510251	Resistor—carbon 6800 Ohms ±10% 1 watt	.16
111	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
112	510189	Resistor—carbon 820,000 Ohms ±10% ½ w.	.12
113	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
114	510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
116	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
117	510281	Resistor—carbon 330,000 Ohms ±10% 1 w.	.16
118	510148	Resistor—carbon 4700 Ohms ±10% ½ watt	.12
120	510169	Resistor—carbon 68,000 Ohms ±10% ½ w. (used when letter "D" is included in series designation at rear of chassis)	.12
	510160	Resistor—carbon 22,000 Ohms ±10% ½ w. (used when letter "D" is not included in series designation at rear of chassis)	.12
124	510174	Resistor—carbon 120,000 Ohms ±10% ½ w. (used when letter "D" is included in series designation at rear of chassis)	.12
	510169	Resistor—carbon 68,000 Ohms ±10% ½ w. (used when letter "D" is not included in series designation at rear of chassis)	.12
125	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
126	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
129	510269	Resistor—carbon 68,000 Ohms ±10% 1 w.	.16
134	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
136	510327	Resistor—carbon 330 Ohms ±10% 2 watt	.25
139	510789	Resistor—wire wound 8000 Ohms ±10% 5 w.	.95
145	510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
154	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
157	510249	Resistor—carbon 4700 Ohms 1 watt	.16
159	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
161	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
163	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
164	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
168	510197	Resistor—carbon 10 Meg. ½ watt	.12
169	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
172	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
177	510778	Resistor—carbon 560,000 Ohms ±5% ½ w.	.16
178	510747	Resistor—carbon 820,000 Ohms ±5% ½ w.	.20
182	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
183-B	508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
183-D	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
183-F	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
186	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt	.12
188	510772	Resistor—carbon 2.7 Meg. ±5% ½ watt	.12
191	510134	Resistor—carbon 680 Ohms ½ watt	.12
193	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
195	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
197	510126	Resistor—carbon 270 Ohms ±10% ½ watt	.12
199	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
200	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
201	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
209	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
212	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
213	510254	Resistor—carbon 10,000 Ohms ±10% 1 watt	.16
214	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
215	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
217	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
219	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
221	510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
223	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
224	510326	Resistor—carbon 270 Ohms ±10% 2 watt	.25
225	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
228	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
230	510254	Resistor—carbon 10,000 Ohms ±10% 1 watt	.16
231	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
232	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
234	510781	Resistor—wire wound 100 Ohms ±10% 5 w.	.75
235	510781	Resistor—wire wound 100 Ohms ±10% 5 w.	.75
238	510248	Resistor—carbon 4700 Ohms ±10% 1 watt	.16
242	510151	Resistor—carbon 6800 Ohms ±10% ½ watt (used when letter "F" is included in series designation at rear of chassis)	.12

COILS AND TRANSFORMERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
9	*	Coil—1st I.F. grid and Adjacent Picture I.F. Trap	—
16	*	Coil—1st I.F. plate	—
22	*	Trap—sound I.F. and Adjacent Sound I.F.	—
25	*	Coil—2nd I.F. Grid	—
31	*	Transformer—2nd I.F.	—
37	*	Transformer—3rd I.F.	—
41	520620	Coil—peaking (single pi, coded with black dot)	.65
42	509341	Coil—peaking (single pi, coded with green dot) (used when letter "F" is included in series designation at rear of chassis)	.60
	520985	Coil—peaking (double pi, coded with green dot) (used when letter "F" is not included in series designation at rear of chassis)	.65
49	509603	Coil—4.5 Mc. trap (includes slug and condenser #50)	1.20
	507357	Slug core for 4.5 Mc. trap coil	.20
51	520984	Coil—peaking (single pi, coded with red dot) (used when letter "F" is included in series designation at rear of chassis)	.50
	520689	Coil—peaking (single pi, coded with purple dot) (used when letter "F" is not included in series designation at rear of chassis)	.65
53	509340	Coil—peaking (single pi, coded with white dot) (used when letter "F" is included in series designation at rear of chassis)	.55
	509342	Coil—peaking (single pi, coded with yellow dot) (used when letter "F" is not included in series designation at rear of chassis)	.60
76	521725	Transformer—power	20.00
86	508341	Choke—filter	3.60
128	520943	Transformer—syncroguide	2.50
	521064	Slug core for syncroguide transformer	.70
140	521735	Transformer—horizontal output (includes resistor 145)	14.00
148	508667	Coil—Width (includes slug and clip)	1.75
	508784	Slug core for Width coil (includes mtg. clip)	.65
151-A,B	115423	Yoke—picture tube deflection (includes leads, connectors, resistor 238 and condenser 150)	21.00
153	509378	Transformer—audio take-off	1.50
158	509706	Transformer—TV sound discriminator (includes condensers 158A and 158B)	3.00
180	509376	Transformer—audio output	1.85
184	520980	Transformer—vertical blocking oscillator	1.90
198	520975	Transformer—vertical output (includes connectors for deflection yoke leads)	4.00
226	520911	Coil—Horizontal Linearity (includes slug and clip)	1.50
236	162326	Coil—focus (includes cable and plug)	14.00
241	522020	Coil—43 Mc. trap	.50

CONTROLS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
46	521057	Power Booster (Contrast) potentiometer (300 Ohms ½ watt)	1.00
67-A,B,C	521989	Volume and Brightness potentiometers (includes On-Off switch) A—Brightness (100,000 Ohms ¼ watt) B—On-Off Switch C—Volume (1 Meg. ¼ watt)	2.50
108	508071	Horizontal Drive Condenser (10-160 Mmfd.)	.40
123	521059	Horizontal Hold potentiometer (50,000 Ohms ¼ watt)	2.00
148	508667	Width coil (includes slug and clip)	1.75
	508784	Slug for width coil (includes mtg. clip)	.65
176	520746	Tone potentiometer (500,000 Ohms ¼ watt)	1.00
187	521058	Vertical Hold potentiometer (1 Meg. ¼ w.)	1.00
189	520944	Vertical Size potentiometer (2.5 Meg. ¼ w.)	.80
196	520945	Vertical Linearity potentiometer (5000 Ohms ½ watt)	.90
222	521727	Focus potentiometer (10,000 Ohms 4 watt)	2.00
226	520911	Horizontal Linearity coil (includes slug and clip)	1.50
	115444	Switch-antenna (includes terminal board)	2.50

OTHER ELECTRICAL PARTS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
39	509386	Crystal detector	1.00
69	521183	Ion trap	1.00
75	521803	Fuse; 4 amp. 125 volt "Slow Blow"	.25
78	118921	Channel lite (Mazda #47) 6-8V. 150 Ma.	.15
149	522320	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt "Slow Blow" (used when letter "C" is included in series designation at rear of chassis)	.25
	521752	Fuse for horizontal sweep circuit; ½ Amp. 250 volt (used when letter "C" is not included in series designation at rear of chassis)	.20
181	508174	Speaker—P.M. Dynamic (6"x9")	8.40
183-A to G	508062	Integrator unit (includes all condensers and resistors from 183-A to 183-G)	1.40
	522088	I.F. printed circuit complete with tubes, transformers, condensers and resistors (used when letter "A" is included in series designation at rear of chassis)	20.00
	521816	I.F. printed circuit complete with tubes, transformers, condensers and resistors (used when letter "A" is not included in series designation at rear of chassis)	20.00
	521150	R.F. Tuner; V.H.F. channels 2-13 and U.H.F. channels 14-83 (includes tubes and tuning coils)	85.00

*—This part is not supplied as a Service replacement item.

ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

CIRCUIT DESCRIPTION FOR R. F. TUNER USED ON ALL MODELS 21C-9340; 21T-9340; 24C-9360; AND 27C-9350 SERIES TELEVISION RECEIVERS.

(All circuit diagram numbers mentioned refer to circuit diagram on the reverse side of this page.)

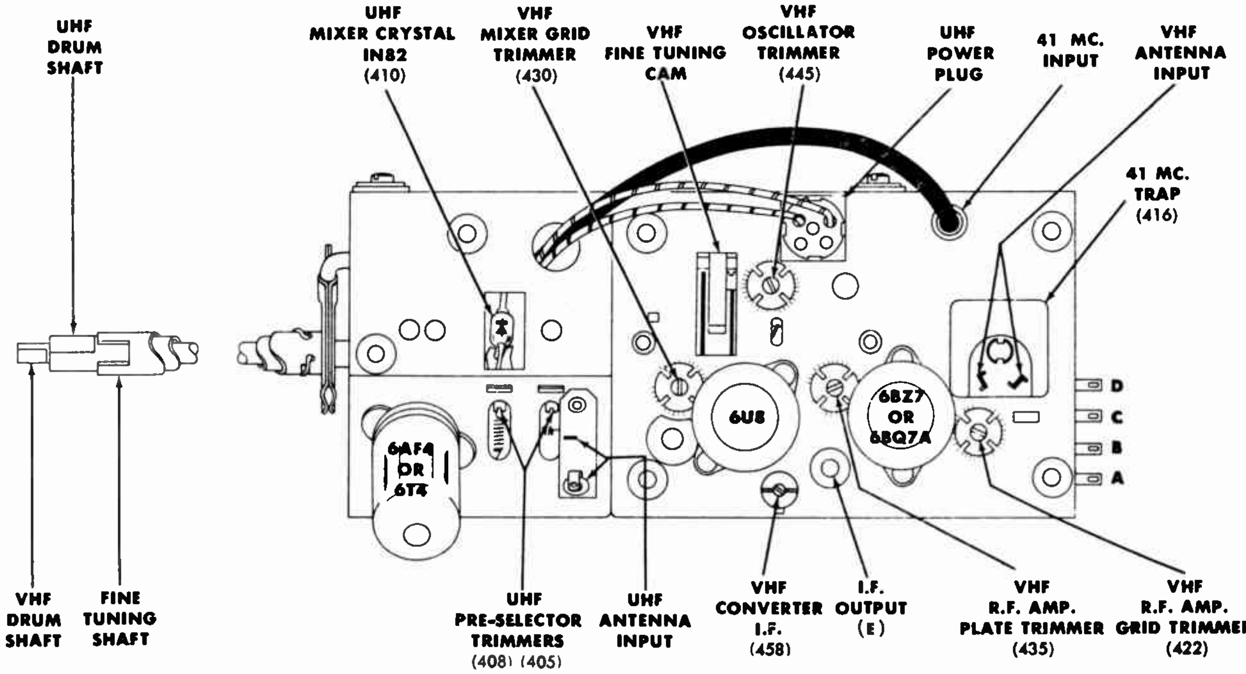


FIG. 1—Complete VHF-UHF R.F. Tuner 521150

The all wave turret type tuner, part 521150, is of the latest design and is capable of tuning all standard television channels in the VHF and UHF range fram channels 2 to 83. It consists of twa separate chassis joined together as ane unit. The front section tunes the UHF stations, channels 14 to 83, and incorporates 2 pre-selectar stages, a 6AF4 or 6T4 tube as the Oscillator and a 1N82 crystal as the Mixer. The rear sectian performs a dual function in that it tunes all the VHF stations, channels 2 to 13 and operates as a 41 Mc. I.F. amplifier when the receiver is tuned to any UHF channel. It incorporates a 6BZ7 or 6BQ7A tube as a cascaded R.F. amplifier for VHF operation and as a cascoded 41 Mc. I.F. amplifier for UHF operation. A 6U8 tube is used as a Mixer-Oscillator for VHF and as a 41 Mc. I.F. amplifier for UHF. In the UHF position, the Oscillatar section of the 6U8 tube is rendered inoperative. See Fig. 4 for block diagram of tuner.

Fine tuning of both the VHF and UHF channels are performed by the same control. The shaft of the fine tuning control rotates two separate pieces of dielectric material simultaneously between two separate sets of capacitor plates connected to their respective UHF and VHF oscillator tank circuit. Front panel oscillator adjustment is similar to that of our VHF turret type tuner and is discussed in its entirety in the instruction book for this receiver under the heading "Auxiliary Fine Tuning Adjustment." The adjustment tool should be a non-metallic screw driver, having a narrow blade, about ⅛" wide, and at least 9 inches long so it can make contact with the VHF oscillator slug which is located in back of the UHF section.

UHF OPERATION

UHF channel selection is accomplished in a dual manner. Rotation of the UHF turret, which is accomplished by turning the middle shaft or middle knob, sets into position a coil assembly that can be tuned through a range of 10 channels. For example, channels 20 to 29, 30 to 39 etc. Eight different coil assemblies are used and they are easily removable for replacement. There are nine settings of the UHF turret one of which is blank, containing no coil assembly. For VHF operation, the UHF turret is placed in the blank position. For tuning of an individual UHF channel, the inner shaft or front knob is turned to the second digit af the desired station within the range of 10 channels set previously. This rotates three eccentric cams of a dielectric material through a group of capacitor plates. These plates are connected to the 2 pre-selector stages and the oscillator circuit.

The UHF signal entering the tuner is first fed through a high pass filter consisting of condensers 402A and 4028, and inductances 403 and 404 that attenuate all frequencies below 470 Mc. It is then coupled to the first pre-selector circuit which consists of a coil connected between terminal "F" and a capacitor plate.

From here it is coupled through condenser 406 to the second pre-selector stage that consists of a cail connected between terminal "H" and a capacitar plate. There is one capacitor plate that is cammon to both pre-selectar stages which is graunded through terminal "G." These pre-selector coils and capacitor plates are maunted on a form (see Fig. 2) and are tunable thraugh a range af 10 channels. Selection af any one channel is accomplished by varying the amount of dielectric material between the capacitor plates.

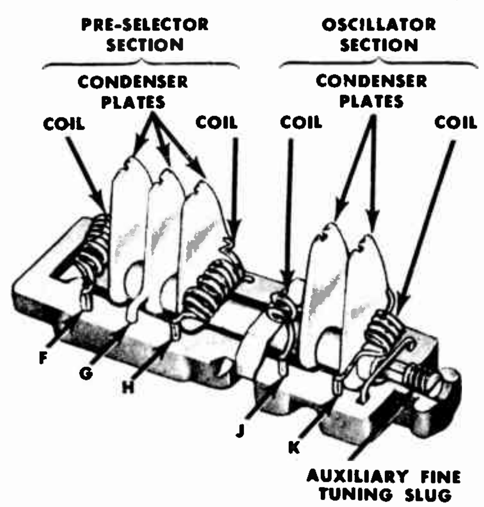


FIG. 2—UHF Coil Form Showing Condenser Plates

Additional tuning, for alignment purposes, is accomplished by adjustment of condensers 405 and 408, (see Fig. 1), and either compressing or expanding the pre-selector coils. **CAUTION:** Exercise extreme care if it is ever found necessary to make these adjustments.

A 6AF4 tube is operated as the UHF oscillator and its tank circuit consists of two capacitor plates and a cail connected ta each plate (see Fig. 2). These oscillator coils and capacitor plates are mounted on the same farm as the pre-selector coils and capacitor plates and forms a complete coil assembly that is tunable through a range of 10 channels. Correct selection of any one channel is achieved by varying the amount of dielectric material between the oscillator plates. The dielectric far the oscillator and pre-selector stages is in the shope of an eccentric cam and ganged together on the same shaft.

Fine tuning is accomplished in a similar manner with the exception that the dielectric material is on a separate shaft and rotates between the bottom section of the oscillator capacitor plate (see Fig. 3). The frequency range of fine tuning on all UHF channels is approximately 2 to 3 Mc.

Auxiliary fine tuning is accomplished by adjusting a metal slug between the oscillator condenser plates on the coil form. On some tuners, auxiliary fine tuning is performed by a screw mounted on the face of UHF drum, which varied the capacity between the oscillator plate and ground. On other tuners this auxiliary fine tuning screw is mounted on the coil form. Adjustment of this screw changes the capacitane between the oscillator plates. Additional tuning, for alignment purposes only, can be brought about by either compressing or expanding the oscillator coils. **CAUTION:** Exercise extreme care if it is ever found necessary to make this type of adjustment.

The output of the oscillator is capacitively coupled ta the second pre-selector stage by a short length of wire; one end is close to one of the oscillator plates and the ather end is clase to the secand pre-selector plate. Note thot na physical contact is made with either plate, (see Fig. 3).

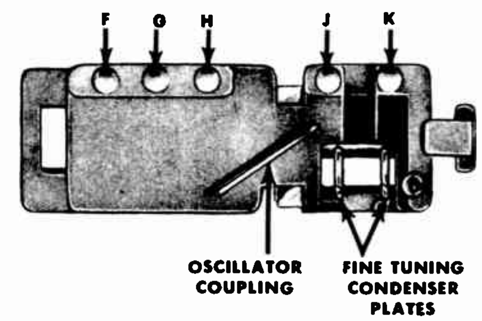


Fig. 3—UHF Coil Form Showing Contact Side

This ascillator frequency and UHF signal are then fed to a 1N82 crystal operating as a UHF Mixer. This action praduces the desired IF frequency of 41 Mc. which is fed thraugh a coaxial cable and connected to the primary af transformer 421 which is mounted on a 41 Mc. contact board.

This board maintains electrical cantact in the circuit of the 6BZ7 and 6U8, only when the tuner is set for UHF operation. This contact board is switched in by a cam action on the rear of the UHF drum which at the same time, breaks contact between the VHF drum and its associated circuit. The reverse af this occurs during VHF operation. The secondary af transformer 421 is connected to the input circuit of the 6BZ7 tube, which is now operating as an 41 Mc. amplifier. The 6BZ7 tube is a dual triode and is connected in the circuit as a direct coupled grounded grid amplifier. Transformer 438 couples the output from the plate, pin 1, of the 6BZ7 to the grid input of the pentade section of the 6U8 tube which operates as a 41 Mc. amplifier during UHF operatian. Transfarmers 421, 438 and coil 440 are all mounted on the 41 Mc. contact board. Note that, when in UHF operation, terminal V3 on the 41 Mc. contact board is left open thus, removing plate valtage from the triode section of the 6U8 tube which makes this section of the tube inoperative. Signal output from the 6U8 tube is coupled through the plate coil, 458, to a coaxial socket on the tuner and then fed to the receivers' I.F. amplifiers.

VHF OPERATION

VHF channel selection is accomplished in a dual manner. The UHF turret must be ratated until the blank setting is detented into position. This occurs when the middle knob shows the letters "VHF" in an upright position or when the flat of the middle knob is in its uppermost position, i.e.: in a horizontal plane. With drum in this position, there is no connection to the UHF drum thus rendering the UHF oscillator inoperative. At the same time this occurs, the 41 Mc. contact board is switched out of the circuit and the VHF drum is placed into operation. VHF channel selection is now performed by the front knob which rotates the VHF drum containing two sets of easily removable coil assemblies for each VHF channel.

From the antenna, the signal is first fed to a 41 Mc. trap network, item 416, which is tunable from the top of the tuner, (see Fig. 1). The output of this trap is coupled to the individual antenna coil section consisting of a balanced primary to minimize noise pick-up on the transmission line and an R.F. grid coil which couples the incoming signal to the grid of the first section of the 6BZ7 R.F. Amplifier. The inductance and amount of coupling of the tuned antenna input circuit are changed for each channel so that a constant input impedance of 300 ohms is maintained. This provides maximum transfer of energy to the R.F. Amplifier stage, particularly when interconnectian between an outdoor antenna and the receiver is made with 300 ohm transmission line.

The R.F. Amplifier tube is a dual-triade tube and is connected in the circuit as a direct coupled ground-grid type amplifier. This circuit was developed to meet the demand far an R.F. Amplifier that wauld provide more nearly equal gain on both the low and high VHF Television Channels, while keeping inherent tube noise ta a minimum. The circuit can be thought of very simply as twa triode tubes in series, the first or driver unit acting not as an amplifier, but rather as an antenna impedance matching device and also as a variable cathade impedance, or bias saurce, for the second, or grounded-grid unit. In addition the first unit of the R.F. Amp. acts as a power amplifier due to its extremely low plate impedance, which is in reality the cathade circuit of unit two, and converts the weak signal voltage from the antenna to a low valtage-high current signal which is then applied to the cathode of unit number two. The signal coupling unit between the first and second units is a series peaking coil, symbol 429, similar to that found in a video amplifier circuit. Its purpose is to form a series resonant circuit with the input capacity of the second unit. The cail is so made as to resonate at a frequency slightly higher than channel 13. In a standard pentode type amplifier, the gain falls off rapidly as progressively higher channels are selected. With the use af the plate to cathode peaking coil an almost equal gain can be realized for all VHF channels.

The R.F. Amp. tube has inherently low interelectrode capacity due to physical design and this factor in conjunction with the low output impedance of the first section is responsible for the low noise factor at this stage. While neutralization of the first unit is not necessary, due to its low plate to grid capacity, additianal noise reduction has been realized, with only a slight decrease in gain, by the addition of a neutralizing condenser, item 427. Due to the low output impedance of the stage, it is not necessary that the neutralizing condenser be tuneable.

Because of the circuits' excellent internal shielding, low imput impedance and radiation rejectian, the secand section of the R.F. Amp. is connected as a driven grounded-grid amplifier. While this might not be apparent at first glance due to the fact that grid has no direct D.C. return, it will be found upon further examination that any high frequency A.C. potentials are by-passed to ground through condenser 430.

The second section of turret coils includes the tuned R.F. amplifier plate coil, tuned mixer grid cail, and oscillator coil. The output af the R.F. amplifier stage is coupled to the grid of the mixer stage, which utilizes the pentode section of a 6U8 tube, V19. The other half of the 6U8 is a triode and is connected as a modified Colpitts oscillator which injects oscillator voltage into the mixer stage through coupling between the oscillator coil and the mixer grid coil. Course oscillator tuning is accomplished by adjusting the positions of the slugs in the individual oscillator coils, while Fine Tuning is obtained when using condenser 444 in the oscillotor plate circuit. This Fine Tuning condenser is composed of two fixed plates, and its capacitance is changed by the insertion of a dielectric material between these plates.

Signal output from the mixer stage is coupled through the converter plate I.F. coil, 458, located on the tuner unit, ta a coaxial socket and then fed to the receivers I.F. amplifiers.

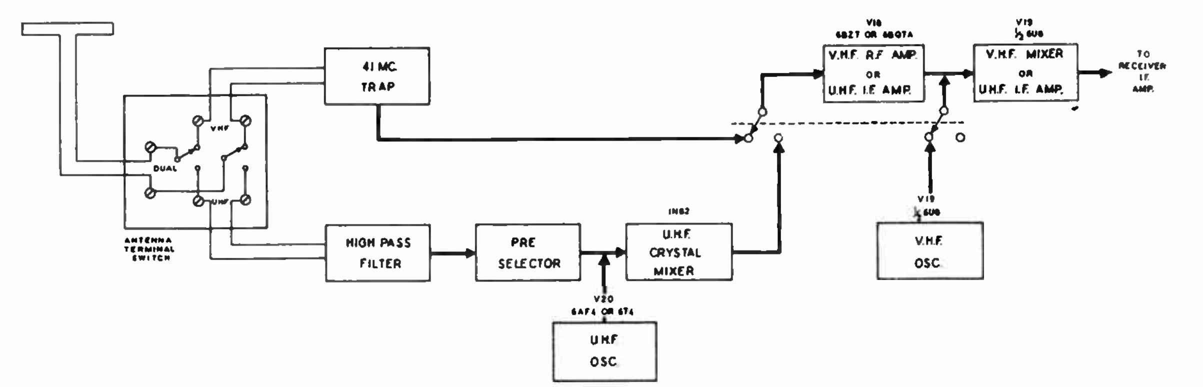
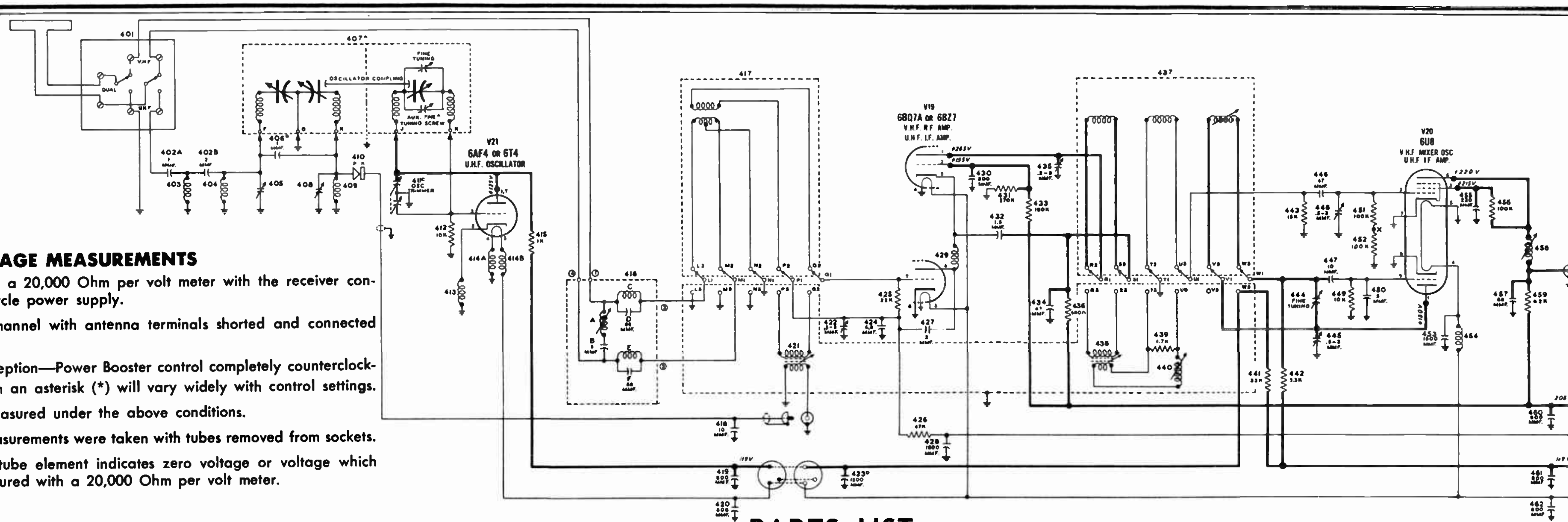


FIG. 4—Block Diagram



VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception—Power Booster control completely counterclockwise. Voltages marked with an asterisk (*) will vary widely with control settings.

B supply voltages were measured under the above conditions.

‡ RF tuner socket voltage measurements were taken with tubes removed from sockets.

No voltage reading at a tube element indicates zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.

PARTS LIST

PRODUCTION CHANGES

The changes listed below were incorporated during the course of tuner production. The letter following the component on the circuit diagram number, thus—407 A, indicates that this item was affected by a circuit change and corresponds to the notes shown below.

NOTE A: There are five different types of U.H.F. tuner strips used in conjunction with this tuner, therefore, inspection of tuner should be made to determine type of strip used for replacement.

With three of these types, the auxiliary fine tuning screw is mounted on the front face of the U.H.F. drum assembly. The color of the plastic coil form is either blue-gray, brown or white. These three coils are interchangeable.

Two of the five types have the auxiliary fine tuning slug mounted directly on the coil form. The color of the plastic form is either brown or white. These latter two coils are interchangeable.

Strips that have the auxiliary fine tuning slug as part of the coil form can not be interchanged with strip whose auxiliary fine tuning screw is mounted on the face of the U.H.F. drum assembly.

NOTE B: On some tuners, condenser 406 (1 Mmfd.), located across the U.H.F. preselection tuning circuit, was formed by a pair of twisted insulated leads.

NOTE C: Some tuners do not have oscillator, trimmer #411.

NOTE D: Condenser #29 (1500 Mmfd.) was added to the 119 volt supply to reduce V.H.F. oscillator radiation.

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
		CONDENSERS	
402-A, B	‡	Condenser—Assembly A—1 Mmfd. B—2 Mmfd.	—
405	‡	Condenser—trimmer	—
406	‡	Condenser—ceramic 1 Mmfd.	—
408	‡	Condenser—trimmer	—
411	‡	Condenser—trimmer	—
416-B	‡	Condenser—ceramic 5 Mmfd. (part of V.H.F. Antenna Filter)	—
416-D	‡	Condenser—ceramic 68 Mmfd. (part of V.H.F. Antenna Filter)	—
416-F	‡	Condenser—ceramic 68 Mmfd. (part of V.H.F. Antenna Filter)	—
418	‡	Condenser—ceramic 10 Mmfd. ±5% (Feed-thru type)	—
419	‡	Condenser—ceramic 800 Mmfd. (Feedthru type)	—
420	‡	Condenser—ceramic 800 Mmfd. (Feedthru type)	—
422	‡	Condenser—trimmer 0.5 to 3 Mmfd.	—
423	‡	Condenser—ceramic 1500 Mmfd. 500 volt	—
424	‡	Condenser—ceramic 6.8 Mmfd. ±10% 500 v.	—
427	‡	Condenser—ceramic 3 Mmfd. ±10% 500 v.	—
428	‡	Condenser—ceramic 1500 Mmfd. 500 volt	—
430	‡	Condenser—ceramic 800 Mmfd. (Feedthru type)	—
432	‡	Condenser—ceramic 1.5 Mmfd. ±10% 500 v.	—
434	‡	Condenser—ceramic 47 Mmfd. ±10% 500 v.	—
435	‡	Condenser—trimmer 0.5 to 3 Mmfd.	—
444	‡	Condenser—V.H.F. fine tuning	—
445	‡	Condenser—trimmer 0.5 to 3 Mmfd.	—
446	‡	Condenser—ceramic 47 Mmfd. ±10% (Feed-thru type)	—
447	‡	Condenser—ceramic 10 Mmfd. ±10% 500 v.	—
448	‡	Condenser—trimmer 0.5 to 3 Mmfd.	—
450	‡	Condenser—ceramic 5 Mmfd. ±5% 500 volt	—
453	‡	Condenser—ceramic 1500 Mmfd. 500 volt	—
455	‡	Condenser—ceramic 220 Mmfd. ±10% 500 v.	—
457	‡	Condenser—ceramic 68 Mmfd. ±3% 500 volt	—
460	‡	Condenser—ceramic 800 Mmfd. (Feedthru type)	—
461	‡	Condenser—ceramic 800 Mmfd. (Feedthru type)	—
462	‡	Condenser—ceramic 800 Mmfd. (Feedthru type)	—
		RESISTORS	
412	‡	Resistor—carbon 10,000 Ohms ½ watt	—
415	‡	Resistor—carbon 1000 Ohms ±10% ½ watt	—
425	‡	Resistor—carbon 22,000 Ohms ±10% ½ w.	—
426	‡	Resistor—carbon 47,000 Ohms ½ watt	—
		RESISTORS—Continued	
431	‡	Resistor—carbon 270,000 Ohms ±10% ½ w.	—
433	‡	Resistor—carbon 180,000 Ohms ±10% ½ w.	—
436	‡	Resistor—carbon 680 Ohms ±10% ½ watt	—
439	‡	Resistor—carbon 4700 Ohms ±10% ½ watt	—
441	‡	Resistor—carbon 33,000 Ohms ½ watt	—
442	‡	Resistor—carbon 3300 Ohms ±10% 1 watt	—
443	‡	Resistor—carbon 15,000 Ohms ±10% ½ watt	—
449	‡	Resistor—carbon 10,000 Ohms ½ watt	—
451	‡	Resistor—carbon 100,000 Ohms ±10% ½ w.	—
452	‡	Resistor—carbon 100,000 Ohms ±10% ½ w.	—
456	‡	Resistor—carbon 100,000 Ohms ±10% ½ w.	—
459	‡	Resistor—carbon 8200 Ohms ±10% ½ watt	—
		COILS AND TRANSFORMERS	
403	‡	Coil—choke	—
404	‡	Coil—choke	—
407	522451	Coil—U.H.F. antenna, mixer and osc., Channel 14-19 (Coded 10B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522461	Coil—U.H.F. antenna, mixer and osc., Channel 14-19 (Coded 10B—Brown or White form; with osc. slug)	5.50
	522452	Coil—U.H.F. antenna, mixer and osc., Channel 20-29 (Coded 20B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522462	Coil—U.H.F. antenna, mixer and osc., Channel 20-29 (Coded 20B—Brown or White form; with osc. slug)	5.50
	522453	Coil—U.H.F. antenna, mixer and osc., Channel 30-39 (Coded 30B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522463	Coil—U.H.F. antenna, mixer and osc., Channel 30-39 (Coded 30B—Brown or White form; with osc. slug)	5.50
	522454	Coil—U.H.F. antenna, mixer and osc., Channel 40-49 (Coded 40B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522464	Coil—U.H.F. antenna, mixer and osc., Channel 40-49 (Coded 40B—Brown or White form; with osc. slug)	5.50
	522455	Coil—U.H.F. antenna, mixer and osc., Channel 50-59 (Coded 50B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522465	Coil—U.H.F. antenna, mixer and osc., Channel 50-59 (Coded 50B—Brown or White form; with osc. slug)	5.50
	522456	Coil—U.H.F. antenna, mixer and osc., Channel 60-69 (Coded 60B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522466	Coil—U.H.F. antenna, mixer and osc., Channel 60-69 (Coded 60B—Brown or White form; with osc. slug)	5.50
		COILS AND TRANSFORMERS—Continued	
407 (Cont.)	522457	Coil—U.H.F. antenna, mixer and osc., Channel 70-79 (Coded 70B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522467	Coil—U.H.F. antenna, mixer and osc., Channel 70-79 (Coded 70B—Brown or White form; with osc. slug)	5.50
	522458	Coil—U.H.F. antenna, mixer and osc., Channel 80-83 (Coded 80B—Blue-gray, Brown or White form; no osc. slug)	5.50
	522468	Coil—U.H.F. antenna, mixer and osc., Channel 80-83 (Coded 80B—Brown or White form; with osc. slug)	5.50
	522434	Slug—U.H.F. auxiliary fine tuning (used with Blue-gray, Brown or White coil form that does not include slug)	.15
	522435	Slug—U.H.F. auxiliary fine tuning (used with Brown or White coil form that includes slug)	.15
409	‡	Coil—choke	—
413	‡	Coil—choke	—
414	‡	Coil—choke	—
416-A	‡	Coil—filter (Part of V.H.F. antenna filter)	—
416-C	‡	Coil—filter (Part of V.H.F. antenna filter)	—
416-E	‡	Coil—filter (Part of V.H.F. antenna filter)	—
417	522402	Coil—V.H.F. antenna, channel #2 (coded 2U)	1.40
	522403	Coil—V.H.F. antenna, channel #3 (coded 3U)	1.40
	522404	Coil—V.H.F. antenna, channel #4 (coded 4U)	1.40
	522405	Coil—V.H.F. antenna, channel #5 (coded 5U)	1.40
	522406	Coil—V.H.F. antenna, channel #6 (coded 6U)	1.40
	522407	Coil—V.H.F. antenna, channel #7 (coded 7U)	1.15
	522408	Coil—V.H.F. antenna, channel #8 (coded 8U)	1.15
	522409	Coil—V.H.F. antenna, channel #9 (coded 9U)	1.15
	522410	Coil—V.H.F. antenna, channel #10 (coded 10U)	1.15
	522411	Coil—V.H.F. antenna, channel #11 (coded 11U)	1.15
	522412	Coil—V.H.F. antenna, channel #12 (coded 12U)	1.15
	522413	Coil—V.H.F. antenna, channel #13 (coded 13U)	1.15
421	‡	Coil—U.H.F. converter I.F.	—
429	‡	Coil—cathode coupling	—
437	522422	Coil—V.H.F. R.F. and osc., channel #2 (coded 2U)	1.85
	522423	Coil—V.H.F. R.F. and osc., channel #3 (coded 3U)	1.85
	522424	Coil—V.H.F. R.F. and osc., channel #4 (coded 4U)	1.85
	522425	Coil—V.H.F. R.F. and osc., channel #5 (coded 5U)	1.85
	522426	Coil—V.H.F. R.F. and osc., channel #6 (coded 6U)	1.85
	522427	Coil—V.H.F. R.F. and osc., channel #7 (coded 7U)	1.70
	522428	Coil—V.H.F. R.F. and osc., channel #8 (coded 8U)	1.70
		COILS AND TRANSFORMERS—Continued	
437 (Cont.)	522429	Coil—V.H.F. R.F. and osc., channel #9 (coded 9U)	1.70
	522430	Coil—V.H.F. R.F. and osc., channel #10 (coded 10U)	1.70
	522431	Coil—V.H.F. R.F. and osc., channel #11 (coded 11U)	1.70
	522432	Coil—V.H.F. R.F. and osc., channel #12 (coded 12U)	1.70
	522433	Coil—V.H.F. R.F. and osc., channel #13 (coded 13U)	1.70
	507986	Slug—V.H.F. auxiliary fine tuning	.05
438	‡	Coil—U.H.F. I.F. amp.	—
440	‡	Coil—U.H.F. I.F. amp.	—
454	‡	Coil—Choke	—
458	‡	Coil—V.H.F. converter plate I.F.	—
		OTHER ELECTRICAL PARTS	
401	115444	Switch-antenna (includes terminal board)	2.50
410	521819	Crystal detector	4.50
416	‡	V.H.F. antenna filter (includes coils 416-A, C, E and condensers 416-B, D, F)	—
		MISCELLANEOUS	
	522414	Cover—tuner	2.00
	522529	Fine tuning drive quadrant	.75
	522599	Fine tuning cam V.H.F.	.30
	500966	Plug—1 pin; tuner I.F. output	.10
	522420	Plug—3 pin; U.H.F. power	.25
	508708	Roller—detent	.10
	522417	Shield, tube—7 pin	.25
	521121	Shield, tube—9 pin	.18
	522434	Slug; U.H.F. auxiliary fine tuning (used with Blue-gray, Brown or White coil form that does not include slug)	.15
	522435	Slug; auxiliary fine tuning (used with Brown or White coil form that includes slug)	.15
	507986	Slug; V.H.F. auxiliary fine tuning	.05
	508709	Spring; detent	.08
	522416	Spring; retains drum shaft (front or rear)	.15
	522415	Spring; retains drum shaft (middle)	.15
	522419	Spring; retains fine tuning shaft and contact board	.15
	522421	Spring; retains fine tuning drive shaft ("C" type)	.15
	522436	Spring; retains U.H.F. slug	.15
	507990	Spring; retains V.H.F. slug	.10
	522418	Spring; rocker arm contact board (external hold down)	.15

‡—This part is not supplied as a Service replacement item. Tuner to be returned to factory for repair.
ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

27" Rectangular Picture Tube
Model 27C-9310A (Mahogany)
Model 27C-9310AB (Blond)

PROCEDURE FOR REMOVAL AND REPLACEMENT OF PICTURE TUBE

Due to the size and weight of the picture tube and the fact that the tube is suspended within the cabinet, the following procedure should be observed whenever replacement is undertaken.

REMOVAL:

1. Disconnect power cord from wall outlet and take off the back of cabinet by removing screws around edges.

2. Remove receiver chassis by first taking off all knobs which may be done by pulling them straight forward. Next, take out the five chassis mounting screws located under chassis mounting shelf. Disconnect focus coil, deflection yoke, picture tube and speaker leads, as well as grounding wire from deflection yoke mounting bracket. Chassis may now be withdrawn from cabinet.

3. CABINET SHOULD NEXT BE PLACED ON ITS FACE ON A CARPETED OR OTHERWISE PROTECTED SURFACE. ALL WORK DESCRIBED IN THE FOLLOWING STEPS SHOULD BE DONE WITH THE CABINET IN THIS POSITION.

4. Slide Ion Trap off picture tube neck.

5. Remove the four corner retaining nuts labeled A in Fig. 24 as well as the four curved retaining plates. Picture tube may be lifted straight up from cabinet **by grasping it under FACE of tube—CAUTION: DO NOT GRASP OF LIFT TUBE BY ITS NECK AS THE WEIGHT OF TUBE (APPROX. 45 LBS.) MIGHT CAUSE IT TO SNAP OFF.** Place tube on its face on a flat protected surface.

6. After tube has been removed loosen the four mounting bracket retaining nuts, labeled B in Fig. 24, and disengage rods from corner brackets. Lift entire focus coil and yoke mounting assembly from neck of tube. This should be done carefully as adhesion of :ubber ring to the flare of the neck may cause assembly to stick to picture tube. Corner brackets on tube may now be removed by loosening the nut labeled C in Fig. 24, that retains the tube mounting strap.

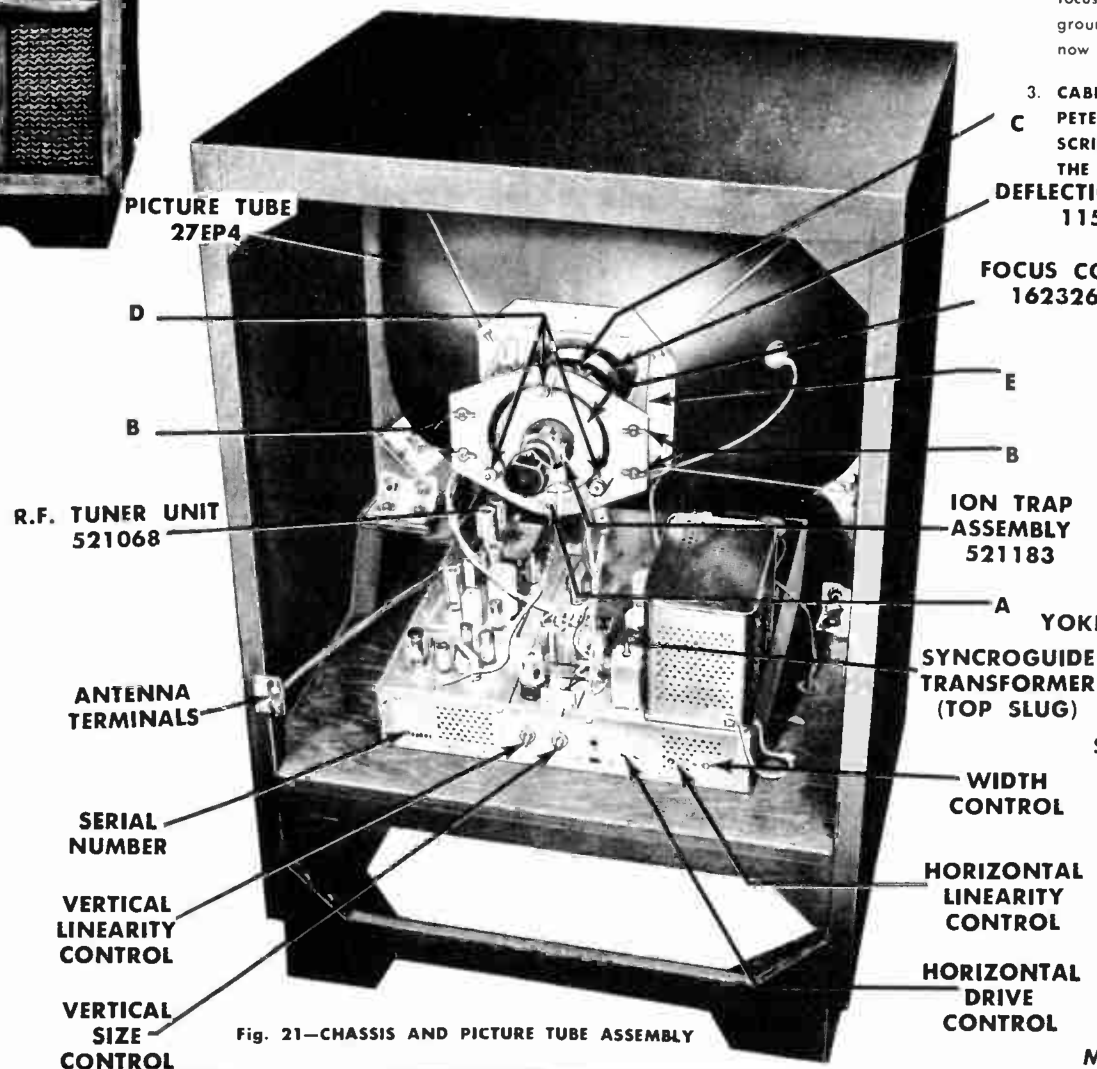


Fig. 21—CHASSIS AND PICTURE TUBE ASSEMBLY

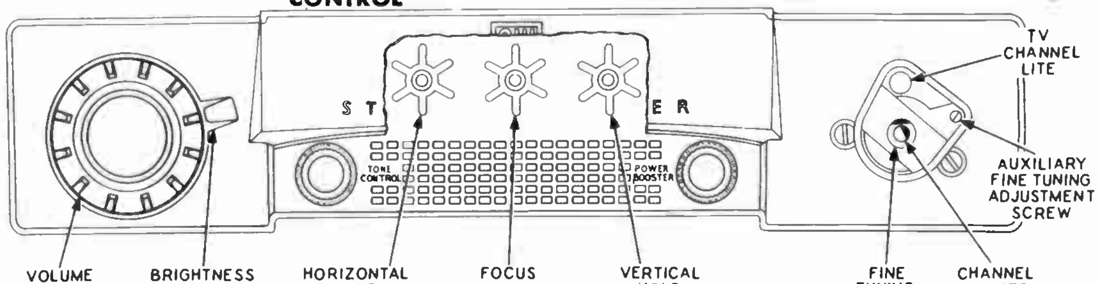


Fig. 11—LOCATIONS OF PRE-SET CONTROLS

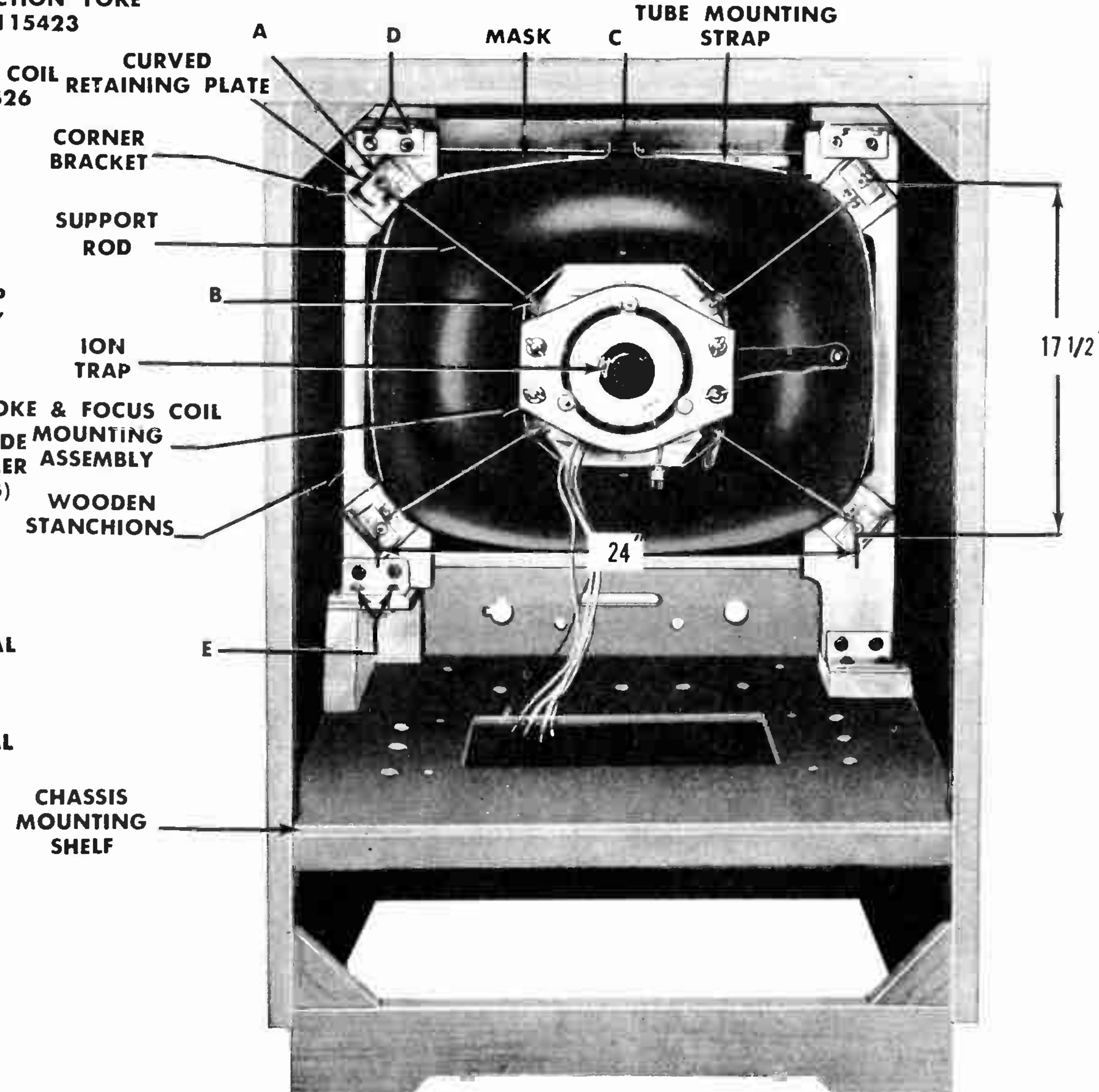


Fig. 24—PICTURE TUBE MOUNTING

REPLACEMENT

The reverse order of the removal procedure should be followed while at the same time exercising the following precautions:

1. Corner brackets and tube mounting strap must be assembled to the picture tube before it is installed into the cabinet and this is accomplished as follows:

   a. Brackets can be temporarily attached to each corner of the picture tube by the use of adhesive tape. They must be placed on each corner of the tube so that the curve of the bracket conforms to the curve of the tube and must be oriented so that the distance between the centers of the square mounting holes, in the brackets, will be 24" on the long side of the tube and 17½" on the short side of the tube. (See Fig. 24 for proper method of measurement.)

   b. Set the tube mounting strap into recesses on corner brackets and tighten nut labeled C until strap is taut. Heel of strap bracket will start to kick up when this tautness is reached.

2. Lower tube into cabinet **by grasping it under its face—CAUTION: DO NOT GRASP OR LIFT TUBE BY ITS NECK.** Should wood stanchions fail to keep tube from seating properly (due to a tolerance difference in the size of the tube) it would then be necessary to again remove tube and to spread distance between stanchions. To do this, loosen ceiling nuts labeled D in Fig. 24 and chassis mounting shelf bolts labeled E.

3. After re-inserting tube into cabinet, and before tightening nuts labeled B, be sure that stanchions are up against corner mounting brackets as far as possible, that there is equal distance on each side between side of stanchion and side wall of cabinet and that ceiling nuts labeled D and chassis mounting shelf bolts labeled E are securely tightened.

4. After tube has been secured and yoke and focus coil mounting assembly has been re-assembled to tube, cabinet can be raised to its normal position. Any forward or backward adjustment of tube with respect to mask can be made by loosening nuts labeled D and bolts labeled E and adjusting position of stanchions.

GENERAL SPECIFICATIONS

PICTURE SIZE

27" Rectangular

DIMENSIONS

Model	Height	Width	Depth
27C-9310A	42¾"	29¼"	23¼"
27C-9310AB	42¾"	29¼"	23¼"

WEIGHT (packed)

Model	Weight
27C-9310A	207 lbs.
27C-9310AB	207 lbs.

POWER REQUIREMENTS

117 volts 60 cycles 275 watts

ANTENNA INPUT IMPEDANCE

300 ohms—balanced to ground.

BUILT-IN ANTENNA

Broad band dipole.

SPEAKER

Model	Type	Size	V.C. Imped.
27C-9310A	P.M. Dynamic	6" x 9"	3.2 ohms
27C-9310AB	P.M. Dynamic	6" x 9"	3.2 ohms

R.F. TUNER

Turret type construction; individually removable coil assemblies for all channels. All components are easily accessible for servicing.

INTERMEDIATE FREQUENCIES

Sound Carrier—21.5 Mc.
Picture Carrier—26 Mc.

I.F. SYSTEM

Three Stages—stagger tuned—for composite signal.
One additional stage for sound channel.

DETECTOR

Sound—Ratio Type
Picture—Germanium Crystal Type

RETRACE LINE SUPPRESSOR

Eliminates retrace lines thruout the normal range of picture brightness and contrast.

DEFLECTION

Magnetic

FOCUS

Magnetic

HORIZONTAL SYNCHRONIZATION

Automatic frequency control provides excellent picture stability.

HIGH VOLTAGE POWER SUPPLY

"Fly-back" type. Completely enclosed in a shielded compartment.

HORIZONTAL OSCILLATOR ADJUSTMENTS

NOTE: These adjustments are very critical and should only be performed by a qualified serviceman. Failure to comply with this caution may result in serious malperformance of the receiver.
If adjustment of the "Horizontal Hold" control as explained in step 3 under the section entitled "Control Adjustment Procedure" fails to lock the picture horizontally, it will be necessary to make the following adjustments:

1. Set "Horizontal Hold" control to its maximum counter-clockwise position.
2. Set "Top Slug" of Syncroguide transformer to its maximum counterclockwise position. Then, adjust "Top Slug" clockwise until picture locks in and does not lose sync when switching "Channel Selector" knob. Turn "Top Slug" counterclockwise until picture is just about ready to lock in sync as shown in Fig. 23.

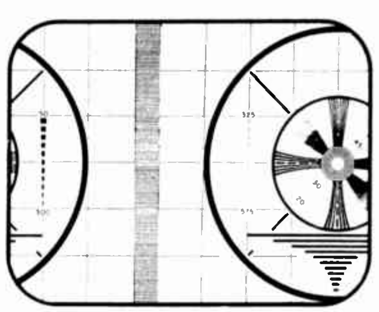


Fig. 23

3. Rotate "Horizontal Hold" control slowly clockwise and picture should hold sync at its maximum clockwise setting.
4. Horizontal holding action of receiver should now be as follows:

   a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 23 or be just out of sync.

   b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.

   c. When "Horizontal Hold" control is set in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.

5. If the preceding steps fail to correct for horizontal movement, then proceed as follows:

   a. Set "Horizontal Drive" control to its maximum counter-clockwise position. See Fig. 21 for location of control.

   b. If any vertical bars appear near the left counter of the picture, adjust "Horizontal Drive" control clockwise until these bars are removed.

   c. Repeat steps 1, 2, 3 and 4.

6. If it still becomes impossible to obtain proper horizontal sync and all tubes and components relating to the horizontal circuit are found to be in good working order, it will be necessary to perform a complete adjustment of the Syncroguide transformer as outlined in the service data section of the service manual.

ALIGNMENT PROCEDURE

The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits.

Alignment of all RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts.

These procedures should preferably be applied in the order in which they are presented. Alignment of Sound Channel or IF Channel may be accomplished individually if desired.

The RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned.

CAUTION

The picture tube is highly evacuated and if broken, fragments will be violently expelled. Handle with care, using safety goggles and gloves.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment process. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated.

   a. IF Frequencies:
   4.5 Mc. Sound Channel
   21.5 Mc. to 26 Mc. IF Channel

   b. RF Frequencies:
   54 to 88 Mc.
   174 to 216 Mc.

2. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.

3. **RF SWEEP GENERATOR** to provide frequency modulated signal for observing the over-all bandpass characteristic and RF Channel alignment at the following frequencies:

   20 to 30 Mc. with 10 Mc. sweep width.
   54 to 88 Mc. with 10 Mc. sweep width.
   174 to 216 Mc. with 10 Mc. sweep width.

4. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe. This instrument is used for observing the over-all band-pass characteristic and for RF Channel alignment.

SOUND CHANNEL ALIGNMENT PROCEDURE

1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and Power Booster control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. A small screwdriver (preferably non-metallic) can be used for alignment of Sound IF. The blade of this tool will fit the slot in the core of the transformer.

STANDARD SIGNAL GENERATOR		VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY				
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Power Booster control to its maximum counter-clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in Fig. 3. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2. 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V3, V4 or V5). This will prevent noise in the RF stages from affecting the voltage reading while adjusting the sound trap.	**#1** 4.5 MC Sound Trap (See Fig. 10)	Adjust for minimum reading on VTVM.
Same as above	Same as above.	Connect as shown in Fig. 4.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	**#2** Discriminator Secondary (See Fig. 10)	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary (See Fig. 11)	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 5.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 5.	**#2** Discriminator Secondary (See Fig. 10)	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.

Replace the type 6CB6 tube previously removed in the above procedure and turn set on. Tune in to a local channel and should there be an unusual amount of "Intercarrier Buzz" refer to procedure on adjoining page to remove this aforementioned fault.

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

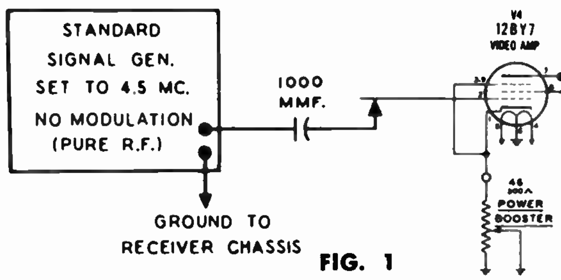


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

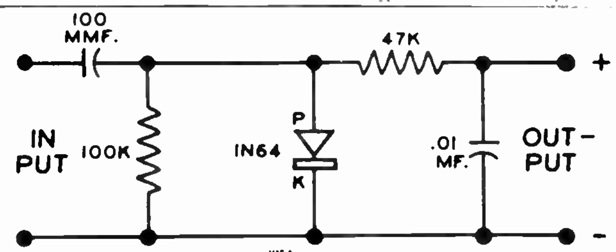


FIG. 3
Circuit Diagram for Crystal Detector shown in Fig. 2

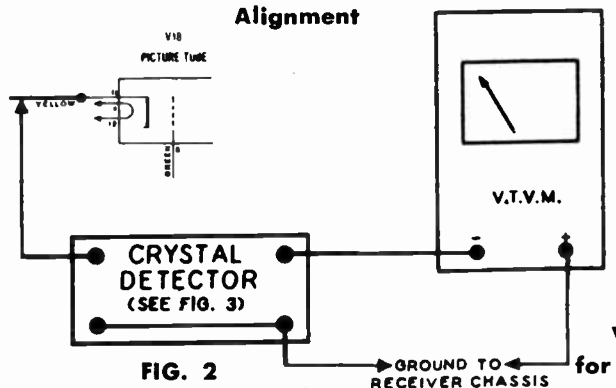


FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

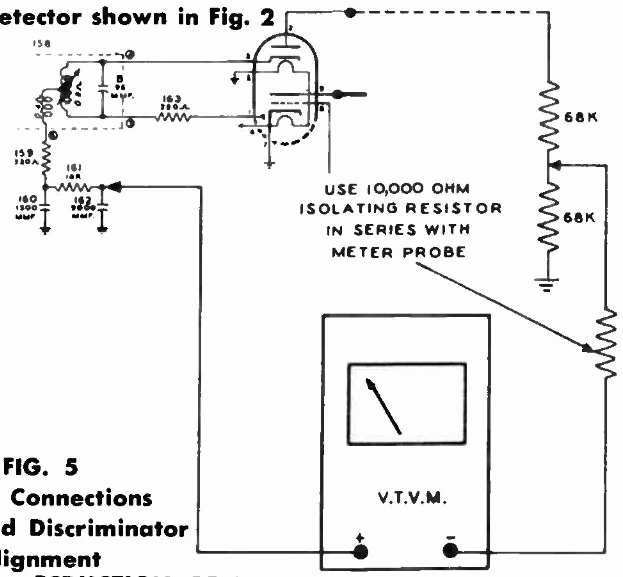


FIG. 5
VTVM Connections for Sound Discriminator Alignment

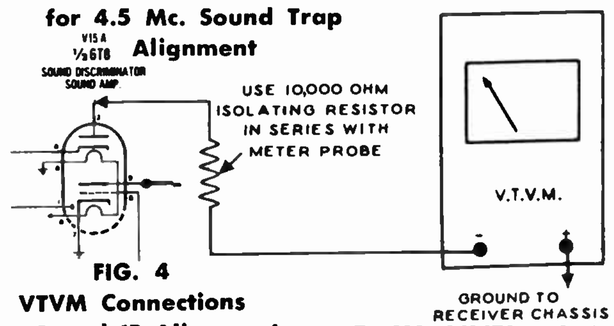


FIG. 4
VTVM Connections for Sound IF Alignment

REDUCTION OF INTERCARRIER BUZZ

Under actuol reception conditions slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an occurate setting of the discriminatar secondary slug under these conditions.

Disconnect all instruments (be sure that I.F. tube remc ved for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

IF CHANNEL ALIGNMENT PROCEDURE

1. A special aligning tool designed to fit the stems on adjustable cores of the I.F. coils (see points 6, 7 and 8 in Fig. 10) is available and may be obtained from Stewart-Warner by requesting I.F. Alignment Tool #507479.

2. In order to eliminate the possibility of spurious oscillations, it is desirable to render the RF oscillator inoperative. This may be readily accomplished by insulating oscillator terminals of tuner. Remove tuner bottom shield and place a piece of transparent cellulose tape on the first two contacts (from front) of drum assembly. Use any inoperative channel and rotate drum to this insulated position.

3. Short antenna terminals together with a jumper wire.

4. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to the AGC line and positive terminal of battery connects to receiver chassis. See Fig. 11 for convenient point of connection.

5. If the IF channel is badly misaligned and two or more immediately adjoining IF stages are tuned to the same frequency, oscillation may occur. Such oscillation shows up as an excessive voltage across the video detector load, circuit reference number 49 and 50, and is indicated by the VTVM that is connected to this point during alignment. It should be noted that voltage due to IF oscillation is unaffected by strength of signal from the generator.

   Where IF oscillation is encountered, it is generally possible to correct the condition by detuning the IF coils in different directions. If that does not have the desired effect, increase fixed bias on AGC line by using a 4½ volt battery instead of the 3 volt battery referred to in instruction #4. After stopping the oscillation in this manner it will then be possible to align all IF stages using the following procedure, however, the AGC bias battery must be changed back to 3 volts when using the oscilloscope to observe band pass characteristics. Once all stages have been aligned using the 4½ volt bias, the IF channel should be stable with reduced bias.

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	'SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Connect as shown in Fig. 7.	23.5 MC.	Not used.	—	Connect as shown in Fig. 9.	Not used.	Be sure that RF oscillator has been rendered inoperative as outlined in instruction #2 at the head of this chart.	#5 Converter plate coil (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	23.5 MC.	Not used.	—	Same as above.	Not used.	Same as above.	#6 1st I.F. (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	25.9 MC.	Not used.	—	Same as above.	Not used.	Same as above.	#7 2nd I.F. (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	25.9 MC.	Not used.	—	Same as above.	Not used.	Same as above.	#8 3rd I.F. (See Fig. 10)	Adjust for maximum reading on VTVM.
Connect as shown in Fig. 8.	26 MC.	Connect as shown in Fig. 8.	25 MC. Sweep Width 10 Mc.	Same as above.	Connect as shown in Fig. 9	IMPORTANT: 1. Adjust output attenuator on sweep generator so that reading on VTVM is approximately one-half volt. 2. Set attenuator on standard signal generator so that marker signal does not distort the pattern on the oscilloscope. 3. Be sure that a 3 volt battery is connected to AGC line as specified in instruction #4 at the head of this chart. Do not use a battery of any other voltage.	The I.F. bandpass characteristic can now be observed by the use of a 'scope. Its general shape and contour should compare with the curve shown in Fig. 6. The picture carrier marker (26 Mc.) should appear at the 50% (±10%) amplitude position of the curve as shown in Fig. 6. Should this observation fail to meet the above requirements, the complete I.F. alignment procedure must be repeated, exercising greater care in frequency setting of the marker generator and adjusting the I.F. transformer slugs for maximum output at the prescribed frequencies.	
Same as above.	21.5 MC.	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.	The sound carrier marker (21.5 Mc.) can be observed by the use of a 'scope and should be compared with that shown in Fig. 6. Increase the vertical gain control on 'scope in order to magnify the sound portion of the response curve. This marker should appear at the position indicated in Fig. 6. Should the sound marker not be properly positioned, check the setting of the picture carrier marker as indicated in the previous step.	

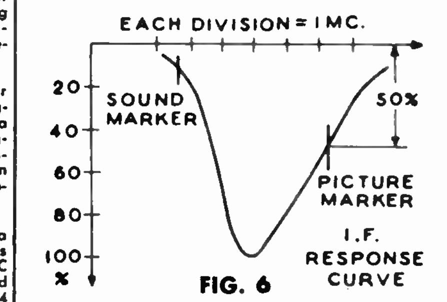


FIG. 6

INSTRUMENT CONNECTIONS FOR IF CHANNEL ALIGNMENT

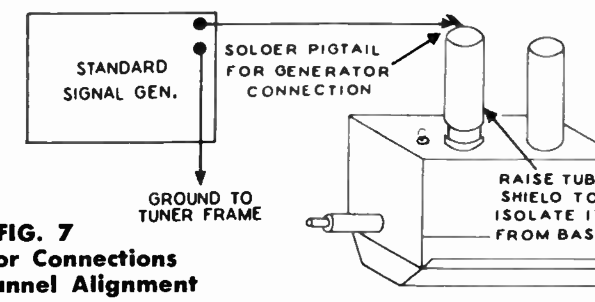


FIG. 7
Generator Connections for IF Channel Alignment

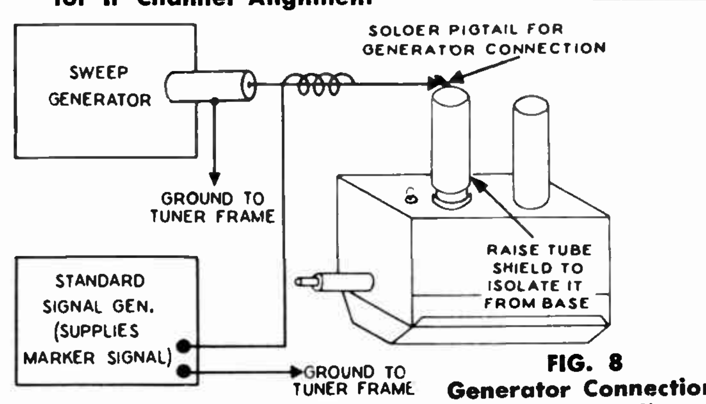


FIG. 8
Generator Connections for IF Channel Alignment

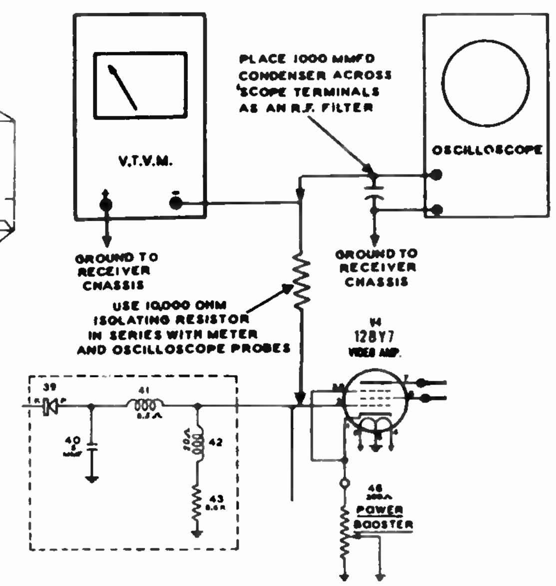


FIG. 9
VTVM and Oscilloscope Connections for IF Channel Alignment

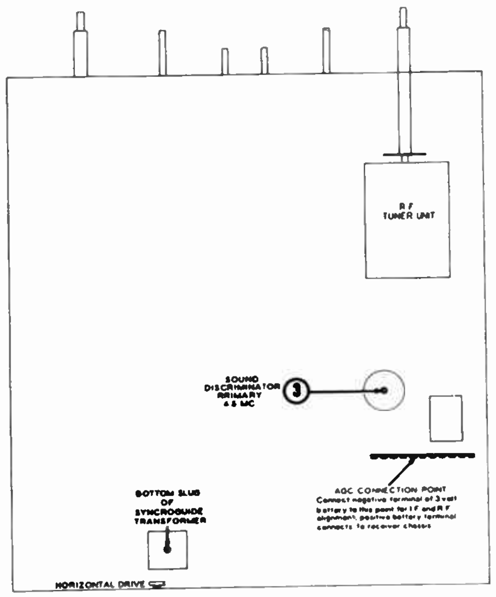


FIG. 11
Bottom View of Chassis

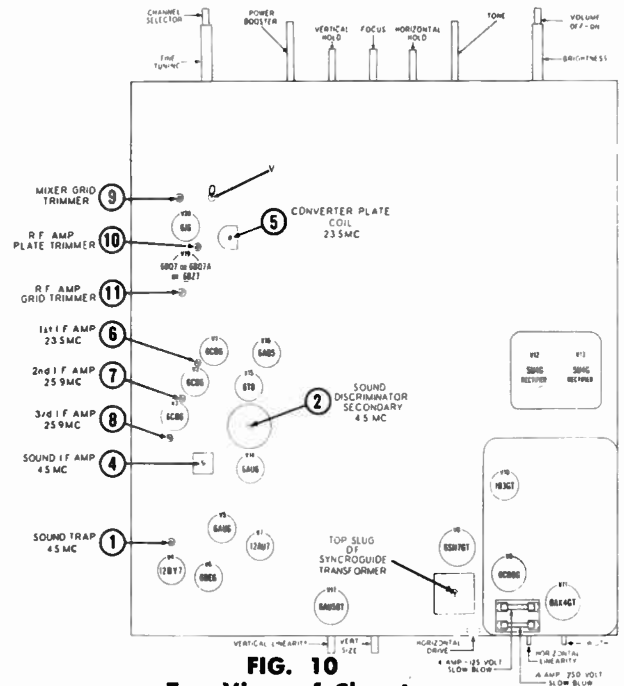


FIG. 10
Top View of Chassis

OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in Fig. 6.
2. During this step and thru-out all succeeding steps it is necessary to keep output of sweep generator at a level that does not allow reading on VTVM to exceed one-half volt.
3. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.

Connect as shown in Fig. 12.	**197.75 MC.** Sound Carrier Marker. **193.25 MC.** Picture Carrier Marker.	Connect as shown in Fig. 12 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	**CHANNEL #10**	Connect as shown in Fig. 14.	Connect as shown in Fig. 14	Set Channel Selector to Channel #10. Be sure that generator's output does not exceed voltage specified in instructions #2 and 3 above.	Using a long non-metallic screwdriver (approx. 12"), adjust channel #10 oscillator slug (accessible thru hole on front of RF Tuner Unit—see Fig. 18) to shift response curve so that picture carrier marker is located at the position indicated in Fig. 17. Position of sound carrier marker should appear as indicated in Fig. 17.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 15.	Same as above.	Set sweep generator to channel frequencies being observed.	Same as above	Same as above.	Set channel selector to channel being observed.	Adjust the RF sweep generator and marker generator for operation on the other television channels. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of RF Tuner Unit (see Fig. 18). This permits response curve to be shifted so that picture and sound carrier markers will appear at the position indicated in Fig. 17. NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 18.)

If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel. If characteristic does not conform reasonably well within the typical curve shown in Fig. 16, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

RF CHANNEL ALIGNMENT PROCEDURE

1. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 11 for convenient point of connection.)
2. During alignment, it is necessary to set the Fine Tuning control so that the tooth on the fiber fine tuning cam points downward (correct position for this control is shown in Fig. 18).

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 12.	**197.75 MC.** Sound Carrier Marker. **193.25 MC.** Picture Carrier Marker.	Connect as shown in Fig. 12 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	**CHANNEL #10**	Not used.	Connect as shown in Fig. 13.	Set Channel Selector to Channel #10. IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	**#9** Mixer Grid. (See Fig. 19) **#10** RF Amp. Plate. (See Fig. 19) **#11** RF Amp. Grid. (See Fig. 19)	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 16. Use Mixer Grid trimmer #9; and RF Amplifier Plate trimmer #10 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #11 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. IMPORTANT: When adjusting trimmers #9, 10 and 11 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 15.	Same as above.	Set sweep generator to channel frequencies being observed.	Not used.	Same as above.	Set channel selector to channel being observed.	The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #9, 10 and 11. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. Band pass characteristic of these channels should conform close to the RF response curve in Fig. 16. If necessary, a compromise may be obtained to compensate for large variations in channel response by returning to channel #10 and making slight changes in the settings of trimmers #9, 10 and 11.	

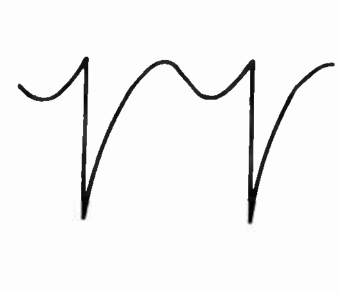
SYNCROGUIDE TRANSFORMER ALIGNMENT

Alignment of the Syncroguide transformer, circuit diagram #128, which is used in the Horizontal Oscillator circuit can be accomplished by utilizing this procedure. To perform this alignment, it will be necessary to use an oscilloscope, preferably one that has a 2 megacycle response and a low input capacity probe—under 100 mmfd. to ground.

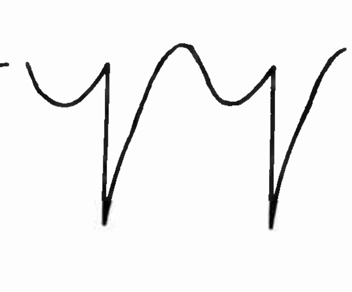
1. Set the "Top Slug" and "Bottom Slug" of the Syncroguide transformer to their maximum counter-clockwise positions.
2. Short together terminals C and D of the Syncroguide transformer.
3. Adjust "Horizontal Drive" control, located on rear of chassis pan, one-half turn out from its maximum clockwise position.
4. Set "Horizontal Hold" control, located at front of chassis, to its maximum clockwise position.
5. Turn on receiver and tune in any local TV channel.
6. Adjust "Top Slug" clockwise until picture just locks in horizontally.
7. Remove short from terminals C and D. If picture does not hold sync when short is removed, adjust "Bottom Slug" clockwise until picture locks in.
8. Connect 'scope to terminal C of Syncroguide transformer and adjust sweep rate of 'scope until two cycles of oscillogram remain stationary. Turn "Bottom Slug" clockwise until wave form peaks are equal in height as shown in Fig. 24.

IMPORTANT: The first peak of the wave form should never be higher than the second peak nor should the first peak be lower than the second peak by more than 3%. Also, when adjusting the "Bottom Slug," the picture must be in sync, therefore, it may be necessary to turn the "Horizontal Hold" control counter-clockwise when performing this step. After this adjustment has been completed, disconnect 'scope from receiver.

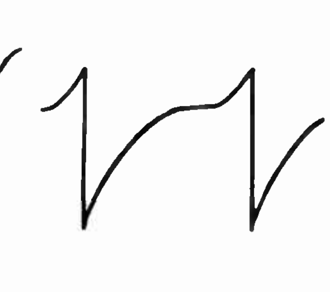
9. Set "Horizontal Hold" control counter-clockwise and adjust "Top Slug" until picture is locked in and does not lose sync when switching "Channel Selector" knob. Then, turn "Top Slug" slowly counter-clockwise until picture is just ready to lose sync. as shown in Fig. 27.
10. Horizontal Holding action of receiver should now be as follows:
    a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 27 or be out of sync.
    b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.
    c. When "Horizontal Hold" control is in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.



CORRECT
Fig. 24



INCORRECT
Fig. 25



INCORRECT
Fig. 26

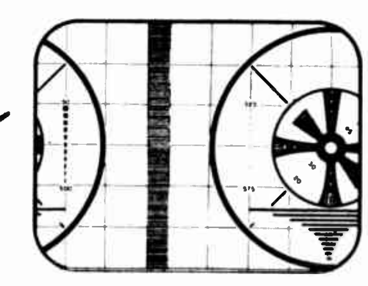


Fig. 27

INSTRUMENT CONNECTIONS FOR R.F. CHANNEL ALIGNMENT

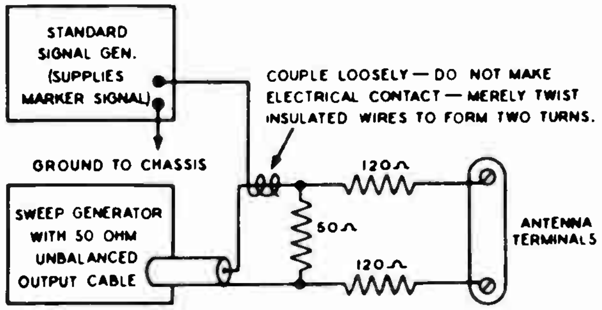


FIG. 12
Generator Connections for RF Channel Alignment

CHANNEL NUMBER	PICTURE CARRIER MARKER FREQ.	SOUND CARRIER MARKER FREQ.
13	211.25 MC.	215.75 MC.
12	205.25 MC.	209.75 MC.
11	199.25 MC.	203.75 MC.
10	193.25 MC.	197.75 MC.
9	187.25 MC.	191.75 MC.
8	181.25 MC.	185.75 MC.
7	175.25 MC.	179.75 MC.
6	83.25 MC.	87.75 MC.
5	77.25 MC.	81.75 MC.
4	67.25 MC.	71.75 MC.
3	61.25 MC.	65.75 MC.
2	55.25 MC.	59.75 MC.

Fig. 15

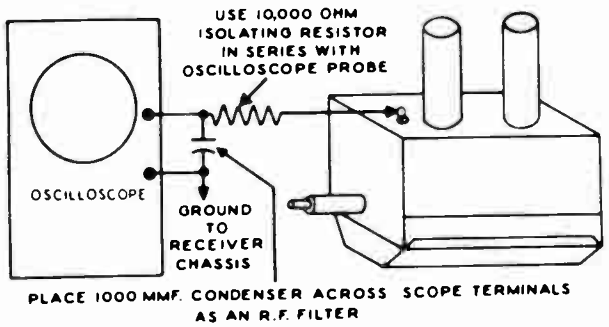


FIG. 13
Oscilloscope Connections for RF Amp. and Mixer Alignment

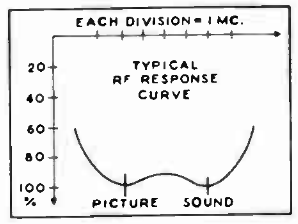


FIG. 16

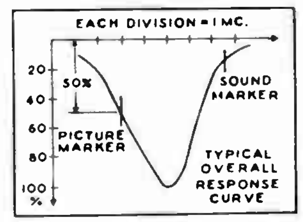


FIG. 17

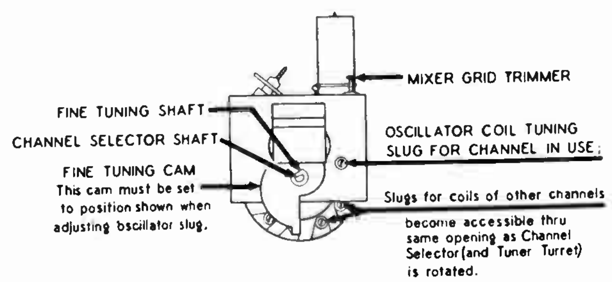


FIG. 18
Front View of RF Tuner Unit

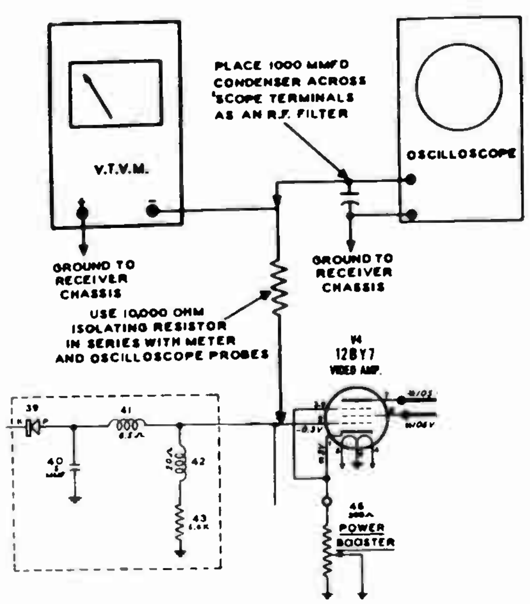


FIG. 14
VTVM and Oscilloscope Connections for Oscillator Alignment

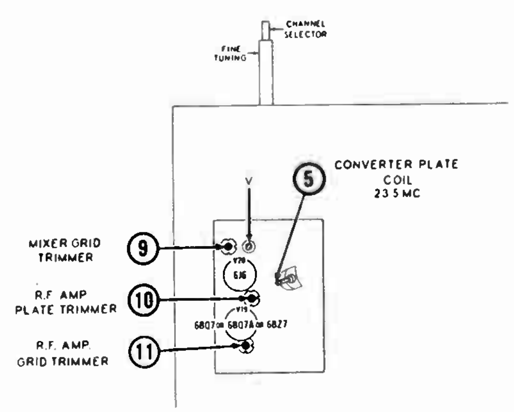


FIG. 19
Trimmer Location of R.F. Tuner

CIRCUIT DESCRIPTION FOR 521068 RF TUNER

The turret type tuner incorporated in this chassis is of the latest design and utilizes a 6BQ7 or 6BZ7 tube as the R.F. amplifier (V5) and a 6J6 tube (V6) as the Mixer-Oscillator.

Channel selection is accomplished by rotation of the turret containing two sets of easily removable coil assemblies for each channel. The individual antenna coil sections consist of a balanced primary to minimize noise pick-up on the transmission line and an R.F. grid coil which couples the incoming signal to the grid of the first section of the R.F. Amplifier tube (V5). The inductance and amount of coupling of the tuned antenna input circuit are changed for each channel so that a constant input impedance of 300 ohms is maintained. This provides maximum transfer of energy to the R.F. Amplifier stage, particularly when interconnection between an outdoor antenna and the receiver is made with 300 ohm transmission line.

The R.F. Amplifier tube is a dual-triode tube and is connected in the circuit as a direct coupled grounded-grid type amplifier. This circuit was developed to meet the demand for an R.F. Amplifier that would provide more nearly equal gain on both the low and high Television Channels, while keeping inherent tube noise to a minimum. The circuit can be thought of very simply as two triode tubes in series, the first or driver unit acting not as an amplifier, but rather as an antenna impedance matching device and also as a variable cathode impedance, or bias source, for the second, or grounded-grid unit. In addition the first unit of the R.F. Amp. acts as a power amplifier due to its extremely low plate impedance, which is in reality the cathode circuit of unit two, and converts the weak signal voltage from the antenna to a low voltage-high current signal which is then applied to the cathode of unit number two. The signal coupling unit between the first and second units is a series peaking coil, symbol 406, similar to that found in a video amplifier circuit. Its purpose is to form a series resonant circuit with the input capacity of the second unit. The coil is so made as to resonate at a frequency slightly higher than channel 13. In a standard pentode type amplifier, the gain falls off rapidly as progressively higher channels are selected. With the use of the plate to cathode peaking coil an almost equal gain can be realized for all channels.

The R.F. Amp. tube has inherently low interelectrode capacity due to physical design and this factor in conjunction with the low output impedance of the first section is responsible for the low noise factor at this stage. While neutralization of the first unit is not necessarily due to its low plate to grid capacity, additional noise reduction has been realized, with only a slight decrease in gain, by the addition of a neutralizing condenser, item 405. Due to the low output impedance of the stage, it is not necessary that the neutralizing condenser be tunable.

Because of the circuits' excellent internal shielding, low input impedance and radiation rejection, the second section of the R.F. Amp. is connected as a driven grounded-grid amplifier. While this might not be apparent at first glance due to the fact that grid has no direct D.C. return, it will be found upon further examination that any high frequency A.C. potentials are by-passed to ground through condenser 407.

The second section of turret coils includes the tuned R.F. amplifier plate coil, tuned mixer grid coil, and oscillator coil. The output of the R.F. amplifier stage is coupled to the grid of the mixer stage, which utilizes one triode section of a 6J6 tube (V6). The other half of the 6J6 is connected as a modified Colpitts oscillator which injects oscillator voltage into the mixer stage through coupling between the oscillator coil and the mixer grid coil. Course oscillator tuning is accomplished by adjusting the positions of the slugs in the individual oscillator coils, while Fine Tuning is obtained when using condenser #417 in the oscillator plate circuit. This Fine Tuning condenser is composed of two fixed plates, and its capacitance is changed by the insertion of a bakelite cam between these plates.

Signal output from the mixer stage is coupled to the IF amplifiers through the converter plate I.F. coil, diagram #427, located on the tuner unit.

REPAIR DATA FOR 521068 RF TUNER

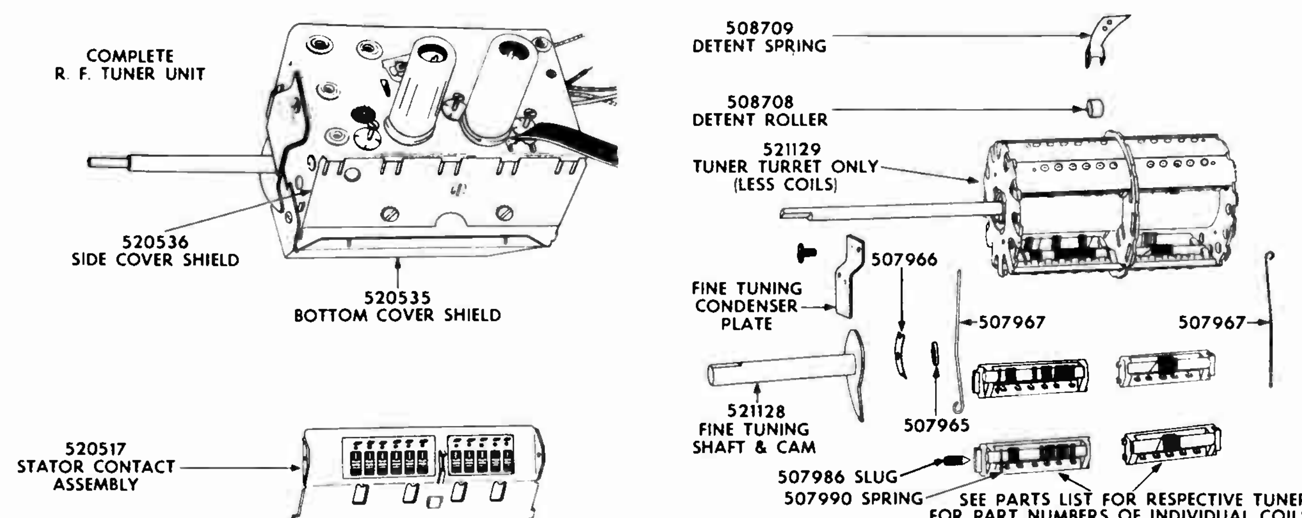


FIG. 20

SERVICE PRECAUTIONS

SUBJECT	PRECAUTIONS
ELECTRICAL COMPONENTS	The high frequencies used in the RF section of a television receiver make it necessary that considerable care be exercised in servicing the tuner. Lead dress and location of components are very critical at these frequencies. When replacing parts, it is important to use components of identical electrical characteristics and physical size. Always reconnect the replacement item in the same location and position in the tuner as the original component.
TUBES	Replacement of tubes in the Tuner Unit may cause slight detuning of RF circuits due to inherent differences in inter-electrode capacitances. When replacing tubes (especially 6J6 mixer-oscillator tube) make sure that Fine Tuning control will tune in television stations at approximately the middle of its range. It may be necessary to change the setting of the individual oscillator coil slugs for some channels to accomplish this.

SUBJECT	PRECAUTIONS
CHANNEL COILS AND SLUGS	Channel Coils must be handled with care. **Do not disturb coil windings.** If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.
FINE TUNING CONTROL	Rubbing of the bakelite Fine Tuning Cam against the Fine Tuning Condenser Plate is intentional in order to avoid vibration with resulting microphonics. However, the Fine Tuning Cam should **not** rub or contact the small circular plate located on the body of the tuner.

REMOVAL AND REPLACEMENT OF PARTS

ITEM	PROCEDURE
RF TUNER UNIT	To remove the Tuner Unit from receiver chassis, proceed as follows: 1. Remove channel selector dial lamp socket. 2. Remove screws which hold tuner to front and rear support brackets. 3. Disconnect the leads from the tuner to the main chassis. See illustration on circuit diagram page showing tuner connections. 4. Tuner unit may now be withdrawn from underside of chassis.
CHANNELS COILS	It is not necessary to remove entire tuner unit to replace a snap-in channel coil but removal of bottom shield will be required. This may be accomplished by grasping the front end of the shield and pulling downward and unhooking it from rear of tuner frame. Insert a screwdriver blade between Coil Retainer Spring and the end of the Tuner Turret. Twist the blade to pull spring away from the molded body of Channel Coil. Lift this end of coil body upward and remove individual coil assembly from tuner. When replacing Channel Coils, be sure they are reinstalled in their correct positions. Coil numbers should increase consecutively in a counter-clockwise direction when tuner is viewed from the front. If all the Channel Coils have been removed from the Tuner Turret, rotate turret until flat surface on end of tuner shaft points down. Install #3 Channel Coils into bottom position on turret. Then follow the correct sequence indicated above to replace other coils.
TUNER TURRET ASSEMBLY	To remove turret from RF Tuner Unit, remove complete tuner and bottom shield as described in previous sections and proceed as follows: 1. Remove rear Turret Shaft Retaining Spring by disengaging straight end of spring from projection on tuner frame. 2. Remove Fine Tuning Condenser Plate from front of Tuner Unit. This plate forms one side of Fine Tuning control condenser and is held in place by one screw. 3. Slide Fine Tuning Cam and Shaft off of main Channel Selector Shaft. 4. Remove Spring Contactor Washer and Fiber Spacer Washer from Channel Selector Shaft. 5. Remove Shaft Retaining Spring at front of tuner by disengaging straight end of spring from projection on frame. 6. Remove turret assembly from frame. To replace turret, reverse the above procedure. Tooth on bakelite Fine Tuning Cam should point downward during assembly so that it does not become locked between the stops on the Fine Tuning Condenser Plate. Also be sure to replace bottom shield.
STATOR CONTACT ASSEMBLY	To remove this assembly, remove complete tuner as described in previous sections and proceed as follows: 1. Remove side shield by taking out the two retaining screws and unsolder shield at one point. Now, disengage shield from upper edge of tuner frame. 2. Remove the two screws at the front and rear of the Stator Contact Assembly. 3. Unsolder all electrical connections to contact plate. 4. Unsolder five soldered joints between Stator Contact Assembly and Tuner Unit. 5. Contact Assembly may now be withdrawn from frame. To reinstall this assembly: 1. Place Stator Contact Assembly in position and replace, but do not tighten, the two screws at the front and rear of the assembly. 2. Remove 3 consecutive pairs of Channel Coils from the turret (for example, the antenna and rf-osc. coils for channels #5, 6 and 7). 3. Position Tuner Turret so that the edges of the next highest Channel Coils (in this case, the coils for channel #8) just pass the row of 11 contacts on the Stator Contact Assembly. 4. Adjust position of the Stator Contact Assembly so that there are a few thousandths of an inch spacing between the contacts on the contact plate and the molded body of the Channel Coils. 5. The Contact Assembly is now correctly positioned and screws at front and rear may be tightened. 6. Solder Stator Contact Assembly to tuner frame at same points that were used previously. 7. Make all electrical connections to contact plate. 8. Replace Channel Coils. 9. Replace side shield.

CIRCUIT DIAGRAM FOR 521068 RF TUNER

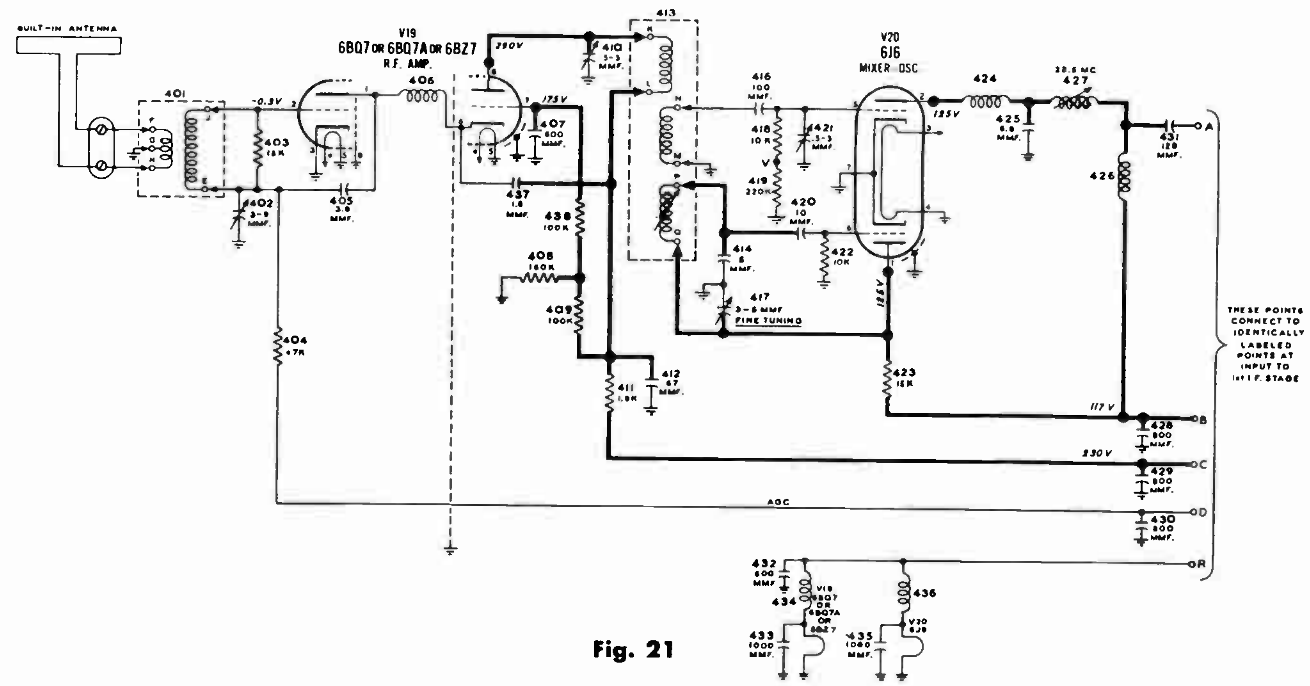
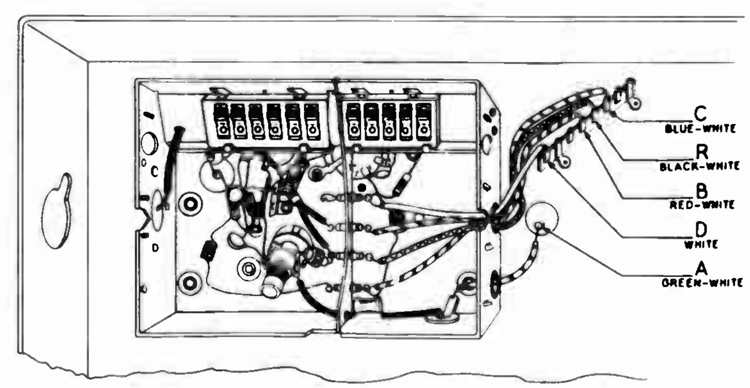


Fig. 21



BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNIT

FIG. 22

VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

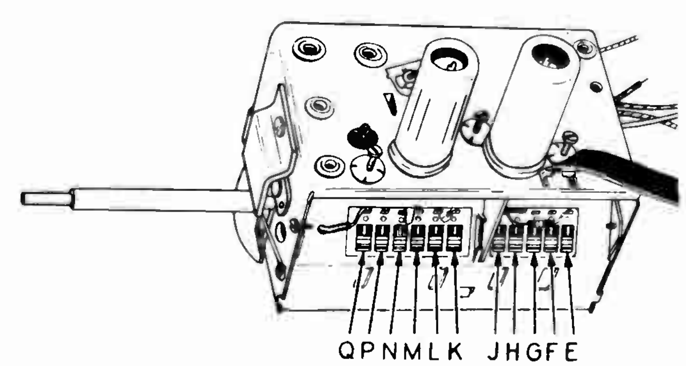
Controls set for normal reception—Power Booster control completely counterclockwise.

Voltages marked with an asterisk (*) will vary widely with control settings.

B supply voltages were measured under the above conditions.

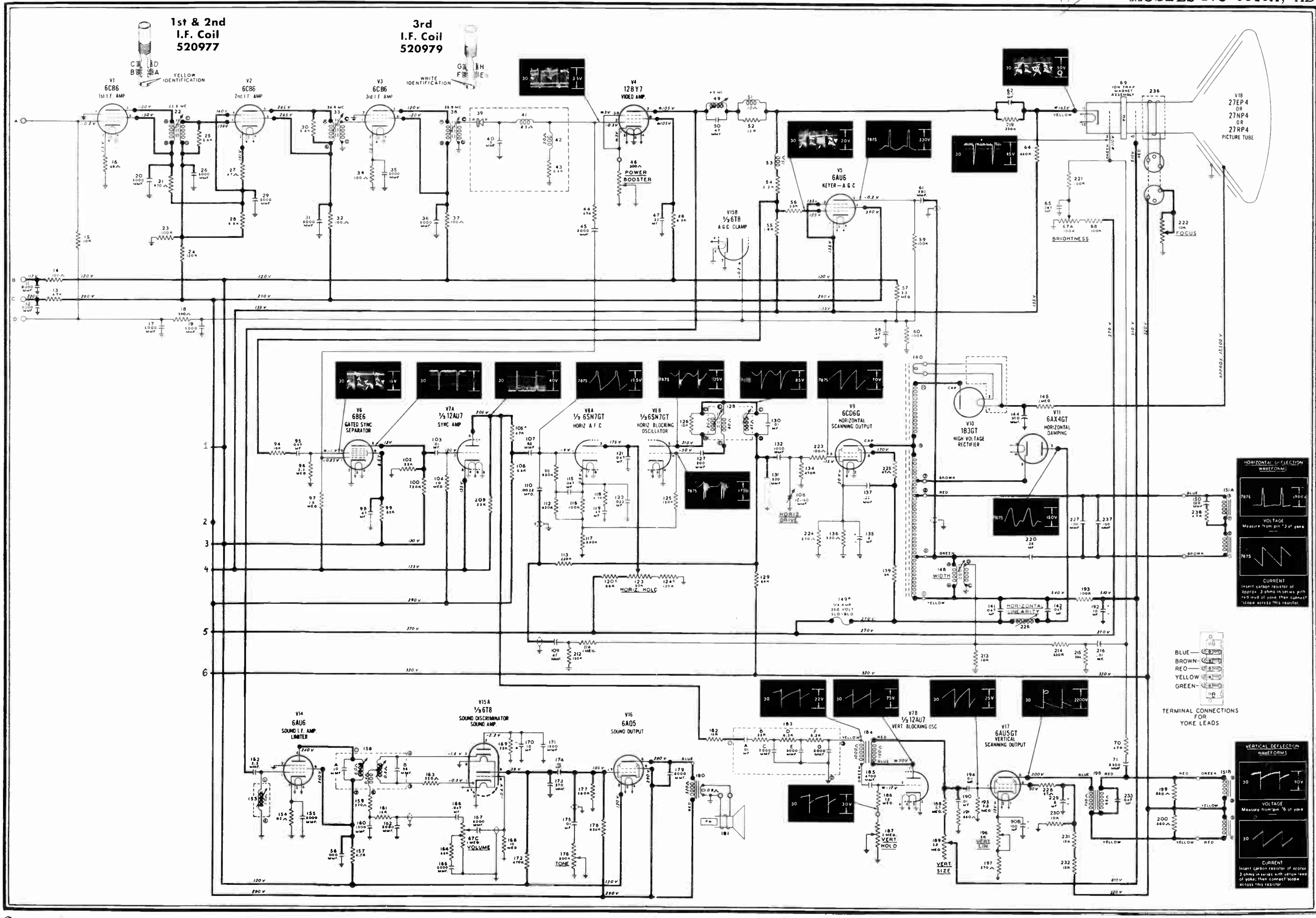
R.F. tuner socket voltage measurements were taken with tubes removed from socket.

No voltage reading at a tube element indicate zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.



521068 R.F. TUNER UNIT
(SHOWN WITH SIDE SHIELD REMOVED)

FIG. 23


1st & 2nd
I.F. Coil
520977
YELLOW IDENTIFICATION
3rd
I.F. Coil
520979
WHITE IDENTIFICATION
V1 6CB6 1st I.F. AMP
V2 6CB6 2nd I.F. AMP
V3 6CB6 3rd I.F. AMP
V4 12BY7 VIDEO AMP.
POWER BOOSTER
V5 6AU6 KEYER-A G C
V15B 1/2 6T8 A G C CLAMP
V18 27EP4 OR 27NP4 OR 27RP4 PICTURE TUBE
ION TRAP MAGNET ASSEMBLY
BRIGHTNESS
FOCUS
V6 6BE6 GATED SYNC SEPARATOR
V7A 1/2 12AU7 SYNC AMP
V8A 1/2 6SN7GT HORIZ A F C
V8B 1/2 6SN7GT HORIZ BLOCKING OSCILLATOR
V9 6CD6G HORIZONTAL SCANNING OUTPUT
V10 1B3GT HIGH VOLTAGE RECTIFIER
V11 6AX4GT HORIZONTAL DAMPING
HORIZ. DRIVE
HORIZ. HOLD
WIDTH
HORIZONTAL LINEARITY
HORIZONTAL DEFLECTION WAVEFORMS
VOLTAGE
CURRENT
BLUE
BROWN
RED
YELLOW
GREEN
TERMINAL CONNECTIONS FOR YOKE LEADS
V14 6AU6 SOUND I.F. AMP. LIMITER
V15A 1/2 6T8 SOUND DISCRIMINATOR SOUND AMP.
V16 6AQ5 SOUND OUTPUT
VOLUME
TONE
V7B 1/2 12AU7 VERT BLOCKING OSC
V17 6AU5GT VERTICAL SCANNING OUTPUT
VERT HOLD
VERT SIZE
VERT LIN
VERTICAL DEFLECTION WAVEFORMS

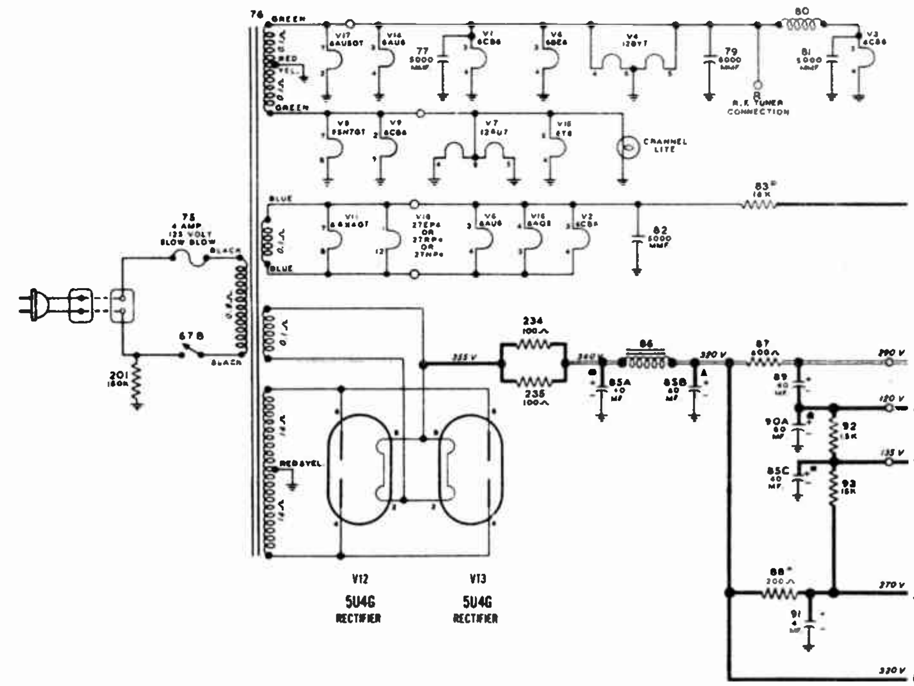
PRODUCTION CHANGES

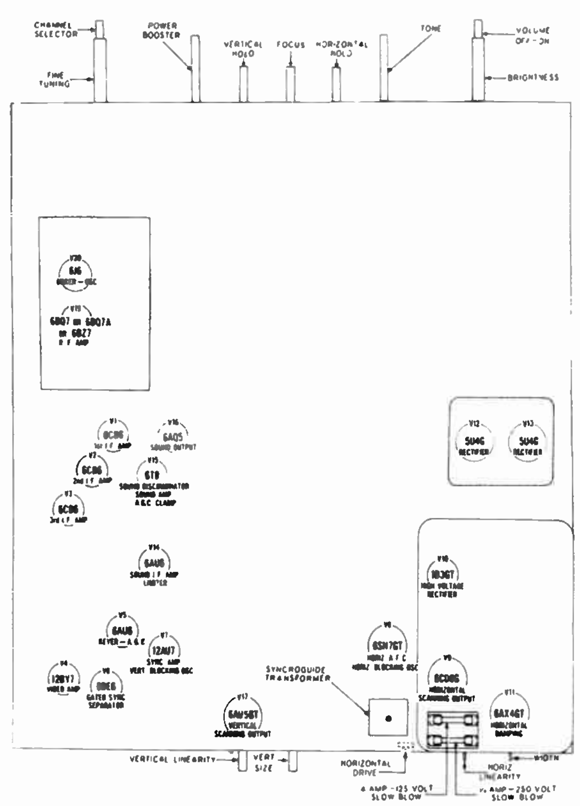
The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. The coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D".

The circuit shown on this page applies to "SERIES ABCD" chassis

A letter following the component circuit diagram number thus—201^A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
UNCODED	**INITIAL PRODUCTION**
"A"	The following change was incorporated to improve sync. stability in the presence of electrical interference or weak signal. 1. Disconnect resistor 94 (18,000 Ohms) from the plate of tube V4-12BY7 (Video Amp.) and reconnect it to the junction of resistors 54 (2200 Ohms) and 55 (1800 Ohms) located in plate load circuit of tube V4. Note: The sound take-off for tube V14 (Sound I.F. Amp.) remains connected to the plate of tube V4 (Video Amp.) The following change was incorporated to provide for adequate width of the picture under the condition of low line voltage. 1. Change resistor 88 in 280 volt supply from 400 Ohms to 200 Ohms. The following change was incorporated to provide a greater margin of safety for the plate load resistor of tube V7A (12AU7). 1. Change resistor 105 located in plate circuit of tube V7A (Sync. Amp.) from 4700 Ohms ½ watt to 4700 Ohms 1 watt.
"B"	The following change was incorporated to protect resistor 88, located in the 280 volt supply, in the event of abnormal current drain in the high voltage system. 1. Change fuse 149 in the horizontal sweep circuit from a ½ Amp. 250 volt to a ¼ Amp. "Slow Blow" 250 volt.
"C"	The following changes were incorporated to improve the range of the horizontal hold control. 1. Change resistor 120, located in the plate circuit of tube V7A (Horiz. A.F.C.) from 22,000 Ohms to 68,000 Ohms. 2. Change resistor 124 located in the plate circuit of tube V7A (Horiz. A.F.C.) from 68,000 Ohms to 120,000 Ohms. The above change should only be undertaken when the letter "A" is included in the SERIES designation at rear of chassis.
"D"	The following change was incorporated to protect the filament winding of power transformer 76 that connects to the 6AX4GT (Horiz. Damping) in the event this tube develops a cathode to filament short. 1. Change resistor 83, located in filament supply, from 100,000 Ohms to 18,000 Ohms.





TUBE AND CONTROL LOCATIONS

VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception—Power Booster control completely counterclockwise.

Voltages marked with an asterisk (*) will vary widely with control settings.

No voltage reading at a tube element indicates zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.

OSCILLOGRAMS

All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Power Booster control adjusted to give 50 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within 20% at 2 MC.

Number appearing to the left of oscillogram specifies setting of horizontal sweep frequency control on 'Scope.

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
		OTHER ELECTRICAL PARTS	
39	509386	Crystal detector	1.00
69	521183	Ion trap	1.00
75	521803	Fuse; 4 amp. 125 volt "Slow Blow"	.25
78	118921	Channel lite (Mazda #47) 6-8V. 150 Ma.	.15
149	522320	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt "Slow Blow" (used when letter "B" is included in series designation at rear of chassis)	.25
149	521752	Fuse for horizontal sweep circuit; ½ Amp. 250 volt (used when letter "B" is not included in series designation at rear of chassis)	.20
181	508174	Speaker—P.M. Dynamic (6"x9")	8.40
183 A to G	508062	Integrator unit (includes all condensers and resistors from 183-A to 183-G)	1.40

CONDENSERS FOR R.F. TUNER

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
402	W509064	Condenser—trimmer 3-9 Mmfd.	.50
405	W513453	Condenser—ceramic 3 Mmfd. ±10% 500 volt	.35
407	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
410	507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
414	520717	Condenser—ceramic 5 Mmfd. ±5% 500 volt (Temperature compensating)	.35
416	520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	520718	Condenser—ceramic 10 Mmfd. ±10% 500 volt (Temperature compensating)	.30
421	507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	520716	Condenser—ceramic 6.8 Mmfd. ±5% (Temperature compensating)	.35
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	513029	Condenser—ceramic 120 Mmfd. ±10% 500 volt	.35
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
435	520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
437	520720	Condenser—ceramic 1.5 Mmfd. 500 volt	.35

RESISTORS FOR R.F. TUNER

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
403	510157	Resistor—carbon 15,000 Ohms ±10% ½ w.	.12
404	510167	Resistor—carbon 47,000 Ohms ½ w.	.12
408	510774	Resistor—carbon 160,000 Ohms ±5% ½ w.	.16
409	510751	Resistor—carbon 100,000 Ohms ±5% ½ w.	.20
411	510139	Resistor—carbon 1500 Ohms ±10% ½ w.	.12
418	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
419	510179	Resistor—carbon 220,000 Ohms ½ w.	.12
422	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
423	510157	Resistor—carbon 15,000 Ohms ±10% ½ w.	.12
438	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12

COILS FOR R.F. TUNER

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
401	520702	Coil-antenna; channel #2 (coded "2Q")	1.40
	520703	Coil-antenna; channel #3 (coded "3Q")	1.40
	520704	Coil-antenna; channel #4 (coded "4Q")	1.40
	520705	Coil-antenna; channel #5 (coded "5Q")	1.40
	520706	Coil-antenna; channel #6 (coded "6Q")	1.40
	520707	Coil-antenna; channel #7 (coded "7Q")	1.15
	520708	Coil-antenna; channel #8 (coded "8Q")	1.15
	520709	Coil-antenna; channel #9 (coded "9Q")	1.15
	520710	Coil-antenna; channel #10 (coded "10Q")	1.15
	520711	Coil-antenna; channel #11 (coded "11Q")	1.15
	520712	Coil-antenna; channel #12 (coded "12Q")	1.15
	520713	Coil-antenna; channel #13 (coded "13Q")	1.15
406	520701	Coil-cathode coupling	.15
413	520722	Coil-R.F. and osc; channel #2 (coded "2Q")	1.85
	520723	Coil-R.F. and osc; channel #3 (coded "3Q")	1.85
	520724	Coil-R.F. and osc; channel #4 (coded "4Q")	1.85
	520725	Coil-R.F. and osc; channel #5 (coded "5Q")	1.85
	520726	Coil-R.F. and osc; channel #6 (coded "6Q")	1.85
	520727	Coil-R.F. and osc; channel #7 (coded "7Q")	1.70
	520728	Coil-R.F. and osc; channel #8 (coded "8Q")	1.70
	520729	Coil-R.F. and osc; channel #9 (coded "9Q")	1.70
	520730	Coil-R.F. and osc; chan. #10 (coded "10Q")	1.70
	520731	Coil-R.F. and osc; chan. #11 (coded "11Q")	1.70
	520732	Coil-R.F. and osc; chan. #12 (coded "12Q")	1.70
	520733	Coil-R.F. and osc; chan. #13 (coded "13Q")	1.70
	507986	Slug for osc coil; auxiliary fine tuning adj.	.05
424	520714	Coil-choke	.15
426	520715	Coil-choke	.45
427	520734	Coil—converter plate I.F. (includes slug and clip)	.75
	509062	Slug core for converter plate coil	.12
434	520518	Coil-choke	.10
436	520520	Coil-choke	.10

CONDENSERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
11	513013	Condenser—ceramic 5000 Mmfd. 450 volt	$ .36
12	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
17	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
19	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
20	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
26	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
29	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
31	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
35	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
36	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
40	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
45	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
47	512238	Condenser—.22 Mfd. 200 volt	.50
50	513438	Condenser—ceramic 47 Mmfd. ±5% 500 v. (Temperature compensating)	.45
58	512239	Condenser—.47 Mfd. 200 volt	.75
61	513032	Condenser—ceramic 220 Mmfd. 1000 volt	.40
62	512216	Condenser—.1 Mfd. 200 volt	.30
65	512235	Condenser—.047 Mfd. 200 volt	.30
71	512520	Condenser—mica 3300 Mmfd. ±2% 500 volt	1.30
77	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
79	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
82	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
85-A,B,C	508072	Condenser—electrolytic A—40 Mfd. 450 volt; B—40 Mfd. 450 volt; C—40 Mfd. 450 volt	4.50
89	160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
90-A,B	509002	Condenser—electrolytic A—80 Mfd. 250 volt; B—100 Mfd. 50 volt	3.00
91	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
95	512235	Condenser—.047 Mfd. 200 volt	.30
98	512239	Condenser—.47 Mfd. 200 volt	.75
103	512205	Condenser—.01 Mfd. 400 volt	.25
107	513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
108	508071	Condenser—trimmer 10-160 Mmfd. (Horizontal Drive)	.40
109	513030	Condenser—ceramic 47 Mmfd. 1000 volt	.40
110	512232	Condenser—.0022 Mfd. 400 volt	.25
115	512235	Condenser—.047 Mfd. 200 volt	.30
119	512239	Condenser—.47 Mfd. 200 volt	.75
121	512236	Condenser—.047 Mfd. 400 volt	.30
122	512233	Condenser—.022 Mfd. 400 volt	.30
127	513427	Condenser—ceramic 200 Mmfd. ±2% 500 v. (Temperature compensating)	.65
130	512311	Condenser—.01 Mfd. 400 volt (Special Characteristic)	.30
131	512547	Condenser—mica 820 Mmfd. ±5% 500 volt	.50
132	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
135	520921	Condenser—electrolytic 4 Mfd. 150 volt	1.20
137	512223	Condenser—.25 Mfd. 400 volt	.60
141	512236	Condenser—.047 Mfd. 400 volt	.30
142	512236	Condenser—.047 Mfd. 400 volt	.30
144	521737	Condenser—ceramic 500 Mmfd. 30,000 volt	4.00
150	513042	Condenser—ceramic 150 Mmfd. ±5% 2000 v.	.30
152	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
155	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
156	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
158-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
158-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
160	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
162	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
165	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
166	512235	Condenser—.047 Mfd. 200 volt	.30
167	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
170	505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
171	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
173	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
174	512205	Condenser—.01 Mfd. 400 volt	.25
175	512204	Condenser—.01 Mfd. 200 volt	.25
179	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
183-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
183-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
185	512533	Condenser—mica 4700 Mmfd. ±5% 1000 v.	1.40
190	512218	Condenser—.1 Mfd. 600 volt	.55
192	508680	Condenser—electrolytic 10 Mfd. 600 volt	2.55
194	512218	Condenser—.1 Mfd. 600 volt	.55
206	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
216	512204	Condenser—.01 Mfd. 200 volt	.25
220	512223	Condenser—.25 Mfd. 400 volt	.60
227	513043	Condenser—ceramic 100 Mmfd. ±10% 3000 volt	.30
229	507386	Condenser—electrolytic 8 Mfd. 300 volt	1.25
233	512237	Condenser—.047 Mfd. 600 volt	.40
237	513042	Condenser—ceramic 150 Mmfd. ±5% 2000 v.	.30

RESISTORS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
13	510348	Resistor—carbon 4700 Ohms ±10% 2 watt	.25
14	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
15	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
16	510116	Resistor—carbon 68 Ohms ½ watt	.12
18	510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
21	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
23	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
24	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
25	510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
27	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
28	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
30	510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
32	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
34	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
37	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
43	510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
44	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
48	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
52	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt	.16
54	510242	Resistor—carbon 2200 Ohms ±10% 1 watt	.16
55	510141	Resistor—carbon 1800 Ohms ±10% ½ watt	.12
56	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
57	510701	Resistor—carbon 3.3 Meg. ±10% ½ watt	.12
59	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
60	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
64	510186	Resistor—carbon 560,000 Ohms ±10% ½ w.	.12
68	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
70	510167	Resistor—carbon 47,000 Ohms ±10% ½ watt	.12
83	510359	Resistor—carbon 18,000 Ohms ±10% 2 watt (used when letter "D" is included in series designation at rear of chassis)	.25
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "D" is not included in series designation at rear of chassis)	.12
87	510741	Resistor—wire wound 600 Ohms ±10% 10 w.	.90
88	510792	Resistor—wire wound 200 Ohms ±10% 10 watt (used when letter "A" is included in series designation at rear of chassis)	.90
	510779	Resistor—wire wound 400 Ohms ±10% 10 watt (used when letter "A" is not included in series designation at rear of chassis)	.75
92	510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
93	510357	Resistor—carbon 15,000 Ohms ±10% 2 w.	.35
94	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
96	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
97	510752	Resistor—carbon 1.5 Meg. ±10% ½ watt	.12
99	510171	Resistor—carbon 82,000 Ohms ±10% ½ w.	.12
100	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
102	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
104	510197	Resistor—carbon 10 Meg. ½ watt	.12
105	510248	Resistor—carbon 4700 Ohms ±10% 1 watt (used when letter "A" is included in series designation at rear of chassis)	.16
	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "A" is not included in series designation at rear of chassis)	.12
106	510251	Resistor—carbon 6800 Ohms ±10% 1 watt	.16
111	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
112	510189	Resistor—carbon 820,000 Ohms ±10% ½ w.	.12
113	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
114	510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
116	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
117	510281	Resistor—carbon 330,000 Ohms ±10% 1 w.	.16
118	510148	Resistor—carbon 4700 Ohms ±10% ½ watt	.12
120	510169	Resistor—carbon 68,000 Ohms ±10% ½ w. (used when letter "C" is included in series designation at rear of chassis)	.12
	510160	Resistor—carbon 22,000 Ohms ±10% ½ w. (used when letter "C" is not included in series designation at rear of chassis)	.12
124	510174	Resistor—carbon 120,000 Ohms ±10% ½ w. (used when letter "C" is included in series designation at rear of chassis)	.12
	510169	Resistor—carbon 68,000 Ohms ±10% ½ w. (used when letter "C" is not included in series designation at rear of chassis)	.12
125	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
126	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
129	510269	Resistor—carbon 68,000 Ohms ±10% 1 w.	.16
134	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
136	510327	Resistor—carbon 330 Ohms ±10% 2 watt	.25
139	510789	Resistor—wire wound 8000 Ohms ±10% 5 w.	.95
145	510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
154	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
157	510249	Resistor—carbon 4700 Ohms 1 watt	.16
159	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
161	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
163	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
164	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
168	510197	Resistor—carbon 10 Meg. ½ watt	.12
169	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
172	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
177	510778	Resistor—carbon 560,000 Ohms ±5% ½ w.	.16
178	510747	Resistor—carbon 820,000 Ohms ±5% ½ w.	.20
182	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
183-B	508062	Resistor—carbon 22,000 Ohms 1/5 watt (part of Integrator Unit)	1.40
183-D	508062	Resistor—carbon 8200 Ohms 1/5 watt (part of Integrator Unit)	1.40
183-F	508062	Resistor—carbon 8200 Ohms 1/5 watt (part of Integrator Unit)	1.40
186	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt	.12
188	510772	Resistor—carbon 2.7 Meg. ±5% ½ watt	.12
191	510134	Resistor—carbon 680 Ohms ½ watt	.12
193	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
195	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
197	510126	Resistor—carbon 270 Ohms ±10% ½ watt	.12
199	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
200	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
201	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
209	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
212	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
213	510254	Resistor—carbon 10,000 Ohms ±10% 1 watt	.16
214	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
215	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
217	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
219	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
221	510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
223	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
224	510326	Resistor—carbon 270 Ohms ±10% 2 watt	.25
225	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
228	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
230	510254	Resistor—carbon 10,000 Ohms ±10% 1 watt	.16
231	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
232	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
234	510781	Resistor—wire wound 100 Ohms ±10% 5 w.	.75
235	510781	Resistor—wire wound 100 Ohms ±10% 5 w.	.75
238	510248	Resistor—carbon 4700 Ohms ±10% 1 watt	.16

COILS AND TRANSFORMERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
22	520977	Transformer—1st video I.F. (less slug)	.75
	507357	Slug core for 1st video I.F. coil	.20
33	520977	Transformer—2nd video I.F. (less slug)	.75
	507357	Slug core for 2nd video I.F. coil	.20
38	520979	Transformer—3rd video I.F. (less slug)	.75
	507357	Slug core for 3rd video I.F. coil	.20
41	520620	Coil—peaking	.65
42	520985	Coil—peaking	.65
49	509603	Coil—4.5 Mc. trap (includes slug and condenser #50)	1.20
	507357	Slug core for 4.5 Mc. trap coil	.20
51	520689	Coil—peaking	.20
53	520342	Coil—peaking	.50
76	521725	Transformer—power	20.00
80	507584	Coil—choke	.28
86	508341	Choke—filter	3.60
128	520943	Transformer—syncroguide	2.50
	521064	Slug core for syncroguide transformer	.70
140	521735	Transformer—horizontal output (includes resistor 145)	14.00
148	508667	Coil—Width (includes slug and clip)	1.75
	508784	Slug core for Width coil (includes mtg. clip)	.65
151-A,B	115423	Yoke—picture tube deflection (includes leads, connectors, resistor 238 and condenser 150)	21.00
153	509378	Transformer—audio take-off	1.50
158	509706	Transformer—TV sound discriminator (includes condensers 158A and 158B)	3.00
180	509376	Transformer—audio output	1.85
184	520980	Transformer—vertical blocking oscillator	1.90
198	520975	Transformer—vertical output (includes connectors for deflection yoke leads)	4.00
226	520911	Coil—Horizontal Linearity (includes slug and clip)	1.50
236	162326	Coil—focus (includes cable and plug)	14.00

CONTROLS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
46	521057	Power Booster (Contrast) potentiometer (300 Ohms ½ watt)	1.00
67-A,B,C	521060	Volume and Brightness potentiometers (includes On-Off switch) A—Brightness (100,000 Ohms ¼ watt); B—On-Off Switch; C—Volume (1 Meg. ¼ watt)	1.00
108	508071	Horizontal Drive Condenser (10-160 Mmfd.)	.40
123	521059	Horizontal Hold potentiometer (50,000 Ohms ¼ watt)	2.00
148	508667	Width coil (includes slug and clip)	1.75
	508784	Slug for width coil (includes mtg. clip)	.65
176	520746	Tone potentiometer (500,000 Ohms ¼ watt)	1.00
187	521058	Vertical Hold potentiometer (1 Meg. ¼ w.)	1.00
189	520944	Vertical Size potentiometer (2.5 Meg. ¼ w.)	.80
196	520945	Vertical Linearity potentiometer (5000 Ohms ½ watt)	.90
222	521727	Focus potentiometer (10,000 Ohms 4 watt)	2.00
226	520911	Horizontal Linearity coil (includes slug and clip)	1.50

21" Rectangular Picture Tube
Model 21C-9325F (Mahogany)
Model 21C-9325G (Blond)

GENERAL SPECIFICATIONS

DIMENSIONS

Model	Height	Width	Depth
21C-9325F	37½"	25⅛"	22¾"
21C-9325G	37½"	25⅛"	22¾"

WEIGHT (packed)

Model	Weight
21C-9325F	130 lbs.
21C-9325G	132 lbs.

POWER REQUIREMENTS

117 volts 60 cycles 220 watts

PICTURE SIZE

21" Rectangular

ANTENNA INPUT IMPEDANCE

300 ohms—balanced to ground.

BUILT-IN ANTENNA

Broad band dipole.

R. F. TUNER

V.H.F.—Turret type
U.H.F.—Continuous tuning type

SPEAKER

Model	Type	Size	V.C. Imped.
21C-9325F	P.M. Dynamic	6"x9"	3.2 ohms
21C-9325G	P.M. Dynamic	6"x9"	3.2 ohms

INTERMEDIATE FREQUENCIES

Sound Carrier—41.25 Mc.
Picture Carrier—45.75 Mc.

I.F. SYSTEM

Three Stages—overcoupled—for composite signal.
One additional stage for sound channel.

DETECTOR

Sound—Ratio Type
Picture—Germanium Crystal Type
U.H.F. Mixer—Silicone Crystal Type

RETRACE LINE SUPPRESSOR

Eliminates retrace lines thruout the normal range of picture brightness and contrast.

DEFLECTION

Magnetic

FOCUS

Electrostatic

HORIZONTAL SYNCHRONIZATION

Automatic frequency control provides excellent picture stability.

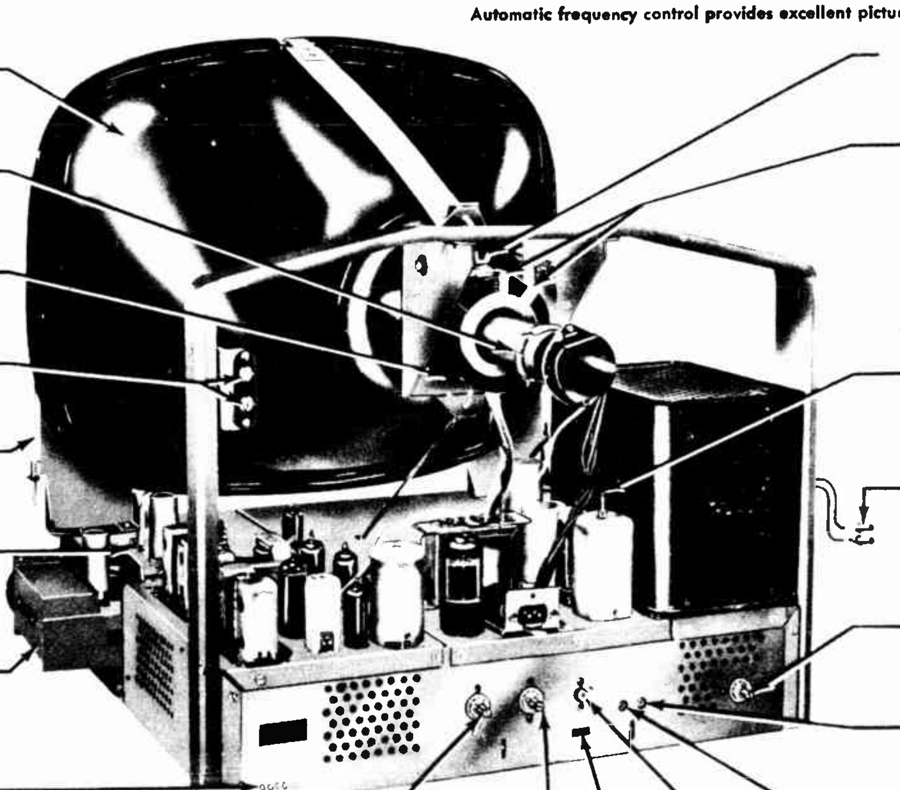


Fig. 16—CHASSIS AND PICTURE TUBE ASSEMBLY

ALIGNMENT PROCEDURE

The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits.

Alignment of all VHF RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts. These procedures should preferably be applied in the order in which they are presented. Alignment of Sound Channel or IF Channel may be accomplished individually if desired.

The VHF RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned.

CAUTION

The picture tube is highly evacuated and if broken, fragments will be violently expelled. Handle with care. Avoid contact with metal shell of picture tube as this is part of the high voltage circuit.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated.
   a. IF Frequencies:
   4.5 Mc. Sound Channel
   39.75 Mc. to 47.25 Mc. IF Channel
   b. RF Frequencies:
   54 to 88 Mc.
   174 to 216 Mc.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the UHF Tuner, part 521170, must be returned to the factory in accordance with the removal instructions, listed in a subsequent section under the heading "VHF-UHF Tuner Servicing Procedure" located on page 1953-33.
2. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.
3. **RF SWEEP GENERATOR** to provide frequency modulated signal for observing the over-all bandpass characteristic and RF Channel alignment at the following frequencies:

   40 to 50 Mc. with 10 Mc. sweep width.
   54 to 88 Mc. with 10 Mc. sweep width.
   174 to 216 Mc. with 10 Mc. sweep width.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the UHF Tuner, part 521170, must be returned to the factory in accordance with the removal instructions, listed in a subsequent section under the heading "VHF-UHF Tuner Servicing Procedure" located on page 1953-33.
4. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe. This instrument is used for observing the over-all bandpass characteristic and for RF Channel alignment.

SOUND CHANNEL ALIGNMENT PROCEDURE

1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and Power Booster control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. A small screwdriver (preferably non-metallic) can be used for alignment of Sound IF. The blade of this tool will fit the slot in the core of the transformer.

STANDARD SIGNAL GENERATOR: CONNECTIONS	STANDARD SIGNAL GENERATOR: FREQUENCY	VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Power Booster control to its maximum counter-clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in Fig. 3. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V1, V2 or V3). This will prevent noise in the RF stages from affecting the voltage reading while adjusting the sound trap.	#1 4.5 MC Sound Trap (See Fig. 10)	Adjust for minimum reading on VTVM.
Same as above	Same as above.	Connect as shown in Fig. 4.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	#2 Discriminator Secondary (See Fig. 10)	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary (See Fig. 8)	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 5.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 5.	#2 Discriminator Secondary (See Fig. 10)	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.

Replace the type 6CB6 tube previously removed in the above procedure and turn set on. Tune in to a local channel and should there be an unusual amount of "Intercarrier Buzz" refer to procedure on adjoining page to remove this aforementioned fault.

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

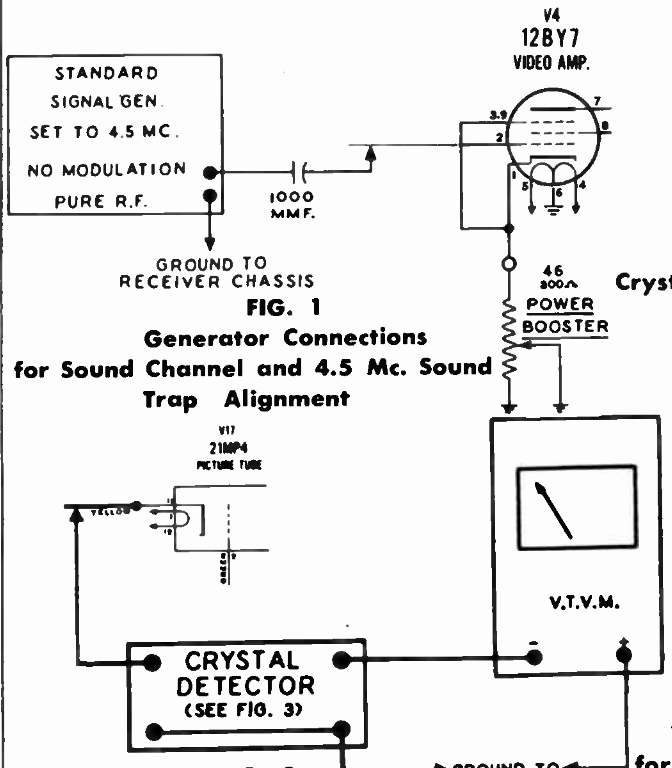


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

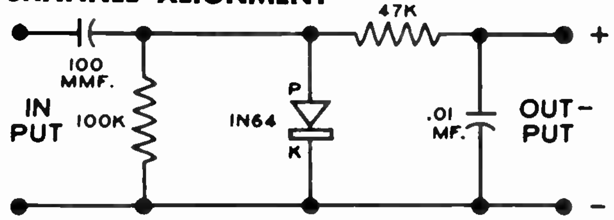


FIG. 3
Circuit Diagram for Crystal Detector shown in Fig. 2

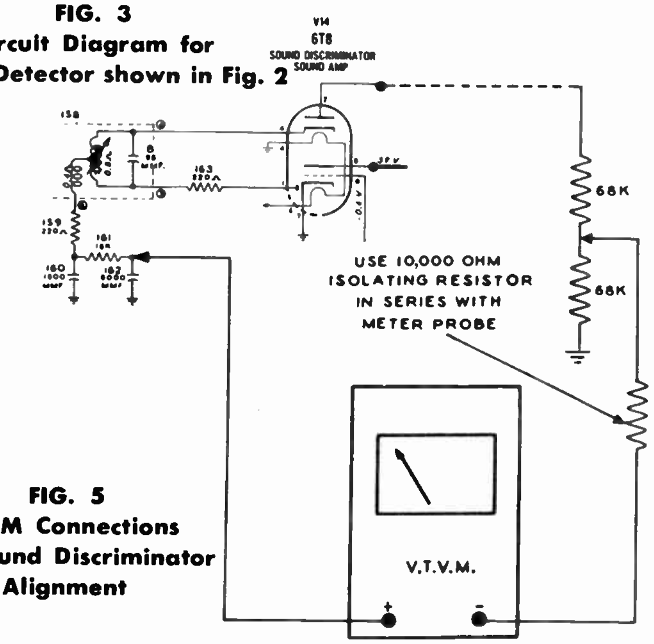


FIG. 5
VTVM Connections for Sound Discriminator Alignment

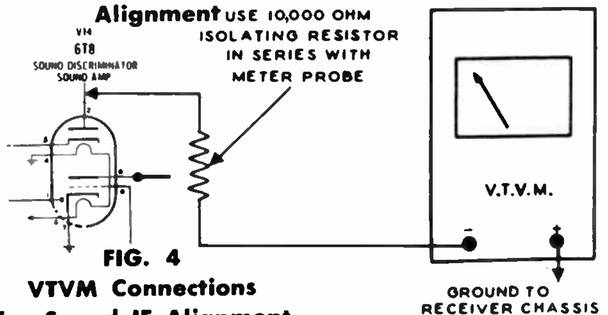


FIG. 4
VTVM Connections for Sound IF Alignment

REDUCTION OF INTERCARRIER BUZZ

Under actual reception conditions slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under these conditions.

Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

IF CHANNEL ALIGNMENT PROCEDURE

1. A non-metallic screw driver must be used when adjusting the trimmers of the IF transformers to prevent a false indication.
2. In order to eliminate the possibility of spurious oscillation, it is desirable to render the VHF RF oscillator inoperative. This may be accomplished by insulating oscillator contacts on the tuner strips. Remove tuner bottom shield and place a piece of transparent cellulose tape on the first two contacts (from front) of drum assembly. Use any inoperative channel and rotate drum to this insulated position.
3. Short antenna terminals together with a jumper wire.
4. Connect a V.T.V.M. and oscilloscope as shown in Fig. 7.
5. Adjust output attenuator on sweep generator so that reading on V.T.V.M. is not in excess of one volt.
6. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.
7. Certain alignment steps will require a fixed 3 volt A.G.C. bias. When necessary, connect negative terminal of battery to the receiver A.G.C. line and positive terminal to receiver chassis. See Fig. 8 for convenient point of connection.

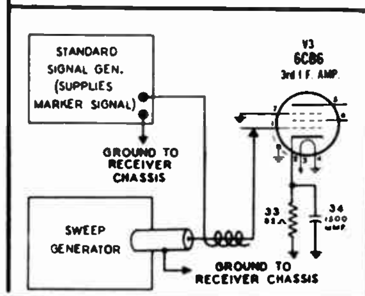
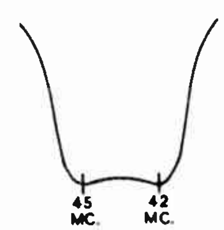
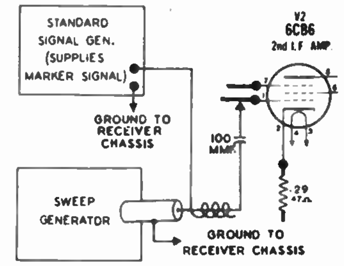
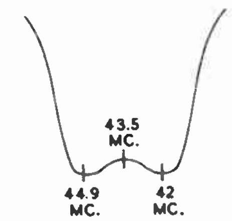
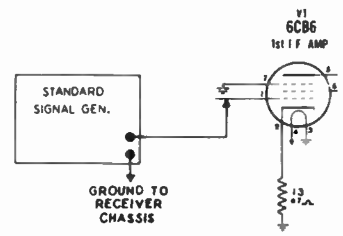
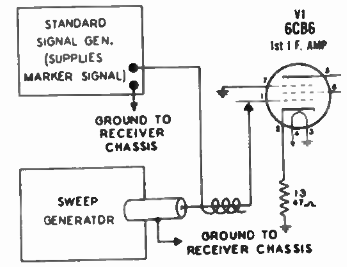
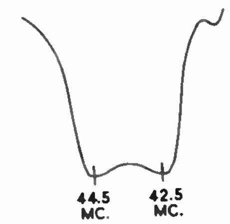
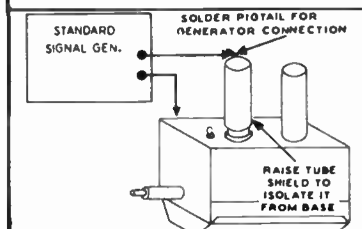
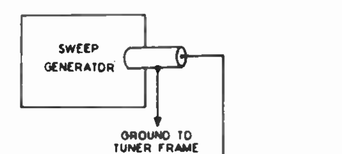
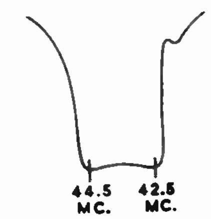
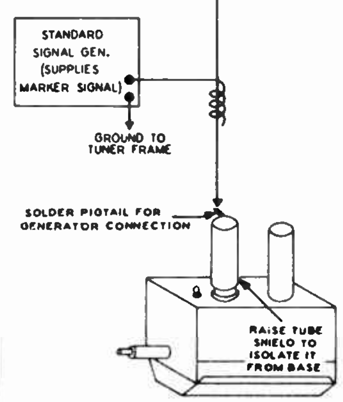
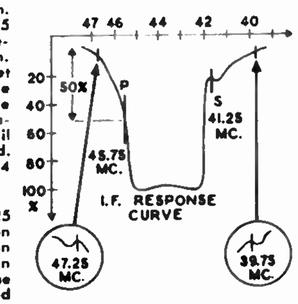
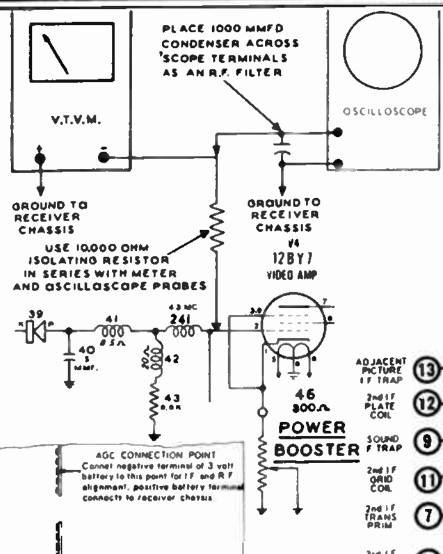
GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR 42 Mc. & 45 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Detune 2nd IF transformer by soldering a short piece of wire or connecting a clip to pin 5 of V2 (6CB6, 2nd IF Amp.) Other end of wire or clip is left unconnected.	# 5 and # 6 3rd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 42 Mc., 43.5 Mc. & 44.9 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Remove detuning clip discussed in previous step. Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 7 and # 8 2nd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 41.25 Mc. SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 9 Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 47.25 Mc. SWEEP GENERATOR Not Used	Same as above.	# 10 Adjacent Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 42.5 Mc. & 44.5 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 11 2nd IF Grid Coil and # 12 1st IF Plate Coil (See Fig. 9)	Adjust trimmers for maximum amplitude bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 39.75 Mc. SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 13 Adjacent Picture IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 42.5 Mc. & 44.5 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 14 1st IF Grid Coil (See Fig. 9) #15 Converter Plate Coil (See Fig. 10)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 39.75 Mc., 41.25 Mc., 45.75 Mc. & 47.25 Mc. SWEEP GENERATOR 45 Mc. Sweep Width 10 Mc.	Same as above.		The general shape of the overall IF response curve and position of markers should compare with that shown. The picture carrier marker (45.75 Mc.) should appear at approximately the 50% amplitude position. Should this observation fail to meet the above requirement, it will be necessary to make a small change in the setting of one or a combination of the following trimmers until the desired results are achieved. Trimmers, # 5, 6, 7, 8, 11, 12, 14 and slug 15. The sound carrier marker (41.25 Mc.) should appear at the position shown on the curve. If the position of this marker is not correct, then it will be necessary to readjust the setting of trimmer # 9 as explained previously in this procedure. To properly observe the position of the adjacent channel picture carrier (39.75 Mc.) and the adjacent channel sound carrier (47.25 Mc.), it will be necessary to increase the vertical gain control on the 'scope and the output of the sweep and standard signal generators. Also, be sure to disconnect the 3 volt AGC battery from receiver. If these markers do not compare favorably with that shown, repeat the adjustment of trimmers # 10 and 13 as explained previously in this procedure, exercising greater care in obtaining a minimum reading on the VTVM. 

FIG. 7
VTVM and Oscilloscope Connections for IF Channel Alignment



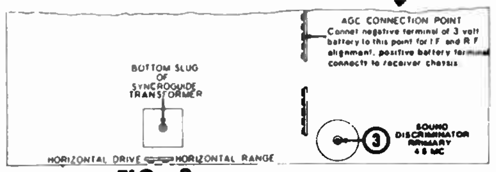


FIG. 8
Bottom View of Chassis

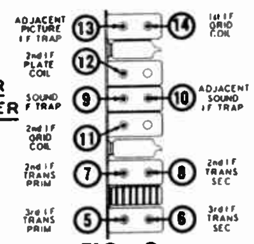


FIG. 9
View of IF Strip

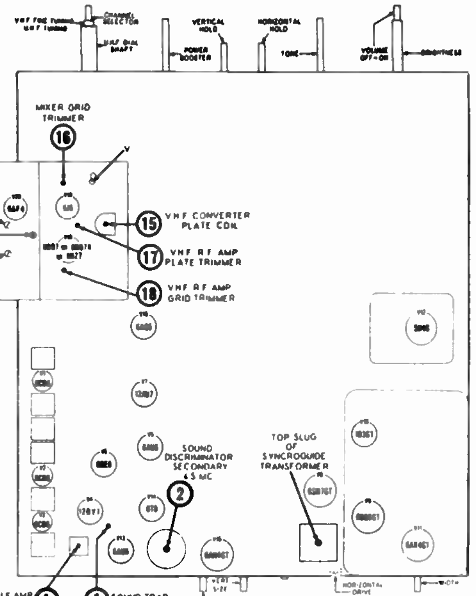


FIG. 10
Top View of Chassis

VHF RF CHANNEL ALIGNMENT PROCEDURE

The procedure listed below is only for the VHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the UHF Tuner, part 521170, must be returned to the factory in accordance with the removal instructions, listed in a subsequent section under the heading "VHF-UHF Tuner Servicing Procedure," located on page 1953-33.

1. **CAUTION:** The shell of the picture tube has a high voltage potential, approximately 14,000 volts, and contact should be avoided. As the adjustment screws are in relatively close proximity to this shell, some means of insulation from accidental contact should be provided.
2. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 8 for convenient point of connection.)

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 11.	197.75 MC. Sound Carrier 193.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #10	Not used.	Connect as shown in Fig. 12.	Set Channel Selector to #10. IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	#16 Mixer Grid. (See Fig. 18) #17 RF Amp. Plate. (See Fig. 18) #18 RF Amp. Grid. (See Fig. 18)	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 15. Use Mixer Grid trimmer #16; and RF Amplifier Plate trimmer #17 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #18 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. **IMPORTANT:** When adjusting trimmers #16, 17 and 18 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Not used.	Same as above.	Set channel selector to channel being observed.	The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #16, 17 and 18. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. Band pass characteristic of these channels should conform close to the RF response curve in Fig. 15. If necessary, a compromise may be obtained to compensate for large variations in channel response by returning to channel #10 and making slight changes in the settings of trimmers #16, 17 and 18.	

OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in IF alignment procedure.
2. During oscillator alignment, it is necessary to set the Fine Tuning control so that the tooth on the fiber fine tuning cam points downward (correct position for this control is shown in Fig. 17).
3. During this step and thru-out all succeeding steps it is necessary to: keep output of sweep generator at a level that does not allow reading on VTVM to exceed one volt.
4. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.

Connect as shown in Fig. 11.	197.75 MC. Sound Carrier Marker. 193.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #10	Connect as shown in Fig. 13.	Connect as shown in Fig. 13.	Set Channel Selector to #10. Be sure that generator's output does not exceed voltage specified in instructions #3 and 4 above.	Using a long, non-metallic screwdriver (approx. 12"), adjust channel #10 oscillator slug (accessible thru hole on front of RF Tuner Unit—see Fig. 17) shift response curve so that picture carrier marker is located at the position indicated in Fig. 16. Position of sound carrier marker should appear as indicated in Fig. 16.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Same as above.	Same as above.	Set channel selector to channel being observed.	Adjust the RF sweep generator and marker generator for operation on the other television channels. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of RF Tuner Unit (see Fig. 17). This permits response curve to be shifted so that picture and sound carrier markers will appear at the position indicated in Fig. 16. NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 17).

If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel. If characteristic does not conform reasonably well within the typical curve shown in Fig. 15, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

INSTRUMENT CONNECTIONS FOR R.F. CHANNEL ALIGNMENT

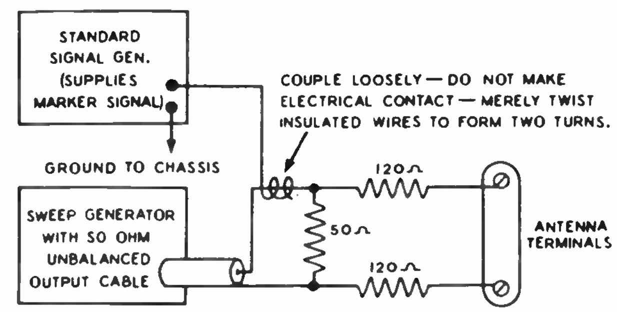
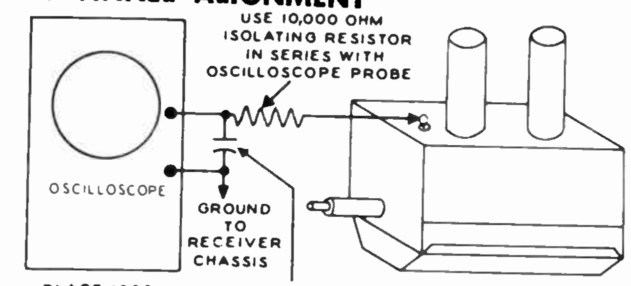


FIG. 11
Generator Connections for RF Channel Alignment



PLACE 1000 MMF. CONDENSER ACROSS SCOPE TERMINALS AS AN R.F. FILTER

FIG. 12
Oscilloscope Connections for RF Amp. and Mixer Alignment

CHANNEL NUMBER	PICTURE CARRIER MARKER FREQ.	SOUND CARRIER MARKER FREQ.
13	211.25 MC.	215.75 MC.
12	205.25 MC.	209.75 MC.
11	199.25 MC.	203.75 MC.
10	193.25 MC.	197.75 MC.
9	187.25 MC.	191.75 MC.
8	181.25 MC.	185.75 MC.
7	175.25 MC.	179.75 MC.
6	83.25 MC.	87.75 MC.
5	77.25 MC.	81.75 MC.
4	67.25 MC.	71.75 MC.
3	61.25 MC.	65.75 MC.
2	55.25 MC.	59.75 MC.

FIG. 14

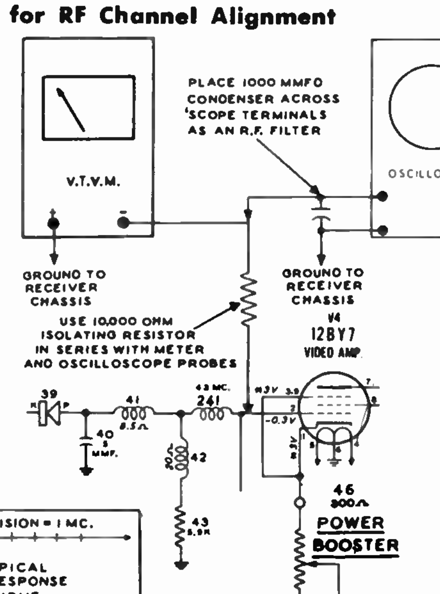


FIG. 13
VTVM and Oscilloscope Connections for Oscillator Alignment

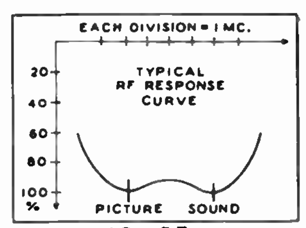


FIG. 15

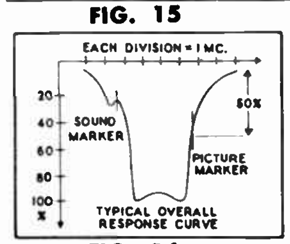


FIG. 16

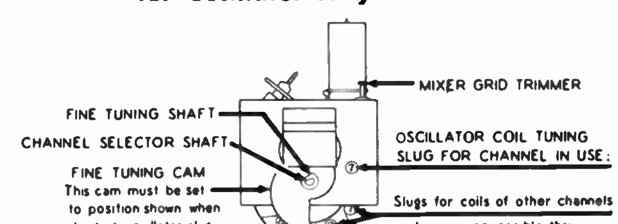


FIG. 17
Front View of VHF RF Tuner Unit

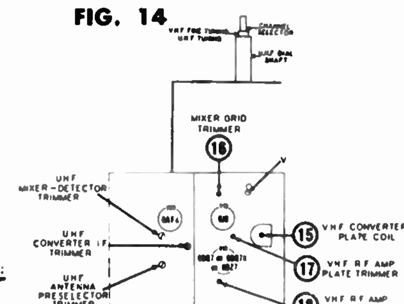


FIG. 18
Trimmer Location of VHF RF Tuner

REPAIR DATA FOR V.H.F. RF TUNER

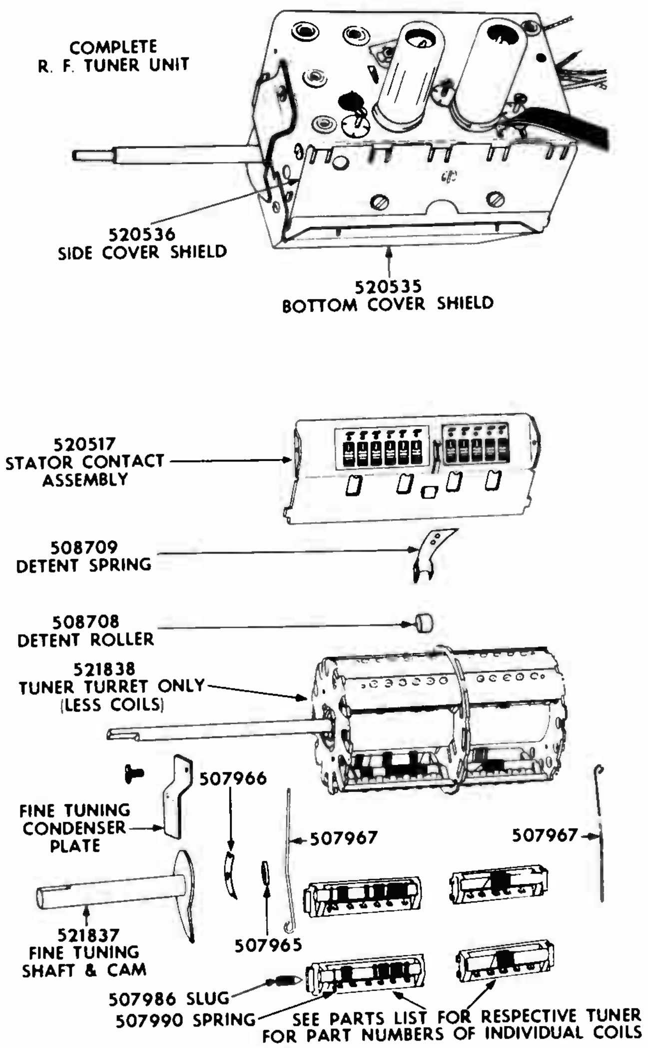


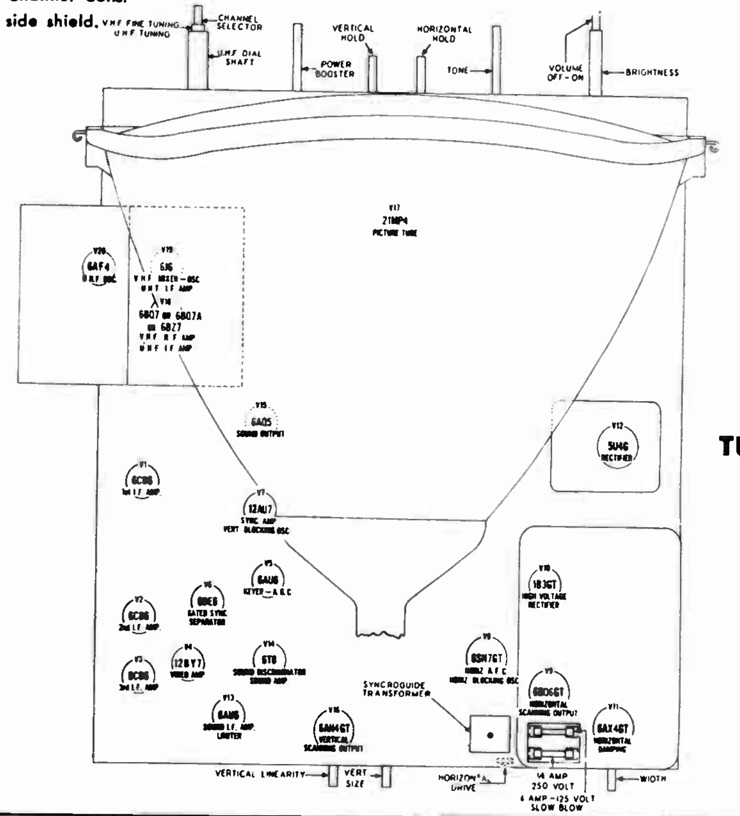
FIG. 19

SERVICE PRECAUTIONS

SUBJECT	PRECAUTIONS
ELECTRICAL COMPONENTS	The high frequencies used in the RF section of a television receiver make it necessary that considerable care be exercised in servicing the tuner. Lead dress and location of components are very critical at these frequencies. When replacing parts, it is important to use components of identical electrical characteristics and physical size. Always re-connect the replacement item in the same location and position in the tuner as the original component.
TUBES	Replacement of tubes in the Tuner Unit may cause slight detuning of RF circuits due to inherent differences in inter-electrode capacitances. When replacing tubes (especially 6J6 mixer-oscillator tube) make sure that Fine Tuning control will tune in television stations at approximately the middle of its range. It may be necessary to change the setting of the individual oscil-lator coil slugs for some channels to accomplish this.
CHANNEL COILS AND SLUGS	Channel Coils must be handled with care. **Do not disturb coil windings.** If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retain-ing Spring when that spring is returned to its normal position.
FINE TUNING CONTROL	Rubbing of the bakelite Fine Tuning Cam against the Fine Tuning Condenser Plate is intentional in order to avoid vibration with resulting microphonics. However, the Fine Tuning Cam should **not** rub or contact the small circular plate located on the body of the tuner.

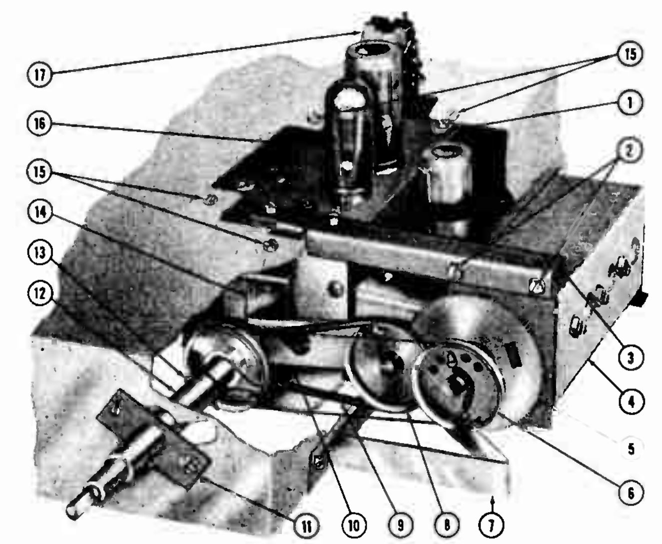
REMOVAL AND REPLACEMENT OF PARTS

ITEM	PROCEDURE
RF TUNER UNIT	To remove the Tuner Unit from receiver chassis, refer to "Removing V.H.F. Tuner" in section entitled "V.H.F.—U.H.F. Tuner Servicing Procedure" located on page 1953-33.
CHANNELS COILS	It is not necessary to remove entire tuner unit to replace a snap-in channel coil but removal of bottom shield will be re-quired. This may be accomplished by grasping the front end of the shield and pulling downward and unhooking it from rear of tuner frame. Insert a screwdriver blade between Coil Retainer Spring and the end of the Tuner Turret. Twist the blade to pull spring away from the molded body of Channel Coil. Lift this end of coil body upward and remove individual coil assembly from tuner. When replacing Channel Coils, be sure they are reinstalled in their correct positions. Coil numbers should increase consecu-tively in a counter-clockwise direction when tuner is viewed from the front. If all the Channel Coils have been removed from the Tuner Turret, rotate turret until flat surface on end of tuner shaft points down. Install #3 Channel Coils into bottom position on turret. Then follow the correct sequence indicated above to replace other coils.
TUNER TURRET ASSEMBLY	To remove turret from RF Tuner Unit, remove complete tuner and bottom shield as described in previous sections and proceed as follows: 1. Remove rear Turret Shaft Retaining Spring by disengaging straight end of spring from projection on tuner frame. 2. Remove Fine Tuning Condenser Plate from front of Tuner Unit. This plate forms one side of Fine Tuning control condenser and is held in place by one screw. 3. Slide Fine Tuning Cam and Shaft off of main Channel Selector Shaft. 4. Remove Spring Contactor Washer and Fiber Spacer Washer from Channel Selector Shaft. 5. Remove Shaft Retaining Spring at front of tuner by disengaging straight end of spring from projection on frame. 6. Remove turret assembly from frame. To replace turret, reverse the above procedure. Tooth on bakelite Fine Tuning Cam should point downward during assembly so that it does not become locked between the stops on the Fine Tuning Condenser Plate. Also be sure to replace bottom shield.
STATOR CONTACT ASSEMBLY	To remove this assembly, remove complete tuner as described in previous sections and proceed as follows: 1. Remove side shield by taking out the two retaining screws and unsolder shield at one point. Now, disengage shield from upper edge of tuner frame. 2. Remove the two screws at the front and rear of the Stator Contact Assembly. 3. Unsolder all electrical connections to contact plate. 4. Unsolder five soldered joints between Stator Contact Assembly and Tuner Unit. 5. Contact Assembly may now be withdrawn from frame. To reinstall this assembly: 1. Place Stator Contact Assembly in position and replace, but do not tighten, the two screws at the front and rear of the assembly. 2. Remove 3 consecutive pairs of Channel Coils from the turret (for example, the antenna and rf-osc. coils for channels #5, 6 and 7). 3. Position Tuner Turret so that the edges of the next highest Channel Coils (in this case, the coils for channel #8) just pass the row of 11 contacts on the Stator Contact Assembly. 4. Adjust position of the Stator Contact Assembly so that there are a few thousandths of an inch spacing between the con-tacts on the contact plate and the molded body of the Channel Coils. 5. The Contact Assembly is now correctly positioned and screws at front and rear may be tightened. 6. Solder Stator Contact Assembly to tuner frame at same points that were used previously. 7. Make all electrical connections to contact plate. 8. Replace Channel Coils. 9. Replace side shield.



TUBE AND CONTROL LOCATIONS

V.H.F.–U.H.F. TUNER SERVICING PROCEDURE



The tuning mechanism of this receiver comprises two R.F. tuning units—a 13-position V.H.F. tuner which covers the 12 V.H.F. channels and a continuous type U.H.F. tuner which covers all of the U.H.F. television channels.

When it is necessary to remove the tuning units for service, it can be accomplished by following the procedure given in the following paragraphs. For simplicity, there is a separate removal procedure for each of the tuners.

Instructions for replacing the U.H.F. tuning belt and the dial drive cord are also given below.

REMOVING U.H.F. TUNER

(Numbers which appear after parts mentioned in text refer to parts shown in illustration above.)

1. Disconnect leads marked S, R and T on "Bottom View of Chassis Showing Connections of R.F. Tuners." Also disconnect 300-ohm twin-lead to U.H.F. Tuner (4) at V.H.F. Selector Switch (17); terminals S3 and S12.
2. Remove Bracket and Triangular Shaped Guard (7) shielding U.H.F. Tuning Gear (5).
3. Turn fine tuning knob until U.H.F. tuner shaft is fully counter-clockwise, then loosen two set screws and slide U.H.F. Dial Drive Pulley (6) off of shaft. (To avoid the necessity of restringing U.H.F. dial drive cord, hold Drive Pulley (6) so that cord does not slip off and clamp cord tightly around pulley by wrapping "scotch" tape around the two strands of cord as near as possible to the pulley. Also clamp cord around Dial Pulley and Shaft (12) in this manner.)
4. Remove the two U.H.F. Tuner Mounting Screws (2) and a third screw (not shown in illustration) located underneath chassis on Mounting Bracket (1).
5. Loosen the two set screws on U.H.F. Tuning Gear (5) and free tuner from mounting by pulling away from bottom of chassis. Tuner may now be completely removed by sliding it toward rear of chassis, thus disengaging unit from Gear (5) and Pulley Brackets (10).

If tuner is returned to factory for repair it must be shipped with all parts removed as indicated above.

REMOVING V.H.F. TUNER

(Numbers which appear after parts mentioned in text refer to parts shown in illustration above.)

1. Remove U.H.F. tuner as described above.
2. Disconnect leads marked M, N, P, Q and U on "Bottom View of Chassis Showing Connections of R.F. Tuners." Also disconnect the two white and yellow leads from the tuner to the V.H.F. Selector Switch (17); at terminals S8 and S17.
3. Rotate Channel Selector knob until V.H.F. Selector Switch Actuator Cam is completely disengaged from Switch (17) and remove the two switch mounting screws.
4. Remove channel Selector knob, Fine Tuning knob and U.H.F. Dial from their shafts by pulling them forward.
5. Remove Fiber Bracket (11) which supports tuner operating shafts. Also remove fiber dial lite shield which is fastened by one of the fiber bracket mounting screws.
6. Remove the four Tuner Mounting Screws (15) and lift V.H.F. tuner (16) from chassis.
7. Remove Clip (13) which retains U.H.F. Dial Shaft and Pulley (12) and slide shaft and pulley off of inner shaft.
8. Remove U.H.F. Tuning Belt (9) from pulleys.
9. Loosen two set screws and remove U.H.F. Tuning Pulley (14).
10. Remove U.H.F. Tuning Pulley and Bracket Assembly (10).
11. Remove Front Mounting Bracket (3) and Rear Mounting Bracket (1).
12. Loosen set screw and remove V.H.F. Selector Switch Actuator Cam mounted on rear of turret shaft.

If tuner is returned to factory for repair it must be shipped with all parts removed as indicated above.

REINSTALLING TUNERS

The reinstallation of the tuner can be made in the reverse order given in the removal procedure, observing the following precautions.

1. Remount V.H.F. Tuner (16) in mounting holes that place tuner as far forward on chassis as possible.
2. Position coaxial cable lead so that it completely clears the V.H.F. Selector Switch Actuator Cam.
3. When reinstalling U.H.F. Dial Drive Pulley (6), turn U.H.F. tuning shaft to its extreme counter-clockwise position and turn Drive Pulley (6) until the opening in its rim is as shown in **lower** illustration before tightening pulley set screws.
4. When removing "scotch" tape from U.H.F. dial drive cord, hold drive pulleys so that cord is sufficiently taut to prevent it from sliding off of pulleys.
5. Before replacing U.H.F. dial, be sure that **"Fine Tuning" shaft** is in a fully counter-clockwise position or until U.H.F. dial shaft is fully **clockwise**. Place U.H.F. dial on its shaft so that the number 83 is in top center position.

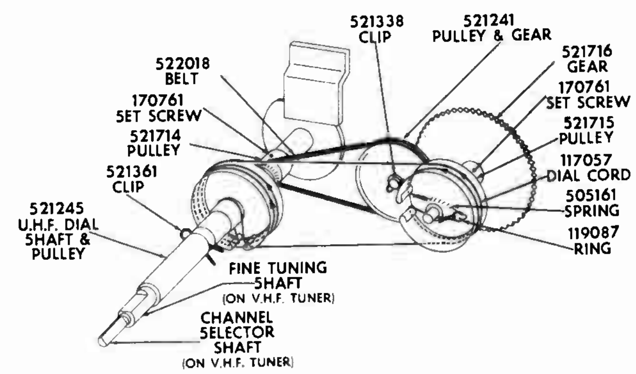
REPLACING U.H.F. DIAL DRIVE CORD

As it is necessary to remove drive cord when replacing U.H.F. Tuning Belt (9), the belt should be replaced at this time if it is worn. The method of accomplishing this is given in a separate procedure outlined below.

1. Remove Bracket and Triangular Shaped Guard (7).
2. Turn U.H.F. tuner shaft fully counter-clockwise and if necessary loosen set screws and turn Drive Pulleys (6) and (12) until opening in their rims are located as shown in **lower** illustration.
3. String drive cord by placing ring at end of cord over tongue of Drive Pulley (6) and winding cord around pulleys as shown in **lower** illustration.
4. Replace U.H.F. dial by following procedure given in paragraph 5 in section entitled "Reinstalling Tuners."

REPLACING U.H.F. TUNING BELT

1. Follow steps 2 and 3 in procedure entitled "Removing U.H.F. Tuner" and step 4 in procedure entitled "Removing V.H.F. Tuner."
2. Remove old Tuning Belt (9) by pulling it over Drive Pulleys (6) and (12) and through shaft opening on front of chassis.
3. Install new belt by using reverse of procedure given in step 2 above.
4. Replace Drive Pulley (6) following procedure given in paragraphs 3, 4 and 5 in section "Reinstalling Tuners."



DIAL DRIVE CORD ARRANGEMENT

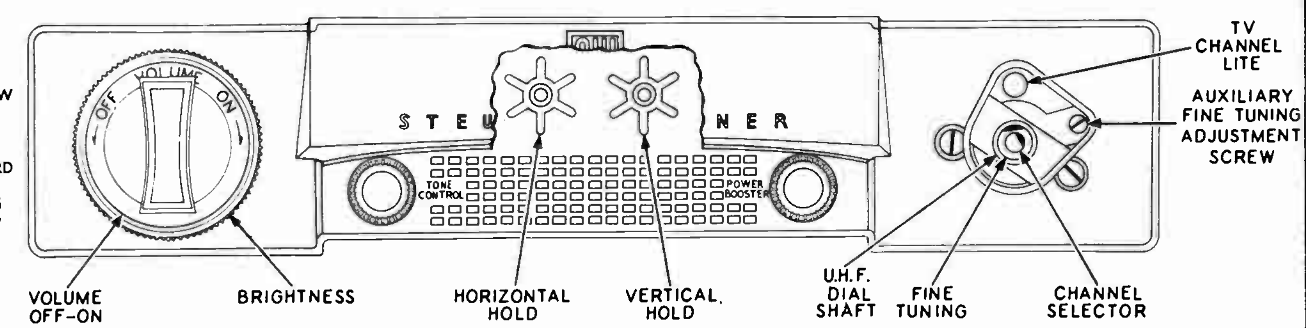
PRODUCTION CHANGES

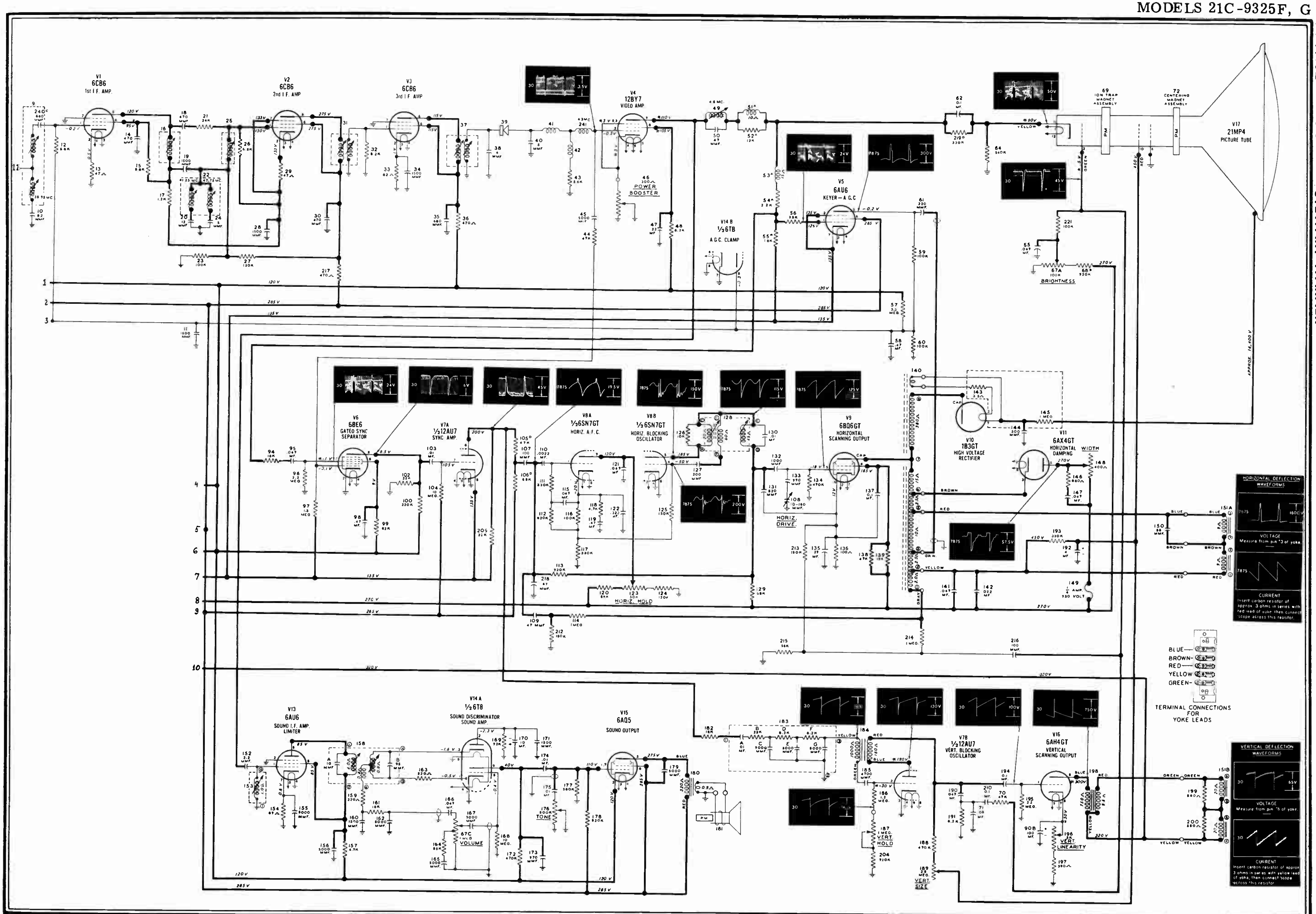
The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. The coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D".

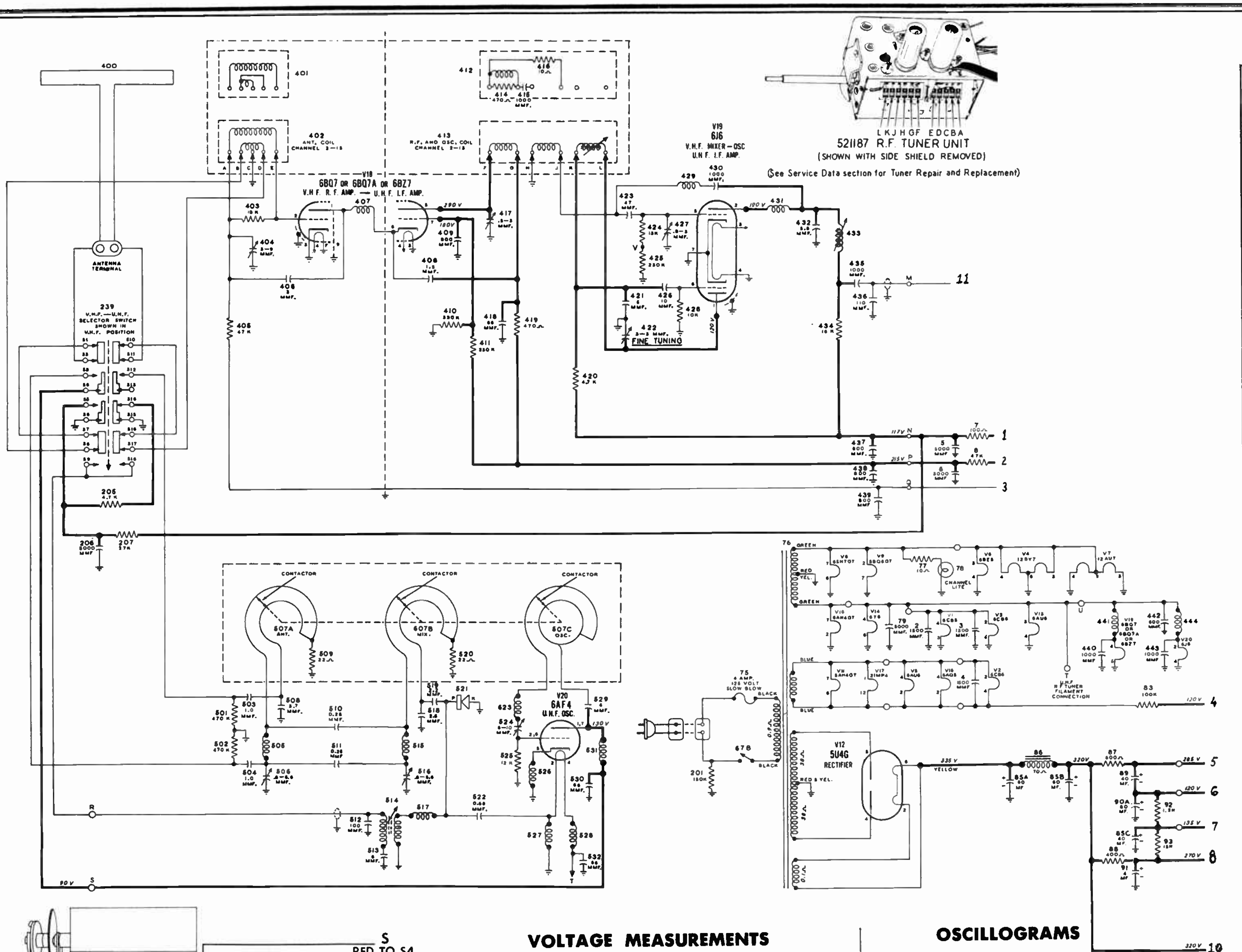
The circuit shown on this page applies to "SERIES ABCD" chassis

A letter following the component circuit diagram number thus—201A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
UNCODED	**INITIAL PRODUCTION**
"A"	The following changes were incorporated to improve the video response. 1. Change peaking coil 51 in plate circuit of tube V4 (Video Amp.) from part 520984 to 520689. 2. Change resistor 52 in parallel with peaking coil 51 from 15,000 Ohms to 12,000 Ohms. 3. Change peaking coil 53 in plate circuit of tube V4 (Video Amp.) from part 520986 to part 509342. 4. Change resistor 54 in plate circuit of tube V4 (Video Amp.) from 3900 Ohms to 2200 Ohms. 5. Change resistor 55 in plate circuit of tube V4 (Video Amp.) from 1500 Ohms to 1800 Ohms.
"B"	The following change was incorporated to maintain proper focus for the normal range of the brightness control. 1. Change resistor 68 in brightness circuit from 100,000 Ohms to 220,000 Ohms.
"C"	The following change was incorporated to facilitate production. 1. Add condenser 240 (680 Mmfd.) between the grid of tube V1 (1st I.F. Amp.) and I.F. transformer 9.
"D"	The following change was incorporated to improve sync. stability in the presence of electrical interference or weak signal. 1. Disconnect resistor 94 (18,000 Ohms) from the plate of tube V4-12BY7 (Video Amp.) and reconnect it to the junction of resistors 54 (2200 Ohms) and 55 (1800 Ohms) located in plate load circuit of tube V4. Note: The sound take-off for tube V13 (Sound I. F. Amp.) remains connected to the plate of tube V4 (Video Amp.) 2. Change resistor 106 located in plate circuit of tube V7A (Sync. Amp.) from 4700 Ohms ±10% ½ watt to 6800 Ohms ±10% 1 watt. The following changes were incorporated to improve picture quality. 1. Change resistor 219 in the cathode circuit of tube V17 (Picture Tube) from 470,000 Ohms to 330,000 Ohms. 2. Change connection of grid, pin 10, of tube V17 (Picture Tube) from 320 volt supply to 450 volt supply. 3. Change connection of grid, pin 6, of tube V17 (Picture Tube) from 270 volt supply to receiver chassis. The following change was incorporated to provide a greater margin of safety for the plate load resistor of tube V7A (12AU7). 1. Change resistor 105 located in plate circuit of tube V7A (Sync. Amp.) from 4700 Ohms ½ watt to 4700 Ohms 1 watt.
"E"	The following change was incorporated to improve picture quality by reducing the noise level (snow) in Video Amp. system. 1. Add resistor 242 (6800 Ohms) in parallel with peaking coil 41 located in grid circuit of V4 (Video Amp.) 2. Change peaking coil 42 located in grid circuit of tube V4 (Video Amp.) from part 520985 (double pi, coded with green dot) to part 509341 (single pi, coded with green dot). 3. Change peaking coil 51 located in plate circuit of tube V4 (Video Amp.) from part 520689 (single pi, coded with purple dot) to part 520984 (single pi, coded with red dot). 4. Change resistor 52 located across peaking coil 51 in plate circuit of V4 (Video Amp.) from 12,000 Ohms to 15,000 Ohms. 5. Change peaking coil 53 located in plate circuit of tube V4 (Video Amp.) from part 509342 (single pi, coded with yellow dot) to part 509340 (single pi, coded with white dot).

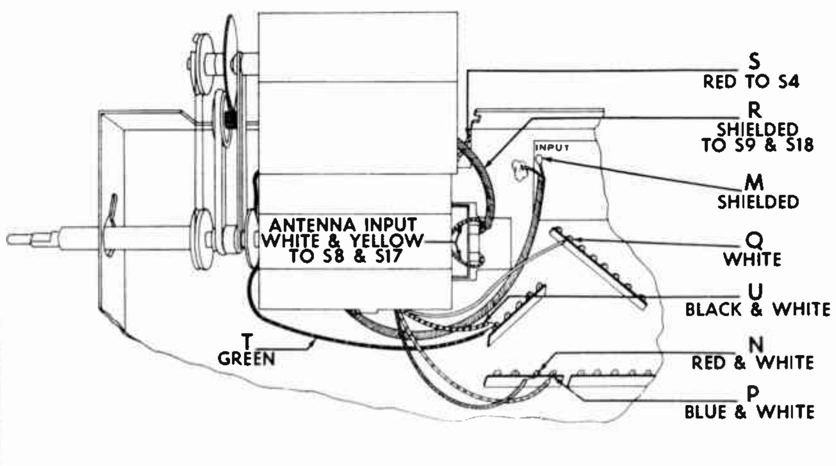



V1 6CB6 1st I.F. AMP.
V2 6CB6 2nd I.F. AMP
V3 6CB6 3rd I.F. AMP
V4 12BY7 VIDEO AMP
POWER BOOSTER
V14B ½6T8 A.G.C. CLAMP
V5 6AU6 KEYER—A.G.C.
ION TRAP MAGNET ASSEMBLY
CENTERING MAGNET ASSEMBLY
V17 21MP4 PICTURE TUBE
BRIGHTNESS
V6 6BE6 GATED SYNC SEPARATOR
V7A ½12AU7 SYNC AMP.
V8A ½6SN7GT HORIZ. A.F.C.
V8B ½6SN7GT HORIZ. BLOCKING OSCILLATOR
V9 6BQ6GT HORIZONTAL SCANNING OUTPUT
HORIZ. DRIVE
HORIZ. HOLD
V10 1B3GT HIGH VOLTAGE RECTIFIER
V11 6AX4GT HORIZONTAL DAMPING
WIDTH
HORIZONTAL DEFLECTION WAVEFORMS
VOLTAGE Measure from pin "3 of yoke.
CURRENT Insert carbon resistor of approx. 3 ohms in series with red lead of yoke then connect scope across this resistor.
BLUE
BROWN
RED
YELLOW
GREEN
TERMINAL CONNECTIONS FOR YOKE LEADS
V13 6AU6 SOUND I.F. AMP. LIMITER
V14A ½6T8 SOUND DISCRIMINATOR SOUND AMP.
V15 6AQ5 SOUND OUTPUT
VOLUME
TONE
V7B ½12AU7 VERT. BLOCKING OSCILLATOR
VERT. HOLD
V16 6AH4GT VERTICAL SCANNING OUTPUT
VERT. LINEARITY
VERT. SIZE
VERTICAL DEFLECTION WAVEFORMS
VOLTAGE Measure from pin "6 of yoke.
CURRENT Insert carbon resistor of approx 3 ohms in series with yellow lead of yoke, then connect scope across this resistor.
APPROX. 16,000 V



521187 R.F. TUNER UNIT
(SHOWN WITH SIDE SHIELD REMOVED)

(See Service Data section for Tuner Repair and Replacement)



VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception—Power Booster control completely counterclockwise.

Voltages marked with an asterisk (*) will vary widely with control settings.

R.F. tuner voltages were measured with tubes removed from sockets.

No voltage reading at a tube element indicates zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.

OSCILLOGRAMS

All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Power Booster control adjusted to give 50 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within 20% at 2 MC.

Number appearing to the left of oscillogram specifies setting of horizontal sweep frequency control on 'Scope.

PARTS LIST

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
		CONDENSERS	
2	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
3	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
4	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
5	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
6	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
10	513455	Condenser—ceramic 8.2 Mmfd. ±5% 400 volt (Temperature compensating)	.25
11	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
14	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
18	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
19	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.45
20	513448	Condenser—ceramic 12 Mmfd. ±5% 500 volt (Temperature compensating)	1.05
24	513449	Condenser—ceramic 5 Mmfd. ±1% 500 volt (Temperature compensating)	1.05
28	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
30	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
34	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
35	513044	Condenser—ceramic 680 Mmfd. 400 volt	.25
38	513454	Condenser—ceramic 4 Mmfd. ±1% 500 volt (Temperature compensating)	.25
40	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
45	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
47	512238	Condenser—.22 Mfd. 200 volt	.50
50	513438	Condenser—ceramic 47 Mmfd. ±5% 500 v. (Temperature compensating)	.45
58	512239	Condenser—.47 Mfd. 200 volt	.75
61	513032	Condenser—ceramic 220 Mmfd. 1000 volt	.40
62	512216	Condenser—.1 Mfd. 200 volt	.30
65	512235	Condenser—.047 Mfd. 200 volt	.30
71	512210	Condenser—.03 Mfd. 200 volt	.35
79	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
85-A,B,C	508072	Condenser—electrolytic A—40 Mfd. 450 volt; B—40 Mfd. 450 volt; C—40 Mfd. 450 volt	4.50
89	160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
90-A,B	509002	Condenser—electrolytic A—80 Mfd. 250 volt; B—100 Mfd. 50 volt	3.00
91	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
95	512235	Condenser—.047 Mfd. 200 volt	.30
98	512239	Condenser—.47 Mfd. 200 volt	.75
103	512205	Condenser—.01 Mfd. 400 volt	.25
107	512502	Condenser—mica 100 Mmfd. ±10% 500 volt	.25
108	508071	Condenser—trimmer 10-160 Mmfd. (Horizontal Drive)	.40
109	513030	Condenser—ceramic 47 Mmfd. 1000 volt	.40
110	512232	Condenser—.0022 Mfd. 400 volt	.25
115	512235	Condenser—.047 Mfd. 200 volt	.30
119	512239	Condenser—.47 Mfd. 200 volt	.75
121	512236	Condenser—.047 Mfd. 400 volt	.30
122	512233	Condenser—.022 Mfd. 400 volt	.30
127	513427	Condenser—ceramic 200 Mmfd. ±2% 500 v. (Temperature compensating)	.65
130	512311	Condenser—.01 Mfd. 400 volt (Special Characteristic)	.30
131	512547	Condenser—mica 820 Mmfd. ±5% 500 volt	.50
132	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
133	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
135	512238	Condenser—.22 Mfd. 200 volt	.50
137	512218	Condenser—.1 Mfd. 600 volt	.55
141	512237	Condenser—.047 Mfd. 600 volt	.40
142	512234	Condenser—.022 Mfd. 600 volt	.35
144	520990	Condenser—ceramic 500 Mmfd. 20,000 volt	1.75
147	512235	Condenser—.047 Mfd. 200 volt	.30
150	513027	Condenser—ceramic 56 Mmfd. ±10% 1500 v.	.45
152	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
155	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
156	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
158-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
158-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
160	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
162	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
165	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
166	512235	Condenser—.047 Mfd. 200 volt	.30
167	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
170	505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
171	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
173	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
174	512205	Condenser—.01 Mfd. 400 volt	.25

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
175	512204	Condenser—.01 Mfd. 200 volt	.25
179	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
183-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
183-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
185	512533	Condenser—mica 4700 Mmfd. ±5% 1000 v.	1.40
190	512236	Condenser—.047 Mfd. 400 volt	.30
192	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
194	512218	Condenser—.1 Mfd. 600 volt	.55
206	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
210	512216	Condenser—.1 Mfd. 200 volt	.30
216	512502	Condenser—mica 100 Mmfd. 500 volt	.25
218	513030	Condenser—ceramic 47 Mmfd. 1,000 volt	.40
240	513044	Condenser—ceramic 680 Mmfd. 400 volt (used when letter "C" is included in series designation at rear of chassis)	.25
404	509064	Condenser—trimmer 3-9 Mmfd.	.50
406	513453	Condenser—ceramic 3 Mmfd. ±10% 500 v. (Temperature compensating)	.35
408	513033	Condenser—ceramic 1.5 Mmfd. 500 volt	.35
409	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
415	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
417	509063	Condenser—trimmer 0.5-3 Mmfd.	.40
418	513040	Condenser—ceramic 68 Mmfd. ±10% 500 v.	.40
421	513450	Condenser—ceramic 5 Mmfd. ±5% 500 v.	.40
422	*	Condenser—fine tuning (3-5 Mmfd)	—
423	520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
426	513437	Condenser—ceramic 10 Mmfd. ±10% 500 volt (Temperature compensating)	.40
427	509063	Condenser—trimmer 0.5-3 Mmfd.	.40
430	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
432	513451	Condenser—ceramic 6.8 Mmfd. ±5% 500 v.	.85
435	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
436	513452	Condenser—ceramic 110 Mmfd. ±5%	.45
437	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
438	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
439	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
440	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
442	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
443	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
503	‡	Condenser—ceramic 1.0 Mmfd. ±10% 500 v.	—
504	‡	Condenser—ceramic 1.0 Mmfd. ±10% 500 v.	—
506	‡	Condenser—trimmer 0.8-6.5 Mmfd.	—
508	‡	Condenser—ceramic 2.7 Mmfd. 500 v.	—
510	‡	Condenser—ceramic 0.25 Mmfd. ±10% 500 v.	—
511	‡	Condenser—ceramic 0.25 Mmfd. ±10% 500 v.	—
512	‡	Condenser—ceramic 100 Mmfd. ±10% 500 v.	—
513	‡	Condenser—ceramic 8.0 Mmfd. 500 v.	—
516	‡	Condenser—trimmer 0.8-6.5 Mmfd.	—
518	‡	Condenser—ceramic 2.5 Mmfd. ±10% 500 v.	—
519	‡	Condenser—ceramic 2.2 Mmfd. ±10% 500 v.	—
522	‡	Condenser—ceramic 0.68 Mmfd. ±10% 500 v.	—
524	‡	Condenser—trimmer 3-10 Mmfd.	—
529	‡	Condenser—ceramic 6.0 Mmfd. 500 v.	—
530	‡	Condenser—ceramic 68 Mmfd. 500 v.	—
532	‡	Condenser—ceramic 68 Mmfd. 500 v.	—

RESISTORS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
7	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
8	510348	Resistor—carbon 4700 Ohms ±10% 2 watt	.25
12	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
13	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
15	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
17	510138	Resistor—carbon 1200 Ohms ±10% ½ watt	.12
21	510783	Resistor—carbon 24,000 Ohms ±5% ½ watt	.30
23	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
26	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
27	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
29	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
32	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
33	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
36	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
43	510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
44	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
48	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
52	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt (used when letter "A" is included in series designation at rear of chassis)	.16
	510744	Resistor—carbon 15,000 Ohms ±5% ½ watt (used when letter "A" is not included in series designation at rear of chassis)	.16
54	510242	Resistor—carbon 2200 Ohms ±10% 1 watt (used when letter "A" is included in series designation at rear of chassis)	.16
	510247	Resistor—carbon 3900 Ohms ±10% 1 watt (used when letter "A" is not included in series designation at rear of chassis)	.16
55	510141	Resistor—carbon 1800 Ohms ±10% ½ watt (used when letter "A" is included in series designation at rear of chassis)	.12
	510139	Resistor—carbon 1500 Ohms ±10% ½ watt (used when letter "A" is not included in series designation at rear of chassis)	.12
56	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
57	510701	Resistor—carbon 3.3 Meg. ±10% ½ watt	.12
59	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
60	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
64	510186	Resistor—carbon 560,000 Ohms ±10% ½ w.	.12
68	510178	Resistor—carbon 220,000 Ohms ±10% ½ w. (used when letter "B" is included in series designation at rear of chassis)	.12
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "B" is not included in series designation at rear of chassis)	.12
70	510167	Resistor—carbon 47,000 Ohms ±10% ½ watt	.12
77	510101	Resistor—carbon 10 Ohms ±10% ½ w.	.12
83	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
87	510741	Resistor—wire wound 600 Ohms ±10% 10 w.	.90
88	510779	Resistor—wire wound 400 Ohms ±10% 10 w.	.75
92	510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
93	510357	Resistor—carbon 15,000 Ohms ±10% 2 w.	.35
94	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
96	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
97	510752	Resistor—carbon 1.5 Meg. ±10% ½ watt	.12
99	510171	Resistor—carbon 82,000 Ohms ±10% ½ w.	.12
100	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
102	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
104	510197	Resistor—carbon 10 Meg. ½ watt	.12
105	510248	Resistor—carbon 4,700 Ohms ±10% 1 watt (used when letter "D" is included in series designation at rear of chassis)	.16
	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "D" is not included in series designation at rear of chassis)	.12
106	510251	Resistor—carbon 6800 Ohms ±10% 1 watt (used when letter "D" is included in series designation at rear of chassis)	.16
	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "D" is not included in series designation at rear of chassis)	.12
111	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
112	510189	Resistor—carbon 820,000 Ohms ±10% ½ w.	.12
113	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
114	510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
116	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
117	510281	Resistor—carbon 330,000 Ohms ±10% 1 w.	.16
118	510148	Resistor—carbon 4700 Ohms ±10% ½ watt	.12
120	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
124	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
125	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
126	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
129	510269	Resistor—carbon 68,000 Ohms ±10% 1 w.	.16
134	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
136	510318	Resistor—carbon 100 Ohms ±10% 2 watt	.25
138	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
139	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
143	510725	Resistor—carbon 3.3 Ohms ±10% ½ watt	.16
145	510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
146	510134	Resistor—carbon 680 Ohms ±10% ½ watt	.12
154	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
157	510249	Resistor—carbon 4700 Ohms 1 watt	.16
159	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
161	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
163	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
164	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
168	510197	Resistor—carbon 10 Meg. ½ watt	.12
169	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
172	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
177	510778	Resistor—carbon 560,000 Ohms ±5% ½ w.	.16
178	510747	Resistor—carbon 820,000 Ohms ±5% ½ w.	.20
182	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
183-B	508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
183-D	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
183-F	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
186	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt	.12
188	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
191	510153	Resistor—carbon 8200 Ohms ±10% ½ w.	.12
193	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
195	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
197	510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
199	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
200	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
201	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
204	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
205	510348	Resistor—carbon 4700 Ohms ±10% 2 watt	.25
207	510344	Resistor—carbon 2700 Ohms ±10% 2 watt	.35
209	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
212	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
213	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
214	510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
215	510168	Resistor—carbon 56,000 Ohms ±10% ½ watt	.12
217	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
219	510181	Resistor—carbon 330,000 Ohms ±10% ½ watt (used when letter "D" is included in series designation at rear of chassis)	.12
	510184	Resistor—carbon 470,000 Ohms ±10% ½ watt (used when letter "D" is not included in series designation at rear of chassis)	.12
221	510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
403	510158	Resistor—carbon 15,000 Ohms ½ watt	.12
405	510167	Resistor—carbon 47,000 Ohms ½ watt	.12
410	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
411	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
414	510130	Resistor—carbon 470 Ohms ±10% ½ w.	.12
416	510100	Resistor—carbon 10 Ohms ±10% ½ w.	.12
419	510131	Resistor—carbon 470 Ohms ½ w.	.12
420	510149	Resistor—carbon 4700 Ohms ½ watt	.12
424	510158	Resistor—carbon 15,000 Ohms ½ watt	.12
425	510179	Resistor—carbon 220,000 Ohms ½ watt	.12
428	510155	Resistor—carbon 10,000 Ohms ½ watt	.12
434	510158	Resistor—carbon 15,000 Ohms ½ watt	.12
501	‡	Resistor—carbon 470,000 Ohms ½ watt	—
502	‡	Resistor—carbon 470,000 Ohms ½ watt	—
509	‡	Resistor—carbon 22 Ohms ½ watt	—
520	‡	Resistor—carbon 22 Ohms ½ watt	—
525	‡	Resistor—carbon 12,000 Ohms ±10% ½ w.	—

COILS AND TRANSFORMERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
9	*	Coil—1st I.F. grid and Adjacent Picture I.F. Trap	—
16	*	Coil—1st I.F. plate	—
22	*	Trap—sound I.F. and Adjacent Sound I.F.	—
25	*	Coil—2nd I.F. Grid	—
31	*	Transformer—2nd I.F.	—
37	*	Transformer—3rd I.F.	—
41	520620	Coil—peaking	.65
42	520985	Coil—peaking	.65
49	509603	Coil—4.5 Mc. trap (includes slug and condenser #50)	1.20
	507357	Slug core for 4.5 Mc. trap coil	.20
51	520689	Coil—peaking (used when letter "A" is included in series designation at rear of chassis)	.65
	520984	Coil—peaking (used when letter "A" is not included in series designation at rear of chassis)	.50
53	509342	Coil—peaking (used when letter "A" is included in series designation at rear of chassis)	.60
	520986	Coil—peaking (used when letter "A" is not included in series designation at rear of chassis)	.60
76	520951	Transformer—power	17.50
86	508341	Choke—filter	3.60
128	520943	Transformer—syncroguide	2.50
	521064	Slug core for syncroguide transformer	.70
140	521066	Transformer—horizontal output	8.50
151-A,B	520942	Yoke—picture tube deflection (includes leads, connectors and resistors #199 and #200)	7.50
153	509378	Transformer—audio take-off	1.50
158	509706	Transformer—TV sound discriminator (includes condensers 158A and 158B)	3.00
180	509376	Transformer—audio output	1.85
184	520980	Transformer—vertical blocking oscillator	1.90
198	520975	Transformer—vertical output (includes connectors for deflection yoke leads)	4.00
241	522020	Coil—43 Mc. trap	.50

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
◆401	521821	Coil—U.H.F. I.F. Coupling (Coded "•1Q•") (includes resistors 414, 416 and condenser 415)	2.75
◆402	521822	Coil—antenna; channel #2 (Coded "•2Q•")	1.40
	521823	Coil—antenna; channel #3 (Coded "•3Q•")	1.40
	521824	Coil—antenna; channel #4 (Coded "•4Q•")	1.40
	521825	Coil—antenna; channel #5 (Coded "•5Q•")	1.40
	521826	Coil—antenna; channel #6 (Coded "•6Q•")	1.40
	521827	Coil—antenna; channel #7 (Coded "•7Q•")	1.15
	521828	Coil—antenna; channel #8 (Coded "•8Q•")	1.15
	521829	Coil—antenna; channel #9 (Coded "•9Q•")	1.15
	521830	Coil—antenna; chan. #10 (Coded "•10Q•")	1.15
	521831	Coil—antenna; chan. #11 (Coded "•11Q•")	1.15
	521832	Coil—antenna; chan. #12 (Coded "•12Q•")	1.15
	521833	Coil—antenna; chan. #13 (Coded "•13Q•")	1.15
407	520701	Coil—cathode coupling	.15
◆412	521841	Coil—U.H.F. I.F. Coupling (Coded "•1R•")	2.75
◆413	521842	Coil—R.F. & osc.; chan. #2 (Coded "•2R•")	1.85
	521843	Coil—R.F. & osc.; chan. #3 (Coded "•3R•")	1.85
	521844	Coil—R.F. & osc.; chan. #4 (Coded "•4R•")	1.85
	521845	Coil—R.F. & osc.; chan. #5 (Coded "•5R•")	1.85
	521846	Coil—R.F. & osc.; chan. #6 (Coded "•6R•")	1.85
	521847	Coil—R.F. & osc.; chan. #7 (Coded "•7R•")	1.70
	521843	Coil—R.F. & osc.; chan. #8 (Coded "•8R•")	1.70
	521849	Coil—R.F. & osc.; chan. #9 (Coded "•9R•")	1.70
	521850	Coil—R.F. & osc.; ch. #10 (Coded "•10R•")	1.70
	521851	Coil—R.F. & osc.; ch. #11 (Coded "•11R•")	1.70
	521852	Coil—R.F. & osc.; ch. #12 (Coded "•12R•")	1.70
	521853	Coil—R.F. & osc.; ch. #13 (Coded "•13R•")	1.70
	507786	Slug for osc. coil; auxiliary fine tuning adj.	.05
429	521834	Coil—neutralizing	.85
431	521835	Choke—mixer plate	.85
433	521836	Coil	.85
441	520518	Coil—choke	.10
444	520520	Coil—choke	.10
505	‡	Inductor—Ant. End	—
507A	‡	Inductor—Antenna Preselector tuning	—
507B	‡	Inductor—Mixer-Detector tuning	—
507C	‡	Inductor—Oscillator tuning	—
514	‡	Transformer—U.H.F. converter I.F.	—
515	‡	Inductor—Mixer End	—
517	‡	Coil—choke	—
523	‡	Inductor—Oscillator End	—
526	‡	Coil—choke	—
527	‡	Coil—choke	—
528	‡	Coil—choke	—
531	‡	Coil—choke	—

CONTROLS

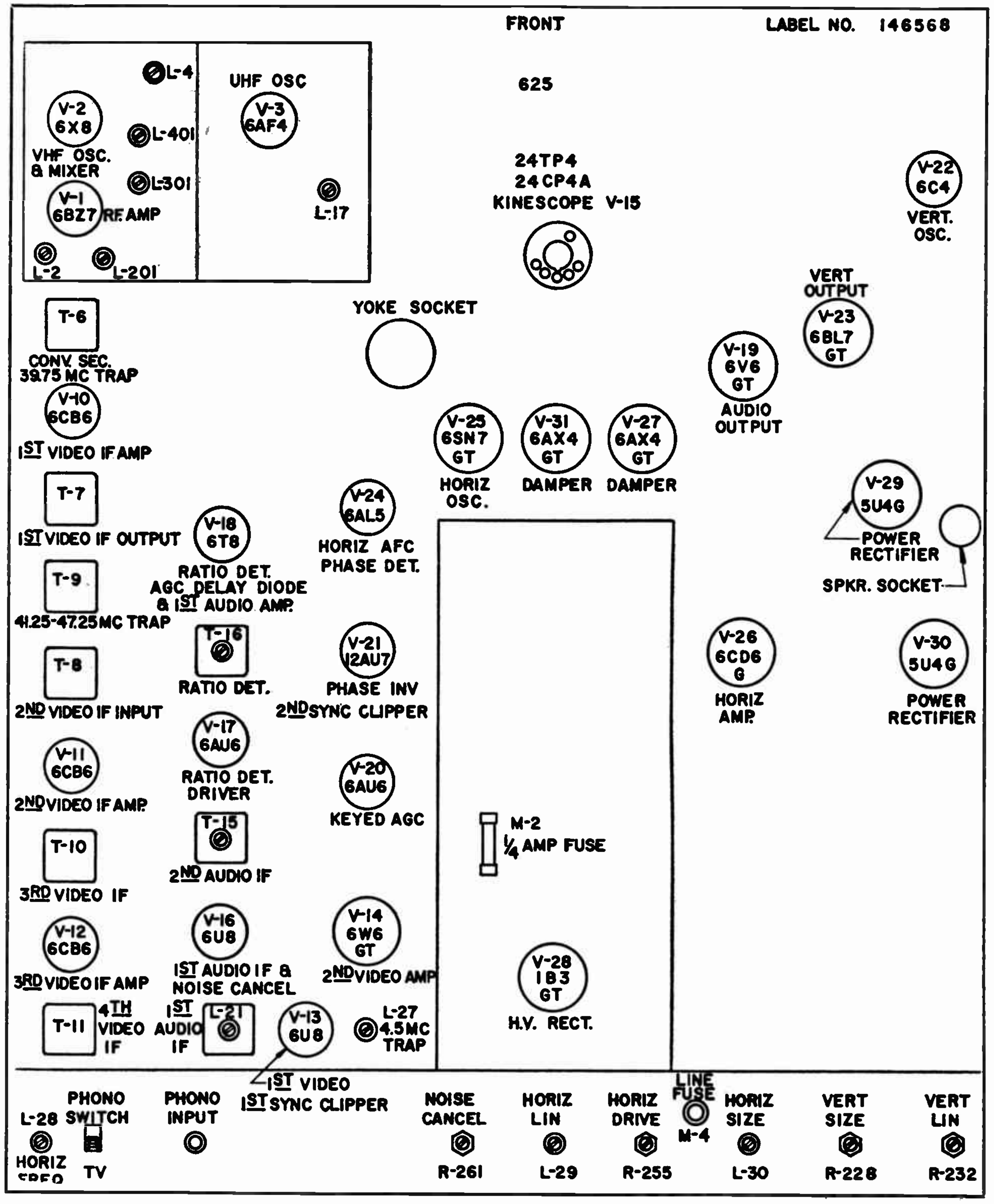
DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
46	521057	Power Booster (Contrast) potentiometer (300 Ohms ½ watt)	1.00
67-A,B,C	521060	Volume and Brightness potentiometers (includes On-Off switch) A—Brightness (100,000 Ohms ¼ watt) B—On-Off Switch C—Volume (1 Meg. ¼ watt)	1.00
108	508071	Horizontal Drive Condenser (10-160 Mmfd.)	.40
123	521059	Horizontal Hold potentiometer (50,000 Ohms ¼ watt)	2.00
148	520996	Width potentiometer (400 Ohms ±10% 4 w.)	1.50
176	520746	Tone potentiometer (500,000 Ohms ¼ watt)	1.00
187	521058	Vertical Hold potentiometer (1 Meg. ¼ w.)	1.00
189	520944	Vertical Size potentiometer (2.5 Meg. ¼ w.)	.80
196	520945	Vertical Linearity potentiometer (5000 Ohms ½ watt)	.90
422	*	Fine Tuning condenser (3-5 Mmfd.)	—

OTHER ELECTRICAL PARTS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
39	509386	Crystal detector	1.00
69	521183	Ion trap	1.00
72	521267	Centering magnets (included with back cover of yoke)	1.10
75	521803	Fuse; 4 amp. 125 volt "Slow Blow"	.25
78	118921	Channel lite (Mazda #47) 6-8V. 150 Ma.	.15
149	508713	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt	.20
181	508174	Speaker—P.M. Dynamic (6"x9")	8.40
183 A to G	508062	Integrator unit (includes all condensers and resistors from 183-A to 183-G)	1.40
239	521188	Switch, V.H.F.-U.H.F. selector	3.50
400	509695	Built-in antenna	1.00

*—This part is not supplied as a Service replacement item.
‡—This part is not supplied as a Service replacement item. Tuner to be returned to factory for repair.
ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

625 SERIES (CONSOLE) TELEVISION RECEIVER



TUBE VOLTAGE CHART

1. Measurements are made at 117 Volts line using vacuum tube voltmeter. All voltages are D.C. and are positive with respect to chassis ground except where noted.
2. Contrast and brightness controls set at minimum, antenna disconnected.

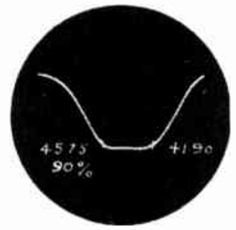
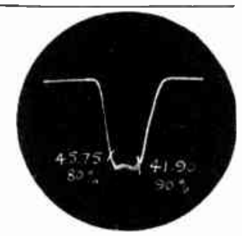
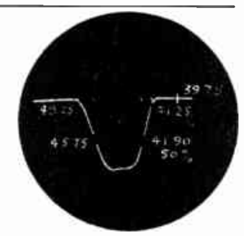
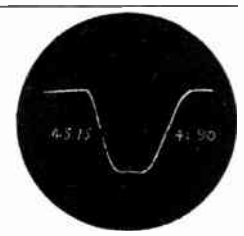
			PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10
V-10	6CB6	1st VIDEO I.F.	.0	.65	AC 6.3	AC 6.3	97	90	Gnd.			
V-11	6CB6	2nd VIDEO I.F.	.0	.65	AC 6.3	AC 6.3	95	96	Gnd.			
V-12	6CB6	3rd VIDEO I.F.	.0	.9	AC 6.3	AC 6.3	97	99	Gnd.			
V-13	6U8	1st VIDEO AMP. & 1st SYNC. CLIPPER	32	—.25	86	AC 6.3	Gnd.	92	Gnd.	Gnd.	—1.8	
V-14	6W6	2nd VIDEO AMP.	8.2	AC 6.3	265	112	7.8	425	Gnd.	23		
V-16	6U8	1st AUDIO I.F. & NOISE CANCEL	91	.0	110	Gnd.	AC 6.3	106	.6	—.1	—.7	
V-17	6AU6	RATIO DET. DRIVER	—.46	Gnd.	Gnd.	AC 6.3	75	83	Gnd.			
V-18	6T8	RATIO DET.	—.43	—1.65	—.58	Gnd.	AC 6.3	.0	Gnd.	.13	47	
V-19	6V6	AUDIO OUTPUT	NC	Gnd.	225	245	.0	NC	AC 6.3	13		
V-20	6AU6	KEYED A.G.C.	97	112	110	112	2.4	300	112			
V-21	12AU7	PHASE INV. & 2nd SYNC. CLIPPER	38	Gnd.	6.0	AC 6.3	AC 6.3	91	10	15	Gnd.	
V-22	6C4	VERT. OSC.	NC	NC	Gnd.	AC 6.3	180	—43	.0			
V-23	6BL7	VERT. OUTPUT	.0	278	18	0	278	18	AC 6.3	Gnd.		
V-24	6AL5	PHASE DET.	.0	.0	Gnd.	AC 6.3	12	NC	—5.7			
V-25	6SN7	HORIZ. OSC.	—15	190	13	4.8	290	13	AC 6.3	Gnd.		
V-26	6CD6	HORIZ. OUTPUT	NC	Gnd.	20	135	7.2	7.2	AC 6.3	135		
V-27	6AX4	DAMPER	NC	NC	565	NC	255	255	AC 6.3	Gnd.		
V-29	5U4	L.V. RECTIFIER	NC	335	NC	Plate	NC	Plate	NC	335		
V-30	5U4	L.V. RECTIFIER	NC	335	NC	Plote	NC	Plote	NC	335		
V-31	6AX4	DAMPER	NC	NC	565	NC	255	NC	AC 6.3	Gnd.		
		DEFLECTION SOCKET	NC	NC	NC	600	560	Gnd.	290	290		
TUNER TERMINAL STRIP VOLTAGES:												PIN 10
		V.H.F. TUNER (V.H.F. POS.)	110	113	AC 6.3	—1.0	.0	.0	0	—.5	.0	225
		UHF POSITION	110	112	AC 6.3	110	.0	.0	AC 6.3	—.5	.0	225

			PIN 1	PIN 2	PIN 10	PIN 11	PIN 12
V-15	24CP4A	KINESCOPE	Gnd.	.0	440	94	AC 6.3

ALIGNMENT PROCEDURE

Apply A.G.C. bias of approximately—2 V to A.G.C. Line (across C-202). Maintain the output level of the sweep generator such that the second detector output is 2 volts peak to peak. Scope Cal. 1-V per inch.

NOTE—USE A NON-METALLIC ALIGNING TOOL AND LIGHT PRESSURE ON ALL SLUGS.

Signal Generator Connection	Oscilloscope or VTVM Connection	Adjustments	Figure
1. Output of 40mc. Sweep Generator to grid of 3rd I.F. Tube, pin 1 of 6CB6 V-12 thru 100 MMF isolating capacitor.	Input of scope to grid of Video Amplifier, pin 2 of 6U8 V-13 thru 47K ohm isolating resistor.	1. Adjust top and bottom of T-11 for marker positions as shown on curve Figure 1.	 FIG. 1
2. Output of 40mc. Sweep Generator to grid of 2nd I.F. Tube, pin 1 of 6CB6 V-11 thru 100 MMF isolating capacitor.	Same as Step #1.	1. Adjust top and bottom of T-10 for marker positions as shown on curve Figure 2.	 FIG. 2
3. Output of 40mc. Sweep Generator to grid of 1st I.F. Tube, pin 1 of 6CB6 V-10 thru 100 MMF isolating capacitor.	Same as Step #1.	1. Adjust top of T-9 for marker position of 47.25mc. 2. Adjust bottom of T-9 for marker positions at 41.25mc. 3. Adjust bottom of T-6 for marker position at 39.75mc. 4. Adjust bottom of T-7 and T-8 to produce curve as shown on Figure 3.	 FIG. 3
4. Raise converter tube shield from ground and connect output of 40mc. sweep generator to the shield.	Same as Step #1.	1. Adjust top of T-6 and L-4 on tuner (L-14 on standard coil tuner) assembly to produce a curve as shown on Figure 4.	 FIG. 4
5. Connect a 400 cycle modulated 4.5mc. signal to the junction of Video detector M-13 and C-130. Adjust generator output to a level to indicate 1.5 Volts on VTVM.	Connect 2-100 resistors in series from plate of ratio detector pin 2 of V-18, 6T8 to ground. Connect VTVM from junction of the 2-100K resistors to ground.	1. Adjust L-21, T-15 and bottom slug of T-16 for maximum indication.	
6. Same as Step #5.	Connect — VTVM ground lead to the junction of the 2-100K resistors (see 5 above). Connect VTVM D.C. lead to the junction of C-183 and R-182.	1. Adjust the secondary (Top slug) of T-16 for zero volts between the positive and negative excursions. (Increase Generator output for good deflection).	

Alternate Trap Alignment

IF THIS METHOD IS USED, IT SHOULD BE PERFORMED BEFORE THE I.F. CURVE ALIGNMENT

Signal Generator Connection	Oscilloscope or VTVM Connection	Adjustments
1. Connect a modulated (400 cycle) 39.75mc. signal to grid, pin 1 of the 1st video I.F. Tube—V-10.	Same as Step #1.	1. Adjust bottom of T-6 for minimum response on scope.
2. Connect a modulated (400 cycle) 41.25mc. signal to the grid, pin 1 of 1st video I.F. Tube 6CB6—V-10.	Same as Step #1.	1. Adjust bottom of T-9 for minimum response on scope.
3. Connect a modulated (400 cycle) 47.25mc. signal to grid, pin 1 of 1st video I.F. Tube 6CB6—V-10.	Same as Step #1.	1. Adjust top of T-9 for minimum response on scope.

GENERAL ASSEMBLY

DESCRIPTION	625 CM	625 CDM	625 CDO
BACK PANEL ASSEMBLY	101229	101229	101235
CABINET	108320	108325	108324
CASTER	147047		
CHASSIS ASSEMBLY	112160	112160	112160
DECAL	121176	121176	121176
DIAL	122041	122041	122041
DOOR PULL		132229	132228
GLIDER—FEET	81890	81890	81890
GRILLE CLOTH	81891	81894	81895
KNOB TUNING	134195	134195	134195
KNOB—CHANNEL INDICATOR	134197	134197	134205
KNOB—TONE	134196	134196	134196
KNOB—VOLUME	134199	134199	134207
KNOB—OUTER	134202	134202	134204
KNOB—INNER	134201	134201	134203
LENS	138039	138039	138039
MASK	174045	174045	174046
NUT—"T" SPEAKER MTG.	163182	163182	163182
PAD—LENS REST	133133	133133	133133
SCREEN—CHASSIS SHELF	130194	130194	130194
SCREW—CHASSIS MTG.	203549	203549	203549
SCREW—LENS MOULDING	524206	524206	524206
SCREW—BACK PANEL	521076	521076	521076
STRIP—LENS EDGE	105412	105412	105412
SOCKET—CASTER	147053		
SPEAKER	155730	155730	155730
SPEAKER ASSEMBLY	155735	155735	155735

PARTS LIST

TUBES

Circuit Symbol	S-C Part No.	Description
V-1	162175	6BZ7 RF Amplifier
V-2	162179	6X8 VHF Converter and I.F. Amplifier for UHF
V-3	162159	6AF4 UHF Oscillator
V-10	162092	6CB6 1st I.F. Amplifier
V-11	162092	6CB6 2nd I.F. Amplifier
V-12	162092	6CB6 3rd I.F. Amplifier
V-13	162171	6U8 1st Video Amplifier and 1st Sync Clipper
V-14	162101	6W6GT Video Output
V-15	162178	24CP4A Kinescope
V-16	162171	6U8 1st Audio I.F. Amplifier and Noise Cancellation Amp.
V-17	162032	6AU6 Ratio Detector Driver
V-18	162077	6T8 Ratio Detector and 1st Audio Amplifier
V-19	162136	6V6GT Audio Output
V-20	162032	6AU6 Keyed AGC
V-21	162042	12AU7 2nd Sync Clipper and Phase Inverter
V-22	162030	6C4 Vertical Oscillator
V-23	162102	6BL7 Vertical Output
V-24	162022	6AL5 Phase Detector
V-25	162018	6SN7GT Horizontal Oscillator
V-26	162176	6CD6G Horizontal Output
V-27	162161	6AX4 Damper
V-28	162029	1B3GT H.V. Rectifier
V-29	162107	5U4G L.V. Rectifier
V-30	162107	5U4G L.V. Rectifier
V-31	162161	6AX4 Damper

COILS

Circuit Symbol	S-C Part No.	Description
L-1	171271	Matching Coil
L-2	171272	44Mc Input from UHF Tuner
L-3	171273	Neutralizing Coil
L-4	171274	VHF Tuner I.F. Output Adjust
L-5	171275	Filament Choke
L-6		
L-7		
L-8		
L-9		
L-10	171800	Antenna Input
L-11	171801	UHF Tuning
L-12	171802	UHF Tuning
L-13	171803	Filament Choke
L-14	171804	Filament Choke
L-15	171805	Crystal Pickup Loop
L-16	171806	Crystal Diode Load
L-17	171807	44Mc I.F. Adjust
L-18	171808	Oscillator Coupling Loop
L-19		
L-20	114747	40Mc Rejection
L-21	114400	1st Audio I.F.
L-22	114748	Peaking Coil
L-23		
L-24	114749	Peaking Coil
L-25	114750	Peaking Coil
L-26	114751	Peaking Coil
L-27	114415	4.5Mc Trap
L-28	114132	Horizontal Oscillator
L-29	114125	Horizontal Linearity
L-30	114129	Horizontal Size
L-31	161030	Filter Choke
L-32	114746	Deflection Yoke
L-33	114693	2.2 uh Choke
L-34		
L-35		
L-101	See T-6	39.75Mc Trap
L-102	See T-9	41.25Mc Trap
L-103	See T-9	47.25Mc Trap
L-104		
L-201	171292	VHF Grid Adjust
L-202 thru L-213	171809 thru 171820	VHF Grid Coils
L-301	171293	VHF RF Plate Adjust
L-302 thru L-315	171484 thru 171497	VHF RF Plate Coils
L-401	171294	VHF Mixer Grid Adjust
L-402 thru L-415	171584 thru 171597	VHF Mixer Grid Coils
L-501	171295	VHF Oscillator Adjust
L-502 thru L-508	171253 thru 171259	VHF Oscillator Coils
L-509	171296	VHF Low Channel Osc. Adjust
L-510 thru L-513	171260 thru 171263	VHF Osc. Coil

TRANSFORMERS

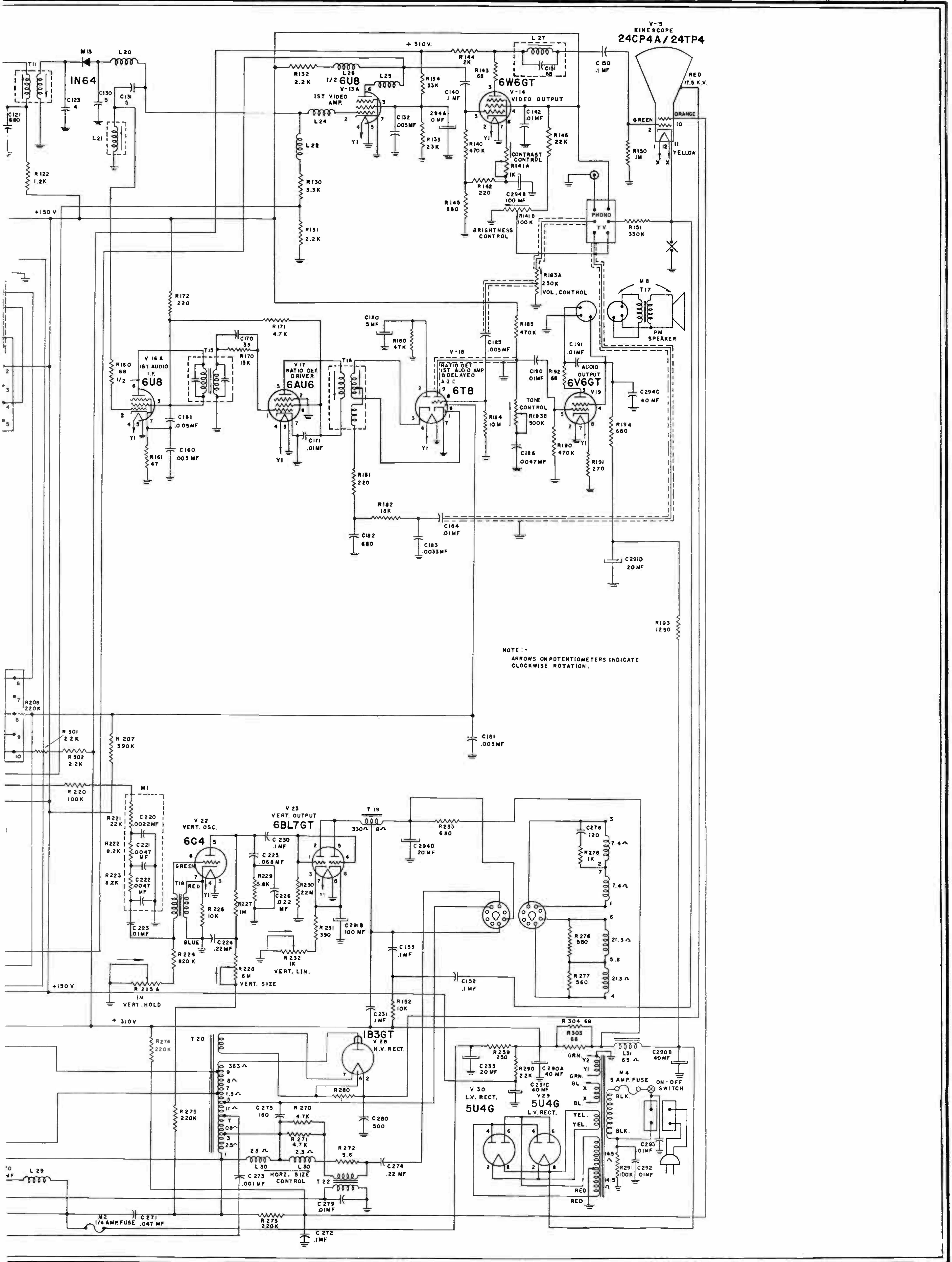
Circuit Symbol	S-C Part No.	Description
T-1	171276	VHF Antenna Input
T-2		
T-3		
T-4		
T-5		
T-6	171246	Converter Secondary and 39.75Mc Trap Coil
T-7	171247	1st Video I.F. Output
T-8	171248	2nd Video I.F. Input
T-9	171249	41.25 and 47.25Mc Trap
T-10	171250	3rd Video I.F.
T-11	171251	4th Video I.F.
T-12		
T-13		
T-14		
T-15	114401	2nd Audio I.F.
T-16	114375	Ratio Detector
T-17	See M-8	Audio Output
T-18	161254	Vertical Blacking
T-19	161266	Vertical Output
T-20	161045	Horizontal Output
T-22	114127	Sawtooth Transformer
T-21	161444	Power Transformer
T-23		

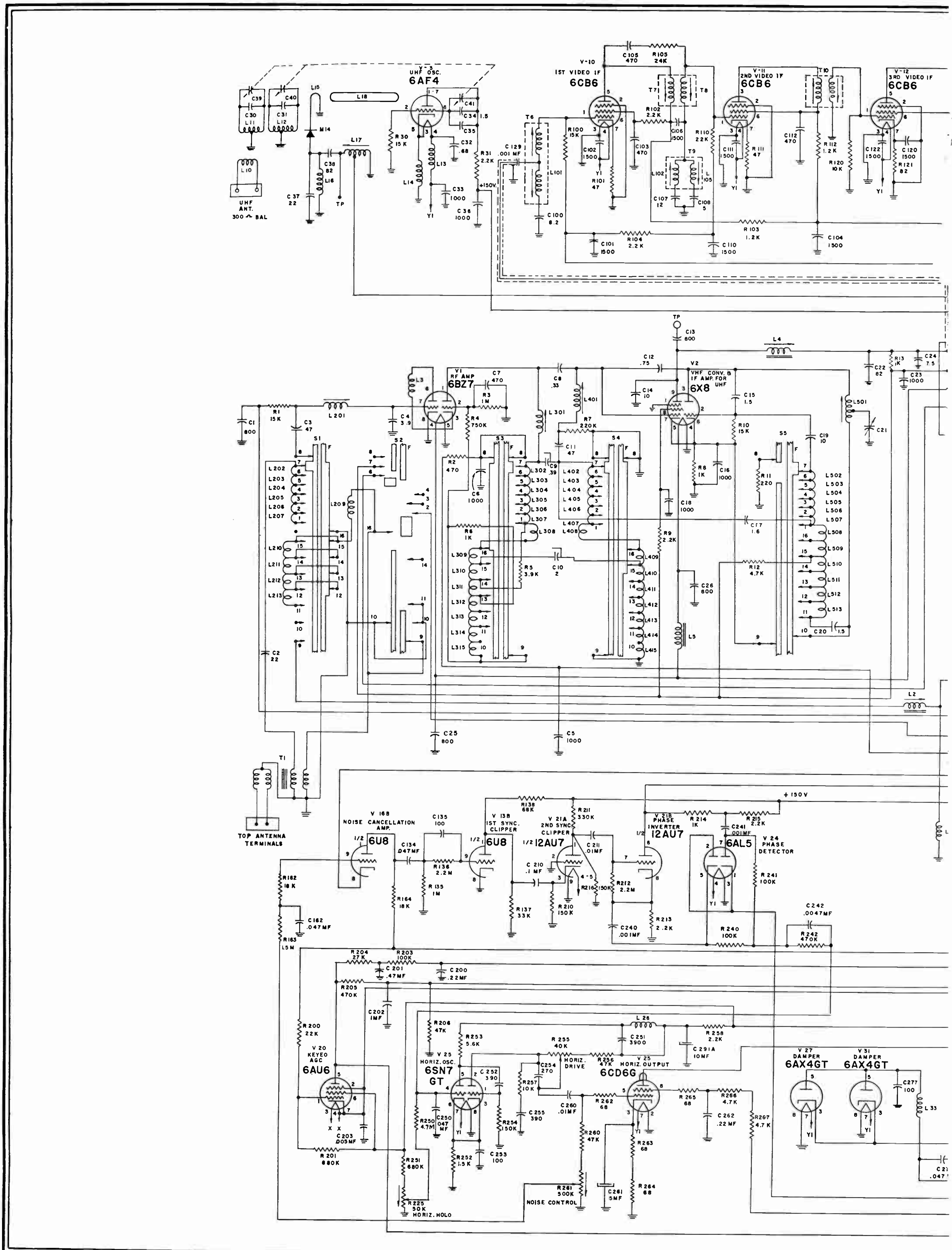
MISCELLANEOUS

Circuit Symbol	S-C Part No.	Description
M-1	128200	Circuit Network
M-2	128003	Fuse, ¼ Amp.
M-3	158037	Slide Switch
M-4	128007	Fuse, 5 Amp.
M-5		
M-6	34421	Phono Jack
M-7	128203	I.F. Strip
M-8	155734	Speaker Assembly
M-9		
M-10		
M-11	164023	VHF Tuning Unit
M-12	164024	UHF Tuning Unit
M-13	162157	1N64 Crystal Diode
M-14	171252	K-3 (Kemtron) Crystal Diode

RESISTORS

Circuit Symbol	S-C Part No.	Resistance	Watt	Tol.
R-1	28172	15K ohms	½ W	10%
R-2	28154	470 ohms	½ W	10%
R-3	171297	1 Megohm	½ W	5%
R-4	149315	750K ohms	½ W	5%
R-5	28165	3.9K ohms	½ W	10%
R-6	28158	1K ohms	½ W	10%
R-7	28183	220K ohms	½ W	10%
R-8	28158	1K ohms	½ W	10%
R-9	28162	2.2K ohms	½ W	10%
R-10	28172	15K ohms	½ W	10%
R-11	28150	220 ohms	½ W	10%
R-12	28166	4.7K ohms	½ W	10%
R-13	28158	1K ohms	½ W	10%
R-14				
R-15				
R-16				
R-17				
R-18				
R-19				
R-20	149282	4.7 ohms	1 W	10%
R-30	28172	15K ohms	½ W	10%
R-31	149048	2.2K ohms	2 W	10%
R-32				
R-33-39				
R-40-49				
R-100	28170	10K ohms	½ W	10%
R-101	28142	47 ohms	½ W	10%
R-102	149103	2.2K ohms	½ W	20%
R-103	28159	1.2K ohms	½ W	10%
R-104	149103	2.2K ohms	½ W	20%
R-105	171238	24K ohms	½ W	5%
R-106				
R-110	149384	22K ohms	½ W	10%
R-111	28142	47 ohms	½ W	10%
R-112	28159	1.2K ohms	½ W	10%
R-113				
R-120	28170	10K ohms	½ W	10%
R-121	28145	82 ohms	½ W	10%
R-122	28159	1.2K ohms	½ W	10%
R-123				
R-130	28164	3.3K ohms	½ W	10%
R-131	28162	2.2K ohms	½ W	10%
R-132	28162	2.2K ohms	½ W	10%
R-133	149404	33K ohms	1 W	10%
R-134	149012	33K ohms	2 W	10%
R-135	149119	1 Megohm	½ W	20%
R-136	149121	2.2 Megohms	½ W	20%
R-137	28175	33K ohms	½ W	10%
R-138	28179	68K ohms	½ W	10%
R-139				
R-140	149117	470K ohms	½ W	20%
R-141	145140	1K-100K ohms	Dual Pot.	
R-142	149134	220 ohms	1 W	20%
R-143	149094	68 ohms	½ W	20%
R-144	149411	2K ohms	7 W	10%
R-145	149075	680 ohms	2 W	20%
R-146	149109	22K ohms	½ W	20%
R-147				
R-148				
R-149				
R-150	149119	1 Megohm	½ W	20%
R-151	28185	330K ohms	½ W	10%
R-152	149107	10K ohms	½ W	20%
R-153				
R-160	149094	68 ohms	½ W	20%
R-161	149093	47 ohms	½ W	10%
R-162	28173	18K ohms	½ W	10%
R-163	149120	1.5 Megohms	½ W	20%
R-164	28173	18K ohms	½ W	10%
R-165				
R-170	149108	15K ohms	½ W	20%
R-171	149142	4.7K ohms	1 W	20%
R-172	149097	220 ohms	½ W	20%
R-173				
R-180	149111	47K ohms	½ W	20%
R-181	149097	220 ohms	½ W	20%


V-15
KINESCOPE
24CP4A/24TP4
RED
17.5 K.V.
GREEN
ORANGE
YELLOW
1/2 6U8
V-13A
1ST VIDEO AMP.
6W6GT
V-14
VIDEO OUTPUT
IN64
CONTRAST CONTROL
BRIGHTNESS CONTROL
PHONO
TV
VOL. CONTROL
PM SPEAKER
V 16A
1ST AUDIO I.F.
6U8
V 17
RATIO DET DRIVER
6AU6
V-18
RATIO DET 1ST AUDIO AMP & DELAYED A G C
6T8
AUDIO OUTPUT
6V6GT
V19
TONE CONTROL
NOTE:-
ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
V 22
VERT. OSC.
6C4
V 23
VERT. OUTPUT
6BL7GT
VERT. LIN.
VERT. SIZE
VERT. HOLD
1B3GT
V 28
H.V. RECT.
HORZ. SIZE CONTROL
V 30
L.V. RECT.
5U4G
V29
5U4G
L.V. RECT.
5 AMP. FUSE
ON-OFF SWITCH
1/4 AMP. FUSE
+310 V.
+150 V


V-3 UHF OSC. 6AF4
V-10 1ST VIDEO IF 6CB6
V-11 2ND VIDEO IF 6CB6
V-12 3RD VIDEO IF 6CB6
UHF ANT. 300 Ω BAL
V1 RF AMP 6BZ7
V2 VHF CONV. & IF AMP. FOR UHF 6X8
TOP ANTENNA TERMINALS
V 16B NOISE CANCELLATION AMP. 1/2 6U8
V 13B 1ST SYNC. CLIPPER 1/2 6U8
V 21A 2ND SYNC. CLIPPER 1/2 12AU7
V 21B PHASE INVERTER 1/2 12AU7
6AL5 V 24 PHASE DETECTOR
+150V
V 20 KEYED AGC 6AU6
V 25 HORIZ. OSC. 6SN7 GT
V 26 HORIZ. OUTPUT 6CD6G
V 27 DAMPER 6AX4GT
V 31 DAMPER 6AX4GT
HORIZ. DRIVE
NOISE CONTROL
HORIZ. HOLD

Circuit Symbol	S-C Part No.	Resistance	Watt	Tol.
R-182	28173	18K ohms	½ W	10%
R-183	145148	250K-500K ohms	Dual Pot.	
R-184	149125	10 Megohms	½ W	20%
R-185	149117	470K ohms	½ W	20%
R-186				
R-190	149117	470K ohms	½ W	20%
R-191	149014	270 ohms	2 W	10%
R-192	149094	68 ohms	½ W	20%
R-193	149420	1250 ohms	5 W	10%
R-194	149075	680 ohms	2 W	20%
R-200	149384	22K ohms	½ W	10%
R-201	28189	680K ohms	½ W	10%
R-202				
R-203	149113	100K ohms	½ W	20%
R-204	149403	27K ohms	1 W	10%
R-205	28187	470K ohms	½ W	10%
R-206	149111	47K ohms	½ W	20%
R-207	28186	390K ohms	½ W	10%
R-208	149115	220K ohms	½ W	20%
R-209				
R-210	149114	150K ohms	½ W	20%
R-211	28185	330K ohms	½ W	10%
R-212	149121	2.2 Megohms	½ W	20%
R-213	28162	2.2K ohms	½ W	10%
R-214	28158	1K ohms	½ W	10%
R-215	28162	2.2K ohms	½ W	10%
R-216	149114	150K ohms	½ W	20%
R-220	149113	100K ohms	½ W	20%
R-221	See M-1	22K ohms		
R-222	See M-1	8200 ohms		
R-223	See M-1	8200 ohms		
R-224	28190	820K ohms	½ W	10%
R-225	145146	1 Megohm		
		50K ohms	Dual Pot.	
R-226	149107	10K ohms	½ W	20%
R-227	28191	1 Megohm	½ W	10%
R-228	145100	6 Megohms	Pot.	
R-229	28167	5.6K ohms	½ W	10%
R-230	149121	2.2 Megohms	½ W	20%
R-231	149039	390 ohms	2 W	10%
R-232	145149	1000 ohms	Pot.	
R-233	149075	680 ohms	2 W	20%
R-234				
R-240	149385	100K ohms	½ W	10%
R-241	149385	100K ohms	½ W	10%
R-242	149117	470K ohms	½ W	20%
R-243				
R-250	149123	4.7 Megohms	½ W	20%
R-251	28189	680K ohms	½ W	10%
R-252	149387	1.5K ohms	½ W	5%
R-253	149184	5.6K ohms	1 W	10%
R-254	149386	150K ohms	½ W	10%
R-255	145150	40K ohms	Pot.	
R-256	28177	47K ohms	½ W	10%
R-257	28170	10K ohms	½ W	10%
R-258	149103	2.2K ohms	½ W	20%
R-259	149434	250 ohms	10 W	10%
R-260	149111	47K ohms	½ W	20%
R-261	145147	500K ohms	Pot.	
R-262	149094	68 ohms	½ W	20%
R-263	149017	68 ohms	2 W	10%
R-264	149017	68 ohms	2 W	10%
R-265	149094	68 ohms	½ W	20%

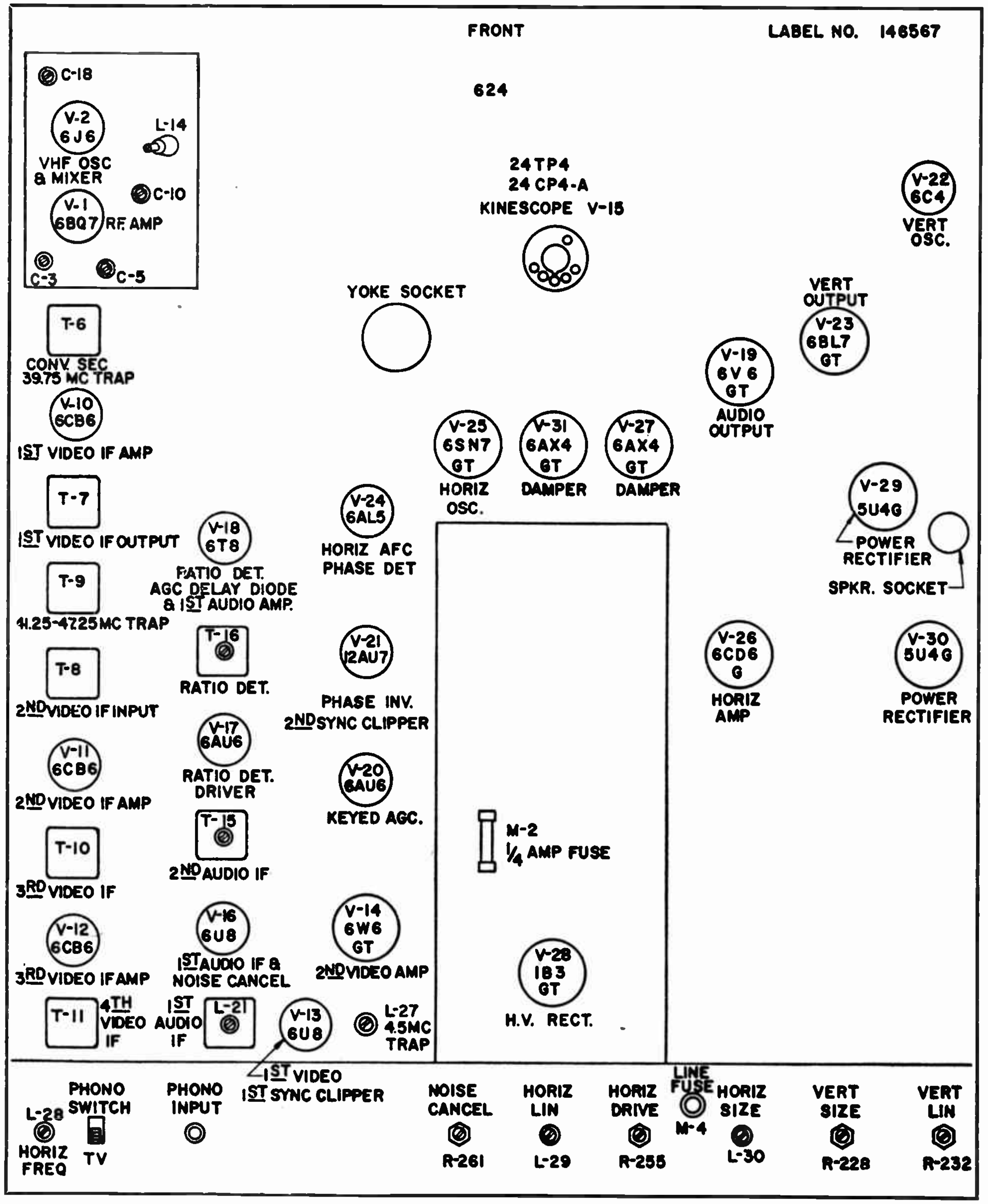
Circuit Symbol	S-C Part No.	Resistance	Watt	Tol.
R-266	149051	4.7K ohms	2 W	10%
R-267	149051	4.7K ohms	2 W	10%
R-268				
R-269				
R-270	149051	4.7K ohms	2 W	10%
R-271	149051	4.7K ohms	2 W	10%
R-272	149430	5.6 ohms	1 W	10%
R-273	149115	220K ohms	½ W	20%
R-274	149115	220K ohms	½ W	20%
R-275	149115	220K ohms	½ W	20%
R-276	28155	560 ohms	½ W	10%
R-277	28155	560 ohms	½ W	10%
R-278	149101	1K ohms	½ W	20%
R-279				
R-280	149435	1 ohm	½ W	20%
R-281				
R-290	149433	2.2K ohms	25 W	10%
R-291	149113	100K ohms	½ W	20%
R-292				
R-300				
R-301	149078	2.2K ohms	2 W	20%
R-302	149078	2.2K ohms	2 W	20%
R-303	149069	68 ohms	2 W	20%
R-304	149069	68 ohms	2 W	20%

CAPACITORS

Circuit Symbol	S-C Part No.	Capacity	Type	Voltage
C-1	171298	800 MMF	Disc Ceramic	
C-2	171299	22 MMF	Ceramic	
C-3	110402	47 MMF	Ceramic	
C-4	171300	3.9 MMF	Ceramic	
C-5	171233	1000 MMF	Disc Ceramic	
C-6	171301	1000 MMF	Ceramic	
C-7	171498	470 MMF	Disc Ceramic	
C-8	171499	.33 MMF	Ceramic	
C-9	171500	.39 MMF	Ceramic	
C-10	171501	2 MMF	Ceramic	
C-11	110402	47 MMF	Ceramic	
C-12	171599	.75 MMF	Ceramic	
C-13	171298	800 MMF	Disc Ceramic	
C-14	171264	10 MMF	Ceramic	
C-15	171265	1.5 MMF	Ceramic	
C-16	171233	1000 MMF	Disc Ceramic	
C-17	171266	1.6 MMF	Ceramic	
C-18	171233	1000 MMF	Disc Ceramic	
C-19	171264	10 MMF	Ceramic	
C-20	171267	1.5 MMF	Ceramic	
C-21	171268	Fine Tuning		
C-22	171269	82 MMF	Ceramic	
C-23	171233	1000 MMF	Disc Ceramic	
C-24	171270	7.5 MMF	Ceramic	
C-25	171298	800 MMF	Disc Ceramic	
C-26	171298	800 MMF	Disc Ceramic	
C-27				
C-30	171285		Trimmer	
C-31	171285		Trimmer	
C-32	171598	.68 MMF	Ceramic	
C-33	171233	1000 MMF	Disc Ceramic	
C-34	171265	1.5 MMF	Ceramic	
C-35	171286		Trimmer	
C-36	171233	1000 MMF	Disc Ceramic	

Circuit Symbol	S-C Part No.	Capacity	Type	Voltage
C-37	171287	22 MMF	Ceramic	
C-38	171288	82 MMF	Disc Ceramic	
C-39	171289	Variable—RF Tuning		
C-40	171290	Variable—RF Tuning		
C-41	171291	Variable—Osc. Tuning		
C-100	171239	8.2 MMF	Ceramic	
C-101	171240	1500 MMF	Ceramic	
C-102	171240	1500 MMF	Ceramic	
C-103	171241	470 MMF	Ceramic	
C-104	171240	1500 MMF	Ceramic	
C-105	171241	470 MMF	Ceramic	
C-106	171240	1500 MMF	Ceramic	
C-107	171242	12 MMF	Ceramic	
C-108	171243	5 MMF	Ceramic	
C-109				
C-110	171240	1500 MMF	Ceramic	
C-111	171240	1500 MMF	Ceramic	
C-112	171241	470 MMF	Ceramic	
C-113				
C-120	171240	1500 MMF	Ceramic	
C-121	171244	680 MMF	Ceramic	
C-122	171240	1500 MMF	Ceramic	
C-123	171245	4 MMF	Ceramic	
C-124				
C-129	110824	.001 MF	Ceramic	450
C-130	110598	5 MMF	Ceramic	350
C-131	110598	5 MMF	Ceramic	350
C-132	110586	.005 MF	Disc Ceramic	450
C-133				
C-134	110722	.047 MF	Tubular	400
C-135	110460	100 MMF	Ceramic	500
C-136				
C-140	110724	.1 MF	Tubular	400
C-141				
C-142	110672	.01 MF	Disc Ceramic	450
C-144				
C-150	110724	.1 MF	Tubular	400
C-151	110459	68 MMF (See L27)	Ceramic	500
C-152	110743	.1 MF	Tubular	600
C-153	110724	.1 MF	Tubular	400
C-154				
C-160	110586	.005 MF	Disc Ceramic	450
C-161	110586	.005 MF	Disc Ceramic	450
C-162	110703	.047 MF	Tubular	200
C-163				
C-170	110486	33 MMF	Ceramic	400
C-171	110672	.01 MF	Disc Ceramic	450
C-172				
C-180	111093	5 MF	Electrolytic	50
C-181	110586	.005 MF	Disc Ceramic	450
C-182	110465	680 MMF	Ceramic	350
C-183	110715	.0033 MF	Tubular	400
C-184	110718	.01 MF	Tubular	400
C-185	110586	.005 MF	Disc Ceramic	450
C-186	110735	.0047 MF	Tubular	600
C-187				
C-190	110737	.01 MF	Tubular	600
C-191	110737	.01 MF	Tubular	600
C-192				
C-200	110707	.22 MF	Tubular	200
C-201	110533	.47 MF	Tubular	200

Circuit Symbol	S-C Part No.	Capacity	Type	Voltage
C-202	110823	1 MF	Tubular	100
C-203	110586	.005 MF	Disc Ceramic	450
C-204				
C-210	110705	.1 MF	Tubular	200
C-211	110718	.01 MF	Tubular	400
C-212				
C-220	See M-1	.0022 MF		
C-221	See M-1	.0047 MF		
C-222	See M-1	.0047 MF		
C-223	110718	.01 MF	Tubular	400
C-224	110745	.22 MF	Tubular	600
C-225	110560	.068 MF	Tubular	600
C-226	110557	.022 MF	Tubular	600
C-227				
C-230	110561	.1 MF	Tubular	600
C-231	110561	.1 MF	Tubular	600
C-232				
C-233	111105	20 MF	Electrolytic	450
C-240	110534	.001 MF	Tubular	400
C-241	110534	.001 MF	Tubular	400
C-242	110716	.0047 MF	Tubular	400
C-243				
C-250	110722	.047 MF	Tubular	400
C-251	110309	3900 MMF	Mica	500
C-252	110262	390 MMF	Mica	500
C-253	110291	100 MMF	Mica	500
C-254	110260	270 MMF	Mica	500
C-255	110262	390 MMF	Mica	500
C-256				
C-260	110737	.01 MF	Tubular	600
C-261	111093	5 MF	Electralytic	50
C-262	110548	.22 MF	Tubular	400
C-263				
C-270	110722	.047 MF	Tubular	400
C-271	110722	.047 MF	Tubular	400
C-272	110743	.1 MF	Tubular	600
C-273	110562	.001 MF	Tubular	1KV
C-274	110548	.22 MF	Tubular	400
C-275	110825	180 MMF	Ceramic	3KV
C-276	110311	120 MMF	Mica	1.5KV
C-277	110291	100 MMF	Mica	500
C-278				
C-279	110718	.01 MF	Tubular	400
C-280	110820	500 MMF	Ceramic	30KV
C-281				
C-290	111095	40-40 MF	Electrolytic	450
C-291	111104	40-20-10 MF	Electrolytic	450
		100 MF	Electrolytic	50
C-292	110568	.01 MF	Tubular	1KV
C-293	110568	.01 MF	Tubular	1KV
C-294	111104	40-20-10 MF	Electrolytic	450
		100 MF	Electrolytic	50
C-295				



TUBE VOLTAGE CHART

1. Measurements are made at 117 Volts line using vacuum tube voltmeter. All voltages are D.C. and are positive with respect to chassis ground except where noted.
2. Contrast and brightness controls set at minimum, antenna disconnected.

			PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V-10	6CB6	1st VIDEO I.F.	.0	.6	AC 6.3	AC 6.3	98	92	Gnd.		
V-11	6CB6	2nd VIDEO I.F.	.0	.7	AC 6.3	AC 6.3	97	98	Gnd.		
V-12	6CB6	3rd VIDEO I.F.	.0	1.0	AC 6.3	AC 6.3	100	102	Gnd.		
V-13	6U8	1st VIDEO AMP.	27.5	—.2	82	AC 6.3	Gnd.	94	Gnd.	Gnd.	—.7
V-14	6W6	2nd VIDEO AMP.	7.7	AC 6.3	285	118	7.2	425	Gnd.	22	
V-16	6U8	1st AUDIO I.F.	94	.0	110	Gnd.	AC 6.3	110	.6	0	—7
V-17	6AU6	RATIO DET. DRIVER	0	Gnd.	Gnd.	AC 6.3	84	84	Gnd.		
V-18	6T8	RATIO DET.	—2	—4.6	—2.6	Gnd.	AC 6.3	0	Gnd.	—.9	44
V-19	6V6	AUDIO OUTPUT	NC	Gnd.	225	250	.0	.0	AC 6.3	14	
V-20	6AU6	KEYED A.G.C.	100	115	115	116	3.0	305	115		
V-21	12AU7	PHASE INV. 2nd SYNC. CLIPPER	38	Gnd.	4.2	AC 6.3	AC 6.3	92	9	14	Gnd.
V-22	6C4	VERT. OSC.	NC	NC	Gnd.	AC 6.3	150	—34	.0		
V-23	6BL7	VERT. OUTPUT	.0	280	18	.0	280	18	AC 6.3	Gnd.	
V-24	6AL5	PHASE DET.	.0	.0	Gnd.	AC 6.3	7.0	NC	—5.2		
V-25	6SN7	HORIZ. OSC.	—12	210	18.5	3.0	245	18.5	AC 6.3	Gnd.	
V-26	6CD6	HORIZ. OUTPUT	NC	Gnd.	18	140	—6	—6	AC 6.3	140	
V-27	6AX4	DAMPER	NC	NC	520	NC	270	270	AC 6.3	Gnd.	
V-29	5U4	L.V. RECTIFIER	NC	335	NC	Plate	NC	Plate	NC	335	
V-30	5U4	L.V. RECTIFIER	NC	335	NC	Plate	NC	Plate	NC	335	
V-31	6AX4	DAMPER	NC	NC	560	NC	290	NC	AC 6.3	Gnd.	
		DEFLECTION SOCKET	NC	NC	NC	550	520	Gnd.	300	300	
			PIN 1	PIN 2	PIN 10	PIN 11	PIN 12				
V-15	24CP4A	KINESCOPE	Gnd.	.0	410	90	AC 6.3				

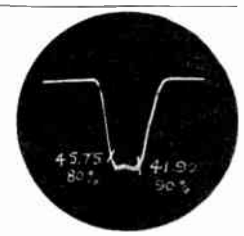
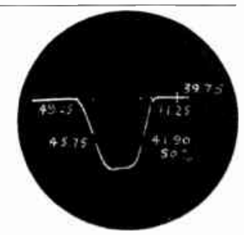
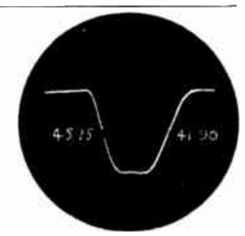
TUNER Blue Lead—Plate RF 245 Volts
TUNER Red Lead—B+ to Conv. 115 Volts

NOTE—
NC—No connection.

ALIGNMENT PROCEDURE

Apply A.G.C. bias of approximately—2 V to A.G.C. Line (across C-202). Maintain the output level of the sweep generator such that the second detector output is 2 volts peak to peak. Scope Cal. 1-V per inch.

NOTE—USE A NON-METALLIC ALIGNING TOOL AND LIGHT PRESSURE ON ALL SLUGS.

Signal Generator Connection	Oscilloscope or VTVM Connection	Adjustments	
1. Output of 40mc. Sweep Generator to grid of 3rd I.F. Tube, pin 1 of 6CB6 V-12 thru 100 MMF isolating capacitor.	Input of scope to grid of Video Amplifier, pin 2 of 6U8 V-13 thru 47K ohm isolating resistor.	1. Adjust top and bottom of T-11 for marker positions as shown on curve Figure 1.	 FIG. 1
2. Output of 40mc. Sweep Generator to grid of 2nd I.F. Tube, pin 1 of 6CB6 V-11 thru 100 MMF isoloting capacitor.	Same as Step #1.	1. Adjust top and bottom of T-10 for marker positions as shown on curve Figure 2.	 FIG. 2
3. Output of 40mc. Sweep Generator to grid of 1st I.F. Tube, pin 1 of 6CB6 V-10 thru 100 MMF isolating capacitor.	Same as Step #1.	1. Adjust top of T-9 for marker position of 47.25mc. 2. Adjust bottom of T-9 for marker positions at 41.25mc. 3. Adjust bottom of T-6 for marker position of 39.75mc. 4. Adjust bottom of T-7 and T-8 to produce curve as shown on Figure 3.	 FIG. 3
4. Raise converter tube shield from ground and connect output of 40mc. sweep generator to the shield.	Same as Step #1.	1. Adjust top of T-6 and L-4 on tuner (L-14 on standord coil tuner) assembly to produce a curve as shown on Figure 4.	 FIG. 4
5. Connect a 400 cycle modulated 4.5mc. signal to the junction of Video detector M-13 and C-130. Adjust generator output to a level to indicate 1.5 Volts on VTVM.	Connect 2-100 resistors in series from plate of ratio detector pin 2 of V-18, 6T8 to ground. Connect VTVM from junction of the 2-100K resistors to ground.	1. Adjust L-21, T-15 and bottom slug of T-16 for maximum indication.	
6. Same as Step #5.	Connect — VTVM ground lead to the junction of the 2-100K resistors (see 5 above). Connect VTVM D.C. lead to the junction of C-183 and R-182.	1. Adjust the secondary (Top slug) of T-16 for zero volts between the positive and negative excursions. (Increase Generator output for good deflection).	

Alternate Trap Alignment

IF THIS METHOD IS USED, IT SHOULD BE PERFORMED BEFORE THE I.F. CURVE ALIGNMENT

Signal Generator Connection	Oscilloscope or VTVM Connection	Adjustments
1. Connect a modulated (400 cycle) 39.75mc. signal to grid, pin 1 of the 1st video I.F. Tube—V-10.	Same as Step #1.	1. Adjust bottom of T-6 for minimum response on scope.
2. Connect a modulated (400 cycle) 41.25mc. signal to the grid, pin 1 of 1st video I.F. Tube 6CB6—V-10.	Same as Step #1.	1. Adjust bottom of T-9 for minimum response on scope.
3. Connect a modulated (400 cycle) 47.25mc. signal to grid, pin 1 of 1st video I.F. Tube 6CB6—V-10.	Same as Step #1.	1. Adjust top of T-9 for minimum response on scope.

PARTS LIST

TUBES

Circuit Symbol	S-C Part No.	Description
V-1	162100	6BQ7 RF Amplifier
V-2	162118	6J6 Converter
V-3		
V-10	162092	6CB6 1st Video I.F. Amplifier
V-11	162092	6CB6 2nd Video I.F. Amplifier
V-12	162092	6CB6 3rd Video I.F. Amplifier
V-13	162171	6U8 1st Video Amp. & 1st Sync Clipper
V-14	162101	6W6GT Video Output
V-15	162178	24CP4A Kinescope
V-16	162171	6U8 1st Audio I.F. Amplifier and Noise Concellation Amp.
V-17	162032	6AU6 Ratio Detector Driver
V-18	162077	6T8 Ratio Detector and 1st Audio Amplifier
V-19	162136	6V6GT Audio Amplifier
V-20	162032	6AU6 Keyed AGC
V-21	162042	12AU7 2nd Sync Clipper and Phase Inverter
V-22	162030	6C4 Vertical Oscillator
V-23	162102	6BL7 Vertical Output
V-24	162022	6AL5 Phase Detector
V-25	162018	6SN7GT Horizontal Oscillator
V-27	162161	6AX4 Damper
V-28	162029	1B3GT H.V. Rectifier
V-29	162107	5U4G L.V. Rectifier
V-30	162107	5U4G L.V. Rectifier
V-31	162161	6AX4 Damper

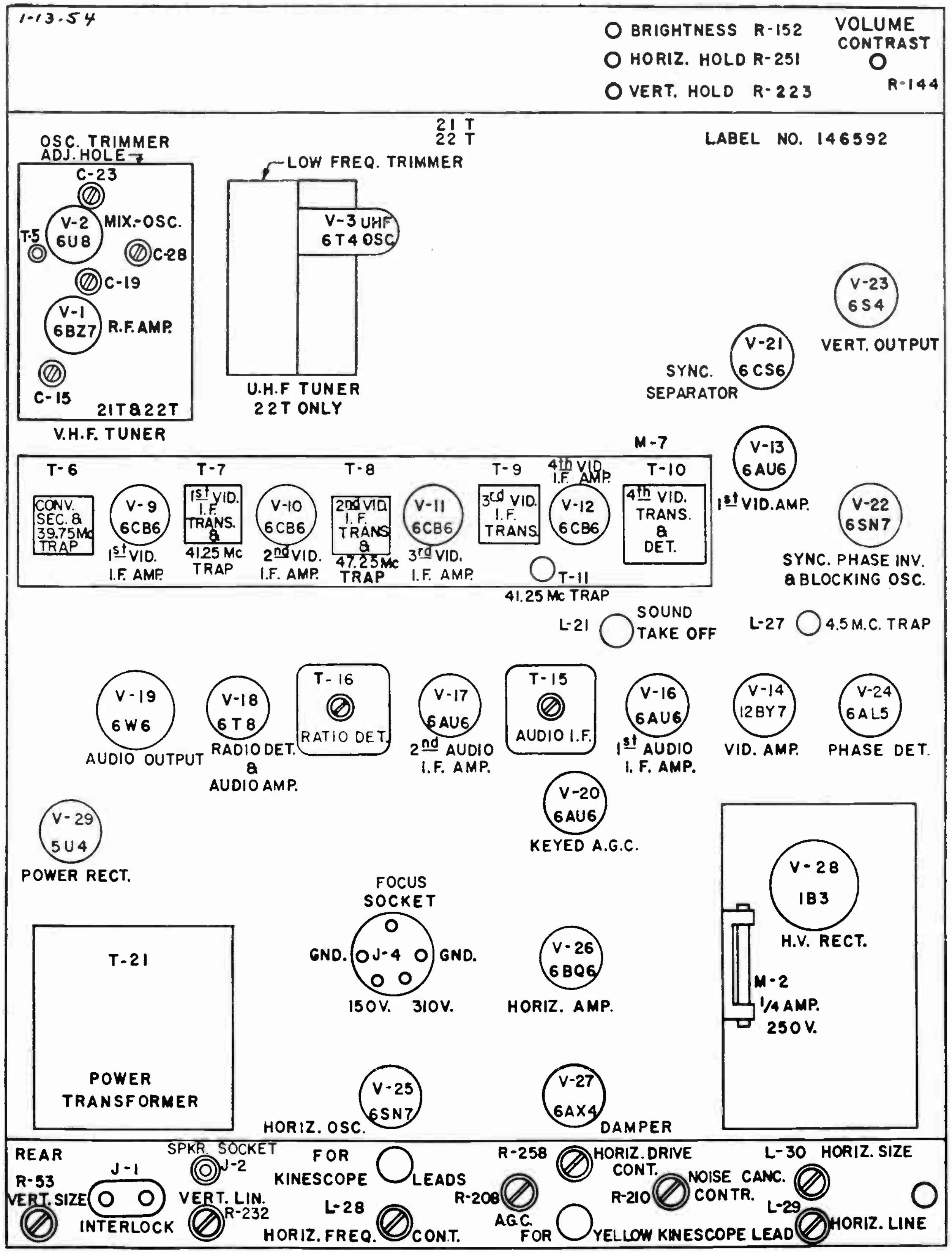
TRANSFORMERS

Circuit Symbol	S-C Part No.	Description
T-1 thru	171502 171583	VFH and UHF Antenna and Oscillator Transformer
T-2		
T-3		
T-4		
T-5		
T-6	171246	Converter Secondary and 39.75Mc Trap Coil
T-7	171247	1st Video I.F. Output
T-8	171248	2nd Video I.F. Input
T-9	171249	41.25Mc and 47.25Mc Trap
T-10	171250	3rd Video I.F.
T-11	171251	4th Video I.F.
T-12		
T-13		
T-14		
T-15	114401	2nd Audio I.F.
T-16	114375	Ratio Detector
T-17	See M-8	Audio Output
T-18	161254	Vertical Blocking
T-19	161266	Vertical Output
T-20	161045	Horizontal Output
T-21	161444	Power Transformer
T-22	114127	Sawtooth Transformer
T-23		

COILS

Circuit Symbol	S-C Part No.	Description
L-1	171280	40Mc Trap
L-2	171280	40Mc Trap
L-3	See T-1	VHF and UHF Antenna Coil
L-4	See T-1	VHF and UHF Antenna Coil
L-5	171281	40Mc Trap
L-6	171224	Cathode Choke
L-7	171220	Filament Choke
L-8	See T-1	VHF and UHF Oscillator Coil
L-9	See T-1	VHF and UHF Oscillator Coil
L-10	171237	Filament Choke
L-11	See T-1	VHF and UHF Oscillator Coil
L-12	171282	Neutralizing Coil
L-13	171283	Mixer Plate Choke
L-14	171284	I.F. Output Adjust
L-15		
L-20	114747	40Mc Rejection
L-21	114400	1st Audio I.F.
L-22	114748	Peaking Coil
L-23		
L-24	114749	Peaking Coil
L-25	114750	Peaking Coil
L-26	114751	Peaking Coil
L-27	114415	4.5Mc Trap
L-28	114132	Horizontal Oscillator
L-29	114125	Horizontal Linearity
L-30	114129	Horizontal Size
L-31	161030	Filter Choke
L-32	114746	Deflection Yoke
L-33	114693	2.2uh Choke
L-34		
L-101	See T-6	39.75Mc Trap
L-102	See T-9	41.25Mc Trap
L-103	See T-9	47.25Mc Trap
L-104		

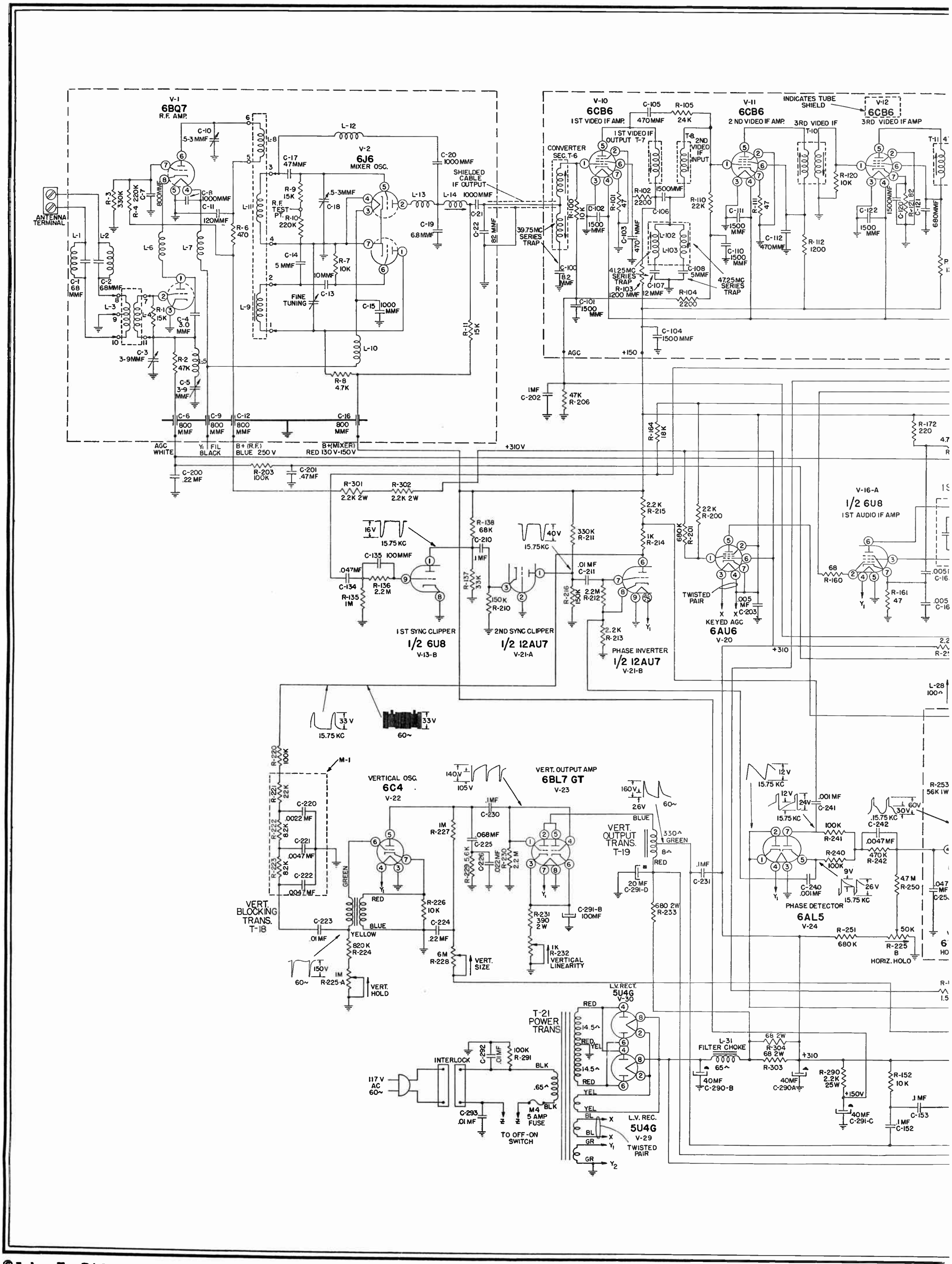
21T-22T Series Television Receiver

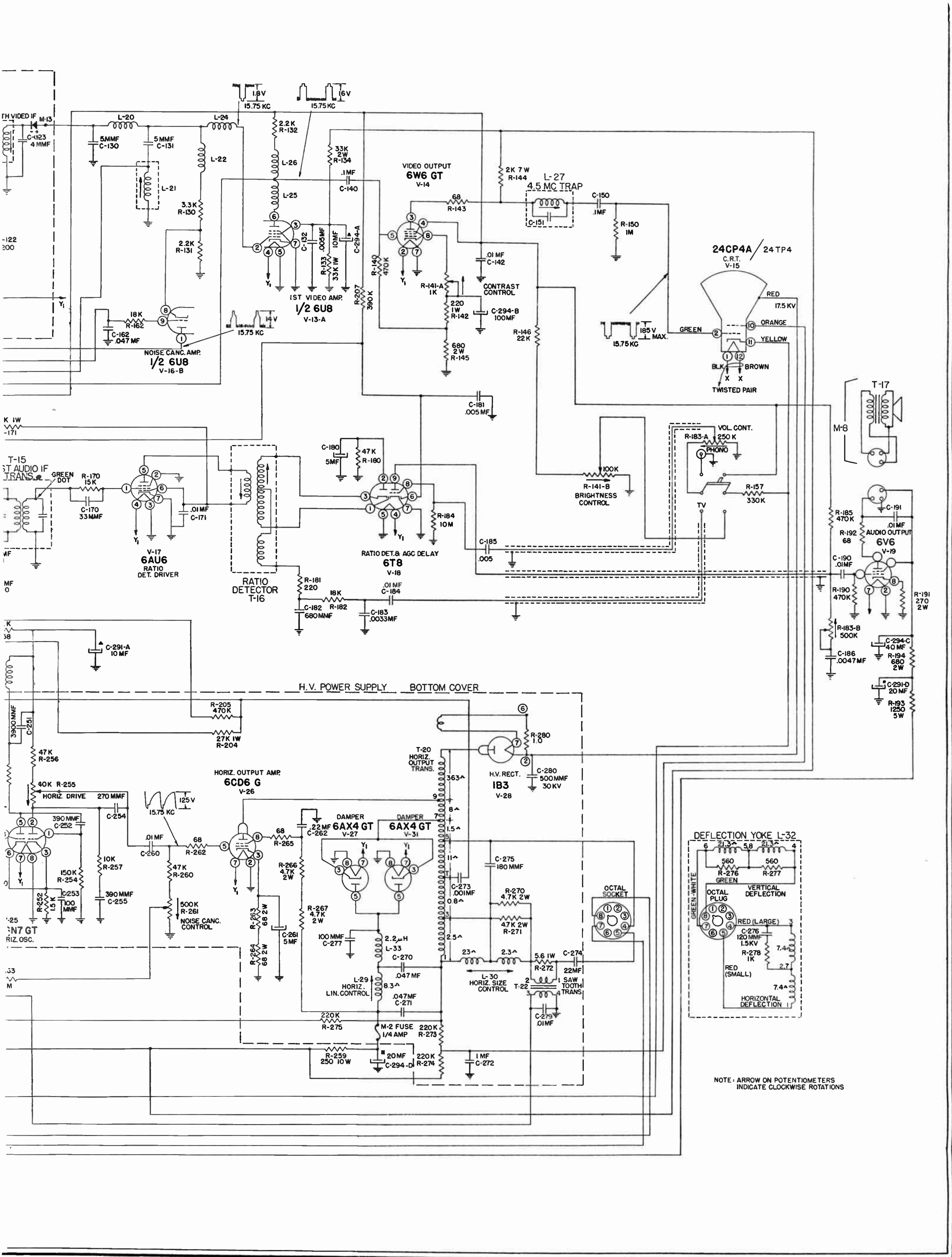


NOTE: 1N105 Diode Detector is Located Under Removable Shield Cover of T-10 4th Video IF Trans.

GENERAL ASSEMBLY

DESCRIPTION	21TQ	21TM	22TQ	22TM
BACK PANEL ASSEMBLY	101240	101240	101243	101243
CABINET ASSEMBLY	108351	108350	108351	108350
CHASSIS ASSEMBLY	112167	112167	112165	112165
DECAL	121079	121079	121079	121079
DIAL — U.H.F.			122044	122044
EXTENSION TUBE FOR KNOB ASSEMBLY	125069	125069	125069	125069
GRILLE ASSEMBLY	130211	130211	130211	130211
KNOB — VOLUME-OFF-ON SWITCH	134225	134225	134225	134225
KNOB — CONTRAST	134234	134234	134234	134234
KNOB — CHANNEL INDICATOR	134229	134229	134224	134224
KNOB — FINE TUNING V.H.F. - TUNING U.H.F.	134233	134233	134233	134233
KNOB — VERTICAL, HORIZONTAL, BRIGHTNESS	134232	134232	134232	134232
LENS	138041	138041	138041	138041
MASK	174048	174048	174048	174048
PAD — LENS REST	133133	133133	133133	133133
SCREEN — CHASSIS SHELF	130204	130204	130204	130204
SCREW — ANTENNA BINDING POST	521016	521016	521016	521016
SCREW — STRIP	163211	163211	163211	163211
SCREW — BACK PANEL	521076	521076	521076	521076
SEMS UNIT	203549	203549	203549	203549
SPEAKER ASSEMBLY	155821	155821	155821	155821
SPEAKER — MOUNTING BOLT	132241	132241	132241	132241
STRIP — RIGHT LENS EDGE	105445	105445	105445	105445
STRIP — LEFT LENS EDGE	105446	105446	105446	105446
LOCKWASHER — SPEAKER MOUNTING	526042	526042	526042	526042
NUT — SPEAKER MOUNTING	525050	525050	525050	525050
TABS	146563	146563		


V-1
6BQ7
R.F. AMP.
V-2
6J6
MIXER OSC.
ANTENNA TERMINAL
SHIELDED CABLE IF OUTPUT
FINE TUNING
R.F. TEST PT.
AGC WHITE
Y1 FIL BLACK
B+ (R.F.) BLUE 250 V
B+(MIXER) RED 130 V-150 V
+310V
V-10
6CB6
1 ST VIDEO IF AMP.
V-11
6CB6
2 ND VIDEO IF AMP.
INDICATES TUBE SHIELD
V-12
6CB6
3RD VIDEO IF AMP
CONVERTER SEC. T-6
1 ST VIDEO IF OUTPUT T-7
T-8 2ND VIDEO IF INPUT
3RD VIDEO IF T-10
39.75MC SERIES TRAP
41.25MC SERIES TRAP
47.25MC SERIES TRAP
AGC
+150
1 ST SYNC CLIPPER
1/2 6U8
V-13-B
2ND SYNC CLIPPER
1/2 12AU7
V-21-A
PHASE INVERTER
1/2 12AU7
V-21-B
KEYED AGC
6AU6
V-20
TWISTED PAIR
V-16-A
1/2 6U8
1 ST AUDIO IF AMP
M-1
VERTICAL OSC.
6C4
V-22
VERT. OUTPUT AMP
6BL7 GT
V-23
VERT. OUTPUT TRANS. T-19
VERT. BLOCKING TRANS. T-18
VERT. SIZE
VERT. HOLD
VERTICAL LINEARITY
PHASE DETECTOR
6AL5
V-24
HORIZ. HOLD
T-21 POWER TRANS
L.V. RECT. 5U4G V-30
L.V. REC. 5U4G V-29
L-31 FILTER CHOKE
INTERLOCK
117 V AC 60~
M4 5 AMP FUSE
TO OFF-ON SWITCH
TWISTED PAIR



NOTE: ARROW ON POTENTIOMETERS INDICATE CLOCKWISE ROTATIONS

MISCELLANEOUS

Circuit Symbol	S-C Part No.	Description
M-1	128200	Circuit Network
M-2	128003	Fuse, ¼ Amp.
M-3	158037	Slide Switch
M-4	128007	Fuse, 5 Amp.
M-5		
M-6	34421	Phono Jack
M-7	128203	I.F. Strip
M-8	155734	Speaker Assembly
M-9		
M-10		
M-11	164022	Tuning Unit
M-12		
M-13	162157	1N64 Crystal Diode
M-14		

RESISTORS

Circuit Symbol	S-C Part No.	Resistance	Watt	Tol.
R-1	28172	15K ohms	½ W	10%
R-2	149111	47K ohms	½ W	20%
R-3	28185	330K ohms	½ W	10%
R-4	28183	220K ohms	½ W	10%
R-5				
R-6	149099	470 ohms	½ W	20%
R-7	28170	10K ohms	½ W	10%
R-8	28166	4.7K ohms	½ W	10%
R-9	28172	15K ohms	½ W	10%
R-10	149115	220K ohms	½ W	10%
R-11	28172	15K ohms	½ W	10%
R-12				
R-13				
R-100	28170	10K ohms	½ W	10%
R-101	28142	47 ohms	½ W	10%
R-102	149103	2.2K ohms	½ W	20%
R-103	28159	1.2K ohms	½ W	10%
R-104	149103	2.2K ohms	½ W	20%
R-105	171238	24K ohms	½ W	5%
R-106				
R-110	149384	22K ohms	½ W	10%
R-111	28142	47 ohms	½ W	10%
R-112	28159	1.2K ohms	½ W	10%
R-113				
R-120	28170	10K ohms	½ W	10%
R-121	28145	82 ohms	½ W	10%
R-122	28159	1.2K ohms	½ W	10%
R-123				
R-130	28164	3.3K ohms	½ W	10%
R-131	28162	2.2K ohms	½ W	10%
R-132	28162	2.2K ohms	½ W	10%
R-133	149404	33K ohms	1 W	10%
R-134	149012	33K ohms	2 W	10%
R-135	149119	1 Megohm	½ W	20%
R-136	149121	2.2 Megohms	½ W	20%
R-137	28175	33K ohms	½ W	10%
R-138	28179	68K ohms	½ W	10%
R-139				
R-140	149117	470K ohms	½ W	20%
R-141	145140	1K-100K ohms	Dual Pot.	
R-142	149134	220 ohms	1 W	20%
R-143	149094	68 ohms	½ W	20%
R-144	149411	2K ohms	7 W	10%
R-145	149075	680 ohms	2 W	20%
R-146	149109	22K ohms	½ W	20%
R-147				
R-148				
R-149				
R-150	149119	1 Megohm	½ W	20%
R-151	28185	330K ohms	½ W	10%
R-152	149107	10K ohms	½ W	20%
R-153				
R-160	149094	68 ohms	½ W	20%
R-161	149093	47 ohms	½ W	10%
R-162	28173	18K ohms	½ W	10%
R-163	149120	1.5 Megohms	½ W	20%
R-164	28173	18K ohms	½ W	10%
R-165				
R-170	149108	15K ohms	½ W	20%
R-171	149142	4.7K ohms	½ W	20%
R-172	149097	220 ohms	½ W	20%
R-173				
R-180	149111	47K ohms	½ W	20%
R-181	149097	220 ohms	½ W	20%
R-182	28173	18K ohms	½ W	10%
R-183	145148	250K-500K ohms	Dual Pot.	
R-184	149125	10 Megohms	½ W	20%
R-185	149117	470K ohms	½ W	20%
R-186				
R-190	149117	470K ohms	½ W	20%
R-191	149014	270 ohms	2 W	10%
R-192	149094	68 ohms	½ W	20%
R-193	149420	1250 ohms	5 W	10%
R-194	149075	680 ohms	2 W	20%
R-200	149384	22K ohms	½ W	10%
R-201	28189	680K ohms	½ W	10%
R-202				
R-203	149113	100K ohms	½ W	20%
R-204	149403	27K ohms	1 W	10%
R-205	28187	470K ohms	½ W	10%
R-206	149111	47K ohms	½ W	20%
R-207	28186	390K ohms	½ W	10%
R-208				
R-209				
R-210	149114	150K ohms	½ W	20%
R-211	28185	330K ohms	½ W	10%
R-212	149121	2.2 Megohms	½ W	20%
R-213	28162	2.2K ohms	½ W	10%
R-214	28158	1K ohms	½ W	10%
R-215	28162	2.2K ohms	½ W	10%
R-216	149114	150K ohms	½ W	20%
R-220	149113	100K ohms	½ W	20%
R-221	See M-1	22K ohms		
R-222	See M-1	8200 ohms		
R-223	See M-1	8200 ohms		
R-224	28190	820K ohms	½ W	10%
R-225	145146	1 Megohm-50K ohms	Dual Pot.	
R-226	149107	10K ohms	½ W	20%
R-227	28191	1 Megohm	½ W	10%
R-228	145100	6 Megohms	Pot.	
R-229	28167	5.6K ohms	½ W	10%
R-230	149121	2.2 Megohms	½ W	20%
R-231	149039	390 ohms	2 W	10%
R-232	145149	1K ohms	Pot.	
R-233	149075	680 ohms	2 W	20%
R-234				
R-240	149385	100K ohms	½ W	10%
R-241	149385	100K ohms	½ W	10%
R-242	149117	470K ohms	½ W	20%
R-243				
R-250	149123	4.7 Megohms	½ W	20%
R-251	28189	680K ohms	½ W	10%
R-252	149387	1.5K ohms	½ W	5%
R-253	149184	5.6K ohms	1 W	10%
R-254	149386	150K ohms	½ W	10%
R-255	145150	40K ohms	Pot.	
R-256	28177	47K ohms	½ W	10%
R-257	28170	10K ohms	½ W	10%
R-258	149103	2.2K ohms	½ W	20%
R-259	149434	250 ohms	10 W	10%
R-260	149111	47K ohms	½ W	20%
R-261	145147	500K ohms	Pot.	
R-262	149094	68 ohms	½ W	20%
R-263	149017	68 ohms	2 W	10%
R-264	149017	68 ohms	2 W	10%
R-265	149094	68 ohms	½ W	20%
R-266	149051	4.7K ohms	2 W	10%
R-267	149051	4.7K ohms	2 W	10%
R-268				
R-269				
R-270	149051	4.7K ohms	2 W	10%
R-271	149051	4.7K ohms	2 W	10%
R-272	149430	5.6 ohms	1 W	10%
R-273	149115	220K ohms	½ W	20%
R-274	149115	220K ohms	½ W	20%
R-275	149115	220K ohms	½ W	20%
R-276	28155	560 ohms	½ W	10%
R-277	28155	560 ohms	½ W	10%
R-278	149101	1K ohms	½ W	20%
R-279				
R-280	149435	1 ohm	½ W	10%
R-281				
R-290	149433	2.2K ohms	25 W	10%
R-291	149113	100K ohms	½ W	20%
R-292				
R-300				
R-301	149078	2.2K ohms	2 W	20%
R-302	149078	2.2K ohms	2 W	20%
R-303	149069	68 ohms	2 W	20%
R-304	149069	68 ohms	2 W	20%

CAPACITORS

Circuit Symbol	S-C Part No.	Capacity	Type	Voltage
C-1	171277	68 MMF	Ceramic	
C-2	171277	68 MMF	Ceramic	
C-3	171213	3-9 MMF	Trimmer	
C-4	171225	3 MMF	Ceramic	
C-5	171213	3-9 MMF	Trimmer	
C-6	171218	800 MMF	Ceramic	
C-7	171226	800 MMF	Ceramic	
C-8	171227	1000 MMF	Ceramic	
C-9	171218	800 MMF	Ceramic	
C-10	171212	.5-3 MMF	Trimmer	
C-11	171278	120 MMF	Disc Ceramic	
C-12	171218	800 MMF	Ceramic	
C-13	171232	10 MMF	Ceramic	
C-14	171231	5 MMF	Ceramic	
C-15	171233	1000 MMF	Ceramic	
C-16	171218	800 MMF	Ceramic	
C-17	171230	47 MMF	Ceramic	
C-18	171212	.5-3 MMF	Trimmer	
C-19	171234	6.8 MMF	Ceramic	
C-20	171233	1000 MMF	Disc Ceramic	
C-21	171233	1000 MMF	Disc Ceramic	
C-22	171279	82 MMF	Ceramic	
C-23				
C-24				
C-100	171239	8.2 MMF	Ceramic	
C-101	171240	1500 MMF	Ceramic	
C-102	171240	1500 MMF	Ceramic	
C-103	171241	470 MMF	Ceramic	
C-104	171240	1500 MMF	Ceramic	
C-105	171241	470 MMF	Ceramic	
C-106	171240	1500 MMF	Ceramic	
C-107	171242	12 MMF	Ceramic	
C-108	171243	5 MMF	Ceramic	
C-109				
C-110	171240	1500 MMF	Ceramic	
C-111	171240	1500 MMF	Ceramic	
C-112	171241	470 MMF	Ceramic	
C-113				
C-120	171240	1500 MMF	Ceramic	
C-121	171244	680 MMF	Ceramic	
C-122	171240	1500 MMF	Ceramic	
C-123	171245	4 MMF	Ceramic	
C-124				
C-130	110598	5 MMF	Ceramic	350
C-131	110598	5 MMF	Ceramic	350
C-132	110586	.005 MF	Disc Ceramic	450
C-133				
C-134	110722	.047 MF	Tubular	400
C-135	110460	100 MF	Ceramic	500
C-136				
C-140	110724	.1 MF	Tubular	400
C-141				
C-142	110672	.01 MF	Disc Ceramic	450
C-143				
C-150	110724	.1 MF	Tubular	400
C-151	110459 (See L27)	68 MMF	Ceramic	500
C-152	110743	.1 MF	Tubular	600
C-153	110724	.1 MF	Tubular	400
C-154				
C-160	110586	.005 MF	Disc Ceramic	450
C-161	110586	.005 MF	Disc Ceramic	450
C-162	110703	.047 MF	Tubular	200
C-163				
C-170	110486	33 MMF	Ceramic	400
C-171	110672	.01 MF	Disc Ceramic	450
C-172				
C-180	111093	5 MF	Electrolytic	50
C-181	110586	.005 MF	Disc Ceramic	450
C-182	110465	680 MMF	Ceramic	350
C-183	110715	.0033 MF	Tubular	400
C-184	110718	.01 MF	Tubular	400
C-185	110586	.005 MF	Disc Ceramic	450
C-186	110735	.0047 MF	Tubular	600
C-187				
C-190	110737	.01 MF	Tubular	600
C-191	110737	.01 MF	Tubular	600
C-192				
C-200	110707	.22 MF	Tubular	200
C-201	110533	.47 MF	Tubular	200
C-202	110823	1 MF	Tubular	100
C-203	110586	.005 MF	Disc Ceramic	450
C-204				
C-210	110705	.1 MF	Tubular	200
C-211	110718	.01 MF	Tubular	400
C-212				
C-220	See M-1	.0022 MF		
C-221	See M-1	.0047 MF		
C-222	See M-1	.0047MF		
C-223	110718	.01 MF	Tubular	400
C-224	110745	.22 MF	Tubular	600
C-225	110560	.068 MF	Tubular	600
C-266	110557	.022 MF	Tubular	600
C-227				
C-230	110561	.1 MF	Tubular	600
C-231	110561	.1 MF	Tubular	600
C-232				
C-233	111105	20 MF	Electrolytic	450
C-240	110534	.001 MF	Tubular	400
C-241	110534	.001 MF	Tubular	400
C-242	110716	.0047 MF	Tubular	400
C-243				
C-250	110722	.047 MF	Tubular	400
C-251	110309	3900 MMF	Mica	500
C-252	110262	390 MMF	Mica	500
C-253	110291	100 MMF	Mica	500
C-254	110260	270 MMF	Mica	500
C-255	110262	390 MMF	Mica	500
C-256				
C-260	110737	.01 MF	Tubular	600
C-261	111093	5 MF	Electrolytic	50
C-262	110548	.22 MF	Tubular	400
C-263				
C-270	110722	.047 MF	Tubular	400
C-271	110722	.047 MF	Tubular	400
C-272	110743	.1 MF	Tubular	600
C-273	110562	.001 MF	Tubular	1KV
C-274	110548	.22 MF	Tubular	400
C-275	110825	180 MMF	Ceramic	3KV
C-276	110311	120 MMF	Mica	1.5KV
C-277	110291	100 MMF	Mica	500
C-278				
C-279	110718	.01 MF	Tubular	400
C-280	110820	500 MMF	Ceramic	30KV
C-281				
C-290	111095	40-40 MF	Electrolytic	450
C-291	111104	40-20-10 MF	Electrolytic	450
		100 MF	Electrolytic	450
C-292	111568	.01 MF	Tubular	1KV
C-293	110568	.01 MF	Tubular	1KV
C-294	111104	40-20-10 MF	Electrolytic	450
		100 MF	Electrolytic	50
C-295				

ALIGNMENT PROCEDURE

Apply AGC bias of approximately 3 volts to AGC line (across C-160).

Maintain the output level of the sweep generator to obtain a second detector output of 2 volts peak-to-peak. Oscilloscope should be calibrated to read 1-VOLT per inch vertical deflection.

NOTE: To Perform IF Alignment it is not necessary to Remove Picture Tube. Use a non metallic aligning tool such as Walsco No. 2526 or equivalent which permits all slugs to be adjusted from the underside of the chassis.

SIGNAL GENERATOR CONNECTION	OSCILLOSCOPE OR VTVM CONNECTION	ADJUSTMENTS
1. Output of 40MC. sweep generator to grid of 1st IF tube, pin 1 of V9, 6CB6 thru 100 MMF isolating capacitor.	Input of scope to grid of Video Amp., pin 1 of V-13, 6AU6 thru 47K-Ohm isolating resistor.	1. Adjust the bottom slug of T-7 1st IF transformer for low intermediate frequency (43.2 MC approx.). 2. Adjust the bottom slug of T-9 3rd IF transformer for low frequency. (42.0 MC approx.). 3. Adjust the bottom slug of T-8 2nd IF transformer for high frequency. (45.0 MC approx.). 4. Adjust the bottom slug of T-10 4th IF transformer for high intermediate frequency. (44.5 MC approx.). 5. Maintaining the above relative frequency positions of the individual stages, adjust the slugs to produce a curve as shown with the 41.9 and 45.75 MC markers at 50% response Fig. # 1.
2. Output of 40MC sweep generator to junction of T-6 and L-18. Using 39.75MC marker.	Same as Step # 1.	1. Adjust the top slug of T-6 for response 39.75MC as shown on curve Fig. 2.
3. Same as Step # 2. Using 41.25MC marker.	Same as Step # 1.	1. Adjust the top slug of T-7 and T-11 for response as shown on curve Fig. 2.
4. Same as Step # 1 using 47.25 MC marker.	Same as Step # 1.	1. Adjust the top slug of T-8 for response curve as shown on Fig. 3. 2. Repeat Step # 1 (IF response) to reproduce the curve as shown in Fig. 1.
5. Raise converter tube shield from ground and connect output of 40 MC sweep generator to the shield.	Same as Step # 1.	1. Adjust the bottom slug of T-6 and T-5 tuner assembly to produce a curve as shown in Fig. 4.
6. Connect a 400 cycle modulated 4.5 MC signal to the junction of Video Detector M-13 and C-126. Adjust generator output to a level to indicate 1.5 volts VTVM.	Connect 2-100K resistors in series from the plate of ratio detector, pin 2 of V-18, 6T8 to ground, connect VTVM from junction of the resistors to ground.	1. Adjust L-21, T-15, and the bottom slug of T-16 for maximum indication.
7. Same as Step # 6.	Connect VTVM ground Lead to the junction of the 2-100K resistors (see step # 6 above). Connect VTVM D.C. lead to the junction of C-181 and R-181.	1. Adjust the secondary (top slug) of T-16 for zero volts between the positive and negative excursions. (Increase generator output for good deflection).

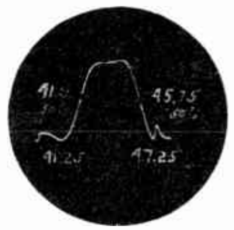


FIG. 1

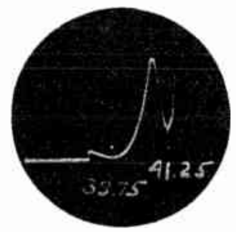


FIG. 2

FIG. 3

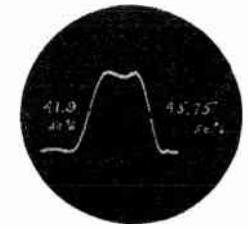
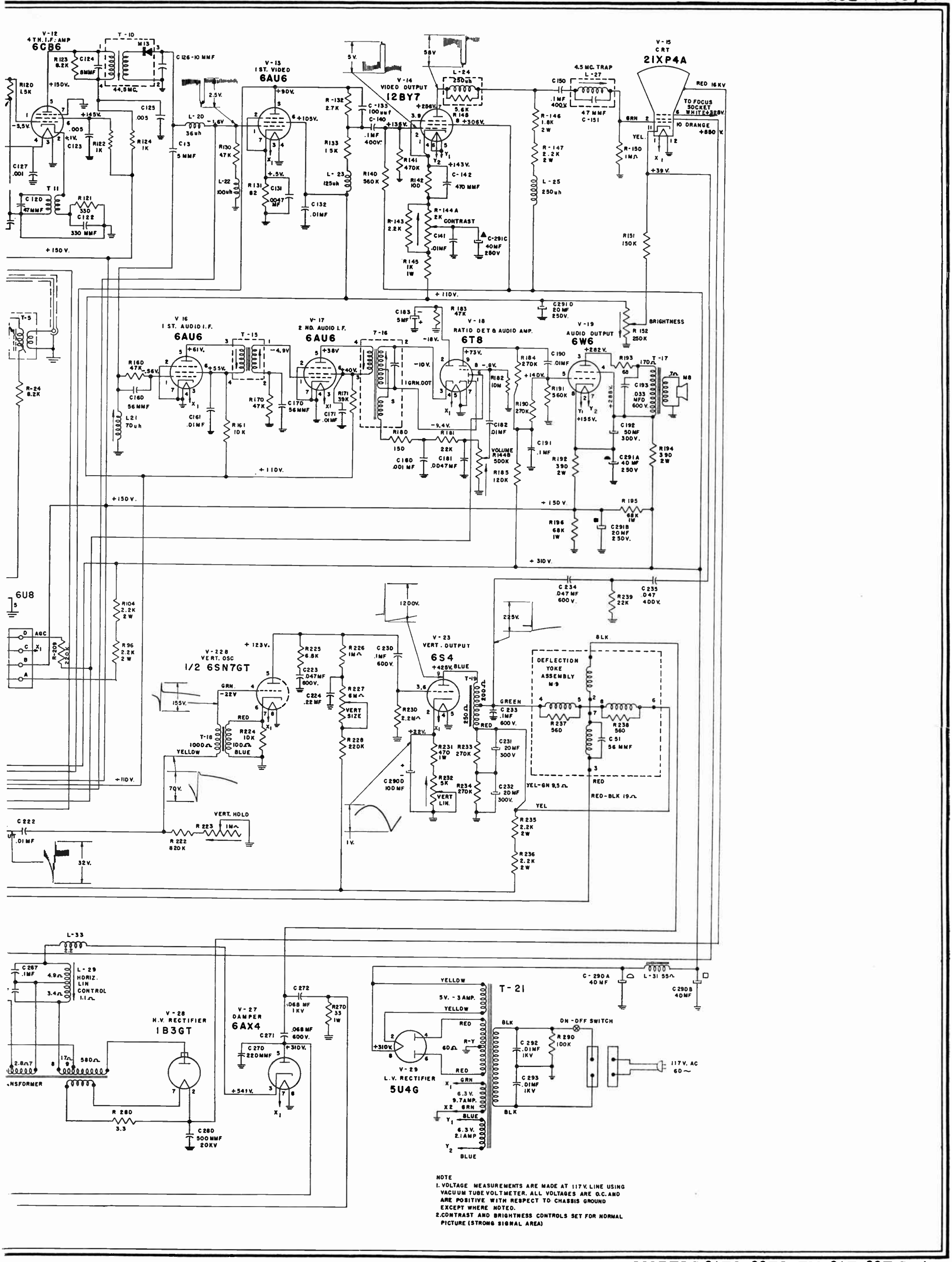


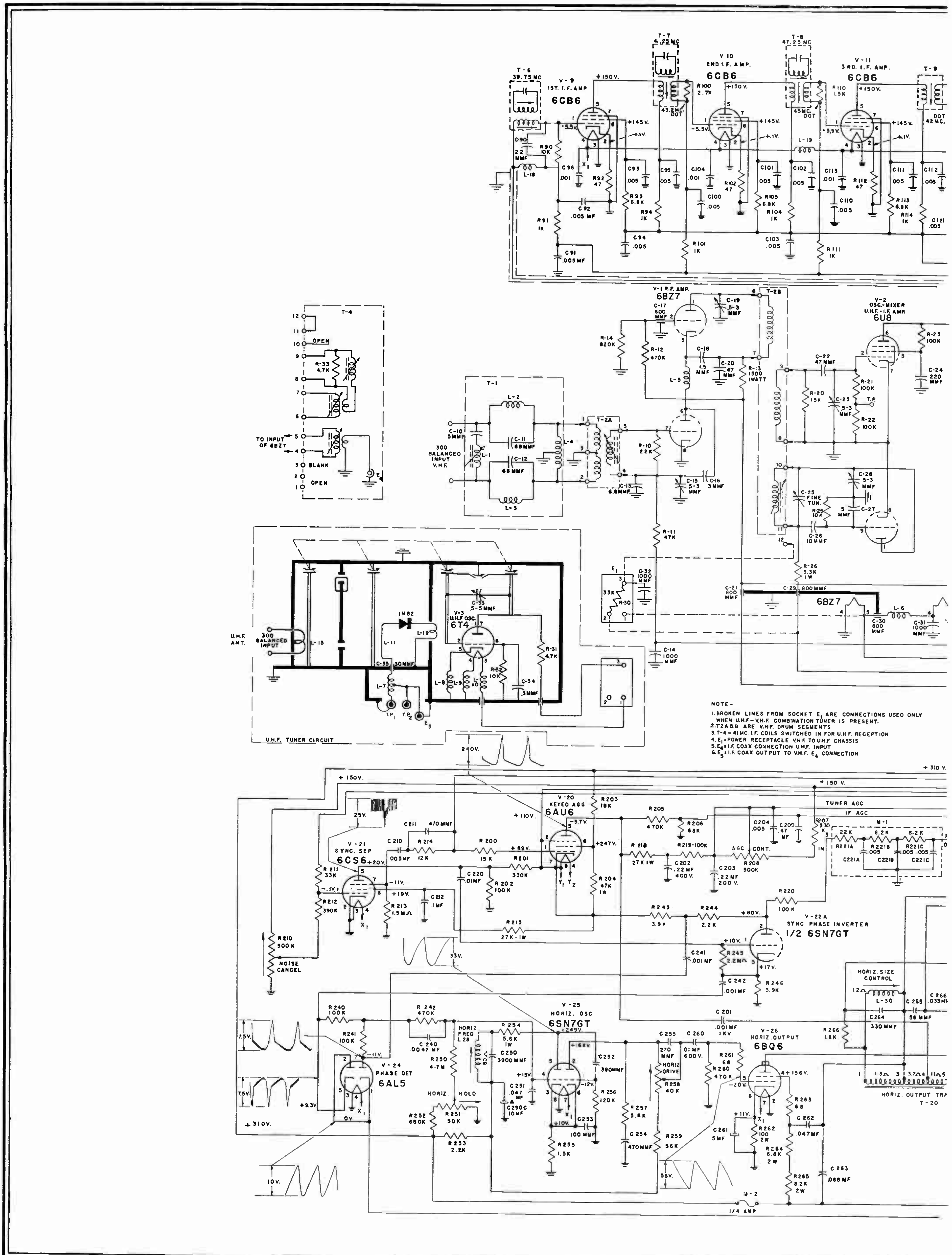
FIG. 4

ALTERNATE TRAP ALIGNMENT

IF THIS METHOD IS USED, IT SHOULD BE PERFORMED BEFORE THE IF CURVE ALIGNMENT

SIGNAL GENERATOR CONNECTION	OSCILLOSCOPE OR VTVM CONNECTION	ADJUSTMENTS
1. Connect a modulated (400 cycle) 39.75 MC signal to the grid of 1st IF tube, pin 1 of V-9, 6CB6.	Same as Step # 1. (above).	1. Adjust top slug of T-6 for minimum response on scope.
2. Connect a modulated (400 cycle) 47.25 MC signal to the grid of 1st IF tube, pin 1 of V-9, 6CB6.	Same as Step # 1.	2. Adjust top slug of T-8 for minimum response on scope.
3. Connect a modulated (400 cycle) 41.25 MC signal to the grid, pin 1 of V-9, 6CB6.	Same as Step # 1.	3. Adjust top slug of T-7 and T-11 for minimum response on scope.


V-12
4 TH. I.F. AMP
6CB6
T-10
44.5 MC.
V-13
1 ST. VIDEO
6AU6
V-14
VIDEO OUTPUT
12BY7
CONTRAST
V-15
CRT
21XP4A
4.5 MC. TRAP
TO FOCUS SOCKET
BRIGHTNESS
V 16
1 ST. AUDIO I.F.
6AU6
V-17
2 ND. AUDIO I.F.
6AU6
V-18
RATIO DET & AUDIO AMP.
6T8
V-19
AUDIO OUTPUT
6W6
VOLUME
6U8
AGC
V-22B
VERT. OSC
1/2 6SN7GT
VERT. HOLD
VERT SIZE
V-23
VERT. OUTPUT
6S4
VERT LIN.
DEFLECTION YOKE ASSEMBLY M-9
L-29
HORIZ. LIN CONTROL
V-28
H.V. RECTIFIER
1B3GT
V-27
DAMPER
6AX4
T-21
V-29
L.V. RECTIFIER
5U4G
ON-OFF SWITCH
117V. AC 60~
NOTE
1. VOLTAGE MEASUREMENTS ARE MADE AT 117V. LINE USING VACUUM TUBE VOLTMETER. ALL VOLTAGES ARE D.C. AND ARE POSITIVE WITH RESPECT TO CHASSIS GROUND EXCEPT WHERE NOTED.
2. CONTRAST AND BRIGHTNESS CONTROLS SET FOR NORMAL PICTURE (STRONG SIGNAL AREA)


V-9 1ST. I.F. AMP 6CB6
V 10 2ND I.F. AMP. 6CB6
V-11 3RD. I.F. AMP. 6CB6
T-6 39.75 MC
T-7 41.25 MC
T-8 47.25 MC
T-9
V-1 R.F. AMP. 6BZ7
V-2 OSC.-MIXER U.H.F.-I.F. AMP. 6U8
T-4
TO INPUT OF 6BZ7
T-1
300 BALANCED INPUT V.H.F.
U.H.F. ANT.
300 BALANCED INPUT
V-3 U.H.F. OSC. 6T4
1N82
U.H.F. TUNER CIRCUIT
NOTE-
1.BROKEN LINES FROM SOCKET E1 ARE CONNECTIONS USED ONLY WHEN U.H.F.-V.H.F. COMBINATION TUNER IS PRESENT.
2.T2A&B ARE V.H.F. DRUM SEGMENTS
3.T-4 = 41MC. I.F. COILS SWITCHED IN FOR U.H.F. RECEPTION
4.E1 = POWER RECEPTACLE V.H.F. TO U.H.F. CHASSIS
5.E4 = I.F. COAX CONNECTION U.H.F. INPUT
6.E5 = I.F. COAX OUTPUT TO V.H.F. E4 CONNECTION
V-20 KEYED AGC 6AU6
V-21 SYNC. SEP 6CS6
TUNER AGC
IF AGC
AGC CONT.
M-1
V-22A SYNC PHASE INVERTER 1/2 6SN7GT
R210 500 K NOISE CANCEL
V-24 PHASE DET 6AL5
V-25 HORIZ. OSC 6SN7GT
HORIZ FREQ L28
HORIZ HOLD
V-26 HORIZ. OUTPUT 6BQ6
HORIZ DRIVE
HORIZ SIZE CONTROL
HORIZ. OUTPUT TRA T-20
1/4 AMP

PARTS LIST

TUBES

Circuit Symbol	S-C Part No.	Description
V-1	162175	6BZ7 R.F. Amp.
V-2	162171	6U8 Mixer
V-3	162182	6T4 UHF osc.
V-9	162092	6CB6 1st I.F. Amp.
V-10	162092	6CB6 2nd I.F. Amp.
V-11	162092	6CB6 3rd I.F. Amp.
V-12	162092	6CB6 4th I.F. Amp.
V-13	162032	6AU6 1st Video Amp.
V-14	162180	12BY7 Video Output
V-15	162185	21XP4A — Kinescope
V-16	162032	6AU6 1st Audio IF
V-17	162032	6AU6 2nd Audio IF
V-18	162077	6T8 — Ratio Det.
V-19	162101	6W6GT — Audio Output
V-20	162032	6AU6 — A. G. C.
V-21	162181	6CS6 — Sync. Sep.-phase inv.
V-22	162018	6SN7GT — Vert. Osc.
V-23	162173	6S4 Vert. Output
V-24	162022	6AL5 — Phase Det.
V-25	162018	6SN7GT — Horiz. Osc.
V-26	162174	6BQ6GT — Horiz. Output
V-27	162161	6AX4 Damper
V-28	162029	1B3GT H. V. Rect.
V-29	162107	5U4G L.V. Rect.

COILS

Circuit Symbol	S-C Part No.	Description
L-1	Part of T-1	
L-2	Part of T-1	
L-3	Part of T-1	
L-4	Part of T-1	
L-5	171829	Plate load coil
L-6	171830	Filament Choke
L-7	171831	40 Mc IF Adj.
L-8	171832	Choke coil
L-9	171833	Choke coil
L-10	171834	Choke coil
L-11	171835	Crystal Diode pick-up loop
L-12	171836	Crystal Diode load
L-13	171837	UHF Antenna Input
L-18	114693	2.2 uh choke
L-19	114693	2.2 uh Choke
L-20	114756	Peaking 36 uh.
L-21	114419	4.5 Mc Sound Take-off
L-22	114745	Peaking 100 uh.
L-23	114639	Peaking 125 uh.
L-24	114760	Peaking 250 uh.
L-25	114759	Peaking 250 uh.
L-27	114417	4.5 Mc Trap
L-28	114132	Horiz. Osc.
L-29	114084	Horiz. Lin.
L-30	114133	Horiz. Size
L-31	161049	Filter Choke
L-32	See M-9	Deflection Yoke
L-33	114693	2.2 uh Choke

TRANSFORMERS

Circuit Symbol	S-C Part No.	Description
T-1	171838	VHF-Input trans.
T-2	171902 thru 171983	VHF & UHF Antenna Trans.*
T-4	171901	UHF to VHF coupling
T-5	171839	Tuner to IF link
T-6	114420	Input — 39.75 Mc Trap
T-7	114421	1st Video IF — 41.25 Mc Trap
T-8	114422	2nd Video IF — 47.25 Mc Trap
T-9	114423	3rd Video IF
T-10	114424	Video Det. Assembly
T-11	114426	41.25 Mc Trap
T-15	114401	2nd Audio I.F.
T-16	114418	Ratio Detector
T-17	161267	Audio Output
T-18	161271	Vert. Blocking
T-19	161269	Vert. Output
T-20	161048	Horiz. Output
T-21	161446	L. V. Power Trans.

* Note: Last two digits of Part Number indicate the channel number of strip. Third digit from the right indicates "U" type strip used on 164037 and 164034 tuners.

MISCELLANEOUS

Circuit Symbol	S-C Part No.	Description
M-1	128200	Circuit Network
M-2	128003	¼ Amp. Fuse
M-8	155821	Speaker
M-9	114755	Yoke Assembly
M-10	162200	1N82 Crystal Diode UHF Converter
M-13	162202	1N105 Crystal Diode Video Detector

RESISTORS

Circuit Symbol	S-C Part No.	Resistance	Watt	Percent
R-10	149384	22K ohms	½	10
R-11	149111	47K ohms	½	20
R-12	28187	470K ohms	½	10
R-13	149178	1.5K ohms	1	10
R-14	28190	820K ohms	½	10
R-20	28172	15K ohms	½	10
R-21	149385	100K ohms	½	10
R-22	149385	100K ohms	½	10
R-23	149385	100K ohms	½	10
R-24	28169	8.2K ohms	½	10
R-25	28170	10K ohms	½	10
R-26	149181	3.3 ohms	1	10
R-30	149110	33K ohms	½	20
R-31	149183	4.7 ohms	1	10
R-32	28170	10K ohms	½	10
R-33	Part of T-4	4.7K ohms	½	10
R-90	28163	2.7K ohms	½	10
R-91	28158	1K ohms	½	10
R-92	28142	47 ohms	½	10
R-93	28168	6.8K ohms	½	10
R-94	149101	1K ohms	½	20
R-100	28163	2.7K ohms	½	10
R-101	28158	1K ohms	½	10
R-102	28142	47 ohms	½	10
R-103	28168	6.8K ohms	½	10
R-104	149101	1K ohms	½	20
R-105	28168	6.8K ohms	½	10
R-110	28160	1.5K ohms	½	10
R-111	28158	1K ohms	½	10
R-112	28142	47 ohms	½	10
R-113	28168	6.8K ohms	½	10
R-114	149101	1K ohms	½	20
R-120	28160	1.5K ohms	½	10
R-121	28152	330 ohms	½	10
R-122	149101	1K ohms	½	20
R-123	149107	10K ohms	½	20
R-124	149101	1K ohms	½	20
R-130	28166	4.7K ohms	½	10
R-131	28145	82 ohms	½	10
R-132	28163	2.7K ohms	½	10
R-133	28160	1.5K ohms	½	10
R-140	28188	560K ohms	½	10
R-141	28187	470K ohms	½	10
R-142	149095	100 ohms	½	20
R-143	149103	2.2K ohms	½	20
R-144	145164	2K-500K ohms	Volume Control	
R-145	149138	1K ohms	1	20
R-146	149047	1.8K ohms	2	10
R-147	149078	2.2K ohms	2	20
R-148	See L-24	5.6K ohms	½	10
R-150	149119	1 Megohm	½	20
R-151	149114	150K ohms	½	20
R-152	145157	250K ohms	Brightness	
R-160	149111	47K ohms	½	20
R-161	149107	10K ohms	¼	20
R-170	149111	47K ohms	½	20
R-171	28176	39K ohms	½	10
R-180	149096	150 ohms	½	20
R-181	149109	22K ohms	½	20
R-182	149125	10 Megohms	½	20
R-183	149111	47K ohms	½	20
R-184	28184	270K ohms	½	10
R-185	28181	120K ohms	½	10
R-190	28184	270K ohms	½	10
R-191	28188	560K ohms	½	10
R-192	149039	390 ohms	2	10
R-193	149094	68 ohms	½	20
R-194	149039	390 ohms	2	10
R-195	149149	68K ohms	1	20
R-196	149149	68K ohms	1	20
R-200	149108	15K ohms	½	20
R-201	149116	330K ohms	½	20
R-202	149113	100K ohms	½	20
R-203	28173	18K ohms	½	10
R-204	149148	47K ohms	1	20
R-205	149117	470K ohms	½	20
R-206	149112	68K ohms	½	20
R-207	149116	330K ohms	½	20
R-208	145163	500K ohms	AGC Control	
R-209	149115	220K ohms	½	20
R-210	145163	500K ohms	Noise Concel Control	
R-211	28175	33K ohms	½	10
R-212	28186	390K ohms	½	10
R-213	149120	1.5 Megohms	½	20
R-214	28171	12K ohms	½	10
R-215	149403	27K ohms	1	10
R-218	149403	27K ohms	1	10
R-219	149113	100K ohms	½	20
R-220	149113	100K ohms	½	20
R-221	See M-1			
R-222	28190	820K ohms	½	10
R-223	145160	1 Megohm	Vertical Hold Control	
R-224	149107	10K ohms	½	20
R-225	28168	6.8K ohms	½	10
R-226	28191	1 Megohm	½	10
R-227	145159	6 Megohms	Vertical Size Control	
R-228	149115	220K ohms	½	20
R-230	149121	2.2 Megohms	½	20
R-231	149136	470 ohms	1	20
R-232	145158	5K ohms	Vertical Lin. Control	
R-233	28184	270K ohms	½	10
R-234	28184	270K ohms	½	10
R-235	149078	2.2K ohms	2	20
R-236	149078	2.2K ohms	2	20
R-237	See M-9	560 ohms	½	
R-238	See M-9	560 ohms	½	
R-239	149109	22K ohms	½	20
R-240	149385	100K ohms	½	10
R-241	149385	100K ohms	½	10
R-242	149117	470K ohms	½	20
R-243	28165	3.9K ohms	½	10
R-244	149103	2.2K ohms	½	20
R-245	149121	2.2 Megohms	½	20
R-246	28165	3.9K ohms	½	10
R-250	149123	4.7 Megohms	½	20
R-251	145161	50K ohms	Horizontal Hold Control	
R-252	28189	680K ohms	½	10
R-253	149103	2.2K ohms	½	20
R-254	149184	5.6K ohms	1	10
R-255	28160	1.5K ohms	½	10
R-256	28181	120K ohms	½	10
R-257	28167	5.6K ohms	½	10
R-258	145162	40K ohms	Horizontal Drive Control	
R-259	28178	56K ohms	½	10
R-260	149117	470K ohms	½	20
R-261	149094	68 ohms	½	20
R-262	149070	100 ohms	2	20
R-263	149094	68 ohms	½	20
R-264	149053	6.8K ohms	2	10
R-265	149054	8.2K ohms	2	10
R-266	28161	1.8K ohms	½	10
R-270	149161	33 ohms	1	10
R-280	149419	3.3 ohms	½	20
R-290	149113	100K ohms	½	20
R-291	149078	2.2K ohms	2	20
R-292	149078	2.2K ohms	2	20
R-293	149136	470 ohms	1	20

CAPACITORS

Circuit Symbol	S-C Part No.	Capacity	Type	Voltage
C-10	Part of T-1	5 MMF		
C-11	Part of T-1	68 MMF		
C-12	Part of T-1	68 MMF		
C-13	171234	6.8 MMF	Disc Ceramic	
C-14	171227	1000 MMF	Disc Ceramic	
C-15	171212	.5-3 MMF	Trimmer	
C-16	171225	3 MMF	Disc Ceramic	
C-17	171218	800 MMF	Feed thru	
C-18	171821	1.5 MMF	Disc Ceramic	
C-19	171212	.5-3 MMF	Trimmer	
C-20	171230	47 MMF	Disc Ceramic	
C-21	171218	800 MMF	Feed thru	
C-22	171822	47 MMF	Ceramic	
C-23	171212	.5-3 MMF	Trimmer	
C-24	171823	220 MMF	Disc Ceramic	
C-25	171824	Fine Tuning		
C-26	171232	10 MMF	Disc Ceramic	
C-27	171825	5 MMF	Disc Ceramic	
C-28	171212	.5-3 MMF	Trimmer	
C-29	171218	800 MMF	Feed thru	
C-30	171218	800 MMF	Feed thru	
C-31	171227	1000 MMF	Disc Ceramic	
C-32	171227	1000 MMF	Disc Ceramic	
C-33	171826	.5-5 MMF	Trimmer	
C-34	171827	.3 MMF	Ceramic	
C-35	171828	30 MMF	Feed thru	
C-90	110455	470 MMF	Ceramic	
C-91	110586	.005 MF	Disc Ceramic	450
C-92	110586	.005 MF	Disc Ceramic	450
C-93	110586	.005 MF	Disc Ceramic	450
C-94	110586	.005 MF	Disc Ceramic	450
C-95	110586	.005 MF	Disc Ceramic	450
C-96	110824	.001 MF	Disc Ceramic	450
C-100	110586	.005 MF	Disc Ceramic	450
C-101	110586	.005 MF	Disc Ceramic	450
C-102	110586	.005 MF	Disc Ceramic	450
C-103	110586	.005 MF	Disc Ceramic	450
C-104	110824	.001 MF	Disc Ceramic	450
C-110	110586	.005 MF	Disc Ceramic	450
C-111	110586	.005 MF	Disc Ceramic	450
C-112	110586	.005 MF	Disc Ceramic	450
C-113	110824	.001 MF	Disc Ceramic	450
C-120	110458	.47 MMF	Ceramic	
C-121	110586	.005 MF	Disc Ceramic	450
C-122	110463	330 MMF	Ceramic	
C-123	110586	.005 MF	Disc Ceramic	450
C-124	110598	5 MMF	Ceramic	350
C-125	110586	.005 MF	Disc Ceramic	450
C-126	110469	10 MMF	Ceramic	
C-127	110824	.001 MF	Disc Ceramic	450
C-130	110598	5 MMF	Ceramic	350
C-131	110716	.0047 MF	Tubular	400
C-132	110672	.01 MF	Disc Ceramic	450
C-133	110401	100 MMF	Ceramic	
C-140	110724	.1 MF	Tubular	400
C-141	110672	.01 MF	Disc Ceramic	450
C-142	110464	470 MMF	Ceramic	
C-150	110724	.1 MF	Tubular	400
C-151	See L-27	47 MMF		
C-160	110253	56 MMF	Ceramic	500
C-161	110672	.01 MF	Disc Ceramic	450
C-170	110253	56 MMF	Ceramic	500
C-171	110672	.01 MF	Disc Ceramic	450
C-180	110534	.001 MF	Tubular	400
C-181	110716	.0047 MF	Tubular	400
C-182	110718	.01 MF	Tubular	400
C-183	111093	5 MF	Electrolytic	50
C-190	110718	.01 MF	Tubular	400
C-191	110724	.1 MF	Tubular	400
C-192	111114	50 MF	Electrolytic	
C-193	110740	.03 MF	Tubular	600
C-200	110709	.47 MF	Tubular	200
C-201	110562	.001 MF	Tubular	1KV
C-202	110726	.22 MF	Tubular	400
C-203	110707	.22 MF	Tubular	200
C-204	110586	.005 MF	Disc Ceramic	450
C-210	110586	.005 MF	Disc Ceramic	450
C-211	110464	470 MMF	Ceramic	
C-212	110724	.1 MF	Tubular	400
C-220	110672	.01 MF	Disc Ceramic	450
C-221	See M-1			
C-222	110718	.01 MF	Tubular	400
C-223	110741	.047 MF	Tubular	600
C-224	110745	.22 MF	Tubular	600
C-230	110743	.1 MF	Tubular	600
C-231	111089	20 MF	Electrolytic	300
C-232	111089	20 MF	Electrolytic	300
C-233	110743	.1 MF	Tubular	600
C-234	110741	.047 MF	Tubular	600
C-235	110722	.047 MF	Tubular	400
C-240	110716	.0047 MF	Tubular	400
C-241	110534	.001 MF	Tubular	400
C-242	110534	.001 MF	Tubular	400
C-250	110309	3900 MMF	Mica	500
C-251	110703	.047 MF	Tubular	200
C-252	110262	390 MMF	Mica	500
C-253	110291	100 MMF	Mica	500
C-254	110263	470 MMF	Mica	500
C-255	110260	270 MMF	Mica	500
C-260	110737	.01 MF	Tubular	600
C-261	111093	5 MF	Electrolytic	50
C-262	110741	.047 MF	Tubular	600
C-263	110723	.068 MF	Tubular	400
C-264	110454	330 MMF	Mica	350
C-265	110819	56 MMF	Ceramic	7KV
C-266	110721	.033 MF	Tubular	400
C-267	110724	.1 MF	Tubular	400
C-268	See M-9	56 MMF		
C-270	110207	220 MMF	Mica	500
C-271	110742	.068 MF	Tubular	600
C-272	110573	.068 MF	Tubular	1KV
C-280	110830	500 MMF	Ceramic	20KV
C-290A	111115	40 MF	Electrolytic	450
B		40 MF		450
C		10 MF		450
D		100 MF		50
C-291A	111113	40 MF	Electrolytic	250
B		20 MF		250
C		40 MF		250
D		20 MF		250
C-292	110568	.01 MF	Tubular	1KV
C-293	110568	.01 MF	Tubular	1KV
C-294	110745	.22 MF	Tubular	600

CAUTION: Speaker is mounted in cabinet assembly. Be sure to disconnect speaker plug before removing chassis.

The 22-T series receiver is identical to the 21-T receiver with the exception that the VHF tuner has a thirteenth position, employed as a 40 Mc amplifier when the UHF continuous tuner is in operation.

VIDEO IF, 4.5MC TRAP AND SOUND ALIGNMENT PROCEDURES

VIDEO IF ALIGNMENT

PREALIGNMENT INSTRUCTIONS READ CAREFULLY

1. Stand chassis on side with high voltage shield down for under chassis adjustments.
2. Set Fringe (AGC) switch to fully counterclockwise position (normal or "non-fringe" position).
3. Ground all test equipment unless otherwise stated.
4. Keep detector circuit leads as short as possible.
5. Use non-metallic alignment tools for powdered iron cores. Metallic screwdriver may be used for brass screw adjustments.

STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Connect 3V. battery (-) terminal to junction of C130 (.22 mfd.) and R145 (220K) and connect (+) terminal to chassis. Set VHF tuner to signal-free channel with minimum interference.	MARKER GENERATOR - to ungrounded tube shield on Osc./Mixer tube on VHF tuner. VTVM - D.C. Probe to junction of L58 peaking coil and R147 (4.7K).	L54 (top core) for MIN. at 39.75 MC. T55 (top core) for MIN. at 41.25 MC. L55 for MIN. at 41.25 MC. T56 (top core) for MIN. at 47.25 MC. Use sufficient marker generator output for satisfactory VTVM reading.
2.	Same as 1.	Same as 1.	T58 for MAX. at 44.0 MC. T57 for MAX. at 42.0 MC. T56 (bottom core) for MAX. at 45.2 MC. T55 (bottom core) for MAX. at 43.2 MC. Adjust marker generator output to keep VTVM reading between 1 and 2 volts.
3.	Repeat step 1 trap adjustments.		
4.	Remove 3V. AGC battery. Disconnect T55 lead from pin 5 of V1 (6CB6). Connect 330 ohm resistor from R128 (1K) to pin 5 of V1. Set VHF tuner: To any signal-free high channel on Sarkes tuner chassis, OR Between any two channels on G.I. tuner chassis.	SWEEP GENERATOR - to looker point "B" on Sarkes tuner; OR to pin 5 of 6J6 tube on G.I. tuners. Set to 43.5 MC with 10 MC sweep. MARKER GENERATOR - loosely couple to sweep generator lead. OSCILLOSCOPE - through detector circuit to pin 5 of V1 (6CB6).	SARKES TUNER CHASSIS ONLY: L54 (bottom core) and T2 (VHF tuner) for response curve shown: 42.1 MC. 45.75 MC. L54 (TOP) 39.75 MC. L54 (BOT) T2 (TUNER) G.I. TUNER CHASSIS ONLY: L54 (bottom core), L8 (VHF tuner) and L53 for response curve shown: 42.1 MC. L53 L54 (BOT) L8 (TUNER) 45.75 MC. L54 (TOP) 39.75 MC.
5.	Repeat step 4 adjustments until response curve is flat with 42.1 MC and 45.75 MC markers on corners.		
6.	Connect 3V. battery (-) terminal to junction of C130 (.22 mfd.) and R145 (220K) and connect (+) terminal to chassis. REMOVE 330 OHM RESISTOR AND RECONNECT T55. Set VHF tuner to signal-free channel with minimum interference	SWEEP GENERATOR - to ungrounded tube shield on Osc./Mixer tube on VHF tuner. Set to 43.5 MC with 10 MC sweep. MARKER GENERATOR - loosely couple to sweep generator lead. OSCILLOSCOPE - through 33K resistor to junction of L58 peaking coil and R147 (4.7K).	Retouch T58, T57, T56 (bottom core) and T55 (bottom core) if necessary to obtain response curve shown: 46.0 MC. RESPONSE 100% 42.1 MC. 45.75 MC. SOUND 41.25 MC. 70% 50% 47.25 MC.

4.5MC TRAP ALIGNMENT

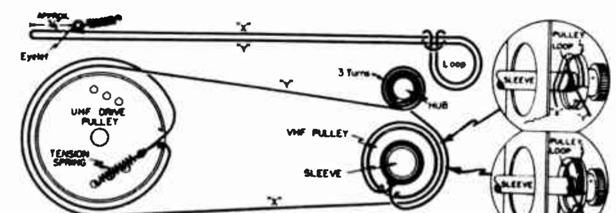
STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Short pin 1 of V4 (6CB6) to chassis	SIGNAL GENERATOR - to pin 2 of V5 (12BY7). Set to 4.5 MC. VTVM - R.F. Probe to pin 11 of V20 (Picture Tube); Ground Lead to chassis.	L81 for MINIMUM.

SOUND ALIGNMENT

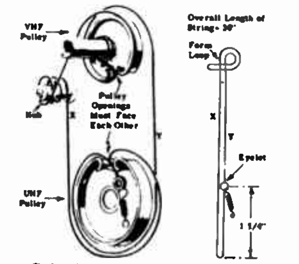
STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Set VHF tuner to signal-free channel with minimum interference. DO NOT GROUND VTVM.	MARKER GENERATOR #1 - through 1K resistor to pin 1 of V1 (6CB6). Set to 45.0 MC. MARKER GENERATOR #2 - through 1K resistor to pin 1 of V1 (6CB6). Set to 4.5 MC. OR MARKER GENERATOR - through 1K resistor to pin 1 of V1 (6CB6). Set to 45.0 MC with a crystal controlled 4.5 MC marker. ALSO VTVM - D.C. Probe to pin 5 of V7 (6AL5); Ground Lead to pin 7 of V7 (6AL5).	T52 (both cores) for MAXIMUM. L82 for MAXIMUM. Repeat adjustments until maximum reading is reached.
2.	Same as 1	USE SAME MARKER GENERATOR HOOKUP AS IN STEP 1 VTVM - D.C. Probe to junction of two matched 100K resistors connected in series across R104 (68K); Ground Lead through 100K resistor to terminal 5 of T52	T52 (top core) for ZERO. Use lowest VTVM scale set to zero center. At correct core setting, a slight turn of core will give either a positive or negative reading.
3.	Remove test equipment and resistors; then, tune in a weak station and adjust T52 (top core) for optimum signal-to-noise ratio.		

ALTERNATE SOUND ALIGNMENT

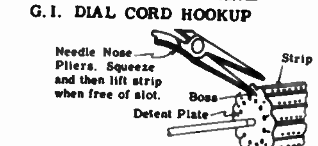
STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1	Connect a good antenna installation to receiver. Set VHF tuner to a strong station. DO NOT GROUND VTVM	VTVM - D.C. Probe to pin 5 of V7 (6AL5); Ground Lead to pin 7 of V7 (6AL5).	T52 (bottom core) for MAXIMUM. L82 for MAXIMUM. Repeat adjustments until maximum reading is reached.
2	Same as 1	VTVM - D.C. Probe to junction of two matched 100K resistors connected in series across R104 (68K), Ground Lead through 100K resistor to terminal 5 of T52	T52 (top core) for ZERO. Use lowest VTVM scale set to zero center. At correct core setting, a slight turn of core will give either a positive or negative reading.
3	Remove test equipment and resistors, then, tune in a weak station and adjust T52 (top core) for optimum signal-to-noise ratio.		



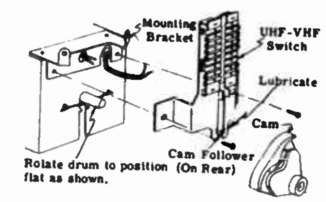
S.T. DIAL CORD HOOKUP



G.I. DIAL CORD HOOKUP

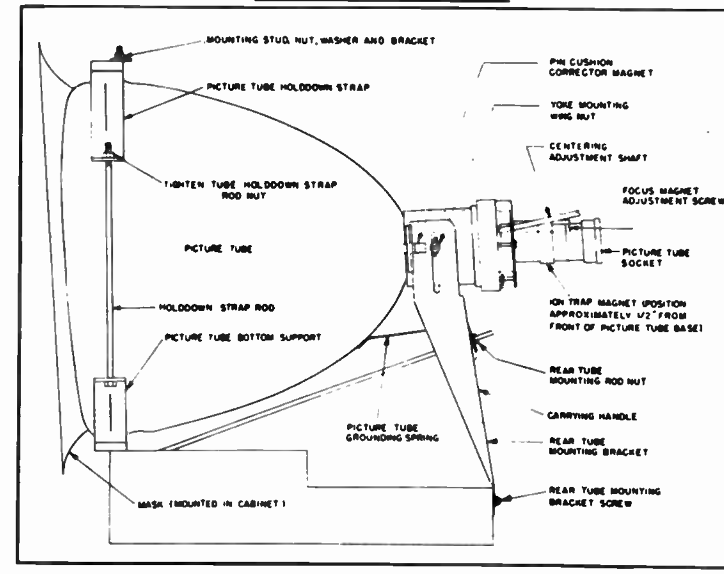


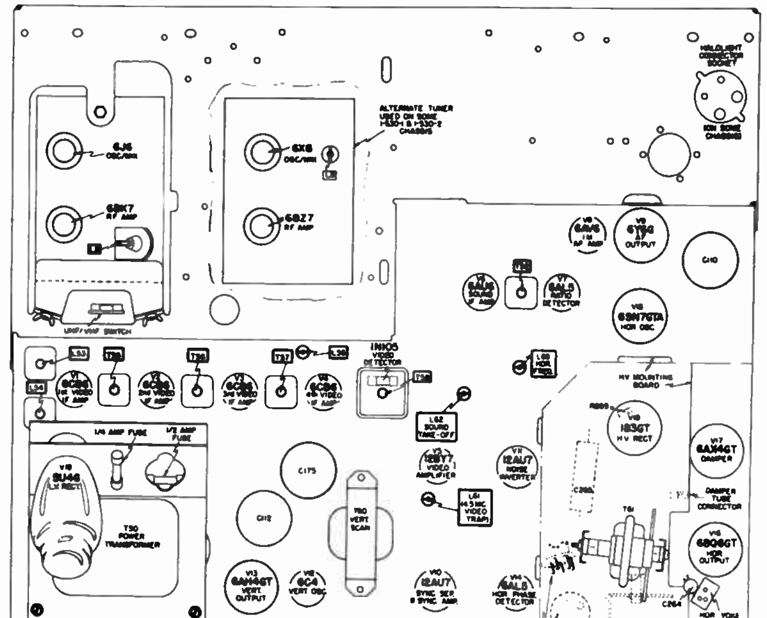
G.I. TUNER STRIP REMOVAL

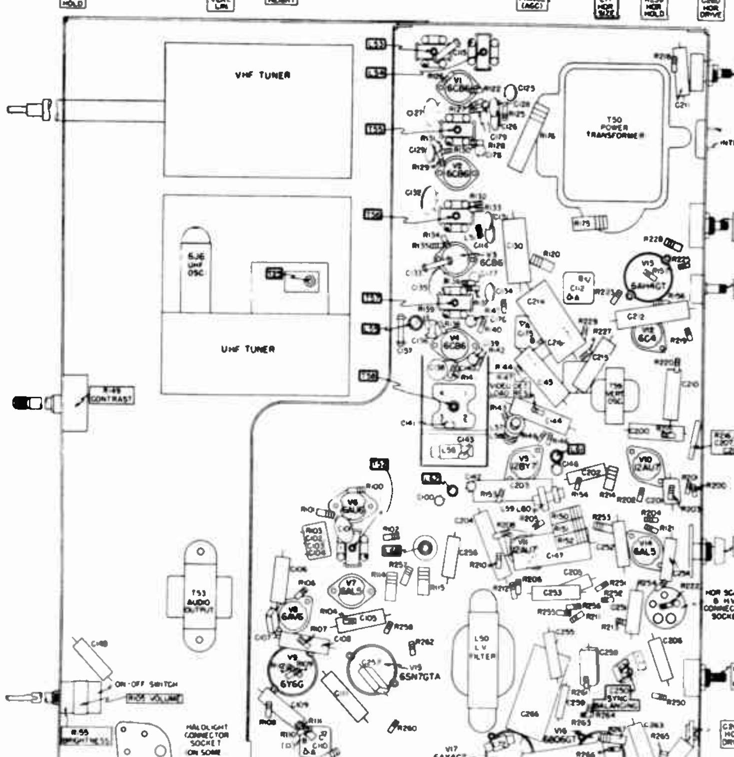


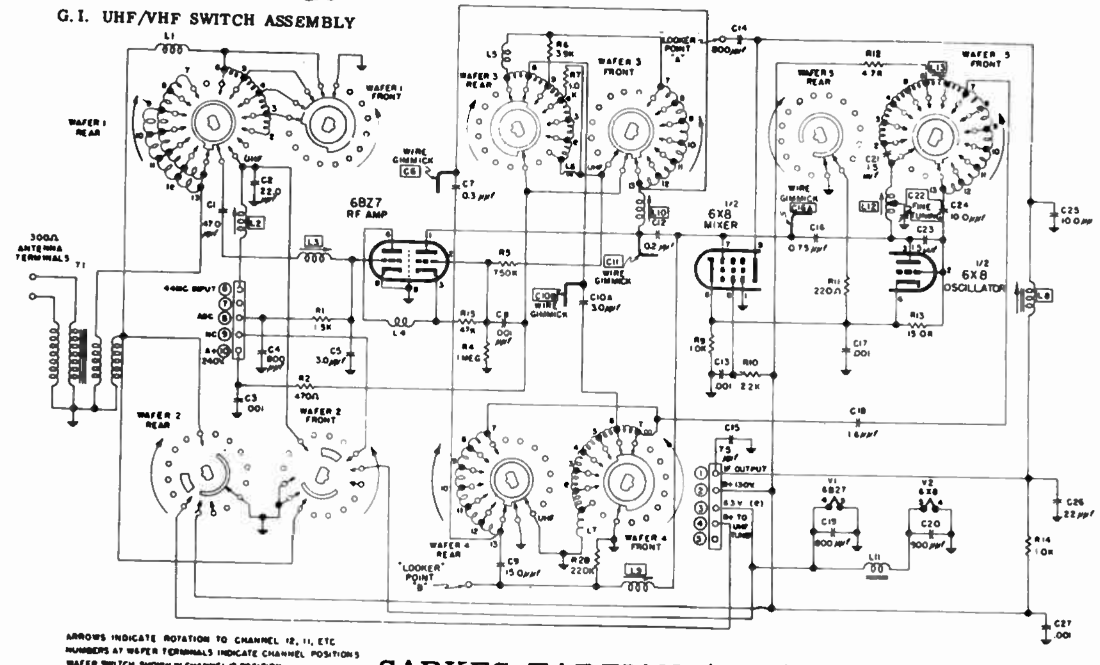
G.I. UHF/VHF SWITCH ASSEMBLY

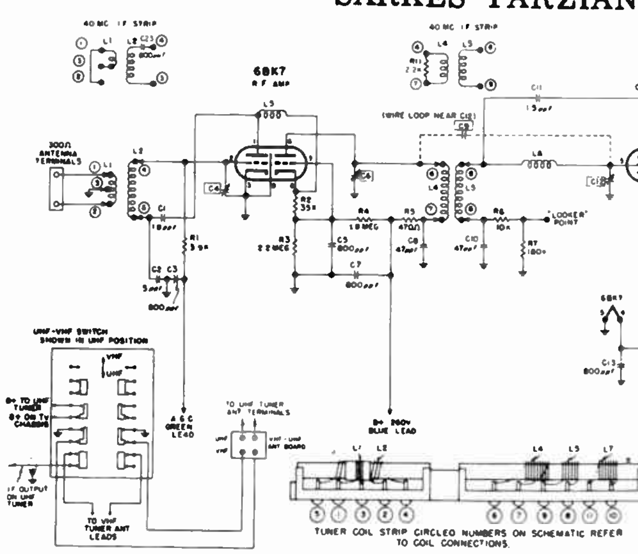
PICTURE TUBE REPLACEMENT




TOP OF PARTS


BOTTOM OF PARTS


SARKES TARZIAN (S.T.) TYPE TUNER


GENERAL INSTRUMENT (G.I.) TYPE TUNER

STEP	TUNER SET TO CHANNEL	GENERATORS SWEEP (10 MC)	GENERATORS IF MARKER	GENERATORS RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1	4	Channel 4 69 MC	———	67 25 MC (P) 71 75 MC (S)	RF Output	C12, C6, C4, then C9* (wire loop near C12)	30% deviation permissible as shown below	Connect 300 ohm resistor across Antenna Leads. Passband should be somewhat broader than that with antenna circuit operating and with picture marker inside
2	13	Channel 13 213 MC	———	211 25 MC (P) 215 75 MC (S)	RF Output	See "Comments" and note at bottom of chart		Interstage band width is adjusted by C9*. When proper band width cannot be obtained by adjustment of C9, it may be necessary to move C8* and C10* slightly farther apart. Overall band width also depends on antenna selectivity. Interstage band width should be adjusted so that proper overall band width occurs with antenna circuit aligned
3	4	Channel 4 69 MC	———	67 25 MC (P) 71 75 MC (S)	RF Output	C4 Antenna Trimmer		Obtain symmetrical response curve
4	Set VHF tuner between any two channels. Connect sweep generator set to 43.25 MC (sweeping 10 MC) thru hole in VHF tuner cover to pin 5 of 6J6 Osc./Mixer tube. Inject 42.1 MC and 45.75 MC markers.				RF Output	L8, then L54 and L53 (both on TV Chassis)	OR	Adjust for symmetrical overcoupled, double peaked response curve with markers on peaks. L8 and L54 determine position of 45.75 MC marker. L53 determines band width or position of 42.1 MC marker
5	4	Channel 4 69 MC	45.75 MC	71.75 MC	IF Output	C15		If C15 cannot be made to track properly, L7 is out of adjustment and must be tuned as in step 8
6	2	Channel 2 57 MC	Alternate 42.1 MC and 45.75 MC or two Markers	55 25 MC (P) 59 75 MC (S)	IF Output	L7	30% TILT	Check RF Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels
7	3	Channel 3 63 MC	Alternate 42.1 MC and 45.75 MC or two Markers	61 25 MC (P) 65 75 MC (S)	IF Output	L7		Check RF Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels
8	4	Channel 4 69 MC	Alternate 42.1 MC and 45.75 MC or two Markers	67 25 MC (P) 71 75 MC (S)	IF Output	L7		Check RF Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels
9	5	Channel 5 79 MC	Alternate 42.1 MC and 45.75 MC or two Markers	77 25 MC (P) 81 75 MC (S)	IF Output	L7	OR	Check RF Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels
10	6	Channel 6 85 MC	Alternate 42.1 MC and 45.75 MC or two Markers	83 25 MC (P) 87 75 MC (S)	IF Output	L7	30%	Check RF Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels
11	7	Channel 7 177 MC	Alternate 42.1 MC and 45.75 MC or two Markers	175 25 MC (P) 179 75 MC (S)	IF Output	L7		See note below
12	8	Channel 8 183 MC	Alternate 42.1 MC and 45.75 MC or two Markers	181 25 MC (P) 185 75 MC (S)	IF Output	L7	P=PICTURE MARKER S=SOUND MARKER	See note below
13	9	Channel 9 189 MC	Alternate 42.1 MC and 45.75 MC or two Markers	187 25 MC (P) 191 75 MC (S)	IF Output	L7		Same as for steps 6 through 18
NOTE: If one or more coil strips cannot be made to track properly, replace strips. Do not peak coils to correct passbands. If Channels 7 and 8 show deep valley, adjust L9 as in step 18. If this does not correct conditions change the 6J6 Oscillator/Mixer tube. This will necessitate repetition of steps 1 through 5								
14	10	Channel 10 195 MC	Alternate 42.1 MC and 45.75 MC or two Markers	193 25 MC (P) 197 75 MC (S)	IF Output	L7	See curves above	Check Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels.
15	11	Channel 11 201 MC	Alternate 42.1 MC and 45.75 MC or two Markers	199 25 MC (P) 203 75 MC (S)	IF Output	L7	See curves above	Check Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels.
16	12	Channel 12 207 MC	Alternate 42.1 MC and 45.75 MC or two Markers	205 25 MC (P) 209 75 MC (S)	IF Output	L7	See curves above	Check Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels.
17	13	Channel 13 213 MC	Alternate 42.1 MC and 45.75 MC or two Markers	211 25 MC (P) 215 75 MC (S)	IF Output	L7	See curves above	Check Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels.
18	13	Channel 13 213 MC	Alternate 42.1 MC and 45.75 MC or two Markers	211 25 MC (P) 215 75 MC (S)	IF Output	See "Comments" and note at bottom of chart.	See curves above	A valley that is too deep can be flattened by adjusting turns spacing on L9*.

*In order to adjust C8, C9, C10 and L9, it is necessary to remove side cover of tuner. Remove side cover by means of a small wrench and slide cover out between chassis and tuner. The above mentioned adjustments may then be made through hole in chassis opposite tuner. Replace cover when adjustments are complete.

UHF TUNER ALIGNMENT

STEP	SIGNAL GENERATOR Connection	SIGNAL GENERATOR Freq.	SWEEP GENERATOR Connection	SWEEP GENERATOR Freq.	VTVM CONNECTION	OSCILLOSCOPE CONNECTION	ADJUST	OUTPUT READING	COMMENTS
	PERFORM "OSCILLATOR ALIGNMENT" ONLY IN CASES OF POOR UHF TUNER TRACKING								
1.	UHF RF gen. to UHF ant. terminals. (SEE COMMENTS)	896 MC			Across video detector load resistor, R147 4.7K.		C28	Max.	Turn UHF tuning shaft until tuning capacitor plates are fully unmeshed. If UHF RF generator is not internally terminated to 300 ohms, use matching pad in Fig. B.
2.	Check Video IF bandpass response as outlined in step 2 of "Video IF Alignment". Leave detector circuit connected for use in following step 3.								
3.	IF marker to test point on UHF tuner.	42.1 and 45.75 MC	IF sweep to test point on UHF tuner.	43.25 MC (10 MC sweep)		See preceding step 2.	T25	Response curve in Fig. A.	Set VHF tuner to "UHF" position. Maintain marker generator coupling as small as possible to prevent loading and distortion of response curve.
4.	IF marker to test point on UHF tuner.	42.1 and 45.75 MC	UHF sweep to UHF ant. terminals.	464 to 896 MC		Pin 5, 1st Video IF Amp. thru detector circuit in Fig. C.	C37, C38, C39* (C39 adjustment very critical at high end. See Note.)	Response curves in Fig. D.	Tune UHF sweep generator and UHF tuner simultaneously across UHF band. Adjust C37, C38 and C39* for best compromise on dip, tilt and amplitude. Additional adjustment may be accomplished by a slight bending of rotor plates.
CAUTION: Do not attempt to correct for excessive dip or tilt in overall UHF response curves by adjusting bandpass circuit (L8, L53, L54). Readjustment of these circuits will adversely affect VHF reception of receiver.									
5.	Remove detector circuit, 330 Ohm resistor, all test equipment and reconnect T55.								

*NOTE: As a double check for proper C39 adjustment, connect microammeter from UHF tuner test point to chassis. Tune through range; current will vary slightly with frequency. However, improper adjustment of C39 may cause current to drop to O on high end of range, while on low end operation is satisfactory.

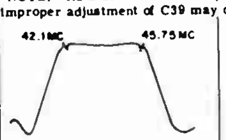


FIG. A

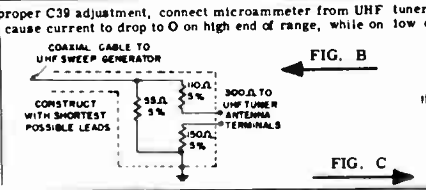


FIG. B

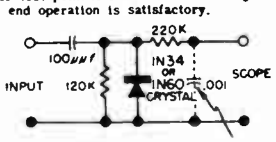


FIG. C (NOT NECESSARY IF SHIELDED LEAD IS USED ON SCOPE)

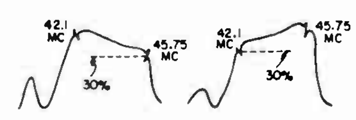
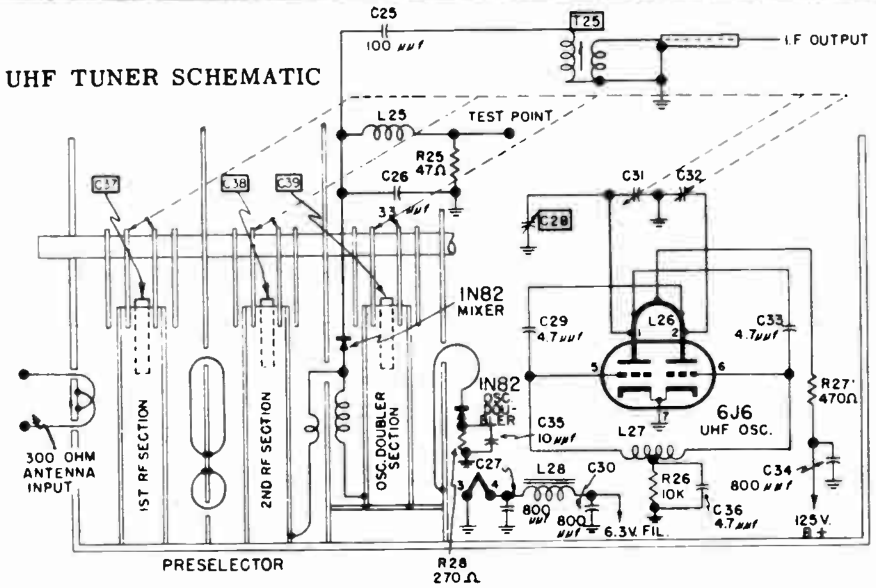
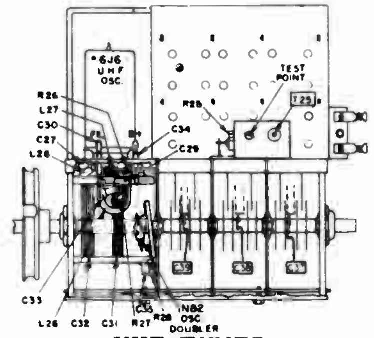


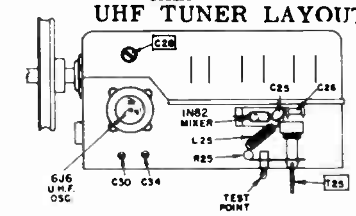
FIG. D

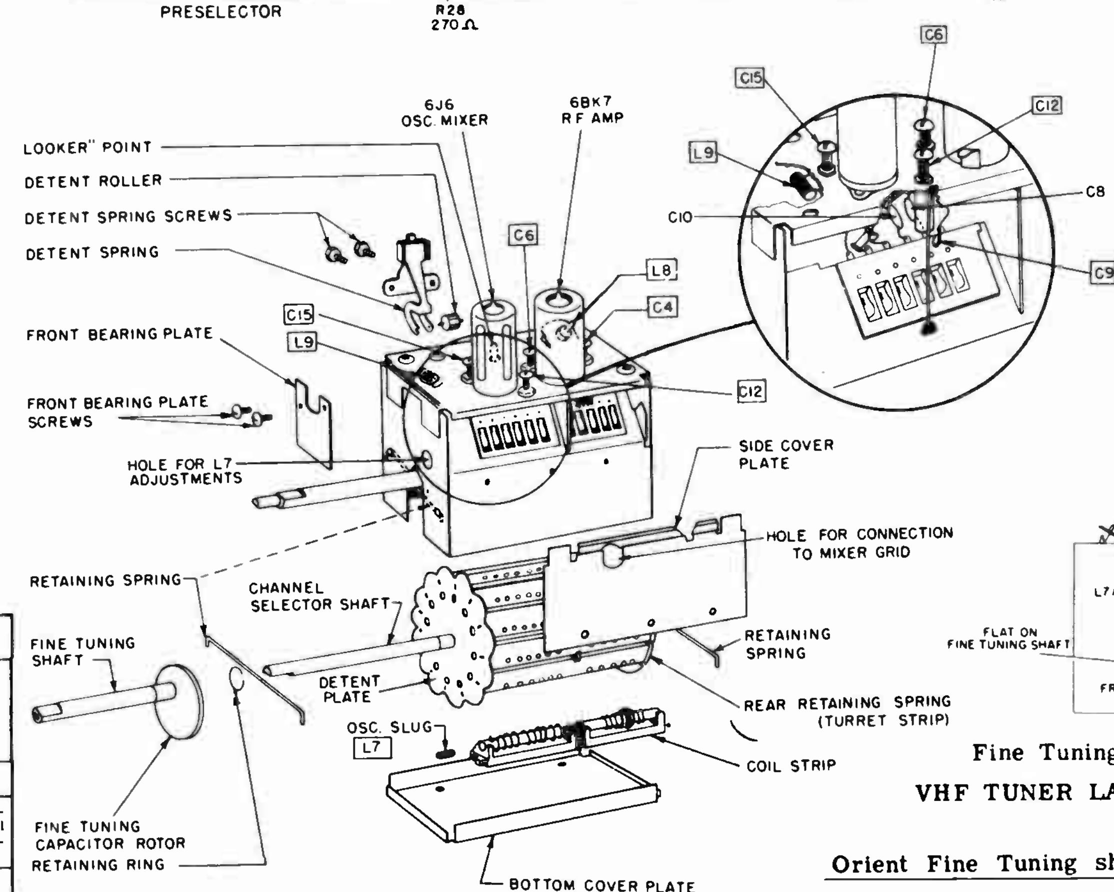
UHF TUNER SCHEMATIC

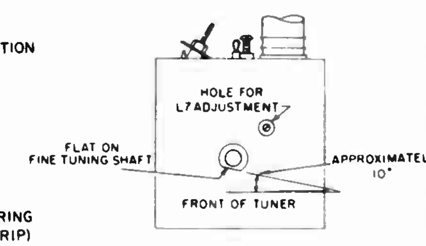




UHF TUNER LAYOUT







Fine Tuning Shaft Positioning

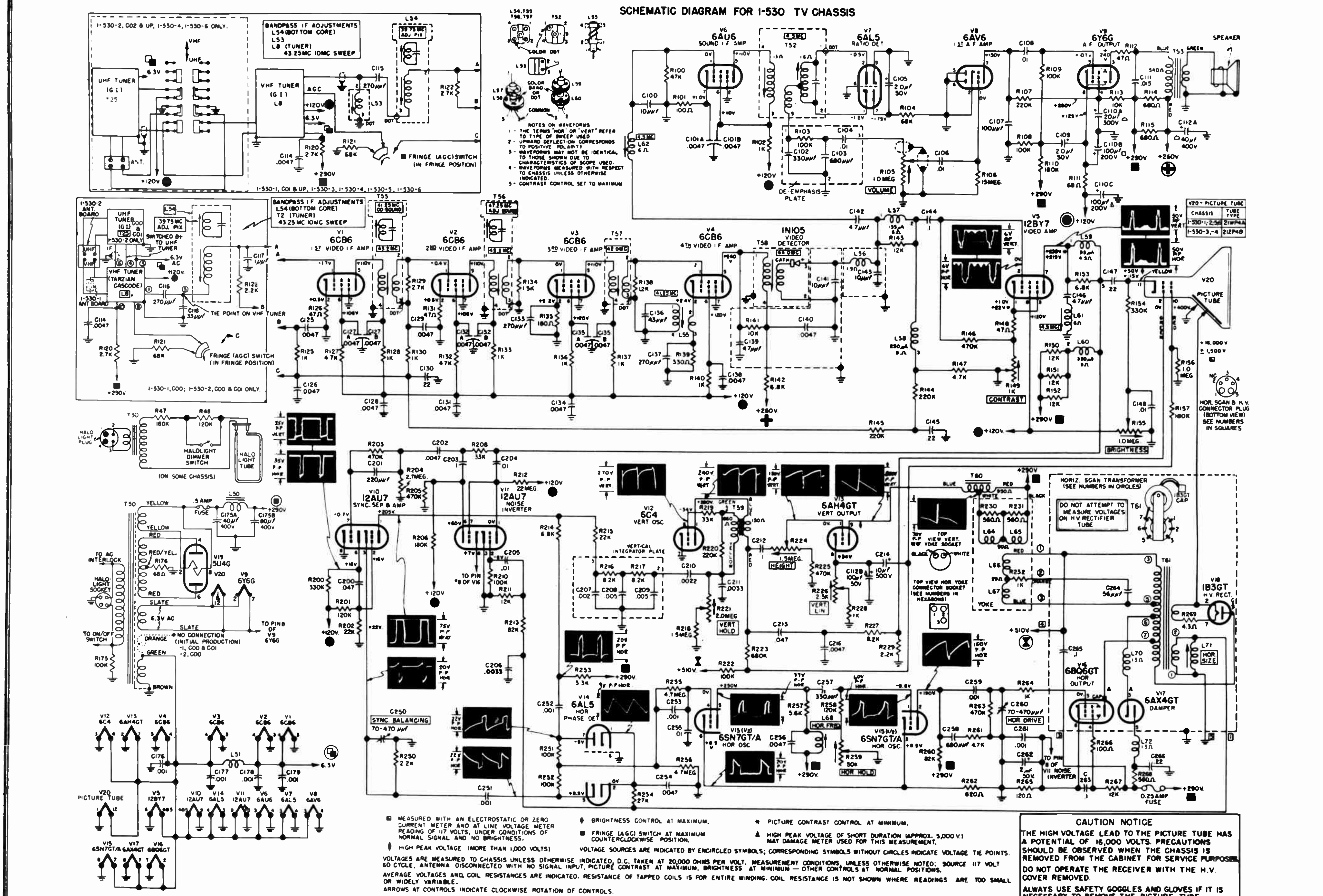
VHF TUNER LAYOUT

Orient Fine Tuning shaft as shown.

HIGH BAND OSCILLATOR ALIGNMENT

STEP	TUNER SET TO CHANNEL	GENERATORS SWEEP (10 MC)	GENERATORS IF MARKER	GENERATORS RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1.	13	Channel 13 213 MC	45.75 MC	211.25 MC	RF Output	L12 Screw	See Curves below	Coincide Markers as shown.
NOTE: Refer to VHF Tuner Layout and VHF Tuner Schematic for location of specified Wafers, Coil Increments, and Screw Adjustments mentioned in the following steps. As Channels 12 to 7 and 5 to 2 are aligned by means of consecutive coil increments, the aligned increments that precede must not be disturbed.								
2.	12	Channel 12 207 MC	45.75 MC	205.25 MC	RF Output	Channel 12 Loop on Wafer 5	TYPICAL CURVES IF & RF MARKERS 100%	Squeeze or spread loop for Channel 12 on Wafer 5 to coincide Markers as shown.
3.	11	Channel 11 201 MC	45.75 MC	199.25 MC	RF Output	Channel 11 Loop on Wafer 5		Adjust each succeeding Hi-Channel Loop on Wafer 5 (steps 3 to 7) to coincide appropriate Markers for that Channel.
4.	10	Channel 10 195 MC	45.75 MC	193.25 MC	RF Output	Channel 10 Loop on Wafer 5	IF & RF MARKERS 100%	
5.	9	Channel 9 189 MC	45.75 MC	187.25 MC	RF Output	Channel 9 Loop on Wafer 5		
6.	8	Channel 8 183 MC	45.75 MC	181.25 MC	RF Output	Channel 8 Loop on Wafer 5	Note: Curves may not be symmetrical until RF alignment is complete.	
7.	7	Channel 7 177 MC	45.75 MC	175.25 MC	RF Output	Channel 7 Loop on Wafer 5		

SCHEMATIC DIAGRAM FOR 1-530 TV CHASSIS



■ MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.

♦ HIGH PEAK VOLTAGE (MORE THAN 1,000 VOLTS)

♦ BRIGHTNESS CONTROL AT MAXIMUM.

■ FRINGE (AGC) SWITCH AT MAXIMUM COUNTERCLOCKWISE POSITION.

* PICTURE CONTRAST CONTROL AT MINIMUM.

▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000 V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.

VOLTAGE SOURCES ARE INDICATED BY ENCIRCLED SYMBOLS; CORRESPONDING SYMBOLS WITHOUT CIRCLES INDICATE VOLTAGE TIE POINTS.

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.

AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.

ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION OF CONTROLS.

CAUTION NOTICE

THE HIGH VOLTAGE LEAD TO THE PICTURE TUBE HAS A POTENTIAL OF 16,000 VOLTS. PRECAUTIONS SHOULD BE OBSERVED WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE PURPOSES.

DO NOT OPERATE THE RECEIVER WITH THE H.V. COVER REMOVED.

ALWAYS USE SAFETY GOGGLES AND GLOVES IF IT IS NECESSARY TO REMOVE THE PICTURE TUBE.

LOW BAND OSCILLATOR ALIGNMENT

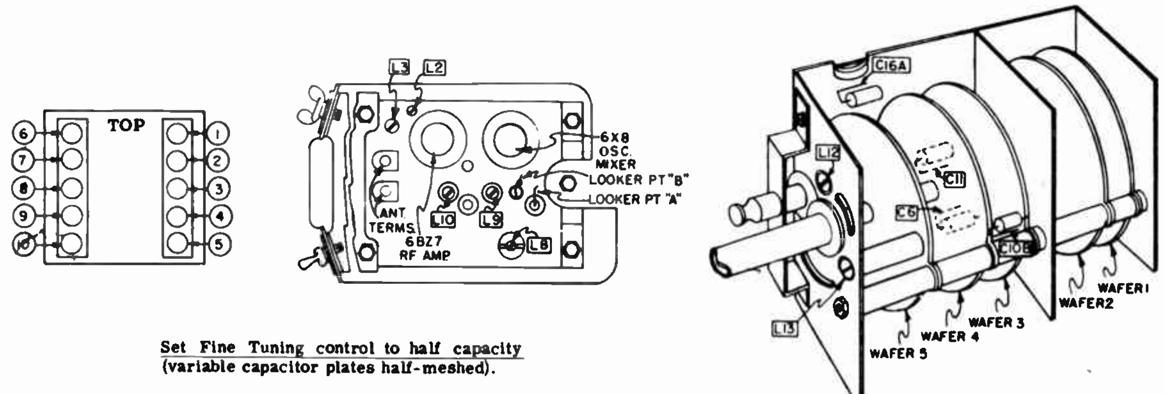
8.	6	Channel 6 85 MC	45.75 MC	83.25 MC	RF Output	L13 Screw	See Curves above	Coincide Markers as shown.
9.	5	Channel 5 79 MC	45.75 MC	77.25 MC	RF Output	Channel 5 Coil on Wafer 5		Squeeze or spread turns of Channel 5 Coil on Wafer 5 to coincide Markers as shown.
10.	4	Channel 4 69 MC	45.75 MC	67.25 MC	RF Output	Channel 4 Coil on Wafer 5		Adjust each succeeding Lo-Channel Coil on Wafer 5 (steps 10 to 12) to coincide appropriate Markers for that Channel.
11.	3	Channel 3 63 MC	45.75 MC	61.25 MC	RF Output	Channel 3 Coil on Wafer 5		
12.	2	Channel 2 57 MC	45.75 MC	55.25 MC	RF Output	Channel 2 Coil on Wafer 5		

HIGH AND LOW BAND RF ALIGNMENT

1.	13	Channel 13 213 MC	——	211.25 MC (P) 215.75 MC (S)	RF Output	L3, L9, L10 Screws	211.25 MC / 215.75 MC	Adjust L3 for maximum mid-band height regardless of skirts. Adjust L10 for proper skirt figuring. Adjust L9 for flat top. Picture carrier must be at 100%; sound carrier may ride down 30%.
2.	13	Same as 1	45.75 MC and 42.1 MC		IF Output	L8 on Tuner and L54 on main Chassis	42.1 MC / 45.75 MC	Adjust for response curve shown.
3.	13	Same as 1	——	211.25 MC (P) 215.75 MC (S)	RF Output	L9 Screw	211.25 MC / 215.75 MC	Touch up for flat top if necessary. There must not be more than 5% dip.
4.	12	Channel 12 207 MC	——	205.25 MC (P) 209.75 MC (S)	RF Output	Channel 12 Loops on Wafers 1, 3 and 4	PICTURE 100% / SOUND	Squeeze or spread loops for Channel 12 to acquire acceptable response curve. Loop on Wafer 1 adjusts mid-band amplitude; Loop on Wafer 3 adjusts skirt frequency; Loop on Wafer 4 adjusts for flat top. Align each succeeding channel (steps 5 to 14) adjusting inductances of appropriate loops or coils on Wafers 1, 3, and 4. Refer to VHF Tuner Schematic and Parts Layout for locations of specified loop increments. Picture and Sound carriers must remain on top of curve.
5.	11	Channel 11 201 MC	——	199.25 MC (P) 203.75 MC (S)	RF Output	Channel 11 Loops on Wafers 1, 3 and 4	OR	
6.	10	Channel 10 195 MC	——	193.25 MC (P) 197.75 MC (S)	RF Output	Channel 10 Loops on Wafers 1, 3 and 4	PICTURE / SOUND / 70%	
7.	9	Channel 9 189 MC	——	187.25 MC (P) 191.75 MC (S)	RF Output	Channel 9 Loops on Wafers 1, 3 and 4	OR	
8.	8	Channel 8 183 MC	——	181.25 MC (P) 185.75 MC (S)	RF Output	Channel 8 Loops on Wafers 1, 3 and 4	PICTURE / SOUND / 70%	
9.	7	Channel 7 177 MC	——	175.25 MC (P) 179.75 MC (S)	RF Output	Channel 7 Loops on Wafers 1, 3 and 4	OR	
10.	6	Channel 6 85 MC	——	83.25 MC (P) 87.75 MC (S)	RF Output	Channel 6 Coils on Wafers 1, 3 and 4	PICTURE 70% / SOUND 100%	
11.	5	Channel 5 79 MC	——	77.25 MC (P) 81.75 MC (S)	RF Output	Channel 5 Coils on Wafers 1, 3 and 4		
12.	4	Channel 4 69 MC	——	67.25 MC (P) 71.75 MC (S)	RF Output	Channel 4 Coils on Wafers 1, 3 and 4		
13.	3	Channel 3 63 MC	——	61.25 MC (P) 65.75 MC (S)	RF Output	Channel 3 Coils on Wafers 1, 3 and 4		
14.	2	Channel 2 57 MC	——	55.25 MC (P) 59.75 MC (S)	RF Output	Channel 2 Coils on Wafers 1, 3 and 4		

NOTE: As each Channel is aligned by adjustment of its inductance increments in the order listed in steps 4 to 14, care must be exercised not to disturb the aligned increments preceding the one being adjusted.

15. Recheck all channels for flat top response curve, touching up L9 for Chan. 13 and appropriate coil increments for other channels. Up to 30% Dip is permissible for all channels. If bandwidth on any channel is insufficient after these adjustments, touch up by bending gimmick capacitors C6, C10B and C11 towards or away from C7, C10A and C12, respectively.

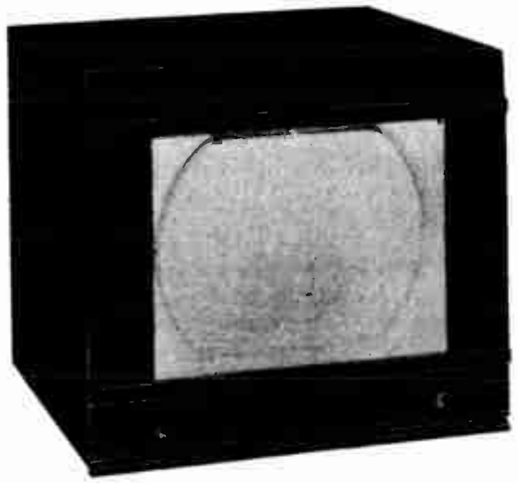


Set Fine Tuning control to half capacity (variable capacitor plates half-meshed).

VHF TUNER LAYOUT

REPAIR PARTS LIST

SCHEMATIC LOCATION	SERVICE PART NO.	DESCRIPTION
	CAPACITORS	
C100	166-0010P	10 Mmfd. - 500V. - Ceramic
C101	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C102, C103, C104		Listed under "Miscellaneous Electrical Parts"
C105	161-1001	2 Mfd. - 50V. - Electrolytic
C106	160-0411	.01 Mfd. - 400V. - Molded Paper
C107	163-0100	100 Mmfd. - 500V. - Mica
C108	160-0611	.01 Mfd. - 600V. - Molded Paper
C109	161-1001	2 Mfd. - 50V. - Electrolytic
	161-3017	Three Section Electrolytic
C110A		20 Mfd. - 300V.
C110B		100 Mfd. - 200V.
C110C		100 Mfd. - 200V.
C111	160-06115	.015 Mfd. - 600V. - Molded Paper
	161-2005	Two Section Electrolytic
C112A		40 Mfd. - 400V.
C112B		100 Mfd. - 50V.
C114	166-4700D	.0047 Mfd. - 500V. - Ceramic
C115	166-0270N	270 Mmfd. - 500V. - Ceramic
C116	166-0270N	270 Mmfd. - 500V. - Ceramic
C117	166-0001P	1 Mmfd. - 500V. - Ceramic
C118	166-0033P	33 Mmfd. - 500V. - Ceramic
C125	166-4700D	.0047 Mfd. - 500V. - Ceramic
C126	166-4700D	.0047 Mfd. - 500V. - Ceramic
C127	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C128	166-4700D	.0047 Mfd. - 500V. - Ceramic
C129	166-4700D	.0047 Mfd. - 500V. - Ceramic
C130	162-0202	.22 Mfd. - 200V. -Paper
C131	166-4700D	.0047 Mfd. - 500V. - Ceramic
C132	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C133	166-0270N	270 Mmfd. - 500V. - Ceramic
C134	166-4700D	.0047 Mfd. - 500V. - Ceramic
C135	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C136	166-0043P	43 Mmfd. - 500V. - Ceramic
C137	166-0270N	270 Mmfd. - 500V. - Ceramic
C138	166-4700D	.0047 Mfd. - 500V. - Ceramic
C139	168-0008N	4.7 Mmfd. - 500V. - Ceramic
C140	166-4700D	.0047 Mfd. - 500V. - Ceramic
C141	166-0010P	10 Mmfd. - 500V. - Ceramic
C142	168-0008N	4.7 Mmfd. - 500V. - Ceramic
C143	166-0010P	10 Mmfd. - 500V. - Ceramic
C144	160-0201	.1 Mfd. - 200V. - Molded Paper
C145	162-0202	.22 Mfd. - 200V. - Paper
C146	168-0008N	4.7 Mmfd. - 500V. - Ceramic
C147	160-06022	.22 Mfd. - 600V. - Molded Paper
C148	160-0411	.01 Mfd. - 400V. - Molded Paper
	161-2004	Two Section Electrolytic
C175A		40 Mfd. - 400V.
C175B		80 Mfd. - 400V.
C176	166-1000D	.001 Mfd. - 500V. - Ceramic
C177	166-1000D	.001 Mfd. - 500V. - Ceramic
C178	166-1000D	.001 Mfd. - 500V. - Ceramic
C179	166-1000D	.001 Mfd. - 500V. - Ceramic
C200	160-04147	.047 Mfd. - 400V. - Molded Paper
C201	163-0220	220 Mmfd. - 500V. - Mica
C202	160-04247	.0047 Mfd. - 400V. - Molded Paper
C203	160-0601	.1 Mfd. - 600V. - Molded Paper
C204	160-0611	.01 Mfd. - 600V. - Molded Paper
C205	160-0411	.01 Mfd. - 400V. - Molded Paper
C206	162-06233	.0033 Mfd. - 600V. - Paper
C210	162-0622	.0022 Mfd. - 600V. - Paper
C211	162-0623	.0022 Mfd. - 600V. - Paper
C212	160-0401	.1 Mfd. - 400V. - Molded Paper
C213	162-06147	.047 Mfd. - 600V. - Paper
C214	161-1010	10 Mfd. - 500V. - Electrolytic
C216	160-06247	.0047 Mfd. - 600V. - Molded Paper
C250	172-0032	Trimmer: 70-470 Mmfd.
C251	160-0421	.001 Mfd. - 400V. - Molded Paper
C252	160-0421	.001 Mfd. - 400V. - Molded Paper
C253	160-0421	.001 Mfd. - 200V. - Molded Paper
C254	162-04247	.0047 Mfd. - 400V. - Paper
C255	160-0411	.01 Mfd. - 400V. - Molded Paper
C256	160-06247	.0047 Mfd. - 600V. - Molded Paper
C257	163-0330	330 Mmfd. - 500V. - Mica
C258	163-0680	680 Mmfd. - 500V. - Mica
C259	166-1000P	.001 Mfd. - 500V. - Ceramic
C260	172-0032	Trimmer: 70-470 Mmfd.
C261	166-1000D	.001 Mfd. - 500V. - Ceramic
C262	161-1001	2 Mfd. - 50V. - Electrolytic
C263	160-0601	.1 Mfd. - 600V. - Molded Paper
C264	174-0056	56 Mmfd. - 2,000V. - Ceramic
C265	160-0601	.1 Mfd. - 600V. - Molded Paper
C266	160-06022	.22 Mfd. - 600V. - Molded Paper
	COILS, CHOKES AND TRANSFORMERS	
L50	145-0004	Choke - B+ Filter
L51	147-0014	Choke - Heater
L53	115-0001	Coil - Link Shunt
L54	119-0002	Coil - Tuner Coupling
L55	118-0011	Coil - Cathode Trap
L56	118-0010	Coil - Filter
L57, L58	131-2003	Coil - Dual Peaking
L59, L60	131-2008	Coil - Dual Peaking
L61	130-0001	Coil - 4.5 MC Trap
L62	130-0001	Coil - Sound Take-off
L64, L65	100-0009	Yoke - Deflection - Vertical
L66, L67		- Horizontal
L68	132-0001	Coil - Horizontal Frequency
L69	118-0010	Coil - Filter
L70	118-0010	Coil - Filter
L71	132-0005	Coil - Horizontal Size Adjustment
L72	118-0010	Coil - Filter
T30	141-0030	Transformer - HaloLight Power
T50	141-0039	Transformer - Power - 117V. 60 Cycle
T52	128-0008	Transformer - Sound Discriminator
T53	143-0023	Transformer - Audio Output
T55	119-0003	Transformer - 1st Video IF
T56	119-0004	Transformer - 2nd Video IF
T57	119-0005	Transformer - 3rd Video IF
T58	126-0001	Transformer - Video IF Output
T59	242-0002	Transformer - Vertical Oscillator
T60	241-0008	Transformer - Vertical Scan
T61	241-0019	Transformer - Horizontal Scan
	CONTROLS	
	157-0024	Control - Dual & On/Off Switch
R105		Volume
R155		Brightness
R149	153-3013	Control - Contrast (1-530-1, -2 Chassis)
R149	153-3019	Control - Contrast (1-530-3, -4, -5, -6)
R221	153-0018	Control - Vertical Hold
R224	153-0014	Control - Height
R226	153-3011	Control - Vertical Linearity
R259	153-0021	Control - Horizontal Hold
	RESISTORS	
		All resistors are 10% carbon unless otherwise specified.
R47	183-0184	180,000 Ohm - 2W.
R48	183-0124	120,000 Ohm - 2W.
R100	181-0473	47,000 Ohm - 1/2W.
R101	181-0101	100 Ohm - 1/2W.
R102	181-0102	1,000 Ohm - 1/2W.
R104	181-0683	68,000 Ohm - 1/2W.
R106	181-0156	15 Megohm - 1/2W.
R107	181-0224	220,000 Ohm - 1/2W.
R108	181-01045	100,000 Ohm - 1/2W. - 5%
R109	181-0104	100,000 Ohm - 1/2W.
R110	181-01845	180,000 Ohm - 1/2W. - 5%
R111	182-0680	68 Ohm - 1W.
R112	181-0470	47 Ohm - 1/2W.
R113	182-0103	10,000 Ohm - 1W.
R114	183-0681	680 Ohm - 2W.
R115	183-0681	680 Ohm - 2W.
R120	183-0272	2,700 Ohm - 2W.
R121	181-0683	68,000 Ohm - 1/2W.
R122	181-0272	2,700 Ohm - 1/2W.
R122	181-0222	2,200 Ohm - 1/2W. (1-530-1, -2 only)
R125	181-0102	1,000 Ohm - 1/2W.
R126	181-04705	47 Ohm - 1/2W. - 5%
R127	181-0472	4,700 Ohm - 1/2W.
R128	181-0102	1,000 Ohm - 1/2W.
R129	181-0272	2,700 Ohm - 1/2W.
R130	181-0102	1,000 Ohm - 1/2W.
R131	181-04705	47 Ohm - 1/2W. - 5%
R132	181-0472	4,700 Ohm - 1/2W.
R133	181-0102	1,000 Ohm - 1/2W.
R134	181-0152	1,500 Ohm - 1/2W.
R135	181-0181	180 Ohm - 1/2W.
R136	181-0102	1,000 Ohm - 1/2W.
R137	181-0102	1,000 Ohm - 1/2W.
R138	181-0152	1,500 Ohm - 1/2W.
R139	181-0331	330 Ohm - 1/2W.
R140	181-0102	1,000 Ohm - 1/2W.
R141	181-0103	10,000 Ohm - 1/2W.
R142	181-0682	6,800 Ohm - 1/2W.
R143	181-0123	12,000 - 1/2W.
R144	181-0224	220,000 Ohm - 1/2W.
R145	181-0224	220,000 Ohm - 1/2W.
R146	181-0474	470,000 Ohm - 1/2W.
R147	181-0472	4,700 Ohm - 1/2W.
R148	181-0470	47 Ohm - 1/2W.
R149		Listed under "Controls"
R150	189-0038	12,000 Ohm - 2W.
R151	189-0038	12,000 Ohm - 2W.
R152	189-0038	12,000 Ohm - 2W.
R153	181-0682	6,800 Ohm - 1/2W.
R154	181-0334	330,000 Ohm - 1/2W.
R155		Listed under "Controls"
R156	181-0105	1 Megohm - 1/2W.
R157	181-0184	180,000 Ohm - 1/2W.
R175	183-0104	100,000 Ohm - 2W.
R176	187-0013	68 Ohm - 10W. - W.W.
R200	181-0334	330,000 Ohm - 1/2W.
R201	181-0124	120,000 Ohm - 1/2W.
R202	181-0223	22,000 Ohm - 1/2W.
R203	181-0474	470,000 Ohm - 1/2W.
R204	181-0275	2.7 Megohm - 1/2W.
R205	181-0474	470,000 Ohm - 1/2W.
R206	181-0184	180,000 Ohm - 1/2W.
R208	181-0333	33,000 Ohm - 1/2W.
R210	181-0104	100,000 Ohm - 1/2W.
R211	181-0123	12,000 Ohm - 1/2W.
R212	181-0226	22 Megohm - 1/2W.
R213	181-0823	82,000 Ohm - 1/2W.
R214	183-0682	6,800 Ohm - 2W.
R215	181-0223	22,000 Ohm - 1/2W.
R216, R217		Listed under "Miscellaneous Electrical Parts"
R218	181-0155	1.5 Megohm - 1/2W.
R219	181-0333	33,000 Ohm - 1/2W.
R220	181-0224	220,000 Ohm - 1/2W.
R221		Listed under "Controls"
R222	181-0104	100,000 Ohm - 1/2W.
R223	181-0684	680,000 Ohm - 1/2W.
R224		Listed under "Controls"
R225	181-0474	470,000 Ohm - 1/2W.
R226		Listed under "Controls"
R227	181-08225	8,200 Ohm - 1/2W. - 5%
R228	182-0102	1,000 Ohm - 1W.
R229	181-0222	2,200 Ohm - 1/2W.
R230	181-0561	560 Ohm - 1/2W.
R231	181-0561	560 Ohm - 1/2W.
R232	181-0102	1,000 Ohm - 1/2W.
R250	181-0222	2,200 Ohm - 1/2W.
R251	181-0104	100,000 Ohm - 1/2W.
R252	181-0104	100,000 Ohm - 1/2W.
R253	182-0332	3,300 Ohm - 1W.
R254	181-0273	27,000 Ohm - 1/2W.
R255	181-0475	4.7 Megohm - 1/2W.
R256	181-0475	4.7 Megohm - 1/2W.
R257	182-0562	5,600 Ohm - 1W.
R258	181-0124	120,000 Ohm - 1/2W.
R259		Listed under "Controls"
R260	181-0823	82,000 Ohm - 1/2W.
R261	181-0472	4,700 Ohm - 1/2W.
R262	181-0821	820 Ohm - 1/2W.
R263	181-0474	470,000 Ohm - 1/2W.
R264	181-0102	1,000 Ohm - 1/2W.
R265	183-0121	120 Ohm - 2W.
R266	181-0101	100 Ohm - 1/2W.
R267	183-0123	12,000 Ohm - 2W.
R268	189-0047	560 Ohm - 10W. - W.W.
R269	189-0007	4.3 Ohm - 1/2W. - W.W.
C102		330 Mmfd. - 400V.
C103		680 Mmfd. - 400V.
C104		.01 Mfd. - 400V.
R103		100,000 Ohm - 1/5W.
	190-0012	Plate - Vertical Integrator
C207		.002 Mfd. - 500V.
C208		.005 Mfd. - 500V.
C209		.005 Mfd. - 500V.
R216		8,200 Ohm - 1/2W.
R217		8,200 Ohm - 1/2W.
	539-0525	Speaker - 5 3/4" P.M. (410 Models)
	539-4600	Speaker - 4" x 6" P.M. (514 Models)
	539-0602	Speaker - 6 1/2" P.M. (525 Models)
	539-0802	Speaker - 8" P.M. (529 Models)
L1, L2, L4, L5	110-0001	Strip - VHF Tuner Coil - 40 MC
L1, L2, L4, L5, L7	110-0002 to	Strip - VHF Tuner Coil - Channel 2 to 13



MODEL 1210X

SPECIFICATIONS

Frequency Range

All 12 television channels,
54 Mc. to 88 Mc., 174 Mc. to 216 Mc.
Picture IF Carrier 26.4 Mc.
Sound IF Carrier 4.5 Mc. & 21.9 Mc.

Power Supply

117 Volts 60 cycle AC, 275 Watts

Loud Speaker

5 1/4" P.M.

Cabinet Dimensions (inches)	Width	Height	Depth
	22.0	19.8	21.0

Weight (pounds)	Net	Gross
	68.5	88.0

Antenna Input Impedance

This receiver has an antenna input impedance of 300 ohms and is shipped to the customer with the built-in antenna connected. This must be disconnected if it is desired to attach an external antenna.

SYLVANIA TUBE COMPLEMENT

(includes rectifiers and picture tube)

Symbol	Function	Type
V1	RF Amplifier	6CB6
V2	Oscillator-Mixer	6J6
V3	1st Video IF Amplifier	6CB6
V4	2nd Video IF Amplifier	6CB6
V5	3rd Video IF Amplifier	6BC5
V6	Video Detector - AGC Line Clamper	6AL5
V7	Video Amplifier	6BF5
V8	Sound IF Amplifier	6AU6
V9	Sound IF Limiter	6AU6
V10	Ratio Detector - 1st Audio Amplifier	6T8
V11	Audio Output	6V6GT
V12	AGC Amplifier - Sync Amplifier & Clipper	12AU7
V13	AGC Rectifier - Sync Separator	12AX7
V14	Vertical Oscillator & Output	6BL7GT
V15	Horizontal Discriminator	6AL5
V16	Horizontal Control	6AU6
V17	Horizontal Oscillator & Discharge	12AU7
V18	Horizontal Output	6BQ6GT
V19	Damper	6W4GT
V20	High Voltage Rectifier	5642
V21	High Voltage Rectifier	5642
V22	Low Voltage Rectifier	5U4G
V23	Low Voltage Rectifier	5U4G
V24	Picture Tube	16AP4

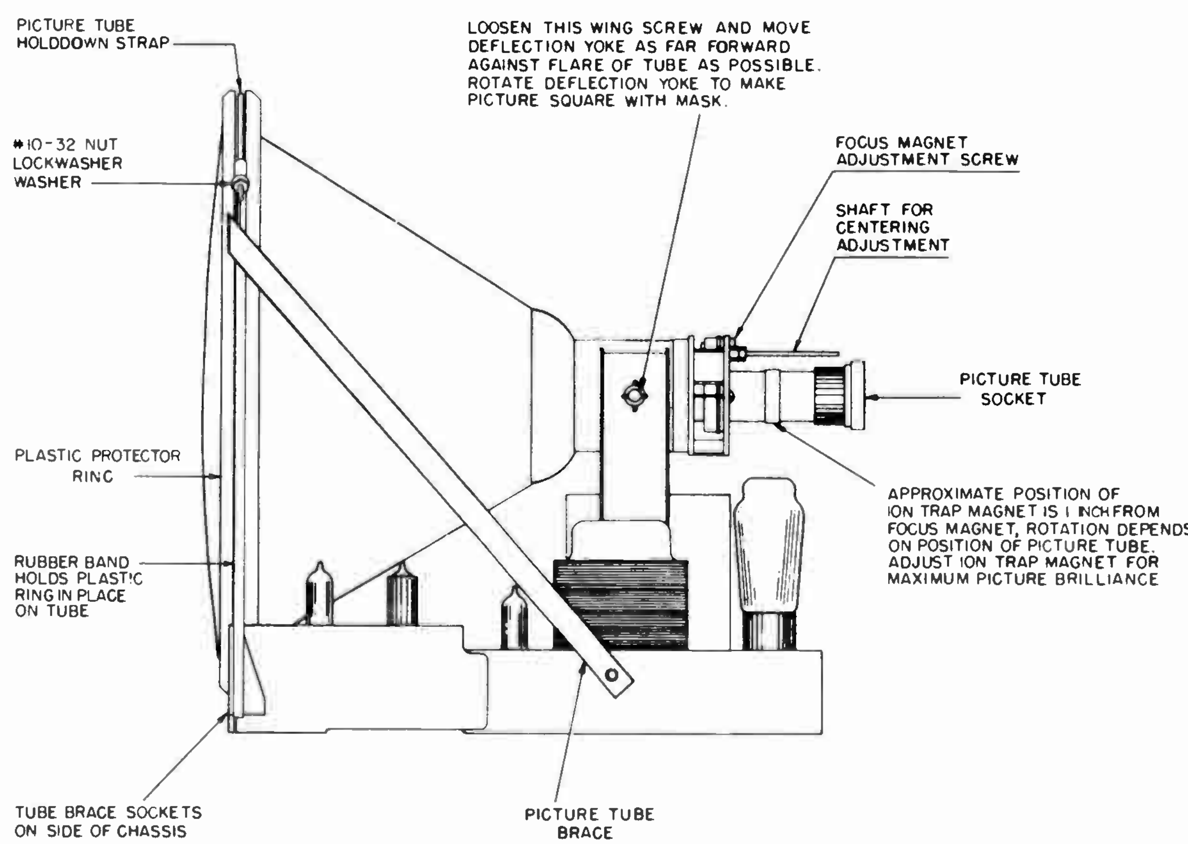


FIGURE 3 - PICTURE TUBE INSTALLATION

GENERAL DESCRIPTION

Model 1210X is a direct viewing television receiver which provides reception of all 12 commercial television channels. The television picture is reproduced on a round 16 inch white-faced, electromagnetically deflected, tetrode type picture tube.

ADJUSTMENT OF HORIZONTAL AFC CIRCUIT

Check of Operation

The operation of the AFC circuit should be checked as follows:

A. Tune the receiver to a channel on which no signal is received and return to the original channel. The picture should immediately fall into synchronization.

B. Switch off the power to the receiver for about five minutes and then switch back on. Picture should immediately fall into sync.

C. Check for correct phasing of Horizontal AFC circuit by noting that there is approximately 1/8" of blanking visible on the right hand edge of the picture. It will be necessary to turn the contrast control to minimum and readjust the brightness control to see the blanking.

NOTE: Before making check C above, be sure the horizontal drive control is correctly adjusted. Refer to "Preset Controls Adjustment," page 8. If the receiver passes the above checks, no adjustments to the horizontal AFC circuits need be made.

If the receiver cannot pass checks "A," "B," or "C" the adjustment of the Horizontal Hold Control as noted under "Horizontal Hold Adjustment" should be made.

Horizontal Hold Adjustment

A. Tune in a station and adjust the tuning control for best picture quality. Adjust the contrast and brightness controls for normal picture.

B. Remove V15 - 6AL5 - Horizontal Discriminator tube.

C. Turn the Horizontal Hold Control until the picture moves back and forth across the screen with blanking bars vertical.

D. Replace the Horizontal Discriminator tube and repeat A, B, and C under "Check of Operation" above.

E. If receiver still will not pass these checks, it will be necessary to proceed with "Phase Adjustment."

F. Check the "free-running" of the horizontal oscillator as described under paragraphs "B," "C," and "D," and, if necessary, readjust the frequency adjustment screw on top of horizontal discriminator transformer.

G. Make a final check of the phasing as described in paragraph "E" above. It is important that both the "free-running" and the phasing are correct.

H. Remove the short from across the 4700 ohm resistor R226 and re-adjust the horizontal drive control as described in "A". Turn the core in the horizontal "ringing" coil clockwise until approximately 1/8" of "blanking" is again visible on the right-hand edge of the picture.

I. Before the horizontal synchronization circuit is adjusted to the final position, it will be necessary to check the operation as follows:

Slowly turn the oscillator frequency adjustment screw (top of transformer T62) in either direction until the picture suddenly falls out of synchronization as indicated by the presence of a number of diagonal bars. The total number of bars visible must not be less than six. These bars may consist of either several full bars and two half bars for the total number or they may be all full bars for the same total number. Slowly turn the adjustment screw so as to decrease the number of bars and note the total number of bars visible just before the picture again falls into synchronization. The last number of bars visible must not be less than three, or more than four. In order to get an accurate indication of the minimum number of bars obtainable, the adjustment screw must be turned very slowly and carefully once the number of bars has been reduced to four or five.

Turn the adjustment screw in the opposite direction until the picture suddenly falls out of synchronization in the opposite direction and repeat the foregoing procedure. Again, the total number of bars visible when the picture falls out of synchronization must not be less than six, and not less than three or more than four bars must be visible just before the picture falls into synchronization.

J. After checking the operation as in I, it is necessary to repeat the procedure described in paragraphs "B," "C," and "D."

K. Remove the signal by tuning to a "free" channel, then retuning to the original channel. The picture should immediately fall into synchronization.

L. Switch "off" the power to the receiver for about five minutes and then switch receiver "on" and check that the picture pulls into synchronization.

Phase Adjustment

A. Turn the core in the horizontal "ringing" coil all the way out (counterclockwise). Short out the 4700 ohm horizontal charge circuit peaking resistor R226.

With the horizontal size coil set for approximately the correct picture width, and with the horizontal linearity coil adjusted for best linearity, rotate the horizontal drive control fully counterclockwise. Slowly turn the drive control clockwise until crowding is visible in the center of the picture. Now carefully turn the control back (counterclockwise) only enough to remove the crowding in the picture or pattern. On some chassis, it may not be possible to obtain crowding of the picture. In such cases the control should be set to the fully clockwise position.

NOTE: Do not operate the receiver with the horizontal drive control mis-adjusted.

B. Remove V15 - 6AL5 - Horizontal Discriminator Tube from its socket.

C. Carefully turn the frequency adjustment screw (top of discriminator transformer T62) until the picture moves back and forth across the screen of the picture tube with the blanking bar vertical.

D. Replace the 6AL5 - Horizontal Discriminator Tube in its socket.

E. Adjust the phase adjustment screw (underside of discriminator transformer T62) until approximately 1/8" of "blanking" is visible on the right-hand edge of the picture. In order to see the "blanking", turn contrast control almost to minimum, readjust brightness control, and reduce picture size.

AGC CONTROL ADJUSTMENT

This control has been correctly adjusted at the factory and should require no further adjustment. If adjustment becomes necessary as evidenced by poor horizontal or vertical sync; or a video signal with poor contrast, proceed as follows:

1. Connect a good antenna installation to the receiver.

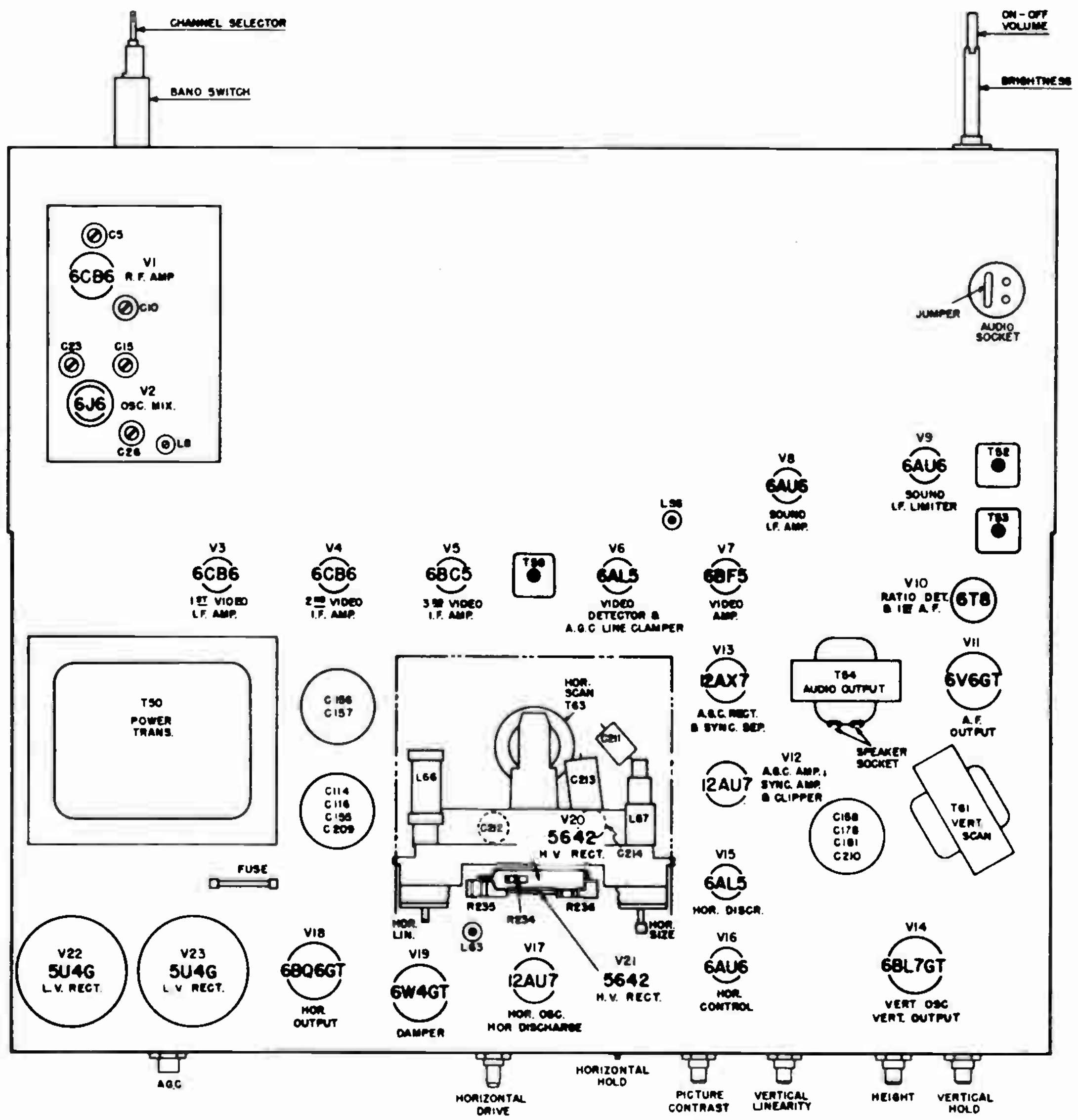


FIGURE 4 - CHASSIS TOP LAYOUT

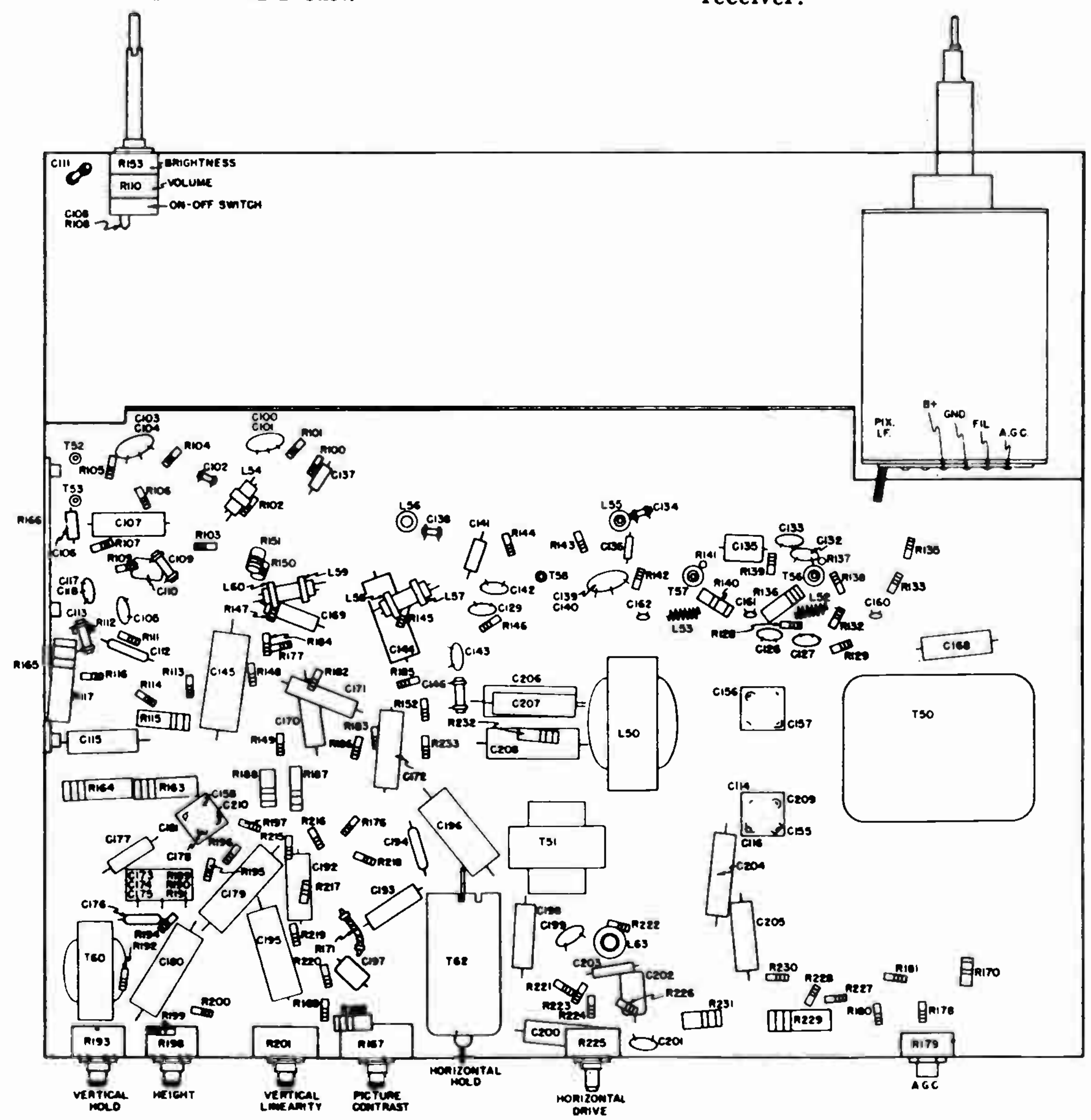


FIGURE 6 - CHASSIS BOTTOM LAYOUT

2. Tune the receiver to a channel on which no picture is received.

3. Set the contrast control to mid-position.

4. Turn the AGC control fully clockwise. The AGC control is located on the rear panel of the chassis.

5. Connect a VTVM from the AGC Amplifier plate to ground (V12, 12AU7, pin 6) and set the AGC control to obtain a negative 0.1 volt reading.
Note: On some receivers the closest approach to this reading will be the fully clockwise position.

6. With the AGC Control set as above, turn the contrast control almost to maximum (about 7/8) and tune in the strongest station available in the area.

7. Again read the AGC Amplifier plate voltage; if reading is less than a negative 2.0 volts leave the control as set.

8. If the AGC Amplifier plate voltage is more than 2 volts negative, slowly turn the AGC control counterclockwise observing the picture.

9. The picture will get darker and then finally start to fall out of sync as evidenced by a sudden shift or jittering of the picture in either the horizontal or vertical direction. Do not turn beyond this point.

10. Back off (clockwise) slowly on the control until the picture holds in sync without flutter and turn slightly beyond. (Experience will dictate how far beyond to turn).

11. Rock the tuning control slightly either side of the best tuning point to insure picture stays in sync; if not, turn slightly further clockwise and check again.

12. As a final check, turn the volume control up to normal level. Intercarrier buzz should be negligible.

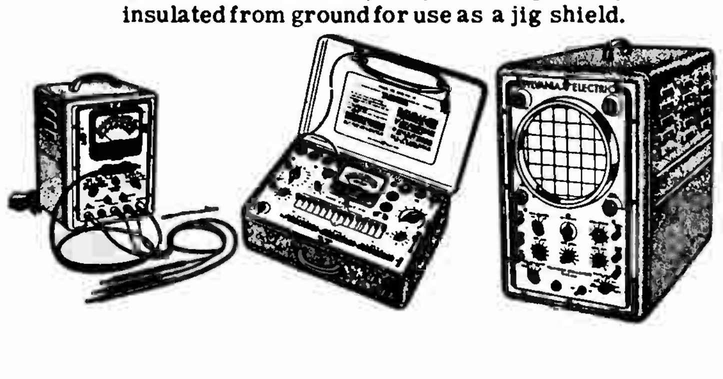
13. Remove objectionable intercarrier buzz by turning the AGC control slightly further clockwise. (Note: The intercarrier buzz is merely a reference for correct adjustment of the AGC control and only a slight touch-up should be necessary. If much adjustment is required to remove intercarrier buzz, the sound section is maladjusted and requires realignment.

14. Rock the tuning control slightly either side of the best tuning point and turn the AGC control slightly more clockwise as necessary to remove objectionable intercarrier buzz.

The intent of the above AGC control adjustment is to provide a maximum of AGC action consistent with proper sync and minimum intercarrier buzz on strong signals.

TEST EQUIPMENT REQUIREMENTS

1. RF sweep generator or generators with frequency range from 4-220 Mc. having sweep width adjustable from 50 Kc. to 10 Mc. with an output of at least 0.1 volt, a marker system, either built-in or external type and flat within ± 1 Db.
2. Signal generator or generators with a frequency range from 4-222 Mc. and an adjustable output of at least 0.1 volt.
3. Sylvania cathode ray oscilloscope type 400 or equivalent capable of passing a 60 cycle square wave.
4. Sylvania Polymeter type 221 or equivalent vacuum tube voltmeter.
5. Sylvania High Voltage Probe Adapter type 225 or equivalent with 0-30 KV DC range (not shown).
6. Sylvania tube tester type 220 or equivalent capable of testing shorts with proper voltages and performance under dynamic conditions.
7. Jig Tube Shield - made by insulating or cutting off a tube shield, so it will not ground when in place on the converter tube. The existing shield around V2, oscillator-converter tube, may be temporarily insulated from ground for use as a jig shield.



SYLVANIA POLYMETER TYPE 221 | SYLVANIA TUBE TESTER TYPE 220 | SYLVANIA OSCILLOSCOPE TYPE 400

FIGURE 7 - SYLVANIA TEST EQUIPMENT

ALIGNMENT PROCEDURE

Should any chassis under service require complete realignment, the alignment procedure should be carried out in the following listed order.

PRE-ALIGNMENT INSTRUCTIONS - READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT.

Lay chassis on left side for alignment. Ground all equipment to receiver chassis. Use special alignment tool Service Part No. 898-0003.

VIDEO I F ALIGNMENT

1. Connect signal generator to the jig shield on the Oscillator-Converter tube. Allow generator and set to warm-up for fifteen minutes.

2. Connect the negative lead of a 3 volt battery to the AGC Line, positive lead to ground.

3. Connect D.C. VTVM across the diode load resistor R145 - 3900 ohm.

4. Tune generator to 27.9 Mc. and adjust trap coil L55 for minimum output. Keep voltmeter reading under 2 volts by reducing generator output as required.

5. Adjust the cores of the Video IF Transformers in the following order. Reduce generator output to keep voltmeter reading between 1 and 2 volts.

Set Signal Generator At:	Adjust:
26.2 Mc.	Core on 2nd Video IF Transformer T57 for maximum output
24.1 Mc.	Core on 1st Video IF Transformer T56 for maximum output
25.3 Mc.	Core on Converter Coil L8 for maximum output
27.9 Mc.	Core on trap coil L55 for minimum output

6. Disconnect signal generator and VTVM.

7. Connect sweep generator (frequency 25 Mc., sweeping 10 Mc.) using a .005 Mfd. capacitor to pin 1 of 3rd Video IF Amplifier - 6BC5.

8. Connect oscilloscope to junction of diode load resistor R145 - 3900 ohm and coil L58.

9. Adjust primary (top core) and then secondary (bottom core) of IF Bandpass T58 to obtain curve shown in Figure 8. (Both cores adjusted from bottom of transformer using hex end of special alignment tool).

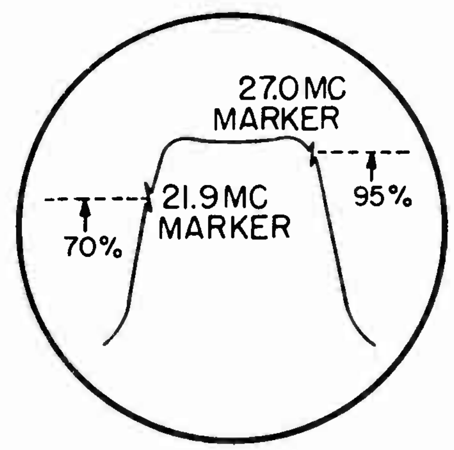


FIGURE 8 - IF BANDPASS RESPONSE

10. Disconnect Sweep Generator from 3rd IF Grid and connect it to the Jig Shield on the Converter Tube. Loosely couple signal generator at this point for markers.

11. Observe IF Response Curve and if necessary adjust IF Transformer Cores slightly to obtain response curve shown in Figure 9. Keep oscilloscope gain high enough to prevent overload of the receiver as overload will distort the curve.

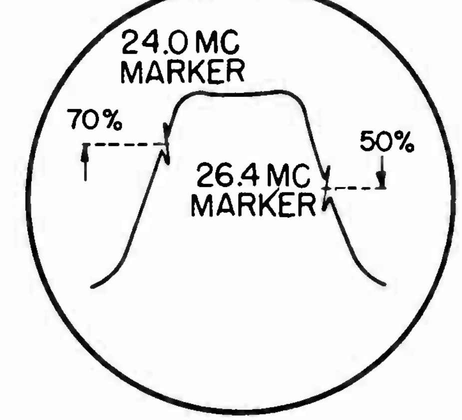


FIGURE 9 - OVERALL IF RESPONSE

SOUND TAKE-OFF & 4.5 MC. TRAP ALIGNMENT

1. Connect a 4.5 Mc. sweep generator having a 250 Kc. sweep through .005 Mfd. to pin 7 of video detector - 6AL5. Loosely connect signal generator for use as markers.

2. Connect oscilloscope to limiter grid resistor R104 - 47M through a 270M isolating resistor. Adjust trap core L56 until 4.5 Mc. marker is centered at the peak of the response curve. See Figure 10.

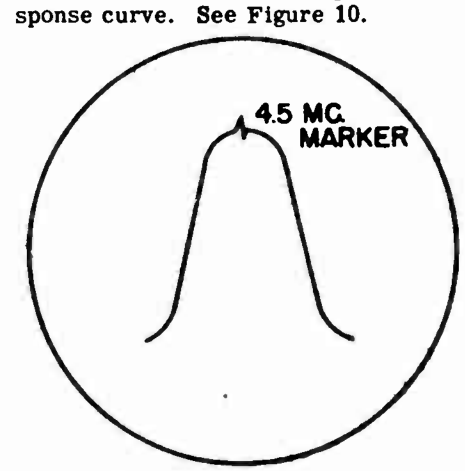


FIGURE 10 - SOUND IF RESPONSE

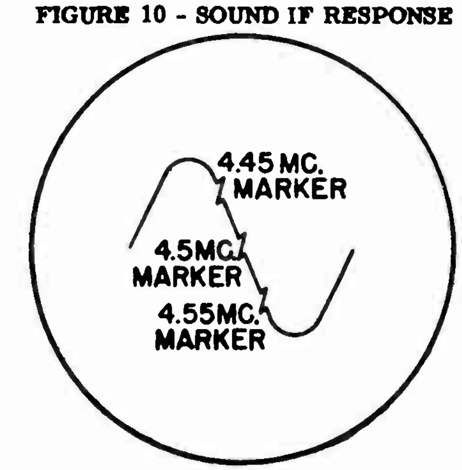


FIGURE 11 - SOUND DISCRIMINATOR RESPONSE

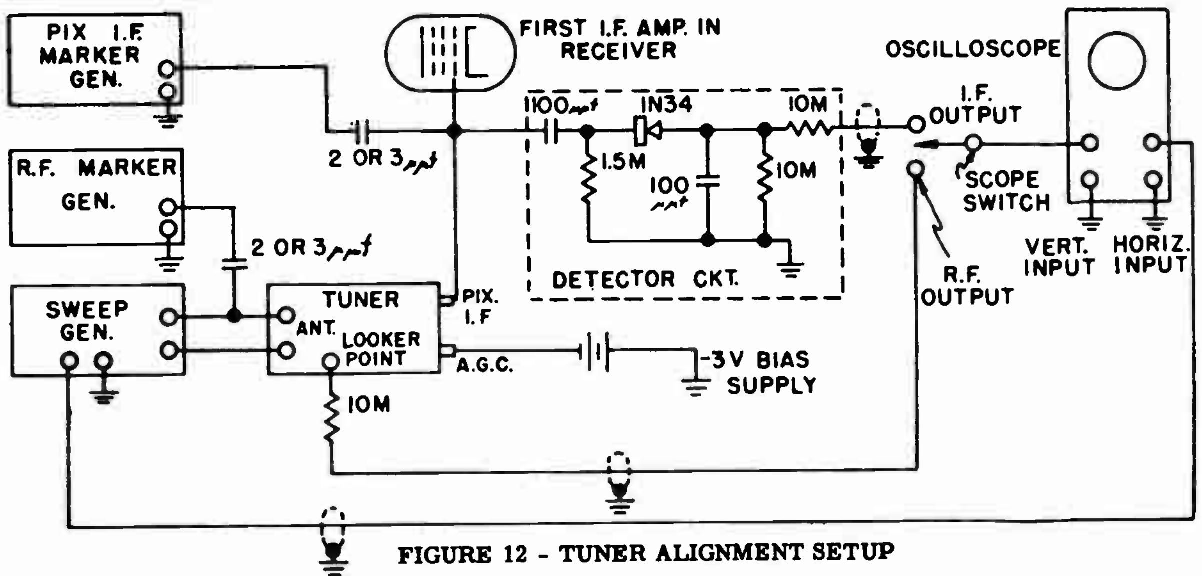


FIGURE 12 - TUNER ALIGNMENT SETUP

SOUND DISCRIMINATOR ALIGNMENT

1. Connect oscilloscope across the Volume Control.

2. Adjust the cores of the discriminator transformers T52 and T53 until the discriminator curve corresponds to that in Figure 11. Note especially that:

   (a) 4.5 Mc. marker is exactly in the center of the curve.
   (b) The curve is linear between the outside two markers.
   (c) The amplitude is the greatest obtainable.

R F TUNER ALIGNMENT

NOTES ON TUNER ALIGNMENT SETUP

In reference to Figure 12, the following precautions should be taken in making the equipment setup.

1. The detector circuit should be so constructed as to maintain leads as short as possible. Connection of the detector circuit to the 1st IF grid terminal (see Fig. 12 for location) should also be made with short leads.

2. Shielded leads should be used in making the following connections to reduce hum and synchronous voltage pick-up.

   (a) The lead for observation of the RF response from the scope isolating resistor (10,000 ohms located at the tuner "looker point") to the RF output switch position of the scope switch.
   (b) The connection from the IF detector circuit output to the IF switch position of the scope switch.
   (c) The connection from the sweep generator to the horizontal input of the scope. (Use externally generated sweep instead of internal oscilloscope sweep in order to obtain synchronization).

3. The single pole double throw "Scope Switch" should be located at the vertical input terminals of the scope. This switching arrangement will permit observation of either the IF response or the overall RF response. The aforementioned positions will be referred to in subsequent text as the "IF" and "RF" positions respectively.

4. The marker generator coupling condenser should be as small a value as possible to prevent any effect on tuner response, but must be large enough to permit easy observation of markers on either the IF response or overall RF response. (Approximately 2 or 3 MMF should be satisfactory in most cases).

5. For all tuner alignment tests which are outlined in this text, remove the second IF amplifier tube or bypass its plate circuit with approximately 1000 MMF to prevent coupling back from the receiver IF system.

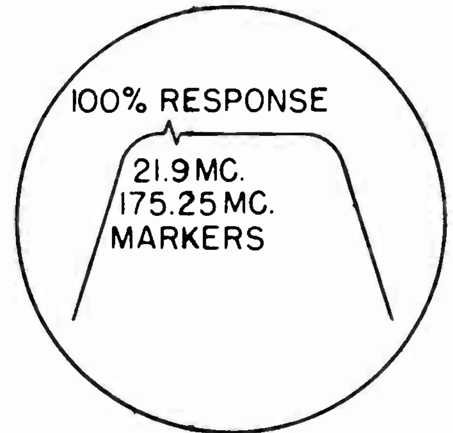
6. In all of the following tests the oscilloscope vertical gain should be as close to maximum gain as possible, consistent with hum and synchronous voltage interference limitations. This precaution will allow the use of low levels from RF sweep Generator and increase the visibility of IF and RF markers.

OSCILLATOR ALIGNMENT

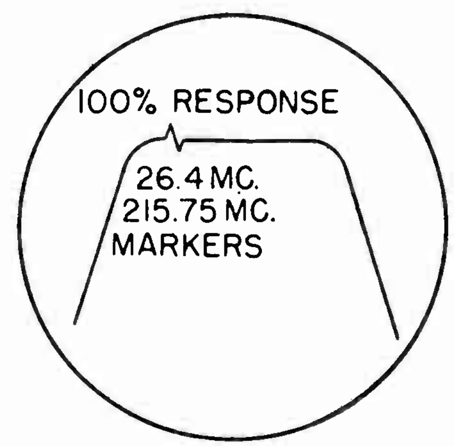
In making adjustments of the oscillator alignment it should be noted that any change in the setting of the high band oscillator trimmer will also effect the low band oscillator tuning, however, because of switching, the adjustment of the low band oscillator trimmer will not affect high band oscillator tuning. Also, there is a slight shift of oscillator frequency in the high band position only when the bottom cover is removed.

High Band Oscillator Alignment

1. Remove the bottom cover and rotate the band switch to the high band position.
2. Rotate variable capacitor to maximum capacity position (fully counterclockwise position of tuning control knob).
3. Tune sweep generator to channel 7 and set scope switch to IF output position.
4. Inject 175.25 Mc. and 21.9 Mc. markers.
5. With a non-metallic pick vary the turns spacing on the high band oscillator coil L9 until markers coincide (squeezing the coil lowers the oscillator frequency and spacing the turns farther apart raises oscillator frequency.



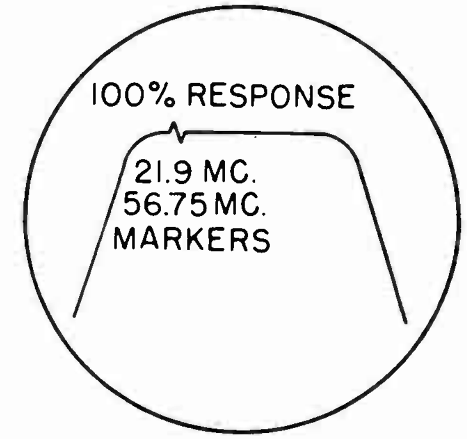
6. Replace bottom cover and check for shift of markers. If there is a shift remove the bottom cover and compensate by re-adjusting L9 as necessary. Repeat until markers coincide with bottom cover in place.
7. Rotate variable capacitor to minimum capacity (fully clockwise position of tuning control knob).
8. Tune sweep generator to channel 13.
9. Inject 215.75 Mc. and 26.4 Mc. markers.
10. With bottom cover in place, adjust oscillator grid trimmer C23 to make markers coincide.



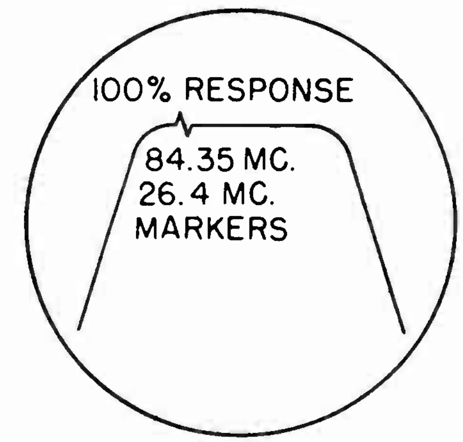
11. Repeat steps one through ten until proper end frequencies are reached at maximum and minimum capacity settings.

Low Band Oscillator Alignment

12. Remove bottom cover, turn band switch to low band position and rotate variable capacitor to maximum capacity (tuning control knob fully counterclockwise).
13. Tune sweep generator to channel 2.
14. Inject 56.75 Mc. and 21.9 Mc. markers.
15. Using a non-metallic pick adjust the spacing between turns on the low band oscillator coil L9 until the markers coincide.



16. Rotate the variable capacitor to minimum capacity (tuning control knob fully clockwise).
17. Tune sweep generator to channel 6.
18. Inject 84.35 Mc. and 26.4 Mc. markers.
19. Adjust oscillator plate trimmer C26 to make markers coincide.
20. Replace bottom cover and recheck in steps 12-19.



21. Recheck all four oscillator frequencies as in steps 1-19.

R. F. PASSBAND ALIGNMENT

1. If only the RF Passband is being aligned it is advisable to check oscillator coverage as noted under Oscillator Alignment step 21 above.
2. Remove bottom cover and turn band switch to high band position.
3. Rotate tuning control so that pointer is at channel 7 on the dial calibration.
4. Tune sweep generator to channel 7. Set scope switch to the IF output.
5. Inject 175.25 Mc. and 26.4 Mc. markers and adjust tuning control so the markers coincide. Leave tuning control at this setting for the remainder of channel 7 adjustment.

6. Change scope switch to the RF output.
7. Check that the RF response curve is similar to those shown in Figure 13.
8. If the response curve differs much from those shown in Figure 13, adjust the inductance and coupling of the high band RF plate coil L3, the high band mixer grid coil L4, and the high band antenna coil L1, for proper band width and symmetry. In determining the band width, it will be necessary to switch the marker generator alternately between channel 7 picture carrier (175.25 Mc.) and sound carrier (179.75 Mc.).
9. The high band RF plate coil L3 and the high band mixer grid coil L4 are properly adjusted when a slight variation in the inductance of either coil will result in a frequency shift of the entire response with no noticeable narrowing of the band width.
10. The high band antenna coil L1 is properly adjusted when a slight variation of its inductance will cause both peaks to rock slightly. If only one peak moves, the high band antenna coil L1 is staggered away from the center of the passband.
11. The inductance of these coils (L1, L3, L4) is varied by pushing the coil on or off the brass stud. Pushing the coil on the stud will raise the frequency and pushing the coil off the stud will lower the frequency.
12. The band width of channel 7 interstage transformer (L3, L4) is controlled by dressing the ground leads of these coils past the cut out in the RF shield plate (see Fig. 13). When both leads cross the cutout the greater separation of peaks occurs. For maximum gain the band width should be adjusted so that the response is no greater than that required to keep the sound and picture carrier frequency markers on the peaks of the overall RF curves.
13. Replace tuner bottom cover and check RF passband response.
14. If necessary, remove bottom cover and make slight compensating adjustments.
15. With the bottom cover in place, rotate the tuning control knob so that the pointer indicates channel 13.
16. Tune sweep generator to channel 13 and change scope switch to IF output.
17. Inject 215.75 Mc. and 21.9 Mc. markers and adjust tuning control so markers coincide. Leave tuning control as set for remainder of channel 13 adjustments.
18. Change scope switch to RF output position, if RF response differs noticeably from the curves in Figure 14. (The antenna trimmer C5), the RF plate trimmer (C10) and mixer grid trimmer (C15) must be adjusted for proper passband and maximum amplitude of response.
19. Return tuner and sweep generator to channel 7 and check response as in part 13 above. A slight compensation of coils L1, L3, and L4 may be necessary.
20. Recheck passband on both channel 7 and channel 13, compromising adjustments for tilt as necessary until satisfactory High Band RF passband responses are obtained.

Low Band RF Alignment

21. Rotate band switch to Low Band position.
22. Turn the tuning control knob so that the pointer indicates channel 2 on the dial.
23. Set the scope switch to the IF output position and inject 59.75 Mc. and 21.9 Mc. markers. Adjust the tuning control so the markers coincide. Leave the tuning control as set for the remainder of the channel 2 adjustments.
24. Change the scope switch to the RF output position.
25. If the desired passband response is not obtained (as shown in Fig. 14) the Low Band RF coil L5, the low band mixer coil (L6), and the low band antenna transformer (T1) secondary must be adjusted until the desired passband is obtained.
26. When the low band RF coil (L5) and the low band mixer coil are aligned slight variation in the inductance of either should cause no noticeable narrowing of the passband.
27. When the secondary of the low band antenna transformer is properly adjusted, a slight variation in its inductance should cause both peaks to rock slightly. If only one peak moves, the T1 secondary is staggered away from the center of the double tuned circuit response.
28. The low band mutual coil (L7) varies the band width of the interstage coupling circuit. Squeezing the turns together broadens the band width and separating the turns narrows the band width. The band width should be adjusted so that it is not greater than that required to keep both the picture carrier and sound carrier markers at the peaks of the response curve.
29. Replace the tuner bottom cover and check passband response.
30. Remove bottom cover and make any compensating adjustments as needed.
31. With the bottom cover in place, rotate the tuning control knob to align the pointer with channel 6 on the dial.
32. Tune the sweep generator to channel 6 and change the scope output switch to the IF output position.
33. Inject 83.25 Mc. and 26.4 Mc. markers and adjusting tuning control to make the markers coincide. Leave the tuning control at this setting for the remainder of the channel 6 adjustments.
34. Change the scope switch to the RF output position.
35. Check the response curve. If not as desired, remove the bottom cover and slightly readjust the inductance of the low band RF coil L5, the low band mixer coil (L6), the low band mutual coil (L7) and the secondary of the low band antenna transformer (T1) as necessary, keeping in mind that these adjustments must be compromised with those made for channel 2 in steps 21-30 above.
36. Recheck passband on channel 2 and channel 6 and re-adjust as necessary to obtain acceptable passband on both channel 2 and 6.

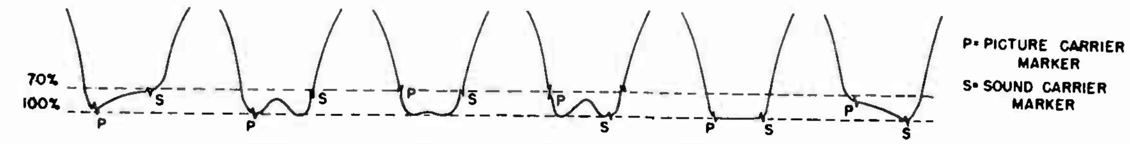
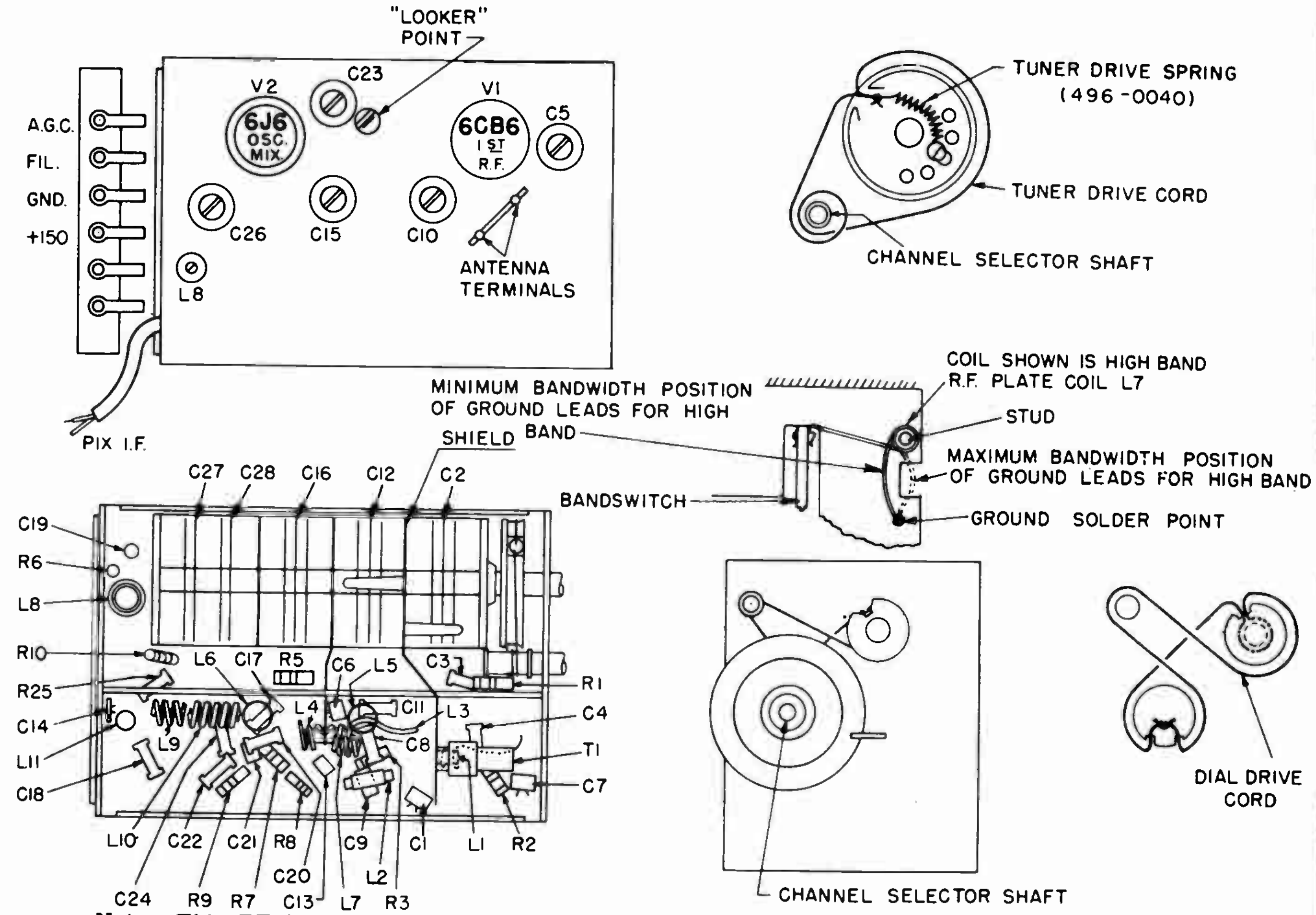


FIGURE 13 - ACCEPTABLE RF RESPONSE CURVES FOR TUNER



Note: This RF tuner has been thoroughly tested at the factory and should provide trouble-free reception throughout the life of the chassis. However, if service other than alignment is required, return the complete tuner to the factory for replacement.

FIGURE 14 - TUNER LAYOUT

GENERAL DESCRIPTION

Sylvania Model 1110X is a direct viewing television receiver which provides reception of the 12 commercial television channels 2 through 13. The television picture is reproduced on a round 16 inch, electromagnetically deflected, tetrode type picture tube.

The 1-329 chassis used in Model 1110X very closely resembles the 1-381 chassis described in Bulletin 9-15.

Circuitwise, chassis 1-329 differs from the 1-381 in that a new type RF Tuner Unit is used and the High Voltage Scan circuit has been modified to eliminate the Heater Isolation Transformer for the 6W4GT Damper tube V19.

The 1-329 chassis uses 6SN7GT tubes for V12 and V17, but the associated circuits remain the same as those of the 1-381 where V12 and V17 are 12AU7 tubes.

Front panel controls on the 1110X are On-Off & Volume, Tuning, and Brightness. No Band Switch is needed on this model because of the continuous tuning feature of the new type RF Tuner Unit.

LOW BAND ALIGNMENT

1. Tune sweep generator to channel 6. Rotate tuner drive shaft to channel 6. (Correct position may be determined by replacing dial and knob on tuner. Desired channel number should be vertical at top of dial.)
2. Load T2-C, Low Band RF coil (touch C12 stator plate, as described in 6 of "Notes on Tuner Alignment"), adjust C9, Low Band mixer trimmer, until the single peaked response curve falls midway between the RF carrier markers (Fig. A).

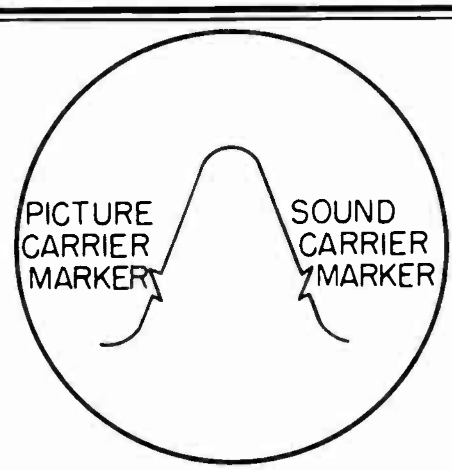


FIGURE A

3. Load T2-B, Low Band mixer coil (touch C13 stator plate), and adjust C8, Low Band RF trimmer, until the single peaked response curve falls midway between the RF carrier markers (Fig. A).

4. Without loading, adjust C15, Low Band oscillator trimmer, until the IF marker is almost coincident with the sound marker and both sound and picture markers are above the 70% level. (Fig. B).

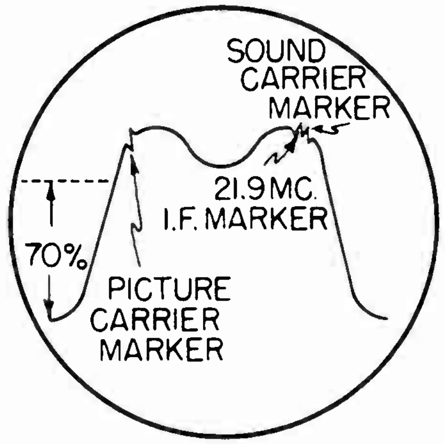


FIGURE B

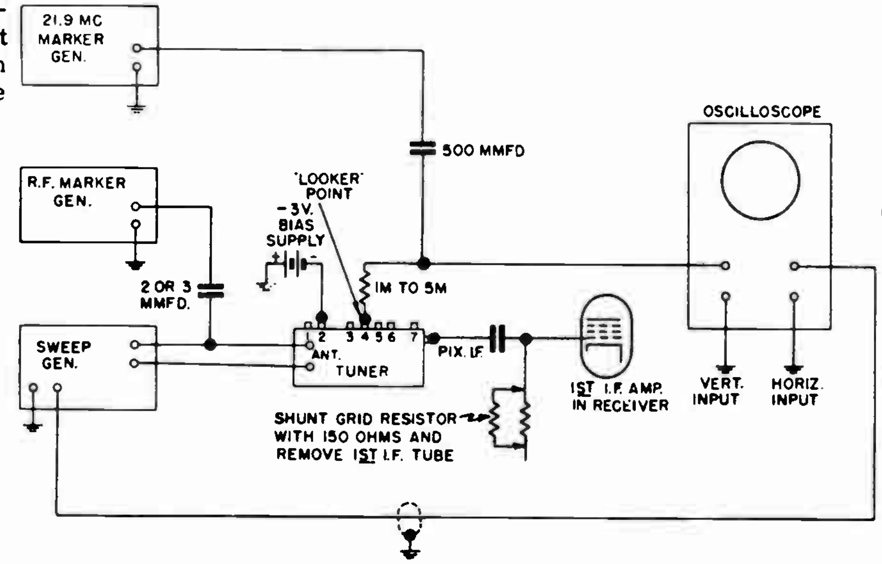


FIGURE 19 - TUNER ALIGNMENT SETUP

5. Tune sweep generator to channel 2. Rotate tuner drive shaft to channel 2 position.
6. Load T2-C, Low Band RF coil (touch C12 stator plate), and, with a non-metallic pick, vary spacing on T2-B, Low Band mixer grid coil, until the single peaked response curve is midway between the RF carrier markers (Fig. A).
7. Repeat step 6, only load T2-B, Low Band mixer coil (touch C13 stator plate), and adjust T2-C, Low Band RF coil.
8. Without loading, adjust turns on T2-A, Low Band oscillator coil, so the IF marker nearly coincides with the sound marker. (Fig. B)
9. Adjust spacing between T2-C, RF coil, and T2-B, mixer coil, to obtain a peak to valley ratio of precisely 30%. Decreasing the spacing will deepen the valley.
10. Repeat steps 2 to 9 to obtain best possible adjustments.

HIGH BAND ALIGNMENT

1. Adjust sweep generator and tuner drive shaft to channel 13.

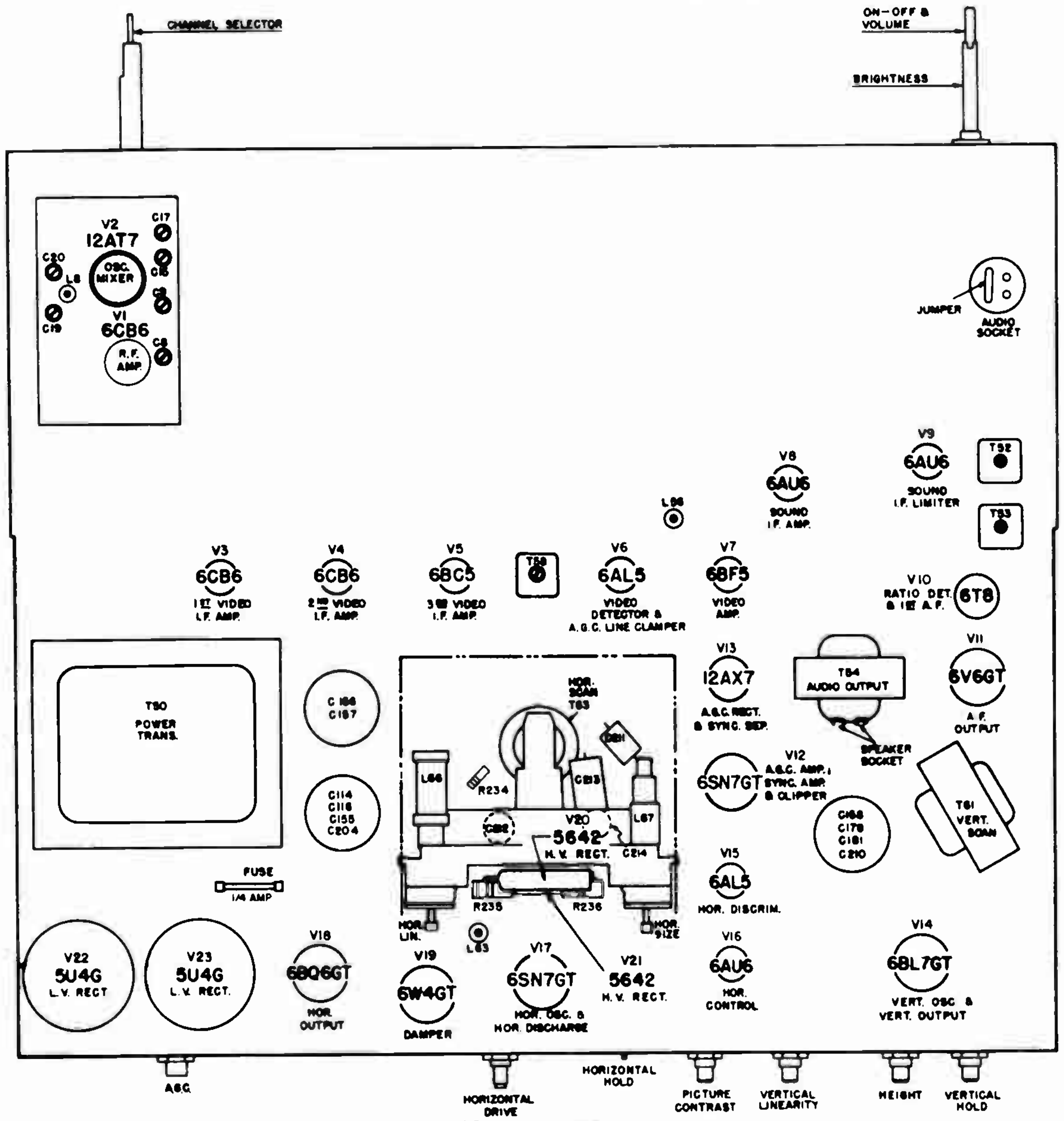


FIGURE 18 - CHASSIS TOP LAYOUT

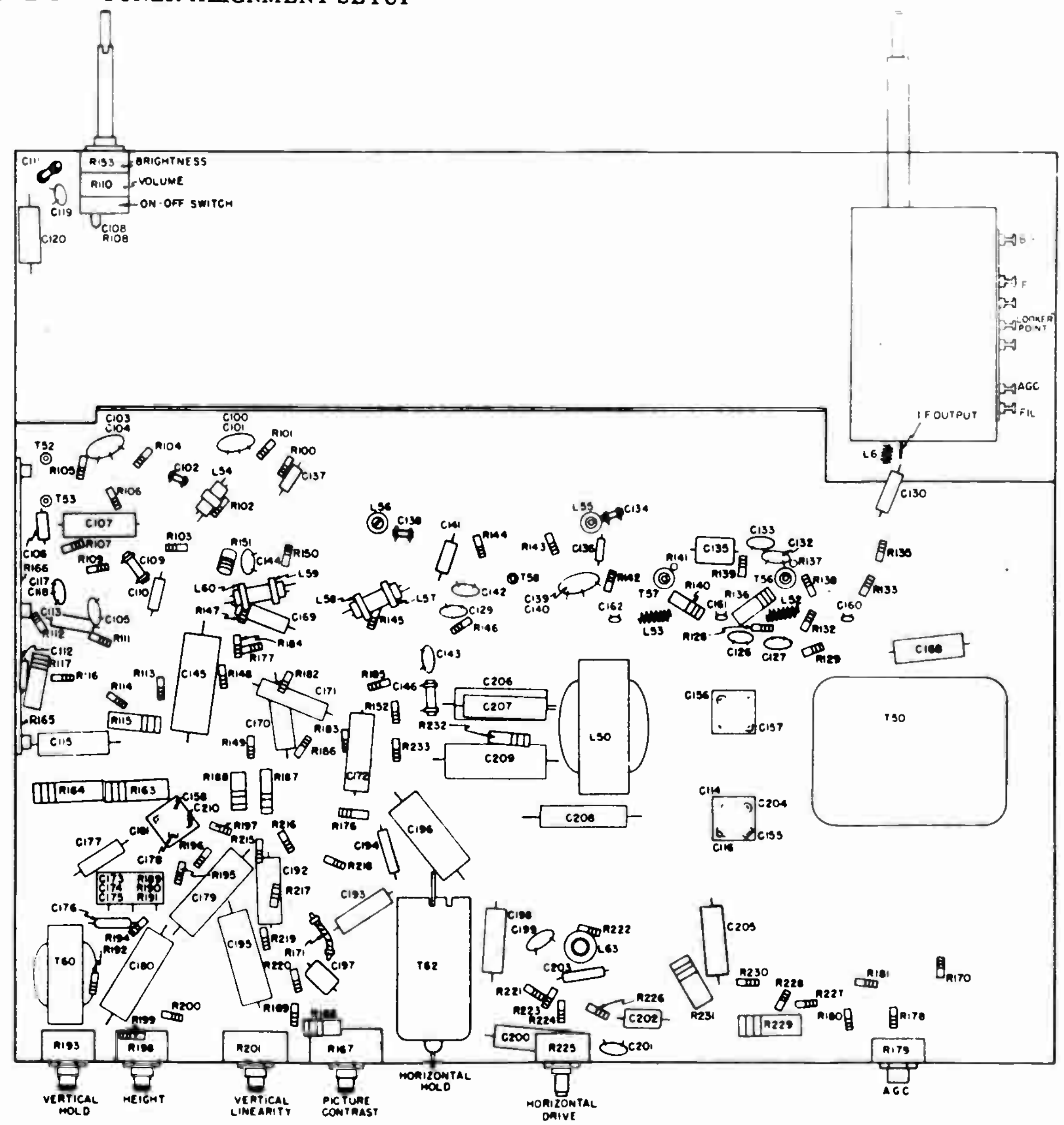


FIGURE 20 - CHASSIS BOTTOM LAYOUT

2. Load L3, High Band RF coil (touch #7 switch lug as described in 6 of "Notes on Tuner Alignment") and adjust C20, High Band mixer trimmer so the single peaked response curve falls midway between the RF carrier markers (Fig. A).

3. Repeat step 2, only loading L4, High Band mixer coil (touch #4 switch lug) and adjusting C19, High Band RF trimmer.

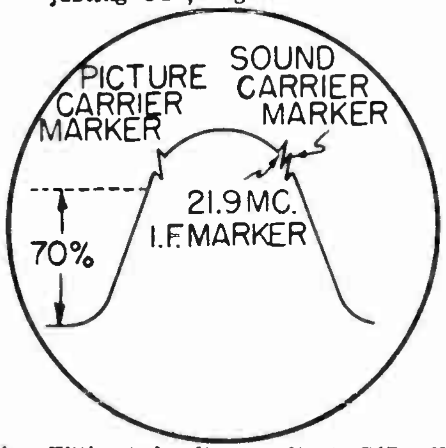


FIGURE C

4. Without loading, adjust C17, High Band oscillator trimmer, so the IF marker and sound carrier marker are coincident. (Fig. C)

Should either carrier, or carrier markers, fall below the 70% level, increase coupling between the double tuned coils by decreasing the angle made by L4, mixer grid coil strap and the ground leg of L3, the RF coil (see Fig. 21).

5. Adjust sweep generator and tuner drive shaft to channel 7.

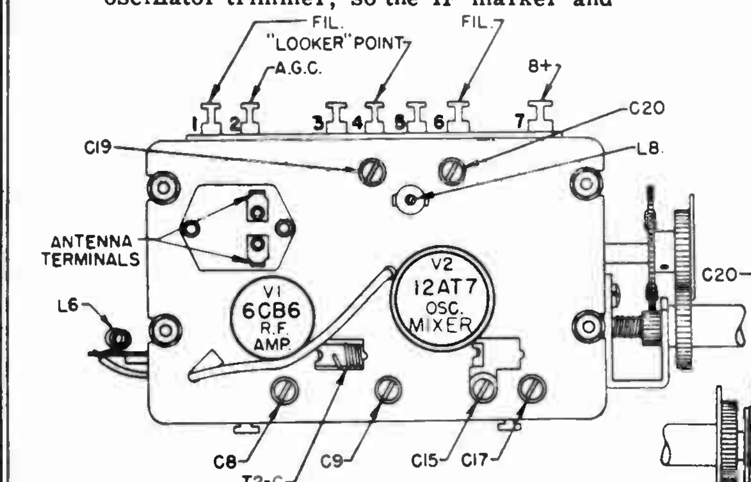
6. Spread or compress L5, High Band oscillator coil, turns as necessary to make the sound carrier marker and IF marker coincide. Load L3, High Band RF coil (touch #7 switch lug), and bend L4, mixer coil strap slightly in or out as necessary to make the mixer grid coil response curve fall about midway between the RF carrier markers (Fig. A).

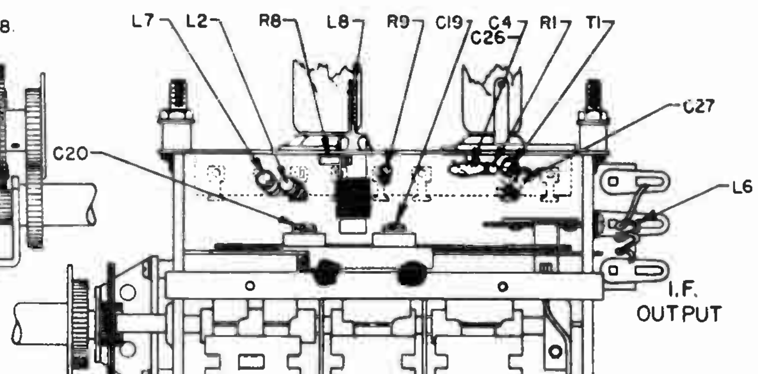
7. Repeat step 6, only loading L4, mixer coil (touch #4 switch lug), and adjusting L3, RF coil, turns so its response is at same frequency as the mixer response.

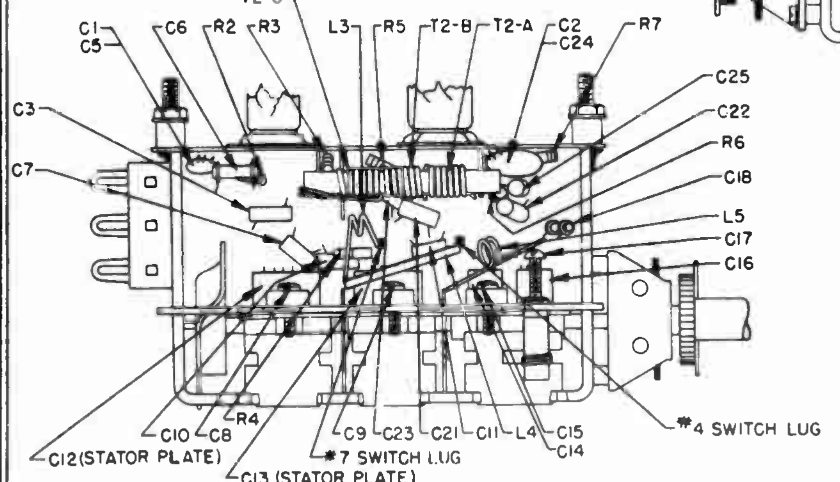
8. Without loading, adjust turns on L5, High Band oscillator coil, so the IF marker and sound carrier marker almost coincide (Fig. B).

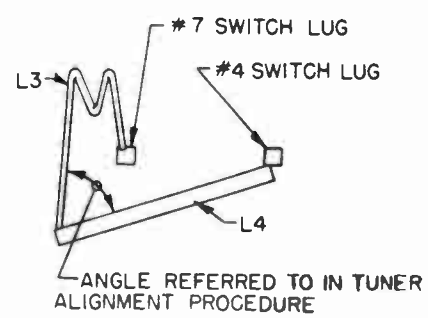
9. If peak to valley ratio on channel 7 is more or less than 30%, change mixer coil-RF coil angle (Fig. 21) as necessary to achieve this optimum coupling.

10. Repeat steps 1 to 8 to obtain optimum adjustments.









NOTE: This RF tuner has been thoroughly tested at the factory and should provide trouble-free reception throughout the life of the chassis. However, if service other than alignment is required, return the complete tuner to the factory for replacement.

FIGURE 21 - TUNER LAYOUT

WAVEFORMS

Note 1: The terms "Horizontal," "Vertical" or "60 cps sine wave" refer to the oscilloscope sweep employed.

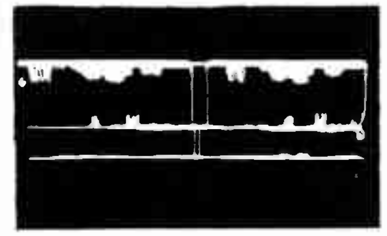
Note 2: All waveforms are taken with the oscilloscope horizontal sweep direction from left to right and with upward deflection corresponding to positive polarity.

Note 3: In some instances the waveforms obtained will not be identical with those shown, due to the electrical characteristics of the oscilloscope used.

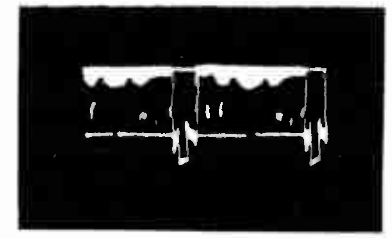
Note 4: All waveforms are measured with respect to chassis unless otherwise indicated.

Note 5: Contrast maximum unless otherwise indicated.

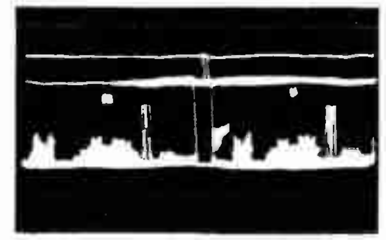
*The peak to peak (P/P) voltages of these waveforms are dependent on the depth of modulation of the transmitted signal; voltages shown are obtained when modulation is approximately 90 percent.



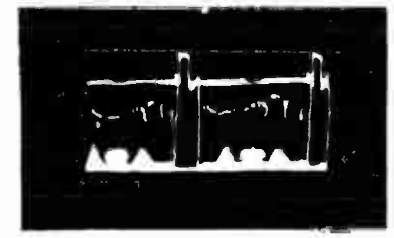
*6BF5 (V7) Video Amplifier Control Grid (Pins 1 and 7) 3.5 Volts P/P Vertical



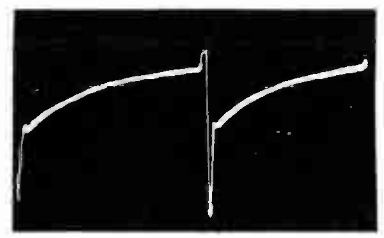
*6BF5 (V7) Video Amplifier Control Grid (Pins 1 and 7) 3.5 Volts P/P Horizontal



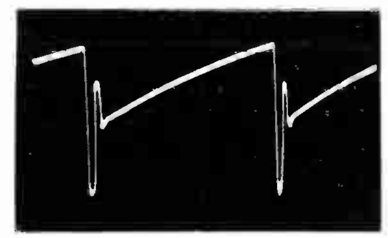
*6BF5 (V7) Video Amplifier Plate (Pin 5) 55 Volts P/P Vertical



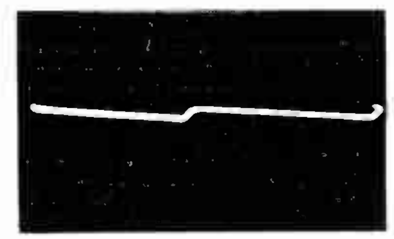
*6BF5 (V7) Video Amplifier Plate (Pin 5) 55 Volts P/P Horizontal



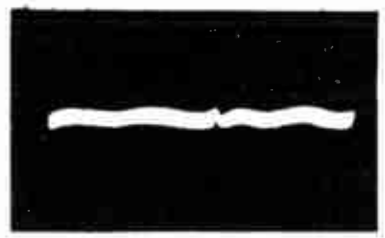
6BL7GT (V14) Vertical Oscillator Control Grid (Pin 1) 600 Volts P/P Vertical



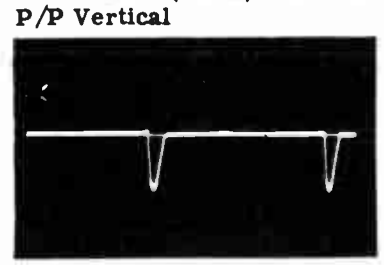
6BL7GT (V14) Vertical Oscillator Plate (Pin 2) 235 Volts P/P Vertical



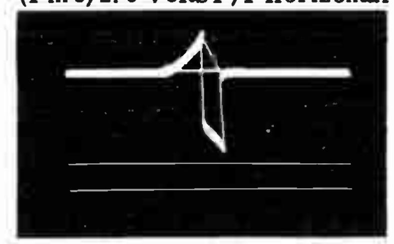
12AX7 (V13) Hor. Sync. Sep. and AGC Rectifier Cathode (Pin 8) 2.6 Volts P/P Horizontal



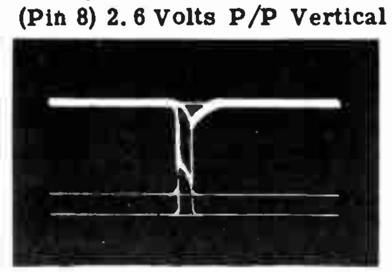
12AX7 (V13) Hor. Sync. Sep. and AGC Rectifier Cathode (Pin 8) 2.6 Volts P/P Vertical



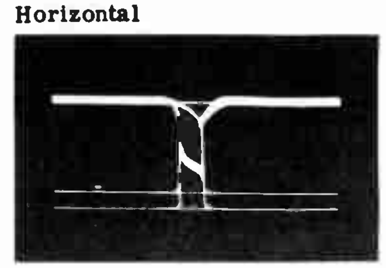
12AX7 (V13) Hor. Sync. Sep. Plate (Pin 6) 37 Volts P/P Horizontal



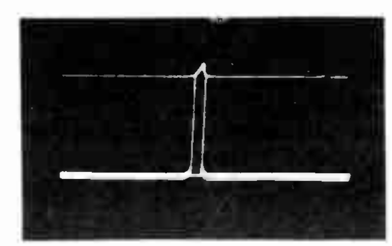
12AX7 (V13) Hor. Sync. Sep. Plate (Pin 6) 37 Volts P/P Vertical



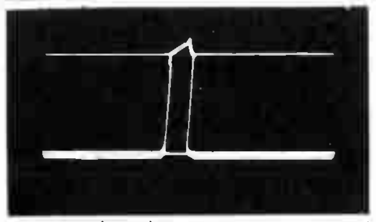
12AX7 (V13) Sync Separator Plate (Pin 1) 25 Volts P/P Vertical



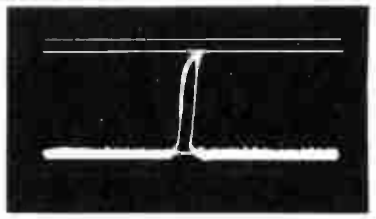
12AX7 (V13) Sync. Separator Plate (Pin 1) 25 Volts P/P 60 cps sine wave



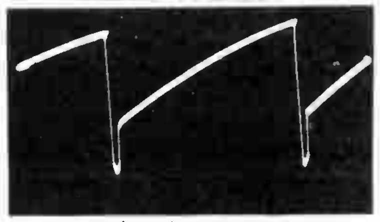
12AU7 (V12) Sync. Amp. and Clipper Plate (Pin 1) 110 Volts P/P Vertical



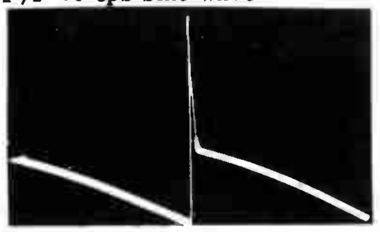
12AU7 (V12) Sync. Amp. and Clipper Plate (Pin 1) 110 Volts P/P 60 cps sine wave



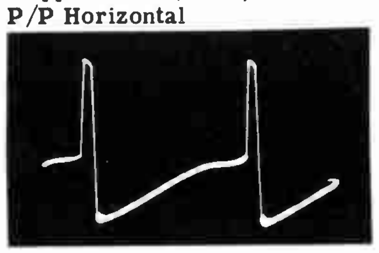
12AU7 (V12) Sync. Amp. and Clipper Plate (Pin 1) 100 Volts P/P Horizontal



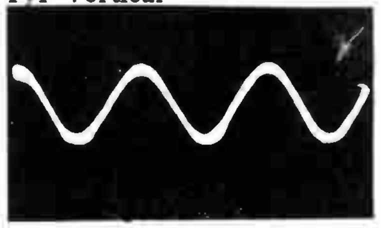
6BL7GT (V14) Vertical Output Control Grid (Pin 4) 95 Volts P/P Vertical



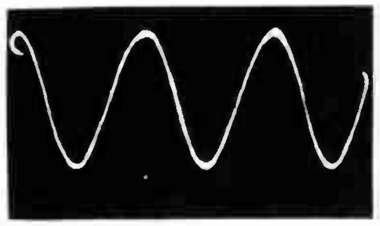
6BL7GT (V14) Vertical Output Plate (Pin 5) 830 Volts P/P Vertical



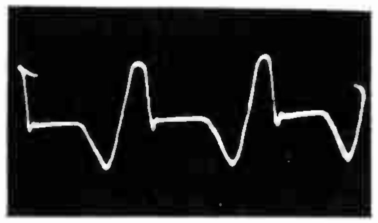
6AL5 (V15) Hor. Discriminator Plate (Pin 7) 70 Volts P/P Horizontal



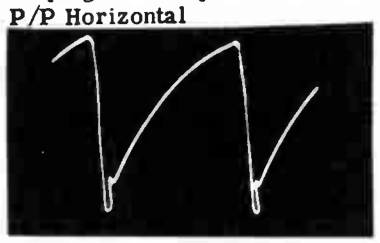
6AL5 (V15) Hor. Discriminator Plate to Plate (Pin 7 to Pin 2) Scope ground to pin 7 - 23 Volts P/P Horizontal



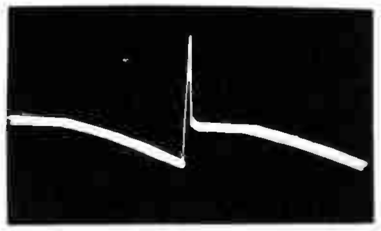
6AU6 (V16) Hor. Control Plate (Pin 5) 68 Volts P/P Horizontal



12AU7 (V17) Hor. Oscillator Plate (Pin 6) 95 Volts P/P Horizontal

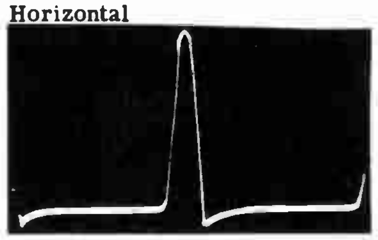


12AU7 (V17) Hor. Discharge Plate (Pin 1) 105 Volts P/P Horizontal

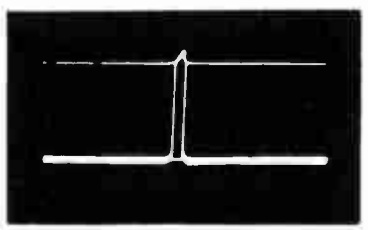


Vertical Yoke Coils (Test Point 1) 55 Volts P/P Vertical

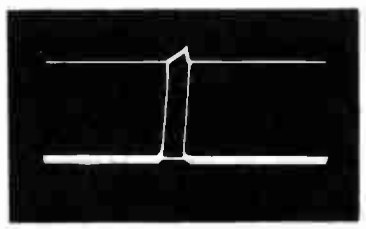
6W4GT Damper Cathode (Pin 3) 2000 Volts P/P Horizontal



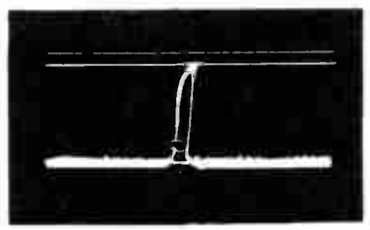
Waveform data in Bulletin 9-15 applies to chassis 1-329 except as shown here. This information replaces that given for 12AU7 and 6W4GT tubes.



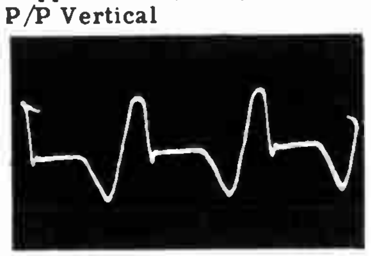
6SN7GT (V12) Sync. Amp. and Clipper Plate (Pin 2) 110 Volts P/P Vertical



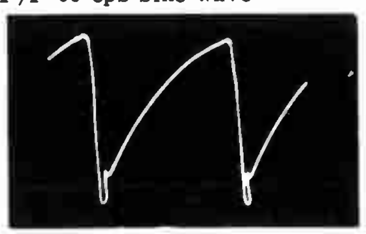
6SN7GT (V12) Sync. Amp. and Clipper Plate (Pin 2) 110 Volts P/P 60 cps sine wave



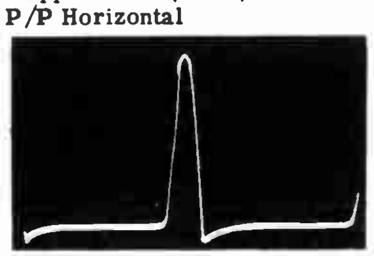
6SN7GT (V12) Sync. Amp. and Clipper Plate (Pin 2) 100 Volts P/P Horizontal



6SN7GT (V17) Hor. Oscillator Plate (Pin 5) 95 Volts P/P Horizontal



6SN7GT (V17) Hor. Discharge Plate (Pin 2) 105 Volts P/P Horizontal



6W4GT (V19) Damper Cathode (Pin 3) 1000 Volts P/P Horizontal

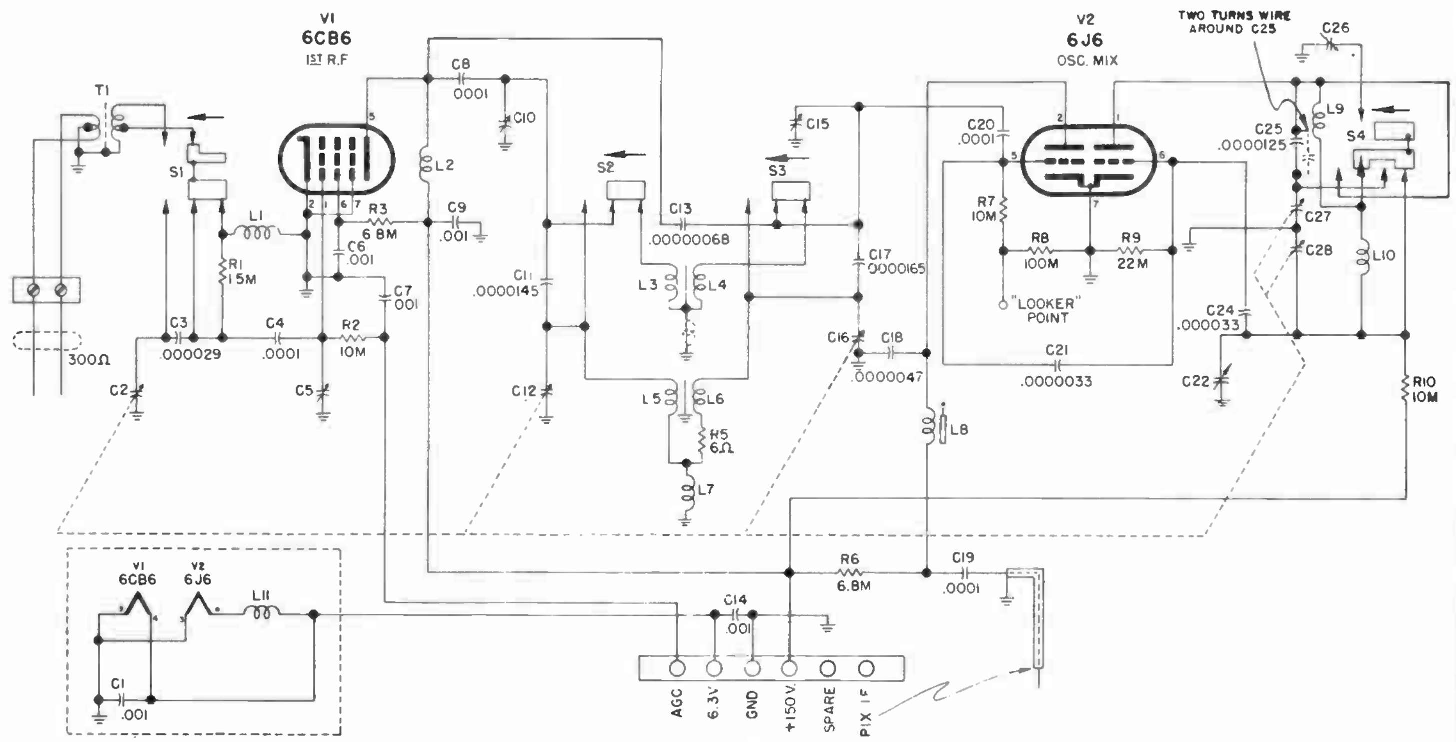


FIGURE 25 - R.F. TUNER FOR 1-381 CHASSIS

NOTE:
1. SWITCH SECTIONS 1-4 ARE PARTS OF A TWO POSITION SLIDE SWITCH. SWITCH SHOWN IN POSITION FOR HI BAND RECEPTION. ARROW INDICATES SWITCH DIRECTION FOR LO TV RECEPTION.

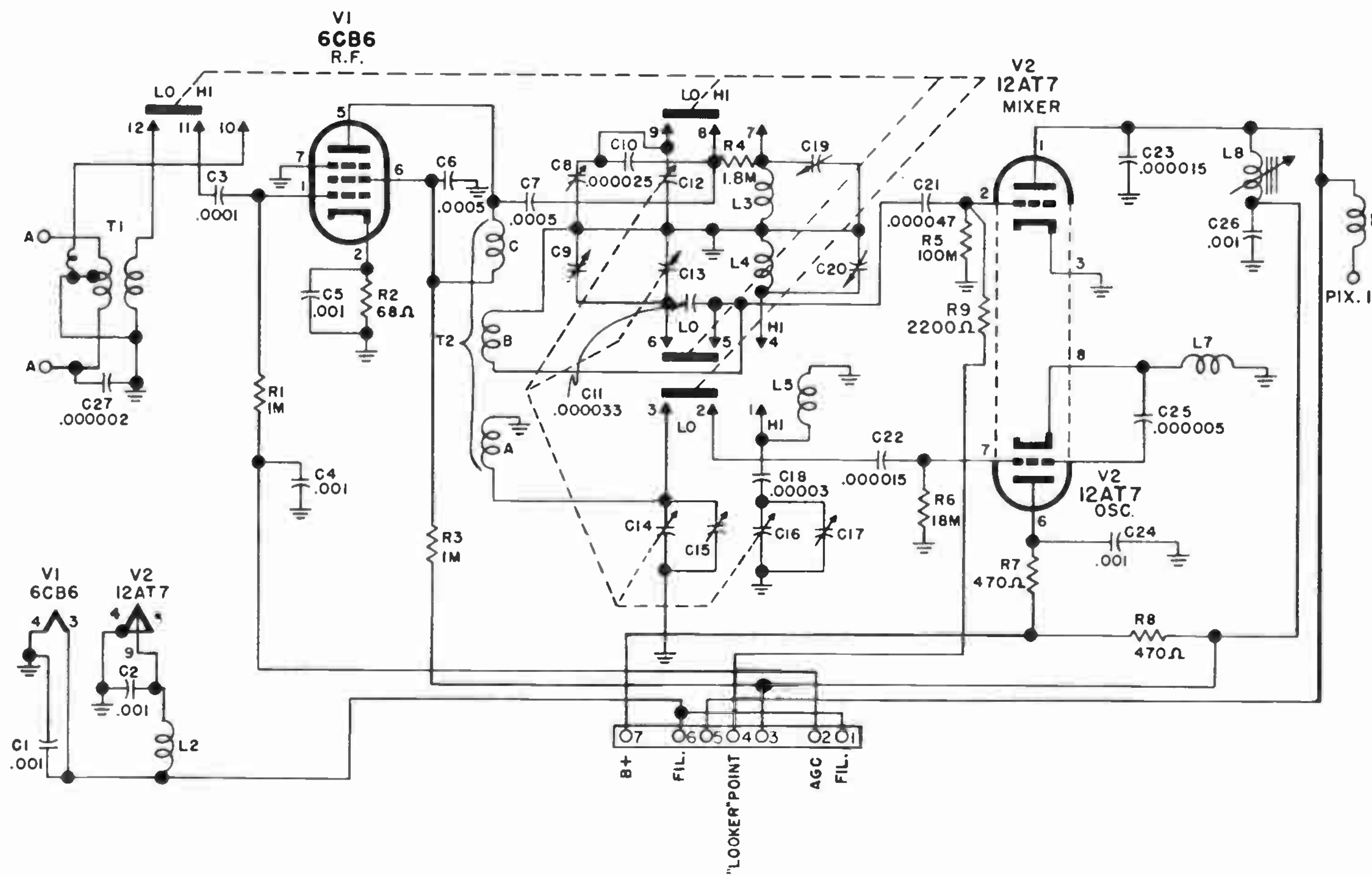
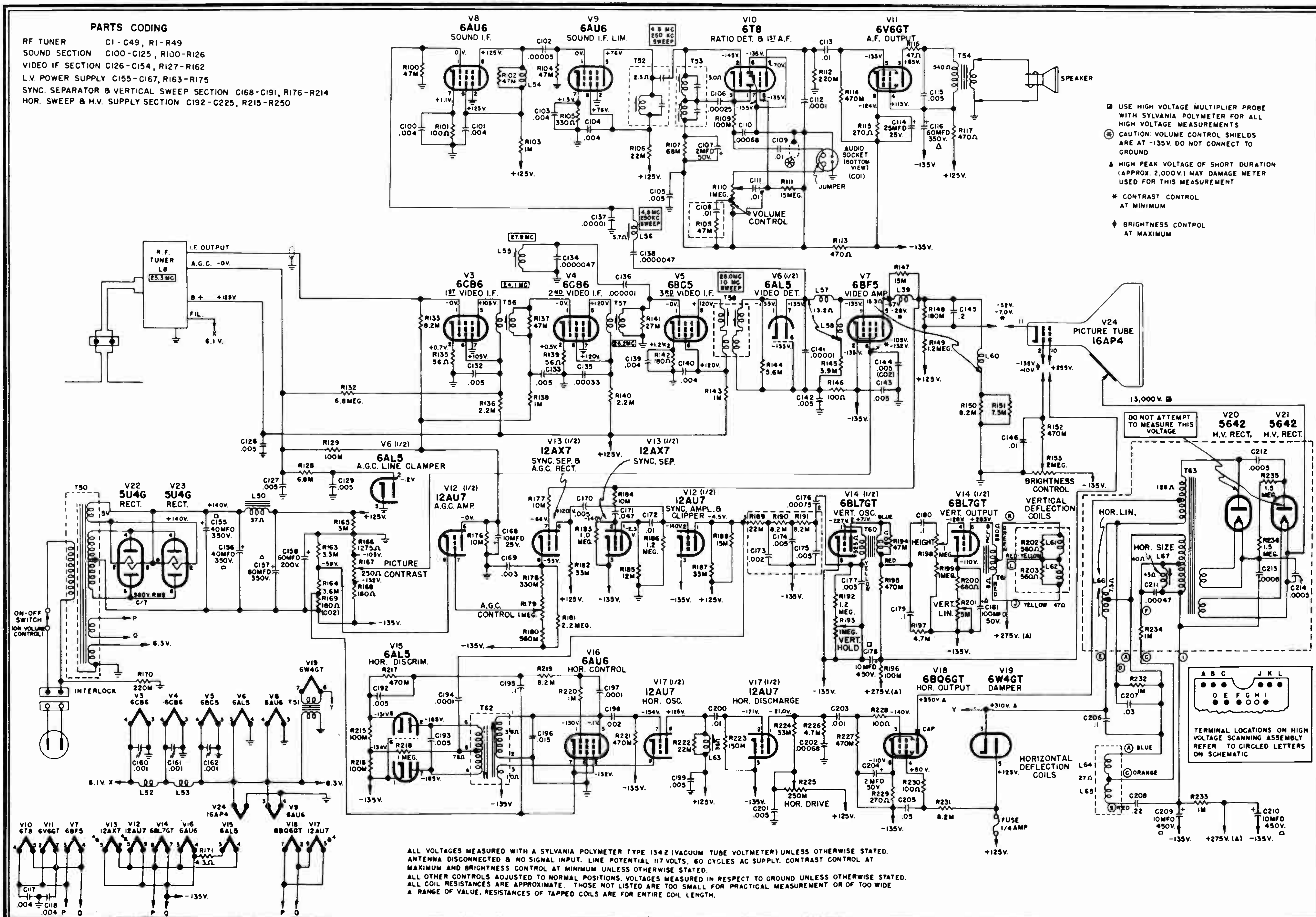
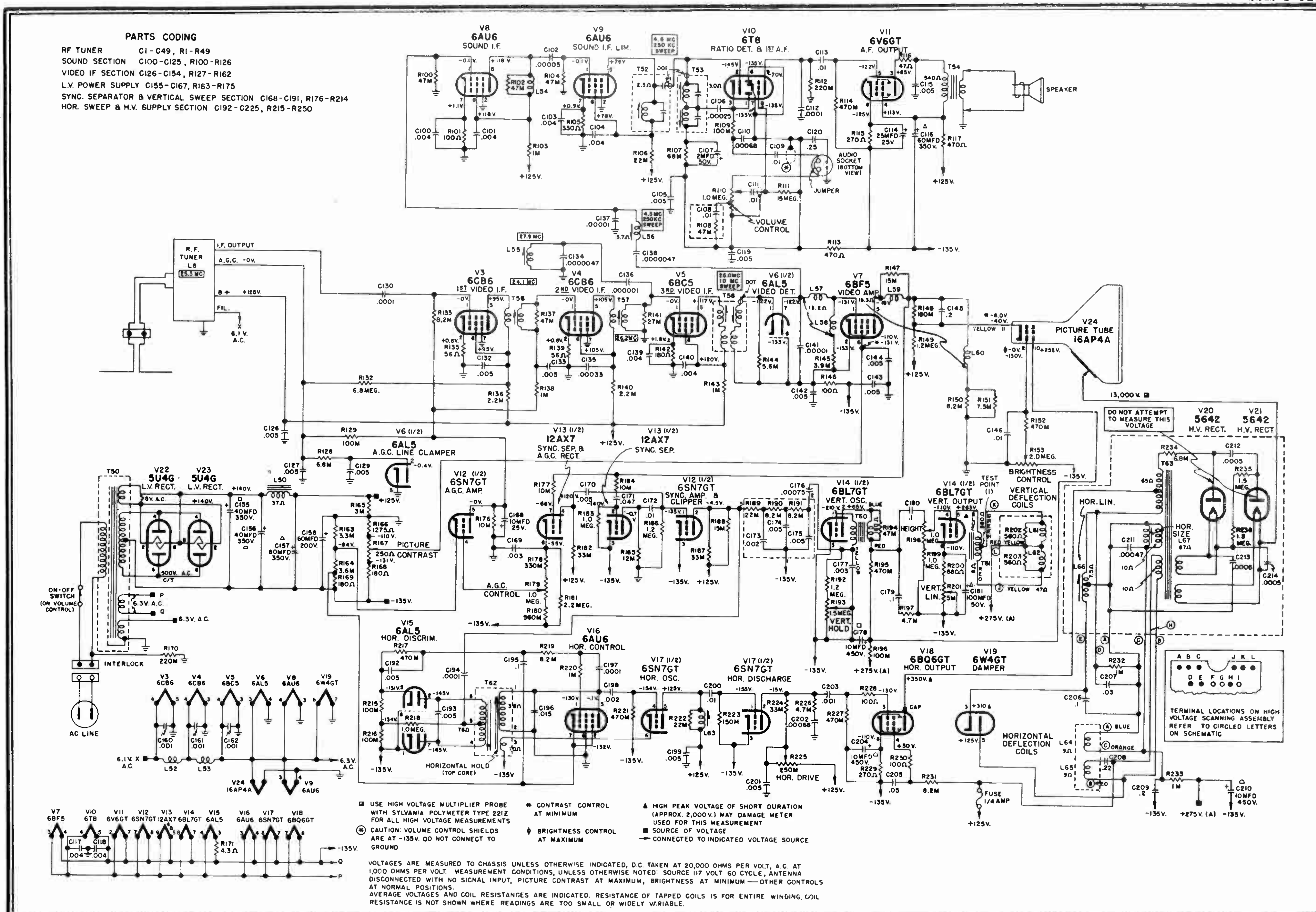


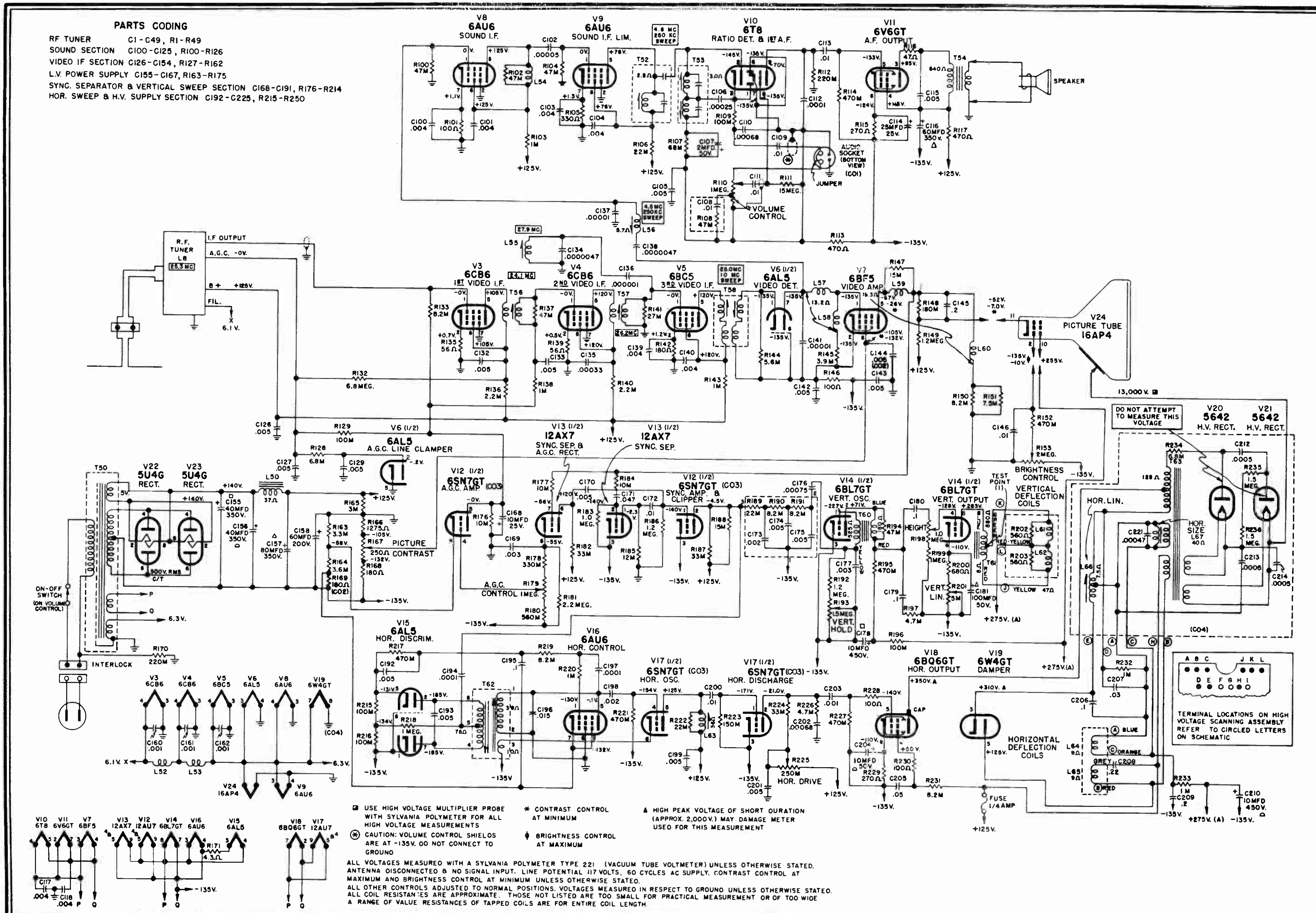
FIGURE 23 - R. F. TUNER SCHEMATIC FOR 1-329


PARTS CODING
RF TUNER C1-C49, R1-R49
SOUND SECTION C100-C125, R100-R126
VIDEO IF SECTION C126-C154, R127-R162
L.V. POWER SUPPLY C155-C167, R163-R175
SYNC. SEPARATOR & VERTICAL SWEEP SECTION C168-C191, R176-R214
HOR. SWEEP & H.V. SUPPLY SECTION C192-C225, R215-R250
V8 6AU6 SOUND I.F.
V9 6AU6 SOUND I.F. LIM.
V10 6T8 RATIO DET. & 1ST A.F.
V11 6V6GT A.F. OUTPUT
SPEAKER
AUDIO SOCKET (BOTTOM VIEW) (C01)
JUMPER
VOLUME CONTROL
USE HIGH VOLTAGE MULTIPLIER PROBE WITH SYLVANIA POLYMETER FOR ALL HIGH VOLTAGE MEASUREMENTS
CAUTION: VOLUME CONTROL SHIELDS ARE AT -135V. DO NOT CONNECT TO GROUND
HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 2,000V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT
CONTRAST CONTROL AT MINIMUM
BRIGHTNESS CONTROL AT MAXIMUM
R.F. TUNER L8
I.F. OUTPUT
A.G.C. -0V.
B+ +125V.
FIL.
V3 6CB6 1ST VIDEO I.F.
V4 6CB6 2ND VIDEO I.F.
V5 6BC5 3RD VIDEO I.F.
V6 (1/2) 6AL5 VIDEO DET.
V7 6BF5 VIDEO AMP.
V24 PICTURE TUBE 16AP4
13,000V.
DO NOT ATTEMPT TO MEASURE THIS VOLTAGE
V20 5642 H.V. RECT.
V21 5642 H.V. RECT.
V6 (1/2) 6AL5 A.G.C. LINE CLAMPER
V13 (1/2) 12AX7 SYNC. SEP. & A.G.C. RECT.
V13 (1/2) 12AX7 SYNC. SEP.
V12 (1/2) 12AU7 A.G.C. AMP
V12 (1/2) 12AU7 SYNC. AMPL. & CLIPPER
V14 (1/2) 6BL7GT VERT. OSC.
V14 (1/2) 6BL7GT VERT. OUTPUT
BRIGHTNESS CONTROL
VERTICAL DEFLECTION COILS
HOR. LIN.
HOR. SIZE
V22 5U4G RECT.
V23 5U4G RECT.
PICTURE CONTRAST
A.G.C. CONTROL
HEIGHT
VERT. LIN.
VERT. HOLD
ON-OFF SWITCH (ON VOLUME CONTROL)
INTERLOCK
V15 6AL5 HOR. DISCRIM.
V16 6AU6 HOR. CONTROL
V17 (1/2) 12AU7 HOR. OSC.
V17 (1/2) 12AU7 HOR. DISCHARGE
V18 6BQ6GT HOR. OUTPUT
V19 6W4GT DAMPER
HOR. DRIVE
HORIZONTAL DEFLECTION COILS
FUSE 1/4 AMP
TERMINAL LOCATIONS ON HIGH VOLTAGE SCANNING ASSEMBLY REFER TO CIRCLED LETTERS ON SCHEMATIC
ALL VOLTAGES MEASURED WITH A SYLVANIA POLYMETER TYPE 134Z (VACUUM TUBE VOLTMETER) UNLESS OTHERWISE STATED. ANTENNA DISCONNECTED & NO SIGNAL INPUT. LINE POTENTIAL 117 VOLTS, 60 CYCLES AC SUPPLY. CONTRAST CONTROL AT MAXIMUM AND BRIGHTNESS CONTROL AT MINIMUM UNLESS OTHERWISE STATED.
ALL OTHER CONTROLS ADJUSTED TO NORMAL POSITIONS. VOLTAGES MEASURED IN RESPECT TO GROUND UNLESS OTHERWISE STATED.
ALL COIL RESISTANCES ARE APPROXIMATE. THOSE NOT LISTED ARE TOO SMALL FOR PRACTICAL MEASUREMENT OR OF TOO WIDE A RANGE OF VALUE. RESISTANCES OF TAPPED COILS ARE FOR ENTIRE COIL LENGTH.


PARTS CODING
RF TUNER C1-C49, R1-R49
SOUND SECTION C100-C125, R100-R126
VIDEO IF SECTION C126-C154, R127-R162
L.V. POWER SUPPLY C155-C167, R163-R175
SYNC. SEPARATOR & VERTICAL SWEEP SECTION C168-C191, R176-R214
HOR. SWEEP & H.V. SUPPLY SECTION C192-C225, R215-R250
V8 6AU6 SOUND I.F.
V9 6AU6 SOUND I.F. LIM.
V10 6T8 RATIO DET. & 1ST A.F.
V11 6V6GT A.F. OUTPUT
SPEAKER
AUDIO SOCKET (BOTTOM VIEW)
JUMPER
VOLUME CONTROL
R.F. TUNER L6
I.F. OUTPUT
A.G.C. -0V.
V3 6CB6 1ST VIDEO I.F.
V4 6CB6 2ND VIDEO I.F.
V5 6BC5 3RD VIDEO I.F.
V6 (1/2) 6AL5 VIDEO DET.
V7 6BF5 VIDEO AMP.
V24 PICTURE TUBE 16AP4A
13,000 V.
DO NOT ATTEMPT TO MEASURE THIS VOLTAGE
V20 5642 H.V. RECT.
V21 5642 H.V. RECT.
V22 5U4G L.V. RECT.
V23 5U4G L.V. RECT.
V6 (1/2) 6AL5 A.G.C. LINE CLAMPER
V12 (1/2) 6SN7GT A.G.C. AMP.
V13 (1/2) 12AX7 SYNC. SEP. & A.G.C. RECT.
V13 (1/2) 12AX7 SYNC. SEP.
V12 (1/2) 6SN7GT SYNC. AMP. & CLIPPER
V14 (1/2) 6BL7GT VERT. OSC.
V14 (1/2) 6BL7GT VERT. OUTPUT
TEST POINT
BRIGHTNESS CONTROL
VERTICAL DEFLECTION COILS
HOR. LIN.
HOR. SIZE
PICTURE CONTRAST
A.G.C. CONTROL
HEIGHT
VERT. LIN.
VERT. HOLD
ON-OFF SWITCH (ON VOLUME CONTROL)
INTERLOCK
AC LINE
V15 6AL5 HOR. DISCRIM.
V16 6AU6 HOR. CONTROL
V17 (1/2) 6SN7GT HOR. OSC.
V17 (1/2) 6SN7GT HOR. DISCHARGE
V18 6BQ6GT HOR. OUTPUT
V19 6W4GT DAMPER
HORIZONTAL HOLD (TOP CORE)
HOR. DRIVE
HORIZONTAL DEFLECTION COILS
FUSE 1/4 AMP
TERMINAL LOCATIONS ON HIGH VOLTAGE SCANNING ASSEMBLY REFER TO CIRCLED LETTERS ON SCHEMATIC
USE HIGH VOLTAGE MULTIPLIER PROBE WITH SYLVANIA POLYMETER TYPE 221Z FOR ALL HIGH VOLTAGE MEASUREMENTS
CAUTION: VOLUME CONTROL SHIELDS ARE AT -135V. DO NOT CONNECT TO GROUND
CONTRAST CONTROL AT MINIMUM
BRIGHTNESS CONTROL AT MAXIMUM
HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 2,000V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT
SOURCE OF VOLTAGE
CONNECTED TO INDICATED VOLTAGE SOURCE
VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.
AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.

PARTS CODING

RF TUNER C1-C49, R1-R49
SOUND SECTION C100-C125, R100-R126
VIDEO IF SECTION C126-C154, R127-R162
L.V. POWER SUPPLY C155-C167, R163-R175
SYNC. SEPARATOR & VERTICAL SWEEP SECTION C168-C191, R176-R214
HOR. SWEEP & H.V. SUPPLY SECTION C192-C225, R215-R250



■ USE HIGH VOLTAGE MULTIPLIER PROBE WITH SYLVANIA POLYMETER FOR ALL HIGH VOLTAGE MEASUREMENTS

(*) CAUTION: VOLUME CONTROL SHIELDS ARE AT -135V. DO NOT CONNECT TO GROUND

* CONTRAST CONTROL AT MINIMUM

♦ BRIGHTNESS CONTROL AT MAXIMUM

▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 2,000V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT

ALL VOLTAGES MEASURED WITH A SYLVANIA POLYMETER TYPE 221 (VACUUM TUBE VOLTMETER) UNLESS OTHERWISE STATED. ANTENNA DISCONNECTED & NO SIGNAL INPUT. LINE POTENTIAL 117 VOLTS, 60 CYCLES AC SUPPLY. CONTRAST CONTROL AT MAXIMUM AND BRIGHTNESS CONTROL AT MINIMUM UNLESS OTHERWISE STATED.
ALL OTHER CONTROLS ADJUSTED TO NORMAL POSITIONS. VOLTAGES MEASURED IN RESPECT TO GROUND UNLESS OTHERWISE STATED.
ALL COIL RESISTANCES ARE APPROXIMATE. THOSE NOT LISTED ARE TOO SMALL FOR PRACTICAL MEASUREMENT OR OF TOO WIDE A RANGE OF VALUE. RESISTANCES OF TAPPED COILS ARE FOR ENTIRE COIL LENGTH.

REPAIR PARTS LIST

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	196-0013	Anode Connector and Lead Assembly
	416-0008	Board - Antenna Terminal
	417-0005	Cable & Socket Assembly (Picture Tube)
C136	166-0001P	Capacitor - Ceramic - .000001 Mfd. - 500 V.
C134, C138	168-0008N	Capacitor - Ceramic - .0000047 Mfd. - 500 V.
C137, C141	166-0010P	Capacitor - Ceramic - .00001 Mfd. - 500 V.
C102	166-0050N	Capacitor - Ceramic - .00005 Mfd. - 500 V.
C106	166-0250P	Capacitor - Ceramic - .00025 Mfd. - 500 V.
C203	166-1000P	Capacitor - Ceramic - .001 Mfd. - 500 V.
C160, C161, C162	166-1000D	Capacitor - Ceramic - .001 Mfd. - 600 V.
C100, C101, C103, C104, C117, C118, C139, C140	168-0003D	Capacitor - Ceramic - Dual - .004 Mfd. - 450 V.
C105, C126, C127, C129, C132, C133, C142, C143, C144, C199, C201	166-5000D	Capacitor - Ceramic - .005 Mfd. - 450 V.
C109, C111, C113, C146	168-0002N	Capacitor - Ceramic - .01 Mfd. - 500 V.
C107, C204	161-1001	Capacitor - Electrolytic - 2 Mfd. - 50 V.
C168	161-1000	Capacitor - Electrolytic - 10 Mfd. - 25 V.
C156	161-2003	Capacitor - Electrolytic - 40 Mfd. - 350 V.
C157		80 Mfd. - 350 V.
C209	161-4002	Capacitor - Electrolytic - 10 Mfd. - 450 V.
C155		40 Mfd. - 350 V.
C116		60 Mfd. - 350 V.
C114		25 Mfd. - 25 V.
C178	161-4003	Capacitor - Electrolytic - 10 Mfd. - 450 V.
C210		10 Mfd. - 450 V.
C181		100 Mfd. - 50 V.
C158		60 Mfd. - 200 V.
C112, C194, C197	163-0100	Capacitor - Mica - .0001 Mfd. - 500 V.
C135	163-0330	Capacitor - Mica - .00033 Mfd. - 500 V.
C211	174-0470	Capacitor - Mica - .00047 Mfd. - 1,000 V.
C110, C202	163-0680	Capacitor - Mica - .00068 Mfd. - 500 V.
C176	163-0750	Capacitor - Mica - .00075 Mfd. - 500 V.
C171	160-02147	Capacitor - Molded Paper - .047 Mfd. - 200 V.
C208	160-02022	Capacitor - Molded Paper - .22 Mfd. - 200 V.
C212, C213, C214	160-14350	Capacitor - Molded Paper - .0005 Mfd. - 10,000 V.
C196	169-0010	Capacitor - Molded Polystyrene - .015 Mfd. - 400 V.
C195	162-0201	Capacitor - Paper - .1 Mfd. - 200 V.
C145	162-0202	Capacitor - Paper - .2 Mfd. - 200 V.
C198	162-0422S	Capacitor - Paper - .002 Mfd. - 400 V.
C170, C193	162-0625	Capacitor - Paper - .005 Mfd. - 400 V.
C205	162-0415	Capacitor - Paper - .05 Mfd. - 400 V.
C179, C180	162-0401	Capacitor - Paper - .1 Mfd. - 400 V.
C169, C177	162-0623	Capacitor - Paper - .003 Mfd. - 600 V.
C115, C192	162-0625	Capacitor - Paper - .005 Mfd. - 600 V.
C172, C200	162-0611	Capacitor - Paper - .01 Mfd. - 600 V.
C207	162-0613	Capacitor - Paper - .03 Mfd. - 600 V.
C206	162-0601	Capacitor - Paper - .1 Mfd. - 600 V.
	190-0006	Capacitor - Resistor Combination
C108		Capacitor - .01 Mfd.
R108		Resistor - 47,000 Ohm
	190-0007	Capacitor - Resistor - Integrator Plate
C173		.002 Mfd. - 500 V.
C174		.005 Mfd. - 500 V.
C175		.005 Mfd. - 500 V.
C113, C172, C200	162-0611	Capacitor - Paper - .01 Mfd. - 600 V.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
R190		8,200 Ohm
R191		8,200 Ohm
R189		22,000 Ohm
L50	145-0004	Choke - Filter B+
L52, L53	147-0014	Choke - Heater
L54	146-0012	Coil - 4.5 Mc.
L66	133-0001	Coil - Horizontal Linearity
L67	132-0001	Coil - Horizontal Size
L55	118-C007	Coil - I.F. Trap
L59, L60	131-2003	Coil - Peaking - Dual
L57, L58	131-2004	Coil - Peaking - Dual
L63	146-0005	Coil - Ringing
L56	130-0001	Coil - Sound Take-Off
R179	153-0009	Control - AGC
R153, R110	157-0015	Control - Brightness, Volume & On-Off
R198	153-0001	Control - Height
R225	153-0007	Control - Horizontal Drive
R167	153-3007	Control - Picture Contrast
R193	153-0014	Control - Vertical Hold
R201	153-0010	Control - Vertical Linearity
R171	189-0007	Resistor - 4.3 Ohm - 1/2 W. - W.W.
R116	181-0470	Resistor - 47 Ohm - 1/2 W.
R135, R139	181-0560	Resistor - 56 Ohm - 1/2 W.
R101, R146, R228, R230	181-0101	Resistor - 100 Ohm - 1/2 W.
R169	181-01815	Resistor - 180 Ohm - 1/2 W.
R142	181-0181	Resistor - 180 Ohm - 1/2 W.
R105	181-0331	Resistor - 330 Ohm - 1/2 W.
R113	181-0471	Resistor - 470 Ohm - 1/2 W.
R202, R203	181-0561	Resistor - 560 Ohm - 1/2 W.
R200	181-0681	Resistor - 680 Ohm - 1/2 W.
R103, R138, R143, R220, R233	181-0102	Resistor - 1,000 Ohm - 1/2 W.
R145	181-03925	Resistor - 3,900 Ohm - 1/2 W.
R197	181-04725	Resistor - 4,700 Ohm - 1/2 W.
R226	181-0472	Resistor - 4,700 Ohm - 1/2 W.
R144	181-0562	Resistor - 5,600 Ohm - 1/2 W.
R128, R234	181-0682	Resistor - 6,800 Ohm - 1/2 W.
R133, R219	181-0822	Resistor - 8,200 Ohm - 1/2 W.
R176, R177, R184	181-0103	Resistor - 10,000 Ohm - 1/2 W.
R185	181-0123	Resistor - 12,000 Ohm - 1/2 W.
R147	181-0153	Resistor - 15,000 Ohm - 1/2 W.
R106, R222	181-0223	Resistor - 22,000 Ohm - 1/2 W.
R141	181-0273	Resistor - 27,000 Ohm - 1/2 W.
R182, R224	181-0333	Resistor - 33,000 Ohm - 1/2 W.
R100, R102, R104, R137, R194	181-0473	Resistor - 47,000 Ohm - 1/2 W.
R107	181-0683	Resistor - 68,000 Ohm - 1/2 W.
R109, R129, R196, R215, R216	181-0104	Resistor - 100,000 Ohm - 1/2 W.
R223	181-0154	Resistor - 150,000 Ohm - 1/2 W.
R148	181-01845	Resistor - 180,000 Ohm - 1/2 W.
R112, R170	181-0224	Resistor - 220,000 Ohm - 1/2 W.
R178	181-03345	Resistor - 330,000 Ohm - 1/2 W.
R114, R152, R195, R217, R221, R227	181-0474	Resistor - 470,000 Ohm - 1/2 W.
R180	181-05645	Resistor - 560,000 Ohm - 1/2 W.
R183, R199, R218	181-0105	Resistor - 1.0 Megohm - 1/2 W.
R186, R192	181-0125	Resistor - 1.2 Megohm - 1/2 W.
R149	181-01255	Resistor - 1.2 Megohm - 1/2 W.
R181	181-0225	Resistor - 2.2 Megohm - 1/2 W.
R132	181-0685	Resistor - 6.8 Megohm - 1/2 W.
R111	181-0156	Resistor - 15 Megohm - 1/2 W.
R115	182-0271	Resistor - 270 Ohm - 1 W.
R136, R140	182-0222	Resistor - 2,200 Ohm - 1 W.
R187	182-0333	Resistor - 33,000 Ohm - 1 W.
R168	183-0181	Resistor - 180 Ohm - 2 W.
R117	183-0471	Resistor - 470 Ohm - 2 W.
R232	183-0102	Resistor - 1,000 Ohm - 2 W.
R193	153-0014	Control - Vertical Hold
R110, R153	157-0012	Control - Volume, Brightness & On-Off

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
R151	183-07525	Resistor - 7,500 Ohm - 2 W.
R150, R231	183-0822	Resistor - 8,200 Ohm - 2 W.
R188	183-0153	Resistor - 15,000 Ohm - 2 W.
R235, R236	189-0019	Resistor - 1.5 Megohm - 2 W.
R164	189-0023	Resistor - 3,600 Ohm - 3 W.
R229	187-0003	Resistor - 270 Ohm - 5 W. - W.W.
	189-0021	Resistor - Metalclad
R166		1275 Ohm - 8 W.
R165		3000 Ohm - 8 W.
	539-0502	Speaker - 5 1/4" P.M.
T54	143-0014	Transformer - Audio Output
T52	128-0004	Transformer - Discriminator Primary
T53	128-0005	Transformer - Discriminator Secondary
T51	240-0001	Transformer - Heater Isolation
T62	128-0006	Transformer - Horizontal Discriminator
T63	241-0003	Transformer - Horizontal Scan
T58	120-0002	Transformer - I.F. Bandpass
T50	141-0013	Transformer - Power
T60	242-0001	Transformer - Vertical - Oscillator
T61	241-0004	Transformer - Vertical Scan
V22, V23	633-0003G	Tube - 5U4G
V20, V21	636-0001G	Tube - 5642
V6, V15	623-0003G	Tube - 6AL5
V8, V9, V16	623-0005G	Tube - 6AU6
V5	623-0011G	Tube - 6BC5
V7	623-0017G	Tube - 6BF5
V14	622-0011G	Tube - 6BL7GT
V18	622-0008G	Tube - 6BQ6GT
V1, V3, V4	623-0022G	Tube - 6CB6
V2	623-0002G	Tube - 6J6
V10	623-0010G	Tube - 6T8
V11	622-0004G	Tube - 6V6GT
V19	633-0004G	Tube - 6W4GT
V12, V17	623-0006G	Tube - 12AU7
V13	623-0008G	Tube - 12AX7
V24	642-0007G	Tube - 16AP4
	323-0005	Tuner Unit
L64, L65	100-0004	Yoke - Deflection - Horizontal
L61, L62		Yoke - Deflection - Vertical

CHASSIS 1-381 C01 &C02

The C01 & C02 changes are indicated on the Schematic Diagram (Figure 15) and are included in the parts list.

C01 added the Audio Socket, Jumper and the Spring and Foil Shields.

C02 changed R169 from 47 ohms to 180 ohms and moved it and the cathode return of V16 (6AU6) (see schematic) from below R168 to below R164. The bottom end of R164 was previously connected directly to -135 V. C144 was changed from .1 Mfd. to .005 Mfd. The grounded end of this capacitor was previously connected to -135 V.

CHASSIS 1-329 CHANGES

The following changes have been made as noted below. A partial schematic of the revised Sound IF Limiter circuit under code C02 and an add and delete parts list are given here.

C01 Factory Change:
Remove C117 & C118 - .004 Mfd. - 450 V. Dual Ceramic Capacitor - Service Part 168-0003D. Change C211 from Mica Capacitor .00047 Mfd. - 1000 V. -Service Part 174-0470 to Paper Capacitor .00075 Mfd. - 1600 V. - Service Part 162-16375.

C02 Factory Change:
Remove C103 & C104 - .004 Mfd. - 450 V. Dual Ceramic Capacitor - Service Part 168-0003D. Remove R105 - 330 Ohm - 1/2 W. Resistor Service Part 181-0331. Add C103 - .005 Mfd. - 500 V. Ceramic Capacitor Service Part 166-5000D as screen grid bypass on V9-6AU6 Sound IF Limiter tube. Return cathode on V9-6AU6 Sound IF Limiter tube to ground.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		Delete
C103, C104, C117	168-0003D	Capacitor - Ceramic - Dual - .004 Mfd. - 450 V.
C118		
C211	174-0470	Capacitor - Mica - .00047 Mfd. - 1000 V.
R105	181-0331	Resistor - 330 Ohm - 1/2 W.
		Add
C103	166-5000D	Capacitor - Ceramic - .005 Mfd. - 500 V.
C211	162-16375	Capacitor - Paper - .00075 Mfd. - 1600 V.

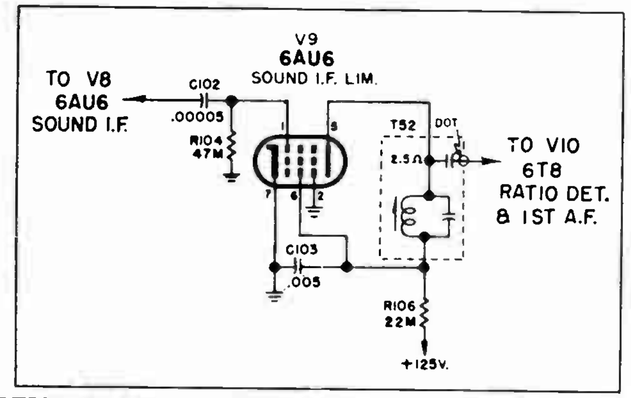


FIGURE 27 - PARTIAL SCHEMATIC DIAGRAM SHOWING 1-329 CHASSIS C02 CHANGE

CHASSIS 1-381 CHANGES

The following change has been made in the 1-381 chassis under code C05. A partial schematic diagram and an add and delete parts list covering this change are given. For all other service information refer to original Bulletin 9-15 and supplements.

C05 C119 - .005 Mfd. - 500 V. ceramic capacitor added. C112 and C115 returned to ground. To eliminate 4.5 Mc. Harmonic Interference.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		Add
C119	166-5000D	Capacitor - Ceramic - .005 Mfd. - 500 V.

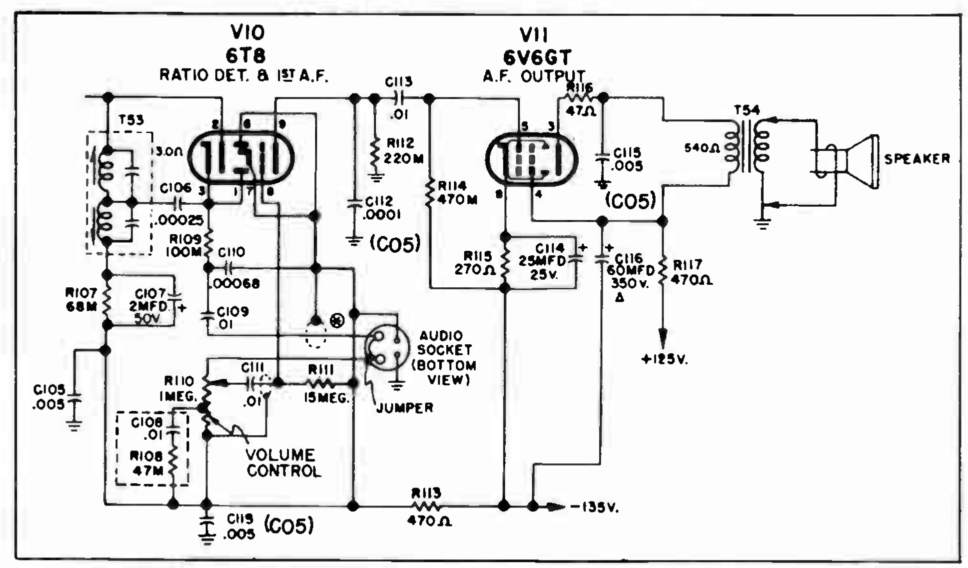
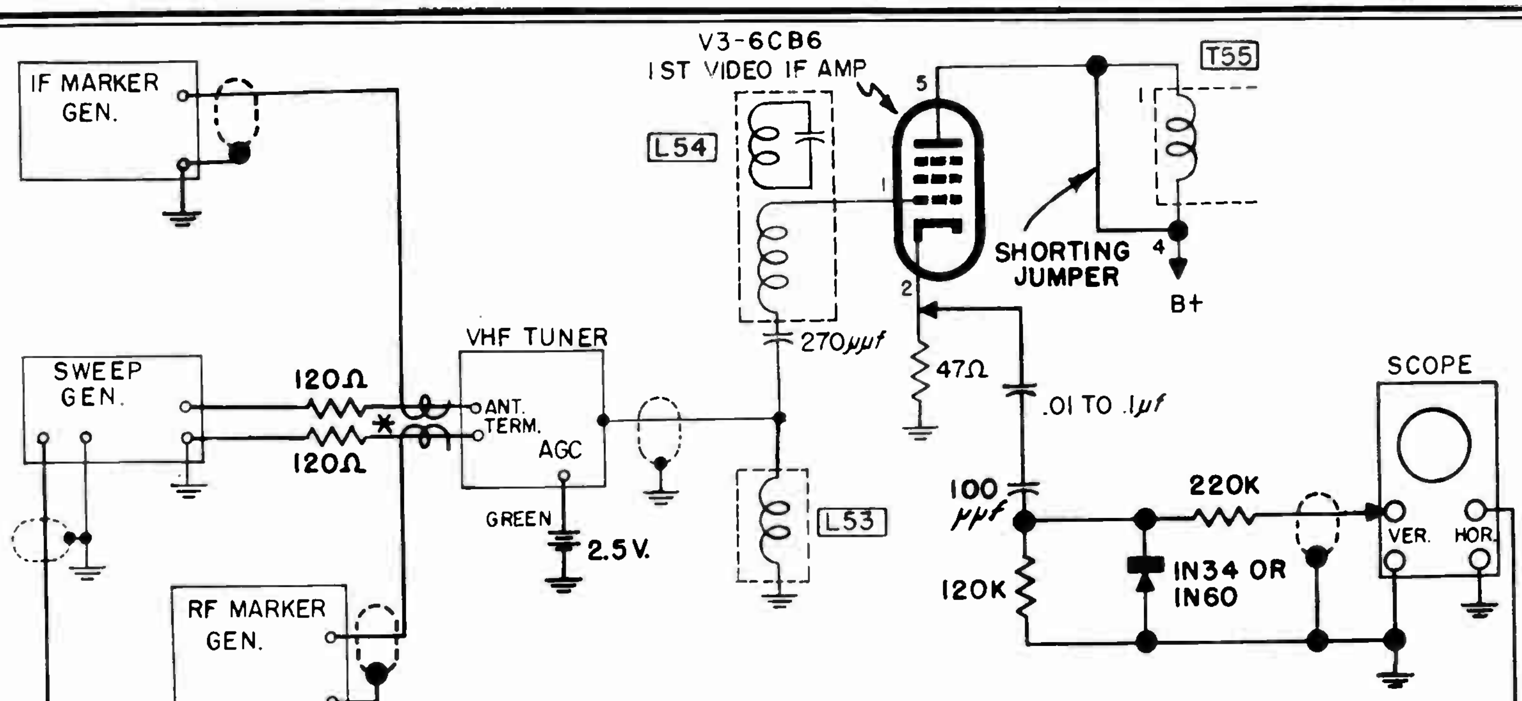
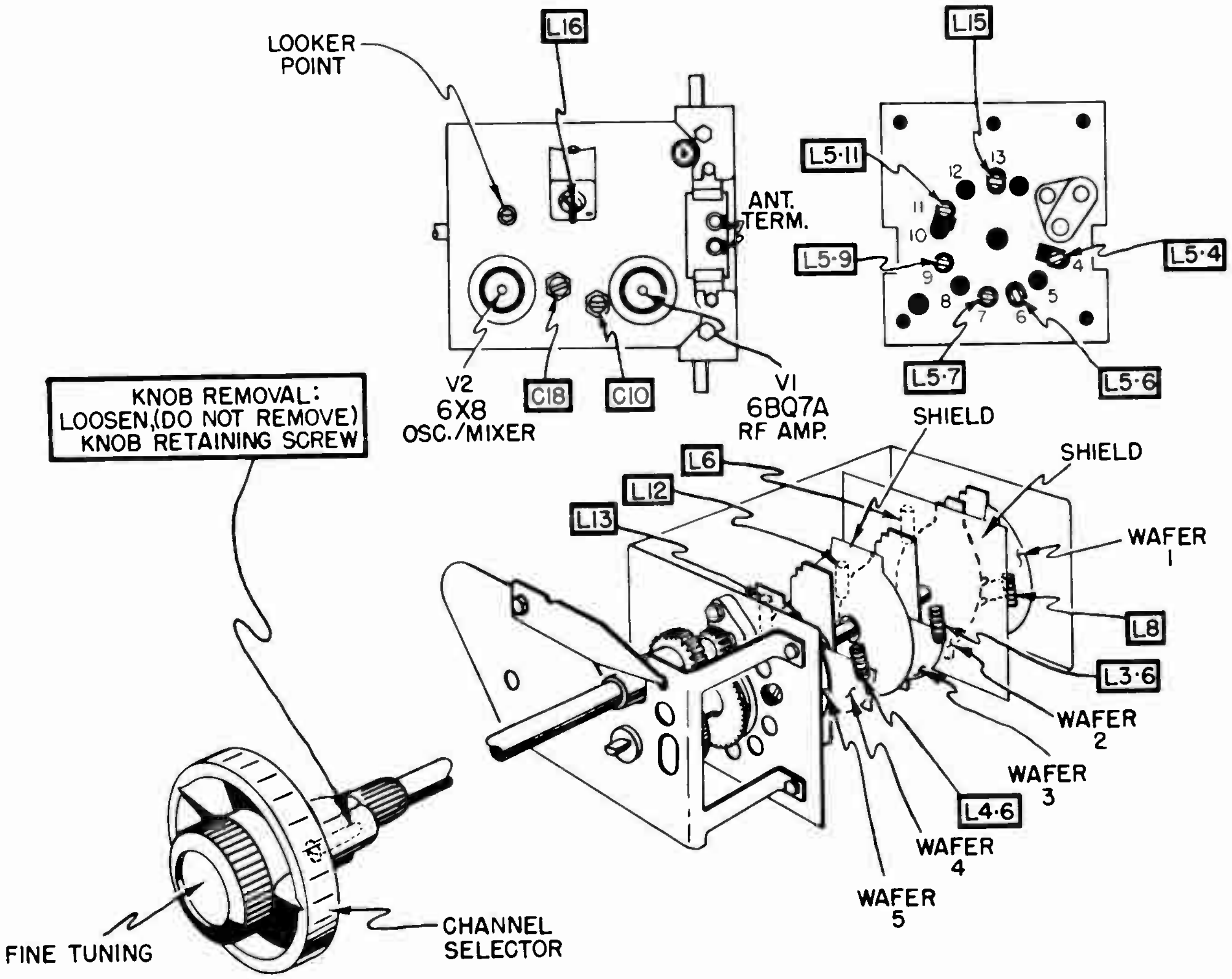


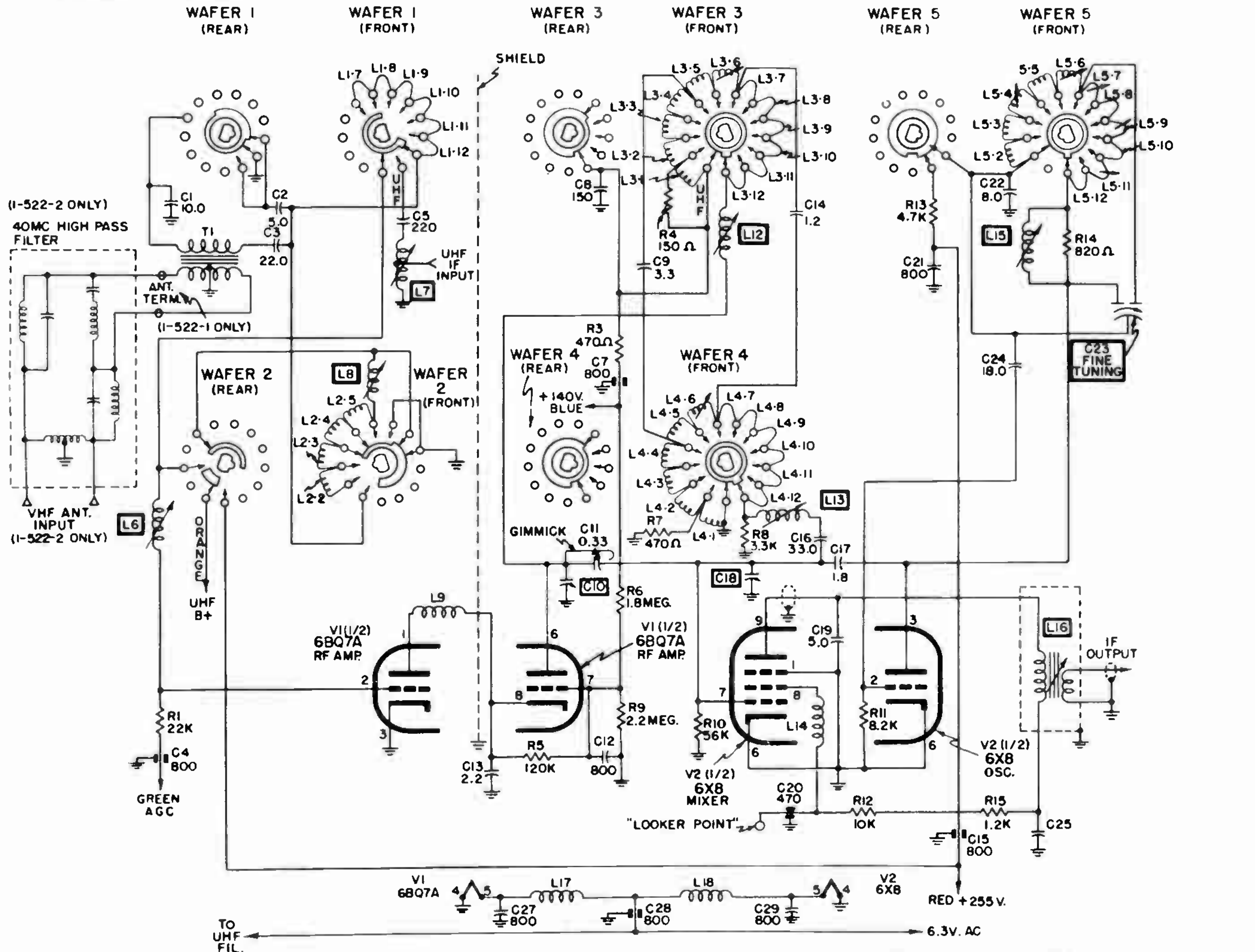
FIGURE 26 - PARTIAL SCHEMATIC DIAGRAM SHOWING 1-381 CHASSIS C05 CHANGE



VHF TUNER ALIGNMENT SETUP



VHF TUNER PARTS LAYOUT



NOTES:
CHANNEL SELECTOR WAFER SWITCH SHOWN IN CHANNEL 13 POSITION.
WAFER SWITCH INDUCTANCE INCREMENTS CODED ACCORDING TO WAFER AND CHANNEL. FOR EXAMPLE, L5.11 INDICATES WAFER 5, CHANNEL 11; L3.6 INDICATES WAFER 3, CHANNEL 6, ETC.

VHF TUNER SCHEMATIC

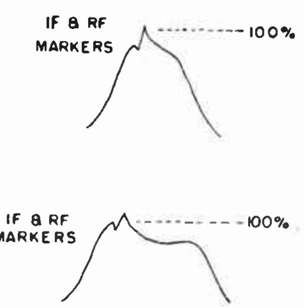
VHF TUNER ALIGNMENT

NOTES ON VHF TUNER ALIGNMENT
Refer to "VHF Tuner Alignment Setup" illustration:

1. Construct detector circuit with short leads.
2. Use shielded leads where indicated.
3. Connect shorting jumper across T55 primary, from terminal 1 to terminal 4.
4. Remove V4 (6CB6) to prevent coupling back from receiver IF system.
5. A turn or two of wire around points marked "*" will provide sufficient marker coupling without distorting response curve.
6. Use high scope gain and low sweep generator output.
7. Use non-metallic tools for all alignment adjustments.

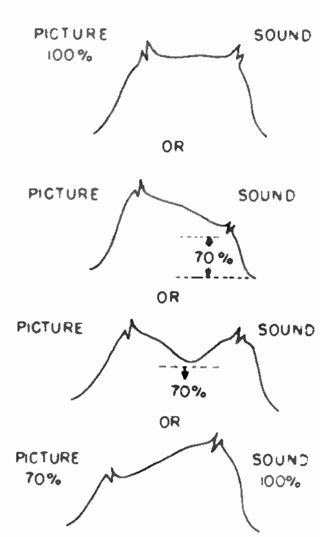
OSCILLATOR ALIGNMENT

STEP	TUNER SETTING	GENERATORS SWEEP (10 MC)	IF MARKER	RF MARKER	ADJUST	ACCEPTABLE RESPONSE CURVES
1.	Channel 13	Channel 13 213 MC	45.75 MC	211.25 MC	L15 Screw on Wafer 5	COINCIDE IF and RF markers as shown below.
2.	Channel 11	Channel 11 201 MC	45.75 MC	199.25 MC	L5.11 Screw on Wafer 5	
3.	Channel 9	Channel 9 189 MC	45.75 MC	187.25 MC	L5.9 Screw on Wafer 5	
4.	Channel 7	Channel 7 177 MC	45.75 MC	175.25 MC	L5.7 Screw on Wafer 5	
5.	Channel 6	Channel 6 85 MC	45.75 MC	83.25 MC	L5.6 Screw on Wafer 5	
6.	Channel 4	Channel 4 69 MC	45.75 MC	67.25 MC	L5.4 Screw on Wafer 5	NOTE: Curves may not be symmetrical until RF alignment is complete.
7.	If a touch up adjustment of channels 5, 3 and 2 is desired, "spike" (squeeze or spread) turns of the appropriate coil on wafer 5 (L5.5, L5.3 and L5.2 respectively) to coincide appropriate markers for those channels.					



RF ALIGNMENT

STEP	TUNER SETTING	GENERATORS SWEEP (10 MC)	RF MARKER	ADJUST	ACCEPTABLE RESPONSE CURVES
1.	CHECK BANDPASS CIRCUIT ALIGNMENT AS DESCRIBED IN STEP 4 OF "VIDEO IF ALIGNMENT".				
2.	Channel 13	Channel 13 213 MC	211.25 MC (P) 215.75 MC (S)	L12 core for skirt frequency. L13 core for flat top. L6 core for maximum height.	30% DEVIATION PERMISSIBLE:
3.	Channel 7	Channel 7 177 MC	175.25 MC (P) 179.75 MC (S)	C10 and C18 trimmer for best symmetrical response.	
4.	Switch tuner and generators through channels 8 to 12 and observe response curve. If any response curve is not within acceptable limits, repeat steps 2 and 3 and, if necessary, compromise the adjustments.				
5.	Channel 6	Channel 6 85 MC	83.25 MC (P) 87.75 MC (S)	L3.6 core for skirt frequency. L4.6 core for flat top. L8 core for maximum height.	
6.	Switch tuner and generators through channels 5 to 2 and observe response curve. If any response curve is not within acceptable limits, "spike" (squeeze or spread) turns of appropriate coils on wafers 2, 3 and 4 until response curve is acceptable. SEE VHF TUNER LAYOUT AND VHF TUNER SCHEMATIC DIAGRAM FOR LOCATIONS OF SPECIFIC CHANNEL COILS AND WAFERS.				



7.	REWAX COIL CORES by placing hot soldering iron near coil. Do not lay hot iron directly on coil.

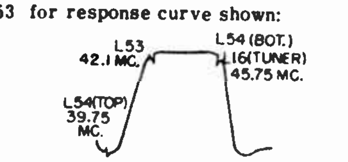
VIDEO IF, 4.5MC TRAP AND SOUND ALIGNMENT PROCEDURES

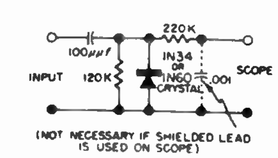
VIDEO IF ALIGNMENT

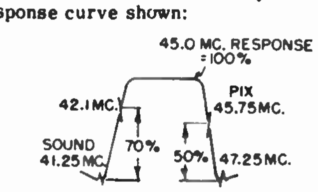
PREALIGNMENT INSTRUCTIONS
READ CAREFULLY

1. Stand chassis on side with high voltage shield down for under chassis adjustments.
2. Ground all test equipment unless otherwise stated.
3. Keep detector circuit leads as short as possible.
4. Allow test equipment and receiver chassis to warm up for 15 minutes after the intial equipment and AGC battery setup.
5. Deflection yoke should be connected during alignment.
6. Use non-metallic alignment tools for powdered iron cores. Metallic screwdriver may be used for brass screw adjustments.
7. Wrap a short length of insulated wire around pin 7 prong of V2 (6X8) tube in VHF tuner to facilitate test equipment connections.

STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Connect 20V. battery (-) terminal to junction of C129 (.047 mfd.) and R128 (120K) and connect (+) terminal to chassis. Set VHF tuner to signal-free channel with minimum interference.	SIGNAL GENERATOR - to ungrounded tube shield on Osc./Mixer tube on VHF tuner. VTVM - D.C. Probe to junction of L58 peaking coil and R151 (2.7K).	L54 (top core) for MIN. at 39.75 MC. T55 (top core) for MIN. at 41.25 MC. L55 for MIN. at 41.25 MC. T56 (top core) for MIN. at 47.25 MC. Use sufficient signal generator output for satisfactory VTVM reading.
2.	Same as 1.	Same as 1.	T58 for MAX. at 44.0 MC. T57 for MAX. at 42.0 MC. T56 (bottom core) for MAX. at 45.2 MC. T55 (bottom core) for MAX. at 43.2 MC. Adjust signal generator output to keep VTVM reading between 1 and 2 volts.
3.	Repeat step 1 trap adjustments.		
4.	Remove 20V. AGC battery. Disconnect T55 lead from pin 5 of V3 (6CB6). Connect 330 ohm resistor across T55 primary from R132 (1K) to pin 5 of V3. Set VHF tuner to signal-free channel with minimum interference.	SWEEP GENERATOR - to pin 7 of V2 (6X8). Set to 43.5 MC with 10 MC sweep. SIGNAL GENERATOR - loosely couple to sweep generator lead. OSCILLOSCOPE - through detector circuit to pin 5 of V3 (6CB6).	L54 (bottom core), L16(VHF tuner) and L53 for response curve shown:
5.	Repeat step 4 adjustments until response curve is flat with 42.1 MC and 45.75 MC markers on corners.		
6.	Connect 20V. battery (-) terminal to junction of C129 (.047 mfd.) and R128 (120K) and connect (+) terminal to chassis. REMOVE 330 OHM RESISTOR AND RECONNECT T55. Set VHF tuner to signal-free channel with minimum interference.	SWEEP GENERATOR - to ungrounded tube shield on Osc./Mixer tube on VHF tuner. Set to 43.5 MC with 10 MC sweep. SIGNAL GENERATOR - loosely couple to sweep generator lead. OSCILLOSCOPE - through 33K resistor to junction of L58 peaking coil and R151 (2.7K).	Retouch T58, T57, T56 (bottom core) and T55 (bottom core) if necessary to obtain response curve shown:







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4.5MC TRAP ALIGNMENT

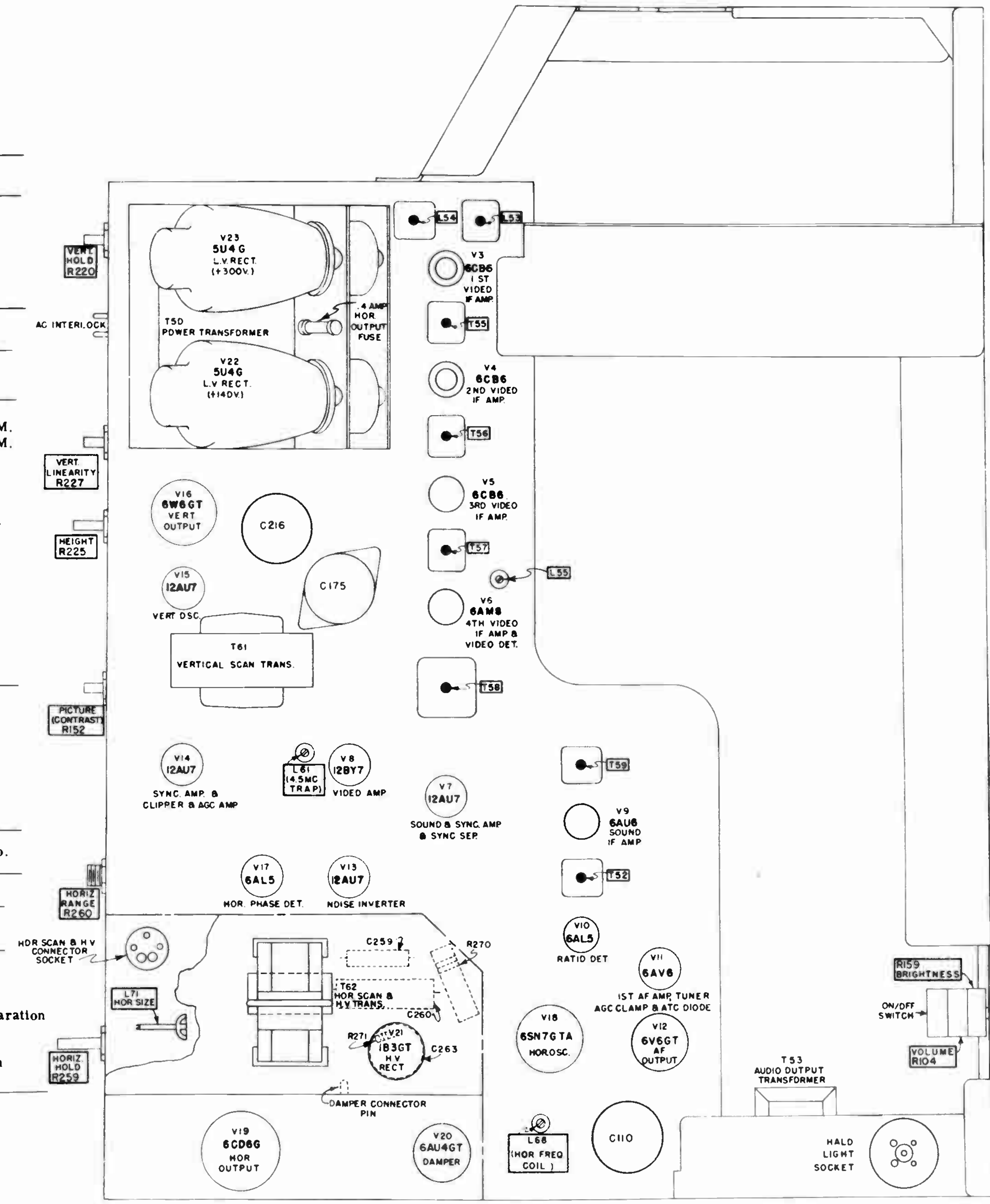
STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Short pin 2 of V6 (6AM8) to chassis.	SIGNAL GENERATOR - to pin 2 of V8 (12BY7). Set to 4.5 MC. VTVM - R. F. Probe to pin 11 of V24 (Picture Tube); Ground Lead to chassis.	L61 for MINIMUM.

SOUND ALIGNMENT

STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Short pin 1 of V5 (6CB6) to chassis. DO NOT GROUND VTVM.	SIGNAL GENERATOR #1 - through 1K resistor to pin 2 of V6 (6AM8). Set to 45.0 MC. SIGNAL GENERATOR #2 - through 1K resistor to pin 2 of V6 (6AM8). Set to 4.5 MC. OR SIGNAL GENERATOR - through 1K resistor to pin 2 of V6 (6AM8). Set to 45.0 MC with a crystal controlled 4.5 MC marker. ALSO VTVM - D.C. Probe to pin 5 of V10 (6AL5); Ground Lead to pin 7 of V10 (6AL5).	T52 (both cores) for MAXIMUM. T59 (both cores) for MAXIMUM. Use peak resulting in greatest separation of cores. Repeat adjustments until maximum reading is reached.
2.	Same as 1.	USE SAME SIGNAL GENERATOR HOOKUP AS IN STEP 1. VTVM - D.C. Probe through 100K resistor to terminal #1 of de-emphasis plate; Ground Lead to junction of two matched 100K resistors connected in series across R106 (68K).	T52 (top core) for ZERO. Use lowest VTVM scale set to zero center. At correct core setting, a slight turn of core will give either a positive or negative reading.
3.	Remove test equipment and resistors; then, tune in a weak station and adjust T52 (top core) for optimum signal-to-noise ratio.		

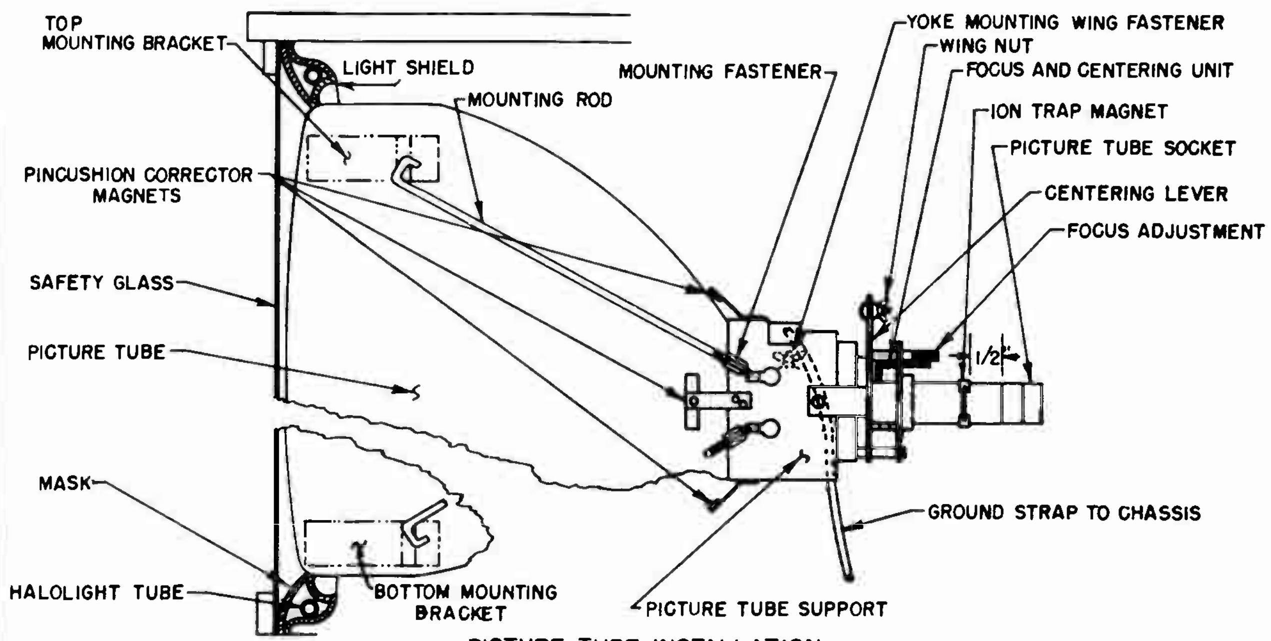
ALTERNATE SOUND ALIGNMENT

STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Connect a good antenna installation to receiver. Set VHF tuner to a strong station. DO NOT GROUND VTVM.	VTVM - D.C. Probe to pin 5 of V10 (6AL5); Ground Lead to pin 7 of V10 (6AL5).	T52 (both cores) for MAXIMUM. T59 (both cores) for MAXIMUM. Use peak resulting in greatest separation of cores. Repeat adjustments until maximum reading is reached.
2.	Same as 1.	VTVM - D.C. Probe through 100K resistor to terminal #1 of de-emphasis plate; Ground Lead to junction of two matched 100K resistors connected in series across R106 (68K).	T52 (top core) for ZERO. Use lowest VTVM scale set to zero center. At correct core setting, a slight turn of core will give either a positive or negative reading.
3.	Remove test equipment and resistors; then, tune in a weak station and adjust T52 (top core) for optimum signal-to-noise ratio.		



CHASSIS TOP PARTS LAYOUT

SPECIAL INSTALLATION AND SERVICE INSTRUCTIONS



PICTURE TUBE INSTALLATION

CHASSIS REMOVAL AND PICTURE TUBE INSTALLATION

To remove the picture tube, observe the following procedure. Refer to Picture Tube Installation illustration. GOGGLES AND GLOVES SHOULD BE WORN and special caution exercised while handling the picture tube.

1. Disconnect receiver from power outlet; remove antenna connection and rear interlock cover.

2. Disconnect the following items prior to removal of receiver chassis:

   a. High voltage anode lead.
   b. Speaker plug.
   c. Horizontal and vertical yoke connector plugs.
   d. Picture tube socket.
   e. HaloLight connector plug.
   f. Ground strap to chassis.

3. Remove front panel knobs, chassis mounting bolts, antenna terminal board from chassis and slide chassis from cabinet.

4. LAY CABINET ON FRONT SIDE. Remove Ion Trap magnet.

5. Unscrew four Mounting Fasteners until heads can be removed through enlarged openings in Picture Tube Support; remove Mounting Rods from Mounting Brackets in cabinet.

6. Remove Picture Tube Support with yoke and Focus and Centering unit attached.

7. TWO PERSONS should now reach down along opposite sides of picture tube, reach under face of tube with fingers, and lift tube from cabinet. DO NOT GRASP NECK OF TUBE AT ANY TIME.

8. To install a new picture tube, reverse the preceding steps. Tighten the four Mounting Fasteners evenly and snugly. Apply just enough pressure against Mounting Rods to seat them properly at cabinet Mounting Brackets. Be careful that dust or dirt does not get inside mask or on picture tube face.

HORIZONTAL AFC CIRCUIT ADJUSTMENT

1. Tune in a normal air signal and adjust L71 Horizontal Size control for approximately normal scan using a locked-in picture.

2. Turn receiver power "off" and connect shorting jumpers as follows:

   a. From junction of R212 (330 ohm) and T60 sync phase splitting coil to chassis.

   b. Across terminals of L68 Horizontal Frequency coil.

3. Turn receiver power "on" and tune in a normal air signal.

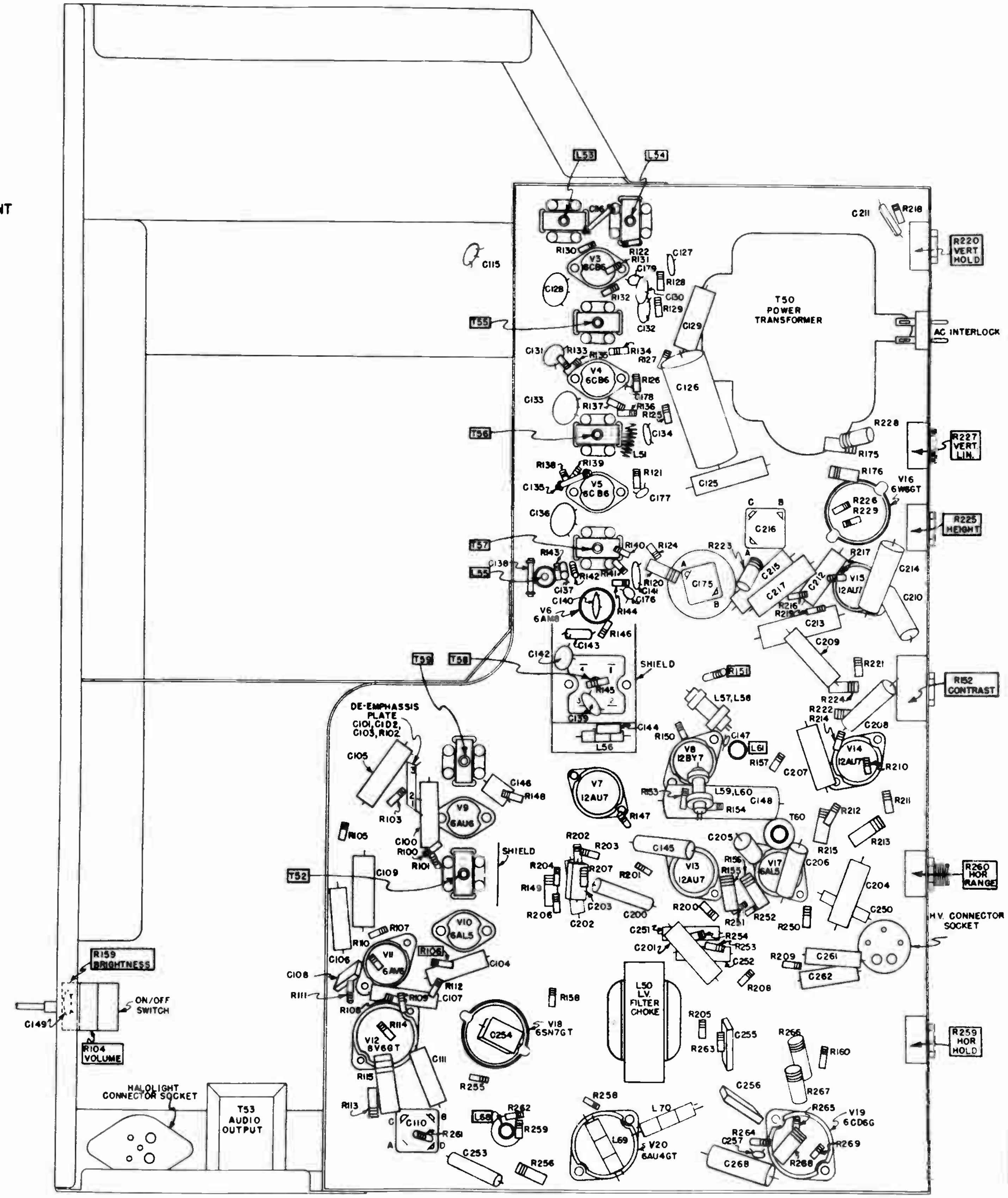
4. Rotate R259 Horizontal Hold control to center position.

5. Adjust R260 Horizontal Range control until picture moves back and forth across screen with blanking bar vertical.

6. Remove shorting jumper from L68 Horizontal Frequency coil.

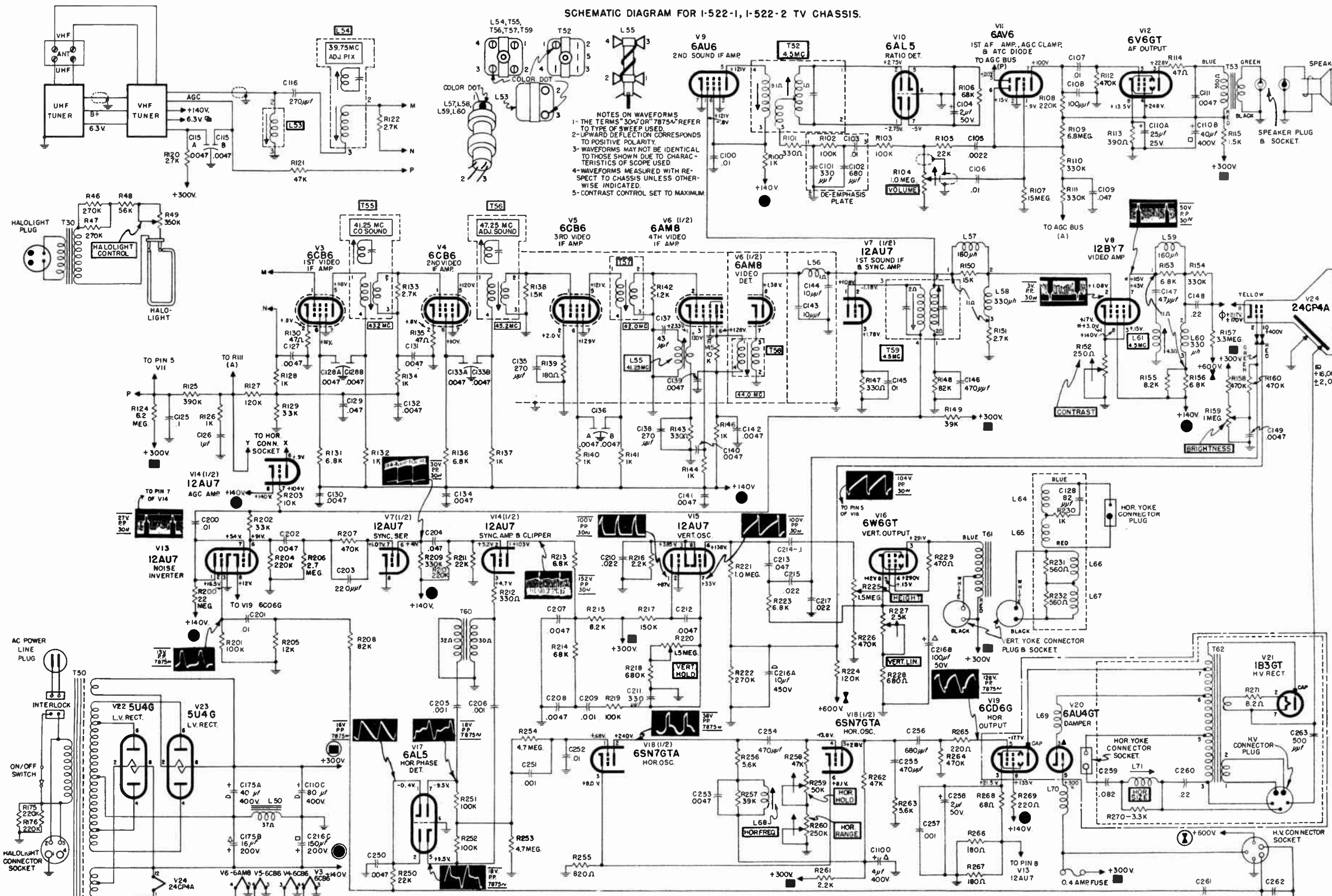
7. Adjust L68 Horizontal Frequency coil until picture moves back and forth across screen with blanking bar vertical.

8. Remove shorting jumper from junction of R212 (330 ohm) and T60 sync phase splitting coil to chassis.



CHASSIS BOTTOM PARTS LAYOUT

SCHEMATIC DIAGRAM FOR 1-522-1, 1-522-2 TV CHASSIS.



■ MEASURED WITH A VTVM HIGH VOLTAGE PROBE AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL, NO BRIGHTNESS AND CORRECT SCAN SIZE.

Φ BRIGHTNESS CONTROL AT MAXIMUM.
* CONTRAST CONTROL AT MINIMUM.
VOLTAGE SOURCES ARE INDICATED BY ENCIRCLED SYMBOLS; CORRESPONDING SYMBOLS WITHOUT CIRCLES INDICATE VOLTAGE TIE POINTS.

▲ HIGH PEAK VOLTAGE OF SHORT DURATION MAY DAMAGE METER USED FOR THIS MEASUREMENT.

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED USING VACUUM TUBE VOLTMETER. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT, 60 CYCLE, ANTENNA DISCONNECTED, ANTENNA TERMINALS SHORTED AND GROUNDED, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM—OTHER CONTROLS AT NORMAL POSITIONS. AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COIL IS FOR ENTIRE WINDING. RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.

ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION OF CONTROLS.

CAUTION NOTICE

THE HIGH VOLTAGE LEAD TO THE PICTURE TUBE MAY HAVE A POTENTIAL OF 18,000 VOLTS. PRECAUTIONS SHOULD BE OBSERVED WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE PURPOSES.

DO NOT OPERATE THE RECEIVER WITH THE H.V. COVER REMOVED.

ALWAYS WEAR SAFETY GOGGLES AND GLOVES WHEN NECESSARY TO REMOVE THE PICTURE TUBE.

SPECIAL SERVICE INSTRUCTIONS

1. To maintain the correct electrical relationships between circuits, all cabinet mounted components (except HaloLight) should be connected to chassis during any electrical tests to receiver with AC power applied.

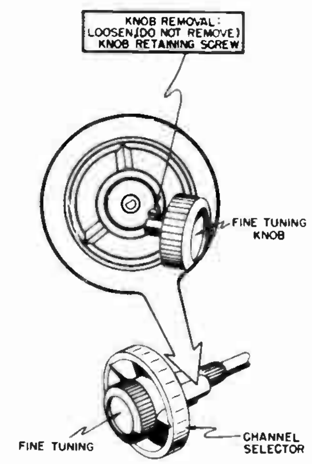
2. An extension cable assembly to accomplish the above requirements may be constructed using extra plugs and sockets identical to those utilized by the receiver chassis.

3. The metal shorting bar on high voltage shield must be held in a forward (non-shorting) position; place a plate over high voltage shield hole through which the shorting bar enters.

4. REMOVAL AND CALIBRATION OF CHANNEL SELECTOR KNOB:

   a. To remove Channel Selector knob, loosen (do not remove completely) knob retaining clamp screw. Knob may then be pulled off tuner shaft.

   b. To calibrate Channel Selector knob, rotate Channel Indicator Dial in cabinet front until channel number that tuner is set to appears behind picture window glass. Install Channel Selector knob meshing its gears with those of the dial. Make any minor adjustments required to insure that dial number corresponds to tuner setting.



PARTS LIST

SCHEMATIC LOCATION	SERVICE PART NO.	DESCRIPTION
		CAPACITORS
C100	160-0211	.01 Mfd. - 200V. - Molded Paper
C101, C102, C103		See "Miscellaneous Electrical Parts"
C104	161-1001	2 Mfd. - 50V. - Electrolytic
C105	160-04222	.0022 Mfd. - 400V. - Molded Paper
C106	160-0211	.01 Mfd. - 200V. - Molded Paper
C107	160-0611	.01 Mfd. - 600V. - Molded Paper
C108	163-0100	100 Mmfd. - 500V. - Mica
C109	160-02147	.047 Mfd. - 200V. - Molded Paper
	161-4015	Four Section Electrolytic
C110A		25 Mfd. - 25V.
C110B		40 Mfd. - 400V.
C110C		80 Mfd. - 400V.
C110D		4 Mfd. - 400V.
C111	160-06247	.0047 Mfd. - 600V. - Molded Paper
C115	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C116	166-0270N	270 Mmfd. - 500V. - Ceramic
C125	160-0201	.1 Mfd. - 200V. - Molded Paper
C126	169-0018	1.0 Mfd. - 200V. - Molded Paper
C127	166-4700D	.0047 Mfd. - 500V. - Ceramic
C128	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C129	160-02147	.047 Mfd. - 200V. - Molded Paper
C130	166-4700D	.0047 Mfd. - 500V. - Ceramic
C131	166-4700D	.0047 Mfd. - 500V. - Ceramic
C132	166-4700D	.0047 Mfd. - 500V. - Ceramic
C133	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C134	166-4700D	.0047 Mfd. - 500V. - Ceramic
C135	166-0270N	270 Mmfd. - 500V. - Ceramic
C136	168-0011D	.0047 Mfd. - 500V. - Dual Ceramic
C137	166-0043P	43 Mmfd. - 500V. - Ceramic
C138	166-0270N	270 Mmfd. - 500V. - Ceramic
C139	166-4700D	.0047 Mfd. - 500V. - Ceramic
C140	166-4700D	.0047 Mfd. - 500V. - Ceramic
C141	166-4700D	.0047 Mfd. - 500V. - Ceramic
C142	166-4700D	.0047 Mfd. - 500V. - Ceramic
C143	166-0010P	10 Mmfd. - 500V. - Ceramic
C144	166-0010P	10 Mmfd. - 500V. - Ceramic
C145	160-0211	.01 Mfd. - 200V. - Molded Paper
C146	163-0470	470 Mmfd. - 500V. - Mica
C147	168-0008N	4.7 Mmfd. - 500V. - Ceramic
C148	160-0202	.22 Mfd. - 200V. - Molded Paper
C149	166-4700D	.0047 Mfd. - 500V. - Ceramic
	161-2010	Two Section Electrolytic
C175A		40 Mfd. - 400V.
C175B		16 Mfd. - 200V.
C176	166-1000D	.001 Mfd. - 500V. - Ceramic
C177	166-1000D	.001 Mfd. - 500V. - Ceramic
C178	166-1000D	.001 Mfd. - 500V. - Ceramic
C179	166-1000D	.001 Mfd. - 500V. - Ceramic
C200	160-0211	.01 Mfd. - 200V. - Molded Paper
C201	160-0611	.01 Mfd. - 600V. - Molded Paper
C202	160-04247	.0047 Mfd. - 400V. - Molded Paper
C203	163-0220	220 Mmfd. - 500V. - Mica
C204	160-02147	.047 Mfd. - 200V. - Molded Paper
C205	160-0421	.001 Mfd. - 400V. - Molded Paper
C206	160-0421	.001 Mfd. - 400V. - Molded Paper
C207	160-06247	.0047 Mfd. - 600V. - Molded Paper
C208	160-06247	.0047 Mfd. - 600V. - Molded Paper
C209	160-0621	.001 Mfd. - 600V. - Molded Paper
C210	160-02122	.022 Mfd. - 200V. - Molded Paper
C211	163-0330	330 Mmfd. - 500V. - Mica
C212	160-06247	.0047 Mfd. - 600V. - Molded Paper
C213	160-06147	.047 Mfd. - 600V. - Molded Paper
C214	160-0401	.1 Mfd. - 400V. - Molded Paper
C215	160-06122	.022 Mfd. - 600V. - Molded Paper
	161-3019	Three Section Electrolytic
C216A		10 Mfd. - 450V.
C216B		100 Mfd. - 50V.
C216C		150 Mfd. - 200V.
C217	160-06122	.022 Mfd. - 600V. - Molded Paper
C218		82 Mmfd. - 2000V - Ceramic (Part of Yoke)
C250	160-04247	.0047 Mfd. - 400V. - Molded Paper
C251	160-0221	.001 Mfd. - 200V. - Molded Paper
C252	160-0211	.01 Mfd. - 200V. - Molded Paper
C253	160-04247	.0047 Mfd. - 400V. - Molded Paper
C254	163-0470	470 Mmfd. - 500V. - Mica
C255	163-0470	470 Mmfd. - 500V. - Mica
C256	163-0680	680 Mmfd. - 500V. - Mica
C257	166-1000D	.001 Mfd. - 500V. - Ceramic
C258	161-1001	2 Mfd. - 50V. - Electrolytic
C259	160-06182	.082 Mfd. - 600V. - Molded Paper
C260	160-0602	.22 Mfd. - 600V. - Molded Paper
C261	160-0211	.01 Mfd. - 200V. - Molded Paper
C262	160-06222	.0022 Mfd. - 600V. - Molded Paper
C263	169-0015	500 Mmfd. - 20,000V. - Ceramic
		CHOKES, COILS AND TRANSFORMERS
L50	145-0009	Choke - B+ Filter
L51	147-0014	Choke - IF Amp. Filament
L53	115-0001	Coil - Link Shunt
L54	119-0002	Coil - Tuner Coupling
L55	118-0011	Coil - 4th IF Amp. Cathode Trap
L56	118-0010	Coil - IF Filter
L57, L58	131-2006	Coil - Dual Peaking
L59, L60	131-2006	Coil - Dual Peaking
L61	130-0001	Coil - 4.5 MC Video Trap
	100-0013	Yoke - Deflection Coils
L64, L65		Horizontal
L66, L67		Vertical
L68	132-0001	Coil - Horizontal Frequency Adjustment
L69	118-0010	Coil - Filter
L70	118-0010	Coil - Filter
L71	132-0003	Coil - Horizontal Size Adjustment
T30	141-0041	Transformer - HaloLight Power
T50	141-0042	Transformer - Power - 117V. 60 Cycle AC
T52	128-0008	Transformer - Sound IF Discriminator
T53	143-0033	Transformer - Audio Output
T55	119-0003	Transformer - 1st Video IF
T56	119-0004	Transformer - 2nd Video IF
T57	119-0005	Transformer - 3rd Video IF
T58	126-0002	Transformer - Video IF Output
T59	120-0003	Transformer - Sound IF
T60	243-0001	Transformer - Sync Phase Splitter
T61	241-0018	Transformer - Vertical Scan
T62	241-0013	Transformer Assembly - Horizontal Scan
		CONTROLS (VARIABLE RESISTORS)
R49	153-0023	HaloLight
	157-0033	Volume, Brightness & On/Off Switch
R104		Volume - 1.0 Megohm
R159		Brightness - 1.0 Megohm
R152	153-0038	Contrast - 250 Ohm
R220	153-0014	Vertical Hold - 1.5 Megohm
R225	153-0014	Height - 1.5 Megohm
R227	153-3011	Vertical Linearity - 2,500 Ohm
R259	153-0042	Horizontal Hold - 50,000 Ohm
R260	153-0007	Horizontal Range - 250,000 Ohm
		RESISTORS
		All resistors 10% carbon units unless otherwise specified.
R46	183-0274	270,000 Ohm - 2W.
R47	183-0274	270,000 Ohm - 2W.
R48	183-0563	56,000 Ohm - 2W.
R49		See "Controls"
R100	181-0102	1,000 Ohm - 1/2W.
R101	181-0331	330 Ohm - 1/2W.
R102		See "Miscellaneous Electrical Parts"
R103	181-0104	100,000 Ohm - 1/2W.
R104		See "Controls"
R105	181-0223	22,000 Ohm - 1/2W.
R106	181-0683	68,000 Ohm - 1/2W.
R107	181-0156	15 Megohm - 1/2W.
R108	181-0224	220,000 Ohm - 1/2W.
R109	181-0685	6.8 Megohm - 1/2W.
R110	181-0334	330,000 Ohm - 1/2W.
R111	181-0334	330,000 Ohm - 1/2W.
R112	181-0474	470,000 Ohm - 1/2W.
R113	182-0391	390 Ohm - 1W.
R114	181-0470	47 Ohm - 1/2W.
R115	187-0021	1,500 Ohm - 5W.
R120	183-0272	2,700 Ohm - 2W.
R121	181-0473	47,000 Ohm - 1/2W.
R122	181-0272	2,700 Ohm - 1/2W.
R124	181-06255	6.2 Megohm - 1/2W. - 5%
R125	181-03945	390,000 Ohm - 1/2W. - 5%
R126	181-0102	1,000 Ohm - 1/2W.
R127	181-01245	120,000 Ohm - 1/2W. - 5%
R128	181-0102	1,000 Ohm - 1/2W.
R129	181-03335	33,000 Ohm - 1/2W. - 5%
R130	181-04705	47 Ohm - 1/2W. - 5%
R131	181-0682	6,800 Ohm - 1/2W.
R132	181-0102	1,000 Ohm - 1/2W.
R133	181-0272	2,700 Ohm - 1/2W.
R134	181-0102	1,000 Ohm - 1/2W.
R135	181-04705	47 Ohm - 1/2W. - 5%
R136	181-0682	6,800 Ohm - 1/2W.
R137	181-0102	1,000 Ohm - 1/2W.
R138	181-0152	1,500 Ohm - 1/2W.
R139	181-0181	180 Ohm - 1/2W.
R140	181-0102	1,000 Ohm - 1/2W.
R141	181-0102	1,000 Ohm - 1/2W.
R142	181-0122	1,200 Ohm - 1/2W.
R143	181-0331	330 Ohm - 1/2W.
R144	181-0102	1,000 Ohm - 1/2W.
R145	181-0103	10,000 Ohm - 1/2W.
R146	181-0102	1,000 Ohm - 1/2W.
R147	181-0331	330 Ohm - 1/2W.
R148	181-0823	82,000 Ohm - 1/2W.
R149	181-0393	39,000 Ohm - 2W.
R150	181-0153	15,000 Ohm - 1/2W.
R151	181-0272	2,700 Ohm - 1/2W.
R152		See "Controls"
R153	181-0682	6,800 Ohm - 1/2W.
R154	181-0334	330,000 Ohm - 1/2W.
R155	183-0822	8,200 Ohm - 2W.
R156	183-0682	6,800 Ohm - 2W.
R157	181-0335	3.3 Megohm - 1/2W.
R158	181-0474	470,000 Ohm - 1/2W.
R159		See "Controls"
R160	181-0474	470,000 Ohm - 1/2W.
R175	183-0224	220,000 Ohm - 2W.
R176	183-0224	220,000 Ohm - 2W.
R200	181-0226	22 Megohm - 1/2W.
R201	181-0104	100,000 Ohm - 1/2W.
R202	181-0333	33,000 Ohm - 1/2W.
R203	181-0103	10,000 Ohm - 1/2W.
R204	181-0224	220,000 Ohm - 1/2W.
R205	181-0123	12,000 Ohm - 1/2W.
R206	181-0272	2,700 Ohm - 1/2W.
R207	181-0474	470,000 Ohm - 1/2W.
R208	181-0823	82,000 Ohm - 1/2W.
R209	181-0334	330,000 Ohm - 1/2W.
R210	181-0224	220,000 Ohm - 1/2W.
R211	181-0223	22,000 Ohm - 1/2W.
R212	181-0331	330 Ohm - 1/2W.
R213	183-0682	6,800 Ohm - 2W.
R214	181-0682	6,800 Ohm - 1/2W.
R215	183-0822	8,200 Ohm - 2W.
R216	181-0222	2,200 Ohm - 1/2W.
R217	181-0154	150,000 Ohm - 1/2W.
R218	181-0684	680,000 Ohm - 1/2W.
R219	181-0104	100,000 Ohm - 1/2W.
R220		See "Controls"
R221	181-0105	1 Megohm - 1/2W.
R222	182-0274	270,000 Ohm - 1W.
R223	183-0682	6,800 Ohm - 2W.
R224	182-0124	120,000 Ohm - 1W.
R225		See "Controls"
R226	181-0474	470,000 Ohm - 1/2W.
R227		See "Controls"
R228	183-0681	680 Ohm - 2W.
R229	181-0471	470 Ohm - 1/2W.
R230	181-0102	1,000 Ohm - 1/2W. (Part of Yoke)
R231	181-0561	560 Ohm - 1/2W. (Part of Yoke)
R232	181-0561	560 Ohm - 1/2W. (Part of Yoke)
R250	181-0223	22,000 Ohm - 1/2W.
R251	181-0104	100,000 Ohm - 1/2W.
R252	181-0104	100,000 Ohm - 1/2W.
R253	181-0472	4.7 Megohm - 1/2W.
R254	181-0472	4.7 Megohm - 1/2W.
R255	181-0821	820 Ohm - 1/2W.
R256	182-0562	5,600 Ohm - 1W.
R257	181-0393	39,000 Ohm - 1/2W.
R258	181-0473	47,000 Ohm - 1/2W.
R259		See "Controls"
R260		See "Controls"
R261	181-0222	2,200 Ohm - 1/2W.
R262	181-0473	47,000 Ohm - 1/2W.
R263	181-0562	5,600 Ohm - 1/2W.
R264	181-0474	470,000 Ohm - 1/2W.
R265	181-0221	220 Ohm - 1/2W.
R266	183-0181	180 Ohm - 2W.
R267	183-0181	180 Ohm - 2W.
R268	183-0680	68 Ohm - 2W.
R269	181-0221	220 Ohm - 1/2W.
R270	189-0037	3,300 Ohm - 10W.
R271	189-0036	8.2 Ohm - 1/2W.
		MISCELLANEOUS ELECTRICAL PARTS
	195-0001	Cord - AC Power Line
	191-0016	Fuse - 0.4 Amp. - 250V.
	190-0013	Plate - Audio De-emphasis
C101		330 Mmfd. - 400V.
C102		680 Mmfd. - 400V.
C103		.01 Mfd. - 400V.
R102		100,000 Ohm - 1/5W.
	539-1006	Speaker - 10" P.M.
	611-2401	Tube - HaloLight
	323-0050	Tuner Unit - VHF
	323-0051	Tuner Unit - UHF

VIDEO IF ALIGNMENT *

1- Connect the common lead of a Vacuum Tube Volt Meter to chassis ground. Set the meter on −volts setting, and connect DC probe to junction of L188 and R137 (load resistor of second pix detector).

2- Remove 6AU6 AGC control tube (V132).

3- Apply -3 volts bias to the AGC line (junction of C230, R255, and R260). This bias voltage may be obtained by connecting two 1.5 volt flashlight batteries in series. The positive end should be connected to ground and the negative end to AGC line. (For fringe areas, −1.5V bias should be used)

4- Turn the tuner channel selector to a station which does not have a local signal, (i. e., in New York City, channel 6).

5- Apply the IF signal with an accurate generator (20to 30 Mc range) to the 6J6 tube in the tuner. This may be done by placing an ungrounded shield over the 6J6 tube and applying the signal to the shield. The ground connection for the IF signal generator should be kept as short as possible. However, under no circumstances should the shield over the 6J6 tube be allowed to touch ground during alignment.

6- Set the generator to 23.4 Mc with high output and adjust L185 for maximum reading on the VTVM (keep meter on lowest scale). Always keep generator output low enough to prevent VTVM from reading over 1.5 volts during all alignment steps.

7- Set signal generator to 25.2 Mc and adjust L183 for maximum reading on VTVM, as above.

8- Set VTVM to 21.25 Mc and adjust T105 for minimum reading on VTVM.

9a- Set signal generator to 19.75 Mc† and adjust T104 (top) for minimum reading on VTVM.

b- Set signal generator to 22.3 Mc and adjust T104 (bottom) for maximum reading on VTVM, as in step 6.

c- Repeat steps 9a and 9b.

10a- Set signal generator to 27.25 Mc and adjust T103 (Top) for minimum reading on VTVM.

b- Set signal generator to 25.3 Mc and adjust T103 (bottom) for maximum reading on VTVM, as in step 6.

11- Set signal generator to 21.8 Mc and adjust L11 on tuner (see figure 2) for maximum reading on VTVM, as in step 6.

* All wired and tested chassis are completely aligned before shipment from our factory.

SOUND IF ALIGNMENT

1- Connect signal generator to pin 1 of V106 and set it accurately at 21.25 Mc. The setting of the signal generator should be kept at 21.25 Mc for this complete section. Commence alignment with high generator output and reduce output whenever necessary to keep meter reading within specified scale.

2- Connect the VTVM common lead to ground and the other lead in series with a one megohm resistor to the junction of the diode resistors R219 and R220. Do not remove the discriminator shield to make these connections as it can be made by fashioning a hook on the 1 megohm resistor lead and making connection to the transformer lug "C" through the hole provided for the adjusting tool. The meter should be set on the +10 volt scale and the primary of T113 (top) should be adjusted for maximum reading on the VTVM. (A20,000 ohm per volt meter may be used on the 2.5V scale in series with a 150,000 ohm resistor)

† On 2430 chassis, (without sound trap on tuner) T104 top should be adjusted for minimum response at 21.25 Mc.

3- Connect meter common lead to ground and other lead to junction of R236 and C205. The VTVM should be set to plus 3 or 5 volt scale. Adjust T113 (bottom) for zero reading on meter. It will be found that it is possible to produce either a positive or negative voltage on the meter depending upon this adjustment. T113 (bottom) should be adjusted so that the meter indicates zero output as the voltage swings from positive to negative.

4- Connect probe of VTVM to terminal A of T112. Set meter on -3 or 5 volt scale and adjust both top and bottom of T112 for maximum reading of the VTVM. (a 20,000 ohm per volt meter may be used on 10V scale)

5- Apply 21.25 Mc signal to the 6J6 tube in the same manner as that done in step 5 of the "Video IF Alignment" section. Adjust T111 top and bottom for maximum reading of the VTVM.

6-*Adjust L12, sound takeoff trap on tuner (see figure 2), for maximum reading of the VTVM.

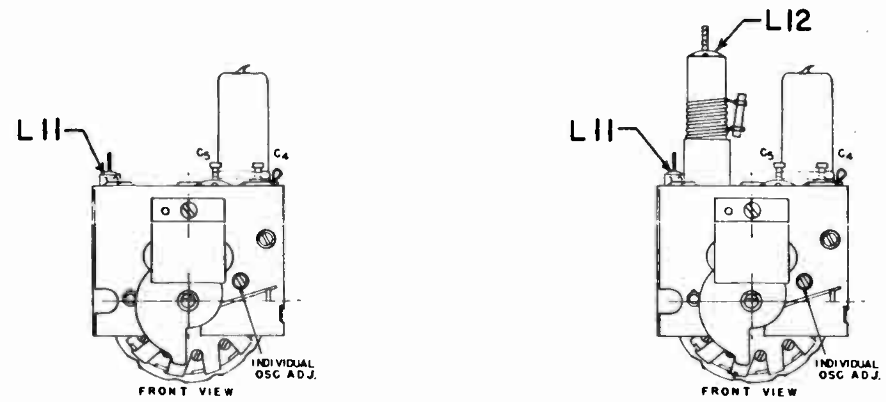
RF OSCILLATOR ALIGNMENT

The RF unit, or tuner, is factory pre-aligned and requires only oscillator adjustment for each channel.

1- Connect an antenna having 300 ohms input impedance to the antenna terminal posts of the receiver. Make certain all tubes are placed firmly in their proper sockets. Turn on the set.

2- Set the channel selector to any channel that is known to be on the air.

3- Set the fine tuning control to its midway position. This will expose a 1/4" hole to the right of the tuner shaft when the chassis is viewed from the front. (see figure below)



MODEL 2430 MODEL 630

FIG. 2

* Model 2430 does not have this coil.

4- Insert a fibre or plastic screw driver through the oscillator adjustment hole and slightly turn the adjustable slug in or out until maximum volume without distortion is obtained. Do not screw slug more than 3/16" from its flush position or it will fall out of the coil, necessitating removal of the coil from the tuner and replacement of the adjustable screw.

5- Keep the fine tuning vernier in the center of its range and adjust each individual channel from which a signal can be received in your location as described in steps 1 through 4 above.

6- Disconnect the antenna from the television chassis.

OVERALL ALIGNMENT

While it is generally unnecessary to use a sweep generator, it may be desirable to view the overall response curve. This curve should be similar to that illustrated below. To obtain it, a 50-216 Mc sweep signal generator is used together with a standard signal generator and an oscilloscope.

1- In a normal signal area, the -3V bias should be applied to the IF strip, as in steps 2 and 3 of the Video IF Alignment section. For fringe area reception, -1.5V bias should be used in the same manner.

2- Connect the RF sweep generator to the receiver antenna terminals and set to channel 12 or 13. Set the receiver channel selector to the same channel.

3- Connect the common lead of a VTVM to ground and the DC probe to the junction of L188 and R137. Set the meter to -3 or -5V scale.

4- Connect the ground lead of an oscilloscope to the chassis ground and the vertical input lead to the junction of L188 and R137.

5- Set the sweep generator to high output and adjust the fine tuning control on the receiver until a response curve appears on the oscilloscope screen. Reduce generator output until a reading of .3 volts is obtained at the VTVM. Readjust oscilloscope gain if necessary to get an adequate sized pattern.

6- Connect the signal generator to the antenna terminals through a small capacitor and feed in a 25.75 Mc IF picture carrier marker.

7- Observe and analyse the response curve obtained. If necessary, the IF adjustments should be slightly retouched in order to obtain a curve similar to the one illustrated below.

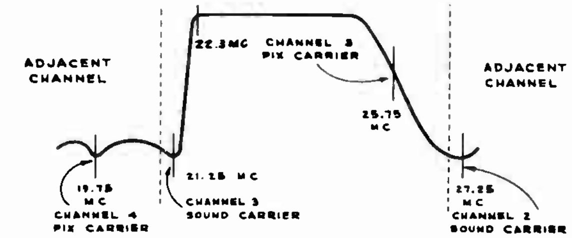


FIG. 3 - OVERALL PICTURE I-F RESPONSE.

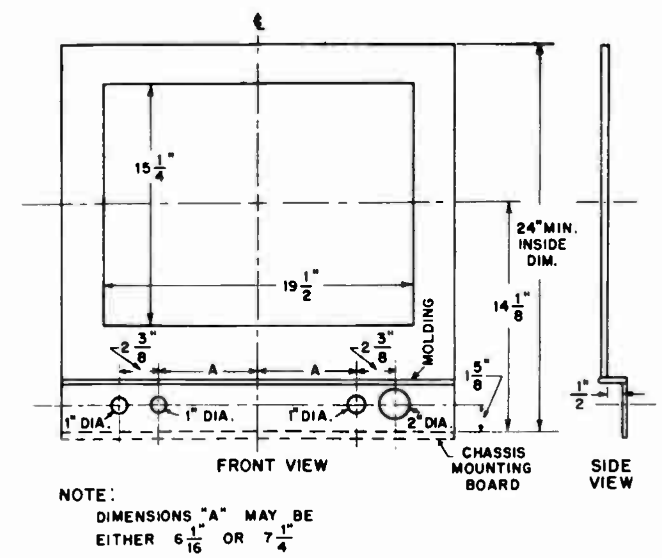
8- If T104 (bottom) requires any adjustment, it may be necessary to readjust T104 (top). When all final adjustments are made, the picture carrier marker 25.75 Mc should be at approximately 50% response. The curve must be approximately flat top with a 22.3 Mc marker at approximately 100% response (a 22.3 Mc marker may be obtained by readjusting the signal generator, as in step 6 above).

9- Throughout the video IF alignment, care should be taken to see that no two transformers are tuned to the same frequency as IF oscillation may result.

10- Check response curve in like manner on several other channels. Slight differences are acceptable.

11- Replace 6AU6 AGC tube and remove bias batteries.

12- Turn off receiver.



UNIVERSAL MOUNTING BRACKET

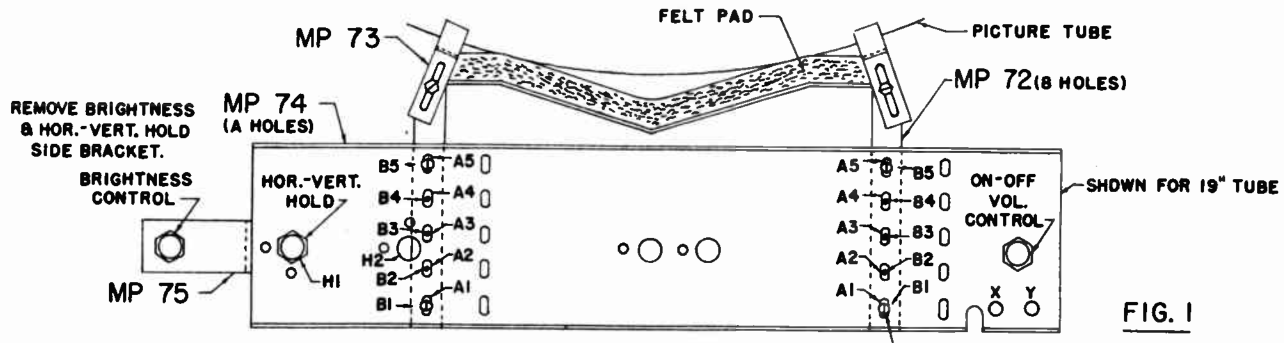


FIG. 1

FRONT VIEW

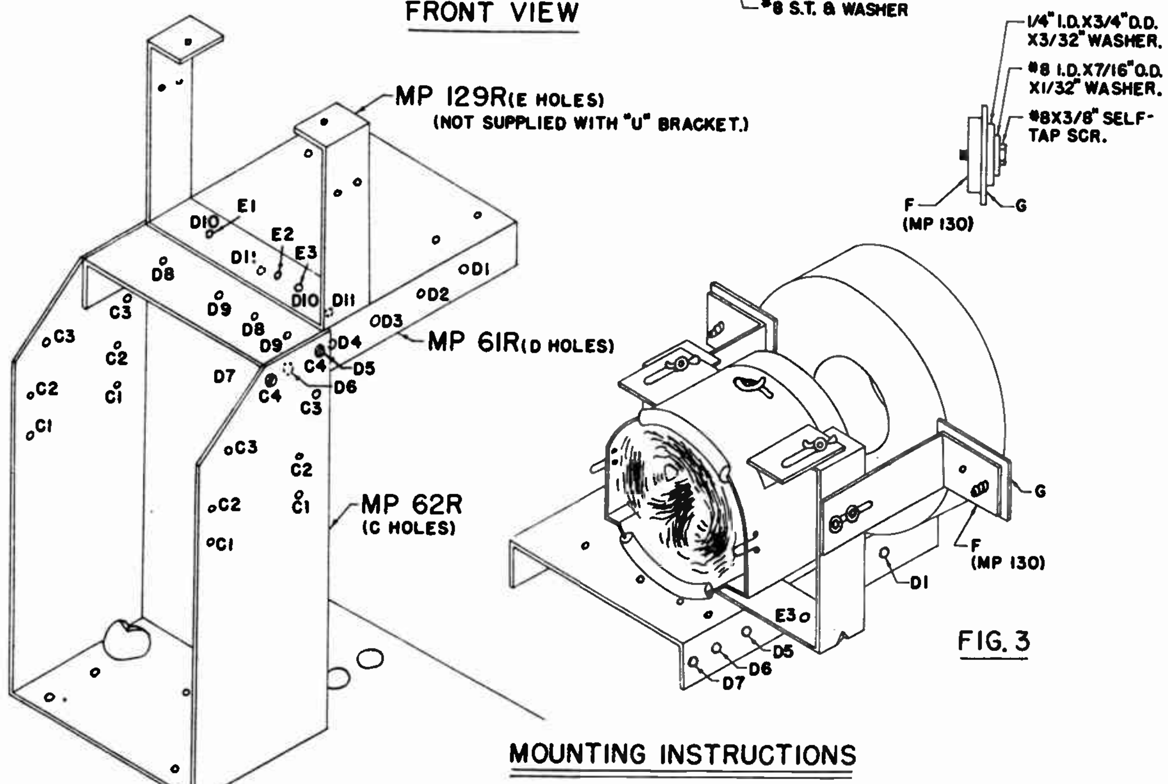
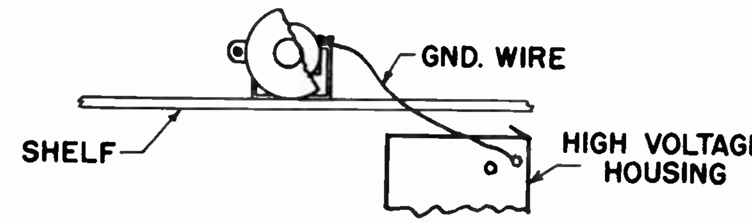


FIG. 2

FIG. 3



1- After mounting the kinescope, the deflection yoke should be placed all the way up on the neck of the tube as far as it will go. On some tubes, it is necessary to remove the rubber cushion from the deflection yoke mounting hood and replace them with strips of tape. This will allow the deflection yoke to be moved closer to the bell portion of the tube.

2- Center the yoke around the neck of the tube by inserting a thin fibre or plastic strip between the inside of the yoke and the neck of the tube.

3- Mount the focus coil, with gap forward, so that the neck of the tube passes through the center of the coil with equal spacing all around the neck. The focus coil should be about 1/4'' behind the yoke and should be parallel to it, not tilted.

4- Mount the ion trap on the kinescope tube near the base. Be certain that the proper type of ion trap magnet is used for the particular kinescope being utilized.

5- Carefully place kinescope socket on the base of the tube, making certain the kinescope grid lead (green lead) is separate from all other leads.

6- Remove insulation from the end of the high voltage lead and solder on proper anode connector. Connect to the picture tube.

MOUNTING INSTRUCTIONS

REMOVE THE TWO SCREWS LOCATED AT X & Y (FIG. 1) FROM THE MOUNTING FOOT. MOUNT MP 74. THEN MOUNT MOUNTING FOOT BACK ON. ASSEMBLE FRONT & REAR BRACKETS USING HOLES AS TABULATED BELOW:

KINESCOPE SIZE	FRONT BKT. HOLES USED		REAR BKT. HOLES USED		
	MP 74	MP 72	MP 62R	MP 61R	MP 129R
20" RECT. GLASS	A3 & 5	B1 & 3	C4 HOLES	D7 & 5, D10 HOLES	E1 & 3
19" RD. METAL	A1 & 5	B1 & 5	C4 HOLES	D7 & 5, D10 HOLES	E1 & 3
17" RECT. GLASS	A4 & 5	B1 & 2	C3 HOLES	D6 & 3, D8 HOLES	E1 & 3
17" RECT. METAL	A3 & 5	B1 & 3	C3 HOLES	D6 & 3, D8 HOLES	E1 & 3
16" RECT. GLASS	A4 & 5	B1 & 2	C3 HOLES	D6 & 3, D8 HOLES	E1 & 3
16" RD. GLASS	A3 & 5	B1 & 3	C4 HOLES	D7 & 5, D8 HOLES	E1 & 3
16" RD. METAL	A3 & 5	B1 & 3	C4 HOLES	D7 & 5, D10 HOLES	E1 & 3
16GP4 TYPE	A2 & 5	B1 & 4	C3 HOLES	D4 & 2, D8 HOLES	E1 & 3
14" RECT. GLASS	A5	B1	C3 HOLES	D3 & 1, D8 HOLES	E1 & 3
12" RD. GLASS	A2 & 5	B1 & 4	C1 HOLES	D4 & 2, D8 HOLES	E1 & 3

NOTES
1. USE FELT PADS FOR GLASS TUBES ONLY.
2. USE ANCHOR PLASTIC OR EQUIVALENT PLASTIC RING & SLEEVE FOR METAL TUBES.
3. ⊖: #8 S.T. & WASHER; ⊘: 6-32X1/2 RHMS.
4. PLACE PADDING BETWEEN MP 73 & PICTURE TUBE.

IN SOME CABINET INSTALLATIONS, IT MAY BE NECESSARY TO REMOVE MP 75, THE BRIGHTNESS CONTROL BRACKET. FOR SUCH INSTALLATIONS, FOLLOW THE INSTRUCTIONS BELOW:
1. SHIFT BRACKET MP 72 1-3/16" FROM SETTING IN ABOVE TABLE TO THE RIGHT BY USING ALTERNATE SET OF HOLES IN MP 74.
2. MOUNT HOR.-VERT. HOLD CONTROL IN HOLE H2 & BRIGHTNESS CONTROL IN H1.
3. SHIFT MP 129R 1-3/16" TO THE RIGHT BY LINING UP HOLES E1 & E2 (MP 129R) WITH D9 HOLES (MP 61R) INSTEAD OF D8 HOLES, OR D11 HOLES INSTEAD OF D10 HOLES. SEE FIG. 3 FOR SHIFT.
4. MOUNT YOKE & FOCUS COIL ASSEMBLY TO MP 129R AS SHOWN IN FIG. 3.

PRELIMINARY ION TRAP ADJUSTMENT

Turn on receiver.

Adjust the brightness control to about 3/4 clockwise position. Then slowly rotate ion trap while moving it gently forward and backward until a bright area begins to appear on the picture tube face. Continue rotating while reducing the brightness control setting until the best brightness has been obtained on the face of the picture tube for a relatively low setting of the brightness control. If either a single horizontal bright line or a vertical bright line appears, turn off receiver to avoid burning the picture tube screen, and check the vertical or horizontal deflection circuits for errors (see trouble shooting chart). If, for any reason, no brightness appears after several trials, rotate the brightness control completely counter clockwise until the trouble is found as picture tube damage may result from incorrect placement of the ion trap.

PRELIMINARY ADJUSTMENTS ON AIR SIGNAL

Before final adjustments can be made, several preliminary adjustments must be made on an air signal. Connect an antenna having 300 ohms input impedance to the antenna terminal posts on the receiver. Turn on the set, and set the channel selector to any channel that is known to be on the air.

1- Turn brightness control completely counter clockwise and then slightly clockwise until a glow begins to appear on the face of the picture tube.

2- On receivers with a rear panel AGC level control, turn control 3/4 clockwise.

3- Turn up contrast until a series of diagonal or horizontal black and white lines are seen on the face of the tube.

4- Adjust secondary of synchrolock transformer, T108 (i. e., located on rear of chassis) until a single picture is seen on the screen. If it is rolling up or down, adjust the vertical hold control until it remains stationary.

Set the horizontal hold control to the extreme clockwise position and readjust the rear screw of synchrolock transformer, if necessary to lock the picture. Next, set the horizontal hold control to the extreme counter clockwise position and re-adjust the synchrolock transformer as stated above. Observe the number of turns necessary for readjustment of the synchrolock transformer. Set the horizontal hold control to the center of the range and readjust the synchrolock transformer by 1/2 the number of turns between the clockwise and counter clockwise positions of the horizontal hold control. When functioning properly, the horizontal hold control may be varied to approximately 80% of its extreme positions and still maintain proper horizontal sync.

5- Adjust the width and horizontal drive controls so that both edges of the picture may be observed.

6- If foldover (i. e., a bright vertical band at either extreme of the received picture) is observed, a slight adjustment of the phasing screw may be necessary. This screw is in the primary of the synchrolock transformer and must be reached from the inside of the chassis. With the horizontal hold control completely clockwise, adjust the phasing screw until the foldover just disappears. Then rotate the horizontal hold control completely counter clockwise. If no foldover occurs, the adjustment is complete. If there is slight foldover, re-adjust the phasing screw, so that the foldover line is 1/2 as wide as previously. The foldover should then disappear over the greatest part of the horizontal hold range.

7- If necessary, readjust the rear screw of the synchrolock transformer according to the instructions in step 4 above.

8- On receivers having an AGC level control, set receiver on strongest channel, turn control clockwise until picture just begins to overload, then back off slightly.

FINAL ADJUSTMENTS ON AIR SIGNAL

For the following adjustments, a test pattern is required:

1- Adjust the deflection yoke so that it is snug against the bell portion of the picture tube, and the top and bottom of the test pattern are in a straight horizontal line, parallel with the floor and table top.

2- Adjust the focus control until the picture is as clear as possible.

3- Adjust vertical linearity and height controls until the top half and bottom half of the test pattern are equal in height and just fill the cabinet mask. The height control has the greatest effect on the bottom half of the picture while the linearity control has the greatest effect on the top half of the picture. It may be necessary during these adjustments to occasionally reset the vertical hold control.

4- Adjust the horizontal and vertical centering controls* until test pattern is properly centered on face of tube.

5a- For picture tubes requiring from 53 to 60 degrees horizontal deflection (i. e., 12LP4, 16AP4, 16DP4, etc.) the width plug on the rear of the chassis should be placed in the 60 degree position.

b- For tubes requiring from 63 to 70 degrees horizontal deflection, (i. e., 19AP4, 16GP4, all rectangular tubes, etc.) the width plug should be placed in the 70 degree position.

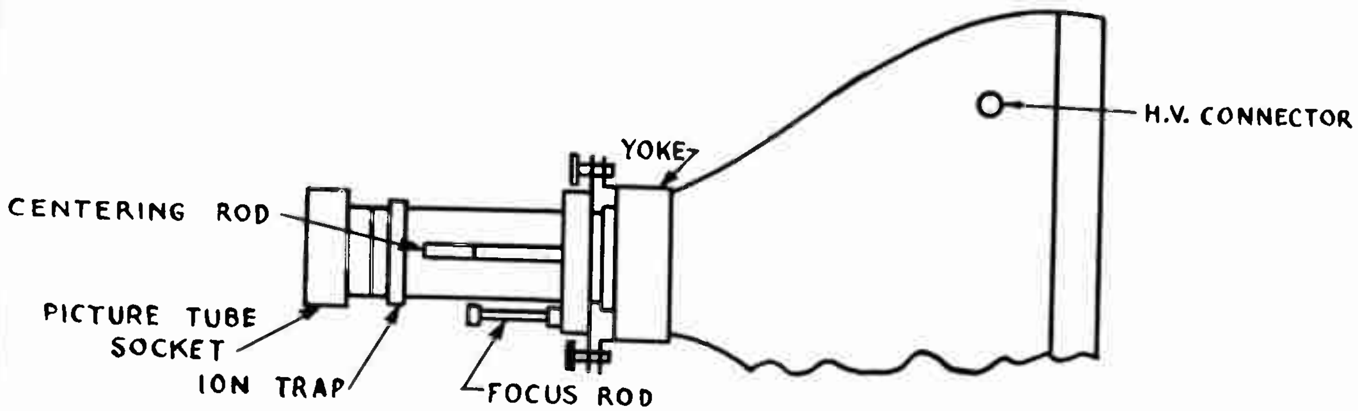
6- Adjust horizontal drive control for greatest width without excessive stretching of left hand portion of picture. If width is excessive, turn width screw out. If too narrow, turn width screw in.†

7- A slight readjustment of the ion trap and focus control may be required.

* On some models, a slight adjustment of position of focus coil will correct centering.

† On some models, a separate width coil is provided for 60 degree adjustments.

A. Installation of Kinescope Components



1-Place components on neck of tube using appropriate mechanical mounting brackets.
2-Connect all plugs and connectors to their proper receptacles.
3-Place deflection yoke forward as close to the bell of the picture tube as possible.
4-Mount the focus coil about 1/4" behind the yoke and parallel to it, leaving an equal clear space around the picture tube neck.
5-Mount the ion trap near the base of the picture tube. Make sure ion trap is correct for picture tube being used.
6-Fasten high voltage connector to picture tube.
7-Turn set on. Adjust "BRIGHTNESS" control 3/4 clockwise. Slowly rotate ion trap magnet while moving it back and forth until best brightness is obtained. If, after several times, no brightness appears or single line is seen, turn "BRIGHTNESS" control completely counter-clockwise until trouble is found.
8-Move centering rod, on focus coil, up and down to center picture horizontally and left to right to center vertically.
9-Reduce brightness to slightly above normal, readjust ion trap for maximum brightness, then screw focus rod in or out until the picture is sharpest.
10-If shadows appear at any corner of the raster, recheck position of yoke and focus coil. The ion trap may be moved slightly provided that it is kept within the range of maximum brightness. A careless adjustment may injure the picture tube.

B. Operating Instructions (applicable only after receiver has been properly set up and adjusted)

1-Turn set ON by rotating "VOLUME" control clockwise.
2-Set "CHANNEL SELECTOR" todesired station.
3-Turn"BRIGHTNESS" control clockwise until a faint glow appears on screen.
4-Adjust "CONTRAST" control for desired contrast.
5-Adjust "FINE TUNING" control for clearest sound and then set "VOLUME" for adequate sound level.
6-If the picture rolls vertically, adjust "VERTICAL HOLD" control.
7-If diagonal lines rather than a stationary pattern appear, adjust "HORIZONTAL HOLD" control.
8-When switching to another station, it may be necessary to repeat step 4.
9-For phonograph operation, turn "BRIGHTNESS" control completely counter-clockwise until click is heard. Then turn phono motor on.

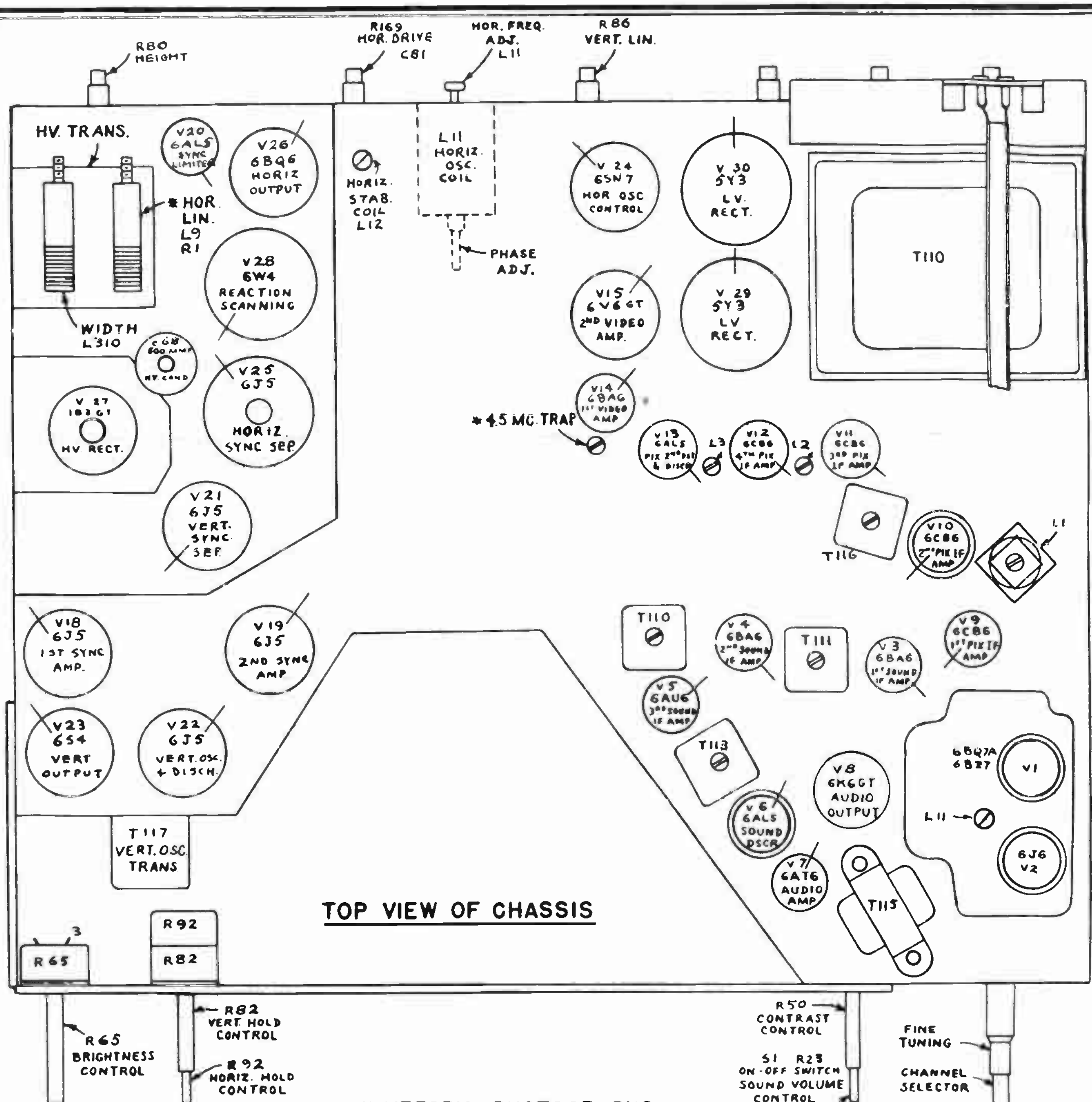
C. Rear Control Adjustment(if required)

1-The "VERTICAL LINEARITY" and "HEIGHT" controls are used to obtain a linear vertical pattern. The "HEIGHT" control affects mainly the bottom half of the picture while the "VERTICAL LINEARITY" control affects the top half. Adjust these controls a little at a time, first one, then the other, and repeat. It may be necessary when adjusting these controls to readjust the "VERTICAL HOLD" control on front of chassis.
2-Screw "HORIZONTAL DRIVE" control in until one or two white vertical lines appear near the center of the screen, back off control until lines just disappear.
3-Rotate "HORIZONTAL HOLD" control (front panel) completely clockwise. Picture may start to pull out at right hand side or one to three diagonal bars slanting down to right may appear. This is normal. Rotate horizontal hold control completely counter-clock-wise. Picture may fall out of sync with one to six bars slanting to left. Slowly rotate "HORIZONTAL" control clockwise. Picture should pull in at about two to four bars. The picture should remain in sync over at least 75% of the horizontal range.

If control does notperform as above, first rotate "HOLD" control to extreme clockwise position. Adjust horizontal oscillator slug in rear until picture is in sync and about to pull out to the right. Recheck operation as in preceeding paragraph. If control does not perform as described, or excessive bend appears in picture a complete readjustment of both horizontal stabilizing coil and oscillator coil is indicated.

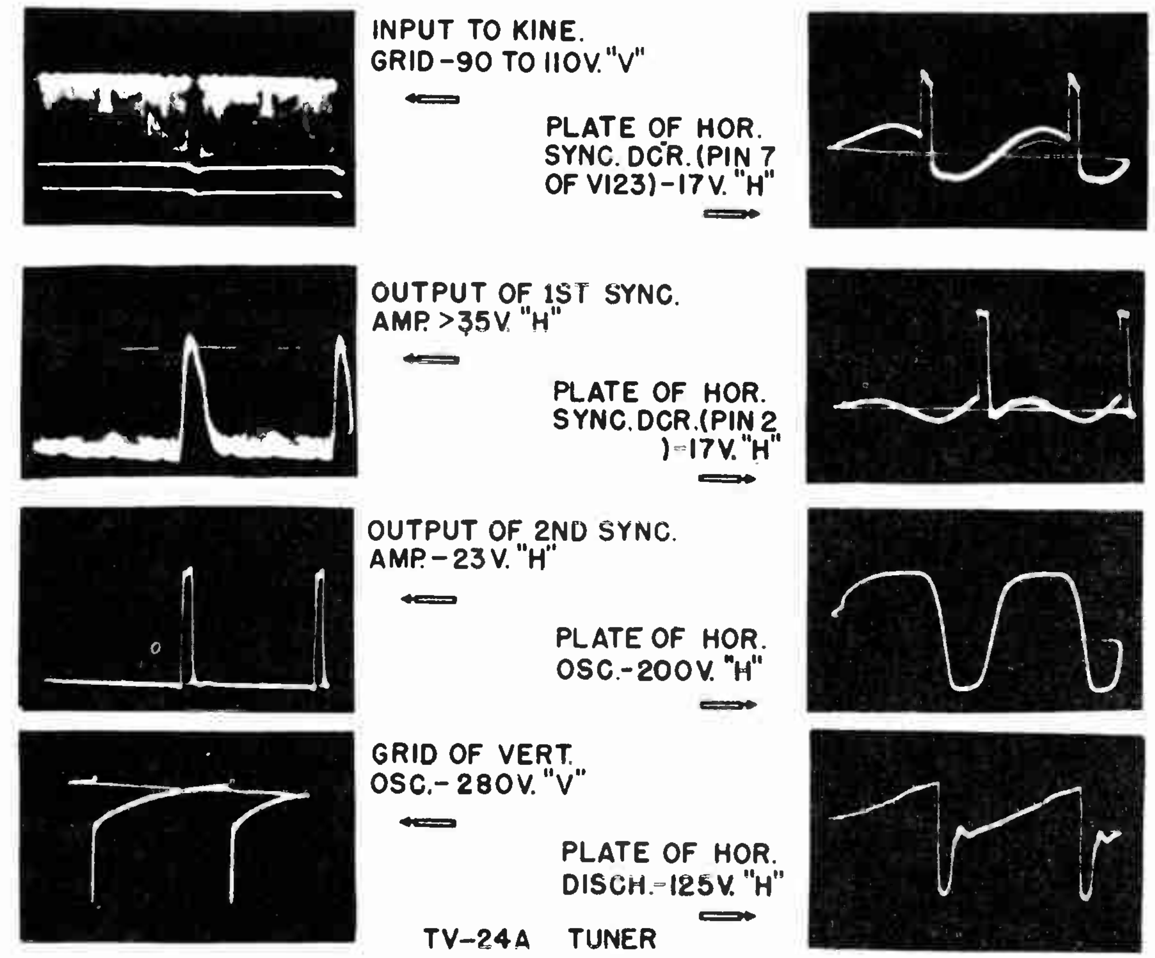
a) Temporarily short out stabilizing coil with a very short wire (3").
b) Turn "HORIZONTAL HOLD" control completely clockwise.
c) Adjust horizontal oscillator coil until picture is in sync and about to pull out to the right.
d) Remove short. Attach oscilloscope through 3 mmf. capacitor to tap on oscillator coil and observe waveform.
e) Adjust horizontal stabilizing coil until broad and sharp peaks are equal in amplitude, keeping picture in sync with "HOLD" control if necessary. Readjust horizontal oscillator coil if required as in step B and C.
f) If oscilloscope is not available, a fairly satisfactory adjustment of the stabilizing coil may be had by turning it out until the picture is centered in the raster without foldover on either side. (To observe this, width must be reduced to expose at least one edge of the picture, contrast must be reduced and brightness increased so that raster is visible.)
g) Recheck horizontal oscillator coil setting as in "C" above.

4- Adjust "WIDTH" coil for proper width; clockwise rotation to increase width; counter-clockwise to reduce width.
5- Adjust "HORIZONTAL LINEARITY" coil for best horizontal linearity with no white vertical lines in raster.
6- Set "AGC LINK" to open or closed position, depending on signal strength in area.



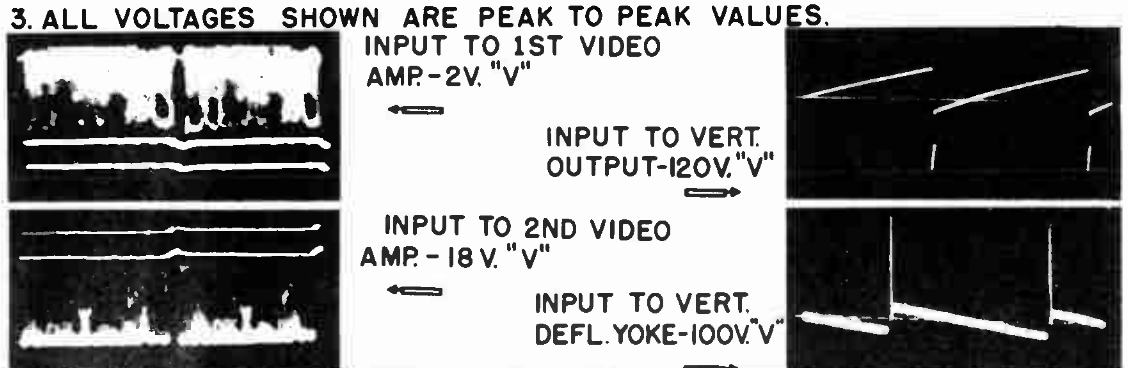
TOP VIEW OF CHASSIS

WAVEFORM PHOTOGRAPHS

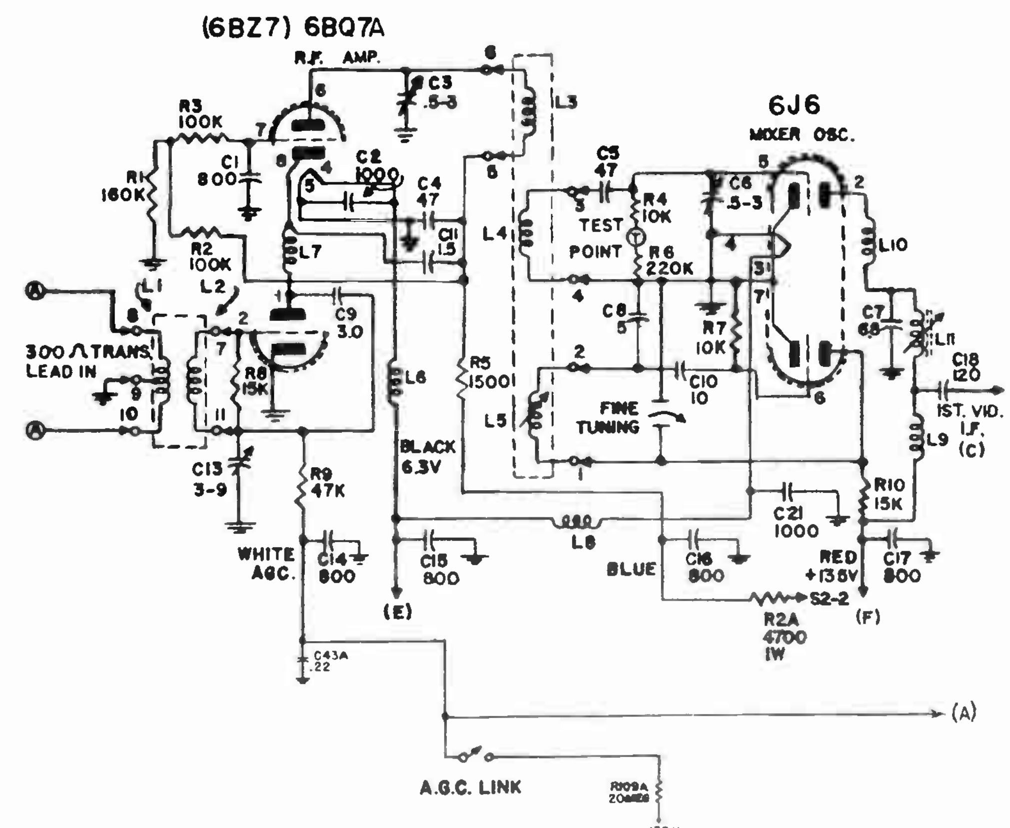


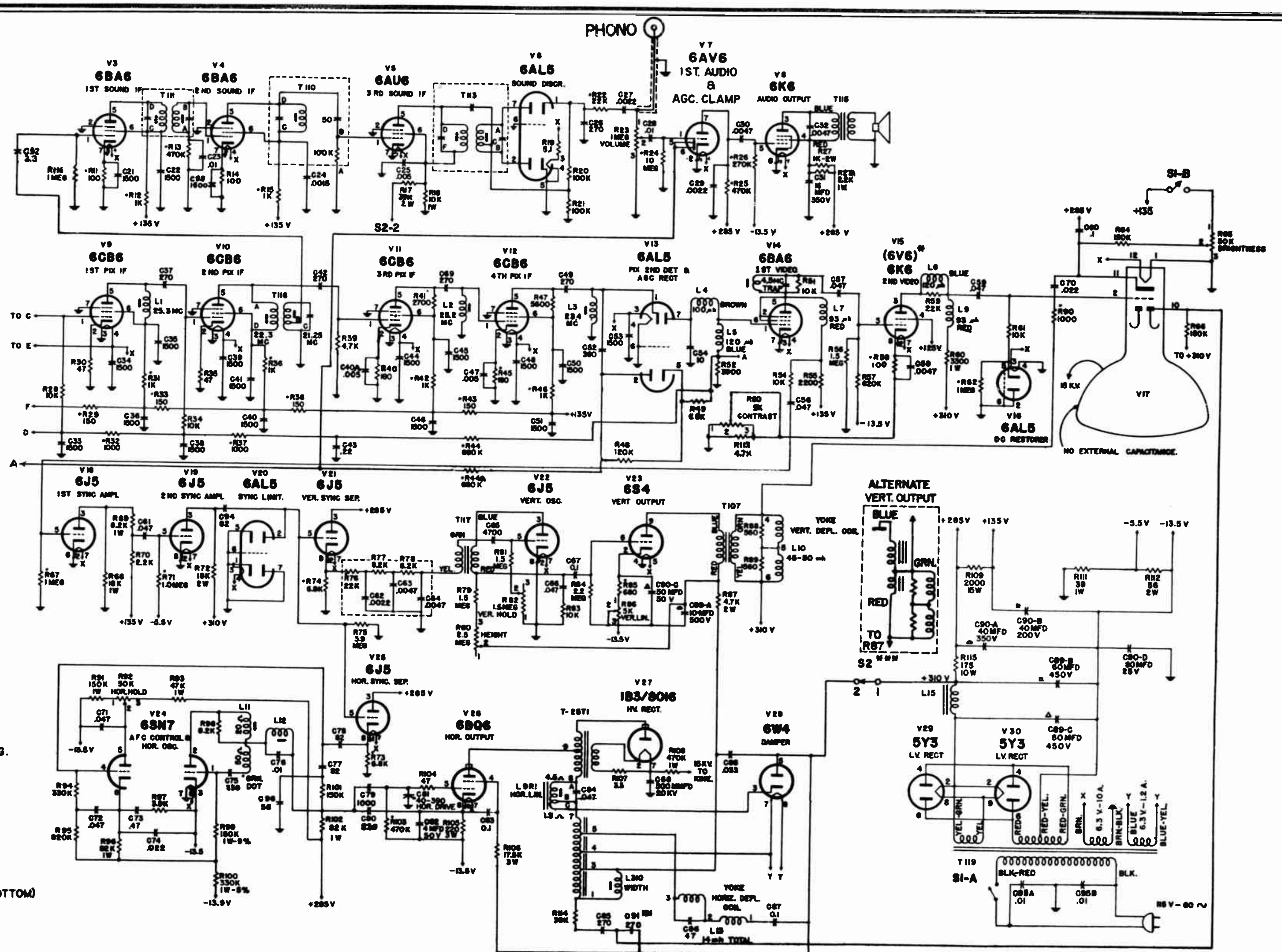
NOTES:

1. "V" INDICATES OSCILLOSCOPE SYNC'D TO 1/2 OF VERT. SWEEP RATE.
2. "H" INDICATES OSCILLOSCOPE SYNC'D TO 1/2 OF HORIZ. SWEEP RATE.
3. ALL VOLTAGES SHOWN ARE PEAK TO PEAK VALUES.



TV-24A TUNER





NOTES.

* USED ON SOME MODELS.
** DECREASE VALUE FOR GREATER BLANKING.
*** S2 IS ON BRIGHTNESS CONTROL.
T.V. POSITION — S2 CLOSED.
PHONO POS. — S2 OPEN
LINK CLOSED-NORMAL AREA
LINK OPEN -STRONG AREA

ON SOME RECEIVERS I.F. ALIGNMENT FREQUENCIES ARE:-

SOUND I.F.	21.9MC.
L11-22.45	T104A-22.95(BOTTOM)
T103-27.9(TOP)	L183-25.65
T103-25.95(BOTTOM)	T105-21.9
T104A-21.9(TOP)	L186-24.05

ALL VOLTAGES ARE MEASURED AT 117V. A.C. INPUT, CONTRAST CONTROL AT MINIMUM. VOLTAGES MAY VARY ±20%.
ALL RESISTANCE VALUES ARE IN OHMS AND ARE 1/2 W.-10% TOLERANCE UNLESS OTHERWISE NOTED. K=1000 (RES. WITH DOT HAVE 20% TOL.)
ALL CAPACITANCE VALUES PRECEDED BY A DECIMAL ARE IN MFD., ALL OTHERS ARE IN MMFD. UNLESS OTHERWISE NOTED.

PARTS LIST

Ckt. Sym.	PART NO.	DESCRIPTION

RESISTORS

All resistors are 1/2 W, 10% Carbon, Tolerance, unless otherwise noted (Res. with dot have 20% Tolerance)

(Continued from previous page)

R-11		• 100Ω, Carbon
R-12		• 1KΩ,
R-13		• 470KΩ
R-14		• 100Ω
R-15		• 1KΩ
R-16		100KΩ (Part of T-110)
R-17		10KΩ, 1W
R-18		10KΩ, 1W
R-19		47Ω
R-20		100KΩ
R-21		100KΩ
R-22		• 22KΩ
R-23	VC-D1A	1MΩ (rear) ON-OFF SW, Volume Control
R-24		• 10MΩ
R-25		• 470KΩ
R-26		• 270KΩ
R-27		• 1KΩ, 2W
R-28		10KΩ
R-29		• 150Ω
R-30		47Ω
R-31		• 1KΩ
R-32		• 1KΩ
R-33		• 150Ω
R-34		10KΩ
R-35		47Ω
R-36		• 1KΩ
R-37		• 1KΩ
R-38		• 150Ω
R-39		4.7KΩ
R-40		47Ω
R-41		2.7KΩ
R-42		• 1KΩ
R-43		• 150Ω
R-44		• 680KΩ
R-45		• 180Ω
R-46		• 1KΩ
R-47		5.6KΩ
R-48		• 120KΩ
R-49		2.2KΩ
R-50	VC-D1A	5KΩ (front) Contrst Control
R-51		10KΩ
R-52		3.9KΩ
R-54		10KΩ
R-55		2.2K
R-56		1.5MΩ
R-57		820KΩ
R-58		• 100Ω
R-59		• 22KΩ
R-60		39Ω, 1W
R-61		10KΩ
R-62		• 1MΩ
R-64		150KΩ
R-65	VC-503	50KΩ, Brightness Control
R-66		150KΩ
R-67		• 1MΩ

R-68		18KΩ, 1W
R-69		8.2KΩ, 1W
R-70		2.2KΩ
R-71		• 1MΩ
R-72		18KΩ, 2W
R-73		• 6.8KΩ
R-74		• 6.8KΩ
R-75		3.9MΩ
R-76	CC-VI	22KΩ Integrator Ckt.
R-77	CC-VI	8.2KΩ Integrator Ckt.
R-78	CC-VI	8.2KΩ Integrator Ckt.
R-79		1.5MΩ
R-80	VC-255	2.5MΩ, Height Control
R-81		1.5MΩ
R-82	VC-D2A	1MΩ (rear) Vert. Hold
R-83		10KΩ
R-84		2.2MΩ
R-85		• 680Ω
R-86	VC-502	5KΩ, 1W, Vert. Lin. Control
R-87		4.7KΩ, 2W
R-88	In Yoke	560Ω
R-89	In Yoke	560Ω
R-90		• 1KΩ
R-91		150KΩ
R-92	VC-D2A	50KΩ (front) Horiz. Hold
R-93		47KΩ, 1W
R-94		330KΩ
R-95		820KΩ
R-96		82KΩ, 1W
R-97		3.9KΩ
R-98		8.2KΩ
R-99		150KΩ, 1W, 5%
R-100		330KΩ, 1W, 5%
R-101		150KΩ
R-102		82KΩ, 1W
R-103		• 470KΩ
R-104		47Ω
R-105		220Ω, 3W, WW
R-106		17.5KΩ, 3W, WW
R-107		3.3Ω
R-108		470KΩ, 1W
R-109		2KΩ, 15W, WW
R-111		39Ω, 1W
R-112		56Ω, 2W
R-113		2.7KΩ
R-114		39KΩ
R-115		175Ω, 10W, WW

CAPACITORS

All capacitance values preceded by a decimal are in MFD. Others are in MMFD, unless otherwise noted. Types are ceramic, unless otherwise noted (mica are preceded with a dot).

C-21		.0015, 500V, dual disc (1/2-C-22)
C-22		.0015, 500V, dual disc (1/2-C-21)
C-23		.01, 600V, paper
C-24		.0015, 500V, disc
C-25		.005, 500V, disc
C-26		• 270, 500V, 20%
C-27		.0022, 600V, paper
C-28		.01, 600V, paper
C-29		.0022, 600V, paper
C-30		.0047, 600V, paper
C-31	CE111	16MFD, 350V, Pig-tail Electrolytic
C-32		.0047, 600V, paper
C-33		.0015, 500V, dual disc (1/2-C-38)
C-34		.0015, 500V, dual disc (1/2-C-35)
C-35		.0015, 500V, dual disc (1/2-C-34)
C-36		.0015, 500V, dual disc (1/2-C-40)
C-37		• 270, 500V, 20%
C-38		.0015, 500V, dual disc (1/2-C-33)
C-39		.0015, 500V, dual disc (1/2-C-41)
C-40		.0015, 500V, dual disc (1/2-C-36)
C-41		.0015, 500V, dual disc (1/2-C-39)
C-42		• 270, 500V, 20%
C-43		.22, 200V, paper
C-44		.0015, 500V, dual disc (1/2-C-45)
C-45		.0015, 500V, dual disc (1/2-C-44)
C-46		.0015, 500V, dual disc (1/2-C-51)
C-47		.005, 500V, disc
C-48		.0015, 500V, dual disc (1/2-C-50)
C-49		• 270, 500V, 20%
C-50		.0015, 500V, dual disc (1/2-C-48)
C-51		.0015, 500V, dual disc (1/2-C-46)
C-52		• 390, 500V, 20%
C-53		.0015, 500V, disc
C-54		10, 500V, 20%
C-55		.005, 500V, disc
C-56		.047, 400V, paper
C-57		.047, 400V, paper
C-58		.0047, 600V, paper
C-59		.047, 400V, paper
C-60		.1, 400V, paper
C-61		.047, 400V, paper
C-62	CCVI	.0022 Integrator Circuit
C-63	CCVI	.0047 Integrator Circuit
C-64	CCVI	.0047 Integrator Circuit
C-65		• 4700, 500V
C-66		.047, 600V, paper
C-67		.1, 600V, paper
C-68		500, 20KV, 10%
C-69		• 270, 500V, 20%
C-70		.022, 400V, paper
C-71		.047, 400V, paper
C-72		.047, 400V, paper
C-73		.47, 200V. paper
C-74		.022, 400V, paper
C-75		• 330, 500V, Silver,5%
C-76		.01, 600V, paper
C-77		• 82, 500V, 10%
C-78		• 82, 500V, 10%
C-79		• .001, 1000V, 20%
C-80		• 820, 500V, 10%
C-81	CV-8	• 40-370, Horiz. Drive Control
C-82		4MFD, 50V, Electrolytic
C-83		.1, 400V, paper
C-84		.047, 400V, paper
C-85		• 270, 500V, 20%
C-86		• 47, 1500V, 10%
C-87		.1, 600V, paper
C-88		.033, 1KV, paper
⌓ C-89A	CE109	10MFD, 500V +20% Electrolytic
□ C-89B	CE109	60MFD, 450V +20% Electrolytic
△ C-89C	CE109	60MFD, 450V +20% Electrolytic
⌓ C-90A	CE110	40MFD, 350V Electrolytic 20%
□ C-90B	CE110	40MFD, 200V Electrolytic 20%
△ C-90C	CE110	50MFD, 50V Electrolytic 20%
C-90D	CE110	80MFD, 25V Electrolytic 20%
C-91		• 270, 500V, 20%
C-92		3.3, 500V, 20%
C-94		• 82, 500V, 10%
C-95A		.01, 500V,
C-95B		dual disc
C-96		• 56, 500V, 10%

COILS & TRANSFORMERS

L-1	L202-1	1st Pix IF
L-2	L202-1	2nd Pix IF
L-3	L202-1	3rd Pix IF
L-4	L203-7	100µh peaking coil
L-5	L203-3	120µh peaking coil
L-6	L308	4.5MC trap
L-7	L203-4	93µh peaking coil
L-8	L203-3	120µh peaking coil
L-9	L203-4	93µh peaking coil
L-10	LD211	Vert. Defl. Yoke
L-11	L304	Horiz. Osc. Coil
L-12	L305	Horiz. Stab. Coil
L-13	LD211	Horiz. Defl. Yoke
L9R1	209R1	Horiz. Lin. Coil
L310	L310	1.5-9mh Width Coil
L-15	TCH-3	1-2h Filter Choke
T-110	T110	Sound IF (single tuned)
T-111	T111	Sound IF 21.25MC
T-113	T113	Sound Discriminator
T-115	T114	Audio Output (3.2Ω VC)
T-116	L302	Pix IF & 21.25 MC trap
T-117	T8T2A	Vert. Osc. Trans.
T-119	TP300A	Power Trans.
T-25T1	T25T1	Horiz. Output Trans.
	SP120	12" Speaker

ALIGNMENT INSTRUCTIONS

Check other possible causes carefully before considering realignment. The following adjustments rarely require attention and alignment should not be attempted unless the circuits are definitely known to be out of adjustment and suitable equipment is available to make these adjustments.

Refer to Figs. 9 and 10 for location of alignment adjustments. Refer to the schematic for location of the test points indicated by the circled letters in the following chart.

PRESETTING IF TRAP COILS USING AM SIGNAL GENERATOR AND VTVM

Connect the negative lead of a 3-volt battery at point (B) shown on the schematic diagram; connect the positive lead to the chassis. Connect the signal generator to the grid of the 1st IF tube. Connect the DC probe of the VTVM at point (A); connect the negative lead to the chassis. Set the picture and fine tuning controls fully clockwise. Set the receiver to channel 12.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
Direct	To 1st IF grid	20.6 Mc (Unmod.)	12	DC probe to point (A). Common to chassis.	Bottom adjustments of L-42B and L-42C.	Adjust for maximum voltage at VTVM.

CAUTION—Once the IF trap coils have been preset, no further adjustment with these coils will be necessary. Proceed to the overall IF response as described below to complete the alignment.

OVERALL IF AMP. RESPONSE CHECK

Connect the synchronized sweep voltage from the sweep signal generator to the horizontal input of the oscilloscope for horizontal deflection. Connect the sweep generator to the loosely coupled shield of the 6J6 tube, making certain that the shield is not grounded; connect the ground lead to the chassis.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
Direct	High side to loosely coupled shield of 6J6; low side to chassis.	24 Mc (10 Mc sweep)	21.75 Mc 26.25 Mc	12	Vertical amplifier to point (A). Common to chassis.	L-13A L-42B (top) L-42C (top) L-6 L-38	Check for response curve similar to Fig. 6 with markers as shown. It is generally necessary to retouch settings of L-13A, L-42B (top), and L-42C (top) for proper response. Note that the adjustment of L-13A will affect the video side of the curve, L-42B (top) the audio side, and L-42C (top) the intermediate range. It may be necessary to touch up settings of L-6 and L-38 for proper symmetry, flatness, and bandpass. A pass band width of 3.5 Mc measured at the 50% response points is recommended at this point.

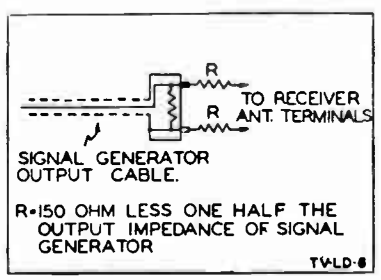


FIG. 4. Dummy Antenna Detail

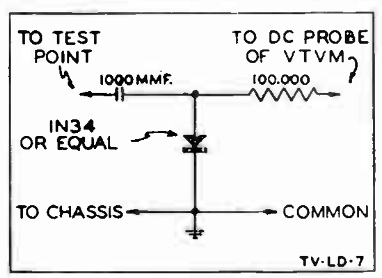


FIG. 5. Diode Detector Detail

SOUND IF AMP ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
Direct	High side to point (A). Low side to chassis.	4.5 Mc (Unmod.)	Any channel unused locally.	Dc probe to point (C). Common to chassis.	L-16A and bottom adjustment of L-17.	Adjust for max. voltage at VTVM.
"	"	"	"	DC probe to point (E). Common to chassis.	Adjust top slug of L-17.	Adjust for zero voltage. A positive and negative reading will be obtained on either side of the correct setting.

CHECK ON SOUND IF AMP ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Connect the synchronized sweep voltage from the signal generator to the horizontal input of the oscilloscope for horizontal deflection.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
Direct	High side to point (A). Low side to chassis.	4.5 Mc (500 Kc sweep)	4.45 Mc 4.5 Mc 4.55 Mc	Any channel unused locally.	Vertical amplifier input to point (C). Common to chassis.	L-17	Touch up the adjustments of L-17 maintaining max. amplitude while adjusting for max. steepness and straightness of the slope. See Fig. 7. Note that the 4.5 Mc marker pip tends to disappear as the correct setting of the top adjustment of L-17 is reached.

4.5 MC TRAP ADJUSTMENT

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
Direct	High side to point (A). Low side to chassis.	4.5 Mc (Unmod.)	Any channel unused locally.	AC probe to cathode of picture tube. Test point (D). Common to chassis.	L-16B	Adjust for minimum voltage. A crystal detector shown in Fig. 5 may be used with the VTVM in place of a commercial AC probe if desired.

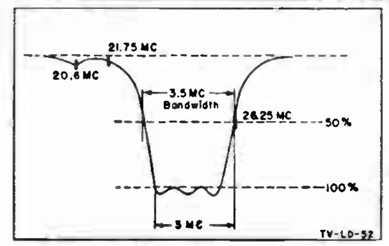


FIG. 6. IF Response Curve

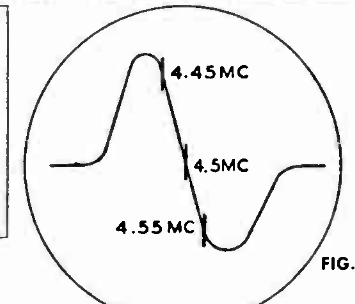


FIG. 7. Audio Response Curve

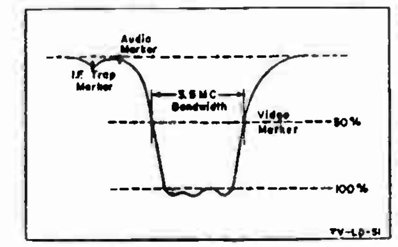


FIG. 8. Overall RF Response Curve

TUNER ALIGNMENT

Unless the tuner assembly has been serviced (tube or parts replacement) an adjustment of the RF stage trimmers will generally not be required. Tuner service, wherever possible, should be restricted to the adjustment of the oscillator trimmers outlined under INSTALLATION AND SERVICE ADJUSTMENTS.

Alignment of the tuner assembly should not be attempted unless suitable equipment is available.

Connect the synchronized sweep voltage from the sweep signal generator to the horizontal input of the oscilloscope for horizontal deflection.

Connect the negative lead of a 3-volt battery at point (B) shown on the schematic diagram; connect the positive lead to the chassis.

Set the fine tuning control to an approximate midway position.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
Two carbon resistors. See Fig. 4	To receiver antenna terminals.	207 Mc (10 Mc sweep)	205.25 Mc 209.75 Mc	12	Vertical amplifier input to point (A). Common to chassis.	C-3 C-6 C-13 Osc. 12	Adjust C-3 RF amp. trimmer, C-6 mixer trimmer, and C-13 RF amp. trimmer for proper pass band and symmetry. Adjust oscillator coil to place the video marker at the 50% response point. Refer to Fig 8.
"	"	213 Mc (10 Mc sweep)	211.25 Mc 215.75 Mc	13	"	Osc. 13	Check frequency response for symmetrical peaks as above and if necessary touch-up adjustments C-3, C-6, and C-13. Adjust oscillator coils so that the video marker will be at the 50% response point of the curve. Note that the oscillator adjustment screw is found to the right of the fine tuning shaft and is made accessible as the channel selector is rotated to each channel.
"	"	201 Mc (10 Mc sweep)	199.25 Mc 203.75 Mc	11	"	Osc. 11	
"	"	195 Mc (10 Mc sweep)	193.25 Mc 197.75 Mc	10	"	Osc. 10	
"	"	189 Mc (10 Mc sweep)	187.25 Mc 191.75 Mc	9	"	Osc. 9	
"	"	183 Mc (10 Mc sweep)	181.25 Mc 185.75 Mc	8	"	Osc. 8	
"	"	177 Mc (10 Mc sweep)	175.25 Mc 179.75 Mc	7	"	Osc. 7	
"	"	85 Mc (10 Mc sweep)	83.25 Mc 87.75 Mc	6	"	Osc. 6	
"	"	79 Mc (10 Mc sweep)	77.25 Mc 81.75 Mc	5	"	Osc. 5	
"	"	69 Mc (10 Mc sweep)	67.25 Mc 71.75 Mc	4	"	Osc. 4	
"	"	63 Mc (10 Mc sweep)	61.25 Mc 65.75 Mc	3	"	Osc. 3	
"	"	57 Mc (10 Mc sweep)	55.25 Mc 59.75 Mc	2	"	Osc. 2	

fold up, indicating over-drive and finally turn the screw clockwise slightly to eliminate this folding action. With this setting the receiver is operating at maximum anode potential necessary for maximum picture brilliance and also eliminates linearity distortion at the center of the picture due to over-drive. (Do not confuse this linearity distortion with the overall linearity adjustment made with the HORIZ. LINEARITY control.) Because of manufacturing tolerances, not all receivers can be over-driven to the extent that fold-over will be observed. In these cases, the HORIZ. DRIVE trimmer screw should be set near minimum capacity (counter-clockwise) for optimum performance.

2. Check the horizontal linearity of the test pattern. It should be symmetrical from left to right and the center of the pattern should line up with the center of the escutcheon. If not, turn the HORIZ. LINEARITY screw adjustment in the direction that produces a symmetrical pattern from left to right.
3. Check the width of the test pattern. If it does not match the escutcheon, turn the HORIZ. WIDTH screw in the direction that produces the desired picture width. If this adjustment affects horizontal sync., reset the HORIZ. FREQUENCY adjustment.

HEIGHT AND VERTICAL LINEARITY—Set the VERT. HEIGHT and VERT. LINEARITY controls for vertical size and symmetry. These two controls interact somewhat and are usually adjusted together to obtain the desired effect.

FOCUS AND CENTERING

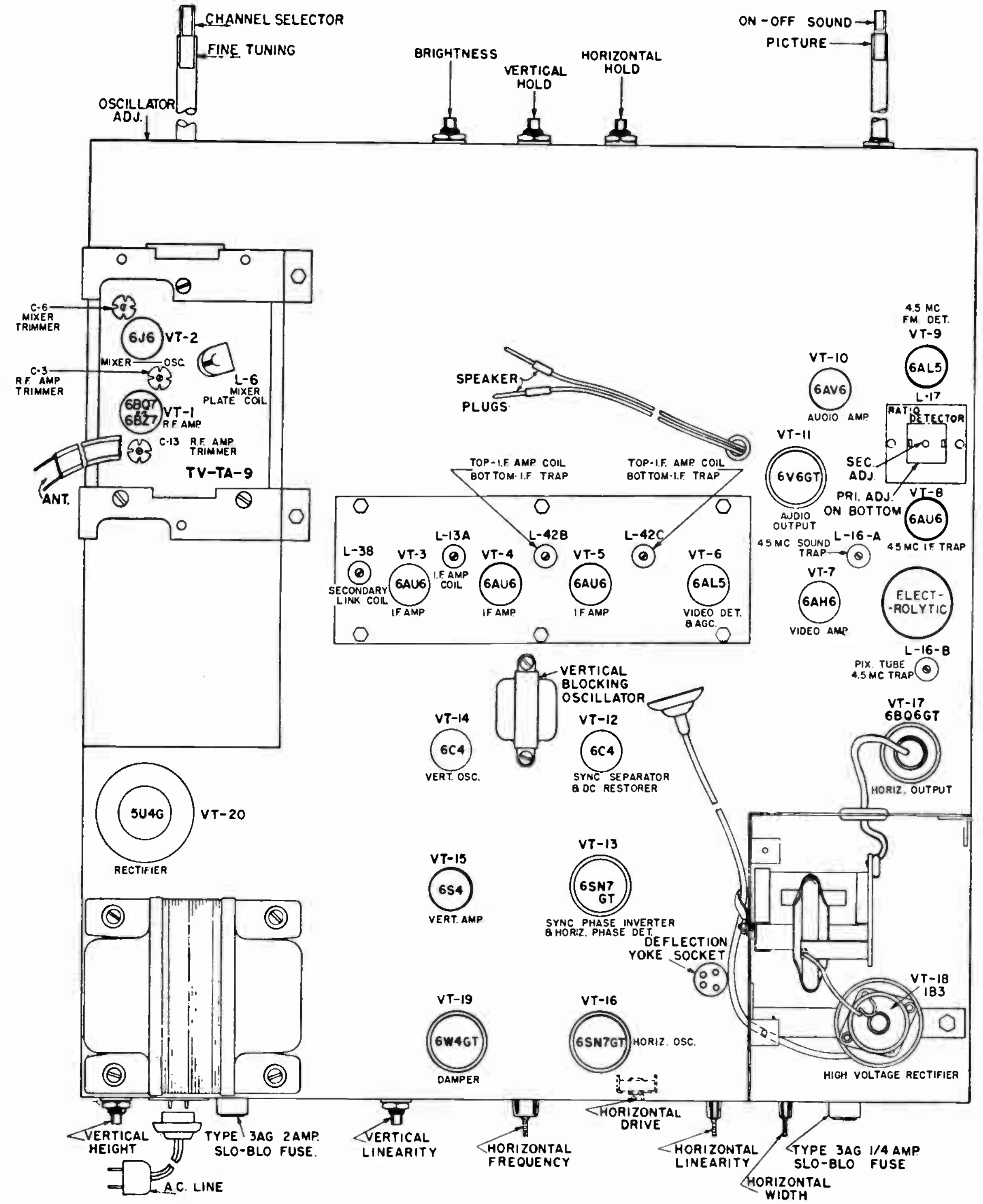
1. Chassis 46A3, 46A4, and 46B3—The picture tubes used in these chassis are electrostatically focused by means of a focus electrode in the gun assembly connected to the primary B+ in the receiver. The picture is centered to the escutcheon by removing the cabinet back* and adjusting the centering device at the rear of the deflection yoke. The ion trap adjustment described under ION TRAP ADJUSTMENT should be made before proceeding to center the picture. To shift the picture, rotate the centering device and adjust the two tabs which project from this device until the pattern is centered without shadowed corners.
2. Chassis 46C3 and 46C4—These chassis employ a P.M. focusing unit located on the neck of the picture tube directly behind the deflection yoke. The picture is centered to the escutcheon by removing the cabinet back* and adjusting the position of the metal tab located at the top of the focusing unit. The metal tab is held in position with a retaining screw and bracket. To re-set the tab, first loosen the retaining screw to permit movement of the tab. Centering can be accomplished by moving the tab in the required direction until the pattern is centered without shadowed corners. Tighten the retaining screw to prevent the tab from shifting. To focus the picture adjust the focusing stud, projecting from the focus unit along the neck of the picture tube, until proper focus is obtained. Focusing can be accomplished without removing the cabinet back. The cup on the cabinet back is provided with a hole to permit focus adjustment. Locate the slotted end of the focus stud and by means of a screwdriver, rotate the stud until the picture is in focus. Care must be used not to disturb the position of the ion trap when making the focus adjustment without removing the cabinet back.

DEFLECTION YOKE ADJUSTMENT—If the picture is tilted at an angle, it may be straightened out by removing the cabinet back* and loosening the single deflection yoke locking screw at the top center of the deflection yoke and rotating the yoke slightly as desired. Tighten the screw after adjustment making certain that the yoke is pushed forward against the flare of the tube.

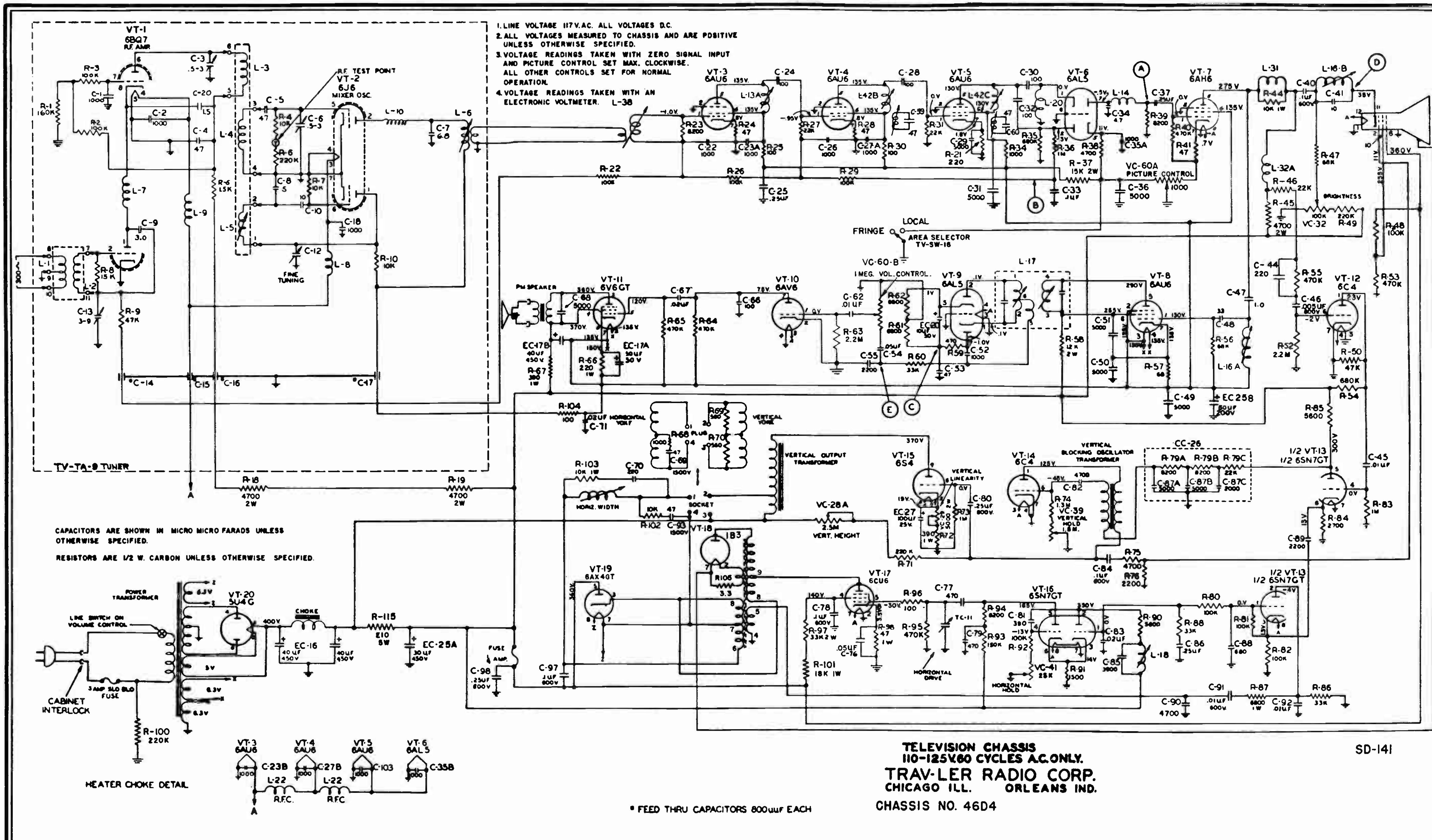
OSCILLATOR TRIMMER ADJUSTMENTS—The oscillator trimmer adjustments have been set at the factory so that the picture just begins to appear and the sound is at maximum when the fine tuning control is about centered. Check the reception on all active TV channels in the area. When the oscillator trimmers are properly adjusted, the fine tuning control should not require readjustment when switching from channel to channel and the control should be about centered when optimum picture quality and sound volume are established. If extensive use of the fine tuning control is necessary when changing stations, proceed as follows:

1. Turn the receiver on and allow 15 minutes to warm up.
2. Select the desired television station by rotating the channel selector control. Set all other controls for a normal picture.
3. Set the fine tuning control in the center of its range.
4. Remove channel selector and fine tuning knobs.
5. The oscillator adjustment is found to the right of the fine tuning shaft. Insert a non-metallic screwdriver with a 1/8" wide tip and about 5 inches long and adjust for best picture and sound. The slug requires a slight rotation only. Should the slug be turned too far, it will fall into the coil. If this happens, it will be necessary to remove the chassis from the cabinet. Remove the bottom cover of the tuner and remove the coil. Hold the retaining spring to one side and lightly tap the open end of the coil until the slug slips out. Then replace the slug and reset the retaining spring.
6. With the fine tuning control still set as in step 3, repeat the procedure in steps 4 and 5 for each active television channel in the area.

*Note—Removing the cabinet back disconnects the line cord. An alternate test cord must be substituted for this adjustment.



Alignment Adjustment and Tube Location Chart



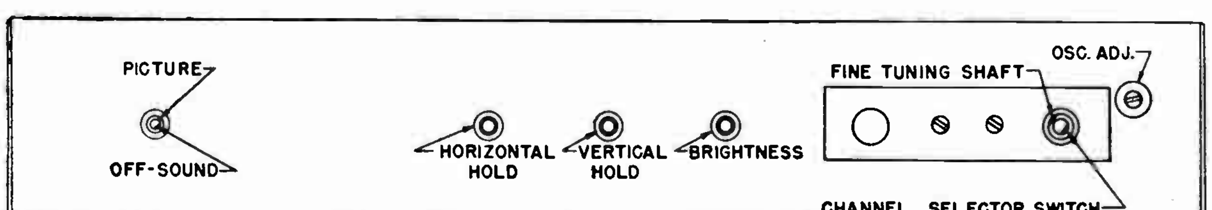


FIGURE-1

TV-LD-62

REAR PANEL CONTROLS

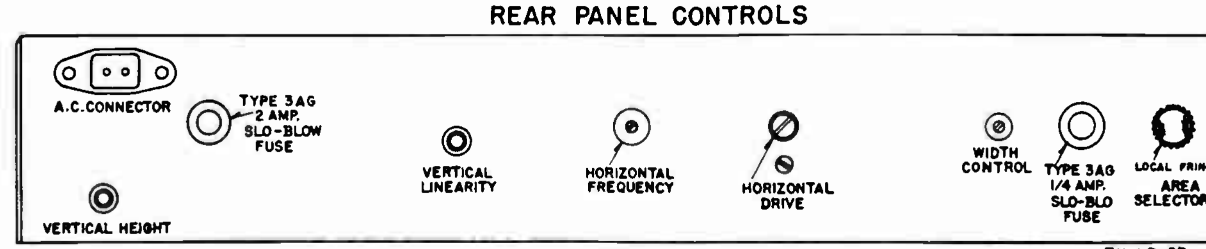
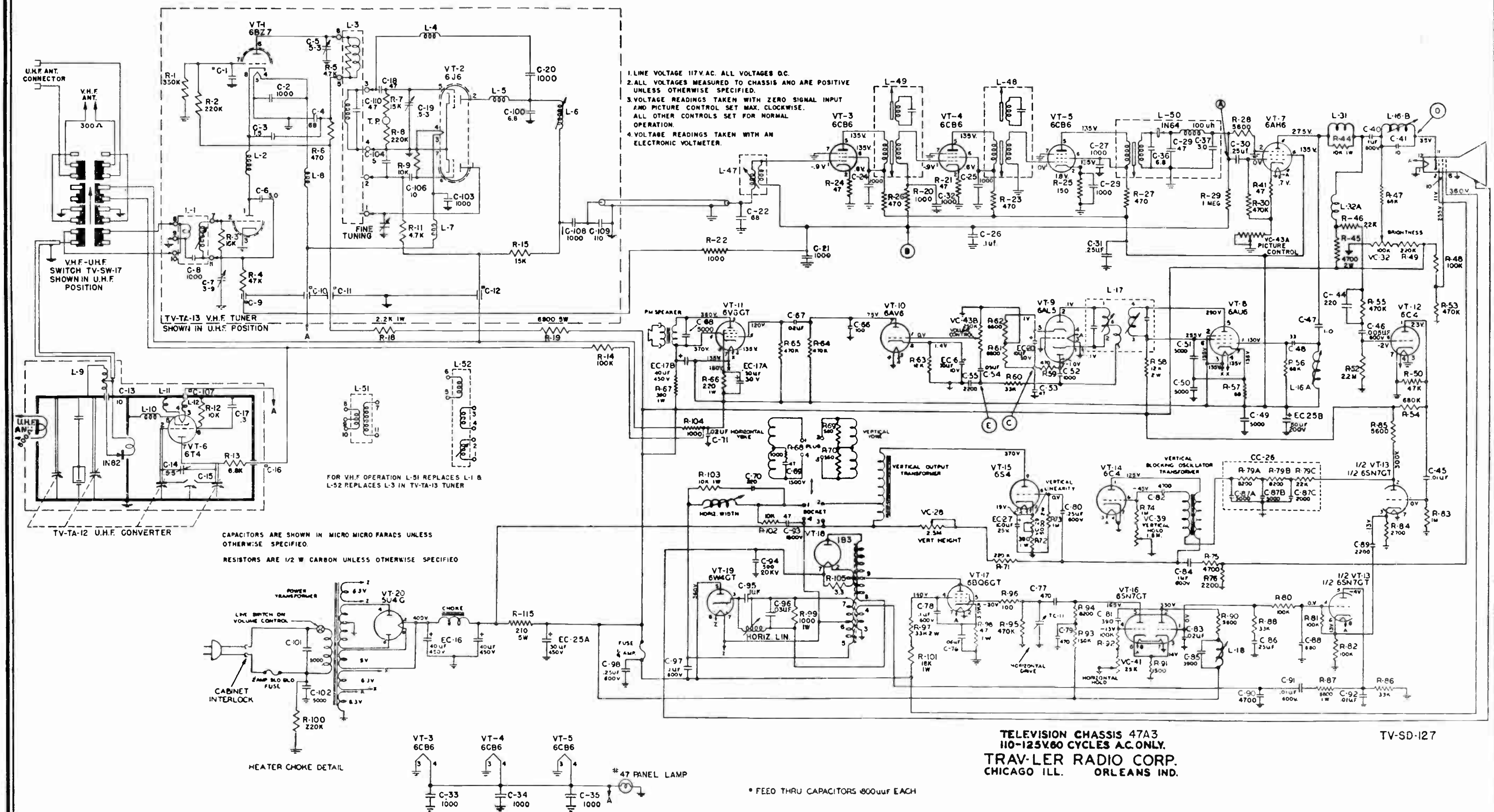


FIGURE 2

TV-LD-83



FRONT PANEL CONTROLS

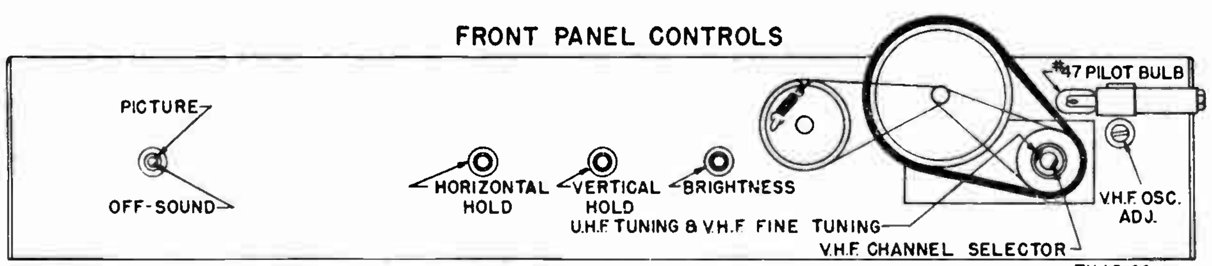


FIGURE-1

TV-LD-88

REAR PANEL CONTROLS

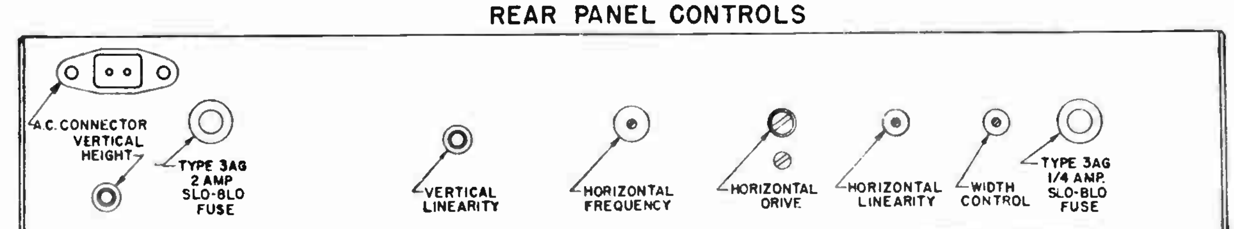
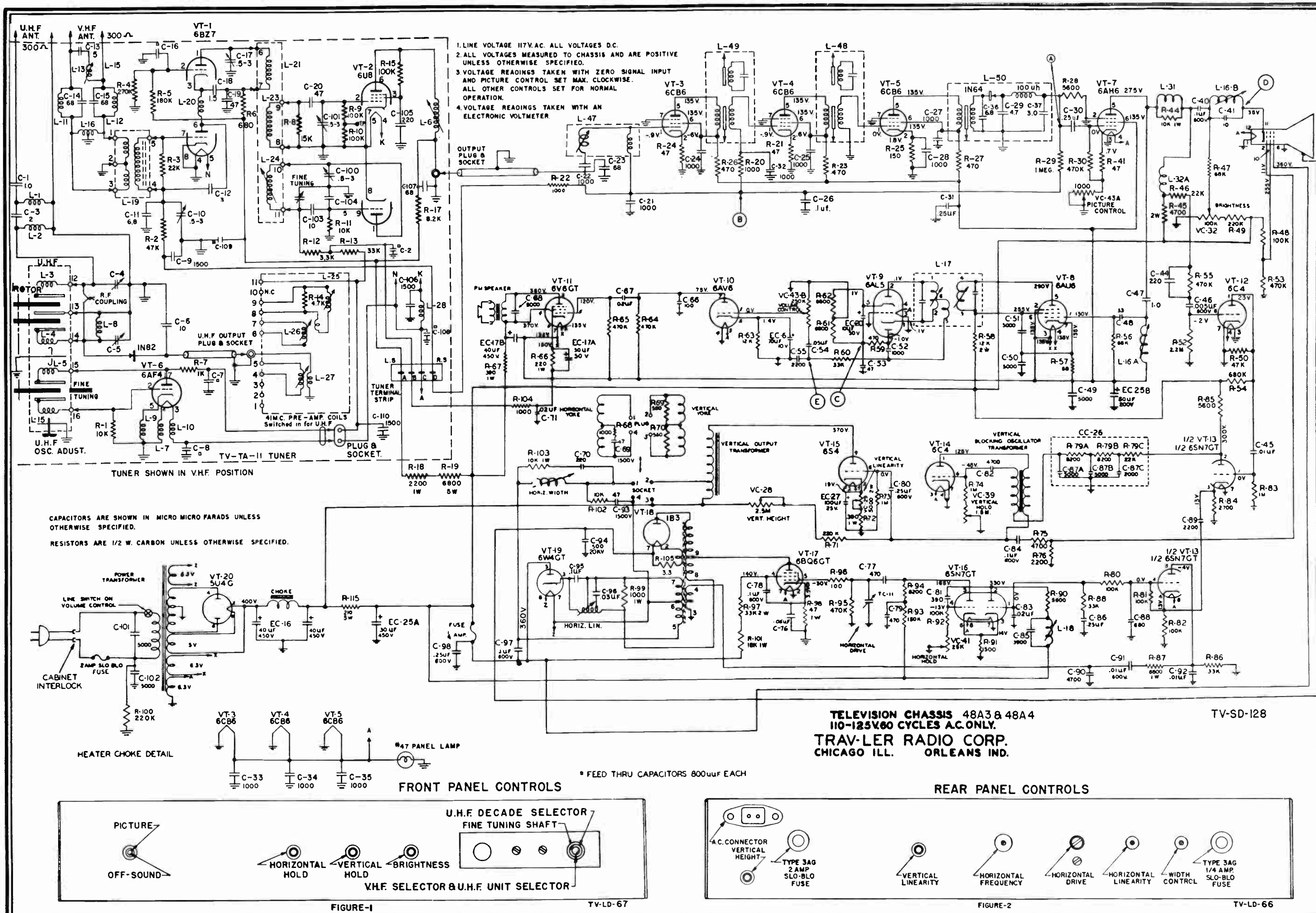
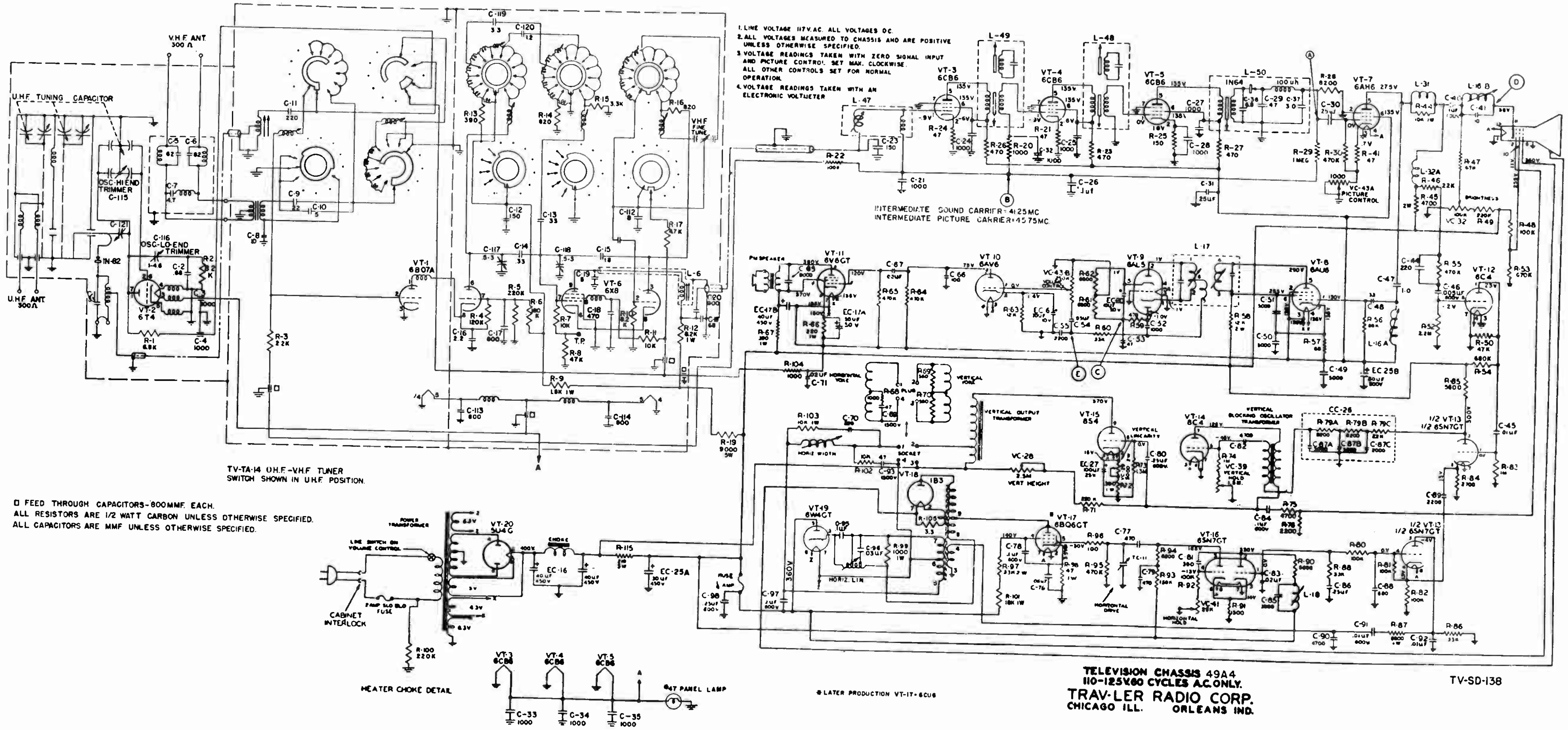


FIGURE-2

TV-LD-66


1. LINE VOLTAGE 117V. A.C. ALL VOLTAGES D.C.
2. ALL VOLTAGES MEASURED TO CHASSIS AND ARE POSITIVE UNLESS OTHERWISE SPECIFIED.
3. VOLTAGE READINGS TAKEN WITH ZERO SIGNAL INPUT AND PICTURE CONTROL SET MAX. CLOCKWISE. ALL OTHER CONTROLS SET FOR NORMAL OPERATION.
4. VOLTAGE READINGS TAKEN WITH AN ELECTRONIC VOLTMETER.
CAPACITORS ARE SHOWN IN MICRO MICRO FARADS UNLESS OTHERWISE SPECIFIED.
RESISTORS ARE 1/2 W. CARBON UNLESS OTHERWISE SPECIFIED.
TUNER SHOWN IN V.H.F. POSITION
TV-TA-11 TUNER
HEATER CHOKE DETAIL
#47 PANEL LAMP
* FEED THRU CAPACITORS 800uuF EACH
TELEVISION CHASSIS 48A3 & 48A4
110-125V. 60 CYCLES A.C. ONLY.
TRAV-LER RADIO CORP.
CHICAGO ILL. ORLEANS IND.
TV-SD-128
FRONT PANEL CONTROLS
PICTURE
OFF-SOUND
HORIZONTAL HOLD
VERTICAL HOLD
BRIGHTNESS
U.H.F. DECADE SELECTOR
FINE TUNING SHAFT
V.H.F. SELECTOR & U.H.F. UNIT SELECTOR
FIGURE-1
TV-LD-67
REAR PANEL CONTROLS
A.C. CONNECTOR
VERTICAL HEIGHT
TYPE 3AG 2 AMP SLO-BLO FUSE
VERTICAL LINEARITY
HORIZONTAL FREQUENCY
HORIZONTAL DRIVE
HORIZONTAL LINEARITY
WIDTH CONTROL
TYPE 3AG 1/4 AMP. SLO-BLO FUSE
FIGURE-2
TV-LD-66



FRONT PANEL CONTROLS 49A4

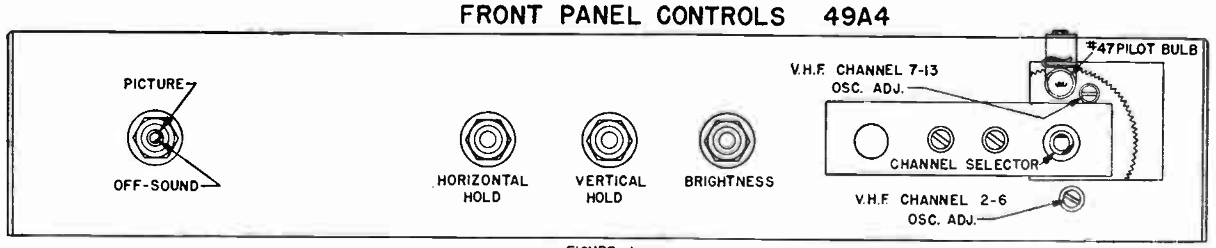


FIGURE-1

TV-LD-82

REAR PANEL CONTROLS

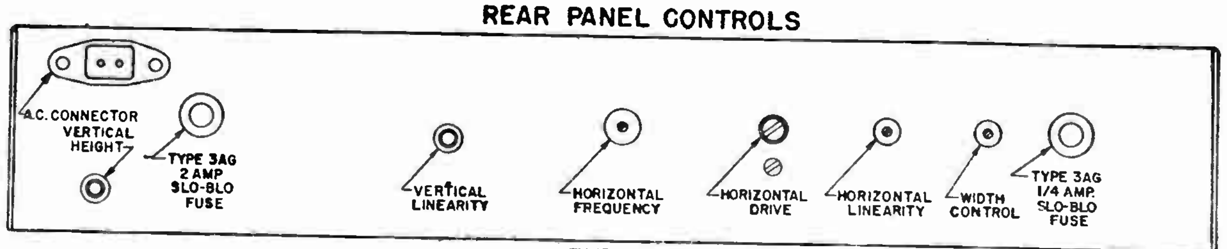
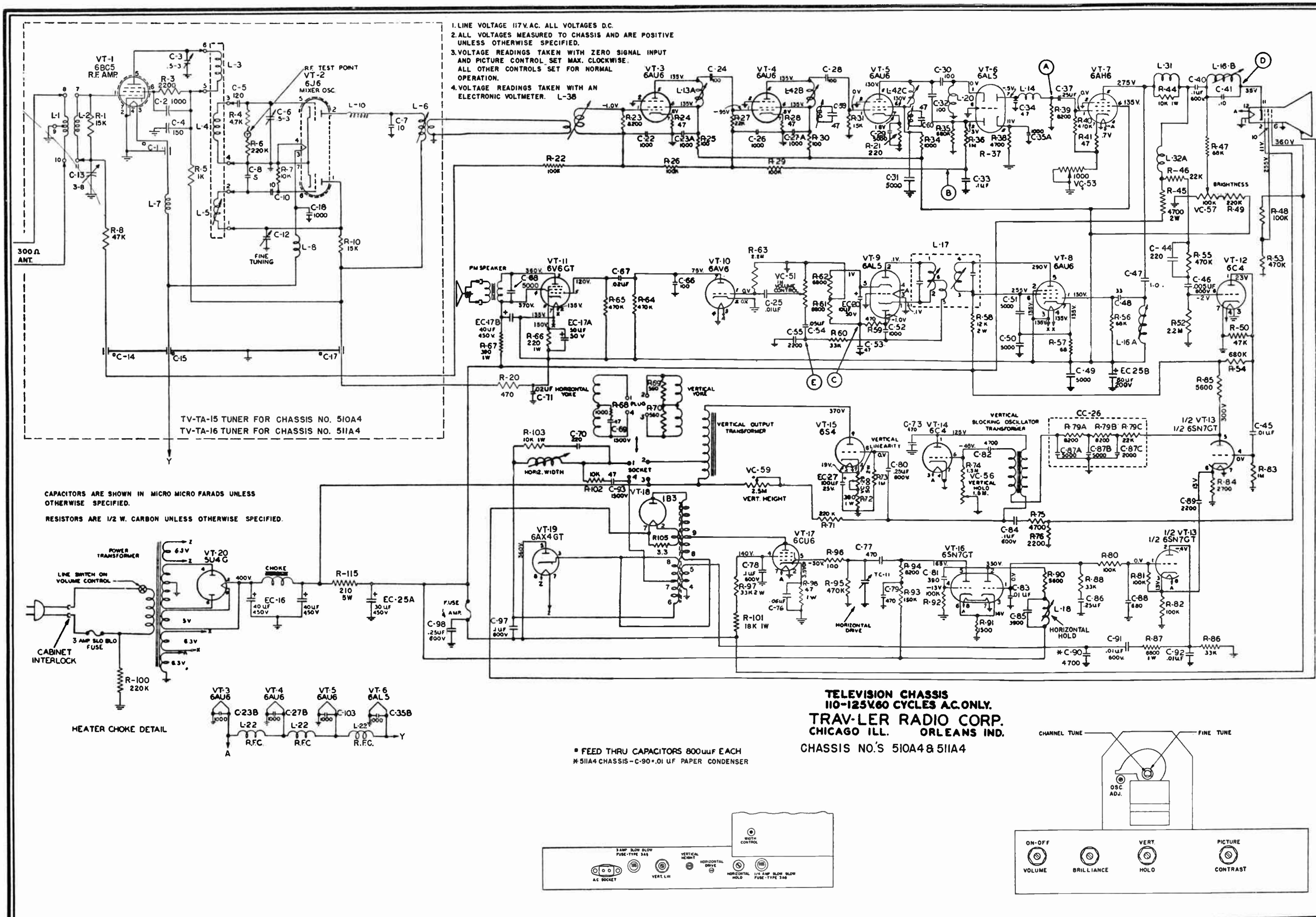


FIGURE-2

TV-LD-66


1. LINE VOLTAGE 117 V. AC. ALL VOLTAGES D.C.
2. ALL VOLTAGES MEASURED TO CHASSIS AND ARE POSITIVE UNLESS OTHERWISE SPECIFIED.
3. VOLTAGE READINGS TAKEN WITH ZERO SIGNAL INPUT AND PICTURE CONTROL SET MAX. CLOCKWISE. ALL OTHER CONTROLS SET FOR NORMAL OPERATION.
4. VOLTAGE READINGS TAKEN WITH AN ELECTRONIC VOLTMETER.
TV-TA-15 TUNER FOR CHASSIS NO. 510A4
TV-TA-16 TUNER FOR CHASSIS NO. 511A4
CAPACITORS ARE SHOWN IN MICRO MICRO FARADS UNLESS OTHERWISE SPECIFIED.
RESISTORS ARE 1/2 W. CARBON UNLESS OTHERWISE SPECIFIED.
HEATER CHOKE DETAIL
* FEED THRU CAPACITORS 800uuF EACH
* 511A4 CHASSIS - C-90 = .01 UF PAPER CONDENSER
TELEVISION CHASSIS
110-125V. 60 CYCLES A.C. ONLY.
TRAV-LER RADIO CORP.
CHICAGO ILL.   ORLEANS IND.
CHASSIS NO.'S 510A4 & 511A4
CHANNEL TUNE
FINE TUNE
OSC ADJ.
ON-OFF
VOLUME
BRILLIANCE
VERT HOLD
PICTURE
CONTRAST
A.C. SOCKET
VERT. LIN
HORIZONTAL HOLD
WIDTH CONTROL
VERTICAL HEIGHT
HORIZONTAL DRIVE
VT-1 6BC5 R.F. AMP.
VT-2 6J6 MIXER OSC.
VT-3 6AU6
VT-4 6AU6
VT-5 6AU6
VT-6 6AL5
VT-7 6AH6
VT-8 6AU6
VT-9 6AL5
VT-10 6AV6
VT-11 6V6GT
VT-12 6C4
1/2 VT-13 1/2 6SN7GT
VT-14 6C4
VT-15 6S4
VT-16 6SN7GT
VT-17 6CU6
VT-18 1B3
VT-19 6AX4GT
VT-20 5U4G
300Ω ANT.
PM SPEAKER
POWER TRANSFORMER
LINE SWITCH ON VOLUME CONTROL
CABINET INTERLOCK
3 AMP SLO BLO FUSE
VERTICAL OUTPUT TRANSFORMER
VERTICAL BLOCKING OSCILLATOR TRANSFORMER
HORIZONTAL YOKE
VERTICAL YOKE
BRIGHTNESS

PARTS LIST

RESISTORS

REF. NO.	DESCRIPTION	TRAV-LER PART NO.	LIST PRICE
R-18	2,200 ohms 10% 1W, carbon	TV-1R-25	.09
R-19	6,800 ohms 10% 5W, wire-wound	TV-WR-8	.90
R-21	220 ohms 10% ½W, carbon	TV-1R-5	.09
R-22, 26, 29, 48* **, 80, 81, 82, 92, 93***	100,000 ohms 10% ½W, carbon	TV-1R-43	.20
R-23, 39, 94	8,200 ohms 10% ½W, carbon	TV-1R-60	.25
R-24, 28, 41	47 ohms 20% ½W, carbon	TV-1R-4	.06
R-25, 30, 96, 104	100 ohms 20% ½W, carbon	TV-1R-36	.06
R-27, 31, 46	22,000 ohms 10% ½W, carbon	TV-1R-45	.06
R-34, 68, 77***	1,000 ohms 20% ½W, carbon	TV-1R-24	.06
R-35, 54	680,000 ohms 20% ½W, carbon	TV-1R-26	.06
R-36, 73, 74, 83, 95***	1 megohm 20% ½W, carbon	TV-1R-12	.06
R-37	15,000 ohms 10% 2W, carbon	TV-1R-70	.20
R-38, 75* **	4,700 ohms 10% ½W, carbon	TV-1R-48	.06
R-40, 53* **, 55, 64, 65, 95* **	470,000 ohms 20% ½W, carbon	TV-1R-11	.06
R-44, 103* **	10,000 ohms 10% 1W, carbon	TV-1R-84	.35
R-45	4,700 ohms 10% 2W, carbon	TV-1R-76	.20
R-47, 56	68,000 ohms 10% ½W, carbon	TV-1R-61	.06
R-49, 71, 100	220,000 ohms 10% ½W, carbon	TV-1R-91	.06
R-50	47,000 ohms 20% ½W, carbon	TV-1R-10	.06
R-52	2.2 megohms 20% ½W, carbon	TV-1R-13	.06
R-57	68 ohms, 10% ½W, carbon	TV-1R-59	.06
R-58	12,000 ohms 10% 2W, carbon	TV-1R-92	.20
R-59	470 ohms 10% ½W, carbon	TV-1R-6	.09
R-60, 86, 88	33,000 ohms 10% ½W, carbon	TV-1R-58	.06
R-61, 62	6,800 ohms 10% ½W, carbon	TV-1R-78	.06
R-63	12,000 ohms 10% ½W, carbon	TV-1R-88	.30
R-66	220 ohms 10% 1W, carbon	TV-1R-75	.12
R-67, 72	390 ohms 10% 1W, carbon	TV-1R-55	.33
R-69, 70	560 ohms 10% ½W, carbon	TV-1R-49	.06
R-75***, 76	2,200 ohms 10% ½W, carbon	TV-1R-67	.06
R-79	R/C Integrator network (R-79, C-87)	TV-CC-26	.90
R-84	2,700 ohms 10% ½W, carbon	TV-1R-79	.06
R-85	5,600 ohms 10% ½W, carbon	TV-1R-52	.06
R-87	6,800 ohms 10% 1W, carbon	TV-1R-80	.09
R-90	5,600 ohms 5% ½W, carbon	TV-1R-73	.20
R-91	1,500 ohms 10% ½W, carbon	TV-1R-29	.06
R-93* **	150,000 ohms 10% ½W, carbon	TV-1R-95	.06
R-97* **	33,000 ohms 10% 2W, carbon	TV-1R-57	.20
R-97***	10,000 ohms 10% 5W, wire wound	TV-WR-13	.80
R-98* **	47 ohms 10% 1W, carbon	TV-1R-41	.09
R-98***	100 ohms 20% 2W, carbon	TV-1R-82	.20
R-99	1,000 ohms 10% 1W, carbon	TV-1R-42	.09
R-101* **	18,000 ohms 10% 1W, carbon	TV-1R-85	.45
R-102	10,000 ohms 10% ½W, carbon	TV-1R-64	.06
R-105	3.3 ohms 10% ½W, carbon	TV-1R-65	.25
R-115	210 ohms 5% 5W, wire-wound	TV-WR-1	.40

NOTE—Resistors used in tuner assembly are not listed or carried in service department stock.

CONTROLS

REF. NO.		DESCRIPTION	TRAV-LER PART NO.	LIST PRICE
VC-28A	VERTICAL HEIGHT	2.5 megohms,carbon	TV-VC-28	.80
VC-29	VERTICAL LINEARITY	5,000 ohms 2W, carbon	TV-VC-29	1.60
VC-32	BRIGHTNESS	100,000 ohms, carbon	TV-VC-32	.75
VC-39	VERTICAL HOLD	1.5 megohms, carbon	TV-VC-39	.75
VC-41* ***	HORIZONTAL HOLD	25,000 ohms, carbon	TV-VC41	.70
VC-43	PICTURE/VOLUME	Dual 1,000 ohms 1W/250,000 ohms, carbon	TV-VC-43	2.25

ELECTROLYTICS

REF. NO.	DESCRIPTION	TRAV-LER PART NO.	LIST PRICE
EC-6	70 mfd. 10V, electrolytic	TV-EC-6	.55
EC-16	40-40 mfd. 450V, electrolytic	TV-EC-16	3.50
EC-17	40 mfd. 450V, 50 mfd. 50V, electrolytic	TV-EC-17	2.50
EC-20	10 mfd. 50V, electrolytic	TV-EC-20	.95
EC-25	30 mfd. 450V, 50 mfd. 200V, electrolytic	TV-EC-25	2.20
EC-27	100 mfd. 25V, electrolytic	TV-EC-27	1.35

TRIMMER

REF. NO.	DESCRIPTION	TRAV-LER PART NO.	LIST PRICE
TC-11	Trimmer, HORIZONTAL DRIVE control	TV-TC-11	.45

*Chassis 46A3, 46A4 only
**Chassis 46B3 only
***Chassis 46C3, 46C4 only

SERVICE ASSEMBLIES

REF. NO.	DESCRIPTION	TRAV-LER PART NO.	LIST PRICE
—	Antenna, built-in	TV-LL-33	5.10
—	Speaker assembly 4"x6" P.M. less transformer (Models 317-44, 317-44A, 317-47, 321-R45, 321-46, 321-54, 321-55)	TV-SPK-25	5.20
—	Speaker assembly 10" P.M. less transformer (Models 321-48, 321-480. 324-49. 324-490, 3210-60. 3210-61)	TV-SPK-26	8.10
—	Tuner assembly complete	TV-TA-9	59.00
—	High voltage supply assembly	TV-X-130	25.15
—	High voltage supply assembly (Model 324-49, 324-490)	TV-X-131	28.05
—	21 Mc IF strip assembly	TV-X-133	41.25

CONDENSERS

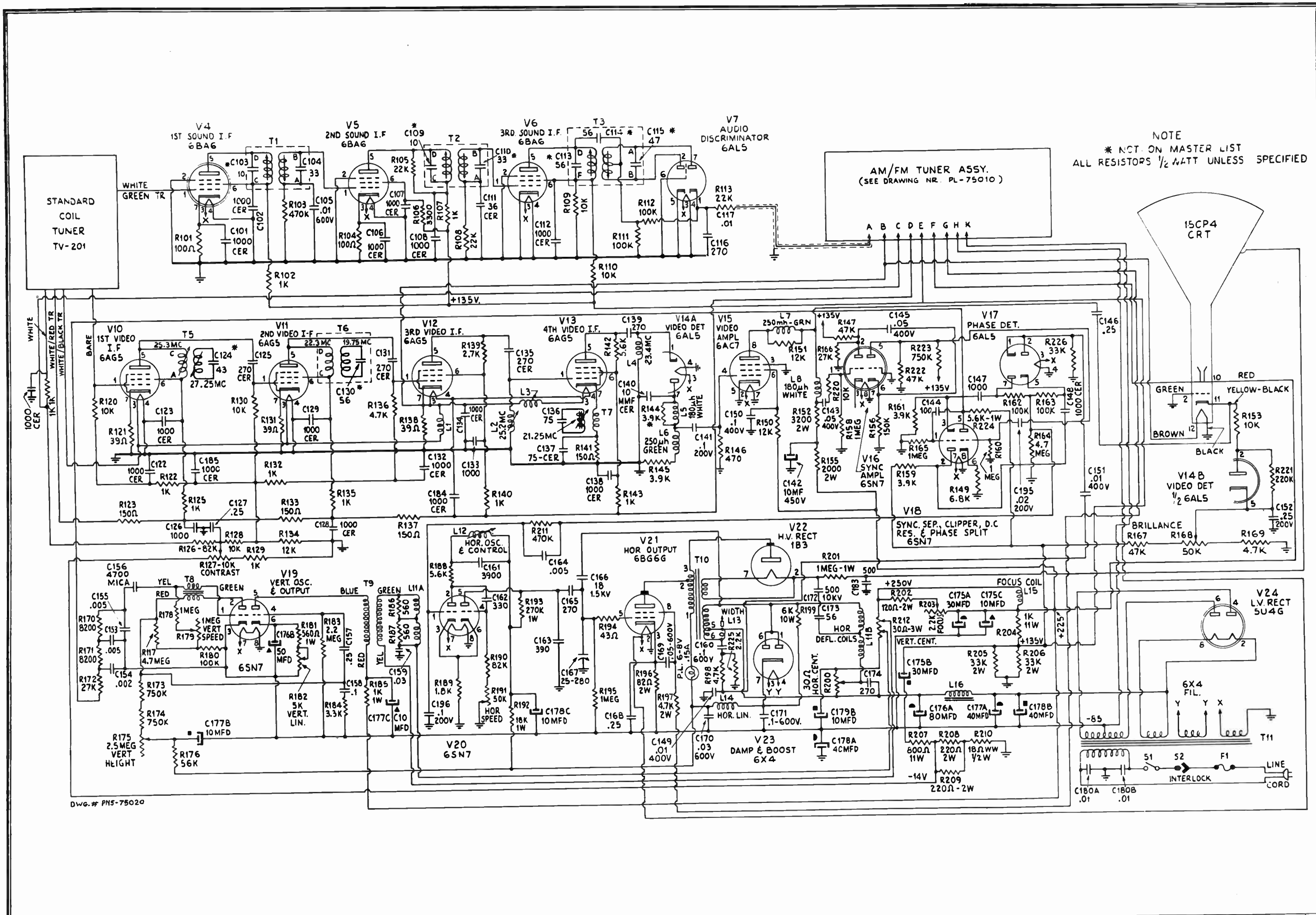
REF. NO.	DESCRIPTION	TRAV-LER PART NO.	LIST PRICE
C-21, 22, 26, 103	1000 mmf. 500V, ceramic	TV-CC-2	.25
C-23, 27, 35	1000/1000 mmf. 500V, dual ceramic	TV-CC-1	.30
C-24, 28, 30, 32	100 mmf. 10% 500V, ceramic	TV-CC-5	.30
C-25, 80, 98	.25 mfd. 600V, paper	TV-PC-17	.45
C-29, 31, 36, 49, 50, 51	5000 mmf. 500V, ceramic	TV-CC-3	.25
C-33, 95	.1 mfd. 200V, paper	TV-PC-3	.25
C-34	4.7 mmf. 10% 500V, ceramic	TV-CC-15	.10
C-37, 76***, 86	.25 mfd. 200V, paper	TV-PC-4	.30
C-40, 70***, 78, 84, 97	.1 mfd. 600V, paper	TV-PC-16	.30
C-41	10 mmf. 20% 500V, mica	TV-MC-6	.15
C-44, 70* **	220 mmf. 20% 500V, mica	TV-MC-3	.20
C-45, 91, 92	.01 mfd. 600V, paper	TV-PC-15	.20
C-46, 68, 101, 102	.005 mfd. 600V, paper	TV-PC-6	.20
C-47	1 mmf. 10% 500V, ceramic	TV-CC-14	1.40
C-48	33 mmf. 10% 500V, ceramic	TV-CC-6	.20
C-52, 77***	1000 mmf. 10% 500V, mica	TV-MC-16	.40
C-53, 59, 60	47 mmf. 10% 500V, ceramic	TV-CC-12	.25
C-54,76* **	.05 mfd. 400V, paper	TV-PC-5	.25
C-55, 89	2200 mmf. 10% 500V, mica	TV-MC-11	.50
C-66	100 mmf. 20% 500V, mica	TV-MC-2	.20
C-67, 71, 75***, 83	.02 mfd. 600V, paper	TV-PC-14	.25
C-69* **	47 mmf. 1500V, ceramic double insulation	TV-CC-25	.30
C-69***	150 mmf. 1500V, ceramic double insulation—part of TV-L-51 filter network	—	—
C-77* **, 79* **	470 mmf. 10% 500V, mica	TV-MC-17	.30
C-79***, 88	680 mmf. 10% 500V, mica	TV-MC-15	.35
C-81	390 mmf. 10% 500V, mica	TV-MC-14	.25
C-82, 90	4700 mmf. 10% 500V, mica	TV-MC-10	.85
C-85	3900 mmf. 10% 500V, mica	TV-MC-12	.70
C-87 (A-B-C)	Refer to R-79	TV-CC-26	.90
C-93	47 mmf. 1500V, ceramic single insulation	TV-CC-27	.30
C-94	500 mmf. 20% 20KV, ceramic	TV-CC-30	1.40
C-96	.03 mfd. 400V, paper	TV-PC-18	.25

NOTE—Condensers used in tuner assembly are not listed or carried in service department stock.

TRANSFORMERS & COILS

REF. NO.	DESCRIPTION	TRAV-LER PART NO.	LIST PRICE
—	Transformer, audio output	TV-AT-11	1.65
—	Transformer, vert. output	TV-TR-8	3.70
—	Transformer, vert. output (Models 324-49, 324-490)	TV-TR-8A	3.70
—	Transformer, power	TV-TR-9	21.70
—	Transformer, vert. block osc.	TV-TR-10	2.30
—	Transformer, horiz. output (see service assembly TV-X-130 and TV-X-131)		
L-17	Transformer, FM sound detector	TV-L-17	3.10
—	Coil, filter choke	TV-FC-1	2.80
L-13A	Coil, IF amplifier	TV-L-13	.60
L-14	Coil, peaking	TV-L-14	.66
L-16A	Coil, sound trap	TV-L-16A	3.50
L-16B	Coil, 4.5 Mc Trap (W/C-41)	TV-L-16B	3.50
L-18	Coil, HORIZONTAL FREQUENCY control	TV-L-18	1.32
L-20	Coil, IF amplifier	TV-L-20	.60
—	Coil, HORIZONTAL LINEARITY control	TV-L-29	1.50
L-31	Coil, video peaking (wound on R-44)	TV-L-31	.75
L-32A	Coil, video peaking	TV-L-32A	.75
—	Coil, HORIZONTAL WIDTH	TV-L-34	2.25
L-38	Coil, secondary link	TV-L-38	.90
—	Coil, HORIZONTAL WIDTH (Models 317-44, 317-44A, 317-47)	TV-L-41	3.00
L-42 (B, C)	Coil, IF amplifier	TV-L-42	1.86
	Coil, deflection (Models 324-49, 324-490)	TV-L-51	20.85
	Coil, deflection (complete with centering magnet)	TV-L-52	11.80

NOTE—Coils used in tuner assembly are not listed or carried in service department stock.



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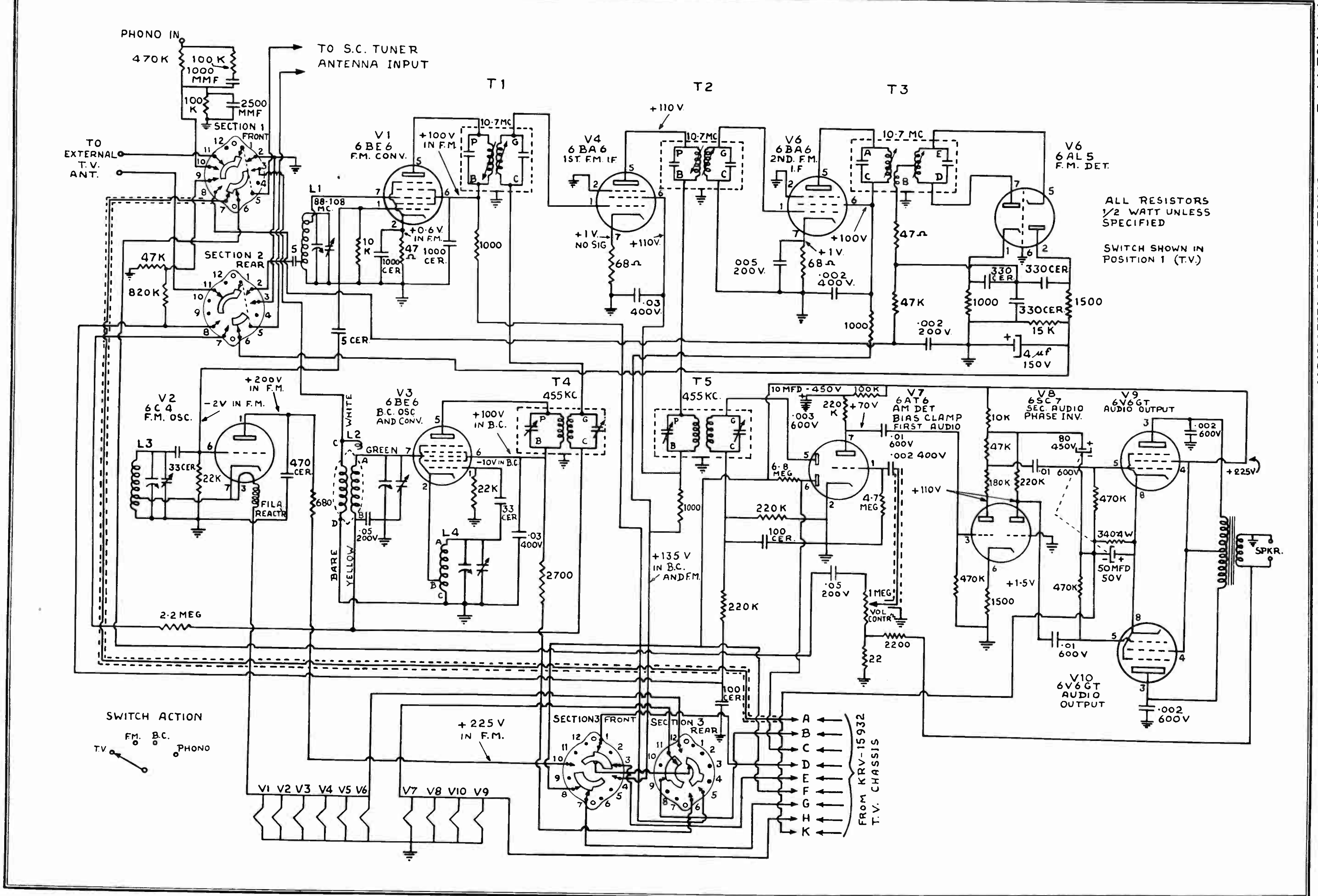
CHASSIS KRV-15932


PHONO IN
470K
100 K
1000 MMF
100 K
2500 MMF
SECTION 1 FRONT
TO EXTERNAL T.V. ANT.
TO S.C. TUNER ANTENNA INPUT
SECTION 2 REAR
47K
820K
T1
T2
T3
T4
T5
V1 6BE6 F.M. CONV.
V4 6BA6 1ST. F.M. IF
V6 6BA6 2ND. F.M. I.F
V6 6AL5 F.M. DET.
V2 6C4 F.M. OSC.
V3 6BE6 B.C. OSC AND CONV.
V7 6AT6 AM DET BIAS CLAMP FIRST AUDIO
V8 6SC7 SEC. AUDIO PHASE INV.
V9 6V6GT AUDIO OUTPUT
V10 6V6GT AUDIO OUTPUT
10.7MC
455KC
L1 88-108 MC.
L2
L3
L4
+100V IN F.M.
+110V
+0.6V IN F.M.
+1V. NO SIG
+100V
+1V.
+200V IN F.M.
-2V IN F.M.
+100V IN B.C.
-10V IN B.C.
+70V
+110V
+1.5V
+225V
+135 V IN B.C. AND F.M.
+225 V IN F.M.
ALL RESISTORS 1/2 WATT UNLESS SPECIFIED
SWITCH SHOWN IN POSITION 1 (T.V.)
10 MFD - 450V
100K
220 K
.003 600V
.01 600V
.002 400V
6.8 MEG
4.7 MEG
220K
100 CER.
.05 200V
1 MEG VOL CONTR.
2200
22
10K
47K
180K
220K
80 450V
.01 600V
470K
340 1/2 W
50MFD 50V
470K
1500
.01 600V
.002 600V
SPKR.
GREEN
WHITE
BARE
YELLOW
FILA REACTR
2.2 MEG
2700
1000
68Ω
.03 400V
005 200V.
.002 400V.
47Ω
47K
330 CER
330CER
1000
1500
15 K
.002 200V
4 μf 150V
SWITCH ACTION
T.V.
FM.
B.C.
PHONO
SECTION 3 FRONT
SECTION 3 REAR
V1 V2 V3 V4 V5 V6
V7 V8 V10 V9
FROM KRV-15932 T.V. CHASSIS
A
B
C
D
E
F
G
H
K

ELECTRICAL SPECIFICATIONS

Power Supply	117 Volts AC 60 Cycles Only
Power Consumption	210 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Range	VHF—Channels 2 thru 13
Intermediate Freq. (Tel.)	Picture—26.20 MC Sound—21.70 MC
Tel. Antenna Input Imp.	300 Ohms Balanced
Intercarrier Sound System	4.5 MC
Loud Speaker	See Parts List
Voice Coil Impedance	3.2 Ohms 400 Cycles

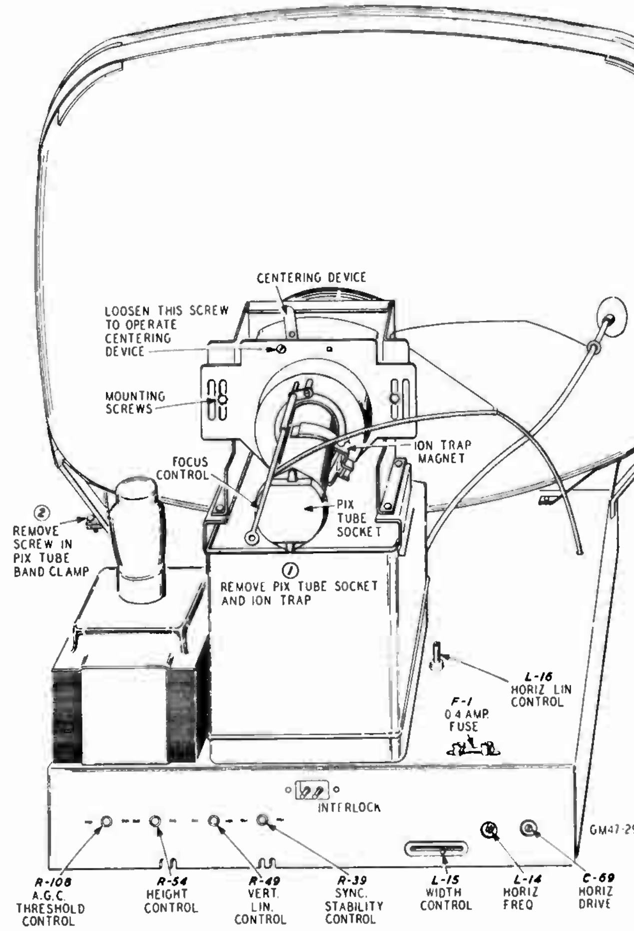


Fig. 3—Removal of Picture Tube and Rear Chassis Controls

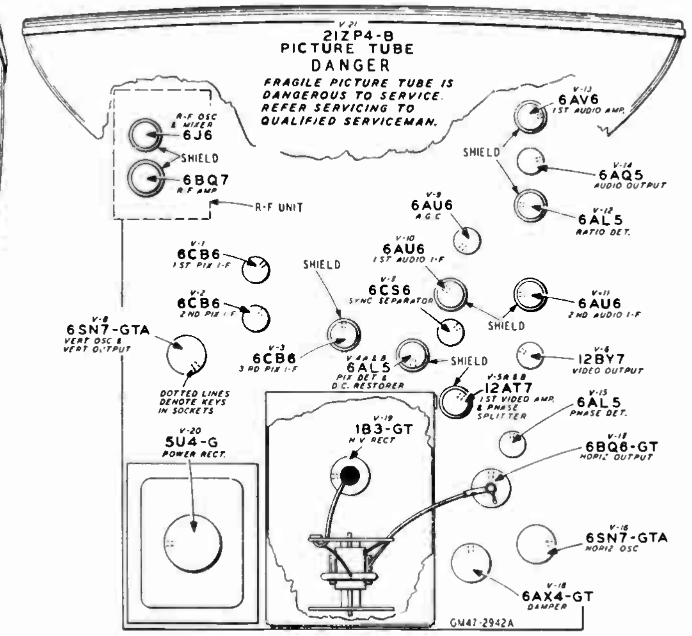


Fig. 1—Tube Layout.

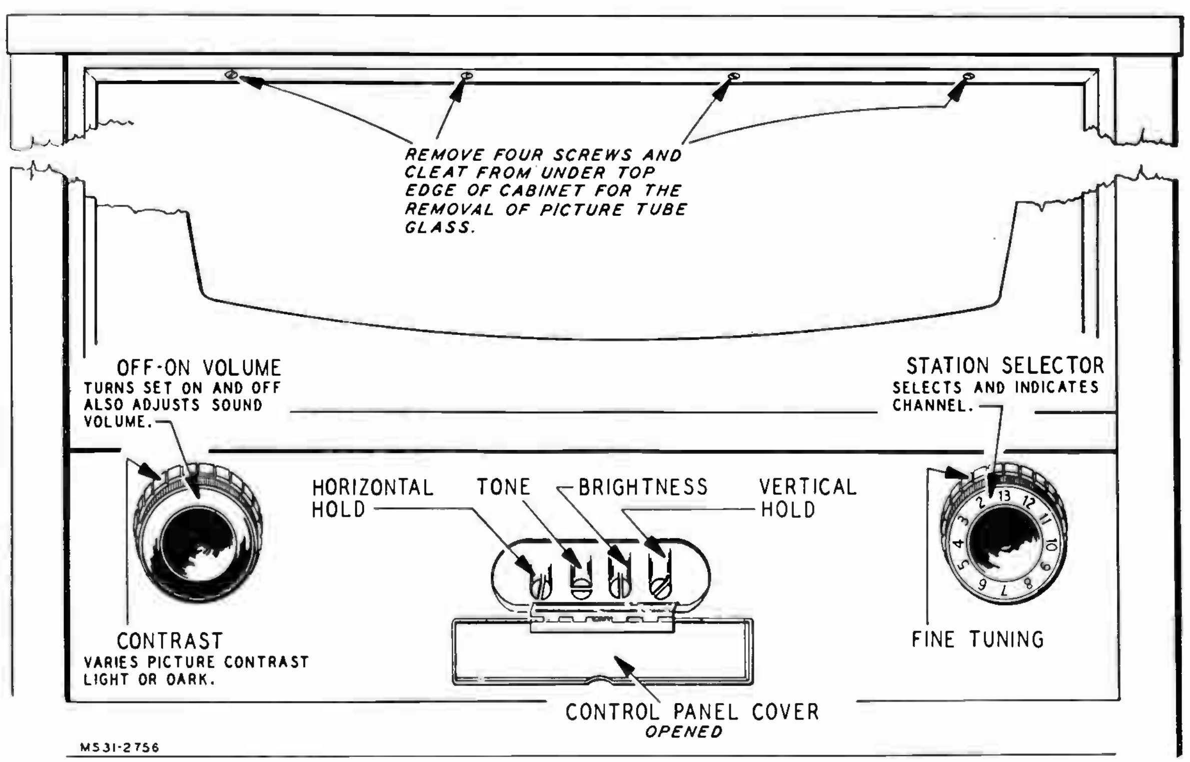


Fig. 2—Front Panel Controls

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 1000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (C-69) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (C-69) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (C-69) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

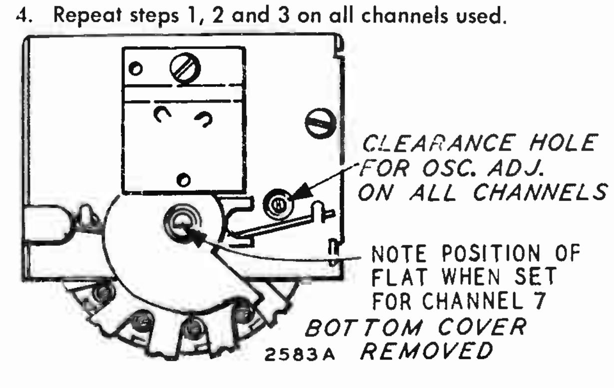


Fig. 4—Tuner Oscillator Adjustments

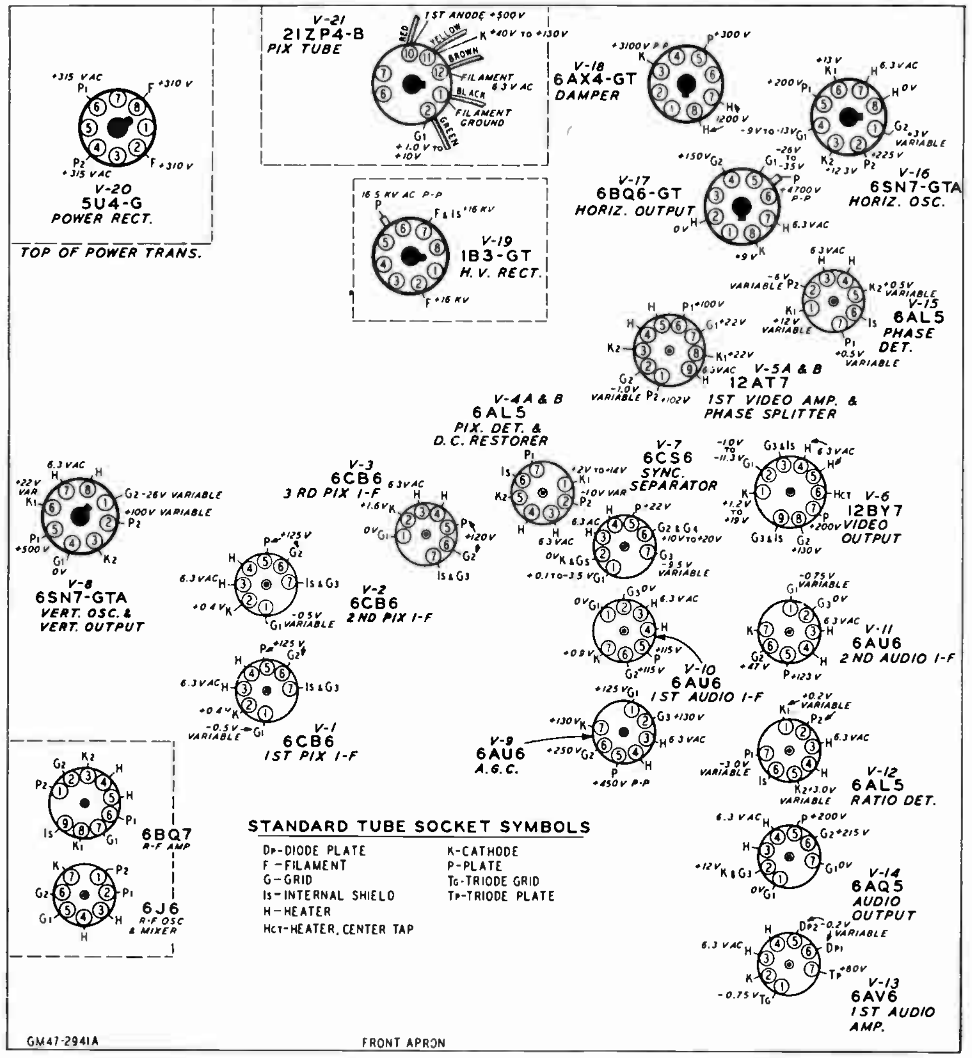


Fig. 5—Bottom Socket Voltages

ALIGNMENT PROCEDURE

TEST EQUIPMENT— To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:
- 18 to 30 mc, 10 mc sweep width
- 40 to 90 mc, 10 mc sweep width
- 170 to 225 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.
- 23.1 mc first picture I-F coil.
- 24.1 mc third picture I-F coil.
- 25.9 mc second picture I-F coil.
- 21.7 mc sound trap.
- 4.5 mc video trap & sound I-F.
- 25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE
PIX I-F

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 2 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line. (Junction of R-28 & R-32).

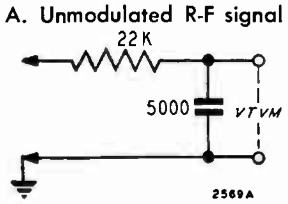


Fig. 9—VTVM Connections

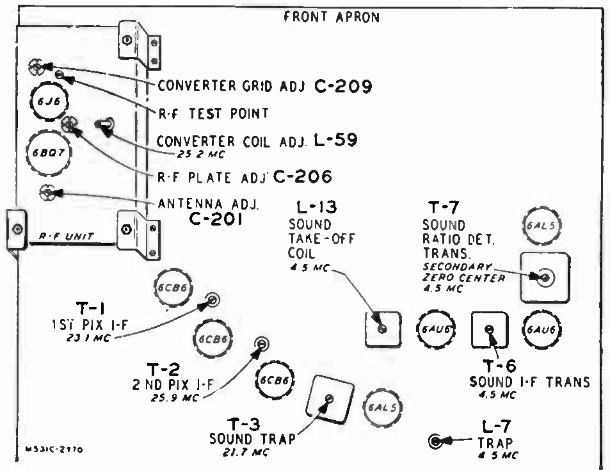


Fig. 7—Top Chassis Video and Audio I-F Adjustments

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

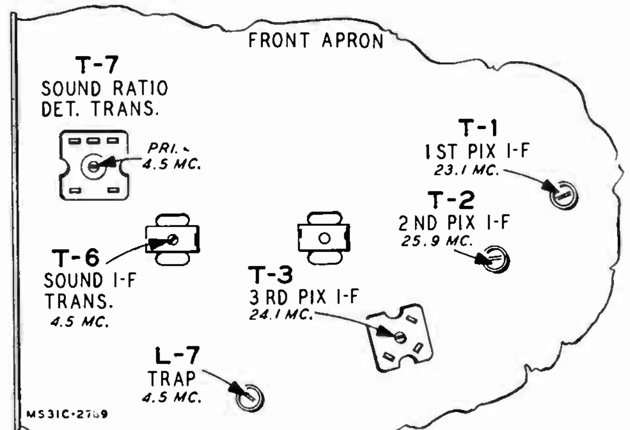


Fig. 8—Bottom Chassis Video and Audio I-F Adjustments

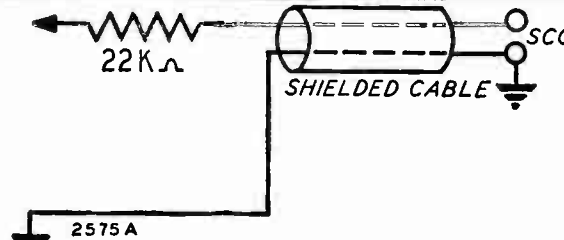


Fig. 10—Oscilloscope Connections

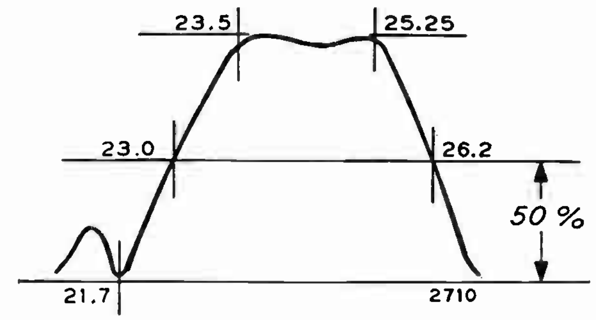


Fig. 11—Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 2-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" Figure 12) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

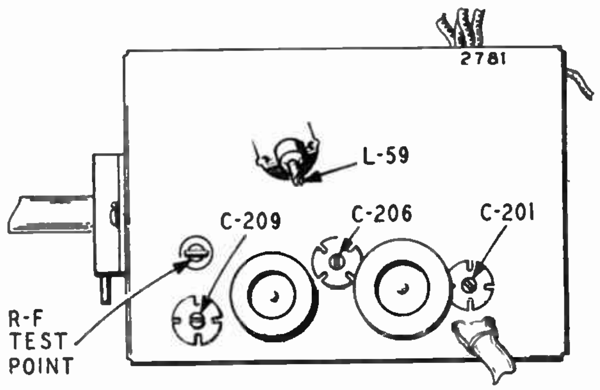


Fig. 12—Top Tuner Adjustments.

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 13. Picture and sound markers at 90% maximum response.

2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

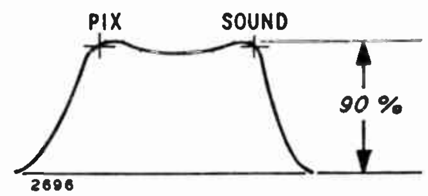


Fig. 13—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.

2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 11).

3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

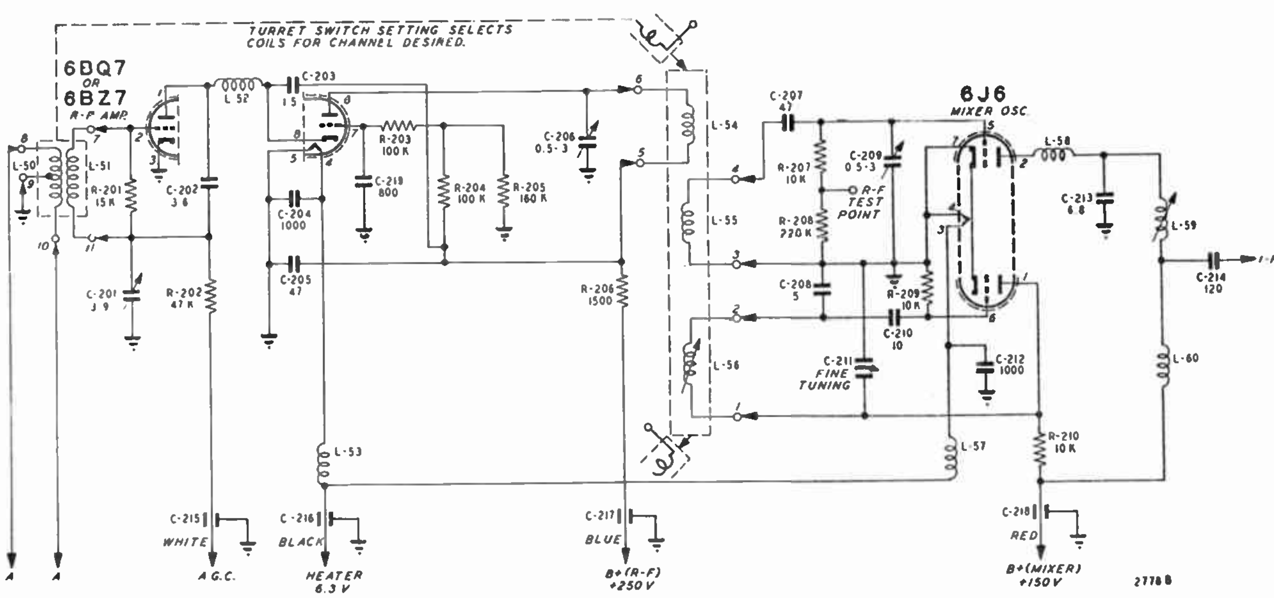
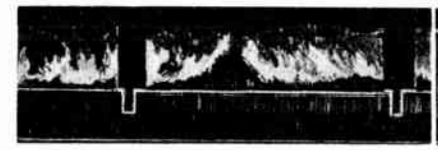


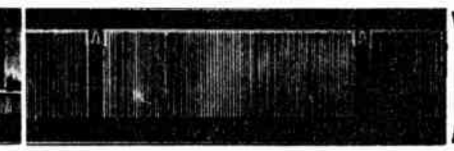
Fig. 15—Tuner Schematic Diagram.

OSCILLOSCOPE WAVEFORM PATTERNS

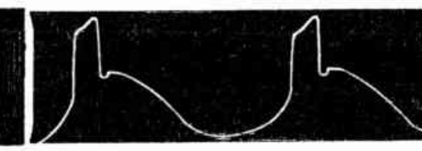
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicate the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



No. 1—6AL5 Pix Det. Plate
2.8V P-P 60 C.P.S.
No. 4—6CS6 Sync Sep.
Grid No. 1 .26V P-P 60 C.P.S.



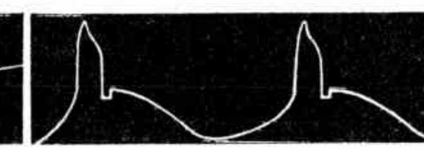
No. 7—12AT7 Phase Splitter Plate
30V P-P 60 C.P.S.



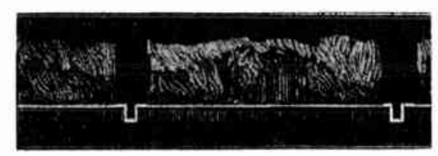
No. 14—6SN7-GTA—Hor. Osc. Plate
47V P-P 15,750 C.P.S.

No. 2—12AT7 Plate
44V P-P 60 C.P.S.
No. 2—12BY7 Grid
9.5V P-P 60 C.P.S.

No. 8—6SN7-GTA—Vert. Osc. Plate
70V P-P 60 C.P.S.
No. 10—6SN7-GTA Vert. Output Grid
70V P-P 60 C.P.S.

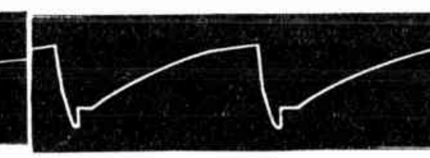


No. 15—6SN7-GTA Hor. Osc. Grid
42V P-P 15,750 C.P.S.

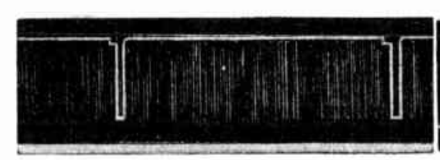


No. 3—Pix Tube Grid
23-150V P-P 60 C.P.S.

No. 9—6SN7-GTA Vert. Osc. Grid
160V P-P 60 C.P.S.

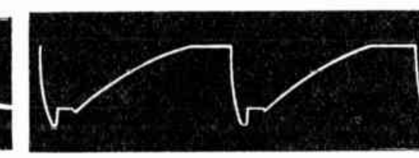


No. 16—6SN7-GTA Hor. Osc. Plate
190V P-P 15,750 C.P.S.



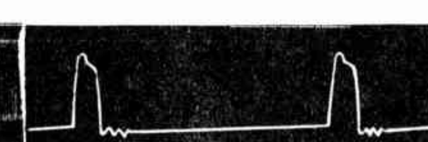
No. 5—6CS6 Sync Sep. Plate
36V P-P 60 C.P.S.

No. 11—Vert. Def. Coil
65V P-P 60 C.P.S.



No. 17—6BQ6 Grid
150V P-P 15,750 C.P.S.

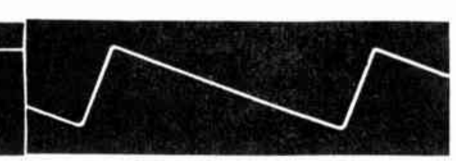
No. 6—12AT7 Phase Splitter Cathode
33V P-P 60 C.P.S.



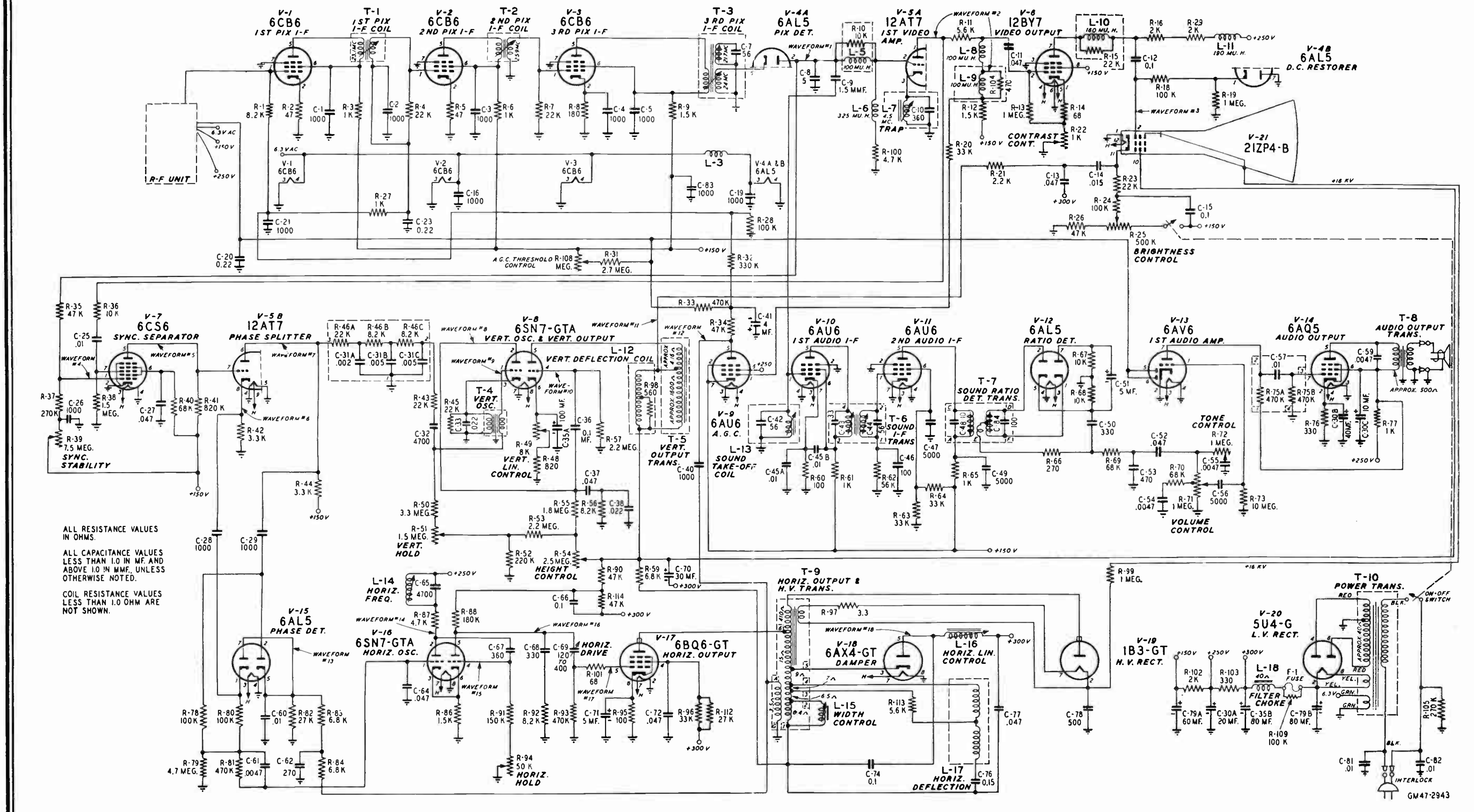
No. 12—6AU6 A.G.C.
510V P-P 15,750 C.P.S.

No. 18—6AX4—GT Damper Plate
115V P-P 15,750 C.P.S.

No. 6—12AT7 Phase Splitter Cathode
33V P-P 15,750 C.P.S.



No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.



ALL RESISTANCE VALUES IN OHMS.

ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF. UNLESS OTHERWISE NOTED.

COIL RESISTANCE VALUES LESS THAN 1.0 OHM ARE NOT SHOWN.

In earlier production R-86 was 1.8K, R-87 was 5.6K, R-88 was 220K, R-90 was 47K 1/2W and R-114 was not used.

PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
207, 209, 210	12A-040	10 K	±10%	0.5
208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2278-1	Antenna Coil	2-Q
	9A2278-2	Antenna Coil	3-Q
	9A2278-3	Antenna Coil	4-Q
	9A2278-4	Antenna Coil	5-Q
	9A2278-5	Antenna Coil	6-Q
	9A2278-6	Antenna Coil	7-Q
	9A2278-7	Antenna Coil	8-Q
	9A2278-8	Antenna Coil	9-Q
	9A2278-9	Antenna Coil	10-Q
	9A2278-10	Antenna Coil	11-Q
	9A2278-11	Antenna Coil	12-Q
	9A2278-12	Antenna Coil	13-Q
	9A2279-1	Oscillator Coil	2-Q
	9A2279-2	Oscillator Coil	3-Q
	9A2279-3	Oscillator Coil	4-Q
	9A2279-4	Oscillator Cil	5-Q
	9A2279-5	Oscillator Coil	6-Q
	9A2279-6	Oscillator Coil	7-Q
	9A2279-7	Oscillator Coil	8-Q
	9A2279-8	Oscillator Coil	9-Q
	9A2279-9	Oscillator Coil	10-Q
	9A2279-10	Oscillator Coil	11-Q
	9A2279-11	Oscillator Coil	12-Q
	9A2279-12	Oscillator Coil	13-Q
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

CAPACITORS

Ref. No.	Part No.	Capacity	Voltage	Type
C-1, C-2, C-3, C-4, C-5, C-16, C-19, C-21, C-26, C-28, C-29, C-40, C-73, C-83	80X1	1000 mmf		Ceramic
C-7	Part of T-3			
C-8	47X562	5 mmf	500 V	Ceramic
C-9	47X584	1.5 mmf		Composition
C-10, C-67	47X568	360 mmf	500 V	Molded Mica
C-11, C-27, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular
C-12, C-66, C-74	RCP10M4104M	.1 mf	400 V	Tubular
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular
C-14	RCP10M6153M	.015 mf	600 V	Tubular
C-15	RCP10M2104M	.1 mf	200 V	Tubular
C-20, C-23	RCP10M2224M	.22 mf	200 V	Tubular
C-25, C-60	RCP10M4103M	.01 mf	400 V	Tubular
C-30A, C-30B, C-30C	45X392	20 mf / 40 mf / 10 mf	400 V / 50 V / 400 V	Dry Electrolytic
C-31A, C-31B, C-31C	Part of 76X7 (See Miscellaneous)			
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica
C-33, C-38	RCP10M2223M	.022 mf	200 V	Molded Mica
C-35A, C-35B	45X391	100 mf / 80 mf	50 V / 400 V	Dry Electrolytic
C-36	RCP10M6104M	.1 mf	600 V	Tubular
C-41	45X361	4 mf	100 V	Dry Electrolytic
C-42	Part of L-13			
C-43, C-44	Part of T-6			
C-45A, C-45B	80X6	.01 mf	500 V	Dual Ceramic
C-46	47X604	100 mmf	500 V	Ceramic
C-47, C-49, C-56	47X507	5000 mmf		Ceramic
C-48, C-84	Part of T-7			
C-50, C-68	47X570	330 mmf	500 V	Molded Mica
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular
C-53	47X525	470 mmf	500 V	Molded Mica
C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular
C-57	Part of 76X5 (See Miscellaneous)			
C-59	RCP10M6472M	.0047 mf	600 V	Tubular
C-62	RCM20A271K	270 mmf	500	Molded Mica
C-69	17A269	120-400 mmf		Horizontal Drive
C-70	45X393	30 mf	400 V	Dry Electrolytic
C-76	RCP10M4154M	.15 mf	400 V	Tubular
C-78	47X560	500 mmf	20 KV	Ceramic
C-79A, C-79B	45X390	60 mf / 80 mf	400 V / 400 V	Dry Electrolytic
C-81, C-82	47X615	.01 mf		Ceramic

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Type
R-1	B83822	8.2 K	0.5	Carbon
R-2, R-5	B83470	47	0.5	Carbon
R-3, R-6, R-27, R-61, R-65	B85102	1 K	0.5	Carbon
R-4, R-7	B83223	22 K	0.5	Carbon
R-8	B84181	180	0.5	Carbon
R-9, R-12	B84152	1.5 K	0.5	Carbon
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon
R-13, R-19	B84105	1.0 Meg.	0.5	Carbon
R-14	B84680	68	0.5	Carbon
R-15	Part of L-10			
R-16, R-29	D83202	2 K	2.0	Carbon
R-18, R-28, R-78, R-80	B84104	100 K	0.5	Carbon
R-20, R-63, R-64	B84333	33 K	0.5	Carbon
R-21	B84222	2.2 K	0.5	Carbon
R-22, R-71	78X19	1.0 K / 1.0 meg.		Contrast and Volume Control
R-23, R-43, R-45	B84223	22 K	0.5	Carbon
R-24	B85104	100 K	0.5	Carbon
R-25	40X333	500 K		Brightness Control
R-26	B85473	47 K	0.5	Carbon
R-31	B84275	2.7 meg.	0.5	Carbon
R-32	B83334	330 K	0.5	Carbon
R-33, R-93	B84474	470 K	0.5	Carbon
R-34, R-35, R-114	B84473	47 K	0.5	Carbon
R-36	B84103	10 K	0.5	Carbon
R-37	B84274	270 K	0.5	Carbon
R-38	B84155	1.5 meg.	0.5	Carbon
R-39	40X370	7.5 meg.		Sync. Stability Control
R-40, R-69, R-70	B84683	68 K	0.5	Carbon
R-41	B84824	820 K	0.5	Carbon
R-42, R-44	B83332	3.3 K	0.5	Carbon
R-46A, R-46B, R-46C	Part of 76X7 (See Miscellaneous)			
R-48	B84821	820	0.5	Carbon
R-49	40X375	8 K		Vertical Lin. Control
R-50	B84335	3.3 meg.	0.5	Carbon
R-51	40X334	1.5 meg.		Vertical Hold Control
R-52	B84224	220 K	0.5	Carbon
R-53, R-57	B84225	2.2 meg.	0.5	Carbon
R-54	40X369	2.5 meg.		Height Control
R-55	B84185	1.8 meg.	0.5	Carbon
R-56	D84822	8.2 K	2.0	Carbon
R-59	D84682	6.8 K	2.0	Carbon
R-60	B84101	100	0.5	Carbon
R-62	B84563	56 K	0.5	Carbon
R-66	B84271	270	0.5	Carbon
R-67, R-68	B83103	10 K	0.5	Carbon
R-72	40X334	1.5 meg.		Tone Control
R-73	B85106	10.0 meg.	0.5	Carbon
R-75A, R-75B	Part of 76X5 (See Miscellaneous)			
R-76	C84331	330	1.0	Carbon
R-77	D84102	1 K	2.0	Carbon
R-79	B85475	4.7 meg.	0.5	Carbon
R-81	B85474	470 K	0.5	Carbon
R-82	B84273	27 K	0.5	Carbon
R-83, R-84	C84682	6.8 K	1.0	Carbon
R-86	B83152	1.5 K	0.5	Carbon
R-87	B83472	4.7 K	0.5	Carbon
R-88	B84184	180 K	0.5	Carbon
R-90	C84473	47 K	1.0	Carbon
R-91	B83154	150 K	0.5	Carbon
R-92	B84822	8.2 K	0.5	Carbon
R-94	40X361	50 K		Horizontal Hold Control
R-95	D84101	100	2.0	Carbon
R-96	D84333	33 K	2.0	Carbon
R-97	43X238	3.3	0.5	Wirewound
R-98	Part of Deflection Yoke			
R-99	C85105	1.0 meg.	1.0	Carbon
R-100	B83472	4.7 K	0.5	Carbon
R-101	B85680	68	0.5	Carbon
R-102	43X285	2 K	10.0	Wirewound
R-103	43X273	330	10.0	Wirewound
R-104	Part of L-9			
R-105	B85274	270 K	0.5	Carbon
R-108	40X369	2.5 meg.		AGC
R-109	D85104	100 K	2.0	Carbon
R-112	D84273	27 K	2.0	Carbon
R-113	B84562	5.6 K		Carbon

TRANSFORMERS AND COILS

Ref. No.	Part No.	Description
L-3	9A2033	R-F Heater Choke
L-5	36A25	Peaking Coil 100 mh
L-6	36A27	Peaking Coil 325 mh
L-7	9A2074	4.5 M.C. Trap
L-8	36A1	Peaking Coil 100 mh
L-9	36A23	Peaking Coil 100 mh
L-10	36A12	Peaking Coil 160 mh
L-11	36A2	Peaking Coil 190 mh
L-12, L-17	Part of Deflection Yoke Assembly	
L-13	9A2201	Sound Take-Off Coil
L-14	9A2096	Horizontal Frequency Coil
L-15	9A2183	Width Control
L-16	9A2262	Horizontal Linearity Control
L-18	52X95	Filter Choke
T-1, T-2	9A2230	1st and 2nd Pix I-F Coils
T-3	9A2333	3rd Pix I-F Coil
T-4	54X10	Vertical Osc. Transformer
T-5	51X168	Vertical Output Transformer
T-6	9A2323	Sound I-F Transformer
T-7	9A2295	Sound Ratio Det. Transformer
T-8	51X166	Audio Output Transformer
T-9	53X330	Horizontal Output Transformer
T-10	53X339	Power Transformer

MISCELLANEOUS

Part No.	Description
25A1095	Tuner, R-F (Standard Coil)
12A519	10" PM Speaker
2A438-2	Focus Magnet Assembly
76X5	Multiple Resistor Capacitor Assembly
76X7	Multiple Resistor Capacitor Assembly
9A2334-1	Deflection Yoke Assembly
2A421	Ion Trap Magnet

FACTORY MODEL 621CW7

INSTALLATION

Instructions

The complete installation of your new Television Receiver and the Television Antenna should be made by a qualified Television Service Technician. The Western Auto Store from whom you purchased the receiver will arrange for its unpacking and proper installation, and instruction in the use of the receiver for best results.

PLACEMENT -- The location in the room for your new Television Receiver should be given careful consideration.

Choose the location -- Where no bright light will fall directly on the picture. (Some illumination in the room is desirable.)

-- To give easy access for operation and comfortable viewing.

-- To permit a convenient connection to the antenna.

-- Convenient to an A-C electrical outlet of the proper voltage and frequency.

-- To allow adequate ventilation.

POWER SUPPLY -- This receiver is designed to operate on 105-125 volts A.C. power only. If plugged into an incorrect power supply, damage to the receiver may result.

CAUTION -- The receiver is provided with adequate ventilation holes in the bottom, back and the top of the cabinet. Care should be taken not to allow these holes to be covered or ventilation impeded in any way.

ANTENNA -- A correctly designed antenna, properly installed, is essential for good picture and sound reception.

Reception up to and sometimes beyond the line of sight to the transmitted antenna may be obtained if local interference conditions permit.

Whenever trouble is experienced, call the Western Auto Store from whom you purchased the instrument. He will arrange for a competent Service Television Technician to service the receiver.

OPERATING INSTRUCTIONS

This Television Receiver produces high definition pictures with fine detail and brilliance. Reception of these pictures is easily accomplished by following the instructions outlined below.

LOCATION OF CONTROLS

2D1303A Console Set

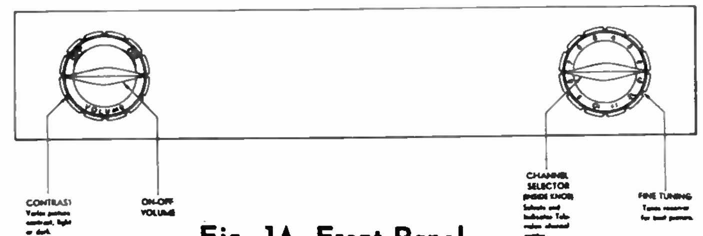


Fig. 1A Front Panel.

2D2302A Mantle Set

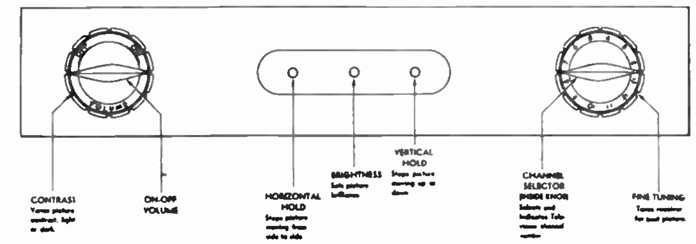


Fig. 2A Front Panel

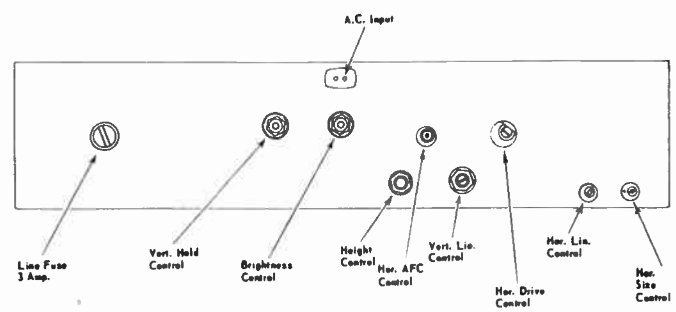


Fig. 1B Rear Panel

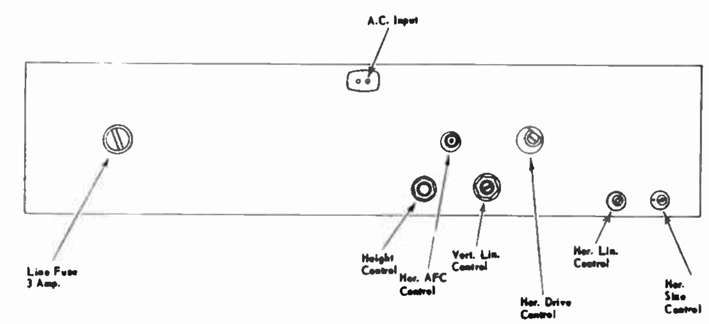


Fig. 2B Rear Panel

TUNING

All the controls normally used in tuning in a program -- both picture and sound -- are located on the front of the receiver. At the rear of the set are several controls which are pre-set at the factory and may need slight readjustment at the time of installation. After installation, they should not be adjusted further, unless required by replacement or aging of tubes, variations in power-line voltage, or other external conditions.

(1) Turn OFF-ON SOUND volume control slightly clockwise to switch the receiver on. Then turn the control clockwise to increase the sound volume.

(2) Set STATION SELECTOR to the desired channel.

(3) Allow a brief warm-up period.

(4) If the station is broadcasting, music or speech will be heard and the FINE TUNING control should be reset for best picture quality. Adjust SOUND volume control to the desired level.

(5) If necessary, adjust PICTURE control so that the picture is clear on the screen.

If the receiver has been in previous operation and other controls have been disturbed besides the OFF-ON knob then proceed as follows:

After switching on and setting for channel and volume as explained previously in steps 1 to 5, proceed as follows:

(a) Turn BRIGHTNESS control fully clockwise.

(b) Turn the PICTURE control fully clockwise until a picture becomes apparent.

(c) If the pattern is moving up or down adjust VERTICAL HOLD control until pattern is stationary in vertical direction.

(d) Adjust PICTURE control until picture is suitable and if necessary make a readjustment of the BRIGHTNESS at the same time.

(e) Adjust FINE TUNING for best picture quality. The sound will always be automatically optimum when the picture is correctly tuned. After the receiver has been on for some time, it may be necessary to readjust FINE TUNING for improved picture quality.

GENERAL DESCRIPTION

The model covered in this manual is a 21 tube, (including the picture tube and rectifiers), AC operated, direct view, 21-inch rectangular television receivers. The receiver is complete in one unit and features full coverage of all 12 V.H.F. channels (with easy conversion to U.H.F.) automatic gain control, automatic horizontal frequency control, inter-carrier sound system, electrostatic focusing, magnetically deflected picture tube and vertical and horizontal blanking circuit to improve picture quality.

At the rear of the receiver is a safety interlock to prevent dangerous electrical shock and as an added safety measure, a fuse is located in the low voltage power supply as well as in the A.C. input to protect the receiver in case of overloading.

OPERATOR'S CONTROLS

Toble Model

FRONT

ON-OFF VOLUME - Turns the receiver on or off and adjusts the sound volume level.

PICTURE - Varies in contrast between the light and the dark portions of picture.

CHANNEL SELECTOR - Selects and indicates desired station or Channel. May be turned in either direction.

FINE TUNING - Tuning receiver for best picture.

BRIGHTNESS - Adjusts picture brilliance, light or dark.

HORIZONTAL HOLD - Stops picture from moving side to side.

VERTICAL HOLD - Stops picture from moving up or down.

Console Molel

FRONT

ON-OFF VOLUME - Turns the receiver on or off and adjusts the sound volume level.

PICTURE - Varies in contrast between the light and the dark portions of picture.

CHANNEL SELECTOR - Selects and indicates desired station or Channel. May be turned in either direction.

FINE TUNING - Tuning receiver for best picture.

REAR

BRIGHTNESS - Controls the brilliance of the picture.

HORIZONTAL HOLD - Controls synchronization of the picture horizontally.

VERTICAL HOLD - Controls synchronization of the picture vertically.

SERVICEMAN'S CONTROLS

V. SIZE - Controls the size of the picture vertically.

V. LINEARITY - Controls vertical distribution of picture.

H. SIZE - Controls the size of the picture horizontally.

H. LINEARITY - Controls horizontal distribution of right side of picture.

CENTERING MAGNET - Controls positioning of picture for proper framing.

ION TRAP MAGNET - Controls focus and picture tube illumination.

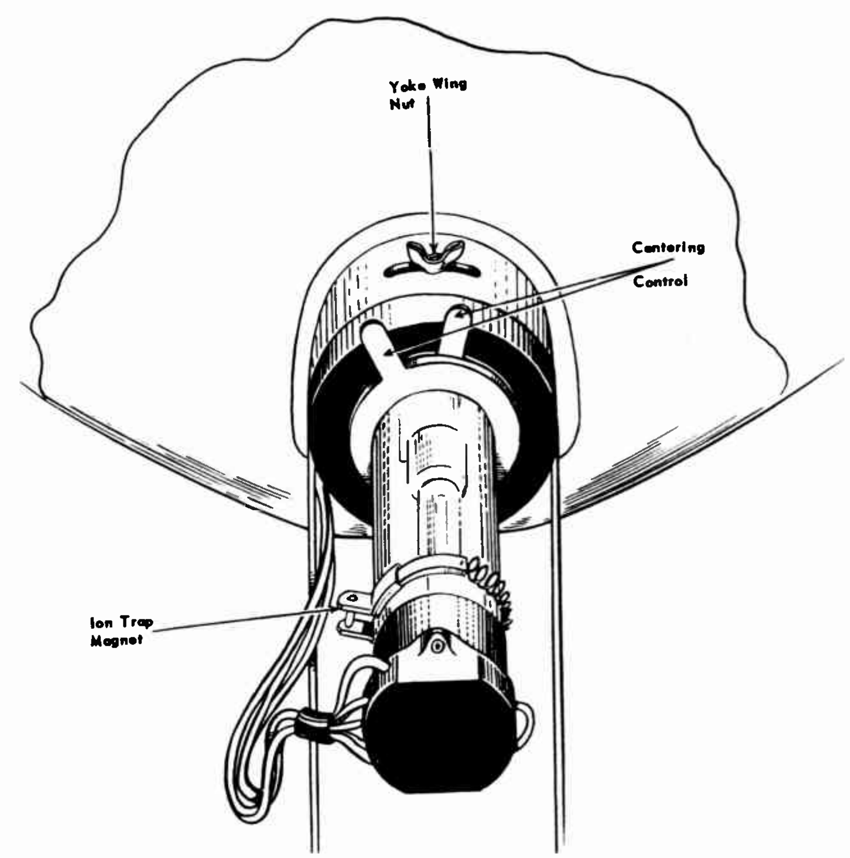


Figure 3. 21-inch Tube Assembly

SERVICE DATA

The front and rear controls are located as shown in figures 1, 2 and 3. All identifying names stamped on chassis.

SERVICE ADJUSTMENTS

VERTICAL SIZE AND VERTICAL LINEARITY CONTROLS

The vertical size and linearity controls should both be adjusted at the same time while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the Vertical Hold control if necessary.

ION TRAP MAGNET (Figure 3)

The position of the ion trap magnet MUST be over the grid of the picture tube (second cylinder from the base identified by a flared forward lip). If adjustment is necessary loosen the tape and rotate until the position which gives maximum illumination is found. Rotate and slide magnet until the best focus position is found. Adjustment should be made with brightness and picture controls set for normal viewing.

HORIZONTAL SIZE CONTROL (Figure 2B)

The horizontal size control should be adjusted until the picture fills the entire screen horizontally. A clockwise rotation will increase size. To some extent the vertical size control setting may be affected by a major horizontal size adjustment.

HORIZONTAL AFC CONTROL (L-5)

The horizontal AFC control is located on the rear flange of the chassis and should be adjusted in the following manner. Set the Picture control to its normal operating position. Turn the AFC Stud with a small screwdriver or adjusting tool until the picture is steady (no horizontal movement). Set the core to the middle of its range (Straight vertical wedges).

CENTERING MAGNET

The centering magnets should be rotated and adjusted until the picture is properly framed keeping in mind that the effect of the magnet is governed by the position of rotation.

DEFLECTION YOKE

The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow.

Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a positioning adjustment is necessary, loosen the yoke wing nut located at the top of the picture tube assembly.

HORIZONTAL LINEARITY COIL

The horizontal linearity coil affects the linearity of the right side of the picture only. It also affects phasing of the picture.

SPECIFICATIONS

Sensitivity at the Antenna

Audio - 5 microvolts
Video - 75-100 microvolts
(20V. P-P at Kinescope)

Antenna Impedance Requirements

Balanced 300-ohm

Audio Power Output Rating

3 watts undistorted

Speaker

Permanent magnet type
3.2 ohm voice coil impedance

Power Supply Rating

115 volts 60 Cycles, AC
Power Consumption, 190 watts

Intermediate Frequencies

Video - 26.0 MC
Audio - 21.5 MC
Intercarrier Sound - 4.5 MC

TUBE COMPLEMENT

Schematic Ref. No.	RTMA Type	Tube Function
V1	6AU6	Ratio Det. Driver
V2	6AL5	Ratio Detector
V3	6AV6	Audio Amplifier
V4	6K6GT	Audio Output
V5	6AU6	1st IF Amplifier
V6-V7	6CB6	2nd and 3rd IF Amplifier
V8	6AL5	Video and AGC Det.
V9	12BH7	Video Amplifier
V10	21FP4	Picture Tube
V11	12AU7	Sync. Sep. and Sync. Amp.
V12	6C4	Vert. Osc.
V13	6V6GT	Vert. Output
V14	5U4G	L. V. Rectifier
V15	6AL5	Hor. Phase Det.
V16	12BH7	Hor. Osc.
V17	6AV5GT	Hor. Output
V18	6W4GT	Damper
V19	1B3GT	H. V. Rectifier
*V20	6AG5	R. F. Amplifier
V21	6J6	R. F. Osc. and Mixer

* May be a 6BC5 or 6CB6.

WARNING:

High voltage on the plate caps of the 1B3 high voltage rectifier and the 6AV5 horizontal pulse amplifier. DO NOT MEASURE this voltage.

SCHEMATIC DIAGRAM:

The schematic diagram located at the rear of this manual shows all the values of resistance and capacitance and the Voltage Measurements Chart gives all the proper voltages at the pins of the tube sockets. The voltage readings were taken with a 20,000 ohm/volt voltmeter with normal operation, no signal input, and line voltage at 115 volts A. C.

REPLACING TUBES

Before replacing the tubes the cabinet back must first be removed. Removing the cabinet back disengages the safety interlock and removes the power to the receiver. Do not tamper with or attempt to defeat the purpose of the safety interlock as shock may result.

Before replacing the High Voltage tubes first be sure the power is turned off and then short the H. V. anode cap to the chassis.

WARNING:

If the receiver has been in operation for some time, the tubes become hot and gloves should be used when replacing tubes to prevent finger burns.

PICTURE TUBE HANDLING:

Due to the large surface and extreme high vacuum of the picture tube, care should be used when handling the chassis outside the cabinet. Do not subject the tube to excessive pressure or rough handling as an implosion may result causing serious personal injury.

HIGH VOLTAGE POWER SUPPLY:

In the process of inspection, repair, changing of tubes or transformers, or for any other reason where it is necessary to work within the high voltage power supply, the following should be closely observed.

1. The corona insulator should not be omitted.
2. The corona insulator must be dressed in such a way as to make its presence useful; that is, covering the top socket terminals.
3. All leads must be dressed as far away as possible from the transformer winding. Excess lead length should be transferred to the top side of the chassis.

When replacement of the H. V. deflection transformer is necessary, be sure to closely follow the precautions listed above. The transformer can easily be replaced with the chassis in the cabinet by the following procedure.

1. Remove the hex head screw holding the H. V. cage.
2. Remove the H. V. assembly hex screws.
3. Remove flyback hex screw.

SERVICE DATA - TELEVISION FREQUENCY RANGES

(All figures represent megacycles)

Channel	Channel Frequencies	Picture Carrier Frequency	Sound Carrier Frequency	Receiver RF Oscillator Frequency
LOW BAND				
2	54- 60	55.25	59.75	82
3	60- 66	61.25	65.75	88
4	66- 72	67.25	71.75	94
5	76- 82	77.25	81.75	104
6	82- 88	83.25	87.75	110
HIGH BAND				
7	174-180	175.25	179.75	202
8	180-186	181.25	185.75	208
9	186-192	187.25	191.75	214
10	192-198	193.25	197.75	220
11	198-204	199.25	203.75	226
12	204-210	205.25	209.75	232
13	210-216	211.25	215.75	238

GENERAL DESCRIPTION

VHF TUNER:

The Tuner is composed of a separate sub-chassis consisting of a 6CB6 pentode RF Amplifier and a 6J6 tube (twin triode) for the oscillator and converter. Separate high and low band coils and trimmers are used with a manual switching device to change bands. The tuner selects and amplifies the station's signal and converts it to the carrier IF frequency of 26.0 MC for video and 21.5 MC for sound which in turn is then fed to the IF amplifiers for further amplification.

VIDEO IF AMPLIFIER:

The Video IF Amplifiers are mounted on a separate sub-chassis along with the low level circuit. The IF amplifier section consists of three (3) stagger-tuned stages with an over-coupled output IF transformer using one 6AU6 and two 6CB6 (pentode) tubes with self-resonant core-tuned coils. Since the receiver is of the intercarrier type both the video and sound IF frequencies are amplified simultaneously and then detected by a 6AL5. The signal is then coupled to the video amplifier and the sync clipper. The A. G. C. network, R-11 and C-7, develops a negative bias voltage proportional to the average composite video signal.

VIDEO AMPLIFIER:

The Video Amplifier section consists of a 12BH7 duo-triode tube with a degenerative picture (or contrast) control (R-19) to vary the signal to the grid of the picture tube. The audio signal is also amplified in this stage and then separated by a 4.5 MC trap (T-4). This trap also serves to separate or keep the audio from appearing in the picture.

SOUND SECTION:

The Sound Section consists of a 6AU6 (pentode) 4.5 MC audio IF amplifier, 6AL5 twin diode ratio detector, 6AV6 (triode) audio amplifier and a 6K6 (pentode power amplifier) output tube. Due to the hetrodyne action between the video and sound IF frequencies at the video detector, a 4.5 MC signa' is obtained containing the audio information. After the video detector the audio information is amplified by the video amplifier, separated from the video by the trap, amplified, detected and further amplified before being coupled to the speaker.

SYNC. CLIPPER:

The Sync. stage utilizes a 12AU7 (duo-triode) tube which functions as a sync. separator and noise clipper. The signal from the output of the video amplifier is coupled to pin 8 through R-27 and C-29. With the negative going signal at Pin 8 and the low plate voltage, sync. separation is accomplished.

VERTICAL DEFLECTION:

The Vertical Deflection section consists of a 6C4 and 6V6 tube, being used as a blocking oscillator and output amplifier. The signal from the plate of the sync. separator is coupled through the Vertical Integrating Network to the grid of the blocking oscillator. The vertical hold control (R-54) in the grid circuit varies the oscillator operating frequency, thus providing adjustment for synchronization. The vertical size control (R-58) varies the amplitude of the pulse to the grid of the amplifier and controls the amount of vertical deflection. The vertical linearity control (R-60) varies the cathode resistance, in the 6V6 vertical output tube circuit thus adjusting the operating characteristics of the amplifier to provide the proper wave shape to obtain a linear picture vertically. The blanking network is designed to eliminate vertical retrace lines at high brightness levels.

AFC DISCRIMINATOR:

The Automatic Frequency Control section utilizes a 6AL5 (twin-diode) tube which functions as a discriminator. The horizontal sync. pulses from the output of the sync separator are coupled to the AFC tube. At the same time a comparison sawtooth is applied from the horizontal sweep amplifier. Any phase shift between the horizontal sync pulses and the horizontal sawtooth will cause one diode section to conduct more than the other. This will result in a DC bias voltage applied to the grid of the multivibrator and change the operating frequency. The output of the AFC discriminator thus synchronizes the horizontal sync. pulse.

HORIZONTAL MULTIVIBRATOR:

The Horizontal Multivibrator uses a 12BH7 (twin-triode) tube and is of the conventional cathode coupled type. The core-tuned parallel resonant circuit (L-5 and C-42) is used as a hold adjustment to stabilize the frequency of oscillation. Because of the wide pull-in range of the automatic frequency control tube a fine hold control is not necessary. The output signal of the multivibrator is coupled to the horizontal pulse amplifier. Capacitor C58 is a negative peaking device to aid in cutting off the pulse amplifier tube at the proper time.

HORIZONTAL PULSE AMPLIFIER:

The Horizontal Pulse Amplifier utilizes a 6AV5 (beam pentode) tube to develop the necessary power for the fly back pulse and the horizontal winding of the deflection yoke.

DAMPER:

The 6W4 Damper tube (diode) performs three functions:

1. Aids in horizontal scanning.
2. Suppresses oscillations which occur over part of the horizontal scanning cycle; and
3. Gives an increase in plate supply voltage for the vertical blocking oscillator, vertical output amplifier and first anode of the pciture tube.

HI-VOLTAGE SUPPLY:

The High Voltage (second anode voltage) is obtained from the primary winding of the HV deflection transformer. When the plate current of the Hor. pulse amplifier tube is cut off, the field built up in the primary winding collapses and induces a high voltage surge which is rectified by the 1X2A tube, filtered by the H. V. capacitor C52 and applied to the second anode. The 1X2A is a conventional half-wave high voltage rectifier and obtains its filament power from a separate secondary winding of the HV deflection transformer.

LOW VOLTAGE SUPPLY

The B plus voltage for the receiver is obtained from the power transformer-driven brute force filter. The receiver tubes obtain their filament power from the filament winding. A safety interlock is provided to reduce shock hazards and a line fuse is connected in series to protect the receiver in case of overloading.

SERVICE HINTS

V. H. F. TUNER:

Before looking into the tuner for a particular trouble, first make the following observations. Since the receiver is of the inter-carrier type both the sound and video information are amplified simultaneously by the tuner, IF and video amplifiers. Therefore, if the sound section is functioning normally it can be assumed that there are no defects in the tuner, IF or video amplifiers. If the receiver is "dead" (no sound or picture - raster normal) first determine whether a signal is being transmitted and then check the antenna, lead-in and connections to the receiver. Next, rotate the contrast or picture control completely to the left (counter-clockwise) and observe the face of the picture tube. Advance the control to the extreme clockwise position and again observe the face of the picture tube. If no snow appears check the video amplifier, detector and second and third IF amplifiers. If, however, an increase of "snow" appears check the first IF amplifier before looking into the tuner.

When working inside the tuner do not move any component a great distance as a change in the distributed capacity may result and offset the alignment. When replacing components be sure to obtain the same lead length and replace them in the same position.

A majority of tuner troubles are often open and high resistance ground or coil solder connections, defective trimmers or coils and defective switch contacts.

Open or high resistance connections can easily be repaired by placing a hot soldering iron at the solder connection.

Defective switch contacts may cause an intermittent condition.

A. G. C.

The A. G. C. is a negative bias voltage proportional to the average composite video signal applied to the RF and first and second IF amplifiers. The magnitude of the A. G. C. voltage will vary according to the strength of the signal being received. However, it will closely correspond to the detector output voltage. As a fast and simple check to determine whether the A. G. C. voltage is normal, measure both the A. G. C. and detector output voltage. Under normal operating conditions these two voltages will be approximately the same.

VERTICAL DISTRIBUTION (LINEARITY)

A fast and simple method to check the vertical distribution of a TV picture, without a test pattern, rotate the vertical hold control until the picture is moving slowly downward. Observe the black horizontal bar. If the vertical size and linearity controls are properly adjusted, the bar will not change in thickness as it moves from top to bottom.

TROUBLE SHOOTING

Trouble	Probable Location
No Raster - No Sound	1. Blown fuse in "B +" Circuit. 2. Defective V14 (5U4G) L. V. Rectifier 3. Defective resistor R46. 4. Defective capacitors C60-61 5. Defective transformer T6 or choke L1. 6. Defective safety interlock or on-off switch.
No Raster - Sound Normal	1. Insufficient or no high voltage, (refer to "No High Voltage" section). 2. Defective picture tube. 3. Second anode lead disconnected. 4. Ion trap magnet misadjusted. 5. Defective C. R. T. socket.
No High Voltage	1. Defective tubes V16, 17, 18, 19. 2. Defective transformer T10, or yoke coil L6, 7, 8, 9. 3. Defective coils L5, L11, L10. 4. Defective resistor R69, 70, 71, 75, 76, 78, 79. 5. Defective capacitors C43, C44, C45, C46, C47, C48, C50, C51, C52, C58.
No Picture - No Sound Raster Normal	1. Defective antenna or lead-in. 2. Defective tuner tube V20, 21. 3. Defective tuner. 4. Defective tubes V5, 6, 7, 8, 9. 5. Improper voltages or resistances at sockets of tubes V5, 6, 7, 8, 9. 6. Improper alignment.
No Sound - Picture Normal	1. Defective tubes V1, 2, 3, 4. 2. Improper voltages or resistances at socket of tube V1, 2, 3, 4. 3. Defective speaker or plug. 4. Defective transformer T5, T7 or T4. 5. Improper sound alignment.
No Sync.	1. Defective tube V11. 2. Improper voltages or resistances at socket of tube V11.
Insufficient or no Vertical Sweep	1. Defective tube V12, V13. 2. Defective transformer T8-9 or yoke L6, 7, 8, 9. 3. Defective capacitor. 4. Defective resistor, R56, 57, 58, 59, 60, 61, 62. 5. Defective C62A, 33, 34, 60D.

TROUBLE - SHOOTING -- (Continued)

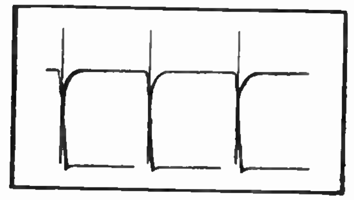
Trouble	Probable Location
Picture Cannot be Centered	1. Defective picture tube. 2. Defective centering magnet. 3. Defective ion trap magnet.
Poor Focus	1. Improper adjustment of Ion trap. 2. Defective picture tube.
Poor Horizontal Linearity	1. Improper adjustment of linearity coil. 2. Defective tube V17-18. 3. Defective capacitor C43, 44, 45. 4. Defective transformer T10 or Coil L10.
Snow or Poor Picture	1. Insufficient signal input. 2. Defective antenna or lead-in. 3. Weak tubes V20, 21, 5, 6, 7. 4. Improper video IF alignment.
Lack of Contrast	1. Defective tube V8, 9. 2. Improper video IF alignment.
Washed Out or Picture Smear	1. Defective V8. 2. Gassy tube V20, 5, 6. 3. Improper video IF alignment.

WAVE FORM ANALYSIS

The drawings on this page illustrate the wave forms at various positions within the receiver. The wave forms are not theoretical but exact copies of that shown by an oscilloscope and were taken under normal operating conditions, with a transmitter signal and the picture in sync. at all times.

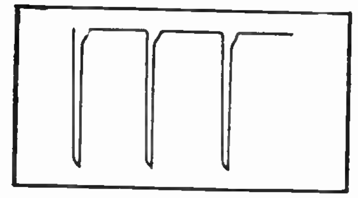
When checking the wave forms, connect the ground lead from the oscilloscope to the chassis and the hot lead to the position indicated. The wave shapes may vary somewhat depending on the strength of the signal, the picture information being transmitted and the adjustments of the various controls.

Under each wave form is the schematic reference, position taken at, peak-to-peak voltage and the type of wave form indicated (Vertical 60 cycles and Horizontal 15, 750 cycles).



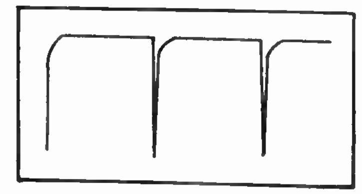
VERTICAL PULSE

Pin 3 of Tube V11. Cath. of Sync. Separator 15 volts Peak-to-Peak.



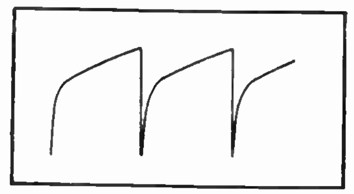
HORIZONTAL PULSE

Pin 3 of Tube V11. Cath. of Sync. Separator 15 volts Peak-to-Peak.



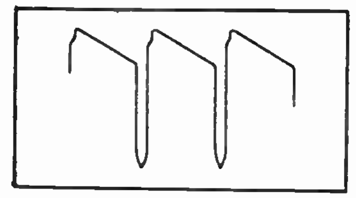
VERTICAL PULSE

Pin 6 of Tube V12 Grid of V. Blocking Osc. 125 volts Peak-to-Peak.



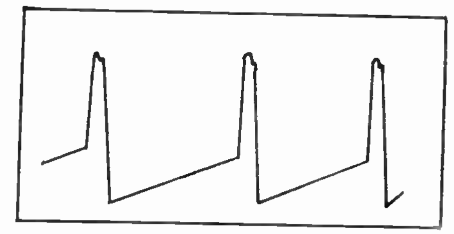
VERTICAL PULSE

Pin 5 of Tube V13. Grid of V. Output 95 volts Peak-to-Peak.



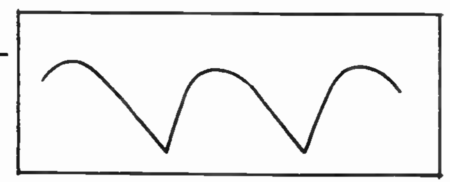
HORIZONTAL PULSE

Pin 5 of Tube V15 Cathode of A. F. C. Discr. 15 volts Peak-to-Peak.



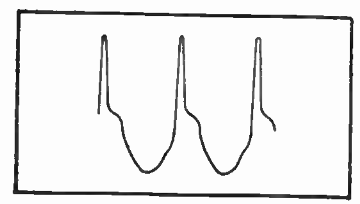
HORIZONTAL PULSE

Pin 7 of Tube V15 Plate of A. F. C. Discr. 15 volts Peak-to-Peak.



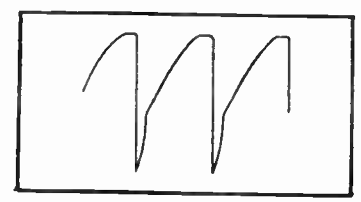
HORIZONTAL PULSE

Pin 1 or 2 of Tube V15 Plate of A. F. C. Discr. 15 volts Peak-to-Peak.



HORIZONTAL PULSE

Pin 6 of Tube V16 Plate of H. Mult. 35 volts Peak-to-Peak



HORIZONTAL PULSE

Pin 1 of Tube V17 Grid of H. Pulse Amp. 100 volts Peak-to-Peak.

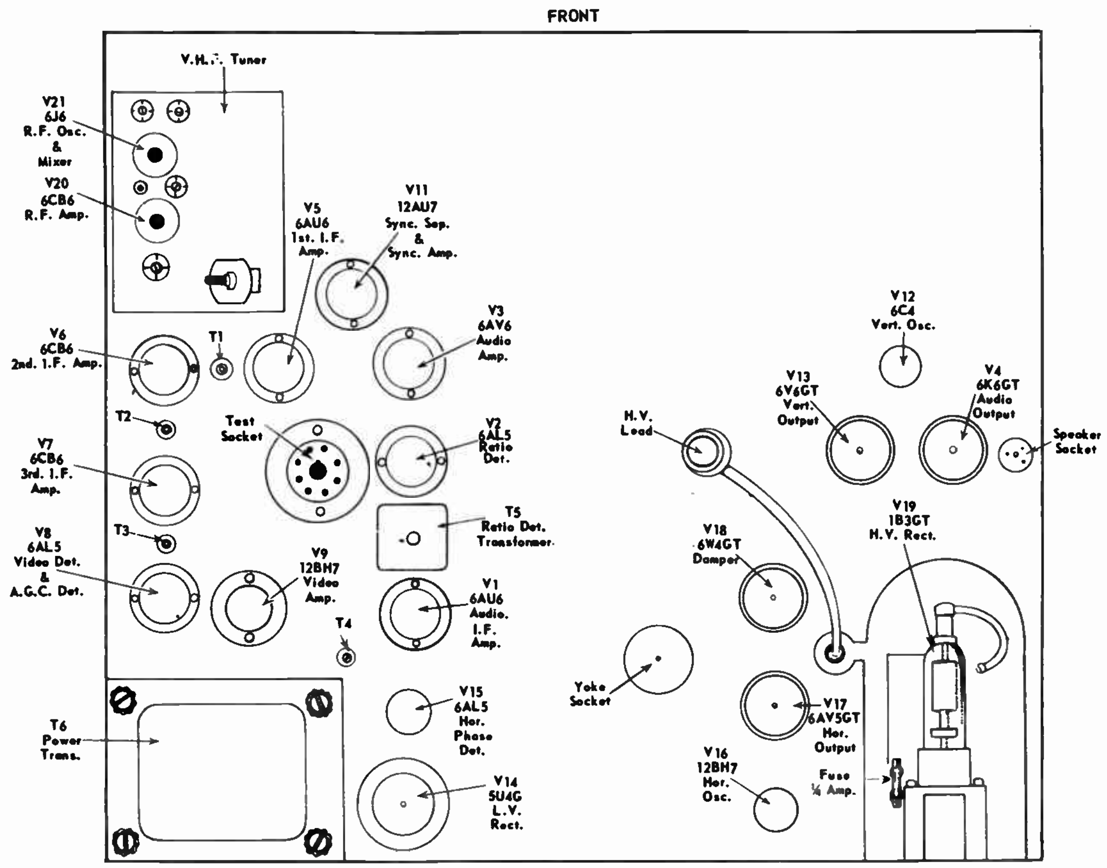


Figure 4. Top Chassis View.

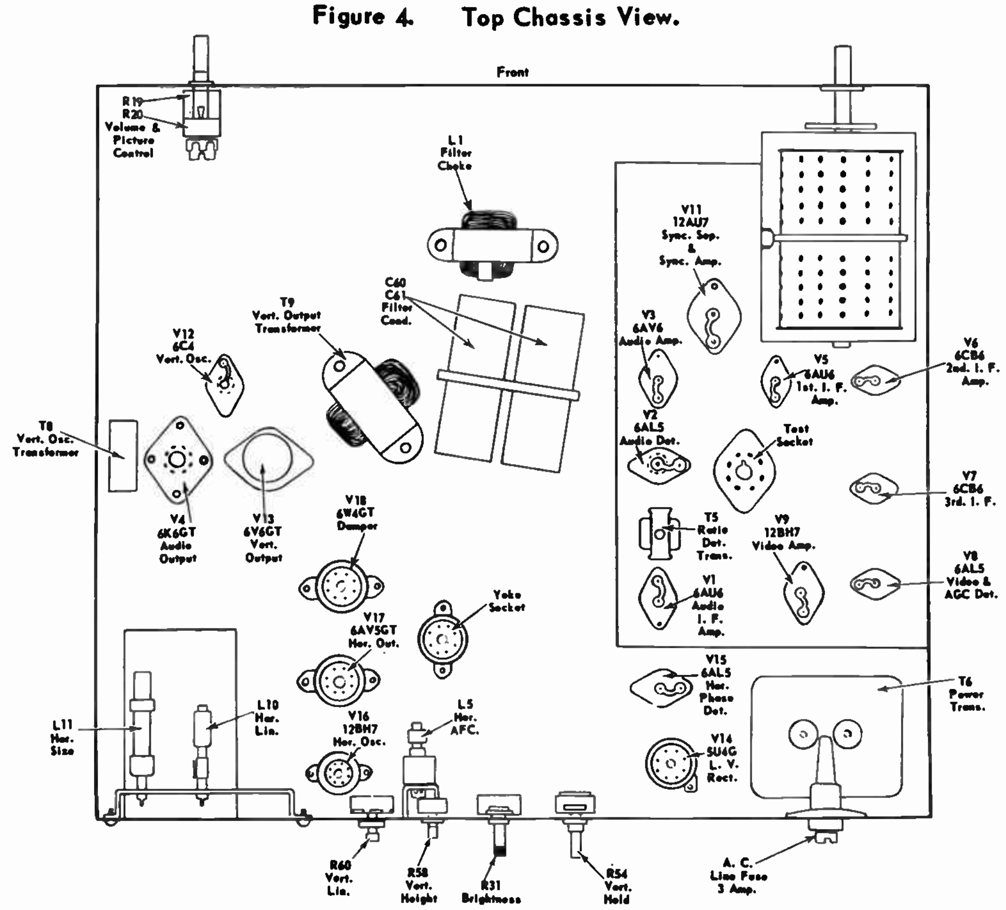


Figure 5. Bottom Chassis View.

ALIGNMENT PROCEDURE

NOTE: Test-socket pins are numbered like tube-sockets, i.e. clockwise from the keyway at the lug side of the socket.

I. Video I. F. Spot Frequency Alignment.

A. Connect 3 volts bias between pins 1 and 2 of the Test-Socket, with negative lead connected to pin 2.

B. Set tuner on a low band channel which does not have a strong local station. Short the antenna input terminal. Set Picture control at maximum clockwise position.

C. Feed the output of an audio-modulated signal generator through a condenser to the tuner test point.

D. Connect the high side of an AC Voltmeter to the Test-Socket, pin no. 4, and low side of the meter to pin no. 1. If necessary, the kinescope lead may be removed.

E. Control output of the signal generator so that the reading on the AC voltmeter goes no higher than 20 volts.

F. Use the proper alignment tool -- an internal male screwdriver for the coil studs, and proceed as follows:

Step Number	Signal Generator Frequency	Adjust	Remarks
1	25.7 MC	T3-Top	Adjust for maximum reading of voltmeter
2	25.7 MC	T1-Top	Same
3	23.6 MC	T2-Top	Same
4	23.6 MC	Tuner Top Slug	Same

II. Intercarrier Sound I. F. Alignment.

A. Remove the 6AL5 video detector from its socket. Set Picture control at maximum clockwise.

B. Connect the high side of the signal generator, through a condenser, to pin 7 of this tube socket. Connect the low side to the chassis. (NOTE: Pins are numbered from the lug side of the socket.)

C. Connect a DC voltmeter or VTVM to the Test-socket, the negative lead to pin 1 and the positive lead to pin 6.

D. Set the signal generator to 4.5 MC, unmodulated, and adjust output of generator so the DC meter reads no higher than 10 volts.

E. Use proper alignment tool: one internal male tool for stud; one external male tool for K-tran Ratio Detector.

Proceed as follows:

Step Number	Signal Generator Frequency	Adjust	Remarks
5	4.5 MC	T4-Top	Adjust for maximum reading of voltmeter.
6	Same	T5-Bottom	Same

F. Now disconnect voltmeter from Test-Socket, and replace with a matched pair of resistors. (NOTE: These resistors should be around 270K each, and should be connected in series between pins 6 and 1 of the test-socket.)

G. Connect the positive lead of the voltmeter to the mid-point of these resistors, and the negative lead to pin 7 of the test-socket.

H. Use 5-volt range of meter, and proceed as follows:

Step Number	Signal Generator Frequency	Adjust	Remarks
7	4.5 MC	T5-Top	Adjust for zero which occurs between a maximum negative and a maximum positive reading.

III. Tuner Oscillator Alignment.

A. Set fine-tuning in mid-position of its range.

B. Align all twelve channels with either an "off the air" station or a monoscope modulated local transmitter.

C. Procedure: Tune oscillator screws until 4.5 m.c. sound "wiggles" are just visible at all vertical edges.

CHART OF VOLTAGE MEASUREMENTS AT TUBE PINS RELATIVE TO CHASSIS

TUBE NO.	TUBE TYPE	FUNCTION	PIN NUMBER 1	2	3	4	5	6	7	8	9	10	11	12
1	6AU6	Ratio Detect. Driver	-.5	0	AC 6.3	0	195	80	.5					
2	6AL5	Ratio Detect.	18	18	0	AC 6.3	48	0	0					
3	6AV6	Audio Amp.	-.8	0	AC 6.3	0	0	0	75					
4	6K6	Audio Out.	0	0	210	225	0	240	AC 6.3	17				
5	6AU6	1st I. F.	-2.8	0	0	AC 6.3	130	130	.25					
6	6CB6	2nd I. F.	-2.8	.3	AC 6.3	0	135	135	0					
7	6CB6	3rd I. F.	0	2.3	AC 6.3	0	135	135	0					
8	6AL5	Video Detect. - AGC	0	-3.3	AC 6.3	0	5	0	-4.5					
9	12BH7	Video Amp.	155	-7.2	0	AC 6.3	AC 6.3	120	-4.5	5	0			
10	21FP4	Picture Tube	160	110				540				540	160	160
11	12AU7	Sync. Amp.	86	18	16	0	0	18	-2.5	12	AC 6.3			
12	6C4	Vert. Osc.	155	155	0	AC 6.3	155	-82	0					
13	6V6	Vert. Out.	36	AC 6.3	240	380	0	36	0	36				
14	5U4	Low Volt. Rect.	AC 6.3	260	150	-20	0	-20	150	260				
15	6AL5	Horiz. Phase Detect.	0	0	AC 6.3	0	12	0	-12					
16	12BH7	Horiz. Osc.	110	-4.2	10	AC 6.3	AC 6.3	210	.3	10	0			
17	6AV5	Horiz. Out.	-28	AC 6.3	0	0	*	0	0	130				
18	6W4	Horiz. Damper	240	0	540	230	200	0	150	150				
19	1B3	High Volt. Ret.	14000 VOLTS D. C.											

* Do Not Measure

All voltages are with respect to chassis.

Measurements were made with receiver controls set for normal picture with 117 volts line voltage. Normal signal applied to antenna terminals. VTVM used for all readings.

CHART OF RESISTANCE MEASUREMENTS AT TUBE PINS RELATIVE TO CHASSIS

TUBE NO.	TUBE TYPE	FUNCTION	PIN NUMBER 1	2	3	4	5	6	7	8	9	10	11	12
1	6AU6	Ratio Detect. Driver	50K	0	.1	0	30K	30K	100					
2	6AL5	Ratio Detect.	1.5M	1.5M	0	0	30K	0	0					
3	6AV6	Audio Amp.	7M	0	.1	0	0	0	500K					
4	6K6	Audio Out.	0	0	30K	30K	500K	30K	.1					
5	6AU6	1st I. F.	1.1M	0	0	.1	30K	30K	80					
6	6CB6	2nd I. F.	1.1M	50	.1	0	30K	30K	0					
7	6CB6	3rd I. F.	.8	150	.1	0	30K	30K	0					
8	6AL5	Video Detect. - A6G Detect.	.2	200K	.1	0	2K	0	5K					
9	12BH7	Video Amp.	40K	1M	0	.5	.5	30K	5K	0-2K	0			
10	21FP4	Picture Tube	400K	30K				Inf.				Inf.	400K	400K
11	12AU7	Sync. Amp.	40K	1.5M	3K	0	0	1.5M	55K	200K	.1			
12	6C4	Vert. Osc.	Inf.	.5-3M	0	.1	.5-3M	1.5M	0					
13	6V6	Vert. Out.	200-5K	.1	30K	500M	7M	12K	0	.2K-5K				
14	5U4	Low Volt. Rect.	.1	30K	.5M	20	Inf.	20	.5M	30K				
15	6AL5	Horiz. Phase Detect.	400	400	.1	0	3M	0	3M					
16	12BH7	Horiz. Osc.	.2M	.2M	2K	.1	.1	35K	3.5M	2K	0			
17	6AV5	Horiz. Out.	.5M	.1	0	Inf.	.5M	Inf.	0	40K				
18	6W4	Horiz. Damper	30K	Inf.	.5M	30K	30K	Inf.	.5M	.5M				
19	1B3	High Volt. Rect.	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.				

Resistance values are in ohms.

K = 1 Thousand
M = 1 Million
Inf. = Infinity

REPLACEMENT PARTS

RESISTORS

SYMBOL NO.	PART NO.	DESCRIPTION
R-1	20T472-32	4.7 K Ohms ±10% 1/2W, Carbon
R-2	20T820-32	82 Ohms ±10% 1/2W, Carbon
R-3	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-4	20T331-32	330 Ohms ±10% 1/2W, Carbon
R-5	20T103-32	10 K Ohms ±10% 1/2W, Carbon
R-6	20T470-32	47 Ohms ±10% 1/2W, Carbon
R-7	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-8	20T331-32	330 Ohms ±10% 1/2W, Carbon
R-9	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-10	20T223-32	22 K Ohms ±10% 1/2W, Carbon
R-11	20T824-32	820 K Ohms ±10% 1/2, Carbon
R-12	20T151-32	150 Ohms ±10% 1/2W, Carbon
R-13	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-14	20T333-32	33 K Ohms ±10% 1/2W, Carbon
R-15	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-16	20T224-32	220 K Ohms ±10% 1/2W, Carbon
R-17	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-18	20T472-32	4.7 K Ohms ±10% 1/2W, Carbon
R-19	50T10	2 K 1/2W, Carbon,
R-20	50T10	1 Meg. Volume, On-Off
R-21	20T332-42	3.3 K Ohms ±10% 1W, Carbon
R-22	20T822-32	8.2 K Ohms ±10% 1/2W, Carbon
R-23	20T105-32	1 Meg. ±10% 1/2W, Carbon
R-24	20T822-32	8.2 K Ohms ±10% 1/2W, Carbon
R-25	20T182-42	1.8 K Ohms ±10% 1W, Carbon
R-26	20T104-42	100 K Ohms ±10% 1W, Carbon
R-27	20T332-32	3.3 K Ohms ±10% 1/2W, Carbon
R-28	20T332-52	3.3 K Ohms ±10% 2W, Carbon
R-29	20T152-42	1.5 K Ohms ±10% 1W, Carbon
R-30	20T334-32	330 K Ohms ±10% 1/2W, Carbon
R-31	50T16	25 K Ohms 1/2W, Carbon Pot., Brightness Control
R-32	20T392-32	3.9 K Ohms ±10% 1/2W, Carbon
R-33	20T822-32	8.2 K Ohms ±10% 1/2W, Carbon
R-34	20T473-32	47 K Ohms ±10% 1/2W, Carbon
R-35	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-36	20T473-32	47 K Ohms ±10% 1/2W, Carbon
R-37	20T473-42	47 K Ohms ±10% 1W, Carbon
R-38	20T102-32	1 K Ohms ±10% 1/2W, Carbon
R-39	20T153-32	15 K Ohms ±10% 1/2W, Carbon
R-40	20T333-32	33 K Ohms ±10% 1/2W, Carbon
R-41	20T685-32	6.8 Meg ±10% 1/2W, Carbon
R-42	20T474-32	470 K Ohms ±10% 1/2W, Carbon
R-43	20T474-32	470 K Ohms ±10% 1/2W, Carbon
R-44	20T561-42	560 Ohms ±10% 1W, Carbon
R-45	20T471-42	47 Ohms ±10% 1W, Carbon
R-46	20T10	2750 Ohms ±10% 10W, Wirewound
R-47	20T155-32	1.5 Meg ±10% 1/2W, Carbon
R-48	20T224-32	220 K Ohms ±10% 1/2W, Carbon
R-49	20T563-32	56 K Ohms ±10% 1/2W, Carbon
R-50	20T272-32	2.7 K Ohms ±10% 1/2W, Carbon
R-51	20T392-32	3.9 K Ohms ±10% 1/2W, Carbon

RESISTORS (Continued)

SYMBOL NO.	PART NO.	DESCRIPTION
R-52	20T392-32	3.9 K Ohms ±10% 1/2W, Carbon
R-53	20T155-32	1.5 Meg. ±10% 1/2W, Carbon
R-54	50T13	1 Meg 1/4W, Carbon Pot., Vert. Hold.
R-55	20T123-32	12 K Ohms ±10% 1/2W, Carbon
R-56	20T474-32	470 K Ohms ±10% 1/2W, Carbon
R-57	20T685-32	6.8 Meg. ±10% 1/2W, Carbon
R-58	50T2	2.5 Meg. 1/4W; Carbon Pot., Vert. Height.
R-59	20T104-32	100 K Ohms ±10% 1/2W, Carbon
R-60	50T3	4 K Ohms 1/2W, Carbon Vert. Linearity.
R-61	20T221-32	220 Ohms ±10% 1/2W, Carbon
R-62	20T473-42	47 K Ohms ±10% 1W, Carbon
R-63	20T184-32	180 K Ohms ±10% 1/2W, Carbon
R-64	20T104-32	100 K Ohms ±10% 1/2W, Carbon
R-65	20T104-32	100 K Ohms ±10% 1/2W, Carbon
R-66	20T391-32	390 Ohms ±10% 1/2W, Carbon
R-67	20T335-32	3.3 Meg. ±10% 1/2W, Carbon
R-68	20T474-32	470 K Ohms ±10% 1/2W, Carbon
R-69	20T392-32	3.9 K Ohms ±10% 1/2W, Carbon
R-70	30T222-32	2.2 K Ohms ±10% 1/2W, Carbon
R-71	20T184-32	180 K Ohms ±10% 1/2W, Carbon
R-72	20T182-32	1.8 K Ohms ±10% 1/2W, Carbon
R-73	20T184-32	180 K Ohms ±10% 1/2W, Carbon
R-74	50T14	50 K Ohms 1/4W, Carbon, Pot., Horiz. Hold.
R-75	20T474-32	470 K Ohms ±10% 1/2W, Carbon
R-76	20T101-32	100 Ohms ±10% 1/2W, Carbon
R-78	20T123-52	12 K Ohms ±10% 2W, Carbon
R-79	20T3	3.3 Ohms 1/2W, ±10%, Wire-wound.
R-80	20T561-32	560 Ohms ±10% 1/2W, Carbon
R-81	20T561-32	560 Ohms ±10% 1/2W, Carbon
R-82	20T123-32	12 K Ohms ±10% 1/2W, Carbon
R-83	20T474-42	470 K Ohms ±10% 1W, Carbon
R-84	20T103-32	10 K Ohms ±10% 1/2W, Carbon
R-85	20T12	100 Ohms ±10% 10W, Wire-wound.
R-86	20T333-32	33 K Ohms ±10% 1/2W., Carbon

CAPACITORS *

SYMBOL NO.	PART NO.	DESCRIPTION
C-1		
C-2	35T27	2X5000 mmf 500V -0% +100%, Ceramic Disk
C-3		
C-4	35T27	2X5000 mmf 500V -0% +100%, Ceramic Disk
C-5		
C-6	35T27	2X5000 mmf 500V -0% +100%, Ceramic Disk

* All paper capacitors tolerance ±20%.

CAPACITORS (Continued)

SYMBOL NO.	PART NO.	DESCRIPTION
C-7	33T15	0.25 mf 200V, Paper
C-8	35T16	5000 mmf, 500V -0% +100%, Ceramic Disk
C-10	35T27	2X5000 mmf 500V -0% +100%, Ceramic Disk
C-11	35T35	3.3 mmf 500V +10%, Tubular Ceramic.
C-12	35T32	470 mmf 500V +10%, Mica
C-13	35T15	100 mmf 500V ±10%, Tubular Ceramic.
C-14		
C-15	35T27	2X5000 mmf 500V -0% +100%, Ceramic Disk
C-16	35T23	10 mmf 500V ±10% Ceramic Tubular.
C-17	35T24	120 mmf 500V ±10%, Ceramic Tubular.
C-18	33T6	0.05 mf 600V Paper Tubular
C-19	35T4	5 mmf 500V ±10%, Ceramic Tubular.
C-20	35T14	39 mmf 500V ±10%, Ceramic Tubular.
C-21		
C-22	35T27	2X5000 mmf 500V -0% +100%, Ceramic Disk
C-23		
C-24	35T30	1500 mmf 500V -0% +100%, Ceramic Disk
C-25	33T19	0.005 mf 200V, Paper Tubular
C-26	33T12	0.02 mf 600V, Paper Tubular
C-27	33T20	0.005 mf 600V, Paper Tubular
C-28	33T23	0.05 mf 200V, Paper Tubular
C-29	33T27	0.2 mf 600V, Paper Tubular
C-30	35T25	220 mf 500V ±10%, Ceramic Tubular.
C-31	33T26	0.002 mf 200V, Paper Tubular
C-32	35T21	4700 mmf 500V ±10%, Mica
C-33	33T6	0.05 mf 600V, Paper Tubular
C-34	33T7	0.1 mf 600V, Paper Tubular
C-35	33T27	0.2 mf 600V, Paper Tubular
C-36	33T27	0.2 mf 600V, Paper Tubular
C-37	33T18	0.001 mf 600V, Paper Tubular
C-38	33T18	0.001 mf 600V, Paper Tubular
C-39	33T21	0.01 mf 200V, Paper Tubular
C-40	33T19	0.005 mf 200V, Paper Tubular
C-41	33T23	0.05 mf 200V, Paper Tubular
C-42	35T20	3900 mmf 500V ±5%, Silver Mica
C-43	35T19	330 mmf 500V ±10%, Mica
C-44	35T3	470 mmf 500V ±10%, Mica
C-45	36T2	25-280 mmf Trimmer, Drive Control
C-46	33T6	0.05 mf 600V, Paper Tubular
C-47	33T20	0.005 mf 600V, Paper Tubular
C-48	33T6	0.05 mf 600V, Paper Tubular
C-49	33T29	0.01 mf 600V, Paper Tubular
C-50	33T7	0.1 mf 600V, Paper Tubular
C-51	33T27	0.2 mf 600V, Paper Tubular

CAPACITORS (Continued)

SYMBOL NO.	PART NO.	DESCRIPTION
C-52	35T11	500 mmf 20KV, Hi-voltage, Stud Terminals.
C-53	35T18	56 mmf 1000V, ±10%, Mica
C-54	35T16	5000 mmf 500V -0% +100%, Ceramic Tubular
C-55	35T31	180 mmf 500V +10%, Ceramic Tubular.
C-56		
C-57	35T27	2X5000 mmf 500V -0% +100%, Ceramic Tubular
C-58	35T33	10 mmf 2000V ±20%, Ceramic Tubular.
C-64	35T23	10 mmf 500V ±10%, Ceramic Tubular.

ELECTROLYTIC CAPACITORS

SYMBOL NO.	PART NO.	DESCRIPTION
C-60A,B,C,D	31T10	40-40-4-4 mf 450V, Electrolytic
C-61A,B,C	31T12	40-40-8 mf 450V, Electrolytic
C-62A,B	31T11	100 mf 50V, 25 mf 50V, Electrolytic.
C-63	31T15	4 mf 100V, Tubular Electrolytic.

TRANSFORMERS

T-1	61T3	1st Video IF Transformer 25.7 MC (blue dot)
T-2	61T5	2nd Video IF Transformer 23.6 MC (red dot)
T-3	61T4	3rd Video IF Transformer 25.7 MC (yellow dot)
T-4	63T12	Sound take-off coil 4.5 MC
T-5	63T23	Ratio Detector transformer 4.5 MC
T-6	90T4	Power Transformer
T-7	91T4	Audio Output Transformer
T-8	91T6	Vertical Oscillator Transformer
T-9	91T3	Vertical Output Transformer
T-10	91T5A	Horizontal Output Transformer

INDUCTANCES

L-1	63T18	Filter Choke 2h
L-2	63T1	Filament RF Choke
L-3	63T1	Filament RF Choke
L-4	63T1	Filament RF Choke
L-5	60T1	Horizontal AFC Coil 12-42 mh.
L-6	64T4	Horizontal Deflection Coil
L-7	64T4	Horizontal Deflection Coil
L-8	64T4	Vertical Deflection Coil
L-9	64T4	Vertical Deflection Coil
L-10	63T22	Linearity Coil 4-20 mh.
L-11	63T20	Width Coil 0.15-0.75 mh.
L-12	63T14	Peaking Coil Red, 0.120 mh on 12 K Ohms 1/2W Res.
L-13	63T16	Peaking Coil Blue, 0.160 mh
L-14	63T13	Peaking Coil Yellow, 0.120 mh On 8.2 K Ohms 1/2W Res.

INDUCTANCES (Continued)

SYMBOL NO.	PART NO.	DESCRIPTION
L-15	63T13	Peaking Coil Yellow, 0.120 mh On 8.2 K Ohms 1/2W Res.
L-16	63T15	Peaking Coil Green, 0.120 mh.

MISCELLANEOUS

PART NO.	DESCRIPTION
10T7	Bracket for Horizontal Oscillator Coil
10T8	Shaft Support for R. F. Unit
10T23	H. V. Mounting Bracket
10T24	H. V. Cage
10T26	Coil Sup. Bracket
10T32	Yoke Mounting Brace
10T54	Cable Clamp
11T3	Line Cord Socket
11T4	9 Pin Min. Wafer 1 1/8
11T5	7/8" Min. Socket, 7 Pin Wafer
11T12	Octal Wafer Socket
11T28	9 Pin Molded 1 1/8 Socket
11T30	H. V. Condensor Plate
11T33	Speaker Receptacle
11T40	Octal Wafer 1 5/16 Socket
11T41	Octal Molded 1 1/2
11T46	Fuse Holder
11T47	Octal Molded Plug
11T50	H. V. Cap and Lead
11T59	Kin Socket w/leads
11T60	H. V. Socket Insulator
11T61	One Prong Plug
15T1	Min. Tube Shield

MISCELLANEOUS (Continued)

PART NO.	DESCRIPTION
15T2	Min. Tube Base Clip
37T1	Couplate (Verticle Integrator)
42T15	"K" Tran Clip
42T17	H. V. Condensor Standoff
42T22	Antenna Binding Post Assembly
42T24	3 Amp. 125 Volt Fuse
42T28	Fuse, 3 AG 1/4 amp.
44T1	Line Cord
44T2	Line Cord
56T1	12 Channel Tuner
63T11	Ion Trap (30 Gauss)
63T24	Centering Device
10T14	Tube Strap
10T17	Tube Support
10T56	Right Stop
10T57	Left Stop
11T29	Tube Cup
11T32	Speaker Plug
11T52	Speaker Shell
12T1	Indoor Antenna
55T3	5" Speaker Assembly (2D2302)
55T4	6" Speaker Assembly (2D1303)
100T2	Carton (2D1303)
100T3	Carton (2D2302)
120T9	Cabinet (2D2302)
120T18	Cabinet (2D1303)
122T10	Channel Selector Knob
122T11	Fine Tuning Knob
122T12	On-Off Volume Knob
122T13	Contrast Knob
123T3	Mask
125T1	Back
126T11	Front Control Plate
130T10	Glass, Safety

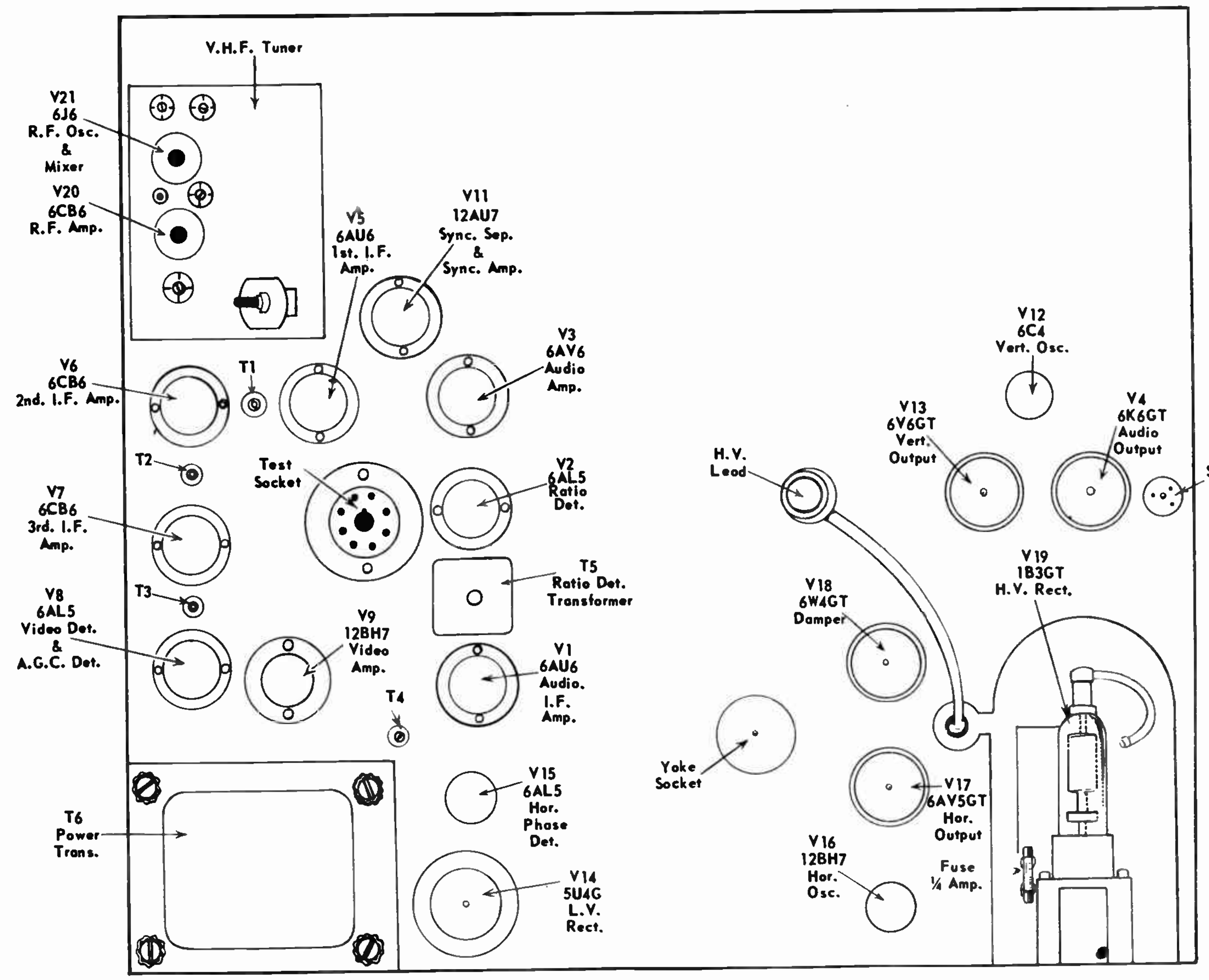
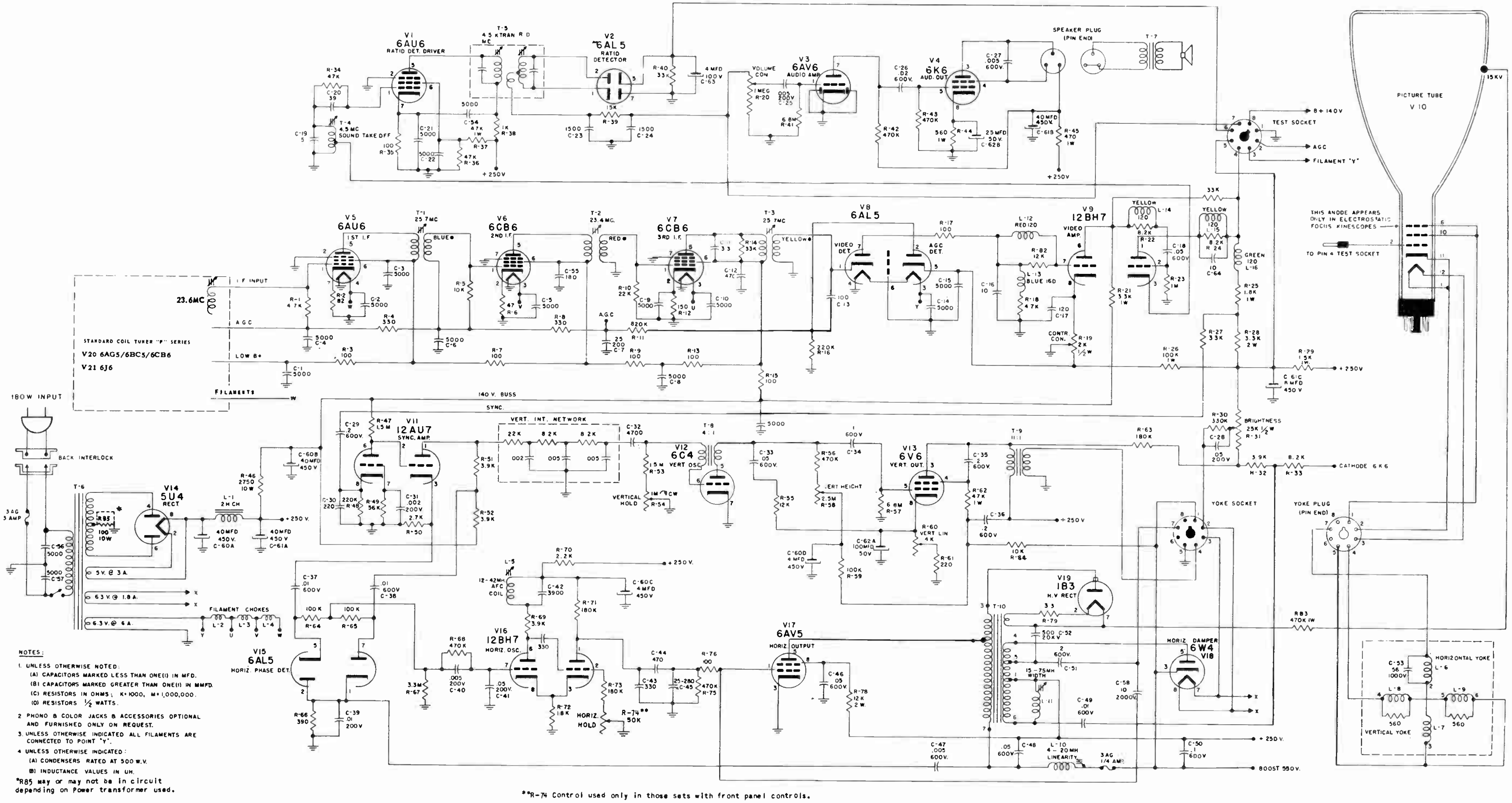


Figure 6.
Tube Layout.



NOTES:

1. UNLESS OTHERWISE NOTED:
   (A) CAPACITORS MARKED LESS THAN ONE(1) IN MFD.
   (B) CAPACITORS MARKED GREATER THAN ONE(1) IN MMFD.
   (C) RESISTORS IN OHMS; K=1000, M=1,000,000.
   (D) RESISTORS 1/2 WATTS.
2. PHONO & COLOR JACKS & ACCESSORIES OPTIONAL AND FURNISHED ONLY ON REQUEST.
3. UNLESS OTHERWISE INDICATED ALL FILAMENTS ARE CONNECTED TO POINT "Y".
4. UNLESS OTHERWISE INDICATED:
   (A) CONDENSERS RATED AT 500 W.V.
   (B) INDUCTANCE VALUES IN UH.

*R85 may or may not be in circuit depending on Power transformer used.

MODEL IDENTIFICATION CHART

MODEL	CHASSIS	CABINET	TYPE
2D-1316A	21T2A	Console	Mahogany
2D-2313A	17T2A	Mantel	Leatherette
2D-2315A	21T2A	Mantel	Leatherette

This booklet has been prepared to enable you to tune in better television pictures more easily and to acquaint you with some facts about television of interest to every set owner. Take the time to read the book thoroughly—you'll be more than amply repaid.

The functions of the controls and the operating procedure are presented first for ready reference. Information concerning installation and other general facts are placed at the rear of the booklet; however, they should be read carefully *before the set is operated.*

GENERAL DESCRIPTION

The models covered in this manual are an 18 tube, including the picture tube, 20 tubes with the UHF Tuner incorporated, AC operated, direct view, 17 and 21-inch rectangular television receivers. The receivers are complete in one unit and feature full coverage of all 12 V.H.F. channels and complete coverage of the entire UHF band with the UHF Tuner, automatic gain control, automatic horizontal frequency control, inter-carrier sound system, electrostatic focusing, magnetically deflected picture tube and a sync stabilizer switch and control to adjust the operational characteristics of the receiver for various signal areas.

At the rear of the receivers is a safety interlock to prevent dangerous electrical shock and as an added safety measure, a fusible resistor is located in the low voltage power supply to protect the receiver in case of overloading.

WARNING

At all times during operation the top chassis plate is at 125 volts DC potential above ground and it also may be at the line-voltage potential depending on how the line cord plug is inserted in the power receptacle.

Extreme caution must be observed when working with the chassis outside the cabinet and when power is applied to the receiver with the cabinet back removed. SEVERE SHOCK may result from contact with chassis.

Use an isolation transformer between the line cord plug and power receptacle when service is required. This removes all shock hazards and is the ONLY safeguard. Damage to the receiver and test equipment may result without the use of an isolation transformer.

CONTROLS

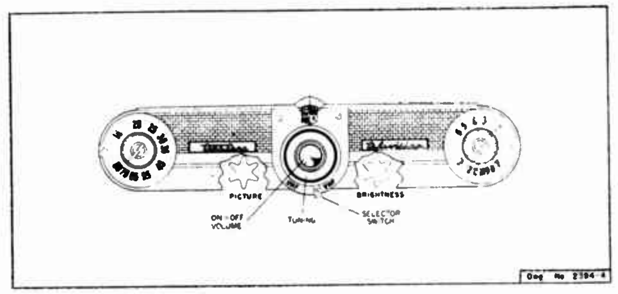


Figure 1. Front Controls.

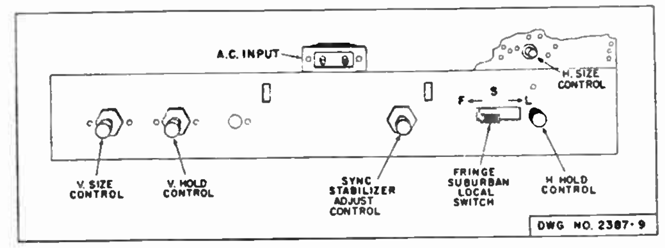


Figure 2. Rear Controls.

FUNCTIONS OF THE CONTROLS

All the controls normally used in tuning in a program—both picture and sound—are located on the front of the receiver and at the top of the back of the cabinet. At the rear of the set are several controls which are preset at the factory and may need slight readjustment at the time of installation. After installation, they should not be adjusted further, unless required by replacement or aging of tubes, variations in power-line voltage, or other external conditions.

The receiver actually requires only three controls when tuning in a program; on-off volume, tuning and picture. The on-off volume and tuning controls are located in the center (dual knob) while the picture control is a finger-tip knob to the left.

The other front controls, brightness and the selector switch, need only be adjusted when required. The front controls are shown below.

The controls at the rear of the receiver should be properly adjusted at the time of installation and should only require readjustment occasionally. The V. Linearity, Ion Trap and Centering control adjustments should not be attempted by the operator as they should be made only by a serviceman.

FRONT CONTROLS

On-Off Volume — Turns the receiver on or off and adjusts the sound volume level.

Tuning—Tunes the receiver to the desired channel or station. This knob may be turned in either direction.

Picture — Varies the contrast between the light and dark portions of the television picture.

Brightness — Varies the brightness of the television picture.

Selector Switch—Selects either the VHF or UHF television band for operation.

REAR CONTROLS

VHF Antenna Knob—Tunes the built-in VHF antenna for maximum signal.

V. Size—Changes size of picture vertically.

V. Hold — Stops picture from moving up or down.

Sync Stabilizer Adjust Control—Changes the operational characteristics of the receiver for the area in which the receiver is located.

Fringe-Suburban-Local Switch — Selects the proper operational characteristics of the receiver for various signal strength areas.

H. Hold—Provides adjustment for a steady picture, no horizontal movement.

H. Size—Changes size of picture horizontally.

V. Linearity—Changes vertical distribution of picture.

Ion Trap—Controls illumination and focus of picture.

Centering—Centers picture for proper framing.

OPERATION

When once you have become familiar with the use of the controls, tuning in a television program— picture and sound — is a simple matter. Carefully follow the procedure detailed below; you'll find the set as easy to operate as your present radio.

Note that the dial at the right is calibrated in VHF channel numbers and the dial at the left in UHF channel numbers. Each station in the country is assigned a definite channel number which represents operating frequencies.

Before attempting to tune in a station, check with your newspaper to see if the station is on the air, and note the channel number. If you experience any difficulty with the operation of the set, try a different station or turn off the set and tune in again at a later time; the fault may have been in the transmission.

TUNING PROCEDURE

1. Turn the ON-OFF VOLUME control clockwise to turn the set on. Allow one-half minute for the set to warm up.
2. Place the SELECTOR SWITCH in the proper position for the desired television range.
3. Turn the Picture control fully clockwise.
4. Rotate the TUNING knob until the indicator points to the desired channel number.
5. Turn the TUNING knob back and forth until the best picture is obtained with adequate sound.
6. Turn the PICTURE control fully counter-clockwise.
7. Turn the BRIGHTNESS control fully counter-clockwise, and then turn it slowly clockwise until the picture tube just becomes light.
8. Adjust the PICTURE control until the proper contrast between black and white is obtained. Readjust the BRIGHTNESS control if necessary.
9. Adjust the VOLUME control for the desired sound level.
10. When tuning from one station to another, it may be necessary to readjust the PICTURE control.

CONTROL ADJUSTMENT HINTS

VHF ANTENNA KNOB—The antenna tuning knob for the built-in VHF antenna should be used as a fine tuning control and should be adjusted until the best picture is obtained. In order to eliminate "Body Effect" when adjusting the antenna, stand in front and reach over the top of the set. Do not at any time force the knob in either direction if it becomes difficult to turn.

TUNING—The tuning knob should be used as a tuning knob on an ordinary home radio. Rotate the knob so the indicator points to the desired chanel number. Turn the knob back and forth until the best picture is obtained with adequate sound, and then adjust the picture control for proper picture contrast.

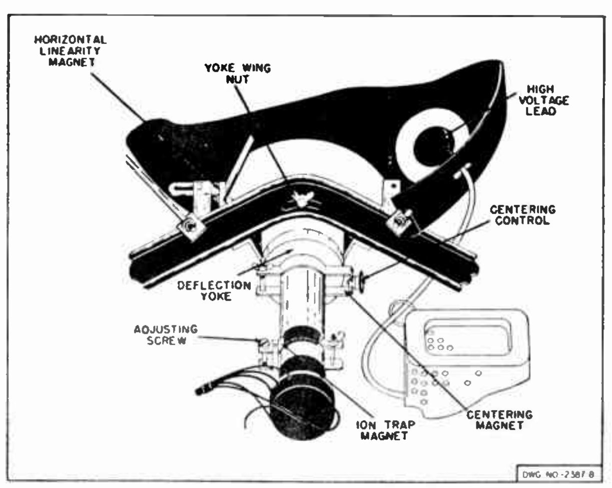


Figure 3A. 17-inch Tube Assembly.

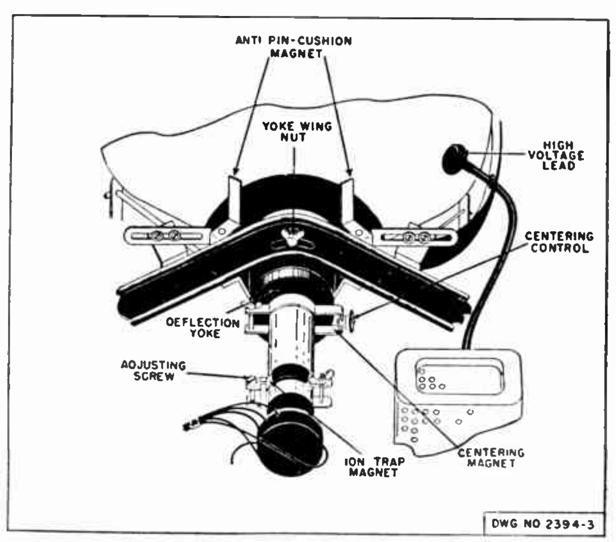
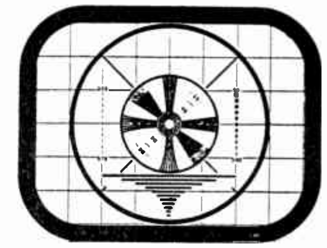


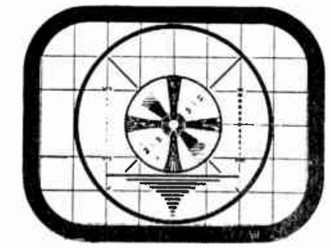
Figure 3B. 21-inch Tube Assembly.

ADJUSTMENT OF PICTURE

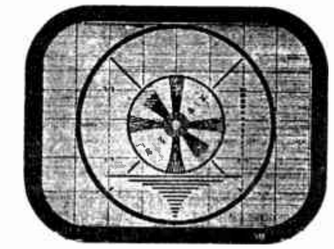
The following pictures illustrate the results of misadjustment of various controls on the receiver and also the effects on the picture of certain conditions external to the set. Underneath each picture is the correction to be made, if one is available. Some of these adjustments should be made only by a serviceman.



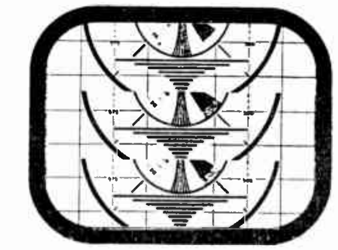
CORRECTLY ADJUSTED—Pattern is clear, steady. Proper contrast between black, white and various shades of gray.



TOO BRIGHT—Adjust brightness and picture controls for proper contrast.

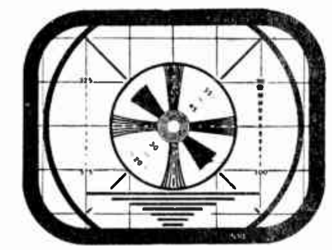


TOO MUCH CONTRAST — Adjust picture and brightness controls for proper contrast.

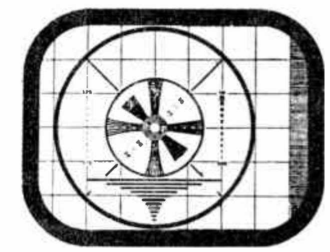


VERTICAL MOVEMENT UP OR DOWN —Adjust V. HOLD control.

TOO SMALL HORIZONTALLY AND VERTICALLY— Adjust both H. SIZE and V. SIZE controls.

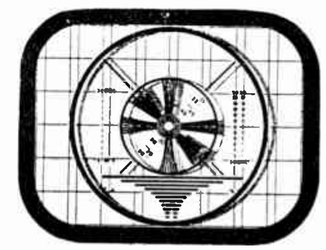


TOO LARGE HORIZONTALLY AND VERTICALLY—Adjust both H. SIZE and V. SIZE controls.

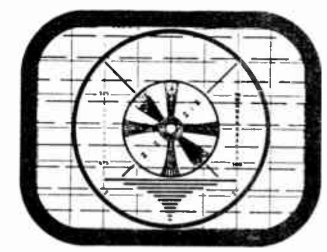


OFF CENTER HORIZONTALLY— Serviceman should adjust CENTERING control.

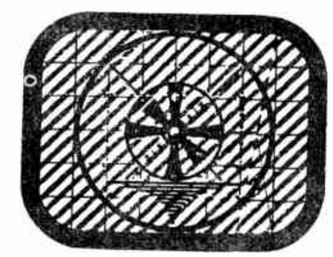
HORIZONTAL MOVEMENT LEFT OR RIGHT—Adjust H. HOLD control



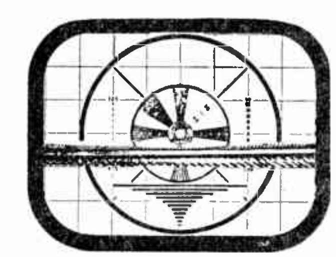
MULTIPLE IMAGES (Ghosts) — Condition can be minimized by proper orientation of antenna.



IGNITION INTERFERENCE—Caused by automobile ignition systems or by electrical motor-driven appliances in vicinity.



R-F INTERFERENCE — Caused by high-powered radio transmitting equipment in vicinity.



DIATHERMY INTERFERENCE—Due to certain electrically operated medical equipment. This herring-bone pattern may move vertically or may remain stationary as shown.

INSTALLATION

POWER SOURCE

The set should be operated from a 115-volt, 60 cycle, AC power source. The power consumption is 230 watts.

LOCATION OF RECEIVER

The set should be so located in the room that no direct light strikes the face of the picture tube. (The surface on which the picture appears is the end of a large, horizontally mounted tube.) However, some indirect illumination in the room is desirable; it is not necessary to darken the room completely for proper viewing of the picture. Due consideration should be given also to the convenience of the electric outlet, and to the position of the receiver which gives the best reception with the built-in antenna.

BUILT-IN VHF TELEVISION ANTENNA

The new Built-in VHF Television Antenna incorporated in your receiver eliminates the need of an outside VHF antenna in most locations. In areas too distant for normal reception with a built-in antenna, provision is made for outside antenna connections. If any other type of antenna is used with the set, disconnect the transmission line from the built-in antenna to the antenna terminals. When connections are made, check to see that the antenna terminal screws are moderately tight.

The antenna is mounted inside the cabinet and is operated by the use of a knob at the top of the back of the cabinet. Since the antenna is fastened to the cabinet, it may be necessary to orient the cabinet to obtain the best reception. It is desirable that either the front or the back of the cabinet face the transmitting station. If however, "ghosts" or multiple images appear, the cabinet may be rotated slightly to minimize this condition. In some cases it may be necessary to face the back or the front of the cabinet toward a window to obtain a television picture. This may be due to walls, water pipes, or a steel structure in your location preventing television reception.

SERVICE ADJUSTMENTS

Vertical Size and Vertical Linearity Controls (R-73 and R-75):

The vertical size and linearity controls should both be adjusted at the same time while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necessary.

CAUTION:

The vertical linearity control is on the top chassis plate, therefore, severe shock may result from contact. If an isolation transformer is unavailable, use an insulated screwdriver for the adjustment to reduce shock hazards. The adjustment can be made from either the top or bottom of the chassis.

Fringe-Suburban-Local Switch (Figure 2):

The three position switch selects the proper operational characteristics of the receiver for the signal strength area in which located. The position of the switch is governed by the signal strength available.

In the Fringe position the A.G.C. voltage is reduced to a bare minimum and the sync stabilizer adjust control affects the sync clipping level to reduce noise affects.

In the Suburban position full A.G.C. is applied and the sync stabilizer adjust control functions as in the fringe position.

In the Local position full A.G.C. is applied and the sync stabilizer adjust control is disabled.

Sync Stabilizer Adjust Control (R-61):

The control varies the operational characteristics of the sync clipper stage to obtain the optimum operation point for the least effect of noise interrupting synchronization. The control should be adjusted for a steady picture.

Ion Trap Magnet (Figure 3):

The position of the ion trap magnet MUST be over the grid of the picture tube (second cylinder from the base identified by a flared forward lip). If the adjustment is necessary, loosen the wing nut and rotate until the position which gives maximum illumination is found. Adjust the screw for maximum illumination. Repeat the above two steps. Rotate and slide magnet until the best focus position is found. Tighten wing nut. Adjustment should be made with brightness and picture controls set for normal viewing.

Horizontal Size Control (Figure 2):

The horizontal size control should be adjusted until the picture fills the entire screen horizontally. A clockwise rotation will decrease size. To some extent the vertical size control setting may be affected by a major horizontal size adjustment.

Horizontal Hold Control (L-30):

The horizontal hold control is located on the rear flange of the chassis and should be adjusted in the following manner.

Set the picture control to its normal operating position. Turn the thumb screw clockwise until it reaches its stop. Turn two complete turns counter-clockwise. The thumb screw is a vernier adjustment and will then be in the center of its range.

Turn the iron core with a small screwdriver or adjusting tool until the picture is steady (no horizontal movement). Set the core to the middle of its range.

After the iron core has been properly adjusted the thumb screw should then be used as a vernier adjustment to control synchronization when necessary.

Centering Magnet (Figure 3):

The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture will be moved up or down. To the left or right of the neck of the picture tube, the picture will be moved either to the left or right.

Deflection Yoke (Figure 3):

The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow. Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a positioning adjustment is necessary, loosen the yoke wing nut located at the top of the picture tube assembly (fig 2).

Horizontal Linearity Magnet - 17" only (Fig. 3A):

The horizontal linearity magnet affects the linearity of the right side of the picture only. The magnet pulls or stretches the right side and has a greater effect closer to the picture tube.

Anti-Pin Cushion Magnet - 21" only (Figure 3B):

Adjust centering until an edge of the raster is visible. Loosen the positioning screws and slide the magnet backward or forward until the edge of the raster is vertically straight. If keystoning is noticed adjust magnets in vertical plane.

SERVICE DATA

SPECIFICATIONS

Sensitivity at the Antenna
Video - 150 microvolts
Audio - 150 microvolts
(one volt above noise at detector)

Antenna Impedance Requirements
Balanced 300-ohm

Audio Power Output Rating
2 watts undistorted

Speaker
Permanent magnet type
3.2 ohm voice coil impedance

Power Supply Rating
115 volts 60 Cycles, AC
Power Consumption, 220 watts

Intermediate Frequencies
Video - 26.75 mc.
Audio - 22.25 mc.
Intercarrier Sound- 4.5 mc.

Dimensions
17" Chassis - 16" x 16½" x 2½"
21" Chassis - 19" x 17½" x 2½"

TUBE COMPLEMENT

Schematic Ref. No.	RTMA Type	Tube Function
1	6BK7	VHF, RF Amplifier
2	12AT7	VHF Oscillator-Converter
3-4-5	6CB6	IF Amplifiers
6	6AH6V	Video Amplifier
7	17HP4	Cathode-Ray Tube
7	21FP4A	Cathode-Ray Tube
8	6AU6	Audio IF Amplifier
9	6AL5	Audio Detector
10	6AV6	Audio Amplifier
11	25L6GT	Audio Output
12	6BE6	Sync Clipper
13	12BH7	Vert. Blocking Osc. and Output.
14	6AL5	A.F.C. Discriminator
15	6SN7GT	Horizontal Multivibrator
16	25BQ6GT	Horizontal Pulse Amplifier
17	6AX4GT	Damper
18	1X2A	High Voltage Rectifier
19	6AF4	UHF Oscillator
20	6BK7	UHF Pre-IF Amplifier

Picture Tube Handling:

Due to the large surface and extreme high vacuum of the picture tube, care should be used when handling the chassis outside the cabinet. Do not subject the tube to excessive pressure of rough handling as an implosion may result causing serious personal injury.

High Voltage Power Supply:

In the process of inspection, repairs, changing of tubes or transformers, or for any other reason where it is necessary to work within the high voltage power supply, the following should be closely observed.

1. Terminals on the 1X2A socket must be dressed toward the inside of the corona ring and be free of sharp protrusions.
2. The corona ring must be dressed in such a way as to make its presence useful; that is, properly centered and about 1/8-inch below the socket terminals.
3. All leads must be dressed as far away as possible from the transformer winding. Excess lead length should be transferred to the top side of the chassis.

When replacement of the H.V. deflection transformer is necessary, be sure to closely follow the precautions listed above. The transformer can easily be replaced with the chassis in the cabinet by the following procedure.

1. Remove two (2) hex head screws on either side of the H. Size control.
2. Disengage the H.V. lead holder ring. (back side of shield can)
3. Remove 25BQ6 plate cap.
4. Remove shield can by pushing back side of shield can toward front and lifting up.

WARNING:

High voltage on the plate caps of the 1X2A high voltage rectifier and the 25BQ6 horizontal pulse amplifier. DO NOT MEASURE this voltage.

Schematic Diagram:

The schematic diagram located at the rear of this manual shows all the values of resistance and capacitance and gives all the proper voltages at the pins of the tube sockets. The voltage readings were taken with a 20,000 ohm/volt voltmeter with normal operation, no signal input, and line voltage at 115 volts A.C.

Replacing Tubes

Before replacing the tubes the cabinet back must first be removed. Removing the cabinet back disengages the safety interlock and removes the power to the receiver. Do not tamper with or attempt to defeat the purpose of the safety interlock as severe shock may result.

Before replacing the High Voltage tubes first be sure the power is turned off and then short the corona ring of the 1X2A to the chassis.

WARNING:

Do not remove any tubes while the receiver is in operation as over-loading and component failures may result. Also contact with the top chassis plate during operation may produce a severe shock.

If the receiver has been in operation for some time, the tubes become hot and gloves should be used when replacing tubes to prevent finger burns.

SERVICE DATA

TELEVISION FREQUENCY RANGES

(All figures represent megacycles)

Channel	Channel Frequencies	Picture Carrier Frequency	Sound Carrier Frequency	Receiver RF Oscillator Frequency
Low Band				
2	54-60	55.25	59.75	82
3	60-66	61.25	65.75	88
4	66-72	67.25	71.75	94
5	76-82	77.25	81.75	104
6	82-88	83.25	87.75	110
High Band				
7	174-180	175.25	179.75	202
8	180-186	181.25	185.75	208
9	186-192	187.25	191.75	214
10	192 198	193.25	197.75	220
11	198-204	199.25	203.75	226
12	204-210	205.25	209.75	232
13	210-216	211.25	215.75	238

R.M.A. WIRE COLOR CODE

Listed below is a R.M.A. wire color code chart to aid in circuit tracing.

Wire Color	Where used
Black	B- or Ground leads
Brown	Filament leads
Red	B+ leads
Orange	Screen leads
Yellow	Cathode leads
Green	Grid or Control leads
Blue	Plate leads
Violet	Not used
Gray	A.C. leads
White	Bias leads

COIL DC RESISTANCE CHART

The DC resistance readings shown in the chart below have been taken with a ohmmeter directly across the coil being measured. The coils not listed in the chart have a DC resistance reading of less than one ohm. A tolerance of ± 5% is permissible.

COILS	RESISTANCE IN OHMS	COILS	RESISTANCE IN OHMS
L17	1.5	T3 pri.	4.7
L20	1.5	T4 pri.	170
L22	2.2	T5 pri.	960
L23	2	sec.	160
L24	2	T6 pri.	1100
L25	2	sec.	6.6
L27	8	T7A	68
L28	8	B	12.5
L29	1.5	T8 25BQ6 plate to 1X2A plate	180
L30	80	25BQ6 plate to term 4	9.5
L31	2.3	25BQ6 plate to term 3	17.5
L32	72	25BQ6 plate to term 1	25.5
L33	8.5	term 7 to term 8	2.6
L34	2.3	term 7 to term 10	5.4
T3 pri.	4.7	T9 pri.	7

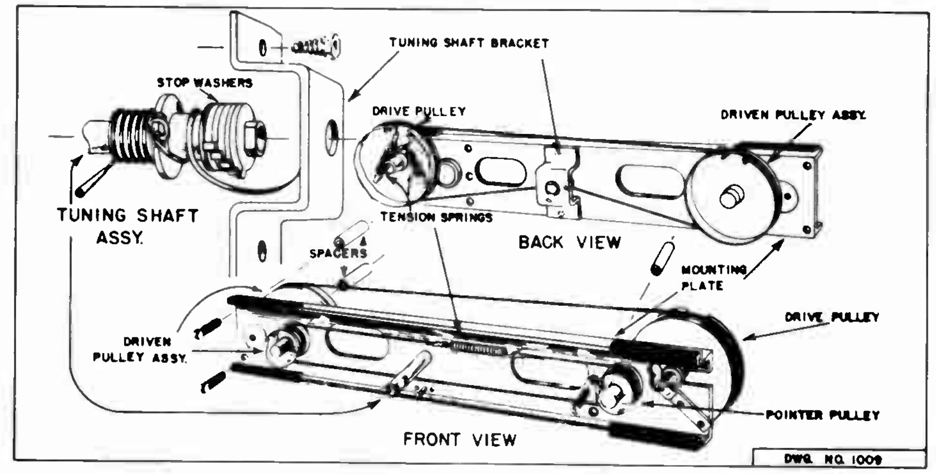
WARNING

Before the chassis can be removed from the cabinet, the escutcheon, on-off-volume and tuning knobs must be removed. Pull knobs straight out and remove the two outside escutcheon screws and escutcheon.

REMOVABLE SAFETY GLASS

To clean the inside of the safety glass or the face of the picture tube, simply follow the procedure below.

1. Remove the three (3) phillips head screws in the safety glass holder directly above the escutcheon.
2. Remove the safety glass holder.
3. Carefully remove the safety glass by pulling out and down from the bottom.



DIAL CORD REPLACEMENT

DIAL CORD STRINGING: Two separate dial cords are used and can be restrung separately if replacement is necessary.

POINTER PULLEY STRINGING: Follow the above diagram (front view) and start by attaching the dial cord to the tension spring, route to pointer pulley and make 2½ clockwise turns around pulley. Route under tuning shaft to small pulley of driven pulley assembly, make 2½ clockwise turns around pulley and connect to other end of tension spring. Tension spring must be in location shown when tuning shaft is rotated to extreme clockwise position.

MECHANICAL TRACKING: If for any reason the stop washers do not correspond to the stop position of the tuner, loosen the two(2) drive pulley allen head set screws and reposition. Turn both the tuning shaft and tuner shaft to the extreme counter-clockwise position. Turn tuning shaft only 1/6 turn clockwise. Tighten allen head set screws.

POINTER POSITIONING: If when a station is properly tuned in and the pointer is off calibration, reposition the pointers as follows.

1. Remove the on-off volume and tuning knobs. (pull straight out)
2. Remove two outside escutcheon screws and escutcheon
3. Remove pointer indicator and reposition.

DRIVE PULLEY STRINGING: Drive pulley restringing requires removal of the mounting plate assembly. To remove the mounting plate assembly follow the simple instructions below.

1. Remove two (2) star knobs
2. Remove two (2) pilot light shields and pilot light bulbs.
3. Loosen two (2) drive pulley allen head set screws.
4. Remove three (3) space screws
5. Pulley assembly straight out.

To restring the drive pulley turn the tuning shaft completely counter-clockwise. Follow the above diagram (back view) and start by attaching the dial cord to the tension spring shown at the extreme left on the drive pulley. Route the cord through the opening in the pulley and make a 1/2 counter-clockwise turn around the pulley and route under the tuning shaft. Make 5 1/2 counter-clockwise turn around tuning shaft between mounting plate and lugged washer. Then make one counter-clockwise turn around lug on washer and continue in the counter-clockwise direction and make 1 1/2 turn around the tuning shaft between the lugged washer. Route to the large driven pulley and make 1 1/2 turn around the pulley and route to the drive pulley. Make 2 complete counter-clockwise turns around the pulley and route through the opening and attach to the tension spring. Add second tension spring as shown.

Replace mounting plate assembly and follow directions for mechanical tracking.

TROUBLE-SHOOTING

Trouble	Probable Location
No Raster No Sound	1. Defective tubes 11-13-16. 2. Defective selenium rectifier. 3. Defective resistors R52-82-101. 4. Defective capacitors C70-72-74-90-91. 5. Defective transformer T9 or choke L32. 6. Defective safety interlock or on-off switch.
No Raster Sound Normal	1. Insufficient or no high voltage, (refer to "No High Voltage" section). 2. Defective picture tube. 3. Second anode lead disconnected. 4. Ion trap magnet misadjusted. 5. Defective C.R.T. socket.
No High Voltage	1. Defective tubes 15-16-17-18. 2. Defective transformer T8, yoke T7 or coil L30-31. 3. Defective capacitor C105-106-107-108-110-111-112. 4. Defective resistor R92-96-97-98-99-100.
No Picture No Sound Raster Normal	1. Defective antenna or lead-in. 2. Defective tuner tube 1-2. 3. Defective tuner (refer to page 14). 4. Defective tubes 3-4-5-6. 5. Improper voltages or resistances at sockets of tubes 3-4-5-6. 6. Improper alignment. 7. Defective crystal detector. 8. UHF power plug not in place.
No Sound Picture Normal	1. Defective tubes 8-9-10-11. 2. Improper voltages or resistances at socket of tube 8-9-10-11. 3. Defective speaker or leads broken or not in place. 4. Defective transformer T3-4 or coil L29. 5. Improper sound alignment.

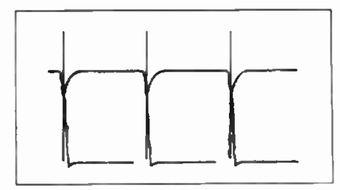
Trouble	Probable Location
No Sync	1. Defective tube 12. 2. Improper voltages or resistances at socket of tube 12. 3. Defective F-S-L switch or in wrong position. 4. Sync stabilizer adjust control misadjusted.
Insufficient or no Vertical Sweep	1. Defective tube 13. 2. Defective transformer T5-6 or yoke T7. 3. Defective capacitor C70-85-86-87. 4. Defective resistor R68-73-74-75-76-77.
Picture Cannot be Centered	1. Defective picture tube. 2. Defective centering magnet. 3. Defective ion trap magnet.
Poor Focus	1. Improper adjustment of Ion trap. 2. Defective picture tube.
Poor Horizontal Linearity	1. Improper adjustment of linearity magnet (17") or anti-pin cushion magnets (21"). 2. Defective tube 16-17. 3. Defective capacitor C105-106-111. 4. Defective transformer T8 or coil L31.
Snow or Poor Picture	1. Insufficient signal input. 2. Defective antenna or lead-in. 3. Improper alignment of C1-A-B. 4. Weak tubes 1-2-3-4-5. 5. Improper video IF alignment.
Lack of Contrast	1. Defective tube 6. 2. Defective crystal detector. 3. Improper video IF alignment.
Washed Out or Picture Smear	1. F-S-L switch in wrong position. 2. Defective crystal detector. 3. Gassy tube 1-3-4. 4. Improper video IF alignment.

WAVE FORM ANALYSIS

The drawings on this page illustrate the wave forms at various positions within the receiver. The wave forms are not theoretical but exact copies of that shown by an oscilloscope and were taken under normal operating conditions, with a transmitted signal and the picture in sync at all times.

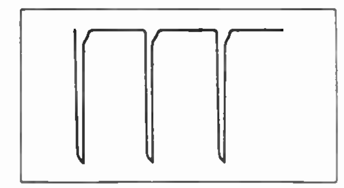
When checking the wave forms, connect the ground lead from the oscilloscope to the top chassis plate and the hot lead to the position indicated. The wave shapes may vary somewhat depending on the strength of the signal, the picture information being transmitted and the adjustments of the various controls.

Under each wave form is the schematic reference, position taken at, peak-to-peak voltage and the type of wave form indicated (Vertical -60 cycles and Horizontal -15,750 cycles).



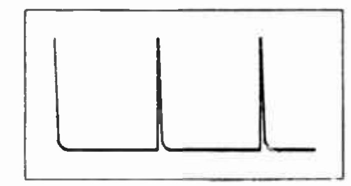
VERTICAL PULSE

Pin 5 of Tube 12.
Plate of Sync Clipper
25 volts Peak-to-Peak



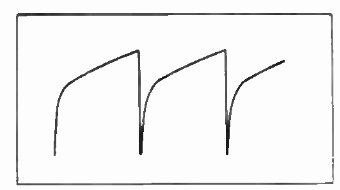
HORIZONTAL PULSE

Pin 5 of Tube 12.
Plate of Sync Clipper
25 volts Peak-to-Peak



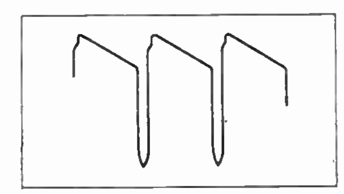
VERTICAL PULSE

Pin 3 of Tube 13
Cathode of V. Blocking Osc.
125 volts Peak-to-Peak



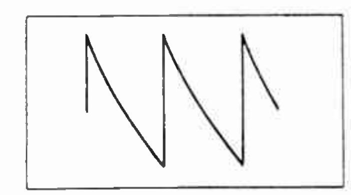
VERTICAL PULSE

Pin 4 of Tube 13
Grid of V. Output
95 volts Peak-to-Peak



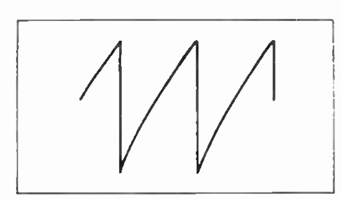
HORIZONTAL PULSE

Pin 1 or 5 of Tube 14
Cathode of A.F.C. Discr.
15 volts Peak-to-Peak



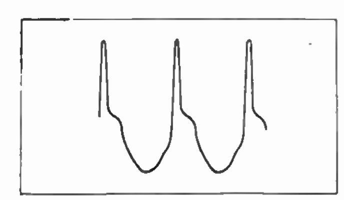
HORIZONTAL PULSE

Pin 2 of Tube 14
Plate of A.F.C. Discr.
4 volts Peak-to-Peak



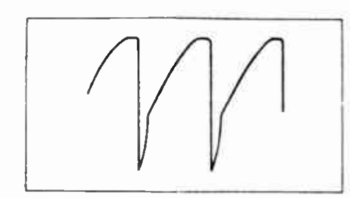
HORIZONTAL PULSE

Pin 7 of Tube 14
Plate of A.F.C. Discr.
6 volts Peak-to-Peak



HORIZONTAL PULSE

Pin 5 of Tube 15
Plate of H. Mult.
35 volts Peak-to-Peak



HORIZONTAL PULSE

Pin 5 of Tube 16
Grid of H. Pulse Amp.
100 volts Peak-to-Peak

GENERAL DESCRIPTION

VHF Tuner:

The Tuner is composed of a separate sub-chassis consisting of a 6BK7 (twin triode) cascode RF Amplifier and a 12AT7 tube (twin triode) for the oscillator and converter. Separate high and low band coils and trimmers are used with an automatic switching device to change bands. The tuner selects and amplifies the stations signal and converts it to the carrier IF frequency of 26.75 MC for video and 22.25 MC for sound which in turn is then fed to the IF amplifiers for further amplification.

Video IF Amplifier:

The Video IF Amplifiers are mounted on a separate sub-chassis along with a crystal video detector and the A.G.C. network. The IF amplifier section consists of three (3) staggered tuned stages with an over coupled output IF transformer using 6CB6 (pentode) tubes with self resonant core tuned coils. Since the receiver is of the intercarrier type both the video and sound IF frequencies are amplified simultaneously and then detected by a Raytheon CK-706 crystal. The signal is then coupled to the video amplifier and the first grid of the sync clipper. The A.G.C. network of R-59 and C-78 develops a negative bias voltage proportional to the average composite video signal.

Video Amplifier:

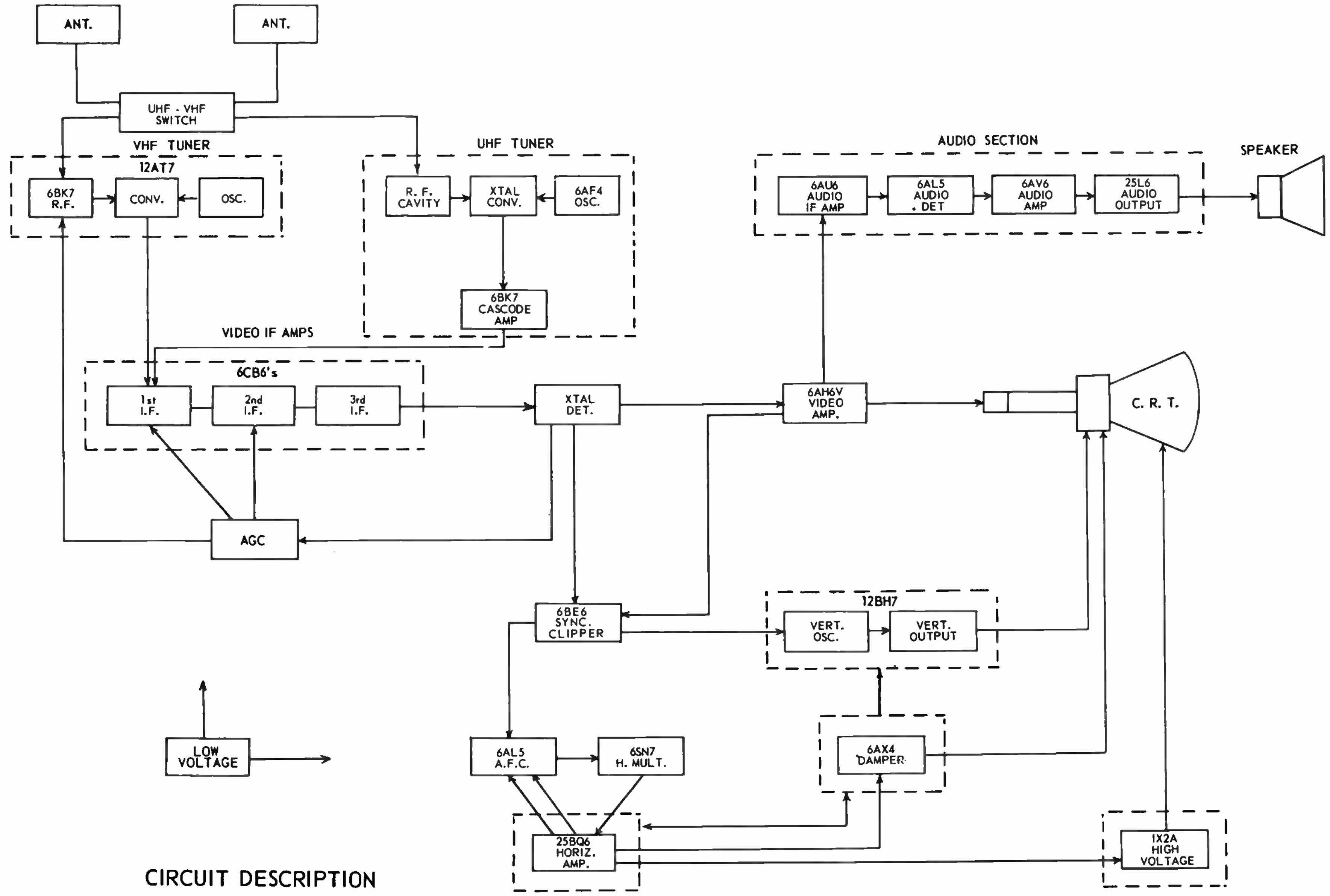
The Video Amplifier section consists of a 6AH6V (pentode) tube with a degenerative picture (or contrast) control (R-33) to vary the signal to the cathode of the picture tube. The audio signal is also amplified in this stage and then separated by a 4.5 MC trap (L-29). This trap also serves to separate or keep the audio from appearing in the picture.

Sound Section:

The Sound Section consists of a 6AU6 (pentode) 4.5 MC audio IF amplifier, 6AL5 (twin diode) ratio detector, 6AV6 (triode) audio amplifier and a 25L6 (beam power amplifier) output tube. Due to the hetrodyne action between the video and sound IF frequencies at the video detector a 4.5 MC signal is obtained containing the audio information. After the video detector the audio information is amplified by the video amplifier, separated from the video by the trap (L-29), amplified, detected and further amplified before being coupled to the speaker.

Sync Clipper:

The Sync Clipper stage utilizes a 6BE6 (heptode) tube which functions as a sync separator and noise clipper. The signal from the output of the video amplifier is coupled to pin 7 through R-34 and C-77. With the positive going signal at pin 7 and the low plate voltage sync separation is accomplished. When noise bursts are present the negative going signal from the video detector, coupled through R-58 to pin 1, cuts the tube off and eliminates false sync information in the output. A sync stabilizer adjust control (R-61) is provided to adjust the cut-off or clipping level by varying the bias voltage to pin number 1. A three position F-S-L switch is also provided to change the operational characteristics of the receiver for various signal level areas. The switch disconnects the control (R-61) from the circuit and applies a fixed bias voltage only in the "local" position. In the "fringe" position the A.G.C. source is connected to 240 volt B plus through 10 megohms of resistance (R-56, R-60). No bias voltage to the RF and IF tubes is utilized in this position allowing maximum amplification. In the "suburban" and "local" positions, full A.G.C. is applied. Sync pulses are separated from the video signal without the noise effects and then coupled to the vertical blocking oscillator cathode and horizontal A.F.C.



CIRCUIT DESCRIPTION

Vertical Deflection:

The Vertical Deflection section consists of a 12SN7 (twin triode) tube, one-half being used as a blocking oscillator and the other half as an output amplifier. The signal from the sync clipper is coupled through R-67 and C-81 to the cathode of the blocking oscillator. The vertical hold control (R-69) in the grid circuit varies the oscillator operating frequency, thus providing adjustment for synchronization. The vertical size control (R-73) varies the amplitude of the pulse to the grid of the amplifier and controls the amount of vertical deflection. The vertical linearity control (R-75) varies the cathode resistance, thus adjusting the operating characteristics of the amplifier to provide the proper wave shape to obtain a linear picture vertically. The network of C-84, C-85 and R-70, R-71 is designed to eliminate vertical retrace lines at high brightness levels.

AFC Discriminator:

The Automatic Frequency Control section utilizes a 6AL5 (twin diode) tube which functions as a discriminator. The horizontal sync pulses from the output of the sync clipper are coupled to the plate of the AFC tube through capacitor C-79. At the same time two feed back voltages of opposite polarity are intergrated and applied to the plates of the AFC tube. The two feed back voltages are obtained from a separate winding (terminals 7 and 10) of the H V deflection transformer and are of the same frequency as the horizontal multivibrator. Any phase shift between the horizontal sync pulses and the horizontal multivibrator signal will cause one diode section to conduct more than that of the other. This will result in a DC bias voltage applied to the grid of the multivibrator and change the operating frequency. The output of the AFC discriminator thus synchronizes the horizontal multivibrator to the incoming horizontal sync pulse.

Horizontal Multivibrator:

The Horizontal Multivibrator uses a 6SN7 (twin triode) tube and is of the conventional cathode coupled type. The core tuned parallel resonant circuit (L-30 and C-97) is used as a hold adjustment to stabilize the frequency of oscillation. Because of the wide pull-in range of the automatic frequency control tube a fine hold control is not necessary. The output signal of the multivibrator is coupled to the horizontal pulse amplifier through capacitor C-106. Capacitor C-107 is a negative peaking device to aid in cutting off the pulse amplifier tube at the proper time.

Horizontal Pulse Amplifier:

The Horizontal Pulse Amplifier utilizes a 25BQ6 (beam pentode) tube to develop the necessary power for the fly back pulse and the horizontal winding of the deflection yoke.

CIRCUIT DESCRIPTION

Damper:

The Damper tube (6AX4-diode) performs three functions: aids in horizontal scanning, suppresses oscillations which occur over part of the horizontal scanning cycle and gives an increase in plate supply voltage for the vertical blocking oscillator, vertical output amplifier and first anode of the picture tube.

Hi-Voltage Supply:

The High Voltage (second anode) is obtained from the auto-transformer type primary winding of the HV deflection transformer (T-8). When the plate current of the H pulse amplifier tube is cut off, the field built up in the primary winding collapses and induces a high voltage surge which is rectified by the 1X2A tube, filtered by the capacity of the aquadag coating of the picture tube and applied to the second anode. The 1X2A is a conventional half-wave high voltage rectifier and obtains its filament power from a separate secondary winding of the HV deflection transformer.

Low Voltage Supply:

The B plus voltage for the receiver is obtained from the voltage doubler arrangement of two selenium rectifiers and filter capacitors C-90 and C-91. The majority of the receivers tubes obtain its filament power from the filament transformer (T-9), however, three tubes are connected in series with resistor R-101 and placed across the 115 volt AC line. A safety interlock is provided to reduce shock hazards and a resistor type fuse is connected in series to protect the receiver in case of overloading.

SERVICE HINTS

V.H.F. Tuner:

Before looking into the tuner for a particular trouble, first make the following observations. Since the receiver is of the inter-carrier type both the sound and video information are amplified simultaneously by the tuner, IF and video amplifiers. Therefore, if the sound section is functioning normally it can be assumed that there are no defects in the tuner, IF or video amplifiers. If the receiver is "dead" (no sound or picture - raster normal) first determine whether a signal is being transmitted and then check the antenna, lead-in and connections to the receiver. Next, rotate the contrast or picture control completely to the left (counter-clockwise) and observe the face of the picture tube. Advance the control to the extreme clockwise position and again observe the face of the picture tube. If no "snow" appears check the video amplifier, detector and second and third IF amplifiers. If, however, an increase of "snow" appears check the first IF amplifier before looking into the tuner.

The tuner can easily be serviced by removing the three hex-head nuts on top and the one on the bottom which holds bottom cover in place. Removing the bottom cover makes all the tuner components within easy reach and all parts can be serviced. When working inside the tuner do not move any component a great distance as a change in the distributed capacity may result and offset the alignment. When replacing components be sure to obtain the same lead length and replace them in the same position.

A majority of tuner troubles are often open and high resistance ground or coil solder connections, defective trimmers or coils and defective switch contacts.

Open or high resistance connections can easily be repaired by placing a hot soldering iron at the solder connection.

Defective switch contacts may cause an intermittent condition or the loss of one or both bands. Contact replacement is easily accomplished by removing the two switch plate tension springs, the hex-head bolt and the switch plate bracket. Lift up the switch plate assembly and remove the switch contact holder and replace contacts (see page 17.

A. G. C.

The A.G.C. is a negative bias voltage proportional to the average composite video signal, developed by the network of R-59 and C-78 and applied to the RF and first and second IF amplifiers. The magnitude of the A.G.C. voltage will vary according to the strength of the signal being received. However, it will closely correspond to the detector output voltage (across R-27). As a fast and simple check to determine whether the A.G.C. voltage is normal, measure both the A.G.C. and detector output voltage. Under normal operating conditions these two voltages will be approximately the same.

Sync Stability:

For optimum sync stability the following points should be considered. A three position F-S-L switch and a sync stabilizer adjust control are provided along with the two hold controls. The position of the switch is governed by the strength of the signal being received and the control should be adjusted for a steady picture. The position of the switch and the adjustment of the control are important for good sync stability (control will not function in "local" switch position).

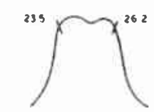
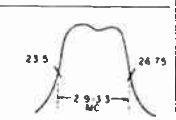
For good horizontal sync stability both the horizontal hold thumb screw and coil core should be set to the center of their respective ranges. (Center position before going out of sync in either direction).

For good vertical sync stability the vertical hold control can be adjusted to reduce the effect of noise that may interrupt synchronization in reception areas where noise conditions exist. Rotate the vertical hold control until the picture is moving upward and just locks into place. At this control setting, the noise will have the least tendency to interrupt vertical synchronization.

Vertical Distribution:

A fast and simple method to check the vertical distribution of a TV picture, without a test pattern, rotate the vertical hold control until the picture is moving slowly downward. Observe the black horizontal bar. If the vertical size and linearity controls are properly adjusted, the bar will not change in thickness as it moves from top to bottom.

VIDEO IF ALIGNMENT

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	23.5 26.2	25	Pin 1 of tube 5	Scope at junction of L25, R27, C58	Connect short between pin 5 and pin 6 of tube 4	T2 pri. T2 sec. Coupling Rod	
2	Calibrate scope for sensitivity of one volt per inch. Adjust peak response for o[illegible]h deflection. Marker should fall 10% down. If response curve is not as shown readjust coupling rod (bottom of T2 [illegible]r proper band-width and T2 primary and secondary for flat response and maximum gain.						
3	21.4	———	Converter grid *	VTVM at junction of L25, R27, C58	Remove Short. Adjust generator for output of approx. 2 volts DC	L19-B (top of chassis)	Maximum Reading
4	26.5	———	Converter grid *	VTVM at junction of L25, R27, C58	Adjust generator for output of approx. 2 volts DC	L19-A (bottom of chassis)	Maximum Reading
5	21.4	———	Converter grid *	VTVM at junction of L25, R27, C58	Remove Short. Adjust generator for output of approx. 2 volts DC	L19-B (top of chassis)	Maximum Reading
6	23.8	———	Converter grid *	VTVM at junction of L25, R27, C58	Adjust generator for output of approx. 2 volts DC	L16	Maximum Reading
7	25.0	———	Converter grid *	VTVM at junction of L25, R27, C58	Adjust generator for output of approx. 2 volts DC	L15	Maximum Reading
8	———	25	Converter grid *	Scope at junction of L25, R27, C58	———	T2 pri. (top of chassis)	Rock for flat response
9	23.5 26.5	25	Converter grid *	Scope at junction of L25, R27, C58	Marker should be 50% down and response curve should be as shown-If not, repeat alignment.	Check point only	

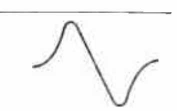
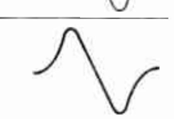
Picture IF frequency 26.75 MC – Sound IF frequency 22.25 MC.
* NOTE: A very short lead from the generator must be used to prevent regeneration.

VIDEO TRAP COIL (L-29) ADJUSTMENT

1. Tune in a station.
2. Adjust the tuner until sound bars just appear.
3. Turn L-29 slug all the way out (counter-clockwise).
4. Turn the slug in (clockwise) until the horizontal scanning lines are smooth and continuous

SOUND I-F ALIGNMENT

Short antenna to ground.

4.5	———	Junction of L25, R27, C58	VTVM at junction of R44, C65, C67	———	T3 pri. (bottom of chassis)	Maximum Reading
———	4.5	Junction of L25, R27, C58	Scope at junction of R44, C65, C67	Sweep approximately 100 kc–Adjust for maximum linearity	T3 sec. (bottom of chassis)	
———	4.5	Junction of L25, R27, C58	Scope at junction of R44, C65, C67	Sweep approximately 100 kc–Adjust for symmetry of peaks	T3 pri. (bottom of chassis)	

NOTE: L-29 coil should only be adjusted as prescribed. Do not adjust for maximum sound.

PRE-ALIGNMENT PRECAUTIONS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot scope lead as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. Set F-S-L switch to "Fringe" position.
5. When aligning the IF Amplifier be sure tuner is turned to high band channel 13.

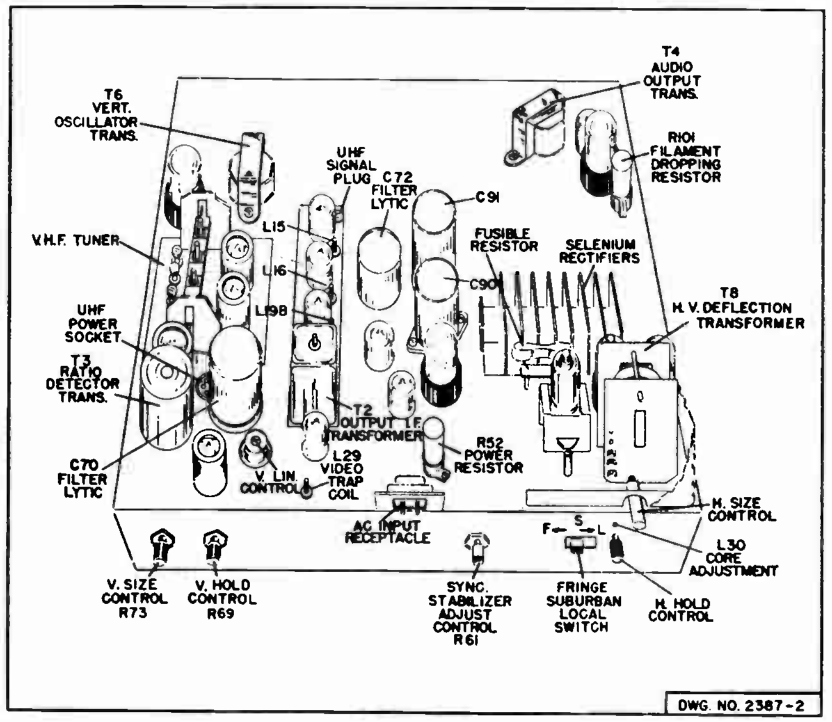


Figure 6. Top Chassis View.

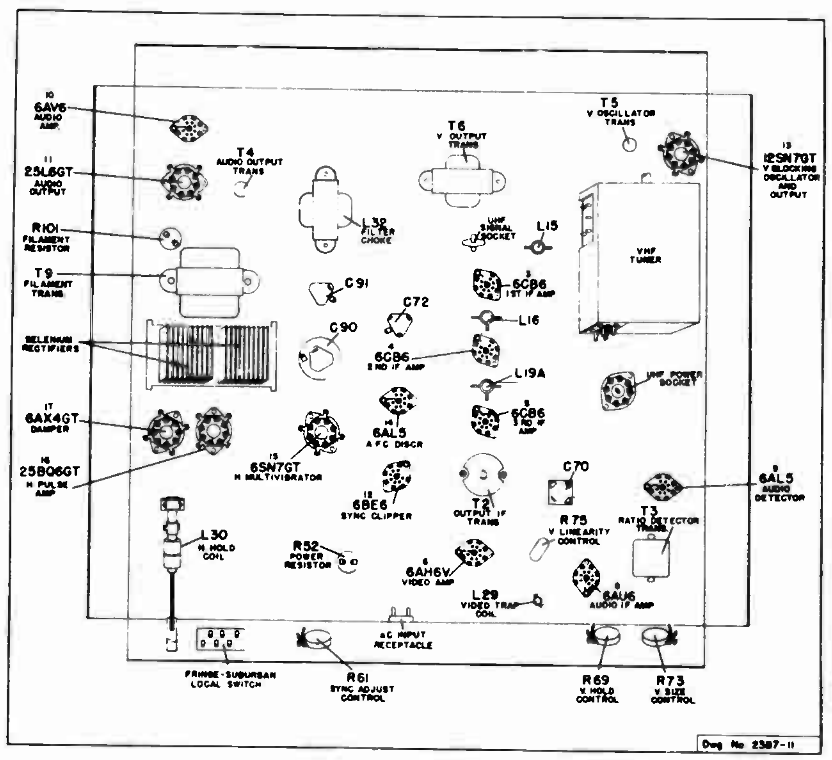


Figure 7. Bottom Chassis View.

VHF TUNER DIAGRAM

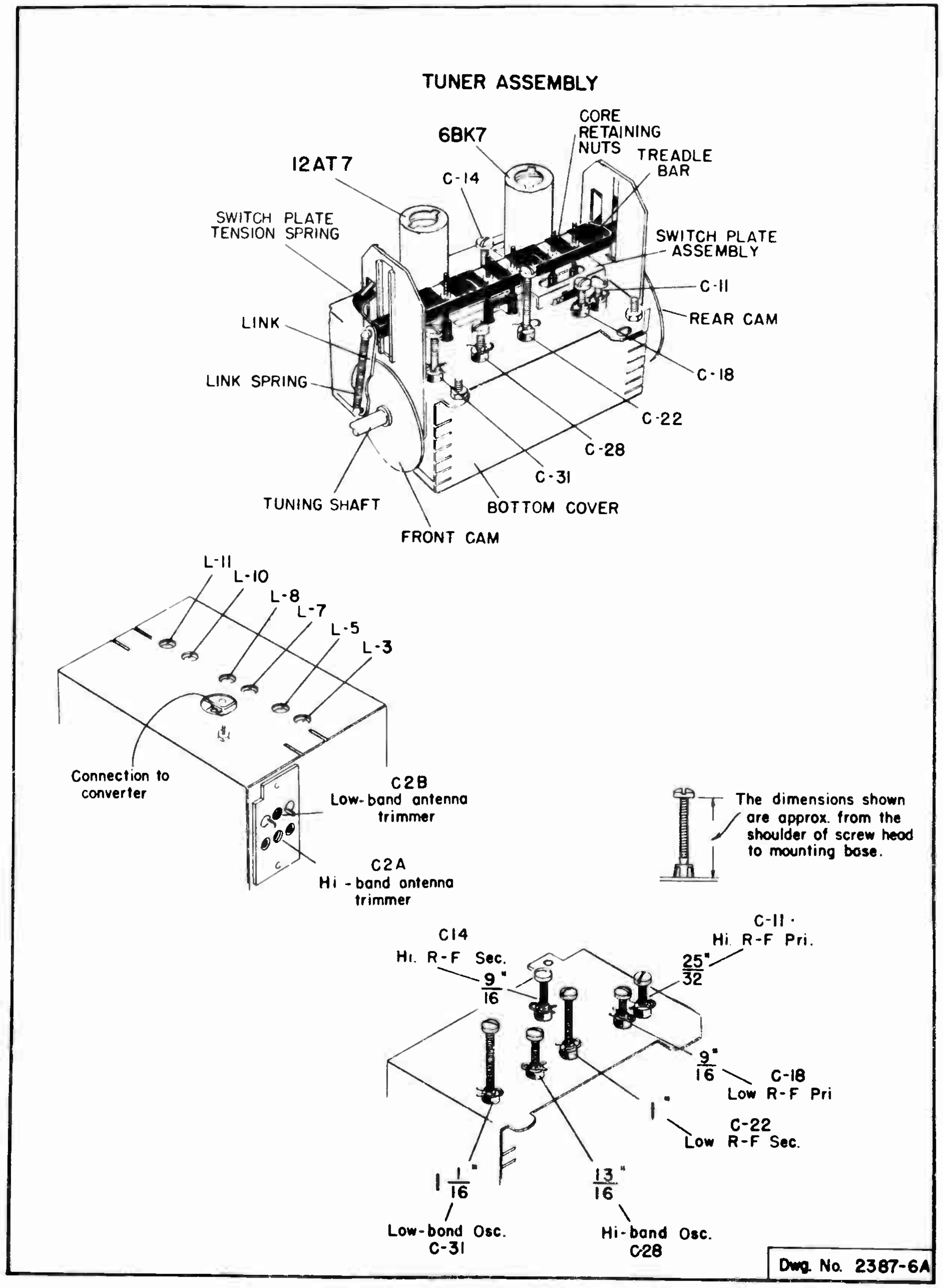


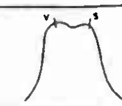
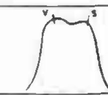
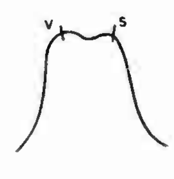
Figure 8. VHF Tuner Diagram.

TUNER ALIGNMENT

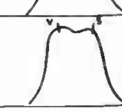
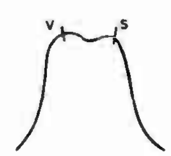
1. Preset trimmer screws C11-14-18-22-28-31- to dimensions shown on page 17).
2. Preset coil cores L3-5-7-8-10-11 in the following manner:
   (a) In low band position, turn tuner to top of stroke (cores furthest out of coil).
   (b) Switch will be in low band position.
   (c) Adjust coil cores 1.6 inch from core to end of coil form (use core aligning tool if available).

V-video
S-sound

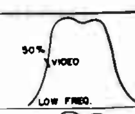
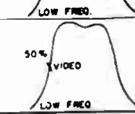
LOW BAND RF TRACKING Turn Tuner to channel 6.
NOTE: Low Band must be aligned before high band.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V-83.25 S-87.75	Channel 6	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-2B	
2	V-83.25 S-87.75	Channel 6	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-18 C-22	
3	V-77.25 S-81.75 V-67.25 S-71.75 V-61.25 S-65.75 V-55.25 S-59.75	Channel 5 Channel 4 Channel 3 Channel 2	Antenna Terminals	Test Point (terminal 6) * See sketch on schematic	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-18 C-22	

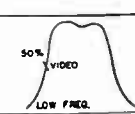
HIGH BAND RF TRACKING Turn Tuner to channel 13.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V-211.25 S-215.75	Channel 13	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-2A	
2	V-211.25 S-215.75	Channel 13	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-11 C-14	
3	V-205.25 S-209.75 V-199.25 S-203.75 V-193.25 S-197.75 V-187.25 S-191.75 V-181.25 S-185.75 V-175.25 S-179.75	Channel 12 Channel 11 Channel 10 Channel 9 Channel 8 Channel 7	Antenna Terminals	Test Point (terminal 6) * See sketch on schematic	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-11 C-14	

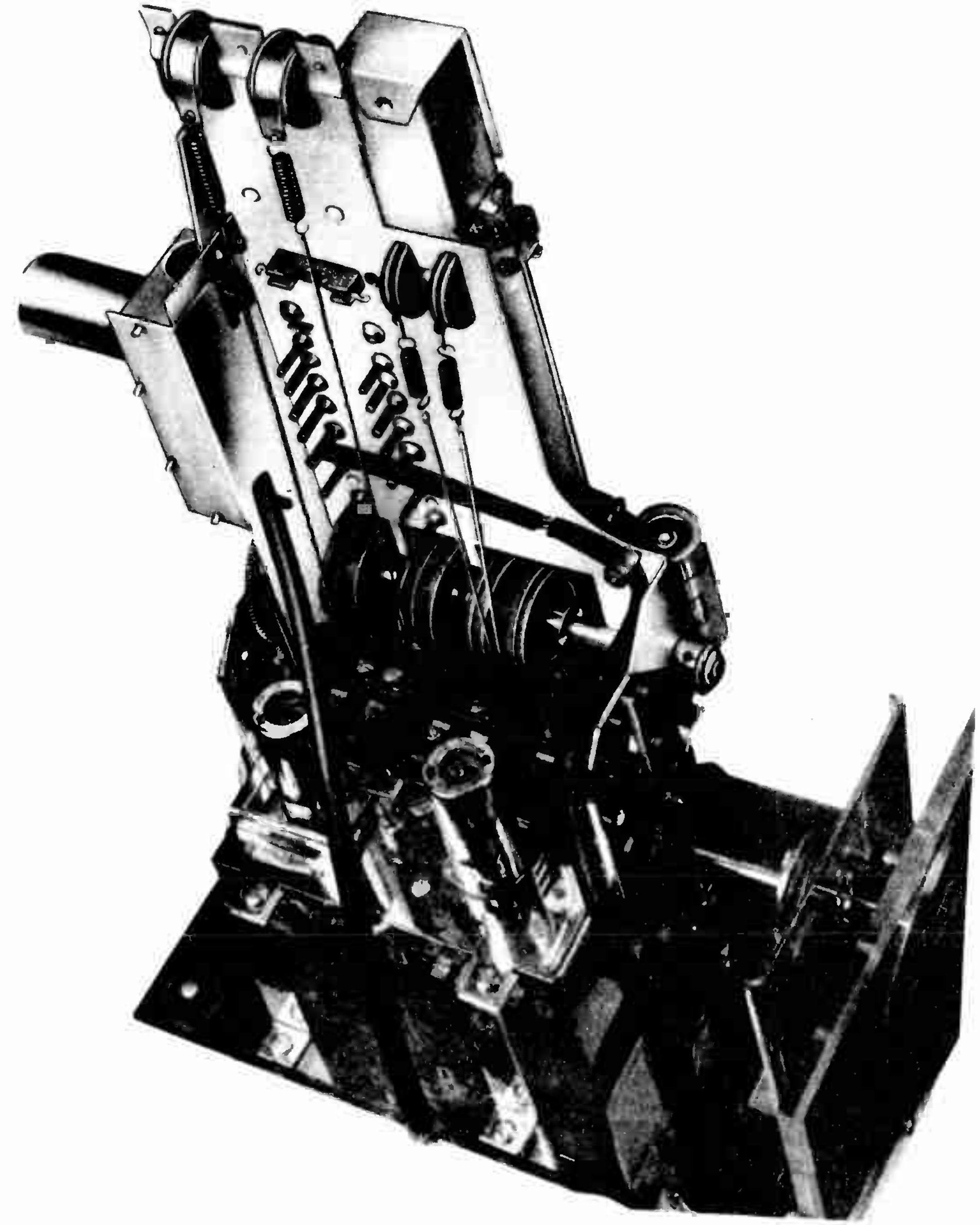
LOW BAND OSCILLATOR TRACKING Turn Tuner to channel 6.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	83.25	Channel 6	Antenna Terminals	Scope at junction of L25, R27, C58	Adjust until marker is 50% down on low frequency slope	C-31	
2	67.25 55.25	Channel 4 Channel 2	Antenna Terminals	Scope at junction of L25, R27, C58	Marker should be 50% down on low frequency slope	——	

HIGH BAND OSCILLATOR TRACKING Turn Tuner to channel 13.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	211.25	Channel 13	Antenna Terminals	Scope at junction of L25, R27, C58	Adjust until marker is 50% down on low frequency slope	C-28	
2	193.25 175.25	Channel 10 Channel 7	Antenna Terminals	Scope at junction of L25, R27, C58	Marker should be 50% down on low frequency slope	——	

UHF TUNER SERVICE MANUAL



GENERAL DESCRIPTION

The UHF Tuner is a single conversion, continuous tuning device which mechanically mounts directly over the VHF tuner in the receiver. The tuner is coupled to the VHF tuner by drive gears which thus provides tuning of both UHF and VHF by the same tuning knob. The tuner obtains its filament and plate supply voltages from the TV chassis and a switch is provided to select the desired tuner for operation. Signal points and filament leads are not switched.

Two variations of UHF tuners may be encountered. Only minor differences exist as can be seen by referring to figures 3 (early version) and 4 (later version). The later version tuner can easily be identified by the terminal strip below resistor R-2. (see figure 5).

The UHF Tuner selects the UHF stations video and sound carrier and converts them to the carrier IF frequency of 26.75 MC for video and 22.25 MC for sound which is coupled to the IF amplifiers in the receiver by 10 inches of RG-62U cable.

CIRCUIT DESCRIPTION

The UHF Tuner employs a double coaxial line RF cavity pre-selector. The coaxial line arrangement has the advantages of high selectivity, low insertion losses, uniform band-width and good shielding against oscillator radiation. The coaxial cavity is basically a one-quarter wave shorted tuned stub. The electrical length of the cavities is varied by a ribbon which is attached to the dial cord and pulley arrangement. In this manner tuning is accomplished similar to varying the length of a tuned stub which would change the resonant length for various frequencies. The dial cord is of a special material which is not affected by temperature or moisture and is locked to the pulleys which eliminates the possibility of slippage. Tracking screws are provided in the cavities to obtain uniform band width and sensitivity. The tracking screws vary the capacity between the ribbon and the cavity wall and thus vary the electrical length of the ribbon.

The oscillator tube used is a 6AF4 which is similar to the 6F4. Oscillator tuning is accomplished by a one-quarter wave shorted parallel wire transmission line arrangement. It differs from the RF cavities, in that a shorting bar is used to vary the electrical length of the lines. This method provides very stable operation.

Inductive or link coupling is employed to transfer the signal between stages. The arrangement of link coupling gives maximum selectivity and constant band-width over the entire UHF band. The signal from the output coupling link is mixed and detected by a CK-710 crystal detector and then applied to the tuned input of the cascode Pre-IF amplifier which is tuned to a center frequency of 25 MC and has the features of low noise and broad band-width. The signal is amplified by the cascode amplifier and then coupled to the IF amplifier section in the receiver through 10 inches of RG-62U coaxial cable.

The UHF Tuner maintains a fairly constant antenna input impedance of 300 ohms, has an overall band-width of 6 to 8 megacycles and has an oscillator injection current ratio of approximately 2 to 1. The only amplification of the signal takes place in the cascode amplifier. The signal is not amplified in the RF cavities, therefore, the sensitivity of the receiver on UHF will not quite equal that of VHF. A receiver equipped with a UHF tuner will have an overall UHF sensitivity of approximately 150 microvolts.

Service features of this tuner provides a convenient check point for measuring the oscillator grid current to determine whether the oscillator is functioning. Also provisions have been made for measuring the oscillator injection current to check both the crystal detector and the oscillator. An opening is also provided for coupling to the input grid coil when alignment of the cascode amplifier is necessary.

SCHEMATIC DIAGRAM

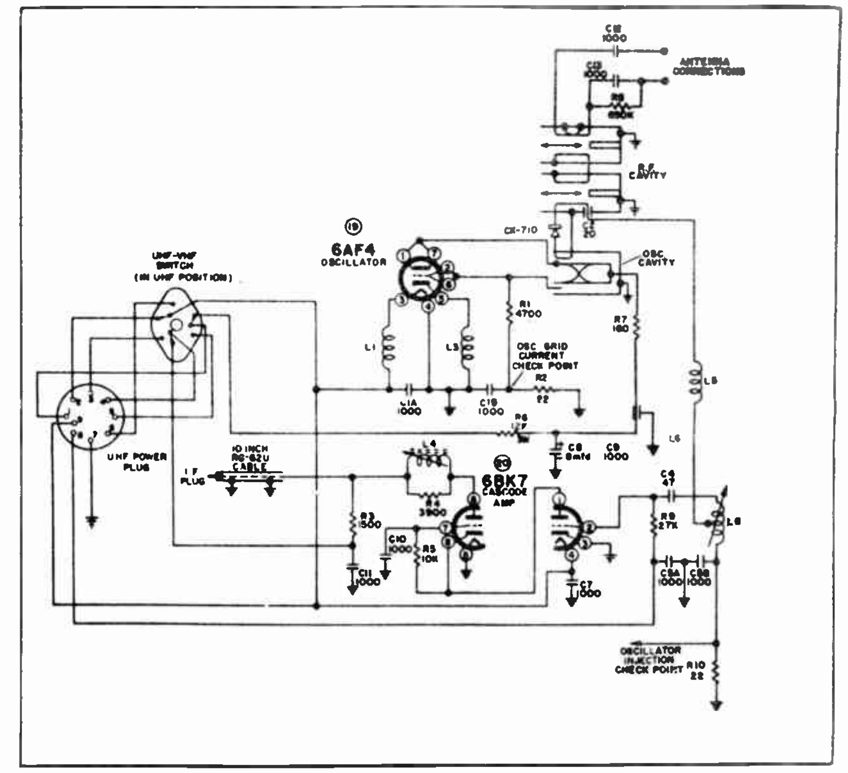


Figure 2 -- Early Version

SERVICE HINTS

If the receiver is "dead" when attempting to view a UHF program, first check the position of the selector switch, then determine whether a signal is being transmitted and then check the antenna and lead-in connections before suspecting the tuner for trouble.

Also as a fast check, view the face of the picture tube at minimum contrast or picture control setting and advance the control to maximum. Compare the difference. If there is little or no difference (no "snow") check the video detector and IF amplifiers. If an increase of "snow" appears at maximum control setting, check the first IF stage before looking to the tuner for a defect.

If the UHF tuner is not functioning properly, first substitute the oscillator (6AF4) and cascode amplifier (6BK7) tubes. Next check the voltages at the UHF power socket or cable connections in the receiver.

If soldering iron servicing, crystal detector or component parts replacement is necessary, the picture tube must be removed. Removing the picture tube makes the majority of the UHF Tuner components within easy reach and most of the parts can be serviced. The tuner should not be removed from the chassis when service is required, also caution must be observed not to lay the chassis on the tuner side. Damage to the UHF Tuner may result.

CAUTION: When attempting to service the Tuner, do not move or rearrange components or mechanical parts as a change in distributed capacity may result and offset the alignment. When replacing a component, be sure to obtain the same lead lengths and replace in the same physical position.

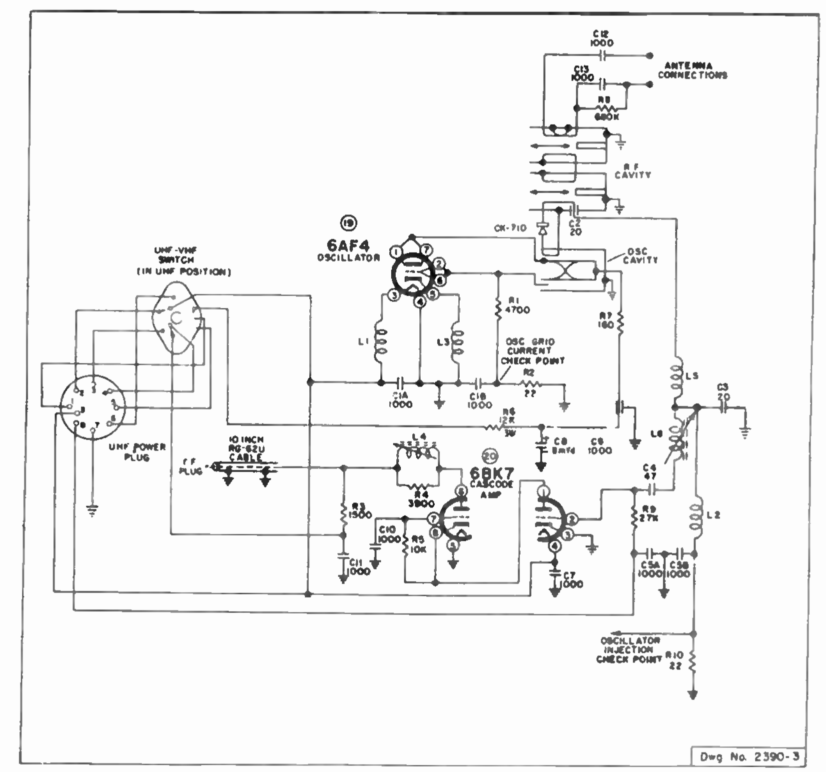


Figure 3 -- Later Version

SERVICE DATA

To determine whether the oscillator section is functioning, a convenient check point has been provided where the oscillator grid current can be measured. To measure the oscillator grid current, place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22-ohm resistor (R2). See figure 4. A reading of 10 to 30 microamperes should be obtained if the oscillator is functioning normally.

Both the oscillator and crystal detector can easily be checked by measuring the oscillator injection current. Place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22 ohm resistor (R 10) at the terminal indicated in Figure 5A or 5B depending on the version of the tuner. A reading of 5 to 40 microamperes should be obtained if both the oscillator and crystal are functioning normally.

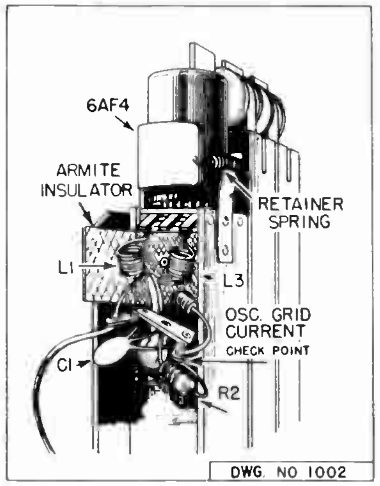


Figure 4

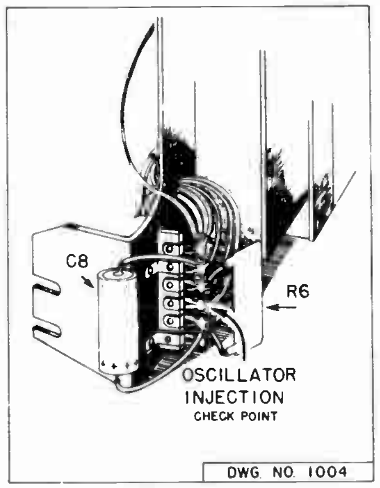


Figure 5A
Early Version

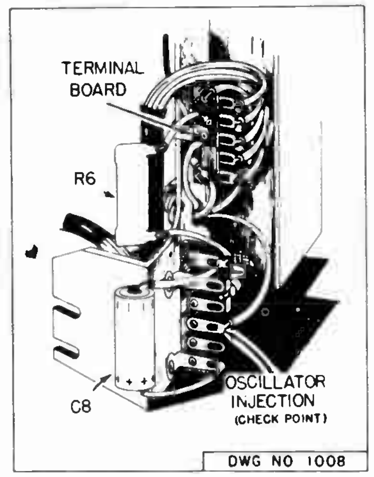


Figure 5B
Later Version

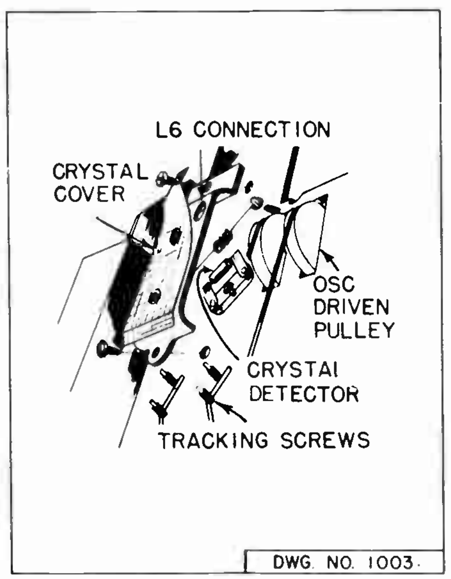


Figure 6

CRYSTAL DETECTOR: If replacement of the CK-710 Crystal Detector is necessary, the picture tube must be removed along with the crystal cover (refer to figure 6). The crystal is soldered into place and should be carefully resoldered after replacement. Overheating may damage the crystal. To dissipate the heat, grasp each crystal lead with a pliers when soldering into place.

ALIGNMENT

Since UHF is a relatively new field, test equipment necessary for RF and Oscillator Alignment is highly expensive and not readily available on the market at the present time. Therefore, a complete alignment procedure is not presented in this manual.

The cascode Pre-IF Amplifier can easily be realigned if necessary by connecting a 25 MC unmodulated signal to the center tap of L6 (see figure 7) or to the junction of Coil L-5 and Capacitor C-2 (see figure 6), depending on the version of the tuner and a VTVM at the video IF Detector output of the receiver. Connect generator through a 1 mmf capacitor. Adjust both L4 and L6 for maximum VTVM reading.

If for any reason such as dial cord replacement, component replacement, etc., the RF cavities may be adjusted for peak performance. Before attempting adjustment, note position of ribbons and mark the UHF drive gear so that original positions can be relocated if necessary. Loosen the pulley positioning screw (refer to figure 8) and rotate tate the pulleys for the sharpest and clearest picture.

CAUTION: Do not under any circumstances attempt adjustment of the tracking screws, oscillator trimmer screw or oscillator cavity. Precision test equipment is necessary for the adjustment.

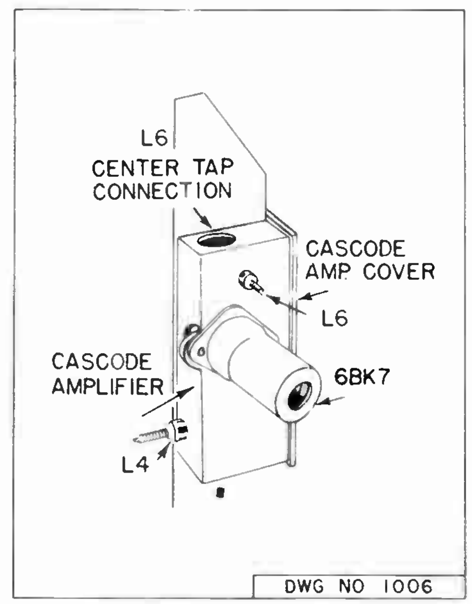


Figure 7

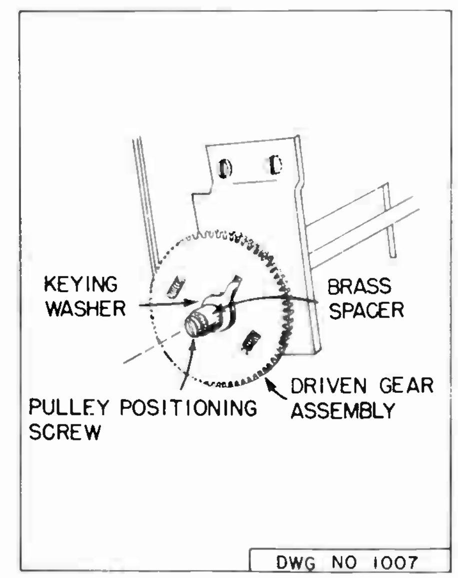


Figure 8

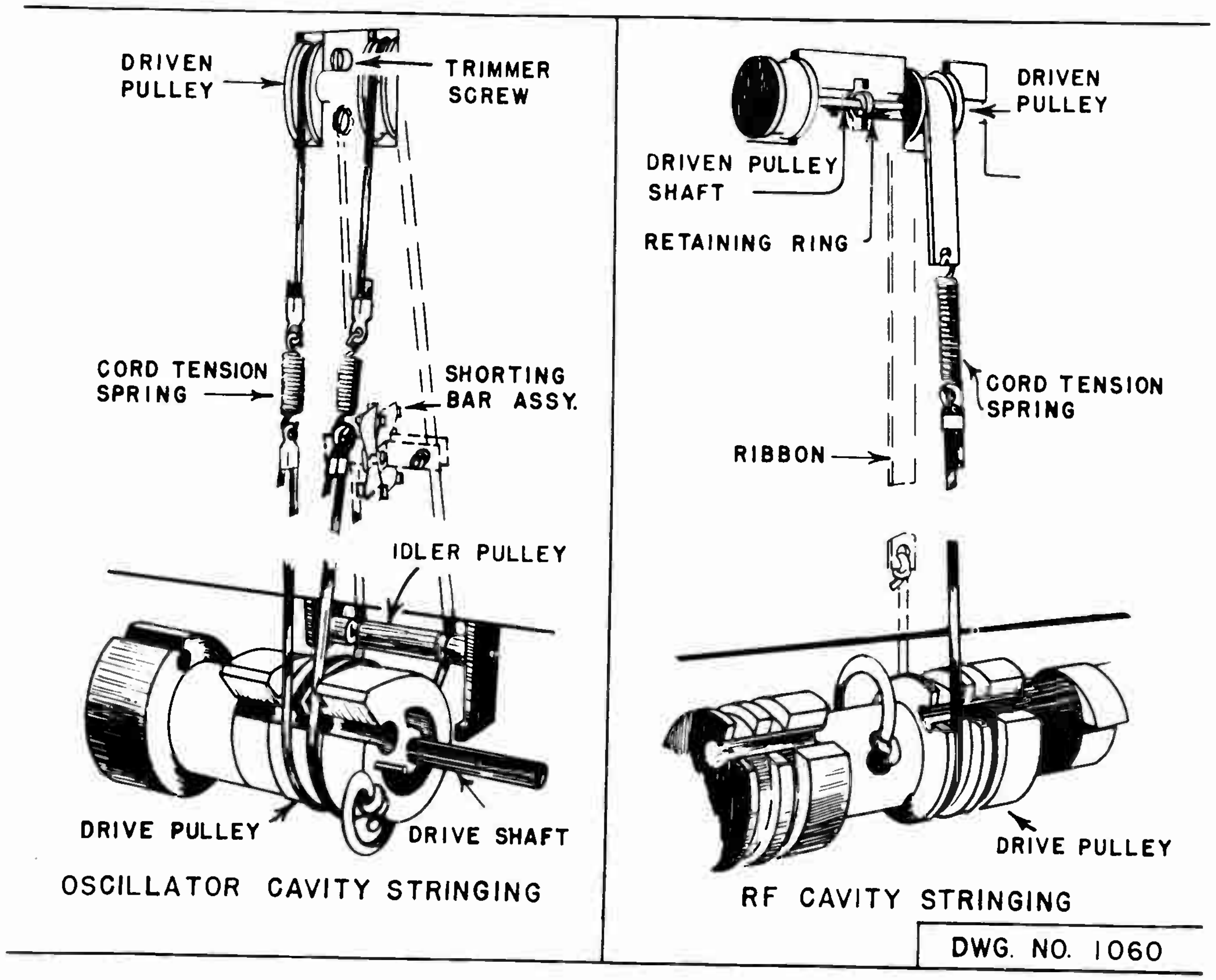


Figure 9

U. H. F. TELEVISION FREQUENCY RANGES

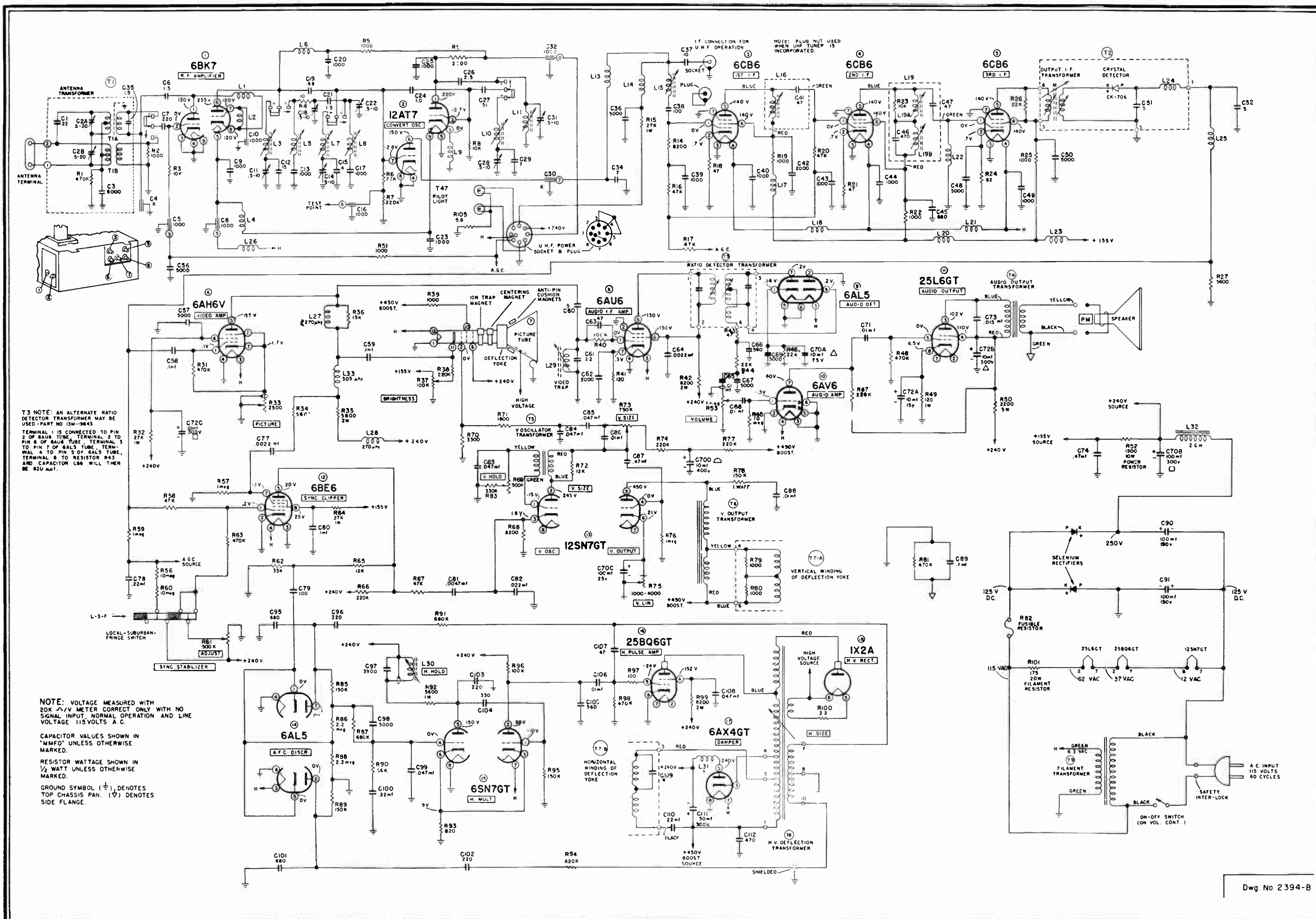
(All Figures Represent Megacycles)

CHANNEL	CHANNEL FREQUENCIES	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY	UHF TUNER OSCILLATOR FREQUENCY
14	470-476	471.25	475.75	498
15	476-482	477.25	481.75	504
16	482-488	483.25	487.75	510
17	488-494	489.25	493.75	516
18	494-500	495.25	499.75	522
19	500-506	501.25	505.75	528
20	506-512	507.25	511.75	534
21	512-518	513.25	517.75	540
22	518-524	519.25	523.75	546
23	524-530	525.25	529.75	552
24	530-536	531.25	535.75	558
25	536-542	537.25	541.75	564
26	542-548	543.25	547.75	570
27	548-554	549.25	553.75	576
28	554-560	555.25	559.75	582
29	560-566	561.25	565.75	588
30	566-572	567.25	571.75	594
31	572-578	573.25	577.75	600
32	578-584	579.25	583.75	606
33	584-590	585.25	589.75	612
34	590-596	591.25	595.75	618
35	596-602	597.25	601.75	624
36	602-608	603.25	607.75	630
37	608-614	609.25	613.75	636
38	614-620	615.25	619.75	642
39	620-626	621.25	625.75	648
40	626-632	627.25	631.75	654
41	632-638	633.25	637.75	660
42	638-644	639.25	643.75	666
43	644-650	645.25	649.75	672
44	650-656	651.25	655.75	678
45	656-662	657.25	661.75	684
46	662-668	663.25	667.75	690
47	668-674	669.25	673.75	696
48	674-680	675.25	679.75	702
49	680-686	681.25	685.75	708
50	686-692	685.25	691.75	714
51	692-698	693.25	697.75	720
52	698-704	699.25	703.75	726
53	704-710	705.25	709.75	732
54	710-716	711.25	715.75	738
55	716-722	717.25	721.75	744
56	722-728	723.25	727.75	750
57	728-734	729.25	733.75	756
58	734-740	735.25	739.75	762
59	740-746	741.25	745.75	768
60	746-758	747.25	751.75	774
61	752-758	753.25	757.75	780
62	758-764	759.25	763.75	786
63	764-770	765.35	769.75	792
64	770-776	771.25	775.75	798
65	776-782	777.25	781.75	804
66	782-788	783.25	787.75	810
67	788-794	789.25	793.75	816
68	794-800	795.25	799.75	822
69	800-806	801.25	805.75	828
70	806-812	807.25	811.75	834
71	812-818	813.25	817.75	840
72	818-824	819.25	823.75	846
73	824-830	825.25	829.75	852
74	829-836	831.25	835.75	858
75	836-842	837.25	841.75	864
76	842-848	843.25	847.75	870
77	848-854	849.25	853.75	876
78	854-860	855.25	859.75	882
79	860-866	861.25	865.75	888
80	866-872	867.25	871.75	894
81	872-878	873.25	877.75	900
82	878-884	879.25	883.75	906
83	884-890	885.25	889.75	912

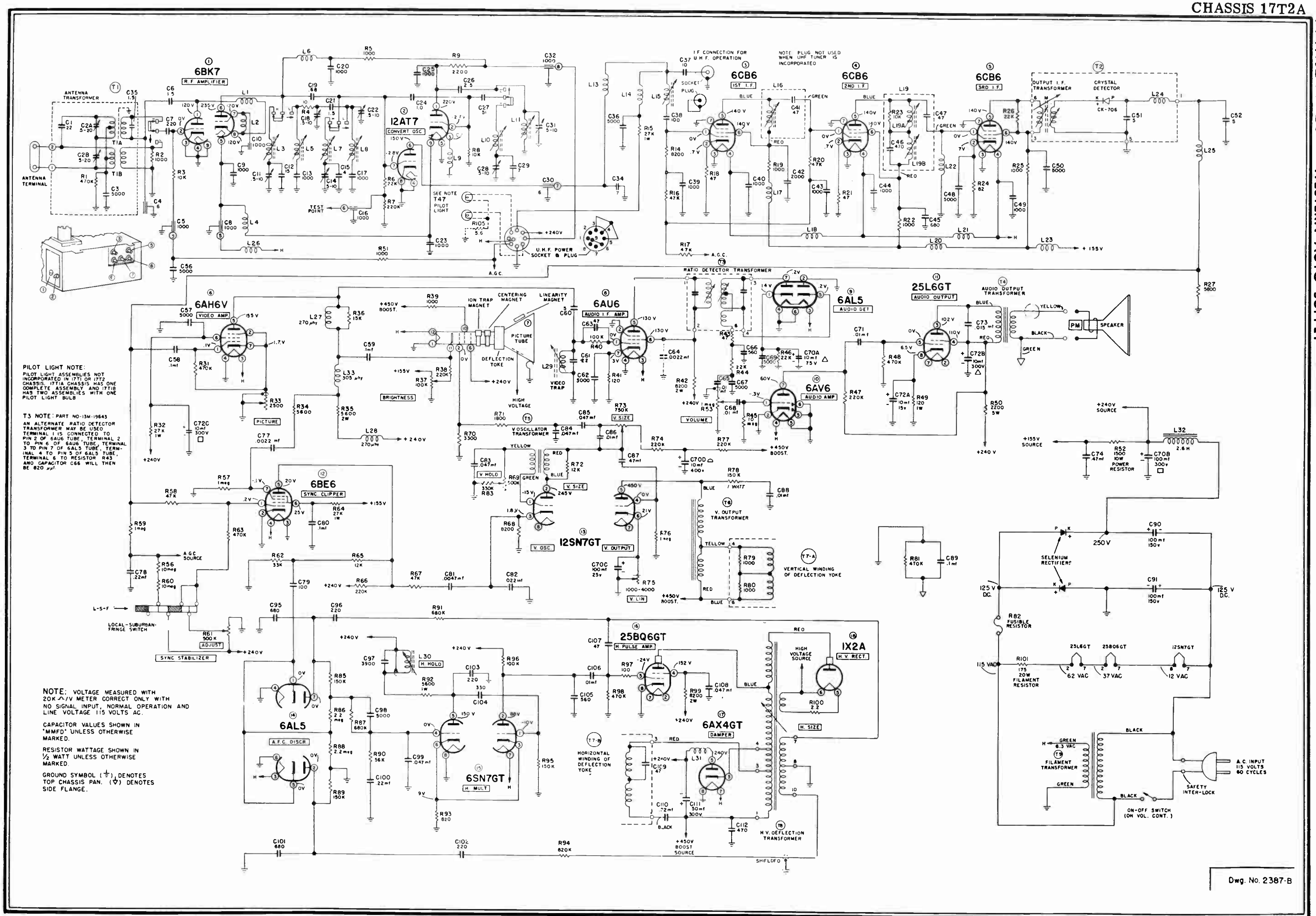
NOTE: The UHF oscillator frequency listed is only for those UHF tuners which employ single conversion and a low frequency video IF strip. (25MC) Below is a simple formula for determining the particular frequencies for any UHF channel.

Fl — (N-14) 6 + 470 MC
Fh -- Fl + 6 MC
Pc -- Fl + 1.25 MC
Sc -- Fl + 4.5 MC
O — Fl + 28 MC

N — UHF Channel number
Fl -- UHF Channel low frequency end
Fh — UHF Channel high frequency end
Pc -- UHF Picture Carrier frequency
Sc — UHF Sound carrier frequency
O -- UHF Oscillator frequency



CHASSIS 21T2A


6BK7
R.F. AMPLIFIER
12AT7
CONVERT OSC
6CB6
1ST I.F.
6CB6
2ND I.F.
6CB6
3RD I.F.
6AH6V
VIDEO AMP
6AU6
AUDIO I.F. AMP
6AL5
AUDIO DET
25L6GT
AUDIO OUTPUT
6AV6
AUDIO AMP
6BE6
SYNC CLIPPER
12SN7GT
V. OSC
V. OUTPUT
25BQ6GT
H. PULSE AMP
1X2A
H.V. RECT.
6AL5
A.F.C. DISCR
6SN7GT
H. MULT
6AX4GT
DAMPER
ANTENNA TRANSFORMER
ANTENNA TERMINAL
U.H.F. POWER SOCKET & PLUG
RATIO DETECTOR TRANSFORMER
AUDIO OUTPUT TRANSFORMER
SPEAKER
PICTURE TUBE
DEFLECTION YOKE
V. OUTPUT TRANSFORMER
VERTICAL WINDING OF DEFLECTION YOKE
HORIZONTAL WINDING OF DEFLECTION YOKE
H.V. DEFLECTION TRANSFORMER
SELENIUM RECTIFIERS
FILAMENT TRANSFORMER
A.C. INPUT 115 VOLTS 60 CYCLES
SAFETY INTER-LOCK
ON-OFF SWITCH (ON VOL. CONT.)
LOCAL-SUBURBAN-FRINGE SWITCH
SYNC STABILIZER
PILOT LIGHT NOTE:
PILOT LIGHT ASSEMBLIES NOT INCORPORATED IN 17T1 OR 17T2 CHASSIS. 17T1A CHASSIS HAS ONE COMPLETE ASSEMBLY AND 17T1B HAS TWO ASSEMBLIES WITH ONE PILOT LIGHT BULB
T3 NOTE: PART NO-13M-19643
AN ALTERNATE RATIO DETECTOR TRANSFORMER MAY BE USED TERMINAL 1 IS CONNECTED TO PIN 2 OF 6AU6 TUBE, TERMINAL 2 TO PIN 6 OF 6AU6 TUBE, TERMINAL 3 TO PIN 7 OF 6AL5 TUBE, TERMINAL 4 TO PIN 5 OF 6AL5 TUBE, TERMINAL 6 TO RESISTOR R43 AND CAPACITOR C66 WILL THEN BE 820 μμf.
NOTE: VOLTAGE MEASURED WITH 20K Ω/V METER CORRECT ONLY WITH NO SIGNAL INPUT, NORMAL OPERATION AND LINE VOLTAGE 115 VOLTS AC.
CAPACITOR VALUES SHOWN IN "MMFD" UNLESS OTHERWISE MARKED.
RESISTOR WATTAGE SHOWN IN 1/2 WATT UNLESS OTHERWISE MARKED.
GROUND SYMBOL (⏚) DENOTES TOP CHASSIS PAN. (▽) DENOTES SIDE FLANGE.
Dwg. No. 2387-B

U H F TUNER

REPLACEMENT PARTS LIST

CAPACITORS

Ref. No.	Part No.	Description	Unit Price
C1A, B	8G-19506	1000 mmf, dual ceramic	
C2	8G-21315	20 mmf, feed thru	
* C3	8G21951	20 mmf, ceramic	
C4	8G20740	47 mmf, ceramic	
C5A, B	8G-19506	1000 mmf, dual ceramic	
C7	8G-13201	1000 mmf, ceramic	
C8	8G-13453	8 mfd x 450 volt, lytic	
C9	8G-20878	1000 mmf, feed thru	
C10,11	8G-13201	1000 mmf, ceramic	
C12,13	8G-19862	100 mmf, ceramic	

RESISTORS

Ref. No.	Part No.	Description	Unit Price
R1	9B1-70	4700 ohm, ½ watt, 10%	
R2	9B1-42	22 ohm, ½ watt, 10%	
R3	9B1-64	1500 ohm, ½ watt, 10%	
R4	9B1-69	3900 ohm, ½ watt, 10%	
R5	9B1-74	10K ohm, ½ watt, 10%	
R6	9C11-1112	12K ohm, 3 watt, 10%	
R7	9B1-140	160 ohm, ½ watt, 5%	
R8	9B1-96	680K ohm, ½ watt, 10%	
R9	9B1-79	27K ohm, ½ watt, 10%	
R10	9B1-42	22 ohm, ½ watt, 10%	

COILS

Ref. No.	Part No.	Description	Unit Price
L1	16A-20469	Filament Choke Coil	
* L2	201-20265	Choke Coil	
L3	16A-20470	Cathode Choke Coil	
L4	201-20483	Output IF Coil	
** L5	16A-20537	Crystal Coupling Coil	
* L5	16A-21934	Crystal Coupling Coil	
** L6	201-20482	Input IF Coil	
* L6	201-21933	Input IF Coil	

MISCELLANEOUS

Ref. No.	Part No.	Description	Unit Price
	201-21283	Ribbon Contact Arm Assembly (bottom)	
	** 201-21284	Ribbon Contact Arm Assy. (top)	
	* 201-21954	Ribbon Contact Arm Assy. (top)	
	5M-21286	RF Driven Pulley	
	3A-21287	Shaft for R.F. Pulley	
	5M-21289	Oscillator Driven Pulley	
	29C-21288	Retaining Ring (RF Pulley Shaft)	
	3A-21290	Oscillator Pulley Shaft	
	3A-21292	Oscillator Idler Pulley	
	213-21583	Oscillator Cover Assembly	
	8M-21655	Crystal (CK-710)	
	200-21295	Crystal Cover	
	200-21298	Driven Gear Assembly	
	3A-21300	Drive Shaft	
	29M-21512	Keying Washer	
	3C-10073	Brass Spacers	
	3C-21374	Sleeve Spacer	
	32F8SE-5882	Pulley Positioning Screw	
	5M-21373	R.F. Cavity Drive Pulley	
	200-21299	Oscillator Drive Pulley & Pin	
	2C-21301	R.F. Cavity Cover	
	2B-21304	Cascode Amplifier Cover	
	3M-21305	Tracking Screw	
	62M-21306	Locking Wire (for above)	

* Note: Later version Tuner only

** Note: Early version Tuner only

REPLACEMENT PARTS LIST

V.H.F. TUNER

Capacitors

Ref. No.	Part No.	Description
C1	8G-11892	22 mmf, 500 volt, ceramic, (included with T1)
C2A-B	8E-17142	5-20 mmf. dual trimmer
C3	8G-13962	5000 mfd, 500 volt, ceramic
C4	8G-20880	6 mmf. feed thru
C5	8G-20878	1000 mmf. feed thru
C6	8G-12495-8	1.5 mmf. 500 volt, ceramic
C7	8G-16045	220 mmf, 500 volt, ceramic
C8	8G-20878	1000 mmf. feed thru
C9	8G-13201	1000 mmf. 500 volt, ceramic
C10	8G-20850	1000 mmf. feed thru
C11	201-15142	.5-10 mmf, trimmer
C12	8G-13017	15 mmf, 500 volt, ceramic
C13	8G-13201	1000 mmf, 500 volt, ceramic
C14	201-15142	.5-10 mmf, trimmer
C15	8G-19314	4 mmf, 500 volt ceramic
C16	8G-20878	1000 mmf, feed thru
C17	8G-13201	1000 mmf, 500 volt, ceramic
C18	201-15142	.5-10 mmf, trimmer
C19	8G-12495-1	.68 mmf, 500 volt, ceramic
C20	8G-13201	1000 mmf, 500 volt, ceramic
C21	8G-12495-8	1.5 mmf, 500 volt, ceramic
C22	201-15142	.5-10 mmf, trimmer
C23	8G-13201	1000 mmf, 500 volt, ceramic
C24	8G-12495-2	1.0 mmf, 500 volt, ceramic
C25	8G-13201	1000 mmf, 500 volt, ceramic
C26	8G-19568	2.5 mmf, 500 volt, ceramic
C27	8G-11891	51 mmf, 500 volt, ceramic
C28	201-15142	.5-10 mmf, trimmer
C29	8G-15224	7 mmf, 500 volt, ceramic
C30	8G-20879	6 mmf, feed thru
C31	201-15142	.5-10 mmf, trimmer
C32	8G-20878	1000 mmf, feed thru
C35	8G-12495-8	1.5 mmf, 500 volt, ceramic

Resistors

Ref. No.	Part No.	Description
R1	9B1-29	470K ohm, ½ watt, 20% (incl. with T1)
R2	9B1-62	1000 ohm, ½ watt, 10%
R3	9B1-74	10K ohm, ½ watt, 10%
R4	9B1-38	10 ohm, ½ watt, 10%
R5	9B1-13	1000 ohm, ½ watt, 20%
R6	9B1-78	22K ohm, ½ watt, 10%
R7	9B1-27	220K ohm, ½ watt, 20%
R8	9B1-74	10K ohm, ½ watt, 10%
R9	9B1-66	2200 ohm, ½ watt, 10%

Chokes, Transformers and Coils

Ref. No.	Part No.	Description
T1 (Incl. T1A, T1B, C1, C2A, C2B, C3 and R1)	201-21192	Antenna transformer assembly
T1A	13E-20767	H.B. Antenna transformer (incl. with T1)
T1B	13E-21189	L.B. Antenna transformer (incl. with T1)
L1	13M-20781	Cascode plate-to-cathode coil
L2	13M-20780	Cascode cathode-to-grid coil
L3	13E-17140	H.B. R.F. primary coil
L4	16A-20777	Filament choke
L5	13E-12046	L.B. R.F. primary coil
L6	16A-17128	R.F. choke
L7	13E-17140	H.B. R.F. secondary coil
L8	13E-12046	L.B. R.F. secondary coil
L10	13E-17140	H.B. oscillator coil
L11	13D-12155	L.B. oscillator coil

Miscellaneous

Ref. No.	Part No.	Description
	200-20772	T1 shield assembly
	201-20766	Coil alignment strip
	200-20779	Switch lever assembly
	2D-20893	Switch lever bracket
	200-18824	Rear cam
	200-21193	Shaft and front cam
	200-20881	Bottom cover
	201-20769	Capacitor plate assembly (included C5-8-16-30-32)
	49A-20763	Hair-pin spring (for trimmer)
	5M-18807	Treadle bar
	2M-16276	Core mounting clip
	43A2-5444	Hex nut, 2-56x3/16"
	51A-15713	Iron core (white) for L-10
	51A-17162	Iron core (brown) for L3-7
	51A-21200	Iron core (pink) for L-11
	51A-15715	Iron core (blue) for L-5
	51A-17161	Iron core (orange) for L-8
	2C-21099-1	Front end plate
	2C-18805-1	Rear end plate
	49A-18799	Link spring
	2M-18800	Front link
	2M-21278	Rear link
	2M-19150	Flat spring
	2B-19323	Tube shield (12AT7)
	2B-20864	Tube shield (6BK7)
	2J-16310	Sliding switch contact
	5F-16311	Switch contact holder

MAIN CHASSIS

Capacitors

Ref. No.	Part No.	Description
C34	8G-15224	7 mmf, 500 volt, ceramic
C36	8G-13962	5000 mmf, 500 volt, ceramic
C37	8G-11789	10 mmf, 500 volt, ceramic
C38	8F3-8	100 mmf, 500 volt, mica
C39-40	8G-13201	1000 mmf, 500 volt, ceramic
C41	8G-19731	47 mmf, 500 volt, ceramic (included with L-16)
C42	8G-19522	2000 mmf, 500 volt, ceramic
C43-44	8G-13201	1000 mmf, 500 volt ceramic
C45	8G-21105	680 mmf, 500 volt, ceramic
C46	8G-11732	470 mmf, 500 volt, ceramic (included with L-19)
C47	8G-19731	47 mmf, 500 volt, ceramic (included with L-19)
C48	8G-13962	5000 mmf, 500 volt, ceramic
C49	8G-13201	1000 mmf, 500 volt, ceramic
C50	8G-13962	5000 mmf, 500 volt, ceramic
C51	8G-12166	5 mmf, 500 volt, ceramic (included with T-2)
C52	8G-12166	5 mmf, 500 volt, ceramic
C56-57	8G-13962	5000 mmf, 500 volt, ceramic
C58	8J-16085	.1 mfd, 200 volt, molded
C59	8J-16083	.1 mfd, 400 volt, molded
C60	8G-12166	5 mmf, 500 volt, ceramic
C61	8G-13909	22 mmf, 500 volt, ceramic
C62	8G-13962	5000 mmf, 500 volt, ceramic
C63	8G-12198	47 mmf, 500 volt, ceramic
C64	8J-20634	.0022 mfd, 400 volt, molded
C65	8J-20582	.01 mfd, 200 volt, molded
C66	8F3-122	560 mmf, 500 volt, mica
C67	8G-21207	5000 mmf, 500 volt, ceramic
C68	8J-20582	.01 mfd, 200 volt, molded
C69	8G-13962	5000 mmf, 500 volt, ceramic
C70A-B-C-D	8C-20808	10 mfd, 75 volt—100 mfd, 300 volt—100 mfd, 25 volt—10 mfd, 300 volt filter lytic
C71	8J-16084	.01 mfd, 400 volt, molded
C72A-B-C	8C-20954	10 mfd, 15 volt—10 mfd, 300 volt—10 mfd, 300 volt filter lytic
C73	8J-20594	.015 mfd, 400 volt, molded
C74	8J-21505	.47 mfd, 400 volt, molded
C77	8J-20590	.0022 mfd, 400 volt, molded
C78	8J-16082	.22 mfd, 200 volt, molded
C79	8F3-113	100 mmf, 500 volt, mica

REPLACEMENT PARTS LIST

Ref. No.	Part No.	Description
C80	8J-16083	.1 mfg, 400 volt molded
C81	8J-20592	.0047 mfd, 400 volt, molded
C-82	8J-16086	.022 mfd, 200 volt, molded
C83-84	8J-16096	.047 mfd, 200 volt, molded
C85	8J-16081	.047 mfd, 400 volt, molded
C86	8J-16084	.01 mfd, 400 volt, molded
C87	8J-21505	.47 mfd, 400 volt, molded
C88	8J-16097	.01 mfd, 600 volt, molded
C89	8J-16083	.1 mfd, 400 volt, molded
C90	8C-20709	100 mfd, 150 volt, lytic
C91	8C-20684	100 mfd, 150 volt, lytic
C95	8F3-123	680 mmf, 300 volt, mica
C96	8F3-117	220 mmf, 500 volt, mica
C97	8J-20613	3900 mmf, 600 volt, ceramic
C98	8J20582	.01 mfd, 200 volt, molded
C99	8J-16096	.047 mfd, 200 volt, molded
C100	8J-16082	.22 mfd, 200 volt, molded
C101	8F3-123	680 mmf, 300 volt, mica
C102-103	8F3-117	220 mmf, 500 volt, mica
C104	8F3-119	330 mmf, 500 volt, mica
C105	8F3-122	560 mmf, 500 volt, mica
C106	8J-16084	.01 mfd, 400 volt, molded
C107	8G-12198	47 mmf, 500 volt, ceramic
C108	8J-16081	.047 mfd, 400 volt, molded
C109	8G-12198	47 mmf, 500 volt, ceramic (included with T-7)
C110	8J-16082	.22 mfd, 200 volt, molded
C111	8C-21274	50 mfd, 300 volts, lytic
C112	8G-21440	470 mmf, 1000 volt, ceramic
C113	8G-19505	1000 mmf, 500 volt, ceramic
	Resistors	
R13	9B1-13	1000 ohm, ½ watt, 20%
R14	9B1-73	8200 ohm, ½ watt, 10%
R15	9B2-79	27K ohm, 1 watt, 10%
R16-17	9B1-82	47K ohm, ½ watt, 10%
R18	9B1-46	47 ohm, ½ watt, 10%
R19	9B1-13	1000 ohm, ½ watt, 20%
R20	9B1-82	47K ohm, ½ watt, 10%
R21	9B1-46	47 ohm, ½ watt, 10%
R22	9B1-13	1000 ohm, ½ watt, 20%
R23	9B1-74	10K ohm, ½ watt, 10% (included with L-19)
R24	9B1-49	82 ohm, ½ watt, 10%
R25	9B1-13	1000 ohm, ½ watt, 20%
R26	9B1-78	22K ohm, ½ watt, 10%
R27	9B1-71	5600 ohm, ½ watt, 10%
R31	9B1-94	470K ohm, ½ watt, 10%
R32	9B2-79	27K ohm, 1 watt, 10%
R33	10B-21476	Picture control—2500 ohm
R34	9B1-71	5600 ohm, ½ watt, 10%
R35	9B4-71	5600 ohm, 2 watt, 10%
R36	9B1-76	15K ohm, ½ watt, 10%
R37	10B-17275	Brightness's control—100K
R38	9B1-90	220K ohm, ½ watt, 10%
R39	9B1-62	1000 ohm, ½ watt, 10%
R40	9B1-86	100K ohm, ½ watt, 10%
R41	9B1-51	120 ohm, ½ watt, 10%
R42	9B4-73	8200 ohm, 2 watt, 10%
R43	9B1-46	47 ohm, ½ watt, 10%
R44	9B1-78	22K ohm, ½ watt, 10%
R45	9B1-110	10 megohm, ½ watt, 10%
R46	9B1-78	22K ohm, ½ watt, 10%
R47	9B1-90	220K ohm, ½ watt, 10%
R48	9B1-94	470K ohm, ½ watt, 10%
R49	9B2-51	120 ohm, 1 watt, 10%
R50	9C12-1103	2200 ohm, 5 watt, 10%
R51	9B1-62	1000 ohm, ½ watt, 10%
R52	9M-20736	1500 ohm, 10 watt, 10% - Power
R53	10A-21484	On-off volume control - 1 meg.
R56	9B-110	10 megohms, ½ watt, 10%
R57	9B1-98	1 megohm, ½ watt, 10%
R58	9B1-82	47K ohm, ½ watt, 10%
R59	9B1-98	1 megohm, ½ watt, 10%
R60	9B1-110	10 megohms, ½ watt, 10%
R61	10B-20558	Sync adjust control - 500K

Ref. No.	Part No.	Description
R62	9B1-80	33K ohm, ½ watt, 10%
R63	9B1-94	470K ohm, ½ watt, 10%
R64	9C12-1115	22K ohm, 5 watt, 10%
R65	9B1-75	12K ohm, ½ watt, 10%
R66	9B1-90	220K ohm, ½ watt, 10%
R67	9B1-82	47K ohm, ½ watt, 10%
R68	9B1-73	8200 ohm, ½ watt, 10%
R69	10B-20558	V. Hold control - 500K
R70	9B1-68	3300 ohm, ½ watt, 10%
R71	9B1-65	1800 ohm, ½ watt, 10%
R72	9B1-75	12K ohm, ½ watt, 10%
R73	10B-19220	V. Size control - 750K
R74	9B1-90	220K ohm, ½ watt, 10%
R75	10B-21052	V. Linearity control - 4000
R76	9B1-98	1 megohm, ½ watt, 10%
R77	9B1-86	100K ohm, ½ watt, 10%
R78	9B1-88	150K ohm, ½ watt, 10%
R79-80	9B1-62	1000 ohm, ½ watt, 10% (included with T-7)
R81	9B1-94	470K ohms, ½ watt, 10%
R82	46M-20681	Fusible resistor, 5.6 ohm, 1 amp
R83	9B1-92	330K ohm, ½ watt, 10%
R85	9B1-88	150K ohm, ½ watt, 10%
R86	9B1-102	2.2 megohm, ½ watt, 10%
R87	9B1-96	680K ohm, ½ watt, 10%
R88	9B1-102	2.2 megohm, ½ watt, 10%
R89	9B1-88	150K ohm, ½ watt, 10%
R90	9B1-83	56K ohm, ½ watt, 10%
R91	9B1-96	680K ohm, ½ watt, 10%
R92	9B2-71	5600 ohm, 1 watt, 10%
R93	9B1-61	820 ohm, ½ watt, 10%
R94	9B1-97	820K ohm, ½ watt, 10%
R95	9B1-88	150K ohm, ½ watt, 10%
R96	9B1-86	100K ohm, ½ watt, 10%
R97	9B1-50	100 ohm, ½ watt, 10%
R98	9B1-94	470K ohm, ½ watt, 10%
R99	9B4-73	8200 ohm, 2 watt, 10%
R100	9C1-1070	3.9 ohm, ½ watt, 10%
R101	9M-21715	175 ohm, 20 watt, 10%-Filament
R105	9C1-1072	5.6 ohm, ½ watt, 10%
	Chokes, Transformers and Coils	
T2 (incl. C51, L24 & CK-706)	13B-21167	Output I.F. transformer
T3 (alternate)	13M-19643	Ratio detector transformer
T3	13M-21644	Ratio detector transformer
T4	12C-21215	Audio output transformer
T5	12M-18241-3	Vertical oscillator transformer
T6	12C-20761-1	Vertical output transformer
**T7A-B(incl. R79-80 & C109)	201-21130	Deflection yoke assembly
*T7A-B(incl. R79-80 & C109)	201-21514	Deflection yoke assembly
T8	201-21025	H.V. Deflection transformer
T9	12D-21160	Filament transformer
L13	16A-21656	R.F. choke
L14	201-15608	R.F. choke
L15	201-20782	1st I.F. coil assembly
L16(incl. C41)	201-21111	2nd I.F. coil assembly
L17	16A-18676	B choke
L18	16A-17937	Filament choke
L19 (incl. R23, C-46-47)	201-21494	3rd I.F. coil assembly
L20	16A-18676	B choke
L21	16A-17937	Filament choke
L22-23	201-15608	Choke coil
L24	201-15608	Choke coil (incl. with T-2)
L25	201-20265	Choke Coil
L26	16A-17937	Filament choke
L27-28	16A-20970	Peaking coil (270 uhy)
L29	201-21398	Video trap coil
L30	201-20291	H. Hold coil
L31	201-15608	Choke coil
L32	16A-21214	Filter choke (2.6 H)
L33	16A-21391	Peaking coil (305 uhy)

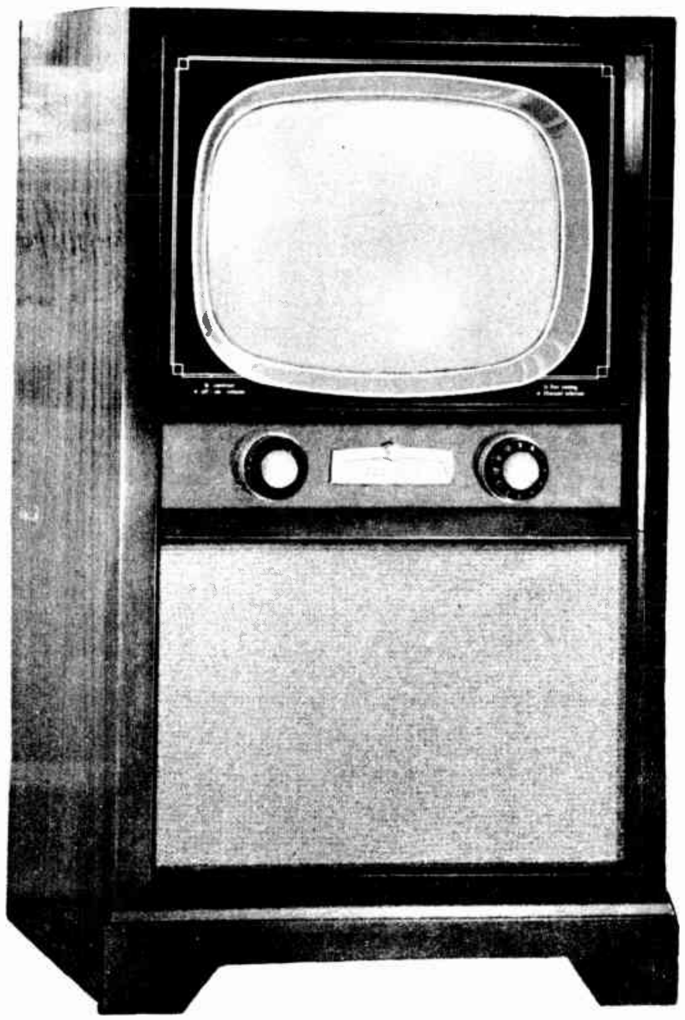
Miscellaneous

Ref. No.	Parts No.	Description	Ref. No.	Part No.	Description
	15C-16007	7-pin tube socket		2B-20549	H.V. shield can cover
	15B-10440	8-pin tube socket		49A-19389	Ring (3 used)
	15B-21968	9-pin tube socket		23M-16744	Yoke wing nut
	15B-20860	6AX4 tube socket		50A-20783	Felt pad tube protector
	19B-11920	UHF tuner socket		16M-19906	Ion Trap magnet
	19A-21244	UHF tuner plug		16M-20697	Centering magnet
	2H-17588	Tube shield		2M-19378	Flat screw spring (L-30)
	2M-17580	Tube shield base		32T8-19377	Thumb screw (L-30)
	15B-21186	Lytic mounting plate (C-90)		25A-13005	Mounting grommet (L-30)
	46M-20681	Fusible resistor		7B-13050	Antenna terminal board
	7M-20751	Fuse mounting board		49A-15857	14½" wire shield
	7M-20752	Fuse terminal board		43D-17860	Coil fastener (L-19)
	19A-19446	A.C. receptacle		51A-17966	Iron core (L-19)
	2D-11490	Condenser mounting clip (C-111)		200-21242	Tuning shaft assembly
	21J-20097	Selenium rectifier		200-21880	Drive assembly
	20B-21506	F-S-L switch		200-21893	Support bracket assembly
	201-21910	1X2A socket assembly (including the five (5) items below)		3C-21896	Spacer
				32F8-3919	Spacer Screw
	15C-18735	1X2A tube socket		25E-21948	Rubber channel
	5M-18733	Standoff insulator		5M-21418	Pointer indicator
	62D-18734	H.V. ring		43D-21392	Ring for above
	41M-20092	Tube positioner		47A-21419	Pilot light assembly
	9C1-1070	3.9 ohm resistor (R-100)		46A-10793	Pilot light bulb (T-47)
	2B-20646	H.V. shield can		25M-18177	Red rubber knob

** 17-INCH MISCELLANEOUS		* 21-INCH MISCELLANEOUS	
2M-20695	C.R.T. outer coat contact	2M-21559	C.R.T. Outer coat contact
14C-19133	H. V. Cable assembly	41M-21584	H. Size extension shaft
38A-21096	Anode retainer	14C-20824	H. V. Cable assembly
2C-20876	R.H. tube holding plate	38A-21515	Anode retainer
2C-20877	L.H. tube holding plate	2C-21490	R.H. tube holding plate
25M-20703	Rubber pad (4 used)	2C-21491	L.H. tube holding plate
213-21464	Deflection yoke mounting brace	213-21466	Deflection yoke mounting brace
2M-20705	Tube strap	200-20109	Tube strap
2D-18542	Tube strap bracket	200-20976	Tube strap
3M-20689	Support rod	25M-19382	Rubber pad (4 used)
15B-17278-7	C.R.T. socket and cable	3M-21497	Support rod
16M-21526	Linearity magnet	15B-17278-8	C.R.T. socket and cable
51A-19322	Iron core (L-30)	51A-21426	Iron core (L-30)
49A-21691	Spring (large)	16M-21499	Anti-pin-cushiong magnet
49A-19707	Spring (small)		

CABINET PARTS

24D-21564	Cabinet (2D-2313A)	32D6-21585	Escutcheon screws
24D-21565	Cabinet (2D-2315A)	18A-21216	5" PM Speaker (2D-2313A)
24D-21567	Cabinet (2D-1316A)	18A-21433	6" PM Speaker (2D-2315A)
25M-21482A-101	Mask (2D-2313A)	18A-21442	10" PM Speaker (2D-1316A)
25M-21579A-106	Mask (2D-2315A)	5B-21423A-103	Volume knob (2D-2313A)
25M-21579A-103	Mask (2D-1316A)	5B-21423A-76	Volume knob (2D-1316A)
30M-20725	17-inch Safety glass	5B-21423-92	Volume knob (2D-2315A)
30M-21485	21-inch Safety glass	5B-21422A-103	Tuning knob (2D-2313A)
2D-21569A-103	Safety glass holder (2D-2313A)	5B-21422A-76	Tuning knob (2D-1316A)
2D-21257A-76	Safety glass holder (2D-1316A)	5B-21422-92	Tuning knob (2D-2315A)
2D-21257A-107	Safety glass holder (2D-2315A)	5B-21422A-56	Tuning knob (2D-1316A)
32D6-21460	Safety glass holder screws	5B-21393-29	Star knob
5C-21255	Escutcheon	200-21438	17-inch Cabinet back assembly



TUBE COMPLEMENT

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A&B	6AL5	Pix Det. and DC Restorer
V-5 A&B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

Symbol	Type	Function
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6W4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	17HP4	Picture Tube 17" Glass Rectangular (Electrostatic)

RADIO FREQUENCY RANGE

Channel Number	Channel Frequency MC	Picture Carrier Frequency MC	Sound Carrier Frequency MC	Receiver R-F Osc. Frequency MC
2	54-60	55.25	59.75	81.45
3	60-66	61.25	65.75	87.45
4	66-72	67.25	71.75	93.45
5	76-82	77.25	81.75	103.45
6	82-88	83.25	87.75	109.45
7	174-180	175.25	179.75	201.45
8	180-186	181.25	185.75	207.45
9	186-192	187.25	191.75	213.45
10	192-198	193.25	197.75	219.45
11	198-204	199.25	203.75	225.45
12	204-210	205.25	209.75	231.45
13	210-216	211.25	215.75	237.45

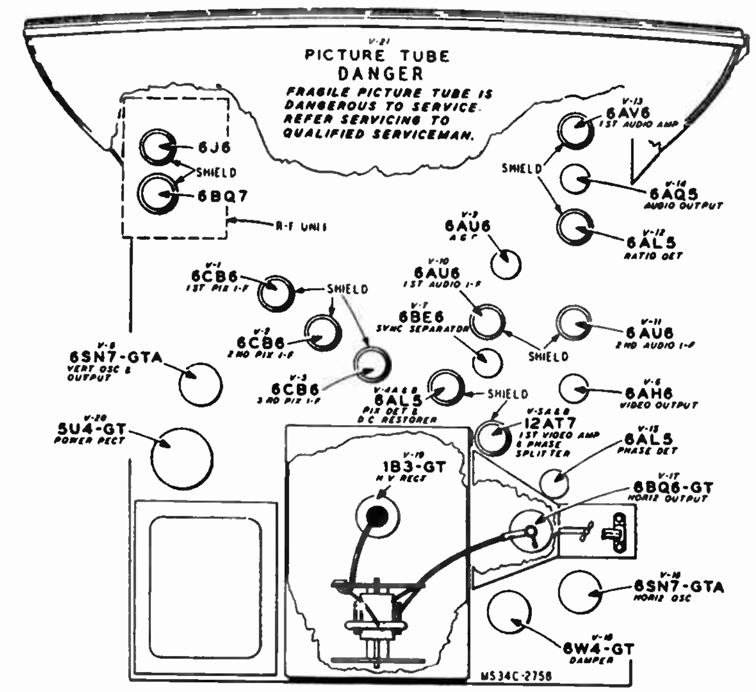


Fig. 1. Tube Layout

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles only
Power Consumption	200 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Range	12 Channel
Antenna Input Imp.	300 Ohms balanced
Intermediate Frequencies	Picture 26.20 MC Sound 21.70 MC
Intercarrier Sound System	4.5 MC
Loud Speaker	8" PM Dynamic
Voice Coil Imp.	3.2 Ohms 400 Cycles

RECEIVER LOCATION -- Advise the owner as to the proper location for the television receiver. The following may be used as a guide.

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.

2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.

3. The receiver should be placed a short distance from the wall to allow adequate ventilation.

4. The receiver should be placed to permit easy access for all operation and comfortable viewing from all angles.

ANTENNA -- This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.

2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.

3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.

4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.

5. To turn off the receiver, turn the OFF-ON VOLUME control counterclockwise until a click is heard.

6. TONE CONTROL -- When this control is turned clockwise, the high notes will predominate and when turned counterclockwise, a deep bass effect will result.

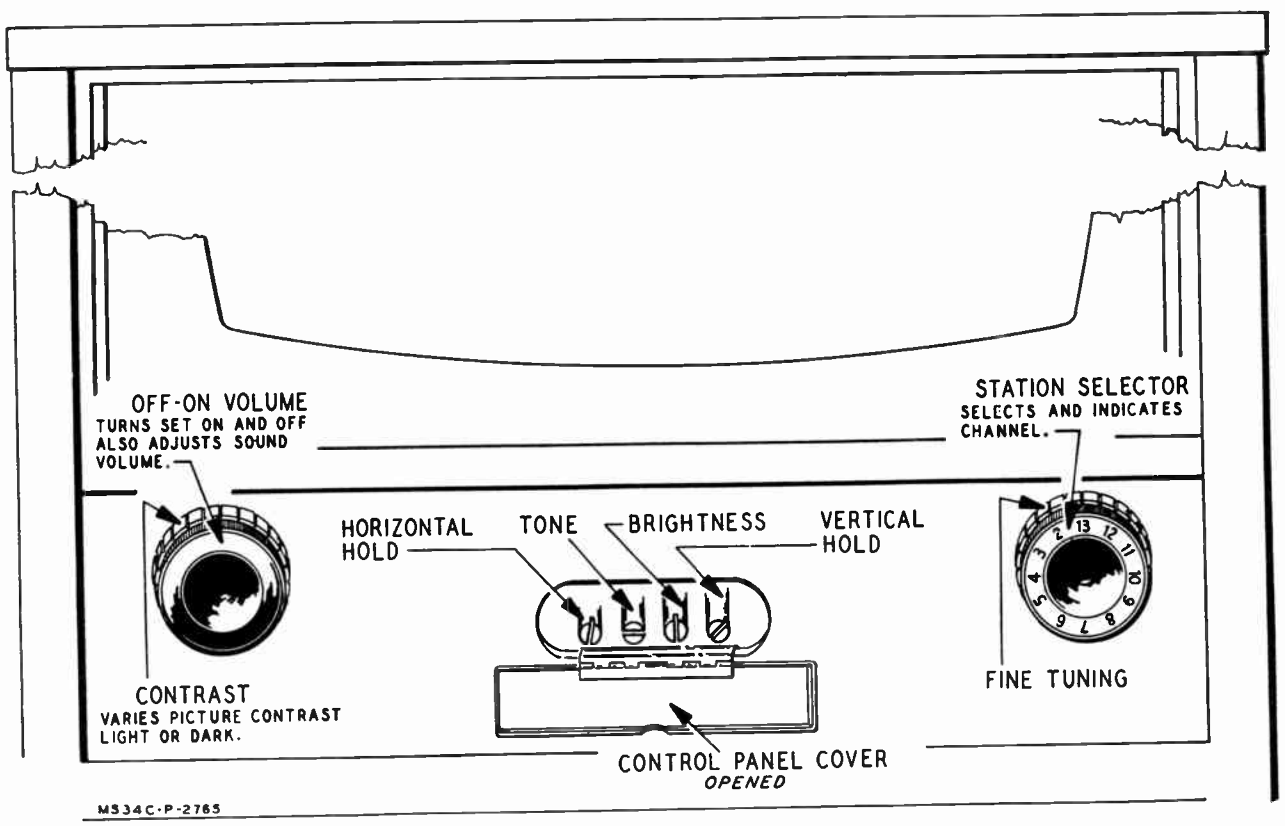


Fig. 2. Front Panel Controls

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are four controls at the front of the chassis which are accessible when the hinged control panel is pulled downward. See illustration. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT -- Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD -- Stops horizontal movement (diagonal bars.)

TONE -- Adjusts for tonal quality bass or treble.

BRIGHTNESS -- Adjusts for desired picture brilliance.

VERTICAL HOLD -- Stops upward or downward picture movement.

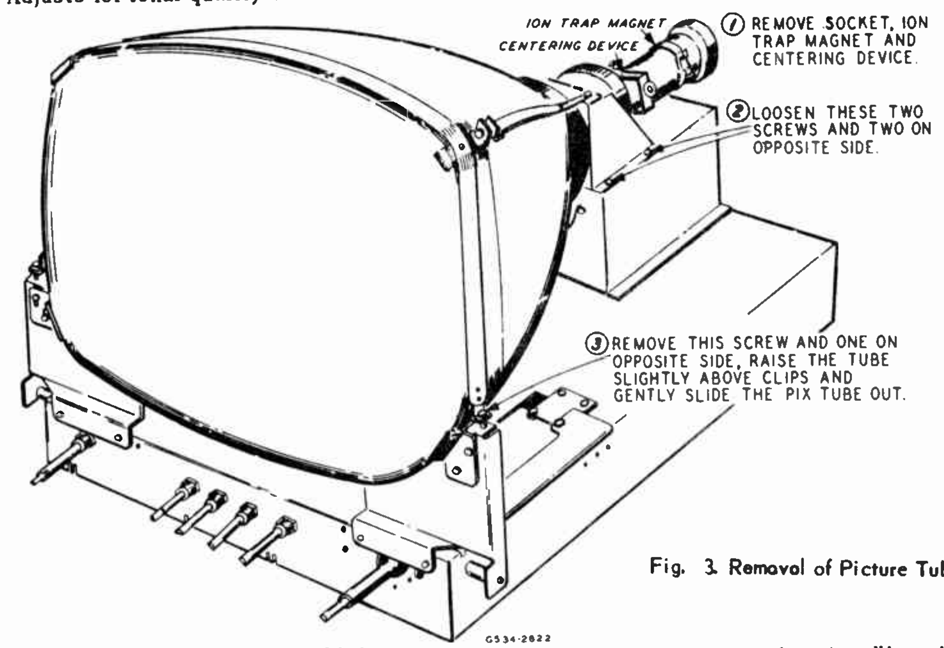


Fig. 3. Removal of Picture Tube

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-94
Brightness	R-25
Tone	R-72
Vertical Hold	R-51

NON-OPERATING CONTROLS

REAR OF CHASSIS

Horizontal Centering	Centering Device
Vertical Centering	Centering Device
Ion Trap Magnet	Wing Nut Adjustment
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Linearity	L-16
Horizontal Drive	R-89
Horizontal Frequency	L-14
Vertical Linearity	R-49
Height	R-54
Sync Stability	R-39
AGC Threshold	R-108

WARNING -- Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT -- To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.

2. Remove the cabinet back.

3. Disconnect the leads from the speaker, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.

4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

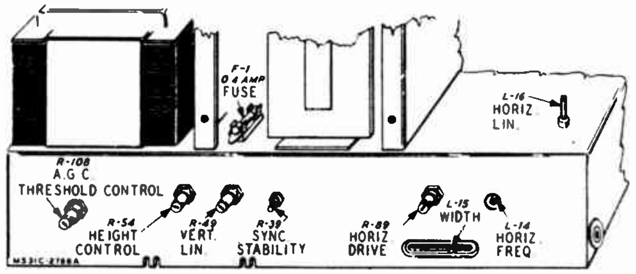


Fig. 4 Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT -- The ion trap magnet should be positioned close to the base of the tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT -- If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT -- If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT -- For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 3. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF AGC THRESHOLD CONTROL -- Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL -- When receiving strong (500 MV or more) signals, set hold controls up that the picture is locked in. Turn the sync control fully counter-clockwise, then, while observing the picture, turn the control slowly clockwise until a minimum amount of bending occurs. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned. When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT -- Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT -- With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT -- Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS -- While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

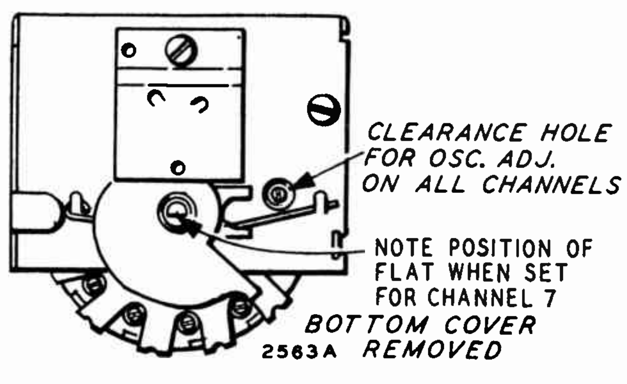


Fig. 5 Tuner Oscillator Adjustments

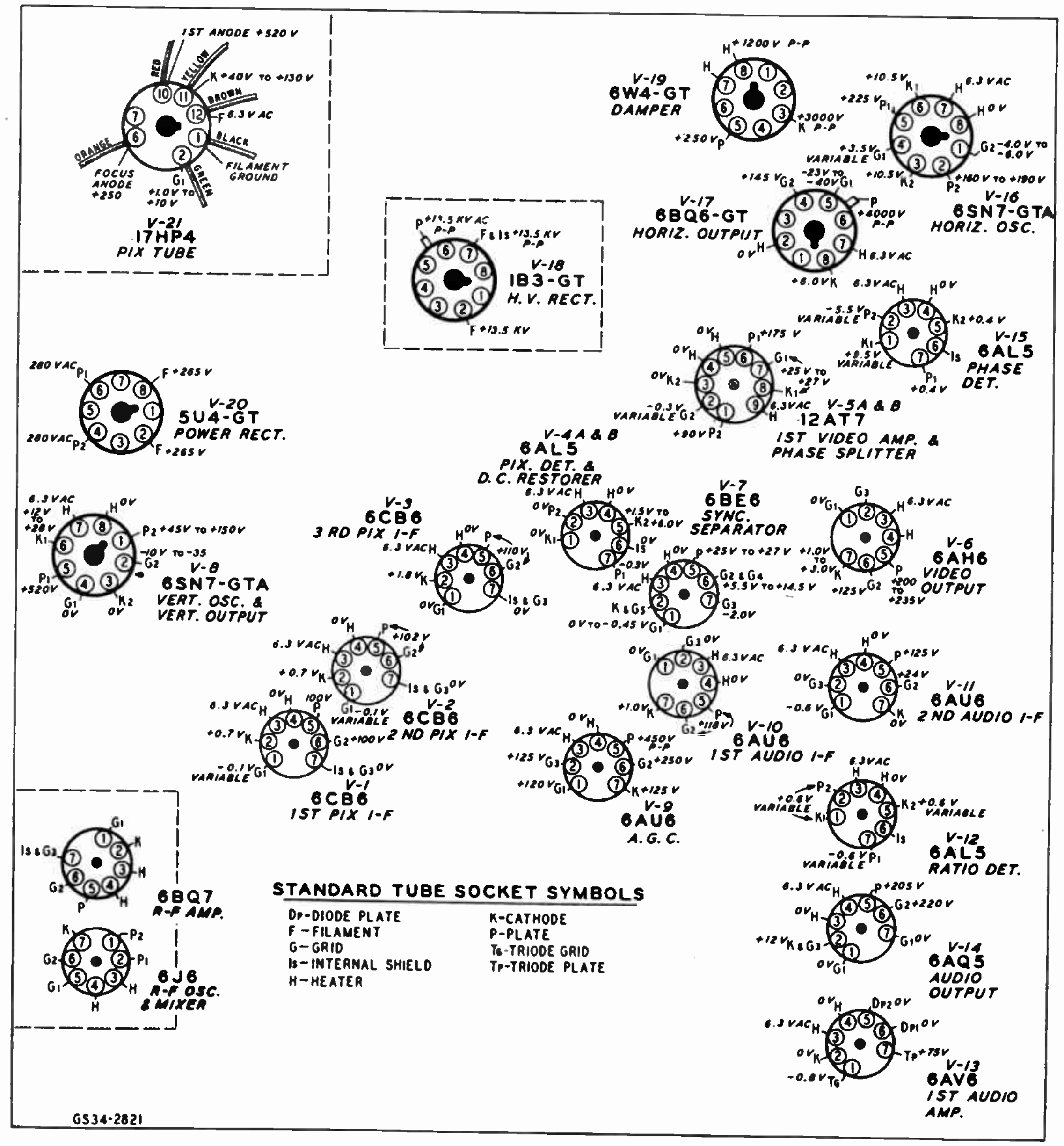


Fig. 6 Bottom Socket Voltages

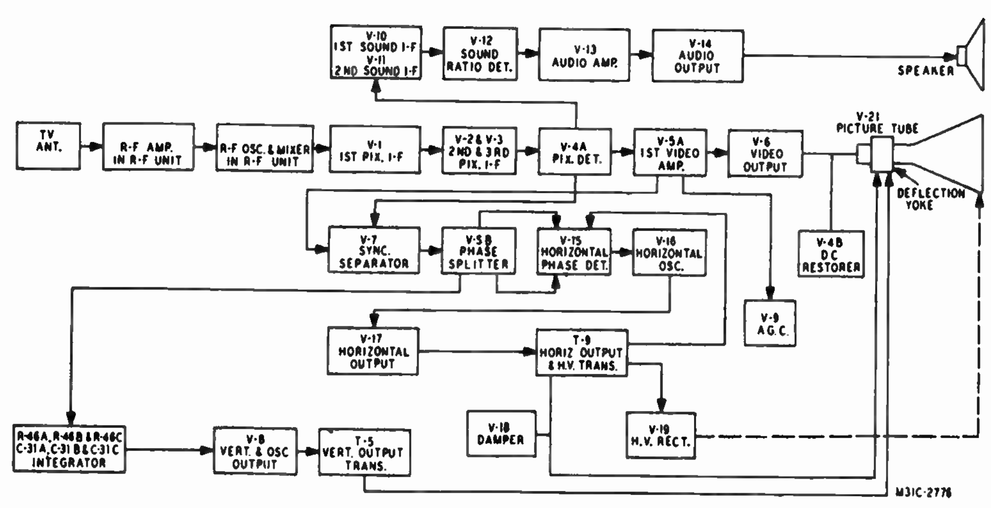


Fig. 7 Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE -- If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.

2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6W4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9.

3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.

4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY -- If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY -- If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A, C-39 or C-70 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY -- If adjustment of Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6W4-GT).
3: Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER -- This condition can be caused by:

1: Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6W4-GT) defective.

SMALL RASTER -- This condition can be caused by:
1: Low +B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6W4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND -- This condition can be caused by:

1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY -- A condition of this nature can be caused by:
1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY -- If this condition is encountered, check:
1: Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY:
1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and 16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION -- If the picture resolution is not up to standard, it may be caused by any of the following:
1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5), or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
1: Check all potentials in video circuits.
2: Check picture tube grid circuit for poor or dirty contact.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:
1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)
1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING
1: Check sync stability control adjustment.
2: Check capacitors C-35B and C-79B.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL -- NO SOUND OR WEAK OR DISTORTED SOUND.
1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

POOR FOCUS
1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:
1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

ALIGNMENT PROCEDURE

TEST EQUIPMENT -- To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR -- meeting the following requirements:
(a) Frequency ranges:
    18 to 30 mc, 10 mc sweep width
    40 to 90 mc, 10 mc sweep width
    170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE -- preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR -- To provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
    23.1 mc first picture I-F coil.
    24.1 mc third picture I-F coil.
    25.9 mc second picture I-F coil.
    21.7 mc sound trap.
    4.5 mc video trap & sound I-F.
    25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE PIX I-F

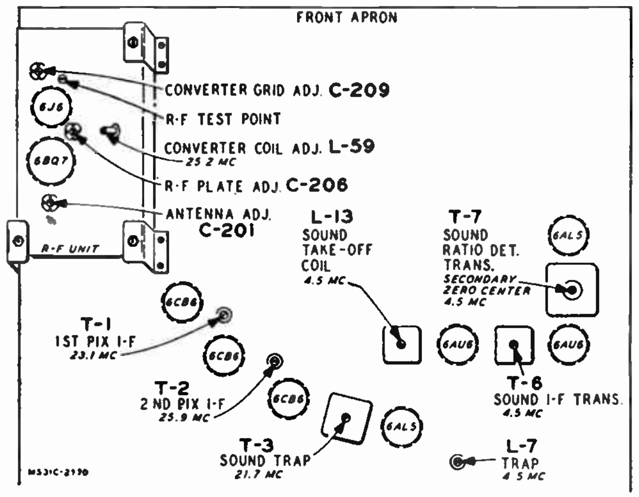


Fig. 8 Top Chassis Video and Audio I-F Adjustments

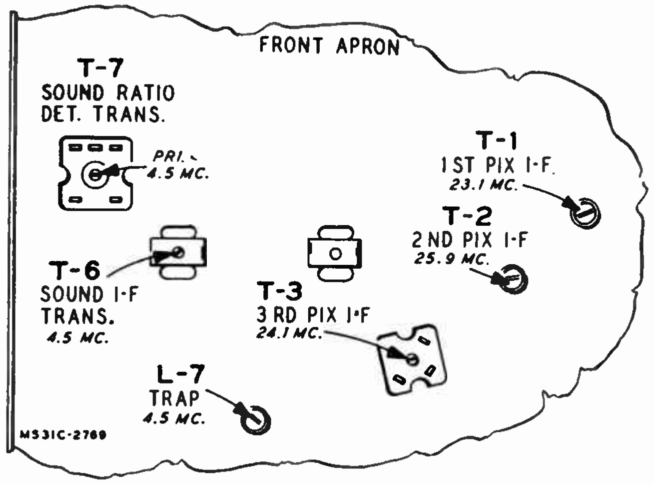


Fig. 9 Bottom Chassis Video and Audio I-F Adjustments

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coils
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.
2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.
3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE -- If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

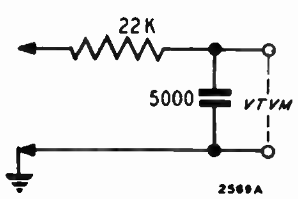


Fig. 10 VTVM Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.9 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.
Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).
Tuner should be switched to dead channel so as not to cause interference.

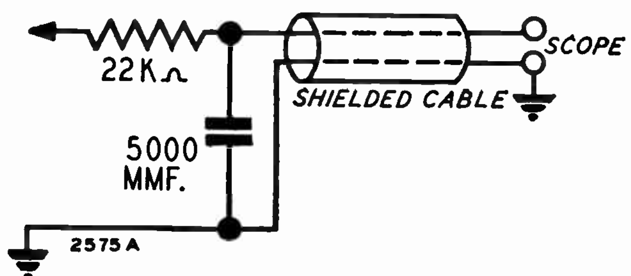


Fig. 11 Oscilloscope Connections

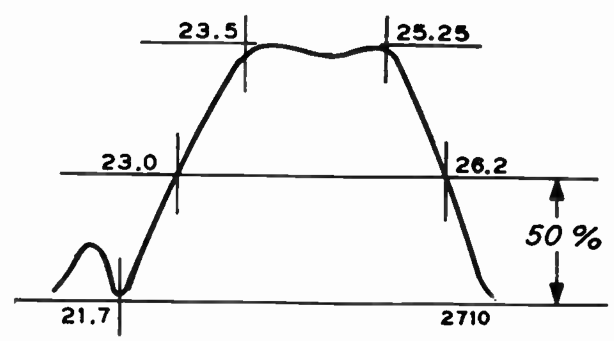


Fig. 12 Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

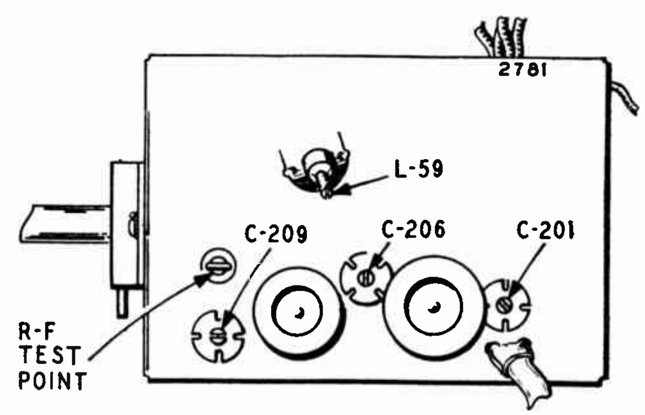


Fig. 13 Top Turner Adjustments

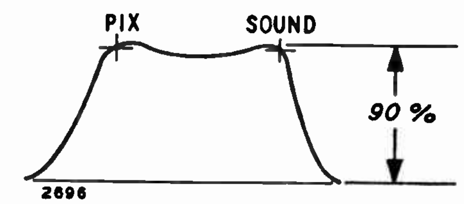


Fig. 14 Pix and Audio Markers

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.

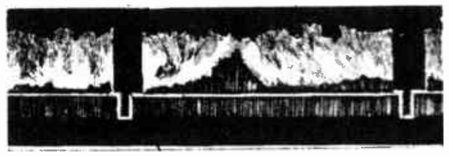
C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

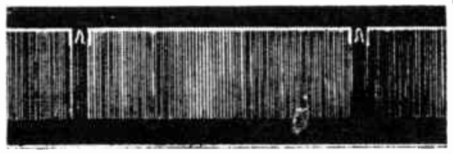
OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.

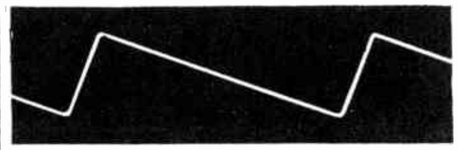


No. 4 -- 6BE6 Sync Sep Grid No. 1 .2V P-P 60 C.P.S.

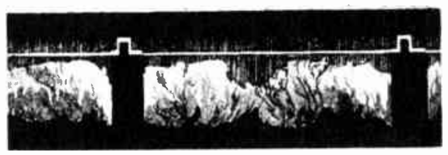


No. 7 -- 12AT7 Phase Splitter Plate

45V P-P 60 C.P.S.

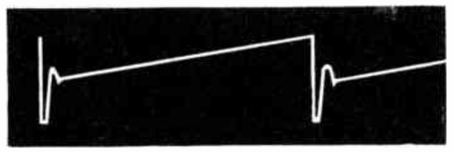


No. 13 -- 6AL5 Phase Det. 18V P-P 15,750 C.P.S.



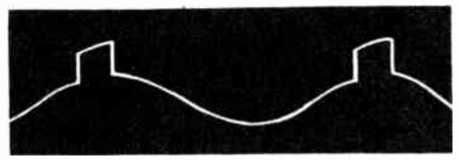
No. 2 -- 12AT7 Plate 35V P-P 60 C.P.S.

No. 2 -- 6AH6 Grid 8V P-P 60 C.P.S.



No. 8 -- 6SN7 -- Vert. Osc. Plate

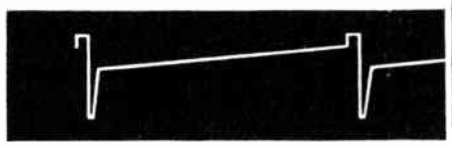
100V P-P 60 C.P.S.



No. 14 -- 6SN7 -- Hor. Osc. Plate

50V P-P 15,750 C.P.S.

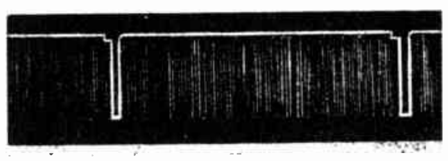
No. 3 -- Pix Tube Grid 20-100V P-P .60 C.P.S.



No. 9 -- 6SN7 Vert. Osc. Grid 130V P-P 60 C.P.S.

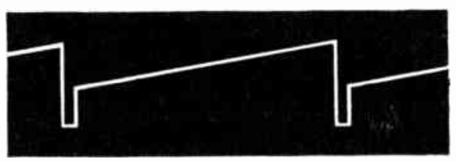
No. 15 -- 6SN7 Hor. Osc. Grid

48V P-P 15,750 C.P.S.



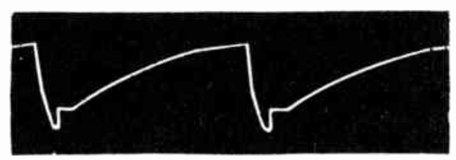
No. 5 -- 6BE6 Sync Sep. Plate

20V P-P 60 C.P.S.



No. 10 -- 6SN7 Vert. Output Grid

120V P-P 60 C.P.S.

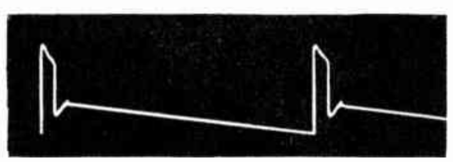


No. 16 -- 6SN7 Hor. Osc. Plate

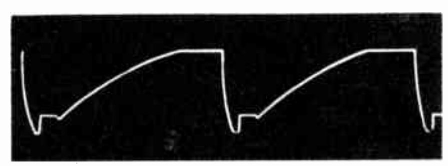
135V P-P 15,750 C.P.S.

No. 6 -- 12AT7 Phase Splitter Cathode

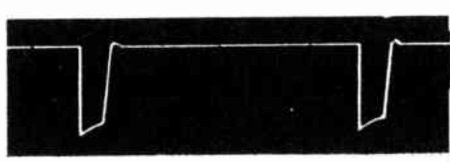
18V P-P 60 C.P.S.



No. 11 -- Vert. Def. Coil 85V P-P 60 C.P.S.

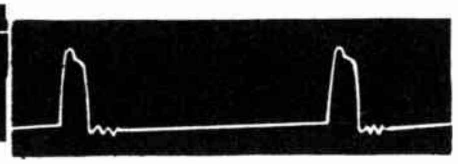


No. 17 -- 6BQ6 Grid 120V P-P 15,750 C.P.S.



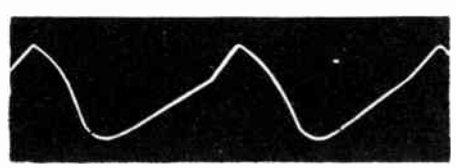
No. 6 -- 12AT7 Phase Splitter Cothode

18V P-P 15,750 C.P.S.



No. 12 -- 6AU6 A.G.C.

450V P-P 15,750 C.P.S.



No. 18 -- 6W4 Damper Plate 120V P-P 15,750 C.P.S.

TUNER ASSEMBLY INFORMATION

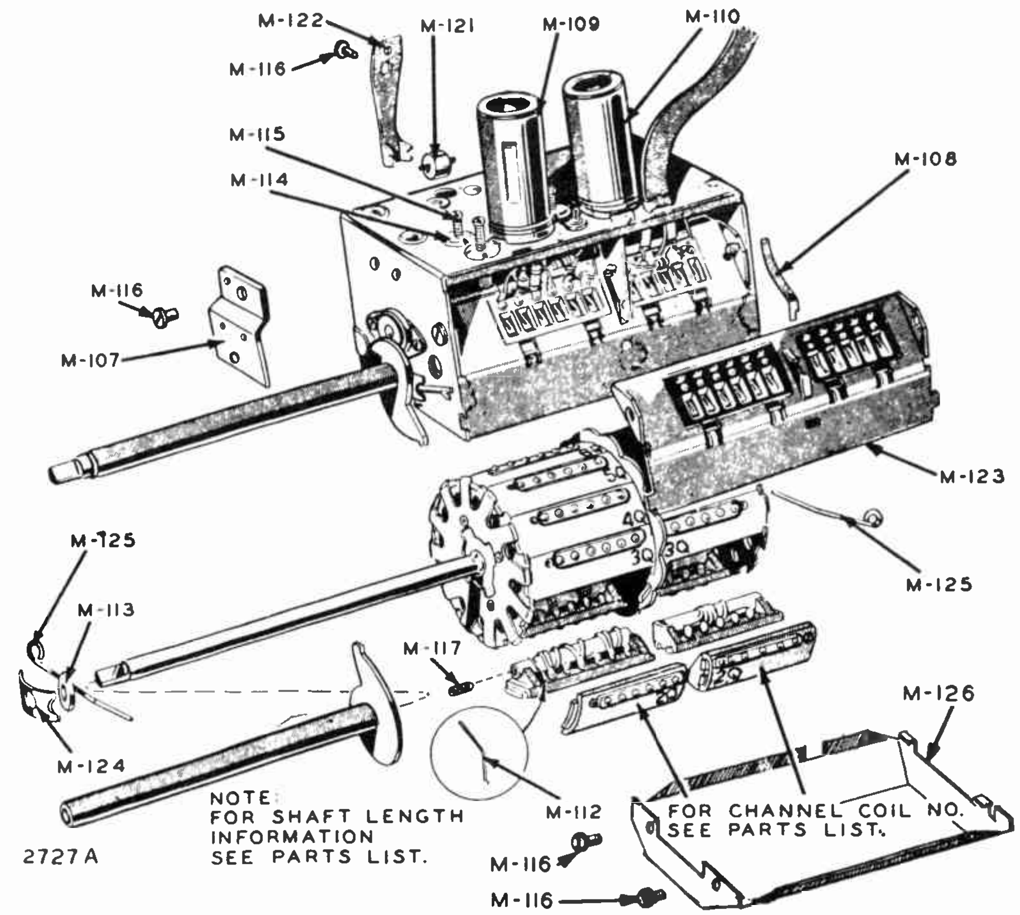


Fig. 15 "Q" Tuner Pictorial

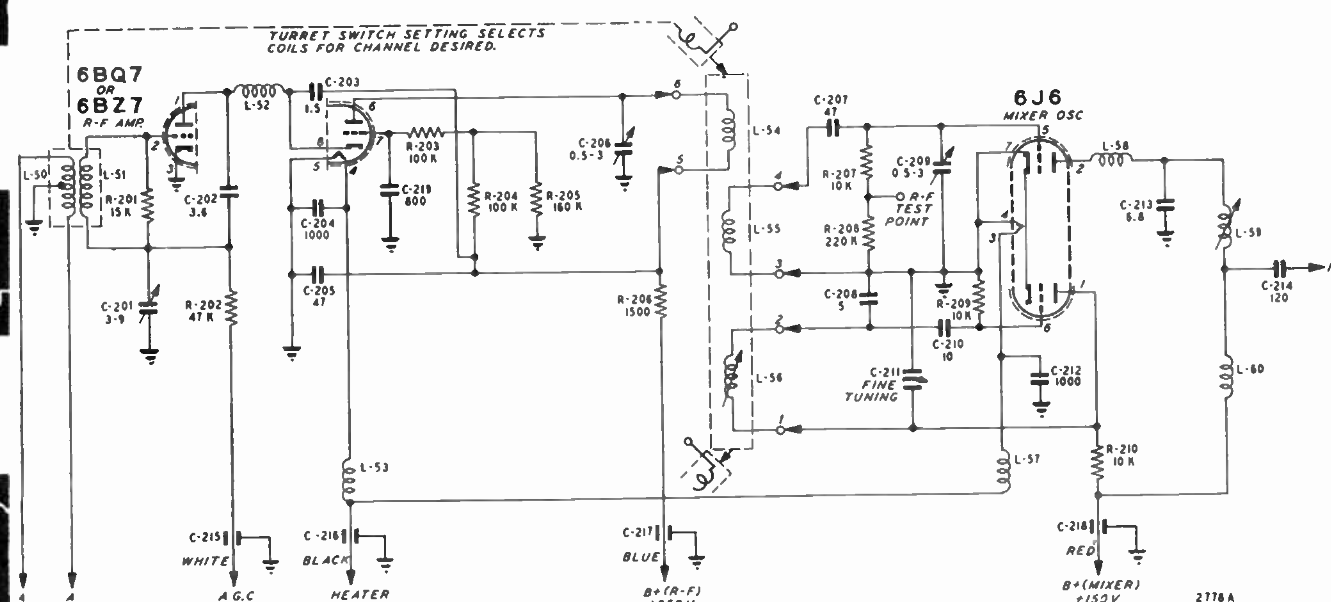
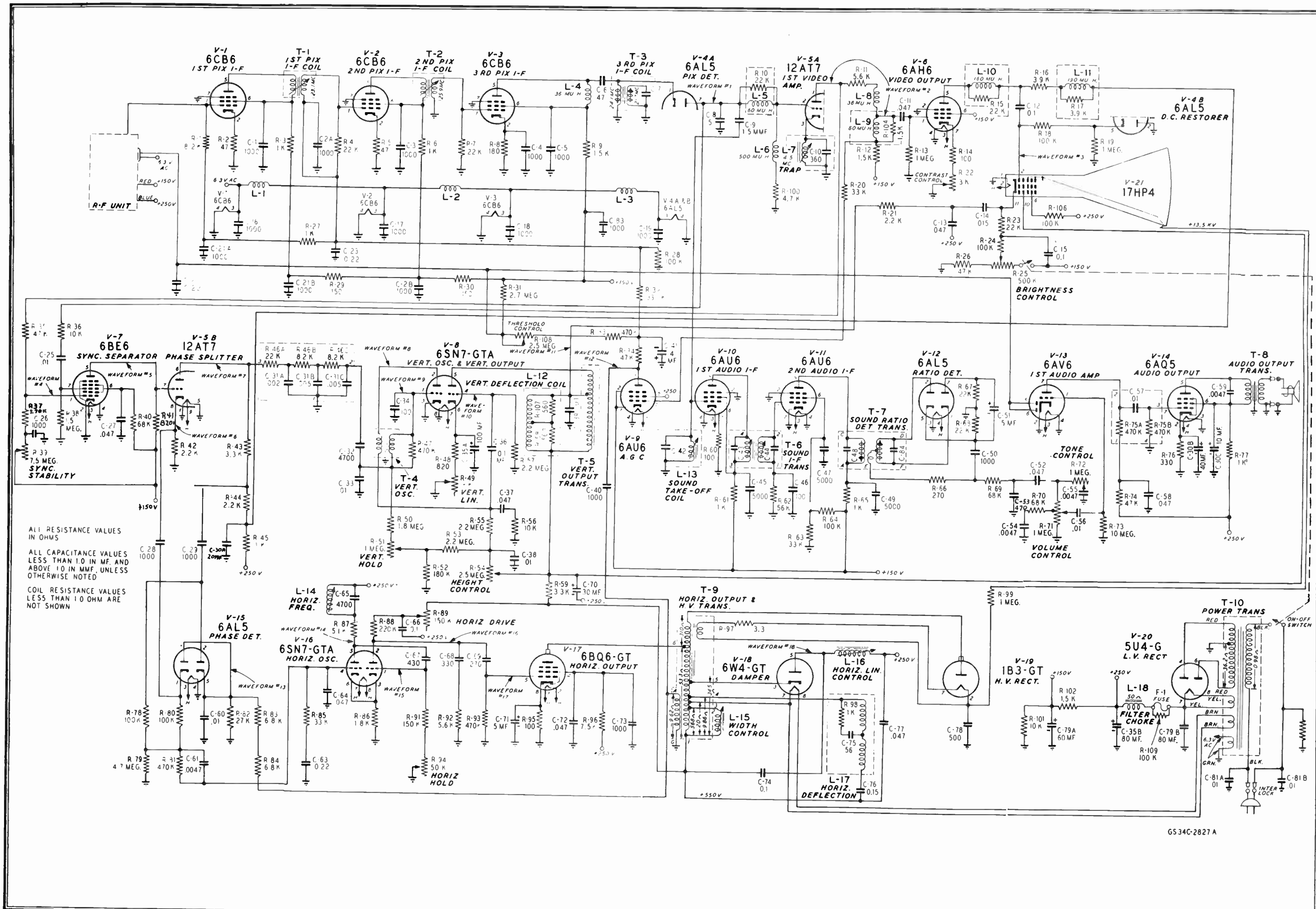


Fig. 16 "Q" Tuner Schematic Diagram



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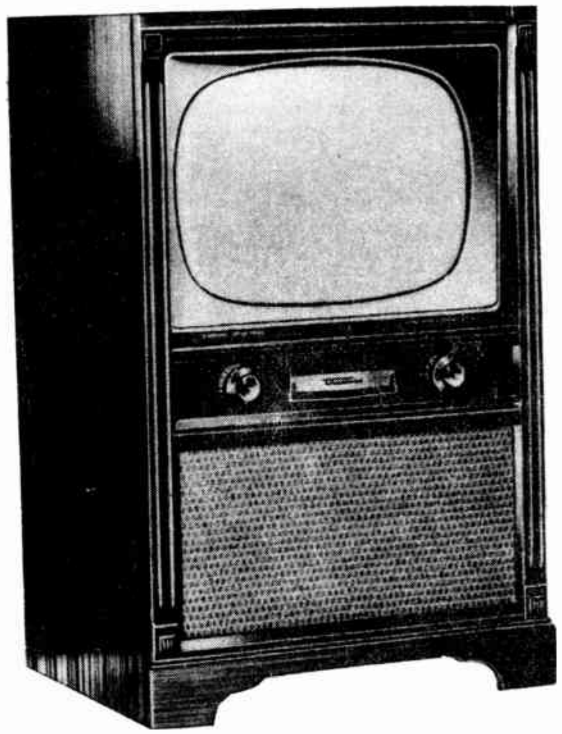
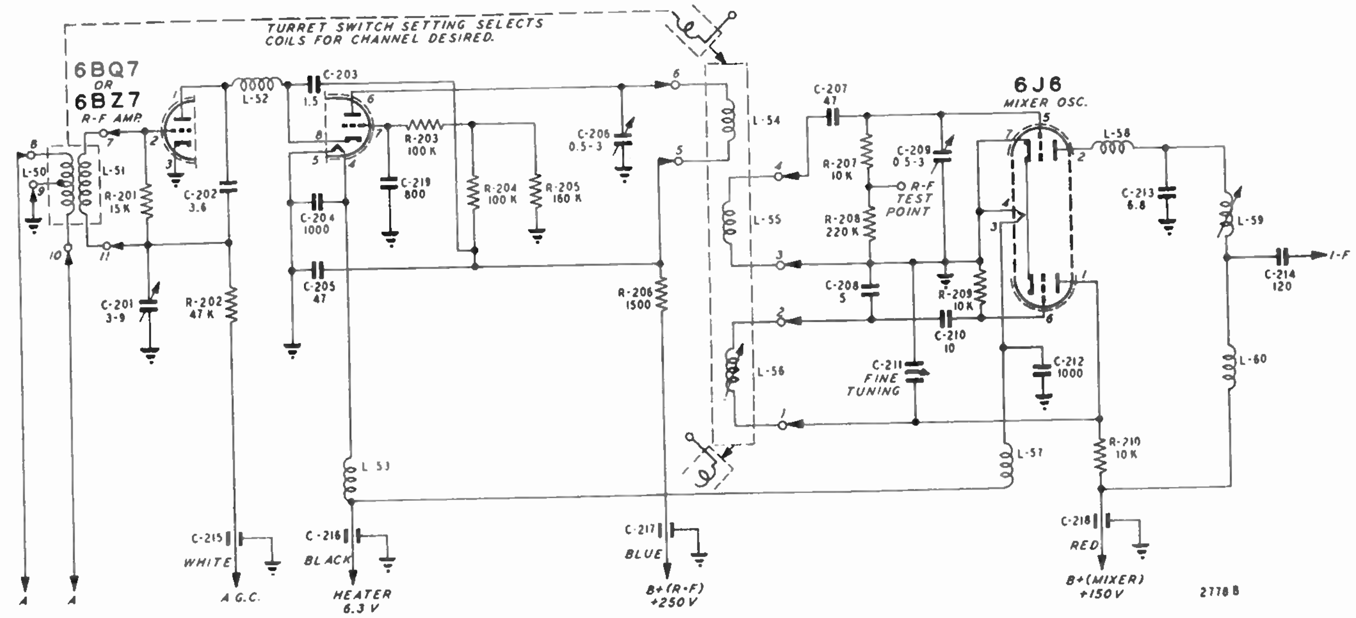
MODEL 2D1235C, D, E, Ch. 217GS34C-266

MODEL 2D1235E

Model 2D1235D is identical to model 2D1235C except for a Gold Tooled Border and Gold Lettered Names on the leatherette covered control panel.





Tuner Schematic Diagram.

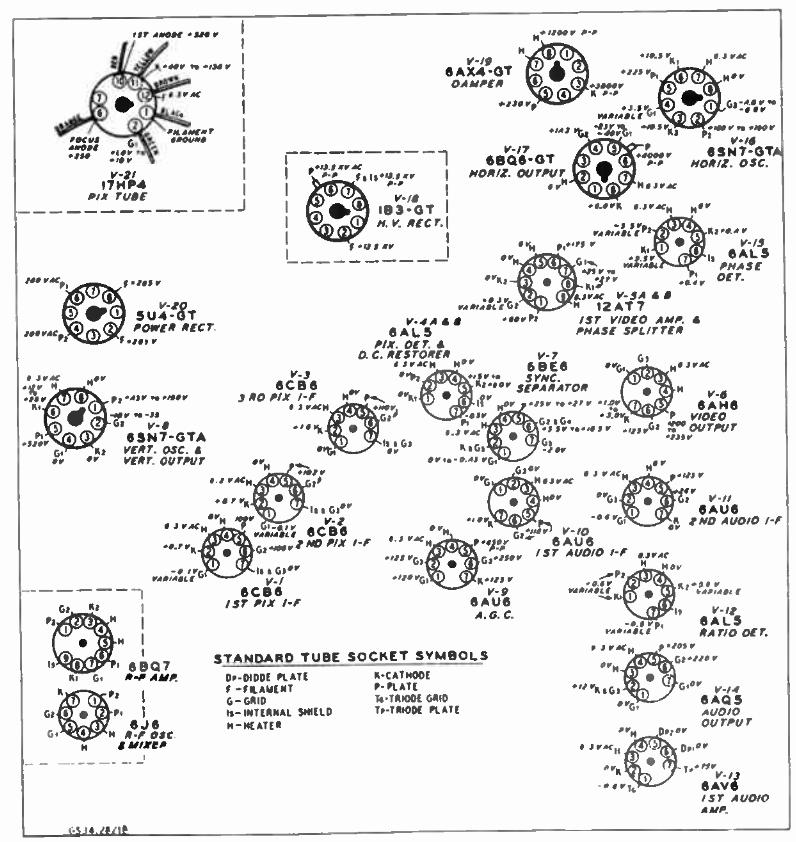
MODEL 2D1235E
(Supplement to 2D1235D)

Model 2D1235E is identical to Model 2D1235D except for a change in the V-18 damper tube from a 6W4-GT to a 6AX4-GT. A schematic diagram with this change incorporated is attached. Illustration on the next page shows the bottom socket voltage chart.

TUBE COMPLEMENT

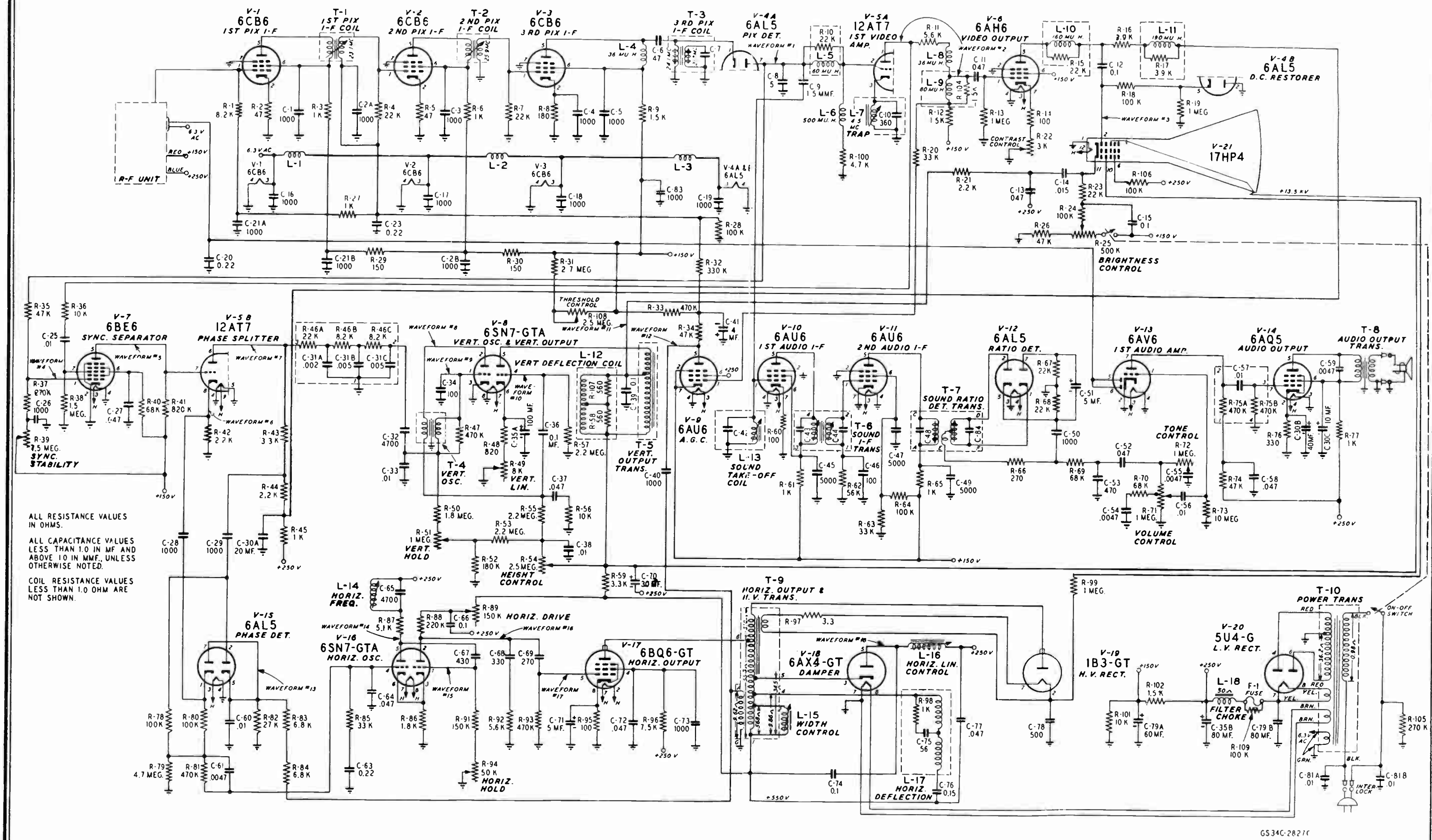
Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A&B	6AL5	Pix Det. and DC Restorer
V-5 A&B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	17HP4	Picture Tube 17" Glass Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.



Bottom Socket Voltages.

MODEL 2D1235E



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TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R-207) R-209) R-210)	12A-040	10 K	±10%	0.5
R-208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204) C-212)	CD8X102Z	1000 mmf	
C-205) C-207)	CD8Q470K	47 mmf	±10%
C-206) C-209)	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215) C-216) C-217) C-218)	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2278-1	Antenna Coil	2-Q
	9A2278-2	Antenna Coil	3-Q
	9A2278-3	Antenna Coil	4-Q
	9A2278-4	Antenna Coil	5-Q
	9A2278-5	Antenna Coil	6-Q
	9A2278-6	Antenna Coil	7-Q
	9A2278-7	Antenna Coil	8-Q
	9A2278-8	Antenna Coil	9-Q
	9A2278-9	Antenna Coil	10-Q
	9A2278-10	Antenna Coil	11-Q
	9A2278-11	Antenna Coil	12-Q
	9A2278-12	Antenna Coil	13-Q
	9A2279-1	Oscillator Coil	2-Q
	9A2279-2	Oscillator Coil	3-Q
	9A2279-3	Oscillator Coil	4-Q
	9A2279-4	Oscillator Coil	5-Q
	9A2279-5	Oscillator Coil	6-Q
	9A2279-6	Oscillator Coil	7-Q
	9A2279-7	Oscillator Coil	8-Q
	9A2279-8	Oscillator Coil	9-Q
	9A2279-9	Oscillator Coil	10-Q
	9A2279-10	Oscillator Coil	11-Q
	9A2279-11	Oscillator Coil	12-Q
	9A2279-12	Oscillator Coil	13-Q
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-239	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding
M-109	16S-006	Shield, Tube (6J6)
M-110	16S-004	Shield, Tube (6BQ7)
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil)
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD)
M-114	10E-401	Nut, Locking Spring (for trimmers)
M-115	9A-410-7	Screw, Trimmer
M-116	9A-629-3	Screw, Bracket Mounting (6/32" by ¼")
M-117	31B-029	Osc. Slug Trimmer
M-121	31B-016	Roller, Detent (3/8" dia. bearing)
M-122	31B-005	Spring, Detent (2-5/16" long)
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½")
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2¾" long, 3/64" dia.)
M-126	31B-103	Shield, Bottom Cover
	31A-066-12	Fine Tuning Shaft (Sharp Tuning) used with 25A1094 Tuner

TELEVISION RECEIVER CAPACITORS

Ref. No.	Part No.	Capacity	Voltage	Type
C-1) C-3) C-4) C-5) C-16) C-17) C-18) C-19) C-26) C-28)	80X1	1000 mmf		Ceramic
C-29) C-40) C-50) C-73) C-83)	80X1	1000 mmf		Ceramic
C-2A) C-2B) C-21A) C-21B)	80X3	1000 mmf		Dual Ceramic
C-6	47X603	47 mmf	500V	Ceramic
C-7	Part of T-3			
C-8	47X562	5 mmf	500V	Ceramic
C-9	47X584	1.5 mmf		Composition.
C-10	47X568	360 mmf	500V	Molded Mica.
C-11) C-27) C-58) C-72) C-77)	RCP10M4473M	.047 mf	400V	Tubular
C-12) C-66) C-74)	RCP10M4104M	.1 mf	400V	Tubular
C-13) C-37)	RCP10M6473M	.047 mf	600V	Tubular
C-14	RCP10M6153M	.015 mf	600V	Tubular
C-15	RCP10M2104M	.1 mf	200V	Tubular
C-20) C-23) C-63)	RCP10M2224M	.22 mf	200V	Tubular
C-25) C-33) C-56) C-60)	RCP10M4103M	.01 mf	400V	Tubular
C-30A)	45X399	20 mf	300V	Dry Electrolytic
C-30B)		40 mf	50V	
C-30C)		10 mf	300V	
C-31A) C-31B) C-31C)	Part of 76X7 (See Miscellaneous)			
C-32) C-65)	47X543	4700 mmf	500V	Molded Mica.
C-34) C-46)	47X604	100 mmf	500V	Ceramic
C-35A) C-35B)	45X395	100 mf / 80 mf	50V / 300V	Dry Electrolytic
C-36) C-39)	RCP10M6104M	.1 mf	600V	Tubular
C-38	RCP10M6103M	.01 mf	600V	Tubular
C-41	45X361	4 mf	100V	Dry Electrolytic
C-42	Part of L-13			
C-43) C-44)	Part of T-6			
C-45) C-47) C-49)	47X507	5000 mmf		Ceramic
C-48) C-84)	Part of T-7			
C-51) C-71)	45X378	5 mf	25V	Dry Electrolytic
C-52) C-64)	RCP10M2473M	.047 mf	200V	Tubular
C-53) C-54)	47X525	470 mmf	500V	Molded Mica.
C-55) C-61)	RCP10M4472M	.0047 mf	400V	Tubular
C-57	Part of 76X5 (See Miscellaneous)			
C-59	RCP10M6472M	.0047 mf	600V	Tubular
C-67	RCM20B431K	430 mmf	500V	Molded Mica.

CAPACITORS (Continued)

C-68	47X570	330 mmf	500V	Molded Mica.
C-69	RCM20A271K	270 mmf	500V	Molded Mica.
C-70	45X393	30 mf	400V	Dry Electrolytic
C-75	47X598	56 mmf	1500V	Ceramic ....
C-76	RCP10M4154M	.15 mf	400V	Tubular ....
C-78	47X560	500 mmf	20KV	Ceramic ....
C-79A) C-79B)	45X397	60 mf 80 mf	300V 300V	Dry Electrolytic
C-81A) C-81B)	76X8	.01 mf		Dual Ceramic

RESISTORS

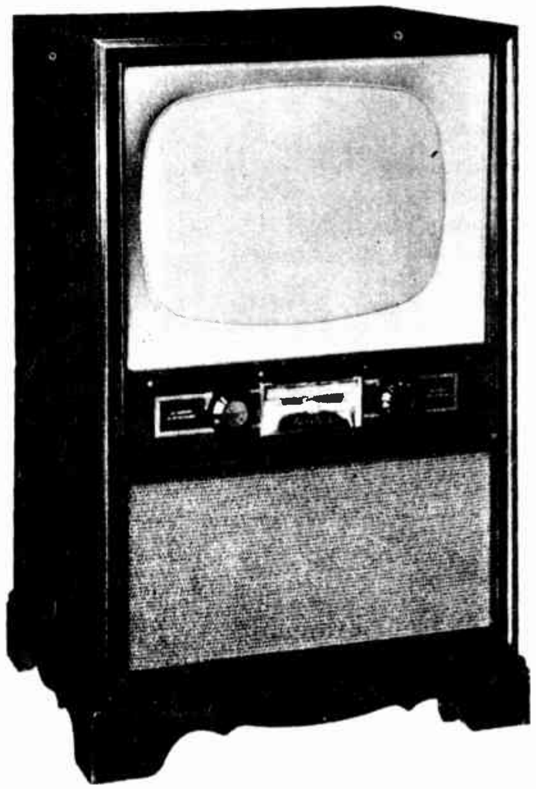
		Ohms	Watts	
R-1	B83822	8.2 K	0.5	Carbon ....
R-2) R-5)	B83470	47	0.5	Carbon ....
R-3) R-6) R-27) R-61) R-65)	B85102	1 K	0.5	Carbon ....
R-4) R-7)	B83223	22 K	0.5	Carbon ....
R-8	B84181	180	0.5	Carbon ....
R-9) R-12)	B84152	1.5 K	0.5	Carbon ....
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon ....
R-13) R-19)	B84105	1.0 Meg.	0.5	Carbon ....
R-14) R-60)	B84101	100	0.5	Carbon ....
R-15	Part of L-10			
R-16	C84392	3.9 K	1.0	Carbon ....
R-17	Part of L-11			
R-18) R-24) R-106)	B85104	100 K	0.5	Carbon ....
R-20) R-63) R-85)	B84333	33 K	0.5	Carbon ....
R-21	B84222	2.2 K	0.5	Carbon ....
R-22) R-71)	78X13	3 K 1.0 meg.		Contrast and Volume Control ......
R-23) R-67) R-68)	B84223	22 K	0.5	Carbon ....
R-25	40X290	500 K		Brightness Control ..
R-26) R-74)	B85473	47 K	0.5	Carbon ....
R-28) R-64) R-78) R-80)	B84104	100 K	0.5	Carbon ....
R-29) R-30)	B85151	150	0.5	Carbon ....
R-31	B84275	2.7 meg.	0.5	Carbon ....
R-32	B83334	330 K	0.5	Carbon ....
R-33) R-93)	B84474	470 K	0.5	Carbon ....
R-34) R-35)	B84473	47 K	0.5	Carbon ....
R-36) R-56)	B84103	10 K	0.5	Carbon ....
R-37	B84274	270 K	0.5	Carbon ....
R-38	B84155	1.5 meg.	0.5	Carbon ....
R-39	40X363	7.5 meg.		Sync. Stability Control ....
R-40) R-69) R-70)	B84683	68 K	0.5	Carbon ....
R-41	B84824	820 K	0.5	Carbon ....
R-42) R-44)	B83222	2.2 K	0.5	Carbon ....
R-43	B84332	3.3 K	0.5	Carbon ....
R-45	C84102	1 K	1.0	Carbon ....
R-46A) R-46B) R-46C)	Part of 76X7 (See Miscellaneous)			
R-47) R-81)	B85474	470 K	0.5	Carbon ....
R-48	B84821	820	0.5	Carbon ....
R-49	40X362	8 K		Vertical Lin. Control
R-50	B84185	1.8 meg.	0.5	Carbon ....
R-51	40X291	1.0 meg.		Vertical Hold Control ....
R-52	B84184	180 K	0.5	Carbon ....
R-53) R-55) R-57)	B84225	2.2 meg.	0.5	Carbon ....
R-54	40X364	2.5 meg.		Height Control ......
R-58) R-107)	B84561	560	0.5	Carbon ....
R-59	C84332	3.3 K	1.0	Carbon ....
R-62	B84563	56 K	0.5	Carbon ....
R-66	B84271	270	0.5	Carbon ....
R-72	40X291	1.0 meg.		Tone Control ....
R-73	B85106	10.0 meg.	0.5	Carbon ....
R-75A) R-75B)	Part of 76X5 (See Miscellaneous)			
R-76	C84331	330	1.0	Carbon ....
R-77	D84102	1 K	2.0	Carbon ....
R-79	B85475	4.7 meg.	0.5	Carbon ....
R-82	B83273	27 K	0.5	Carbon ....
R-83) R-84)	C84682	6.8 K	1.0	Carbon ....
R-86	B83182	1.8 K	0.5	Carbon ....
R-87	C83512	5.1 K	1.0	Carbon ....
R-88	B83224	220 K	0.5	Carbon ....
R-89	40X331	150 K		Horizontal Drive Control ....
R-91	B83154	150 K	0.5	Carbon ....
R-92	B84562	5.6 K	0.5	Carbon ....
R-94	40X292	50 K		Horizontal Hold Control ....
R-95	D84101	100	2.0	Carbon ....
R-96	D84752	7.5 K	2.0	Carbon ....
R-97	43X238	3.3	0.5	Wirewound ......
R-98	B85102	1 K	0.5	Carbon ....
R-99	C85105	1.0 meg.	1.0	Carbon ....
R-100	B83472	4.7 K	0.5	Carbon ....
R-101	43X272	10 K	5.0	Wirewound ......
R-102	43X275	1.5 K	15.0	Wirewound ......
R-104	Part of L-9			
R-105	B85274	270 K	0.5	Carbon ....
R-108	40X364	2.5 meg.		AGC Threshold Control
R-109	D85104	100 K	2.0	Carbon

TRANSFORMERS AND COILS

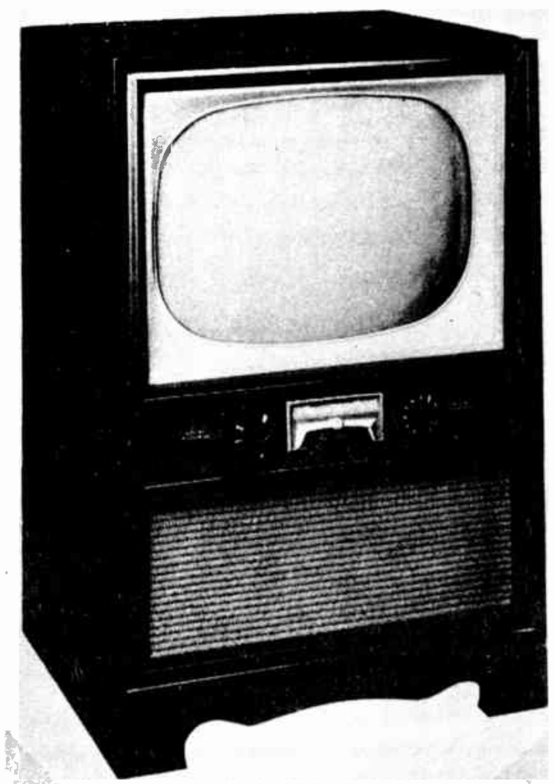
L-1) L-2) L-3)	9A2033	R-F Heater Choke ....
L-4) L-8)	9A1979	Peaking Coil 36 mh ....
L-5	36A10	Peaking Coil 60 mh ....
L-6	36A11	Peaking Coil 500 mh ....
L-7	9A2074	4.5 MC Trap ....
L-9	36A16	Peaking Coil 80 mh ....
L-10	36A12	Peaking Coil 160 mh ....
L-11	36A13	Peaking Coil 190 mh ....
L-12) L-17)		Part of Deflection Yoke Assembly
L-13	9A2168	Sound Take-Off Coil ....
L-14	9A2096	Horizontal Frequency Coil ......
L-15	9A2183	Width Control ....
L-16	9A2262	Horizontal Linearity Control ...
L-18	52X90	Filter Choke ....
T-1) T-2)	9A2230	1st and 2nd Pix I-F Coils ......
T-3	9A2226	3rd Pix I-F Coil ....
T-4	54X8	Vertical Osc. Transformer ......
T-5	51X156	Vertical Output Transformer ....
T-6	9A2170	Sound I-F Transformer ....
T-7	9A2269	Sound Ratio Det. Transformer ...
T-8	51X150	Audio Output Transformer ....
T-9	53X329	Horizontal Output Transformer ..
T-10	53X325	Power Transformer ....

MISCELLANEOUS

12A477	8" PM Speaker ....
2A426	Centering Device ....
76X5	Multiple Resistor Capacitor Assembly.
76X7	Multiple Resistor Capacitor Assembly.
9A2261	Deflection Yoke Assembly ....
2A421	Ion Trap ....
25A1094	R.F. Tuner Assembly ....
4A408	Antenna Terminal Strip ....
3A427	Tube Socket (Miniature) ....
3A458	Tube Socket (6CB6) (6AU6) (6AL5) ....
3A463	Tube Socket (12AT7) ....
3A303	Tube Socket (5U4) ....
3A464	Tube Socket (6BQ6-6SN7) ....
3A445	Tube Socket (6W4) ....
3A466	Tube Socket (1B3) ....
3A470	Tube Socket (Octal) ....
13X816	Pix Tube Socket ....
7A234	Pilot Light Socket Assembly ....
7A32	No. 51 Pilot Bulb ....
32X403	Tube Shield (3A458 Socket) ....
32X405	Tube Shield (3A463 Socket) ....
6A320	Anode Connector and Lead Assembly ...
25X1827	Bracket, Pix Tube Rear Mtg. ....
8X227	Collar, Pix Tube Rear Mtg. ....
S-25X69	Tube Mtg. Strap Assembly ....
S-25X70	Tube Mtg. Strap Assembly (Top) .....
20X1652	Wing Screw ....
6X67	Rubber Grommet ....
25X1844	Bracket, Tube Front Support (R.H.) ..
25X1845	Bracket, Tube Front Support (L.H.) ..
16X146	Fuse Holder ....
16X147-3	Fuse 4/10 Amp. 125-250 V. ....
28X599	Spring ....
S-4X20	Escutcheon (Control Panel) ....
17X159	Pix Crystal ....
4X1150	Pix Mask ....
14X485	Ventilator Grille ....
S-14X63	Cabinet Back Assembly ....
10A820-1	Knob (Fine Tuning) ....
10A821-1	Knob (Contrast) ....
10A812	Knob (Channel Selector) ....
10A779	Knob (Volume) ....
4X1157	Pix Tube Mtg. Ring ....
20X1683	Wing Screw ....
S-34X19	Tube Cover & Power Cord Assembly ....



MODEL NO. 2D1331C



Model No. 2D1331D is identical to 2D1331C except for slight change in cabinet design and change in Pix Mast part number from 4X1230-2 to 4X1230-1

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	210 Watts
Power Output	2.4 Watts (Max) 1.8 Watts (10% Distortion)
Tuning Range ..... VHF	Channels 2 thru 13
UHF	Channels 14 thru 83
Antenna Input Imp.	300 Ohms Balanced
Intermediate Frequencies	Picture 26.20 MC Sound 21.70 MC
I-F (UHF Position Only)	Picture 121.75 Sound 126.25
Intercarrier Sound System	4.5 MC
Loud Speaker	See Parts List
Voice Coil Imp.	3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
VHF Tuner	6J6	R-F Osc. and Mixer
VHF Tuner	6BQ7*	R-F Amplifier
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20) V-22)	5U4-G	Low Voltage Rectifiers
V-21	21YP4	Picture Tube 21" Glass Rectangular (Electrostatic)

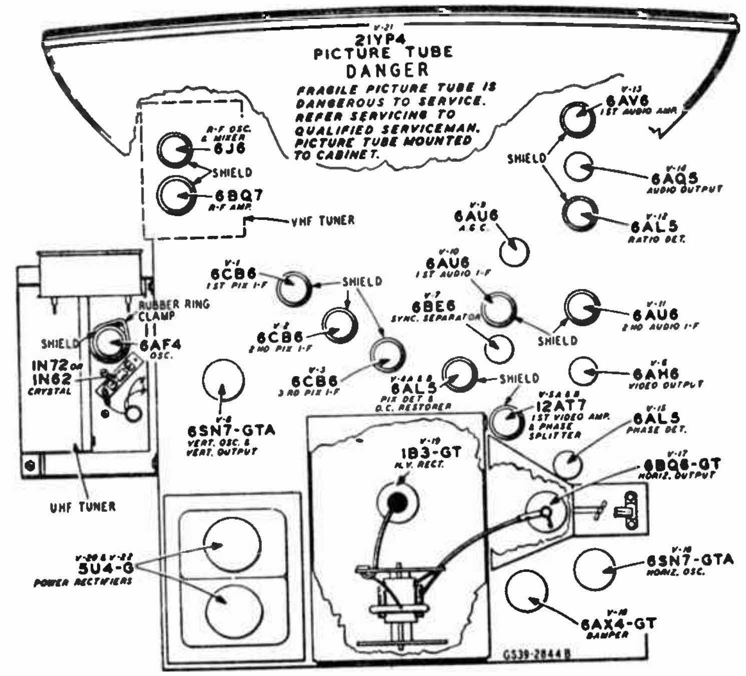


Fig. 1 -- Tube Layout.

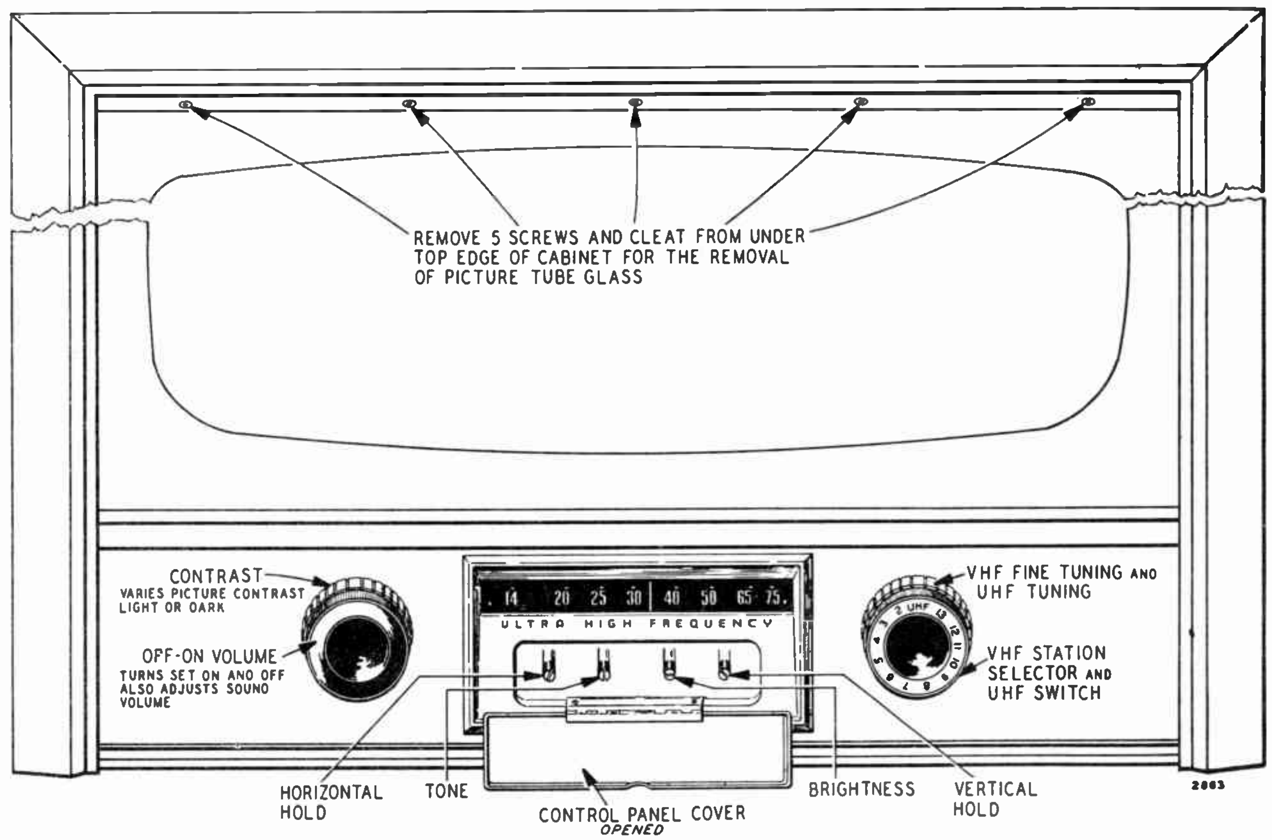


Fig. 2 -- Front Panel Controls

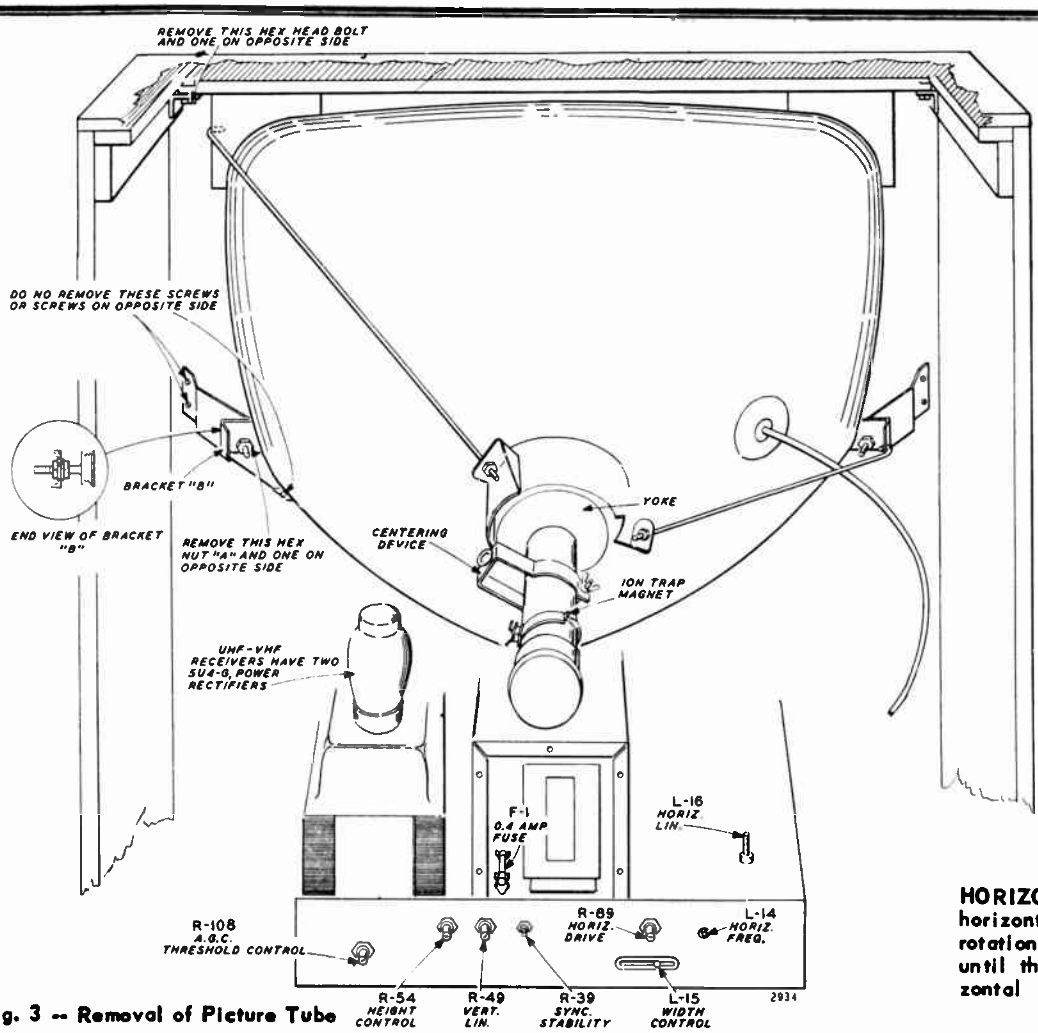


Fig. 3 -- Removal of Picture Tube

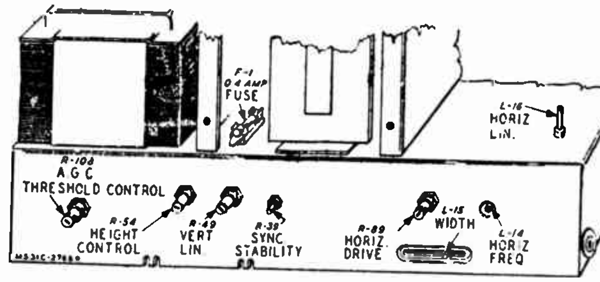


Fig. 4 -- Adjustments Rear of Chassis

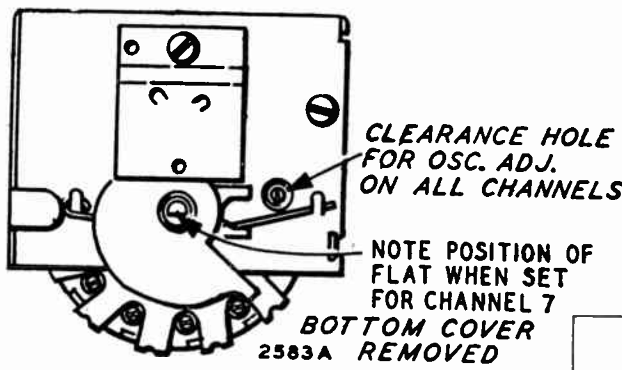


Fig. 5 -- Tuner Oscillator Adjustments

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is pre-set at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PRODEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

CAUTION -- These adjustments are only intended for VHF Channels. For information regarding UHF alignment, see paragraph "Tuner Alignment" on page 11.

HORIZONTAL FREQUENCY ADJUSTMENT

-- With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

ADJUSTMENT OF SYNC STABILITY CONTROL

-- When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control fully counter-clockwise, then, while observing the picture, turn the control slowly clockwise until a minimum amount of bending occurs. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT

-- Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT

-- Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS

-- While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

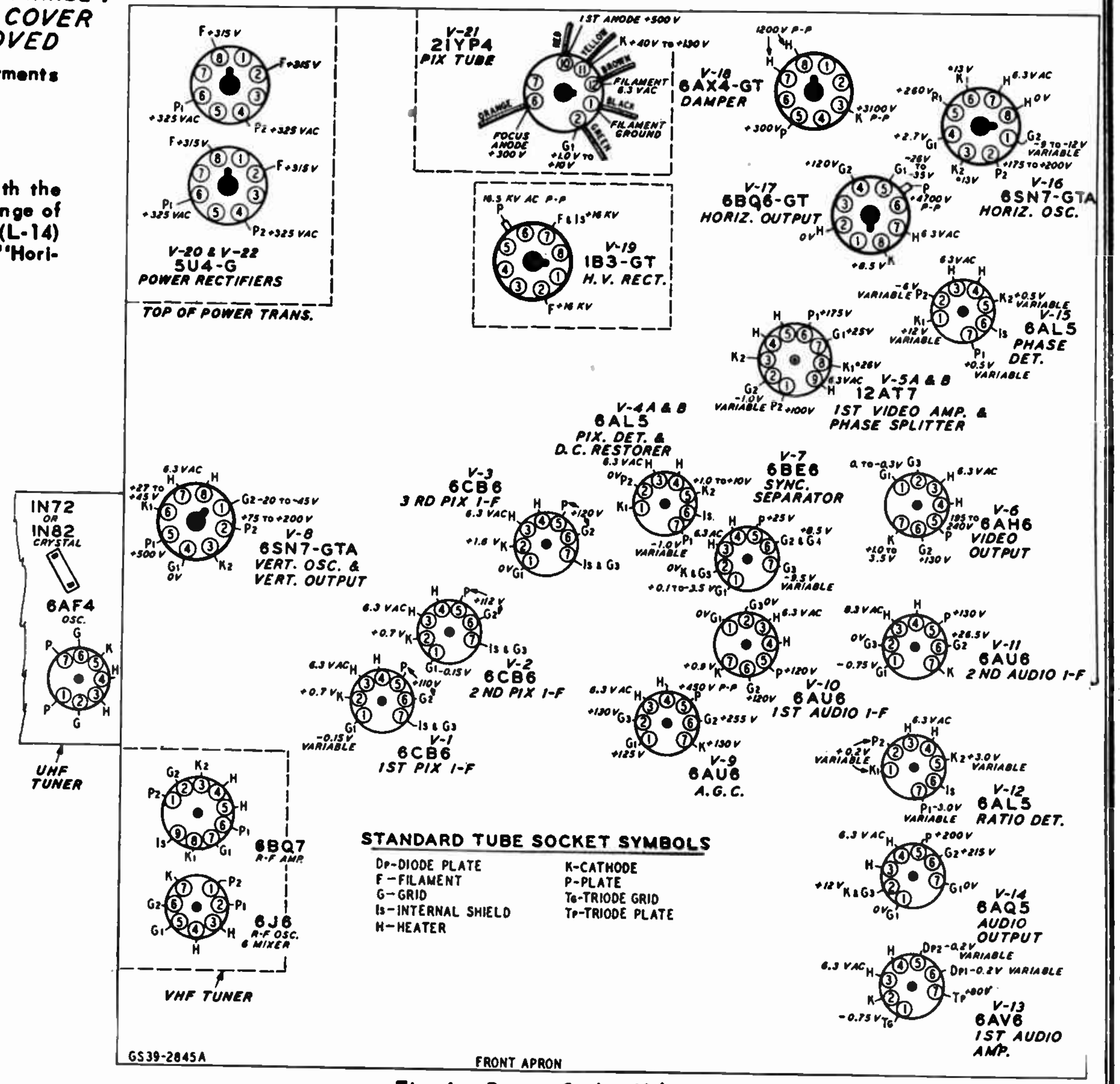


Fig. 6 -- Bottom Socket Voltages

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE -- If raster cannot be obtained check below for the possible causes.
1. Ion trap magnet adjustment is incorrect.
2. No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check.
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9
3. No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4. Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY -- If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:
1. Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2. Vertical oscillator transformer (T-4) defective.
3. Vertical output transformer (T-5) open or shorted.
4. Yoke vertical coils open or shorted.
5. Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY -- If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.
1. Check variable resistors R-49 and R-54.
2. Vertical output transformer (T-5) defective.
3. Capacitors C-35A, C-39 or C-70 defective.
4. V-8 defective, check voltages.
5. Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6. Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7. Capacitor C-36 defective.
8. Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY -- If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:
1. Check or replace horizontal output tube V-17.
2. Check or replace damper tube V-18 (6AX4-GT).
3. Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4. Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1. Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER -- This condition can be caused by:
1. Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2. V-18 (6AX4-GT) defective.

SMALL RASTER -- This condition can be caused by:
1. Low +B or line voltage. Check V-20 & V-22 (5U4G).
2. Insufficient output from horizontal output tube V-17. Replace tube.
3. Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4. Incorrect setting of horizontal drive control R-89.
5. V-18 (6AX4-GT) defective.
6. Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND -- This condition can be caused by:
1. No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2. Bad contact to picture tube grid (lead to socket broken).
3. AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY -- A condition of this nature can be caused by:
1. Defective sync separator V-7 or phase splitter V-5B.
2. If tubes are O. K. check voltages, and associated circuits.
3. AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY -- If this condition is encountered, check:
1. Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2. Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY
1. V-15 or V-16 defective.
2. Improper setting of (L-14) horizontal frequency control.
3. Check setting of horizontal drive control and horizontal linearity control.
4. Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION -- If the picture resolution is not up to standard, it may be caused by any of the following:
1. Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2. Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3. Defective picture tube.
4. Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5. Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
   1. Check all potentials in video circuits.
   2. Check picture tube grid circuit for poor or dirty contact.
   3. Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:
1. A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2. This trouble can also originate at the transmitter. Check reception from another station.
3. Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc.)
1. Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2. Check sound I-F alignment.

BENDING OR S-ING
1. Check sync stability control adjustment.
2. Check capacitors C-35B and C-79B.
3. V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4. Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5. Check AGC threshold control.

SERVICE SUGGESTIONS -- (continued)

PICTURE NORMAL -- NO SOUND OR WEAK OR DISTORTED SOUND
1. Check sound I-F alignment.
2. Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND
This condition can be caused by,
1. Defective pix I-F Amplifier tubes V-1, V-2 or V-3.
2. Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3. Defective R-F Amplifier or oscillator mixer tubes in the tuner.
4. UHF-VHF switch defective.

POOR FOCUS
1. Improper setting of Ion Trap magnet.
2. Defective picture tube or picture tube socket.

PICTURE JITTER:
1. If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2. Vertical instability may be due to loose connections or noise received with the signal.
3. Horizontal instability may be due to unstable transmitted sync.
4. Check receiver AGC system for proper operation.
5. Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6. Check for improper setting of sync stability control.
7. Picture tube grid lead not held in position by support spring, ie; close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8. Check AGC threshold control.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND (UHF Position)
If this condition is encountered:
1. Check to see whether or not a UHF station is operating in the vicinity.
2. The 6AF4 oscillator tube or the 1N72 (or 1N82) crystal may be defective.
3. Pre-selector in UHF tuner defective.
4. Low pass filter defective.
5. The UHF position antenna and oscillator strips in the VHF tuner defective.
6. Defective Switch on UHF tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT -- To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
- 18 to 30 mc, 10 mc sweep width
- 40 to 90 mc, 10 mc sweep width
- 120 to 130 mc, 10 mc sweep width
- 170 to 225 mc, 10 mc sweep width
- 470 to 890 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
- 23.1 mc first picture I-F coil.
- 24.1 mc third picture I-F coil.
- 25.9 mc second picture I-F coil.
- 21.7 mc sound trap.
- 4.5 mc video trap & sound I-F.
- 25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE
PIX I-F

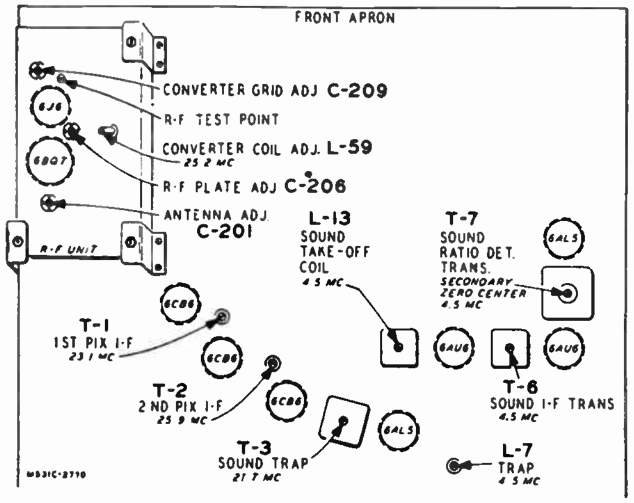


Fig. 8 -- Top Chassis Video and Audio I-F Adjustments

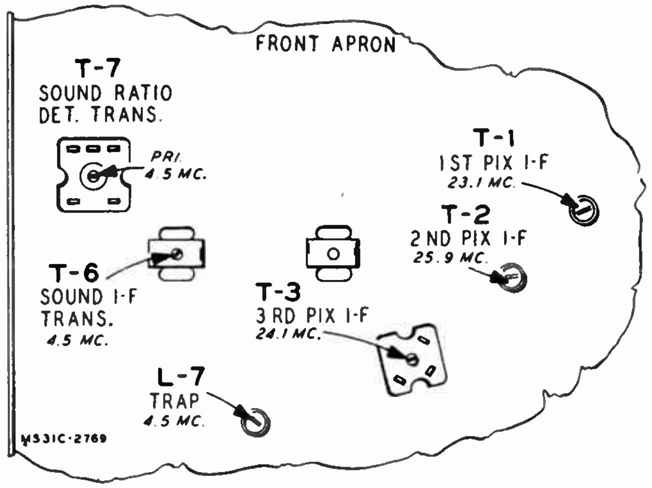


Fig. 9 -- Bottom Chassis Video and Audio I-F Adjustments

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6ALS. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

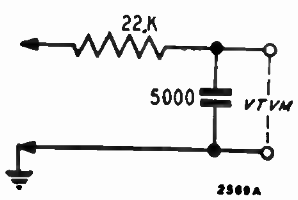


Fig. 10 -- VTVM Connections

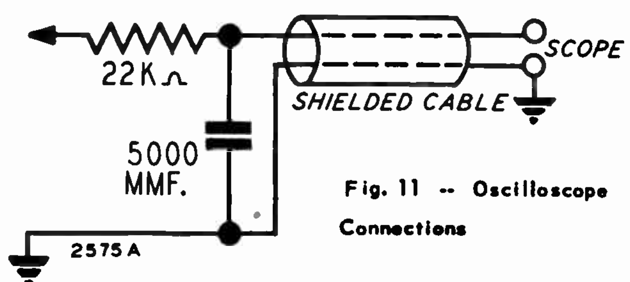


Fig. 11 -- Oscilloscope Connections

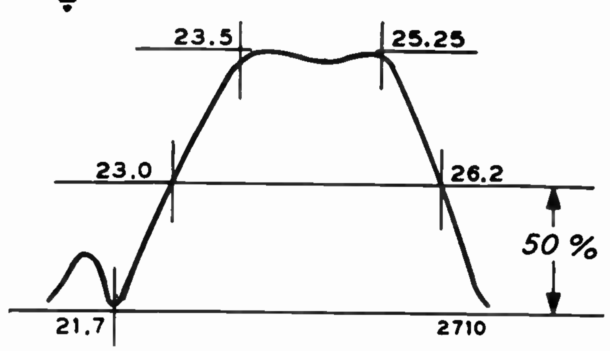


Fig. 12 -- Overall Response Curve

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is not advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

ALIGNMENT PROCEDURE (Continued)

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6ALS) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1. With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.
2. With VTVM connected to pin 7 of V-12 (6ALS) adjust the ratio detector primary (T-7 Bottom) for maximum.
3. With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE-- If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

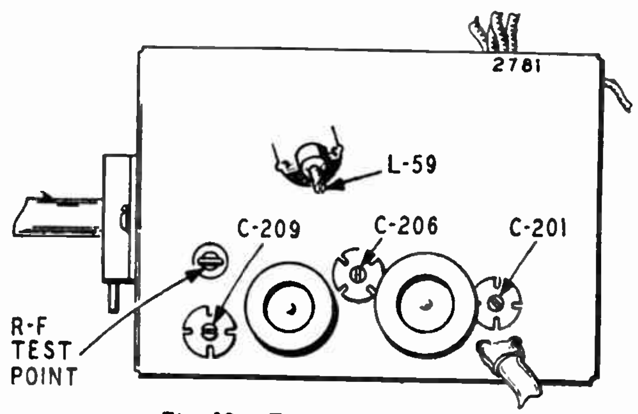


Fig. 13 -- Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

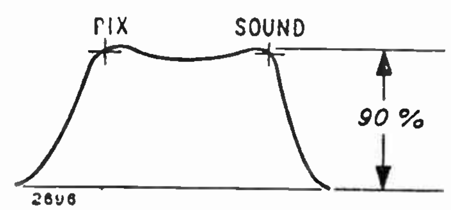


Fig. 14 -- Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. To adjust oscillator on UHF position, feed the sweep generator with center frequency of 124 MC and markers at 121.75 and 126.25 into the input of the low pass filter (output of UHF tuner). Adjust oscillator slug in the VHF tuner so that the 121.75 pix carrier marker is at 50% and that 126.25 marker is in the sound notch. If a sweep generator is not available, a single frequency generator set to 126.25 MC and VTVM may be used. Connect VTVM to the pix detector load resistor R-100. Feed generator into the low pass filter. Adjust oscillator slug in the VHF tuner so that the 126.25 marker is in the sound notch of the I-F curve.
5. If the 6AF4 oscillator tube in the UHF tuner is replaced, it may be necessary to adjust the oscillator trimmer C-309 on the UHF tuner located underneath the chassis. (See Figure 15). Adjust this trimmer until the tuner will cover a range of below 470 MC to above 890 MC.

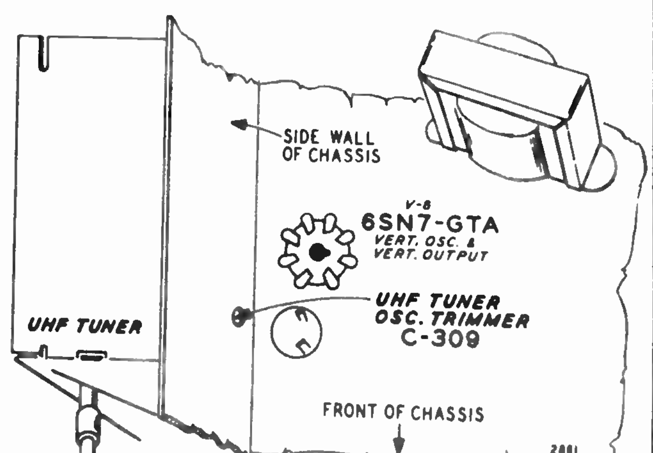


Fig. 15 -- UHF Tuner

DRIVE CORD REPLACEMENT

You will note that there are two cords used for the pointer drive system on this receiver. Part number 10X88 Drive Cord assembly and part number 28X113 Spring are used on the tuning shaft and large pulley, while part number 10X89 Drive Cord and a part number 28X603 Spring are used on the small pulley system and the pointer. Install the cords as shown in the illustration. After completing the installation rotate the fine tuning shaft a few turns to take up the slack in the cord.

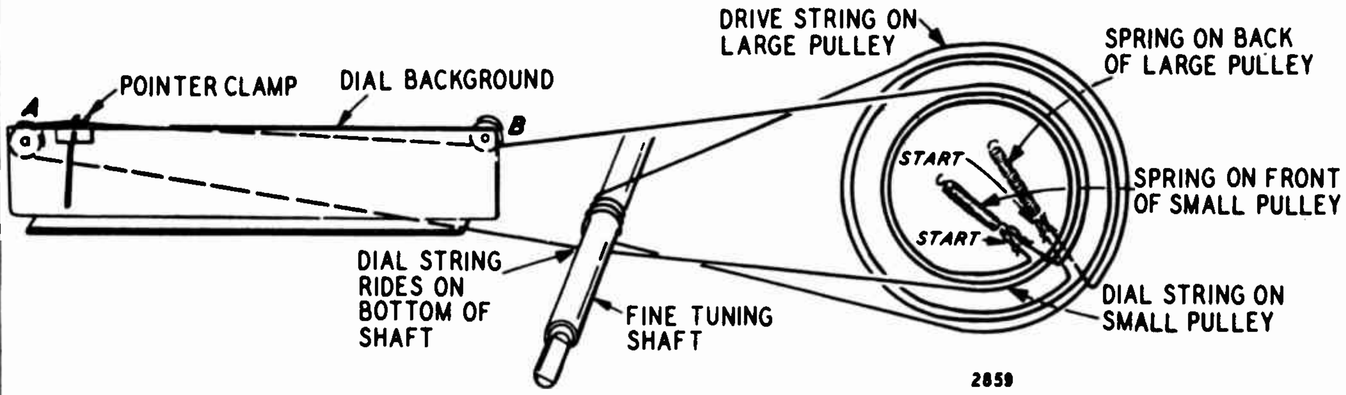


Fig. 16 – Drive Cord Replacement

UHF TUNER INFORMATION

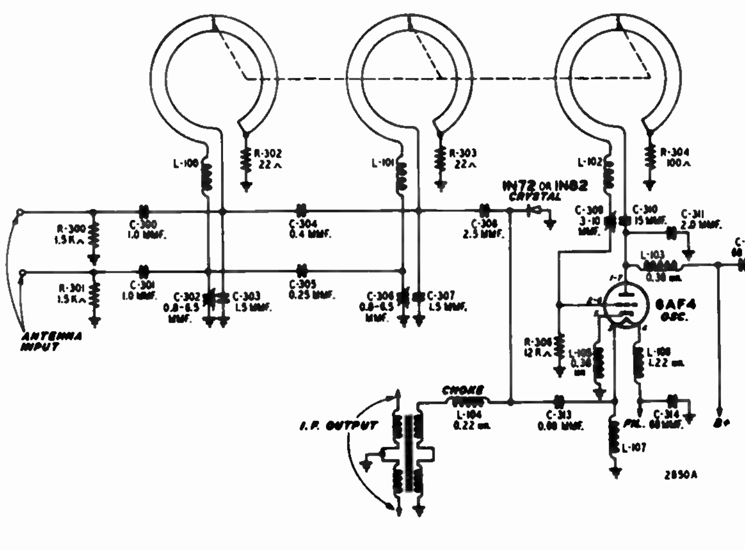


Fig. 17 -- UHF Tuner Schematic

Due to the complexity of the UHF tuner, neither servicing nor aligning is encouraged in the field because replacement of any component within the R-F circuit may disturb the band-pass characteristics of the tuner. However, the 6AF4 tube or the 1N72 (or 1N82) crystal may be replaced in the field if found to be defective. A schematic diagram of this tuner is shown only for the purpose of outlining the circuit used.

If the UHF tuner does not operate satisfactorily after the tube or crystal replacement, disconnect the tuner and return it to the factory for repair.

VHF TUNER ASSEMBLY PARTS LIST

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	± .25 mmf
C-203	CD8C1R5M	1.5 mmf	± 20%
C-204) C-212)	CD8X102Z	1000 mmf	
C-205) C-207)	CD8Q470K	47 mmf	± 10%
C-206) C-209)	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	± 5%
C-210	CD10C100K	10 mmf	± 10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	± .25 mmf
C-214	13D-055	120 mmf	± 10%
C-215) C-216) C-217) C-218)	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	± 10%	0.5
R-202	12A-039	47 K	± 20%	0.5
R-203	12A-094	100 K	± 10%	0.5
R-204	12A-166	100 K	± 5%	0.5
R-205	12A-167	160 K	± 5%	0.5
R-206	12A-183	1500	± 10%	0.5
R-207) R-209) R-210)	12A-040	10 K	± 10%	0.5
R-208	12A-041	220 K	± 20%	0.5

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2297-2	Antenna Coil	2-Q
	9A2297-3	Antenna Coil	3-Q
	9A2297-4	Antenna Coil	4-Q
	9A2297-5	Antenna Coil	5-Q
	9A2297-6	Antenna Coil	6-Q
	9A2297-7	Antenna Coil	7-Q
	9A2297-8	Antenna Coil	8-Q
	9A2297-9	Antenna Coil	9-Q
	9A2297-10	Antenna Coil	10-Q
	9A2297-11	Antenna Coil	11-Q
	9A2297-12	Antenna Coil	12-Q
	9A2297-13	Antenna Coil	13-Q

COILS AND CHOKES (Continued)

Ref. No.	Part No.	Description	Channel and Code No.
	9A2297-91	Antenna Coil	UHF Position
	9A2298-2	Oscillator Coil	2-Q
	9A2298-3	Oscillator Coil	3-Q
	9A2298-4	Oscillator Coil	4-Q
	9A2298-5	Oscillator Coil	5-Q
	9A2298-6	Oscillator Coil	6-Q
	9A2298-7	Oscillator Coil	7-Q
	9A2298-8	Oscillator Coil	8-Q
	9A2298-9	Oscillator Coil	9-Q
	9A2298-10	Oscillator Coil	10-Q
	9A2298-11	Oscillator Coil	11-Q
	9A2298-12	Oscillator Coil	12-Q
	9A2298-13	Oscillator Coil	13-Q
	9A2298-91	Oscillator Coil	UHF Position
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding
M-109	16S-006	Shield, Tube (6J6)
M-110	16S-004	Shield, Tube (6BQ7)
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil)
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD)
M-114	10E-401	Nut, Locking Spring (for trimmers)
M-115	9A-410-7	Screw, Trimmer
M-116	9A-629-3	Screw, Bracket Mounting (6/32" by ¼")
M-117	31B-029	Osc. Slug Trimmer
M-121	31B-016	Roller, Detent (3/8" dia., 3/32" dia. bearing)
M-122	31B-005	Spring, Detent (2-5/16" long)
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½")
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.)
M-126	31B-103	Shield, Bottom Cover
	31B-655-3	Fine Tuning Shaft (Sharp Tuning) used with 25A1104 Tuner

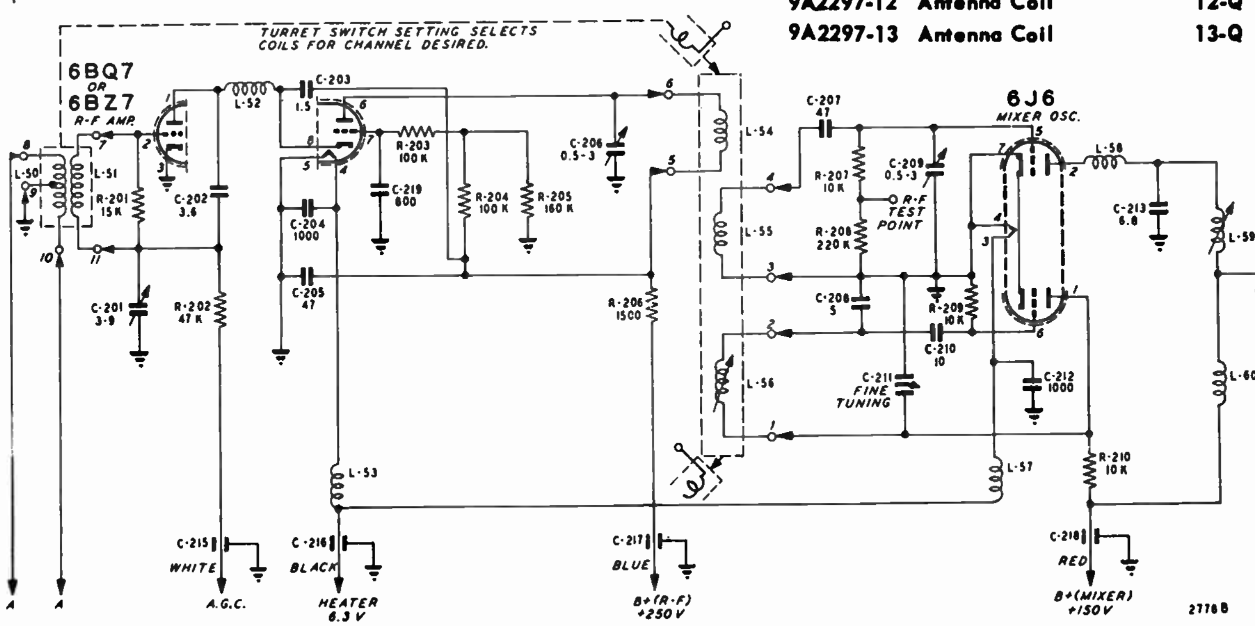
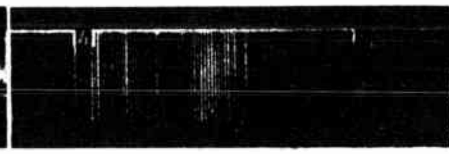


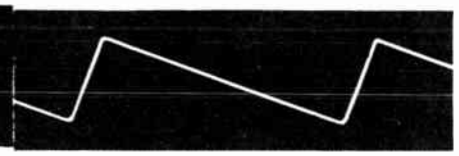
Fig. 19 -- "Q" Tuner Schematic Diagram

OSCILLOSCOPE WAVEFORM PATTERNS

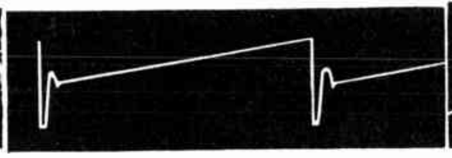
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.

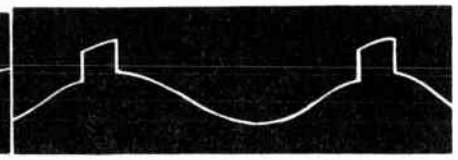

No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.

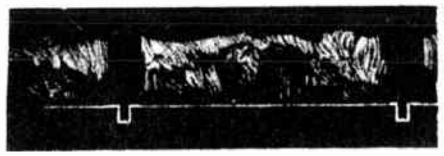

No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.

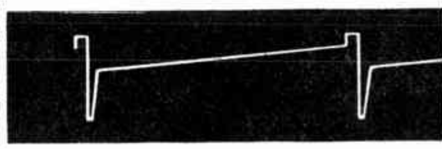

No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.

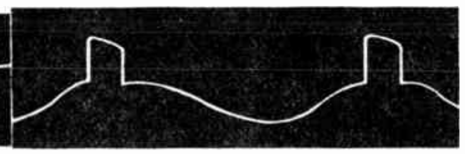

No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.

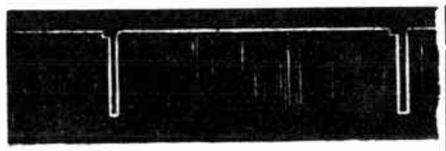

No. 8—6SN7-GTA—Vert. Osc. Plate
125V P-P 60 C.P.S.

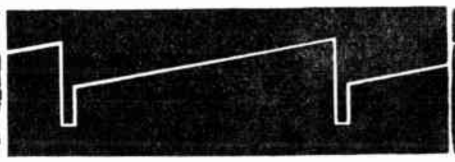

No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.

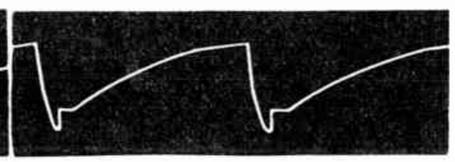

No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.

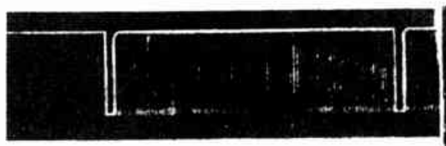

No. 9—6SN7-GTA Vert. Osc. Grid
170V P-P 60 C.P.S.

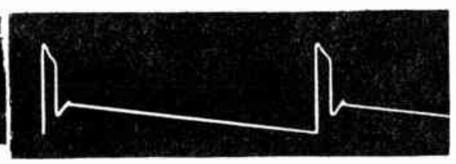

No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.

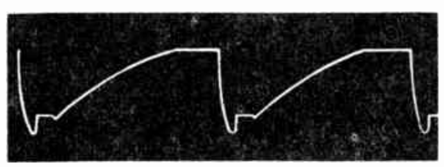

No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.

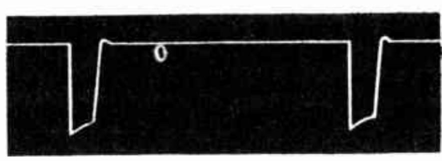

No. 10—6SN7-GTA Vert. Output Grid
150V P-P 60 C.P.S.

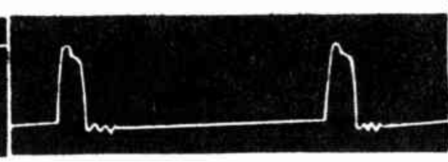

No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.

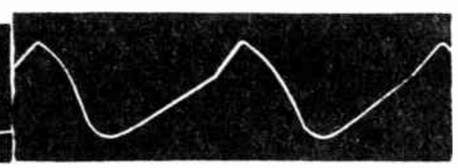

No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.


No. 11—Vert. Def. Coil
100V P-P 60 C.P.S.


No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.


No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.


No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.


No. 18—6AX4-GT Damper Plate
120V P-P 15,750 C.P.S.

REPLACEMENT PARTS LIST -- Con't.

CAPACITORS

					LIST PRICE
C-1, C-3, C-4, C-5, C-16, C-17, C-18, C-19, C-26, C-28, C-29, C-40, C-50, C-73, C-83	80X1	1000 mmf		Ceramic	.20
C-2A, C-2B, C-21A, C-21B	80X3	1000 mmf		Dual Ceramic	.30
C-6	47X603	47 mmf	500 V	Ceramic	.20
C-7	Part of T-3				
C-8	47X562	5 mmf	500 V	Ceramic	.80
C-9	47X584	1.5 mmf		Composition	.10
C-10, C-67	47X568	360 mmf	500 V	Molded Mica	.20
C-11, C-27, C-58, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular	.30
C-12, C-66, C-74	RCP10M4104M	.1 mf	400 V	Tubular	.35
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular	.35
C-14	RCP10M6153M	.015 mf	600 V	Tubular	.30
C-15	RCP10M2104M	.1 mf	200 V	Tubular	.30
C-20, C-23	RCP10M2224M	.22 mf	200 V	Tubular	.45
C-25, C-56, C-60	RCP10M4103M	.01 mf	400 V	Tubular	.25
C-30A, C-30B, C-30C	45X392	20 mf 40 mf 10 mf	400 V 50 V 400 V	Dry Electrolytic	2.50
C-31A, C-31B, C-31C	Part of 76X7	(See Miscellaneous)			
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica	.85
C-33, C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular	.25
C-34, C-46	47X604	100 mmf	500 V	Ceramic	.20
C-35A, C-35B	45X391	100 mf 80 mf	50 V 400 V	Dry Electrolytic	3.70
C-36, C-39	RCP10M6104M	.1 mf	600 V	Tubular	.50
C-38	RCP10M6103M	.01 mf	600 V	Tubular	.30
C-41	45X361	4 mf	100 V	Dry Electrolytic	1.00
C-42	Part of L-13				
C-43, C-44	Part of T-6				
C-45, C-47, C-49	47X507	5000 mmf		Ceramic	.30
C-48, C-84	Part of T-7				
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic	.95
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular	.30
C-53	47X525	470 mmf	500 V	Molded Mica	.25

CAPACITORS -- Continued

					LIST PRICE
C-57	Part of 76X5	(See Miscellaneous)			
C-59	RCP10M6472M	.0047 mf	600 V	Tubular	.25
C-62	RCM20A271K	270 mmf	500 V	Molded Mica	.25
C-68	47X570	330 mmf	500 V	Molded Mica	.25
C-69	RCM20B221J	220 mmf	500 V	Molded Mica	.25
C-70, C-80	45X393	30 mf	400 V	Dry Electrolytic	1.75
C-75	Part of Deflection Yoke Assembly				
C-76	RCP10M4154M	.15 mf	400 V	Tubular	.40
C-78	47X560	500 mmf	20 KV	Ceramic	2.00
C-79A, C-79B	45X390	60 mf 80 mf	400 V 400 V	Dry Electrolytic	4.45
C-81, C-82	47X615	.01 mf		Ceramic	.45

RESISTORS

		Ohms	Watts		
R-1	B83822	8.2 K	0.5	Carbon	.20
R-2, R-5	B83470	47	0.5	Carbon	.20
R-3, R-6, R-27, R-61, R-65	B85102	1 K	0.5	Carbon	.10
R-4, R-7	B83223	22 K	0.5	Carbon	.20
R-8	B84181	180	0.5	Carbon	.15
R-9, R-12	B84152	1.5 K	0.5	Carbon	.15
R-10	Part of L-5				
R-11	C84562	5.6 K	1.0	Carbon	.20
R-13, R-19	B84105	1.0 meg.	0.5	Carbon	.15
R-14, R-60	B84101	100	0.5	Carbon	.15
R-15	Part of L-10				
R-16	C83472	4.7 K	1.0	Carbon	.20
R-18, R-24	B85104	100 K	0.5	Carbon	.10
R-20, R-63	B84333	33 K	0.5	Carbon	.15
R-21	B84222	2.2 K	0.5	Carbon	.15
R-22, R-71	78X12	1.5 K 1.0 meg.		Contrast and Volume Control	2.70
R-23, R-67, R-68	B84223	22 K	0.5	Carbon	.15
R-25	40X333	500 K		Brightness Control	.90
R-26, R-74	B85473	47 K	0.5	Carbon	.10
R-28, R-64, R-78, R-80	B84104	100 K	.05	Carbon	.15
R-29, R-30	B85151	150	0.5	Carbon	.10
R-31	B84275	2.7 meg.	0.5	Carbon	.15
R-32	B83334	330 K	0.5	Carbon	.20
R-33, R-93	B84474	470 K	0.5	Carbon	.15
R-34, R-35, R-90	B84473	47 K	0.5	Carbon	.15
R-36, R-56	B84103	10 K	0.5	Carbon	.15
R-37	B84274	270 K	0.5	Carbon	.15
R-38	B84155	1.5 meg.	0.5	Carbon	.15

RESISTORS -- Continued

		Ohms	Watts		LIST PRICE
R-39	40X363	7.5 meg.		Sync. Stability Control	.80
R-40) R-69) R-70)	B84683	68 K	0.5	Carbon	.15
R-41	B84824	820 K	0.5	Carbon	.15
R-42) R-44) R-86)	B83222	2.2 K	0.5	Carbon	.20
R-43	B84332	3.3 K	0.5	Carbon	.15
R-45	C84102	1 K	1.0	Carbon	.15
R-46A) R-46B) R-46C)	Part of 76X7			(See Miscellaneous)	
R-47 } R-81 }	B85474	470 K	0.5	Carbon	.10
R-48	B84821	820	0.5	Carbon	.15
R-49	40X368	4 K		Vertical Lin. Control	.70
R-50 } R-55 }	B84185	1.8 meg.	0.5	Carbon	.15
R-51	40X334	1.0 meg.		Vertical Hold Control	.90
R-52	B84184	180 K	0.5	Carbon	.15
R-53 } R-57 }	B84225	2.2 meg.	0.5	Carbon	.15
R-54	40X364	2.5 meg.		Height Control	.70
R-58 } R-107}	B84561	560	0.5	Carbon	.15
R-59	D84682	6.8 K	2.0	Carbon	.30
R-62	B84563	56 K	0.5	Carbon	.15
R-66	B84271	270	0.5	Carbon	.15
R-72	40X334	1.0 meg.		Tone Control	.90
R-73	B85106	10.0 meg.	0.5	Carbon	.10
R-75A) R-75B)	Part of 76X5			(See Miscellaneous)	
R-76	C84331	330	1.0	Carbon	.20
R-77	D84102	1 K	2.0	Carbon	.30
R-79	B85475	4.7 meg.	0.5	Carbon	.10
R-82	B84273	27 K	0.5	Carbon	.15
R-83 } R-84 }	C84682	6.8 K	1.0	Carbon	.20
R-87	B84562	5.6 K	0.5	Carbon	.15
R-88	B83224	220 K	0.5	Carbon	.20
R-89	40X378	150 K		Horizontal Drive Control	.80
R-91	B83154	150 K	0.5	Carbon	.20
R-92	C83562	5.6 K	1.0	Carbon	.20
R-94	40X361	50 K		Horizontal Hold Control	.85
R-95	D84101	100	2.0	Carbon	.30
R-96	D84333	33 K	2.0	Carbon	.30
R-97	43X239	5.1	0.5	Wirewound	.40
R-98	Part of Deflection Yoke Assembly				
R-99	C85105	1.0 meg.	1.0	Carbon	.15
R-100	B83472	4.7 K	0.5	Carbon	.20
R-101	43X272	10 K	5.0	Wirewound	.80
R-102	43X275	1.5 K	15.0	Wirewound	.95
R-103	43X273	330	10.0	Wirewound	.80
R-104	Part of L-9				
R-105	B85274	270 K	0.5	Carbon	.10
R-108	40X364	2.5 meg.		AGC	.70
R-109	D85104	100 K	2.0	Carbon	.25
R-110	43X279	8 K	5.0	Wirewound	.80
R-111	D84123	12 K	2.0	Carbon	.30
R-112	D84273	27 K	2.0	Carbon	.30

TRANSFORMERS AND COILS

L-1 } L-2 } L-3 }	9A2033	R-F Heater Choke	.20
L-4 } L-8 }	9A1979	Peaking Coil 36 mh	.50
L-5	36A10	Peaking Coil 60 mh	.40
L-6	36A11	Peaking Coil 500 mh	.45

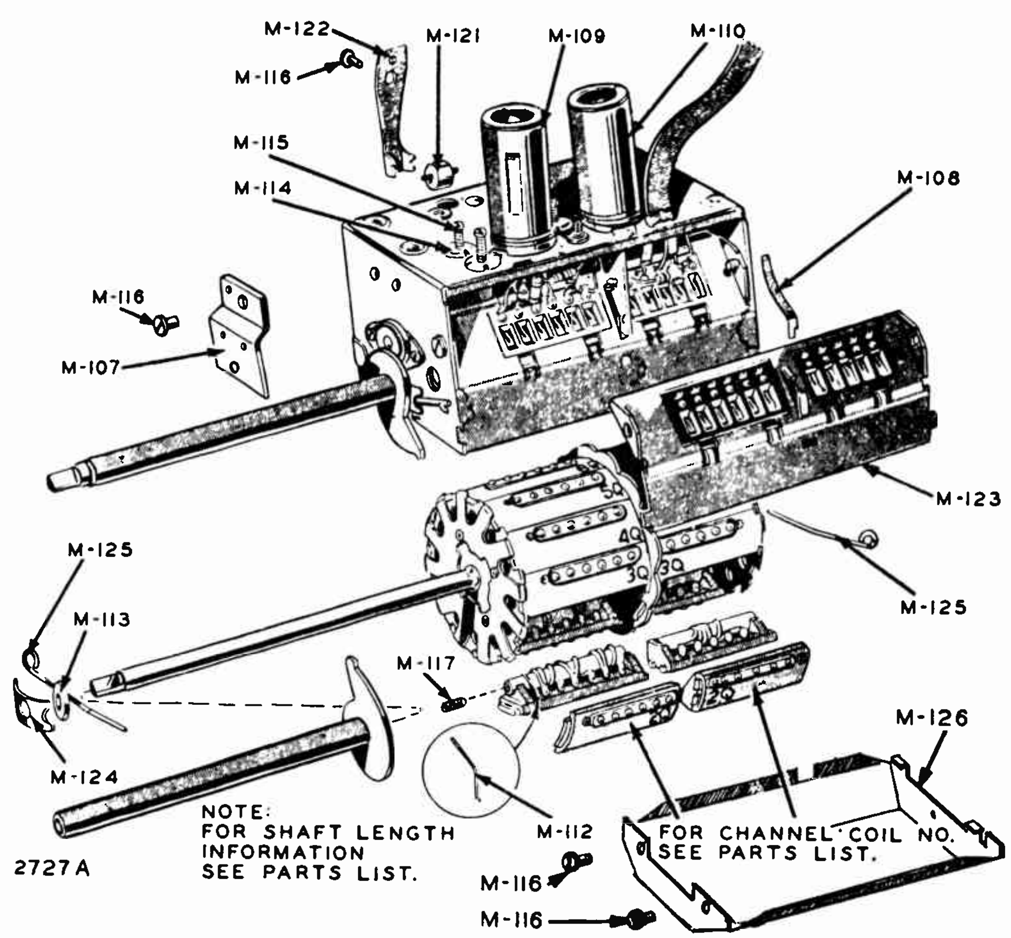
TRANSFORMERS AND COILS -- Continued

			LIST PRICE
L-7	9A2074	4.5 MC Trap	.60
L-9	36A16	Peaking Coil 80 mh	.45
L-10	36A12	Peaking Coil 160 mh	.40
L-11	36A2	Peaking Coil 190 mh	.50
L-12) L-17)		Part of Deflection Yoke Assembly	
L-13	9A2201	Sound Take-Off Coil	1.10
L-14	9A2096	Horizontal Frequency Coil	1.10
L-15	9A2183	Width Control	1.60
L-16	9A2262	Horizontal Linearity Control	.75
L-18	52X91	Filter Choke	3.70
T-1) T-2)	9A2230	1st and 2nd Pix I-F Coils	.75
T-3	9A2226	3rd Pix I-F Coil	1.80
T-4	54X8	Vertical Osc. Transformer	2.35
T-5	51X156	Vertical Output Transformer	4.05
T-6	9A2170	Sound I-F Transformer	1.60
T-7	9A2269	Sound Ratio Det. Transformer	2.75
T-8	51X150	Audio Output Transformer	2.70
T-9	53X330	Horizontal Output Transformer	9.60
T-10	53X333	Power Transformer	22.10

MISCELLANEOUS

2A426	Centering Device	1.15
76X5	Multiple Resistor Capacitor Assembly	.65
76X7	Multiple Resistor Capacitor Assembly	.90
4A408	Antenna Terminal Strip	.40
3A427	Tube Socket (6AQ5)	.25
3A458	Tube Socket (6CB6) (6AU6) (6AL5)	.20
3A463	Tube Socket (12AT7)	.40
3A464	Tube Socket (6BQ6) (6SN7)	.15
3A466	Tube Socket (1B3)	.60
3A470	Tube Socket (Octal)	.15
3A445	Tube Socket (6AX4)	.25
32X403	Tube Shield (3A458 Socket)	.10
32X405	Tube Shield (3A463 Socket)	.20
20X1652	Wing Screw (Deflection Yoke)	.05
6X67	Rubber Grommet	.05
16X146	Fuse Holder	.25
16X147-3	Fuse 4/10 Amp. 125-250 V.	.40
S-34X19	Tube Cover & Power Cord Assembly	2.25
7A246	Pilot Light Socket Assembly (UHF Dial)	.25
7A247	Pilot Light Socket Assembly (Channel Selector)	.25
7A32	No. 51 Pilot Bulb	.15
10X88	UHF Tuner Drive Cord Assembly	.30
10X89	Dial Drive Cord Assembly	.35
28X603	Drive Cord Tension Spring	.05
25A1105	UHF Tuner R. F. (Mallory)	
25A1104	VHF Tuner R. F. (Standard Coil)	
26X528	Shaft & Pulley Assembly	1.05
S-37X4	Shaft Coupling Assembly	.80
S-37X3	Switch Cam Assembly	.80
2A430	Switch Assembly (VHF-UHF)	2.90
11X163	Switch Assembly Cover	.10
25X1887	Dial Bracket	.55
19X108	Flat Washer	.05
58X767	Dial Glass	.55
15X277	Pointer	.30
41X92	Light Shield (Pilot Light)	.10
52X92	Filter Low Pass	4.85
28X564	Spring Clips	.15
25X1804	Tuner Shaft Support Bracket	.05
10A820-1	Knob, Fine Tuning	1.50
10A821-1	Knob, Contrast	1.15
10A822-1	Knob, Channel Selector	1.05
10A779	Knob, Volume	1.45
2110-15	Caster, Rubber Wheel (Caster Only)	.75
	(Set of 4)	2.95
12A477	Speaker, 8" PM Dynamic	7.40
9A2332-2	Deflection Yoke Assembly	9.50

VHF TUNER ASSEMBLY INFORMATION



"Q" Tuner Pictorial

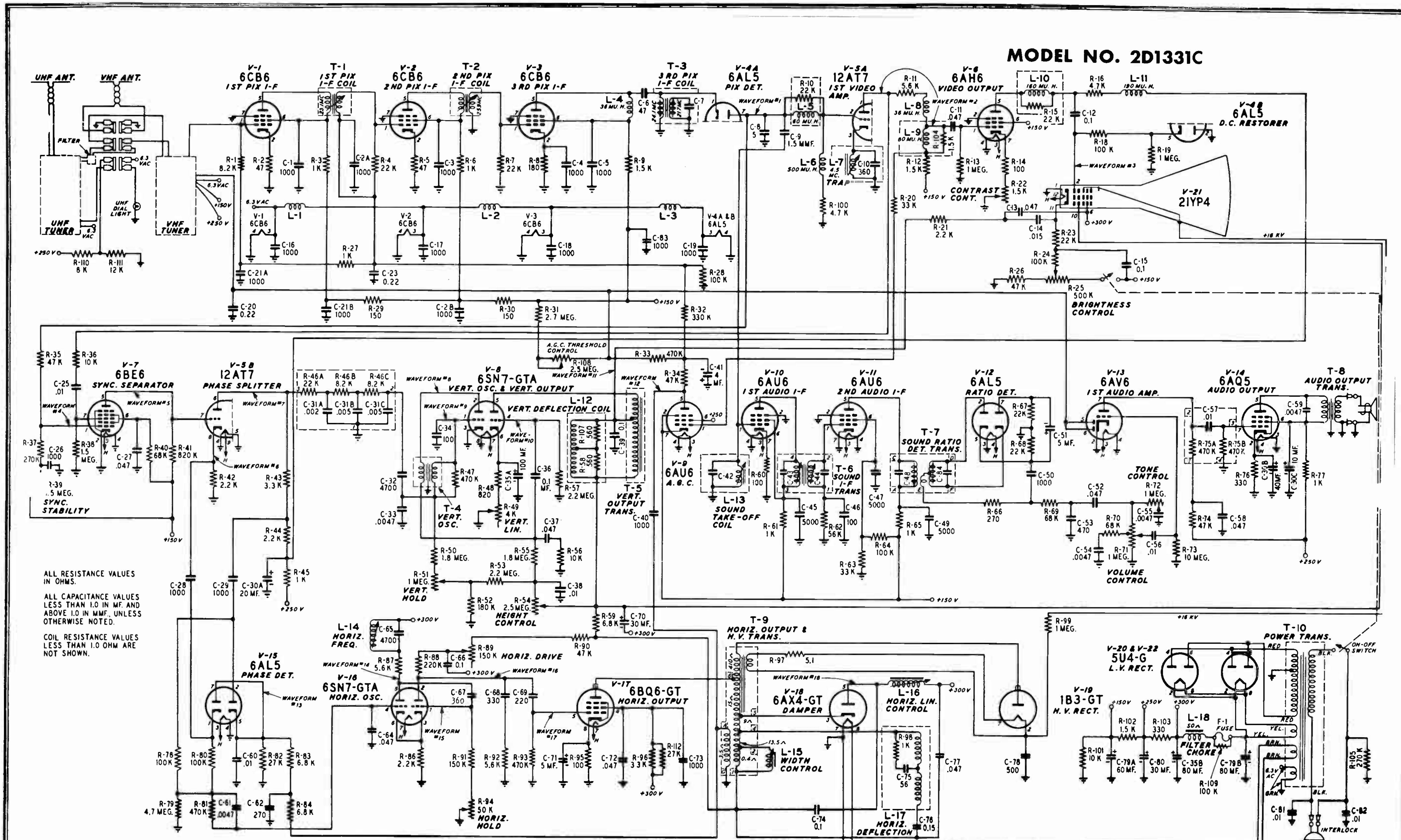
HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.



ALL RESISTANCE VALUES IN OHMS.

ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF., UNLESS OTHERWISE NOTED.

COIL RESISTANCE VALUES LESS THAN 1.0 OHM ARE NOT SHOWN.

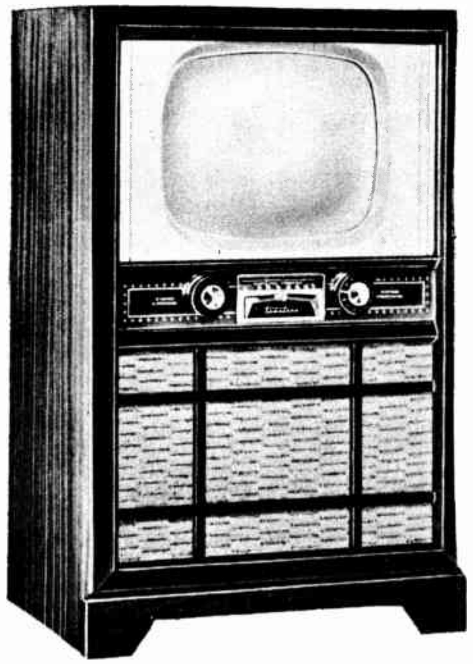
PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-50 becomes 47X570 330 mmf molded mica condenser
R-64 becomes B84333 33K ohm 0.5 W carbon resistor

R-67) R-68) become B83103 10K ohm 0.5 W carbon resistors

In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphabetical identification (A, B, C etc.)



MODEL NO. 2D1336A

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	200 Watts
Power Output	2.4 Watts (Max) 1.8 Watts (10% Distortion)
Tuning Range: VHF	Channels 2 thru 13
Tuning Range: UHF	Channels 14 thru 83
Antenna Input Imp.	300 Ohms Balanced
Intermediate Frequencies	Picture 26.20 MC Sound 21.70 MC
I-F (UHF Position Only)	Picture 121.75 Sound 126.25
Intercarrier Sound System	4.5 MC
Loud Speaker	See Parts List
Voice Coil Imp.	3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
VHF Tuner	6J6	R-F Osc. and Mixer
VHF Tuner	6BQ7*	R-F Amplifier
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20) V-22)	5U4-G	Low Voltage Rectifiers
V-21	17HP4	Picture Tube 17" Glass Rectangular (Electrostatic)

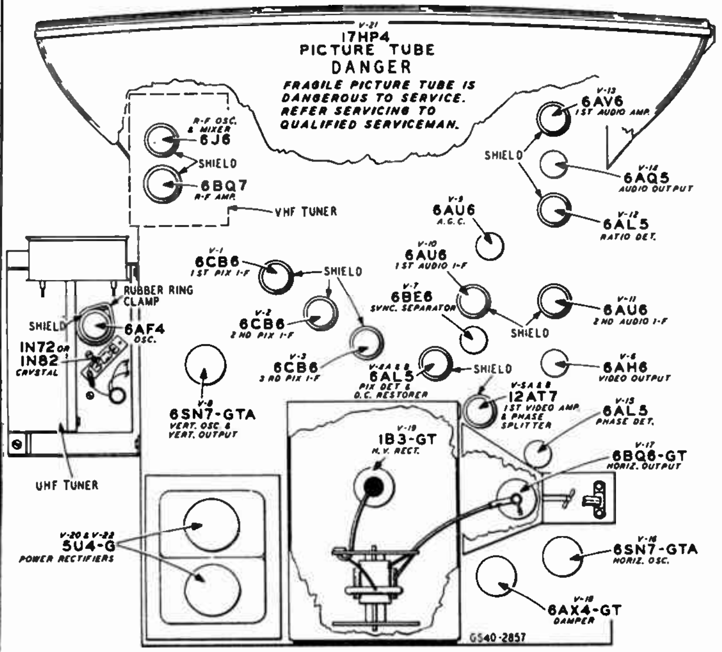


Fig. 1 -- Tube Layout.

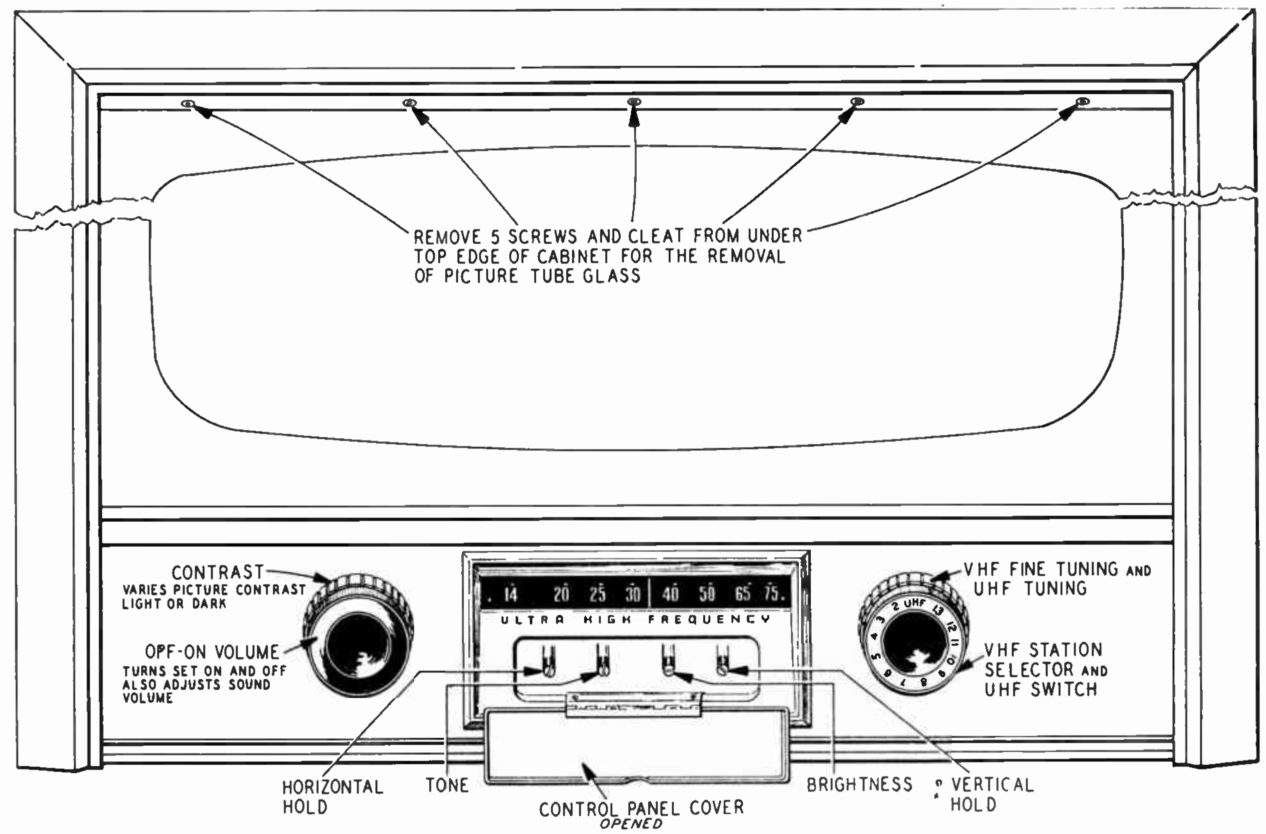


Fig. 2 -- Front Panel Controls

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn the OFF-ON VOLUME control counter-clockwise until a click is heard.
6. TONE CONTROL -- When this control is turned clockwise, the high notes will predominate and when turned counter-clockwise, a deep bass effect will result.
7. In localities where UHF programs are available, turn the STATION SELECTOR control to the UHF position and tune in the desired station with the UHF Tuning Control. The dial scale is calibrated in channel numbers and covers the entire UHF range of channels 14 through 83.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are four controls at the front of the chassis which are accessible when the hinged control panel is pulled downword. See illustration above. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT -- Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD -- Stops horizontal movement (diagonal bars.)

TONE -- Adjusts for tonal quality bass or treble.

BRIGHTNESS -- Adjusts for desired picture brilliance.

VERTICAL HOLD -- Stops upward or downward picture movement.

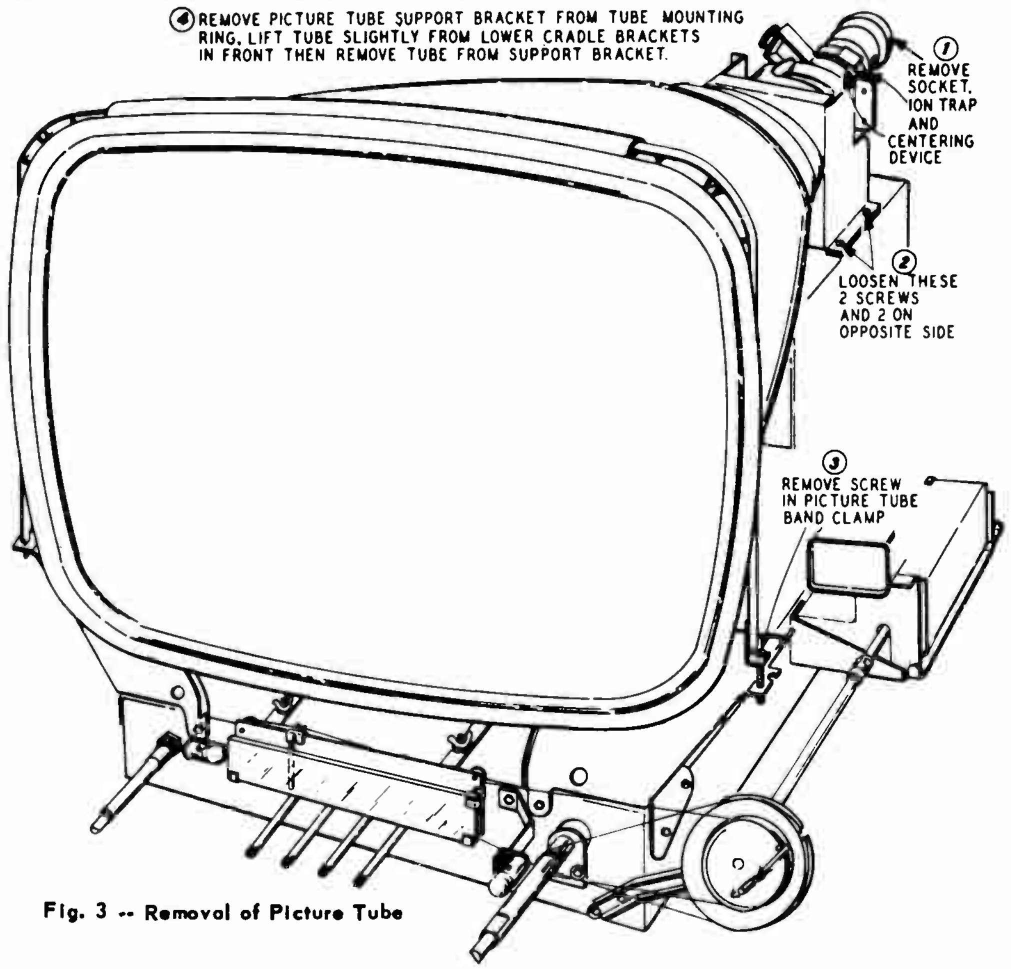


Fig. 3 -- Removal of Picture Tube

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT -- Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT -- With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT -- Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS -- While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is pre-set at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PRODEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

CAUTION -- These adjustments are only intended for VHF Channels. For information regarding UHF alignment, see paragraph "Tuner Alignment" on page 11.

ADJUSTMENT OF AGC THRESHOLD CONTROL -- Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL -- When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control fully counter-clockwise, then, while observing the picture, turn the control slowly clockwise until a minimum amount of bending occurs. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

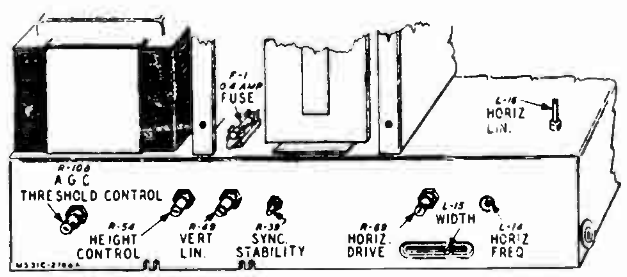


Fig. 4 - Adjustments Rear of Chassis

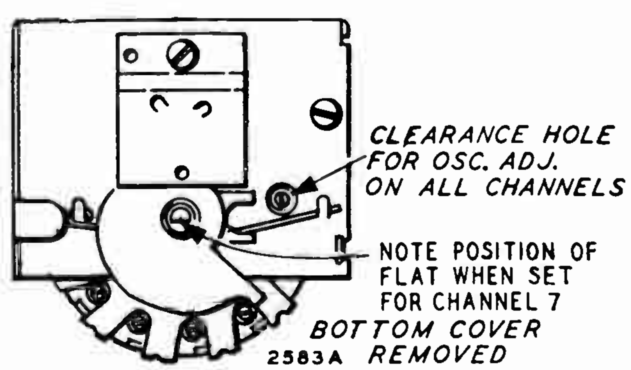


Fig. 5 -- Tuner Oscillator Adjustments

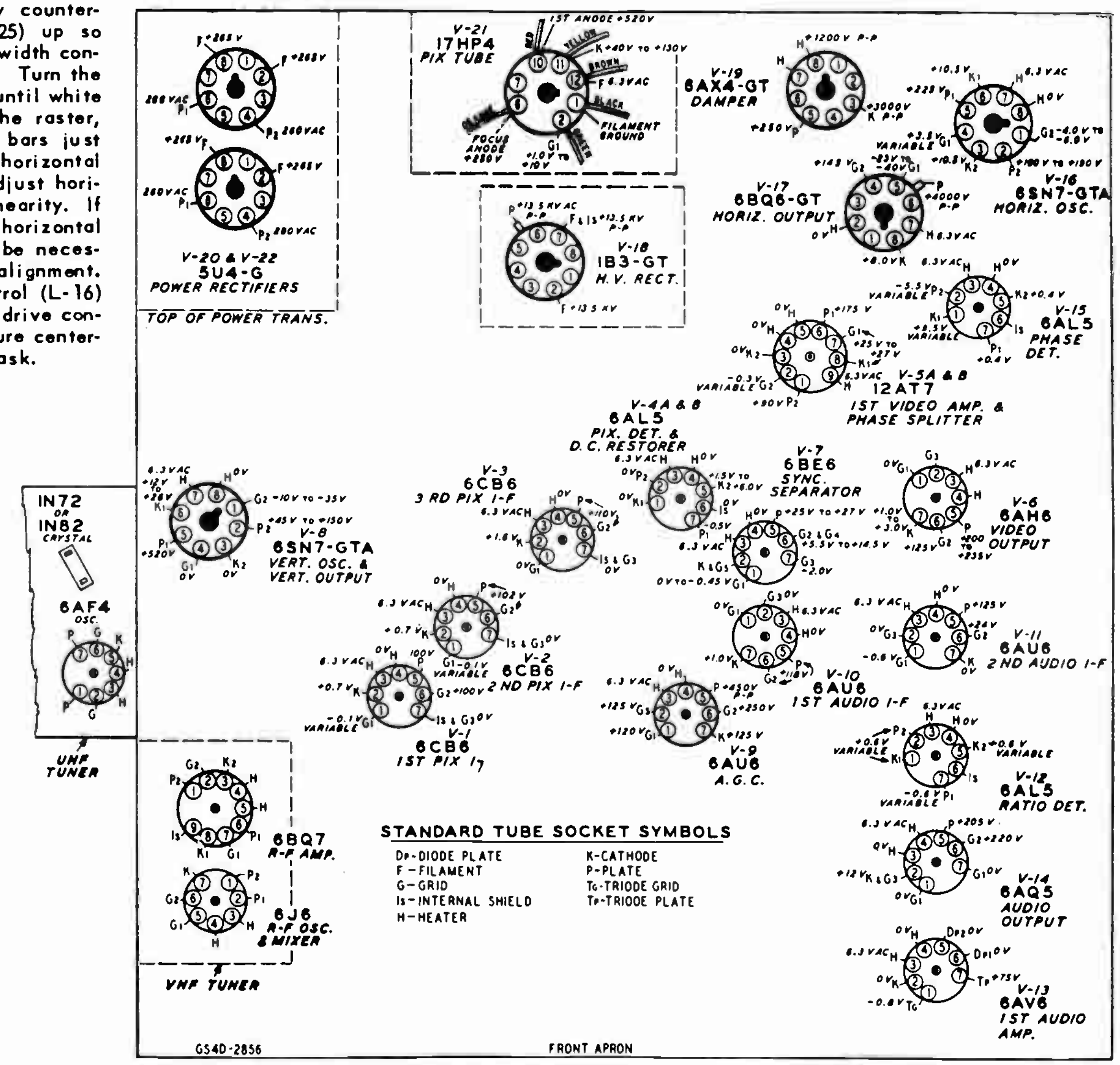


Fig. 6 -- Bottom Socket Voltages

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE -- If raster cannot be obtained check below for the possible causes.
1. Ion trap magnet adjustment is incorrect.
2. No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check.
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9
3. No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4. Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY -- If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:
1. Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2. Vertical oscillator transformer (T-4) defective.
3. Vertical output transformer (T-5) open or shorted.
4. Yoke vertical coils open or shorted.
5. Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY -- If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.
1. Check variable resistors R-49 and R-54.
2. Vertical output transformer (T-5) defective.
3. Capacitors C-35A, C-39 or C-70 defective.
4. V-8 defective, check voltages.
5. Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6. Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7. Capacitor C-36 defective.
8. Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY -- If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:
1. Check or replace horizontal output tube V-17.
2. Check or replace damper tube V-18 (6AX4-GT).
3. Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4. Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1. Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER -- This condition can be caused by:
1. Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2. V-18 (6AX4-GT) defective.

SMALL RASTER -- This condition can be caused by:
1. Low +B or line voltage. Check V-20 & V-22 (5U4G).
2. Insufficient output from horizontal output tube V-17. Replace tube.
3. Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4. Incorrect setting of horizontal drive control R-89.
5. V-18 (6AX4-GT) defective.
6. Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND -- This condition can be caused by:
1. No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2. Bad contact to picture tube grid (lead to socket broken).
3. AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY -- A condition of this nature can be caused by:
1. Defective sync separator V-7 or phase splitter V-5B.
2. If tubes are O. K. check voltages, and associated circuits.
3. AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY -- If this condition is encountered, check:
1. Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2. Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY
1. V-15 or V-16 defective.
2. Improper setting of (L-14) horizontal frequency control.
3. Check setting of horizontal drive control and horizontal linearity control.
4. Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION -- If the picture resolution is not up to standard, it may be caused by any of the following:
1. Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2. Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3. Defective picture tube.
4. Open video peaking coil. Check all peaking coils L-5, L-6, L-8. L-9, L-10 and L-11 for continuity. Note that L-5, L-9, L-10, L-11 have shunting resistors.
5. Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
   1. Check all potentials in video circuits.
   2. Check picture tube grid circuit for poor or dirty contact.
   3. Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:
1. A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2. This trouble can also originate at the transmitter. Check reception from another station.
3. Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc.)
1. Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2. Check sound I-F alignment.

BENDING OR S-ING
1. Check sync stability control adjustment.
2. Check capacitors C-35B and C-79B.
3. V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4. Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5. Check AGC threshold control.

PICTURE NORMAL -- NO SOUND OR WEAK OR DISTORTED SOUND
1. Check sound I-F alignment.
2. Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND
This condition can be caused by,
1. Defective pix I-F Amplifier tubes V-1, V-2 or V-3.
2. Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3. Defective R-F Amplifier or oscillator mixer tubes in the tuner.
4. UHF-VHF switch defective.

POOR FOCUS
1. Improper setting of Ion Trap magnet.
2. Defective picture tube or picture tube socket.

PICTURE JITTER:
1. If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2. Vertical instability may be due to loose connections or noise received with the signal.
3. Horizontal instability may be due to unstable transmitted sync.
4. Check receiver AGC system for proper operation.
5. Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6. Check for improper setting of sync stability control.
7. Picture tube grid lead not held in position by support spring, ie; close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8. Check AGC threshold control.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND (UHF Position)
If this condition is encountered:
1. Check to see whether or not a UHF station is operating in the vicinity.
2. The 6AF4 oscillator tube or the 1N72 (or 1N82) crystal may be defective.
3. Pre-selector in UHF tuner defective.
4. Low pass filter defective.
5. The UHF position antenna and oscillator strips in the VHF tuner defective.
6. Defective Switch on UHF tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT -- To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
- 18 to 30 mc, 10 mc sweep width
- 40 to 90 mc, 10 mc sweep width
- 120 to 130 mc, 10 mc sweep width
- 170 to 225 mc, 10 mc sweep width
- 470 to 890 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
- 23.1 mc first picture I-F coil.
- 24.1 mc third picture I-F coil.
- 25.9 mc second picture I-F coil.
- 21.7 mc sound trap.
- 4.5 mc video trap & sound I-F.
- 25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS -- To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE

PIX I-F

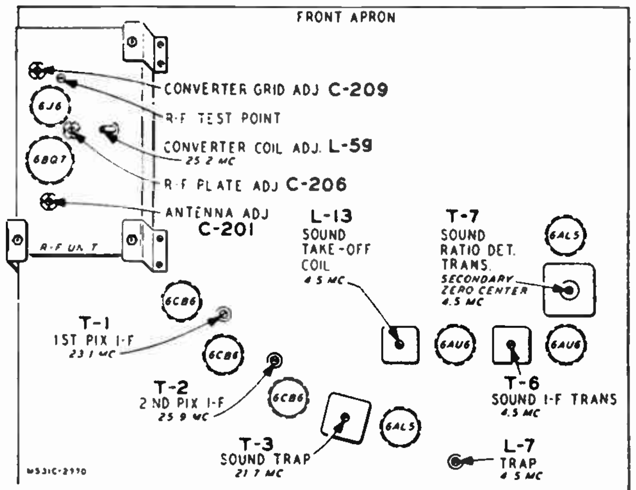


Fig. 8 -- Top Chassis Video and Audio I-F Adjustments

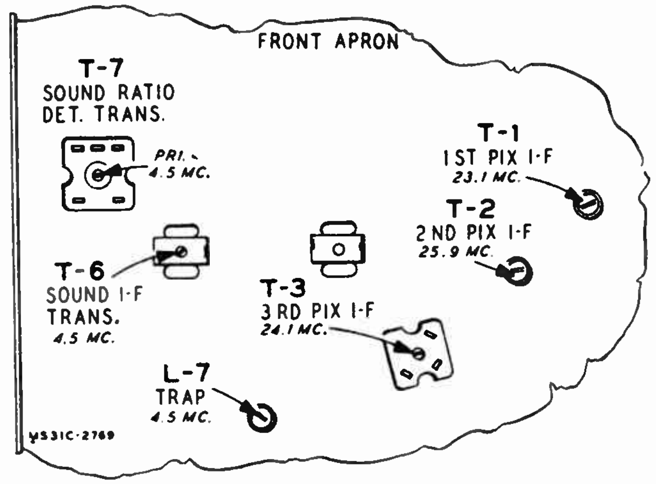


Fig. 9 -- Bottom Chassis Video and Audio I-F Adjustments

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply −4.5V battery bias on AGC line.

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply −4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

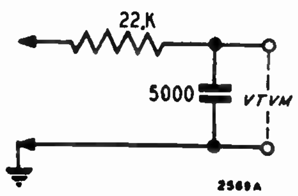


Fig. 10 -- VTVM Connections

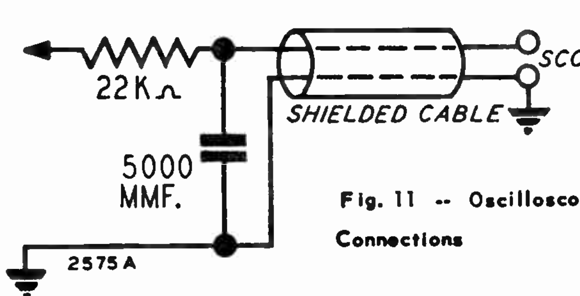


Fig. 11 -- Oscilloscope Connections

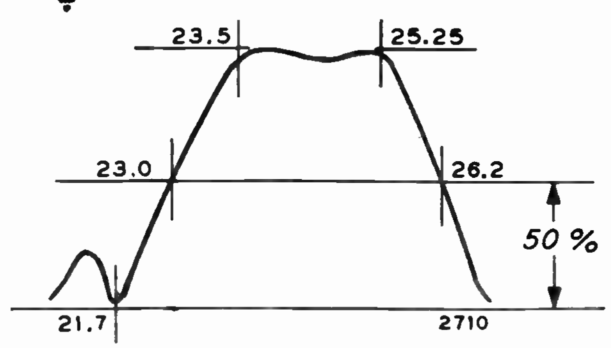


Fig. 12 -- Overall Response Curve

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is not advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1. With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.
2. With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.
3. With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE-- If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

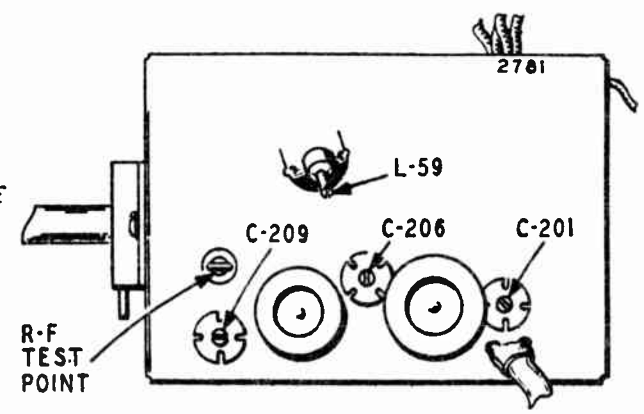


Fig. 13 -- Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

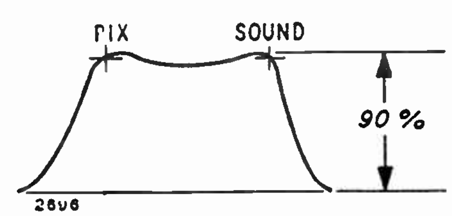


Fig. 14 -- Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply −4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. To adjust oscillator on UHF position, feed the sweep generator with center frequency of 124 MC and markers at 121.75 and 126.25 into the input of the low pass filter (output of UHF tuner). Adjust oscillator slug in the VHF tuner so that the 121.75 pix carrier marker is at 50% and that 126.25 marker is in the sound notch. If a sweep generator is not available, a single frequency generator set to 126.25 MC and VTVM may be used. Connect VTVM to the pix detector load resistor R-100. Feed generator into the low pass filter. Adjust oscillator slug in the VHF tuner so that the 126.25 marker is in the sound notch of the I-F curve.
5. If the 6AF4 oscillator tube in the UHF tuner is replaced, it may be necessary to adjust the oscillator trimmer C-309 on the UHF tuner located underneath the chassis. (See Figure 15). Adjust this trimmer until the tuner will cover a range of below 470 MC to above 890 MC.

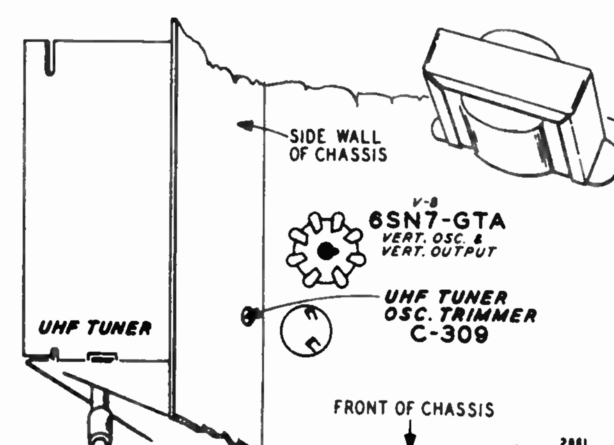


Fig. 15 -- UHF Tuner

DRIVE CORD REPLACEMENT

You will note that there are two cords used for the pointer drive system on this receiver. Part number 10X88 Drive Cord assembly and part number 28X113 Spring are used on the tuning shaft and large pulley, while part number 10X89 Drive Cord and a part number 28X603 Spring are used on the small pulley system and the pointer. Install the cords as shown in the illustration. After completing the installation rotate the fine tuning shaft a few turns to take up the slack in the cord.

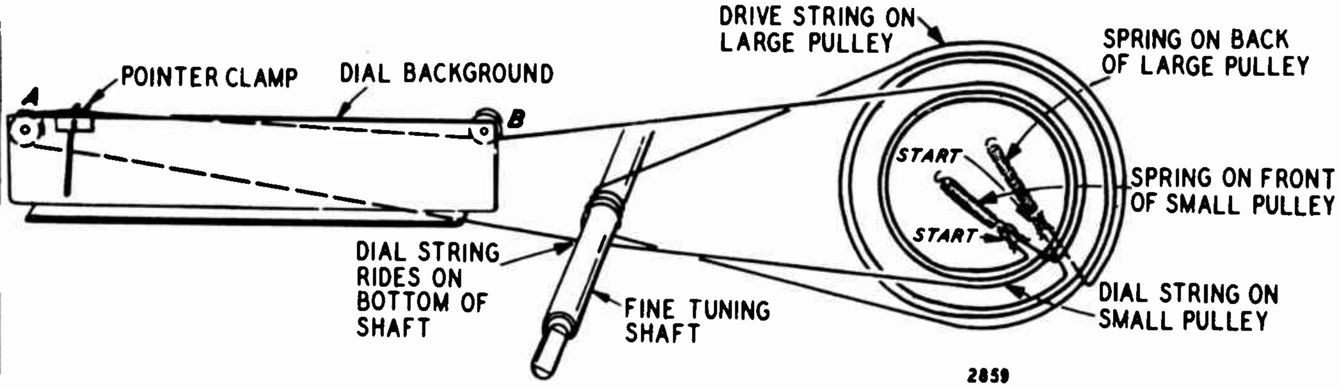


Fig. 16 -- Drive Cord Replacement

UHF TUNER INFORMATION

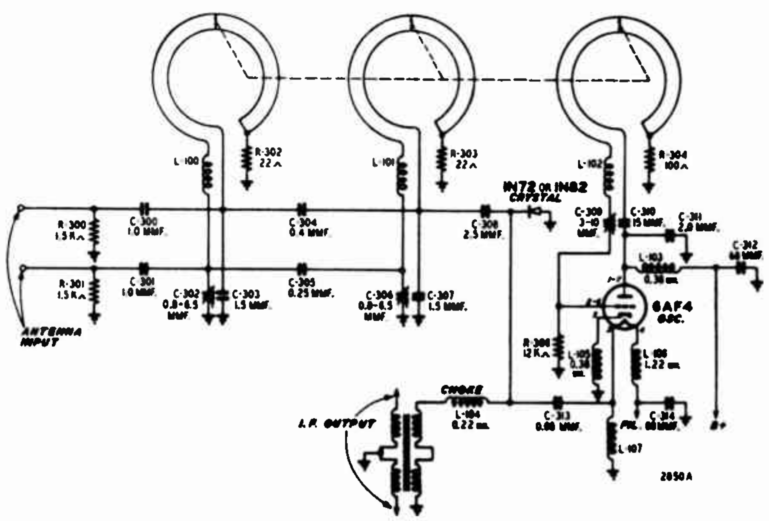


Fig. 17 -- UHF Tuner Schematic

Due to the complexity of the UHF tuner, neither servicing nor aligning is encouraged in the field because replacement of any component within the R-F circuit may disturb the band-pass characteristics of the tuner. However, the 6AF4 tube or the 1N72 (or 1N82) crystal may be replaced in the field if found to be defective. A schematic diagram of this tuner is shown only for the purpose of outlining the circuit used.

If the UHF tuner does not operate satisfactorily after the tube or crystal replacement, disconnect the tuner and return it to the factory for repair.

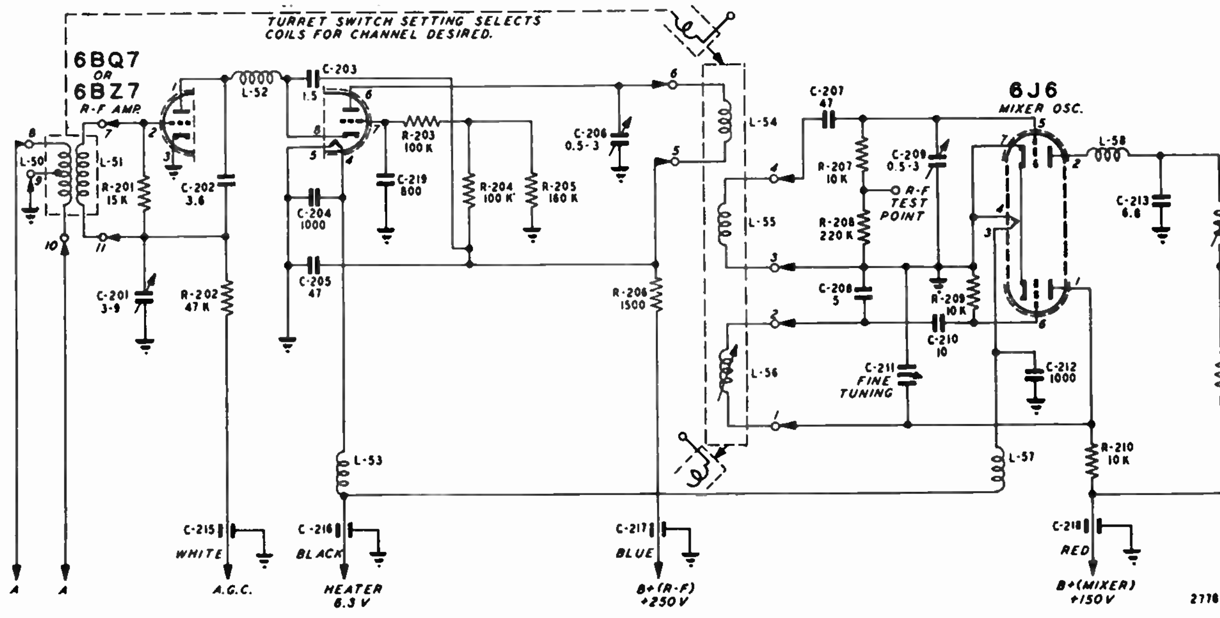


Fig. 19 -- "Q" Tuner Schematic Diagram

VHF TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	± 10%	0.5
R-202	12A-039	47 K	± 20%	0.5
R-203	12A-094	100 K	± 10%	0.5
R-204	12A-166	100 K	± 5%	0.5
R-205	12A-167	160 K	± 5%	0.5
R-206	12A-183	1500	± 10%	0.5
R-207) R-209) R-210)	12A-040	10 K	± 10%	0.5
R-208	12A-041	220 K	± 20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	± .25 mmf
C-203	CD8C1R5M	1.5 mmf	± 20%
C-204) C-212)	CD8X102Z	1000 mmf	
C-205) C-207)	CD8Q470K	47 mmf	± 10%
C-206) C-209)	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	± 5%
C-210	CD10C100K	10 mmf	± 10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	± .25 mmf
C-214	13D-055	120 mmf	± 10%
C-215) C-216) C-217) C-218)	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2297-2	Antenna Coil	2-Q
	9A2297-3	Antenna Coil	3-Q
	9A2297-4	Antenna Coil	4-Q
	9A2297-5	Antenna Coil	5-Q
	9A2297-6	Antenna Coil	6-Q
	9A2297-7	Antenna Coil	7-Q
	9A2297-8	Antenna Coil	8-Q
	9A2297-9	Antenna Coil	9-Q
	9A2297-10	Antenna Coil	10-Q
	9A2297-11	Antenna Coil	11-Q
	9A2297-12	Antenna Coil	12-Q
	9A2297-13	Antenna Coil	13-Q
	9A2297-91	Antenna Coil	UHF Position
	9A2298-2	Oscillator Coil	2-Q
	9A2298-3	Oscillator Coil	3-Q
	9A2298-4	Oscillator Coil	4-Q
	9A2298-5	Oscillator Coil	5-Q
	9A2298-6	Oscillator Coil	6-Q
	9A2298-7	Oscillator Coil	7-Q
	9A2298-8	Oscillator Coil	8-Q
	9A2298-9	Oscillator Coil	9-Q
	9A2298-10	Oscillator Coil	10-Q
	9A2298-11	Oscillator Coil	11-Q
	9A2298-12	Oscillator Coil	12-Q
	9A2298-13	Oscillator Coil	13-Q
	9A2298-91	Oscillator Coil	UHF Position
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

PARTS LIST

Use only GENUINE factory tested parts to insure service jobs you can depend on and to obtain original set performance.

CAPACITORS

C-1, C-3, C-4, C-5, C-16, C-17, C-18, C-19, C-26, C-28, C-29, C-40, C-50, C-73, C-83	80X1	1000 mmf		Ceramic
C-2A, C-2B, C-21A, C-21B	80X3	1000 mmf		Dual Ceramic
C-6	47X603	47 mmf	500 V	Ceramic
C-7	Part of T-3			
C-8	47X562	5 mmf	500 V	Ceramic
C-9	47X584	1.5 mmf		Composition
C-10	47X568	360 mmf	500 V	Molded Mica
C-11, C-27, C-58, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular
C-12, C-66, C-74	RCP10M4104M	.1 mf	400 V	Tubular
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular
C-14	RCP10M6153M	.015 mf	600 V	Tubular
C-15	RCP10M2104M	.1 mf	200 V	Tubular
C-20, C-23, C-63	RCP10M2224M	.22 mf	200 V	Tubular
C-25, C-33, C-56, C-60	RCP10M4103M	.01 mf	400 V	Tubular
C-30A, C-30B, C-30C	45X399	20 mf 40 mf 10 mf	300 V 50 V 300 V	Dry Electrolytic
C-31A, C-31B, C-31C	Part of 76X7	(See Miscellaneous)		
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica
C-34, C-46	47X604	100 mmf	500 V	Ceramic
C-35A, C-35B	45X395	100 mf 80 mf	50 V 300 V	Dry Electrolytic
C-36, C-39	RCP10M6104M	.1 mf	600 V	Tubular
C-38	RCP10M6103M	.01 mf	600 V	Tubular
C-41	45X361	4 mf	100 V	Dry Electrolytic
C-42	Part of L-13			
C-43, C-44	Part of T-6			
C-45, C-47, C-49	47X507	5000 mmf		Ceramic
C-48, C-84	Part of T-7			
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular
C-53	47X525	470 mmf	500 V	Molded Mica
C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular

CAPACITORS -- Continued

C-57	Part of 76X5	(See Miscellaneous)		
C-59	RCP10M6472M	.0047 mf	600 V	Tubular
C-67	RCM20B431K	430 mmf	500 V	Molded Mica
C-68	47X570	330 mmf	500 V	Molded Mica
C-69	RCM20A271K	270 mmf	500 V	Molded Mica
C-70	45X393	30 mf	400 V	Dry Electrolytic
C-75	47X598	56 mmf	1500 V	Ceramic
C-76	RCP10M4154M	.15 mf	400 V	Tubular
C-78	47X560	500 mmf	20 KV	Ceramic
C-79A, C-79B	45X397	60 mf 80 mf	300 V 300 V	Dry Electrolytic
C-81, C-82	47X615	.01 mf		Ceramic

RESISTORS

		Ohms	Watts	
R-1	B83822	8.2 K	0.5	Carbon
R-2, R-5	B83470	47	0.5	Carbon
R-3, R-6, R-27, R-61, R-65	B85102	1 K	0.5	Carbon
R-4, R-7	B83223	22 K	0.5	Carbon
R-8	B84181	180	0.5	Carbon
R-9, R-12	B84152	1.5 K	0.5	Carbon
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon
R-13, R-19	B84105	1.0 meg.	0.5	Carbon
R-14, R-60	B84101	100	0.5	Carbon
R-15	Part of L-10			
R-16	C83392	3.9 K	1.0	Carbon
R-17	Part of L-11			
R-18, R-24, R-106	B85104	100 K	0.5	Carbon
R-20, R-63, R-85	B84333	33 K	0.5	Carbon
R-21	B84222	2.2 K	0.5	Carbon
R-22, R-71	78X13	1.5 K 1.0 meg.		Contrast and Volume Control
R-23, R-67, R-68	B84223	22 K	0.5	Carbon
R-25	40X290	500 K		Brightness Control
R-26, R-74	B85473	47 K	0.5	Carbon
R-28, R-64, R-78, R-80	B84104	100 K	0.5	Carbon
R-29, R-30	B85151	150	0.5	Carbon
R-31	B84275	2.7 meg.	0.5	Carbon
R-32	B83334	330 K	0.5	Carbon
R-33, R-93	B84474	470 K	0.5	Carbon
R-34, R-35	B84473	47 K	0.5	Carbon

RESISTORS -- Continued

		Ohms	Watts	
R-36, R-56	B84103	10 K	0.5	Carbon
R-37	B84274	270 K	0.5	Carbon
R-38	B84155	1.5 meg.	0.5	Carbon
R-39	40X363	7.5 meg.		Sync. Stability Control
R-40, R-69, R-70	B84683	68 K	0.5	Carbon
R-41	B84824	820 K	0.5	Carbon
R-42, R-44	B83222	2.2 K	0.5	Carbon
R-43	B84332	3.3 K	0.5	Carbon
R-45	C84102	1 K	1.0	Carbon
R-46A, R-46B, R-46C	Part of 76X7		(See Miscellaneous)	
R-47, R-81	B85474	470 K	0.5	Carbon
R-48	B84821	820	0.5	Carbon
R-49	40X362	8 K		Vertical Lin. Control
R-50	B84185	1.8 meg.	0.5	Carbon
R-51	40X291	1.0 meg.		Vertical Hold Control
R-52	B84184	180 K	0.5	Carbon
R-53, R-55, R-57	B84225	2.2 meg.	0.5	Carbon
R-54	40X364	2.5 meg.		Height Control
R-58, R-107	B84561	560	0.5	Carbon
R-59	C84332	3.3 K	1.0	Carbon
R-62	B84563	56 K	0.5	Carbon
R-66	B84271	270	0.5	Carbon
R-72	40X291	1.0 meg.		Tone Control
R-73	B85106	10.0 meg.	0.5	Carbon
R-75A, R-75B	Part of 76X5		(See Miscellaneous)	
R-76	C84331	330	1.0	Carbon
R-77	D84102	1 K	2.0	Carbon
R-79	B85475	4.7 meg.	0.5	Carbon
R-82	B84273	27 K	0.5	Carbon
R-83, R-84	C84682	6.8 K	1.0	Carbon
R-86	B83182	1.8 K	0.5	Carbon
R-87	C83512	5.1 K	1.0	Carbon
R-88	B83224	220 K	0.5	Carbon
R-89	40X331	150 K		Horizontal Drive Control
R-91	B83154	150 K	0.5	Carbon
R-92	B84562	5.6 K	0.5	Carbon
R-94	40X292	50 K		Horizontal Hold Control
R-95	D84101	100	2.0	Carbon
R-96	D84752	7.5 K	2.0	Carbon
R-97	43X238	3.3	0.5	Wirewound
R-98	B85102	1 K	0.5	Carbon
R-99	C85105	1.0 meg.	1.0	Carbon
R-100	B83472	4.7 K	0.5	Carbon
R-101	43X272	10 K	5.0	Wirewound
R-102	43X275	1.5 K	15.0	Wirewound
R-104	Part of L-9			
R-105	B85274	270 K	0.5	Carbon
R-108	40X364	2.5 meg.		AGC
R-109	D85104	100 K	2.0	Carbon
R-110	43X279	8 K	5.0	Wirewound
R-111	D84123	12 K	2.0	Carbon

TRANSFORMERS AND COILS

L-1, L-2, L-3	9A2033	R-F Heater Choke
L-4, L-8	9A1979	Peaking Coil 36 mh
L-5	36A10	Peaking Coil 60 mh
L-6	36A11	Peaking Coil 500 mh
L-7	9A2074	4.5 MC Trap
L-9	36A16	Peaking Coil 80 mh
L-10	36A12	Peaking Coil 160 mh
L-11	36A13	Peaking Coil 190 mh
L-12, L-17	Part of Deflection Yoke Assembly	
L-13	9A2168	Sound Take-Off Coil
L-14	9A2096	Horizontal Frequency Coil
L-15	9A2183	Width Control
L-16	9A2262	Horizontal Linearity Control
L-18	52X91	Filter Choke
T-1, T-2	9A2230	1st and 2nd Pix I-F Coils
T-3	9A2226	3rd Pix I-F Coil
T-4	54X8	Vertical Osc. Transformer
T-5	51X156	Vertical Output Transformer
T-6	9A2170	Sound I-F Transformer
*T-7	9A2269	Sound Ratio Det. Transformer
T-8	51X150	Audio Output Transformer
T-9	53X329	Horizontal Output Transformer
T-10	53X334	Power Transformer

*See Note on schematic Page

MISCELLANEOUS

2A426	Centering Device
76X5	Multiple Resistor Capacitor Assembly
76X7	Multiple Resistor Capacitor Assembly
9A2261	Deflection Yoke Assembly
2A421	Ion Trap Magnet
4A408	Antenna Terminal Strip
3A427	Tube Socket (6AQ5)
3A458	Tube Socket (6CB6) (6AU6) (6AL5)
3A463	Tube Socket (12AT7)
3A464	Tube Socket (6BQ6) (6SN7)
3A466	Tube Socket (1B3)
3A470	Tube Socket (Octal)
3A445	Tube Socket (6AX4)
13X816	Pix Tube Socket
32X403	Tube Shield (3A458 Socket)
32X405	Tube Shield (3A463 Socket)
6A320	Anode Connector & Lead Assembly
8X227	Collar, Pix Tube Rear Mtg.
S-25X69	Tube Mtg. Strap Assembly
S-25X70	Tube Mtg. Strap Assembly (Top)
20X1652	Wing Screw (Deflection Yoke)
6X67	Rubber Grommet
25X1844	Bracket, Tube Front Support (R.H.)
25X1845	Bracket, Tube Front Support (L.H.)
16X146	Fuse Holder
16X147-3	Fuse 4/10 Amp. 125-250 V.
S-34X19	Tube Cover & Power Cord Assembly
7A246	Pilot Light Socket Assembly (UHF Dial)
7A234	Pilot Light Socket Assembly (Channel Selector)
7A32	No. 51 Pilot Bulb
25X1827	Bracket Pix Tube Rear Mtg.
12A477	Speaker, 8" PM Dynamic
17X178	Pix Crystal
4X1217-2	Pix Mask

VHF TUNER ASSEMBLY INFORMATION

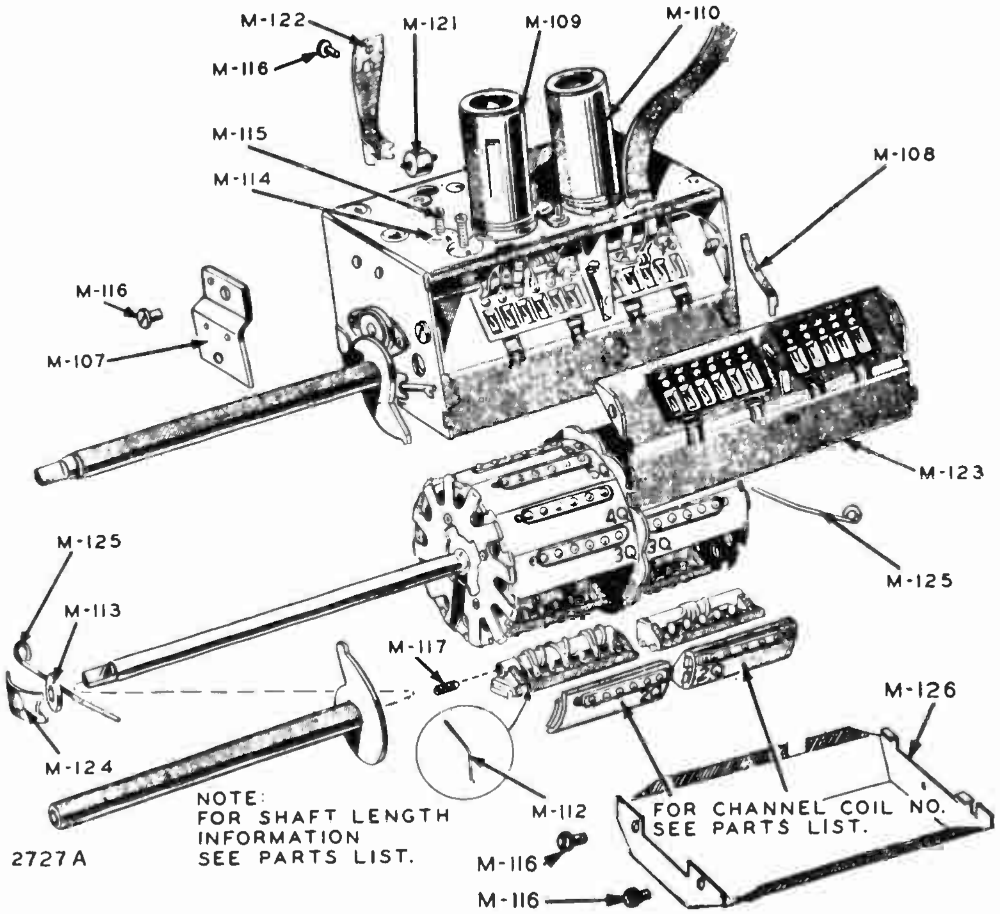
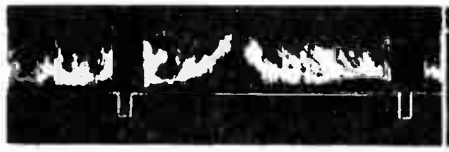


Fig. 18 – "Q" Tuner Pictorial

OSCILLOSCOPE WAVEFORM PATTERNS

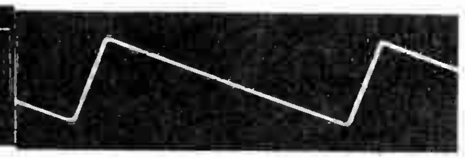
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.

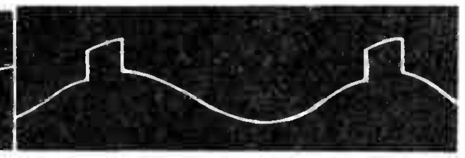
No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.



No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.

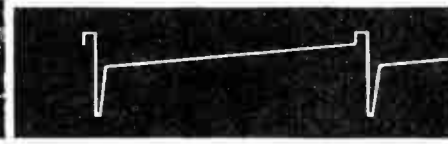
No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.

No. 8—6SN7-GTA—Vert. Osc. Plate
100V P-P 60 C.P.S.

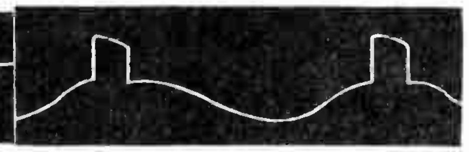


No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.

No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.

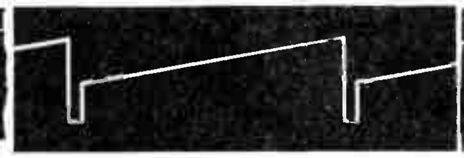


No. 9—6SN7-GTA Vert. Osc. Grid
130V P-P 60 C.P.S.

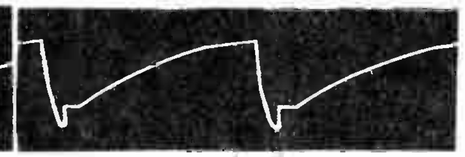


No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.

No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.

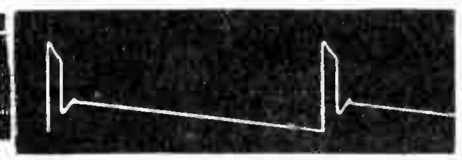


No. 10—6SN7-GTA Vert. Output Grid
120V P-P 60 C.P.S.

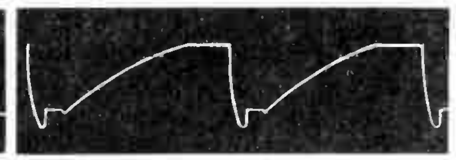


No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.

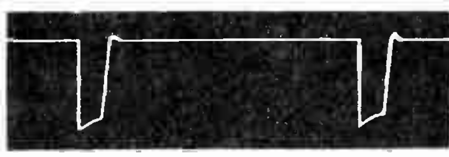
No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.



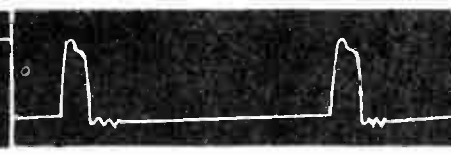
No. 11—Vert. Def. Coil
85V P-P 60 C.P.S.



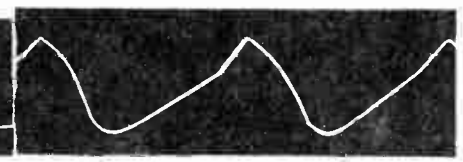
No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.



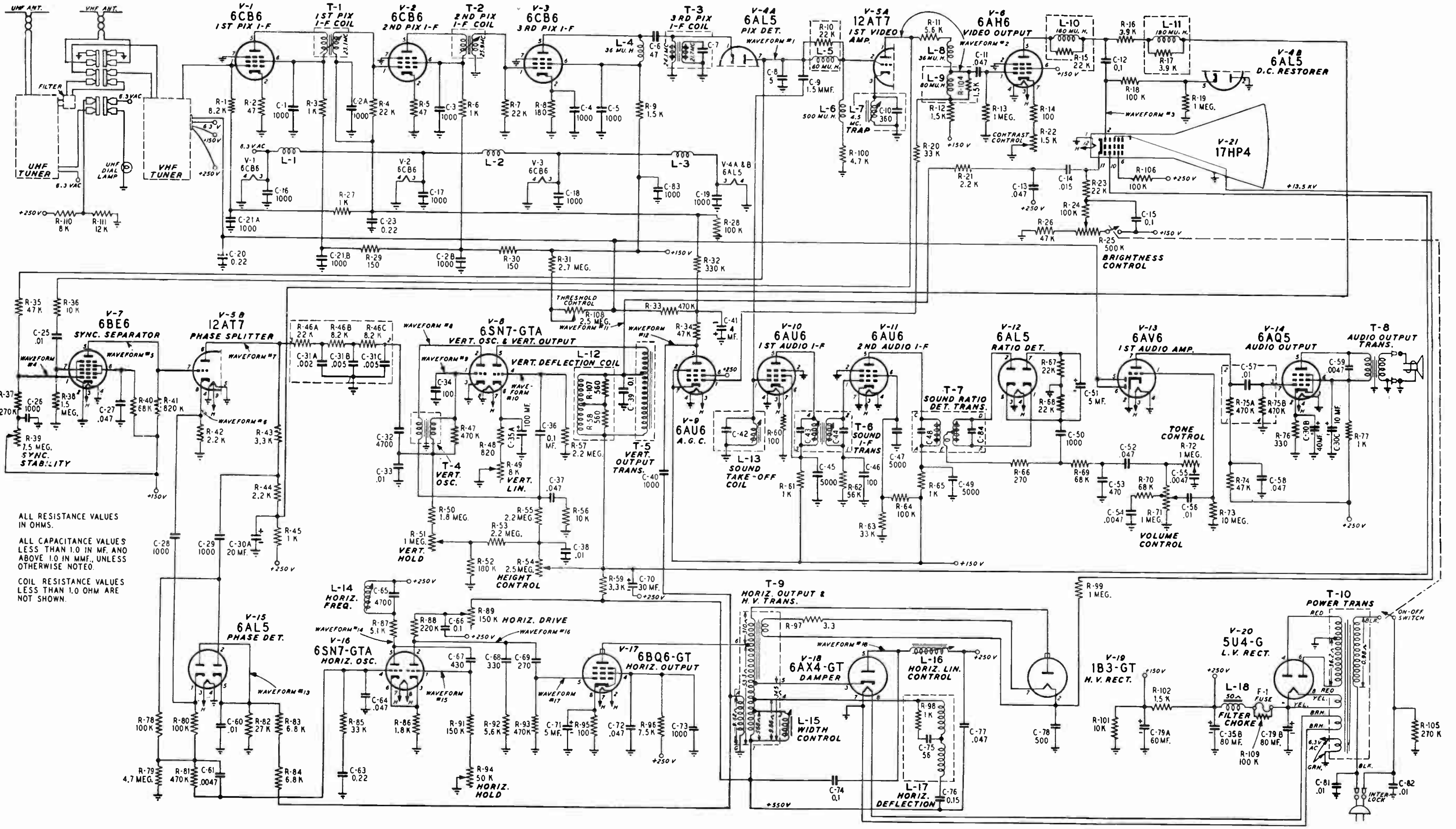
No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.



No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4-GT Damper Plate
120V P-P 15,750 C.P.S.



NOTE - There are two different ratio detector transformers used in these receivers, Part numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-50 becomes 47X570 330 mmf molded mica condenser.
R-64 becomes B84333 33K ohm 0.5W carbon resistor.
R-67, R-68 become B83103 10K ohm 0.5W carbon resistors.

In addition to the above, the 9A2295 ratio detector has terminals with numerical identification (1,2,3 etc) whereas the 9A2269 has alphabetical identification (A,B,C etc) on its terminals.

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	Television-245 Watts Radio-35 Watts Phonograph-55 Watts
Power Output	2.4 Watts (Max.) 1.8 watts (10% Distortion)
Tuning Ranges	TV-12 Channel AM-540-1600 KC
Intermediate Freq. (Tel.)	Picture-26.20 MC Sound-21.70 MC
Intermediate Freq. (Radio)	AM-455 KC
Selectivity (Radio)	AM-45 KC Broad at 1000 Times Signal, measured at 1000 KC
Sensitivity (Radio)	(For .5 Watt Output) AM-10 Microvolts Average
Tel. Antenna Input Imp. .	300 Ohms Balanced
Loud Speaker	8" PM Dynamic
Voice Coil Impedance ...	3.2 Ohms 400 Cycles

TUBE COMPLEMENT TV CHASSIS

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6BL7	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	AGC Diodes
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6W4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

TUBE COMPLEMENT RADIO CHASSIS

1	6BA6	R-F Amplifier
1	6BE6	AM Converter
1	6BA6	I-F Amplifier
1	6AV6	Det. & 1st Audio Amplifier
1	6AQ5	Audio Output
1	6X4	Rectifier
2	No. 47	Dial Lamps

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency MC	Picture Carrier Frequency MC	Sound Carrier Frequency MC	Receiver R-F Osc. Frequency MC
2	54-60	55.25	59.75	81.45
3	60-66	61.25	65.75	87.45
4	66-72	67.25	71.75	93.45
5	76-82	77.25	81.75	103.45
6	82-88	83.25	87.75	109.45
7	174-180	175.25	179.75	201.45
8	180-186	181.25	185.75	207.45
9	186-192	187.25	191.75	213.45
10	192-198	193.25	197.75	219.45
11	198-204	199.25	203.75	225.45
12	204-210	205.25	209.75	231.45
13	210-216	211.25	215.75	237.45

RECEIVER LOCATION -- Advise the owner as to the proper location for the television receiver. The following may be used as a guide.

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA -- This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

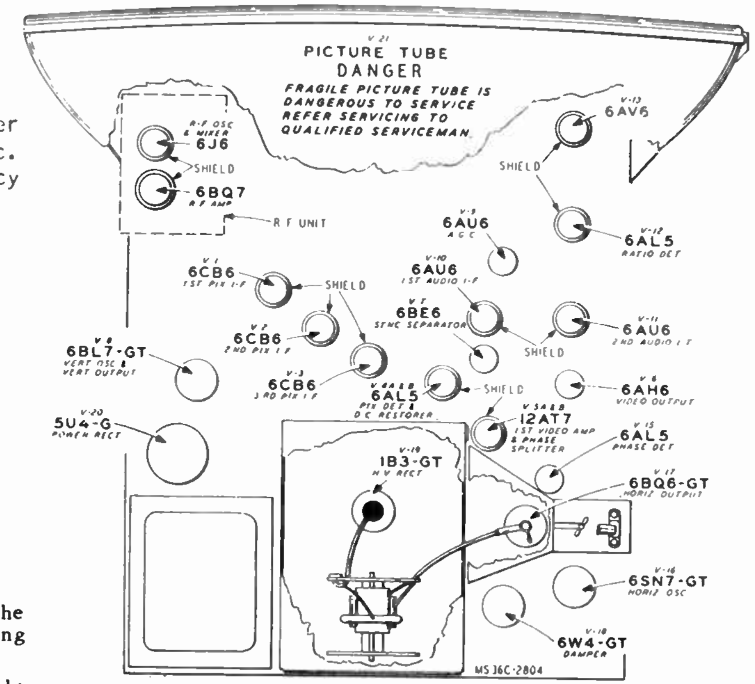


Fig. 1 -- Tube Layout.

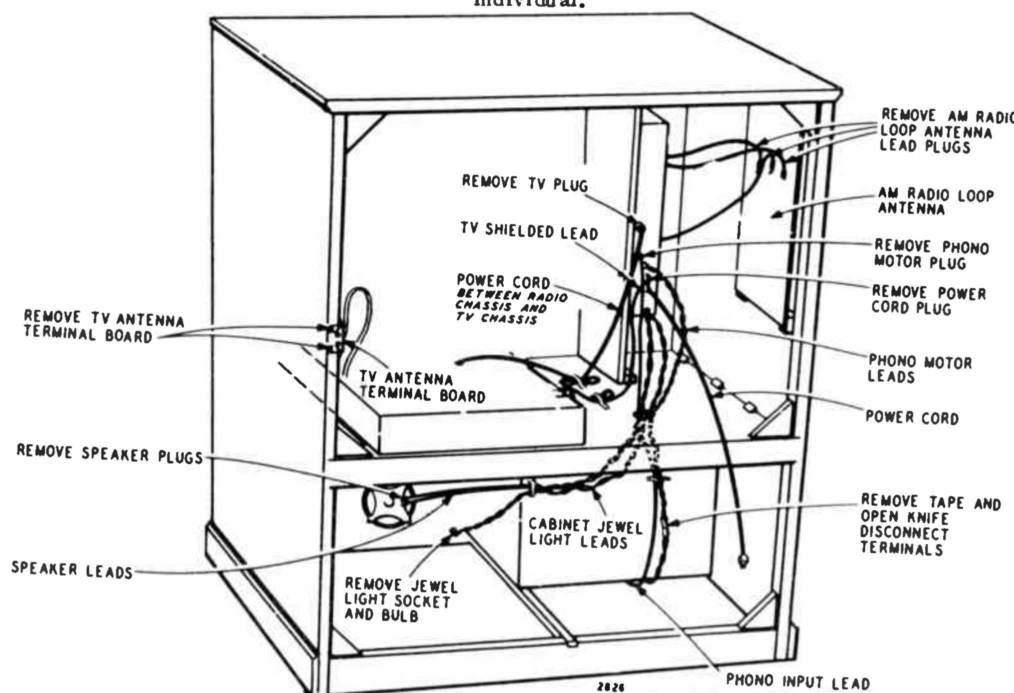
HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.



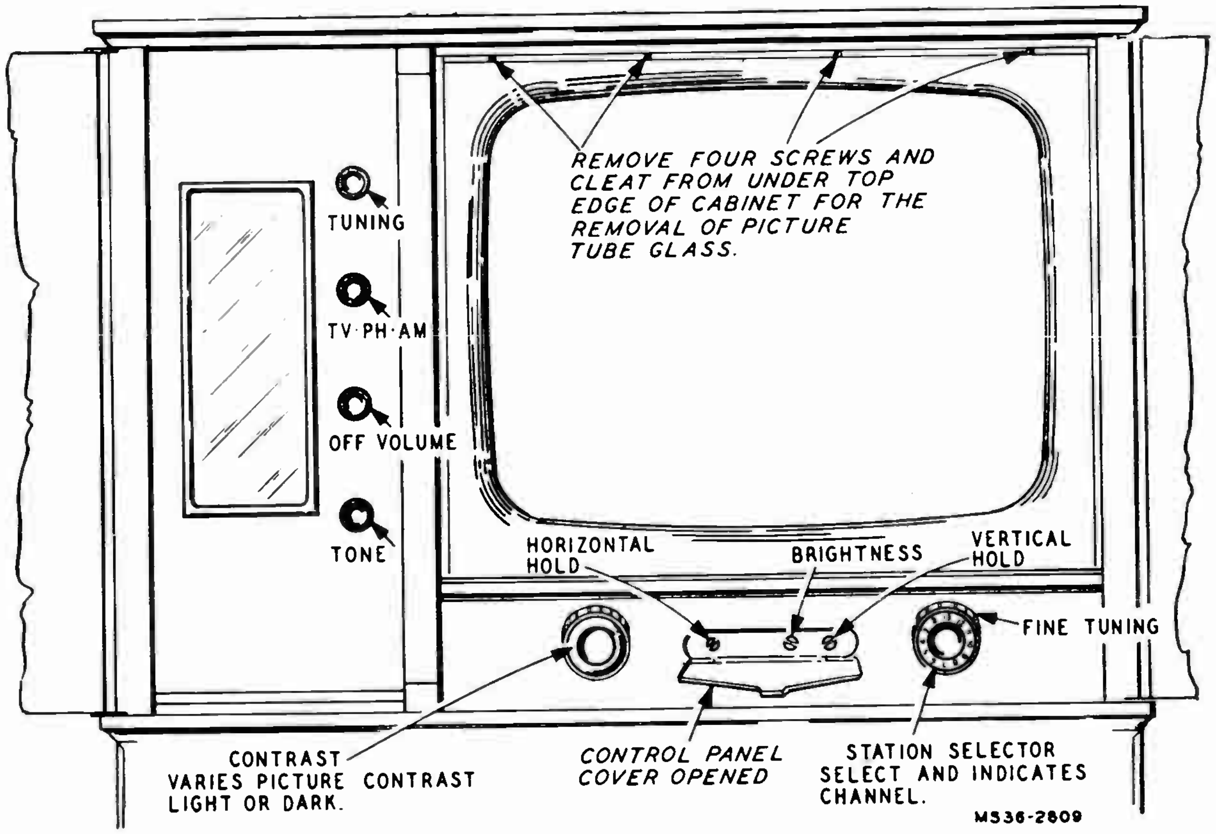


Fig. 2. -- Front Panel Controls

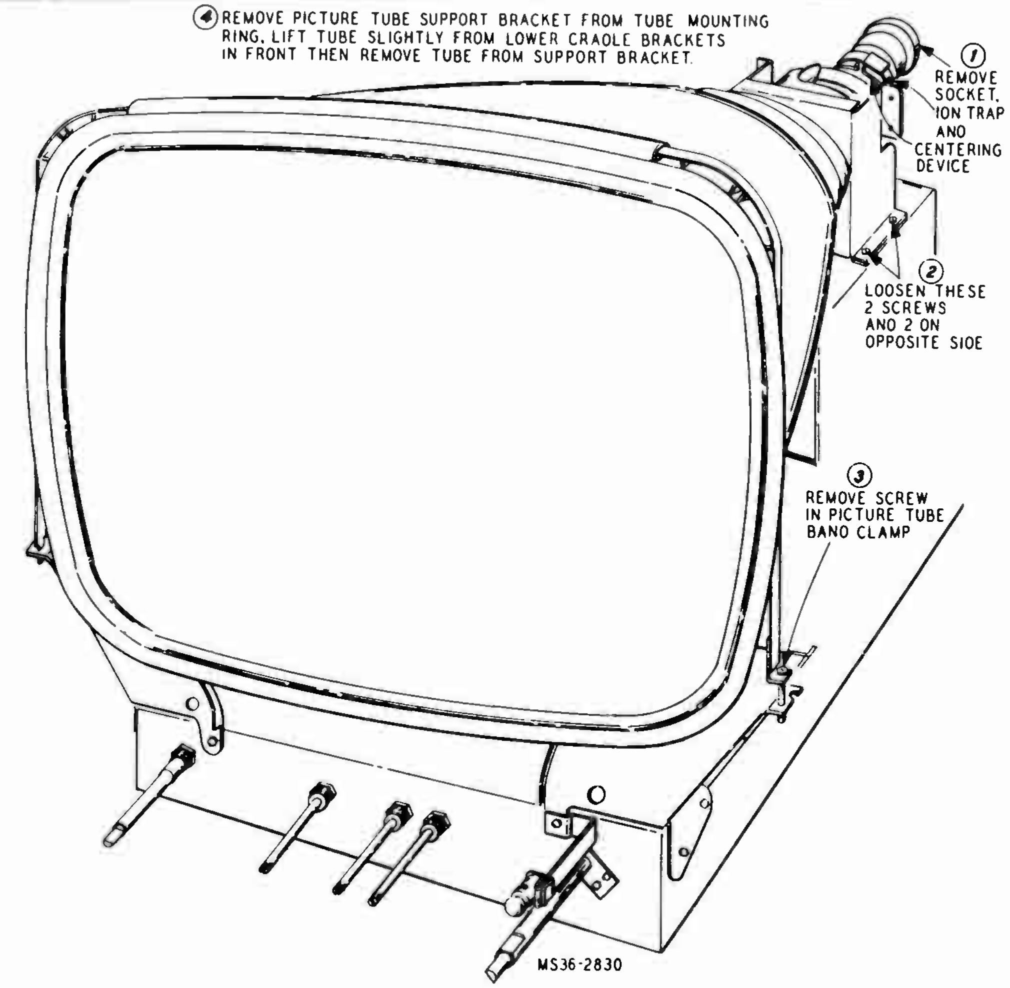


Fig. 3 -- Removal of Picture Tube

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control on the radio panel clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn BAND SWITCH control on the radio panel to the TV position.
3. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
4. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
5. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
6. To turn off the receiver, turn only the OFF-ON VOLUME control counterclockwise until a click is heard.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are three controls at the front of the chassis which are accessible when the hinged control panel is pulled downward. See illustration on this page. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT -- Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD -- Stops horizontal movement (diagonal bars.)

BRIGHTNESS -- Adjusts for desired picture brilliance.

VERTICAL HOLD -- Stops upward or downward picture movement.

PICTURE TUBE SAFETY GLASS

It will be necessary to clean this glass and the face of the picture tube occasionally. Remove the safety glass carefully as outlined in the illustration.

CAUTION--UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS WILL FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

WARNING -- Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT -- To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker and radio chassis, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-94
Brightness	R-25
Vertical Hold	R-51

NON-OPERATING CONTROLS REAR OF CHASSIS

Horizontal Centering	) Centering
Vertical Centering	) Device
Ion Trap Magnet	Wing Nut Adjustment
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Linearity	L-16
Horizontal Drive	R-89
Horizontal Frequency	L-14
Vertical Linearity	R-49
Height	R-54
Sync Stability	R-39

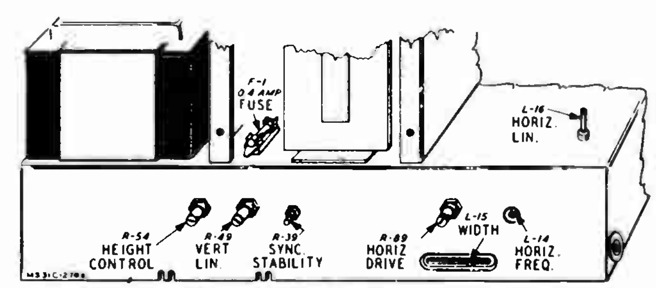


Fig. 4 -- Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT -- The ion trap magnet should be positioned close to the base of the tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to ensure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT -- If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT -- If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until picture is centered correctly.

PICTURE ADJUSTMENT -- For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 4. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF SYNC STABILITY CONTROL -- When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control fully counter-clockwise, then, while observing the picture, turn the control slowly clockwise until a minimum amount of bending occurs. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned. When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT -- Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT -- With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT -- Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS -- While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps, 1, 2 and 3 on all channels used.

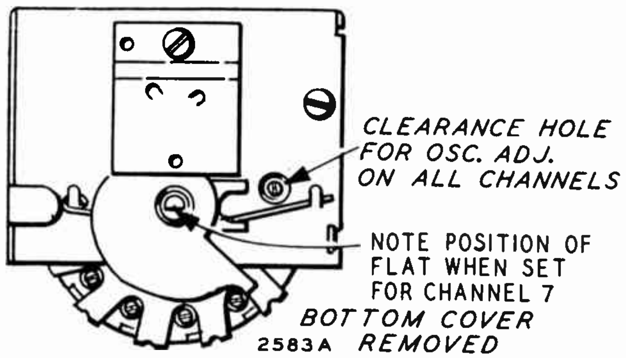


Fig. 5 -- Tuner Oscillator Adjustments

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE -- If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No B+ voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6W4-GT)
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuits. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY -- If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 (6BL7) inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

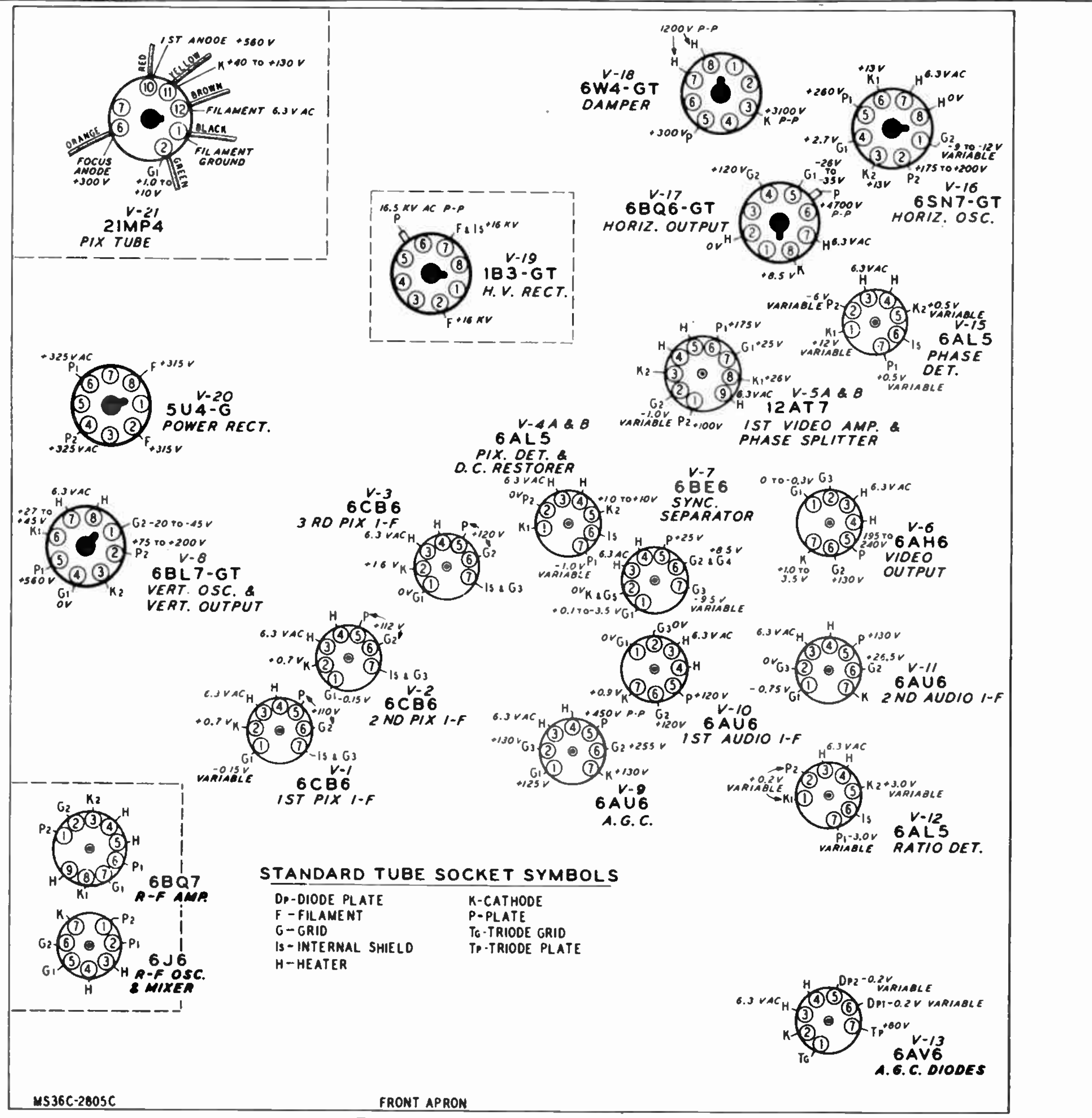


Fig. 6 -- Bottom Socket Voltages

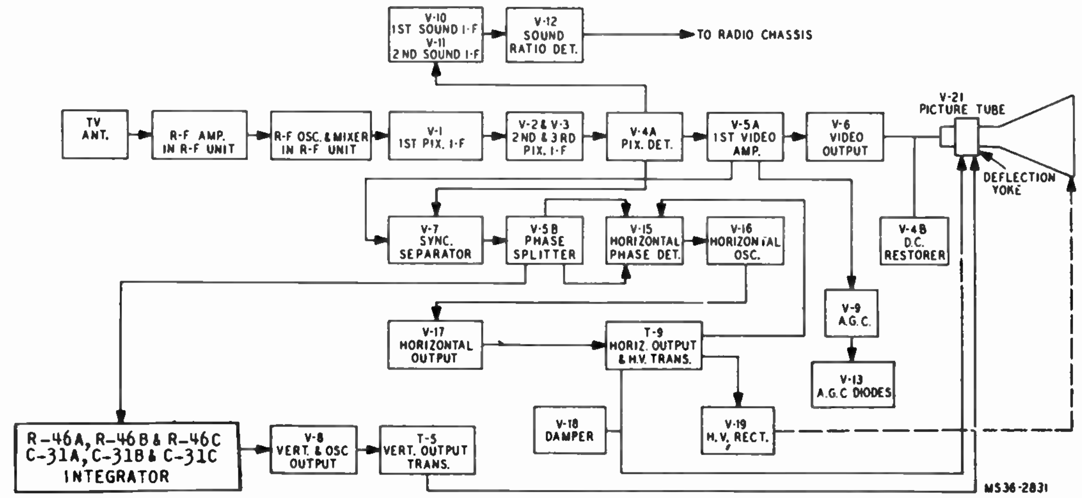


Fig. 7 -- Block Diagram

SERVICE SUGGESTIONS -- (continued)

POOR VERTICAL LINEARITY -- If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A, C-39 or C-70 defective.
4: V-8 (6BL7) defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitors C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY -- If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6W4-GT).
3: Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coil (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER -- This condition can be caused by:

1: Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6W4-GT) defective.

SMALL RASTER -- This condition can be caused by:

1: Low +B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6W4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER: NO IMAGE, BUT ACCOMPANYING SOUND -- This condition can be caused by:

1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY -- If this condition is encountered check:

1: Defective sync separator V-7 or splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY -- If this condition is encountered check:

1. Vertical network capacitors C-31A, B & C and resistors R-46A, B & C.
2: Vertical control (R-61) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.
5: If R-90 (see schematic) is connected as shown with dotted lines, reposition resistor as solid lines indicate.

PICTURE STABLE BUT WITH POOR RESOLUTION -- If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
1: Check all potentials in video circuits.
2: Check picture tube grid circuit for poor or dirty contact.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency and of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc.)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING

1: Check sync stability control adjustment.
2: Check capacitors C-35B and C-79B.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.

PICTURE NORMAL-NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) and associated circuits.

POOR FOCUS

1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.

ALIGNMENT PROCEDURE

TEST EQUIPMENT -- To service this receiver properly, it is recommended that the following test equipment be available.

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:

18 to 30 mc, No. mc sweep width
40 to 90 mc, No. mc sweep width
170 to 225 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.

23.1 mc first picture I-F coil.
24.1 mc third picture I-F coil.
25.9 mc second picture I-F coil.
21.7 mc sound trap.
4.5 mc video trap & sound I-F.
25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS -- To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts, The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the high voltage housing.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE
PIX I-F

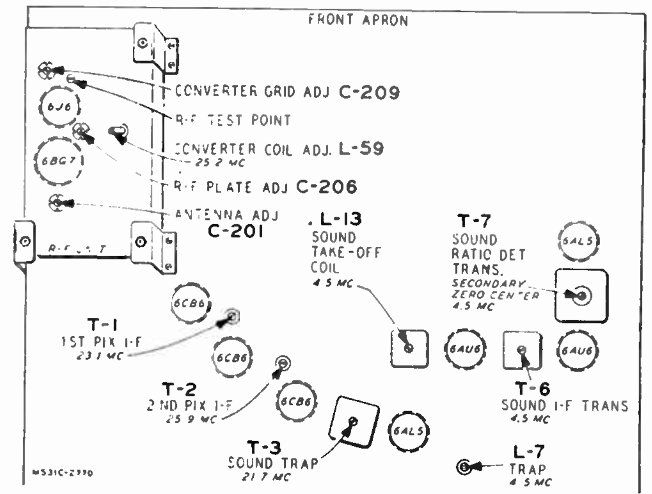


Fig. 8 -- Top Chassis Video and Audio I-F Adjustments

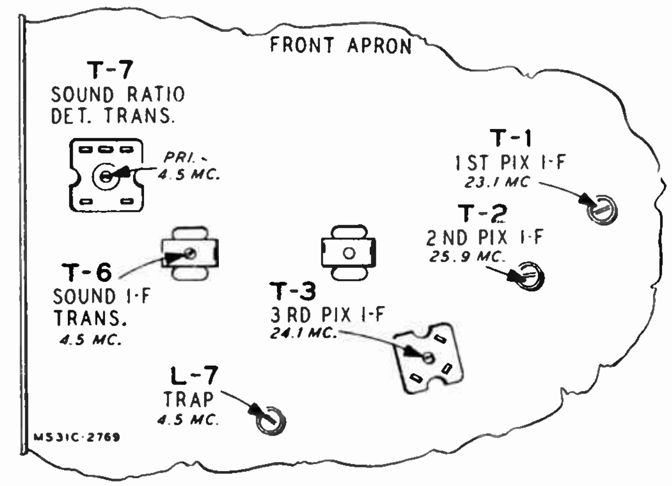


Fig. 9 -- Bottom Chassis Video and Audio I-F Adjustment

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

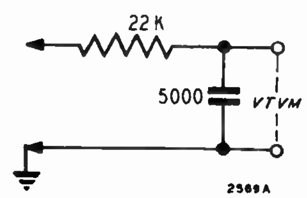


Fig. 10 -- VTVM Connections

ALIGNMENT PROCEDURE (Continued)

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil (L-59) for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

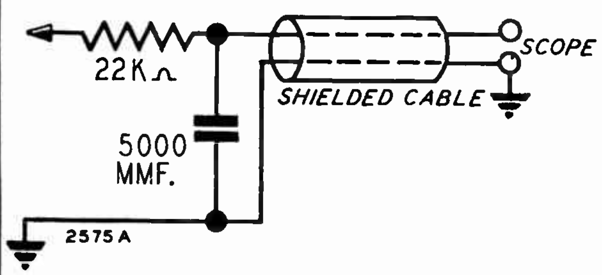


Fig. 11 -- Oscilloscope Connection

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V (DC) bias to AGC line (battery). Tuner should be switched to dead channel so as not to cause interference.

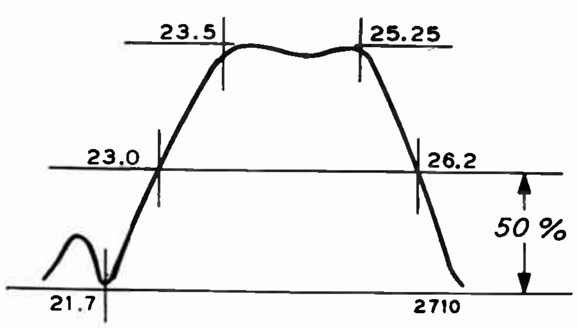


Fig. 12 -- Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response, VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62, and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-66, R-69 & C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE -- If no signal generator is available, the procedure above may be followed by tuning in a station and using a 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect $1\frac{1}{2}$ V bias to AGC line at junction of R-33 and C-20 on the receiver.

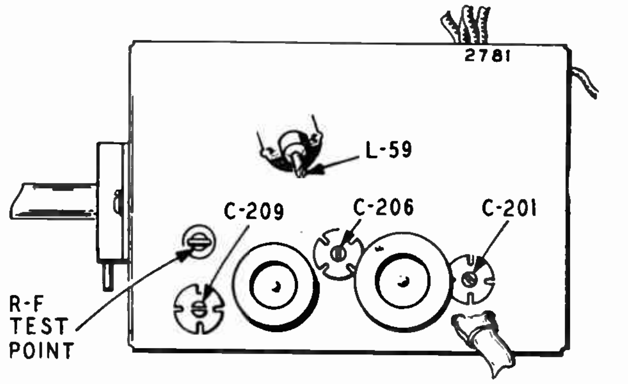


Fig. 13 -- Top Tuner Adjustment

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% an any channels, readjust C-201, C-206, and C-209. Recheck all channels.

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

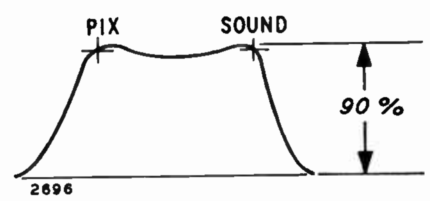


Fig. 14 -- Pix & Audio Markers

TUNER ASSEMBLY INFORMATION

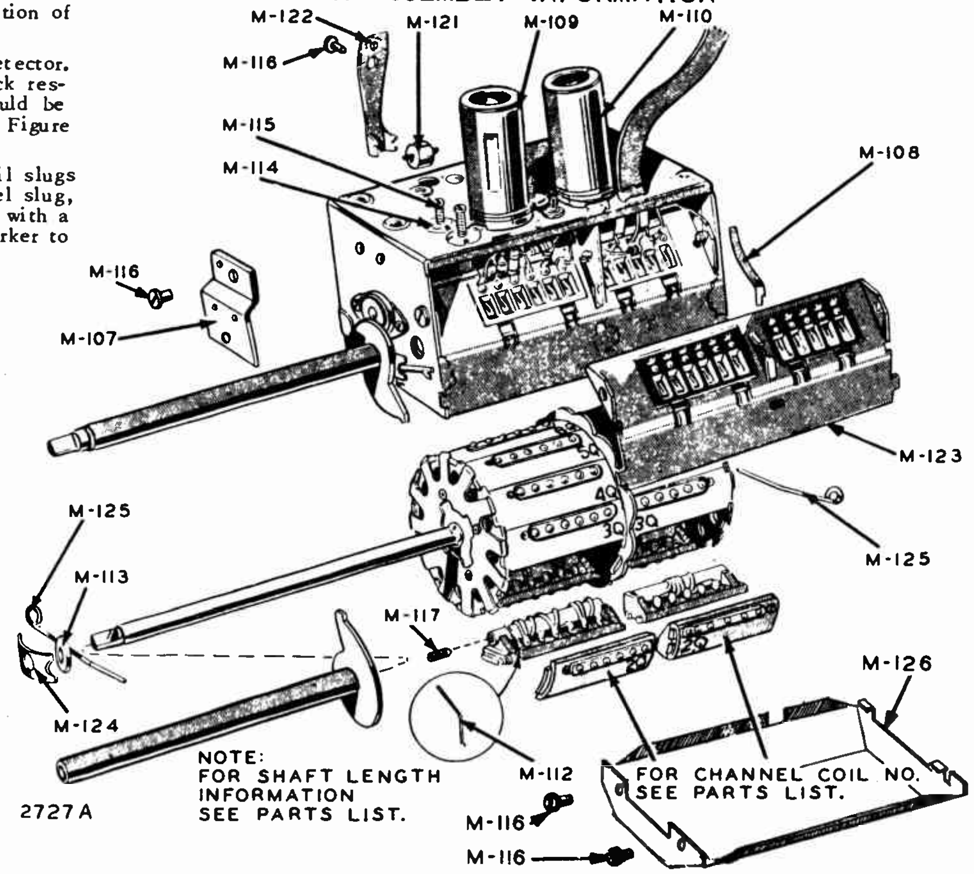


Fig. 15 -- "Q" Tuner Pictorial

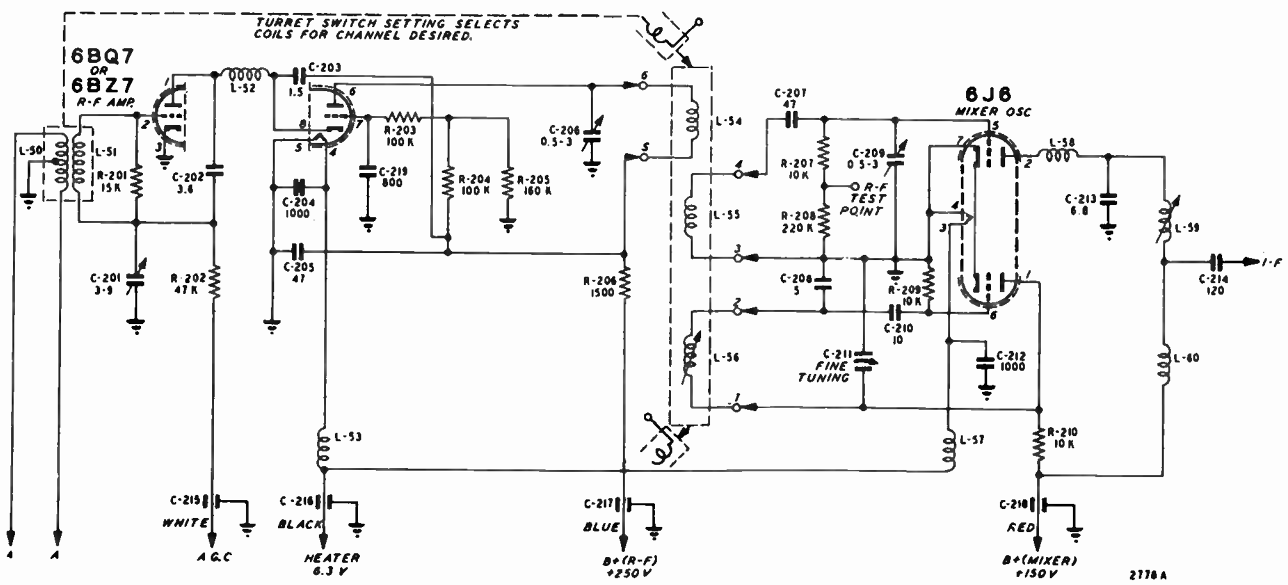


Fig. 16 -- "Q" Tuner Schematic Diagram

OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.

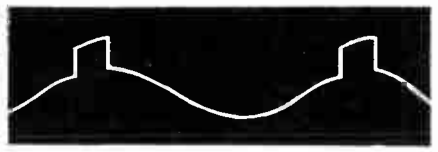
No. 1 -- 6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4 -- 6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.

No. 7 -- 12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.

No. 13 -- 6AL5 Phase Det.
18V P-P 15,750 C.P.S.

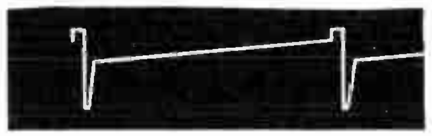
No. 2 -- 12AT7 Plate
35V P-P 60 C.P.S.
No. 2 -- 6AH6 Grid
8V PP 60 C.P.S.

No. 8 -- 6BL7 -- Vert. Osc. Plate
125V P-P 60 C.P.S.



No. 14 -- 6SN7 -- Hor. Osc. Plate
50V P-P 15,750 C.P.S.

No. 3 -- Pix Tube Grid
20-100V P-P 60 C.P.S.



No. 9 -- 6BL7 Vert. Osc. Grid
170V P-P 60 C.S.P.

No. 15 -- 6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.

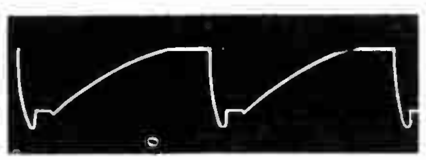
No. 5 -- 6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.

No. 10 -- 6BL7 Vert. Output Grid
150V P-P 60 C.P.S.

No. 16 -- 6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.

No. 6 -- 12AT7 Phase Splitter
Cathode
18V P-P 60 C.P.S.

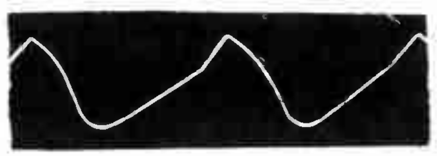
No. 11 – Vert. Def. Coil
100V P-P 60 C.P.S.



No. 17 -- 6BQ6 Grid
120 V P-P 15,750 C.P.S.

No. 6 -- 12AT7 Phase Splitter
Cathode
18V P-P 15,750 C.P.S.

No. 12 -- 6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18 -- 6W4 Damper Plate
120V P-P 15,750 C.P.S.

RADIO INFORMATION

ALIGNMENT PROCEDURE

RADIO

The following is required for aligning:

An all Wave Signal Generator Which Will Provide an Accurately Calibrated Signal at the Test Frequencies as Listed.

Output Indicating Meter, Non-Metallic Screwdriver, Dummy Antennas, -- .1 mf, and 50 mmf.

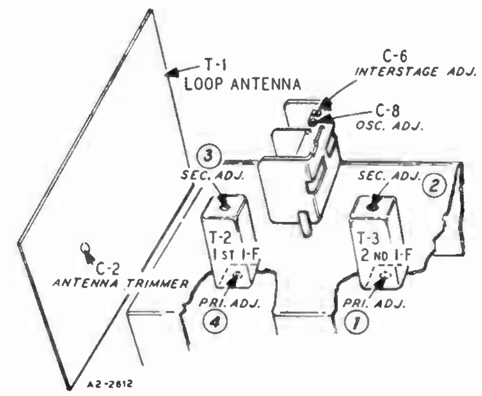
Volume Control Maximum all Adjustments.

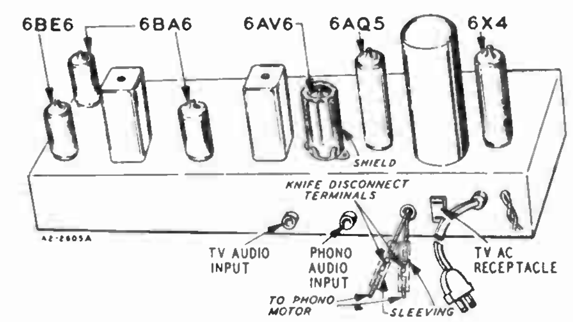
Connect Radio Chassis to Ground Post of Signal Generator with a Short Heavy Lead.

Allow Chassis and Signal Generator to "Heat Up" for Several Minutes.

SIGNAL GENERATOR						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid I-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I-F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (4) and Sec. (3)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid R-F 6BA6 Pin NO. 1	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-8	Maximum Output
1400 KC	Control Grid R-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Turn Rotor to Max Output. Set Pointer to 1400 KC See Note A	Interstage C-6 See Note B	Maximum Output
1400 KC	External Antenna Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2 See Note B	Maximum Output

NOTE A -- If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.
NOTE B -- Turn the rotor back and forth and adjust the trimmer until the peak of greatest intensity is obtained.

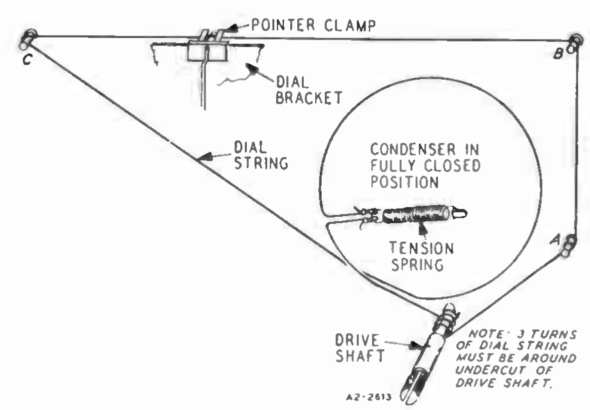


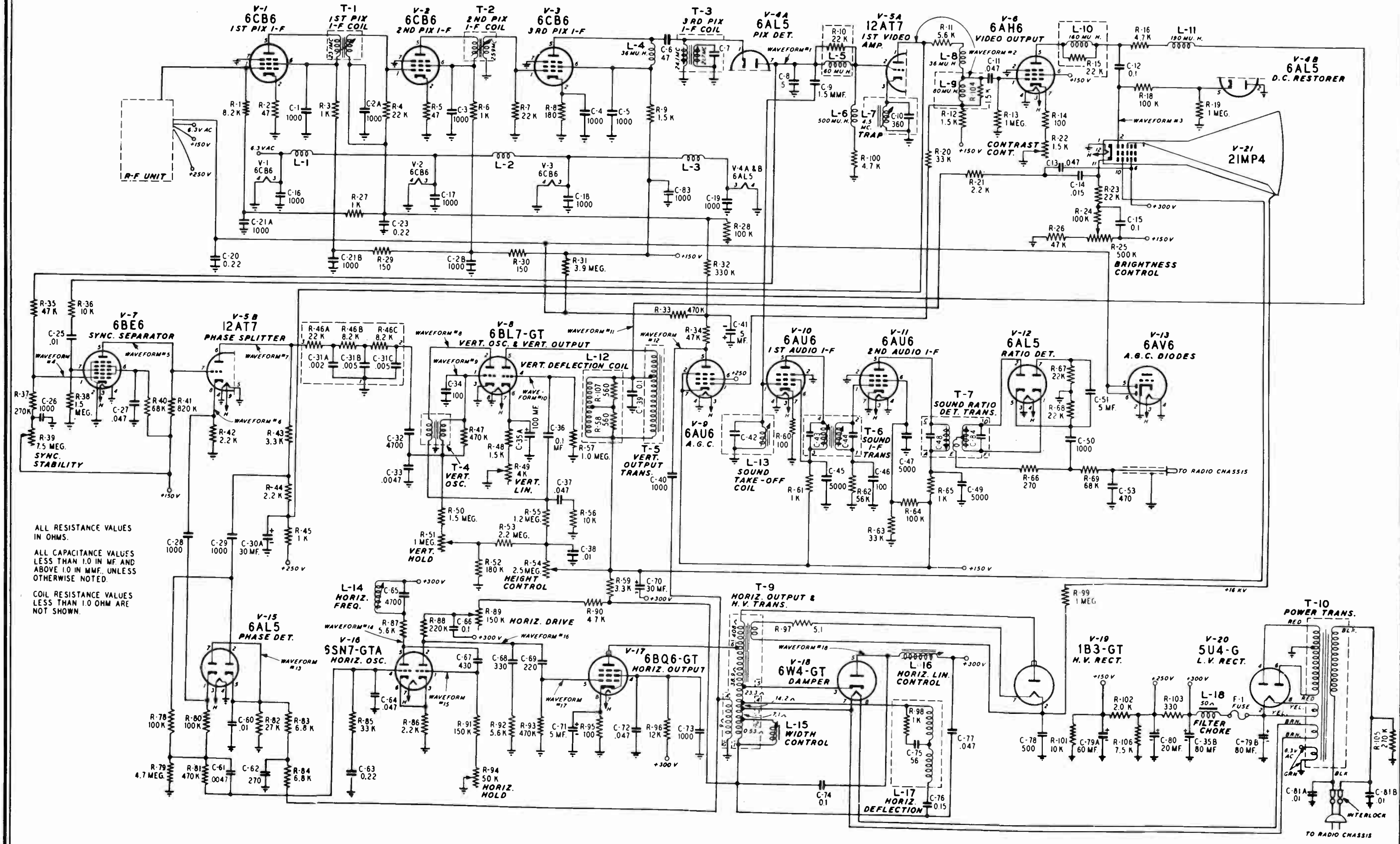


DRIVE CORD REPLACEMENT

DIAL POINTER CORD

Use a new S-10X77 drive cord assembly or a new length of cord 48 inches long for the installation. Install the cord as shown in the illustration, winding three turns counterclockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.

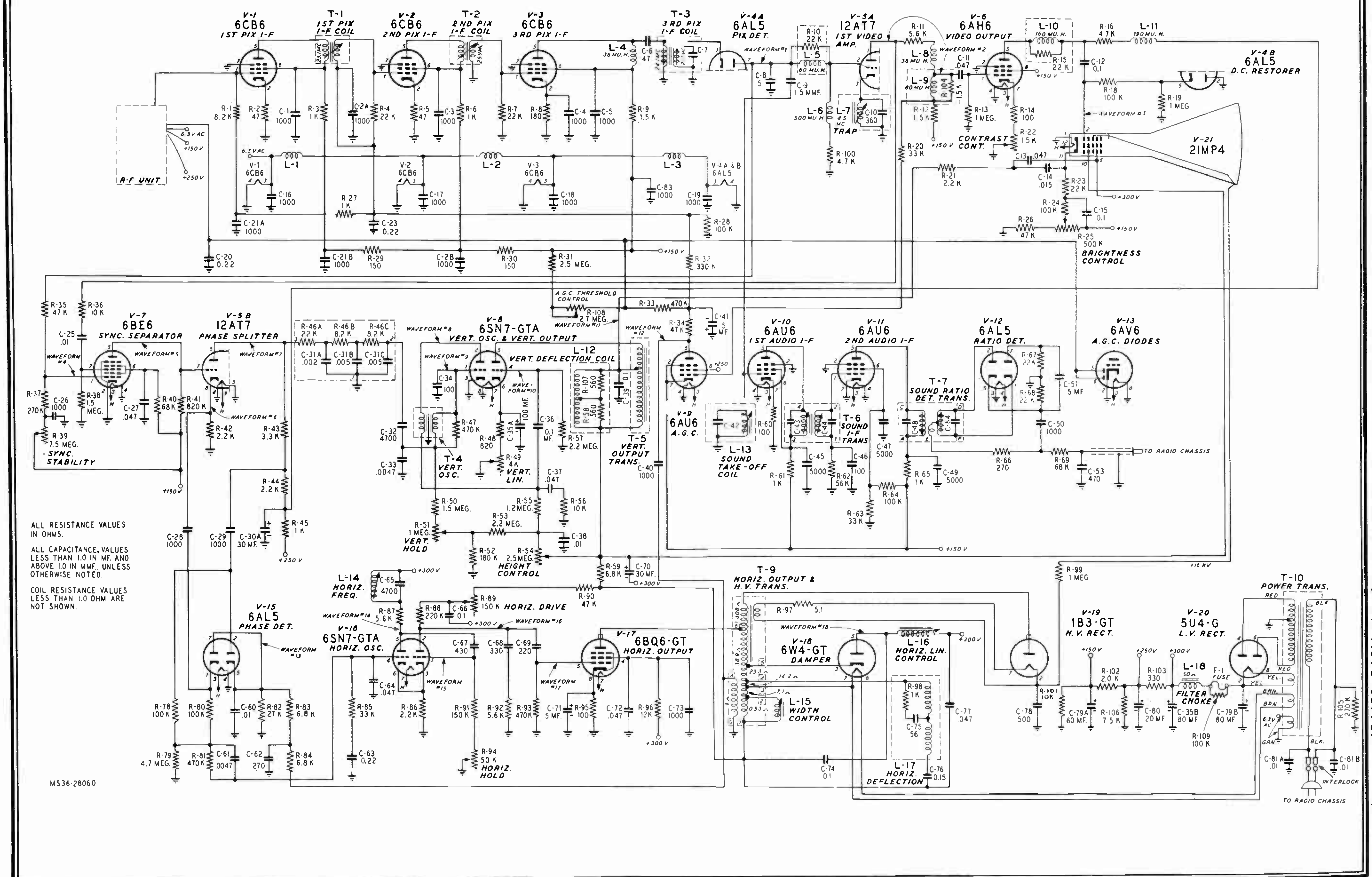




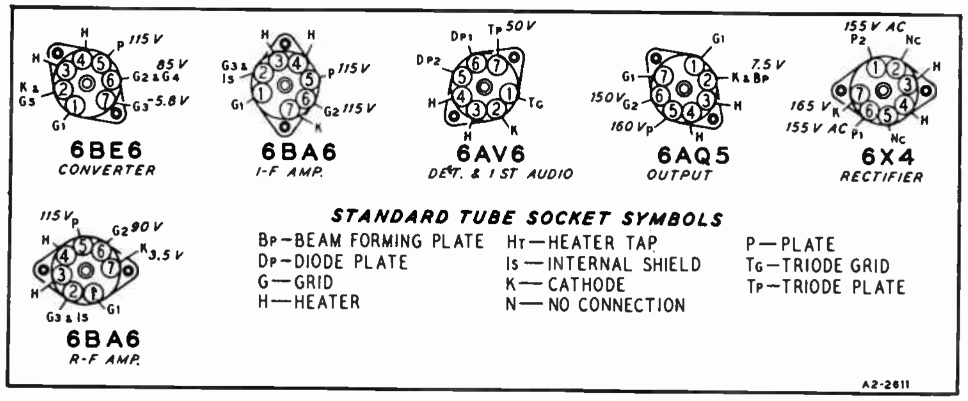
SCHEMATIC DIAGRAM

MODEL 2D1344B

W.G.



WESTERN AUTO SUPPLY TV PAGE 14-63



NOTICE: There is a model number label on the chassis. This label identifies the receiver as to chassis and issue letter. When ordering parts or writing, give ALL information on this label.

TUBE SOCKET VOLTAGES

Socket voltages are shown on the Bottom Socket diagram at the tube socket terminals. All voltages are between the socket terminal and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter. Conditions of measurement are:

Line voltage .... 117 Volts AC
Signal Input .... None
A Variation of ±10% is usually permissible.

MISCELLANEOUS

Part No.	DESCRIPTION
12A477	8" PM Speaker
10A759	Knobs
4X1162	Escutcheon
2A403	Band Switch
13X546	Line Cord and Plug Assembly
3A426	Tube Socket
6A307	TV-AC Receptacle
30X560	Line Cord Clamp
3A305	Phono and TV Audio Socket
3A458	Tube Socket
32X403	Tube Shield
76X1	Capacitor-Resistor Combination
76X5	Capacitor - Resistor Combination
	Cabinet No. 256

PARTS LIST

RADIO AND RECORD CHANGER

Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance.

CAPACITORS

Ref. No.	Part No.	Description			
C-1A) C-1B) C-1C)	14A213	Gang Condenser Assembly			
C-2	17A235	2-24 mmf		Trimmer	
C-3) C-5) C-9) C-14)	B66503	.05 mf	200 V	Tubular	
C-4) C-10) C-13)	B66203	.02 mf	200 V	Tubular	
C-6) C-8)	Part of Gang Condenser Assembly				
C-7	47X558	30 mmf		Ceramic	
C-11A) C-11B)	Part of 76X1 Assembly (See Miscellaneous)				
C-12	47X471	68 mmf		Ceramic	
C-15	D66502	.005 mf	400 V	Tubular	
C-16A) C-16B)	Part of 76X5 Assembly (See Miscellaneous)				
C-17	F66102	.001 mf	600 V	Tubular	
C-18A) C-18B) C-18C)	45X381	20 mf / 40 mf / 40 mf	25 V / 150 V / 200 V	Dry Electrolytic	
C-19	B66104	.1 mf	200 V	Tubular	
C-20	B66103	.01 mf	200 V	Tubular	
C-21	47X508	500 mmf	500 V	Ceramic	

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description
R-1	B84101	100	0.5	Carbon
R-2	B85104	100 K	P.5	Carbon
R-3	B84563	56 K	0.5	Carbon
R-4	B85470	47	0.5	Carbon

RESISTORS (Continued)

Ref. No.	Part No.	Ohms	Watts	Description
R-5	B85223	22 K	0.5	Carbon
R-6	B84472	4.7 K	0.5	Carbon
R-7	B84471	470	0.5	Carbon
R-8	B85225	2.2 Meg	0.5	Carbon
R-9	Part of 76X1 Assembly (See Miscellaneous)			
R-10	B84274	270 K	0.5	Carbon
R-11	B84153	15 K	0.5	Carbon
R-12	C85182	1.8 K	1.0	Carbon
R-13	36X372	500 K		Volume Control
R-14	B85106	10 Meg	0.5	Carbon
R-15A) R-15B)	Part of 76X5 Assembly (See Miscellaneous)			
R-16	40X310	500 K		Tone Control
R-17	B85473	47 K	0.5	Carbon
R-18	B84271	270	0.5	Carbon
R-19	D84821	820	2.0	Carbon
R-20	B84303	30 K	0.5	Carbon

TRANSFORMERS AND COILS

Ref. No.	Part. No	Description
L-1	9A2283	R.F. Interstage Coil
L-2	9A2113	Oscillator Coil
T-1	9A2114	"B" Range Loop Antenna
T-2	9A2112	1st I.F. Trans.
T-3	9A2063	2nd I.F. Trans.
T-4	51X134	Output Trans.
T-5	53X291	Power Trans.

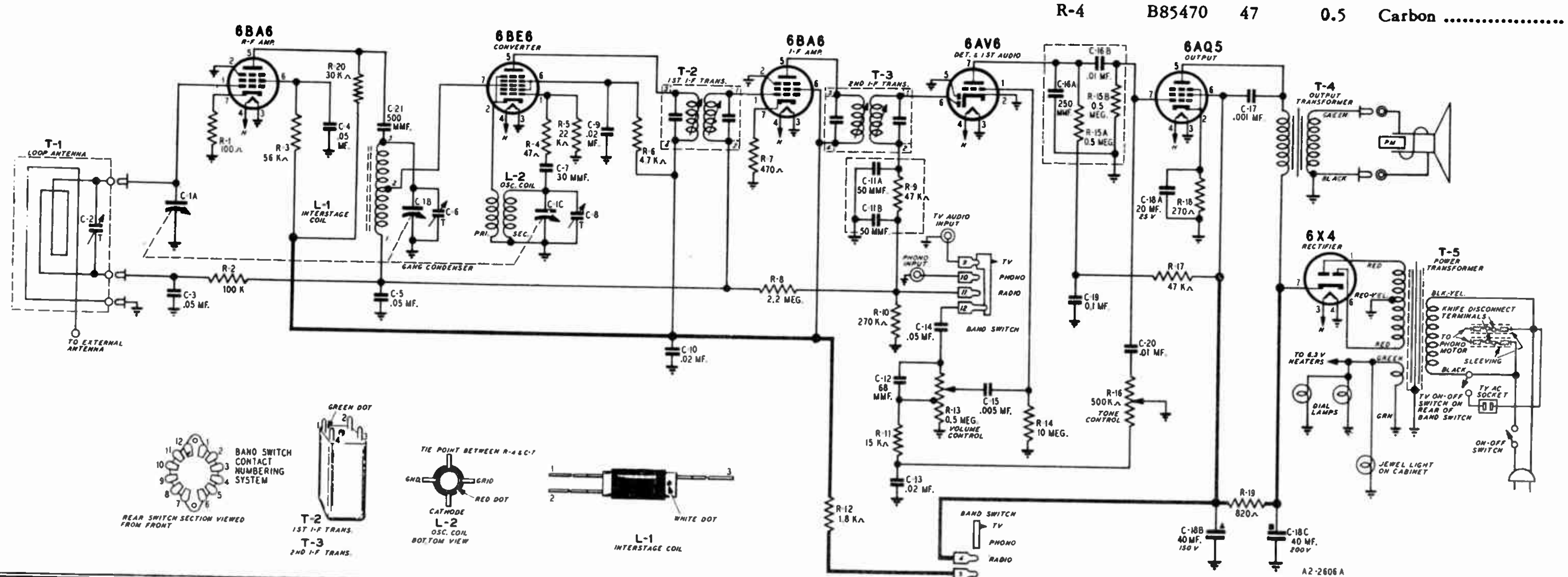
DIAL AND DRIVE ASSEMBLY

Part. No	Description
S-10X77	Drive Cord Assembly
15X251	Pointer
25X1616	Dial Bracket
58X764	Dial Glass
26X524	Drive Shaft
7A233	Pilot Light Socket Assembly
7A32	No. 51 Pilot Bulb
7A230	Jewel-Pilot Light
41X88	Dial Light Reflector
28X113	Drive Cord Tension Spring
7A199	Dial Light Assembly
7A103	No. 47 Dial Light
19X192	"C" Washer (Mtg. Drive Shaft)

TYPE V-28A187 RECORD CHANGER PARTS

See Note	Motor Assembly, 60 cycles 105-125 Volts AC
V-2503G	Pickup Arm
10L3-J	Astatic Cartridge Complete with Needles
A1-J	Needle (1-Mil)
A3-J	Needle (3 Mil)

NOTE: Specify part number stamped on motor Assy.



TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	± 10%	0.5
R-202	12A-039	47 K	± 20%	0.5
R-203	12A-094	100 K	± 10%	0.5
R-204	12A-166	100 K	± 5%	0.5
R-205	12A-167	160 K	± 5%	0.5
R-206	12A-183	1500	±10%	0.5
R-207) R-209) R-210)	12A-040	10 K	±10%	0.5
R-208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204) C-212)	CD8X102Z	1000 mmf	
C-205) C-207)	CDCQ470K	47 mmf	±10%
C-206) C-209)	31B-206	0.5-3mmf	Trimmers
C-208	CD8UO50C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215) C-216) C-217) C-218)	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2278-1	Antenna Coil	2-Q
	9A2278-2	Antenna Coil	3-Q
	9A2278-3	Antenna Coil	4-Q
	9A2278-4	Antenna Coil	5-Q
	9A2278-5	Antenna Coil	6-Q
	9A2278-6	Antenna Coil	7-Q
	9A2278-7	Antenna Coil	8-Q
	9A2278-8	Antenna Coil	9-Q
	9A2278-9	Antenna Coil	10-Q
	9A2278-10	Antenna Coil	11-Q

COILS AND CHOKES (Continued)

Ref. No.	Part No.	Description	Channel and Code No.
	9A2278-11	Antenna Coil	12-Q
	9A2278-12	Antenna Coil	13-Q
	9A2279-1	Oscillator Coil	2-Q
	9A2279-2	Oscillator Coil	3-Q
	9A2279-3	Oscillator Coil	4-Q
	9A2279-4	Oscillator Coil	5-Q
	9A2279-5	Oscillator Coil	6-Q
	9A2779-6	Oscillator Coil	7-Q
	9A2279-7	Oscillator Coil	8-Q
	9A2279-8	Oscillator Coil	9-Q
	9A2279-9	Oscillator Coil	10-Q
	9A2279-10	Oscillator Coil	11-Q
	9A2279-11	Oscillator Coil	12-Q
	9A2279-12	Oscillator Coil	13-Q
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-239	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding
M-109	16S-006	Shield, Tube (6J6)
M-110	16S-004	Shield, Tube (6BQ7)
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil)
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD)
M-114	10E-401	Nut, Locking Spring (for Trimmers).
M-115	9A-410-7	Screw, Trimmer
M-116	9A-629-3	Screw, Bracket Mounting (6/32" by 1/4")
M-117	31B-029	Osc. Slug Trimmer
M-121	31B-016	Roller, Detent (3/8" dia., 3/32" dia. bearing)
M-122	31B-005	Spring, Detent (2-5/16" long)
M-123	31B-278	Contact Plate and Bracket Assy
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½")
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.
M-126	31B-103	Shield, Bottom Cover
	31A-066-26	Fine Tuning Shaft (Sharp Tuning) used with 25A1095 Tuner

PARTS LIST TELEVISION CHASSIS

CAPACITORS

Ref. No.	Part No.	Description			
C-1) C-3) C-4) C-5) C-16) C-17) C-18) C-19) C-26) C-28) C-29) C-40) C-50) C-73) C-83)	80X1	1000 mmf			Ceramic
C-2A) C-2B) C-21A) C-21B)	80X3	1000 mmf.			Dual Ceramic
C-6	47X603	47	mmf	500 V	Ceramic
C-7	Part of T-3				
C-8	47X562	5	mmf	500 V	Ceramic
C-9	47X584	1.5	mmf		Composition Cond
C-10	47X568	360	mmf	500 V	Molded Mica.
C-11) C-27) C-72) C-77)	RCP10M4473M	.047	mf	400 V	Tubular
C-12) C-66) C-74)	RCP10M4104	.1	mf	400	Tubular
C-13) C-37)	RCP10M6473M	.047	mf	600 V	Tubular
C-14)	RCP10M6153M	.015	mf	600 V	Tubular
C-15	RCP10M2104M	.1	mf	200 V	Tubular
C-20) C-23) C-63)	RCP10M2224M	.22	mf	200 V	Tubular
C-25) C-60)	RCP10M4103M	.1	mf	400 V	Tubular
C-30A	45X380	30	mf	450 V	Dry Electrolytic
C-31A) C-31B) C-31C)	Part of 76X7				
C-32) C-65)	47X543	4700	mmf	500 V	Molded Mica.
C-33) C-61)	RCP10M4472M	.0047	mf	400 V	Tubular
C-34) C-46)	47X604	100	mmf	500 V	Ceramic
C-35A) C-35B)	45X391	80 100	mf mf	400 V 50 V	Dry Electrolytic
C-36) C-39)	RCP10M6104M	.1	mf	600 V	Tubular
C-38	RCP10M6103M	.01	mf	600 V	Tubular
C-41	45X361	4	mf	100 V	Dry Electrolytic
C-42	Part of L-13				
C-43) C-44)	Part of T-6				
C-45) C-47) C-49)	47X507	5000	mmf		Ceramic
C-48) C-84)	Part of T-7				
C-51) C-71)	45X378	5	mf	25 W.V	Dry Electrolytic
C-53	47X525	470	mmf	500 V	Molded Mica.

CAPACITORS (Continued)

Ref. No.	Part No.	Description			
C-62	RCM20A271K	270	mmf	500 V	Molded Mica.
C-64	RCP10M2473M	.047	mf	200 V	Tubular
C-67	RCM20B431K	430	mmf	500 V	Molded Mica.
C-68	47X570	330	mmf	500 V	Molded Mica.
C-69	RCM20A221K	220	mmf	500 V	Molded Mica.
C-70	45X393	30	mf	400 V	Dry Electrolytic
C-75	47X598	56	mmf	1500 V	Ceramic
C-76	RCP10M4154M	.15	mf	400 V	Tubular
C-78	47X560	500	mmf	20 K.V.	Ceramic
C-79A) C-79B)	45X390	80 60	mf mf	400 V 400 V	Dry Electrolytic
C-80	45X386	60	mf	450 V	Dry Electrolytic
C-81A) C-81B)	76X8	.01	mf		Dual Ceramic

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description
R-1	B83822	8.2 K	0.5	Carbon
R-2) R-5)	B83470	47	0.5	Carbon
R-3) R-6) R-27) R-61) R-65) R-98)	B85102	1 K	0.5	Carbon
R-4) R-7)	B83223	22 K	0.5	Carbon
R-8	B84181	180	0.5	Carbon
R-9) R-12) R-48)	B84152	1.5 K	0.5	Carbon
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon
R-13) R-19) R-57)	B84105	1.0 Meg	0.5	Carbon
R-14) R-60)	B84101	100	0.5	Carbon
R-15	Part of L-10			
R-16	C83472	4.7 K	1.0	Carbon
R-18) R-24)	B85104	100 K	0.5	Carbon
R-20) R-63) R-85)	B84333	33 K	0.5	Carbon
R-21) R-42) R-44) R-86)	B83222	2.2 K	0.5	Carbon
R-22	40X367	1.5 K		Contrast Control
R-23) R-67) R-68)	B84233	22 K	0.5	Carbon
R-25	40X333	500 K		Brightness Control
R-26	B85473	47 K	0.5	Carbon
R-28) R-64) R-78) R-80)	B84104	100 K	0.5	Carbon

RESISTORS (Continued)

Ref. No.	Part No.	Description		
R-29) R-30)	B85151	150	0.5	Carbon
R-31	B83395	3.9 Meg		Carbon
R-32	B83334	330 K	0.5	Carbon
R-33) R-93)	B84474	470 K	0.5	Carbon
R-34) R-35) R-90)	B84473	47 K	0.5	Carbon
R-36) R-56)	B84103	10 K	0.5	Carbon
R-37	B84274	270 K	0.5	Carbon
R-38) R-50)	B84155	1.5 Meg	0.5	Carbon
R-39	40X363	7.5 Meg		Sync Stability Control
R-40) R-69)	B84683	68 K	0.5	Carbon
R-41	B84824	820 K	0.5	Carbon
R-43	B84332	3.3 K	0.5	Carbon
R-45	C84102	1 K	1.0	Carbon
R-46A) R-46B) R-46C)	Part of 76X7 (See Miscellaneous)			
R-47) R-81)	B85474	470 K	0.5	Carbon
R-49	40X368	4 K		Vertical Linearity
R-51	40X334	1.0 Meg		Vertical Hold
R-52	B84184	180 K	P.5	Carbon
R-53	B84225	2.2 Meg	0.5	Carbon
R-54	40X364	2.5 Meg		Height Control
R-55	B84125	1.2 Meg	0.5	Carbon
R-58) R-107)	B84561	560	0.5	Carbon
R-59	D84332	3.3 K	2.0	Carbon
R-62	B84563	56 K	0.5	Carbon
R-66	B84271	270	0.5	Carbon
R-79	B85475	4.7 Meg	0.5	Carbon
R-82	B84273	27 K	0.5	Carbon
R-83) R-84)	C84682	6.8 K	1.0	Carbon
R-87	C83562	5.6 K	1.0	Carbon
R-88	B83224	220 K	0.5	Carbon
R-89	40X331	150 K		Horizontal Drive
R-91	B83154	150 K	0.5	Carbon
R-92	B84562	5.6 K	0.5	Carbon
R-94	40X361	50 K		Horizontal Hold
R-95	D84101	100	2.0	Carbon
R-96	43X276	12	5.0	Wirewound
R-97	43X239	5.1		Wirewound
R-99	C85105	1.0 Meg	1.0	Carbon
R-100	B83472	4.7 K	0.5	Carbon
R-101	43X272	10 K	5.0	Wirewound
R-102	43X277	2 K	15.0	Wirewound
R-103	43X273	330	10.0	Wirewound
R-104	Part of L-9			
R-105	B85274	270 K	0.5	Carbon
R-106	43X274	7.5 K	10.0	Wirewound

TRANSFORMERS AND COILS

Ref. No.	Part No.	Description
L-1) L-2)	9A2033	R. F. Heater Choke
L-3) L-4) L-8)	9A1979	Peaking Coil (36 Mu. h)
L-5	36A10	Peaking Coil (60 Mu. h)
L-6	36A11	Peaking Coil (500 Mu. h)
L-7	9A2074	4.5 MC Trap
L-9	36A16	Peaking Coil (80 Mu. h)
L-10	36A12	Peaking Coil (160 Mu. h)
L-11	36A2	Peaking Coil (190 Mu. h)
L-12) L-17)	Part of Deflection Yoke Assembly	
L-13	9A2168	4.5 MC Sound Take-Off Coil
L-14	9A2096	Horizontal Hold Control
L-15	9A2183	Width Control
L-16	9A2262	Horizontal Linearity Control
L-18	52X90	Filter Choke
T-1) T-2)	9A2230	1st and 2nd P. I. F. Trans.
T-3	9A2226	3rd P.I.F. Trans.
T-4	54X8	Vertical Osc. Trans.
T-5	51X159	Vertical Output Trans.
T-6	9A2170	Sound I.F. Trans.
T-7	9A2269	Sound Ratio Detector Trans.
T-9	53X330	Horizontal Output Trans.
T-10	53X324	Power Trans.

MISCELLANEOUS

Part No.	Description
9A2274	Deflection Yoke Assembly
76X7	Multiple Resistor-Capacitor
2A407	Ion Trap Magnet
2A426	Centering Device
3A303	Tube Socket (5U4)
3A427	Tube Socket (6AL5) (6AV6) (6AH6) (6BE6)
3A445	Tube Socket Octal
3A458	Tuoe Socket (6AU6) (6CB6) (6AL5)
3A463	Tube Socket (12AT7)
3A464	Tube Socket Octal - Top Mounting
3A470	Tube Socket Octal
3A466	Tube Socket (1B3)
13X817	Pix Tube Socket
32X403	Tube Shield (3A458 Socket)
32X405	Tube Shield (3A463 Socket)
S-34X19	Tube Cover and Power Cord Assembly
S-25X85	Tube Mtg. Strap Assembly
25A1095	Tuner R.F. Assembly
S-6A1	Anode Connector and Lead Assembly
6X67	Rubber Grommet
6X73	Rubber Grommet (6BQ6 Plate Lead)
20X1652	Wing Screw
4A408	Antenna Terminal Strap
28X599	Ground Spring

MISCELLANEOUS (Continued)

Part No.	Description
25X1815	Bracket, Tube Front Support (R.H.)
25X1816	Bracket, Tube Front Support (L.H.)
25X1828	Bracket, Pix Tube Rear Mtg.
8X227	Collar, Pix Tube Rear Mtg
6A305	Power Cord Receptacle
7A240	Pilot Light Socket Assembly
7A32	No. 51 Pilot Bulb
41X89	Light Shield
16X146	Fuse Holder
16X147-3	Fuse 4/10 Amp. 125-250 V
17X174	Pix Crystal
4X1200	Pix Mask
S-4X20	Escutcheon Control Panel
10A820-1	Knob (Fine Tuning)
10A821-2	Knob (Contrast)
10A812-2	Knob (Contrast)
10A812	Knob (Channel Selector)
S-14X67	Cabinet Back Assembly
14X485	Ventilator Grille
4X1157	Pix Tube Mtg. Ring

Models 2D1344B are identical to models 2D1344A except for the following changes:

1. An AGC Control was added to the circuit, reference number R-108.
2. Resistor R-31 was changed in value from 3.9 megohms to 2.7 megohms.
3. V-8 6BL7-GT (Vertical Oscillator and Vertical OutputLtube has been replaced with a 6SN7-GTA tube.
4. Resistor R-48 has been changed in value from 1500 ohms to 820 ohms.
5. Resistor R-57 has been changed in value from 1.0 megohm to 2.2 megohms.
6. Resistor R-59 has been changed in value from 15,000 ohms to 6800 ohms.
7. Resistor R-109 100,000 ohms added to fuse circuit to discharge electrolytic in case of fuse failure.

The part numbers and description of the new resistors are as follows:

REF. NO.	PART NO.	DESCRIPTION	
R-31	B84275	2.7 megohms	0.5 W
R-48	B84821	820 ohms	0.5 W
R-57	B84225	2.2 megohms	0.5 W
R-59	D84682	6800 ohms	2.0 W
R-108	40X364	2.5 megohms	AGC Control
R-109	D85104	100 K ohms	2.0 W

A new schematic diagram MS36-2806D showing all these changes is on the next page.

ADJUSTMENT OF AGC THRESHOLD CONTROL

Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

TUBE COMPLEMENT

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A&B	6AL5	Pix Det. and DC Restorer
V-5 A&B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6W4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube'21'' Metal Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

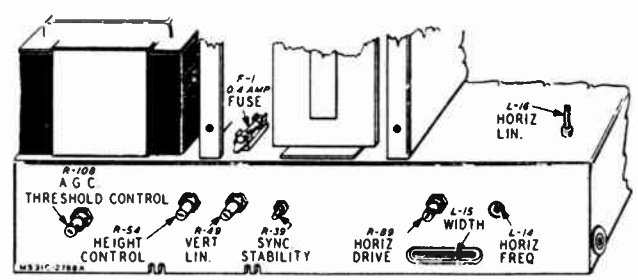
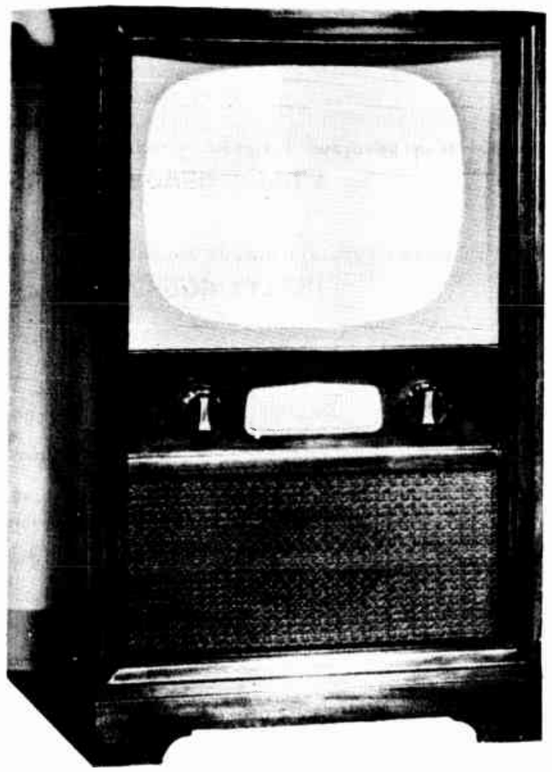


Fig. 4 Adjustments Rear of Chassis

For test patterns, service suggestions and complete parts list, refer to 2D1344A service manual.



MODEL NO. 2D1353A

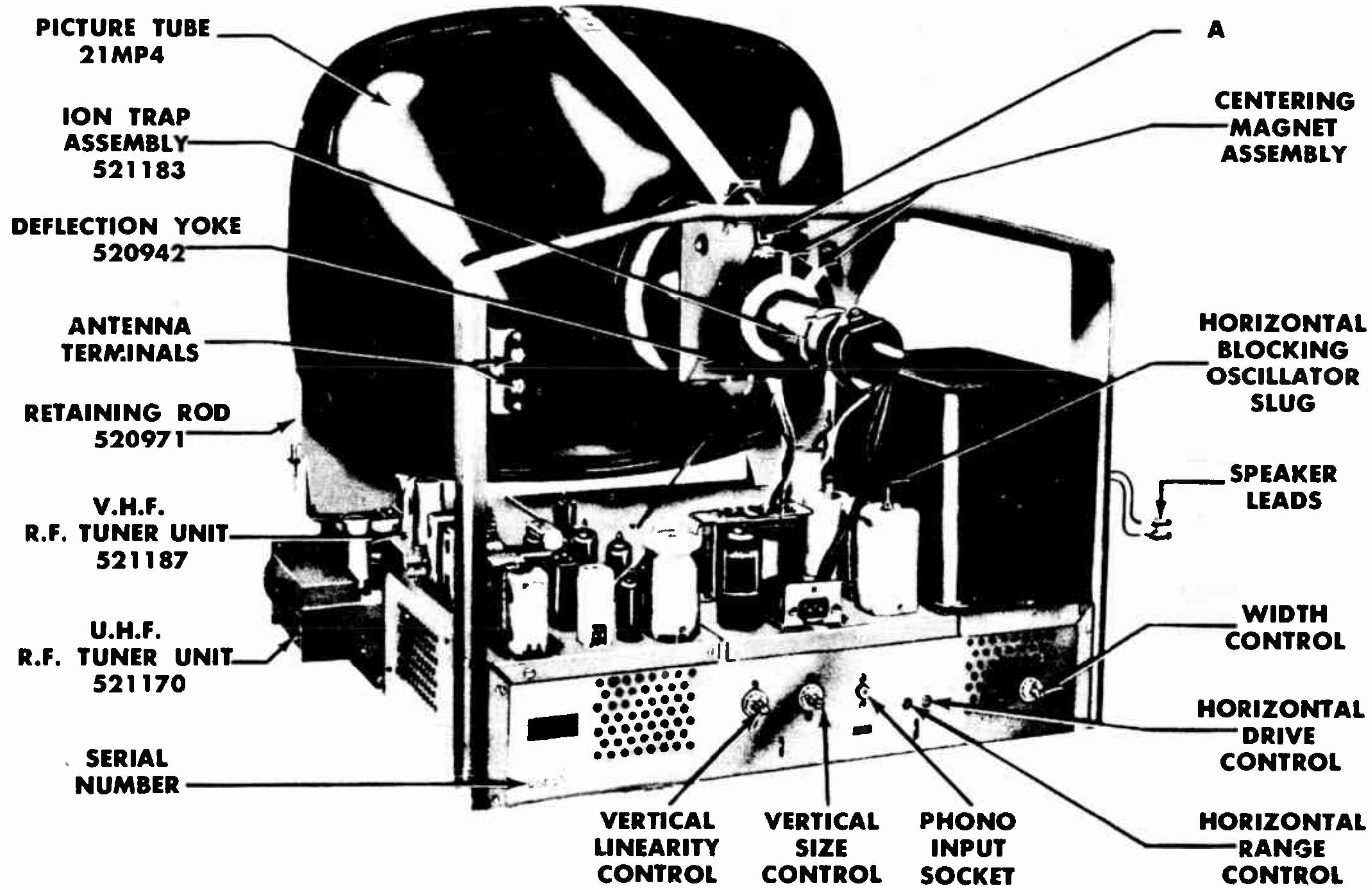


Fig. 15—CHASSIS AND PICTURE TUBE ASSEMBLY

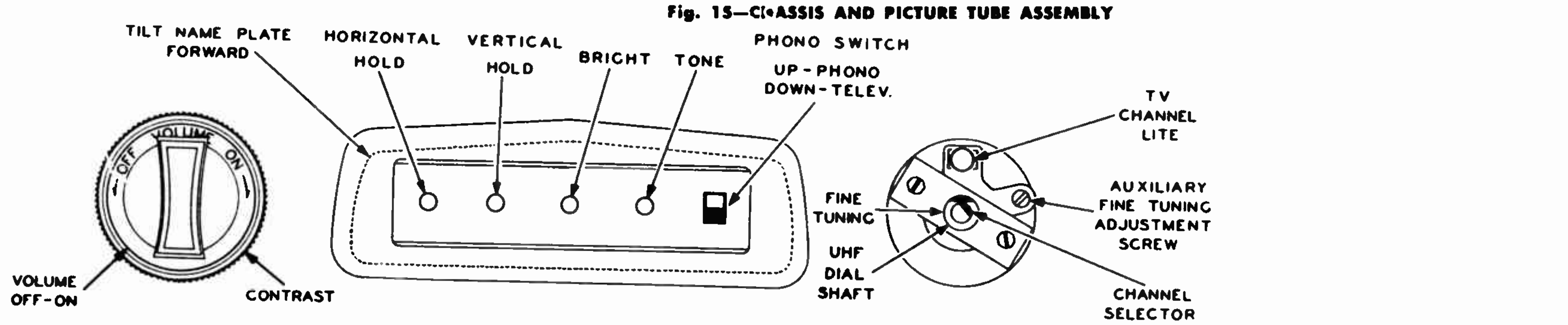


Fig. 11—LOCATIONS OF PRE-SET CONTROLS

HORIZONTAL OSCILLATOR ADJUSTMENTS

NOTE: These adjustments are very critical and should only be performed by a qualified serviceman. Failure to comply with this caution may result in serious malperformance of the receiver.

If adjustment of the "Horizontal Hold" control as explained in step 3 under the section entitled "Control Adjustment Procedure" fails to lock the picture horizontally, it will be necessary to make the following adjustments:

1. Set the "Horizontal Hold" control to the center of its range.
2. Adjust the "Horizontal Blocking Oscillator Slug" until picture remains stationary and does not lose horizontal sync when operating "Channel Selector" knob. See Fig. 15 for location of slug.
3. If the preceding step fails to correct for horizontal movement, then proceed as follows:
   a. Set the "Horizontal Blocking Oscillator Slug" to a position which is approximately in the center of its range.
   b. Remove snap button cover of "Horizontal Range" control and adjust this control until picture locks in horizontally and does not lose sync when operating "Channel Selector" knob. See Fig. 15 for location of control. Then repeat step 2 for a greater degree of horizontal stability.
4. If it still becomes impossible to obtain proper horizontal sync, it will be necessary to adjust the "Horizontal Sine Wave Oscillator Slug" by the method outlined in the alignment section of the service manual.

SPECIFICATIONS

DIMENSIONS

Height	Width	Depth
37 7/8"	24½"	23 1/8"

WEIGHT (Packed)
122 lbs.

POWER REQUIREMENTS
117 volts 60 cycles 220 watts

PICTURE SIZE
21" Rectangular

ANTENNA INPUT IMPEDANCE
300 Ohms--balanced to ground

BUILT-IN ANTENNA
Broad band dipole

R.F. TUNER
V.H.F.--Turret Type
U.H.F.--Continuous tuning type

SPEAKER

Type	Size	V.C. Impedance
P.M. Dynamic	6"x9"	3.2 Ohms

INTERMEDIATE FREQUENCIES
Sound Carrier--41.25 Mc.
Picture Carrier--45.75 Mc.

I.F. SYSTEM
Three stages--overcoupled--for composite signal
One additional stage for sound channel.

DETECTOR
Sound--Ratio type
Picture--Germanium crystal type
U.H.F. Mixer--Germanium crystal type

RETRACELINE SUPPRESSOR
Eliminates retrace lines thruout the range of picture brightness and contrast.

DEFLECTION
Magnetic

FOCUS
Electrostatic

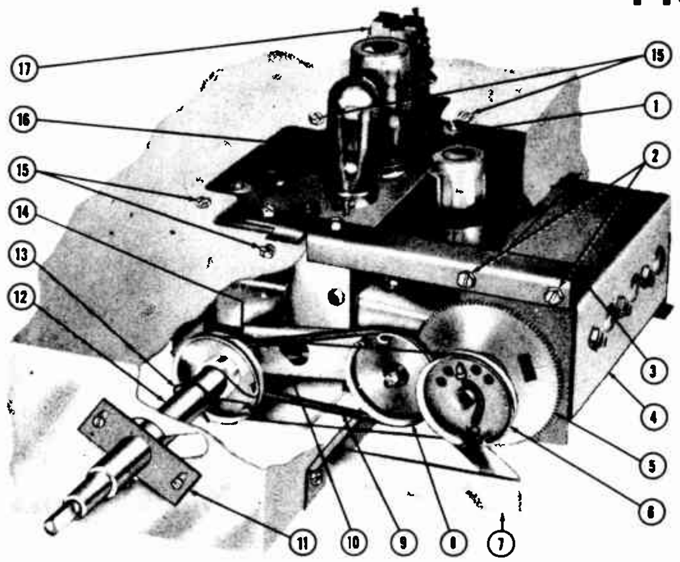
HORIZONTAL SYCHRONIZATION
Automatic frequency control provides excellent picture stability.

HIGH VOLTAGE POWER SUPPLY
"Fly-back" type. Completely enclosed in a shielded compartment.

TUBE COMPLEMENT

TUBE NO.	TUBE TYPE	FUNCTION
V1	6CB6	1st. I.F. Amplifier
V2	6CB6	2nd. I.F. Amplifier
V3	6CB6	3rd. I.F. Amplifier
V4	12BY7	Video Amplifier
V5	6AU6	Keyer--A.G.C.
V6	6BE6	Gated Sync. Separator
V7	12AU7	Sync Amplifier--Vertical Blocking Oscillator
V8	6SN7GT	Horizontal A.F.C.--Horizontal Blocking Oscillator
V9	6BQ6GT	Horizontal Scanning Output
V10	1B3GT	High Voltage Rectifier
V11	6AX4GT	Horizontal Damping
V12	5U4G	Rectifier
V13	6AU6	Sound I.F. Amplifier--Sound Limiter
V14	6T8	Sound Discriminator--Sound Amplifier
V15	6AQ5	Sound Output
V16	6AH4GT	Vertical Scanning Output
V17	21MP4	Picture Tube
V18	6BQ7 or 6BQ7A or 6BZ7	V.H.F. R.F. Amplifier--U.H.F. I.F. Amplifier
V19	6J6	V.H.F. Mixer-Oscillator--U.H.F. I.F. Amplifier
V20	6AF4	U.H.F. Oscillator

V.H.F.–U.H.F. TUNER SERVICING PROCEDURE



The tuning mechanism of this receiver comprises two R.F. tuning units—a 13-position V.H.F. tuner which covers the 12 V.H.F. channels and a continuous type U.H.F. tuner which covers all of the U.H.F. television channels.

When it is necessary to remove the tuning units for service, it can be accomplished by following the procedure given in the following paragraphs. For simplicity, there is a separate removal procedure for each of the tuners.

Instructions for replacing the U.H.F. tuning belt and the dial drive cord are also given below.

REMOVING U.H.F. TUNER

(Numbers which appear after parts mentioned in text refer to parts shown in illustration above.)

1. Disconnect leads marked S, R and T on "Bottom View of Chassis Showing Connections of R.F. Tuners." Also disconnect 300-ohm twin-lead to U.H.F. Tuner (4) at V.H.F. Selector Switch (17); terminals S3 and S12.
2. Remove Bracket and Triangular Shaped Guard (7) shielding U.H.F. Tuning Gear (5).
3. Turn fine tuning knob until U.H.F. tuner shaft is fully counter-clockwise, then loosen two set screws and slide U.H.F. Dial Drive Pulley (6) off of shaft. (To avoid the necessity of restringing U.H.F. dial drive cord, hold Drive Pulley (6) so that cord does not slip off and clamp cord tightly around pulley by wrapping "scotch" tape around the two strands of cord as near as possible to the pulley. Also clamp cord around Dial Pulley and Shaft (12) in this manner.)
4. Remove the two U.H.F. Tuner Mounting Screws (2) and a third screw (not shown in illustration) located underneath chassis on Mounting Bracket (1).
5. Loosen the two set screws on U.H.F. Tuning Gear (5) and free tuner from mounting by pulling away from bottom of chassis. Tuner may now be completely removed by sliding it toward rear of chassis, thus disengaging unit from Gear (5) and Pulley Brackets (10).

If tuner is returned to factory for repair it must be shipped with all parts removed as indicated above.

REMOVING V.H.F. TUNER

(Numbers which appear after parts mentioned in text refer to parts shown in illustration above.)

1. Remove U.H.F. tuner as described above.
2. Disconnect leads marked M, N, P, Q and U on "Bottom View of Chassis Showing Connections of R.F. Tuners." Also disconnect the two white and yellow leads from the tuner to the V.H.F. Selector Switch (17); at terminals S8 and S17.
3. Rotate Channel Selector knob until V.H.F. Selector Switch Actuator Cam is completely disengaged from Switch (17) and remove the two switch mounting screws.
4. Remove channel Selector knob, Fine Tuning knob and U.H.F. Dial from their shafts by pulling them forward.
5. Remove Fiber Bracket (11) which supports tuner operating shafts. Also remove fiber dial lite shield which is fastened by one of the fiber bracket mounting screws.
6. Remove the four Tuner Mounting Screws (15) and lift V.H.F. tuner (16) from chassis.
7. Remove Clip (13) which retains U.H.F. Dial Shaft and Pulley (12) and slide shaft and pulley off of inner shaft.
8. Remove U.H.F. Tuning Belt (9) from pulleys.
9. Loosen two set screws and remove U.H.F. Tuning Pulley (14).
10. Remove U.H.F. Tuning Pulley and Bracket Assembly (10).
11. Remove Front Mounting Bracket (3) and Rear Mounting Bracket (1).
12. Loosen set screw and remove V.H.F. Selector Switch Actuator Cam mounted on rear of turret shaft.

If tuner is returned to factory for repair it must be shipped with all parts removed as indicated above.

REINSTALLING TUNERS

The reinstallation of the tuner can be made in the reverse order given in the removal procedure, observing the following precautions.

1. Remount V.H.F. Tuner (16) in mounting holes that place tuner as far back on chassis as possible.
2. Position coaxial cable lead so that it completely clears the V.H.F. Selector Switch Actuator Cam.
3. When reinstalling U.H.F. Dial Drive Pulley (6), turn U.H.F. tuning shaft to its extreme counter-clockwise position and turn Drive Pulley (6) until the opening in its rim is as shown in **lower** illustration before tightening pulley set screws.
4. When removing "scotch" tape from U.H.F. dial drive cord, hold drive pulleys so that cord is sufficiently taut to prevent it from sliding off of pulleys.
5. Before replacing U.H.F. dial, be sure that **"Fine Tuning" shaft** is in a fully counter-clockwise position or until U.H.F. dial shaft is fully **clockwise.** Place U.H.F. dial on its shaft so that the number 83 is in top center position.

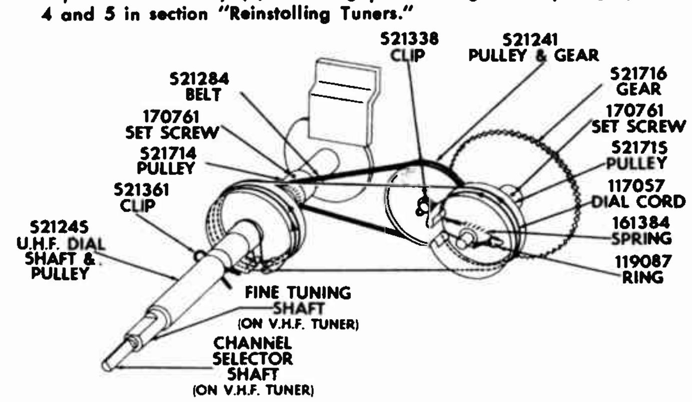
REPLACING U.H.F. DIAL DRIVE CORD

As it is necessary to remove drive cord when replacing U.H.F. Tuning Belt (9), the belt should be replaced at this time if it is worn. The method of accomplishing this is given in a separate procedure outlined below.

1. Remove Bracket and Triangular Shaped Guard (7).
2. Turn U.H.F. tuner shaft fully counter-clockwise and if necessary loosen set screws and turn Drive Pulleys (6) and (12) until opening in their rims are located as shown in **lower** illustration.
3. String drive cord by placing ring at end of cord over tongue of Drive Pulley (6) and winding cord around pulleys as shown in **lower** illustration.
4. Replace U.H.F. dial by following procedure given in paragraph 5 in section entitled "Reinstalling Tuners."

REPLACING U.H.F. TUNING BELT

1. Follow steps 2 and 3 in procedure entitled "Removing U.H.F. Tuner" and step 4 in procedure entitled "Removing V.H.F. Tuner."
2. Remove old Tuning Belt (9) by pulling it over Drive Pulleys (6) and (12) and through shaft opening on front of chassis.
3. Install new belt by using reverse of procedure given in step 2 above.
4. Replace Drive Pulley (6) following procedure given in paragraphs 3, 4 and 5 in section "Reinstalling Tuners."



DIAL DRIVE CORD ARRANGEMENT

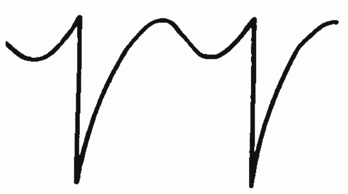
SYNCROGUIDE TRANSFORMER ALIGNMENT
(Chassis that do not include series "E" change)

Alignment of the Syncroguide transformer, circuit diagram #128, which is used in the Horizontal Oscillator circuit on those receivers that **do not** include the letter "E" in the series designation at the rear of the chassis, can be accomplished by utilizing the procedure outlined below. To perform this alignment, it will be necessary to use an oscilloscope, preferably one that has a 2 megacycle response and a low input capacity probe—under 100 mmfd. to ground.

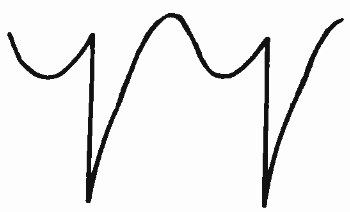
1. Set the "Top Slug" and "Bottom Slug" of the Syncroguide transformer to their maximum counter-clockwise positions.
2. Short together terminals C and D of the Syncroguide transformer.
3. Set "Horizontal Range" control, located on rear of chassis pan, to its maximum clockwise position.
4. Set "Horizontal Hold" control, located at front of chassis to its maximum counter-clockwise position.
5. Turn on receiver and tune in any local TV channel.
6. Adjust "Top Slug" clockwise until picture just locks in horizontally.
7. Remove short from terminals C and D. If picture does not hold sync when short is removed, adjust "Bottom Slug" clockwise until picture locks in.
8. Connect 'scope to terminal C of Syncroguide transformer and adjust sweep rate of 'scope until two cycles of oscillogram remain stationary. Turn "Bottom Slug" clockwise until wave form peaks are equal in height as shown in Fig. 1.

IMPORTANT: The first peak of the wave form should never be higher than the second peak nor should the first peak be lower than the second peak by more than 3%. Also when adjusting the "Bottom Slug," the picture must be in sync, therefore it may be necessary to turn the "Horizontal Hold" control clockwise when performing this step. After this adjustment has been completed, disconnect 'scope from receiver.

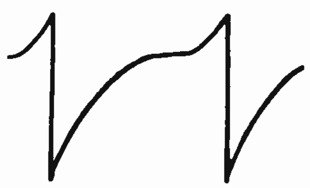
9. Set "Horizontal Hold" control counter-clockwise and adjust "Top Slug" until picture is locked in and does not lose sync when switching "Channel Selector" knob. Then, turn "Top Slug" slowly counter-clockwise until picture is just ready to lose sync as shown in Fig. 4.
10. Horizontal holding action of receiver should now be as follows:
    a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 4 or be out of sync.
    b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.
    c. When "Horizontal Hold" control is in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.
11. If the foregoing steps fail to correct for loss of horizontal holding action under normal receiver operation, be sure that condenser 130 (.01 mfd.) connected across terminals C and D of the Syncroguide transformer is Stewart-Warner part 512311, tubular, .01 mfd., 400 V. Do not use a substitute part.



CORRECT
Fig. 1



INCORRECT
Fig. 2



INCORRECT
Fig. 3

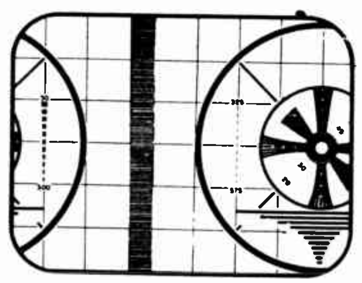


Fig. 4

SYNCROGUIDE TRANSFORMER ALIGNMENT
(Series "E" type chassis)

Alignment of the Syncroguide transformer, circuit diagram #128, which is used in the Horizontal Oscillator circuit can be accomplished by utilizing the procedure outlined below. To perform this alignment, it will be necessary to use an oscilloscope, preferably one that has a 2 megacycle response and a low input capacity probe—under 100 mmfd. to ground.

1. Set the "Top Slug" and "Bottom Slug" of the Syncroguide transformer to their maximum counter-clockwise positions.
2. Short together terminals C and D of the Syncroguide transformer.
3. Adjust "Horizontal Drive" control, located on rear of chassis pan, one-half turn out from its maximum clockwise position.
4. Set "Horizontal Hold" control, located at front of chassis, to its maximum clockwise position.
5. Turn on receiver and tune in any local TV channel.
6. Adjust "Top Slug" clockwise until picture just locks in horizontally.
7. Remove short from terminals C and D. If picture does not hold sync when short is removed, adjust "Bottom Slug" clockwise until picture locks in.
8. Connect 'scope to terminal C of Syncroguide transformer and adjust sweep rate of 'scope until two cycles of oscillogram remain stationary. Turn "Bottom Slug" clockwise until wave form peaks are equal in height as shown in Fig. 1.

IMPORTANT: The first peak of the wave form should never be higher than the second peak nor should the first peak be lower than the second peak by more than 3%. Also, when adjusting the "Bottom Slug," the picture must be in sync, therefore, it may be necessary to turn the "Horizontal Hold" control counter-clockwise when performing this step. After this adjustment has been completed, disconnect 'scope from receiver.

9. Set "Horizontal Hold" control counter-clockwise and adjust "Top Slug" until picture is locked in and does not lose sync when switching "Channel Selector" knob. Then, turn "Top Slug" slowly counter-clockwise until picture is just ready to lose sync as shown in Fig. 4.
10. Horizontal Holding action of receiver should now be as follows:
    a. When "Horizontal Hold" control is at its maximum counter-clockwise position and "Channel Selector" knob is switched, picture may appear as shown in Fig. 4 or be out of sync.
    b. When "Horizontal Hold" control is at its maximum clockwise position, picture may lose sync when switching "Channel Selector" knob.
    c. When "Horizontal Hold" control is in the center or near the center of its range, picture remains stable when switching "Channel Selector" knob.

ALIGNMENT PROCEDURE

The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits.

Alignment of all RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts.

These procedures should preferably be applied in the order in which they are presented. Alignment of Sound Channel or IF Channel may be accomplished individually if desired.

The RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned.

CAUTION

The picture tube is highly evacuated and if broken fragments will be violently expelled. Handle with care. Avoid contact with metal shell of picture tube as this is part of the high voltage circuit.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated.
   a. IF Frequencies:
      4.5 Mc. Sound Channel
      39.75 Mc. to 47.25 Mc. IF Channel
   b. RF Frequencies:
      54 to 88 Mc.
      174 to 216 Mc.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the UHF Tuner, part 521170, must be returned to the factory in accordance with the removal instructions, listed in a subsequent section under the heading "VHF-UHF Tuner Servicing Procedure."
2. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.
3. **RF SWEEP GENERATOR** to provide frequency modulated signal for observing the over-all bandpass characteristic and RF Channel alignment at the following frequencies:

   40 to 50 Mc. with 10 Mc. sweep width.
   54 to 88 Mc. with 10 Mc. sweep width.
   174 to 216 Mc. with 10 Mc. sweep width.

   No frequencies are listed for the UHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the UHF Tuner, part 521170, must be returned to the factory in accordance with the removal instructions, listed in a subsequent section under the heading "VHF-UHF Tuner Servicing Procedure."
4. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe. This instrument is used for observing the over-all bandpass characteristic and for RF Channel alignment.

SOUND CHANNEL ALIGNMENT PROCEDURE

1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and Contrast control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. A small screwdriver (preferably non-metallic) can be used for alignment of Sound IF. The blade of this tool will fit the slot in the core of the transformer.

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Contrast control to its maximum counter-clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in Fig. 3. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V1, V2 or V3). This will prevent noise in the RF stages from affecting the voltage reading while adjusting the sound trap.	#1 4.5 MC Sound Trap (See Fig. 10)	Adjust for minimum reading on VTVM.
Same as above	Same as above.	Connect as shown in Fig. 4.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	#2 Discriminator Secondary (See Fig. 10)	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary (See Fig. 8)	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer (See Fig. 10)	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 5.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 5.	#2 Discriminator Secondary (See Fig. 10)	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.

Replace the type 6CB6 tube previously removed in the above procedure and turn set on. Tune in to a local channel and should there be an unusual amount of "Intercarrier Buzz" refer to procedure on adjoining page to remove this aforementioned fault.

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

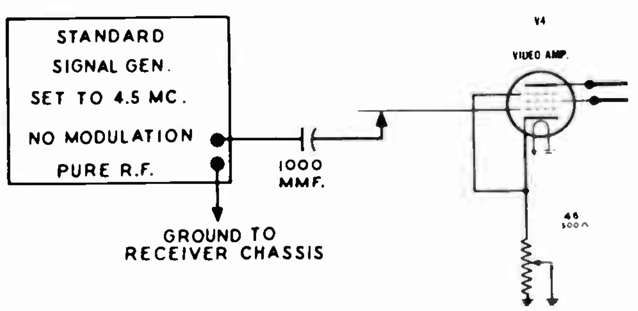


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

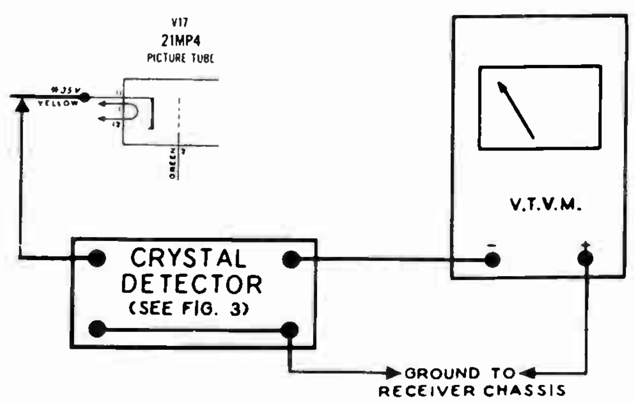


FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

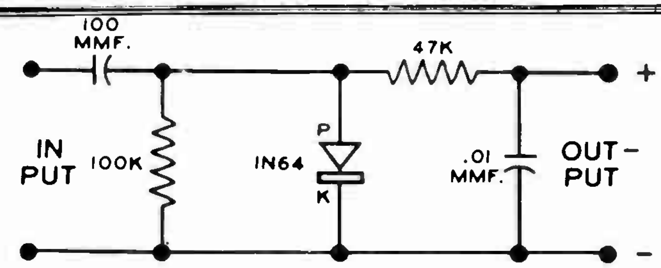


FIG. 3
Circuit Diagram for Crystal Detector shown in Fig. 2

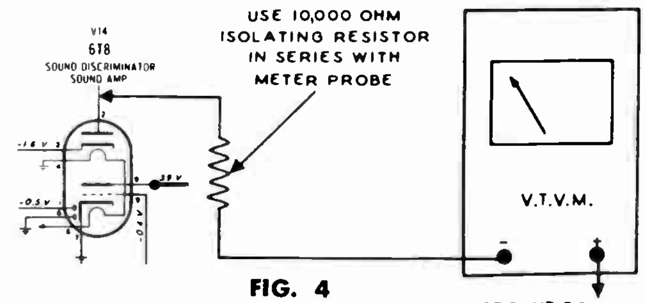


FIG. 4
VTVM Connections for Sound IF Alignment

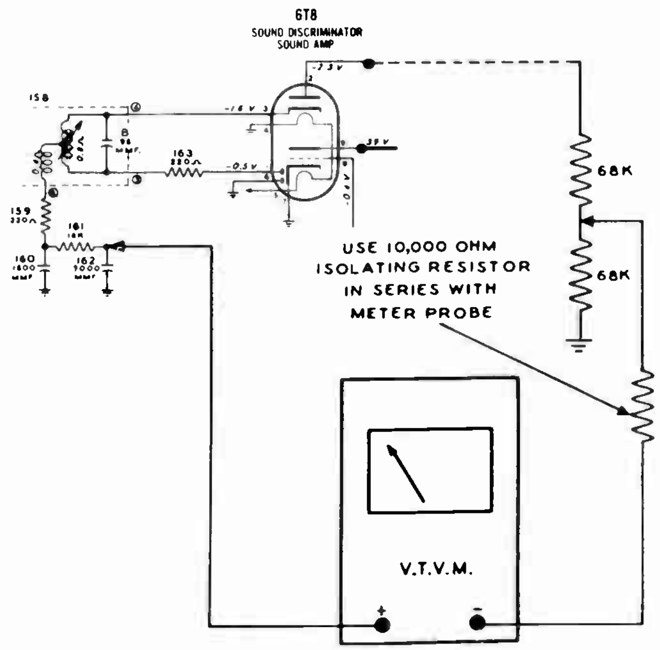


FIG. 5
VTVM Connections for Sound Discriminator Alignment

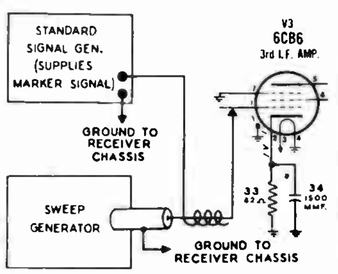
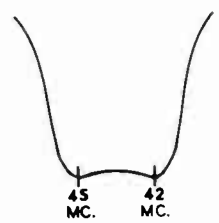
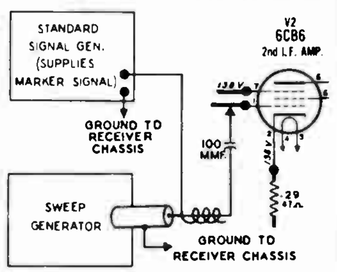
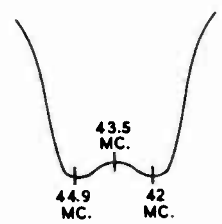
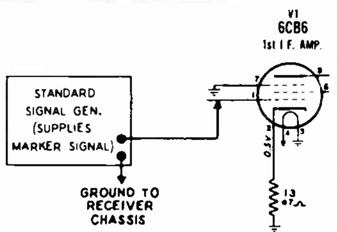
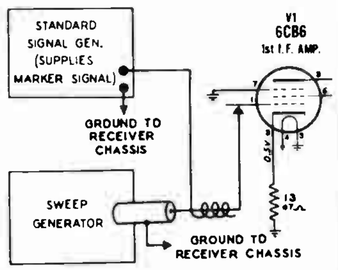
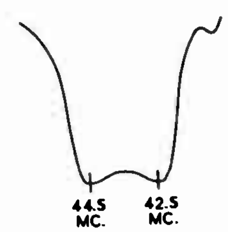
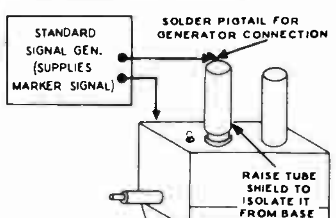
REDUCTION OF INTERCARRIER BUZZ

Under actual reception conditions slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under these conditions.

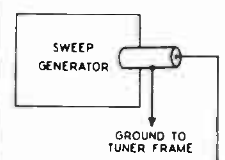
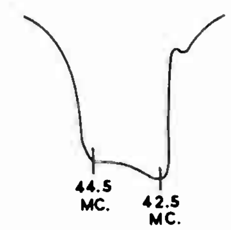
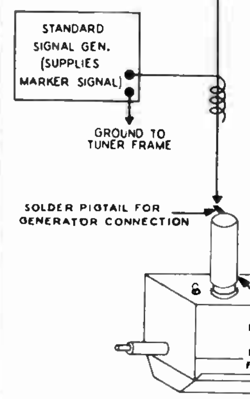
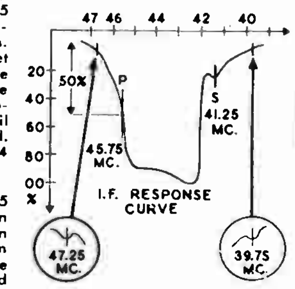
Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

IF CHANNEL ALIGNMENT PROCEDURE

1. A non-metallic screw driver must be used when adjusting the trimmers of the IF transformers to prevent a false indication.
2. In order to eliminate the possibility of spurious oscillation, it is desirable to render the RF oscillator inoperative. This may be accomplished by insulating oscillator contacts on the tuner strips. Remove tuner bottom shield and place a piece of transparent cellulose tape on the first two contacts (from front) of drum assembly. Use any inoperative channel and rotate drum to this insulated position.
3. Short antenna terminals together with a jumper wire.
4. Connect a V.T.V.M. and oscilloscope as shown in Fig. 7.
5. Adjust output attenuator on sweep generator so that reading on V.T.V.M. is not in excess of one volt.
6. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.
7. Certain alignment steps will require a fixed 3 volt A.G.C. bias. When necessary, connect negative terminal of battery to the receiver A.G.C. line and positive terminal to receiver chassis. See Fig. 8 for convenient point of connection.

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR 42 Mc. & 45 Mc. SWEEP GENERATOR 45 Mc. ±5 Mc.	Detune 2nd IF transformer by soldering a short piece of wire or connecting a clip to pin 5 of V2 (6CB6, 2nd IF Amp.) Other end of wire or clip is left unconnected.	# 5 and # 6 3rd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 42 Mc., 43.5 Mc. & 44.9 Mc. SWEEP GENERATOR 45 Mc. ±5 Mc.	Remove detuning clip discussed in previous step. Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 7 and # 8 2nd IF Trans. (See Fig. 9)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 41.25 Mc. SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 9 Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 47.25 Mc. SWEEP GENERATOR Not Used	Same as above.	# 10 Adjacent Sound IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.
	STANDARD SIGNAL GENERATOR 42.5 Mc. & 44.5 Mc. SWEEP GENERATOR 45 Mc. ±5 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 11 2nd IF Grid Coil and # 12 1st IF Plate Coil (See Fig. 9)	Adjust trimmers for maximum amplitude bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 39.75 Mc. SWEEP GENERATOR Not Used	Disconnect 3 volt AGC battery from receiver.	# 13 Adjacent Picture IF Trap (See Fig. 9)	Adjust for minimum reading on V.T.V.M.

IF CHANNEL ALIGNMENT PROCEDURE—Continued

GENERATOR CONNECTIONS	GENERATOR FREQUENCIES	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
	STANDARD SIGNAL GENERATOR 42.5 Mc. & 44.5 Mc. SWEEP GENERATOR 45 Mc. ±5 Mc.	Connect a 3 volt battery to receiver AGC system as explained in instruction 7 at the head of this chart.	# 14 1st IF Grid Coil (See Fig. 9) #15 Converter Plate Coil (See Fig. 10)	Adjust trimmers for maximum amplitude, bandwidth and correct positioning of markers as shown. 
	STANDARD SIGNAL GENERATOR 39.75 Mc., 41.25 Mc., 45.75 Mc. & 47.25 Mc. SWEEP GENERATOR 45 Mc. ±5 Mc.	Same as above.		The general shape of the overall IF response curve and position of markers should compare with that shown. The picture carrier marker (45.75 Mc.) should appear at approximately the 50% amplitude position. Should this observation fail to meet the above requirement, it will be necessary to make a small change in the setting of one or a combination of the following trimmers until the desired results are achieved. Trimmers, # 5, 6, 7, 8, 11, 12, 14 and slug 15. The sound carrier marker (41.25 Mc.) should appear at the position shown on the curve. If the position of this marker is not correct, then it will be necessary to readjust the setting of trimmer # 9 as explained previously in this procedure.  To properly observe the position of the adjacent channel picture carrier (39.75 Mc.) and the adjacent channel sound carrier (47.25 Mc.), it will be necessary to increase the vertical gain control on the 'scope and the output of the sweep and standard signal generators. Also, be sure to disconnect the 3 volt AGC battery from receiver. If these markers do not compare favorably with that shown, repeat the adjustment of trimmers # 10 and 13 as explained previously in this procedure, exercising greater care in obtaining a minimum reading on the VTVM.

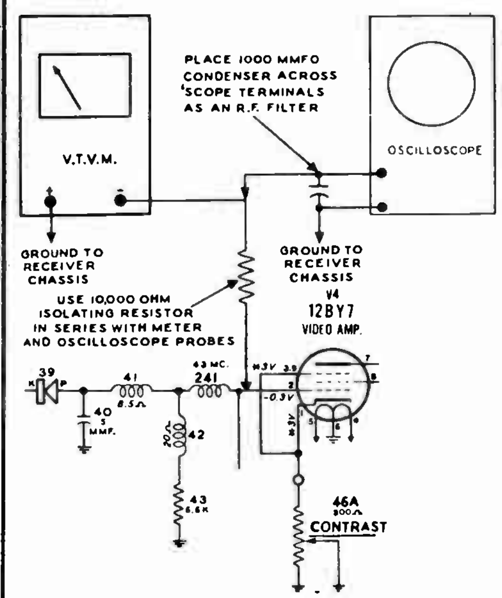


FIG. 7
VTVM and Oscilloscope Connections for IF Channel Alignment

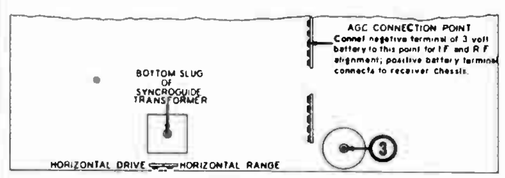


FIG. 8
Bottom View of Chassis

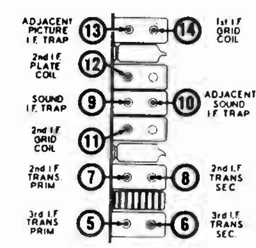


FIG. 9
View of IF Strip

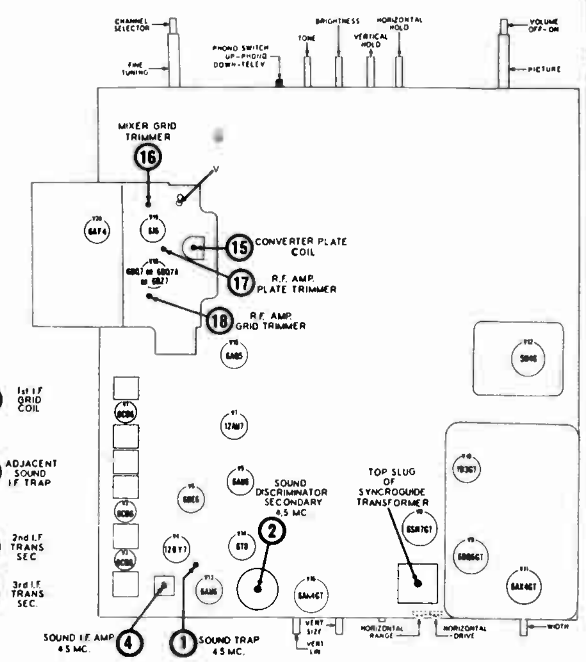


FIG. 10
Top View of Chassis

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VHF RF CHANNEL ALIGNMENT PROCEDURE

The procedure listed below is only for the VHF RF Channels. If it ever becomes necessary to align the UHF RF Channels, the UHF Tuner, part 521170, must be returned to the factory in accordance with the removal instructions, listed in a subsequent section under the heading "VHF-UHF Tuner Servicing Procedure."

1. **CAUTION:** The shell of the picture tube has a high voltage potential, approximately 14,000 volts, and contact should be avoided. As the adjustment screws are in relatively close proximity to this shell, some means of insulation from accidental contact should be provided.
2. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 10 for convenient point of connection.)

STANDARD SIGNAL GENERATOR: CONNECTIONS	STANDARD SIGNAL GENERATOR: FREQUENCY	SWEEP GENERATOR: CONNECTIONS	SWEEP GENERATOR: FREQ.	VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 11.	209.75 MC. Sound Carrier 205.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Not used.	Connect as shown in Fig. 12.	Set Channel Selector to #12. IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	#16 Mixer Grid. (See Fig. 18) #17 RF Amp. Plate. (See Fig. 18) #18 RF Amp. Grid. (See Fig. 18)	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 15. Use Mixer Grid trimmer #16; and RF Amplifier Plate trimmer #17 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #18 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. IMPORTANT: When adjusting trimmers #9, 10 and 11 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Not used.	Same as above.	Set channel selector to channel being observed.		The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #16, 17 and 18. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. Band pass characteristic of these channels should conform close to the RF response curve in Fig. 15. If necessary, a compromise may be obtained to compensate for large variations in channel response by returning to channel #12 and making slight changes in the settings of trimmers #16, 17 and 18.

OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in IF alignment procedure.
2. During oscillator alignment, it is necessary to set the Fine Tuning control so that the tooth on the fiber fine tuning cam points downward (correct position for this control is shown in Fig. 17).
3. During this step and thru-out all succeeding steps it is necessary to: keep output of sweep generator at a level that does not allow reading on VTVM to exceed one volt.
4. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.

STANDARD SIGNAL GENERATOR: CONNECTIONS	STANDARD SIGNAL GENERATOR: FREQUENCY	SWEEP GENERATOR: CONNECTIONS	SWEEP GENERATOR: FREQ.	VTVM CONNECTIONS	SCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig. 11.	209.75 MC. Sound Carrier Marker. 205.25 MC. Picture Carrier Marker.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Connect as shown in Fig. 13.	Connect as shown in Fig. 13.	Set Channel Selector to #12. Be sure that generator's output does not exceed voltage specified in instructions #3 and 4 above.		Using a non-metallic screwdriver to adjust channel #12 oscillator slug (accessible thru hole on front of RF Tuner Unit—see Fig. 17) shift response curve so that picture carrier marker is located at the position indicated in Fig. 16. Position of sound carrier marker should appear as indicated in Fig. 16.
Same as above.	The bandpass characteristic for each of the successive channels should now be observed individually. For frequency setting of marker signals see table in Fig. 14.	Same as above.	Set sweep generator to channel frequencies being observed.	Same as above.	Same as above.	Set channel selector to channel being observed.		Adjust the RF sweep generator and marker generator for operation on the other television channels. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of RF Tuner Unit (see Fig. 17). This permits response curve to be shifted so that picture and sound carrier markers will appear at the position indicated in Fig. 16. NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 17).

If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel. If characteristic does not conform reasonably well within the typical curve shown in Fig. 15, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

INSTRUMENT CONNECTIONS FOR R.F. CHANNEL ALIGNMENT

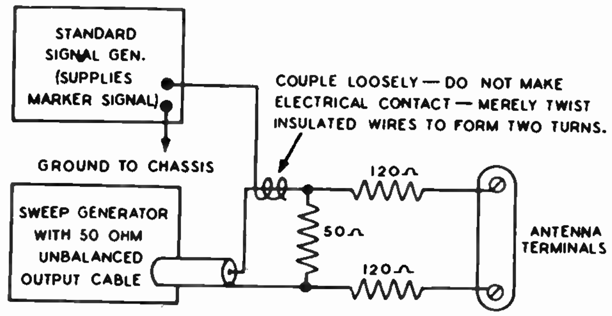


FIG. 11
Generator Connections for RF Channel Alignment

CHANNEL NUMBER	PICTURE CARRIER MARKER FREQ.	SOUND CARRIER MARKER FREQ.
13	211.25 MC.	215.75 MC.
12	205.25 MC.	209.75 MC.
11	199.25 MC.	203.75 MC.
10	193.25 MC.	197.75 MC.
9	187.25 MC.	191.75 MC.
8	181.25 MC.	185.75 MC.
7	175.25 MC.	179.75 MC.
6	83.25 MC.	87.75 MC.
5	77.25 MC.	81.75 MC.
4	67.25 MC.	71.75 MC.
3	61.25 MC.	65.75 MC.
2	55.25 MC.	59.75 MC.

FIG. 14

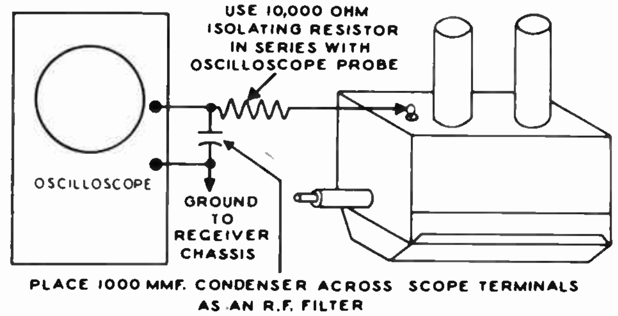


FIG. 12
Oscilloscope Connections for RF Amp. and Mixer Alignment

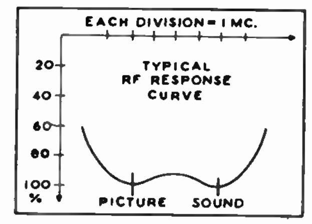


FIG. 15

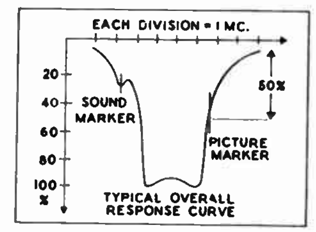


FIG. 16

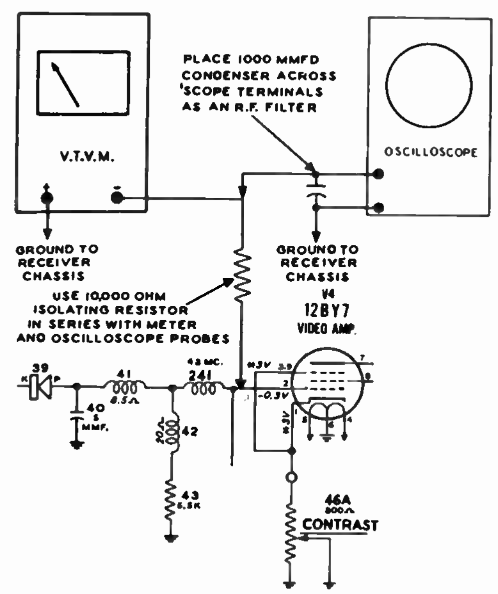


FIG. 13
VTVM and Oscilloscope Connections for Oscillator Alignment

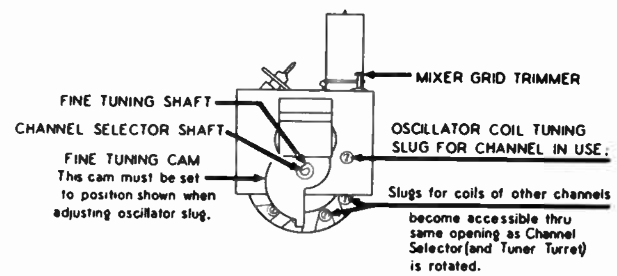


FIG. 17
Front View of VHF RF Tuner Unit

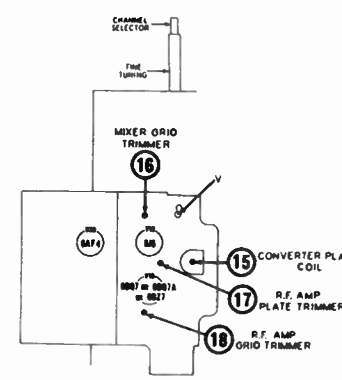
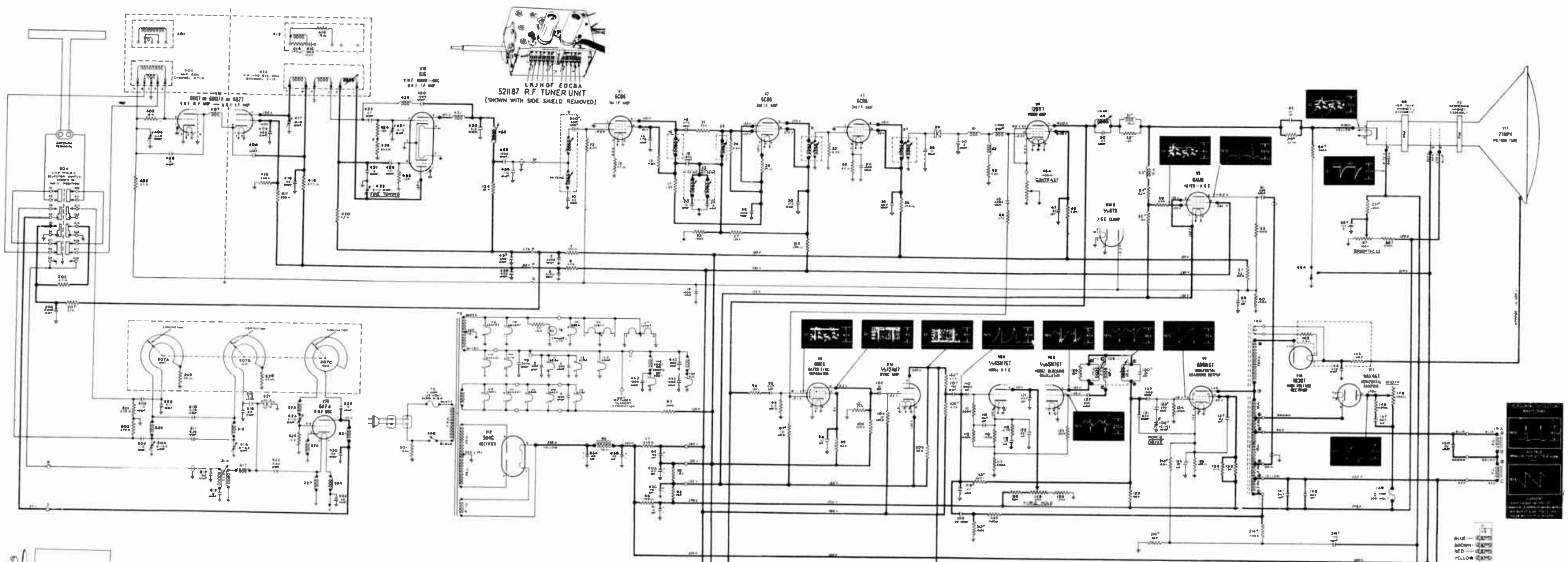
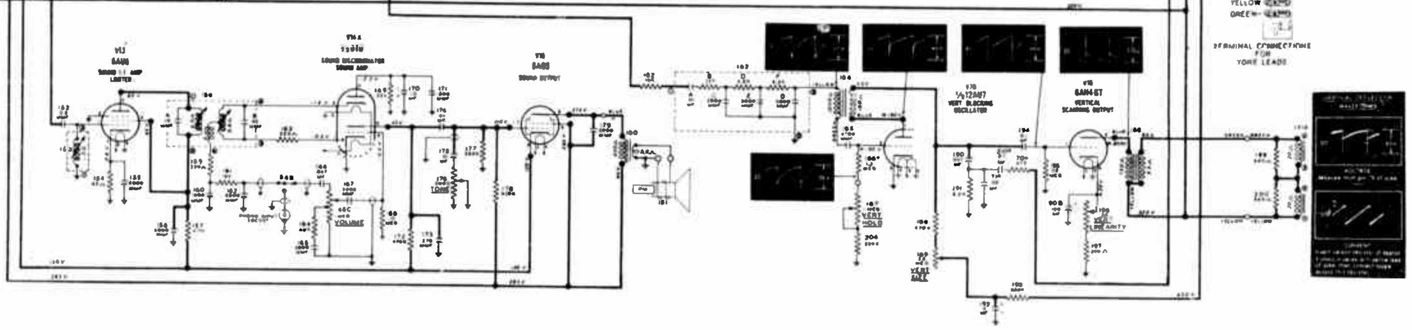
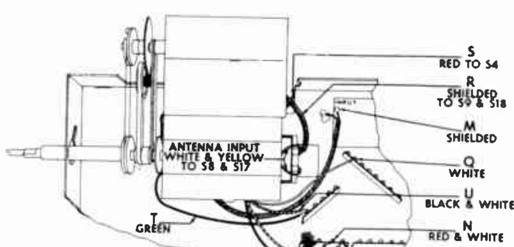


FIG. 18
Trimmer Location of VHF RF Tuner







BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNITS

VOLTAGE MEASUREMENTS

All voltages measured with a 20,000 Ohm per volt meter with the receiver connected to a 117 volt 60 cycle power supply.

Tuner set to an inactive channel with antenna terminals shorted and connected to ground.

Controls set for normal reception — Contrast control completely counterclockwise.

Voltages marked with an asterisk (*) will vary widely with control settings.

R.F. tuner voltages were measured with tubes removed from sockets.

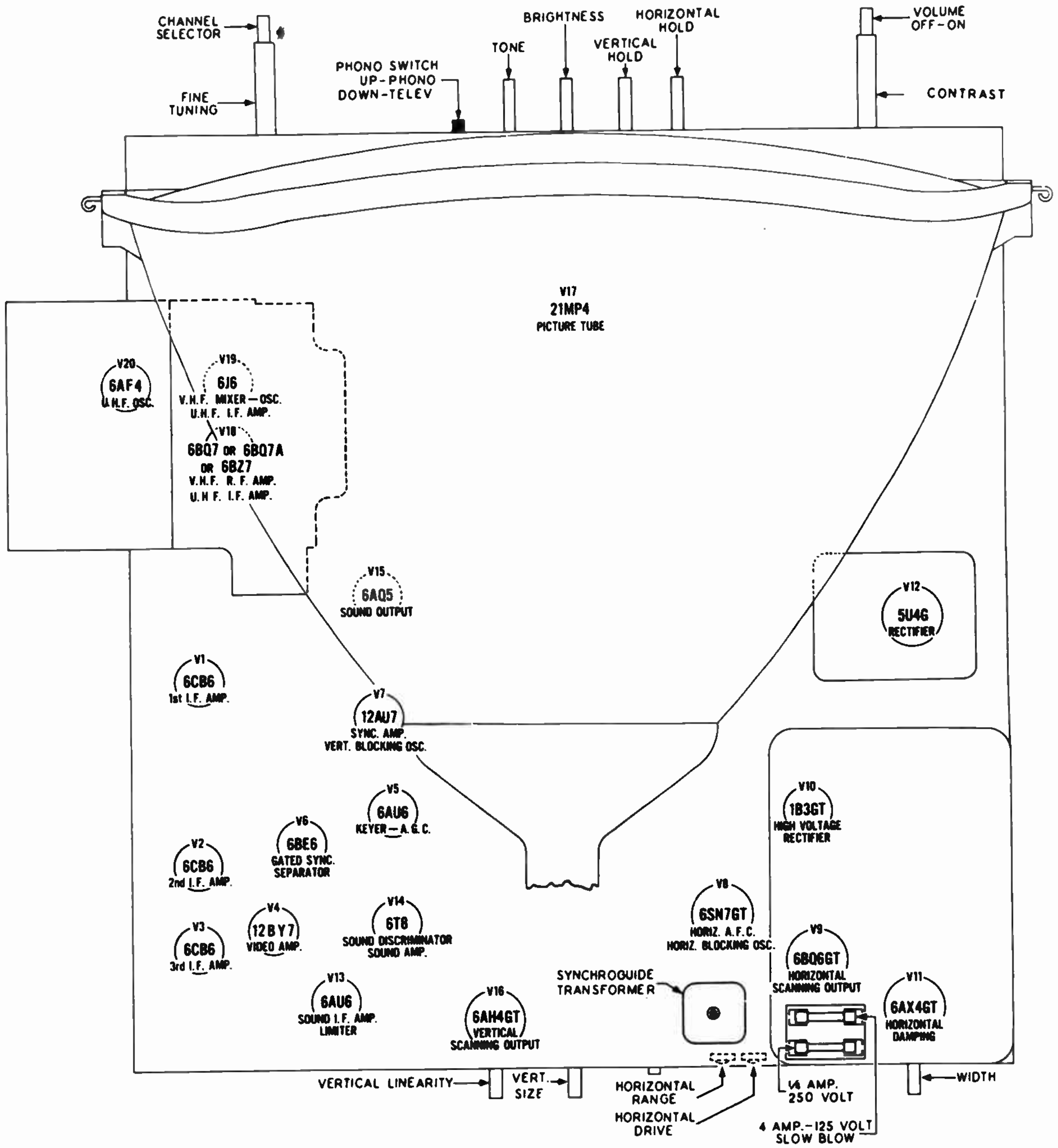
No voltage reading at a tube element indicates zero voltage or voltage which cannot be accurately measured with a 20,000 Ohm per volt meter.

OSCILLOGRAMS

All oscillograms taken with ground lead of 'Scope connected to receiver chassis and controls set for normal reception. Contrast control adjusted to give 50 volts peak to peak at cathode of picture tube. Oscilloscope vertical amplifier response was flat to within 20% at 2 MC.

Number appearing to the left of oscillogram specifies setting of horizontal sweep frequency control on 'Scope.

TUBE AND CONTROL LOCATIONS



PARTS LIST

Notice: Some parts listed below have special characteristics. Do not use substitutes for replacement purposes.

CONDENSERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
C 1	513447	Condenser—ceramic 9 Mmfd. ±10% 500v.	1.05
C 2	513039	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 3	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 4	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.	.35
C 5	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 6	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.	.35
C 7	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 8	513448	Condenser—ceramic 12 Mmfd. ± 5% 500v.	1.05
C 9	513449	Condenser—ceramic 5 Mmfd. ±10% 500v.	1.05
C 10	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 11	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 12	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.	.35
C 13	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 14	513037	Condenser—ceramic 470 Mmfd. ±10% 400v.	.35
C 15	513038	Condenser—ceramic 1500 Mmfd. ±10% 400v.	.35
C 16	513443	Condenser—ceramic 8 Mmfd. ±10% 500v.	.35
		(The above condensers were used when letter "A" is not included in series designations at rear of chassis.)	
2	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
3	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
4	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
5	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
6	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
10	513455	Condenser—ceramic 8.2 Mmfd. ±5% 400 volt (Temperature compensating)	.25
11	513039	Condenser—ceramic 1500 Mmfd. 400 volt	.35
14	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
18	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
19	513039	Condenser—ceramic 1500 Mmfd. 400 volt	.45
20	513448	Condenser—ceramic 12 Mmfd. ±5% 500 volt (Temperature compensating)	1.05
24	513449	Condenser—ceramic 5 Mmfd. ±1% 500 volt (Temperature compensating)	1.05
28	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
30	513037	Condenser—ceramic 470 Mmfd. 400 volt	.35
34	513038	Condenser—ceramic 1500 Mmfd. 400 volt	.35
35	513044	Condenser—ceramic 680 Mmfd. 400 volt	.25
38	513454	Condenser—ceramic 4 Mmfd. ±1% 500 volt (Temperature compensating)	.25
		(The above condensers were used when letter "A" is included in series designation at rear of chassis.)	
40	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
45	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
47	512238	Condenser—.22 Mfd. 200 volt	.50
50	513438	Condenser—ceramic 47 Mmfd. ±5% 500 v. (Temperature compensating)	.45
58	512239	Condenser—.47 Mfd. 200 volt	.75
61	513032	Condenser—ceramic 220 Mmfd. 1000 volt	.40
62	512216	Condenser—.1 Mfd. 200 volt	.30
65	512235	Condenser—.047 Mfd. 200 volt	.30
71	512210	Condenser—.03 Mfd. 200 volt (used when letter "B" is included in series designation at rear of chassis)	.35
	513013	Condenser—ceramic 5000 Mmfd. 450 volt (used when letter "B" is not included in series designation at rear of chassis)	.36
77	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
79	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
81	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
82	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
85-A,B,C	508072	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—40 Mfd. 450 volt	4.50
89	160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
90-A,B	509002	Condenser—electrolytic A—80 Mfd. 250 volt B—100 Mfd. 50 volt	3.00
91	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
95	512235	Condenser—.047 Mfd. 200 volt	.30
98	512239	Condenser—.47 Mfd. 200 volt	.75
103	512205	Condenser—.01 Mfd. 400 volt	.25
107	512502	Condenser—mica 100 Mmfd. ±10% 500 volt	.25
108	508071	Condenser—trimmer 10-160 Mmfd. (Horizontal Drive) (used when letter "E" is included in series designation at rear of chassis)	.40
	W520991	Condenser—trimmer assembly A—10-160 Mmfd. (Horizontal Range) B—10-160 Mmfd. (Horizontal Drive) (used when letter "E" is not included in series designation at rear of chassis)	.90
109	513030	Condenser—ceramic 47 Mmfd. 1000 volt	.40
110	512232	Condenser—.0022 Mfd. 400 volt	.25
115	512235	Condenser—.047 Mfd. 200 volt	.30

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
119	512239	Condenser—.47 Mfd. 200 volt	.75
121	512236	Condenser—.047 Mfd. 400 volt	.30
122	512233	Condenser—.022 Mfd. 400 volt	.30
127	513427	Condenser—ceramic 200 Mmfd. ±2% (Temperature compensating)	.65
130	512311	Condenser—.01 Mfd. 400 volt (Special characteristic) (used when letter "F" is included in series designation at rear of chassis)	.30
	512205	Condenser—.01 Mfd. 400 volt (used when letter "F" is not included in series designation at rear of chassis)	.25
131	512547	Condenser—mica 820 Mmfd. ±5% 500 volt	.50
132	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
133	513006	Condenser—ceramic 270 Mmfd. 500 volt (used when letter "E" is included in series designation at rear of chassis)	.25
135	512238	Condenser—.22 Mfd. 200 volt	.50
137	512218	Condenser—.1 Mfd. 600 volt	.55
141	512237	Condenser—.047 Mfd. 600 volt	.40
142	512234	Condenser—.022 Mfd. 600 volt	.35
144	520990	Condenser—ceramic 500 Mmfd. 20,000 volt	1.75
147	512235	Condenser—.047 Mfd. 200 volt	.30
150	513027	Condenser—ceramic 56 Mmfd. ±10% 1500 v.	.45
152	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
155	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
156	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
158-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
158-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
160	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
162	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
165	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
166	512235	Condenser—.047 Mfd. 200 volt	.30
167	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
170	505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
171	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
173	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
174	512205	Condenser—.01 Mfd. 400 volt	.25
175	512204	Condenser—.01 Mfd. 200 volt	.25
179	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
183-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
183-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
183-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
185	512533	Condenser—mica 4700 Mmfd. ±5% 1000 v.	1.40
190	512236	Condenser—.047 Mfd. 400 volt	.30
192	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
194	512218	Condenser—.1 Mfd. 600 volt	.55
206	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
210	512216	Condenser—.1 Mfd. 200 volt (used when letter "G" is included in series designation at rear of chassis)	.30
216	512502	Condenser—mica 100 Mmfd. 500 volt (used when letter "E" is included in series designation at rear of chassis)	.25
218	513030	Condenser—ceramic 47 Mmfd. 1000 volt (used when letter "E" is included in series designation at rear of chassis)	.40
240	513044	Condenser—ceramic 680 Mmfd. 400 volt (used when letter "K" is included in series designation at rear of chassis)	.25
404	509064	Condenser—trimmer 3-9 Mmfd.	.50
406	513453	Condenser—ceramic 3 Mmfd. ±10% 500 v. (Temperature compensating)	.35
408	513033	Condenser—ceramic 1.5 Mmfd. 500 volt	.35
409	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
415	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
417	509063	Condenser—trimmer 0.5-3 Mmfd.	.40
418	513040	Condenser—ceramic 68 Mmfd. ±10% 500 v.	.40
421	513450	Condenser—ceramic 5 Mmfd. ±5% 500 v.	.40
422	*	Condenser—fine tuning (3-5 Mmfd)	—
423	520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
426	513437	Condenser—ceramic 10 Mmfd. ±10% 500 volt (Temperature compensating)	.40
427	509063	Condenser—trimmer 0.5-3 Mmfd.	.40
430	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
432	513451	Condenser—ceramic 6.8 Mmfd. ±5% 500 v.	.85
435	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
436	513452	Condenser—ceramic 110 Mmfd. ±5%	.45

*—This part is not supplied as a Service replacement item.
‡—This part is not supplied as a Service replacement item. Tuner to be returned to factory for repair.
ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
437	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
438	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
439	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
440	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
442	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
443	513041	Condenser—ceramic 1000 Mmfd. 500 volt	.30
503	*	Condenser—ceramic 1.0 Mmfd. ±10% 500 v.	—
504	*	Condenser—ceramic 1.0 Mmfd. ±10% 500 v.	—
506	*	Condenser—trimmer 0.8-6.5 Mmfd.	—
508	*	Condenser—ceramic 2.7 Mmfd. 500 v.	—
510	*	Condenser—ceramic 0.25 Mmfd. ±10% 500 v.	—
511	*	Condenser—ceramic 0.25 Mmfd. ±10% 500 v.	—
512	*	Condenser—ceramic 100 Mmfd. ±10% 500 v.	—
513	*	Condenser—ceramic 8.0 Mmfd. 500 v.	—
516	*	Condenser—trimmer 0.8-6.5 Mmfd.	—
518	*	Condenser—ceramic 2.5 Mmfd. ±10% 500 v.	—
519	*	Condenser—ceramic 2.2 Mmfd. ±10% 500 v.	—
522	*	Condenser—ceramic 0.68 Mmfd. ±10% 500 v.	—
524	*	Condenser—trimmer 3-10 Mmfd.	—
529	*	Condenser—ceramic 6.0 Mmfd. 500 v.	—
530	*	Condenser—ceramic 68 Mmfd. 500 v.	—
532	*	Condenser—ceramic 68 Mmfd. 500 v.	—

RESISTORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
R 1	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
R 2	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
R 3	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
R 4	510138	Resistor—carbon 1200 Ohms ±10% ½ watt	.12
R 5	510142	Resistor—carbon 2200 Ohms ±10% ½ watt	.12
R 6	510783	Resistor—carbon 24,000 Ohms ±5% ½ watt	.30
R 7	510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
R 8	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
R 9	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
R 10	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
R 11	510114	Resistor—carbon 56 Ohms ±10% ½ watt	.12
R 12	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
		(The above resistors were used when letter "A" is not included in series designation at rear of chassis.)	
7	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
8	510348	Resistor—carbon 4700 Ohms ±10% 2 watt	.25
12	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
13	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
15	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
17	510138	Resistor—carbon 1200 Ohms ±10% ½ watt	.12
21	510783	Resistor—carbon 24,000 Ohms ±5% ½ watt	.30
23	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
26	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
27	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
29	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
32	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
33	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
36	510130	Resistor—carbon 470 Ohms ±10% ½ watt	.12
		(The above resistors were used when letter "A" is included in series designation at rear of chassis.)	
43	510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
44	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
48	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
52	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt (used when letter "H" is included in series designation at rear of chassis)	.16
	510744	Resistor—carbon 15,000 Ohms ±5% ½ watt (used when letter "H" is not included in series designation at rear of chassis)	.16
54	510242	Resistor—carbon 2200 Ohms ±10% 1 watt (used when letter "H" is included in series designation at rear of chassis)	.16
	510247	Resistor—carbon 3900 Ohms ±10% 1 watt (used when letter "H" is not included in series designation at rear of chassis)	.16
55	510141	Resistor—carbon 1800 Ohms ±10% ½ watt (used when letter "H" is included in series designation at rear of chassis)	.12
	510139	Resistor—carbon 1500 Ohms ±10% ½ watt (used when letter "H" is not included in series designation at rear of chassis)	.12
56	510163	Resistor—carbon 33,000 Ohms ±10% ½ w.	.12
57	510701	Resistor—carbon 3.3 Meg. ±10% ½ watt	.12
59	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
60	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
63	510157	Resistor—carbon 15,000 Ohms ±10% ½ w. (used when letter "G" is not included in series designation at rear of chassis)	.12
64	510186	Resistor—carbon 560,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)	.12
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is not included in series designation at rear of chassis)	.12

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
68	510178	Resistor—carbon 220,000 Ohms ±10% ½ w. (used when letter "J" is included in series designation at rear of chassis)	.12
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)	.12
	510181	Resistor—carbon 330,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)	.12
	510184	Resistor—carbon 470,000 Ohms ±10% ½ w. (used when letters "E," "G" and "J" are not included in series designation at rear of chassis)	.12
70	510167	Resistor—carbon 47,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)	.12
	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is not included in series designation at rear of chassis)	.12
77	510101	Resistor—carbon 10 Ohms ±10% ½ w.	.12
83	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
84	510782	Resistor—wire wound 50 Ohms ±10% 5 w.	.40
87	510741	Resistor—wire wound 600 Ohms ±10% 10 w.	.90
88	510779	Resistor—wire wound 400 Ohms ±10% 10 w.	.75
92	510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
93	510357	Resistor—carbon 15,000 Ohms ±10% 2 w.	.35
94	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
96	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
97	510752	Resistor—carbon 1.5 Meg. ±10% ½ watt (used when letter "E" is included in series designation at rear of chassis)	.12
	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt (used when letter "E" is not included in series designation at rear of chassis)	.12
99	510171	Resistor—carbon 82,000 Ohms ±10% ½ w.	.12
100	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
102	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
104	510197	Resistor—carbon 10 Meg. ½ watt	.12
105	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)	.12
	510145	Resistor—carbon 3300 Ohms ±10% ½ w. (used when letter "E" is not included in series designation at rear of chassis)	.12
106	510148	Resistor—carbon 4700 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)	.12
	510254	Resistor—carbon 10,000 Ohms ±10% 1 w. (used when letter "E" is not included in series designation at rear of chassis)	.16
111	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
112	510189	Resistor—carbon 820,000 Ohms ±10% ½ w.	.12
113	510178	Resistor—carbon 220,000 Ohms ±10% ½ w. (used when letter "Q" is included in series designation at rear of chassis)	.12
	510175	Resistor—carbon 150,000 Ohms ±10% ½ w. (used when letter "Q" is not included in series designation at rear of chassis)	.12
114	510190	Resistor—carbon 1 Meg. ±10% ½ w. (used when letter "Q" is included in series designation at rear of chassis)	.12
	510181	Resistor—carbon 330,000 Ohms ±10% ½ w. (used when letter "Q" is not included in series designation at rear of chassis)	.12
116	510172	Resistor—carbon 100,000 Ohms ±10% ½ w.	.12
117	510281	Resistor—carbon 330,000 Ohms ±10% 1 w.	.16
118	510148	Resistor—carbon 4700 Ohms ±10% ½ watt	.12
120	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
124	510174	Resistor—carbon 120,000 Ohms ±10% ½ w.	.12
125	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
126	510154	Resistor—carbon 10,000 Ohms ±10% ½ w.	.12
129	510269	Resistor—carbon 68,000 Ohms ±10% 1 w.	.16
133	510154	Resistor—carbon 10,000 Ohms ±10% ½ w. (used when letter "E" is not included in series designation at rear of chassis)	.12
134	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
136	510318	Resistor—carbon 100 Ohms ±10% 2 watt	.25
138	510166	Resistor—carbon 47,000 Ohms ±10% ½ w.	.12
139	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
143	510725	Resistor—carbon 3.3 Ohms ±10% ½ watt	.16
145	510190	Resistor—carbon 1 Meg. ±10% ½ watt	.12
146	510134	Resistor—carbon 680 Ohms ½ watt	.12
154	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
157	510249	Resistor—carbon 4700 Ohms 1 watt	.16
159	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
161	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
163	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
164	510169	Resistor—carbon 68,000 Ohms ±10% ½ w.	.12
168	510197	Resistor—carbon 10 Meg. ½ watt	.12
169	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
172	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
177	510778	Resistor—carbon 560,000 Ohms ±5% ½ w.	.16
178	510747	Resistor—carbon 820,000 Ohms ±5% ½ w.	.20
182	510159	Resistor—carbon 18,000 Ohms ±10% ½ w.	.12
183-B	508062	Resistor—carbon 22,000 Ohms ⅓ watt (part of Integrator Unit)	1.40
183-D	508062	Resistor—carbon 8200 Ohms ⅓ watt (part of Integrator Unit)	1.40
183-F	508062	Resistor—carbon 8200 Ohms ⅓ watt (part of Integrator Unit)	1.40

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
186	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt (used when letter "B" is included in series designation at rear of chassis)	.12
	510767	Resistor—carbon 1.5 Meg. ±5% ½ watt (used when letter "B" is not included in series designation at rear of chassis)	.12
188	510184	Resistor—carbon 470,000 Ohms ±10% ½ w.	.12
191	510153	Resistor—carbon 8200 Ohms ±10% ½ w.	.12
193	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
195	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
197	510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
199	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
200	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
201	510175	Resistor—carbon 150,000 Ohms ±10% ½ w.	.12
204	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
205	510348	Resistor—carbon 4700 Ohms ±10% 2 watt	.25
207	510344	Resistor—carbon 2700 Ohms ±10% 2 watt	.35
208	510727	Resistor—wire wound 7500 Ohms ±10% 5 w. (used when letter "C" is not included in series designation at rear of chassis)	1.00
209	510160	Resistor—carbon 22,000 Ohms ±10% ½ w.	.12
212	510175	Resistor—carbon 150,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)	.12
213	510175	Resistor—carbon 150,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)	.12
214	510190	Resistor—carbon 1 Meg. ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)	.12
215	510168	Resistor—carbon 56,000 Ohms ±10% ½ w. (used when letter "E" is included in series designation at rear of chassis)	.12
217	510130	Resistor—carbon 470 Ohms ±10% ½ watt (used when letter "A" or "K" is included in series designation at rear of chassis)	.12
219	510184	Resistor—carbon 470,000 Ohms ±10% ½ w. (used when letter "G" is included in series designation at rear of chassis)	.12
221	510172	Resistor—carbon 100,000 Ohms ±10% ½ w. (used when letter "G" is included in designation at rear of chassis)	.12
403	510158	Resistor—carbon 15,000 Ohms ½ watt	.12
405	510167	Resistor—carbon 47,000 Ohms ½ watt	.12
410	510181	Resistor—carbon 330,000 Ohms ±10% ½ w.	.12
411	510178	Resistor—carbon 220,000 Ohms ±10% ½ w.	.12
414	510130	Resistor—carbon 470 Ohms ±10% ½ w.	.12
416	510100	Resistor—carbon 10 Ohms ±10% ½ w.	.12
419	510131	Resistor—carbon 470 Ohms ½ w.	.12
420	510149	Resistor—carbon 4700 Ohms ½ watt	.12
424	510158	Resistor—carbon 15,000 Ohms ½ watt	.12
425	510179	Resistor—carbon 220,000 Ohms ½ watt	.12
428	510155	Resistor—carbon 10,000 Ohms ½ watt	.12
434	510158	Resistor—carbon 15,000 Ohms ½ watt	.12
501	*	Resistor—carbon 470,000 Ohms ½ watt	—
502	*	Resistor—carbon 470,000 Ohms ½ watt	—
509	*	Resistor—carbon 22 Ohms ½ watt	—
520	*	Resistor—carbon 22 Ohms ½ watt	—
525	*	Resistor—carbon 12,000 Ohms ±10% ½ w.	—

COILS AND TRANSFORMERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
T 1	*	Coil—1st I.F. Grid and Adjacent Picture I.F. Trap	—
T 2	*	Coil—1st I.F. Plate	—
T 3	*	Coil—2nd I.F. Grid	—
T 4	*	Transformer—2nd I.F.	—
T 5	*	Transformer—3rd I.F.	—
T 6	*	Trap—Sound I.F. and Adjacent Sound I.F.	—
		(The above coils and transformers were used when letter "A" is not included in series designation at rear of chassis)	
9	*	Coil—1st I.F. grid and Adjacent Picture I.F. Trap	—
16	*	Coil—1st I.F. plate	—
22	*	Trap—sound I.F. and Adjacent Sound I.F.	—
25	*	Coil—2nd I.F. Grid	—
31	*	Transformer—2nd I.F.	—
37	*	Transformer—3rd I.F.	—
		(The above coils and transformers were used when letter "A" is included in series designation at rear of chassis)	
41	520620	Coil—peaking	.65
42	520985	Coil—peaking	.65
49	509603	Coil—4.5 Mc. trap (includes slug and condenser #50)	1.20
	507357	Slug core for 4.5 Mc. trap coil	.20
51	520689	Coil—peaking (used when letter "H" is included in series designation at rear of chassis)	.65
	520984	Coil—peaking (used when letter "H" is not included in series designation at rear of chassis)	.50

COILS AND TRANSFORMERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
53	509342	Coil—peaking (used when letter "H" is included in series designation at rear of chassis)	.60
	520986	Coil—peaking (used when letter "H" is not included in series designation at rear of chassis)	.60
76	520951	Transformer—power	17.50
86	508341	Choke—filter	3.60
128	520943	Transformer—syncroguide	2.50
	521064	Slug core for syncroguide transformer	.70
140	521066	Transformer—horizontal output	8.50
151-A,B	520942	Yoke—picture tube deflection (includes leads, connectors and resistors #199 and #200)	7.50
153	509378	Transformer—audio take-off	1.50
158	509706	Transformer—TV sound discriminator (includes condensers 158A and 158B)	3.00
180	509376	Transformer—audio output	1.85
184	520980	Transformer—vertical blocking oscillator	1.90
198	520975	Transformer—vertical output (includes connectors for deflection yoke leads)	4.00
241	522020	Coil—43 Mc. trap (used when letter "D" is included in series designation at rear of chassis)	
401	521821	Coil—U.H.F. I.F. Coupling (Coded "•1Q•") (includes resistors 414, 416 and condenser 415)	2.75
402	521822	Coil—antenna; channel #2 (Coded "•2Q•")	1.40
	521823	Coil—antenna; channel #3 (Coded "•3Q•")	1.40
	521824	Coil—antenna; channel #4 (Coded "•4Q•")	1.40
	521825	Coil—antenna; channel #5 (Coded "•5Q•")	1.40
	521826	Coil—antenna; channel #6 (Coded "•6Q•")	1.40
	521827	Coil—antenna; channel #7 (Coded "•7Q•")	1.15
	521828	Coil—antenna; channel #8 (Coded "•8Q•")	1.15
	521829	Coil—antenna; channel #9 (Coded "•9Q•")	1.15
	521830	Coil—antenna; chan. #10 (Coded "•10Q•")	1.15
	521831	Coil—antenna; chan. #11 (Coded "•11Q•")	1.15
	521832	Coil—antenna; chan. #12 (Coded "•12Q•")	1.15
	521833	Coil—antenna; chan. #13 (Coded "•13Q•")	1.15
407	520701	Coil—cathode coupling	.15
412	521841	Coil—U.H.F. I.F. Coupling (Coded "•1R•")	2.75
413	521842	Coil—R.F. & osc.; chan. #2 (Coded "•2R•")	1.85
	521843	Coil—R.F. & osc.; chan. #3 (Coded "•3R•")	1.85
	521844	Coil—R.F. & osc.; chan. #4 (Coded "•4R•")	1.85
	521845	Coil—R.F. & osc.; chan. #5 (Coded "•5R•")	1.85
	521846	Coil—R.F. & osc.; chan. #6 (Coded "•6R•")	1.85
	521847	Coil—R.F. & osc.; chan. #7 (Coded "•7R•")	1.70
	521848	Coil—R.F. & osc.; chan. #8 (Coded "•8R•")	1.70
	521849	Coil—R.F. & osc.; chan. #9 (Coded "•9R•")	1.70
	521850	Coil—R.F. & osc.; ch. #10 (Coded "•10R•")	1.70
	521851	Coil—R.F. & osc.; ch. #11 (Coded "•11R•")	1.70
	521852	Coil—R.F. & osc.; ch. #12 (Coded "•12R•")	1.70
	521853	Coil—R.F. & osc.; ch. #13 (Coded "•13R•")	1.70
	507786	Slug for osc. coil; auxiliary fine tuning adj.	.05
429	521834	Coil—neutralizing	.85
431	521835	Choke—mixer plate	.85
433	521836	Coil	.85
441	520518	Coil—choke	.10
444	520520	Coil—choke	.10
505	*	Inductor—Ant. End	—
507A	*	Inductor—Antenna Preselector tuning	—
507B	*	Inductor—Mixer-Detector tuning	—
507C	*	Inductor—Oscillator tuning	—
514	*	Transformer—U.H.F. converter I.F.	—
515	*	Inductor—Mixer End	—
517	*	Coil—choke	—
523	*	Inductor—Oscillator End	—
526	*	Coil—choke	—
527	*	Coil—choke	—
528	*	Coil—choke	—
531	*	Coil—choke	—

CONTROLS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
46-A,B,C	521288	Contrast and Volume potentiometers (includes On-Off switch) A—Contrast (300 Ohms ½ watt) B—On-Off Switch C—Volume (1 Meg. ¼ watt)	2.50
66-A,B	520563	Switch, "PHONO-TELEV."	.55
67	509893	Brightness potentiometer (100,000 Ohms ¼ watt)	1.00
108	508071	Horizontal Drive Condenser (10-160 Mmfd.) (used when letter "E" is included in series designation at rear of chassis)	.40
	520991	Horizontal Range and Horizontal Drive trimmer condenser assembly A—Horizontal Range (10-160 Mmfd.) B—Horizontal Drive (10-160 Mmfd.) (used when letter "E" is not included in series designation at rear of chassis)	.90
123	521059	Horizontal Hold potentiometer (50,000 Ohms ¼ watt)	2.00
148	520996	Width potentiometer (400 Ohms ±10% 4 w.)	1.50
176	520746	Tone potentiometer (500,000 Ohms ¼ watt)	1.00
187	521058	Vertical Hold potentiometer (1 Meg. ¼ w.)	1.00
189	520944	Vertical Size potentiometer (2.5 Meg. ¼ w.)	.80
196	520945	Vertical Linearity potentiometer (5000 Ohms ½ watt)	.90
422	*	Fine Tuning condenser (3-5 Mmfd.)	—

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		OTHER ELECTRICAL PARTS	
39	509386	Crystal detector	1.00
69	521183	Ion trap	1.00
72	521267	Centering magnets (included with back cover of yoke)	1.10
75	521803	Fuse; 4 amp. 125 volt "Slow Blow"	.25
78	118921	Channel lite (Mozda #47) 6-8V. 150 Ma.	.15
149	508713	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt	.20
181	508174	Speaker—P.M. Dynamic (6"x9"); Mod. 9081A	8.40
183-A to G	508062	Integrator coupling unit A—Condenser—ceramic .01 Mfd. 450 v. B—Resistor—carbon 22,000 Ohms ⅕ w. C—Condenser—ceramic 2000 Mmfd. 450 v D—Resistor—carbon 8200 Ohms ⅕ w. E—Condenser—ceromic 5000 Mmfd. 450 v. F—Resistor—carbon 8200 Ohms ⅕ w. G—Condenser—ceromic 5000 Mmfd. 450	1.40
239	521188	Switch, V.H.F.-U.H.F. selector	3.50
400	509695	Built-in antenna	1.00

MECHANICAL PARTS OF 521187 V.H.F. R.F. TUNER

(for electrical parts see preceding clossified listings of condensers, resistors and coils)

	521187	R.F. Tuner; 12 channels V.H.F., 1 position U.H.F. (includes tubes and tuning coils, LESS: U.H.F. dial shaft, pulleys, brackets, selector switch, and actuating cam)	42.50
	521324	Bracket, pulley support	.65
	521321	Bracket, supports U.H.F. and V.H.F. tuners (front)	.20
	521322	Bracket, supports U.H.F. and V.H.F. tuners (rear)	.20
	521713	Cam, switch actuator (includes set screws)	.75
	507339	Clip for mounting converter plate coil	.10
	521361	Clip, retains U.H.F. dial shaft and pulley	.05
	521837	Fine tuning cam ond shaft	.75
	521714	Pulley, U.H.F. tuning (includes set screws)	.85
	508708	Roller—detent	.10
	170761	Screw, set; #6-32 x ⅛" "Allen type"; retains tuning pulley	.10
	13392	Screw, set; #8-32 x 3/16" "Allen type"; retains cam	.15
	521245	Shaft and pulley for U.H.F. dial	1.40
	520535	Shield, bottom cover	.50
	520536	Shield, side cover	.35
	520519	Shield, tube; miniature for 6BQ7, 6BQ7A or 6BZ7 tube	.20
	520534	Shield—tube; miniature for 6J6 tube	.15
	507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
	520521	Socket—miniature (9 pin) for 6BQ7, 6BQ7A or 6BZ7 (includes base for mounting shield)	.50
	507986	Slug for osc. coil fine tuning adjustment	.05
	509062	Slug core for converter plate coil	.12
	508709	Spring—detent	.08
	507967	Spring—turret shaft retaining	.03
	507966	Spring contactor washer (on front turret shaft)	.08
	507990	Spring—retains osc. fine tuning slug	.10
	520517	Stator contact assembly (includes 11 contacts and metal frame)	3.75
	521838	Tuner turret and shaft assembly (less coils)	3.75
	507965	Washer, fiber spacer (on turret shaft)	.01

MECHANICAL PARTS OF 521170 U.H.F. R.F. TUNER

(for electrical parts see preceding classified listings of condensers, resistors and coils)

	521170	R.F. Tuner; U.H.F. tuner, channels 14-83; (includes tubes, tuning segments and coils, LESS: pulleys, gears and brackets)	42.50
	522018	Belt, U.H.F. tuning	.40
	521324	Bracket, pulley support	.65
	521321	Bracket, supports U.H.F. and V.H.F. tuners (front)	.20
	521322	Bracket, supports U.H.F. and V.H.F. tuners (rear)	.20
	521338	Clip, retains U.H.F. tuning pulley and gear	.05
	117057	Cord—dial drive (3 ft. required)........per ft.	.05
	521282	Dial, U.H.F.	.65
	521716	Gear, U.H.F. tuning (includes set screws)	1.50
	521715	Pulley, U.H.F. dial drive (includes set screws)	.65
	521241	Pulley and gear for U.H.F. tuning	1.25
	170761	Screw, set; #6-32 x ⅛" "Allen type"; retains gear	.10
	111766	Spring, anti-backlash	.02
	161384	Spring—dial cord tension	.06

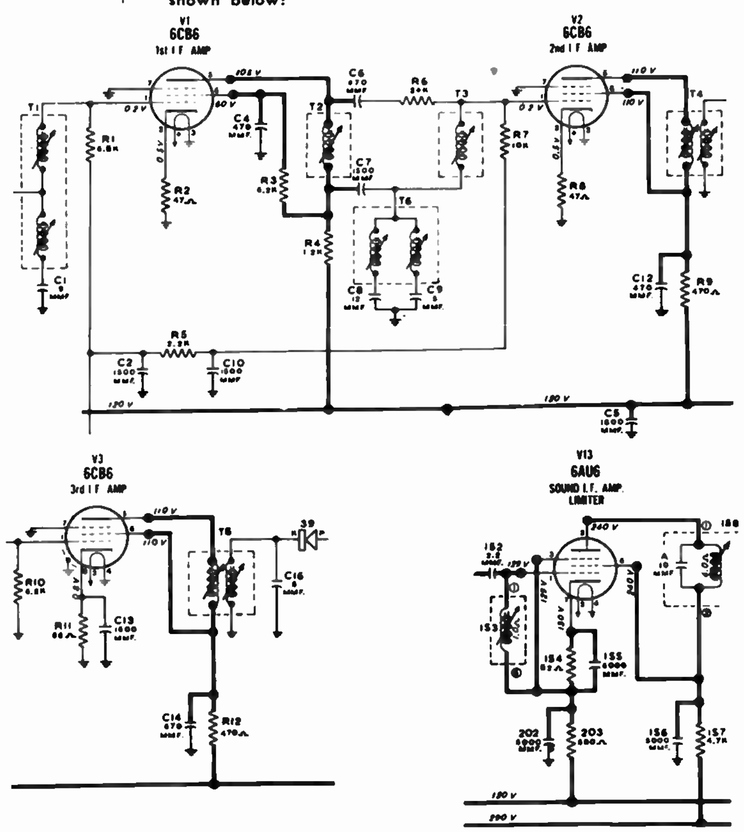
PRODUCTION CHANGES

The following tabulation furnishes complete detoils on changes which occurred during receiver production. The receivers incorporoting these changes are identified by coding stamped on rear surfoce of chassis. The coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" ar "D".

The circuit shown on this page applies to "SERIES ABCDEFGHJK" chassis

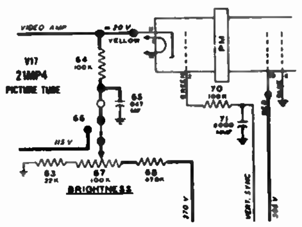
A letter following the component circuit diagram number thus—201 A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change calumn, from which complete change information can be obtoined.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
UNCODED	**INITIAL PRODUCTION**
"A"	The following changes were incorporated to provide for the use of an alternate type of I. F. system. 1. The voltage supply of the various elements of tube V1 (1st I.F. Amp.) and V2 (2nd I.F. Amp.) and V13 (Sound I.F. Amp-Limiter) as well as components to these elements were changed. The circuit, for tubes V1, V2, V3, and V13 for chassis that do not incorporate the letter "A" is shown below:



LETTER DESIGNATION	DESCRIPTION OF CHANGE
"B"	The following changes were incorporated to improve interlace and vertical hold action. 1. Change condenser 71 in plate circuit of tube V7B (Vert. Blocking Osc.) from 5000 Mmfd./to .03 Mfd. 2. Change resistor 186 in grid circuit of tube V7B (Vert. Blocking Osc.) from 1.5 Meg. to 1.2 Meg.
"C"	The following change was incorporated to reduce current drain. 1. Omit resistor 208 (7500 Ohms) connected between the 120 volt supply and the 270 volt supply. This change should only be undertaken when the letter "A" is incorporated in series designation at rear of chassis.
"D"	The following change wos incorporated to prevent regeneration in I.F. system. 1. Add trap coil 241 (Part 522020) between the grid of tube V4 (Video Amp.) and perking coil 41.

PRODUCTION CHANGES—Continued

LETTER DESIGNATION	DESCRIPTION OF CHANGE
"E"	The following changes were incorporated to extend the useful range of the Horizontal Hold control. 1. Change Horizontal Range 108-A control in the grid circuit of V8A (Horizontal A.F.C.) from a variable condenser (10-160 Mmfd.) to a fixed condenser 218 (47 Mmfd.). 2. Change resistor 113 in grid circuit of tube V8A (Horizontal A.F.C.) from 150,000 Ohms to 220,000 Ohms. 3. Change resistor 114 in grid circuit of tube V8A (Horizontal A.F.C.) from 330,000 Ohms to 1 Meg. 4. Add resistor 212 (150,000 Ohms) from the junction of condenser 109 (47 Mmfd.) and resistor 114 (1 Meg.) to chassis ground. 5. Remove resistor 133 (10,000 Ohms) in grid circuit of tube V9 (Horizontal Scanning Output) and replace with condenser 133 (270 Mmfd.). 6. Change resistor 97 in grid circuit of tube V6 (Gated Sync. Separator) from 820,000 Ohms to 1.5 Meg. 7. Change resistor 106 from 10,000 Ohms to 4700 Ohms and add resistor 105 (4700 Ohms) in series with resistor 106 and plate of tube V7A. Resistor 182 (18,000 Ohms) remains connected to the plate of tube V7A—12AU7 while condenser 107 (100 Mmfd.) is reconnected to the junction of resistors 105 and 106. In addition to the above changes the Syncroguide transformer must be readjusted in accordance with the procedure (for a Series "E" chassis) given in the service data section of the manual.
"E" (cont.)	The following changes were incorporated to improve the blanking during horizontal retrace interval. 1. Add resistor 213 (150,000 Ohms) between cathode of tube V9 (Horizontal Scanning Output) and the grid circuit of tube V17 (Picture Tube). 2. Add resistor 214 (1 Meg.) between pin 1 of the horizontal output transformer and grid circuit of tube V17 (Picture Tube). 3. Add resistor 215 (56,000 Ohms) from the junction of resistors 213 and 214 to chassis ground. 4. Add condenser 216 (100 Mmfd.) from the junction of resistors 213 and 214 to the grid of tube V17 (Picture Tube). The following change was incorporated to reduce illumination of picture tube with minimum setting of the Brightness Control. 1. Change resistor 68 in the brightness circuit from 470,000 Ohms to 330,000 Ohms.
"F"	The following change was incorporated to minimize frequency drift in the syncroguide circuit. 1. Change condenser 130 from a .01 Mfd. to a .01 Mfd. (Special characteristic) part 512311 only.
"G"	The following changes were incorporated to improve the useful range of the Contrast control. 1. Change connection of Brightness control 67A associated circuit from cathode of tube V17 (Picture tube) to grid of the same tube. The Brightness circuit for chassis that do not incorporate the letter "G" is shown at the right:  2. Add resistor 219 (470,000 Ohms) in parallel with condenser 62 (.1 Mfd.) located in cathode circuit of tube V17 (Picture tube). 3. Change resistor 70 in plate circuit of tube V7B (Vert. Blocking Osc.) from 100,000 Ohms to 47,000 Ohms and add condenser 210 (.1 Mfd.) in series with resistor 70. Connect other end of condenser 210 to the junction of condenser 190 (.047 Mfd.) and resistor 191 (8200 Ohms).
"H"	The following changes were incorporated to improve the video response. 1. Change peaking coil 51 in plate circuit of tube V4 (Video Amp.) from port 520984 to 520689. 2. Change resistor 52 in parallel with peaking coil 51 from 15,000 Ohms to 12,000 Ohms. 3. Change peaking coil 53 in plate circuit of tube V4 (Video Amp.) from part 520986 to part 509342. 4. Change resistor 54 in plate circuit of tube V4 (Video Amp.) from 3900 Ohms to 2200 Ohms. 5. Change resistor 55 in plate circuit of tube V4 (Video Amp.) from 1500 Ohms to 1800 Ohms.
"J"	The following change was incorporated to maintain proper focus for the normal range of the brightness control. 1. Change resistor 68 in brightness circuit from 100,000 Ohms to 220,000 Ohms.
"K"	The following change was incorporated to permit the use of the I.F. system in various type chassis. 1. Add condenser 240 (680 Mmfd.) between the grid of tube V1 (1st I.F. Amp.) and I.F. transformer 9.

H-770T21
(MAHOGANY)
H-771T21
(BLOND)

H-772K21
(MAHOGANY)
H-773K21
(BLOND)

H-774K21
(MAHOGANY)
H-775K21
(BLOND)

H-776T21
(MAHOGANY)

CHASSIS ASSEMBLY V-2243-1

MODELS CONTAINING ALL-CHANNEL UHF TUNERS

When the letter "U" appears in the model number, it indicates that the receiver contains an all-channel UHF tuner in addition to its VHF facilities. For example, Model H-770TU21 is the same as Model H-770T21 except that an all-channel UHF tuner has been added to it. For service information on the UHF tuner, refer to the Model H-804 service notes.

SERVICE NOTES

SPECIFICATIONS

FREQUENCY RANGES:

CHANNEL NUMBER	CHANNEL FREQUENCY (MC.)	VIDEO CARRIER FREQUENCY (MC.)	SOUND CARRIER FREQUENCY (MC.)	RECEIVER H-F OSCILLATOR FREQUENCY (MC.)
2	54 - 60	55.25	59.75	101
3	60 - 66	61.25	65.75	107
4	66 - 72	67.25	71.75	113
5	76 - 82	77.25	81.75	123
6	82 - 88	83.25	87.75	129
7	174 - 180	175.25	179.75	221
8	180 - 186	181.25	185.75	227
9	186 - 192	187.25	191.75	233
10	192 - 198	193.25	197.75	239
11	198 - 204	199.25	203.75	245
12	204 - 210	205.25	209.75	251
13	210 - 216	211.25	215.75	257

NOTE: Provisions for UHF reception are included. To activate the UHF positions of the channel selector, small single-channel UHF units can be inserted into the UHF sockets at the rear of the RF tuner or an all-channel UHF tuner can be installed. Installation instructions are furnished with the units.

FINE TUNING RANGES:
1 mc. minimum; 2 mc. maximum

OPERATING VOLTAGE:
105 to 120 volts, 60 cycles A-C

POWER CONSUMPTION: .... 225 watts

AUDIO POWER OUTPUT:
Undistorted .... 2.5 watts
Maximum .... 3 watts

LOUDSPEAKER:
Type .... P.M.
Voice Coil Impedance ..3.2 ohms at 400 cycles

RECEIVER ANTENNA INPUT IMPEDANCE:
......300 ohms balanced or 72 ohms unbalanced

TUBE COMPLEMENT:

1	1B3GT	High voltage rectifier
1	5U4G	Low voltage rectifiers
1	6AL5	Horizontal AFC
1	6AU6	Sound I-F amplifier
1	6AU6	Sync separator
1	6AU6	Keyed AGC
1	6AX4GT	Horizontal damper
1	6BK5	Audio output
1	6BN6	FM detector
1	6BQ6GT	Horizontal output
1	6BZ7	RF amplifier
3	6CB6	I-F amplifiers
1	6SN7GT	Vertical multivibrator
1	6X8	HF oscillator and mixer
1	12AT7	Sync amplifier and sync control
1	12AU7	Horizontal multivibrator
1	12BH7	Vert. output and noise clipper
1	12BY7	Video output
1	21YP4	Cathode ray tube

VIDEO CARRIER INTERMEDIATE FREQUENCY:
.... 45.75 mc.

VIDEO RESPONSE: .... 3.5 mc.

SOUND CARRIER INTERMEDIATE FREQUENCY:
.... 4.5 mc.

FOCUS: .... Electrostatic

SWEEP DEFLECTION: .... Magnetic

SCANNING: .... Interlaced 525 line

HORIZONTAL SCANNING FREQUENCY:
.... 15,750 CPS

VERTICAL SCANNING FREQUENCY: ....60 CPS

FRAME FREQUENCY:
(picture repetition rate): .... 30 CPS

HIGH VOLTAGE WARNING

The danger accompanying shock is always present when the receiver is operated outside the cabinet or when the rear cover is removed from the cabinet. Only a person familiar with the precautions to be observed when working with high-voltage equipment should service this receiver.

CATHODE RAY TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves should be worn at all times when handling a cathode ray tube. The tube should not be handled in the vicinity of any person not so equipped. When handling the tube, always keep it away from the body.

Due to the large surface area of the tube and the high vacuum contained within, more than ordinary care is required to prevent shattering the tube. The large end of the bulb, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure. If the tube binds during removal or replacement, determine the cause of the trouble — **DO NOT FORCE THE TUBE.**

An additional precaution is required when handling a cathode ray tube that has an aquadag coating on the outside of the tube. The outside aquadag coating forms one plate of a capacitor, and the inside coating to which the high voltage is applied serves as the other plate. The high voltage charge may be retained in this capacitor for a long time after the high voltage lead is disconnected. Since the charge could produce a shock that would startle the handler into dropping the tube, the charge should be dissipated before any handling of the tube is attempted. To dissipate the charge, place a jumper from the outside aquadag coating to the high voltage button on the tube. Due to the relatively high resistance of the aquadag, the jumper should be held in place for some time to insure complete discharge.

PRODUCTION CHANGES AFFECTING CHASSIS V-2243-1

In production, any or all of the following changes may be incorporated in the V-2243-1 chassis. See Fig. 12, V-2243-1 schematic revised.

1. SPECIFICATION CHANGES. C100, .005 mfd. and C101, .005 mfd. are replaced with a dual .005 mfd. capacitor designated C100. C206, .005 mfd. and C208, .005 mfd. are replaced with a dual capacitor designated C206.

2. ALTERNATE HORIZONTAL OUTPUT TUBE. A 6BQ6G can be substituted for the 6BQ6GT horizontal output tube.

3. IMPROVED UHF RECEPTION. The gain of the pentode section of the 6X8 tube, when operating as an IF amplifier stage for the UHF tuner, has been increased. The 220 ohm cathode resistor, previously out of the circuit during UHF operation, is now grounded by soldering a piece of #22 bus wire from the junction of the 220 ohm resistor and wafer switch section 1B to the ground terminal of wafer switch 2A.

4. TWEET SUPPRESSION. To eliminate tweet interference in the picture which might otherwise occur under certain conditions, a resistor, R223, is inserted between C211 and the junction of R203, C210 and R204. At the same time a filament choke, L505, is added in series with filament (pin 3) of the 6BN6 FM detector.

5. INCREASED SOUND ATTENUATION. C302 has been changed from 1.5 mmf to 2.2 mmf. This change increases the attenuation of the sound trap, L301 – C303, to a point where any 4.5 mc. tweet, that might appear in the picture, is suppressed. C301 is now unnecessary and has been removed.

6. SOUND HASH ELIMINATION. To avoid hash in the sound which occurred in some sets due to pick-up of scanning energy in sound system, C319 has been increased to .02 mfd.

7. IMPROVED PICTURE QUALITY. To reduce ringing in the video amplifier plate circuit, R314 has been changed to 6800 ohms.

8. REDUCTION OF HORIZONTAL DRIVE. To prevent overdrive of the horizontal output stage R435 is increased to 12,000 ohms.

9. IMPROVED AGC PERFORMANCE. To improve the action of the AGC circuit under strong signal conditions and to provide a wider range of AGC control settings, R326 is increased to 390,000 ohms and R327, the AGC control is changed to 750,000 ohms.

10. DECREASED PLATE DISSIPATION TO REDUCE 6BQ6 TUBE FAILURE. The output voltage of the low voltage power supply has been reduced from 290VDC to 278VDC. To compensate for this change in other circuits, R442, 68,000 ohms and R456, 100,000 ohms have been removed. R444 is decreased to 1800 ohms, the audio decoupling resistor R211 is changed to 560 ohms and a 27,000 ohm resistor has been added in parallel with R454. This resistor is designated R464. The power transformer is changed to part no. V-11544-3N.

11. IMPROVED SYNC. The gain of the 6AU6 sync separator tube is increased by reducing the cathode resistor (R405) from 2,700 ohms to 1,200 ohms.

12. SPECIFICATION CHANGE. C209 and C210 have been replaced with a single .0015 mfd. capacitor designated C210.

13. UHF TUNER DRIVE BELT. To prevent slippage, the UHF tuner drive belt has been changed to part number V-11338-4.

INSTALLATION AND SERVICE ADJUSTMENTS

THE INDIVIDUAL CHANNEL OSCILLATOR ADJUSTMENTS OF EVERY RECEIVER SHOULD BE CHECKED AT THE TIME OF INSTALLATION AND WHENEVER SERVICING IS NECESSARY.

If these adjustments are made correctly, the receiver can be switched from channel to channel by merely turning the channel selector. With proper adjustment, the best picture detail and sound quality will be found when the fine tuning control is in the center of its range.

Individual channel oscillator adjustments can be made on an "air signal". It is not necessary to remove the chassis from its cabinet.

Proceed as follows:

1. Allow 5 min. for receiver warm-up.

2. Set the channel selector for the channel to be adjusted. Set the other operating controls for a normal picture and sound.

3. Remove the channel selector knob and fine tuning knob.

4. Set the fine tuning control to the center of its range by rotating the fine tuning shaft until the flat side faces up.

5. Insert a non-metallic alignment tool (see Fig. 3) through the opening in the cabinet and into the small hole provided in the tuner. The oscillator slug for the channel being adjusted will be in position to receive the alignment tool. Adjust the slug for best picture detail and sound quality. In most instances, only a slight rotation of the slug is necessary. Always adjust the slug by turning it counterclockwise first. Turning the slug too far clockwise will cause it to pass its retaining spring. If this occurs, it will be necessary to remove the coil strip and reset the slug in its retaining spring.

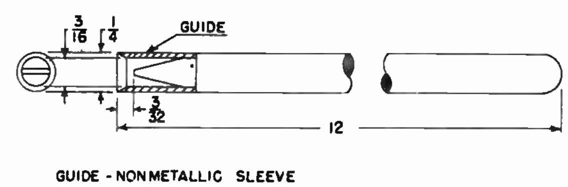


FIG. 4 – OSCILLATOR ADJUSTMENT TOOL

ALIGNMENT CHARTS

COMMON I-F SECTION

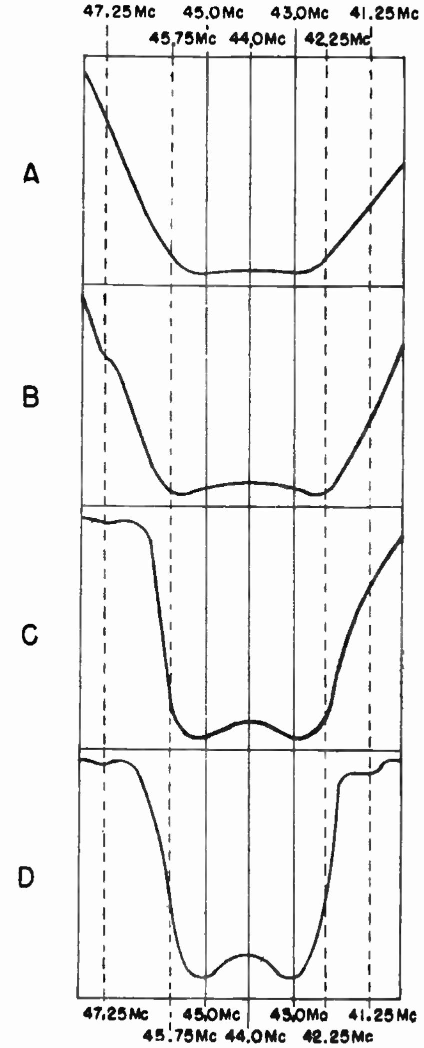
Rotate the channel selector to channel 13.

Connect the oscilloscope to the video test terminal, point "B" on Fig. 5, through the decoupling network shown in Fig. 2.

Connect a 9 volt bias battery to the AGC line, point "A" on Fig. 8.

Couple the marker generator output to the sweep generator output. In the steps that follow, use the marker to check the response curve at the frequencies indicated on Fig. 6.

Step	Alignment Signal	Remarks	Adjust –
1.	Remove the 6BZ7 RF amplifier tube.		
2.	44 mc. sweep to 3rd IF grid	Connect detuning clips to 1st & 2nd IF plates	Pri. of T302 for max. response and sec. of T302 for symmetrical curve shown in Fig. 6A
3.	47.25 mc. amplitude modulated to 1st IF grid	Use sufficient signal to produce sine wave response on oscilloscope	L302 for min. response
4.	44 mc. sweep to 2nd IF grid	Connect detuning clip to 1st IF plate	Pri. of T301 for max. response and sec. of T301 for symmetrical curve shown in Fig. 6B
5.	44 mc. sweep to 1st IF grid	Detune L103 before adjusting T300	Pri. of T300 for max. response and sec. of T300 for symmetrical curve
6.	44 mc. sweep to 1st IF grid		L103 for "suck-out" at 44 mc. (center of curve). See Fig. 6C
7.	Replace the 6BZ7 RF amplifier tube		
8.	213 mc. sweep to antenna terminals through network	Fine tuning set to mid-range	L300 for symmetrical curve and L301 for min. 41.25 mc. marker amplitude. See Fig. 6D



– RESPONSE CURVES AT VARIOUS STAGES OF ALIGNMENT

Connect the signal generator to the video test terminal (point "B" on Fig. 5) through a .001 mfd capacitor.

Step	Signal Gen. Frequency	VTVM Connections	Remarks	Adjust –
1.	4.5 mc. unmodulated	RF probe to point "C" (see Fig. 8) and common lead to chassis.	Use strong signal from generator	L303 for minimum voltage

SOUND SECTION

Using a weak signal, adjust L200 and L201 for maximum response to a 4.5 mc. FM signal. Using a strong signal, adjust L202 for maximum response on a 4.5 mc. FM signal. Using a weak signal, adjust the quieting control for minimum AM noise.

Model H-793KU21 is the same as Model H-793K21 except that it contains a built-in all- channel UHF tuner. For service information on the UHF tuner, refer to the H-804 service notes.

MODELS H-786KU21 AND H-787KU21 are the same as Models H-786K21 and H-787K21 except that they contain a built-in all-channel UHF tuner. For service information on the UHF tuner, refer to the H-804

For service information on the V-2243-1 and V-2243-2 chassis, refer to the H-770T21, H-771T21, H-772K21, H-773K21, H-774K21. H-775K21, and H-776T21 service notes and supplementary information thereto.

R. F. AND MIXER ALIGNMENT

1. Refer to the basic service notes on the H-770T21, H-771T21, H-772K21, H-773K21, H-774K21, H-775K21 and the H-776T21 for test equipment details and general information.

2. Disconnect the tuner AGC lead (white wire) from the junction of C324, R327 and R326. Apply -2 volts bias to the tuner.

3. Connect the output of the sweep generator to the receiver antenna terminals. Be sure the proper impedance matching network is used.

4. Loosely couple the marker generator to the sweep output cable at antenna terminals.

5. Connect the oscilloscope, through a 10,000 ohm isolating resistor, to the "VHF test point" on the tuner. (See Fig. 1).

6. Turn on the receiver and test equipment and allow 5 min. warm-up.

7. Set the receiver channel selector to channel 12 and adjust the sweep generator to sweep channel 12 frequencies. Sweep width of 12 mc. is desirable so that the skirts of the response curve will fall to zero.

8. Set the marker generator to 207 mc. and adjust the output level so that the marker pip is barely visible. Excessive marker injection will distort the response curve.

9. Using 205.25 mc. and 209.75 mc. settings of the marker generator as reference, adjust in sequence the antenna (RF) trimmer, C117; the RF plate circuit trimmer, C119; and the mixer grid trimmer, C120 to produce a response curve similar to that shown in Fig. 4. The response curve should be symmetrical and the depth of the valley between peaks should not exceed 30% of the overall amplitude. Tolerances in amplitude of 30% at or between carrier frequencies are permissable. Avoid "stagger tuning" these circuits by tuning each for maximum pattern height at the point midway between the two markers.

The adjustment should result in maximum amplitude of the response curve, proper positioning of the sound and picture carriers and the closest approach to equal amplitude of the two humps with minimum valley between. Fig. 4 is the RF and mixer response curve and should not be confused with the overall RF-IF response curve of the tuner.

10. Without disturbing the settings of C117, C119 and C120, check the response curve on the other TV channels by changing the frequency of the sweep generator and the marker generator to correspond with the channel being checked. (See Fig. 7) The response curves should be substantially the same on all channels and the marker frequencies should fall in the same positions on the response curve. A slight amount of "tilt" indicated by the relative amplitude of the two humps can be tolerated but should not exceed 30% of the overall amplitude of the response curve. The ideal response curve has a flat top.

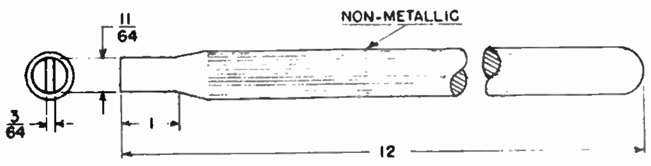


FIG. 3 – Alignment Tool

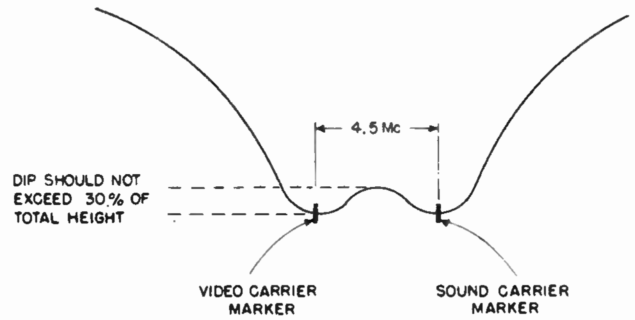


FIG. 4 – RF-Mixer Response Curve

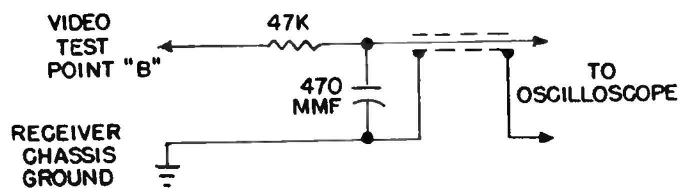


FIG. 5 – Decoupling Network

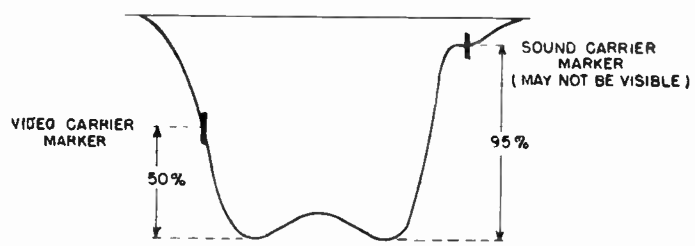
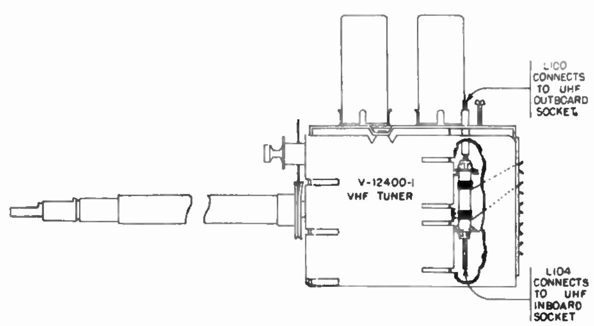


FIG. 6 – Overall Response Curve



V-12400-1 – Tuner UHF Adjustments

OSCILLATOR ALIGNMENT

Under the INSTALLATION AND SERVICE ADJUSTMENTS section of this note, adjustment of the individual oscillator circuits using "air signals" was outlined. The following procedure covers shop alignment of the oscillator circuits and does not require "air signals". Before undertaking oscillator alignment, all IF circuits must be properly aligned for pass band characteristics and trap settings. (Refer to basic service note).

1. With the exception of the oscilloscope, the test equipment hook-up is the same as that used when aligning the RF and mixer stages. Connect the vertical input of the oscilloscope to the video test point "B" (See Fig. 10 schematic diagram) through the decoupling network shown in Fig. 5.

2. Set the fine tuning control to center frequency by turning the fine tuning shaft until the flat section faces up. Using the sweep and marker generator frequencies in the chart, (See Fig. 7) adjust the oscillator slug so that the video carrier marker is at half amplitude on the high frequency slope of the IF response curve. (See Fig. 6)

CHANNEL	SWEEP GENERATOR CENTER FREQUENCY 12 MC. SWEEP	MARKER GENERATOR FREQUENCY PIX	SOUND
2	57 MC	55.25	59.75
3	63 "	61.25	65.75
4	69 "	67.25	71.75
5	79 "	77.25	81.75
6	85 "	83.25	87.75
7	177 "	175.25	179.75
8	183 "	181.25	185.75
9	189 "	187.25	191.75
10	195 "	193.25	197.95
11	201 "	199.25	203.75
12	207 "	205.25	209.75
13	213 "	211.25	215.75

FIG. 7 – Alignment Frequencies

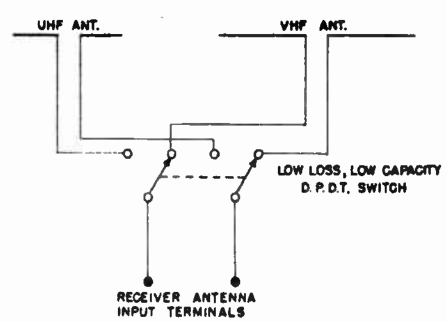


FIG. 8 – Antenna Switch

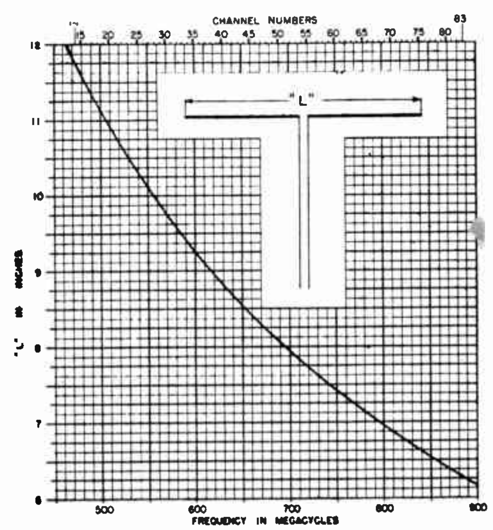


FIG. 9 – UHF Dipole Lengths

CHASSIS ASSEMBLY V-2243-4

In addition to the V-2243-1 and V-2243-3 chassis assemblies, the V-2243-4 chassis assembly is also used in production of some of the models covered by this service note. The V-2243-4 chassis uses a new tuner, part V-12400-1, otherwise it is identical to chassis V-2243-1.

V-12400-1 TUNER ASSEMBLY

The V-12400-1 tuner is basically the same as the V-11794-1 tuner, which is used in the 2243-1 chassis, with the exception that the UHF input circuit has been modified to provide link-coupling for an all-channel UHF continuous tuner. (See circuit schematic Fig. 12). Refer to the Model H-804 service notes for specific information covering all-channel UHF continuous tuners.

Model H-802 plug-in receptors can also be used for UHF reception in the V-2243-4 chassis. Both sections

in frequency. 300 ohm tubular transmission line is acceptable.

Where two or more antennas are used for receivers containing a single antenna input, an antenna switching or isolating device may be required. A low capacity, manually operated switch can be attached to the back of the receiver. (See Fig. 8) A variety of antenna isolating devices are now available. Their installation is simple and their operation is automatic. Some are designed for installation on the antenna mast, thus avoiding the need for additional transmission lines.

of the dual UHF input circuit of the V-12400-1 VHF tuner are adjustable to provide optimum coupling between the UHF receptors and the VHF tuner.

Referring to Figs. 10 and 11, L100 is the coupling adjustment for the receptor installed in the outboard UHF socket; L104 is the coupling adjustment for the receptor installed in the inboard UHF socket. To make the adjustment, set the channel selector to the proper UHF position, tune the receiver in the normal manner and adjust the slug (L100 or L104) for best picture quality.

NOTE: The series resonant trap, L106-C118 is normally set for maximum capacity but should be adjusted in the field if local interference on channel 2 is encountered.

UHF ANTENNA INFORMATION

Antenna requirements for satisfactory UHF television reception are determined by the signal conditions in the particular locality.

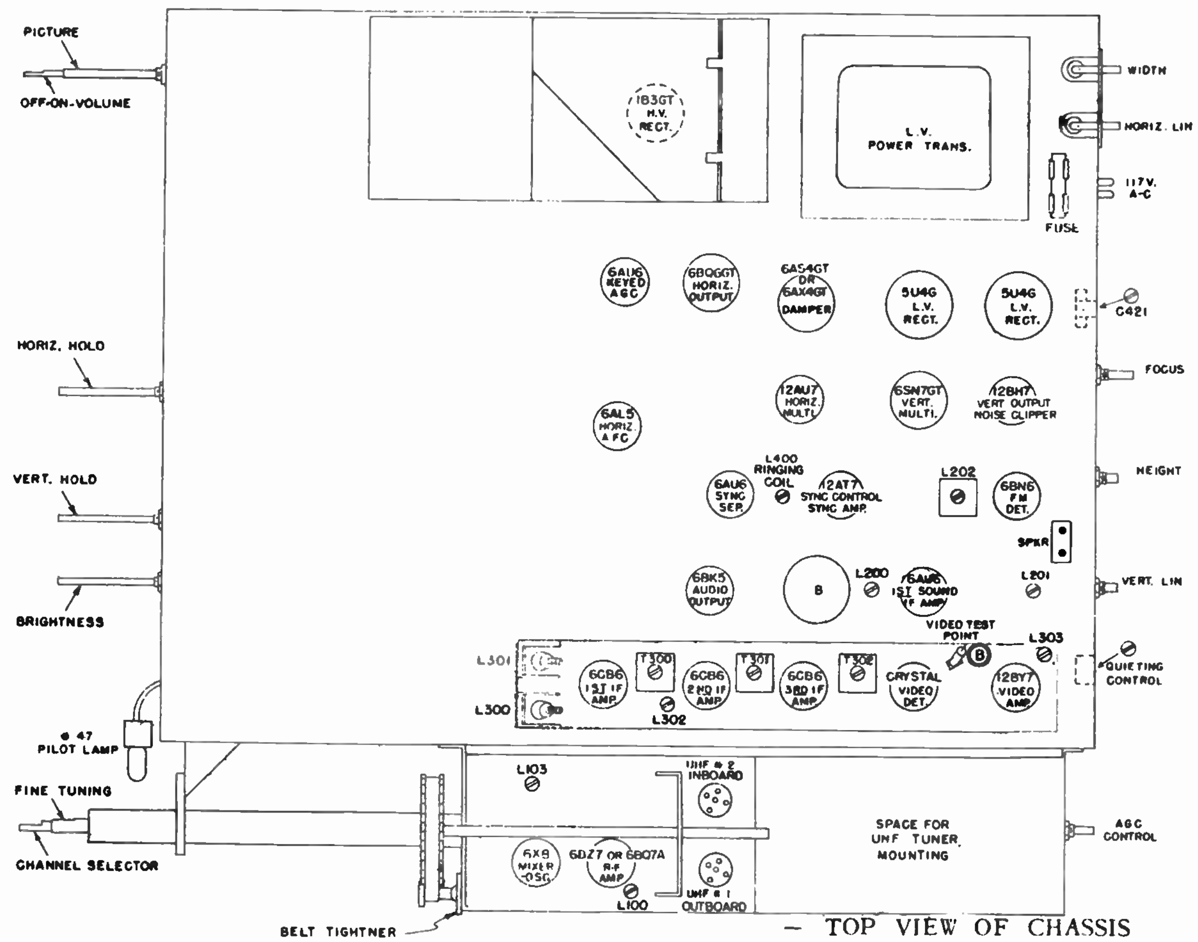
Some of the possibilities are as follows:

1. In areas where signals are very strong and reflections are not troublesome, satisfactory reception can be obtained by using a single broad-band VHF-UHF antenna.

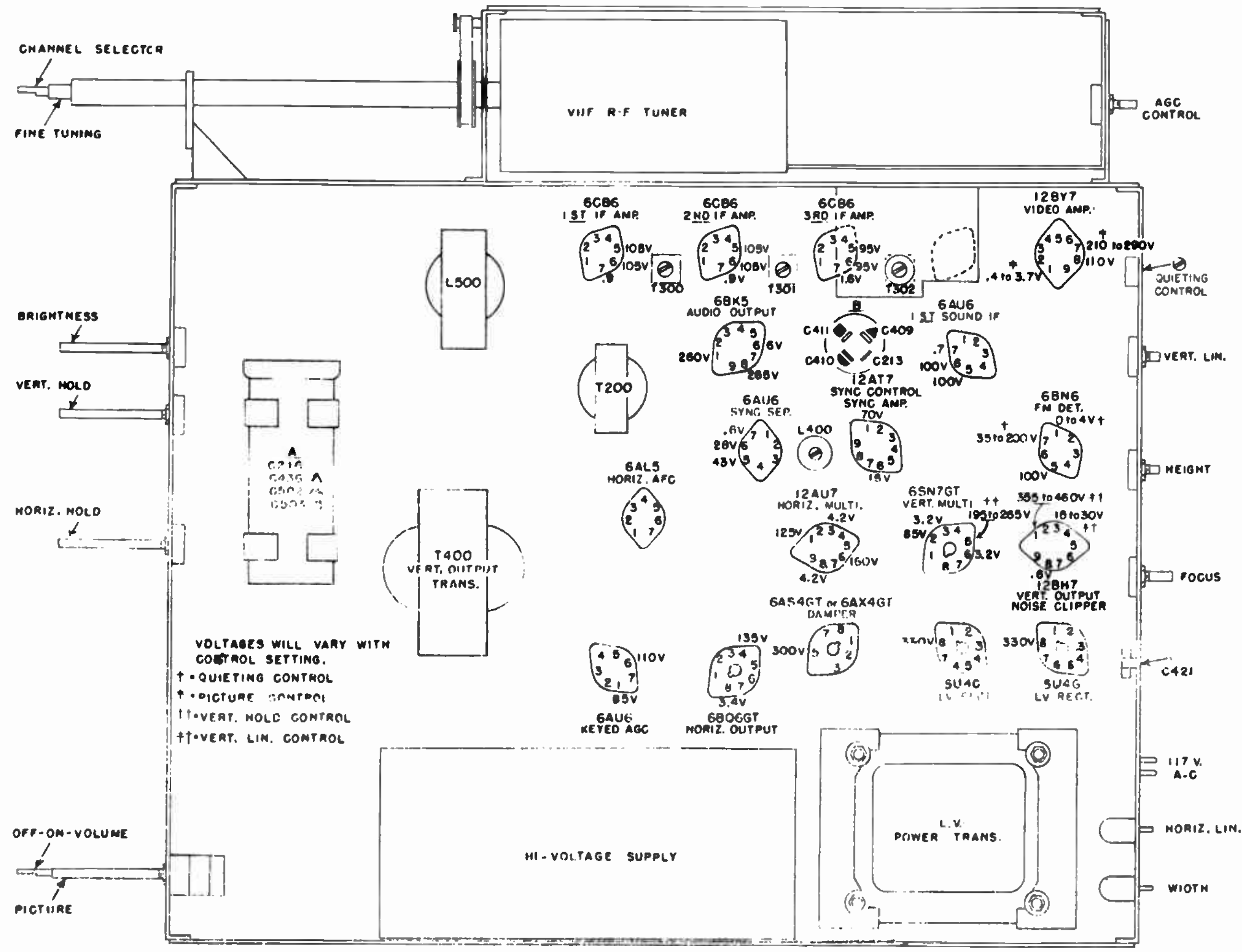
2. In medium signal areas, a separate UHF antenna may be required. A simple resonant dipole usually provides satisfactory UHF reception. The chart, Fig. 9, gives the total length of a half-wave dipole element for any frequency in the UHF spectrum.

3. Where signals are weak or reflections are troublesome, a high gain, directive UHF antenna system should be used. Typical of this type are the Corner Reflector, the Conical and the Yagi.

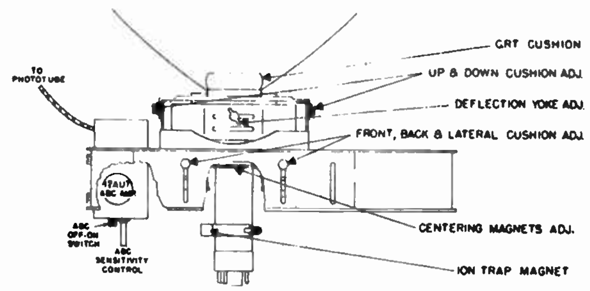
Transmission lines should be of an approved low loss type. The use of 300 ohm ribbon type transmission line for UHF installations is not recommended as its attenuation factor, when wet, rises sharply with increase



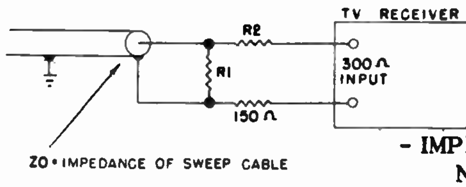
— TOP VIEW OF CHASSIS



BOTTOM VIEW OF CHASSIS

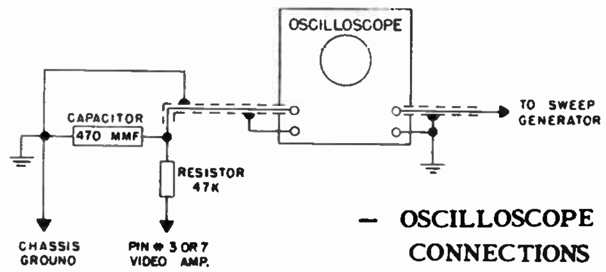


CRT AND ABC ADJUSTMENTS

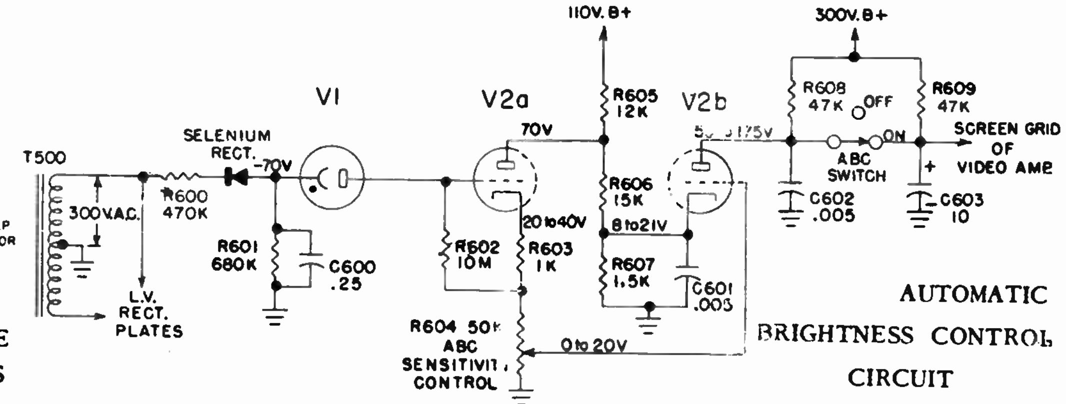


ZO	R1	R2
50 Ω	56 Ω	120 Ω
72 Ω	82 Ω	110 Ω

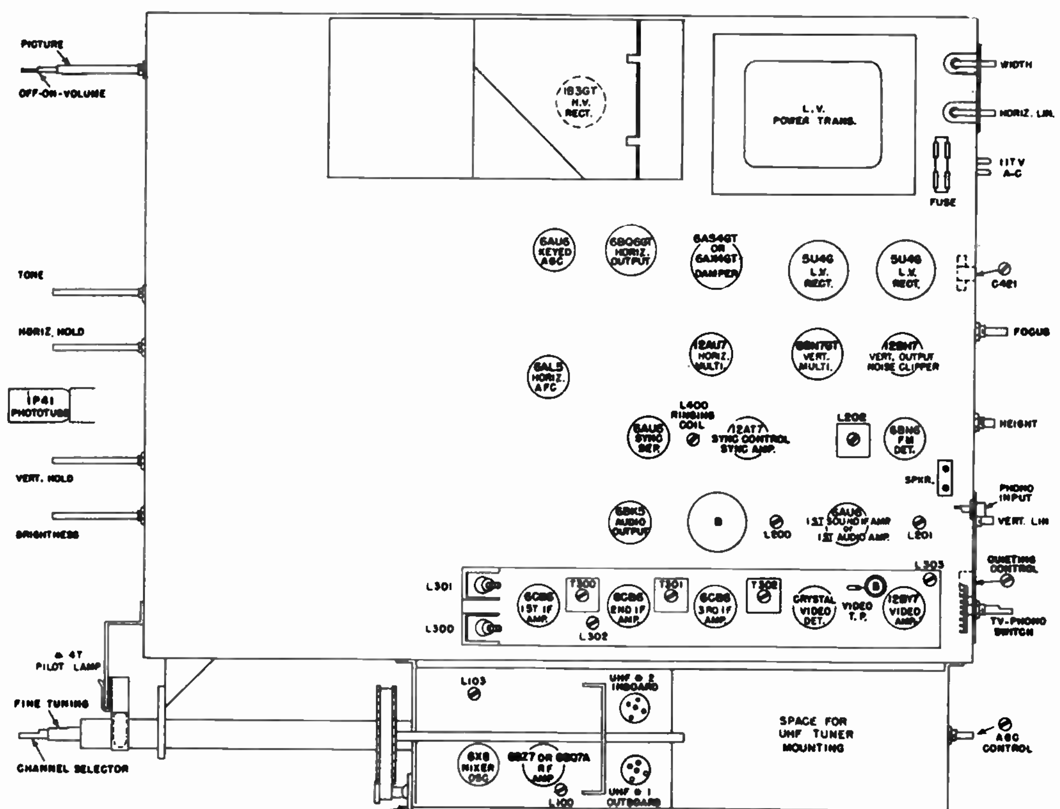
- IMPEDANCE MATCHING NETWORK



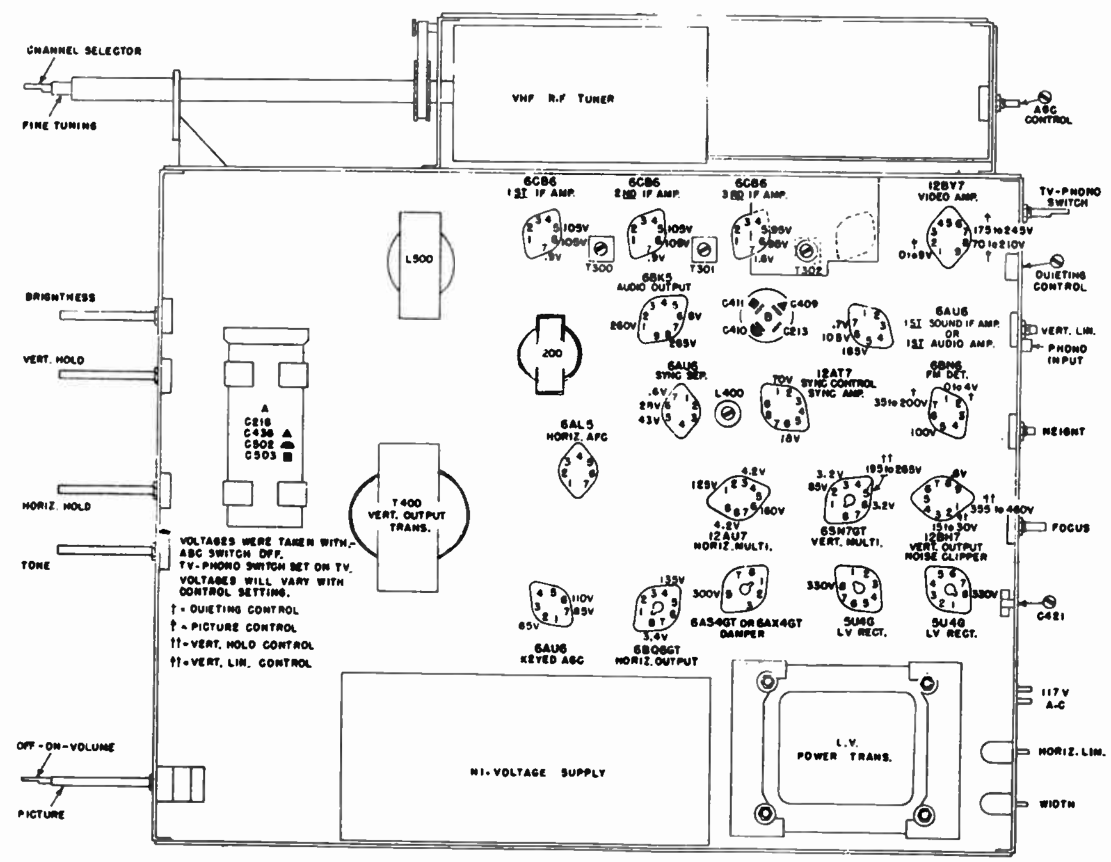
- OSCILLOSCOPE CONNECTIONS



AUTOMATIC BRIGHTNESS CONTROL CIRCUIT



- TOP VIEW OF CHASSIS



BOTTOM VIEW OF CHASSIS

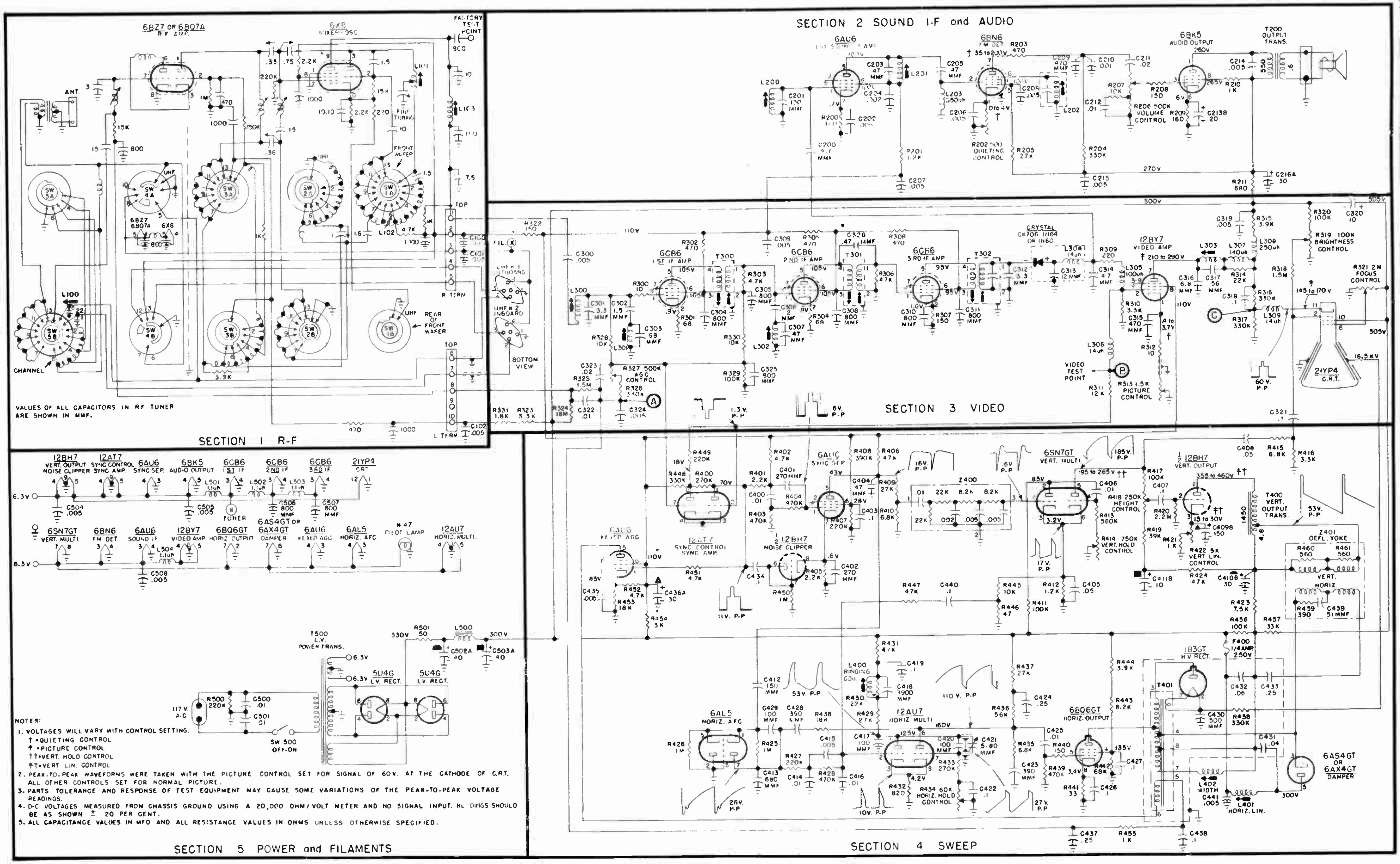
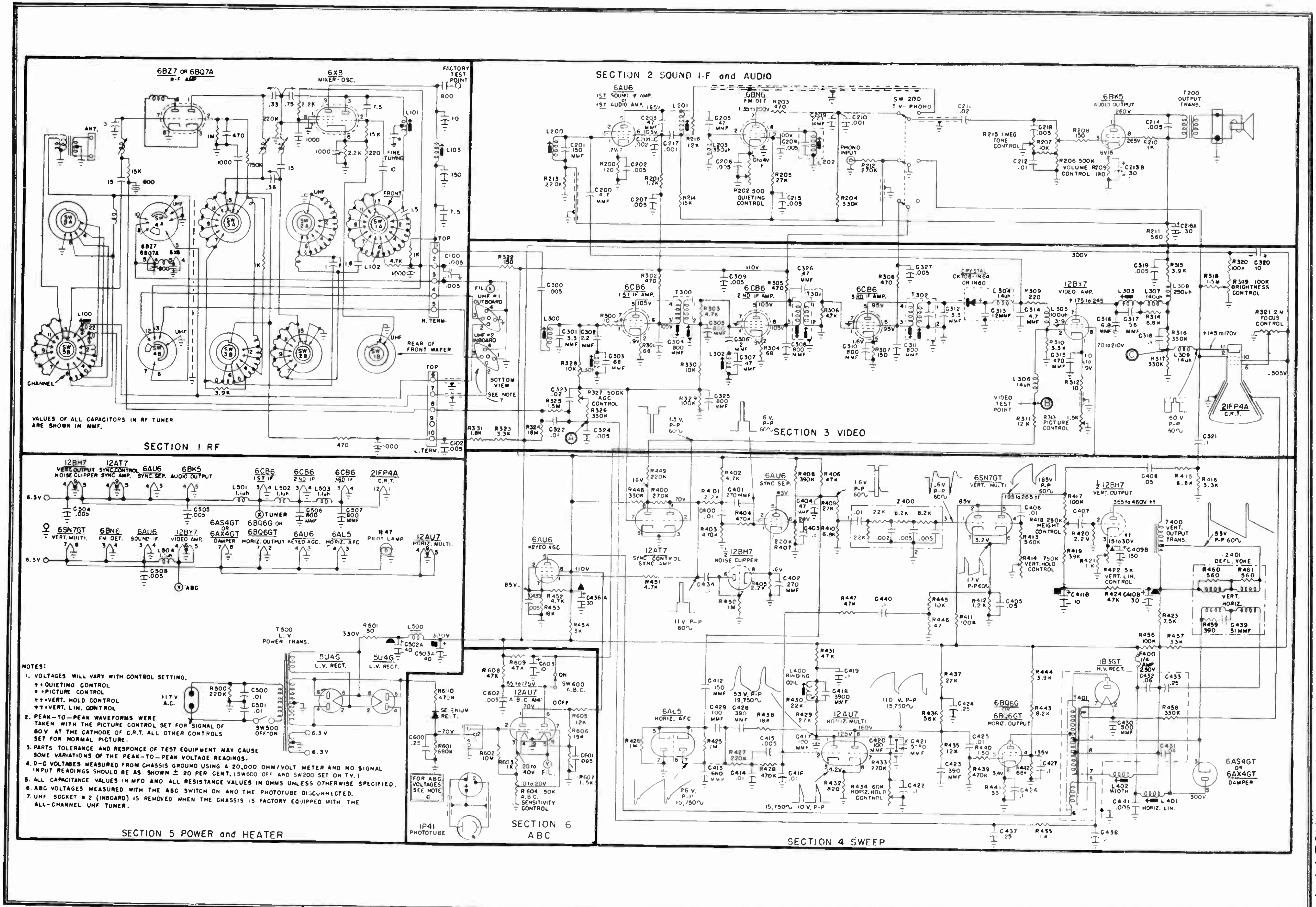
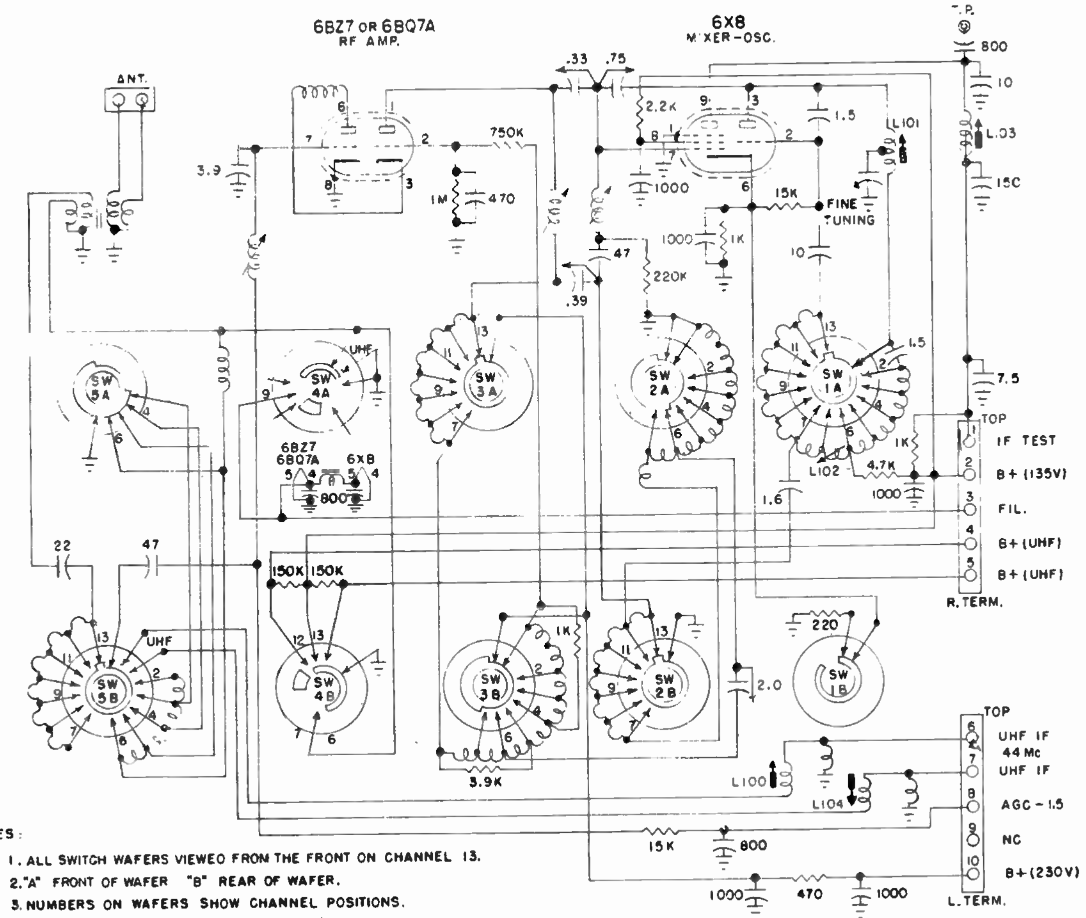


FIG. 8 — SCHEMATIC DIAGRAM

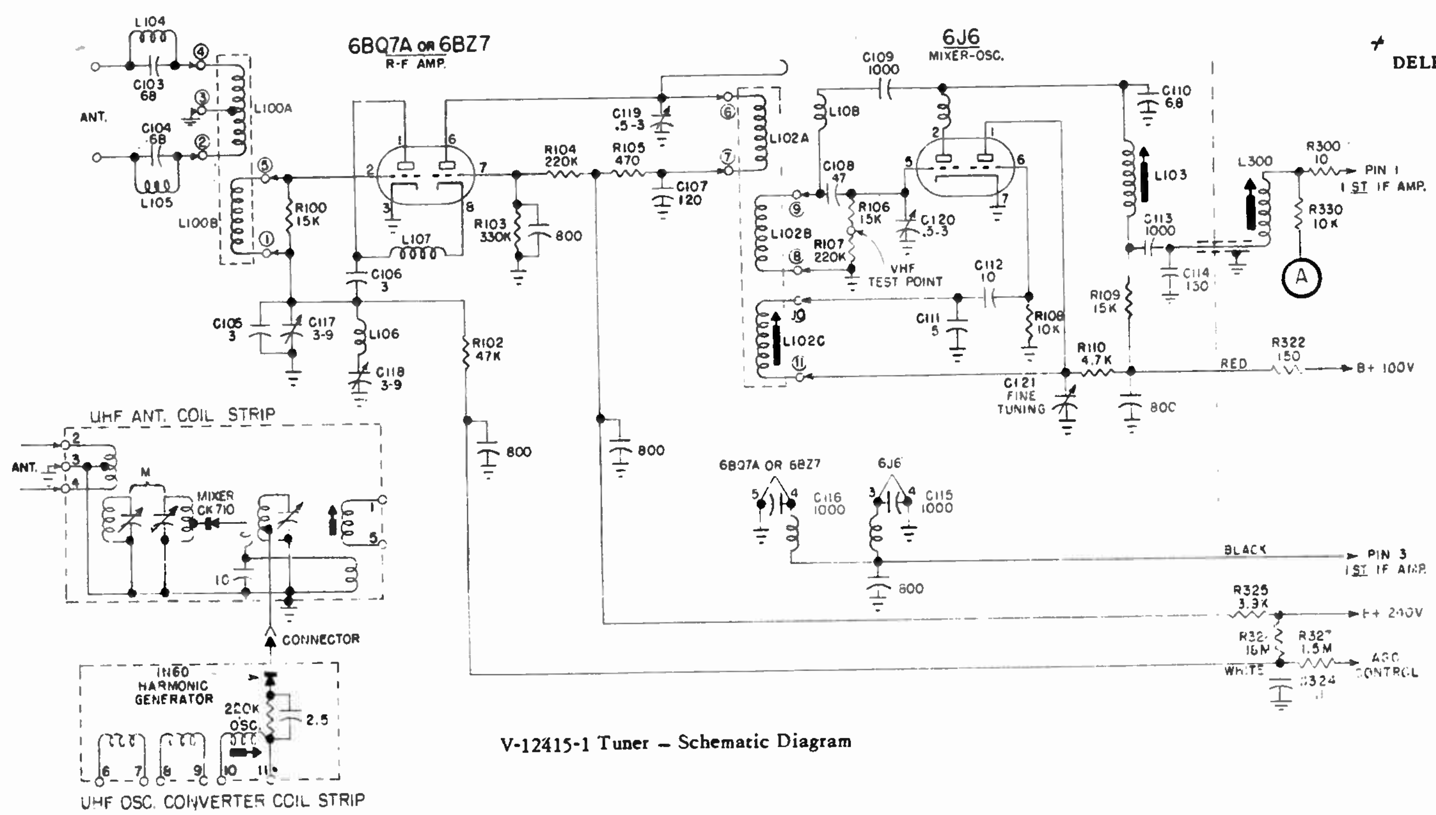
IMPORTANT — Since many of the components are very critical, exact duplicates must be used for replacement purposes. However, any substitute supplied by Westinghouse will assure performance equal to or better than the list part.


SECTION 1 RF
SECTION 2 SOUND I-F and AUDIO
SECTION 3 VIDEO
SECTION 4 SWEEP
SECTION 5 POWER and HEATER
SECTION 6 ABC
VALUES OF ALL CAPACITORS IN RF TUNER ARE SHOWN IN MMF.
NOTES:
1. VOLTAGES WILL VARY WITH CONTROL SETTING.
† = QUIETING CONTROL
* = PICTURE CONTROL
†† = VERT. HOLD CONTROL
*† = VERT. LIN. CONTROL
2. PEAK-TO-PEAK WAVEFORMS WERE TAKEN WITH THE PICTURE CONTROL SET FOR SIGNAL OF 60V AT THE CATHODE OF C.R.T. ALL OTHER CONTROLS SET FOR NORMAL PICTURE.
3. PARTS TOLERANCE AND RESPONCE OF TEST EQUIPMENT MAY CAUSE SOME VARIATIONS OF THE PEAK-TO-PEAK VOLTAGE READINGS.
4. D-C VOLTAGES MEASURED FROM CHASSIS GROUND USING A 20,000 OHM/VOLT METER AND NO SIGNAL INPUT READINGS SHOULD BE AS SHOWN ± 20 PER CENT. (SW600 OFF AND SW200 SET ON TV.)
5. ALL CAPACITANCE VALUES IN MFD AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
6. ABC VOLTAGES MEASURED WITH THE ABC SWITCH ON AND THE PHOTOTUBE DISCONNECTED.
7. UHF SOCKET # 2 (INBOARD) IS REMOVED WHEN THE CHASSIS IS FACTORY EQUIPPED WITH THE ALL-CHANNEL UHF TUNER.



NOTES:
1. ALL SWITCH WAFERS VIEWED FROM THE FRONT ON CHANNEL 13.
2. "A" FRONT OF WAFER "B" REAR OF WAFER.
3. NUMBERS ON WAFERS SHOW CHANNEL POSITIONS.
4. VALUES OF ALL CAPACITORS ARE GIVEN IN MMF.

V-12400-1 – Tuner Schematic Diagram



V-12415-1 Tuner – Schematic Diagram

Additional parts used in the V-2243-3 chassis and for production changes in the V-2243-1 chassis.

When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	*Part No.*	*Description*	*List Price Each*
C100	V-9044-1	Capacitor, dual, .005 mfd. .005 mfd.	.39
C206	V-9044-1	Capacitor, dual, .005 mfd. .005 mfd.	.39
C210	R2CC62Y5Y152M	Capacitor, .0015, 600V	.20
C302	V-5658-14	Capacitor, 2.2 mmf.	.10
C319	RCP10W6203M	Capacitor, .02 mfd. 600V	.20
L505	V-4886-2	Reactor, 1.1 microhenry	.38
R211	RC40AE561K	Resistor, 560 ohms, 2W	.20
R223	RC20AE123K	Resistor, 12,000 ohms, ½W.	.05
R314	RC20AE682K	Resistor, 6800 ohms, ½W.	.05
R326	RC20AE394K	Resistor, 390,000 ohms, ½W	.05
+ R327	V-12272-1	Control, 750,000 ohms	•
R405	RC20AE122K	Resistor, 1,200 ohms	.05
R435	RC20AE123K	Resistor, 12,000 ohms, ½W.	.05
R444	RC30AE182K	Resistor, 1800 ohms, 1W	.12
R464	RC40AE273K	Resistor, 27,000 ohms 2W	.22
+ T500	V-11544-3N	Transformer, power	•
	V-11338-4	Belt, Dial Drive, UHF	•
ADD:		V-2243-3 Chassis Only	
	V-12415-1	RF Tuner Assy.	47.50
	V-12404-1	Knob, channel selector, 12 pos. (Model H-776T21)	.95
DELETE:	V-11794-1	RF Tuner Assy.	
	V-12118-1	Knob, channel selector, (Model H-776T21)	
	V-11338-3	Belt, dial drive, VHF	
	V-12249-1	Ring, sleeve retainer	
	V-12026-1	Sleeve, fiber tuning shaft	
	V-10970-1	Socket, 5 prong, UHF	

MODEL PARTS

Additions and changes to the Models H-770T21, H-771T21, H-772K21, H-773K21, H-774K21, H-775K21, and H-776T21 Parts List.

ADD:	V-11987-8	Cover Assy, back (All but H-776T21)	3.60
	V-12034-9	Cover assy, back (H-776T21 only)	•
	V-11983-3	Door, front controls (all models)	1.35
	V-12409-1	Gasket, dust seal (H-776T21 only)	.60
+ DELETE:	V-11987-2	Cover Assy, back	
	V-12034-2	Cover Assy, back	

PARTS LIST

Section 1--RF

C100	V-5596
C101	V-5596
C102	V-5596
TUNER	V-11794-1

Section 2--Sound I-F and Audio

Crystal 10 FM	V-9770-1
C200	V-9926-3
C202	V-5596-1
C206	V-5596-1
C207	V-5596-1
C208	V-5596-1
C213B	V-11535-1
C215	V-5596-1
C216A	V-9891-1
L200	V-9882-5
L201	V-9882-2
L202	V-11396-1
L203	V-9915-2
R202	V-11345-2
R206	V-9877-7
T200	V-9238-2

Section 3--Video

C300	V-5596-1
C301	V-9926-2
C302	V-5658-9
C304	V-9863-1
C305	V-9863-1
C306	V-5658-2
C308	V-9863-1
C309	V-5596
C310	V-9863-1
C311	V-9863-1
C312	V-9926-2
C314	V-9926-3
C316	V-5658-12
C319	V-5596
C320	V-10293-1
C324	V-5596-1
C325	V-9863-1
C326	V-5658-1
IN34	V-10916-1
L300	V-9882-7
L301	V-11973-1
L302	V-11973-1
L303	V-9882-3
L304	V-4886-1
L305	V-9915-1
L306	V-4886-1
L307	V-5902-1
L308	V-5902-5
L309	V-4886-1
R303	V-9927-2
R306	V-9927-2
R313	V-9877-7
R315	V-5924-3
R319	V-11536-2
R321	V-9894-2
R327	V-9813-3
R328	V-9927-10
T300	V-9879
T301	V-9879
T302	V-9880-2

Section 4--Sweep

C409B	V-11535-1
C410B	V-11535-1
C411B	V-11535-1
C421	V-11228-2
C430	V-9901-3
C435	V-5596-1
C436A	V-9891-1
C439	V-9792-10510J
C439	V-9792-10430J
C441	V-5596-1
F400	V-6171-3
L400	V-6764
L401	V-11789-1
L402	V-11791-1
R414	V-11539-2
R418	V-9813-4
R422	V-6463
R423	V-12171-3
R434	V-11538-3
R443	V-11328-9
R454	V-9375-4
R458	V-9927-7
T400	V-10909-2
T401	V-11548-1
Z400	V-11192-1
Z401	V-12218-1
C506	V-9863-1
C507	V-9863-1
C508	V-5596-1
L500	V-6471-3
L501	V-4886-2
L502	V-4886-2
L503	V-4886-2
L504	V-4886-2
R501	V-11328-8
T500	V-11544-3

Section 5--Power and Filament

C500	V-5040-15
C501	V-5040-15
C502A	V-9891-1
C503A	V-9891
C504	V-5596-1
C505	V-5596-1
C506	V-9863-1
C507	V-9863-1
C508	V-5596-1
L500	V-6471-3
L501	V-4886-2
L502	V-4886-2
L503	V-4886-2
L504	V-4886-2
R501	V-11328-8
T500	V-11544-3

Section 6--AGC

C601	V-5596-1
C602	V-5596-1
C603	V-10293-1
R604	V-9916-1
	V-11189-1

MODELS H-786K21 (MAHOGANY) AND H-787K21 (BLOND)

CHASSIS ASSEMBLY V-2243-1

MODELS H-786KU21 AND H-787KU21

These models are the same as Models H-786K21 and H-787K21 except that they contain a built-in all-channel UHF tuner. For service information on the UHF tuner, refer to the H-804 service notes.

SERVICE NOTES

For service information on the V-2243-1 chassis, refer to the H-770T21, H-771T21, H-772K21, H-773K21, H-774K21, H-775K21 and H-776T21 service notes and any supplementary information thereto.

H-786K21 AND H-787K21 MODEL PARTS

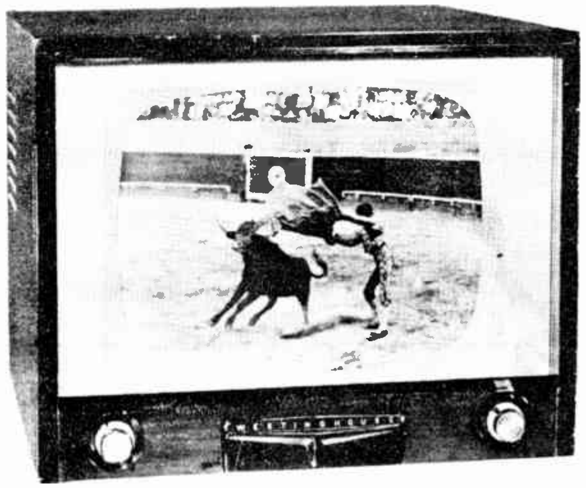
The following parts are used in Models H-786K21 and H-787K21 in lieu of the MODEL PARTS listed in the H-770T21, H-771T21, H-772K21, H-773K21, H-774K21, H-775K21 and H-776T21 service notes:

	Part No.	*Description*	*List Price Each*
✝	V-1320-1	Cabinet, H-786K21	$ ••
✝	V-1320-2	Cabinet, H-787K21	••
	V-11856-1	Caster, swivel	.50
	V-5522	Cord, AC power	1.25
	V-11987-2	Cover Assembly, back	3.60
✝	V-8639	Doors, matched pair (H-786K21)	••

	Part No.	*Description*	*List Price Each*
✝	V-8640	Doors, matched pair	$ ••
	V-10361-15	Grille Cloth (H-786K21)	••
	V-10261-15	Grille Cloth (H-787K21)	••
	V-12004-1	Gasket, dust seal	.75
	V-9091-1	Hinge, upper LH and lower RH (H-786K21)	.30
	V-9091-2	Hinge, upper RH and lower LH (H-786K21)	.30
	V-9091-3	Hinge, upper LH and lower RH (H-787K21)	.35
	V-9091-4	Hinge, upper RH and lower LH (H-787K21)	.35
✝	V-11964-1	Knob, channel selector (H-786KU21)	••
✝	V-12118-1	Knob Assy., channel selector (H-786K21)	••
✝	V-11964-3	Knob, channel selector (H-787KU21)	••
✝	V-12118-3	Knob Assy., channel selector (H-787K21)	••
	V-11963-1	Knob, fine tuning	.75
	V-11980-1	Knob, off-on-volume (H-786K21)	.55
	V-11980-3	Knob, off-on-volume (H-787K21)	.55
	V-11979-1	Knob, picture	.75
✝	V-11962-1	Knob, dial, UHF (H-786KU21, H-787KU21)	••
	V-11865-1	Mask, picture, spherical	3.50
	V-11988-1	Panel Assy., controls (H-786K21)	4.75
	V-11988-2	Panel Assy., controls (H-787K21)	4.75
	V-11918-1	Plate, glass	12.00
✝	V-11194-13	Pull, door (H-786K21)	••
✝	V-5306-3	Pull, door (H-787K21)	••
	V-9770-1	Speaker, 10"PM	8.00•

✝ New part number listed for the first time in Westinghouse radio or television service information.
• Price includes Federal Excise Tax.
•• Price furnished on request.
NOTE: All prices are subject to change without notice.

H-765T17 **H-766T17**



The V-2260-14 chassis is the same as the V-2260-12 chassis with the exception that a V-12415 RF tuner is used. For service and alignment information on the V-12415 tuner, refer to Supplement 1 of the H-765T17 and H-766T17 service notes.

For alignment, adjustments, and other service information refer to the H-765T17 and H-766T17 service notes.

MODELS H-798TU17 AND H-799TU17 USING A V-2270 CHASSIS

The V-2270 chassis is identical to the V-2260 chassis with the exception that an all-channel UHF has been factory installed to provide reception of the UHF television channels (14 through 83). For service information on the UHF tuner, refer to the Model H-804 service note and any supplementary information thereto.

Several different combinations of VHF and UHF tuners are used in the V-2270 chassis. The following chart will identify these combinations.

Chassis assembly	*VHF tuner*	*Positions*	*UHF tuner*
V-2270-122	V-12400-1	16	V-12390-1
V-2270-124	V-12400-1	16	V-11972-1

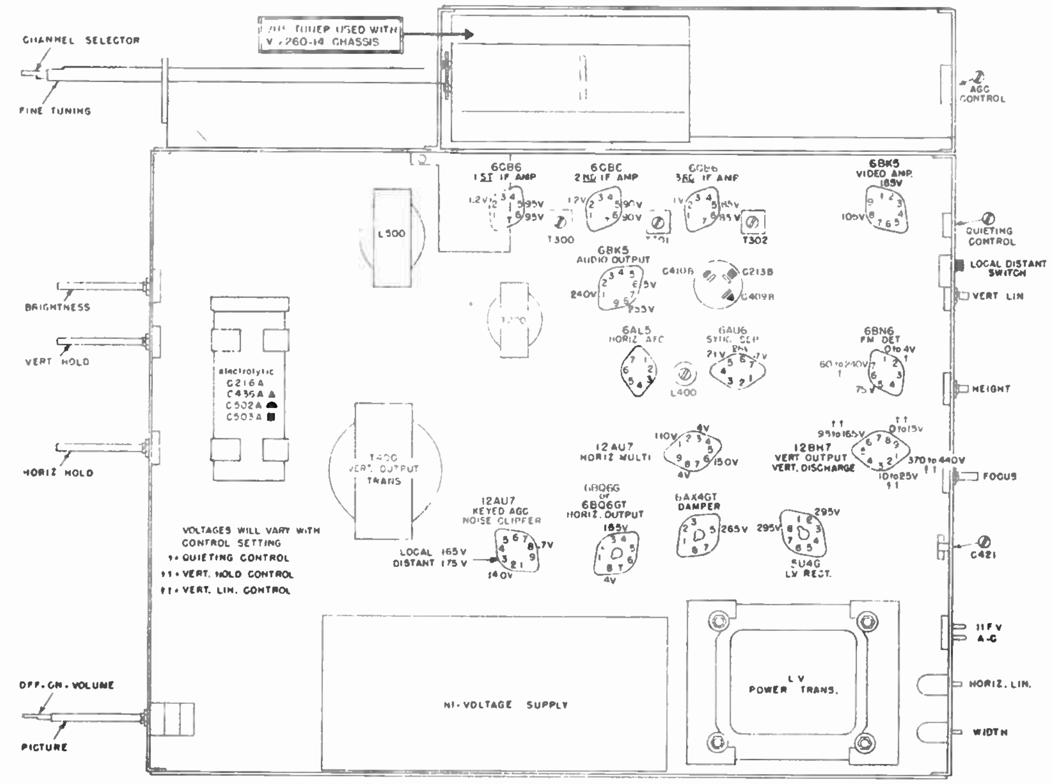


FIG 1 BOTTOM VIEW OF V-2260-12 AND V-2260-14 CHASSIS

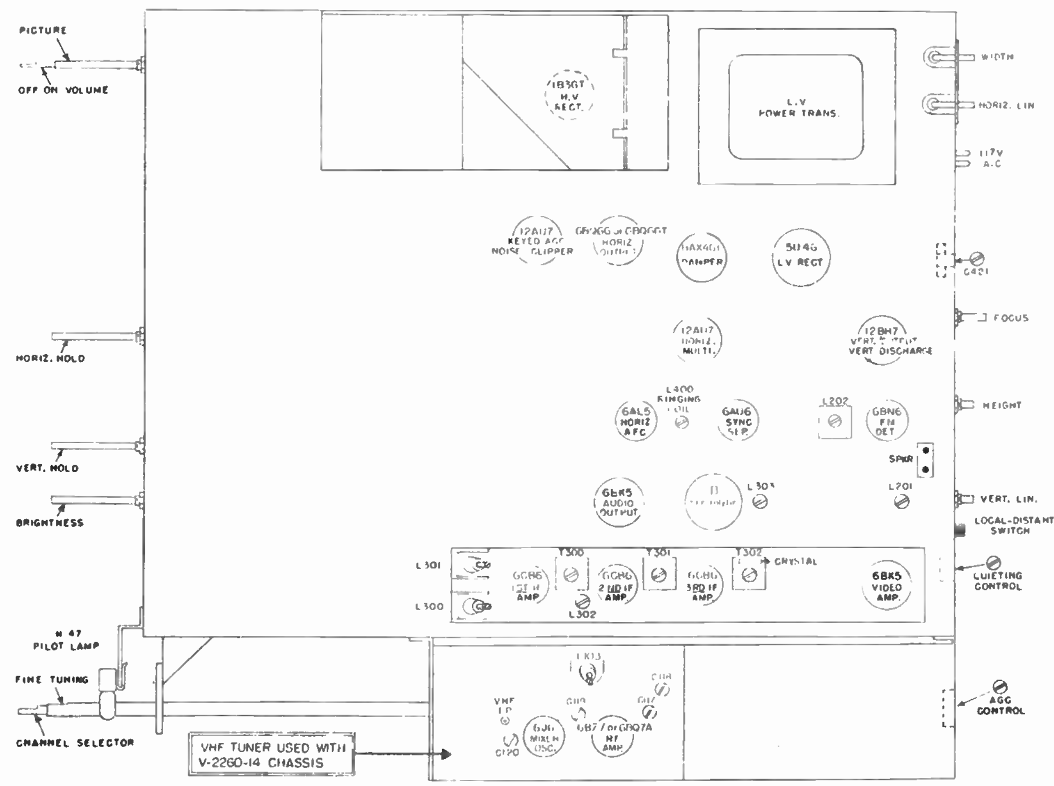


FIG. 2 TOP VIEW OF V-2260-12 AND V-2260-14 CHASSIS

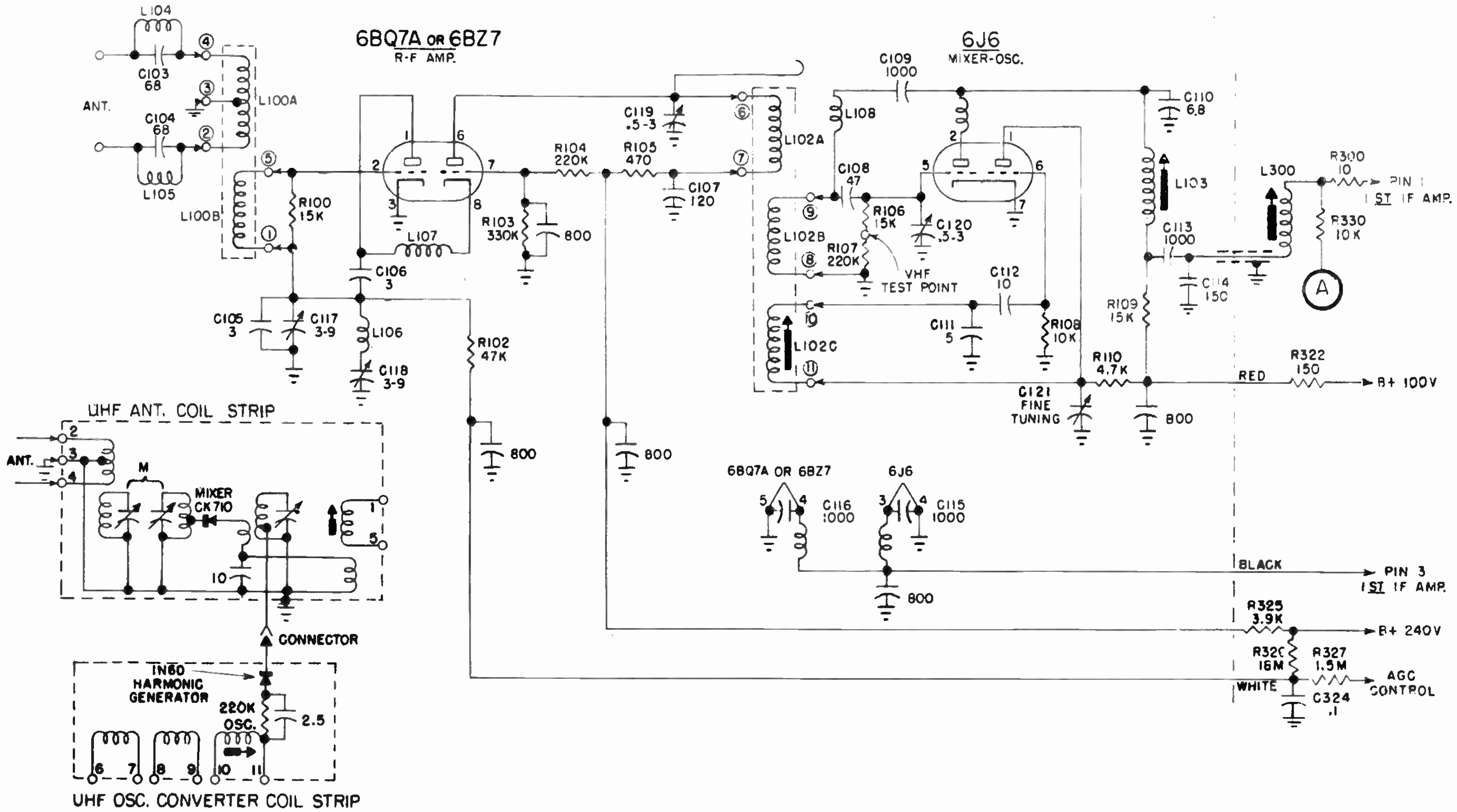


Fig. 2 V-12415-1 Tuner — Schematic Diagram

Production Changes Affecting Chassis V-2240-1

In production, any or all of the following changes may be incorporated in V-2240-1 chassis. See Fig. 10, V-2240-1 Schematic Revised.

1. R450 is changed from 6.8K to 12K to prevent horizontal overdrive.

2. A condenser C447, 47mmf. is added between the plate (pin 5) of the 6AU6 sync separator and ground. C447 provides additional video modulation filtering to prevent bending of the picture at the top.

3. R316 is increased to 270K and R332 to 120K to prevent picture streaking at high brightness.

4. C100, .005 mfd., and C101, .005 mfd. are replaced with a dual .005 mfd. capacitor. The new capacitor is designated C100.

5. C206, .005 mfd., and C208, .005 mfd. are replaced with a dual .005 mfd. capacitor. The new capacitor is designated C206.

6. Filament choke L505 part #V-4886-2 has been added in series with the filament (pin 3) of the 6BN6. A 12K resistor has been inserted between R203, 470 ohms and C211, .02 mfd. These changes were made to reduce tweet in the picture caused by harmonics generated in the 6BN6.

7. C419 is changed from 100 mmf. to 150 mmf. to improve the locking range of the horizontal hold control.

8. C302, 1.5 mmf. has been changed to 2.2 mmf. to increase sound attenuation. With this change C301, 3.3 mmf., is unnecessary and has been removed.

9. To increase the gain of the pentode section of the 6X8 when working as an IF stage for the UHF tuner, the 220 ohm cathode resistor is connected to ground. This is done by soldering a piece of #22 wire from the junction of the 220K resistor and wafer switch section 1B to the ground terminal of wafer switch section 2A.

10. Ion trap magnet, part V-9784-5, has been replaced with, ion trap magnet, part V-9784-4 to improve ion trap action.

11. The two outside connections to R400 have been reversed, decreasing the B+ to the picture control, thus stabilizing the picture brightness at various settings of the picture control.

12. To prevent slippage the UHF tuner drive belt has been replaced with part V-11338-4.

R. F. AND MIXER ALIGNMENT

1. Refer to page 5 of the basic service notes on the H-765T17 and the H-766T17 for test equipment details and general information.

2. Disconnect the tuner AGC lead (white wire) from the junction of C324, R327 and R326. Apply -2 volts bias to the tuner.

3. Connect the output of the sweep generator to the receiver antenna terminals. Be sure the proper impedance matching network is used.

4. Loosely couple the marker generator to the sweep output cable at antenna terminals.

5. Connect the oscilloscope, through a 10,000 ohm isolating resistor, to the "VHF test point" on the tuner. (See Fig. 1).

6. Turn on the receiver and test equipment and allow 5 min. warm-up.

7. Set the receiver channel selector to channel 12 and adjust the sweep generator to sweep channel 12 frequencies. Sweep width of 12 mc. is desirable so that the skirts of the response curve will fall to zero.

8. Set the marker generator to 207 mc. and adjust the output level so that the marker pip is barely visible. Excessive marker injection will distort the response curve.

9. Using 205.25 mc. and 209.75 mc. settings of the marker generator as reference, adjust in sequence the antenna (RF) trimmer, C117; the RF plate circuit trimmer, C119; and the mixer grid trimmer, C120 to produce a response curve similar to that shown in Fig. 4. The response curve should be symmetrical and the depth of the valley between peaks should not exceed 30% of the overall amplitude. Tolerances in amplitude of 30% at or between carrier frequencies are permissable. Avoid "stagger tuning" these circuits by tuning each for maximum pattern height at the point midway between the two markers.

The adjustment should result in maximum amplitude of the response curve, proper positioning of the sound and picture carriers and the closest approach to equal amplitude of the two humps with minimum valley between. Fig. 4 is the RF and mixer response curve and should not be confused with the overall RF-IF response curve of the tuner.

10. Without disturbing the settings of C117, C119 and C120, check the response curve on the other TV channels by changing the frequency of the sweep generator and the marker generator to correspond with the channel being checked. (See Fig. 7) The response curves should be substantially the same on all channels and the marker frequencies should fall in the same positions on the response curve. A slight amount of "tilt" indicated by the relative amplitude of the two humps can be tolerated but should not exceed 30% of the overall amplitude of the response curve. The ideal response curve has a flat top.

NOTE: The series resonant trap, L106-C118 is normally set for maximum capacity but should be adjusted in the field if local interference on channel 2 is encountered.

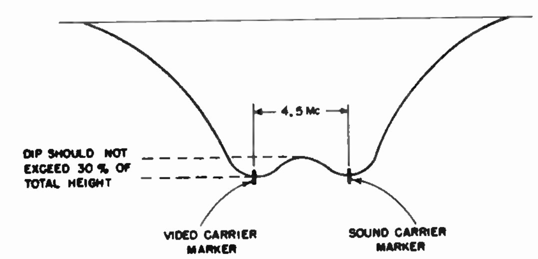


Fig. 4 RF Mixer Response Curve

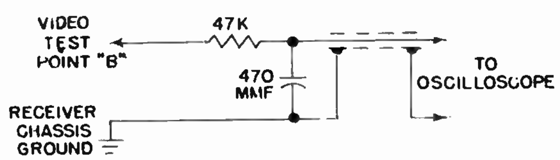


Fig. 5 Decoupling Network

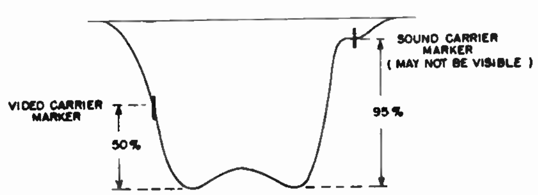


Fig. 6 Overall Response Curve

OSCILLATOR ALIGNMENT

Under the INSTALLATION AND SERVICE ADJUSTMENTS section of this note, adjustment of the individual oscillator circuits using "air signals" was outlined. The following procedure covers shop alignment of the oscillator circuits and does not require "air signals". Before undertaking oscillator alignment, all IF circuits must be properly aligned for band pass characteristics and trap settings. (Refer to basic service note)

1. With the exception of the oscilloscope, the test equipment hoop-up is the same as that used when aligning the RF and mixer stages. Connect the vertical input of the oscilloscope to the video test point "B" (See Fig. 10 schematic diagram) through the decoupling network shown in Fig. 5.

2. Set the fine tuning control to center frequency by turning the fine tuning shaft until the flat section faces up. Using the sweep and marker generator frequencies in the chart, (See Fig. 7) adjust the oscillator slug so that the video carrier marker is at half amplitude on the high frequency slope of the IF response curve. (See Fig. 6)

Channel	Sweep Generator Center Frequency 12 mc. Sweep	Marker Generator Frequency Pix	Sound
2	57 mc.	55.25	59.75
3	63 mc.	61.25	65.75
4	69 mc.	67.25	71.75
5	79 mc.	77.25	81.75
6	85 mc.	83.25	87.75
7	177 mc.	175.25	179.75
8	183 mc.	181.25	185.75
9	189 mc.	187.25	191.75
10	195 mc.	193.25	197.75
11	201 mc.	199.25	203.75
12	207 mc.	205.25	209.75
13	213 mc.	211.25	215.75

Fig. 7 Alignment Frequencies

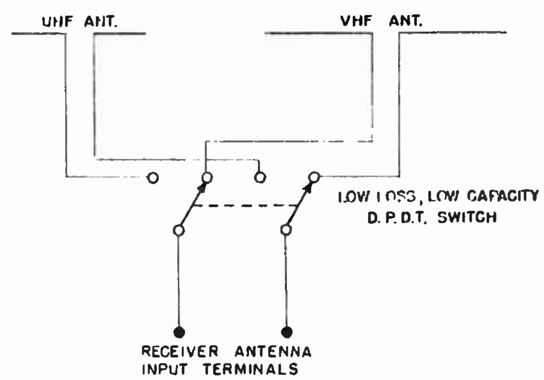


Fig. 8 VHF-UHF Antenna Switch

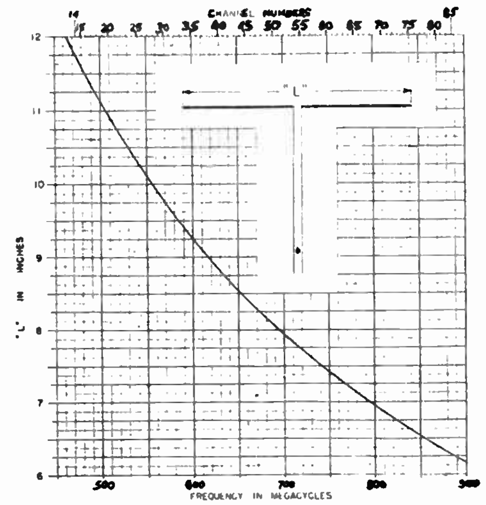


Fig. 9 UHF Dipole Antenna Length

UHF ANTENNA INFORMATION

Antenna requirements for satisfactory UHF television reception are determined by the signal conditions in the particular locality.

Some of the possibilities are as follows:

1. In areas where signals are very strong and reflections are not troublesome, satisfactory reception can be obtained by using a single broadband VHF-UHF antenna.

2. In medium signal areas, a separate UHF antenna may be required. A simple resonant dipole provides satisfactory UHF reception. The chart, Fig. 9 gives the total length of a half-wave dipole element for any frequency in the UHF spectrum.

3. Where signals are weak or reflections are troublesome, a high gain, directive UHF antenna system should be used. Typical of this type are the Corner Reflector, the Conical and the Yagi.

Transmission lines should be of an approved low loss type. The use of 300 ohm ribbon type transmission line for UHF installations is not recommended as its attenuation factor, when wet, rises sharply with increase in frequency. 300 ohm tubular transmission line is acceptable.

Where two or more antennas are used for receivers containing a single antenna input, an antenna switching or isolating device may be required. A low capacity, manually operated switch can be attached to the back of the receiver. (See Fig. 8) A variety of antenna isolating devices are now available. Their installation is simple and their operation is automatic. Some are designed for installation on the antenna mast, thus avoiding the need for additional transmission lines.

ADDITIONS AND CHANGES TO THE MODEL H-765T17 AND H-766T17 PARTS LIST

When ordering parts, specify model number of set in addition to part number and description of part.

ADDITIONAL PARTS USED IN V-2240-3 CHASSIS AND FOR PRODUCTION CHANGES IN V-2240-1 CHASSIS

Ref. No.	Part No.	Description	Function	List Price Each
C100	V-9044-1	Capacitor, dual .005, .005 mfd.	Fil & B– Bypass	.39
C206	V-9044-1	Capacitor, dual .005, .005 mfd.	Cath. –Screen Bypass	.39
C210	R2CC63Y5Y202M	Capacitor, .002 mfd. 600V	Tone Compensation	..25
C419	RCM20B151K	Capacitor, 150 mmf.	A.F.C. Coupling	.20
C447	RCM20B470K	Capacitor, 47 mmf.	Sync Sep. Circuit	.22
L505	V-4886-2	Reactor, 1.1 microhemps	Heater Isolation	.38
R223	RC20AE123K	Resistor, 12,000 Ohms, ½W	Grid Cir. Hor. Amp.	.05
R316	RC20AE274K	Resistor, 270,000 Ohms, ½W	Video Output Cir.	.06
R322	RC20AE124K	Resistor, 120,000 Ohms, ½W	Brightness Control Cir.	.10
R450	RL20AE123K	Resistor, 12,000 Ohms, ½W	Hor. Pulse Shaping	.05
R457	V-9927-7	Resistor, 330,000 Ohms 1W	Hi Voltage Filter	.10
T200	V-9238-2	Transformer	Audio Output	1.90
†T302	V-9880-2	Transformer	3RD IF	1.50
	V-9784-4	Magnet, Ion Trap		.85
†	V-11338-4	Belt, Dial Drive		*

V-2240-3 CHASSIS ONLY

	Part No.	Description	List Price Each
ADD			
	V-12415-1	RF Tuner Assembly	*
	V-12404-1	Knob Assy. Channel Selector, 12 Pos. (H-766T17)	*
	V-12403-2	Knob Assy. Channel Selector, 12 Pos. (H-765T17)	*
DELETE			
	V-10970-1	Socket 5 prong, UHF	
	V-12026-1	Sleeve Assy., Dial	
	V-12249-1	Ring, Sleeve Retainer	
	V-11338-3	Belt, Dial Drive	
	V-12118-1	Knob. Assy., Channel Selector (H766T17)	
	V-12118-2	Knob. Assy., Channel Selector (H765T17)	

H-765T17 AND H-766T17 MODEL PARTS

	Part No.	Description	List Price Each
ADD			
	V-12034-1	Cover Assembly, Back (H-766T17) (Omitted from Original Service Notes)	4.25

ELECTRICAL PARTS V-12415-1 TUNER ASSEMBLY

Ref. No.	Part No.	Description	List Price Each
†C105	V-8659	3 mmf. NPO	*
†C106	V-8659	3 mmf. NPO	*
†C107	V-8660	120 mmf.	*
†C108	V-8661	47 mmf. N1400	*
†C109	V-8662	1000 mmf. GMV	*
†C110	V-8663	6.8 mmf. NPO	*
†C111	V-8664	5 mmf. N750	*
†C112	V-8665	10 mmf. NPO	*
†C113	V-8682	1000 mmf. GMV	*
†C114	V-8666	150 mmf.	*
†C115	V-8662	1000 mmf. GMV	*
†C116	V-8662	1000 mmf. GMV	*
†C117	V-8667	3-9 mmf. Trimmer	*
†C118	V-8667	3-9 mmf. Trimmer	*
†C119	V-8668	.5-3 mmf. Trimmer	*
†C120	V-8668	.5-3 mmf. Trimmer	*
†L103	V-8669	IF Output Coil	*
†L104-C103	V-8670	Trap, ANT	*
†L105-C104	V-8671	Trap, ANT	*
†L106	V-8676	Coil	*
R100	RC20AE153K	Resistor 15K ± 10% (IRC Type BTS)	.05
R102	RC20AE473K	Resistor 47K ± 10%	.05
R103	RC20AE334K	Resistor 330K ± 10%	.05
R104	RC20AE224K	Resistor 220K ± 10%	.05
R105	RC20AE471K	Resistor 470 Ohms ± 10%	.05
R106	RC20AE153K	Resistor 15K ± 10%	.05
R107	RC20AE224K	Resistor 220K ± 10%	.05
R108	RC20AE103K	Resistor 10K ± 10%	.05
R109	RC20AE153K	Resistor 15K ± 10%	.05
R110	RC20AE472K	Resistor 4.7K ± 10%	.05

MECHANICAL PARTS FOR V-12415-1 TUNER

Ref. No. On Illus.	Part No.	Description	List Price Each
† 1	V-8672	Fine Tuning Shaft and Rotor	*
† 2	V-8673	Drum Assy. Without Coils	*
† 3	V-8674	Spring, Fine Tuning Ground	*
† 4 & 5	V-8675	Spring, Shaft Retaining Front and Rear	*
† 6	V-8677	Spring, Detent	*
† 7	V-8678	Roller, Detent	*
† 8	V-8679	Spring, Slug Retaining	*
† 9	V-8680	Slug, Osc. Tuning	*
† 10	V-8681	Contact Bracket Assy.	*
† 11	V-12484-(2 through 83)	ANT-RF Coil Strip	*
† 12	V-12485-(2 through 83)	Mixer-Osc. Coil Strip	*

NOTE: The dash number following the basic part numbers for coil strips indicates the channel numbers .1 e; The part number for channel 48 ANT-RF coil strip would be V-12484-48.

†New part number listed for first time in Westinghouse Radio or Television service information.

* Price furnished on request.

All prices are subject to change without notice.

POWER CONSUMPTION: .... 225 watts

AUDIO POWER OUTPUT:
- Undistorted .... 2.8 watts
- Maximum .... 3.2 watts

LOUDSPEAKER:
- Type .... 5¼" P.M.
- Voice Coil Impedance .. 3.2 ohms at 400 cycles

RECEIVER ANTENNA INPUT IMPEDANCE:
...... 300 ohms balanced or 72 ohms unbalanced

TUBE COMPLEMENT:
- 1 1B3GT .... High voltage rectifier
- 1 5U4G .... Low voltage rectifier
- 1 6AL5 .... Horizontal AFC
- 1 6AS4GT or 6AX4GT ...... Horizontal damper
- 1 6AU6 .... Sync separator
- 1 6BQ7A or 6BZ7 .... RF amplifier
- 1 6BK5 .... Video amplifier
- 1 6BK5 .... Audio output
- 1 6BN6 .... FM detector
- 1 6BQ6GT .... Horizontal output
- 1 6CB6 .... IF amplifiers
- 1 6X8 .... HF osc. and mixer
- 1 12AU7 .... Keyed AGC and noise clipper
- 1 12AU7 .... Horizontal multivibrator
- 1 12BH7 ...... Vert. output and vert. discharge
- 1 17LP4 or 17VP4 .... Cathode ray tube

VIDEO CARRIER INTERMEDIATE FREQUENCY:
.... 45.75 mc.

VIDEO RESPONSE: .... 3.5 mc.

SOUND CARRIER INTERMEDIATE FREQUENCY:
.... 4.5 mc.

FOCUS: .... Electrostatic

SWEEP DEFLECTION: .... Magnetic

SCANNING: .... Interlaced 525 line

HORIZONTAL SCANNING FREQUENCY:
.... 15,750 CPS

VERTICAL SCANNING FREQUENCY: .... 60 CPS

FRAME FREQUENCY:
(picture repetition rate): .... 30 CPS

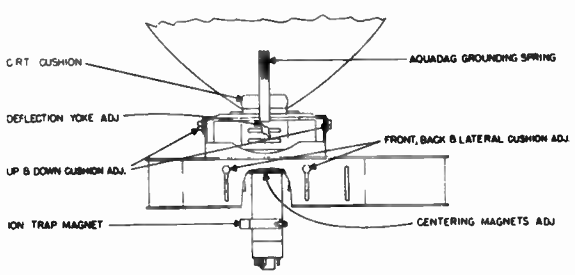
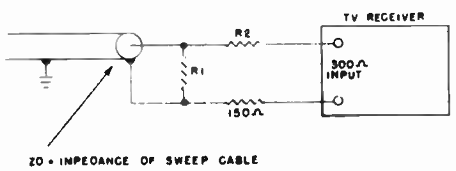


FIG. 1 — CRT ADJUSTMENTS



Z0	R1	R2
50Ω	56Ω	120Ω
72Ω	82Ω	110Ω

FIG. 3 — IMPEDANCE MATCHING NETWORK

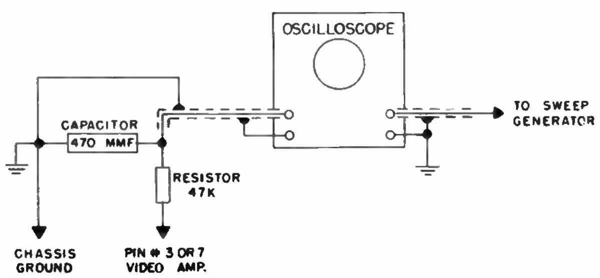


FIG. 2 — OSCILLOSCOPE CONNECTIONS

H. F. OSCILLATOR ALIGNMENT PROCEDURE

If the 6X8 oscillator tube is replaced, the different inter-electrode capacitance of the new tube may change the oscillator frequency enough to necessitate re-alignment of the oscillator.

Alignment of the oscillator on the high band is accomplished by adjusting the brass slug located adjacent to the vernier drive wheel on the front of the tuner. Alignment of the oscillator on the low band is accomplished by adjusting the brass slug on the lower front of the tuner. These slugs can be adjusted from the front of the receiver without removing the chassis from the cabinet if a non-metallic tool similar to that shown in Fig. 4 is used. The guide on the end of the tool is helpful in seating the tool in the screw slot. The adjustment procedure is as follows:

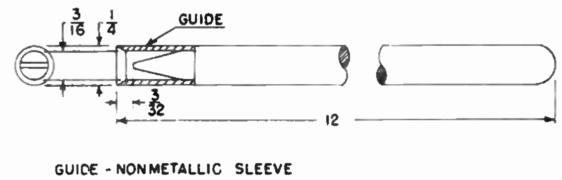


FIG. 4 — OSCILLATOR ADJUSTMENT TOOL

1. Set the fine tuning control to the middle of its range by rotating it until the middle hole near the edge of the fine tuning drive wheel is straight up, and keep it in this position during the following adjustments.
2. Set the channel selector to the highest of the low band (channels 2 through 6) stations operating in your vicinity.
3. Peak the low band adjustment slug (L102) for the best picture detail.
4. Set the channel selector to the highest of the high band (channels 7 through 13) stations operating in your vicinity.
5. Peak the high band adjustment slug (L101) for the best picture detail.
6. Check the previously made low band adjustment, and if the tuning has changed repeat steps 2 and 3.

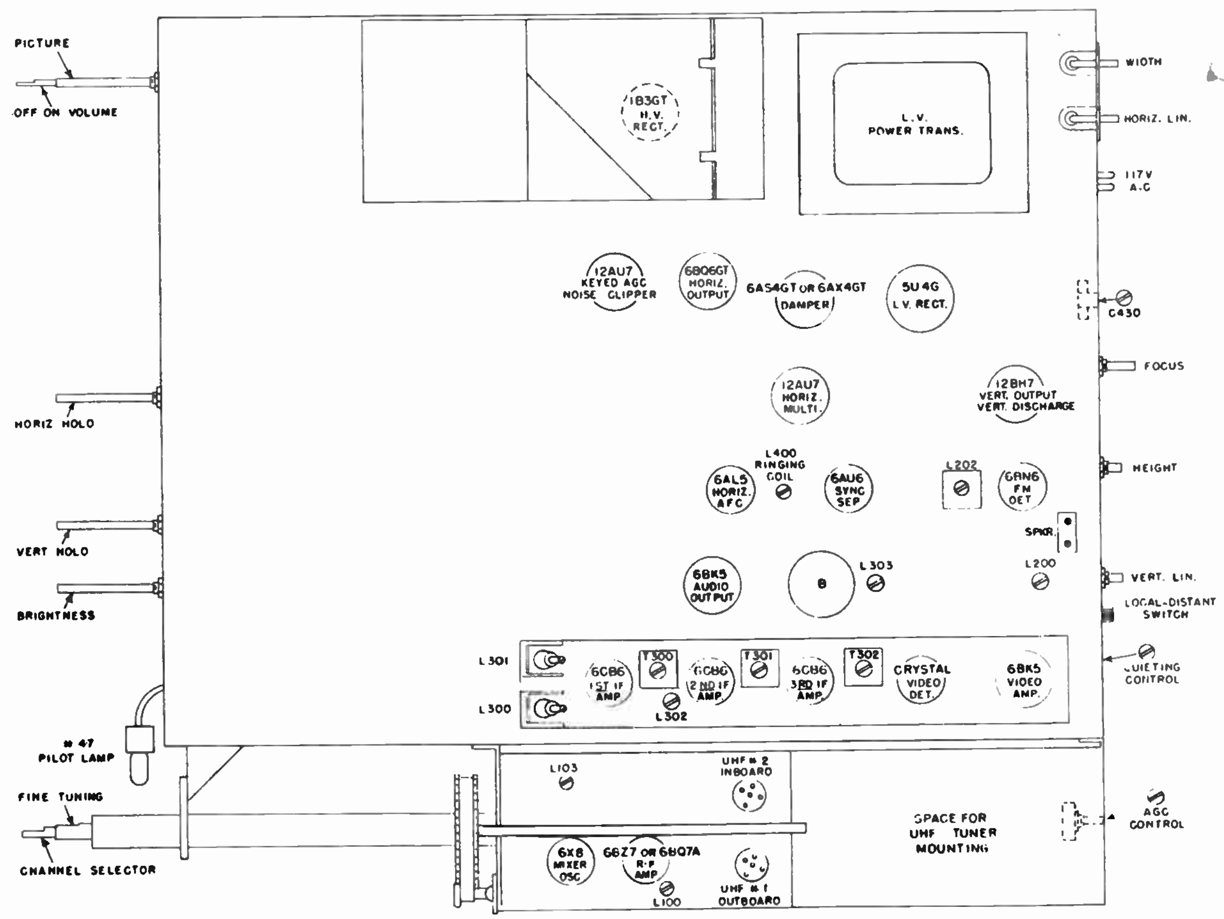


FIG. 5 — TOP VIEW OF CHASSIS

COMMON I-F SECTION

Rotate the channel selector to channel 13.

Connect the oscilloscope to the video test terminal, point "B" on Fig. 8, through the decoupling network shown in Fig. 2.

Connect a 9 volt bias battery to the AGC line, point "A" on Fig. 8.

Couple the marker generator output to the sweep generator output. In the steps that follow, use the marker to check the response curve at the frequencies indicated on Fig. 6.

Step	*Alignment Signal*	*Remarks*	*Adjust —*
1.	Remove the 6BZ7 R-F amplifier tube		
2.	44 mc. sweep to 3rd I-F grid	Connect detuning clips to 1st & 2nd I-F plates	Pri. of T302 for max. response and sec. of T302 for symmetrical curve shown in Fig. 6A
3.	47.25 mc. amplitude modulated to 1st I-F grid	Use sufficient signal to produce sine wave response on oscilloscope	L302 for min. response
4.	44 mc. sweep to 2nd I-F grid	Connect detuning clip to 1st I-F plate	Pri. of T301 for max. response and sec. of T301 for symmetrical curve shown in Fig. 6B
5.	44 mc. sweep to 1st I-F grid	Detune L103 before adjusting T300	Pri. of T300 for max. response and sec. of T300 for symmetrical curve
6.	44 mc. sweep to 1st I-F grid		L103 for "suck-out" at 44 mc. (center of curve). See Fig. 6C
7.	Replace the 6BZ7 R-F amplifier tube		
8.	213 mc. sweep to antenna terminals through network	Fine tuning set to mid-range	L300 for symmetrical curve and L301 for min. 41.25 mc. marker amplitude. See Fig. 6D

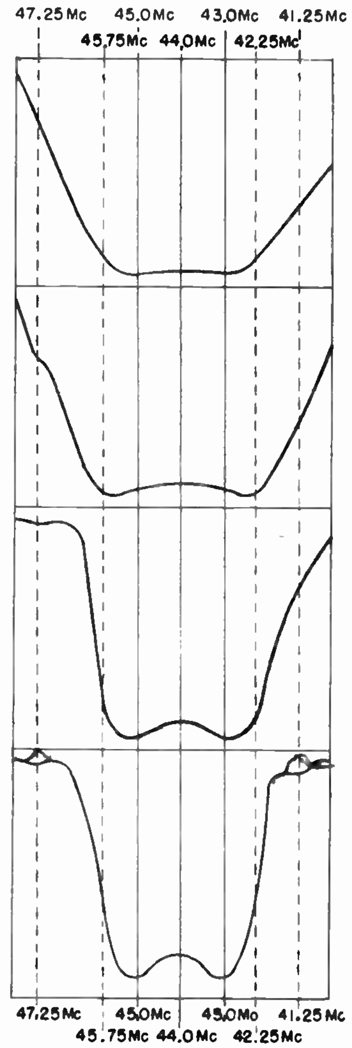


FIG. 6 — RESPONSE CURVES AT VARIOUS STAGES OF ALIGNMENT

4.5 MC. TRAP

Connect the signal generator to pin #3 or #7 of the 6BK5 video amplifier (point "B" on Fig. 8) through a .001 mfd capacitor.

Step	*Signal Gen. Frequency*	*VTVM Connections*	*Remarks*	*Adjust —*
1.	4.5 mc. unmodulated	R-F probe to point "C" (see Fig. 8) and common lead to chassis .	Use strong signal from generator	L303 for minimum voltage

SOUND SECTION

Refer to SOUND ALIGNMENT PROCEDURE on page 7. Using a weak signal, adjust L200 for maximum response to a 4.5 mc. FM signal. Using a strong signal, adjust L202 for maximum response on a 4.5 mc. FM signal. Using a weak signal, adjust the quieting control for minimum AM noise.

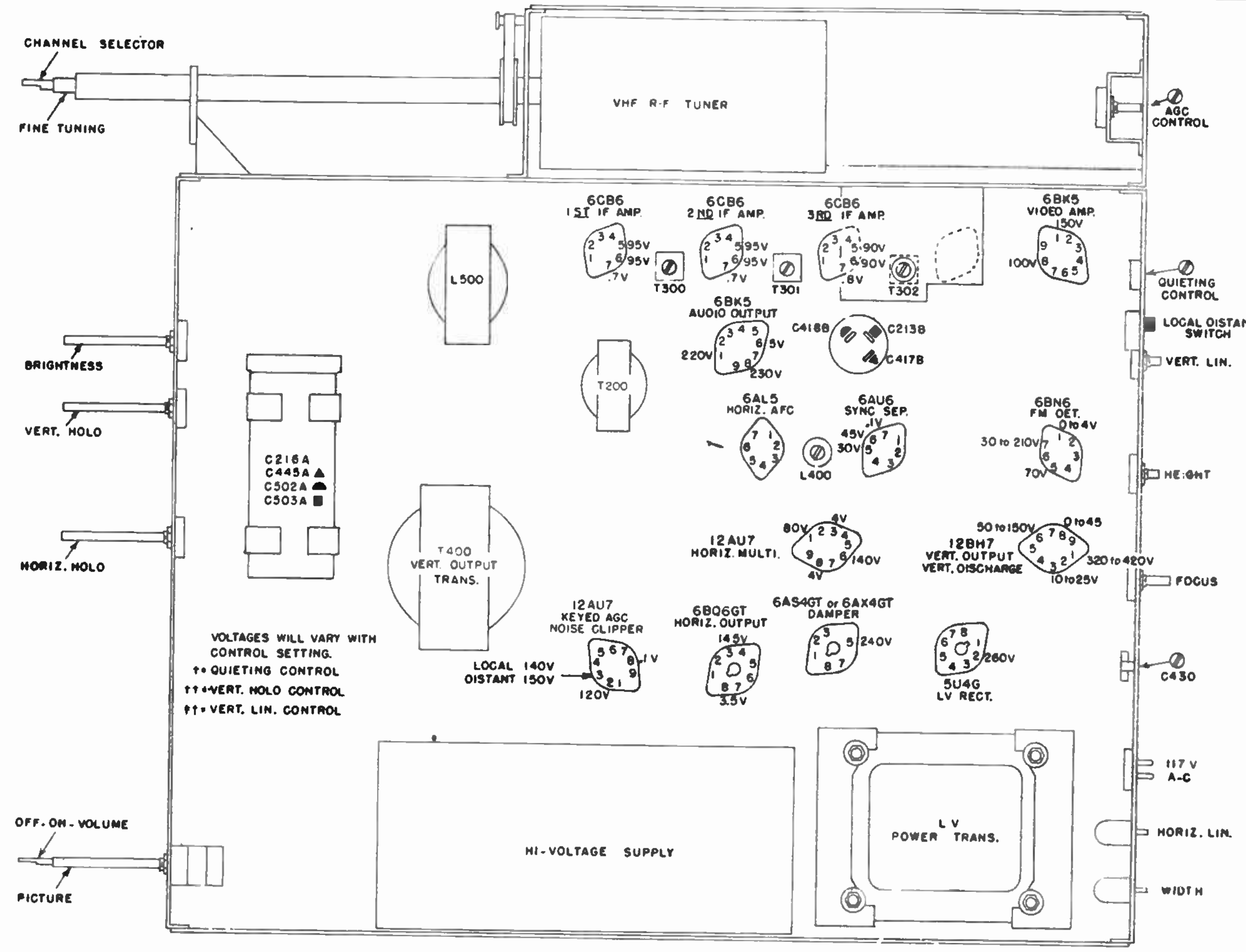


FIG. 7 — BOTTOM VIEW OF CHASSIS

CHASSIS REMOVAL

To avoid scratching or chipping the cathode ray tube, the speaker and baffle should be removed before attempting to remove the chassis from the cabinet. To release the speaker and baffle from the cabinet, remove the four No. 6 Phillips-head screws from the top of the cabinet.

CRITICAL LEAD DRESS

All leads located near the horizontal multivibrator trimmer capacitor, C430, must be dressed away from the capacitor and close to the chassis.

All resistors rated above one watt must be dressed away from each other and clear of other components and wires.

Video peaking coils should be dressed away from the chassis and clear of adjacent parts.

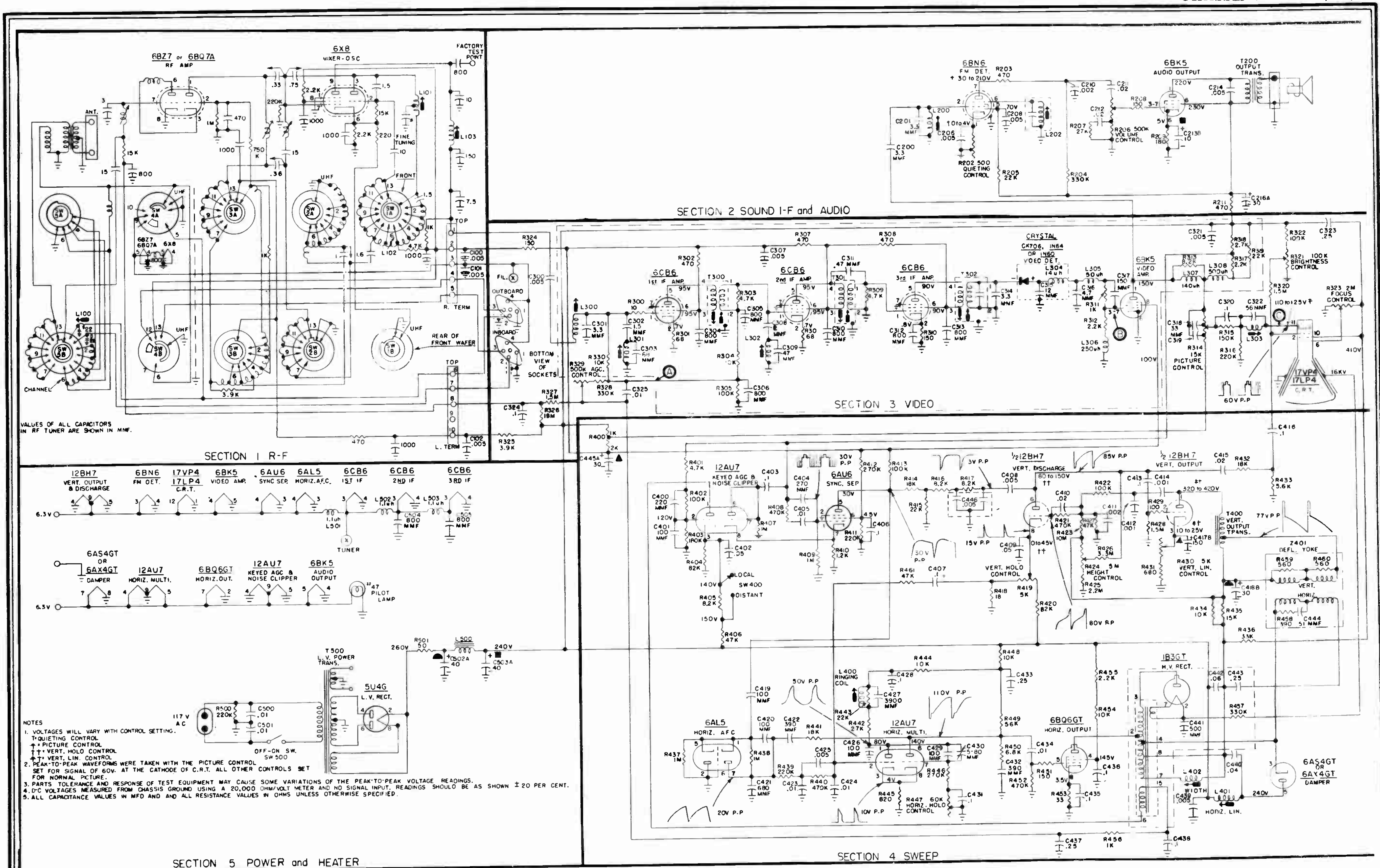
All leads in the high voltage unit must be dressed away from the high voltage transformer to prevent arcing.

Keep all leads in the I-F and video circuits as short as possible.

REFLECTION ELIMINATION

Light reflection from the pilot lamp can appear on the lower right hand corner of the CRT unless preventive measures are taken. To eliminate the reflection, a piece of electrical tape (1" x 6") is applied to the edge of the lower right corner of the CRT face.

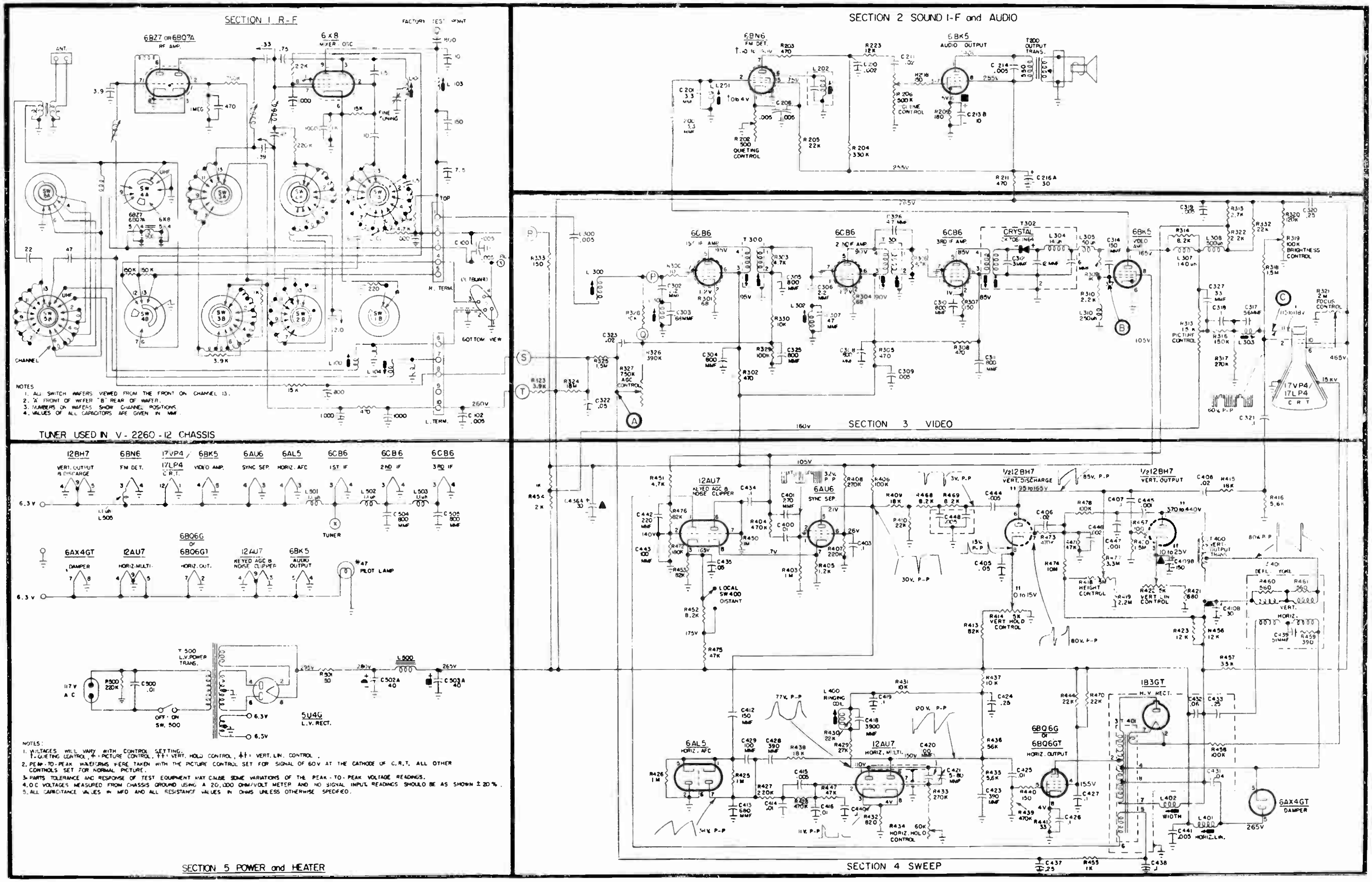
When replacing a CRT, the electrical tape must be applied to the new tube in the same manner as it was applied to the old tube.



CHASSIS NO. V2240-1

FIG. 8 — SCHEMATIC DIAGRAM

IMPORTANT — Since many of the components are very critical, exact duplicates must be used for replacement purposes. However, any substitute supplied by Westinghouse will assure performance equal to or better than the list part.



CHASSIS NO. V-2260-12

PARTS LIST FOR MODELS H-765T17 AND H-766T17

SECTION 1 — R-F

Ref. No.	Part No.	Description	Function	List Price Each
C100	V-5596	Capacitor, .005 mfd	Filament bypass	$ .25
C101	V-5596	Capacitor, .005 mfd	B plus bypass	.25
C102	V-5596	Capacitor, .005 mfd	B plus bypass	.25
	V-11794-1	R-F tuner assy. (less fiber shaft & retainer ring)		47.50

SECTION 2 — SOUND I-F AND AUDIO

Ref. No.	Part No.	Description	Function	List Price Each
C200	V-9926-2	Capacitor, 3.3 mmf	Sound take-off	.10
C201	V-9926-2	Capacitor, 3.3 mmf	Sound take-off	.10
C206	V-5596-1	Capacitor, .005 mfd	Cathode bypass	.25
C208	V-5596-1	Capacitor, .005 mfd	Screen bypass	.25
C210	RCP10M6202M	Capacitor, .002 mfd 600 v.	Plate bypass	.19
C211	RCP10M6203M	Capacitor, .02 mfd 400 v.	Coupling	.25
C212	RCP10M6203M	Capacitor, .02 mfd 400 v.	Tone compensation	.25
•C213B	V-10306-1	Capacitor, 10 mfd 450 v. elec. (assy. consists of C213B, C417B, C418B)	Cathode bypass	3.25•
C214	RCP10M6502M	Capacitor, .005 mfd 400 v.	Tone compensation	.20
•C216A	V-9891-1	Capacitor, 30 mfd 350 v. elec. (assy. consists of C216A, C445A, C502A, C503A)	Screen bypass	4.35•
L200	V-9883-3	Reactor	Sound IF	.70
L202	V-11396-1	Coil, quadrature	FM detector	1.60
R202	V-11345-2	Resistor, variable (0-500 ohms)	Quiet, control	1.40
R203	RC20AE471M	Resistor, 470 ohms ½ w.	Plate linearity	.05
R204	RC20AE334K	Resistor, 330,000 ohms ½ w.	Plate load	.05
R205	RC40AE223K	Resistor, 22,000 ohms 2 w.	Screen dropping	.18
•R206	V-11695-2	Control, 500,000 ohms (assy. consists of R206, R314, SW500)	Volume control	2.65•
R207	RC20AE273K	Resistor, 27,000 ohms ½ w.	Tone compensation	.06
R208	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.05
R209	RC20AE181K	Resistor, 180 ohms ½ w.	Cathode bias	.10
R211	RC40AE471K	Resistor, 470 ohms 2 w.	Audio decoupling	.25
T200	V-9238-1	Transformer	Audio output	1.90

SECTION 3 — VIDEO

Ref. No.	Part No.	Description	Function	List Price Each
C300	V-5596-1	Capacitor, .005 mfd	Tuner I-F coupling	.25
C301	V-9926-2	Capacitor, 3.3 mmf	1st I-F tank	.10
C302	V-5658-9	Capacitor, 1.5 mmf	Sound trap coupling	.07
C303	R1CC20S2L680K	Capacitor, 68 mmf	41.25 mc. trap	.20
C304	V-9863-1	Capacitor, 800 mmf	Screen bypass	.20
C305	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C306	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C307	V-5596	Capacitor, .005 mmf	Bypass	.25
C308	V-5658-2	Capacitor, 2 mmf	Adjacent channel trap coupling	.08
C309	R1CC20S2L470K	Capacitor, 47 mmf	Adjacent channel trap	.20
C310	V-9863-1	Capacitor, 800 mmf	Screen bypass	.20
C311	V-5658-11	Capacitor, .47 mmf	I-F coupling	.08
C312	V-9863-1	Capacitor, 800 mmf	Cathode bypass	.20
C313	V-9863-1	Capacitor, 800 mmf	Screen bypass	.20
C314	V-9926-2	Capacitor, 3.3 mmf	I-F tank	.10
C315	R1CC20S2L120K	Capacitor, 12 mmf	Video detector filter	.18
C316	V-9926-3	Capacitor, 4.7 mmf	Video detector filter	.07
C317	RCM20B151K	Capacitor, 150 mmf	Video grid	.20
C318	V-5658-13	Capacitor, 33 mmf	Video amp. plate	.15
C319	V-5658-13	Capacitor, 33 mmf	Video amp. plate	.15
C320	RCP10W4104M	Capacitor, .1 mfd 400 v.	CRT cathode	.24
C321	V-5596	Capacitor, .005 mfd	B plus bypass	.25
C322	RCM20B560K	Capacitor, 56 mmf	4.5 mc. trap	$ .20
C323	RCP10W4254M	Capacitor, .25 mfd 400 v.	Focus filter	.35
C324	RCP10W4104M	Capacitor, .1 mfd 400 v.	AGC decoupling	.24
C325	RCP10M6103M	Capacitor, .01 mfd 200 v.	AGC antihunt	.21
	V-10916-1	Crystal diode	Video detector	1.20
L300	V-9882-7	Reactor	Video I-F input	.60
L301	V-11973-1	Coil	41.25 mc. trap	•••
L302	V-11973-1	Coil	Adjacent channel trap	•••
L303	V-9882-3	Reactor	4.5 mc. trap	.70
L304	V-4886-1	Reactor, 14 microhenries	Video detector filter	.55
L305	V-9915-5	Reactor, 50 microhenries	Video peaking	.18
L306	V-5902-5	Reactor, 250 microhenries	Video peaking	.39
L307	V-5902-1	Reactor, 140 microhenries	Video peaking	.45
L308	V-9915-3	Reactor, 500 microhenries	Video peaking	.30
R300	RC20AE100M	Resistor, 10 ohms ½ w.	1st I-F grid	.06
R301	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R302	RC20AE471M	Resistor, 470 ohms ½ w.	Decoupling	.05
R303	V-9927-2	Resistor, 4700 ohms ½ w.	Damping	.11
R304	RC20AE103M	Resistor, 10,000 ohms ½ w.	Grid decoupling	.05
R305	RC20AE104J	Resistor, 100,000 ohms ½ w.	AGC decoupler	.09
R306	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R307	RC20AE471M	Resistor, 470 ohms ½ w.	Decoupling	.05
R308	RC20AE471M	Resistor, 470 ohms ½ w.	Decoupling	.05
R309	V-9927-2	Resistor, 4700 ohms ½ w.	Damping	.11
R310	RC20AE151K	Resistor, 150 ohms ½ w.	Cathode bias	.05
R311	RC20AE102K	Resistor, 1000 ohms ½ w.	Current limiting	.05
R312	RC20AE222K	Resistor, 2,200 ohms ½ w.	Detector load	.05
R313	RC20AE822K	Resistor, 8,200 ohms ½ w.	Peaking damping	.05
•R314	V-11695-2	Control, 15,000 ohms (assy. consists of R206, R314, SW500)	Picture control	2.65•
R315	RC20AE154K	Resistor, 150,000 ohms ½ w.	Divider	.07
R316	RC20AE224K	Resistor, 220,000 ohms ½ w.	DC Divider	.05
R317	RC40AE222K	Resistor, 2200 ohms 2 w.	Plate load	.25
R318	RC40AE272K	Resistor, 2700 ohms 2 w.	Dropping	.18
R319	RC30AE223K	Resistor, 22,000 ohms 1 w.	Load	.09
R320	RC20AE155K	Resistor, 1.5 megohms ½ w.	Retrace suppression	.05
R321	V-11536-2	Control, 100,000 ohms	Brightness	.80
R322	RC20AE104K	Resistor, 100,000 ohms ½ w.	Divider	.05
R323	V-9894-2	Control, 2 megohms	Focus	.75
R324	RC20AE151M	Resistor, 150 ohms ½ w.	Tuner decoupling	.06
R325	RC40AE392K	Resistor, 3900 ohms 2 w.	Tuner B plus dropping	.22
R326	RC20AE186J	Resistor, 18 megohms ½ w.	AGC divider	.15
R327	RC20AE155J	Resistor, 1.5 megohms ½ w.	AGC divider	.15
R328	RC20AE334K	Resistor, 330,000 ohms ½ w.	AGC divider	.05
R329	V-9813-3	Control, 500,000 ohms	AGC control	.75
R330	V-9927-10	Resistor, 10,000 ohms ½ w.	I-F damping	.10
T300	V-9879	Transformer	1st I-F	1.30
T301	V-9879	Transformer	2nd I-F	1.30
T302	V-9880	Transformer	3rd I-F	1.40

SECTION 4 — SWEEP

Ref. No.	Part No.	Description	Function	List Price Each
C400	RCM20B221K	Capacitor, 220 mmf	AC divider	.22
C401	RCM20B101K	Capacitor, 100 mmf	Divider	.22
C402	RCP10W4503M	Capacitor, .05 mfd 400 v.	Cathode bypass	.24
C403	RCP10W4104M	Capacitor, .1 mfd 400 v.	Noise clipper coupling	.25
C404	RCM20B271K	Capacitor, 270 mmf	Sync sep. grid	.20
C405	RCP10M6103M	Capacitor, .01 mfd 600 v.	Vertical sync coupling	.21
C406	RCP10W4104M	Capacitor, .1 mfd 400 v.	Screen bypass	.25
C407	RCP10W4104M	Capacitor, .1 mfd 400 v.	Coupling	.25
C408	RCP10M6502M	Capacitor, .005 mfd 600 v.	Coupling	.20
C409	RCP10W4503M	Capacitor, .05 mfd 400 v.	Cathode bypass	.24
C410	RCP10M6203M	Capacitor, .02 mfd 600 v.	Coupling	.25

Ref. No.	Part No.	Description	Function	List Price Each
C411	RCP10M6202M	Capacitor, .002 mfd 600 v.	Pulse shaping	$ .19
C412	RCP10M6102M	Capacitor, .001 mfd 600 v.	Bypass	.18
C413	RCP10M6104M	Capacitor, .1 mfd 600 v.	Coupling VMV to vertical output	.35
C414	RCP10M10102M	Capacitor, .001 mfd 1000 v.	Coupling	.17
C415	RCP10M6203K	Capacitor, .02 mfd 600 v.	Retrace suppression	.25
C416	RCP10W4104M	Capacitor, .1 mfd 400 v.	CRT grid	.25
•C417B	V-10306-1	Capacitor, 150 mfd 50 v. elec. (assy. consists of C213B, C417B, C418B)	Cathode bypass	3.25•
•C418B	V-10306-1	Capacitor, 30 mfd 450 v.elec. (assy. consists of C213B, C417B, C418B)	Plate decoupling	3.25•
C419	RCM20B101K	Capacitor, 100 mmf	Coupling	.22
C420	RCM20B101K	Capacitor, 100 mmf	AFC cathode	.22
C421	RCM20B681K	Capacitor, 680 mmf	Plate bypass	.25
C422	RCM20B391K	Capacitor, 390 mmf	Plate coupling	.23
C423	RCP10M6103M	Capacitor, .01 mfd 600 v.	AFC delay	.21
C424	RCP10M6103M	Capacitor, .01 mfd 600 v.	MV grid	.21
C425	RCP10M6502M	Capacitor, .005 mfd 600 v.	Coupling	.20
C426	RCM20B101K	Capacitor, 100 mmf	Plate bypass	.22
C427	RCM30C392K	Capacitor, 3900 mmf	MV plate tank	1.17
C428	RCP10W4104M	Capacitor, .1 mfd 400 v.	Plate decoupling	.25
C429	RCM20B101K	Capacitor, 100 mmf	HMV plate	.22
C430	V-11228-2	Capacitor, 5-80 mmf	MV trimmer	.35
C431	RCP10W4104M	Capacitor, .1 mfd 400 v.	Horizontal hold bypass	.25
C432	RCM20B391K	Capacitor, 390 mmf	Pulse shaping	.23
C433	RCP10W4254M	Capacitor, .25 mfd 400 v.	Decoupling	.35
C434	RCP10M6103M	Capacitor, .01 mfd 600 v.	Coupling	.21
C435	RCP10W4104M	Capacitor, .1 mfd 400 v.	Cathode bypass	.25
C436	RCP10W4104M	Capacitor, .1 mfd 400 v.	Screen bypass	.25
C437	RCP10W4254M	Capacitor, .25 mfd 400 v.	AGC filter	.35
C438	RCP10W4104M	Capacitor, .1 mfd 400 v.	AGC filter input	.25
C439	V-5596-1	Capacitor, .005 mfd	B plus bypass	.25
C440	RCP10M4403M	Capacitor, .04 mfd 400 v.	Phasing network	.25
C441	V-9901-3	Capacitor, 500 mmf	High voltage filter	1.70
C442	RCP10M4603M	Capacitor, .06 mfd 400 v.	Phasing network	.25
C443	RCP10M4254M	Capacitor, .25 mfd 400 v.	Hor. yoke return	.35
C444	V-9792-10510J	Capacitor, 51 mmf 1000 v.	Deflection yoke	.25
•C445A	V-9891-1	Capacitor, 30 mfd 350 v. elec. (assy. consists of C216A, C445A, C502A, C503A)	I-F decoupling	4.35•
C446	V-9044-1	Capacitor, dual .005-.005 mfd	Integrator network	.39
L400	V-6764	Coil	Ringing	1.45
L401	V-11789-1	Reactor	Horizontal linearity	1.30
L402	V-11791-1	Reactor	Width control	1.40
R400	V-10054-3	Resistor, 3000 ohms	Voltage divider	.80
R401	RC20AE472K	Resistor, 4700 ohms ½ w.	Decoupling	.05
R402	RC20AE104K	Resistor, 100,000 ohms ½ w.	Divider	.05
R403	RC20AE184K	Resistor, 180,000 ohms ½ w.	Divider	.05
R404	RC20AE823J	Resistor, 82,000 ohms ½ w.	Cathode bias	.15
R405	RC20AE822K	Resistor, 8,200 ohms ½ w.	AGC cathode	.05
R406	RC20AE473J	Resistor, 47,000 ohms ½ w.	AGC cathode	.15
R407	RC20AE105K	Resistor, 1 megohm ½ w.	Load	.05
R408	RC20AE474K	Resistor, 470,000 ohms ½ w.	Coupling limiter	.05
R409	RC20AE105K	Resistor, 1 megohm ½ w.	Sync separator grid	.05
R410	RC20AE122K	Resistor, 1,200 ohms ½ w.	Cathode bias	.05
R411	RC20AE224K	Resistor, 220,000 ohms ½ w.	Bypass	.05
R412	RC20AE274K	Resistor, 270,000 ohms ½ w.	Dropping	.06
R413	RC20AE104K	Resistor, 100,000 ohms ½ w.	Plate load	.05
R414	RC20AE183K	Resistor, 18,000 ohms ½ w.	DC divider	.05
R415	RC20AE223K	Resistor, 22,000 ohms ½ w.	Signal divider	.06
R416	RC20AE822K	Resistor, 8,200 ohms ½ w.	Vertical integrator	.05
R417	RC20AE822K	Resistor, 8,200 ohms ½ w.	Vertical integrator	.05
R418	RC20AE180K	Resistor, 18 ohms ½ w.	Divider	.09
R419	V-11539-3	Control, 5000 ohms	Vertical hold	.80
R420	RC30AE823K	Resistor, 82,000 ohms 1 w.	Divider	.09
R421	RC20AE474K	Resistor, 470,000 ohms ½ w.	Delay network	.05
R422	RC20AE104K	Resistor, 100,000 ohms ½ w.	Vertical grid	$ .05
R423	RC20AE106K	Resistor, 10 megohms ½ w.	Vertical discharge grid	.10
R424	V-9813-5	Control, 5 megohms	Height	.75
R425	RC20AE225K	Resistor, 2.2 megohms ½ w.	Height limiting	.05
R426	RC20AE335K	Resistor, 3.3 megohms ½ w.	Height limiting	.09
R427	RC20AE473K	Resistor, 47,000 ohms ½ w.	VMV grid	.05
R428	RC20AE155K	Resistor, 1.5 megohms ½ w.	Grid return	.05
R429	RC20AE101K	Resistor, 100 ohms ½ w.	Suppressor	.05
R430	V-6463	Control, 5000 ohms	Vertical linearity	.76
R431	RC20AE681K	Resistor, 680 ohms ½ w.	Cathode bias	.08
R432	RC20AE183J	Resistor, 18,000 ohms ½ w.	Retrace suppression	.15
R433	RC20AE562K	Resistor, 5600 ohms ½ w.	Pulse shaping	.06
R434	RC40AE103K	Resistor, 10,000 ohms 2 w.	Decoupling	.18
R435	RC40AE153K	Resistor, 15,000 ohms 2 w.	Decoupling	.20
R436	RC20AE333K	Resistor, 33,000 ohms ½ w.	Boost decoupling	.05
R437	RC20AE105K	Resistor, 1 megohm ½ w.	AFC bleeder	.05
R438	RC20AE105K	Resistor, 1 megohm ½ w.	AFC bleeder	.05
R439	RC20AE224K	Resistor, 220,000 ohms ½ w.	AFC filter	.05
R440	RC20AE474K	Resistor, 470,000 ohms ½ w.	AFC delay	.05
R441	RC20AE183K	Resistor, 18,000 ohms ½ w.	AFC take-off	.05
R442	RC20AE273K	Resistor, 27,000 ohms ½ w.	Plate load	.06
R443	RC20AE223K	Resistor, 22,000 ohms ½ w.	Coil shunt	.06
R444	RC20AE103K	Resistor, 10,000 ohms ½ w.	Decoupling	.05
R445	RC20AE821K	Resistor, 820 ohms ½ w.	Cathode bias	.05
R446	RC20AE274J	Resistor, 270,000 ohms ½ w.	HMV grid	.15
R447	V-11538-3	Control, 60,000 ohms	Horizontal hold	.80
R448	RC20AE103K	Resistor, 10,000 ohms ½ w.	Decoupling	.05
R449	RC20AE563K	Resistor, 56,000 ohms ½ w.	Plate load	.10
R450	RC20AE682K	Resistor, 6800 ohms ½ w.	Pulse shaping	.05
R451	RC20AE151M	Resistor, 150 ohms ½ w.	Suppressor	.06
R452	RC20AE474K	Resistor, 470,000 ohms ½ w.	Grid return	.05
R453	RC30AE330K	Resistor, 33 ohms 1 w.	Cathode bias	.11
R454	V-11328-2	Resistor, 10,000 ohms 5 w.	Bleeder	.90
R455	RC40AE222K	Resistor, 2200 ohms 2 w.	Dropping	.25
R456	RC20AE102K	Resistor, 1000 ohms ½ w.	AGC filter	.05
R457	V-9927-1	Resistor, 330,000 ohms 1 w.	High voltage filter	.11
R458	RC20AE391K	Resistor, 390 ohms ½ w.	Transient damping	.08
R459	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R460	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R461	RC20AE473K	Resistor, 47,000 ohms ½ w.	HMV grid	.05
SW400	V-5406	Switch	Local-distant	.34
T400	V-10909-2	Transformer	Vertical output	3.90
T401	V-11548-3	Transformer	Horizontal output	13.50
Z401	V-12218-1	Yoke assembly	Deflection	13.50

SECTION 5 — POWER

Ref. No.	Part No.	Description	Function	List Price Each
C500	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
C501	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
•C502A	V-9891-1	Capacitor, 40 mfd 450 v. elec. (assy. consists of C216A, C445A, C502A, C503A)	Input filter	4.35•
•C503A	V-9891-1	Capacitor, 40 mfd 450 v. elec. (assy. consists of C216A, C445A, C502A, C503A)	Output filter	4.35•
C504	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
C505	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
L500	V-6471-3	Reactor	Low voltage filter	2.45
L501	V-4886-2	Reactor, 1.1 microhenries	Filament choke	.38
L502	V-4886-2	Reactor, 1.1 microhenries	Filament choke	.38
L503	V-4886-2	Reactor, 1.1 microhenries	Filament choke	.38
R500	RC30AE224M	Resistor, 220,000 ohms 1 w.	Protection	.10
R501	V-11328-8	Resistor, 50 ohms 10 w.	Current limiter	.75
•SW500	V-11695-2	Switch (assy. consists of R206, R314, SW500)	Off-on-switch	2.65•
T500	V-11544-4	Transformer	Power	19.50

V-10030-1 Speaker, 5¼" PM .... 3.90••

✢ *New part number listed for the first time in Westinghouse radio or television service information.*
• *Sold only as complete assembly. Price shown covers complete assembly.*
•• *Price includes Federal Excise Tax.*
••• *Price furnished on request.*
NOTE: *All prices are subject to change without notice.*

DESCRIPTION

Model H-802 UHF Receptors are designed for use with Westinghouse television receivers that contain specific provisions for their use. Receivers that contain the necessary provisions will accommodate two UHF Receptors, and each receptor used will provide reception on one UHF television channel. If only one UHF station is active in a particular locality, only one UHF Receptor is required. If two UHF stations transmit in the locality, they can both be received by installing two UHF Receptors. The UHF reception provided by these receptors is in addition to the standard VHF reception provided by the VHF tuner in the television receiver.

Each receptor contains a local oscillator which employs a 6AF4 tube and operates 45.75 mc. *higher* than the video carrier frequency of the received UHF signal. The oscillator frequency is initially adjusted by the oscillator trimmer, C10, and fine tuning is provided by the fine tuning capacitor which is mechanically coupled to the fine tuning control on the television receiver. Suitable band-pass circuits tuned to the frequency of the received signal by the R-F trimmers (C1 and C2) serve as the antenna input circuit in each receptor. The incoming UHF signal mixes with the local oscillator signal in a crystal mixer circuit, and the resultant I-F output (center frequency is 44 mc.) is fed to the R-F amplifier in the television receiver. When the channel selector on the television receiver is set to either of the UHF positions, the R-F amplifier and mixer circuits in the television receiver serve as I-F amplifiers at 44 mc., and the VHF oscillator is disabled. Thus, the 44 mc. output of the UHF Receptor is amplified in these circuits and fed into the I-F strip in the receiver.

IDENTIFICATION

Model H-802 Receptors are shipped pre-adjusted to receive a particular UHF channel. The channel to which the receptor is tuned is marked on the label which is attached to the unit.

In addition, the receptors are divided into categories depending on the frequency range covered by each. The identifying markings which are stamped on the receptors and the corresponding frequency coverages are as follows:

Receptors Marked —	*Can Be Tuned To —*
V-11900-1	Channels 14 through 29
V-11900-2	Channels 28 through 43
V-11900-3	Channels 43 through 58
V-11900-4	Channels 58 through 73
V-11900-5	Channels 73 through 83
V-11213 (early production)	Special ranges

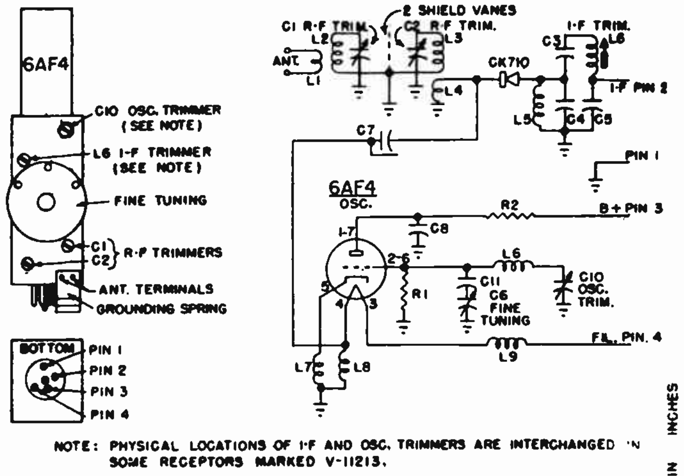


FIG. 1 — MODEL H-802 UHF RECEPTOR

INSTALLATION

To install a UHF Receptor:

1. Remove the rear of the television receiver.

2. Plug the receptor into either of the two UHF sockets located on the rear of the VHF tuner mounting plate in the television receiver. If the receptor is plugged into the socket nearer the side of the chassis, the UHF position nearer channel 13 on the channel selector is activated. If the receptor is plugged into the socket nearer the center of the chassis, the UHF position next to channel 2 on the channel selector is activated. The receptor should be seated firmly in the socket with the slots in the top of the receptor engaging the top of the VHF tuner bracket. If the center tongue of the tuner bracket is bent too far toward the back of the cabinet, it will catch the top of the receptor and prevent proper insertion. In this event, bend the center tongue toward the front of the cabinet just enough to allow insertion of the receptor. The sharp bend in the center tongue must bear on the top of the receptor when the receptor is fully seated. The fine tuning wheel on the receptor must engage the drive wheel located on the shaft between the two sockets. If the two wheels are not correctly aligned, undue pressure will be required to mesh the wheels, and the drive torque will be excessive. In this event, loosen the set screw in the metal drive wheel and slide the wheel to the correct position on the shaft.

3. Connect the ribbon-type antenna lead from the receptor to the UHF antenna terminals on the back cover of the receiver. To prevent impaired reception which may result if the antenna lead runs close to the receiver chassis, the lead should be passed through the same clip that supports the VHF antenna lead, but do not allow the two antenna leads to run close together for any appreciable distance.

4. Replace the rear cover of the television receiver.

5. Make appropriate antenna arrangements (see ANTENNA INFORMATION), and check the operation.

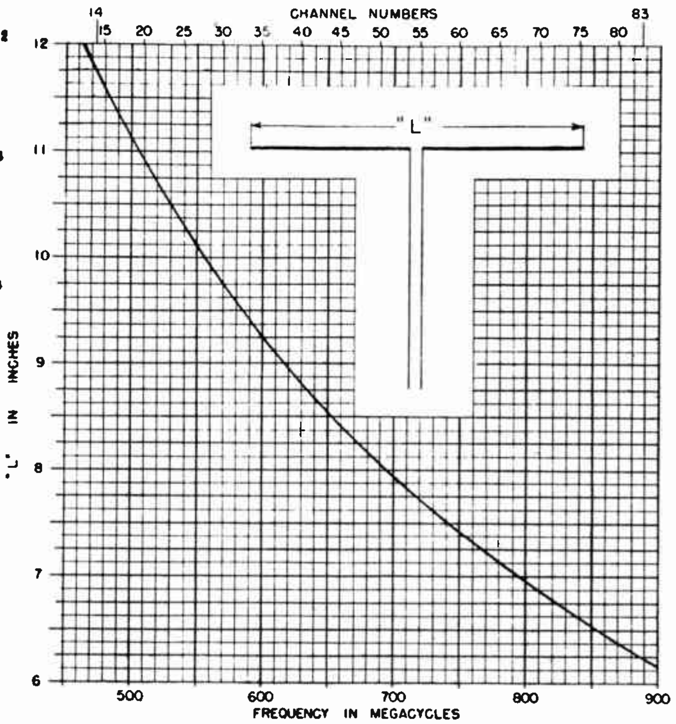


FIG. 2 — UHF DIPOLE ANTENNA LENGTH

ANTENNA INFORMATION

Antenna requirements for satisfactory UHF television reception are determined by the signal conditions in the particular locality. Some of the possibilities are as follows:

1. In areas where signals are strong and reflections are not troublesome, satisfactory reception may be obtained by using the existing VHF antenna (built-in or external) for both VHF and UHF. This can be done by connecting two jumper wires from the UHF antenna terminals to the STD antenna terminals so as to connect the two sets of terminals in parallel. If this method is used, make certain that it does not adversely affect reception on the standard VHF channels.

If an external antenna is used for VHF reception, satisfactory UHF reception may be obtained by connecting the built-in VHF antenna to the UHF antenna terminals.

2. If the above methods are not satisfactory, a simple, resonant dipole antenna may provide satisfactory reception in medium-signal areas. The chart, Fig. 2, gives the total length of a dipole element for any frequency in the UHF television spectrum.

3. Where signals are weak or reflections are troublesome, a high gain, directive antenna system should be used. Typical of this type of antenna are the corner reflector, the rhombic, and the Yagi.

ADJUSTMENTS

It is desirable to check for best adjustment each time a receptor is installed. This is accomplished as follows:

1. Rotate the fine tuning wheel on the receptor to its center frequency position. The fine tuning capacitor is centered when the middle hole in the rim of the wheel is straight up from the center of the wheel.

2. Rotate the channel selector on the receiver to the appropriate UHF position (see step 2 under INSTALLATION).

3. Rotate the oscillator trimmer (C10) to the position that provides best picture detail. *NOTE: Since the units are pre-adjusted for a particular frequency, only a slight re-adjustment at most should be needed to bring in the station. If the station is not received, make certain the antenna facilities are adequate before moving the oscillator trimmer far from its original setting.*

4. Rotate the R-F trimmers (C1 and C2) to the positions that provide best picture detail. *NOTE: If the R-F trimmers are rotated too far counterclockwise, they will be detached from the unit, and the procedure given under SERVICE must be followed to avoid damage when replacing the screws.*

5. Rotate the I-F trimmer (L6) for best picture detail. This trimmer has a broad tuning characteristic and is effective mostly in weak signal areas.

SERVICE

Troubleshooting inside the UHF Receptor is not recommended.

There are critical adjustments inside. One critical adjustment consists of two shield vanes located between the R-F coils (L2 and L3) which determine the coupling between the coils. Since special equipment and techniques are required to make the adjustments, care must be exercised to avoid altering the original factory placement of wires and components.

The R-F trimmers (C1 and C2) will detach from the unit if they are rotated too far counterclockwise. If this occurs, the following procedure should be used to avoid damaging the ceramic part of the trimmer when replacing the screw:

1. With the screw removed from the unit and the metal locking device placed on the screw, rotate the locking device until it is near the head of the screw.

2. Insert the screw in place and rotate it clockwise several full turns.

While keeping the screw from turning, rotate the locking device clockwise until it is moderately tight against the outside of the receptor.

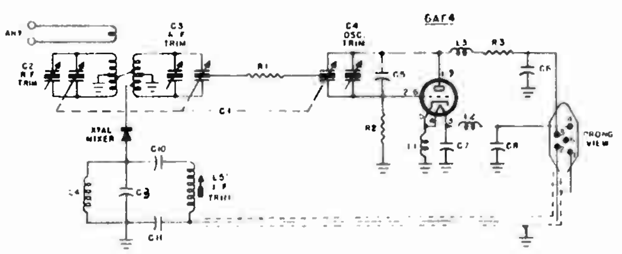


FIG. 1 — V-11390-1 TUNER

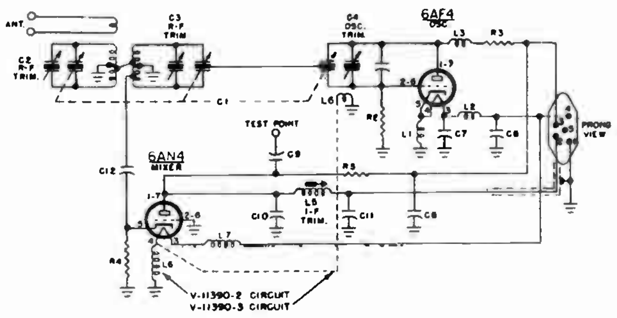
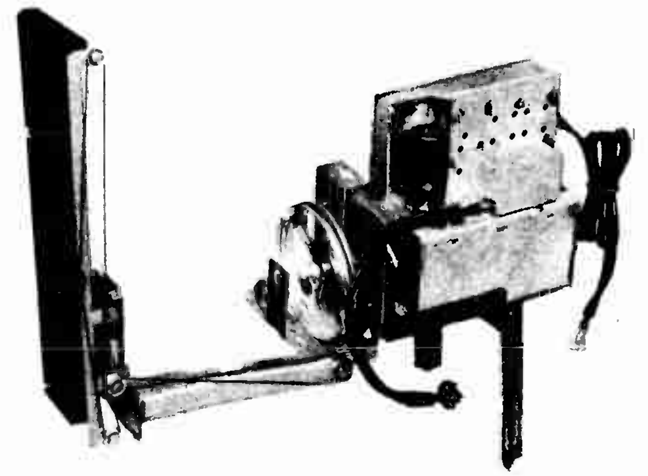


FIG. 2 — V-11390-2 AND V-11390-3 TUNERS



GENERAL DESCRIPTION

Model H-803 All-Channel UHF Television Tuner is designed for use with Westinghouse television receivers that contain specific provisions for its use. Receivers that contain the necessary provisions have two UHF positions on the channel selector and two UHF sockets mounted on the rear of the tuner bracket. When the UHF tuner is correctly installed in such a receiver, reception of all the UHF television channels (14 through 83) is provided in addition to the VHF channels (2 through 13).

The UHF tuner contains an oscillator and a mixer circuit and can be tuned over the entire UHF TV spectrum. In the tuner, the UHF signal is converted to the intermediate frequency of the television receiver (center IF is 44 mc.), and this IF output is fed into the VHF tuner in the receiver. When the channel selector on the receiver is set to the UHF positions, the VHF oscillator in the receiver is disabled and the RF amplifier and mixer circuits serve as IF amplifier stages at 44 mc. Thus, the output of the UHF tuner is amplified in the VHF tuner and fed into the IF strip in the receiver.

IDENTIFICATION

In production, several different UHF tuners are used. They are designated V-11390-1, V-11390-2, V-11390-3, and V-11613-1, and the identifying numbers are stamped on each tuner. Figures 1, 2, 3, and 4 indicate the electrical and mechanical variations between tuners.

Model H-803 tuner assemblies are divided into six categories depending on the type of tuner employed and the type of receiver with which the assembly can be used. On tuner assemblies packed for field installation, the category is identified by a number following the basic model number (H-803) marked on the outside of the carton. The coding is as follows:

Marking on Outside of Carton	*Tuner Type*	*Type of Receiver With Which the Assembly Can Be Used*
H-803-1	V-11390-1, -2, or -3	21" Models
H-803-2	V-11390-1, -2, or -3	17" Models Except Those With Plastic Cabinets
H-803-3	V-11390-1, -2, or -3	17" Models With Plastic Cabinets
H-803-4	V-11613-1	21" Models
H-803-5	V-11613-1	17" Models Except Those With Plastic Cabinets
H-803-6	V-11613-1	17" Models With Plastic Cabinets

V-11390-1, -2, AND -3 CIRCUIT DESCRIPTIONS

As indicated in Figs. 1 and 2, the incoming UHF signal is coupled into the tuner through a 300 ohm balanced input circuit which is double tuned to provide the desired RF bandpass. Operating 45.75 mc. higher than the video carrier frequency of the received signal, the oscillator tuning is ganged with that of the bandpass circuit. A portion of the oscillator voltage is coupled into the bandpass circuit where it mixes with the incoming UHF signal. The difference frequency (center IF is 44 mc.) is extracted in the mixer circuit and fed through a shielded cable to the UHF socket on the television receiver. In the V-11390-1 tuner, a germanium crystal serves as the mixer, while the V-11390-2 and V-11390-3 tuners use a 6AN4 tube in a grounded-grid mixer circuit. Otherwise, the three tuners are basically alike.

V-11613-1 CIRCUIT DESCRIPTION

The bandpass circuit in the V-11613-1 tuner consists of two tuned sections as indicated on Fig. 3. Each section is a capacitor-tuned quarter-wave coaxial line, and the sections are over-coupled through the coupling loops, L3 and L4. Coupling of the UHF signal into the the circuit is effected through the antenna input coupling loops, L1 and L2, and the signal is fed from the bandpass circuit to the mixer through L6.

Also fed to the mixer (through L7) is a locally generated signal which is 45.75 mc. higher than the video carrier frequency of the received signal. This signal is not the fundamental output frequency of the oscillator, however. Instead, the oscillator operates at one-half frequency and its second harmonic is utilized. The second harmonic content of the oscillator output is increased by the action of the harmonic generating crystal and coupled into the oscillator doubler section through L8. Consisting of a quarter-wave coaxial line which is capacitor-tuned 45.75 mc. above the video carrier of the received signal, the oscillator doubler section selects the second harmonic of the oscillator and discriminates against the fundamental.

In the crystal mixer circuit, the difference frequency (center IF is 44 mc.) is derived from the UHF signal and the locally generated signal. A shielded cable carries the IF signal to the UHF socket on the television receiver.

INSTALLATION

1. Remove the back cover, and remove the chassis from the cabinet.

2. Remove the wheel from the back end of the UHF drive shaft, and install the 13/16" pulley on the drive shaft.

3. Mount the tuner support bracket to the tuner and mounting plate assembly as shown in Fig. 4. The bracket is shock-mounted to the assembly by placing rubber grommets in the two large mounting holes, inserting metal spacers inside the grommets, and using ½" self-tapping screws.

4. On models that have the on-off-volume and picture control mounted above the channel selector, loosen the 3/8" palnut which holds the control to the chassis.

5. Make certain the dial background bracket is fitted into the correct slots in the mounting plate assembly. As indicated on Fig. 4, the "A" slots are used for all 17" receivers and the "B" slots are used for all 21" receivers.

6. Place the tuner assembly as shown in Fig. 4. The slots in the mounting plate assembly must be placed over the tongues at the top of the UHF bracket and pressed down until firmly locked in place.

7. On models that have the on-off-volume and picture control mounted above the channel selector, the slot in the front lip of the mounting plate assembly must be positioned down over the shank of the control, between the palnut and the vertical section of chassis, and then tighten the palnut.

8. On models that have the on-off-volume and picture controls located other than above the channel selector, use a 6-32 screw, 6-32 nut and #6 lockwasher to secure the front lip of the mounting plate assembly to the vertical section of chassis. Insert the screw through the slot located near the center of the mounting plate lip and through the similar slot located near the center of the chassis vertical section, and apply the lockwasher and nut.

9. Insert a ¼" self-tapping screw into the hole located to the right of the palnut mentioned in step 7 or the screw mentioned in step 8, and tighten the screw.

10. Insert a ¼" self-tapping screw into the hole located in front of the mounting plate assembly slots which engage the tongues of the UHF bracket, and tighten the screw.

11. With the large pulley rotated to its maximum counterclockwise position, install the 19" drive string and spring as shown in Fig. 5.

12. Insert the UHF plug into the UHF socket farthest from the side of the chassis as indicated in Fig. 4. This socket corresponds to the UHF position next to channel 2 on the channel selector. *The socket nearer the side of the chassis is left unoccupied.*

13. With the large pulley rotated fully counterclockwise, see that the dial pointer is positioned as in-

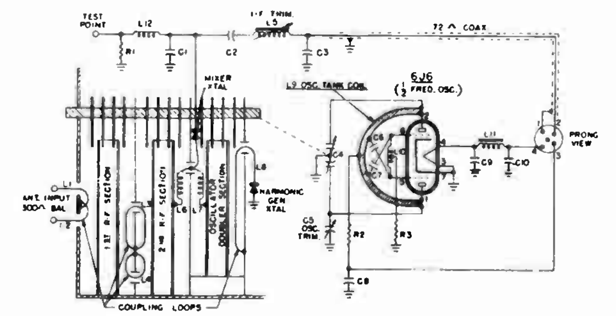


FIG. 3 — V-11613-1 TUNER

dicated in the lower left corner of Fig. 4.

14. Remove the plastic plate from the picture mask inside the cabinet by removing the clips which hold it in place.

15. Install the calibrated UHF dial in place of the plastic plate which was removed in step 14, and replace the clips.

16. Replace the chassis in the cabinet.

17. Connect a suitable antenna to the UHF antenna lead (SEE ANTENNA INFORMATION), and check the operation. If the dial pointer does not indicate the correct channel, turn off the receiver, reach in along the left side of the cabinet, and slide the pointer to the correct position.

18. Route the ribbon type antenna lead from the UHF tuner through the opening above the UHF antenna terminals on the back cover, and attached the lead to the UHF antenna terminals.

19. Replace the back cover.

REPLACING V-11390-1, V-11390-2, OR V-11390-3 TUNER USED WITH MODELS H-803-1, H-803-2, AND H-803-3

1. Remove the two drive strings and springs from the large pulley.

2. Remove the tuner support.

3. Remove the UHF plug from its socket.

4. Unsolder the ground strap from the tuner.

5. Release the tuner from the mounting plate assembly by removing the two self-tapping screws used to shock-mount the tuner.

6. Loosen the two small set screws in the hub of the large pulley, and remove the pulley.

7. With the tuning shaft of the replacement tuner rotated completely counterclockwise, place the large pulley on the shaft so that the opening in the rim of the pulley is as indicated in Fig. 5. Tighten the set screws in the hub of the pulley.

8. Place the tuner in position, and install the shock-mount screws.

9. Solder the ground strap to the tuner, and install the tuner support.

10. String the two dial drive cords, and see hat the dial pointer is positioned as shown in Fig. 4 with the large pulley rotated completely counterclockwise.

11. Insert the UHF plug into the UHF socket farthest from the side of the chassis.

12. Check the dial calibration using an air signal. If the dial pointer does not indicate the correct channel, turn off the receiver, reach in along the left side of the cabinet, and slide the pointer to the correct position.

REPLACING V-11613-1 TUNER USED WITH MODELS H-803-4, H-803-5 AND H-803-6

1. Remove the UHF plug from its socket.

2. Remove the two drive strings and springs from the large pulley.

3. Remove the self-tapping screw which secures the front lip of the mounting plate to the vertical section of chassis.

4. Loosen the off-on-volume and picture control planut or remove the 6-32 screw (whichever is used to secure the front lip of the mounting plate).

5. Remove the self-tapping screw which secures the the mounting plate to the UHF bracket.

6. Remove the two self-tapping screws that secure the tuner support to the receiver chassis.

7. Release the mounting plate assembly from the UHF bracket by pulling straight up.

8. Remove the tuner by removing the three screws from the side of the tuner.

9. Mount the replacement tuner by replacing the three screws in the side.

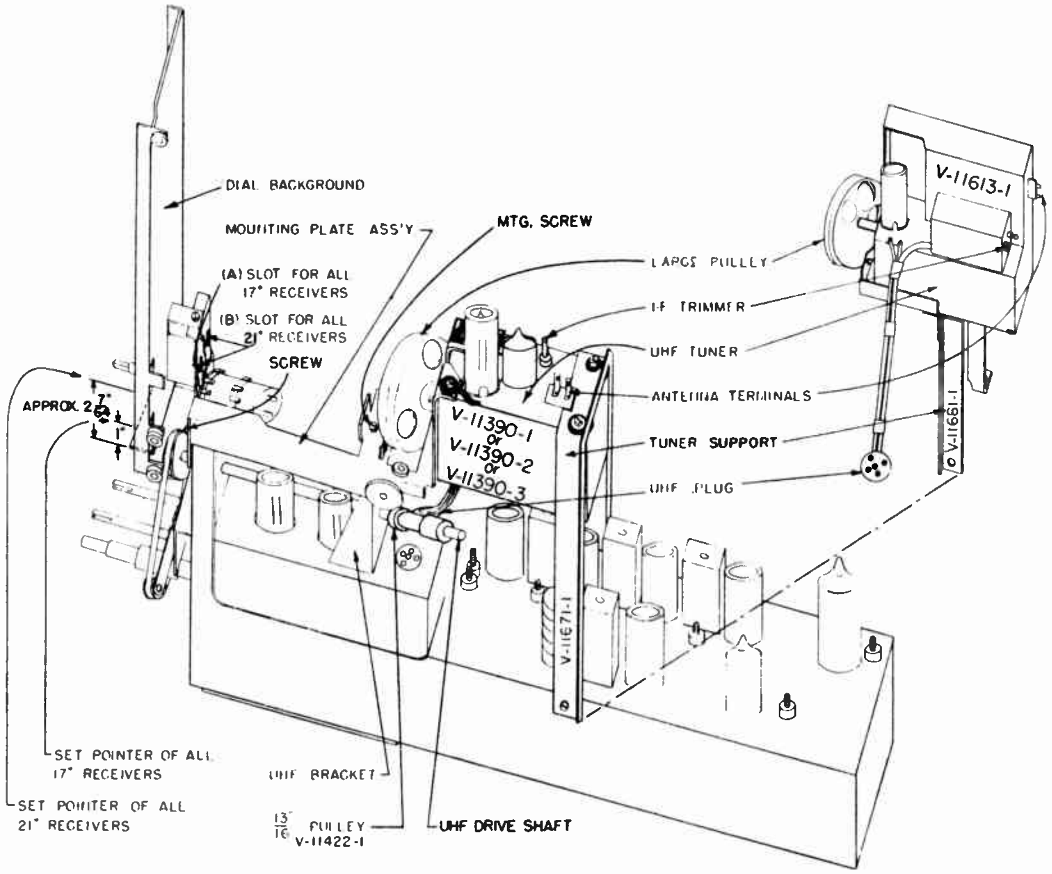
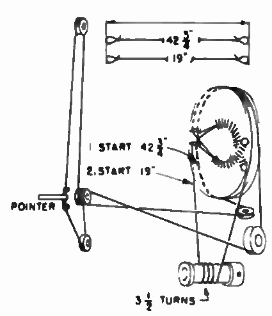


FIG. 4 — INSTALLATION DETAILS

10. Mount the assembly to the chassis by replacing the items removed in the preceding steps.

11. Check the dial calibration using an air signal. If the dial pointer does not indicate the correct channel, turn off the receiver, reach in along the left side of the cabinet, and slide the pointer to the correct position.

FIG. 5 — DIAL STRINGING



ANTENNA INFORMATION

Antenna requirements for satisfactory UHF television reception are determined by the signal conditions in the particular locality. Some of the possibilities are as follows:

1. In areas where signals are strong and reflections are not troublesome, satisfactory reception may be obtained by using the existing VHF antenna (built-in or external) for both VHF and UHF. This can be done by connecting two jumper wires from the UHF antenna terminals to the STD antenna terminals so as to connect the two sets of terminals in parallel. If this method is used, make certain that it does not adversely affect reception on the standard VHF channels.

If an external antenna is used for VHF reception, satisfactory UHF reception may be obtained by connecting the built-in VHF antenna to the UHF antenna terminals.

2. A simple, resonant dipole antenna may provide satisfactory reception in medium-signal areas. The chart, Fig. 6, gives the total length of a half-wave element for any frequency in the UHF television spectrum.

3. Where signals are weak or reflections are troublesome, a high-gain, directive antenna system should be used. Typical of this type of antenna are the corner reflector, the rhombic, and the Yagi.

ADJUSTMENTS

Model H-803 All-Channel UHF Television Tuner is shipped pre-adjusted to receive UHF channels 14 through 83, and additional adjustments are not normally required. In some cases, however, it may be desirable to adjust the IF trimmer, L5, located as shown in Fig. 4 for best picture detail and sound.

SERVICE

A high degree of precision is used in the manufacture of UHF television tuners. Critical factors include lead lengths, lead and component dress, and component sizes. In servicing UHF tuners, problems arise which are not encountered in ordinary service work. Therefore, troubleshooting inside the tuner is not recommended. Defective tuners should be returned through a Westinghouse distributor.

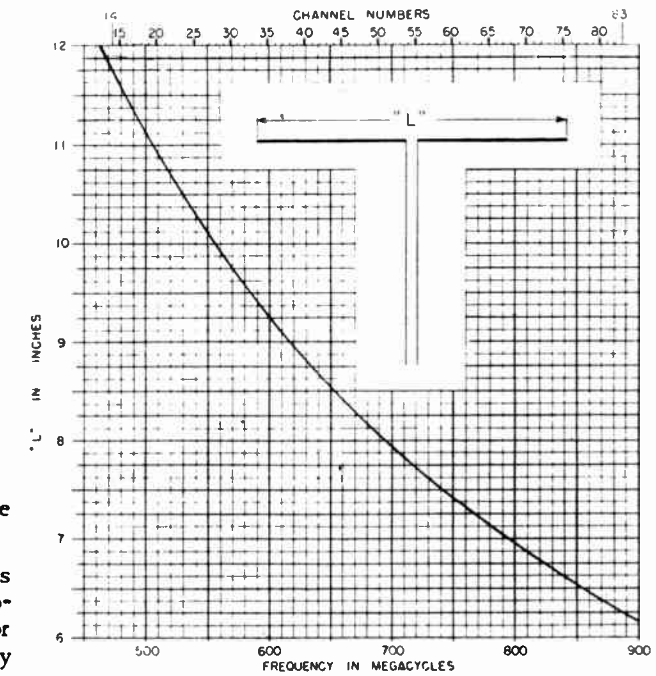
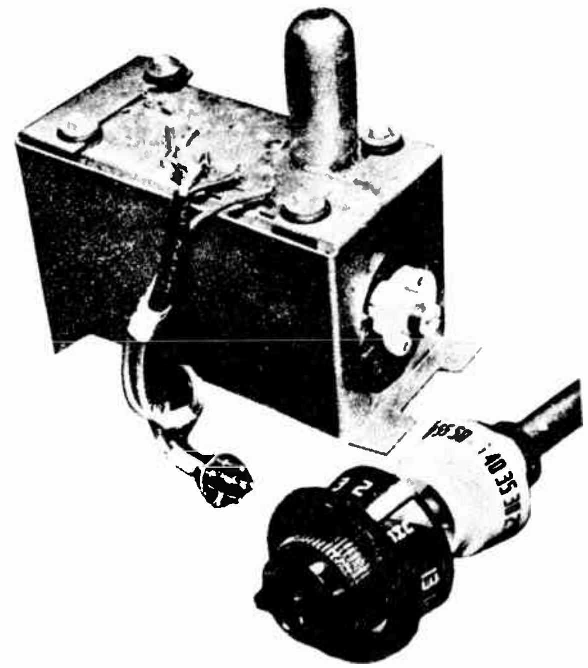


FIG. 6 — UHF DIPOLE ANTENNA LENGTH

PARTS LIST FOR MODEL H-803

Part No.	Description
✛ V-11431-1	Background, dial
✛ V-11424-1	Cable Assembly (V-11390 tuners)
V-3219S	Cord, dial drive (100' spool)
✛ V-11430-1	Dial, UHF 21" (H-803-1, H-803-4)
✛ V-11580-1	Dial, UHF 17" (H-803-2, H-803-5)
✛ V-11581-1	Dial, UHF 17" Plastic (H-803-3, H-803-6)
✛ V-11426-2	Pointer
✛ V-11428-1	Pulley Assembly, large (V-11390 tuners)
✛ V-11422-1	Pulley, UHF drive string
V-10076-1	Spring, dial drive
✛ V-11390-3	Tuner Assembly (H-803-1, -2, -3)
✛ V-11613-1	Tuner Assembly (H-803-4, -5, -6)

✛ *New part number listed for the first time in Westinghouse radio or television service information.*



GENERAL DESCRIPTION

Model H-804 All-Channel UHF Television Tuner is designed for use with the following models of Westinghouse television receivers that contain specific provisions for its use:

H-765T17	H-772K21	H-783K21	H-790C21
H-766T17	H-773K21	H-784K21	H-791K21
H-810T17	H-774K21	H-785K21	H-792K21
H-811T17	H-775K21	H-786K21	H-793K21
H-769T21	H-776T21	H-787K21	H-794C21
H-770T21	H-780T21	H-788C21	H-795T27
H-771T21	H-782K21	H-789C21	

These receivers have two UHF positions on the channel selector and provision to plug in the connecting cable of the UHF Television Tuner into a socket located on the VHF Tuner mounting bracket. When the UHF tuner is correctly installed in such a receiver, reception of all the UHF television channels (14 through 83) is provided in addition to the VHF channels (2 through 13).

The UHF Television Tuner contains the RF Preselector, oscillator and mixer circuits. It can be tuned over the entire UHF TV spectrum. In the tuner, the UHF signal is converted to the intermediate frequency of the television receiver (center IF is 44mc.), and this IF output is fed into the VHF tuner in the receiver. When the channel selector on the receiver is set to the UHF position, the VHF oscillator in the receiver is disabled and the RF amplifier and mixer circuits serve as IF amplifier stages at 44mc. The output of the UHF tuner is amplified in the VHF tuner and fed into the IF strip in the receiver.

IDENTIFICATION

In production two basic UHF tuner types are used. They are designated V-11972-1 and V-12325-1. Tuner assemblies packed for field installation will be identified by a number following the basic model number (H-804) marked on the outside of the carton.

Model No. on Outside of Carton	*UHF Tuner Type*	*For Use in Receivers containing VHF Tuner Type*
H-804-1	V-12325-1	V-11794-1
H-804-2	V-11972-1	V-12100-1. V-12400-1

V-12325-1 CIRCUIT DESCRIPTION

See schmeatic Fig. 1 In this tuner the incoming UHF signal is inductively coupled to the preselector stage of the tuner through a 300 ohm balanced input circuit. The preselector stage is double tuned to provide the desired RF bandpass. The ultraudion oscillator circuit uses a type 6AF4/6T4 tube and operates at a frequency 45.75 mc. higher than the video carrier of the received signal. A portion of the oscillator voltage is link-coupled to the preselector stage. The difference frequency is extracted by a crystal mixer stage (center IF is 44mc.) and is capacitively coupled to the VHF tuner via a shielded. cable.

V-11972-1 CIRCUIT DESCRIPTION

See Schematic Fig. 2. This tuner employs four tuned sections. Three are modified end-tuned quarter-wave coaxial lines and are used in the preselector and oscillator doubler circuits. The fundamental oscillator uses a 6J6 dual triode in a capacitor tuned circuit, operating at one-half the frequency required to mix with the incoming signal. The capacitor tuning plates for the four sections are mounted on a common tuning shaft.

Considering the first two sections comprising the preselector, the input signal is inductively coupled to the first tuning section. The coupling loops L1 and L2 present a 300 ohm impedence to the antenna transmission line. The 1st and 2nd sections of the preselector are over-coupled by means of the coupling loops L3 and L4.

The oscillator doubler section selects the second harmonic of the fundamental via a harmonic generating crystal. This second harmonic frequency is 45.75 mc. higher than the video carrier of the incoming signal.

A crystal mixer taps into the 2nd RF and the oscillator doubler sections, receiving energy from both to produce the IF signal. (center IF is 44mc.) The output of the UHF tuner is link-coupled to the VHF tuner via a shielded cable.

INSTALLATION

The following procedure is recommended for installing the H-804 tuner.

1. Remove the back cover from the cabinet. Installation can be made without removing the receiver chassis from the cabinet.

2. The drive shaft for the UHF tuner is mounted directly above the VHF tuner. It is already coupled to the fine tuning shaft of the VHF tuner and to the fiber shaft on which the UHF channel indicating dial will be installed. (See Fig. #3)

3. Remove and discard the split pulley wheel which is found on the rear of the UHF drive shaft. Also remove the button plug bearing from the rear support bracket for the UHF drive shaft. This part is no longer needed as the rear of the UHF drive shaft will be supported by the UHF tuner shaft. (See Fig. #3)

4. Turn the VHF fine tuning control until the flat section of the UHF drive shaft is in the proper position to slide into the flexible coupling on the UHF tuner shaft.

NOTE: The flexible coupling may be a press fit or secured by set screws. Set screws should be properly tightened.

5. Insert the plug on the connecting cable from the UHF tuner into the UHF socket located on left top of the VHF tuner mounting bracket when viewed from rear. Some receivers will have the UHF socket mounted vertically on the left side of the VHF tuner mounting bracket.

6. Slide the UHF tuner assembly into position so that the bottom of the UHF tuner mounting bracket is securely locked under the protruding lip found on the VHF mounting bracket. While doing this, guide the UHF drive shaft into the flexible coupling on the UHF tuner. Two ¼ self-tapping screws are supplied to secure the rear of the UHF mounting bracket firmly to the VHF tuner mounting bracket. (See Fig. #3)

7. Remove the VHF channel selector knob and calibrated dial from the front of the cabinet. Remove the tape stamped UHF from the inside of the VHF calibrated dial to uncover the window between channel numbers 2 and 13.

8. Rotate the VHF fine tuning knob counter-clockwise until the fiber tuning shaft stops turning.

9. Remove the VHF fine tuning knob.

10. Without disturbing the position of the fiber tuning shaft press the calibrated UHF dial onto the fiber tuning shaft so that channel 14 is barely visible on the left when viewed through the window in the cabinet.

11. Discard both the fiber washer and the felt washer found on the VHF fine tuning knob. Place the felt washer supplied with the kit on the outside shoulder of the calibrated UHF dial and replace the VHF fine tuning knob and the channel selector knob.

12. Route the ribbon type antenna lead from the UHF tuner through the opening provided above the UHF antenna terminals on the back cover and attach.

13. Replace the back cover.

ADJUSTMENTS

Model H-804 All-Channel UHF Television Tuner is shipped pre-adjusted to receive UHF channels 14 through 83. Additional adjustments are not normally required In some cases, however, it may be desirable to adjust the IF trimmers, L5 and L100 (See Fig. #3) for best picture detail and sound. Refer to alignment information for procedure.

OPERATION

1. See the channel selector to the position which allows the UHF channel numbers to be visible through the window in the selector knob.

2. Rotate the VHF fine tuning knob until the calibrated UHF dial is in the approximate position for the desired channel. Since the UHF stations operating in any particular locality are widely separated over the entire UHF tuning range it is not necessary to indicate their exact location on the UHF dial.

3. Adjust the VHF fine tuning knob until the desired program is received with the best picture detail and sound quality.

4. The other controls on the receiver have the same function and are operated in the same manner as they would be when receiving a standard VHF program.

ALIGNMENT INFORMATION

When a H-840 tuner is installed in a fringe area or as a replacement it may be necessary to make minor alignment adjustments. When the channel selector of the VHF tuner is turned to the UHF position the VHF tuner becomes a two stage IF amplifier. It amplifies the signals from the UHF tuner and applies them to the IF stages of the receiver. It is therefore necessary that the combination of the output circuit of the UHF tuner and the input circuit of the VHF tuner have the required band-pass to maintain the desired ratio between sound carrier and picture carrier amplification.

TEST EQUIPMENT

1. UHF Sweep Generato
   Range 470-890 mc.
   Sweep width 10 mc.
2. High Gain Oscilloscope
3. Calibrated Marker Generator capable of producing an accurate 43 mc. marker signal.
4. Resistor network to match sweep generator output to 300 ohm impedance of UHF tuner input. (See Fig. 7)
5. Detector Probe (See Fig. 5)
6. 9 Volt bias battery.

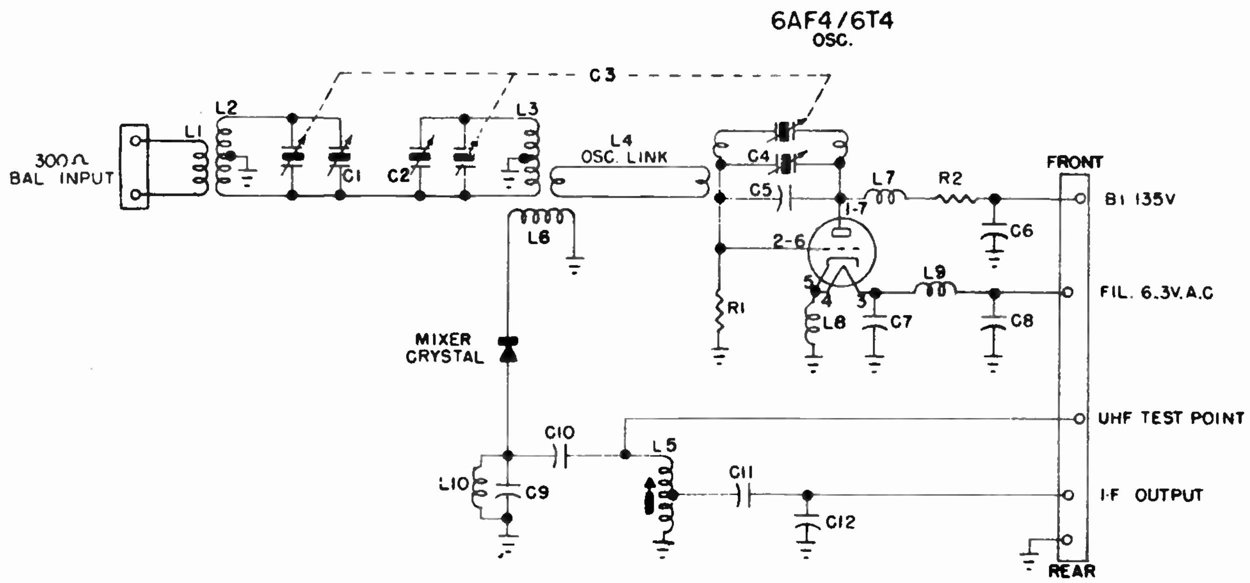


Fig. 1. V-12325-1 Tuner

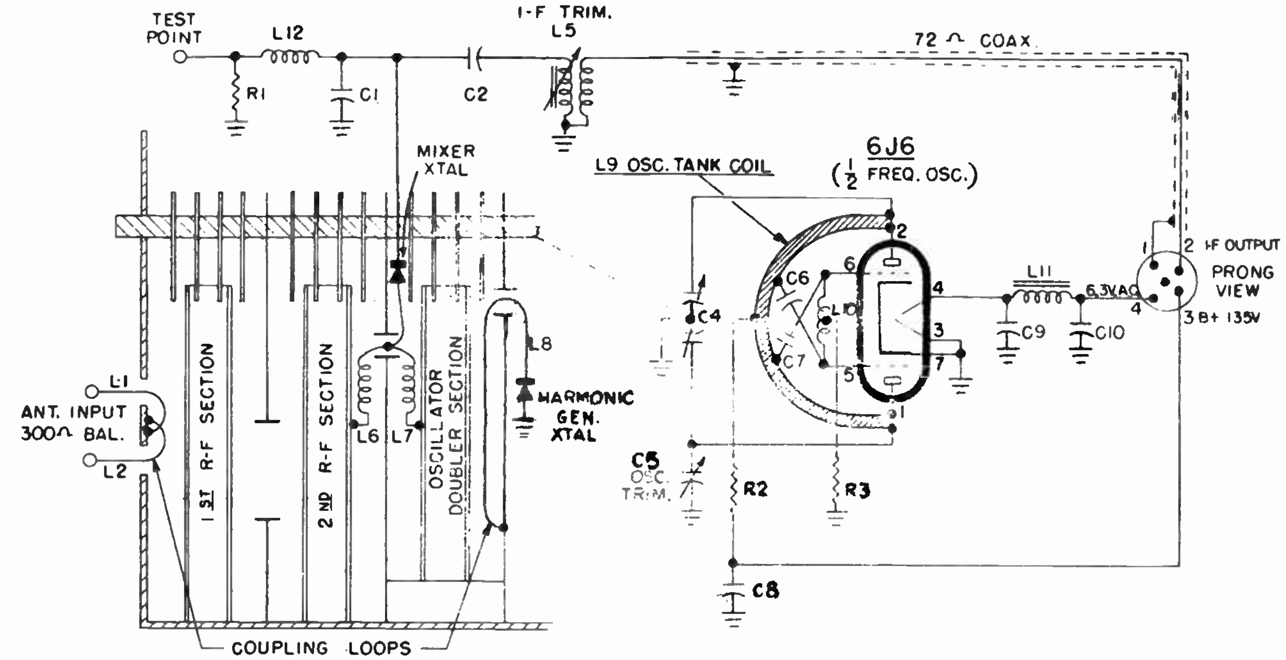


Fig. 2. V-11972-1 Tuner

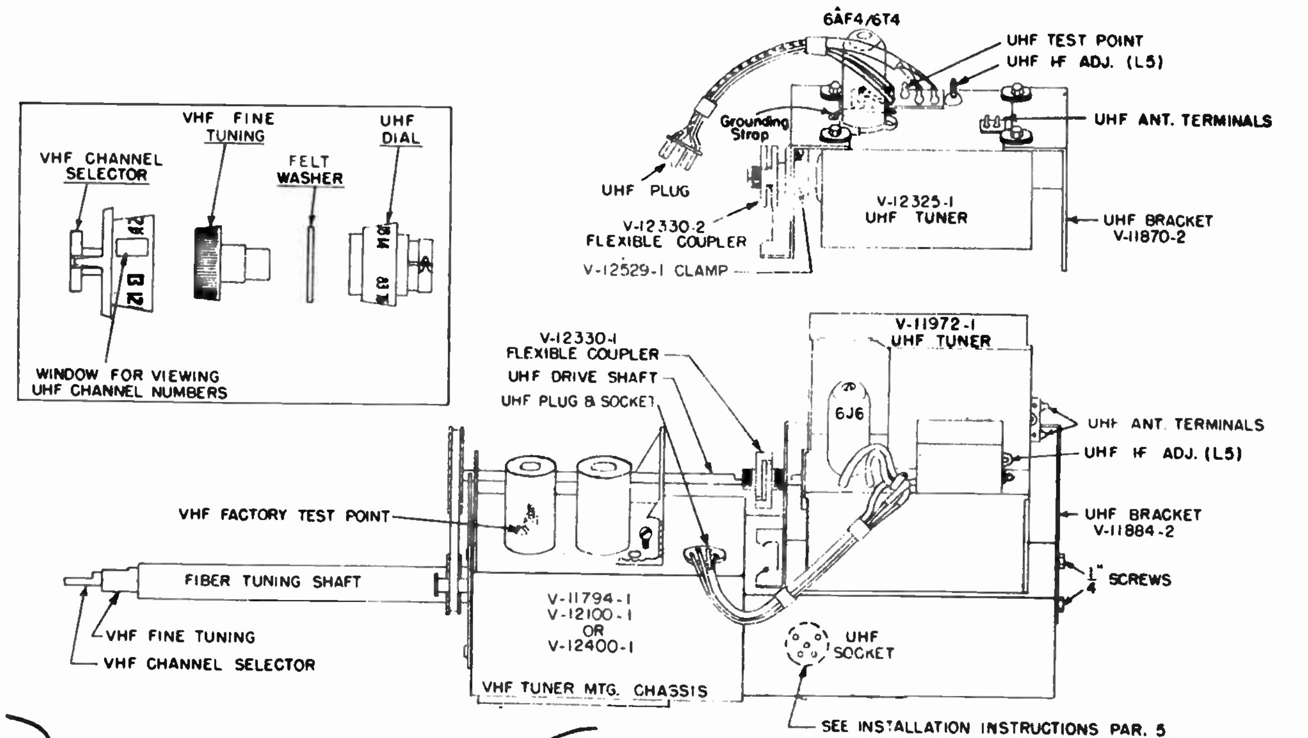


Fig. 3. Installation Details

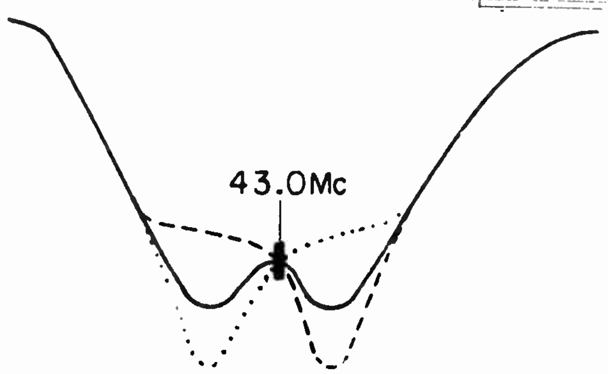


Fig. 4. Response Curve

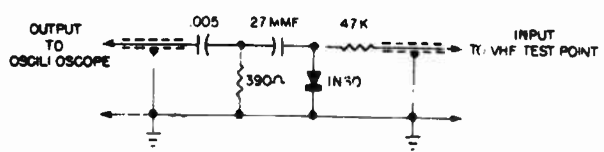


Fig. 5. Detector Probe

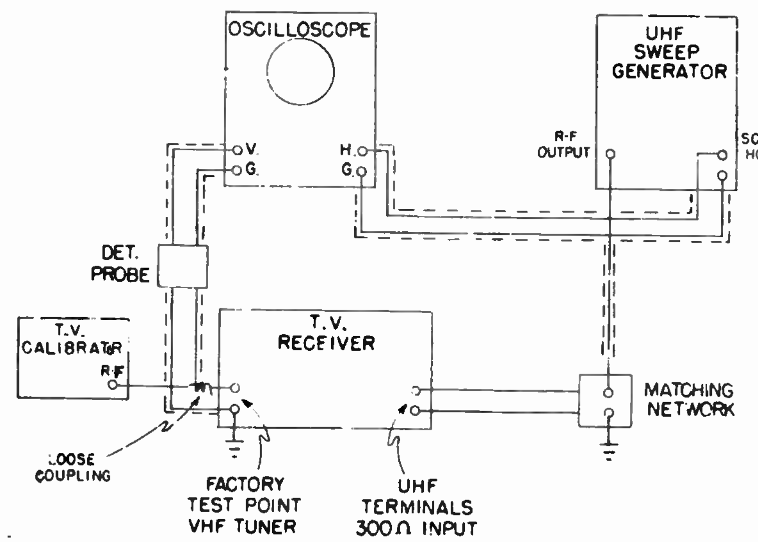
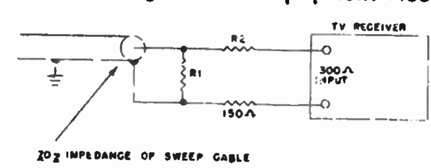


Fig. 6. Test Equipment Hook-up



ZO	R1	R2
50 Ω	56 Ω	120 Ω
72 Ω	82 Ω	110 Ω

Fig. 7. Matching Network

ALIGNMENT PROCEDURE

1. Refer to block diagram Fig. #6 for test equipment hookup.

2. Connect a 9 volt bias battery between the receiver A.G.C. line and ground. Negative to A.G.C. line. Positive grounded to receiver chassis.

3. Connect the input lead of the detector probe (Fig. 5) to the VHF factory test point on the VHF tuner. Connect the output of the detector probe to the vertical input of the oscilloscope. Use shielded cable for all leads. Cable shields should be grounded as close as possible to the point at which the "hot" lead is connected.

4. If the sweep generator has built-in provisions to produce a synchronized horizontal sweep in the oscilloscope, connect a sheilded cable from the horizontal input of the oscilloscope to the corresponding terminals on the sweep generator, (Usually marked "Scope Horiz".)

5. Connect a shielded lead from the UHF Sweep Generator output terminals through the impedance matching network (Fig. 7) to the UHF tuner antenna terminals.

6. Set the receiver channel selector in the UHF position and rotate the VHF fine tuning knob until channel #48 is viewed through the channel selector window.

7. Set the sweep generator to 677 mc. (center frequency of channel 48) and the sweep width to 10 mc. With all equipment on and the oscilloscope controls properly adjusted, adjust the VHF fine tuning control until the response curve appears on the oscilloscope.

8. Set the marker generator to 43 mc. (accuracy is important) Loosely couple the output to the VHF tuner factory test point. Adjust marker signal output so that the pip is barely visible on the scope. Excessive marker injection will distort the response curve.

9. Simultaneously adjust L5 UHF IF Trimer and L100 located on the VHF Tuner (see Fig. 1, 2 and 3) until the response curve is symmetrical and 43 mc. marker pip appears in the center of the response curve. (See Fig. 4)

Replacing V-12325-1 and V-11972-1 UHF Tuner

1. Remove back cover from receiver.

2. Remove the plug on the UHF tuner connecting cable from its socket on the VHF tuner bracket.

3. Unsolder the antenna lead from the UHF tuner antenna terminals.

4. The coupling device between the VHF tuner and the UHF tuner drive shaft is either a press fit or secured by set screws. If set screws are used they must be loosened to release the coupling device from the UHF tuner drive shaft.

5. Remove the two ¼"self-tapping screws that secure the rear of the UHF tuner mounting bracket to the VHF tuner mounting bracket. Pull the tuner assembly toward the rear of the receiver chassis to release the front of the UHF tuner mounting bracket from the VHF tuner mounting bracket.

6. Unsolder the connecting cable from the old tuner and install on the replacement.

7. Remove coupler and install on replacement tuner.

8. Remove UHF mounting bracket from old tuner and install on the replacement.

a. The V-12325-1 tuner is shock mounted to the bracket by four ¼"self-tapping screws located on the top four corner of the tuner. It is grounded by a bonding strap located on the top front of the tuner. It is important that this strap is soldered to the replacement tuner.

b. The V-11972-1 tuner is mounted to the bracket by three 8-32 screws located on the side.

9. Follow the procedure used when installing a H-804 tuner assembly, starting with step #4.

ANTENNA INFORMATION

Antenna requirements for satisfactory UHF television reception are determined by the signal conditions in the particular locality.

Some of the possibilities are as follows:

1. In areas where signals are strong and reflections are not troublesome, satisfactory reception may be obtained by using the existing VHF antenna (built-in or external) for both VHF and UHF. This can be done by connecting two jumper wires from the UHF antenna terminals to the STD antenna terminals so as to connect the two sets of terminals in parallel. If this method is used, make certain that it does not adversely affect reception on the standard VHF channels.

If an external antenna is used for VHF reception, satisfactory UHF reception may be obtained by connecting the built-in VHF antenna to the UHF antenna terminals.

2. A simple, resonant dipole antenna may provide satisfactory reception in medium-signal areas, where reflections are not troublesome. The chart, Fig. 8, gives the total length of a half-wave element for any frequency in the UHF television spectrum.

3. Where signals are weak or reflections are troublesome, a high-gain, directive UHF antenna system should be used. Typical of this type of antenna are corner reflector, the conical, and Yagi.

Transmission lines should be of an approved low loss type. The use of tubular 300 ohm line is preferred over ribbon type 300 ohm line.

SERVICE

A high degree of precision is used in the manufacture of UHF television tuners. Critical factors include lead lengths, lead and component dress, and component sizes. In servicing UHF tuners, problems arise which are not encountered in ordinary service work. Therefore, troubleshooting inside the tuner is not recommended. Defective tuners should be returned through a Westinghouse distributor.

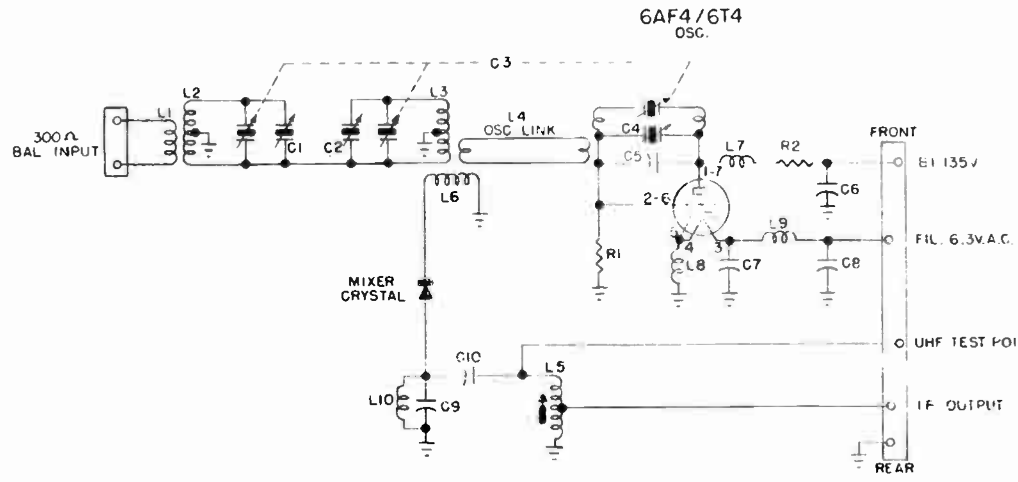
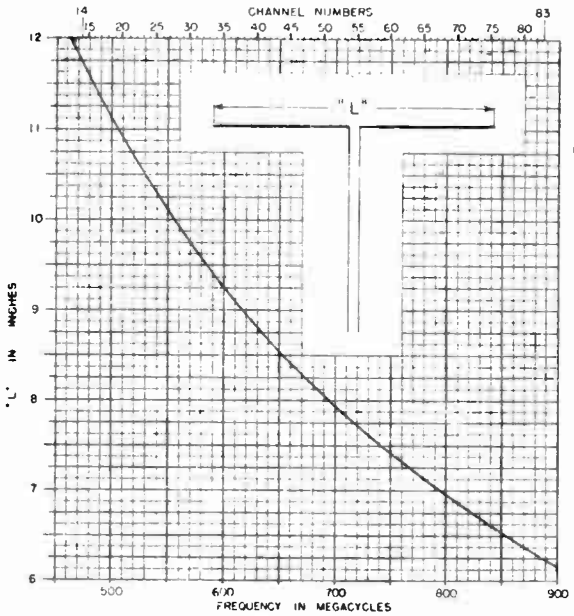


Fig. 1 V-12390-1 Tuner



UHF CHANNEL FREQUENCIES

Channel Number	Channel Frequency (MC)	Channel Number	Channel Frequency (MC)	Channel Number	Channel Frequency (MC)
14	470-476	37	608-614	60	746-752
15	476-482	38	614-620	61	752-758
16	482-488	39	620-626	62	758-764
17	488-494	40	626-632	63	764-770
18	494-500	41	632-638	64	770-776
19	500-506	42	638-644	65	776-782
20	506-512	43	644-650	66	782-788
21	512-518	44	650-656	67	788-794
22	518-524	45	656-662	68	794-800
23	524-530	46	662-668	69	800-806
24	530-536	47	668-674	70	806-812
25	536-542	48	674-680	71	812-818
26	542-548	49	680-686	72	818-824
27	548-554	50	686-692	73	824-830
28	554-560	51	692-698	74	830-836
29	560-566	52	698-704	75	836-842
30	566-572	53	704-710	76	842-848
31	572-578	54	710-716	77	848-854
32	578-584	55	716-722	78	854-860
33	584-590	56	722-728	79	860-866
34	590-596	57	728-734	80	866-872
35	596-602	58	734-740	81	872-878
36	602-608	59	740-746	82	878-884
				83	884-890

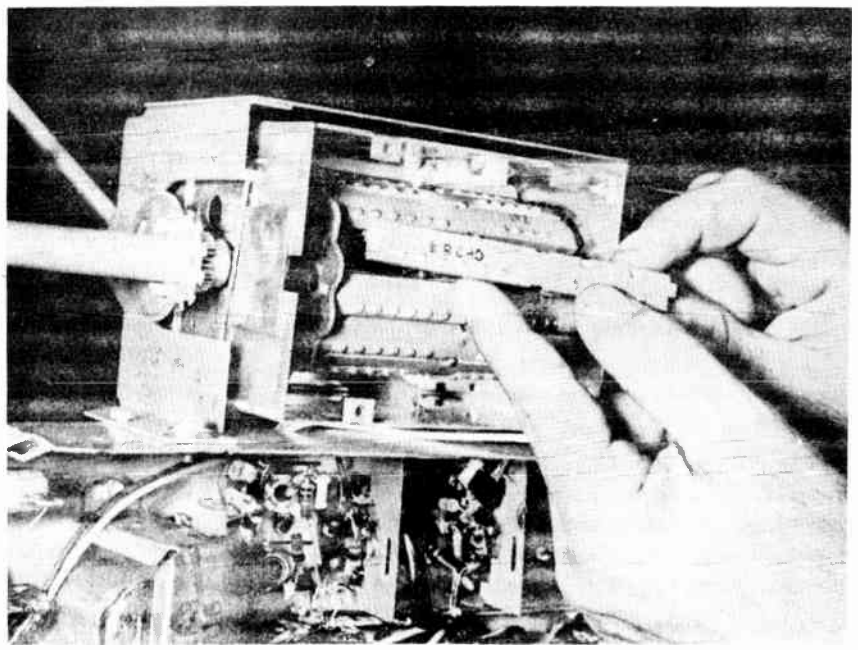
A third UHF tuner assembly is being used in the production of the Model H-804 all-channel UHF tuner kit. This tuner is designated V-12390-1 and will be used in the H-804-3 kit. The V-12390-1 UHF tuner is basically the same as the V-12325-1 UHF tuner (see basic H-804 service note) except that its IF output is designed for link-coupling to the VHF tuner.

Refer to the following chart for identification:

Model No. on Outside of Carton	UHF Tuner Type	For Use in Receivers containing VHF Tuner Type
H-804-1	V-12325-1	V-11974-1
H-804-2	V-11972-1	V-12100-1 or V-12400-1
H-804-3	V-12390-1	V-12100-1 or V-12400-1

PARTS LIST FOR MODEL H-804

Part No.	Description
V-12325-1	Tuner UHF (H-804-1)
V-11972-1	Tuner UHF (H-804-2)
V-12330-2	Coupler, flexible (H-804-1) (Includes one compression ring)
V-12529-1	Clamp for H-804-1 coupler.
V-12330-1	Coupler, flexible (H-804) (Includes two compression rings)
V-11424-1	Cable Assy., includes UHF Male Plug
V-11962-1	Knob, dial UHF (Includes compression ring)
V-5421-13	Washer, Felt UHF dial



GENERAL DESCRIPTION

The Model H-805 single channel UHF coil strips provide reception of the UHF television channels (14 through 83). They are used with Westinghouse television receivers that contain the type V-12100-1 R.F. tuner and are installed in place of unused VHF coil strips. The Model H-805 is a single section assembly comprised of the RF preselector, mixer and local oscillator harmonic generator circuits. Because of size limitations a maximum of six UHF strips can be installed. They cannot be installed adjacent to each other. Fig. 1 is the schematic diagram and also shows the physical layout of the components. All Model H-805 strips are factory aligned and with the exception of the oscillator coil slug, do not require adjustment when installed. THE OSCILLATOR SLUG MUST BE ADJUSTED AT THE TIME OF INSTALLATION.

CIRCUIT DESCRIPTION

Refer to schematic diagram Fig. 1 and block diagram Fig. 2. The received signal is coupled to the double tuned preselector circuit by the 300 balanced antenna input coupling coil. The output of the preselector is applied to the mixer crystal by means of a tap on the second preselector coil.

The frequency required to beat with the incoming signal to produce the IF carrier frequency is obtained by operating the local oscillator at a sub-harmonic and applying its output to the crystal harmonic generator. Thus, to receive channel 30, (567.25 mc.), using a 45.75 mc. video carrier IF frequency, the local oscillator would operate at 204.33 mc. and be tripled in the harmonic generator. (204.33 mc. x 3 = 613 mc. = 567.25 mc. + 45.75 mc.)

As shown in Fig. 1, the output of the local oscillator is fed to the harmonic generator crystal through the 100K resistor and 4.7 mmf capacitor network. This network biases the crystal so that it operates over a non-linear portion of its characteristic curve. The third harmonic of the local oscillator is developed across the harmonic selector circuit and applied to the mixer transformer by means of a coupling loop. The sound and video IF signals appear across the primary of the mixer transformer which serves as an IF transformer to couple the IF signals to the grid of the 6BK7 or 6BK7A cascode amplifier. This stage and one section of the 6J6 dual triode (normally operated as the tuner mixer) function as IF amplifiers.

INSTALLATION INSTRUCTIONS

Extreme care must be exercised when handling UHF coil strips. Component parts positioning and lead dress are important factors in the construction of these strips. Careless handling can easily impair their performance.

To install UHF coil strips, proceed as follows:

1. Remove the receiver chassis from the cabinet.
2. Remove the VHF tuner bottom cover. It is secured by four hex head self tapping screws.
3. Remove unused VHF coil strips and replace with the desired UHF coil strips.
4. Replace bottom cover, turn on the receiver and allow 5 min. warm-up time. Set the channel selector to the channel corresponding to the UHF coil strip, set the fine tuning control in the center of its range (flat of shaft facing down and tilted approximately 10% counterclockwise) and adjust the oscillator slug for best picture detail and sound quality. A non-metallic alignment tool should be used. Always adjust the slug in a counterclockwise direction first. If it is turned too far clockwise, it will pass its retaining spring and slide into the coil form.
5. Replace the chassis in the cabinet and recheck the oscillator setting.

SERVICE

A high degree of precision is used in the manufacture of UHF coil strips, and therefore, component parts replacement or preselector and mixer alignment is not recommended. When ordering replacement UHF coil strips, order by the service part no. V-12550-(14-83). The dash number following the basic part number indicates the channel number, i.e., V-12550-28 is the part number for a channel 28 coil strip.

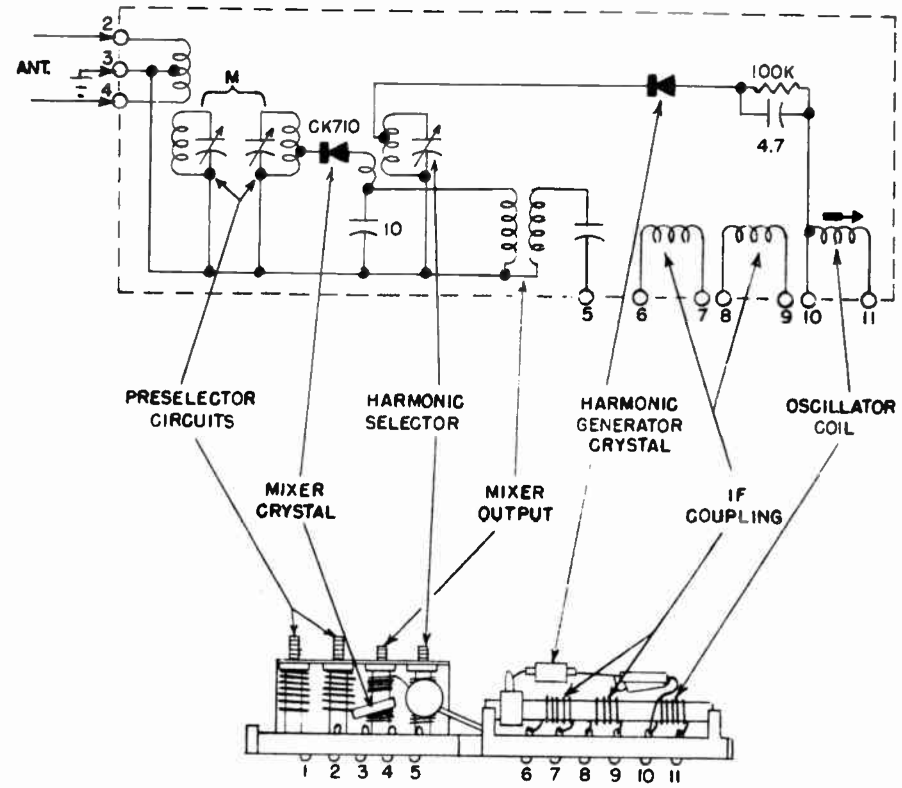


FIG. 1. H-805 – Schematic Diagram

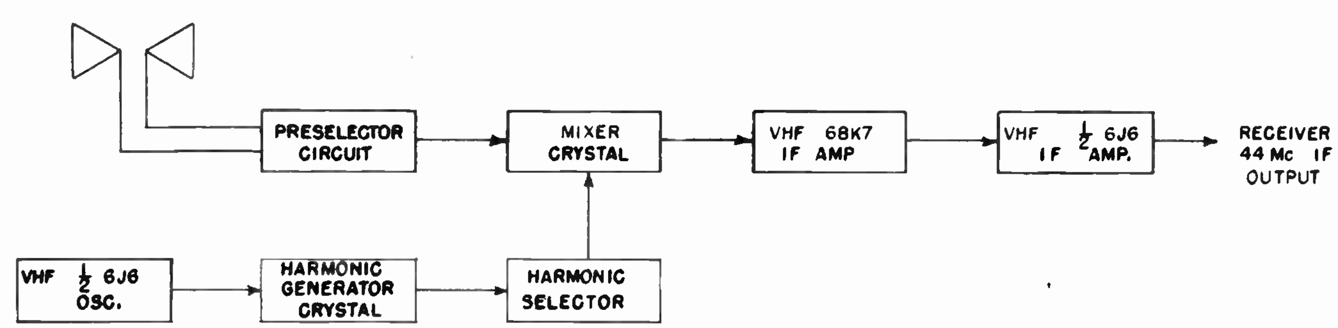
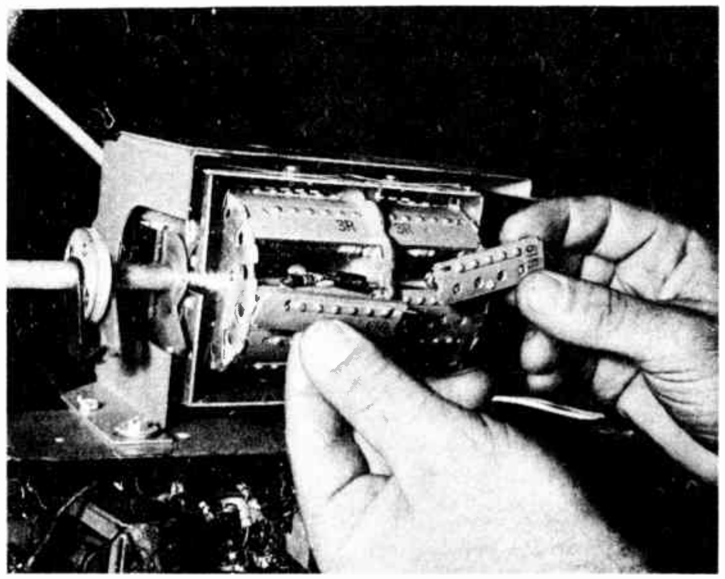


FIG. 2. H-805 – Block Diagram



GENERAL DESCRIPTION

The model H-806 single channel UHF coil strips provide reception of UHF television channels 14 through 83. They are used with Westinghouse television receivers that contain the type V-12415-1 R.F. tuner and are installed in place of unused VHF coil strips. The model H-806 is a dual section coil strip. One section contains the RF preselector, local oscillator harmonic selector and the mixer circuit for the first conversion. The other section contains the oscillator coil and the mixer circuit for the second conversion. Because of size limitations, a maximum of six sets of UHF strips can be installed. They cannot be installed adjacent to each other. Fig. 1 is the schematic diagram and shows the physical layout of the components. All Model H-806 coil strips are factory aligned, and with the exception of the oscillator coil slug, do not require adjustment when installed. THE OSCILLATOR COIL SLUG MUST BE ADJUSTED AT THE TIME OF INSTALLATION.

CIRCUIT DESCRIPTION

Refer to schematic diagram Fig. 1 and block diagram Fig. 2. These UHF strips operate by double conversion of the received signal, using a harmonic of the local oscillator frequency for the first conversion and the fundamental frequency for the second conversion. The received signal is coupled to the double tuned preselector by the 300 ohm balanced antenna input coupling coil. The first mixer circuit (UHF crystal) receives energy from both the preselector and the oscillator harmonic selector to produce the first conversion. This first conversion frequency is amplified by the tuner RF amplifier tube, fed to the second mixer circuit where it beats with the fundamental frequency of the local oscillator to produce the receiver IF frequency.

INSTALLING MODEL H-806 COIL STRIPS

Extreme care must be exercised when handling UHF coil strips. Component parts positioning and lead dress are important factors in the construction of these strips. Careless handling can easily impair their performance.

To install UHF coil strips, proceed as follows:

1. Remove the chassis from its cabinet.

2. Remove the bottom cover of the tuner by pulling the front end away from the tuner chassis and unhooking the rear end.

3. Remove unused VHF coil strips and replace with the desired UHF coil strips. Be sure that the pin connector on the long section makes firm contact with the antenna section. DO NOT BEND THE PIN.

4. Replace bottom cover, turn on the receiver and allow 5 min. warm up. Set the channel selector to the channel corresponding to the UHF coil strip, set the fine tuning control in the center of its range (flat of shaft facing down) and adjust the oscillator slug for best picture detail and sound quality. A non-metallic alignment tool should be used. Always adjust the slug in a counter-clockwise direction first. If it is turned too far clockwise it will pass its retaining spring and slide into the coil form.

5. Replace chassis in the cabinet and recheck the oscillator setting.

SERVICE

A high degree of precision is used in the manufacture of UHF coil strips, and therefore, component parts replacement or alignment is not recommended. When ordering replacement coil strips, order by service part nos.

V-12384-(14-83) for the antenna section, and V-12485-(14-83) for the oscillator section. The dash number following the basic part number indicates the channel number, i.e., V-12484-28 is the antenna section for channel 28.

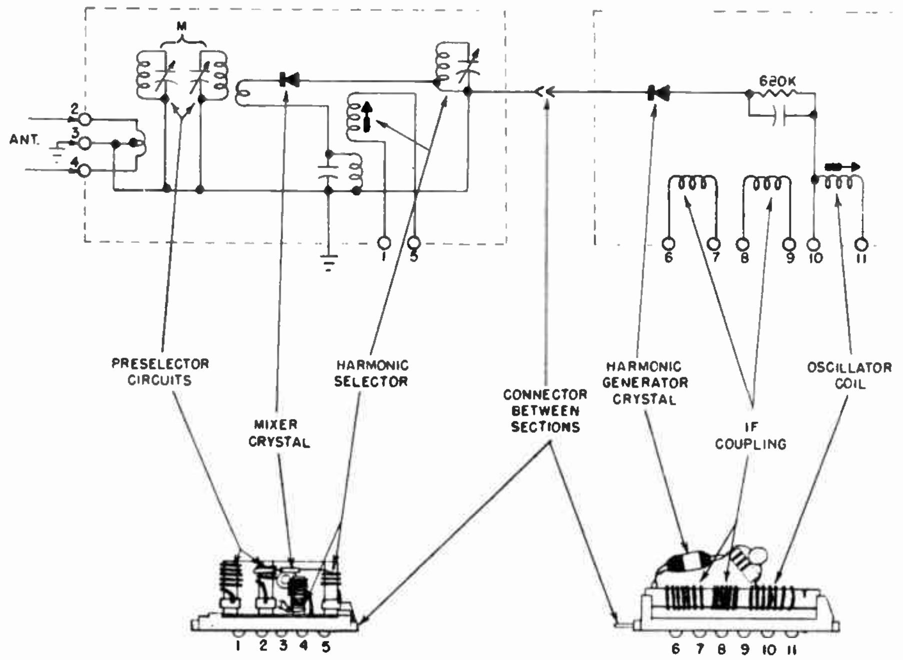


FIG. 1 – Schematic Diagram

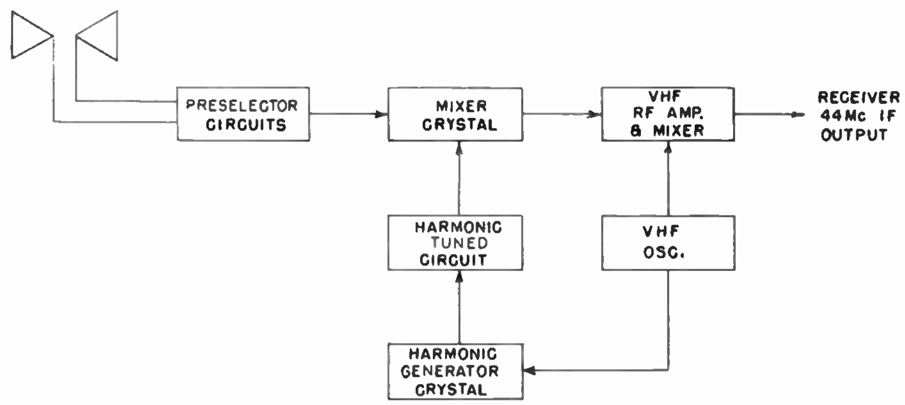


FIG. 2 – H-806 Block Diagram

MODEL AND CHASSIS INFORMATION
"R" SERIES TELEVISION RECEIVERS

MODEL	TYPE	PICTURE TUBE	CHASSIS
R1800E & R	Table	17LP4	19R20
R1800EZ & RZ	Table	17LP4	19M20
R1812E & R	Table	17LP4A	19R20
R1812EZ & RZ	Table	17LP4A	19M20
R2229E & R	Table	21YP4A	19R21
R2229EZ & RZ	Table	21YP4A	19M21
R2230E & R	Table	21YP4A	19R21
R2230EZ & RZ	Table	21YP4A	19M21
R2249E & R	Console	21YP4A	19R21
R2249EZ & RZ	Console	21YP4A	19M21
R2250E & R	Console	21YP4A	19R21
R2250EZ & RZ	Console	21YP4A	19M21
R2253M	Console	21YP4A	19R21
R2257E & R	Console	21YP4A	19R22
R2258E & R	Console	21YP4A	19R21
R2258EZ & RZ	Console	21YP4A	19M21
R2337E & R	Table	21ZP4B	22R20
R2359E & R	Console	21ZP4B	22R20
R2360R	Console	21ZP4B	22R20
R2368R	Console	21ZP4B	22R20
R2367E & Y	Console	21ZP4B	22R20
R2387R	Combination	21ZP4B	22R20/10L20
R2391E	Combination	21ZP4B	22R20/10L20
R2671E & R	Console	24CP4A	22R21
R2975R	Console	27EP4	22R21
R2976E	Console	27EP4	22R21
R2979E	Console	27EP4	22R21
R2994EU	Combination	27EP4	22R21/12R21
R2994HU	Combination	27EP4	22R21/12R21

SUFFIX "U" FOLLOWING ANY MODEL NUMBER INDICATES A RECEIVER EQUIPPED WITH THE ZENITH CONTINUOUS TUNER

TV AUDIO OUTPUT

19R SERIES
- 1.5W. Undistorted
- 1.8W. Maximum

22R SERIES
- 6W. Undistorted
- 9W. Maximum

ANTENNA IMPEDANCE

300 Ohms

POWER SUPPLY

110 Volts - 60 Cycles AC
- 19R Series 185 Watts
- 22R20 265 Watts
- 22R21 300 Watts

FINISH

- E - Blond
- H - Cherry
- M - Maple
- R - Mahogany
- Y - Ebony

INTRODUCTION

The 19R20, 19R21, 22R20 and 22R21 chassis described in this manual are similar in design. Alignment and adjustment procedures are identical. The 22R series is similar to the basic 19R series except for the horizontal output tube, an additional 5U4G rectifier, higher second anode voltage and high fidelity sound. In addition, receivers using the 22R chassis are equipped with a phono connector, push pull audio and top tuning with the switch and volume control mounted in the upper left corner of the cabinet, the channel selector at the right and the fine tuning at the rear adjacent to the turret tuner. The main differences between various chassis are in the type of tuner, audio system and picture tube size (see chart).

"R" CHASSIS IDENTIFICATION

CHASSIS	PICTURE TUBE	TURRET TUNER	UHF PROVISION
*19M20	17LP4	S21060	Use UHF Strips
*19M20U	17LP4	S20989	S21000 Con. tuner
*19M21	21YP4A	S21060	Use UHF Strips
*19M21U	21YP4A	S20989	S21000 Con. tuner
19R20	17LP4 or 17LP4A	S21735	Use UHF Strips
19R20U	17LP4 or 17LP4A	S21700	S21864 Con. tuner
19R21	21YP4A	S21735	Use UHF Strips
19R21U	21YP4A	S21700	S21864 Con. tuner
19R22	21YP4A	S21735	Use UHF Strips
22R20	21ZP4B	S21735	Use UHF Strips
22R20U	21ZP4B	S21700	S21864 Con. tuner
22R21	24CP4A or 27EP4	S21735	Use UHF Strips
22R21U	24CP4A or 27EP4	S21700	S21864 Con. tuner

"R" TUNER IDENTIFICATION

- S20989 - 13 position (VHF ONLY) turret tuner.
- S21000 - UHF continuous tuner used with S20989 turret tuner.
- S21001 - Package incorporating the S20989 turret and S21000 UHF continuous tuner.
- S21060 - 13 position UHF-VHF tuner.
- S21700 - 13 position (VHF ONLY) turret tuner.
- S21735 - 13 position UHF-VHF turret tuner.
- S21845 - VHF-UHF tuner assembly consisting of the S-21700 VHF turret tuner and the S-21864 UHF continuous tuner.
- S21864 - UHF continuous tuner used with the S21700 turret tuner.

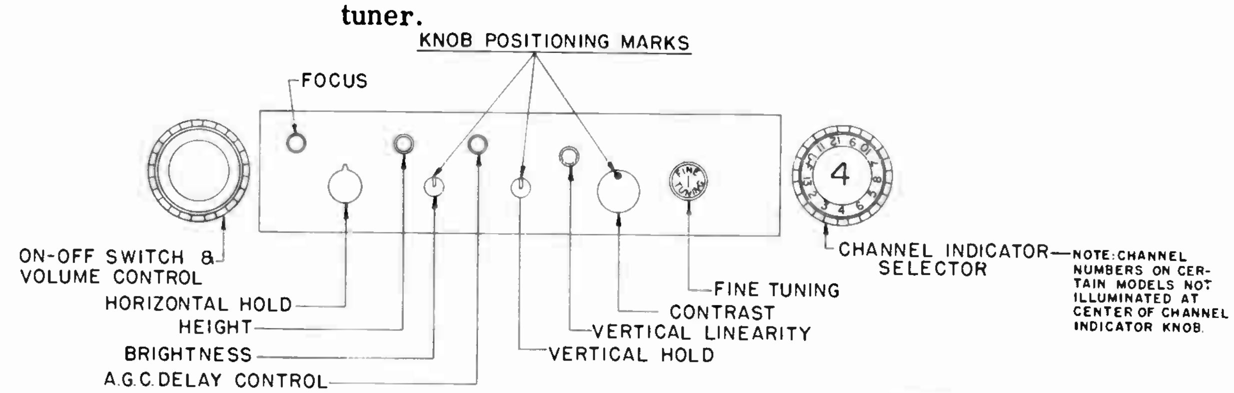


Fig. 1 Control Panel Layout 19R20 & 19R21 Chassis

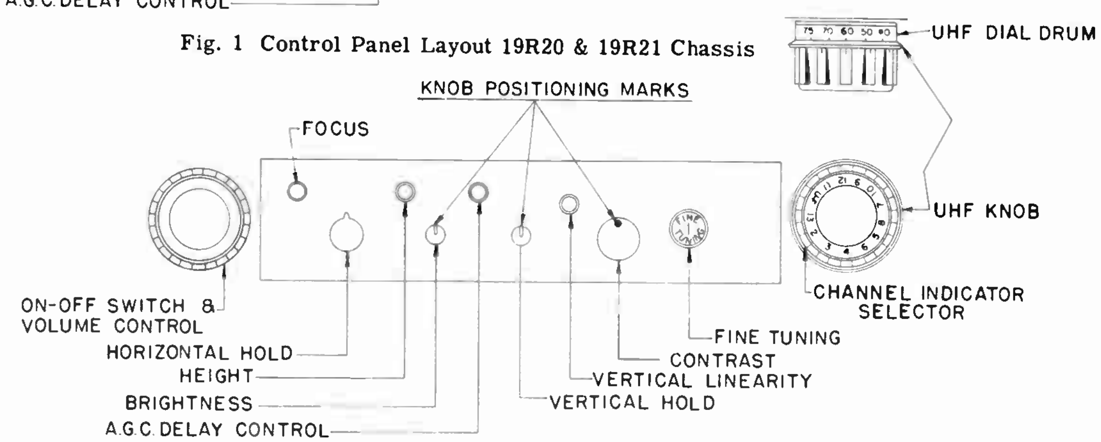
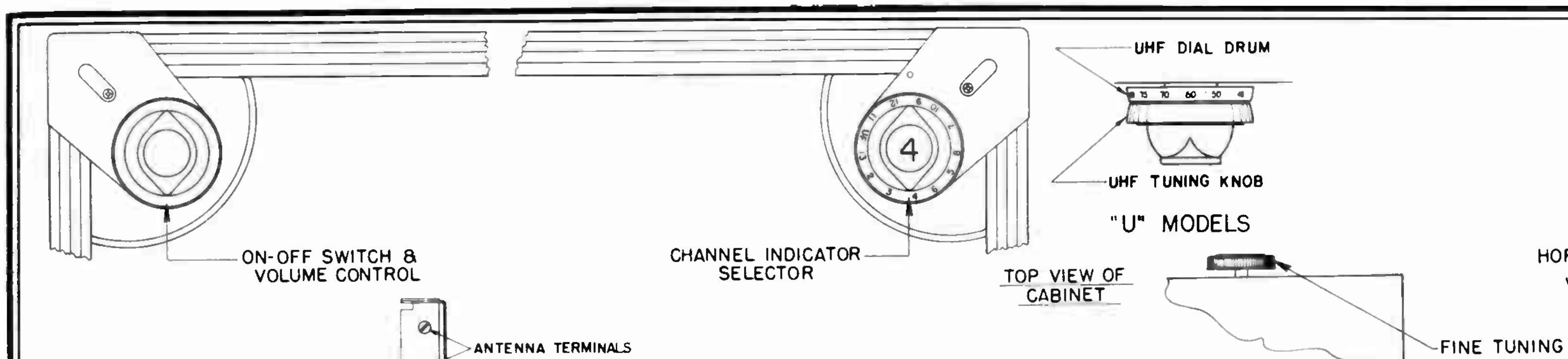


Fig. 2 Control Panel Layout 19R20U & 19R21U Chassis



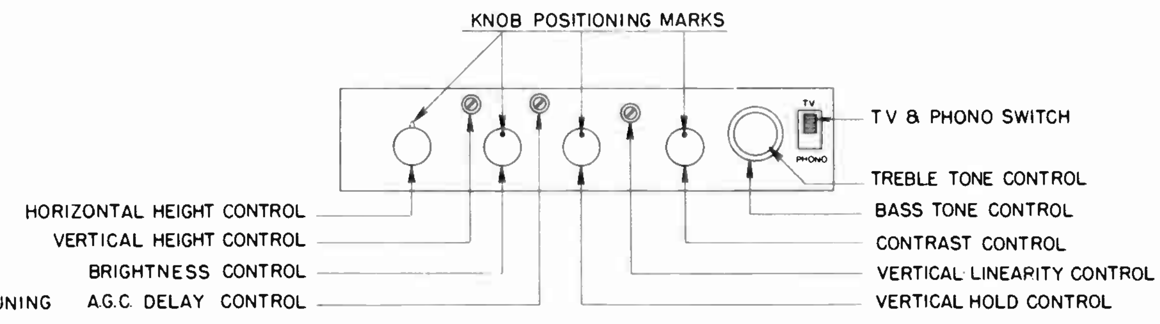


Fig. 3 Control Panel Layout 22R20, 22R20U, 22R21 & 22R21U Chassis

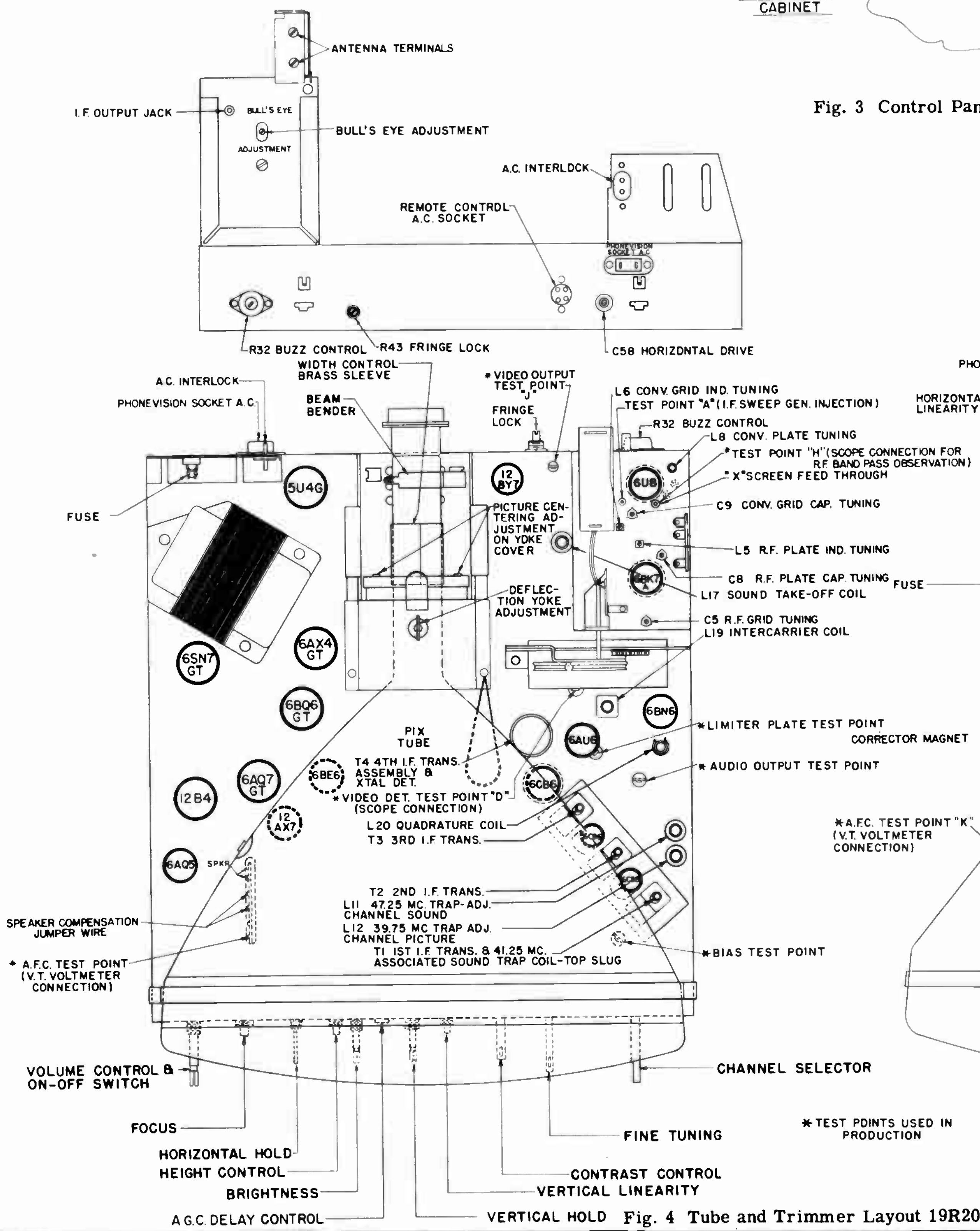


Fig. 4 Tube and Trimmer Layout 19R20 & 19R21 Chassis.

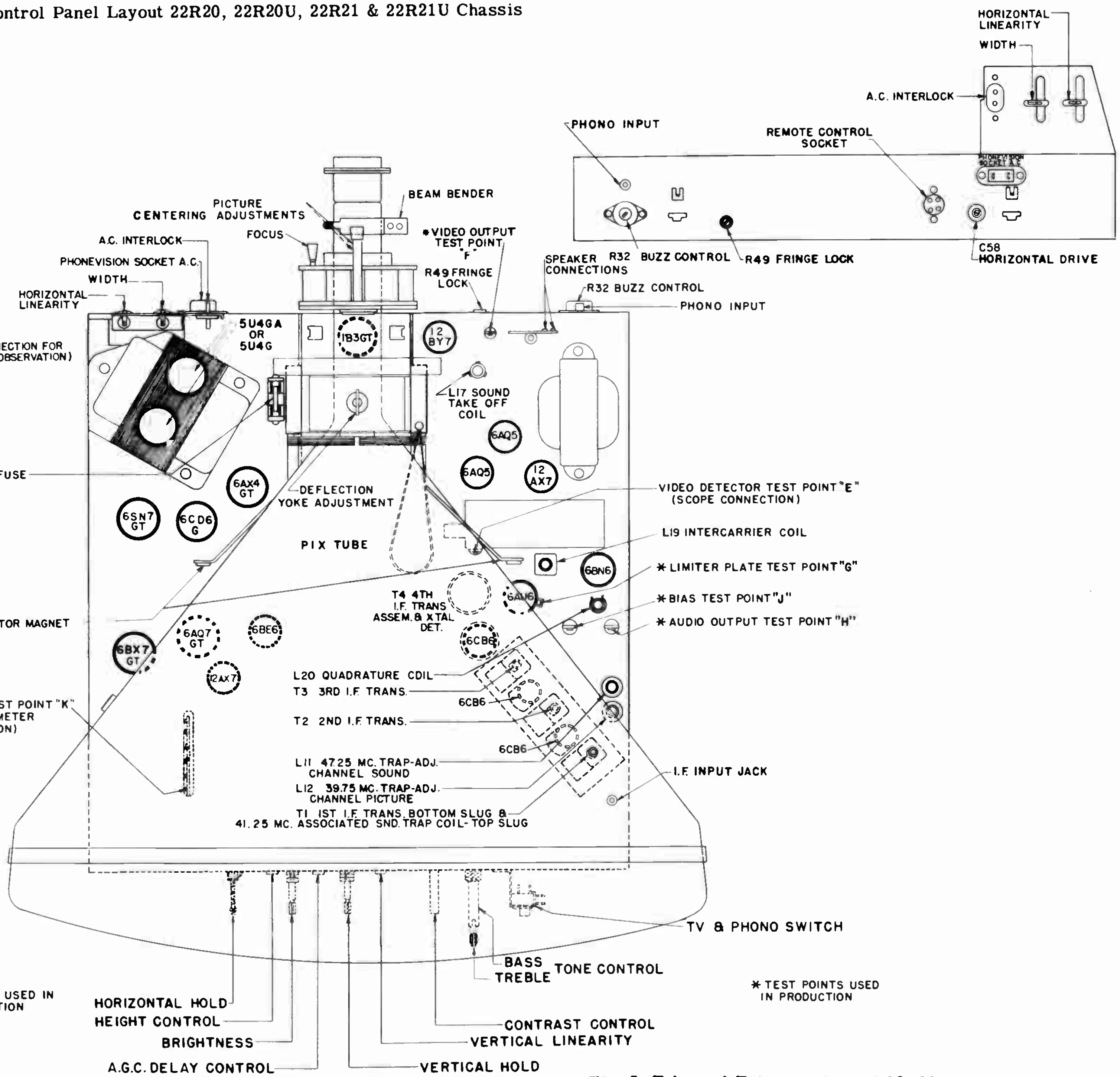


Fig. 5 Tube and Trimmer Layout 22R20

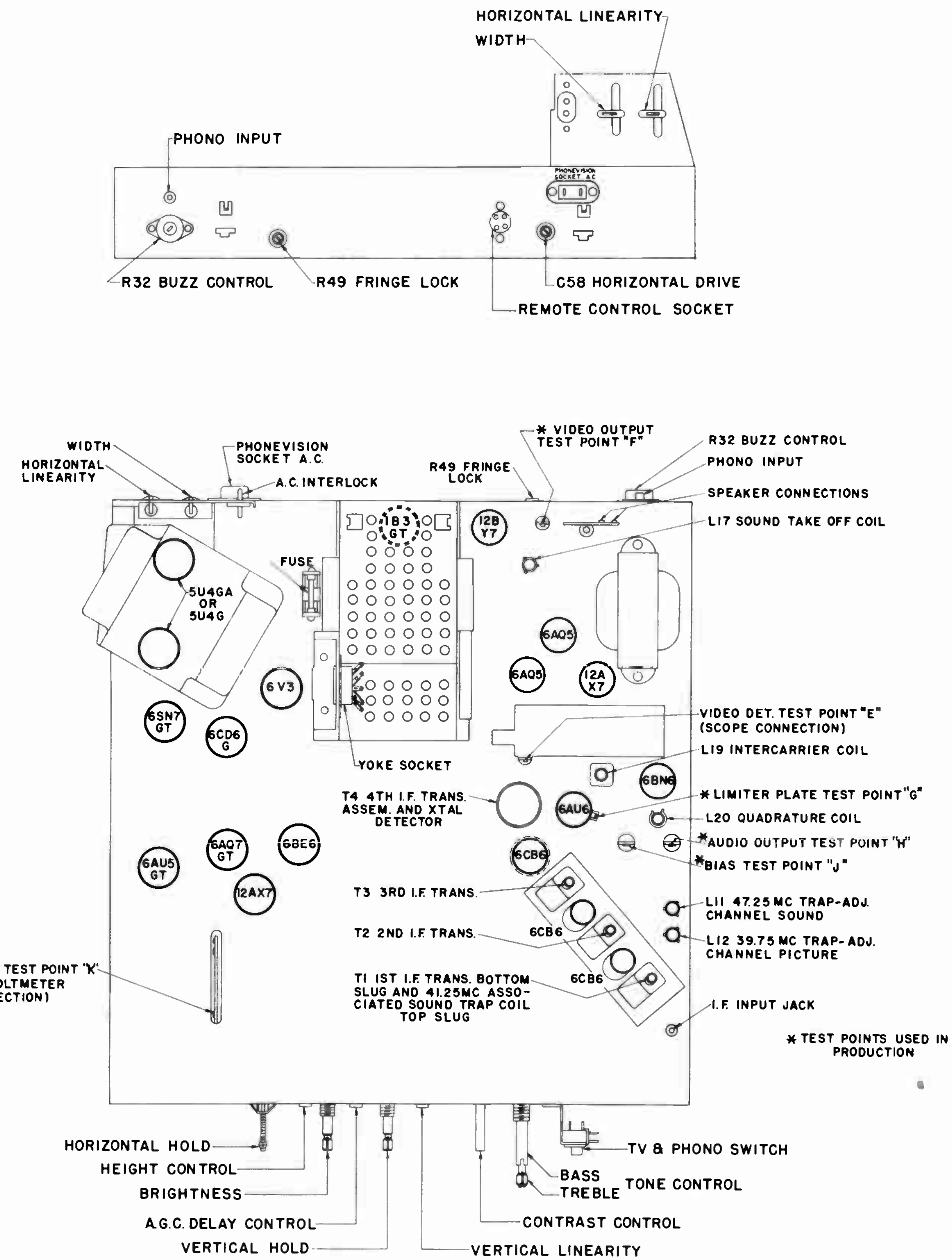


Fig. 6 Tube and Trimmer Layout 22R21 Chassis.

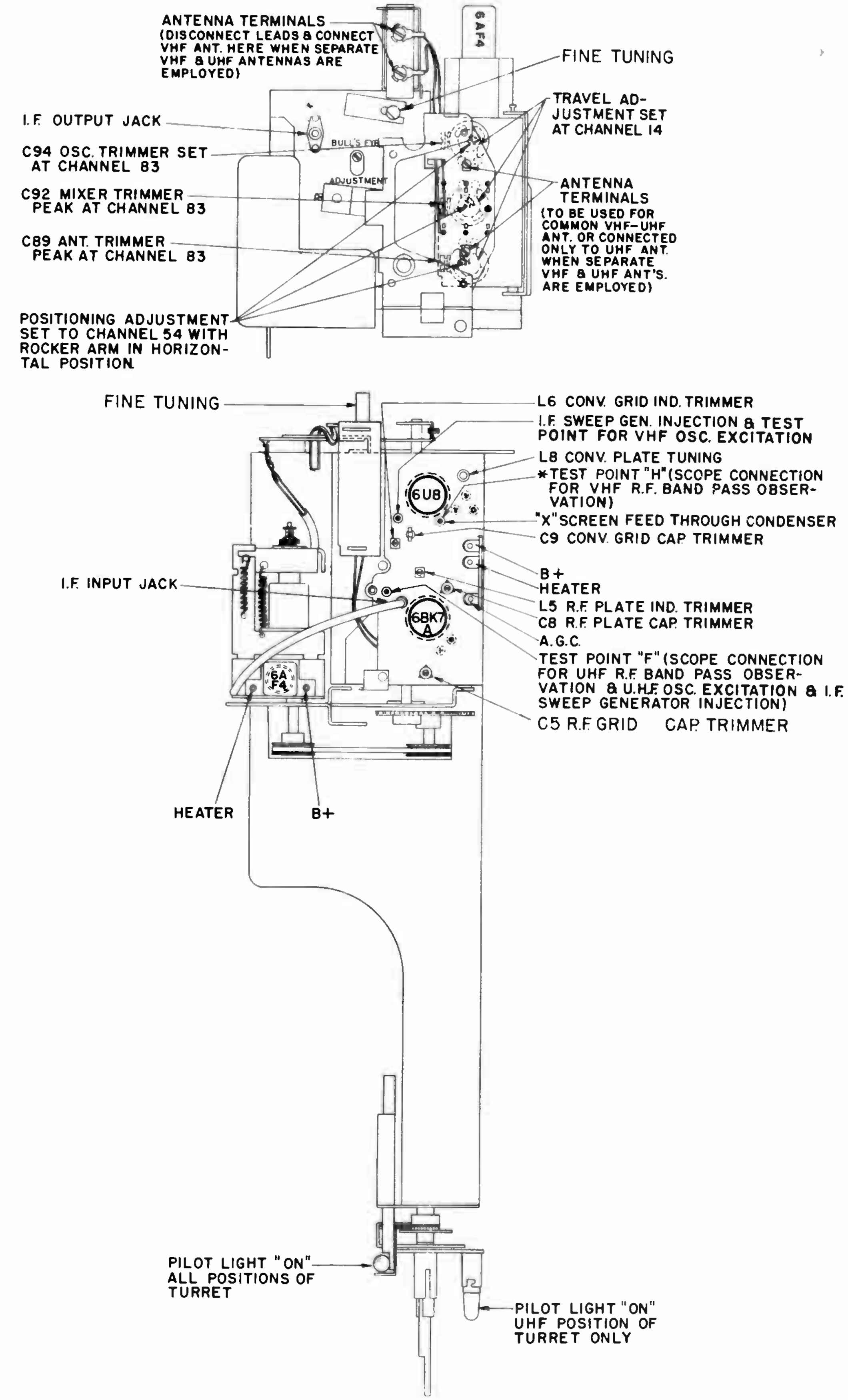


Fig. 7 VHF-UHF Tuners in "U" Models.

TUBE COMPLEMENT

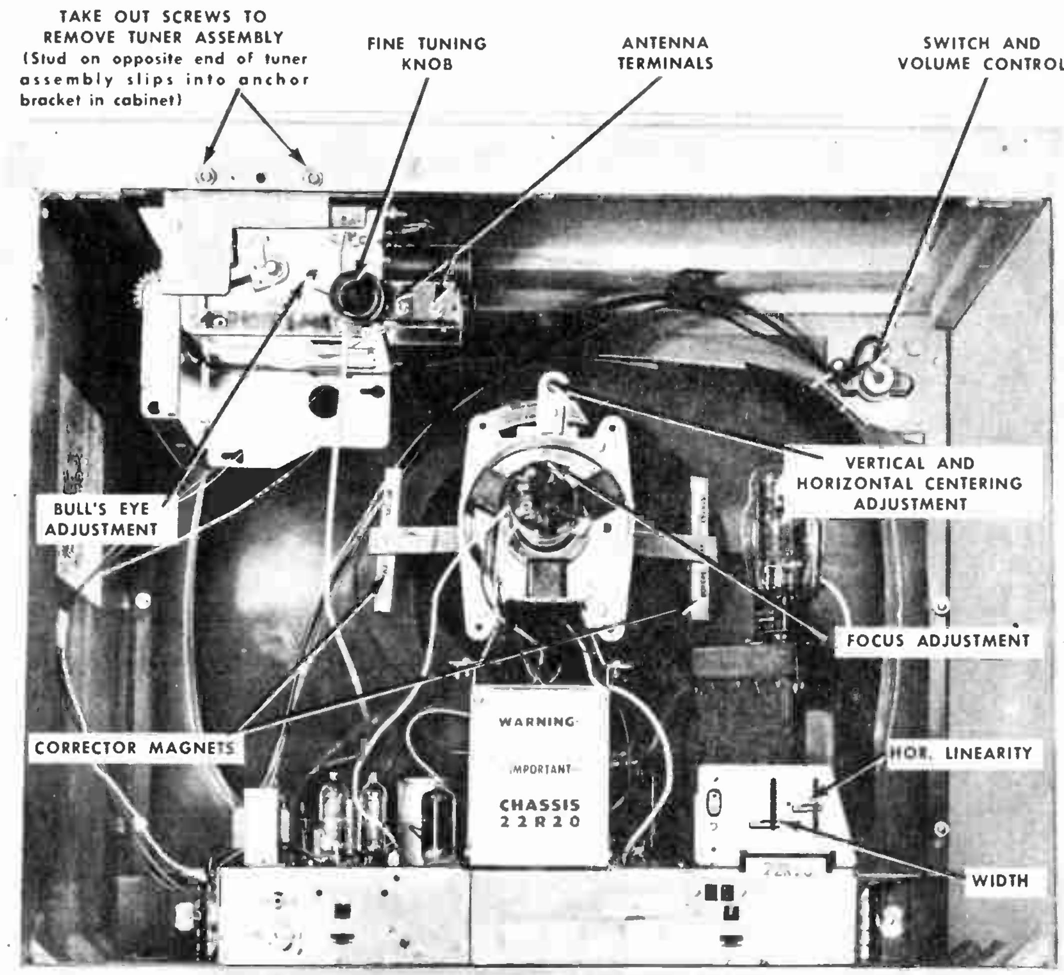
19R20 - 19R21 Chassis

SYMBOL	TUBE	FUNCTION
V1	6BK7A	RF Amplifier
V2	6U8	V2A Mixer V2B RF Oscillator
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	12BY7	Video Amplifier
V7	6AU6	Sound Limiter
V8	6BN6	Audio Detector
V9	6AQ5	Sound Output
V10	12AX7	V10A AGC Amplifier V10B Vertical Osc.
V11	6BE6	Sync Clipper
V12	12B4	Vertical Output
V13	6AQ7GT	V13A Horiz. Phase Det V13B Horiz. Control
V14	6SN7GT	V14A Horiz. Osc. V14B Horiz. Discharge
V15	6BQ6GT/6BQ6GA	Horiz. Output
V16	1B3GT	High Voltage Rect.
V17	6AX4GT	Damper
V18	5U4G/5U4GA	Low Voltage Rect.
V19	17LP4/17LP4A	19R20 Chassis
V19	21YP4/21YP4A	19R21 Chassis

TUBE COMPLEMENT

22R21 Chassis

SYMBOL	TUBE	FUNCTION
V1	6BK7A	RF Amplifier
V2	6U8	V2A Mixer V2B RF Osc.
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	12BY7	Video Amplifier
V7	6AU6	Sound Limiter
V8	6BN6	Audio Detector
V9	12AX7	V9A Sound Amplifier V9B Phase Inverter
V10	6AQ5	Sound Output
V11	6AQ5	Sound Output
V12	12AX7	V12A AGC Amplifier V12B Vertical Osc.
V13	6BE6	Sync Clipper
V14	6AV5	Vertical Output
V15	6AQ7GT	V15A Horiz. Phase Det. V15B Horiz. Control
V16	6SN7GT	V16A Horiz. Osc. V16B Horiz. Discharge
V17	6CD6G	Horizontal Output
V18	1B3GT	High Voltage Rectifier
V19	6V3	Damper
V20	5U4G	Low Voltage Rectifier
V21	5U4G	Low Voltage Rectifier
V22	24CP4A/27EP4	Picture Tube



TUBE COMPLEMENT

22R20 Chassis

SYMBOL	TUBE	FUNCTION
V1	6BK7A	RF Amplifier
V2	6U8	V2A Mixer V2B RF Osc.
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	12BY7	Video Amplifier
V7	6AU6	Sound Limiter
V8	6BN6	Audio Detector
V9	12AX7	V9A Sound Amplifier V9B Phase Inverter
V10	6AQ5	Sound Output
V11	6AQ5	Sound Output
V12	12AX7	V12A AGC Amplifier V12B Vertical Osc.
V13	6BE6	Sync Clipper
V14	6BX7GT	Vertical Output
V15	6AQ7GT	V15A Horiz. Phase Det. V15B Horiz. Control
V16	6SN7GT	V16A Horiz. Osc. V16B Horiz. Discharge
V17	6CD6G	Horizontal Output
V18	1B3GT	High Voltage Rectifier
V19	6AX4GT	Damper
V20	5U4G	Low Voltage Rectifier
V21	5U4G	Low Voltage Rectifier
V22	21ZP4B	Picture Tube

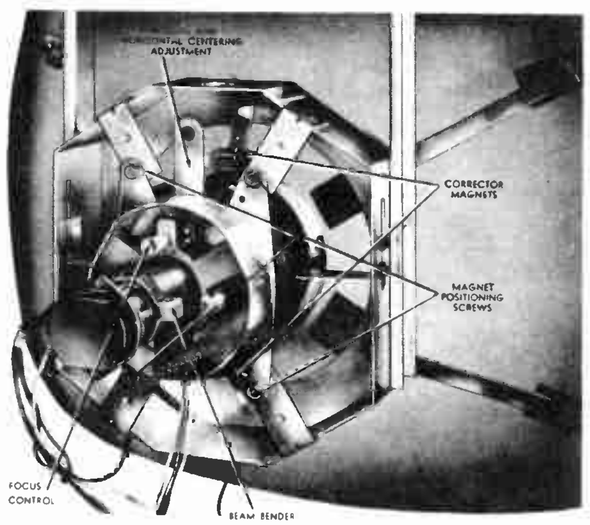


Fig. 9 Adjustments on Neck of Picture Tube 22R21 Chassis

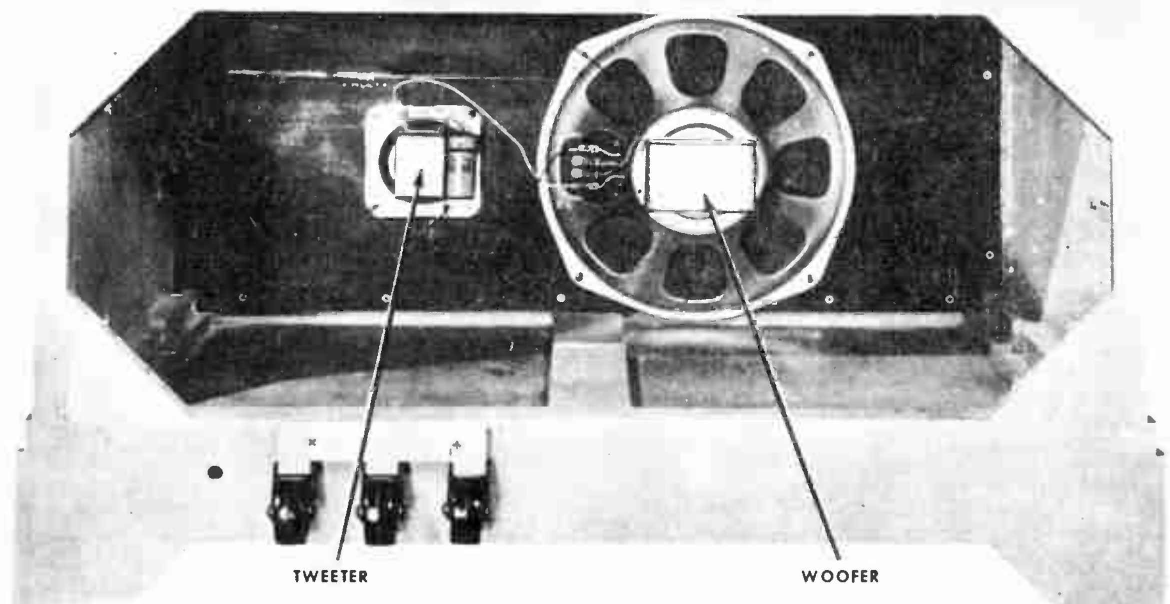


Fig. 10 Rear View of R23--Series Receiver.

ADJUSTMENTS

REMOVABLE PICTURE TUBE PROTECTIVE CUP

With the exception of a few models, a removable cup is provided to allow easy access to the adjustments on the neck of the picture tube.

To remove cup turn it counterclockwise a few degrees at a time and depress each of the three catches with a screwdriver until the cup is unlocked.

To install cup match the cup flanges (different widths) with the cabinet slots and turn clockwise until cup is locked in place.

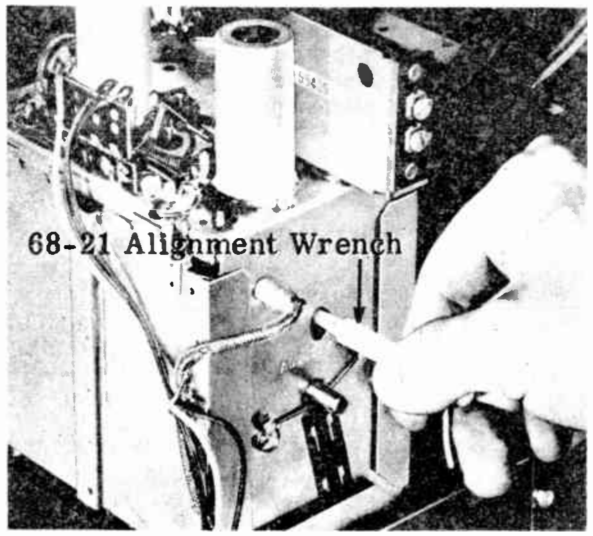


Fig. 11 Bulls-eye Tuning Adjustment

BULLS EYE TUNER ADJUSTMENTS

To adjust the receiver for bulls-eye tuning, set the fine tuning control to its approximate center position as shown in Fig. 1 . Without further adjustment of the fine tuning control insert a 68-21 alignment wrench into the tuner (See Fig. 11) and adjust each operating channel to resonance. It will be noted that tuning to one side of resonance results in a faded, washed-out picture with the spacing between the wedge lines fogged and tuning in the opposite direction causes the spaces between the lines to clear up. However, going beyond this point causes the picture to take on a "wormy" appearance from sound getting into the picture. Correct adjustment is obtained by tuning to the "wormy" picture and then backing the control off slightly until the picture clears up.

CENTERING ADJUSTMENT

In the 19R series, the centering assembly is built into the yoke housing. This assembly is made up of two magnetic rings which can be rotated by means of tabs. Centering is accomplished by gradually rotating the tabs with respect to each other then rotating both tabs simultaneously until the picture is centered.

In the 22R series, PM focusing and centering is utilized. The top screwdriver adjustment on the centering assembly is used to move the picture up or down and the bottom adjustment for side to side movement. The center adjustment is for focusing.

In some 22R20 and 22R21 receivers, a single centering lever is used for both vertical and horizontal centering. The up-down movement of this lever moves the picture horizontally while a left-right movement moves the picture vertically. A screwdriver adjustment is provided for focusing.

AFC ADJUSTMENT

The AFC is adjusted by setting the horizontal hold control L21 to a position where it is virtually impossible to "throw" the receiver out of horizontal sync when switching from channel to channel.

CORRECTOR MAGNET ADJUSTMENT

Two corrector magnets are used (not required in the 19R series) to obtain straight, sharply focused sweep lines across the face of the picture tube. In the 22R21 chassis, the corrector magnets are mounted top and bottom. The magnets are mounted on the deflection coil mounting brackets and can be moved in and out or up and down by bending the flexible arms which support them. Adjustment has been made at the factory and should not require re-adjustment unless accidentally bent out of position. If this occurs, proceed as follows:

1. With the vertical and horizontal size controls, reduce the size of the picture to a point where the four corners and sides of the picture are visible. (In some receivers it may not be possible to reduce the picture size sufficiently to see all the sides and in this case it may be necessary to shift the picture with the centering control to view one side at a time.)

2. Bend the corrector magnet arms until the corners become right angles and the top of the raster is parallel with the bottom and the left side is parallel with the right side. After adjustment, the picture should be restored to normal size.

NOTE: Mis-adjustment of the corrector magnets may cause pincushioning, barreling, keystoning, poor linearity, etc.

THE FRINGE LOCK CIRCUIT

The fringe lock circuit utilizes a 6BE6 heptode, which can be adjusted to assure sync stability over the wide range of noise and signal levels encountered in different areas. In this circuit the output of the crystal detector, approximately -3 volts peak to peak, is fed to grid #1 (pin 1) of the 6BE6. The same signal, after it has been inverted and amplified to approximately 40 volts peak to peak by the first video amplifier, is applied to grid #3 (pin 7) which in this circuit is the signal grid. The fringe lock control is used to pre-set the bias on grid #1 so that the normal 3 volt signal allows proper sync clipping action, i.e. the sync pulses, which have been stripped from the composite video signal appearing at grid #3, will appear at the plate. If a noise pulse drives grid #1 beyond the 3 volt level, plate current cutoff occurs and the noise pulse cannot get through to falsely trigger the sweep oscillators. On rare occasions, a strong noise pulse may occur at the time of the sync pulse and the tube likewise may cut off, however, the flywheel action of the sweep oscillators will maintain sync during this brief period. The entire fringe lock system is based on the principle that the loss of an occasional sync pulse is to be preferred over having a noise pulse get through to falsely trigger the sweep oscillator.

FRINGE LOCK ADJUSTMENT

1. Turn the fringe lock control fully clockwise and then back it off approximately 1/4 turn. Adjust the vertical and horizontal hold controls and check operation of the receiver to see that it syncs normally when the turret is switched from channel to channel.

2. If the picture jitters or shows evidence of delay, tearing, split phase, etc., back down the fringe lock control further, a few degrees at a time, each time re-adjusting the hold controls and switching from channel to channel until normal sync action is obtained. It will be found that under normal signal conditions, the correct adjustment will be near the counter-clockwise position of the control.

3. In fringe and noisy areas, the best adjustment will be found at or near the maximum clockwise position of the control, however, do not automatically turn the fringe lock fully clockwise in fringe areas as has been done on previous models. Follow the procedure outlined. In areas where both local and fringe signals are received, a compromise setting should be made for best overall performance.

DOUBLE DELAYED GATED AGC

In order to obtain the best possible performance in fringe and weak signal areas, it is important that the application of AGC voltage to the 6BK7A RF tube be delayed until the signal level reaches approximately 500 microvolts at the antenna input. The noise figure of the tuner will be optimized only under this condition of no AGC voltage. To accomplish this, the cathode of the 6CB6 1st IF tube is approximately 8 volts positive by virtue of the drop through the cathode resistor of the 6CB6 3rd IF. This voltage plus the voltage which results from current flow through the tube makes the grid of the 6CB6 1st IF approximately 8.6 volts negative with respect to its cathode. It should be noted here that the bias voltage for the 3rd IF is obtained across the 120 ohm portion of the cathode resistor only. The voltage at the junction of the two resistors varies from 8 volts with no signal to 4 volts with strong signals. The 2nd IF tube is in series with the 1st IF tube and any changes in the plate current of the 1st IF tube will also change the 2nd IF tube thus the 2nd IF tube is also controlled indirectly by the AGC.

Under weak signal conditions, the output of the AGC tube at point "E" is approximately 6.8 volts positive. This positive voltage however, does not reach the grid of the 6BK7A because of the 2.2 megohm resistor. Actually the grid of this tube is slightly negative because of contact potential developed as a result of the high resistance in its grid circuit (2.2 megohms). The 6.8 volts positive voltage however, is applied to the grid of the 6CB6 1st IF but because the cathode is 8.6 volts positive the grid is actually 1.8 volts negative with respect to its cathode and AGC control of the IF results under weak signal conditions.

When the receiver is used with normal signals, the signal voltage applied to the grid of the AGC tube will increase and as a result the output of the AGC tube will become 4 to 5 volts negative. This negative voltage will be applied to the 6BK7A through the 2.2 megohm resistor thus both the RF and IF stages will then be controlled by the AGC.

With the application of a negative AGC voltage to the 6BK7A tube under normal signal conditions, the noise figure of the tuner will not be optimized as under weak signal conditions, however, this is not a consideration with normal signal levels.

AGC ADJUSTMENTS

IMPORTANT: THE AGC CONTROL CANNOT BE USED IN ANY WAY TO IMPROVE THE RECEIVER SENSITIVITY. The sole function of this control is to set the level applied to the video amplifier (12BY7) tube so that the output of this tube is approximately 100 volts peak (100% modulated video signal) for application to the picture tube cathode.

The adjustment can also be made by connecting a calibrated oscilloscope through a 10K isolation resistor, to test point "D" (See Fig. 27) and, while receiving the strongest TV signal adjust the AGC delay control for 2.75 volts peak output.

Satisfactory adjustment can also be made by observing the picture and slowly turning the AGC delay control from its maximum clockwise position, counterclockwise until a point is reached where the picture distorts and buzz is heard in the sound. The control should then be turned slowly clockwise and set at a point comfortably below this level of intercarrier buzz, picture distortion and improper sync.

CAUTION: Misadjustment of the AGC delay control can result in a washed-out picture, distorted picture, buzz in sound OR COMPLETE LOSS OF PICTURE AND SOUND.

REMOVING TURRET TUNER FROM THE CHASSIS

1. Pull out the power connector, IF connector and disconnect the antenna transmission line. On some models it is also necessary to pull out the UHF IF connector and unsolder the pilot light and the oscillator B+ lead.

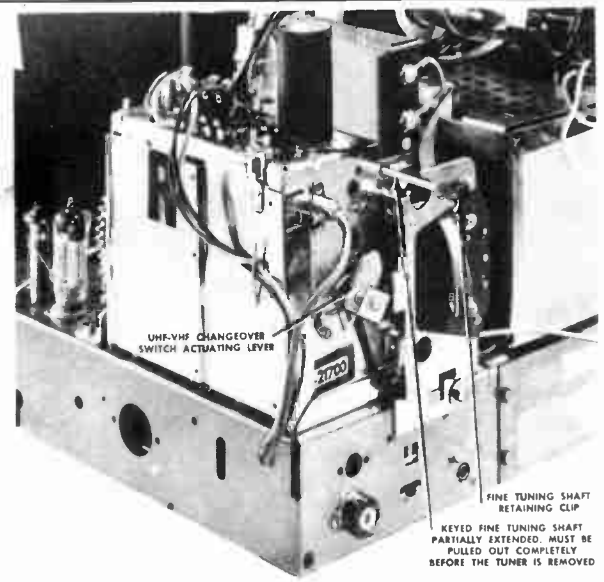


Fig. 12 Removing Fine Tuner Shaft.

2. On those models with the fine tuning control on the front panel it is also necessary to remove the fine tuning shaft from the tuner. This is done by pulling out the fine tuning shaft retaining clip (See Fig. 12) and completely removing the keyed shaft. On those models with the fine tuning control at the rear of the cabinet it is unnecessary to take out the shaft before removing the tuner.

3. To insure proper indexing, note the channel to which the receiver is tuned so that if the turret drum is rotated while the tuner is out of its case it can be turned back to the original channel.

4. Remove the three hex nuts and one machine screw and lift the tuner out of its case.

NOTE: When installing the tuner follow this procedure in reverse. The tuner fine tuning shaft is keyed and can only be inserted one way.

REMOVING CHANNEL STRIPS

1. Rotate the turret drum until the strip to be removed is readily accessible.

2. Insert a small screwdriver in the slot (See Fig. 13). Push in the direction of arrow until the channel strip clears the drum slot then lift straight out in direction of screwdriver shaft. Some strips have a round hole instead of a slot and a pointed tool is used in place of the screwdriver.

CAUTION: TO AVOID DAMAGE TO CHANNEL STRIPS, DO NOT USE PRYING ACTION IN REMOVING STRIPS.

S21845 UHF AND VHF TUNER ASSEMBLY

This unit combines the S21700 Turret Tuner and the S21864 Continuous Tuner. The turret tuner section is conventional except that on UHF a pair of 40Mc IF coils are switched into position making the 6BK7A and the 6U8 tube IF amplifiers. The 6AF4 high frequency oscillator mixes with the incoming UHF signal and produces a 40 Mc IF which is applied to the turret tuner section through terminal "F" see Fig. 33. The turret tuner in this unit is designed for VHF only, UHF strips cannot be used.

UHF-VHF CHANGEOVER SWITCH

The low loss UHF-VHF changeover switch is part of the S21845 UHF-VHF tuner package. The switch performs 3 functions.

1. Is used to switch the antenna between tuners.
2. Switches the oscillator B+ between tuners.
3. Actuates the UHF pilot light.

The switch is actuated by a lever (see Fig. 12) which is mounted on the turret tuner shaft. When the VHF tuner is in the UHF position, the lever, if properly aligned, will actuate the changeover switch.

REMOVING THE S21700 CONTINUOUS TUNER FROM THE CHASSIS

Although it may be more convenient to first take out the VHF tuner before removing the UHF tuner it is not a necessity. The UHF tuner can be removed as follows:

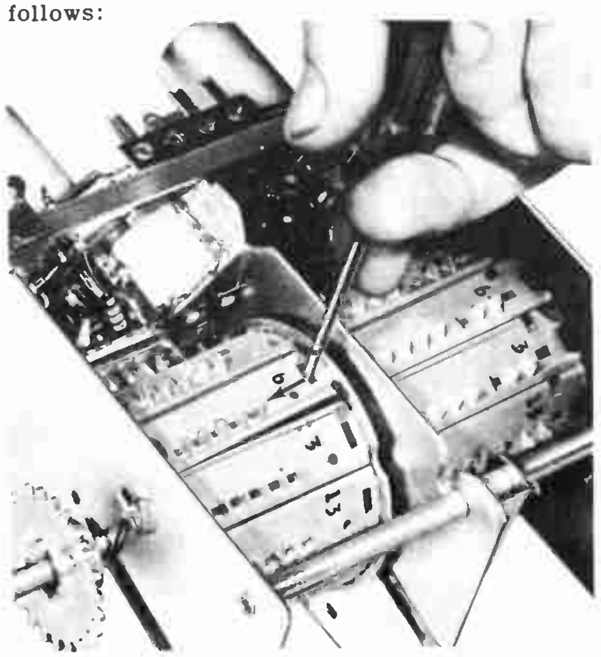


Fig. 13 Removing Channel Strips.

1. Loosen the screws and hex nuts which hold the VHF tuner in place (See Fig. 15). This step is necessary so that the VHF tuner case can be moved slightly to obtain clearance for removal of the UHF tuner. This step is not required in those models in which the tuner is secured to the top of the cabinet.

2. Remove the UHF heater and B+ connections (See Fig. 15).

3. Loosen the set screw and remove the UHF tuner drive pulley.

4. Loosen or remove the UHF tuner locking screw and lift out the tuner. It may be necessary to bear slightly against the VHF tuner case to obtain sufficient clearance for removing the UHF tuner.

When the tuner is reinstalled, reverse this procedure. Do not tighten the UHF tuner drive pulley until the tuner and the indicator dial are in synchronism on channels 14, 54 and 83.

METAL WRAPPED RESISTORS

In servicing the TV receiver, the serviceman will find several circuits in which metal wrapped resistors are used. The metal wrapping dissipates much of the resistor heat and doubles the wattage rating. In replacing a resistor care should be used to mount it as the original. If the metal mounting clamp is discarded, the resistor wattage must be doubled.

ALIGNMENT

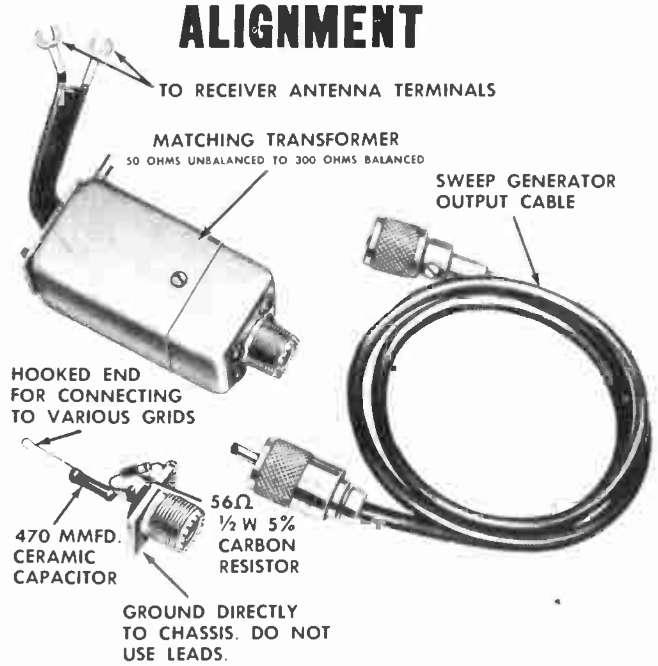


Fig. 14 IF-RF Alignment Fixtures

A suitable VHF and UHF sweep generator in conjunction with an accurate marker must be used for alignment work. It is very important to have the sweep generator output cable properly terminated and to check whether or not its attenuator is reactive. If the attenuator is reactive or if the output cable is improperly terminated, correct alignment cannot be made since the degree of attenuation then may change the shape as well as the amplitude of the response curve. The position of the attenuator should only vary the amplitude and not the shape of the response curve.

CALIBRATING THE OSCILLOSCOPE

When aligning the RF and IF stages of the receiver, it is necessary to measure detector peak output.

This may be done with a voltage calibrator used in conjunction with an oscilloscope. If a calibrator is not available, the oscilloscope can be calibrated with a known DC voltage. To make the calibration, connect the ground lead of the vertical input cable to the negative side of a 3 volt battery supply. Turn the horizontal gain control fully counterclockwise. With the "hot" lead, make a momentary contact to the positive connection on the battery and observe the instantaneous spot deflection on the screen. Discharge the scope input capacitor by shorting out the leads and repeat the procedure, each time re-adjusting the scope vertical gain until the spot deflects 3 large divisions on the screen. Each division then represents 1 volt peak. The position of the vertical gain control should be marked for future reference.

SOUND ALIGNMENT

Proper alignment of the 4.5 Mc intercarrier sound channel can only be obtained if the signal to the receiver antenna terminals is reduced to a level below the limiting point of the 6BN6 Gated Beam Detector. This level can be easily identified by the "hiss" which then accompanies the sound.

Various methods may be used to reduce the signal level, however, it is recommended that a step attenuator similar to the S-17203 unit be used for most satisfactory results. (See Fig. 25).

1. Connect the step attenuator between the antenna and the receiver antenna terminals.

2. Tune in a tone modulated TV signal and adjust the step attenuator until the signal is reduced to a level where "hiss" is heard with the sound.

3. Adjust the sound take-off coil L17 (top and bottom slugs), intercarrier coil L19, quadrature coil L20 and buzz control R32 for the cleanest sound and minimum buzz. It must be remembered that any of these adjustments may cause the "hiss" to disappear and further reduction of the signal will be necessary so that the "hiss" does not disappear during alignment.

If intercarrier buzz is in evidence, after all normal sound adjustments have been made, the cause may be attributed to one or more of the following:

1. Improper adjustment of the AGC delay control.

2. Defective 6AU6 sound limiter.

3. Extremely high signal levels which require attenuation in the antenna circuit.

4. Transmitter over modulation.

VIDEO IF ALIGNMENT

1. Slowly turn the channel selector until the turret is made to rest between two channels. Connect the negative lead of a 2 volt battery supply to terminal "E" (Fig. 27) and the positive lead to chassis. The bias supply should be made variable so that it can be varied from negative 3 volts to positive 3 volts. Keep the supply leads short.

2. Connect the calibrated oscilloscope through a 10,000 ohm isolation resistor between terminal "D" and chassis. The sweep generator input to the receiver should be adjusted for 3 volts peak to peak detector output. Do not exceed this output level during any of the adjustments.

3. Feed the output from the sweep generator through the special termination unit shown in Fig. 14 to point "C" (Pin 1 of 6CB6, 3rd IF). Adjust the generator until a pattern similar to Fig. 16 is obtained.

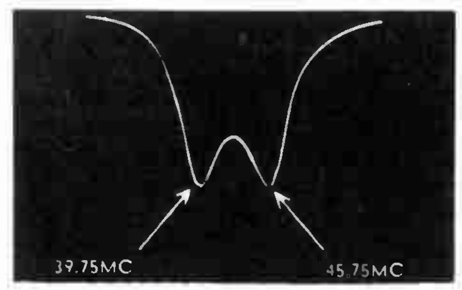


Fig. 16 4th IF Response.

4. Set the Marker Generator to 45.75 Mc and alternately adjust the top and bottom slugs of the 4th IF transformer for maximum gain and symmetry with the 45.75 Mc markers positioned as shown in Fig. 16 The 39.75 Mc marker can be within ±0.5 Mc of the specified frequency. If the correct response curve cannot be obtained in this step, check the position of the two slugs to see that they are entering their respective coils from the opposite ends of the coil form. The position of the slugs near the center of the coils may change the coefficient of coupling, making correct alignment difficult if not impossible.

5. Connect the sweep generator cable to terminal "A" (Mixer Grid). In this step it may be necessary to temporarily reduce the bias to zero or even to go to a slightly positive voltage in order to see the highly attenuated trap slots with the oscilloscope vertical gain near maximum.

6. Adjust the 47.25 Mc, 41.25 Mc (Top slug of 1st IF transformer) and 39.75 Mc traps for minimum marker amplitude, See Fig. 17. It can be seen that maximum oscilloscope gain has been used and as a result the top of the response curve has been "run off" the oscilloscope screen in order to see a "blow-up" of the trap slots.

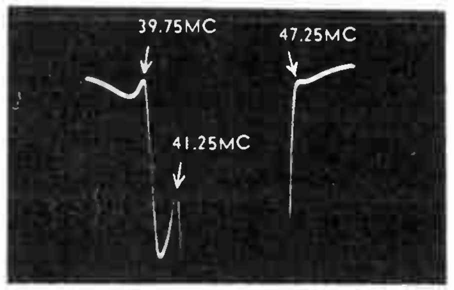


Fig. 17 Exploded View of Traps.

7. Readjust the bias to -2 volts and set the oscilloscope vertical gain to the calibrated position. Adjust the sweep generator for a 3 volt peak to peak output from the video detector.

8. With the test equipment set up as in Step 7, alternately adjust the 2nd IF, 3rd IF, 1st IF and the converter plate coil until an overall response curve similar to Fig. 18 is obtained. Do not adjust the 4th IF in this step. It will be found that the 2nd IF affects the low side (42.75 Mc) and the 3rd IF the high side of the response curve.

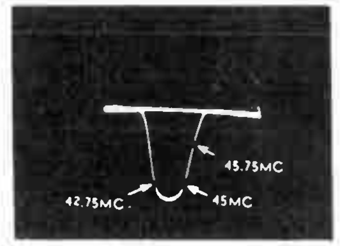
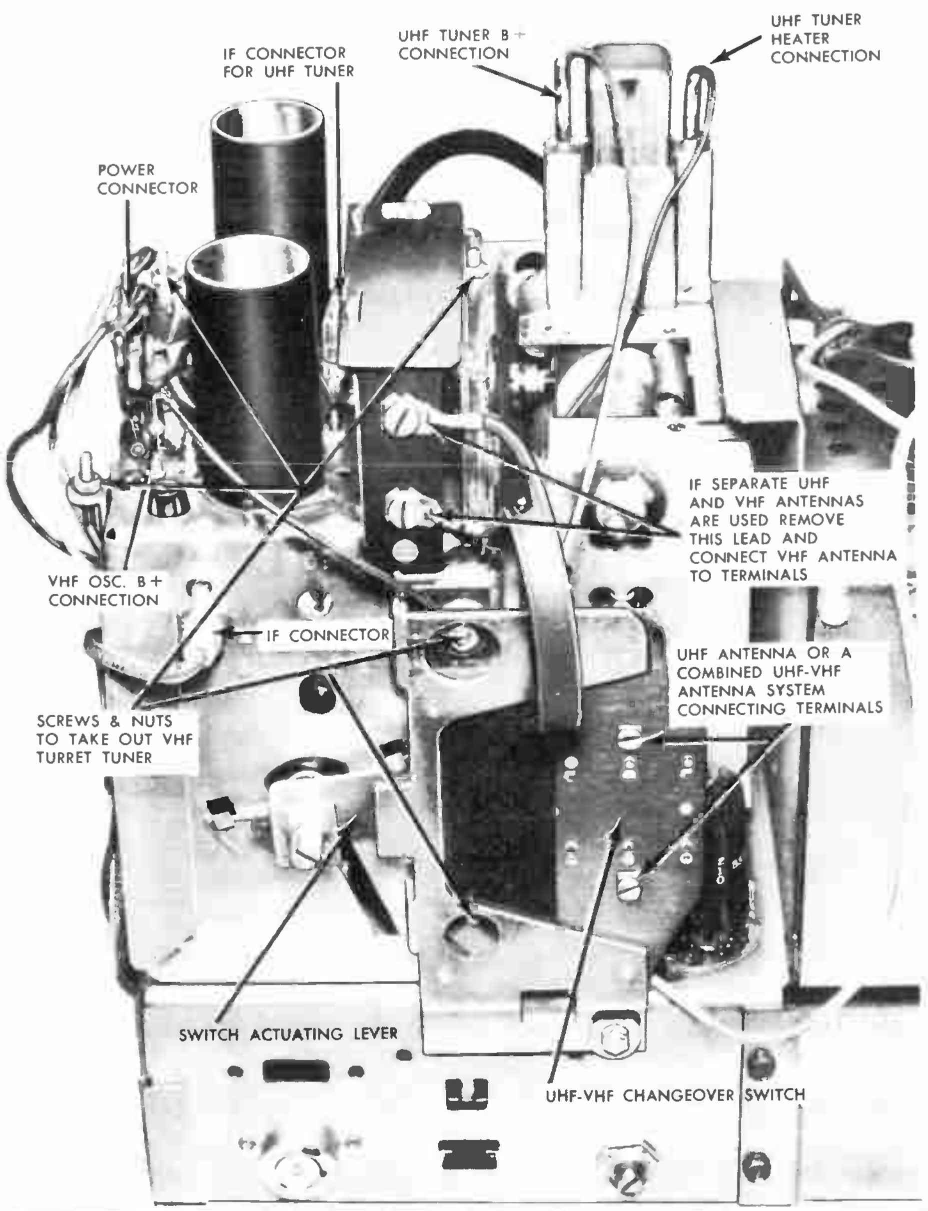


Fig. 18 Overall IF Response.

TURRET TUNER ALIGNMENT

The RF chassis adjustments have been made at the factory and normally do not require readjustment in the field unless tampered with. If adjustment becomes necessary check the overall IF response and proceed as follows:

1. Temporarily ground the turret AGC by connecting a jumper between the AGC bus (yellow lead) and chassis. (If sufficient output from the signal generator is available moderately better results may be obtained with 2 volts of bias.)



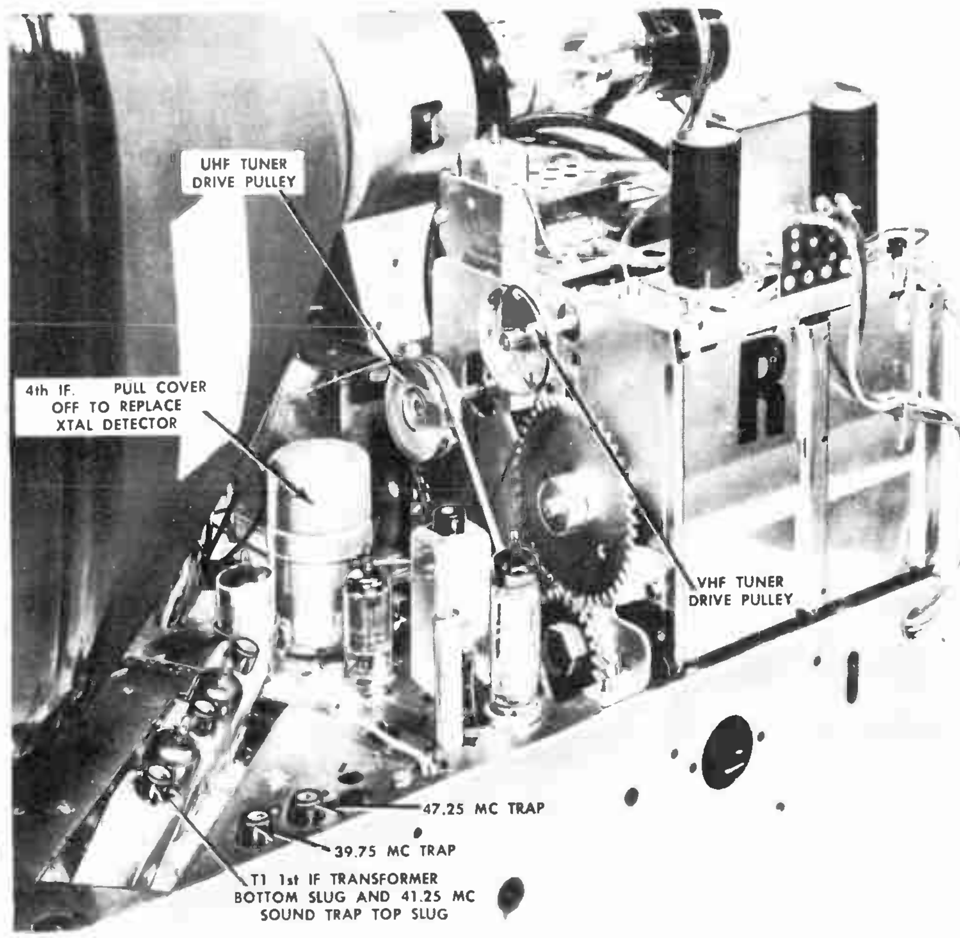


Fig. 15 Front and Rear views of S21845 VHF-UHF Tuners Used in "U" Models

2. Connect the calibrated oscilloscope to the feed through terminal "H" (Fig. 4) through a 10K isolation resistor. This terminal is the screen of the 6U8 mixer.

3. Use a 50 to 300 ohm matching transformer (Fig. 14) and feed the output from the sweep generator to the antenna terminals of the receiver.

4. Turn the channel selector to Channel 4 and adjust the sweep generator until a response curve somewhat similar to Fig. 19 is obtained.

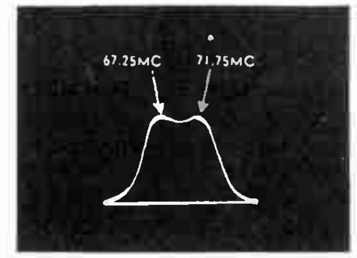


Fig. 19 Channel 4 RF Response.

5. Study Fig. 4 and adjust the converter grid capacitor (C9), the RF plate capacitor (C8) and the RF grid capacitor (C5) until a response curve similar to Fig. 19 is obtained.

6. Turn the channel selector to Channel 11 and adjust the sweep generator until a response somewhat similar to Fig. 20 is obtained. Adjust L5 and L6 to obtain symmetry. If the band pass is too great or too narrow also adjust L7.

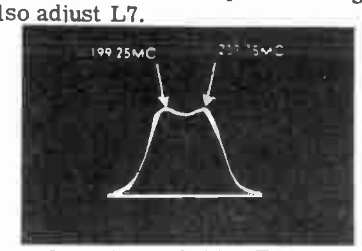


Fig. 20 Channel 11 RF Response.

7. Repeat steps 5 and 6 until the best overall symmetry is obtained. REMOVE AGC JUMPER.

MASTER OSCILLATOR ALIGNMENT

The master oscillator adjustment is to be made only if resonance cannot be obtained with the strip oscillator adjustment wrench with the fine tuning control in its center position, and after it has been determined that the channel strip itself is not at fault.

If channels 2 through 6 can be made to resonate with the bull's-eye adjustment at the rear of the turret and the high channels do not resonate, a slight readjustment of the oscillator inductance L10 (See Fig. 4) may be necessary to affect resonance on the high channels.

S21700 UHF TUNER ALIGNMENT PROCEDURE

The Zenith continuous tuner has been aligned at the factory with precision test equipment. Adjustments should not be attempted in the field unless adequate test equipment is available. It must be remembered that any attempt to peak any one particular channel will usually cause serious degradation of the other channels. If alignment becomes necessary, use a sweep generator, marker and oscilloscope and proceed as follows:

1. Switch the receiver to the UHF position. In this position the UHF pilot light will light up.
2. Through the matching network illustrated in Fig.21 feed the sweep generator to the UHF antenna terminals.
3. Set the UHF tuning knob to channel 54. When this is done, the rocker arm on the tuner should be in the horizontal position. If the rocker arm is not in this position loosen the set screw on the drive pulley and turn the tuner shaft independently of the pulley until the arm is in the horizontal position with the channel indicator on channel 54. Tighten the set screw.

4. Use a marker generator and check calibration on channels 14, 54 and 83. Do not adjust the oscillator unless the calibration is off more than 3 channels. If the calibration is incorrect, the following steps are necessary.

5. Connect an oscilloscope to terminal "D" and 2 volts bias to terminal "E" (Fig. 27). Feed a FM signal to the UHF tuner and adjust sweep to obtain a band pass on channel 54 similar to Fig. 22. Set the positioning adjustments (Fig. 23) so that the channel 54 video marker (711.25 Mc) falls at the 50% point on

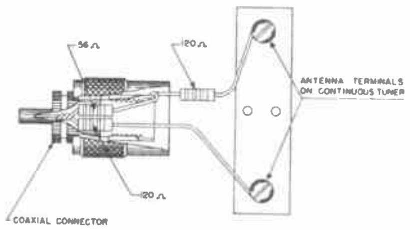


Fig. 21 Matching Network Required for UHF alignment.

the response curve. When adjusting the oscillator, the image (weaker response) and the fundamental will appear. The proper response is towards the counterclockwise position of the oscillator positioning adjustment. Use just enough signal from the sweep generator to obtain 3 volts peak detector output.

6. Turn the UHF tuning indicator to channel 14. Adjust sweep to obtain response as in step 5 and check calibration. If the oscillator is off more than 3 channels, use a pair of slip joint pliers and adjust

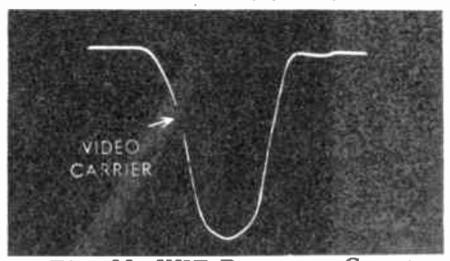


Fig. 22 UHF Response Curve.

the oscillator travel adjustments to scale. When adjusting the travel adjustments, it is possible to move the rocker arm out of its bearing and get an incorrect setting. Check to see that the rocker arm remains seated at all times. After the oscillator is adjusted, set the mixer and antenna travel adjustments for maximum response.

7. Turn the UHF tuning indicator to channel 83 and check for calibration as on channels 54 and 14. Set C94 to scale and adjust C92 and C89 for maximum response.

8. Check calibration on channels 14, 54 and 83. It may be necessary to repeat the above steps to obtain best overall performance.

NOTE: If a high output sweep generator is available, it is unnecessary to go through the IF when aligning the UHF tuner. The output can be viewed at terminal "F" (Fig. 33) by use of an oscilloscope demodulator probe. The adjustments are then made so that the sound and picture carriers appear symmetrical (as in Fig. 20).

SPECIAL TEST EQUIPMENT FOR TV

11-118	9ft. AC Test Cord
68-13	Alignment Tool
68-14	Tuning Wand
68-19	Nylon Alignment Wrench
68-20	Nylon Alignment Wrench
68-21	Nylon Alignment Wrench

SCHEMATIC DIAGRAMS AND PARTS LISTS FOR RADIO CHASSIS USED IN TV COMBINATIONS ARE SEPARATE ITEMS WHICH CAN BE OBTAINED FROM YOUR ZENITH DISTRIBUTOR.

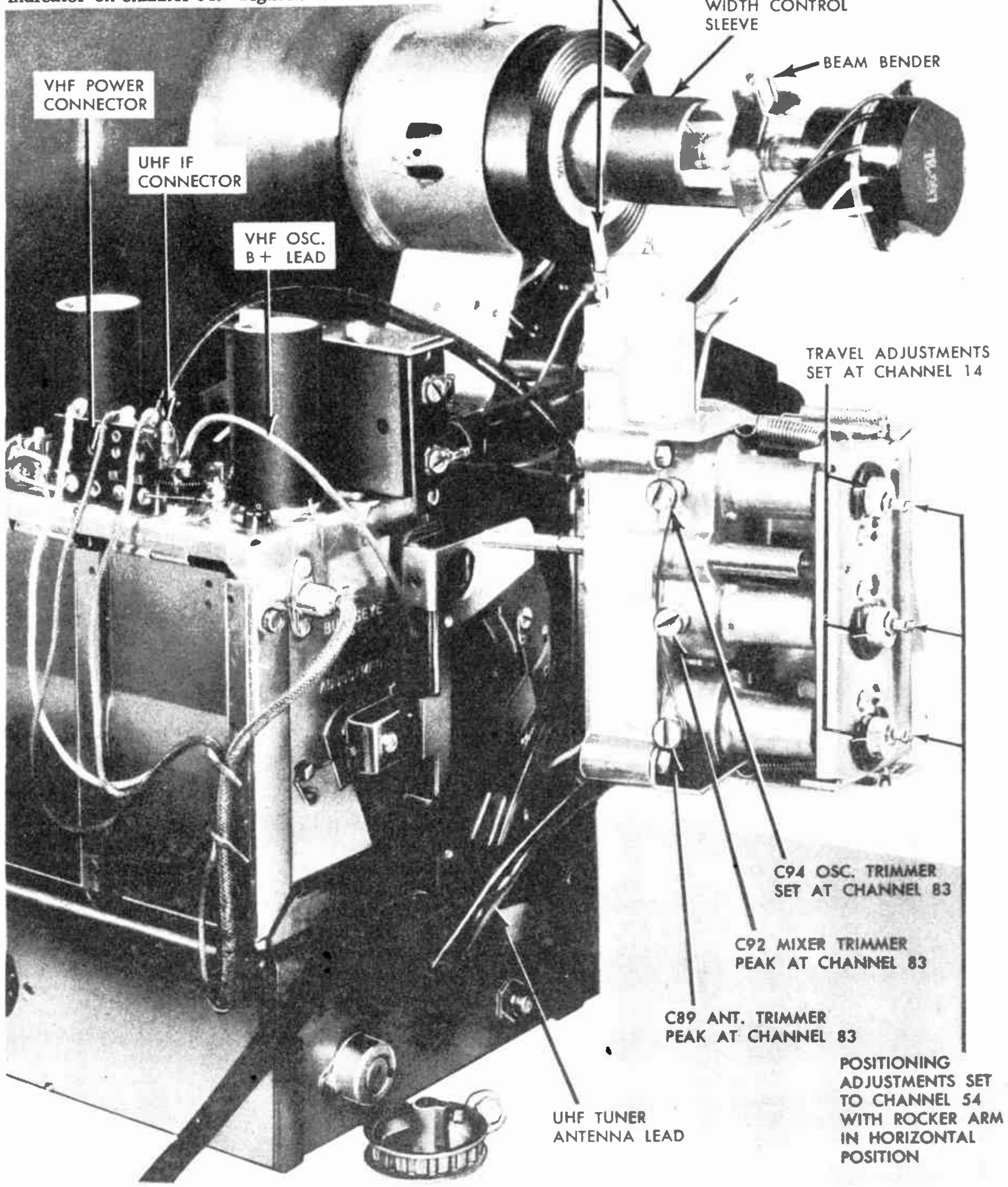


Fig. 23 S21864 UHF Tuner Removed for Servicing.

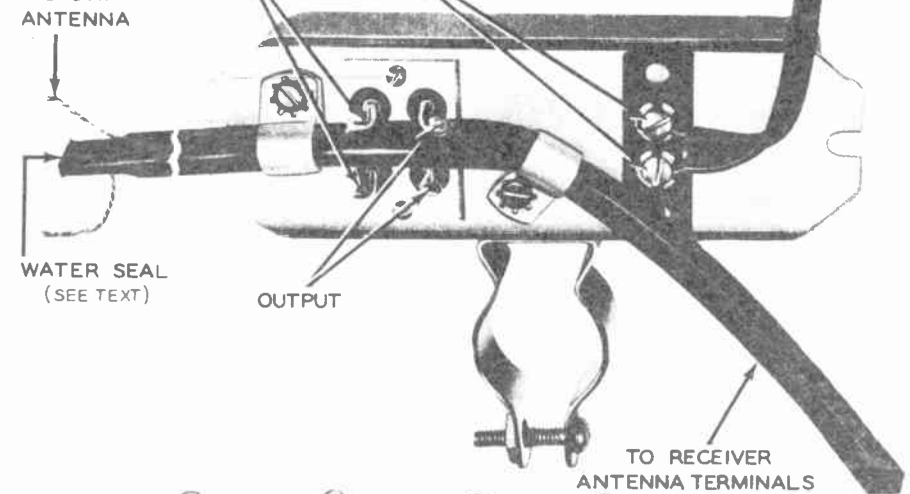


Fig. 24 S-19674 Zenith Diplexer.

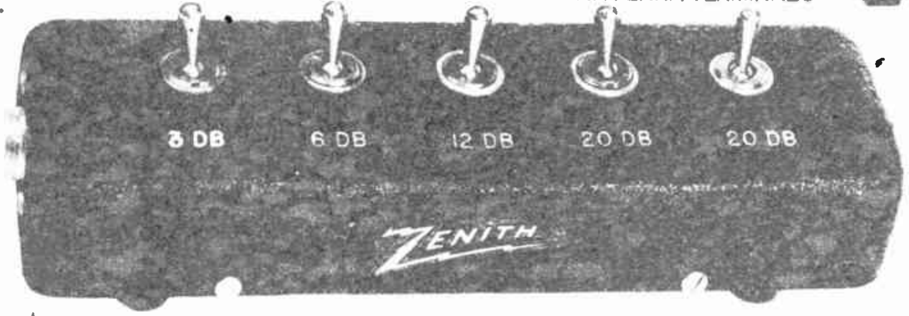


Fig. 25 S-17203 Zenith Step Attenuator.