RCA

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Test Equipment Applications

A Source of Modulated RF Tunable to all TV VHF Channels

The problem

☐ A trouble symptom which occurs on only *one or two* of the active channels of a television receiver can be caused by abnormal performance of the receiver, a defective or inadequate antenna system or an inadequate broadcast signal.

The solution

Determining whether the cause of this type of trouble is in the receiver or external to it is simplified if you have available a source of modulated RF which will produce an interpretable, stable pattern on the screen of the receiver on *all* active channels. This will enable you to verify quickly whether or not the receiver is capable of producing an acceptable picture on all active channels when a fixed, known level of RF is applied to the antenna terminals. If under these conditions the receiver *does* produce an acceptable display on each channel, the source of the trouble is external to the receiver.

A suitable source of modulated RF

A modulated RF signal particularly suited for screen and/or waveform analysis of receiver performance on *all* VHF channels and many UHF channels can be obtained by modulating the tunable RF output of the RCA WR-99A Crystal-Calibrated Marker Generator with the video output of the RCA WR-515A Master Chro-Bar Signalyst.

The modulated RF output produced by "mating" these two RCA test instruments is particularly useful for this application because:

- The variable frequency oscillator (VFO) of the WR-99A can be tuned to the video carrier frequency of *all* VHF channels, and, through the use of harmonics, it also can be tuned to the video carrier frequency of UHF channels.
- The crystal-controlled calibration feature of the WR-99A makes the VFO tuning accurate to within .01% of the 1-MHz point nearest the video carrier frequency. (The video and sound carrier frequencies of all TV VHF channels are indicated on the tuning scales of the WR-99A.)
- The level of the RF output of the WR-99A is at least 100 mv (rms) on all frequencies produced by the generator and can be reduced in 5 dB steps to 60 dB, which is at or below the noise level of television receivers.
- All of the patterns available from the WR-515A can be produced on the screen of the receiver, including color bars, superpulse, crosshatch, vertical lines, horizontal lines, and dots, plus a blank raster.

Connecting the equipment

The method of interconnecting the WR-99A, the WR-515A and the antenna terminals of the receiver is shown in the accompanying illustration.

1) Bend back the leads of an 82-ohm, 1-watt resistor and insert them into the MOD IN and GND jacks of the WR-99A. (A 1-watt resistor is recommended because the diameter of the leads, when bent back, fit snugly into the jacks of the WR-99A.)

2) Connect one end of a shielded cable to the VIDEO OUTPUT jack of the WR-515A, and connect the other end to a WG-430A or WG-458A direct adapter

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3) Connect the RED lead of the adapter to the resistor lead which is inserted into the MOD IN jack of the WR-99A, and connect the BLACK lead of the adapter to the resistor lead which is inserted into the GND jack

4) Connect one end of a WG-428A adapter to the OUTPUT connection of the WR-99A

5) Connect a shielded cable between the other end of the WG-428A adapter and the "cable" end of a WG-451A 75-300 ohm adapter

6) When checking VHF channels, connect the "output" leads of the WG-451A adapter to the VHF 300-ohm antenna terminals of the receiver. When checking UHF channels, connect the "output" leads to the UHF 300-ohm antenna terminals.

Tuning the equipment to a VHF channel

1) Calibrate the WR-99A to the 10-MHz and 1-MHz points nearest the video carrier frequency of the desired VHF channel. (Positions corresponding to the video (P) and sound (S) carrier frequencies are marked on the tuning scales of the WR-99A. These frequencies also are listed in an accompanying chart.)

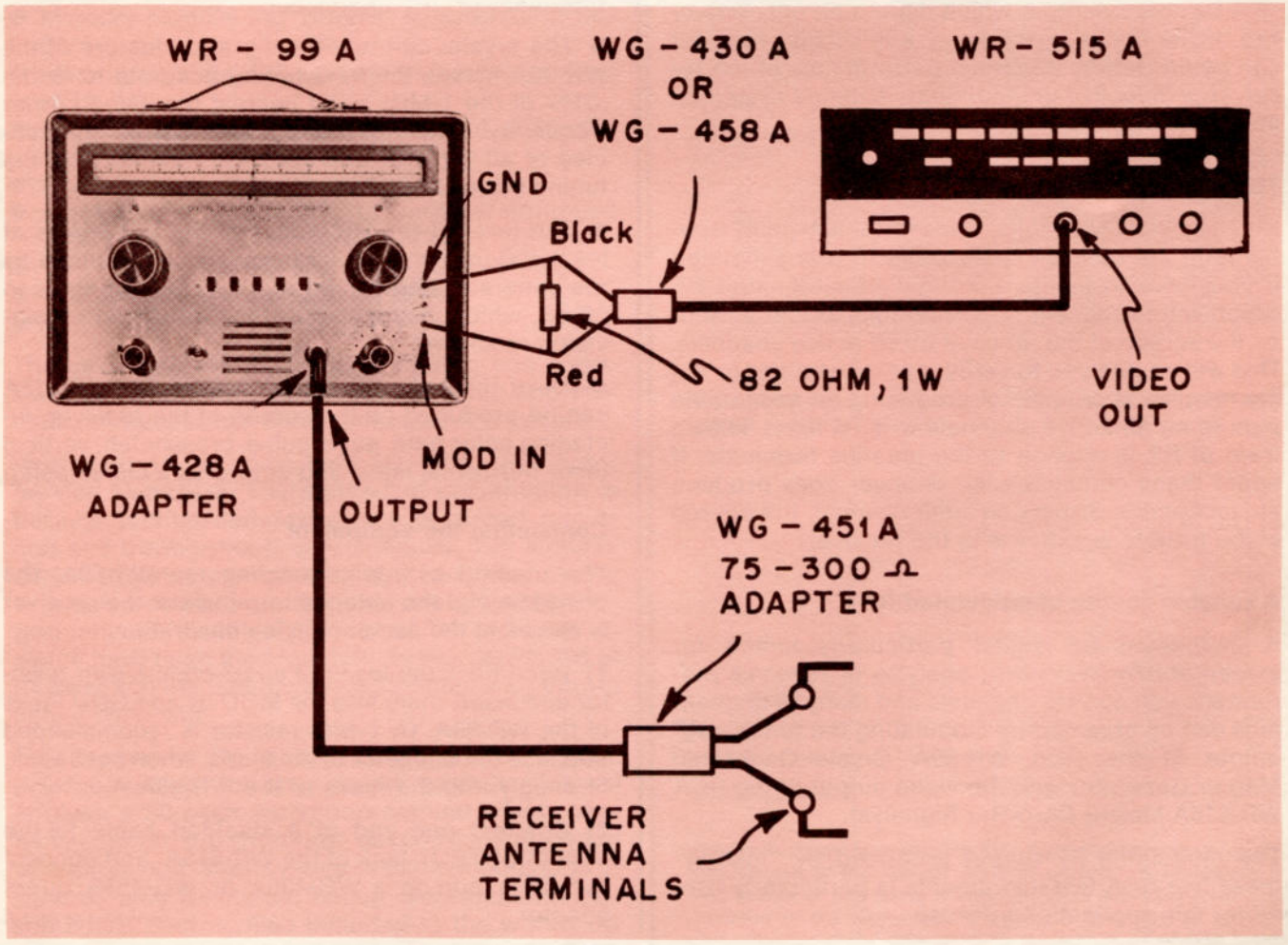
2) With the RF TUNING control, position the frequency-scale pointer of the WR-99A to the video carrier (P) frequency of the desired VHF channel.

3) Be sure all five output-attenuator switches on the front panel of the WR-99A are in the up (no attenuation) position

4) Rotate the VIDEO LEVEL control of the WR-515A completely clockwise, for maximum positive (+) video output

5) Select the desired screen pattern by pushing in the associated button(s) on the front panel of the WR-515A

6) Rotate the VHF CHANNEL SELECTOR of the receiver to the desired channel and adjust the fine tuning and other "customer" controls to produce the best screen display.



Functional diagram showing interconnection of WR-515A, WR-99A and antenna terminals of receiver

TV VHF CHANNEL FREQUENCIES

VHF Channel	Channel Freq. (MHz)	Video-Carrier Freq. (MHz)	Sound-Carrier Freq. (MHz)
2	54-60	55.25	59.75
3	60-66	61.25	65.75
4	66-72	67.25	71.75
5	76-82	77.25	81.75
6	82-88	83.25	87.75
7	174-180	175.25	179.75
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75

TV UHF CHANNEL FREQUENCIES

Examples of relationship of WR-99A fundamental, harmonic and UHF video carrier frequencies

UHF Channel	WR-99A Fundamental Frequency (Approx.)	Harmonic Used	Video Carrier Frequency
14	235.62 MHz	2nd	471.25 MHz
30	141.81 MHz	4th	567.25 MHz
53	235.08 MHz	3rd	705.25 MHz
70	201.81 MHz	4th	807.25 MHz
78	142.81 MHz	6th	855.25 MHz
83	221.31 MHz	4th	885.25 MHz

Tuning the equipment to a UHF channel

Although the fundamental frequency range of the WR-99A does not extend up to the TV UHF frequencies, the video carrier frequency of UHF channels can be produced by using various harmonics of the fundamental frequencies available from the WR-99A. The approximate WR-99A VFO frequencies and related harmonics used to produce the video carrier frequency of six UHF channels are listed in an accompanying chart.

The equipment is tuned to produce modulated UHF video carrier frequencies in the same manner as described for VHF channels except that 1) the VFO of the WR-99A is calibrated and tuned to the fundamental frequency of the desired harmonic, and 2) the "output" leads of adapter WG-451 are connected to the UHF 300-ohm antenna terminals. The receiver then is tuned in the same manner as for an off-the-air UHF signal.

Evaluating receiver performance on each channel

The performance of the receiver can be evaluated by analyzing and comparing the pattern(s) displayed on the screen on each channel or it can be evaluated by waveform analysis.

The particular pattern(s) and areas of the pattern(s) which should be displayed and analyzed depend on the type of trouble symptom. For example, if the trouble symptom with an off-the-air signal is weak or no color on a particular channel, the color-bar pattern probably should be used first to determine whether or not normal color is displayed with RF input from the WR-99A/WR-515A test setup. If it is, the cause of the trouble symptom is external to the receiver.

Specific "one-channel" trouble symptoms and methods of using the WR-99A/WR-515A test setup to localize and isolate the causes will be described in future issues of *Plain Talk.* □

RCA Television Workshop 11
Color TV Electronic Control Systems

Television Workshop 11 is a new hands-on field training program which acquaints technicians with the circuit operation and servicing of remote control systems used with nineteen of the most recent RCA color TV chassis.

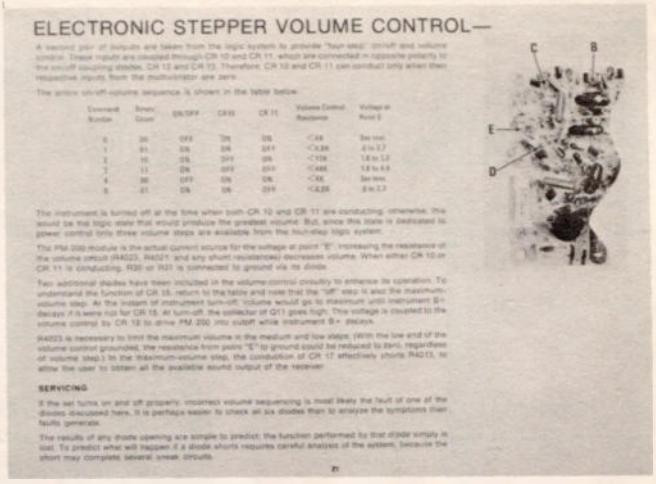
The emphasis of Workshop 11 is on the electronic control circuits which have replaced most of the motors and relays previously used to control receiver functions such as on/off, volume, color and tint. These circuits include:

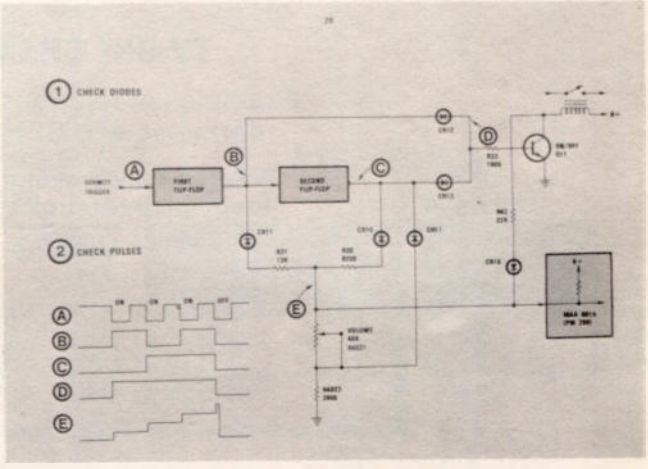
- Single-flip-flop on/off (CTC 48/54/60/64)
- Double-flip-flop on/off/volume (CTC 51/52/53/63/68/71)
- Memory-module DC volume control (CTC 48/60/64)
- Memory-module DC volume/color/tint control (CTC 54)
- Memory-module DC volume control (CTC 42/43/44/46/55/59)
- One-direction channel change
- Electronic programming of varactor-equipped UHF Tuners (CTC 48/60/63/68/71)
- Two-direction channel change (CTC 54/64)
- VHF-to-UHF switching (CTC 39/40)
- VHF-to-UHF switching (CTC 44)

The circuit operation, troubleshooting and alignment of remote receivers and electronic and mechanical transmitter hand units also are covered.

Workshop 11 is conducted by RCA Distributor Service Managers. The method of presentation is through lecture/demonstrations of circuit operation and troubleshooting techniques. The lecture/demonstrations are followed by hands-on training in which workshop participants are given the opportunity to troubleshoot color TV receivers in which have been inserted defects representative of those which the technician might encounter during actual servicing.

To supplement the lecture/demonstration and to provide material for later review, each participant is given a 50-page workshop manual which contains concise, but thorough, descriptions of circuit operation and step-by-step troubleshooting procedures plus functional circuit diagrams and circuit board photos. Also included in the workshop manual are two tear-out, self-stick inserts on which are listed the control frequencies of the remote systems used with each of the nineteen chassis covered by Workshop 11. □


ELECTRONIC STEPPER VOLUME CONTROL—



Shown here are two pages of the 50-page manual given participants in Workshop 11.

CHASSIS — FREQUENCY (kHz) & FUNCTIONS

	27.25	28.75	34.25	35.75	37.25	38.75	40.25	41.75	43.25	44.75
CTC 54	ACM	ON/OFF	TINT ▲	TINT ▼	COLOR▼	VOL ▼	CHAN ▼	CHAN ▲	VOL ▲	COLOR▲
CTC 44		ON/OFF	TINT ▲	TINT ▼	COLOR▼	VOL ▼	VHF CHAN	UHF CHAN	VOL ▲	COLOR▲
CTC 38/39/40			TINT ▲	TINT ▼	COLOR▼	VOL ▼	VHF CHAN	UHF CHAN	VOL ▲	COLOR▲
CTC 64						VOL ▼	CHAN ▼	ON/OFF	CHAN ▲	VOL ▲
CTC 42/43/46/48 55/59/60						VOL ▼	CHAN	ON/OFF	VOL ▼	
CTC 52/53/63 68/71								CHAN		VOL ON/OFF
CTC 52/55 MECH.				CHAN ON/OFF						

The table shown here lists the functions and associated control frequencies of the remote systems covered in Workshop 11. Two copies of this table, printed on small self-stick sheets, are included in the Workshop 11 manual. They can be removed and attached to the CRK 14 (CTC 54) remote hand unit, which, because it generates all frequencies listed in the table, can be used as a "universal substitute test unit" for checking the operation of all other hand units used with the remote systems covered in Workshop 11.