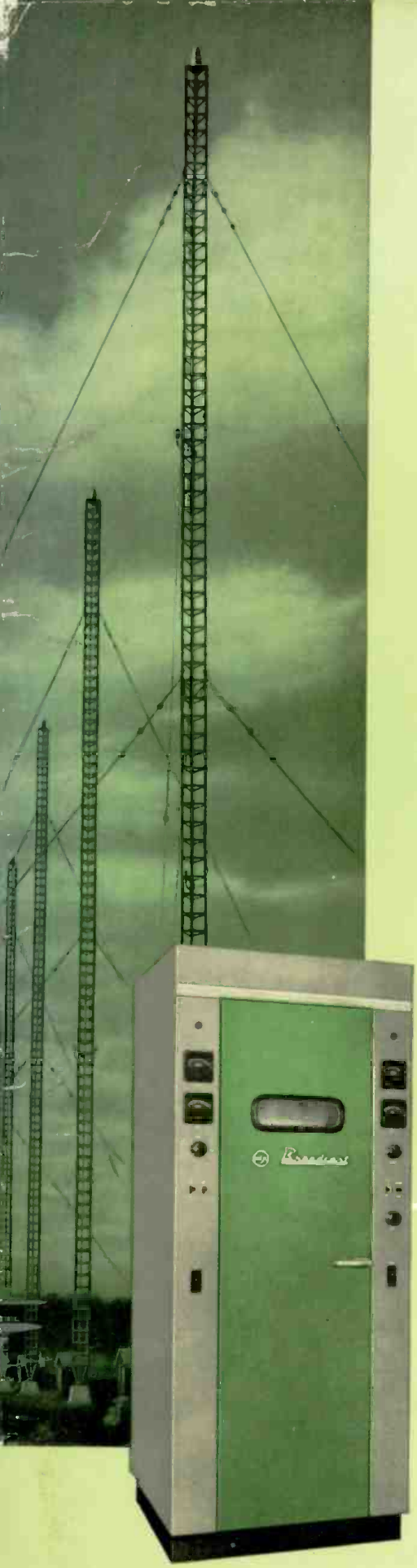


BROADCAST TRANSMITTING EQUIPMENT FOR AM · FM · RADIO

(THIRD EDITION)

AM TRANSMITTERS
REMOTE CONTROL
PHASING
LINE TERMINATING
INPUT & MONITORING
TRANSMISSION LINES
TOWERS
ACCESSORIES

BROADCAST AM-FM TRANSMITTING EQUIPMENT CATALOG

(Third Edition)

PRICE $1.00

Page

RADIO CORPORATION OF AMERICA

Broadcast and Television Equipment Camden 2, N. J.

ABOUT THIS CATALOG

This Catalog is devoted solely to information on RCA radio broadcast equipment designed especially for AM-FM broadcast station use. Other RCA Broadcast Equipment Catalogs contain similar information on audio equipment, TV transmitters, TV cameras, lighting and mobile equipment, TV tape and film equipment, TV terminal, switching and microwave equipment, TV antennas and TV transmission line.

The information contained in this catalog is intended to serve as a buying guide for the user. Complete specifications and ordering information are supplied. For more information on equipment items, or planning assistance, write to the RCA Broadcast Representative in the nearest RCA Sales Office (see Back Cover).

OTHER RCA TECHNICAL PRODUCTS

The RCA equipment described in this catalog is specifically designed for broadcast use, RCA also manufactures many other electronic products, including: two-way radio and microwave relay communications equipment; optical and magnetic film recording equipment; sound systems of all types; 16mm projectors and magnetic recorders; industrial inspection and automation equipment; scientific instruments, such as the electron microscope; closed-circuit television systems; and many types of custom-built equipment for industry, the military, educational and medical services. Information describing these products may be obtained from RCA Sales Offices.

PRICES

The prices of the various equipment units shown in this catalog are given in a separate price list. Prices are listed in the order in which they are shown in the catalog. To determine the price of any equipment first note the page on which it is shown in the catalog, then consult the price list in accordance with this page number. Equipments are identified by type and MI (Master Item) numbers which are used to identify apparatus on invoices and packing slips.

HOW TO ORDER

The RCA AM and FM transmitting equipment shown in this catalog is sold directly through RCA Broadcast Representatives, who are familiar with broadcast equipment and related problems. These RCA Representatives are located in convenient offices. Orders for equipment shown in this catalog, or requests for additional information, should be directed to the nearest RCA Sales Office.

1 KW AM Broadcast Transmitter

TYPE BTA-1R1

FEATURES

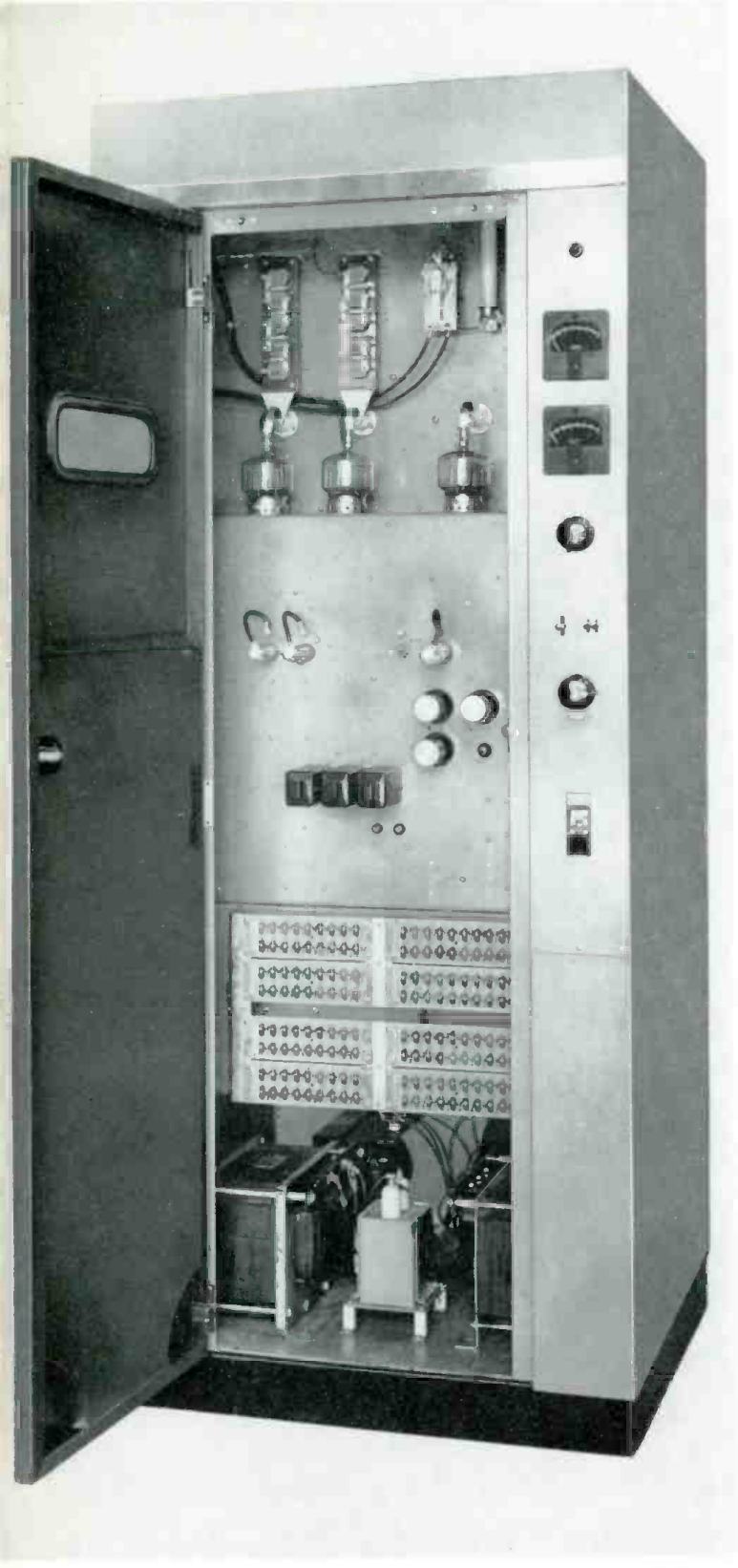
- Lowest power consumption
- Simple to operate—only one tuning control
- Excellent frequency response
- Low distortion and noise level
- No neutralization
- Built-in remote control provision for main, stand-by or Conelrad switching
- Fewer tubes—fewer tube types
- Built-in power cutback
- Circuit breaker overload protection
- Tuned on customer frequency

DESCRIPTION

Years ahead in design and performance, the RCA Type BTA-1R1 AM Broadcast Transmitter is designed to provide high quality amplitude modulated signal at any frequency in the standard broadcast band between 535 kc and 1620 kc. The nominal power output rating is 1000 watts, however, it is capable of producing a maximum of 1100 watts to compensate for losses in the antenna tuning equipment. The equipment will meet all requirements of the FCC and EIA pertaining to this class of equipment.

For truly low operating costs, the BTA-1R1 has few equals. It consumes only 3200 watts at average modulation and about 3900 watts at 100 per cent modulation. Tube costs have been kept low by using fewer tubes and fewer tube types throughout—thus replacement costs are lowered. The BTA-1R1 is a top value for any station from 250 to 1000 watts.

The transmitter is designed to provide improved performance, ease of tuning, simplified installation, and low cost performance. Modern trends in AM radio broadcasting including increased power and remote control require-



BTA-1R1 Transmitter with front door open showing accessibility of tubes and components. Power Amplifier and Modulator tubes are shown on top chassis; below is exciter chassis. All normal operating controls are shown on two side panels.

ments together with all-around economy and dependability are also featured in the BTA-1R1. Tetrodes have been utilized throughout the r-f section of the transmitter to eliminate need of neutralization.

Improved functional design provides a choice of color combinations to harmonize with studio color schemes. Square construction permits locating the transmitter against the wall, or it can be butted against other equipment. The vertical construction makes it accessible from both front and rear for ease of maintenance. A single front panel tuning control provides easiest operation. Remote control provisions permit unattended operation of the transmitter. Also included in the design, with the addition of accessories, is remote Conelrad switching.

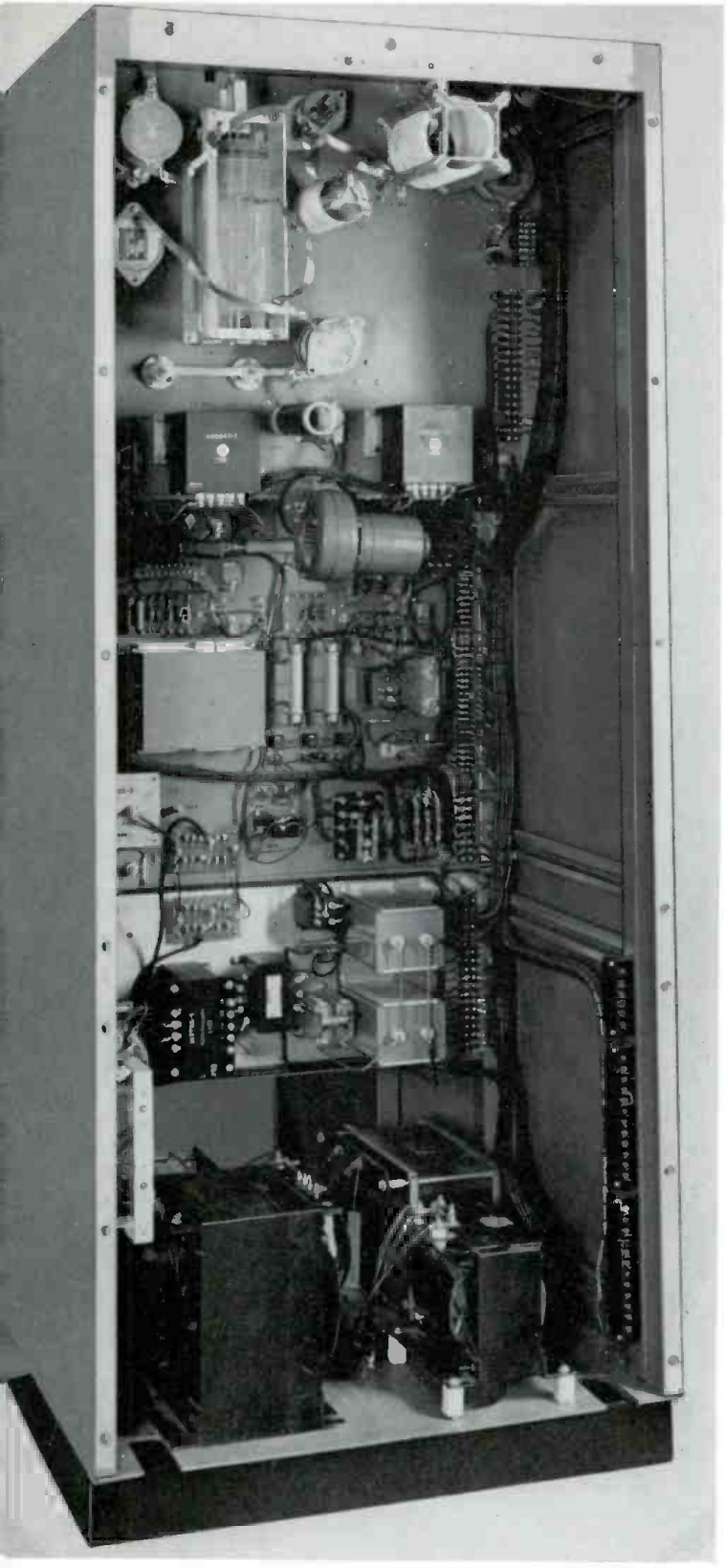
When the transmitter is equipped with a Conelrad Kit, the output circuit is switched to a simple parallel resonant tank circuit during Conelrad operation, with the r-f output tapped directly off the coil.

The BTA-1R1 easily fits into operations where power reduction at night is required. For "day-night" operation the transmitter incorporates a built-in power cutback system. By pressing a switch on the front or at a remote panel, the transmitter can be cut back in power to either 500 or 250 watts.

The entire transmitter is housed in a single aluminized steel cabinet. The cabinet consists of two end panels with the fronts formed to provide control panels mounted on a sturdy welded steel base. Vertical center chassis are fastened between the end panels to form a basic H-cross section. Attractively colored doors are available in red and umber gray. A hinged front door is located between the two control panels. Rear access is provided by two interlocked removable panels. Control components are conveniently located on the control panels on both sides of the front door and all meters are at eye level.

Most BTA-1R1 components are mounted on a vertical center chassis which provides extremely good accessibility. Tubes and overload relays are mounted on the front and the other components are mounted on the rear of these chassis. Larger power components are mounted on the base.

New design techniques utilized in the BTA-1R1 provide simplified tuning, reduced installation time and expense. Three power supplies are used: a low voltage supply for plate and screen voltages of all low voltage tubes, a bias supply for the modulator tubes and a high voltage supply for the modulator and power amplifier tubes. All power



Rear view of BTA-1R1, with rear panels removed, showing vertical construction and accessibility of component parts.

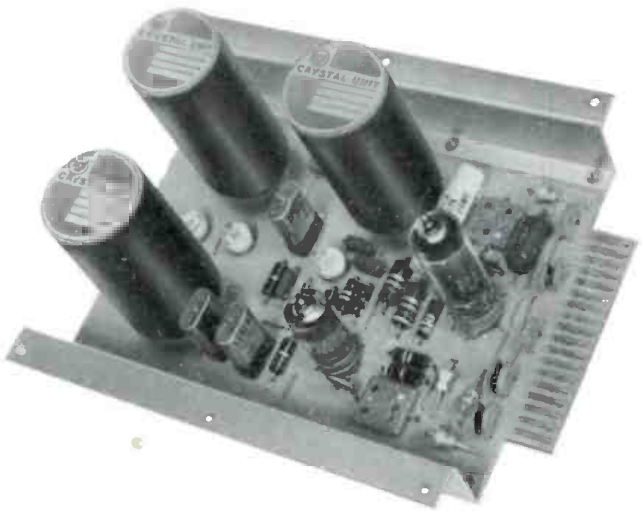
supplies use silicon diodes which results in lower power drain, cooler operation and more reliable performance.

The transmitter operates from a 208-240 volt, 60 cycle, single phase power source for the main power. In addition the crystal heaters require an additional 115 volt, 50/60 cycle, a-c power input. The Transmitter can be modified for operation on 50 cycle a-c current if desired.

The BTA-1R transmitter uses a MI-27632-A Crystal Oscillator which has provisions for three switchable TMV-130B temperature controlled crystal units. These units maintain the frequency constant to within plus or minus five cycles. The three crystals are intended for main, standby and Conelrad operation. Selection of the desired crystal is by means of front panel switches and latching relays. The oscillator employs a broadband circuit with no adjustments, and uses an RCA 6AK5 oscillator tube and an RCA 5763 buffer tube.

The buffer feeds a single 6146 driver tube which in turn feeds the power amplifier which consists of two 4-400A tubes connected in parallel. Neutralization is not required since all tubes are tetrodes.

The modulator comprises two 2E26 tubes in push-pull, resistance coupled to two 4-400A modulator tubes. The modulator tubes operate as a class AB_1 amplifier without grid current which results in an overall distortion of less than 2 per cent up to 10,000 cycles.



View of oscillator chassis. The terminal strip on right contains all of the oscillator connections. The three crystals are switchable from a front panel control.

SPECIFICATIONS

Performance Specifications

AF Input Impedance	150/600 ohms
AF Input Level (100% modulation)	+10 ±2 dbm
AF Response:	
50-7500 cycles	±1 db
30-10,000 cycles	±1.5 db
30-12,000 cycles	±2.5 db
AF Distortion (95% modulation):	
50-10,000 cycles	2%
50-12,000 cycles	3%
Noise (below 100% modulation)	60 db
Frequency Range	535-1620 kc
Frequency Stability	±5 cycles
Type of Output	Single ended
Carrier Shift (0-100% modulation)	3%
Output Impedance	40-250 ohms

Electrical Specifications

RF Voltage (for frequency monitoring)	10 V RMS 75 ohms
RF Voltage (for modulation monitoring)	10 V RMS 75 ohms
Power Output (nominal)	1000 watts
Power Output Capability	1100 watts
Power Supply	208/240 volts
Line Frequency	60 cycles†
Phase	1
Power Consumption:	
(0% modulation)	2900 watts (approx.)
(100% modulation)	4200 watts (approx.)
(average program modulation)	3100 watts (approx.)
Power Factor	90%
Permissible combined line voltage variation and regulation	±5%
Crystal Heater Power Supply	117 volts 50/60 cycles

Tube Complement

1	6AK5	Crystal Oscillator
1	5763	Buffer
1	6146	Intermediate Power Amplifier
2	2E26	Audio Frequency Amplifier
2	4-400A	Modulator
2	4-400A	Power Amplifier

Mechanical Specifications

Height	84"
Width	34"
Depth	32½" (less door handle)
Weight (net)	1500 pounds (approx.)
Altitude Range	0-5000 ft.
Ambient Operating Temperature:	
(min.)	−20°C (−4°F)
(max.)	+45°C (113°F)

Equipment Supplied

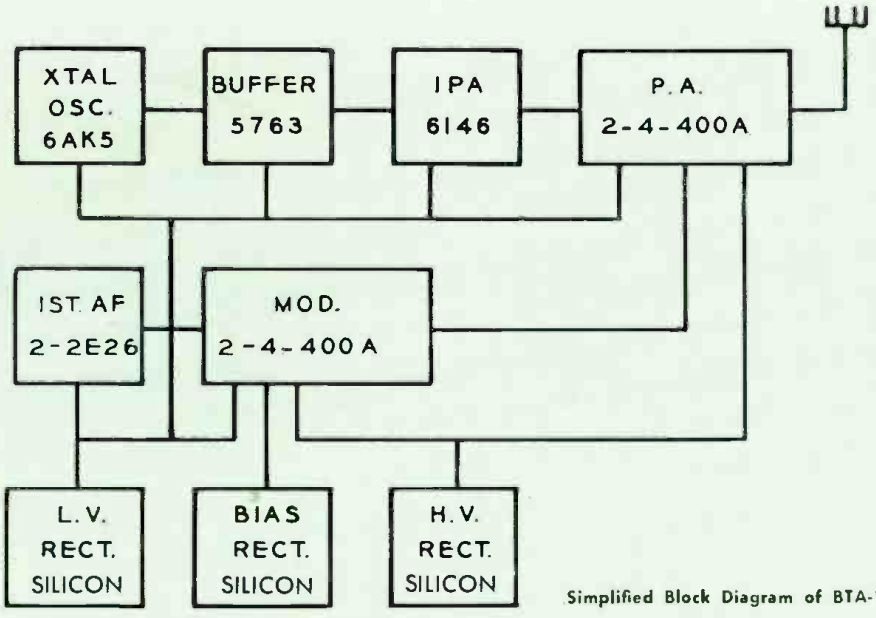
Type BTA-1R1 1000-Watt AM Broadcast Transmitter complete		ES-27238-B
Including the following:		
1	AM Transmitter, Type BTA-1R1	MI-27649-B
1	Touch-Up Finish Kit	MI-27660-B
1	Crystal, Type TMV-130B	MI-27493
1	Set of Operating Tubes	MI-27695-A
1	Set of Frequency Determining Parts	MI-27691
1	Nameplate	MI-28180-1
1	Door, Dark Umber Gray	MI-27645-J2

Accessories

Operating Spare Tube Kit	MI-27695-A
Recommended Minimum Spare Tube Kit	MI-27696-A
Type BTR-11B Remote Control System	ES-34280
Type BTR-20B Remote Control System	ES-34274
Type BW-11A Frequency Monitor	MI-30011-B
Type BW-66F Modulation Monitor	MI-30066-B
Conelrad Kit	ES-34209
RF Output Meters	MI-7157-F Series
Remote Control Metering Panel	MI-27220
Antenna Tuning Equipment	MI-27250
AM "Carrier-Off" Monitor (specify power)	ES-34251
RF Meter Mounting Panel	MI-34656

† 50 cycle operation is possible with a 50 cycle kit.

Allow 30 days for tuning on customer frequency.



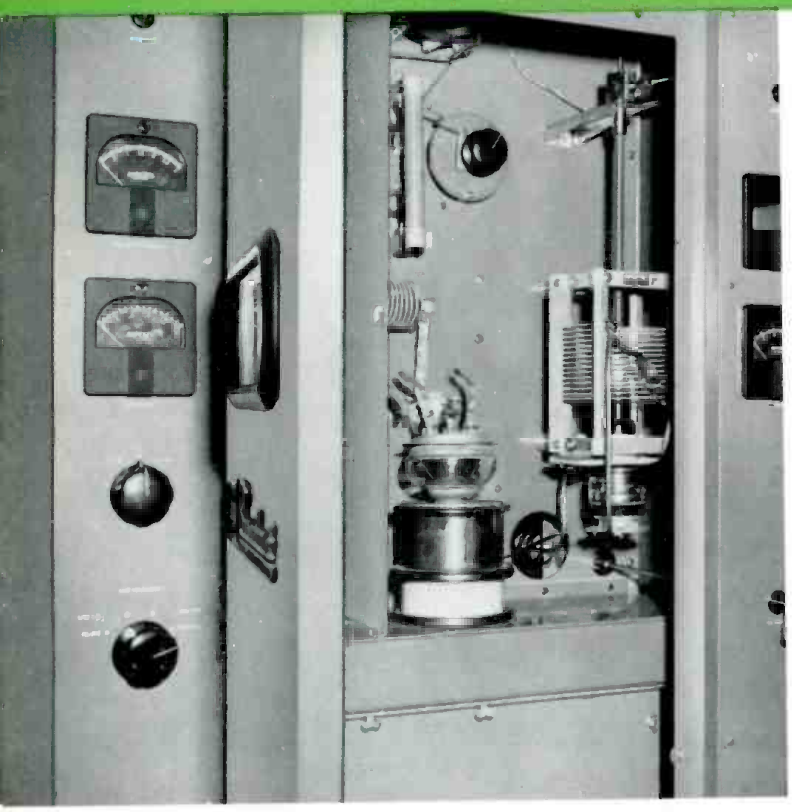
Simplified Block Diagram of BTA-1R1 AM Transmitter.

5 KW AM Broadcast Transmitter

Type BTA-5T

FEATURES

- High efficiency PA—only one long life 5762
- Outstanding performance
- Power economy
- Silicon rectifiers used throughout
- Only two tuning controls
- Broadband neutralization
- Compact size
- Functional styling and decor
- Built-in remote control provisions for main, standby or Conelrad switching



BTA-5T PA stage comprising one 5762 tube used for the high efficiency operation. The coil shown on the right, is the third harmonic coil used in the plate circuit of the PA to increase efficiency by shaping the plate waveform.

DESCRIPTION

The RCA Type BTA-5T AM Broadcast Transmitter is designed to provide an amplitude modulated signal at any frequency in tne standard broadcast band between 535 kc and 1620 kc. The nominal power output rating is 5,000 watts; however, it is capable of producing 5,500 watts to compensate for losses in the antenna tuning equipment. Built-in relays allow remote control of main, standby and Conelrad operations. Conelrad Kit, ES-34245, permits push-button switching of r-f circuits from any operating frequency to either 640 kc or 1240 kc Conelrad frequency. The transmitter meets requirements of the FCC and EIA pertaining to this class of equipment.

The transmitter operates from a 208/240 volt, 60-cycle, three-phase power source for the main power. In addition, the crystal heaters require an additional 115-volt, 50/60-cycle single phase ac power input. The transmitter can be modified for operation on 50-cycle ac current. Simplified power change to 1 kilowatt or 500 watts can be provided, if desired, by Power Cutback Kit MI-34646-A.

New High Efficiency PA

The BTA-5T Transmitter is an air-cooled transmitter featuring a number of RCA's latest developments, including an important development in Class C amplifier design. The new high efficiency plate modulated power amplifier permits a single long-life 5762 tube to deliver the nominal 5 kw with 5.5 kw power output capability because the plate efficiency exceeds that of a conventional class C amplifier by 15 percent. As a result, considerable power savings can be realized. Referring to the simplified schematic, the circuit arrangement is very similar to a conventional class C amplifier, except for the presence of two resonators L_1, C_1 and L_2, C_2. The amplifier is stable and easy to adjust and is the only worthwhile development in class C amplifier design in 20 years. The high-voltage, low-voltage and bias supplies employ silicon type rectifiers throughout. The exciter-driver employs etched circuits, and adjustable broadband circuits for greater operating economies. The equipment also boasts a small-sized, improved plate transformer.

Other new design techniques of the BTA-5T provide simplified tuning, increased safety, longer tube life and improved performance. The transmitter can be tuned from the front panel by only two controls. Provisions for manual or remote control operation are incorporated in the transmitter. All doors and panels are interlocked and grounding switches provide utmost safety for operating personnel. The PA tuning control is located on the front panel. The transmitter is air-cooled, a blower being supplied in the PA cabinet. A delay relay is employed to retain the blower system in operation for one minute after the transmitter has been shut down. This refinement is used to improve tube life and cooling of components.

Improved Mechanical Design

The entire transmitter, except for the plate transformer, is housed in two attractively styled cabinets made of aluminized steel to provide improved magnetic and electrostatic shielding. Each cabinet consists of end panels with wrap-around front edges formed to provide control panels, mounted on a sturdy, welded steel base. Vertical center chassis are fastened between the end panels to form a basic "H" cross section. Hinged, front doors are located between the control panels. Rear access to each cabinet is provided by two removable, interlocked panels. Control components are conveniently located on the panels on both sides of the front doors. All meters are at eye level to facilitate readings.

The matched cabinets are designed to combine an attractive appearance with the utmost in utility. Doors are offered in burgundy red and dark umber gray, to harmonize with station surroundings. Vertical construction permits easier maintenance and service. It also permits installation of the transmitter against a side wall, or allows other equipment to be placed on either side of the cabinet.

The front doors of the transmitter give immediate access to the front of the vertical panels on which circuit components such as tubes, feedback ladders and overload relays are mounted. Remaining components are mounted on the rear of these chassis, while the larger power components are situated in the base of the cabinet. This type of construction provides excellent accessibility.

The left hand cabinet contains the BTA-5T exciter-driver, while the right hand cabinet houses the amplifier, modulator and high voltage rectifier portions of the transmitter. The cabinets require less than 16 square feet of floor space. A plate transfarmer occupies only an additional 3 square feet.

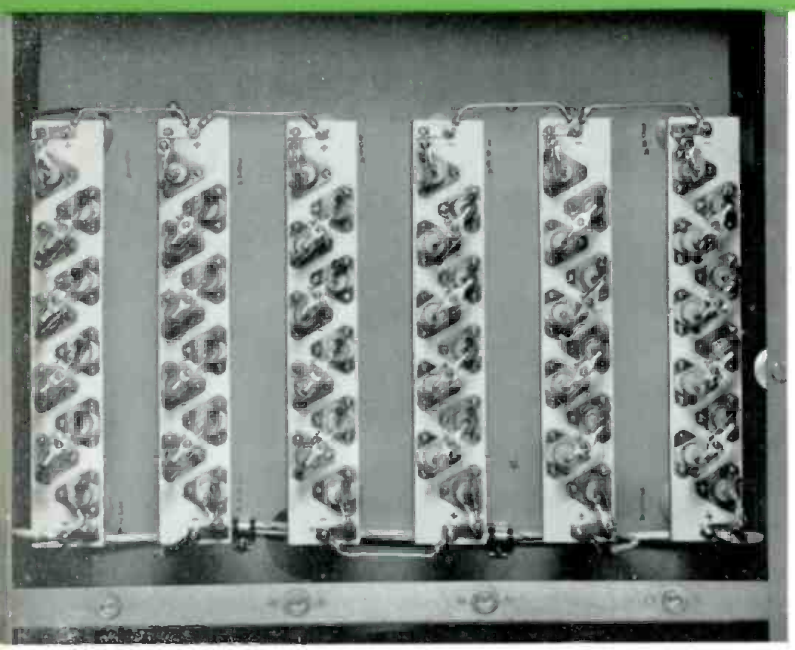
IPA and modulator driver stages of the BTA-5T can be seen at top of open cabinet. The exciter is at the center of the cabinet, and control equipment is placed just below the exciter.

Latest Radio and Audio Frequency Circuit Design

The BTA-5T Transmitter incarparates RCA's new MI-27632-A Crystal Oscillator with three, switchable, temperature-controlled crystal units. Each crystal will remain constant within plus or minus five cycles. The three crystals control main, standby and Conelrad operations. The desired crystal can be selected by means of a front panel switch or by means of a remote-control switch since relays are built into the exciter. The oscillator employs broadband circuits that require no adjustments. A 6AK5 is used as an oscillator tube with a 5763 as the buffer. This unit is built on an etched circuit panel easily accessible for service by removing the cover. The entire oscillator unit can be removed by disconnecting a cable, plug and retaining screws. Also a part of the basic exciter is the 6146 IPA stage which is operated very conservatively and a pair of 2E26 tubes used as the first a-f stage of the modulator circuit.

The output of the 6146 IPA stage is broadband and requires no tuning. It drives a pair of 4-125A tubes where tuning is accomplished by using a slug-tuned coil controlled from the front panel. These tubes, in turn, drive a high-efficiency, long life 5762 output triade. A front panel control of a vacuum variable capacitor tunes the plate circuit.

A new slug-tuned coil was developed for the power output adjustment and it is driven by a reversible motor. The motor is actuated at the front panel or by a remote power output adjustment switch. The second harmonic trap uses a slug-tuned coil, thus eliminating the possibility of contact pitting from high current in the r-f circuit of the transmitter. Neutralization of the 5762 PA stage is achieved by a broadband transformer and a variable vacuum capacitor. The use of a broadband type of transformer holds neutralization over a wide band and prevents spurious oscillation at other frequencies.



Front view of the Silicon Rectifier Chassis of the BTA-5T. The silicon cells offer improved performance since they are particularly resistant to aging, moisture and wide temperature variations.

The modulator of the transmitter consists of a pair of 2E26 tubes located in the exciter portion, resistance coupled to drive a pair of 6155/4-125A second audio frequency amplifiers which, in turn, are resistance coupled to drive a pair of 3X3000F1 modulators. These modulator tubes are low mu triodes, drawing no grid current. They are capable of excellent response and fidelity. Due to the low plate dissipation of the new power amplifier system, the power input of the modulator is also reduced affording appreciable power economies.

Dependable Semiconductor Power Supply

The BTA-5T incorporates 120 silicon-type rectifiers in the high-voltage circuits. This rectifier is ideal not only in a combined operation, but even more so in a remote-control application.

The rectifiers are hermetically sealed so they will not be adversely affected by weather conditions. They can operate at ambient temperatures ranging from —20 degrees C to +45 degrees C and at altitudes up to 7500 feet above sea level. There is no significant aging of the forward drop characteristics. Across each one of the silicon diodes a resistor has been shunted so that they will all share equally the peak inverse voltage rating. RCA specifications have been set higher than EIA standards by adding an additional 30 per cent peak inverse voltage safety factor.

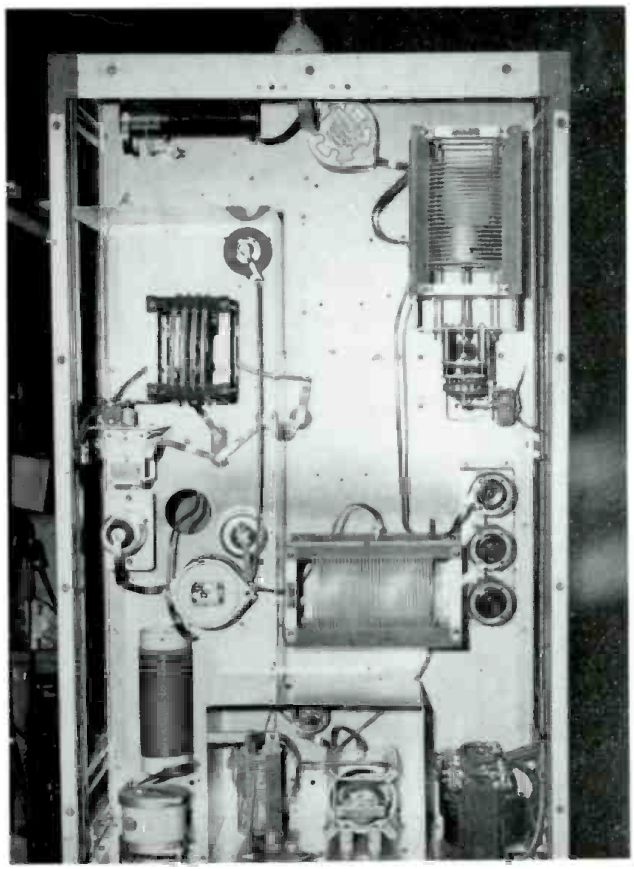
Cooling System

The transmitter is completely air-cooled. Added refinements such as a delay relay have been built-in to keep the blower system in operation for one minute after the transmitter has been shut down. The continued supply of air extends tube life. The exciter cabinet employs air convection cooling. A louvered lower back panel and top grill panel provide good ventilation. In the second cabinet a blower air system distributes air to the modulator and PA tubes.

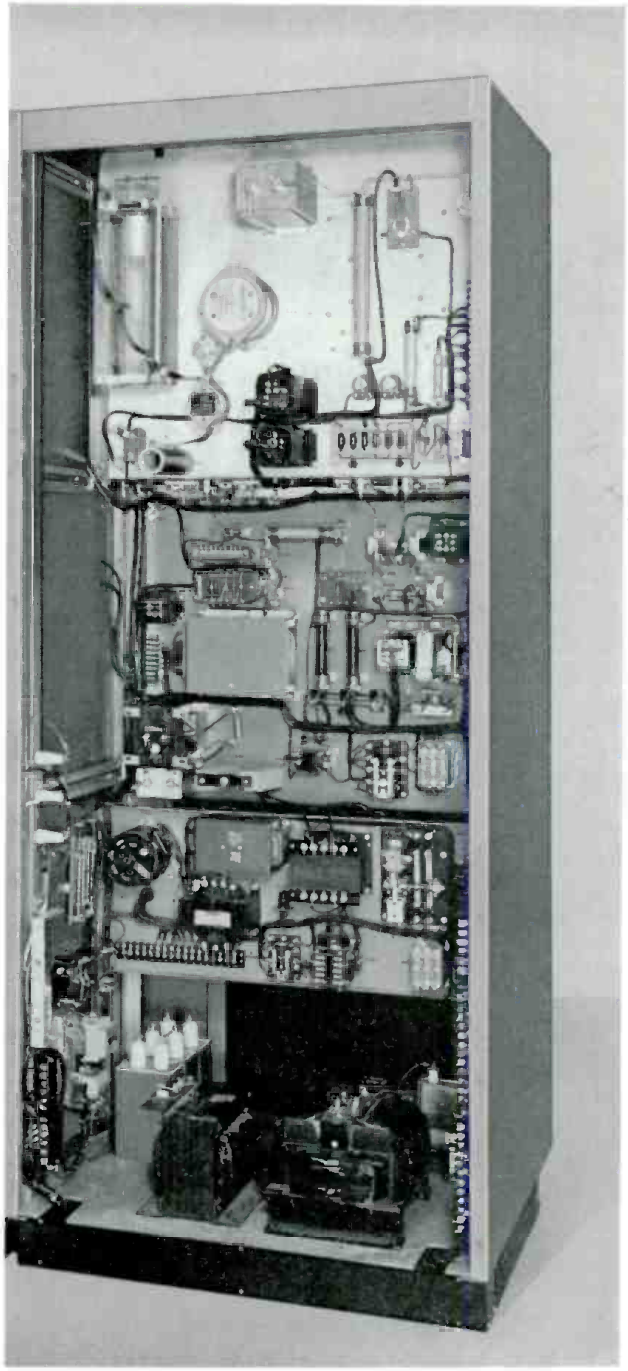
Overload Protection

To provide additional reliability, improvements were made in the control and protective circuitry of the BTA-5T Trans-

Rear view of high efficiency PA and modulator stages. Removal of the rear panel provides complete access to all circuit components for ease of maintenance.

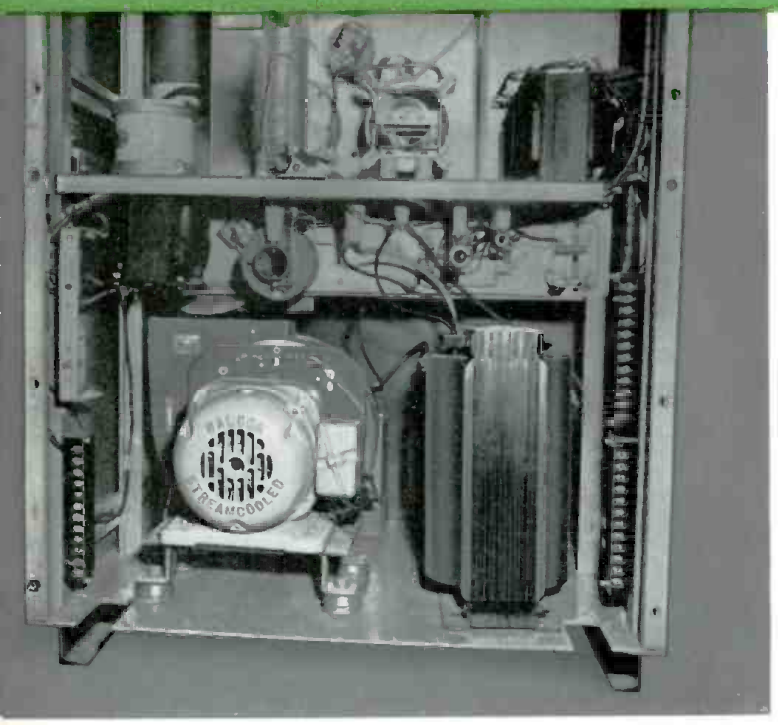


mitter. All primary lines are protected by means of circuit breakers with instantaneous overload trip protection. Line and high-voltage plate circuit breakers have additional built-in thermal protection. The 3-phase blower is protected by a contactor with the thermal cutoff in each phase. Relay switching is sequential so that filaments will not come on unless the blower is operating. Low voltage is delayed to allow proper filament heating. The high voltage is interlocked with the low-voltage and the bias supply so that it will come on only after the low-voltage and bias potential is present. Overload protection is also provided in the low-voltage supply, the second AF stage, the IPA stages, the modulator, the PA stages and the high-voltage rectifier. They are instantaneous in action and each overload relay carries a spare set of contacts wired to terminals that may be connected to an external indicator unit. A two cycle plate overload relay also permits the transmitter to return to the air automatically after one interruption has occurred.



Rear of the BTA-5T exciter-driver cabinet.

Close up view of the exciter with two crystal units in place. Just above the crystals is the 6146 r-f driver. To the left may be noted the pair of 2E26 tubes for the a-f input. Panel below exciter is removed to show circuit breakers and fuses.



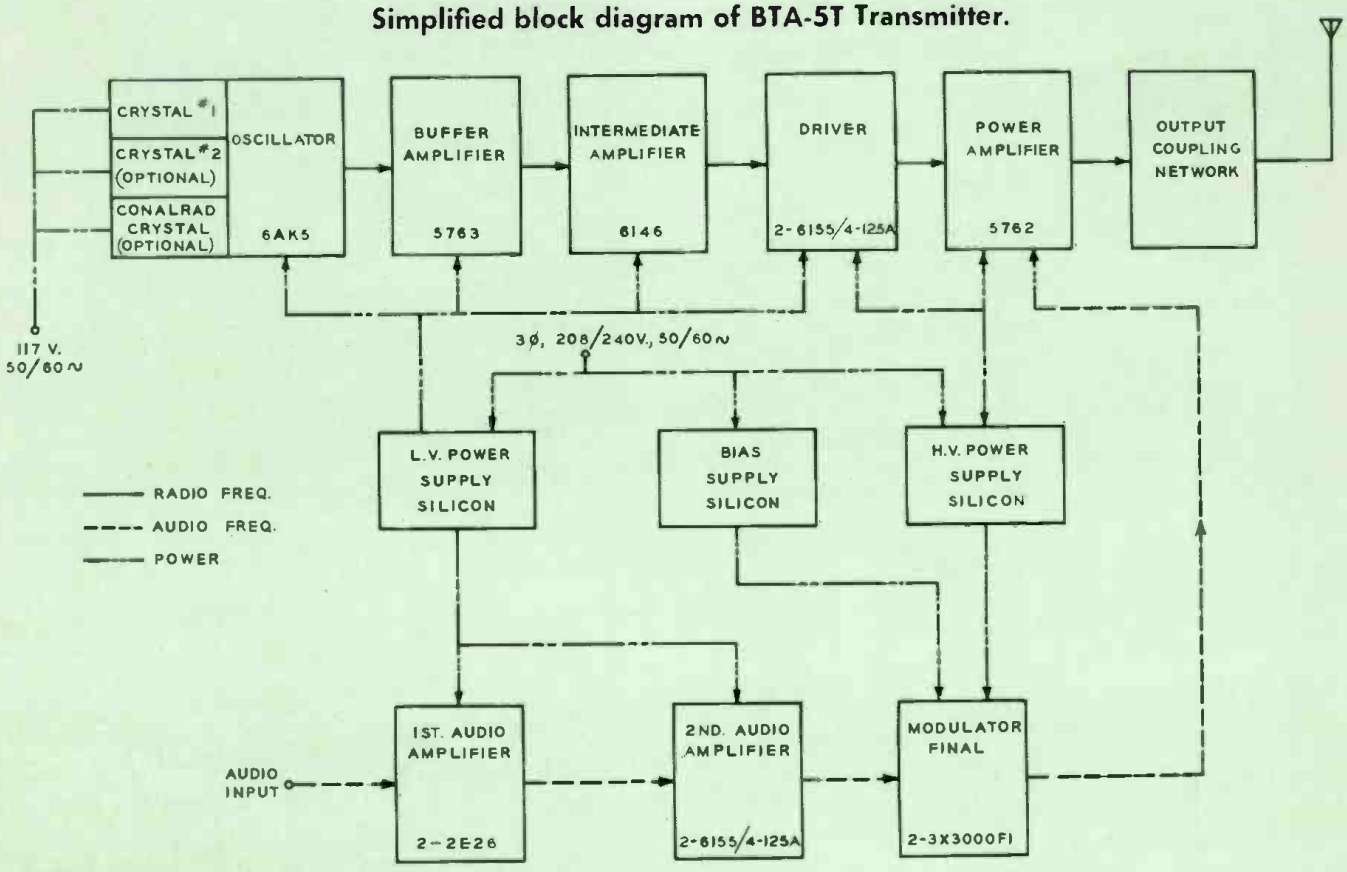
The high efficiency PA permits use of a slow speed blower shown above. The unit is mounted on rubber shock mounts in the base of the PA cubicle. Quiet operation of the blower makes it possible to locate the transmitter in a central control room in smaller stations.

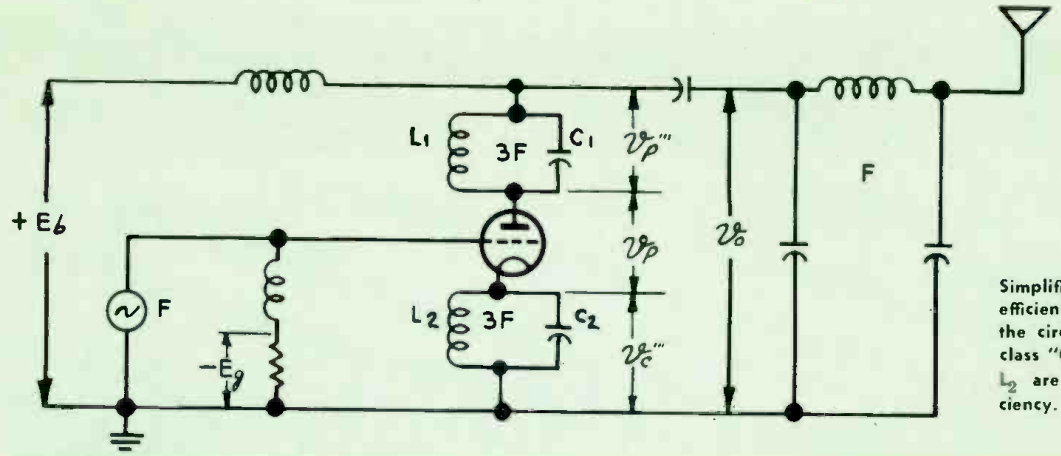
Starting surges in the plate transformer, high voltage rectifier, and the filter capacitor are eliminated by the use of a step-start and damping circuit. This at one time was only available in the higher-power transmitters, but now longer life and added reliability are provided in the BTA-5T with the incorporation of this circuit for the suppression of starting transients. The damping circuit and the primary line reactors afford continuous protection against possible operational transients.

Smaller Transformers

Continuing research has added still another feature to this RCA transmitter. Grain-oriented steel and epoxy resin are used in the manufacture of plate transformers, this results in realizing half the size that would be normally expected in a transformer of this power. This also reflects in lower floor area requirements while still providing high-quality components.

Simplified block diagram of BTA-5T Transmitter.



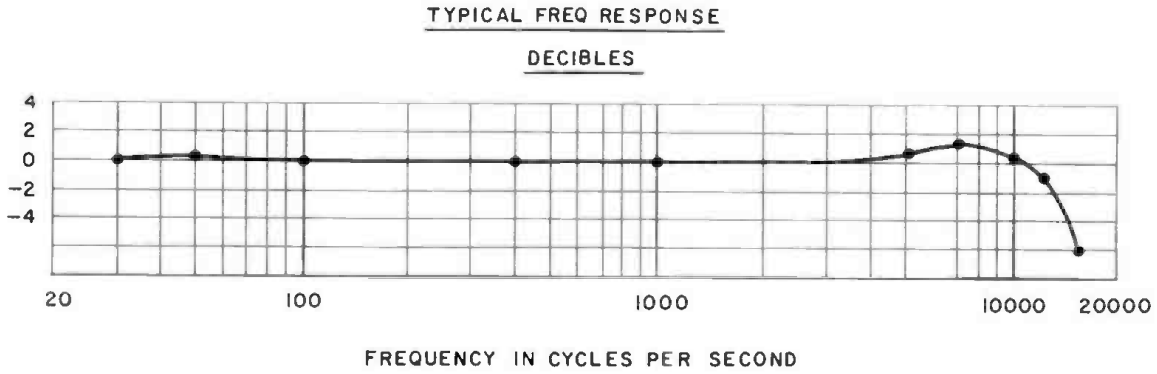


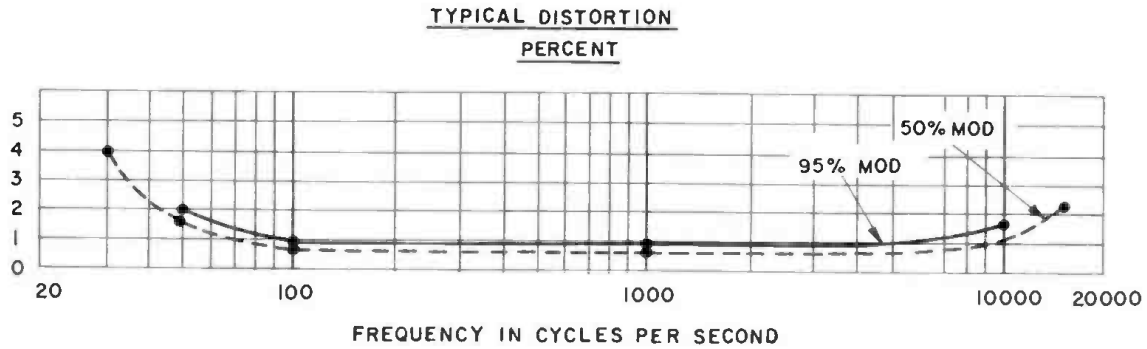
Simplified schematic of the new high efficiency PA stage. The adjustment of the circuit differs from a conventional class "C" only in that the coils L_1 and L_2 are resonated for maximum efficiency.

Accessory Monitor

A Carrier-Off Monitor, MI-34647, is available to remove plate voltage from the transmitter in the event of an arc or fault in the transmission line or antenna system up to the point at which the remote pick-up unit is connected. When there is an interruption in current, the monitor turns off the transmitter for a short time, then it will permit recycling. If, in the event the transmitter goes out again, the transmitter will remain off until manually reset. The unit is designed to be operated with remote pick-up unit, MI-27966, for power up to 5-kw, or MI-28027-A for higher powers, however, it can be operated with any remote current indicator that will develop 0.4 volt or greater, of rectified carrier across a 1400 ohm resistor. The Carrier-Off Monitor is mounted on a panel 8 inches wide and 24 inches high that can be accommodated in the driver cabinet of the transmitter.

Audio Frequency Response for BTA-5T Transmitter





SPECIFICATIONS

Performance Specifications

AF Input Impedance.....150/600 ohms
AF Input Level (100% modulation).....+10 ±2 dbm
AF Response:
50-7500 Cycles.....±1 db
30-10,000 Cycles.....±1.5 db
AF Distortion (95% modulation):
50-10,000 Cycles.....2.5%
Noise (below 100% modulation).....60 db
Frequency Range.....535-1620 kc
Frequency Stability.....±5 cycles
Type of Output.....Single ended
Carrier Shift (0-100% modulation, 400 cycles).....3% at constant line voltage
5% at normal line voltage regulation
Output Impedance.....40-250 ohms

Electrical Specifications

RF Voltage (for frequency monitoring).....10 V RMS 75 ohms
RF Voltage (for modulation monitoring).....10 V, 75 ohms
Power Output (nominal).....5000 watts
Power Output Capability.....5500 watts
Power Supply.....208/240 volts ±11 volts
Line Frequency.....60 cycles (50 cycle kit available)
Phase.....3
Power Consumption:
(0% modulation).....10.0 KW
(100% modulation).....14.5 KW
(Average program modulation).....11.0 KW
Power Factor.....90%
Permissible Combined Line Voltage Variation and Regulation.....±5%
Crystal Heater Power Supply.....117 volts 50/60 cycles

Tube Complement

1 6AK5 Crystal Oscillator
1 5763 Buffer
1 6146 Intermediate Power Amplifier
2 6155/4-125A Driver
1 5762 Power Amplifiers
2 2E26 1st Audio Frequency Amplifier
2 6155/4-125A 2nd Frequency Audio Amplifier
2 3X3000F1 Modulator

Mechanical Specifications

Overall Height.....88" (84" less floor channels)
Cabinet Height.....84" (80" less floor channels)
Width.....69"
Depth.....32" (less door handle)
Overall Depth.....55" (with door open)
Net Weight:
Transmitter.....3800 lbs. (approx.)
Plate Transformer.....420 lbs. (approx.)
Altitude Range.....0-7500 ft.
Ambient Operating Temperature:
BTA-5T.....—20°C (40°F) min.; +45°C (113°F) max.

Equipment Supplied

Type BTA-5T 5000-Watt Broadcast Transmitter (complete).....ES-34229

Including the following:

1 Transmitter Driver.....MI-27650-A
1 Amplifier, Modulator and High Voltage Rectifier.....MI-27635-C
1 Plate Transformer.....MI-27636
1 Installation Material Kit.....MI-34610
1 Miscellaneous Hardware Kit.....MI-7474
1 Blower.....MI-34616/34616-A
(Order MI-34616-A for altitudes up to 2500 feet. Specify MI-34616 for altitudes 2500 feet to 7500 feet.)
1 Door, Right Hand (Choose decor as follows)
Burgundy.....MI-27645-H1
Light Umber Gray.....MI-27645-H2
1 Door, Left Hand (Choose decor as follows)
Burgundy.....MI-27645-J1
Light Umber Gray.....MI-27645-J2
1 Nameplate.....MI-28180-1
1 Touch-Up Finish Kit.....MI-27660-B
2 Instruction Books.....IB-30279
* Dome Type Insulator for PA Output.....MI-19406-A
* Adaptor or Plate for Coaxial Line Output.....MI-34613-*

(* Supply one as specified on sales order. For open type transmission line order MI-19406-A. For coaxial transmission line select from MI-34613-* Series to suit installation requirements.)

1 Set of Frequency Determining Parts.....MI-34648
1 Crystal, Type TMV-130B.....MI-27493
1 Set of Operating Tubes.....ES-24230
† Filament Hours, Elapsed Time Indicator.....MI-34614-*
† Remote Antenna Current Ammeter.....MI-27644-*
† Remote Ammeter Pick-up Unit.....MI-27966

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† Specify one elapsed time indicator MI-34614-1 or one Remote Antenna Current Ammeter, MI-27644, (select proper ammeter range from MI-26744 Series) and one Remote Ammeter Pick-up Unit, MI-27966.

Accessories

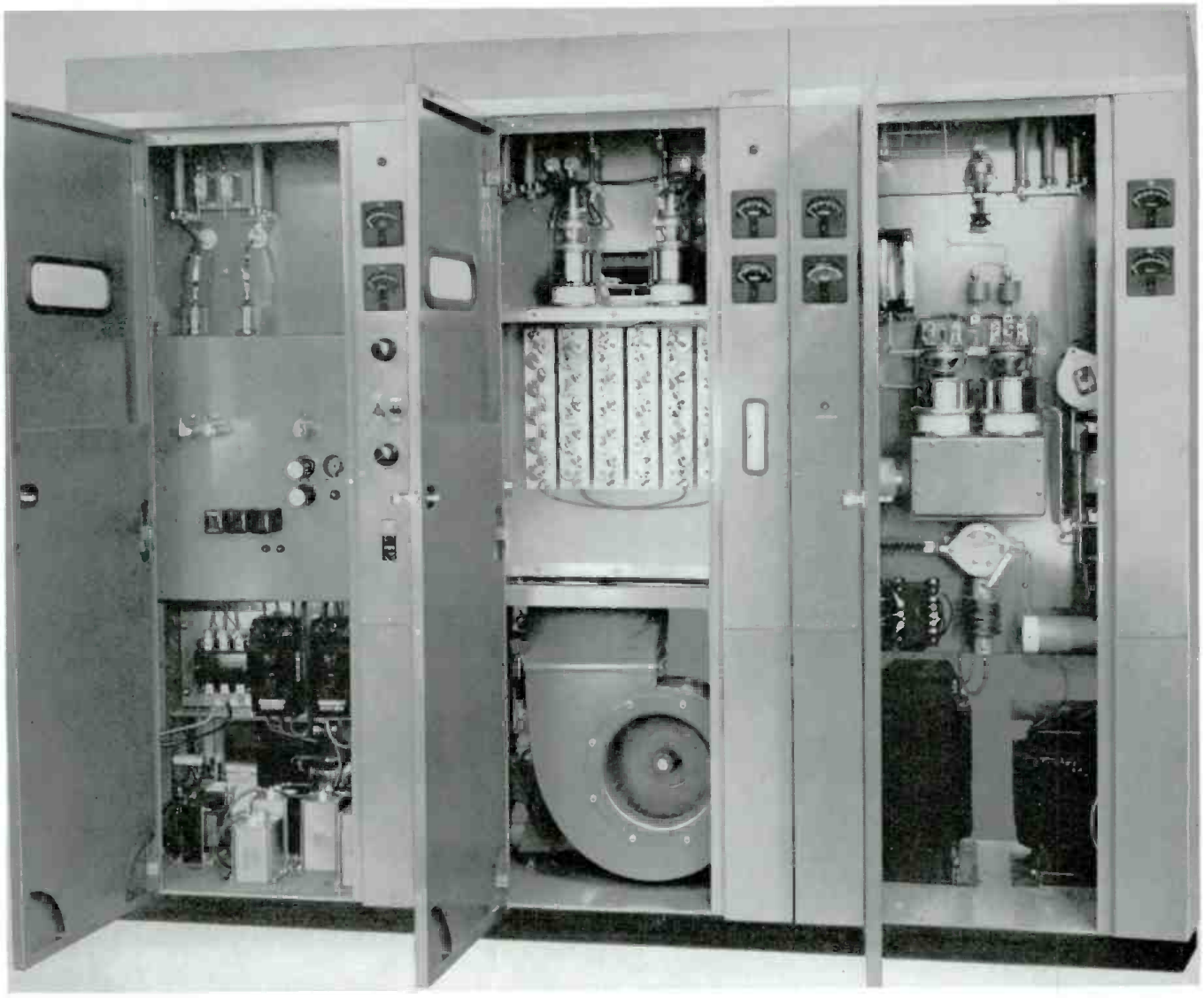
Type BTR-11B Remote Control System.....ES-34280
Type BTR-20B Remote Control System.....ES-34274
Antenna Tuning Equipment.....ES-27256
Recommended Minimum Set of Spare Tubes.....ES-34208
Type BW-11A Frequency Monitor.....MI-30011-A
Type BW-66F Modulation Monitor.....MI-30066-B
Power Cutback Kit (1000/500 watts).....MI-34646-A
Conelrad Kit.....ES-34245
Carrier Off Monitor (specify power).....ES-34251

5/10 KW AM Broadcast Transmitter

TYPE BTA-5U/10U

FEATURES

- High efficiency PA—provides power economy
- Semiconductor power supply
- Meets latest FCC acceptance requirements
- Vertical panel construction provides reach-in accessibility
- Only two tuning controls
- Broadband neutralization
- Improved mechanical design
- Built-in remote control provisions for main, standby or Conelrad switching
- 5-kw plate transformer housed within transmitter
- Factory tuned to customer frequency



Type BTA-10U 10-KW AM Transmitter showing front view of driver-control, Modulator and High Voltage Rectifier, and power amplifier cabinets.

DESCRIPTION

The BTA-5U is a 5-kw amplitude modulated, high fidelity, broadcast transmitter for operation in the standard band between 535 kc and 1620 kc. It is essentially the same as RCA's popular BTA-5T model with advanced provisions for power increase to 10 kilowatts. The RCA BTA-10U AM Broadcast Transmitter is the fully converted deluxe BTA-5U with a second 5762 Amplifier tube to provide 10 kw output. Both transmitters are outstanding in appearance, performance and reliability, and meet requirements of the FCC and EIA pertaining to this class of equipment.

The BTA-5U/10U operates from a 208/240 volt, 60-cycle, three-phase power source for the main power. The crystal heaters require an additional 115-volt 50/60 cycle single phase a-c power input. The transmitter can be modified for operation on 50-cycle a-c current. Both transmitters exceed nominal power output rating to compensate for losses in the antenna tuning equipment. Built-in relays allow remote control of main, standby and Conelrad operations.

The spacious cabinet of the BTA-5U Transmitter permits internal mounting of the 5-kw plate transformer. There are provisions for easy conversion to higher power at a later date. The transmitter also allows simplified power change to 1 kilowatt or 500 watts, if desired, by means of installing the Power Cutback Kit, MI-34646-A. In like manner, the BTA-10U can be operated at reduced 5-kw power, or by means of the cutback kit at 1 kilowatt.

Outstanding Features

The BTA-5U/10U is an air-cooled transmitter featuring a number of design developments, including an important development in Class C amplifier design. The new high-efficiency, plate modulated power amplifier permits one or two long-life 5762 tubes to deliver the nominal 5 or 10 kw with 5.5 or 10.6 kw power output capability. The plate efficiency exceeds that of a conventional class C amplifier by an average 15 per cent. As a result, considerable power savings can be realized. Referring to the simplified schematic, the circuit arrangement is very similar to a conventional class C amplifier, except for the presence of two high efficiency resonators. The amplifier is stable and easy to adjust. The high-voltage, low-voltage and bias supplies employ silicon type rectifiers throughout. The transmitter also boasts a small-sized, improved plate transformer.

Other new design techniques of the BTA-5U/10U provide simplified tuning, increased safety, longer tube life and improved performance. After initial adjustments, the transmitter can be tuned from the front panel. This is accomplished by only two controls. Provisions for manual or remote control operation are incorporated in the transmitter. For safety, all doors and panels are interlocked and grounding switches protect operating personnel. The transmitter is completely air-cooled by a single blower housed in the central Modulator and High Voltage Rectifier cabinet. A delay relay is employed to retain the blower system in operation for one minute after the transmitter has been shut down. This refinement is used to extend tube life.

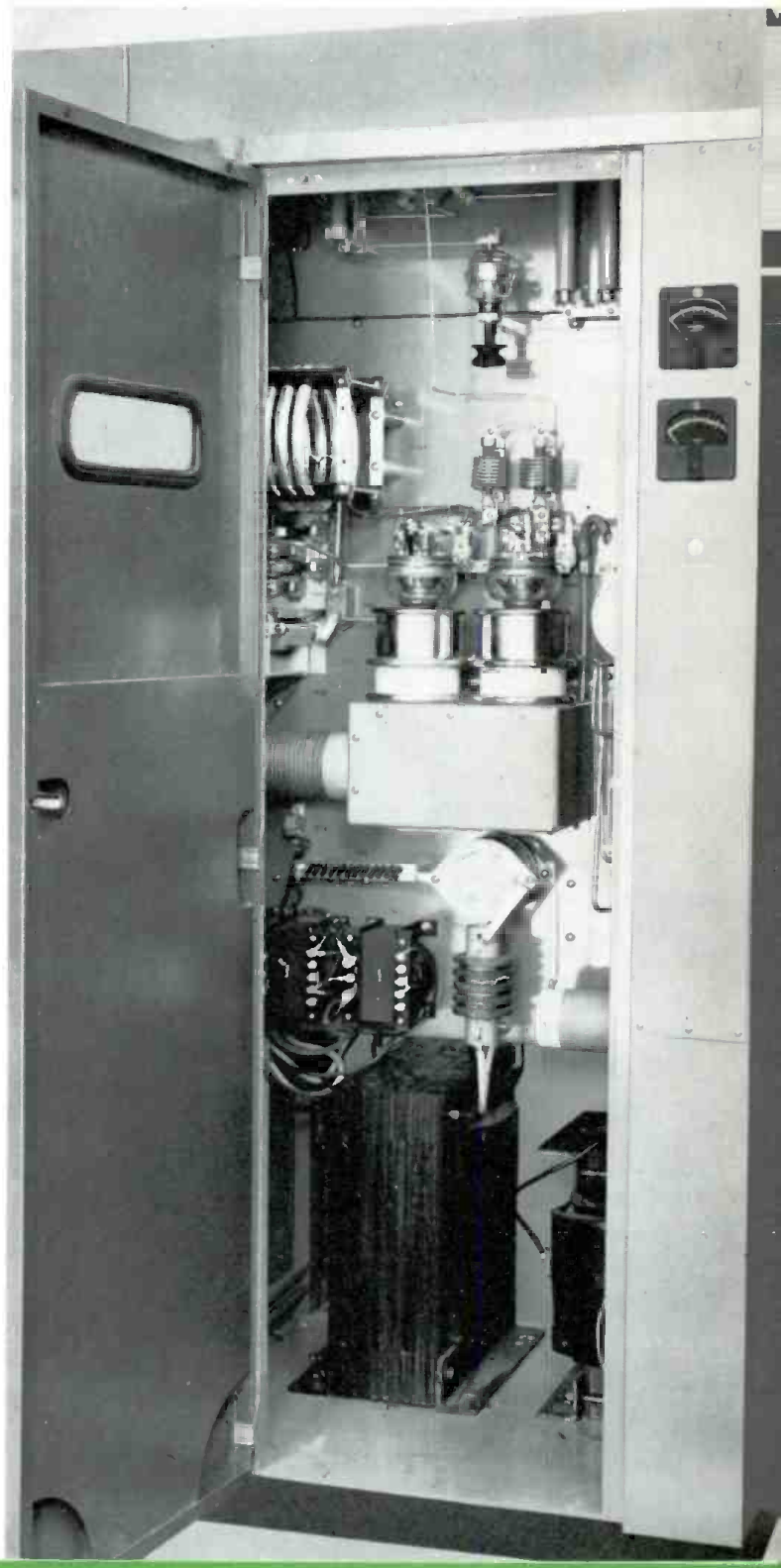
Mechanical Design

The BTA-5U/10U Transmitter is housed in three attractively styled cabinets made of anodized aluminized steel to provide improved magnetic and electrostatic shielding. The left cabinet, or cubicle, contains the Transmitter Driver, MI-27652 including exciter and control panel. The center cabinet houses the Modulator and High Voltage Rectifier, MI-27651 and the Blower, MI-24618. In the right hand cabinet is located the Power Amplifier, MI-27653 and the 5-kw Plate Transformer, MI-27636-B. The plate transformer of the BTA-10U Transmitter, MI-27654, is an external unit which can be mounted near the cabinets.

Each cabinet consists of end panels with wrap-around front edges formed to provide control panels, mounted on a sturdy, welded steel base. Vertical center chassis are fastened between the end panels to form a basic "H" cross section. Reach-in accessibility to transmitter components are afforded by hinged front doors located between the control panels. Rear access to each cabinet is provided by two removable, interlocked panels. Control components are conveniently located on the panels on both sides of the front doors where all meters are situated at eye level to facilitate readings.

The matched cabinets are designed to combine an attractive appearance with the utmost in utility. Doors are offered in burgundy red or dark umber gray, to harmonize with station surroundings. Vertical construction permits

Power Amplifier portion of the BTA-10U Transmitter.



easier maintenance and service. It also permits installation of the transmitter against a side wall, or allows other equipment to be placed on either side of the cabinet. The front doors of the transmitter give immediate access to the front of the vertical panels on which circuit components such as tubes and overload relays are mounted. Remaining components are mounted on the rear of these chassis, while the larger power components are situated in the base of the cabinet.

Latest Radio and Audio Frequency Circuit Design

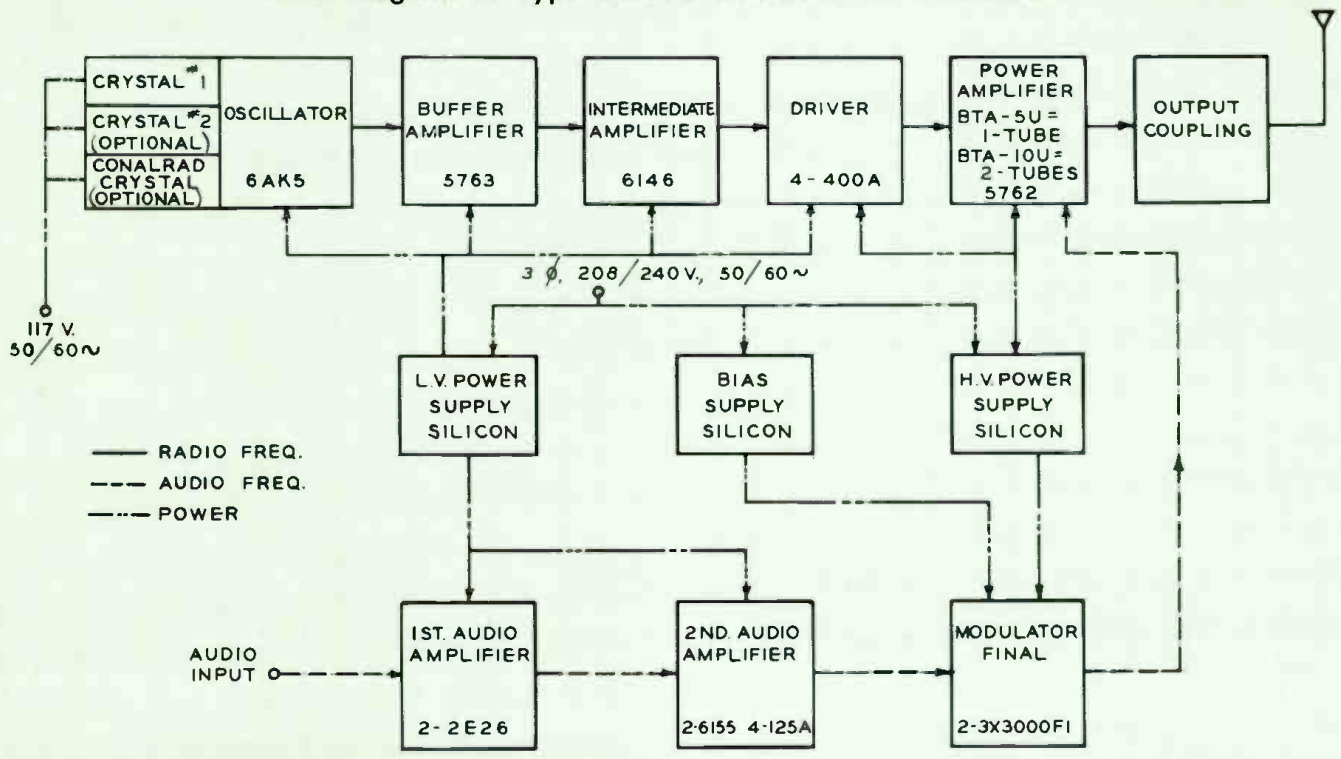
The BTA-5U/10U Transmitter incorporates RCA MI-27632-A Crystal Oscillator with three, switchable, temperature-controlled crystal units. Crystal stability is plus or minus five cycles. The three crystals are for main, spare and Conelrad operation. The desired crystal can be selected by means of a front panel switch or by means of a remote-control switch since relays are built into the exciter. The oscillator employs broadband circuits that require no adjustments. A 6AK5 is used as an oscillator tube with a 5763 as the buffer. This unit is built on an etched circuit panel easily accessible for service by removing the cover. The entire oscillator unit can be removed by disconnecting a cable-plug and retaining screws. Also a part of the basic exciter is the 6146 IPA stage which is operated very conservatively and a pair of 2E26 tubes used as the first a-f stage of the modulator circuit.

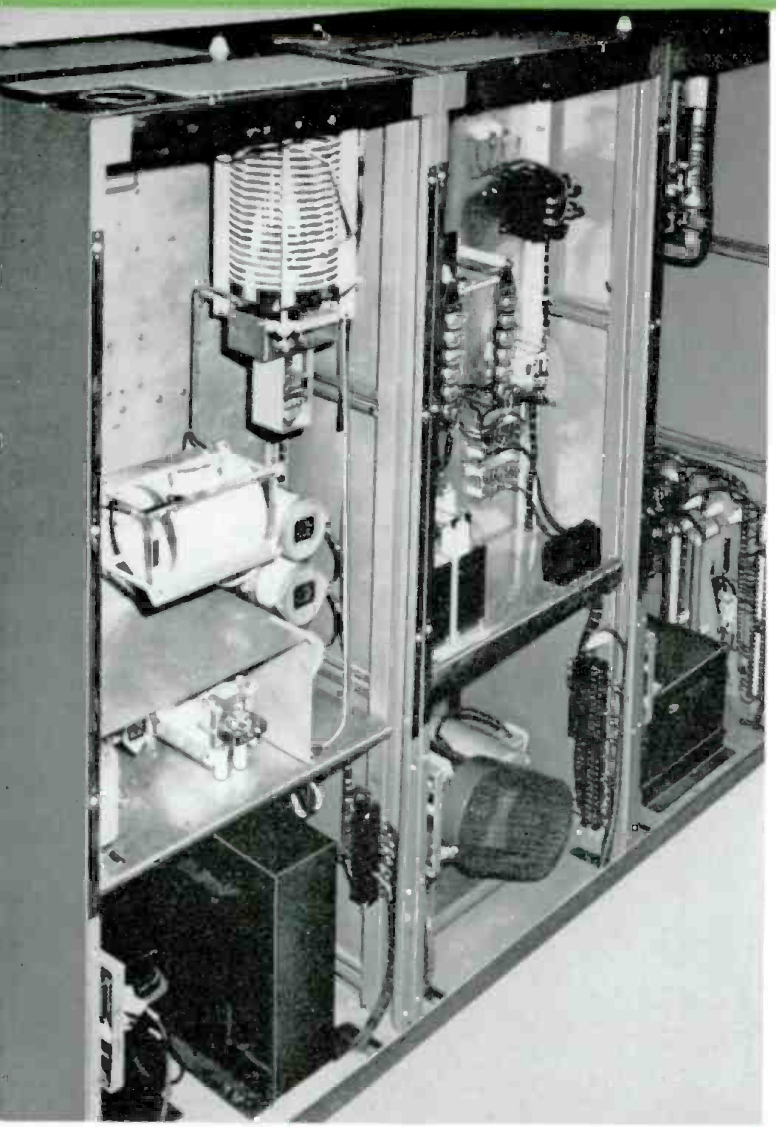
The output of the 6146 IPA stage is broadband and requires no tuning. It drives a single 4-400A tube where tuning is accomplished by using a slug-tuned coil controlled from the front panel. These tubes, in turn, drive one or two high-efficiency, long life 5762 output triodes. A front panel control of a vacuum variable capacitor tunes the plate circuit.

A new slug-tuned coil was developed for the power output adjustment and it is driven by a reversible motor. The motor is actuated at the front panel or by a remote power output adjustment switch. The second harmonic trap uses a slug-tuned coil, thus eliminating the possibility of contact pitting from high RF currents. Neutralization of the PA is achieved by a broadband transformer and a variable vacuum capacitor. The use of a broadband type of transformer holds neutralization over a wide band and prevents spurious oscillation at other frequencies.

The modulator of the transmitter consists of a pair of 2E26 tubes located in the exciter portion, resistance coupled to drive two 4-125A second audio frequency amplifiers which, in turn, are resistance coupled to drive a pair of 3X3000F1 modulators. These modulator tubes are low mu triodes, drawing no grid current. They are capable of excellent response and fidelity. Due to the low plate dissipation of the new power amplifier system, the power input of the modulator is also reduced affording appreciable power economies.

Block diagram of Type BTA-5U and BTA-10U Transmitters.





Rear view of transmitter showing reach-in accessibility to transmitter facilities. The modulation transformer and final PA tank circuitry are seen in foreground, rear of modulator and blower in center cabinet, while heavier components of driver are shown mounted on floor of third cabinet.

Dependable Semiconductor Power Supply

The BTA-5U/10U incorporates silicon-type rectifiers in the high-voltage circuits. This rectifier is ideal not only in a combined operation, but even more so in a remote-control application.

The rectifiers are hermetically sealed so they will not be adversely affected by weather conditions. They can operate at ambient temperatures ranging from —20 degrees to +45 degrees C and at altitudes up to 7500 feet above sea level. There is no significant aging of the forward drop characteristics. Across each of the individual silicon cells a resistor has been shunted so that they will all share equally the peak inverse voltage. RCA specifications have been set higher than EIA standards by adding an additional 30 per cent peak inverse voltage safety factor.

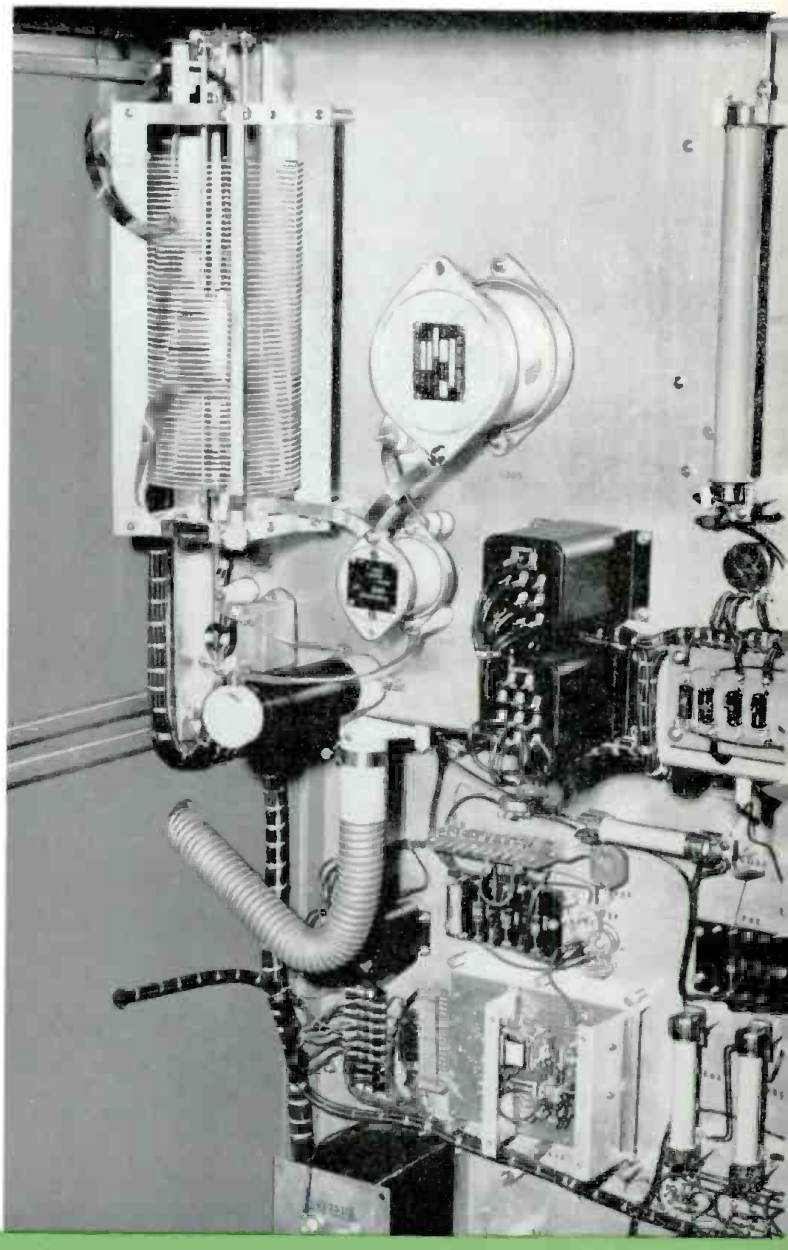
Cooling System

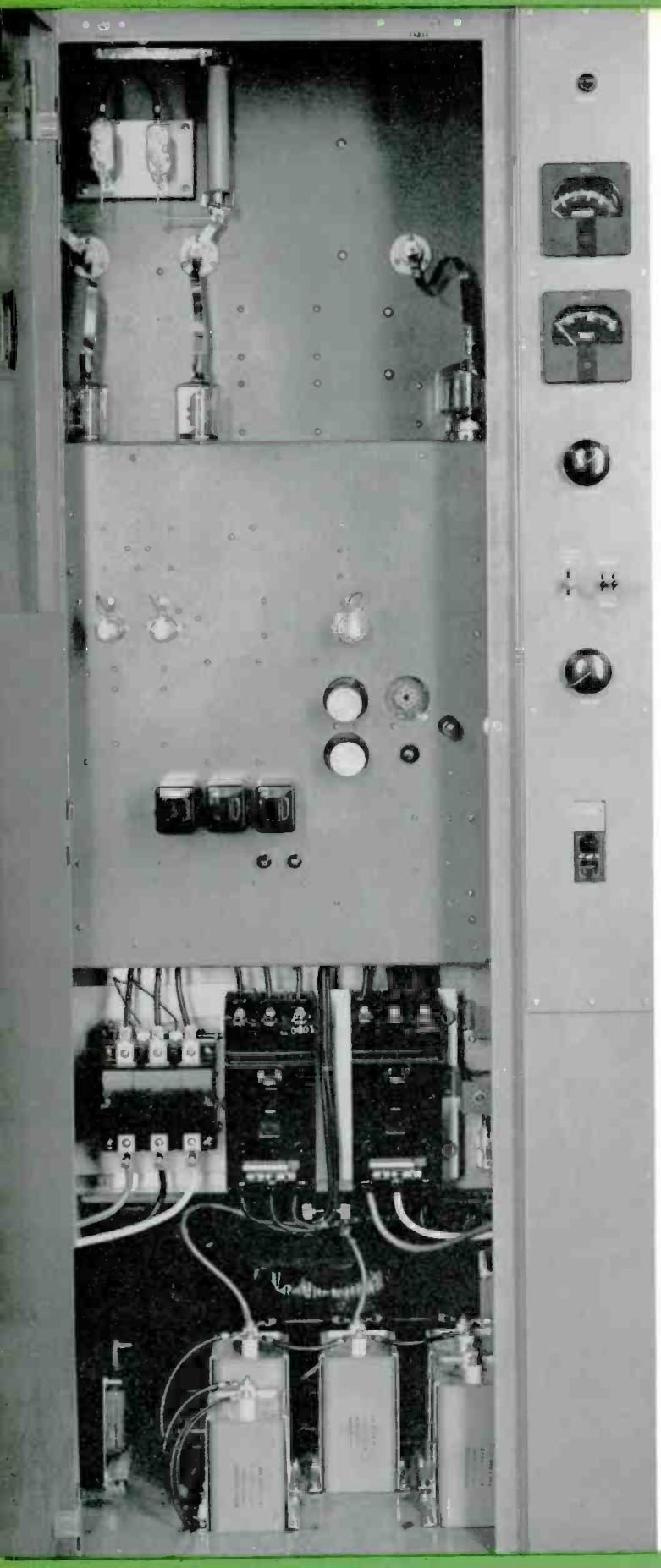
The transmitter is completely air-cooled. Added refinements such as a delay relay have been built-in to keep the blower system in operation for one minute after the transmitter has been shut down. The continued supply of air extends tube life. The exciter cabinet employs convection cooling. A louvered lower back panel and top grill panel provide good ventilation. In the second cabinet a blower air system distributes air to the modulator as well as to the PA tubes in cabinet three.

Overload Protection

To provide additional reliability, improvements were made in the control and protective circuitry of the BTA-5U/10U Transmitter. All primary lines are protected by means of circuit breakers with instantaneous overload trip protec-

Rear view of BTA-10U exciter and control cabinet.



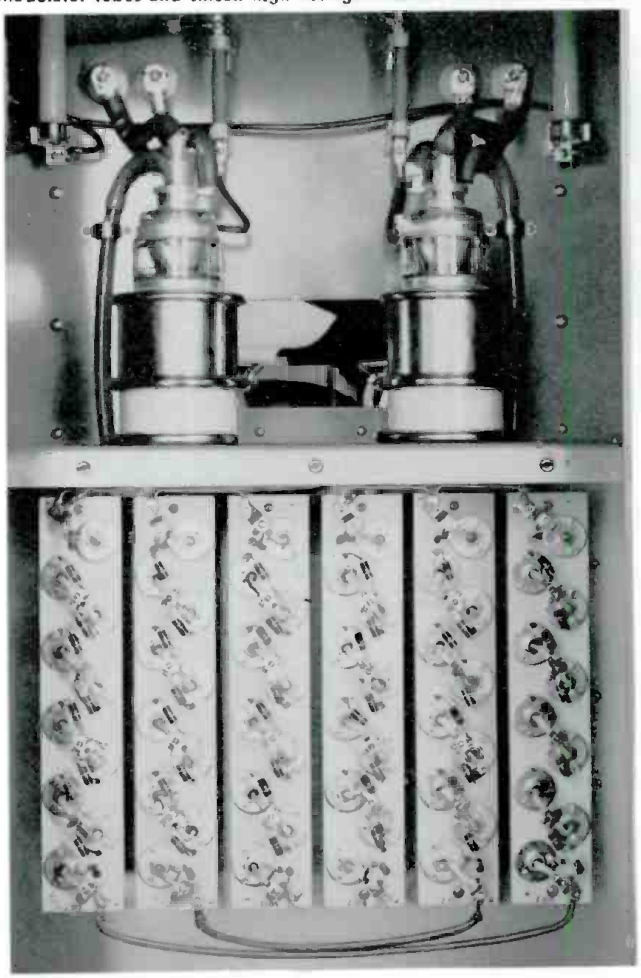


BTA-10U driver including exciter and control panel. Provisions on central panel for third Crystal Oscillator for Conelrad operation is shown.

tion. Line and high-voltage plate circuit breakers have additional built-in thermal protection. The 3-phase blower is protected by a contactor with the thermal cutoff in each phase. Relay switching is sequential so that filaments will not come on unless the blower is operating. Low voltage is delayed to allow proper filament heating. The high voltage is interlocked with the low-voltage and the bias supply so that it will come on only after the low-voltage and bias potential is present. Overload protection is also provided in the low-voltage supply, the second AF stage, the IPA stages, the modulator, the PA stage and the high-voltage rectifier. They are instantaneous in action and each overload relay carries a spare set of contacts wired to terminals that may be connected to an external indicator. A two cycle plate overload relay also permits the transmitter to return to the air automatically after one interruption has occurred.

Starting surges in the plate transformer, high voltage rectifier, and the filter capacitor are eliminated by the use of

Modulator tubes and silicon high voltage rectifiers with cover removed.



a step-start and damping circuit. This at one time was only available in the higher-power transmitters, but now longer life and added reliability are provided in the BTA-5U/10U with the incorporation of this circuit for the suppression of starting transients. The damping circuit and the primary line reactors afford continuous protection against possible operational transients.

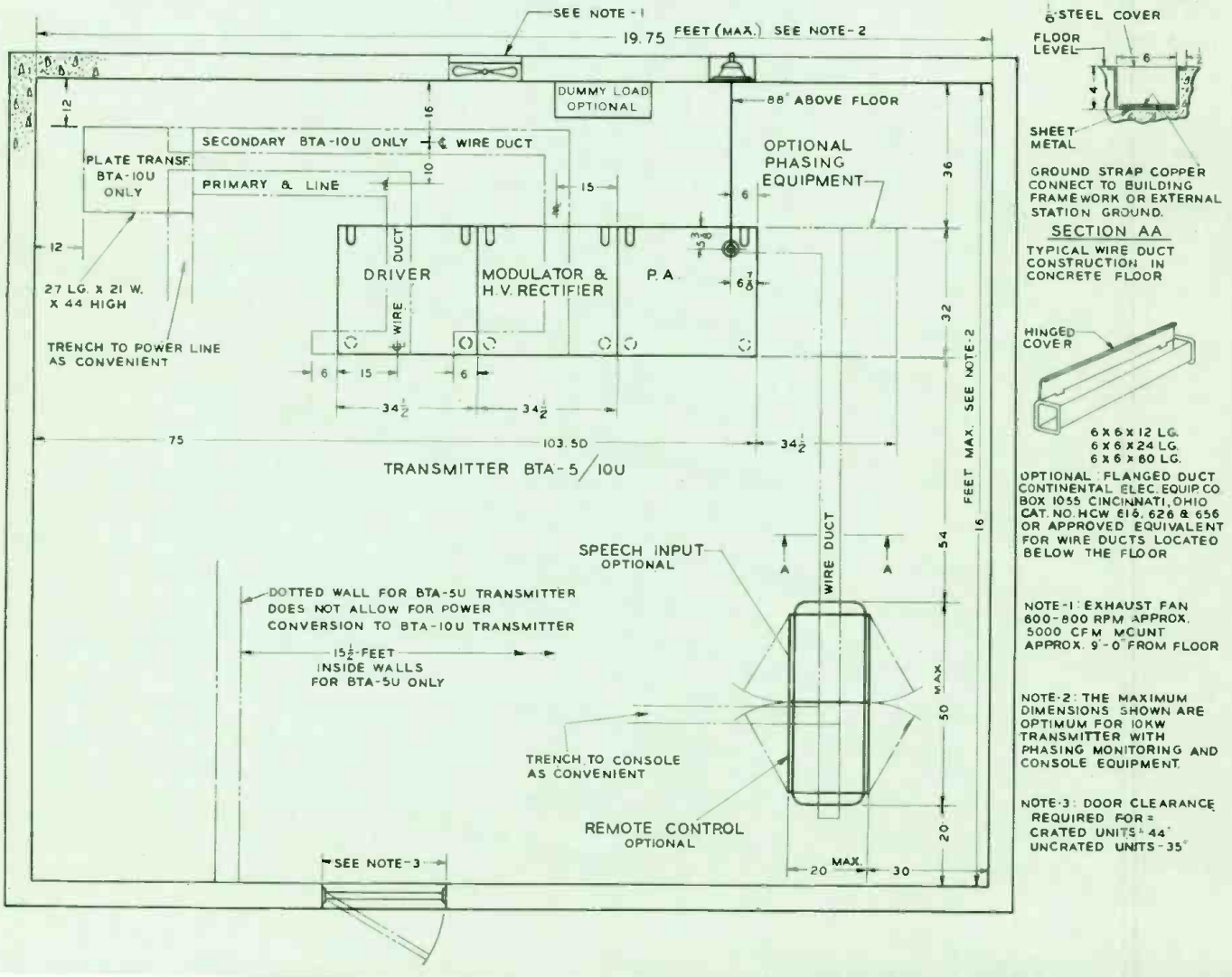
Smaller Transformers

Continuing research has added still another feature to this RCA transmitter. Grain-oriented steel and epoxy resin are used in the manufacture of plate transformers, this results in realizing half the size that would be normally expected in a transformer of this power. This allows the 5-kw unit to be housed within the transmitter while the 10-kw plate transfomer for the model BTA-10U takes up little external floor space.

Accessory Monitor

A Carrier-Off Monitor, MI-34647, is available to remove plate voltage from the transmitter in the event of an arc or fault in the transmission line or antenna system up to the point at which the remote pick-up unit is connected. When there is an interruption in current, the monitor turns off the transmitter for a short time, then it will permit recycling. If, in the event the transmitter goes out again, the transmitter will remain off until manually reset. The unit is designed to be operated with remote pick-up unit, MI-27966, for power up to 5-kw, or MI-28027-A for higher powers, however, it can be operated with any remote current indicator that will develop 0.4 volt or greater, of rectified carrier across a 1400 ohm resistor. The Carrier-Off Monitor is mounted on a panel 8 inches wide and 24 inches high that can be accommodated in the driver cabinet of the transmitter.

Typical floor plan for BTA-5U and BTA-10U transmitters. External plate transformers are required only for the BTA-10U transmitter since the transformer for the BTA-5U can be mounted in the PA cabinet.



SPECIFICATIONS

Performance Specifications

AF Input Impedance.....150/600 ohms
AF Input Level (100% modulation).....+10 ±2 dbm
AF Response:
50—7500 Cycles.....±1 db
30—10,000 Cycles.....±1.5 db
AF Distortion (95% modulation):
50—10,000 Cycles.....2.5%
Noise (below 100% modulotion).....60 db
Frequency Range.....535—1620 kc
Frequency Stability.....±5 cycles
Type of Output.....Single Ended
Carrier Shift (0—100% modulation, 400 cycles).....3% at constant line voltage
5% at normal line voltage regulation
Output Impedance.....40—250 ohms

Electrical Specifications

RF Voltage (for Frequency Monitoring).....10 volts RMS 75 ohms
RF Voltage (for Modulation Monitoring).....10 volts 75 ohms
Power Output (nominal):
BTA-5U.....5000 watts
BTA-10U.....10,000 watts
Power Output Capability:
BTA-5U.....5500 watts
BTA-10U.....10,600 watts
Power Source Required.....208/240 volts ±11 volts
Line Frequency.....60 cycles (50 cycle kit available)
Phase.....3

Power Consumption:	BTA-5U	BTA-10U
(0% modulation)	10.0 kw	17.5 kw
(100% modulation)	14.5 kw	26.0 kw
(Average program modulation)	11.0 kw	21.0 kw
Power Factor	90%	90%
Permissible Combined Line Voltage Variation and Regulation	±5%	±5%

Crystal Heater Power.....117 volts 50/60 cycles

Tube Complement:

1 6AK5 Crystol Oscillator
1 5763 Buffer
1 6146 Intermediate Power Amplifier
1 4-400A Driver
2 2E26 1st Audio Frequency Amplifier
2 6155/4-125A 2nd Audio Frequency Amplifier
2 3X3000F1 Modulator
1 5762 Power Amplifier for BTA-5U
2 5762 Power Amplifier for BTA-10U

Mechanical Specifications

Overall Height.....88" (84" less floor channels)
Cabinet Height.....84" (80" less floor channels)
Width.....116"
Depth.....32" (less door handle)
Overall Depth.....55" (with door open)
Net Weight:
BTA-10U Transmitter.....4700 lbs. (approx.)
Plate Transformer.....600 lbs. (approx.)
BTA-5U Transmitter including Plate Transformer.....4850 lbs. (approx.)
Altitude Range.....0—7500 ft.
Ambient Operating Temperature.....—20°C (40°F) min.; +45°C (113°F) max.

Equipment Supplied

Qty.	Description	BTA-5U	BTA-10U
1	5000 Watt AM Broadcast Transmitter (complete)	ES-27285	
	OR		
1	10,000 Watt AM Broadcast Transmitter (complete)		ES-27286
	Including the following:		
1	Transmitter Driver	MI-27652	MI-27652
1	Modulator and High Voltage Rectifier	MI-27651	MI-27651
1	Power Amplifier	MI-27653	MI-27653
1	Plate Transformer	MI-27636-B	MI-27654
1	Power Determining Components	MI-34607	MI-34609
1	Installation Material Kit	MI-27656	MI-27656
1	Miscellaneous Hardware Kit	MI-7474	MI-7474
1	Blower	MI-34618	MI-34618
2	Doors, Right Hand (Choose Decor as follows):		
	Red	MI-27645-H1	MI-27645-H1
	Light Umber Gray	MI-27645-H2	MI-27645-H2
1	Door, Left Hand (Choose Decor as follows):		
	Red	MI-27645-J1	MI-27645-J1
	Light Umber Gray	MI-27645-J2	MI-27645-J2
1	Nameplate	MI-28180-1	MI-28180-1
1	Touch-up Finish Kit	MI-27660-B	MI-27660-B
*	Dome Type Insulotor for PA Output	MI-19406-A	MI-19406-A
*	Adapter or Plate for Coaxial Line Output	MI-34613-*	MI-34613-*
1	Set of Frequency Determining Parts	MI-34648-A	MI-27693
1	Crystal Type TVM-130B	MI-27493	MI-27493
1	Set of Operating Tubes	ES-34233	ES-27290
1[1]	Remote Antenna Current Ammeter	MI-27644-*	MI-27644-*
1[1]	R-F Transmission Line Current Ammeter (including Thermocouple)	MI-7157-G	MI-7157-G
1[1]	Set of Mounting Hardware for MI-7157-G	MI-34651	MI-34651
1	Miscellaneous Electrical Components		MI-34652

Accessories

Filament Hours, Elapsed Time Indicator[2].....MI-34614*
Type BTR-11B Remote Control System.....ES-342B0
Type BTR-20B Remote Control System.....ES-34274
Antenna Tuning Equipment.....ES-27256
Recommended Spare Tubes for BTA-5U and BTA-10U.....ES-27291
Type BW-11B Frequency Monitor.....MI-30011-A
Type BW-66F Modulation Monitor.....MI-30066-B
Conelrad Kit.....ES-34245
Carrier Off Monitor (specify power).....ES-34251
Power Conversion Kit (for BTA-5U and BTA-10U).....ES-34279
Modulation Reactor (for BTA-10U).....MI-34650
Power Cutback Kit 5 KW to 500/1000 W.....MI-34646-A
Power Cutback Kit 10 KW to 500/1000 W.....ES-34287
Power Cutback Kit 10 KW to 5 KW.....ES-342B6
Carrier-Off Monitor (for 5-10-KW recycling transmitters).....MI-34647
Remote R-F Pick-up Unit for powers up to 5-kw (less meter).....MI-27966
Remote R-F Pick-up Unit for higher powers (less meter).....MI-28027-A
Remote Antenna Meter.....MI-27644-Series

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* Supply one as specified on Sales Order. For open type transmission line order MI-19406-A. For coaxial transmission line select from MI-34613-* Series to suit installation requirements.

[1] The choice of R-F ammeter depends on installation requirements. Select either of the two items required: R-F ammeter, MI-27644 with its associated remote pick-up unit; MI-27966 where remote antenna current reading is desired; or the thermocouple type meter, MI-7157-G and its associated mounting hardware, MI-34651. The latter is used where line or output current reading is desired. Specify range of meter scale required.

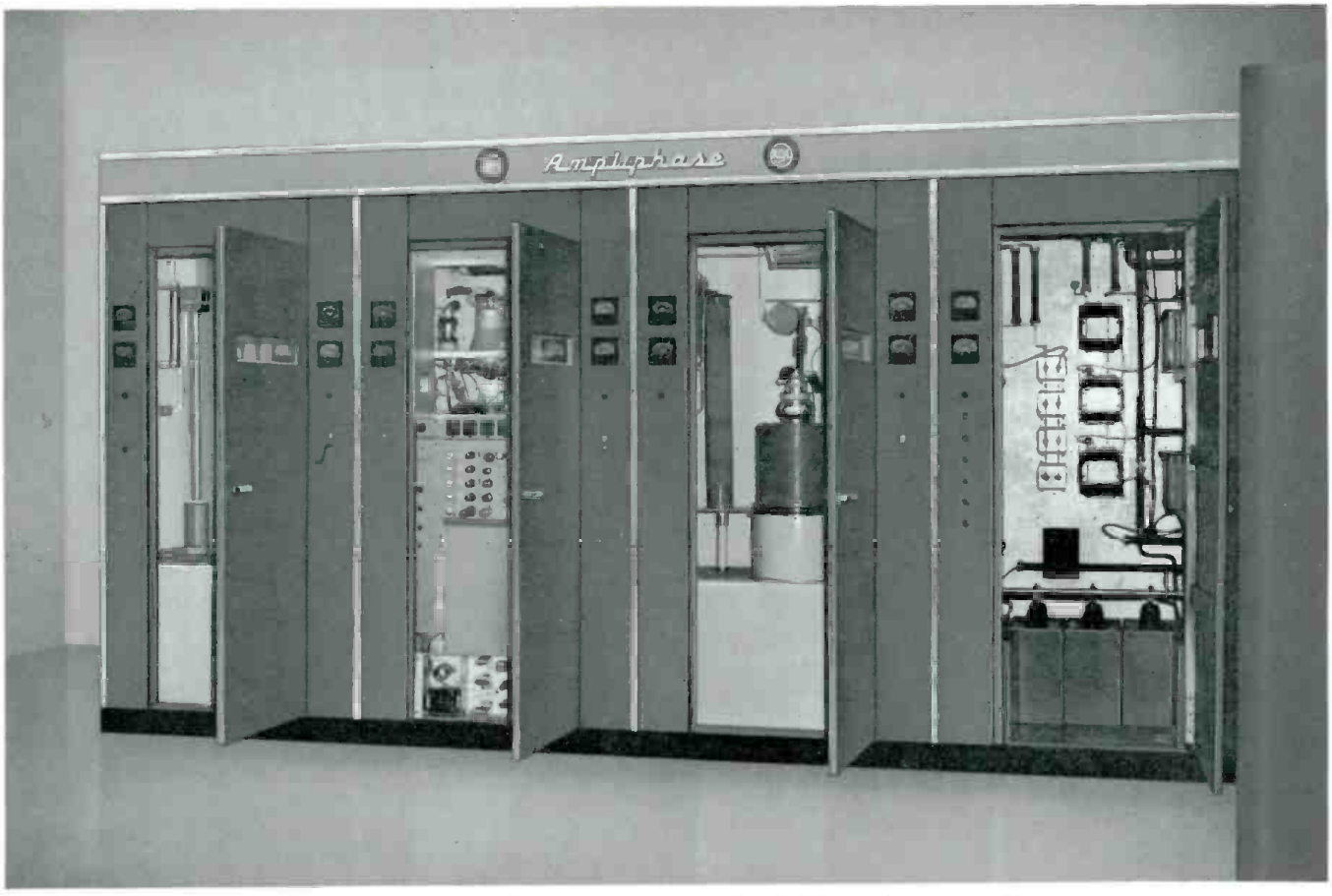
[2] The BTA-5U/10U transmitter has a blank meter bezel which may be replaced with an elapsed time indicator. An optional indicator, MI-34614, is available. Specify 50 or 60 cycles.

50 KW "Ampliphase" AM Transmitter

TYPE BTA-5OH

FEATURES

- Low R-F harmonic distortion—meets new FCC specifications for harmonic suppression
- Wide range frequency response
- Lowest operating cost ever offered in a 50-kw transmitter
- Lightweight tubes used in final amplifier
- Designed for remote control operation
- Solid state rectifiers used throughout
- Complete accessibility—yet requires less than 80 square feet of floor space
- Uses fewer major components than any other transmitter of similar power for maximum dependability
- Internal blowers
- Transmitter factory tuned and tested on customer's frequency



Compact in-line construction of BTA-50H showing left to right, first power amplifier, exciter, second power amplifier, and rectifier-control cubicles with doors open.

DESCRIPTION

The RCA Type BTA-50H AM Broodcast Tronsmitter is o completely oir-cooled, 50-kw phase-to-amplitude modulated equipment designed for high fidelity transmission in the stondard broadcost band (535 kc to 1620 kc). It provides a signal contoining exceptionally low distortion and extended frequency response. Measured response is flat within ±3 db from 35 cycles to 25,000 cycles. The equipment is capoble of being modulated over the frequency range of 10 cycles to 30,000 cycles. Frequency response has been extended largely through the elimination of unnecessary transformers in the audio system as well as improved circuitry.

Low harmonic distortion with negligible carrier shift at maximum signal output has been achieved in the BTA-50H by selection of adequate new tube types and advanced design throughout the entire equipment. The design features an inherently linear system capable of continuous high modulation levels impervious to inadvertent overmodulation. For example, the transmitter may be modulated 100 per cent at any frequency between 30 and 15,000 cycles continuously for many hours without detrimental effects to any of the component parts. A small omount of overoll feedback is incorporoted to provide the exceptionol performonce. With the feedbock circuit removed, the BTA-50H will still meet the FCC specifications for audio frequency response, harmonic distortion ond noise.

A number of new refinements as well as time tested features which have proven their worth are incorporated in RCA's latest 50-kw transmitter. Power requirements are moderate for the BTA-50H equipment. Power amplifier plate efficiency of the order of 76 to 80 per cent is obtained. Total power consumption for 50-kw carrier power will run approximately 94 kw, approximately 100 kw will be required for average levels of modulation, and approximately 130 kw will be required for 100 per cent modulation.

Fewer major components, as compared to those required by many 50-kw transmitters, are used in the BTA-50H. In addition to the low cost of operation of the BTA-50H, a Power Cutback Kit, MI-27688-A can be added which will permit operation at 10 kw.

Lowest Operating Cost in 50-KW Transmitters

Two identical r-f chains, each developing a power of 25 kw, are incorporated in this equipment. Since they are identical, servicing is made easy by comparison of the two chains. Components are directly interchangeable, which allows substitution for comparison purposes. All components are easily accessible which results in a minimum schedule required for maintenance. In addition, fewer replacement parts are required for adequate protection against lost air time should a failure occur. Low power consumption, fewer major components and reduced maintenance schedule make the BTA-50H operation cost the lowest in the 50-kw field.

Completely Designed for Remote Control Operation

The BTA-50H AM Transmitter has been designed with remote control operation in mind. Ready for use with standard RCA remote control equipment, all transmitter components and wiring are standard in the equipment for FCC required metering and control facilities. In addition, other optional metering and control facilities may be incorporated by utilizing components and wiring that is supplied with the equipment. Details relative to incorporating remote switching to an auxiliary transmitter, dummy load and auxiliary power supplies can be supplied according to the needs of the individual customer.

Lightweight Type 6697 Tubes Used in Final Amplifier

One Type 6697 power amplifier tube is used in each of the two r-f chains. Each amplifier tube is capable of delivering in excess of the normal 25 kw of modulated power to the common load. The Type 6697 is rated at 35 kw dissipation while under average modulation conditions it is required to dissipate approximately 14 kw. Operation of the PA tubes so far below their maximum ratings assures the user of long tube life. In addition to providing long life, the 6697 is physically small in size and weighs only 43 lbs. One person, without the aid of mechanical assistance can quickly and easily replace any tube in the BTA-50H.

One Type 4CX5000A tube is used in each of the driver stages in the two r-f chains. The 4CX5000A is also operated well below its maximum ratings and will give long trouble free service. Other tubes used in this equipment are of the small, low cost variety. Tube complement is such that inventory cost for required spares is kept at a minimum while adequate protection to the broadcaster is maintained.

Solid State Rectifiers Used Throughout

All power supplies utilize solid state rectifiers. The plate supplies, bias supply and low voltage supply use silicon units which are very conservatively rated to assure long life. The HV plate supply is immersed in oil to completely eliminate corona and other environmental hazards. The peak inverse voltage rating is 2.2 times operating PIV to withstand abnormal voltage surges. The current rating of the units is such that any conceivable load fault is cleared without jeopardizing the diode units. The use of solid state rectifiers permit the transmitter to operate in ambient temperatures as low as —20 degrees centigrade.

Meets FCC Harmonic Suppression

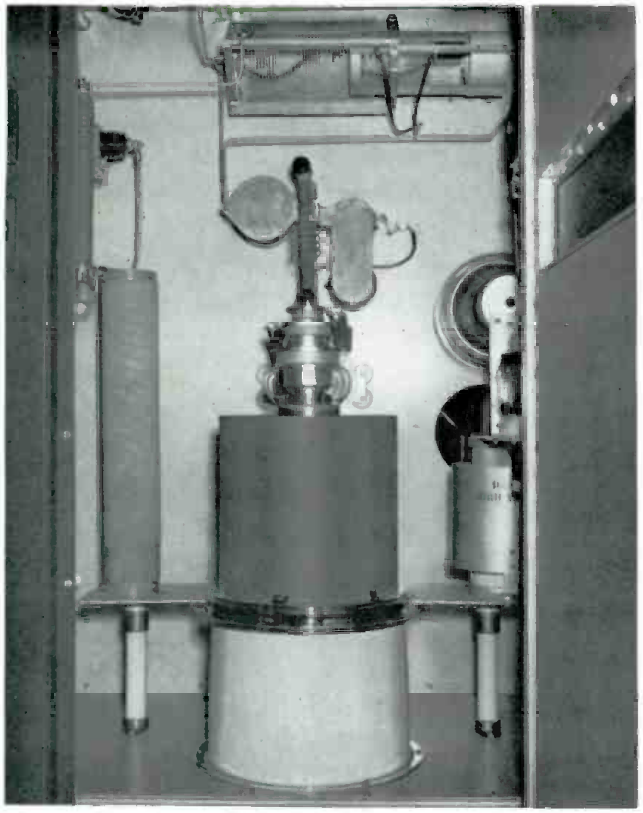
In line with recent concepts concerning degree of suppression of spurious radiation, a completely shielded two section low pass filter is incorporated in the BTA-50H. It consists of one pi (π) section and one T section and each inductive series element is completely shielded. Two series-tuned, shunt-connected traps are used to provide added attenuation of the second harmonic. Typical BTA-50H harmonic measurements are:

		With Reference to Carrier Level
2nd harmonic	—	84 db
3rd harmonic	—	86 db
4th harmonic	—	91 db
5th harmonic	—	83 db
6th harmonic	—	101 db
7th harmonic	—	92 db
8th harmonic	—	97 db
9th harmonic	—	103 db
10th harmonic	—	106 db

Transmitter Equipment

Type BTA-50H AM Broadcast Transmitter consists of four equipment cabinets, two of which house the power amplifiers, one the exciter unit and the fourth cabinet the rectifier and control unit (MI-27888). The high-voltage reactor is housed in the lower rear compartment of the exciter cabinet, and the IHV plate transformer in the lower rear compartment of the rectifier and control unit cabinet. Both may be fastened to the floor as desired.

Each of the four transmitter cabinets measure 44 inches wide by 60 inches deep by 84 inches high, and consists of an all aluminum cubicle erected on a welded steel base. This cubicle consists of a series of panels fabricated and assembled to form a rigid structure. The use of aluminum eliminates unnecessary weight and provides excellent shielding to assure effective confinement of spurious



Close-up view of one of the dual final power amplifier stages. The new Type 6697 tube together with grid circuits and part of the plate circuits are readily accessible from the front of the transmitter.

energy. Maximum accessibility to all transmitter components are afforded by 28-inch wide, full-length front doors, while rear access is through two covers attached with quick-disconnect fasteners for easy removal.

A center vertical panel separates the cabinet into a front compartment and rear compartment which is further divided by a rear horizontal shelf into upper and lower compartments, giving each cabinet three basic totally shielded compartments in which to mount the electrical components. The eye-level meters, pilot lights and interlocks, mounted on eight-inch wide panels flanking each of the front doors, are also shielded.

In the rear at the top of each cabinet there is a built-in wire duct which joins similar ducts of the adjacent cabinets to form a continuous duct on the four front cabinets. This duct has a divider down the center on which the interconnection terminal boards are mounted. The rear half of the duct is used for interconnection wiring while the front half is used for internal cabinet wiring from the terminal boards. The internal wiring is carried through conduits to its destination in the cabinet thus shielding all power and control wiring from r-f fields. Provision is also made at the top of the cabinets for the addition of an exhaust air duct.

Power Amplifiers

The left end cabinet and the third cabinet from the left end are identical and contain the final power amplifier stages. The 6697 tube and its grid circuits and part of the plate circuits are contained in the front portion of the cabinet. The upper rear section contains the plate tank coil, shielded filament transformer and grid leak resistors. The lower rear section contains a low noise blower which cools the 6697 tube and its cabinet and the adjacent half of the exciter cabinet. The two 6697 power amplifiers are designed to supply equal amounts of power to the output network. Because of the balanced dissipation in the two 6697 PA tubes, less air pressure with resultant lower air flow is required for adequate cooling of the power amplifier cubicles. The lower rear panel contains an impingement type air filter for the blower. The PA cabinets are constructed so that the blowers and filters can be mounted externally to the cabinets, if so desired.

Exciter-Modulator

Located directly between the two power amplifier units is a cabinet that houses in its front section all the components from the oscillator through the driver stages. The separate branches are assembled as mirror images for symmetrical feed to the PA units at left and right. The rear cabinet section contains the 50 kw common output circuit, harmonic filter, and reflectometer protective circuits.

Upper rear of exciter portion of the BTA-50H showing the combining and output networks.

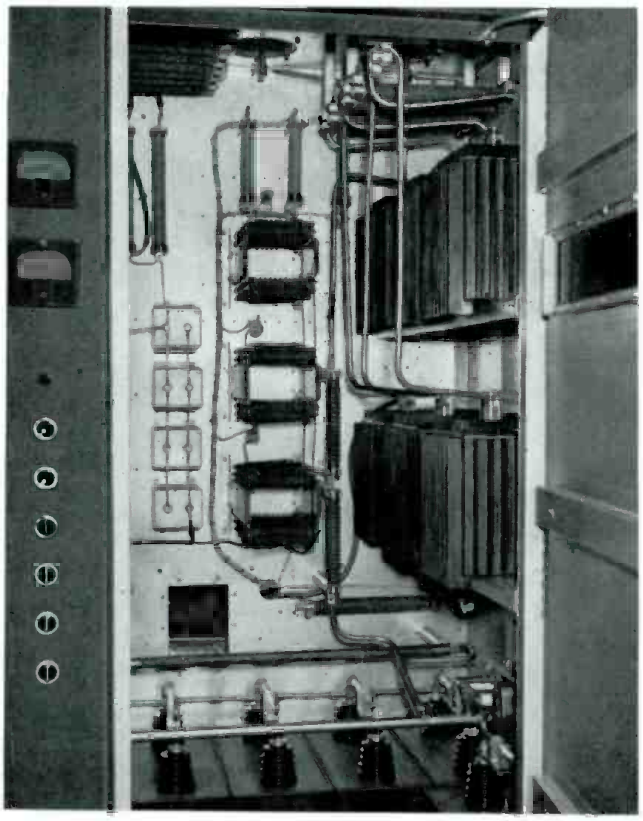
Two 807 crystal oscillators are located at the bottom front of the cabinet. The exciter-modulator unit is mounted on sliding rails directly above the drive regulator. It is a self-contained unit with the r-f and a-f components mounted on a vertical hinged panel which in turn is mounted on a horizontal chassis containing the power components for the exciter-modulator. Above are two vertical sub-compartments behind interlocked doors which contain the 4-250 and 4CX5000A stages. A meter panel for these stages is located at the bottom of these sub-compartments.

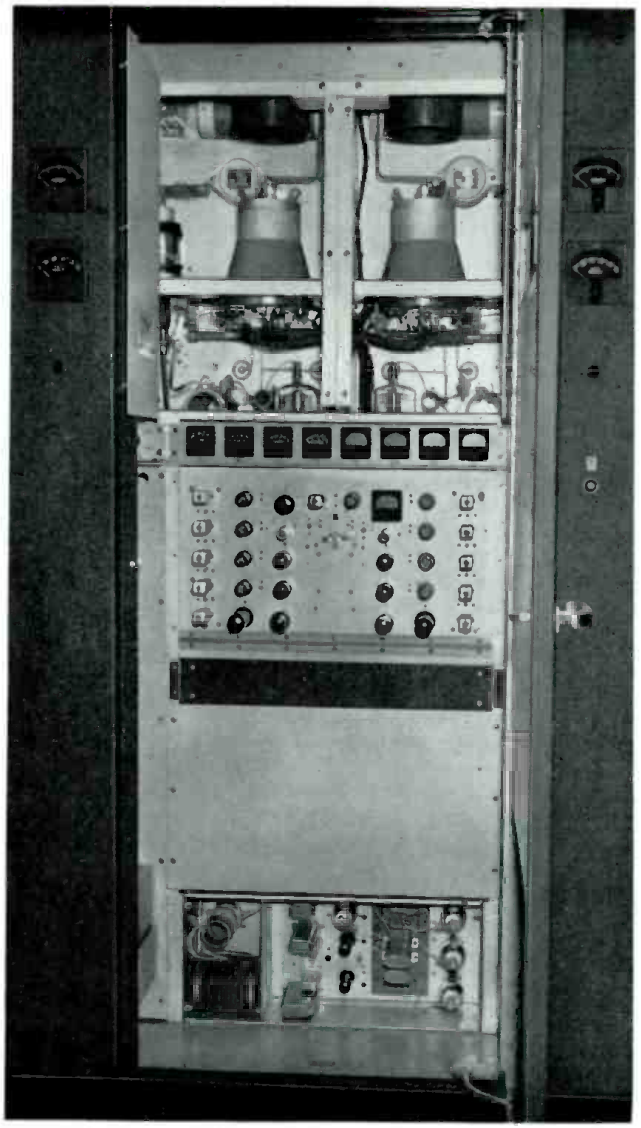
The common output capacitors of the two PA tanks and the harmonic filter are located in the upper rear of the cabinet. Sub-partitions are so arranged in this section that complete isolation and shielding is effected between the various sections of the filter and the output capacitor. The lower rear section of this cabinet contains high voltage filter reactor and driver d-c filament supplies.

Provisions for Standby Operation

Space is provided in the exciter-modulator cabinet for the mounting of a second exciter-modulator unit. It is mounted on sliding rails like the first unit directly above the drive regulator. Each of the above dual modulator-exciter units are complete and arranged so that either may be selected instantly by means of cut-over switches. Thus while modulator #1 is in operation, modulator #2 is in standby condition. Either of the 807 oscillators in the BTA-50H can be instantly switched to either modulator. These provisions with the extreme reliability designed into the high power stages essentially provides a second 50-kw transmitter for standby service. The spare modulator and necessary tubes is supplied in the form of an optional kit (ES-34264).

Front view of rectifier and control unit revealing solid-state power supplies.

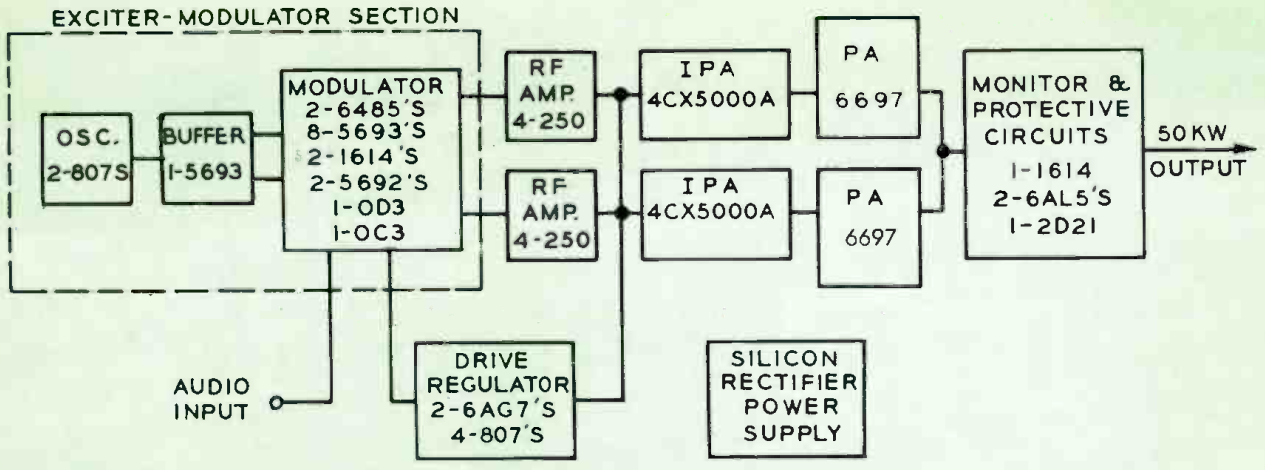




Front section of the exciter-modulator containing all components from oscillator through the driver stages.

Rectifier and Control Unit

The right hand cabinet contains the high power rectifiers, low power distribution components, and the majority of the control components. The front of the cabinet contains the solid state 15-kv, 5-kv, and low-voltage bias supplies. Also included here are the high voltage grounding switches and the 15-kv filter capacitors. The top rear section of the cabinet contains the control relays, overload relays, dis-



Simplified block diagram of the BTA-50H.

tribution contactors, and the low power distribution circuit breakers. The distribution breakers and overload relays are readily accessible, even though recessed so that they will not be damaged or improperly operated. The bottom rear of the cabinet contains the 5-kv rectifier components including plate transformer.

Circuit Description

R-F is generated in the BTA-50H by an 807 crystal controlled oscillator operating at carrier frequency. This signal is amplified and then separated into two channels differing in phase by 180 degrees. Each signal is then passed through d-c modulator stages adjusted so that a phase difference of approximately 135 degrees exists between the two signals. Modulation is applied at this point to each r-f channel by a variable resistance type of phase modulator.

The modulation process consists of the injection of a variable resistance into the plate tank circuit of the 5693 modulated stage in accordance with the modulation intelligence. This variable resistance is obtained through the use of cathode follower stages utilizing 5692 triodes. The outputs of the modulated stages are then fed through the 1614 amplifier stages. The power level after the 1614 amplifiers is in the order of 5 watts, sufficient to adequately drive the following class "C" amplifier stages. These stages use 4-250 tetrodes that in turn drive 4CX5000 ceramic, air-cooled, tetrode amplifiers.

The PA output circuit is a conventional pi-network type of tank circuit. Each tube has its own tank circuit, with a common output shunt element. Each network is adjusted to provide the proper load to the power amplifiers.

A completely shielded low pass filter is incorporated in the output circuit of the equipment. A two-section, low pass filter is used. Two series-tuned shunt connected traps are used to provide added attenuation of the second harmonic. Filtering functions of the BTA-50H easily meet or exceed present requirements of the FCC.

Drive Regulator

The drive regulator samples the audio signal, amplifies it, and applies a desired value to the grids of the second IPA, providing adequate drive to the final amplifiers as required by the level of audio input applied to the equipment. This technique contributes considerably to the overall efficiency during modulation.

The drive regulator, consisting of three audio amplifiers (two 6AG7's and an 807) driving three 807 cathode followers, is used to control the grid operation conditions of the final power amplifier tubes to assure maximum plate efficiency over the complete audio cycle. During the trough of modulation when zero or very little output is required from the final stage, the drive regulator reduces the drive to the final stages; and, conversely, at the peak of modulation when maximum power is required from the final stage, the drive is increased over that at carrier condition.

During periods of 100 percent modulation, the 6697 power amplifier tubes require 15-kv d-c at 7.5 amperes, which is obtained by using oil immersed silicon power rectifiers in a three phase full wave rectifier circuit. Two other plate voltages, 5-kv and 1-kv, are provided by separate silicon supplies. Bias voltages for all tubes are supplied by an additional supply. The high power distribution equipment for the transmitter consists of an electrically operated air circuit breaker, and a manually operated delta-wye switch for the 15-kv rectifier. The remaining transmitter power is distributed through a manually operated distribution circuit breaker to a 460 to 230-volt distribution transformer to valtage regulators and thence to the various low power distribution circuit breakers.

Transmitter Control

Control circuits in the BTA-50H cor.tain a number of features which are designed to provide maximum flexibility in control, protection and operation. Among these are choice of single-button or step-by-step starting, automatic timing and sequencing of starting operations, and location of transmitter faults by a system of indicators. Protection of the operator is achieved by a system of interlocking grounding devices; protection of the equipment by conventional relays and circuit breakers. There are provisions for the protection of the equipment against transmission line irregularities and air failure. A reflectometer is incorporated in the BTA-50H that is sensitive to the changes in voltage to current ratio on the output transmission line to the antenna. A great change in transmitter load acts to remove the carrier by removing drive momentarily to allow any r-f fault to clear. If, however, the fault persists after removing carrier several times, the plate power is automatically removed.

Control of the transmitter is accomplished from the front of the rectifier and control cabinet. All necessary wiring to allow control from a remote location or console has been provided. Lamps which show the status of the transmitter control circuits are also mounted on the front of this cabinet. The control ladder is arranged and interlocked so that the BTA-50H can either be turned on by operating the control switches in sequence or by leaving all control switches in the ON position with the exception of the start switch, which when operated to the ON position allows the transmitter to automatically come on.

The two types of overload circuits used in this transmitter are the current type, instantaneous or time delay, that are connected directly in the tube circuit and rectifier ground leads, and the thermal magnetic circuit breakers connected in the a-c power leads used as back up protection and disconnect switches. The transmitter circuitry is arranged so that an overload will either lock out the plate circuit or allow a single reclosure that will reset if there are no further overloads. In either case, when a lockout position has been reached, the transmitter can be reset by means of an overload reset control. The principal overload relays have indicating flags so that even after the overload has been cleared there is a record of which overload has operated. Another feature of the control circuit is provision of indication lamps on each cabinet that indicate the status of the interlock in that particular cabinet.

A convenient accessory is the MI-27983 Phase Meter Panel which provides a simple, accurate measurement of the phase angle between two r-f input signals of "amplifphase" transmitters. The panel also provides rack mounted remote loading controls which may be used to adjust the output tuning of a BTA-50H Transmitter. The panel is designed for installation in a standard relay rack and requires only seven inches of panel space.

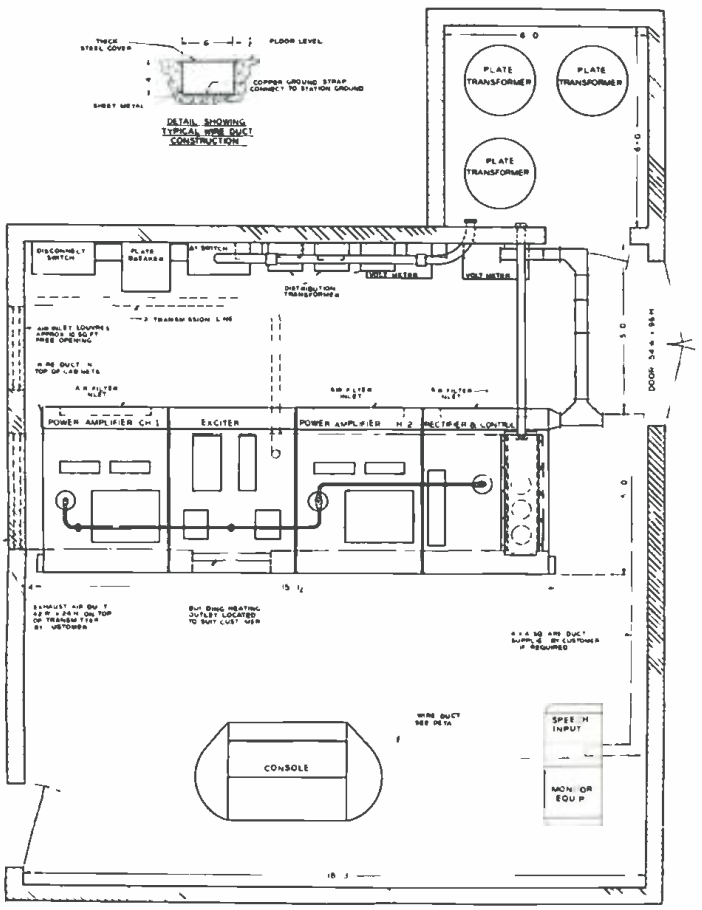
Installation and Layout

Outstanding features of the BTA-50H are the small floor space requirements and ease of installation of the transmitter. In general, the transmitter layout consists of three basic parts: the four in-line cabinets which contain the major part of the transmitter; the wall mounted switchgear components; and the main plate transformers. The floor plan illustrates a typical layout of the complete equipment. Elimination of the need for under-floor cable trenches and considerable reduction in external air ducts, simplifies installation and reduces costs.

As shown in the layout, it is desirable to leave a passageway at the right end of the frontline cabinets since the circuit breakers and overload relays are most accessible from this end of the transmitter. The layout of the front line cabinets is such that a common exhaust duct can be used to carry off heated air from the transmitter.

Wall mounting as shown on the overall floor plan is suggested to make the BTA-50H most adaptable to existing

Typical floor plan for the BTA-50H Transmitter



transmitter buildings. The mounting of these components, however, is not critical as to location. They can be mounted in existing power distribution areas if desired. These components include the main plate circuit breaker, a delta-wye switch, a distribution circuit breaker, a 460 to 230-volt bank of distribution transformers, and two single phase open delta connected regulators with their control panels. These components are wired through conduit and overhead ductwork to the main plate transformers and the transmitter cabinets.

SPECIFICATIONS

Power Line Requirements:
Line.....460 volts, 50/60 cycles, 3 phase
Combined Regulation and Variation.....Not more than ±5%
Power Consumption.....94 kilowatts (approx.) at zero modulation
100 kilowatts (approx.) at average modulation
130 kilowatts (approx.) at 100% modulation
Power Factor.....Better than 90%
Crystal Heaters.....110 volts, 50/60 cycles, 300 watts
Type of Emission.....A3
Power Output (at transmitter terminals).....56 kilowatts (max.)
Frequency.....Any specified betwen 535 and 1620 kc
Frequency Stability.....Assigned frequency ±5 cycles
Type Modulation.....Phase to amplitude
AF Input Impedance.....150/600 ohms
Audio Input Level.....+10 ±2 dbm
Audio Response.....±1.5 db 30—10,000 cycles
AF Distortion (95% mod.).....Less than 3% RMS 50—7500 cycles
Noise Level.....60 db below 100% modulation
Carrier Shift.....Less than 5% neg. 100% modulation
Type Output.....Unbalanced
Output Impedonce.....51.5 ohms or others specified
Spurious Emission (2nd Harmonic and above).....83 db down

Mechanical Specifications

Cabinet Size.....44" wide, 84" high, 63" deep
Overoll Weight.....12,000 lbs. approx.
Maximum Altitude.....7500 ft.
Ambient Temperature.....—20°C +45°C
Maximum Cabinet Weight.....3,093 lbs., approx.
PA Cabinet Weights (each).....953 lbs., approx.
Plate Transformer Weight (total).....820 lbs., approx.
Rectifier Weight.....3,093 lbs., approx.
Exciter Weight.....1,241 lbs., approx.
Filter Reactor.....570 lbs., approx.

TUBE COMPLEMENT:

Exciter-Modulator Section:

2	807	Oscillator Tubes
1	5693	Buffer Amplifier
2	5693	DC Modulator
6	5693	Modulated Amplifier
2	1614	R-F Amplifier
2	6485	1st Audio Amplifier
4	5692	Phase Modulator
1	OD3	Low Voltage Regulator
1	OC3	Low Voltage Regulator

R-F Amplifier Section:

2	4-250A	Intermediate Power Amplifier
2	4CX5000A	Driver Amplifier
2	6697	Power Amplifier

Drive Regulator Section:

1	6AG7	1st Audio Amplifier
1	807	Intermediate Audio Amplifier
1	6AG7	Intermediate Audio Amplifier with Linearity Control
3	807	Cathode Follower Output Amplifier

Monitor Circuits:

1	1614	Frequency Monitor Amplifier
2	6AL5	Reflectometer
1	2D21	Thyratron Control

Equipment Supplied

Type BTA-50H 50 KW "Ampliphase" AM Broadcast Transmitter (complete).....ES-27221-B
Including the following:

2	Power Amplifiers	MI-27601-8
1	Exciter Unit	MI-27887
1	Rectifier and Control Unit	MI-27888
1	Installation Material	MI-27895
3	H.V. Plate Transformers:	
	For 60 cycle line frequency	MI-27605-A
	For 50 cycle line frequency	MI-27605-B
1	I.H.V. Plate Transformer:	
	For 60 cycle line frequency	MI-27889
	For 50 cycle line frequency	MI-27889-A
3	Distribution Transformers:	
	For 60 cycle line frequency	MI-27607
	For 50 cycle line frequency	MI-27607-A
2	Induction Regulators:	
	For 60 cycle line frequency	MI-27608-A
	For 50 cycle line frequency	MI-27607-B
1	High Voltage Reactor	MI-27609
1	Circuit Breaker:	
	For 60 cycle line frequency	MI-27610
	For 50 cycle line frequency	MI-27610-A
1	Reduced Voltage Switch	MI-27611
1	Modulator Exciter	MI-27612-A
2	Blowers	MI-27897
2	Crystal Oscillator Units, Type UL-4392	MI-19458
1	Miscellaneous Hardware Kit	MI-7474
1	Finish Touch-Up Kit	MI-7499-A
1	Set of Operating Tubes	ES-27222-C
2	Type TMV-129B Crystal Units, including crystal ground to frequency specified by D.T.W.	MI-27494
1	Nameplate	MI-28180-1
1	Set of Frequency Determining Parts for Exciter	MI-27892*
1	Set of Frequency Determining Parts for Exciter Modulator	MI-27893*
2	Sets of Frequency Determining Parts for Power Amplifier	MI-27625-A
1	R-F Output Meter	MI-27644†
1	Elapsed Time Meter:	
	For 60 cycle line frequency	MI-27896-1
	For 50 cycle line frequency	MI-27896-2
1	Set of Installation Drawings	8513250-501
2	Instruction Books	IB-30283
2	Installation Books	IB-30276

Accessories

Set of Spare Tubes.....ES-27223-C
Spare Modulator Kit.....ES-34264
Dummy Load Schedule of Parts and Instructions.....ES-34234
50/10 Cutback Kit for BTA-50H Transmitter.....MI-27688-A
Remote Control Equipment.....ES-34243
BPA-50 Antenna Tuning Unit.....MI-28903-A/B
Remote R-F Pickup Unit.....MI-28027-A
Type BW-11A Frequency Monitor.....MI-30011-B
Type BW-66F Modulation Monitor.....MI-30066-B
Phase Deviation Indicator (for BTA-50G/H).....MI-27983

* Specify station's assigned frequency.
† Select current range as determined by customer's transmission line characteristic.

Allow 30 days for tuning on customer's frequency.

1 KW FM Broadcast Transmitter

Type BTF-1D, ES-27279

FEATURES

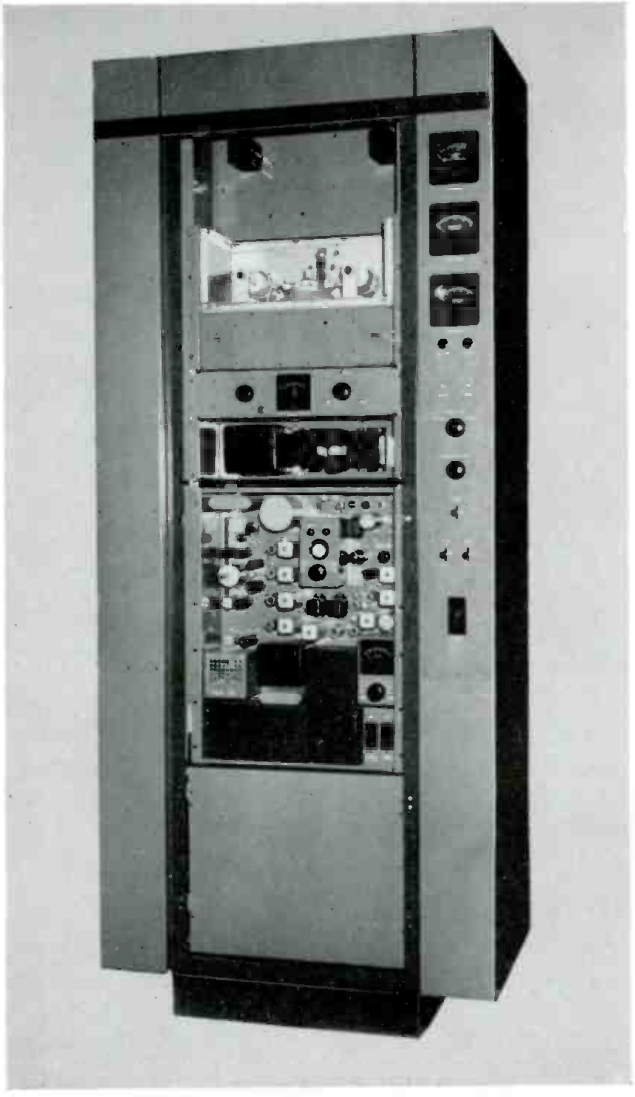
- Exciter and 1 power tube supply 1000 watts — no IPA stage
- Extremely stable
- Incorporates "Direct FM" exciter which requires fewer tubes and parts — easier to tune
- Voltage regulating filament transformer
- Equipped with silicon power supplies
- Meets all FCC requirements for harmonic and spurious emission
- Housed in single rack requiring minimum of floor space
- Designed for remote control
- High quality stereo with optional BTS-1A Generator
- Easy to install and operate

DESCRIPTION

RCA's Type BTF-1D FM Transmitter provides 1,000 watts output for stations operating in the 88 to 108 mc band. It is designed to provide the finest possible performance and reliability, and is specifically built to meet the stringent requirements of multiplex service transmission. It is a simple and compact unit easy to install.

The BTF-1D Transmitter supplies the latest in FM broadcast techniques. Only one tube beyond the exciter is required to supply 1000 watts output. No IPA stoge is required. The transmitter is extremely stable becouse it incorporates RCA's time-proven "Direct FM" Exciter. This exciter requires no special tuning or setting up for standard or for multiplex operations. It also reduces the number of components and tubes required. All circuits are single tuned; and, for further ease of tuning, there is a built-in oscilloscope. Cross-talk and noise are kept to an absolute minimum.

Other features incorporated in the BTF-1D include silicon rectifiers which provide long life with o minimum of maintenonce. Accessibility is ossured both front and rear by vertical chossis construction, surface mounting of components, and hinged mounting of the exciter. Mechanical and electrical overlood protection is provided. All tubes operate at conservative rating for long life. The BTF-1D is also



Type BTF-1D transmitter with door and r-f cavity shield removed.

designed so that a minimum number of tubes and components are required in the transmitter. In an emergency the transmitter can be operated with only eight tubes. To assure performance in accordance with FCC requirements, the transmitter is supplied with harmonic filter. Provisions for remote control have been provided.

High quality FM stereo transmission can be obtained by the addition of an RCA BTS-1A Stereo Generator. SCA programming may be transmitted simultaneously with stereo by the use of the optional BTX-1A subcarrier generator. The BTF-1D is type accepted for such simultaneuos program transmission.

Single Cabinet

The Type BTF-1D FM Transmitter is completely housed in one cabinet with total floor dimensions of only 35 by 21 inches. The cabinet is functionally styled to present a pleasing appearance. All meters and operating controls are conveniently located on a control panel to the right of the cabinet door. Front and rear hinged doors give easy access to all portions of the transmitter.

Located at the front are the overload relays, the 1 kw amplifier and r-f box containing tuning dials for the amplifier. A control panel and screen supply are located next, followed by the hinged mounted exciter. Concealed in the bottom of the transmitter are the high voltage rectifier and power transformer. The rear of the transmitter gives access to the bias resistors, metering circuitry and blower, followed by the rear of the control panel and screen supply. A voltage regulating filament transformer is mounted on the control panel.

Multiplex Exciter

The well known Type BTE-10B Multiplex Exciter contains a modernized version of RCA's modulator and frequency control circuits that require fewer tubes and components. The exciter, including self-contained semi-conductor, d-c power supply and line and plate breaker-switches, is mounted on a single vertical chassis. The chassis hinges forward to provide instant accessibility to all components and wiring.

Frequency modulation is accomplished directly by push-pull reactance tubes connected across the frequency determining circuits of the modulated oscillator. The "direct modulation" process eliminates numerous multiplier and converter stages with resulting low noise and distortion levels. A subcarrier reactance tube is coupled to a small portion of the oscillator coil for modulating one or two subcarriers in multiplex operation. Effective decoupling minimizes the possibility of cross-talk between main and subcarrier channels. Only seven tubes of the exciter are used in the audio and r-f generating circuits. The remaining tubes do not affect the quality of transmission in any way.

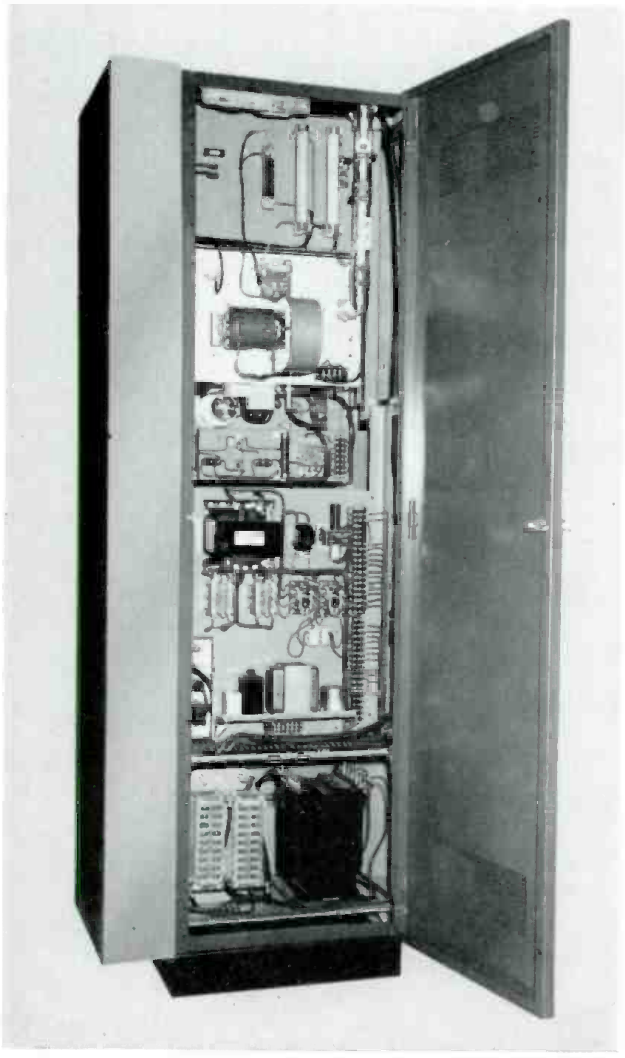
The output frequency is controlled automatically by means of an AFC circuit in association with an off-frequency detector. This circuit has a long record of reliable operation. The transmitter is automatically taken off the air if the operating frequency goes beyond normal tolerances. However, the AFC circuits may be by-passed by means of an AFC switch and the transmitter frequency maintained manually by means of the frequency-control knob. Adjustment of the AFC circuits is simplified by means of a built-in cathode ray oscilloscope. A switch permits instantaneous checking and adjustment of the stable dividers. Lock in is easily observed at any time without disturbing the operation of the transmitter. Single-tuned circuits are used in the r-f multiplier and output stages of the BTE-10B Exciter.

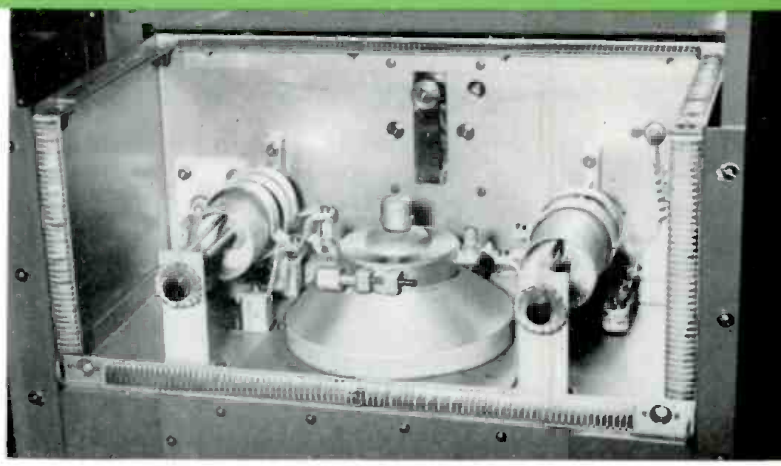
Power Amplifier

The output of the exciter is fed to the input of the ceramic 4CX1000A amplifier tube. The amplifier input circuit is a simple parallel resonant circuit, tuned by a variable inductance with resistance swamping for stability of operation. This stage is neutralized by varying inductance in series with the screen. The output circuit is a modified pi network, having a variable inductance across the tube capacity — which is used to adjust the loading. All capacitors in the final stage are of the fixed ceramic type. A blower mounted on the back of the r-f compartment provides sufficient filtered air for cooling at stations operating below 7500 feet. The filament transformer is of the automatic regulator type and keeps filament voltage constant within one percent.

The power amplifier is new in many respects. The variable inductors use no sliding contacts. There are no variable capacitors in the power amplifier. A single tube, the 4CX1000A, is used in the BTF-1D power amplifier and it is driven directly by the output of the exciter in an exclusive RCA circuit. Consequently, the transmitter can be operated with only eight tubes if there should be a failure in the AFC circuit of the exciter.

Rear view of BTF-1D including blower, voltage regulating filament transformer, and silicon power supply.





R-f cavity with shielded cover removed.

A neutrolizing probe is furnished with the tronsmitter. It utilizes the multimeter to indicote correct neutrolizotion of the power omplifier.

The high voltoge ond screen power supplies moke use of silicon rectifiers in o bridge circuit. This combined with choke input ond odequote filtering results in on excellent well-reguloted power source. A voriable tronsformer is used in the primory of the screen power supply to control power output of the tronsmitter. Filoment voltoge regulotion is provided for the 4CX1000A power omplifier tube.

Harmonic Filter

The harmonic filter supplied with all RCA FM transmitters is not a simple harmonic trap. The filter consists of an M-derived half-T section, several low-pass filter sections, and a constant-K, half-T section. The M-derived section provides rapid cut-off in the second harmonic region, and a termination impedance at one end of the filter of 50 ohms. Attenuation of the harmonics is accomplished by the low-pass filter sections, while the constant-K, half-T section serves to give a termination impedance of 50 ohms at the other end of the unit. The use of such a filter assures compliance with FCC requirements regarding spurious radiation, as all harmonics through the seventh are effectively attenuated.

Protective Circuits

Power circuits are protected by magnetically tripped circuit breakers as well as overload relays. An interlock relay prevents application of plate power until the 4CX1000A filament has heated and the exciter has reached a stable operating condition. Overload relays are used in the high voltage and screen power supplies. There is also an inter-

lock in the air blower circuit. If the blower should fail or air flow be reduced below the proper level, the transmitter is taken off the air and possible damage to the transmitter avoided.

The overload relays are reset remotely or by means of an instantaneous key switch on the front panel. An overload indicator lamp signals when an overload has taken place. All relays are easily accessible. Access to high voltage areas is protected by built-in high voltage shorting devices.

Control Features

The BTE-10B exciter has a self-contained multimeter. It is used to read modulator cathode current, second and third multiplier grid current, PA cathode and plate current, AFC control voltage and plate voltage.

In the amplifier portion of the transmitter, provision is made for metering PA plate current, plate voltage, output power and VSWR; a multimeter is also supplied for neutralization and tuning. All tuning controls are located on the front panel for easy accessibility. They include key switches for filament on-off, plate on-off, and overload reset. The variable power control is also mounted on the front as are the overload indicator and plate power-on lights. The use of latching relays make it possible to control the transmitter with one button.

The BTF-1D transmitter incorporates connections for remote control and remote meter reading when combined with a remote control system such as the BTR-11B or BTR-20B. Terminals for transmitter on-off, plate on-off, overload reset, plate voltage, cathode current, and power output are provided. To control transmitter power output remotely, an accessory motor drive may be connected to the screen supply control.

SPECIFICATIONS

Performance Specifications

Type of Emission	F3 and F9
Frequency Range	88 to 108 mc
Power Output	250-1000 watts
Output Impedance (1⅝" O.D. Line)	50/51.5 ohms
Frequency Deviation, 100% modulation	±75 kc
Modulation Capability	±100 kc
Carrier Frequency Stability	±1000 cycles max.
Audio Input Impedance	600/150 ohms
Audio Input Level—*(100% mod.)	+10 ±2dbm
Audio Frequency Response—**(30-15,000 cycles)	±1 db max.
Harmonic Distortion—***(30-15,000 cycles)	0.5% or less
FM Noise Level (referred to 100% FM mod.)	—65 db max.
AM Noise Level (referred to 100% AM mod.)	—50 db max.
Subcarrier Input Level (30% mod. of Carrier)	5 volt max.
Subcarrier Input Impedance	10,000 ohms
Subcarrier Frequency	30-67 kc

Electrical Specifications

Main-to-Subchonnel Crosstalk.....—53 db referred to ±7.5 kc deviation of the subcarrier by a 400 cps tone. Main channel modulation 85% by 30-15,000 cps tones

Sub-to-Main-Channel Crosstalk.....—65 db referred to ±7.5 kc deviation of the main carrier by a 400 cps tone. Subchannel modulated 100% (±7.5 kc/s) by 30-6000 cps tones. Subcarrier modulated 30% on main carrier

Power Line Requirements:

Line	240/208 volt, 1φ, 50/60 cycles
Slow Voltage Variation	±5%
Power Consumption	2800 watts (approx.)
Power Factor (approx.)	80%

Crystal Heaters:

Line	117 volt, 1φ, 50/60 cycles
Power Consumption	28 watts

Tube Complement

Exciter:

5—6AH6	3—6AQ5	2—5763
1—6146	1—6CL6	1—12AT7
1—6AS6	1—6AU6	1—OD3
1—2D21	1—1EP1	

Power Amplifier:

1—4CX1000A

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* Level measured at input to pre-emphasis network

** Audio Frequency response referred to 75 micro-second pre-emphasis curve

*** Distortion includes all harmonics up to 30 kc and is measured following a standard 75 micro-second de-emphasis network.

Mechanical Specifications

Dimensions (overall):	
Width	34½"
Height	84"
Depth	20⁹⁄₁₆"
Weight	790 lbs.
Finish:	
Cabinets	Dark umber gray, polished stainless steel trim
Doors	Burgundy red or dork umber gray
Altitude	7500 Ft. max.
Ambient Temp. Range	—20° to +45° C

Equipment Supplied

Type BTF-1D 1 KW FM Brodcast Tronsmitter.....ES-27279

Including the following:

1	1 KW FM Transmitter, Type BTF-1D	MI-34532
1	FM Exciter, Type BTE-10B	ES-27278
1	Installation Kit	MI-34537
1	Set of Operating Tubes	ES-27281
1	Nameplate	MI-28180-1
1	Reducer, 3⅛" to 1⅝"	MI-19112-7
1	Coupling	MI-19112-8
1	Harmonic Filter:	
	For Frequency from 88 to 98 mc	MI-27967-1
	For Frequency from 98.1 to 108 mc	MI-27967-2
2	Instruction Books	IB-30274-P
1	Door (front) (Customer to select color from MI-27645 Series)	MI-27645-K1 or K2*
1	Touch-Up Finish Kit (Select color from MI-27600-A to suit color of door.)	MI-27660-B
1	Elbow	MI-19112-18NF

Accessories

Recommended Set of Spare Tubes	ES-27296
Motor, Remote Power Control	MI-27558
Type BTR-11B Remote Control System	ES-34280
Type BTS-1A Stereo Subcarrier Generotor	ES-560202
Type BTX-1A Subcarrier Generator	ES-27295
Filter for BTX-1A, if used during stereo transmissions	MI-560003
BW-73A Modulation and Multiplex Monitor	ES-560200
Frequency and Modulation Monitor	335-BR
Auxiliary Rack Cabinet	ES-34211-A
Frequency Monitor	TBM-3000

5 KW FM Broadcast Transmitter

TYPE BTF-5D

FEATURES

- Designed for Multiplex, Stereo and SCA
- Widest frequency response: 30 - 15,000 cycles flat ±1 db
- Only two tubes beyond the exciter — 1 driver, 1 final
- No double tuned circuits
- Simplified controls with complete circuit protection
- Housed in two compact cabinets affording front and rear accessibility
- Uses silicon high voltage power supply— no rectifier tubes in the transmitter
- Designed and built for remote control— no accessories required
- Incorporates reflective type harmonic filter. Suppression exceeds FCC Specifications

DESCRIPTION

The RCA Type BTF-5D is another in RCA'S line of fine FM broadcast transmitters. The BTF-5D, 5 KW FM transmitter, is the successor to the time proven BTF-5B. Essentially it is the same transmitter with improved design features including building block approach (expansible to higher powers), completely siliconized high voltage rectifiers, separate grid bias in the final for added stability, etc. In addition the BTF-5D is designed for stereo or SCA programming as specified by the FCC.

Compact and simplified mechanical construction with attractive cabinet styling produces an economical installation with dignified appearance. The entire transmitter is housed in two steel cabinets, occupying a floor space of 50½ inches by 32 inches. Accessibility and speedy circuit tracing are assured by vertical chassis construction, surface mounting of components, and tilt-out exciter chassis. One subcarrier generator may be placed in the exciter-driver cabinet of the BTF-5D. A second subcarrier generator, FM broadcast monitor, multiplex monitor, etc., may be placed in a matching cabinet that is attached to the left of the transmitter, giving a symmetrical appearance. This optional accessory rack cabinet, complete with hinged front and back doors, is available as ES-34211-A.

"Direct FM" Exciter

The heart of the transmitter is the experience proven "Direct FM" exciter, Type BTE-10B, which is capable of multiplex operation for stereo and/or standard background music. This exciter produces the highest quality sound with the best bass response. By incorporating the BTE-10B exciter, the frequency response of the BTF-5D is essentially flat ±1 db from 30 to 15,000 cycles. Distortion over the same wide range and harmonics to 30 kc is 0.5 per cent or less.

The "Direct FM" exciter, including self-contained semiconductor DC power supply and line and plate breaker switches, is mounted on a single vertical chassis. The chassis hinges forward to provide instant accessibility to all components and wiring.

Frequency modulation is accomplished directly by push-pull reactance tubes connected across the frequency determining circuits of the modulated oscillator. The "direct modulation" process eliminates numerous multiplier and converter stages with resulting low noise and distortion levels. Effective decoupling minimizes the possibility of cross-talk between main and subcarrier channels. Only six tubes of the exciter are used in the r-f generating circuits. The remaining tubes (balance in AFC and OFF Frequency Alarm circuits) do not affect the quality of transmission in any way.

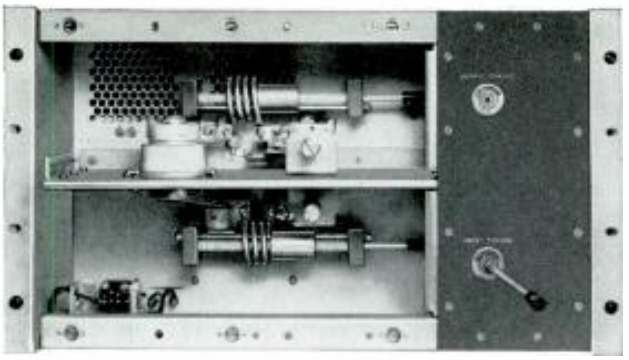
The output frequency is automatically controlled by the AFC circuit in association with an off-frequency detector. Reference for the AFC is a crystal (MI-34509). As a result frequency stability of the exciter is crystal controlled. In an emergency, the AFC circuits may be bypassed by means of an AFC switch and the transmitter frequency maintained manually by means of the frequency-control knob. Adjustment of the AFC circuits is simplified by means of a built-in cathode ray oscilloscope. A switch permits instantaneous checking and adjustment of the stable dividers. Lock-in is easily observed at any time without disturbing the operation of the transmitter by using the "scope" and multimeter.

Amplifier

Two simplified single ended amplifiers operating class "C" follow the exciter. The 250-watt driver stage is a 7034 tube, and the final power amplifier is a 4CX5000A. The 250-watt stage is tuned by means of Pi network input and output circuits. No taps or sliding contacts are used. The inductors are varied by means of silver plated movable slugs. The power amplifier also uses familiar Pi network circuitry; but in this case tuning is accomplished by variable inductors operating at ground potential. Large area contacts having low current density are used. Neutralization is required only in the final amplifier. The adjustment is not critical and can be made by means of preset slides.

The tube, a ceramic tetrode, 4CX5000A, is designed for very high power gain with little drive. By using this tube, only two stages of amplification are required between the exciter and the antenna for 5,000 watts output. With fewer components there is better reliability and less possibility of error in tuning. Actual operating conditions have shown that the 4CX5000A will give excellent performance

Front view of the BTF-5D showing the convenient location of all components. On the right the Exciter is mounted at the bottom of the cabinet; above it is the IPA stage, and at the top the BTX-1A Multiplex Subcarrier Generator. The power supplies, cooling, and PA stage are in the cabinet on the left.



BTF-5D 250-Watt IPA with front panel removed.

and long life when used in the Type BTF-5D transmitters. The BTF-5D is very easy to tune and maintain. Power output is controlled by means of a variable motor-driven transformer connected in the primary of the screen voltage supply. The screen voltage is varied simultaneously on both the driver and final amplifier tubes.

For increased transmitter stabiliy and reliability, a separate grid bias supply has been incorporated in the 5 kw amplifier. No rectifier tubes are used in the BTF-5D. The use of semiconductor rectifiers reduces operating and maintenance costs. Silicon diodes are used in the high voltage supply.

Harmonic Filter

To meet today's stringent requirements regarding spurious emission RCA includes with the BTF-5D, as standard equipment, a reflective type harmonic filter. As a consequence, transmitter performance meets and exceeds the FCC requirements for spurious emission. The filter is not merely a second harmonic trap, but consists of an M-derived half-T section, several low pass filter sections, and a constant K, half-T section. Attenuation of the harmonics is accomplished by the low-pass filter sections, while the constant-K, half-T section serves to give a termination impedance of 50 ohms at the other end of the unit. The use of such a filter assures compliance with FCC requirements regarding spurious radiation, as all harmonics through the seventh are effectively attenuated.

Protective Circuits

Power circuits are protected by magnetically tripped circuit breakers as well as overload relays. An interlock relay prevents application of plate power until all filaments have heated and the exciter has reached a proper operating condition. In addition, a latching relay automatically re-applies power to the transmitter two times before locking-out in case of brief overloads or power interruptions. The overload relays are reset by means of an instantaneous key-switch on the front panel.

An overload indicator lamp signals when an overload has taken place. Access to high voltage areas is protected by built-in high-voltage shorting devices.

Cooling air for the BTF-5D is supplied by means of one blower that is mounted in the amplifier section of the transmitter. Heavy sound insulation is used to reduce noise to a minimum. The blower cools both the IPA and PA stages, which are each protected by air-flow failure switches. To channel maximum air past the tubes, a chimney is mounted over the 7034, and the 4CX5000A is mounted in a chamber that is pressurized below the anode connection.

Control Features

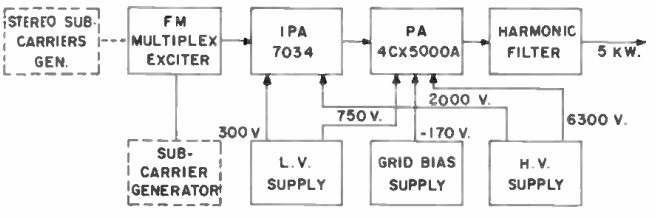
The BTE-10B exciter has a self-contained multimeter. It is used to read modulator cathode current, second and third multiplier grid current, PA cathode and plate current, AFC control voltage and plate voltage.

The 5 kw amplifier cabinet provides metering of the PA plate current, plate voltage, hours elapsed-time, VSWR—power output, a-c line volts and a multimeter. All tuning adjustments can be made by means of front panel controls. They include key switches for filament-on, plate on and off, screen raise and lower, and overload reset. Front panel lights indicate all main functions such as transmitter-on, transmitter ready, plate on, and overload.

Remote Control

Remote control facilities are provided in the transmitter, and terminals are provided for this type of use with remote control units such as the Type BTR-11B or BTR-20A. Terminals are provided for remote control of transmitter on-off, plate on-off, raise-lower power, and overload reset. Remote metering connections in the final amplifier for cathode current, IPA cathode current, plate voltage, and power output are also provided.

Block diagram of the BTF-5D 5 KW Transmitter.



SPECIFICATIONS

Performance Specifications

Type of Emission.....F3 and F9
Frequency Range.....88 to 108 mc
Power Output.....1 to 5 kw
Output Impedance (1⅝" O.D. Line).....51.5 ohms
Frequency Deviation 100% modulation.....±75 kc
Modulation Capability.....±100 kc
Carrier Frequency Stability.....±1000 cycles max.
Audio Input Impedance.....600/150 ohms
Audio Input Level—*(100% mod.).....+10 ±2 dbm
Audio Frequency Response—**(30-15,000 cycles).....±1 db max.
Harmonic Distortion—***(30-15,000 cycles).....0.5% or less
FM Noise Level (referred to 100% FM mod.).....—65 db max.
AM Noise Level (referred to 100% AM mod.).....—50 db max.
Subcarrier Input Level (30% mod. of Carrier).....5 volt max.
Subcarrier Input Impedance.....10,000 ohms

Electrical Specifications

Main-to-Subchannel Crosstalk.....—55 db referred to ±7.5 kc deviation of the subcarrier by a 400 cps tone. Main channel modulation 85% by 30-15,000 cps tones

Sub-to-Main-Channel Crosstalk.....—65 db referred to ±75 kc deviation of the main carrier by a 400 cps tone. Subchannel modulated 100% (±7.5 kc/s) by 30-6000 cps tones. Subcarrier modulated 30% on main carrier

Power Line Requirements:
Line.....240/208 volt, 3 phase, 50/60 cycles
Slow Voltage Variation.....±5%
Power Consumption.....10,000 watts (approx.)
Power Factor (approx.).....90%

Crystal Heaters:
Line.....117 volt, single phase, 50/60 cycles
Power Consumption.....28 watts

Tube Complement

Exciter:

5—6AH6	3—6AQ5	2—5763
1—6146	1—6CL6	1—12AT7
1—6AS6	1—6AU6	1—OD3
1—2D21	1—1EP1	

Driver:
1—7034

Power Amplifier:
1—4CX5000A

———

* Level measured at input to pre-emphasis network

** Audio Frequency response referred to 75 micro-second pre-emphasis curve

*** Distortion includes all harmonics up to 30 kc and is measured following a standard 75 micro-second de-emphasis network.

Mechanical Specifications

Dimensions (overall):
Width.....62 11/16"
Width (with additional optional monitor rack).....84½"
Height.....84"
Depth.....32"
Weight.....1305 lbs. (approx.)

Finish:
Cabinets.....Dark umber gray, polished stainless steel trim
Doors.....Burgundy red or dark umber gray

Altitude.....7500 ft. max.†
Ambient Temperature Range.....—20° to +45°C

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† RCA can provide blowers, etc. for operation above this altitude.

Equipment Supplied

BTF-5D FM Broadcast Transmitter.....ES-34224
Including the following:

1 250-Watt Driver.....MI-34502-A
1 5-KW Amplifier (BTF-5D).....MI-34554
1 FM Exciter (BTE-10B).....ES-27278
1 Plate Transformer.....MI-34507
1 Blower.....MI-34508-A
1 Side Panel (End Shield).....MI-34531-2
1 Harmonic Filter.....MI-27967-1 or -2
1 Reducer 3⅛" to 1⅝".....MI-19112-7
1 Coupling.....MI-19112-8
1 Tool Kit.....MI-27088
1 Installation Material Kit.....MI-34552
1 Installation Material Kit.....MI-34558
1 Finish Touch Up Kit.....MI-27660
1 Set of Operating Tubes.....ES-34227
1 Door, Right Hand, choose decor as follows:
Burgundy.....MI-27645-K1
Light Umber Gray.....MI-27645-K2
1 Door, Left Hand, Choose decor as follows:
Burgundy.....MI-27645-L1
Light Umber Gray.....MI-27645-L2
1 Nameplate.....MI-28180-1

Accessories

Auxiliary Equipment Rack for BTF-5D Transmitter (Specify Door Color).....ES-34211-A
Complete Set of Spare Tubes for BTF-5D.....ES-34227
Recommended Minimum Spare Tubes.....ES-34238
Type BTR-11B Remote Control System.....ES-34280
Type BTX-1A Subcarrier Generator.....ES-27295
Type BTS-1A Stereo Generator.....ES-560202
Set of Spare Tubes for BTS-1A.....MI-560005
53 KC Filter for use with BTX-1A when transmitting stereo and SCA.....MI-560003
Conversion Kit (BTF-5D to BTF-10D).....MI-34553/MI-34559

Specifications subject to change without notice.

10 KW FM Broadcast Transmitter

TYPE BTF-10D

FEATURES

- Designed for Multiplex, Stereo and SCA
- Extremely stable—Frequency response 30 to 15,000 cycles
- Incorporates "Direct FM" Exciter
- Highest fidelity for stereo
- Only two tubes beyond the exciter—1 driver, 1 final
- No double tuned circuits
- Simplified controls with complete circuit protection
- Minimum floor space
- Uses silicon high voltage power supply
- Designed and built for remote control
- Incorporates low pass harmonic filter. Suppression exceeds FCC specifications
- Vertical chassis construction — front and rear accessibility

DESCRIPTION

The RCA Type BTF-10D, 10 KW FM Transmitter is designed for use in the standard FM broadcast band, 88 to 108 mcs, and is specifically designed to meet the stringent requirements of multiplex service transmission. The design of the BTF-10D, which includes the popular "Direct FM" exciter, Type BTE-10B, has proven itself in actual commercial operations.

Compact and simplified mechanical construction with attractive cabinet styling produces an economical installation with dignified appearance. The entire transmitter is housed in two steel cabinets, occupying a floor space of 62 1/16 by 32 inches. Accessibility and speedy circuit tracing are assured by vertical chassis construction, surface mounting of components, and tilt-out chassis.

The exciter unit of the BTF-10D employs "Direct FM" modulator circuits, which require no special tuning when setting up for Multiplex. All circuits are single tuned. There is a built-in scope for ease of tuning. An absolute minimum of tubes and components is required in the new transmitter, and all tubes operate at conservative ratings for long life. The transmitter is designed to operate from a three-phase 240/208 volt, 50/60 cycle power line.

The BTF-10D is specifically designed for highest fidelity stereo. One SCA multiplex channel may also be transmitted simultaneously with stereo. Optional stereo and SCA generators are available. The "Direct FM" system assures stable, reliable stereo transmission.

Unitized Construction

The Type BTF-10D FM transmitter consists of a 250-watt driver housed in a Type BR-84 cabinet and a 10 kw amplifier which includes the power supply and forced air blower in a matching cubicle. The plate transformer is mounted externally in any convenient location. The heart of the transmitter is the exciter designed for use with one or two subcarrier generators. It is housed in the same cabinet as the 250-watt driver.

Accessibility is achieved by vertical chassis construction plus surface mounting of components and wiring for easy and speedy circuit tracing and servicing. Six meters and all controls are grouped on two panels located at either side of the amplifier cubicle. Interlock circuits protect operating personnel from high voltages when doors or panels are opened. The cabinets have been styled functionally to present a pleasing appearance, and the doors of the transmitter may be ordered in burgundy red or dark umber gray.

Multiplex Exciter

The well known Type BTE-10B Multiplex Exciter contains a modernized version of RCA's modulator and frequency control circuits that require fewer tubes and components. The exciter, including self-contained semiconductor d-c power supply and line and plate breaker-switches, is mounted on a single vertical chassis. The chassis hinges forward to provide instant accessibility to all components and wiring.

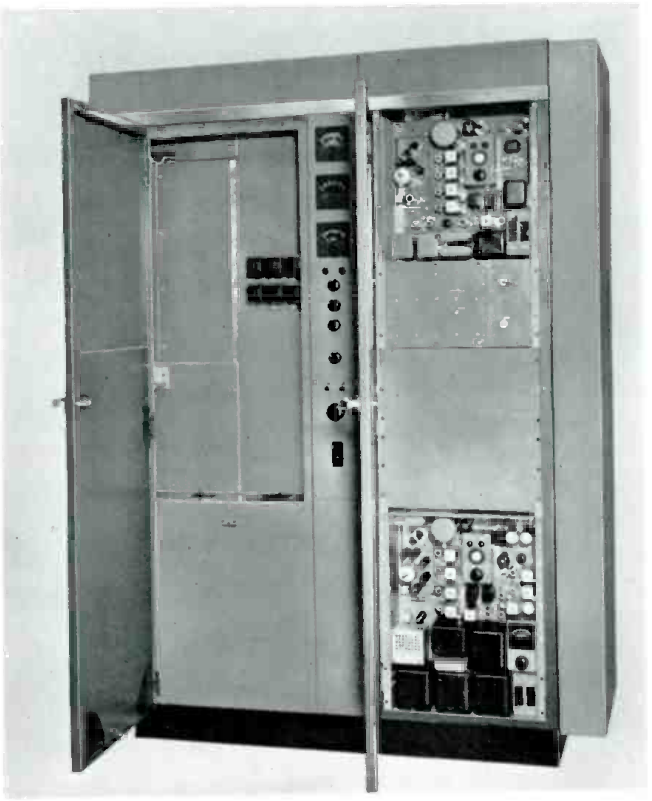
Frequency modulation is accomplished directly by push-pull reactance tubes connected across the frequency determining circuits of the modulated oscillator. The "direct modulation" process eliminates numerous multiplier and converter stages with resulting low noise and distortion levels. A subcarrier reactance tube is coupled to a small portion of the oscillator coil for modulating one or two subcarriers in multiplex operation. Effective decoupling minimizes the possibility of cross-talk between main and subcarrier channels. Only seven tubes of the exciter are used in the r-f generating circuits. The remaining tubes do not affect the quality of transmission in any way.

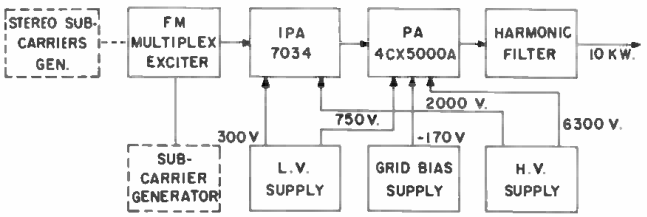
The output frequency is automatically controlled by the AFC circuit in association with an off-frequency detector. This circuit has a long record of reliable operation. The transmitter is automatically taken off the air if the operating frequency goes beyond normal tolerances. However, all of the AFC circuits may be by-passed by means of an AFC switch and the transmitter frequency maintained manually by means of the frequency-control knob. Adjustment of the AFC circuits is simplified by means of a built-in cathode ray oscilloscope. A switch permits instantaneous checking and adjustment of the stable dividers. Lock-in is easily observed at any time without disturbing the operation of the transmitter. Single-tuned circuits are used in the r-f multiplier and output stages of the BTE-10B Exciter.

Amplifier

Two simplified single ended amplifiers operating class "C" follow the exciter. The 250-watt driver stage is a 7034 tube, and the final power amplifier is a 4CX5000A. The 250-watt stage is tuned by means of Pi network input and output circuits. No taps or sliding contacts are used. The inductors are varied by means of silver plated movable slugs. The power amplifier also uses familiar Pi network circuitry; but in this case tuning is accomplished by variable inductors operating at ground potential. Large area contacts having low current density are used. Neutralization is required only in the final amplifier. The adjustment is not critical and can be made by means of preset slides.

Front view of the BTF-10D showing the convenient location of all components. On the right the Exciter is mounted at the bottom of the cabinet; above it is the IPA stage, and at the top the BTX-1A Multiplex Subcarrier Generator. The power supplies, cooling, and PA stage are in the cabinet on the left.





Block diagram of the BTF-10D 10 KW Transmitter.

The tube, a ceramic tetrode, 4CX5000A, is designed for very high power gain with little drive. By using this tube, only two stages of amplification are required between the exciter and the antenna for 10,000 watts output. With fewer components there is better reliability and less possibility of error in tuning. Actual operating conditions have shown that the 4CX5000A will give excellent performance and long life when used in the Type BTF-10D transmitters.

The BTF-10D is very easy to tune and maintain. Power output is controlled by means of a variable motor-driven transformer connected in the primary of the screen voltage supply. The screen voltage is varied simultaneously on both the driver and final amplifier tubes.

For increased transmitter stability and reliability, a separate grid bias supply has been incorporated in the 10 kw amplifier, no rectifier tubes are used in the BTF-10D. The use of semiconductor power supplies reduces operating and maintenance costs.

Harmonic Filter

The harmonic filter supplied with all RCA FM transmitters is not a simple harmonic trap. The filter consists of an M-derived half-T section, several low-pass filter sections, and a constant-K, half-T section. The M-derived section provides rapid cut-off in the second harmonic region, and a termination impedance at one end of the filter of 50 ohms. Attenuation of the harmonics is accomplished by the low-pass filter sections, while the constant-K, half-T section serves to give a termination impedance of 50 ohms at the other end of the unit. The use of such a filter assures compliance with FCC requirements regarding spurious radiation, as all harmonics through the seventh are effectively attenuated.

Protective Circuits

Power circuits are protected by magnetically tripped circuit breakers as well as overload relays. An interlock relay prevents application of plate power until all filaments have heated and the exciter has reached a stable operating condition. In addition, a latching relay automatically re-applies power to the transmitter three times before locking-out in case of brief overloads or power interruptions. The overload relays are reset by means of an instantaneous key-switch on the front panel.

An overload indicator lamp signals when an overload has taken place. Access to high voltage areas is protected by built-in high-voltage shorting devices.

Cooling air for the BTF-10D is supplied by means of one blower that is mounted in the amplifier section of the transmitter. Heavy sound insulation is used to reduce noise to a minimum. The blower cools both the IPA and PA stages, which are each protected by air-flow failure switches. To channel maximum air past the tubes, a chimney is mounted over the 7034, and the 4CX5000A is mounted in a chamber that is pressurized below the anode connection.

Control Features

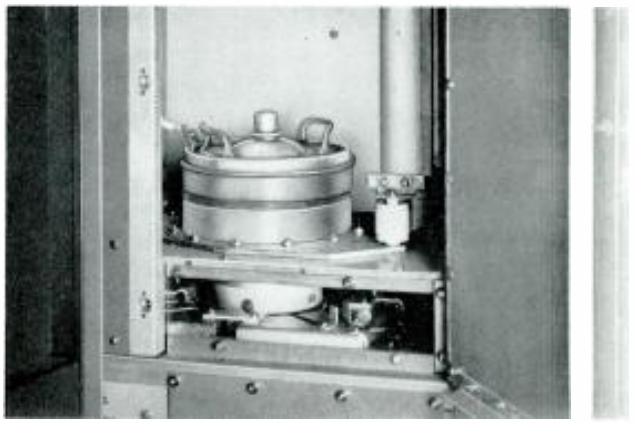
The BTE-10B exciter has a self-contained multimeter. It is used to read modulator cathode current, second and third multiplier grid current, PA cathode and plate current, AFC control voltage and plate voltage.

The 10 kw amplifier cabinet provides metering of the PA plate current, plate voltage, hours elapsed-time, VSWR—power output, a-c line volts and a multimeter. All tuning adjustments can be made by means of front panel controls. They include key switches for filament-on, plate on and off, screen raise and lower, and overload reset. Front panel lights indicate all main functions such as transmitter-on, transmitter ready, plate on, and overload.

Remote Control

Remote control facilities are provided in the transmitter and terminals are provided for this type of use with remote control units such as the Type BTR-11B or BTR-20B. Terminals are provided for remote control of transmitter on-off, plate on-off, raise-lower power, and overload reset. Remote metering connections in the final amplifier for cathode current, IPA cathode current, plate voltage, and power output are also provided.

BTF-10D Power Amplifier shown behind hinged front door.



SPECIFICATIONS

Performance Specifications

Type of Emission.....F3 and F9

Frequency Range.....88 to 108 mc

Power Output.....1 to 10 kw

Output Impedance (1⅝" O.D. Line).....50/51.5 ohms

Frequency Deviation 100% modulation.....±75 kc

Modulation Capability.....±100 kc

Carrier Frequency Stability.....±1000 cycles max.

Audio Input Impedance.....600/150 ohms

Audio Input Level—*(100% mod.).....+10 ±2dbm

Audio Frequency Response—**(30-15,000 cycles).....±1 db max.

Harmonic Distortion—***(30-15,000 cycles).....0.5% or less

FM Noise Level (referred to 100% FM mod.).....—65db max.

AM Noise Level (referred to 100% AM mod.).....—50db max.

Subcarrier Input Level (30% mod. of Carrier).....5 volt max.

Subcarrier Input Impedance.....10,000 ohms

Subcarrier Frequency.....30-67 kc

Electrical Specifications

Main-to-Subchannel Crosstalk.....—55 db referred to ±7.5 kc deviation of the subcarrier by a 400 cps tone. Main channel modulation 85% by 30-15,000 cps tones

Sub-to-Main-Channel Crosstalk.....—65 db referred to ±7.5 kc deviation of the main corrier by a 400 cps tone. Subchannel modulated 100% (±7.5 kc/s) by 30-6000 cps tones. Subcorrier modulated 30% on main corrier

Power Line Requirements:

Line.....240/208 volt, 3ϕ, 50/60 cycles

Slow Voltage Variation.....±5%

Power Consumption (approx.).....17,000 watts

Power Factor (approx.).....90%

Crystol Heaters:

Line.....117 volt, 1ϕ, 50/60 cycles

Power Consumption.....28 watts

Tube Complement

Exciter:

5—6AH6	3—6AQ5	2—5763
1—6146	1—6CL6	1—12AT7
1—6AS6	1—6AU6	1—OD3
1—2D21	1—1EP1	

Driver:

1—7034

Power Amplifier:

1—4CX5000A

* Level measured ot input to pre-emphasis network

** Audio Frequency response referred to 75 micro-second pre-emphasis curve

*** Distortion includes all harmonics up to 30 kc and is measured following a standord 75 micro-second de-emphasis network.

Mechanical Specifications

Width.....62 11/16"

Width.....59½"

Width (with additional optional monitor rack).....84½"

Height.....84"

Depth.....32"

Weight.....2020 lbs. (approx.)

Finish:

Cabinets.....Dark umber gray, polished stainless steel trim

Doors.....Burgundy red or dark umber gray

Altitude.....7500 ft. max.†

Ambient Temperature Range.....—20° to +45°C

† RCA can provide blowers, etc. for operation above this altitude.

Equipment Supplied

BTF-10D FM Broadcost Tronsmitter.....ES-34225
Including the following:

1	250-Watt Driver	MI-34502-A
1	10-KW Amplifier (BTF-10D)	MI-34554
1	FM Exciter (BTE-10B)	ES-27278
1	Plate Transformer	MI-34555
1	Blower	MI-34556
1	Side Panel (End Shield)	MI-34531-2
1	Harmonic Filter	MI-27967-1 or -2
1	Reducer 3⅛" to 1⅝"	MI-19112-7
1	Coupling	MI-19112-8
1	Tool Kit	MI-27088
1	Installation Material Kit	MI-34553
1	Installation Material Kit	MI-34559
1	Finish Touch-Up Kit	MI-27660-B
1	Set of Operating Tubes	ES-34227
1	Door, Right Hand, choose decor os follows: Burgundy	MI-27645-K1
	Light Umber Gray	MI-27645-K2
1	Door, Left Hond, Choose decor as follows: Burgundy	MI-27645-L1
	Light Umber Gray	MI-27645-L2
1	Nameplate	MI-28180-1
2	Instruction Book	IB-30280P

Accessories

Auxiliary Equipment Rack for BTF-10D Transmitter (Specify Door Color).....ES-34211-A

Complete Set or Spare Tubes for BTF-10D.....ES-34227

Recommended Minimum Spore Tubes.....ES-34238

Type BTR-11B Remote Control System.....ES-34280

Type BTX-1A Subcarrier Generator.....ES-27295

Type BTS-1A Stereo Subcorrier Generator.....ES-560202

Set of Spare Tubes for BTS-1A.....MI-560005

53 KC Filter for use with BTX-1A when transmitting stereo and SCA.....MI-560003

20 KW FM Broadcast Transmitter

TYPE BTF-20D

FEATURES

- Proven high power design
- Designed for multiplex and stereo
- Single ended RF circuits—one driver and two final amplifier tubes
- Incorporates "Direct FM" exciter—frequency response 30-15,000 cycles ±1 db maximum—distortion 0.5 percent or less 30-15,000 cycles
- Minimum tube costs—uses proven and reliable tubes
- Designed and built for remote control
- Semiconductor rectifiers used throughout
- Can operate with one power amplifier—each PA independent
- Incorporates two low pass harmonic filters. Suppression exceeds FCC specifications
- Simplified controls with complete circuit protection
- Unitized construction
- Maximum accessibility

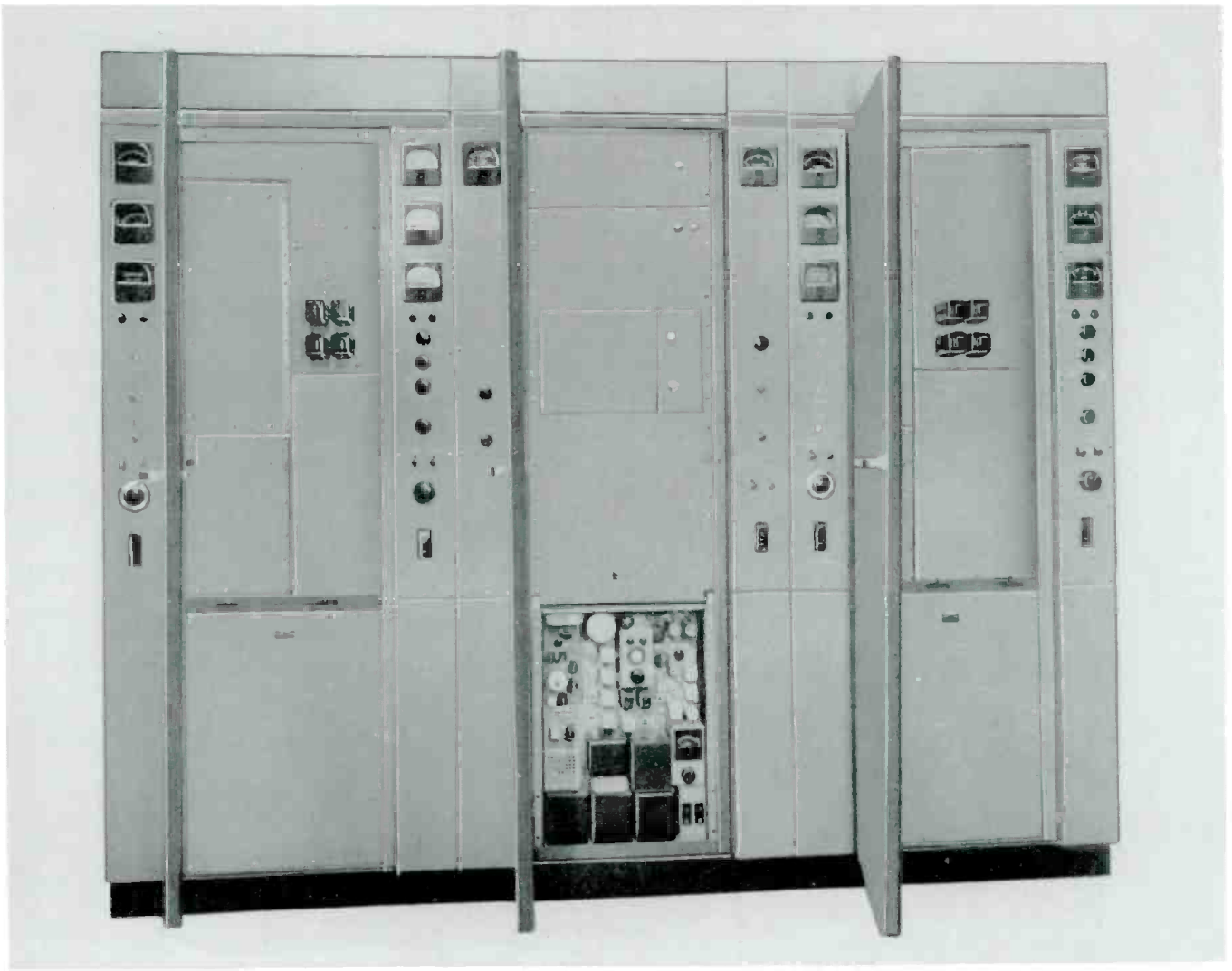
DESCRIPTION

The RCA Type BTF-20D, 20 KW FM Transmitter, is designed for use in the standard FM broadcast band, 88-108 mcs, and is specifically designed to meet the stringent requirements of multiplex service transmission. The transmitter consists of two 10 kw amplifiers driven by a common driver and exciter. The signal is combined in a diplexer and then fed to the antenna. Only ceramic tubes are used beyond the exciter. In all, there are three tubes between the exciter and the antenna feed. Each 10 kw amplifier is completely independent and uses the proven 4CX5000A. The entire transmitter is housed in three space saving, accessible cabinets containing all components except the two plate transformers.

The BTF-20D incorporates the time tested and proven RCA Type BTE-10B "Direct FM" exciter. Balanced reactance tube modulators are used to produce "Direct FM." Automatic frequency control circuits are used to assure operation on proper frequency. This exciter is ideal for multiplex and stereo operations as specified by the F.C.C.

The BTE-10B uses semiconductor power supplies for long life and dependability. For ease of tuning, the exciter includes a built-in oscilloscope and multimeter. All circuits are single tuned for peak readings. Frequency response of the BTE-10B from 30 to 15,000 cycles is flat ±1 db maximum and distortion over the same wide range is 0.5 percent or less.

From the output of the exciter, only three tubes (a ceramic 4CX300A in the IPA and a ceramic 4CX5000A in each PA) are required to generate the full 20-kw signal, and



Front view of BTF-20D Transmitter with doors open. In Center cabinet is seen the "Direct FM" exciter which is housed here together with 400-watt driver. Two 10-kw amplifiers with associated power supplies and blowers occupy matching cubicles on right and left.

only 21 tubes of 13 types are used in the entire transmitter. The BTF-20D is one of the most economical transmitters to operate.

The driver provides a balanced input to each power amplifier. Each PA has its own reflectometer and there is a third which reads the combined output power. A 1.5 kw reject load is coupled to the output and if the load mismatch goes beyond a safe level, an alarm is sounded and the transmitter is automatically taken off the air. A 7.5 kw water cooled reject load can be obtained as an optional item. Using this load it is possible to stay on the air, without transmission line switching, even if one PA should fail. The load absorbs half of the power of the still operating PA and transmission continues at quarter power. By using a 7.5 kw load or other optional transmission line switching, it is possible for the BTE-20D to operate with one PA and for maintenance to be done on the second PA, if necessary. All control circuitry is combined within the transmitter. The splitting of the driver output is accomplished in the driver cabinet and then fed to each power amplifier. Power for the driver is obtained from one of the PA's. If that PA should fail, automatic switching feeds power to the driver from the other PA still operating.

Other outstanding design features of the BTF-20D include two reflective harmonic filters, one for each PA. Harmonic suppression exceeds FCC specifications. The design also incorporates separate grid bias supplies for each PA for guaranteed stability. The use of semiconductor power supplies throughout reduce operating and maintenance costs and provide an operating temperature range of −20 to +45 degrees C. No taps or sliding contacts are used

in the IPA; the inductors are varied by means of silver plated movable slugs. In the power amplifiers, all adjustments are at ground potential. The transmitter has been designed and built for remote controlled operation. Terminals are provided for remote control of transmitter on-off, raise-lower power, overload reset, etc. while remote metering connections for each PA include cathode current, plate voltage and power output.

These features of the BTF-20D can be depended upon to supply maximum power with minimum size and minimum operating cost. Widest frequency response and lowest distortion afford an ideal medium for multiplex operation. It is a versatile transmitter that can be cut back to single PA for maintenance and still stay on air. Consequently, expensive and costly downtime can be kept to the absolute minimum.

Unitized Construction

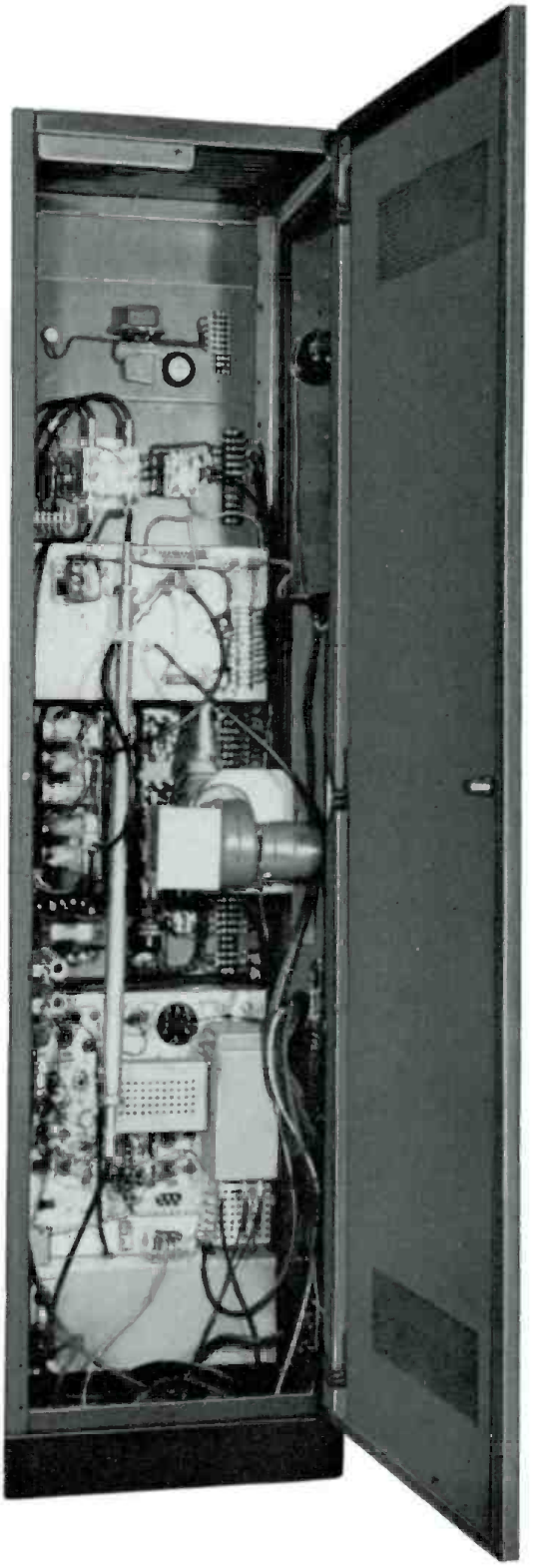
The Type BTF-20D FM Transmitter consists of a 400-watt driver housed in a Type BR-84 cabinet and two 10-kw amplifiers which, together with their associated power supplies and forced-air blowers, occupy matching cubicles on either side of the BR-84 cabinet. The two plate transformers are mounted externally in any convenient location. The heart of the transmitter is the exciter designed for use with one or two subcarrier generators. It is housed in the same cabinet at the 400-watt driver.

The cabinets have been styled functionally to present a pleasing appearance and to assure maximum accessibility. Surface mounting of components and accessibility to all wiring makes maintenance and service as convenient as possible. On six panels flanking the three cabinets are located all controls and the 14 meters used for rapid check of transmitter functions. Interlock circuits protect operating personnel from high voltages when doors or panels are opened. To harmonize with the equipment, front cabinet doors for the transmitter may be ordered in burgundy red or dark umber gray.

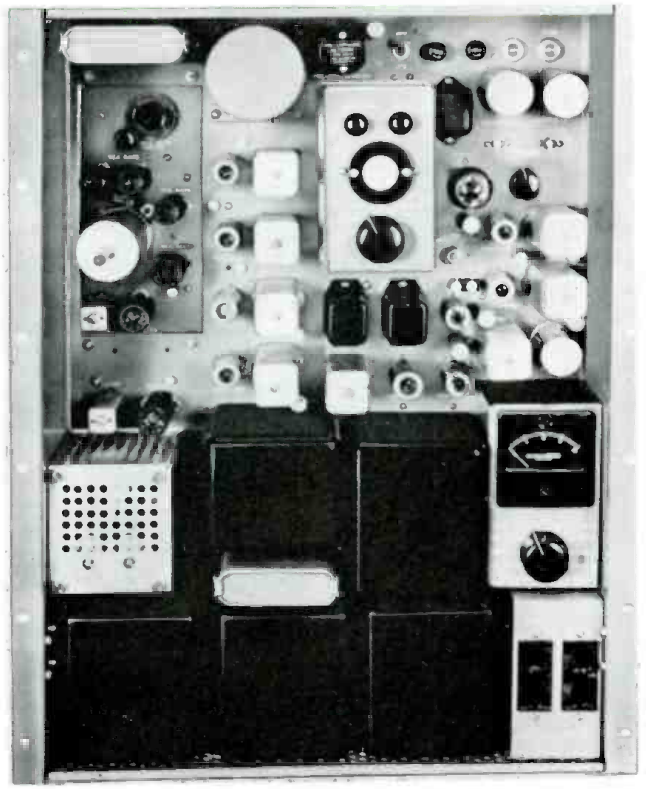
"Direct FM" Exciter

The BTE-10B Exciter, designed for stereo or multiplex, is an all electronic equipment using RCA's modulator and frequency control circuits that require fewer tubes and components. The exciter, including self-contained semiconductor d-c power supply, line and plate breaker-switches, is mounted on a single vertical chassis. The chassis hinges forward to provide instant accessibility to all components and wiring.

Frequency modulation is accomplished directly by push-pull reactance tubes connected across the frequency determining circuits of the modulated oscillator. The "Direct modulation" process eliminates numerous multiplier and converter stages with resulting low noise and distortion levels. A subcarrier reactance tube is coupled to a small



Rear view of exciter-driver cabinet.



BTE-10B Exciter including self-contained semiconductor d-c power supply is housed on hinged vertical chassis which provides instant accessibility to all components and circuits. The built-in scope permits constant observation of the AFC circuits. The meter, in the lower right side, is used to check all important circuit constants.

portion of the oscillator coil for modulating one or two subcarriers in multiplex operation. Effective decoupling minimizes the possibility of crosstalk between main and subcarrier channels. Only seven tubes of the exciter are used in the r-f generating circuits. The remaining tubes do not affect the quality of transmission in any way.

The output frequency is automatically controlled by the AFC circuit in association with an off-frequency detector. This circuit has a long record of reliable operation. The transmitter is automatically taken off the air if the operating frequency goes beyond normal tolerances. However, all of the AFC circuits may be by-passed by means of an AFC switch and the transmitter frequency maintained by means of the frequency-control knob. Adjustment of the AFC circuits is simplified by means of a built-in cathode ray oscilloscope and lock-in is easily observed at any time without disturbing the operation of the transmitter. A switch permits instantaneous checking and adjustment of the stable dividers. Single-tuned circuits are used throughout the BTE-10B Exciter.

Amplifier

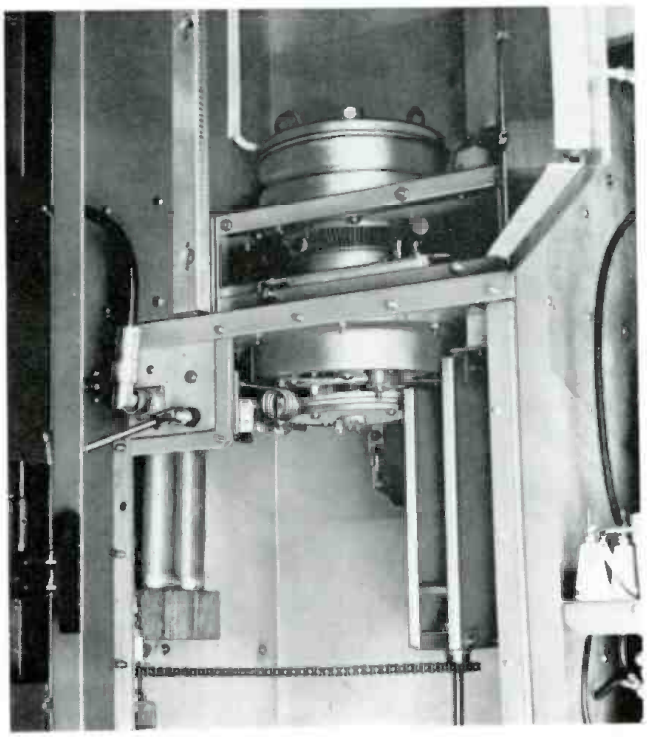
Three simplified single ended amplifiers operating class "C" follow the exciter. The 400-Watt driver stage uses a ceramic 4CX300A tube, and the two final power amplifiers use ceramic 4CX5000A tubes. Input and output circuits of the IPA are conventional Pi networks and inductive tuning permits varying from 88 to 108 mc without the need for neutralization. The stage is self-biased by grid and cathode resistors. No taps or sliding contacts are used. The inductors are varied by means of silver plated movable slugs. The output power of the 400-watt stage is divided to feed the two PA's. Metering is provided at this point to monitor the drive to each amplifier and assure equal division of the power.

Both power amplifiers also use familiar Pi network circuitry; but in this case tuning is accomplished by variable inductors operating at ground potential. Large area contacts having low current density are used. Neutralization is required only in the final amplifiers. The adjustment is not critical and can be made by means of preset slides.

Each power amplifier is identical even to its own high voltage transformer. This duplication makes servicing and trouble shooting quicker and easier since there is a constant reference. By comparing meter readings and by visual comparison, faults can be corrected in much less time than would otherwise be normal.

The PA tube, a ceramic tetrode, 4CX5000A, is designed for very high power gain with little drive. By using this tube, only three stages of amplification are required between the exciter and the antenna for 20,000 watts output. Actual operating conditions have shown that the 4CX5000A will give excellent performance and long life when used in 20 kw transmitters.

10-KW Power Amplifier stage used in the BTF-20D.



Power output in each amplifier is controlled by means of a variable motor driven transformer connected in the primary of the screen voltage supply. The screen voltage is varied simultaneously on both the driver and final amplifier tubes. For increased transmitter stability and reliability, a separate grid bias supply has been incorporated in each of the two 10-kw amplifiers, and no rectifier tubes are employed. The use of semiconductor power supplies reduces operating, maintenance, and building heating costs.

Harmonic Filter and Diplexer

The harmonic filters supplied with the 20D transmitter are not simple harmonic traps, but each consists of an M-derived half-T section, several low-pass filter sections, and a constant-K, half-T section. The M-derived section provides rapid cut-off in the second harmonic region, and a termination impedance at one end of the filter of 50 ohms. Attenuation of the harmonics is accomplished by the low-pass filter sections, while the constant-K half-T section serves to give a termination impedance of 50 ohms at the end of each unit. The two filters assure compliance with FCC requirements regarding spurious radiation, as all harmonics through the seventh are effectively attenuated.

An MI-27980 Diplexer is used to combine the power outputs of the two 10-kw amplifiers and to provide isolation between the two outputs. This is a coaxial bridge-type unit pretuned and adjusted for the desired operating frequency. The diplexer can handle r-f powers up to 50-kw. The diplexer serves to combine the two 10-kw inputs and provide a single 20-kw metered output to the antenna.

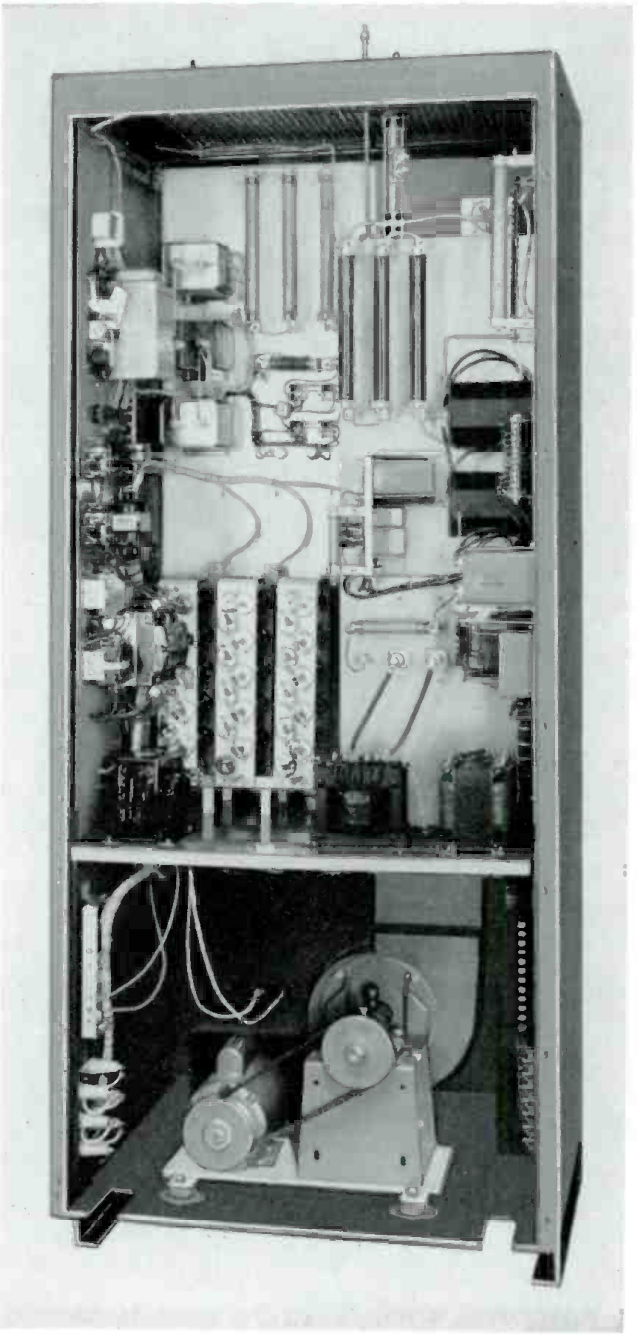
By means of a reject load, it is possible to meter power at the diplexer for final adjustment of the power amplifier circuits. The diplexer should be mounted near the transmitter, preferably ceiling mounted. All input and output terminals are designed for use with 3⅛-inch transmission line.

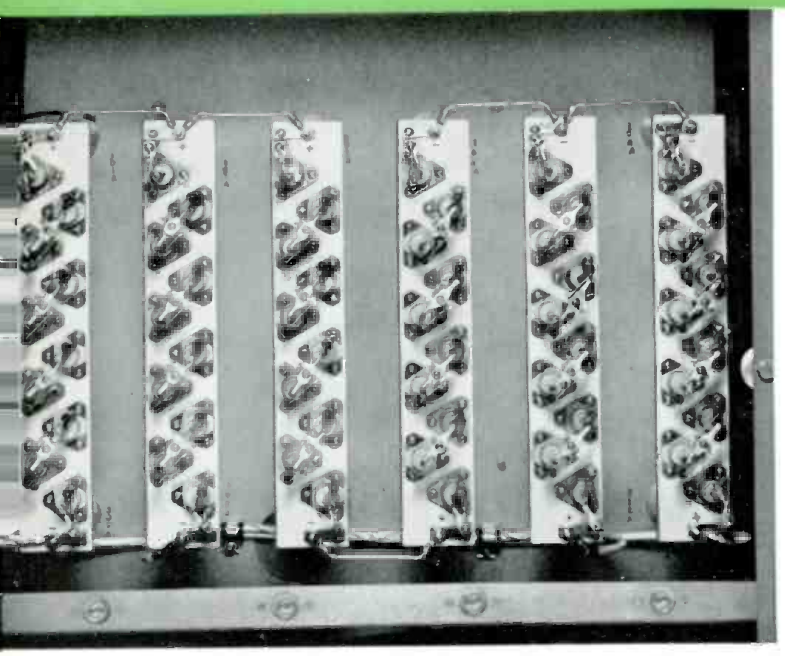
Protective Circuits

Power circuits are protected by magnetically tripped circuit breakers as well as overload relays. An interlock relay prevents application of plate power until all filaments have heated and the exciter has reached a stable operating condition. Overload relays are used in each phase of the high voltage rectifiers. In addition, a latching relay in each amplifier automatically re-applies power to the transmitter output twice before locking-out in case of brief overloads or power interruptions. The overload relays are reset by means of instantaneous key-switches on the front panels. Overload indicator lamps signal when an overload has taken place. Access to high voltage areas is protected by built-in high-voltage shorting devices.

Cooling air for the BTF-20D is supplied by means of two blowers that are mounted in the amplifier sections of the transmitter. A third blower cools the IPA stage. All three blowers are protected by air-flow failure switches and heavy sound insulation is used to reduce noise to a minimum. To channel maximum air past the tubes, a chimney is mounted over the 4CX300A, and the two 4CX5000A are mounted in chambers that are pressurized below the anode connections.

Rear view of one of the dual 10-kw amplifiers with one of the blowers shown at bottom. Each power amplifier is identical even to its own high voltage transformer. Increased stability and reliability is afforded by separate grid bias supplies. Semiconductor power supplies reduce operating and maintenance costs.





View of Silicon Rectifier Chassis. The silicon cells offer improved performance since they are particularly resistant to aging, moisture and wide temperature variations.

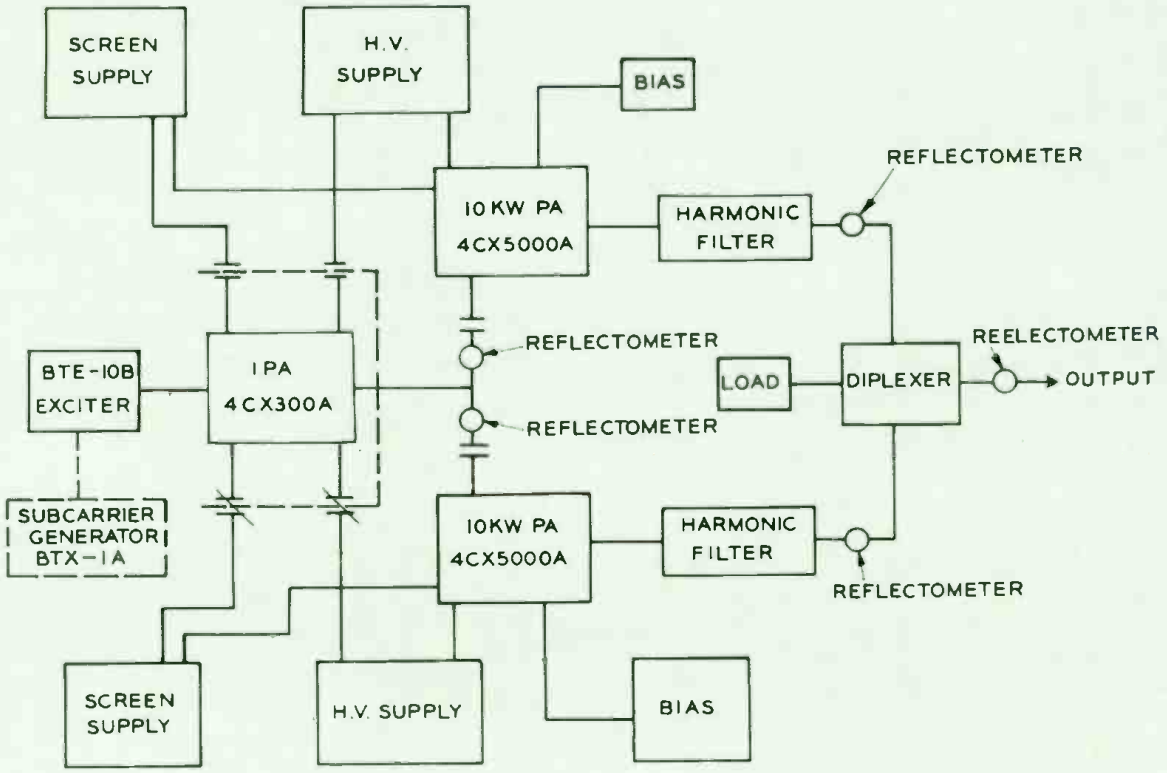
Control Features

The BTE-10B Exciter has a self-contained multimeter. It is used to read modulator cathode current, second and third multiplier grid current, PA cathode and plate current, AFC control voltage and plate voltage.

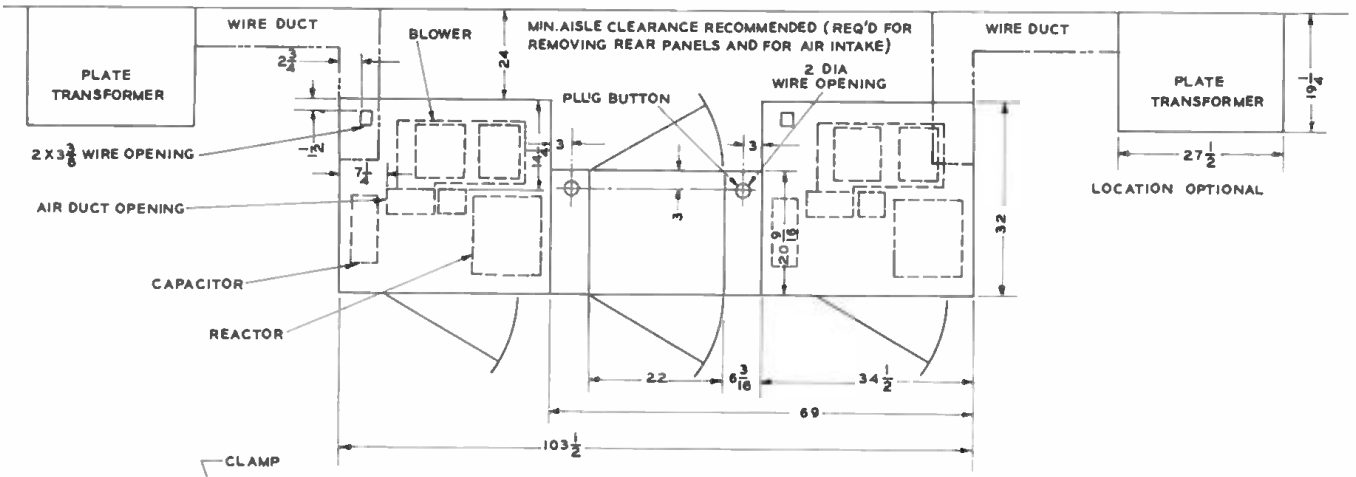
The 10-kw amplifier cabinets provide metering of each PA plate current, plate voltage, hours elapsed-time VSWR/power output, a-c line volts and a multi-meter. All tuning adjustments can be made by means of front panel controls. They include key switches for filament-on, plate on and off, screen raise and lower, and overload reset. Front panel lights indicate all main functions such as transmitter-on, transmitter ready, plate on, and overload.

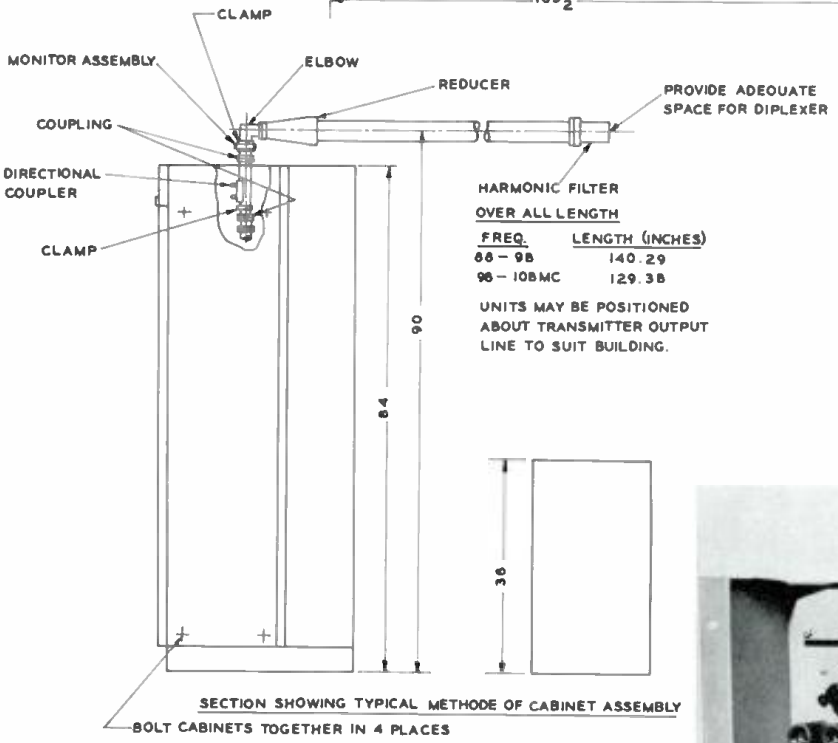
Controls for combined operation of the two amplifiers are housed on the two panels on either side of the driver cabinet. These additional controls include switches to control selection of amplifier as well as common plate filament, two reflectometers to read combined output and PA input matching, and line breakers.

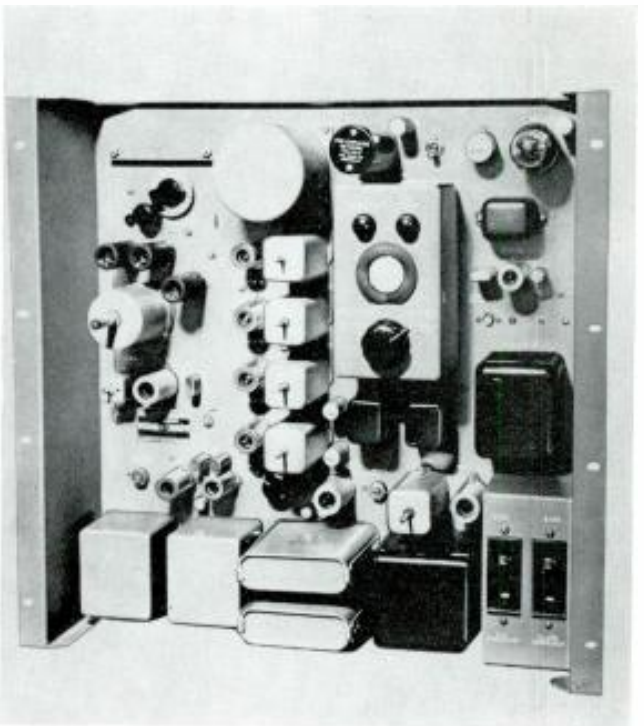
Block diagram of BTF-20D FM Transmitter.



Typical floor plan and installation details of the BTF-20D FM Transmitter.



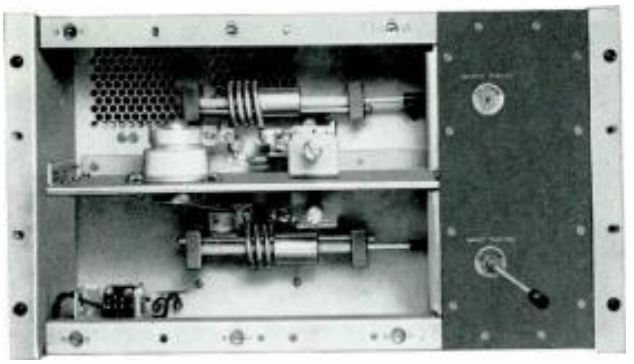




Type BTX-1A Multiplex Subcarrier Generator which is an optional accessory for multiplex operation.

Remote Control

Remote control facilities are provided in the transmitter, terminals being provided for this type of use with the BTR-11B or BTR-20B Remote Control Unit. Provisions are provided for remote control of transmitter on-off, plate on-off, raise-lower power, and overload reset. Remote metering connections in the two final amplifiers for cathode current, IPA cathode current, plate voltage, and power output are also included.



400-Watt IPA stage used to drive the dual 10-kw PA stages of the BTF-20D.

SPECIFICATIONS

Performance Specifications

Type of Emission.....F3 and F9
Frequency Range.....88 to 108 mc
Power Output.....1 to 20 kw
Output Impedance (3⅛" O.D. Line).....51.5 ohms
Frequency Deviation 100% Modulation.....±75 kc
Modulation Capability.....±100 kc min.
Carrier Frequency Stability.....±1000 cycles max.
Audio Input Impedance.....600/150 ohms
Audio Input Level—*(100% mod).....+10 ±2 dbm
Audio Frequency Response—**(30, 1500 cycles).....±1 db max.
Harmonic Distortion—***(30, 15,000 cycles).....0.5% or less
FM Noise Level (referred to 100% FM mod.).....—65 db max.
AM Noise Level (referred to 100% AM mod.).....—50 db max.
Subcarrier Input Level (30% mod. of Carrier).....5 volt max.
Subcarrier Input Impedance.....10,000 ohms
Subcarrier Frequency.....30-67 kc

Electrical Specifications

Main-to-Subchannel Crosstalk.....—55 db referred to ±7.5 kc deviation of the subcarrier by a 400 cps tone. Main channel modulation 70% by 30-15,000 cps tones

Sub-to-Main-Channel Crosstalk.....—65 db referred to ±75 kc deviation of the main carrier by a 400 cps tone. Subchannel modulated 100% (±7.5 kc/s) by 30-6000 cps tones. Subcorrier modulated 30% on main carrier

Power Line Requirements:
Line.....240/208 volts, 3 phase, 50/60 cycles
Slow Voltage Variation.....±5%
Power Consumption.....40,000 watts (approx.)
Power Factor (approx.).....90%

Crystal Heaters:
Line.....117 volt, 1 phase, 50/60 cycles
Power Consumption.....28 watts

Tube Complement:
Exciter:

5—6AH6	3—6AQ5	2—5763
1—6146	1—6CL6	1—12AT7
1—6AS6	1—6AU6	1—OD3
1—2D21	1—1EP1	

Driver:
1—4CX300A
Power Amplifier:
2—4CX5000A

Mechanical Specifications

Dimensions (overall):
Width.....103½"
Height.....84"
Depth.....32"
Weight.....3100 lbs. (approx.)
Transformers (two) Externally Located.....(each) 36" high, 27" wide, 19¼" deep

Finish:
Cabinets.....Dark umber gray, palished stainless steel trim
Doors.....Burgundy red or dark umber gray

Altitude.....7500 ft. max.
Ambient Temperature Range.....—20 to +45°C
Heat Dissipation.....68,000 BTU/hr (approx.)
Exhaust Requirements.....5,000 CFM (approx.)

Equipment Supplied

BTF-20D FM Broadcast Transmitter (ES-34226)

Qty.	Description	Stock No.
1	400-Watt Driver	MI-34502-B
2	10-kw Amplifiers (BTF-10D)	MI-34554
1	FM Exciter (BTE-10B)	MI-34501
1	Crystal (Spec. Frequency)	MI-34509
2	Plate Transformer	MI-34555
2	Blower	MI-34556
2	Harmonic Filter	MI-27967-1 or -2
2	Reducer 3⅛" to 1⅝"	MI-19113-C7
1	Tool Kit	MI-27088
2	Installation Material Kit 10 kw	MI-34553
2	Installation Material Kit	MI-34559
1	Finish Touch-up Kit	MI-27660-B
1	Set of Operating Tubes	ES-34239
1	Door, Right Hand, choose decor as follows:	
	Burgundy	MI-27645-K1
	Light Umber Gray	MI-27645-K2
2	Door, Left Hand, choose decor as follows:	
	Burgundy	MI-27645-L1
	Light Umber Gray	MI-27645-L2
1	Nameplate	MI-28180-1
1	Installation Material Kit (20 KW)	MI-34568
2	Instruction Books	IB-30262-1
2	Instruction Books	IB-30281
1	Control Assembly and Blower	MI-34565
1	L.H. End Shield	MI-34567
1	Diplexer	MI-27980-L/H
1	Line Stretcher	MI-34569
*	Transmission Line and Fittings	MI-19113-C

* Specify on sales order for connection of transmitter output, harmonic filters, diplexers.

1	R-F Load, 1.5 kw/7.5 kw (select one)	MI-19196-L/27396

Select One or Other

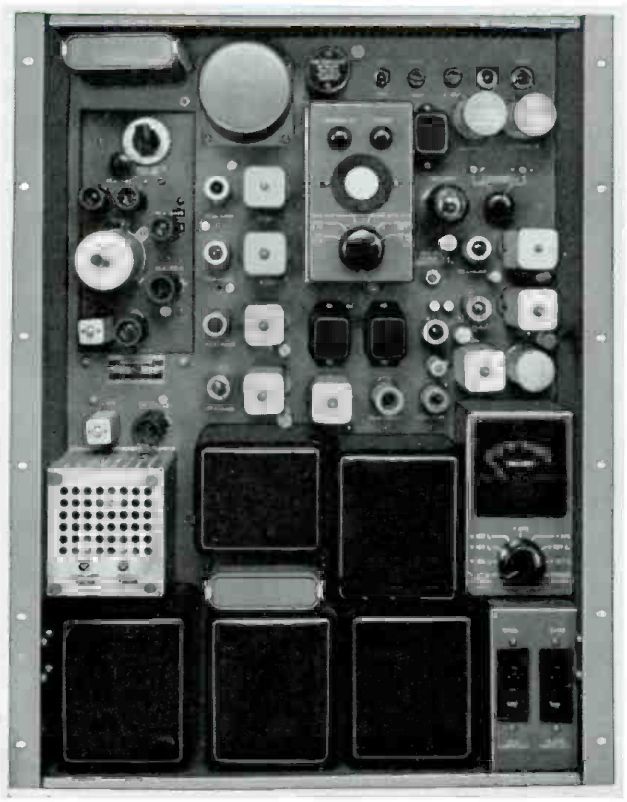
L. H. End Shield Unit		MI-34566
2	Couplings	MI-19112-8

Optional and Accessory Equipment

Auxiliary Equipment Rack for BTF-20D Transmitter (Specify Door Color).....ES-34211-A
Complete Set of Spare Tubes for BTF-20D.....ES-34239
Recommended Set of Spare Tubes for BTF-20D.....ES-34271
Type BTR-20B Remote Control System.....MI-34714/ES-34274
Type BTX-1A Subcarrier Generator.....ES-27295
Type BTS-1A Stereo Subcarrier Generator.....MI-56001
Recommended Minimum Spare Tubes for BTX-1A Subcarrier Generator.....MI-34519
Model 335-BR Frequency and Modulation Monitor 7.5 KW Water Cooled Load.....MI-27396

B-6546

FM Multiplex Equipment



Type BTE-10B Multiplex Exciter.

FEATURES

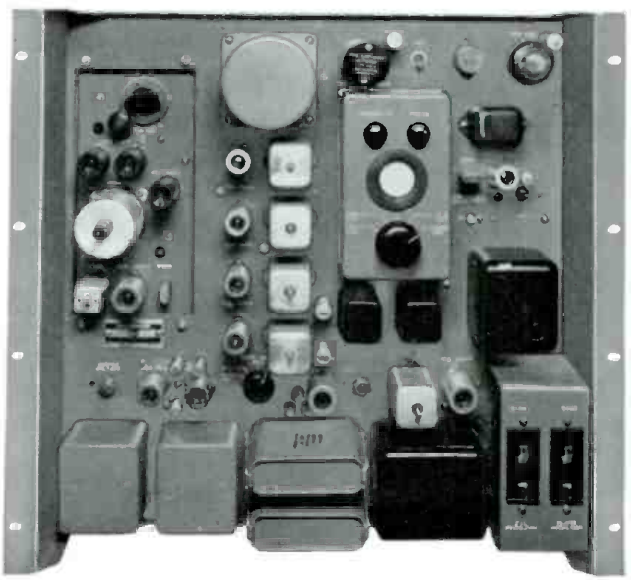
- "Direct FM" modulation
- Fewer stages—easier to tune
- Built-in scope
- No spurious frequencies generated by modulation process
- Exciter requires no special tuning when setting up for Multiplex
- All circuits single tuned
- Muting and cut-off protective circuits provide built-in protection
- Highest fidelity stereo

DESCRIPTION

RCA FM Multiplex Equipment provides on-air FM stations with an inexpensive means of broadcasting two or more services simultaneously over their regularly assigned broadcast channel. With this equipment stations can offer background music services while retaining presently scheduled FM broadcast programming. The use of the equipment for subsidiary communications and stereo is subject to FCC approval.

Multiplexing is the simultaneous transmission of two or more separate program channels on the same r-f carrier. By employing the RCA BTE-10B Multiplex Exciter and one or two Type BTX-1A Subcarrier Generators, one or two additional program channels can be transmitted along with the regular FM program channel. This is accomplished by transferring the sub-channel programs into the supersonic frequency range and frequency modulating the subchannel programs on 30-67 kc subcarriers. The FM supersonic carriers are then used to modulate the r-f carrier. Stereophonic programming requires the use of an optional Stereo Generator, Type BTS-1A. It can be used simultaneously with one BTX-1A, SCA Generator.

Type BTX-1A Subcarrier Generator.



Multiplex Exciter

The RCA Type BTE-10B Multiplex Exciter is a compact, self-contained unit with built-in power supplies and an oscilloscope to facilitate alignment. Miniature tubes are used throughout, and semiconductor rectifiers are used in the power supplies. The BTE-10B incorporates features which make it very easy to adjust and maintain, and extremely reliable in operation.

The r-f multiplier and power amplifier stages of the exciter use relatively broadband, single-tuned circuits, thus simplifying adjustment. A built-in meter can be switched to read the following voltage and currents: modulator cathode current, second and third multiplier grid currents, PA cathode and plate current, AFC control voltage, and plate voltage. A monitor oscilloscope incorporated in the exciter simplifies adjustment and maintenance of the AFC frequency dividers. A switch permits instantaneous checking and adjustment of all five dividers and a check of the control action of the phase detector. Displays are in the form of Lissajous' figures, with the advantage that lock-in of the dividers can be easily observed. Checks can be made during operation without disturbing the AFC action in any way.

Self-Contained Power Supplies

Self-contained power supplies for the BTE-10B employ semiconductor rectifiers throughout. The high voltage regulated supply which furnishes d-c plate and screen voltages utilizes a bridge-type germanium rectifier. Modulator and oscillator filaments are energized by a d-c supply employing a full-wave silicon rectifier.

All components of the BTE-10B are mounted on a vertical chassis designed for standard rack mounting. Special hinge-type mounting pins at the bottom corners permit the top of the chassis to be swung out for access to the wiring and circuit components on the underneath side.

Circuits of the BTE-10B, as shown in the block diagram, consist of a master oscillator which operates at 1/18 of the carrier frequency; two reactance modulators to provide modulation for the main channel; a third reactance modulator for the subcarrier; three frequency multipliers including the output stage to bring the output frequency up to the 88 to 108 mc range; automatic frequency control circuitry; and the power supplies necessary to furnish a-c and d-c voltages for these stages. The final amplifier of the exciter acts as a doubler.

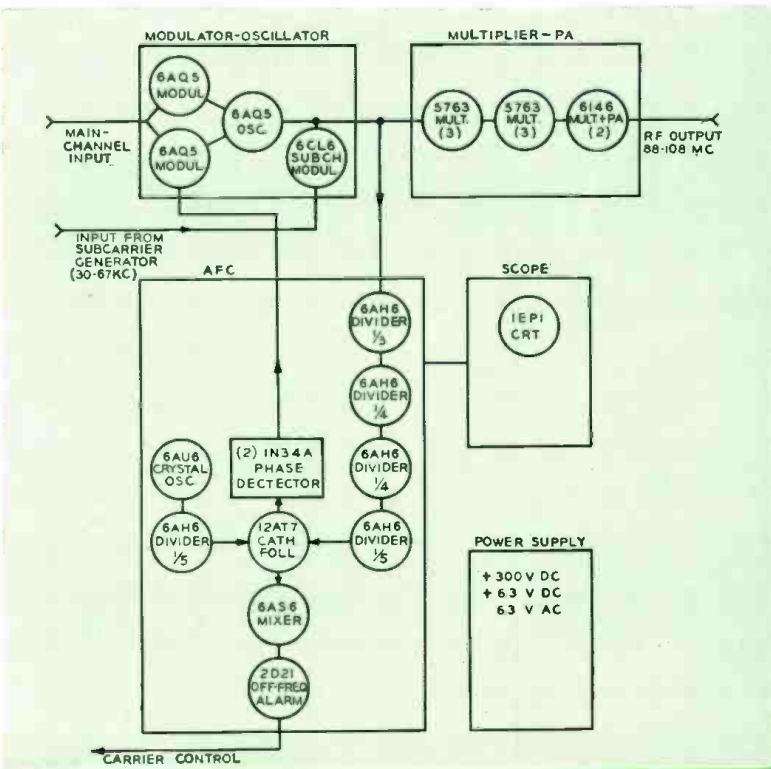
Circuit features include the use of a pushpull modulator and inductive coupling circuit that results in highly linear operation with very low harmonic distortion. Each tube becomes almost a pure reactance. Loading of the oscillator is greatly reduced thus providing better AFC action. Moreover, the pushpull modulator automatically balances out temperature and supply-voltage changes. The modulating circuits are very effectively decoupled, minimizing the possibility of cross-talk between the main channel and subchannel.

Automatic Frequency Control

The automatic frequency control circuitry of the BTE-10B Exciter is characterized by a long record of dependable operation. A phase detector is used to develop a control voltage which establishes and maintains a phase lock between a reference crystal oscillator and the derived signal. Thus the system is actually an automatic phase control system which achieves a stability precisely matching that of the crystal reference source. The master oscillator frequency and swing are reduced to confine phase deviations. Limited pull-in range normally associated with precise frequency control is overcome by the use of an off frequency circuit which simultaneously provides a safeguard against uncontrolled and possible off-frequency operation. The a-c overload switch can be used as a power "ON-OFF" switch, if desired, and the d-c overload switch for "Standby Plate" switching. Manual control of the oscillator is provided so that failure of any tubes or components in the AFC section will not require shutdown of the transmitter.

The BTE-10B Exciter is used in the RCA BTF-1D, 5B/D, 10C/D, and 20D transmitters. In many instances it may be used to replace the exciters in previously designed transmitters that will not meet the stringent requirements of multiplex operation. For stereo, the BTE-10B is type accepted when used with the optional BTS-1A Stereo Generator.

Simplified block diagram of a BTE-10B Exciter. The modulator-oscillator is shown with provisions for inserting one subcarrier.



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BTX-1A Subcarrier Generator

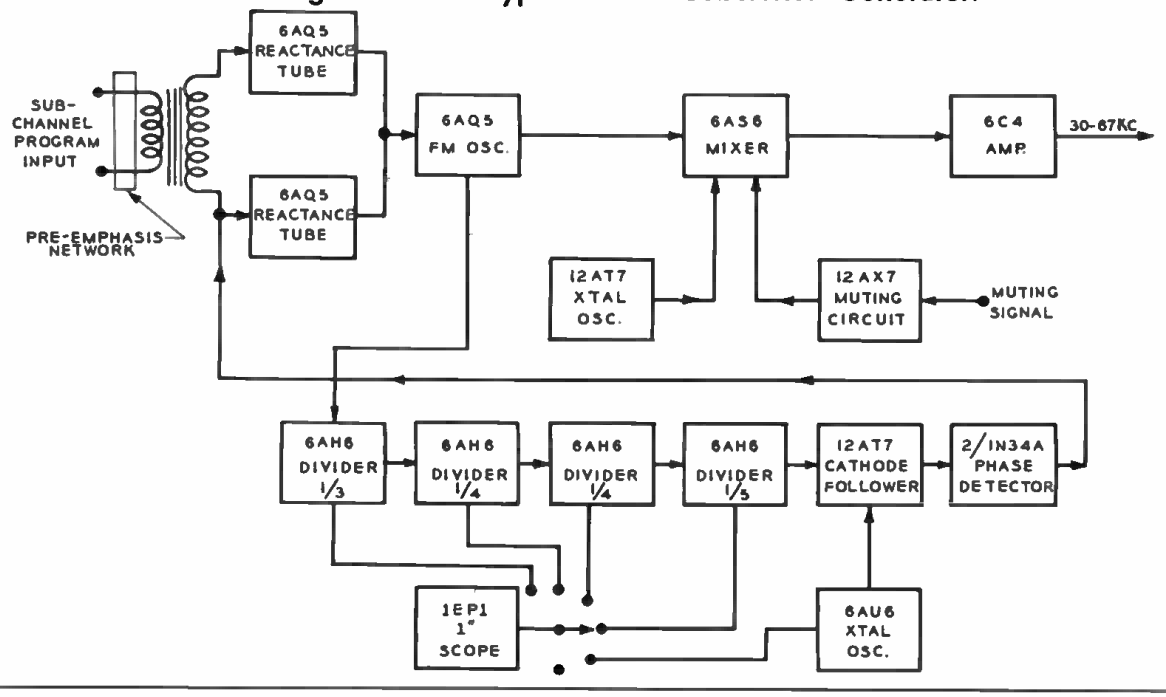
The BTX-1A Subcarrier Generator is designed to provide a frequency modulated r-f signal having a center frequency in the range of 30 to 67 kc. When used in conjunction with the RCA BTE-10B FM Exciter, an FM station can multiplex up to two channels in addition to the regular program channel on a single r-f carrier. Crystal units providing a center frequency of 32.5, 42, 59, and 67 kc are currently available for use in the generator.

All components of the BTX-1A are mounted on a vertical chassis designed for standard rack mounting. The equipment employs miniature tubes in all stages except in the power supply which utilizes an OD3 voltage regulator and germanium rectifiers in a bridge circuit. Other features include a built-in monitor oscilloscope which permits instantaneous check and adjustment of all five AFC frequency dividers, and the control action of the phase detector.

The BTX-1A circuitry consists of a master oscillator, pushpull reactance modulators, crystal oscillator, automatic frequency control, subcarrier muting stage, mixer, cathode follower output stage, alignment oscilloscope and a power supply. Two reactance modulators are connected to the oscillator plate, and the pushpull grids are inductively coupled to the plate tank. R-f voltages on the two modulator grids are 180 degrees out of phase with respect to each other, and each is 90 degrees out of phase with the oscillator plate. Thus one tube appears as a capacitive reactance and the other appears as an inductive reactance across the oscillator tank. The magnitude of the reactive component presented to the tank coil varies with the audio voltage applied to the modulator grids. The frequency of the oscillator is varied accordingly. The mean frequency is controlled by the bias voltage applied to one grid by the automatic frequency control circuit.

The modulated output from the master oscillator and the r-f output from a 12AT7 crystal oscillator are then fed into a mixer. This stage supplies the modulated beat frequency in the range of 30 to 67 kc, which is connected to the cathode follower. A subcarrier muting stage is used to disable the mixer and thus suppress subcarrier output when no audio voltage is present at the audio input terminals of the generator. Operation of this stage is such that with no audio voltage present at the input, the plate of the second half of the 12AX7 tube clamps the grid voltage of the mixer to a very low value, reducing output of the mixer to zero. Audio applied to the input of the muting stage, however, is amplified in the first half of the 12AX7, rectified by a 1N38A crystal diode and applied as bias to disable the clamping section of the tube. A five-position switch is provided for switching the muting stage in and out of the circuit, and also selection of three different values of time delay before muting takes place. The pushpull modulation of the BTX-1A is similar to that in the BTE-10B and has the same features as previously outlined. The automatic frequency control circuitry used in the BTX-1A is also very similar to that in the BTE-10B Exciter, and it performs the same function.

Block diagram of the Type BTX-1A Subcarrier Generator.



SPECIFICATIONS

Type BTE-10B Exciter

Performance Specifications

Type of Emission.....F3
Frequency Range.....88-108 mc/s[7]
Pawer Output.....10 watts
Output Impedance.....50 ohms
Frequency Deviation for 100% modulation.....±75 kc/s
Modulation Capability.....±100 kc/s min.
Carrier Frequency Stability.....±1000 cps max.
Audio Input Impedance.....600/150 ohms
Audio Input Level (100% mod.).....+10 ±2 dbm[1]
Audio Frequency Response (30-15,000 cps).....±1 db max.[2]
Harmonic Distortion (30-15,000 cps).....0.5% or less[3]
FM Noise Level (referred to 100% FM mod.).....—65 db max.
AM Noise Level (referred to carrier voltage).....—50 db max.
Subcarrier Input Level (30% mod. of carrier max.).....5 volts max.[4]
Subcarrier Input Impedance.....10,000 ohms
Subcarrier Center Frequency Range.....30-67 kc/s
Main-ta-Sub-channel Crosstalk.....—53 db[5]
Sub-to-Main Channel Crosstalk.....—65 db[6]

Electrical Specifications

Power Line Requirements:
Transmitter:
Line.....240/208 or 117 V, a-c, 50/60 cps, single phase
Slow Voltage Variations.....±5%
Power Consumption.....300 watts
Crystal Heaters:
Line.....117 V, a-c, 50/60 cps, single phase
Power Consumption.....28 watts

Tube Complement

1 Cathode Ray Tube.....1EP1
2 Reactance Modulator.....6AQ5
1 Master Oscillator.....6AQ5
1 Subcarrier Modulator.....6CL6
2 Frequency Tripler.....5763
1 Frequency Doubler and Power Amplifier.....6146
1 Frequency Divider (⅓) 6AH6
2 Frequency Divider (¼) 6AH6
1 Frequency Divider (1/5) 6AH6
1 Crystal Oscillator.....6AU6
1 Crystal Frequency Divider (1/5).....6AH6
1 Cathode Follower.....12AT7
1 Off-Frequency Detector.....6AS6
1 Off-Frequency Control.....2D21
1 Voltage Regulator.....OD3

Mechanical Specifications

Overall Dimensions.....24½" high, 19" wide, 11" deep
Weight.....80 lbs.
Maximum Altitude.....7500 feet
Ambient Temperature Range.....0-45°C

Equipment Supplied

Type BTE-10B FM Exciter.....ES-27278
Comprising the following:
1 FM Exciter Unit.....MI 34501
1 Crystal Unit.....MI-34509*
(*Sales Order must specify crystal frequency)
1 Set of Operating Tubes.....MI-34510
2 Instruction Book.....IB-30262

[1] Level measured at input to pre-emphasis network using 400 cps tone.
[2] Audio frequency response referred to 75 μs pre-emphasis curve.
[3] Distortion includes all harmonics up to 30 kc/s and is measured following a standard 75 μs de-emphasis network.
[4] Subcarrier modulation percentage can be brought to 50% if required.
[5] Reference shall be ±7.5 kc/s deviation of the subcarrier by a 400 cps tone. Main-channel modulated 85% by 30-15,000 cps tones.

Type BTX-1A Sub-Carrier Generator

Performance Specifications

Type of Modulation.....FM
Center Frequency Range of Sub-carrier.....30-67 kc/s
Output Voltage.....5 volts min.
Source Resistance.....Approx. 400 ohms, cathode follower
Frequency Deviation (100% subcarrier mod.).....±7.5 kc/s
Modulation Capability.....±25 kc/s
Carrier Frequency Stability.....±500 cps
Audio Input Impedance.....600/150 ohms
Audio Input Level (100% mod.).....+10 ±2 dbm[1]
Audio Frequency Response (30-60,000 cps).....±1 db max.[2]
Harmonic Distortion (30-60,000 cps).....0.75%[3]
FM Noise Level (referred to 100% mod.).....—60 db max.
AM Noise Level (referred to carrier).....—50 db max.

Electrical Specifications

Power Line Requirements:
Line.....240/208 V, a-c, 50/60 cps, single phase
Slow Voltage Variation.....±5%
Power Consumption.....100 watts

Tube Complement

2 Reactance Modulator.....6AQ5
1 Master Oscillator.....6AQ5
1 Crystal Oscillator #1.....12AT7
1 Mixer.....6AS6
1 Cathode Follower.....6C4
1 Frequency Divider (⅓) 6AH6
2 Frequency Divider (¼) 6AH6
1 Frequency Divider (1/5) 6AH6
1 Crystal Oscillotor #2.....6AU6
1 Cathode Follower.....12AT7
1 Subcarrier Muting.....12AX7
1 Voltage Regulator.....OD3
1 Cathode Ray Tube.....1EP1

Mechanical Specifications

Overall Dimensions.....17½" high, 19" wide, 10" deep
Weight.....40 lbs.
Maximum Altitude.....7500 feet
Ambient Temperature Range.....0-45°C

Equipment Supplied

Type BTX-1A Subcarrier Generator.....ES-27295
Comprising the following:
1 Subcarrier Generator Unit.....MI-34500
1 Set of Operating Tubes.....MI-34514
1 Crystal Unit, Type CR-18/U.....MI-34520*
(*Order must specify frequency of 67, 58, 42, or 32.5 kc)
1 Instruction Book.....IB-30262

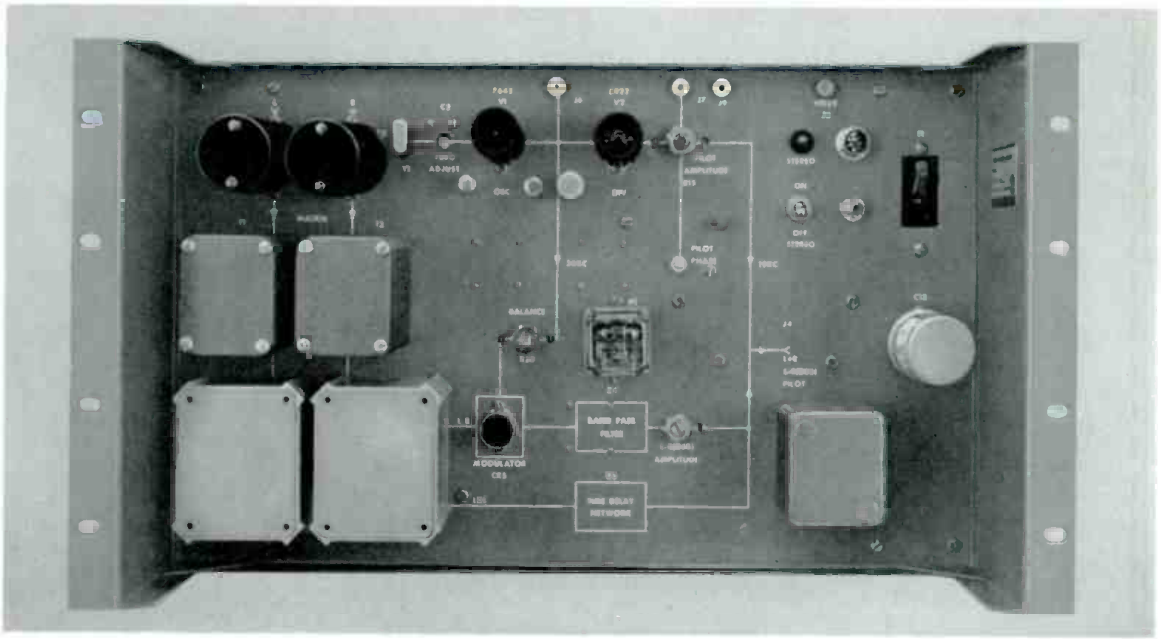
Accessories

BTS-1A Stereo Generator.....ES-560202
Spare Set of Tubes for BTS-1A.....MI-560005
53 kc Filter (required if transmitting Stereo).....MI-560003
Spare Set of Operating Tubes for BTE-10B Exciter.....MI-34510
Set of Spare FCC Tubes for BTE-10B Exciter.....MI-34515
Spare Set of Operating Tubes for BTX-1A Subcarrier Generator.....MI-34514
Set of Spare FCC Tubes for BTX-1A Subcarrier Generator.....MI-34519
Spare Crystal for BTE-10B Exciter.....MI-34509*
(*Sales order must specify channel frequency.)

[6] Reference shall be ±75 kc deviation of the main-carrier by a 400 cps tone. Sub-channel modulated 100% (±7.5 kc/s) by 30-6,000 cps tones.
[7] Coil furnished for 44 to 54 mc for use where a doubler follows the exciter.

FM Stereo Subcarrier Generator

TYPE BTS-1A



FEATURES

- High quality FM Stereo performance
- Plug-in pre-emphasis units
- Built-in matrix
- Sealed silicon diode power supply
- Temperature stability −20° to +45° C
- Mono-stereo relay and indicator included
- Minimum adjustments
- Low power requirements

DESCRIPTION

The RCA Type BTS-1A Stereo Subcarrier Generator, MI-560001, is an all new improved unit, designed for high quality FM stereo operation. The generator produces a composite signal which is fed into the "Direct FM" exciter, BTE-10B, or its predecessor, MI-7016.

All RCA FM transmitters incorporating the BTE-10B Exciter can be used for simultaneous stereo and SCA transmission using the BTS-1A Stereo Subcarrier Generator in conjunction with a BTX-1A SCA Subcarrier Generator. If, however, stereo and SCA service are transmitted simultaneously, a filter, MI-560003, will be required at the output of the BTX-1A to make certain all spurious signals are attenuated at least 60 db at 53 kc and below. Earlier RCA FM transmitters incorporating the MI-7016 Exciter may be used for stereo transmission using the BTS-1A. Simultaneous SCA service is not feasible, however, if the MI-7016 Exciter is used.

The BTS-1A Stereo Subcarrier Generator incorporates a simple, easy-to-follow circuit with a minimum of adjustments resulting in continued reliability and stability. It is designed for remote control operation, and in many instances can be mounted in the transmitter cabinet or in any adjacent 19-inch rack.

Only two long life (10,000 hours) premium tubes, a 7643 and a 6922, are used in the BTS-1A. Frequency stability is maintained with a 38 kc oscillator having an accuracy of ±2 cycles. The power supply consists of hermetically sealed silicon diodes. All parts are designed for conservative operation for maximum reliability. Plate voltage on the tubes is only 100 volts.

A matrix and time delay circuit are incorporated in the BTS-1A. The two stereo signals from the studio, L (left) and R (right), are fed into the matrix to obtain sum and difference signals. The difference signal is amplitude, suppressed carrier modulated. L+R and L−R (DSB) and pilot signals are added to form the composite signal which will frequency modulate the exciter (BTE-10B or MI-7016). The double sideband signal (DSB) is generated in a ring modulator, which consists of four matched germanium diodes in one assembly. The diodes all have identical

electrical characteristics regardless of temperature. The signal-to-noise ratio and distortion levels are the same for monophonic and stereophonic transmission. The L-R Signal at the output of the ring modulator is fed through a bandpass filter and added to the L+R signal.

The BTS-1A has a frequency response of 30-15,000 cycles, ±1.5 db. Distortion (90 per cent main channel modulation by a L-R signal) is 1 per cent or less. The signal-to-noise ratio under the same conditions as above is a maximum of —60 db. Total distortion of a composite signal (45 per cent L+R and 45 per cent L—R) (DSB) modulation will not exceed 0.75 per cent.

The BTS-1A Stereo Subcarrier Generator is designed to fit a standard 19-inch rack, and is only 10½ inches high. It offers utmost accessibility. To get at the back, all that is required is to remove a dust cover. There are four test points on the front panel for ease of servicing. There are only four screwdriver adjustments in the BTS-1A: ring modulator balance, L-R (DSB) amplitude, pilot amplitude, and pilot phase. There is one additional adjustment for matrix balance, that is set once at the factory for better than 50 db balance (the unwanted channel rejected 50 db or more).

The BTS-1A incorporates a switch for monophonic or stereophonic operating modes (local or remote operation). There is an indicator lamp on the BTS-1A to show when it is in the stereo mode. When operating remote control, the monitor or receiver at the studio will indicate the unit is operating by reception of the 19 kc pilot tone. When remote control over telephone lines is desired, the BTR-11A or BTR-20B remote control equipment should be used.

Power supply requirements for the generator are 117 or 208-240, ±11 volts, 50/60 cps. Ambient temperature range is —20 to ±45 degrees, Centigrade (same wide ambient specifications as for any current RCA FM transmitter), which means that no special heating or cooling requirements are necessary for the transmitter area.

SPECIFICATIONS

Electrical

Pilot Carrier Stability	19 kc ±1 cps
Subcarrier Suppression	1% or better
Frequency Response (composite signal)	30-15,000 cycles, ±1.5 db
Pre-emphasis	75 μsec.
Peak Modulation Capability of DSB Signal	±100 kc or better
Separation (BTS-1A and BTE-10B)	30 db or better
Crosstalk (main channel to subchannel)	50 db or better
Crosstalk (subchannel to main channel)	50 db or better
Harmonic Distortion (90% main channel modulation by L-R)	1% or less
Signal-to-noise Ratio (90% main channel modulation by L-R)	—60 db
Line Voltage Requirements	117 or 208-240 ±11 volts, 50/60 cps
Power Consumption	10 watts

Mechanical

Temperature Range	—20 to +45 degrees C.
Altitude	7,500 feet
Finish	Umber gray
Dimensions (overall)	10½" high, 19" wide, 9" deep (excluding plugs)
Weight	25 lbs.

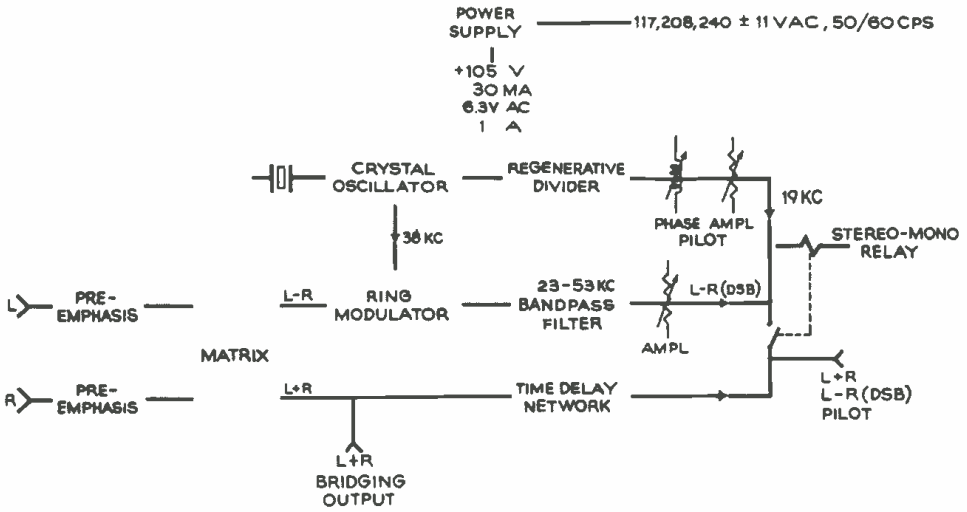
Equipment Supplied (ES-560202)

Type BTS-1A Stereo Subcarrier Generator complete with pre-emphasis network, connectors, plugs and electrolytic capacitor	MI-560001
Input Adaptor for BTE-10B	MI-560004

Accessories

Set Spare Tubes for BTS-1A	MI-560005
53 kc filter for use with BTS-1A when transmitting stereo and SCA service	MI-560003

BLOCK DIAGRAM BTS-1A STEREO SUBCARRIER GENERATOR



AM Remote Automatic Logging and Control Equipment

ES-34282, ES-34283

FEATURES

- Provides means for remotely recording all operating parameters—indicates overloads
- Continuous logging and data recording
- Automatic power output control
- Negative peak limiting
- Modulation peak counter
- Four function alarm system

DESCRIPTION

AM Automatic Logging Equipment supporting 12 functions (ES-34282) or o system supporting 24 functions (ES-34283) is made available by RCA. The equipment provides the following major functions: (1) automatic power control of the transmitter; (2) an alarm to indicate inability of the power control to maintain power output within required limits; (3) an alarm to indicate transmitter overload; (4) negative peak limiting; (5) modulation peak count; (6) automatic logging of the operating parameters. The system is completely automatic and designed to record all operating parameters required by FCC regulations. All meter readings are scanned at half-hour intervals and recorded for a permanent record.

Strip Recorder

An easily read strip chart recorder automatically logs the operating parameters. The 12-function system employs the MI-27554-1 Single-point strip chart type recorder which operates at a speed of two inches per hour and contains paper for over two weeks of operation. The 24-function recorder, MI-27554-2, operates at a speed of four inches per hour and contains paper for over one week of operation.

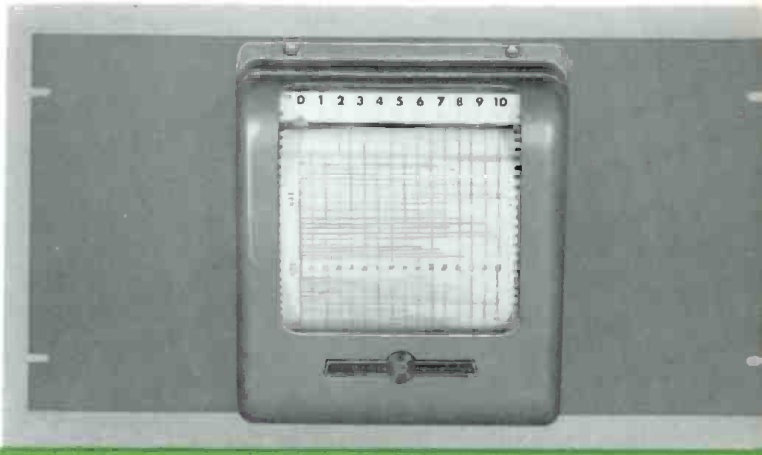
The parameters to be recorded are sequentially selected by a clock driven commutator. Each function is recorded for a period of 2½ minutes separated by a momentary dead spot which provides a separation line on the recorder chart.

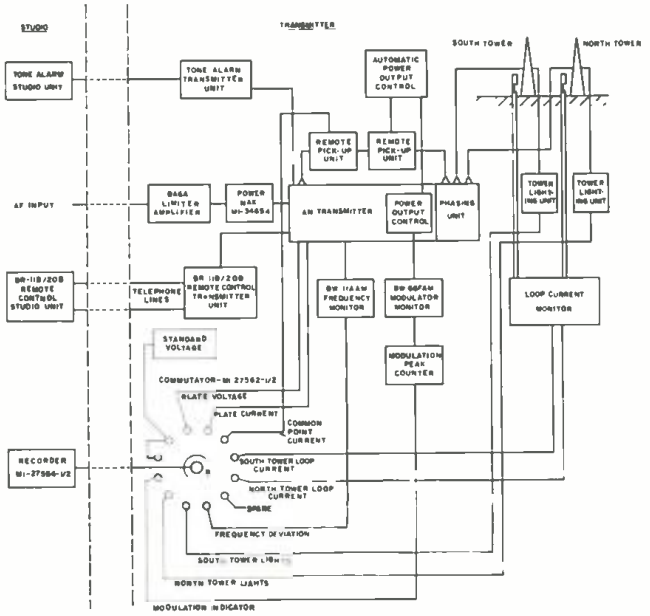
One recorded segment is a zero voltage providing a check of the lower limit of the recorder and one segment records the standardizing voltage providing a full scale calibration for the recorder as well as a starting point to identify the parameters recorded. The calibration feature provides a constant check on any possible changes in the system which may affect the readings and allows correction of the absolute values if necessary. The recorder has a high input impedance which makes the accuracy independent of telephone line variations. Potentiometers are provided to facilitate calibration of all recorded parameters.

System Components

In addition to the Recorder with 6 rolls of strip chart, two contoiners of ink, and commutator, the basic system includes an RCA Automotic Output Control (MI-27564).

Automatic Logging Chart Recorder.





Block diagram of typical remote Automatic Logging Control System for AM Station.

Modulation Peak counter (MI-27563), a Tone Alarm System (ES-34281), and Power Max (MI-34654). The system may be expanded by the addition of the following equipment: BTR-11B Remote Control Equipment (11 functions) or the larger BTR-20B Remote Control Equipment with 20 functions; Tower Light Metering Unit (MI-27544) or Tower Lighting Unit for metering and control (MI-27519). A Remote Pickup Unit (MI-27966 for transmitters up to 5-kw, or MI-28027-A for 10-kw and higher powers); a BW-11A Frequency Monitor (MI-30011-B), BW-66F Modulation Monitor (MI-30066B), and BA-6A Limiting Amplifier (ES-11126) are also suggested. The entire system is easily installed at transmitter and studio sites, where most components can be accommodated in standard BR-84 Equipment Racks.

System Operation

As shown in the systems block diagram all metered circuits in the transmitter are connected to the system and the meter readings recorded on a strip chart located at the studio. It is completely separate from the normal remote control system. High impedance input of the recorder minimizes effects of telephone line resistance variation.

Base and common point currents are monitored via pickup units installed at the towers and phasor. R-F samples are fed to transducers (remote pickup unit MI-27966) calibrated against the station's R-F ammeter. The d-c variation of the transducer is recorded on the chart recorder. Frequency deviation is recorded directly from the frequency monitor (RCA Type BW-11A). Tower lights and flasher are also monitored for proper operation.

SPECIFICATIONS

STRIP CHART RECORDER

Finish.....Light umber gray
Limit of Error.....1%
Chart Speed.....2" per hour (12-function); 4" per hour (24-function)
Paper Roll.....85 ft. long
Calibrate Paper Width.....5"
Measuring Circuit.....Potentiometer
Voltage Reference.....Zener diode
Power Requirements.....117 volts, 60 cycles, 40 watts
Dimensions Overall.....19" wide, 10½" high, 7¾" deep
Weight.....20 lbs.

COMMUTATOR

Power Requirements.....117 volts, 60 cycles, 10 watts
Speed of Operation.....2 revolutions per hour (12 functions); 4 revolutions per hour
Motor.....Synchronous
Finish.....Light umber gray
Dimensions Overall.....19" wide, 5¼" high, 9½" deep
Weight.....20 lbs.

MODULATION PEAK COUNTER

Power Requirements.....117 volts, 50/60 cycles, 10 watts
Counter.....37 max.
Finish.....Light umber gray
Dimensions Overall.....19" wide, 8¾" high, 8¼" deep
Weight.....15 lbs.

TONE ALARM SYSTEM

Power Requirements.....117 volts, 50/60 cycles, 6 watts
No. of Alarm/Status Functions (Basic Unit 4).....8 max.
Finish.....Light umber gray
Dimensions Overall.....19" wide, 7" high, 8⅜" deep
Weight:
Transmitter Unit (MI-27551).....10 lbs.
Receiver Unit (MI-27553).....10 lbs.

POWER MAX

Power Requirements.....117 volts, 60 cycles, 5 watts
Input Level.....+16 dbm ±2 db
Insertion Loss.....6 db
Finish.....Light umber gray
Dimensions Overall.....19" wide, 5½" deep, 7" high
Weight.....18 lbs. approx.

EQUIPMENT SUPPLIED

AM Automatic Logging Equipment....	12-functions ES-34282		24-functions ES-34283	
Recorder (2-inch per hour).....	1	MI-27554-1	—	——
Recorder (4-inch per hour).....	—	——	1	MI-27554-2
Rolls Strip Chart (2-inch per hour)	6	MI-27554-3	—	——
Rolls Strip Chart (4-inch per hour)	—	——	6	MI-27554-4
Containers Ink	2	MI-27554-5	2	MI-27554-5
Commutator (12 position).....	1	MI-27562-1	—	——
Commutator (24 position).....	—	——	1	MI-27562-2
Automatic Output Control.....	1	MI-27564	1	MI-27564
Modulation Peak Counter.....	1	MI-27563	1	MI-27563
Tone Alarm Equipment (5 functions)	1	ES-34281	1	ES-34281
Power Max	1	MI-34654	1	MI-34654

ACCESSORY EQUIPMENT

BTR-11B Remote Control Equipment	1	ES-34280	—	——
BTR-20B Remote Control Equipment	—	——	1	ES-34274
Tower Light Unit.....	*	MI-27544	*	MI-27544
OR				
Tower Metering and Control Unit....	*	MI-27519	*	MI-27519
*(*Order one of MI-27544 or MI-27519 per tower)*				
Remote Pickup Unit (up to 5-kw).....	†	MI-27966	†	MI-27966
OR				
Remote Pickup Unit (10-kw and up)	†	MI-28027-A	†	MI-28027-A
(†For Directional Systems supply one of MI-27966 or MI-28027-A per tower plus two additional units; For non-directional systems supply two units)				
BW-11A Frequency Monitor.....	1	MI-30011-B	1	MI-30011-B
BW-66F Modulation Monitor.....	1	MI-30066-B	1	MI-30066-B
BA-6A Limiting Amplifier.....	1	ES-11126	1	ES-11126
BR-84 Rack	**	MI-30951	**	MI-30951

*(**Select one or two from MI-30951 Series as required)*

Remote Control Systems

TYPES BTR-11B/20B

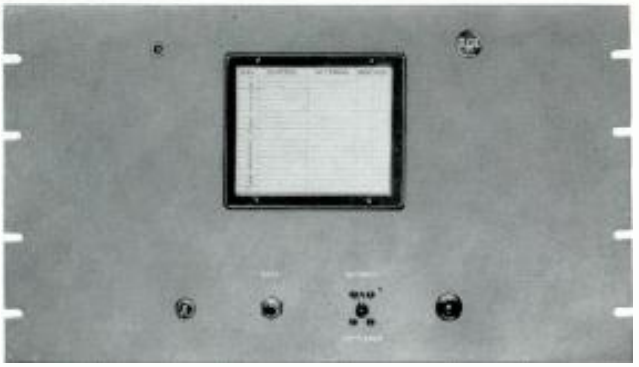
FEATURES

- Flexible systems at minimum cost
- Provisions for checking metering circuit calibration at control point
- Operates without tubes, amplifiers, oscillators or tuned circuits
- Lowest power consumption
- Easy accessibility to all terminal connections and components
- Home-step provision—rapid homing
- Provides fail-safe circuit
- D-C system operates on proven dial telephone principles

DESCRIPTION

The RCA Type BTR-11B and BTR-20B Remote Control Systems are designed for use with AM, FM or TV broadcast transmitter equipment to remotely control the operation of the station transmitter and associated equipment. With these units AM and FM stations now can be operated entirely from the broadcast studio or other remote point without the presence of an engineer at the transmitter site.

The Type BTR-11B Remote Control System provides control or measurement facilities of all essential transmitter functions. Up to ten functions such as transmitter on-off, plate on-off, overload reset, power output, tower lights, Conelrad provisions may be controlled. Metering of filament voltage, plate voltage, plate current, antenna current from a common point or base points, tower light current, modulation monitor, and frequency monitor may be read by means of the system. The Type BTR-20B Remote Control System is an extended deluxe equipment providing up to 19 control and metering facilities. All essential functions performed by the BTR-11B are provided, plus spare control and metering accommodations. This unit may be used to control a second or standby transmitter if desired.



Front view of BTR-20B Transmitter Control Unit.

The radio broadcast transmitter remote control equipment consists essentially of a Studio Control Unit, a Transmitter Control Unit, and a number of auxiliary units, the exact number depending on the functions to be controlled. With this equipment it is possible to control and/or measure the operation of up to 10 transmitter functions with the Type BTR-11B Remote Control System, or 19 functions with the BTR-20B equipment.

The Typical Metering and Control Functions Tables contain a sample list of the transmitter circuits that can be measured and the operations that can be controlled by the Studio Control Unit at the remote location via two telephone lines with a loop resistance up to 5000 ohms. The Studio Control Unit is designed for rack mounting at the studio, while the Transmitter Control Unit and most auxiliary equipment is housed at the transmitter site.

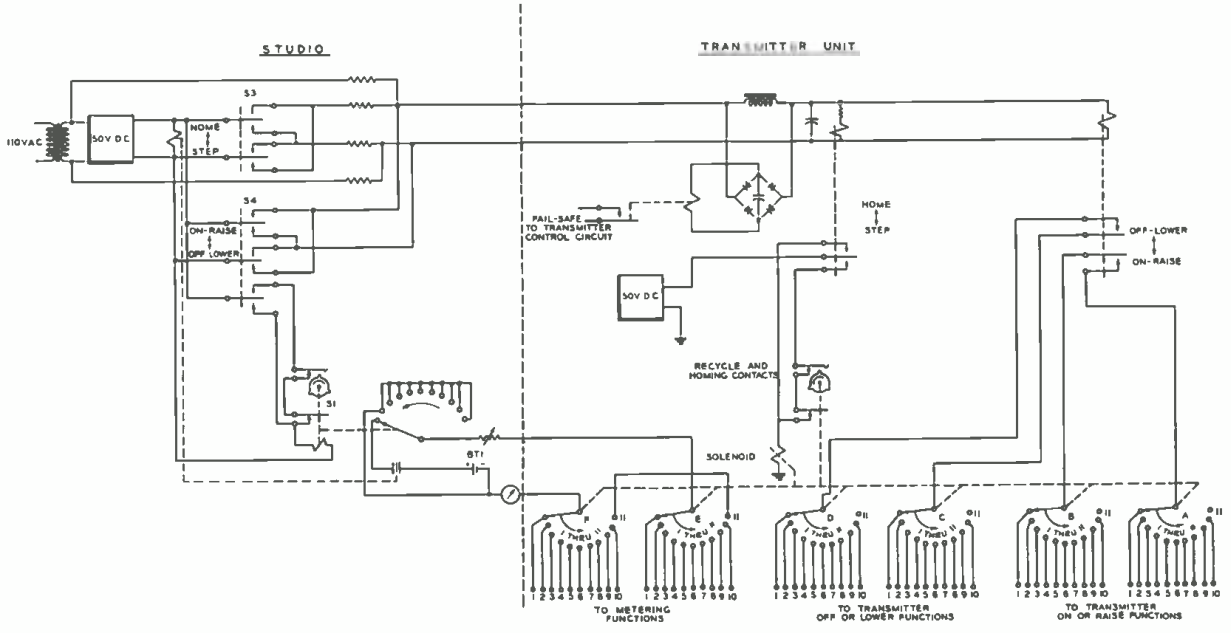
Studio Control Unit

The Studio Control Unit has the following front panel controls: "home-step" switch, "on-raise—off-lower" switch, power switch, indicator lamp, meter, and function indicator dial. The Transmitter Control Unit of the BTR-11B and BTR-20B systems have a power switch, indicator lamp, function indicator dial, step switch, and "on-raise—off-lower" switch to facilitate local set-up or test operations.

Stepping switches located in both studio and transmitter units, are rotated to the desired position by operating the "home-step" switch to the step position. Each operation of the "home-step" switch rotates the stepping switches position. Attached to the shaft of the stepping switches are indicator dials for indicating the position of the stepping switches. Provision is made for rapid homing of the system by operating the "home-step" switch to the home position. After the desired function has been selected, the required operation can be performed by means of the "on-raise—off-lower" switch.

It is possible to read on the studio meter any desired transmitter meter reading in any position of the stepping switches. With the addition of the accessory, MI-27541 Meter Commutator, up to six readings can be made on any one position of the BTR-11B or BTR-20B. Means are provided for calibrating the line resistance by means of a standard cell. A fail-safe circuit is provided in the equipment systems to meet all FCC requirements. In the event of a failure of the remote control system or the control telephone lines, the transmitter is automatically shut down. Both studio and transmitter units have self-contained power supplies. The remote control systems require the use of two

Simplified Schematic of Remote Control System.



"signal service" telephone pairs. In-as-much as these lines carry only d-c they can be rented at a minimum rate.

Auxiliary Equipment

A number of auxiliary equipments are available to expand the facilities or to make more flexible the operation of RCA Remote Control Systems. Chief among these accessories is the Type BTRX-40A Remote Control Extension Unit designed for operation with the BTR-20B. This unit is very similar in appearance and size to the Transmitter Control Unit of the BTR-20B. By dialing a prearranged position on the Studio Control Unit, the BTRX-40A is automatically coupled into the circuit and up to 19 additional points of control and/or metering are available. If so desired, more than one BTRX-40A can be coupled to the BTR-20B; each extension unit providing additional 19 control and 19 meter reading points.

Remote R-F Pickup, MI-28027-A, provides the means of observing the antenna current at the studio control unit. The pickup coil is coupled to the antenna lead where it absorbs a sample of the transmitter r-f output. A diode rectifier provides d-c to operate the meter in the Studio Control Unit. A pickup can be installed at a common point to register the combined current of all the antennas. It can also be installed at the individual antennas to register the current of each antenna. It is satisfactory for use with all transmitters up to and including 50 kw. Remote R-F Pick-up, MI-27966, is similar to the above but is rated only for 5 kw transmitters or a total current of 20 amperes.

Meter Panel (AM Monitoring), ES-27220, provides the means of monitoring the output frequency and modulation of an AM transmitter from the remote location. The studio control unit has provisions for connecting the meter panel to the meter circuit of the stepping switch. The unit contains a separate frequency meter and modulation meter mounted on a standard 19-inch panel. It includes a step-down transformer to supply voltage for illuminating the meter lamps.

A-C Voltage Pickup, MI-27516, is installed at the transmitter and is connected to the transmitter control unit metering section. It provides an indication of the transmitter filament bus or line voltage on the studio control meter.

Tower Lighting Monitoring and Control Unit, MI-27519, may be connected to the transmitter antenna tower lighting circuit to provide both the metering and control connections to the transmitter control unit. It provides d-c voltage to the studio control meter for indicating tower light current and has a relay control circuit which enables the antenna tower lights to be turned on and off from the studio control unit.

Tower Lighting Unit, MI-27544, is similar to the above in that it will measure antenna lighting current up to 20 amperes. It does not incorporate switching for control purposes and is recommended in instances where a photocell or other means are used to control the lighting circuits.

Temperature Indicators, MI-27550-1 and MI-27550-2, permit temperature readings from −30 to +150 degrees F over the remote control system. The MI-27550-1 is designed for indoor use and the MI-27550-2 for outdoor use.

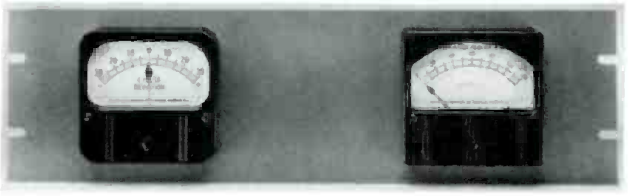
Latching Relay Panel, MI-27509-A, is installed in the transmitting equipment where its function is to turn the transmitter on and off, or other similar function. It contains two relays which perform this control function when activated by the studio control unit. One relay turns the filament supply on or off and the other relay turns the plate voltage on or off.

Typical Control and Metering Functions for BTA-5 AM Transmitter Controlled by BTR-11B Remote Control Unit (1 tower)

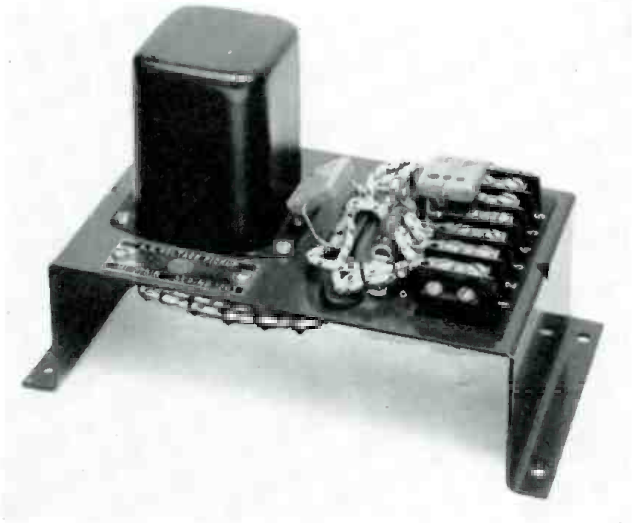
Dial	*Control*	*Metering*
1	Transmitter On-Off	Filament Line
2	Plate On-Off	Plate Volts
3	Output Raise-Lower	Antenna Current
4	Overload Reset	Plate Current
5	Tower Lights On-Off	Tower Lighting Current
6		Frequency Deviation
7		% Modulation
8	Spare	
9	Spare	
10	Spare	
11	Home	Calibrate

Typical Control and Metering Function for BTA-1 AM Transmitter (3 towers) and BTF-5 FM Transmitter Controlled by BTR-20B Remote Control

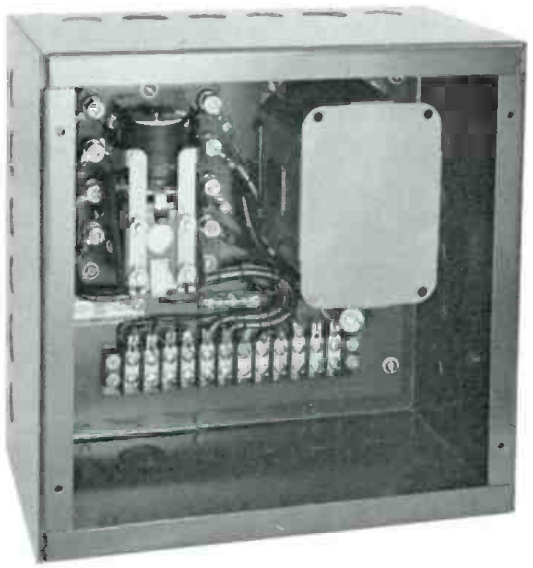
Dial	*Control*	*Metering*
1	AM Transmitter On-Off	Filament Line
2	AM Plate On-Off	Plate Volts
3	AM Output Raise-Lower	Common Point Current
4	Overload Reset	Plate Current
5	AM Day-Night	Common Point Current
6		Base Current 1
7		Base Current 2
8		Base Current 3
9		AM Frequency Deviation
10		AM % Modulation
11	Spare	
12	Spare	
13	FM Transmitter On-Off	Filament Line
14	FM Plate On-Off	Plate Volts
15	FM Output Raise-Lower	Reflectometer
16	FM Overload Reset	Plate Current
17		FM Frequency Deviation
18		
19	Tower Lights On-Off	Lighting Current
20	Home	Calibrate



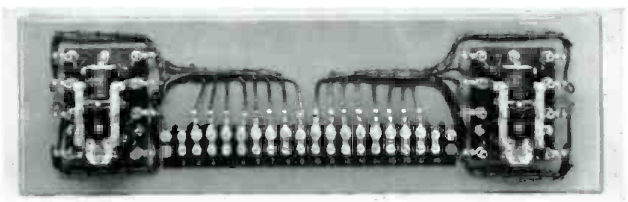
Meter Panel, ES-27220 for AM Monitoring.



A-C Voltage Pickup, MI-27516.



Tower Lighting Unit, MI-27519.



Latching Relay Panel, MI-27509-A.

SPECIFICATIONS

Control Functions:
- BTR-11B 10
- BTR-20B 19

Power Requirements ..... 117 volts, a-c, 50/60 cycles
Power Consumption and/or metering ..... 25 watts maximum
Calibration ..... Standard cell
Meter ..... 0 to 150 per cent (200 microamps)
Telephone Line ..... Special d-c; 5000 ohms loop resistance max.
Fail Safe Control ..... Meets FCC requirements
Fuses ..... Two of each, 1 amp., 105-125 volt inputs
Finish ..... Light umber gray

Dimensions (overall):
- BTR-11B Transmitter Control Unit ..... 19" wide, 10½" high, 11" deep
- BTR-11B Studio Control Unit ..... 19" wide, 10½" high, 6" deep
- BTR-20B Transmitter Control Unit ..... 19" wide, 10½" high, 12⅞" deep
- BTR-20B Studio Control Unit ..... 19" wide, 10½" high, 8⅞" deep

Weight (approx.):
- BTR-11B Transmitter Control Unit ..... 18 lbs.
- BTR-11B Studio Control Unit ..... 18 lbs.
- BTR-20B Transmitter Control Unit ..... 20 lbs.
- BTR-20B Studio Control Unit ..... 20 lbs.

Equipment Supplied

BTR-11B Remote Control System (10 functions) ES-34280
Consisting of:
- 1 Studio Control Unit MI-27537
- 1 Transmitter Control Unit MI-27538-A

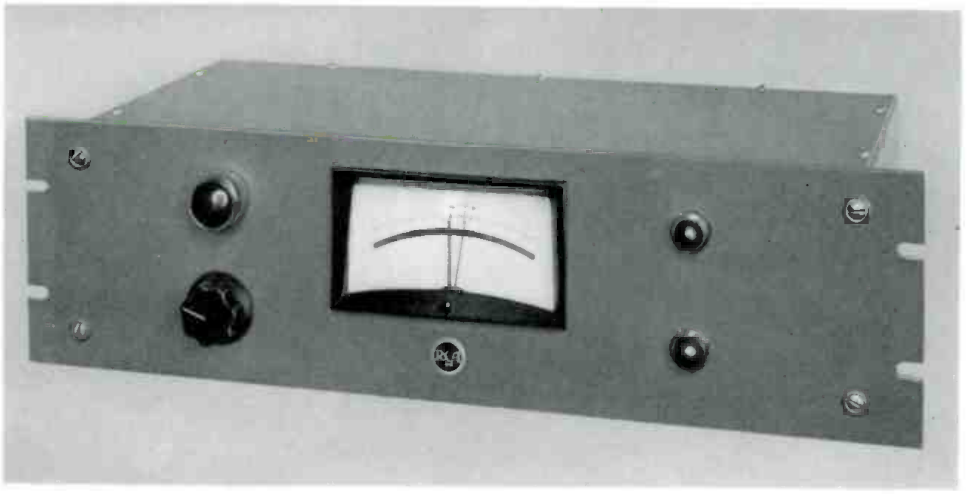
BTR-20B Remote Control System (19 functions) ES-34274
Consisting of:
- 1 Studio Control Unit MI-27539-A
- 1 Transmitter Control Unit MI-27526-A

Accessories

Type BTRX-40A Extension Unit (19 functions)	MI-27556
2-Meter Panels (AM Monitoring)	ES-27220
A-C Voltage Pickup	MI-27516
Tower Lighting Monitoring and Control Unit	MI-27519
Tower Light Monitoring Unit	MI-27544
Weatherproof Enclosure for MI-27544	MI-27543
Latching Relay Panel (including two relays)	MI-27509-A
Latching Relay, DPST, 6 amperes	MI-27524-1
Latching Relay, DPST, 30 amperes	MI-27524-2
Latching Relay, 4DPT, 0.5 ampere	MI-27524-3
R-F Relay, 12.5 amperes	MI-27545-1
Momentary Relay, DPDT, 15-20 amperes	MI-27545-2
R-F Contactor, Latching Type, SPDT, 25 amperes	MI-27755-1
R-F Contactar, DPDT, 25 amperes	MI-27755-2
Remote R-F Pickup (rated up to 50 kw)	MI-28027-A
Remote R-F Pickup (rated up to 5 kw)	MI-27966
Meter Commutator	MI-27555
Remote Control Accessory Kit for BTA-50G	MI-27687
Remote Control Accessory Kit for BTA-250M	MI-27522
Remote Control Accessory Kit for BTA-500MX/1MX	MI-27523
Remote Output Control for BTA-5/10H	MI-27517
Remote Filament Control for BTA-5/10H	MI-27518
Remote Power Cutback Kit for BTA-5/10H	MI-27520
Miscellaneous Resistors and Parts for BTA-5/10H	MI-27540
Temperature Indicator, Indoor —30°F to +150°F	MI-27550-1
Temperature Indicator, Outdoor —30°F to +150°F	MI-27550-2
AM Monitor Preamplifier	108-14C
FM Monitor Preamplifier	108-15C

Automatic Output Control

MI-27564



FEATURES

- Maintains proper transmitter output power
- Easy to install
- Requires only 5¼ inches in standard rack
- Extended scale meter relay
- Manual—Automatic switch provided

DESCRIPTION

The Automatic Output Control, MI-27564, is designed to stabilize and control transmitter output power within FCC allowed limits or to shut down transmitter operation in case of serious failure. It is easily installed at the output of the transmitter.

In the case of AM transmitters, automatic power control is achieved by sampling the common point current and automatically maintaining it at the value corresponding to the licensed power within a tolerance plus 5 percent and minus 10 percent. This is accomplished by the use of an RCA MI-27966 or MI-28027-A Remote Pick-up Unit connected at the common-point and operating as an r-f to d-c current transducer. The output of the transducer is a function of carrier current only and does not respond to the modulation. FM or TV Transmitters are controlled by connecting the output of a reflectometer to the input of the automatic output control. In the case of television transmitters two control units are required to maintain the aural and visual outputs within limits.

The output of the transducer is then fed to the input of the Automatic Output Control which constantly samples this input from the transducer. If it varies beyond the above tolerance, it acts to correct the transmitter output power by operating a motorized transmitter power output control. In the event that the automatic power output control cannot correct the transmitter to proper output level within a selected period (about 1½ minutes) the power control will lock out and sound an alarm at the studio. Provision has been made in the existing remote control system to take manual control and/or to reset the automatic power control. The unit may be automatically disabled while the carrier is being interrupted for a Conelrad test alarm or when the transmitter is shifted to Conelrad operation.

The Automatic Output Control is contained on a panel mounting chassis, 19 inches wide, 5¼ inches high and 9½ inches deep overall. The panel contains a manual-automatic switch, power-on indicator light and two lights designed to indicate increasing or decreasing power output. A meter relay with contacts that are fixed at upper and lower tolerances is also mounted on the panel.

SPECIFICATIONS

Power Requirements	117 volts, a-c, 50/60 cycles, 25 watts
Fuse	½ amp.
Meter	Extended scale, 70 μa to 130 μa with fixed contacts
Finish	Light umber gray
Dimensions Overall	19" wide, 5¼" high, 9½" deep
Weight	10 lbs. approx.

Equipment Supplied

Automatic Output Control	MI-27564

B.6606

Tone Alarm Equipment

TYPE BTRA-5B

FEATURES

- Basic unit provides up to 4 simultaneous alarm/status functions, system can be expanded to 8 functions
- Reserve battery supply for fail-safe operation
- Low power consumption
- Occupies 7 inches in standard rack
- Standard transformer components

Receiver Unit, MI-27553

Transmitter Unit, MI-27551

DESCRIPTION

The RCA Type BTRA-5 Tone Alarm Equipment is an automatic system based on a series of tone generators that can provide up to four simultaneous alarm or status functions when installed at studio and transmitter locations. The system is comprised of the MI-27551 BTRA-5B Transmitter Unit and the MI-27553 BTRA-5B Studio Unit which are connected by an inexpensive low frequency telephone line. When used in conjunction with the BTR-11B or BTR-20B Remote Control Equipment, an additional telephone line is not required.

The alarm system consists of a series of tone generators located at the transmitter. Should trouble develop, the tone generator trips out and a selective detector in the studio then flashes an alarm. The tone alarm system may be used to indicate such varied functions as transmitter overload, out of tolerance operation, burglar alarm, standby generator status, over temperature conditions and many other applications.

Both transmitter and studio units are mounted on panel-mounting chassis 19 inches wide, 7 inches high and 8⅜ inches deep overall. The transmitter panel includes an indicator light indicating when power is on, and a power switch. It operates from a 115 volt, 50/60 cycle a-c line and power consumption is approximately 6 watts. A storage battery is provided for fail-safe operation. The battery is constantly being charged while the equipment is in operation for instantaneous operation if power fails. The oscillator units operating at four different frequencies are epoxy encapsulated.

The alarm tones are transmitted from the transmitter over the telephone line to the studio and fed into a resonant reed relay with reeds tuned to the approximate frequencies. Each of these detectors will flash an alarm if the tone to which it is tuned is removed. The studio unit panel has provisions for four lighted display screens to indicate the fault. There is also a power switch, power-on indicator lamp, and reset button. There is a gain control on both studio and transmitter chassis to regulate the telephone line, and transistor amplifier with input and output transformer and gain control. A fuse and fuse supply is located on the rear of both studio and transmitter units.

SPECIFICATIONS

Number of Alarm/Status Functions	Basic unit 4, 8 max.
Power Requirements	115 volts, a-c, 50/60 cycles, 6 watts
Finish	Light umber gray
Dimensions (overall—both units)	19" wide, 7" high, 8⅜" deep
Weight:	
Transmitter Unit, MI-27551	10 lbs. est.
Receiver Unit, MI-27553	10 lbs. est.

Equipment Supplied

BTRA-5B Tone Alarm Equipment	ES-34281
Including the following:	
1 Transmitter Unit	MI-27551
1 Studio Unit complete with four clear caps, four red and four green bases for display screens, sheet of 8½ x 11-inch Mylar Film and lamp changing tool	MI-27553

"Power Max"

MI-34654

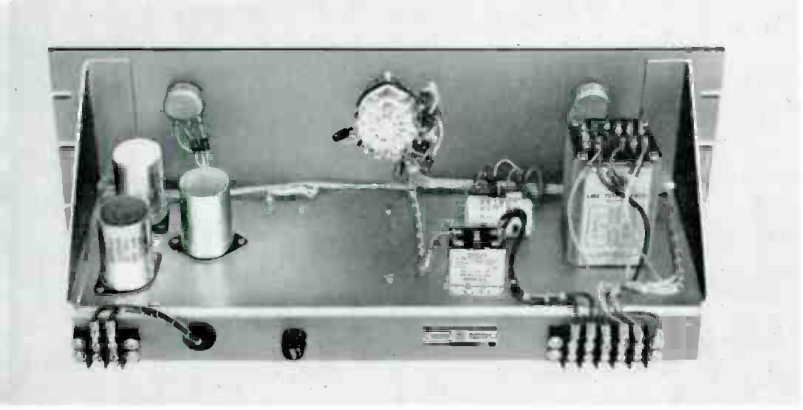
FEATURES

- Extends AM radio coverage
- Increases positive peak modulation without exceeding 100 percent negative peak modulation
- Meets FCC rules
- Easy to install
- Housed in rack-mounted chassis

DESCRIPTION

The RCA "Power Max", MI-34654, is a non-linear limiter designed to extend area coverage of AM broadcast transmitters. With "Power Max" it is possible to modulate the positive peaks as much as 110 to 115 per cent, limited only by transmitter capability without exceeding the FCC maximum 100 percent negative peak modulation. The "Power Max" does not clip the negative peaks; it limits the negative peak by rounding off the signal beyond a predetermined point. Many stations can achieve new maximum coverage from present transmitting equipment with "Power Max."

The equipment is completely housed in a rack-mounting chassis requiring only seven inches of rack space. It is quickly installed in the input of any AM transmitter; and for optimum performance it should be used following an RCA BA-6A Limiter Amplifier. Only two adjustments are necessary upon installation. The equipment is easy to operate. It contains no tubes, transistors or other active circuits, and has a very small power drain. The gain of the overall system is not changed when the "Power Max" is switched in or out.



The MI-34654, "Power Max", is essentially a non-linear limiter which rounds off the negative peak modulation envelope so as to prevent overmodulation of the negative peaks in conformity with established FCC operating rules. The unit consists essentially of a 6 db attenuator pad followed by a non-linear shunt impedance, the impedance of which is a function of voltage amplitude. Thus the effective shunt impedance is reduced with increasing amplitude resulting in lower output at the higher amplitudes. The shunt element is polarized so as to be effective only on negative swings.

Circuit components which includes no tubes, transistors or other active circuits, are mounted on a rack mounting chassis measuring 19 inches wide, 5½ inches deep and 7 inches high. All controls are mounted on the 7-inch high front panel. These include: two set-up screw driver adjustments for compression and threshold (use of an oscilloscope for initial set-up is recommended), a power switch, an indicator lamp, and a phase reversal switch. Provision is made to bypass the unit without changing the insertion loss. This permits the "Power Max" to be removed electrically from the circuit whenever desired.

SPECIFICATIONS

Input Level	+16 dbm ±2 db
Insertion Loss	6 db
Power Requirement	115 volts, a-c, 60 cps, 5 watts
Dimensions Overall	19" wide, 5½" deep, 7" high
Weight	Approx. 18 lbs.
Finish	Light Umber Gray

Ordering Information

Power Max	MI-34654

Antenna Phasing Equipment

FEATURES

- **Individual "custom" design provides optimum operation for day and night patterns**
- **Circuits designed for maximum stability and operating flexibility**
- **Front-panel-controlled variable components provide adjustment under power**
- **Coordination of both phasing and transmitter design assures matched performance**

BTA-1R Transmitter with matching left-wing phasing cabinet.

DESCRIPTION

RCA Phasing and Branching Equipment is custom-built to provide precise coverage patterns to fully meet the requirements of the FCC. This "custom" equipment is designed to assure "tailored" patterns for optimum day and night coverage. From the initial plan to the finished product, RCA bases its design on requirements of the station engineer and his consultant. RCA has had over twenty years of experience with Phasing Equipment and has completed hundreds of custom installations.

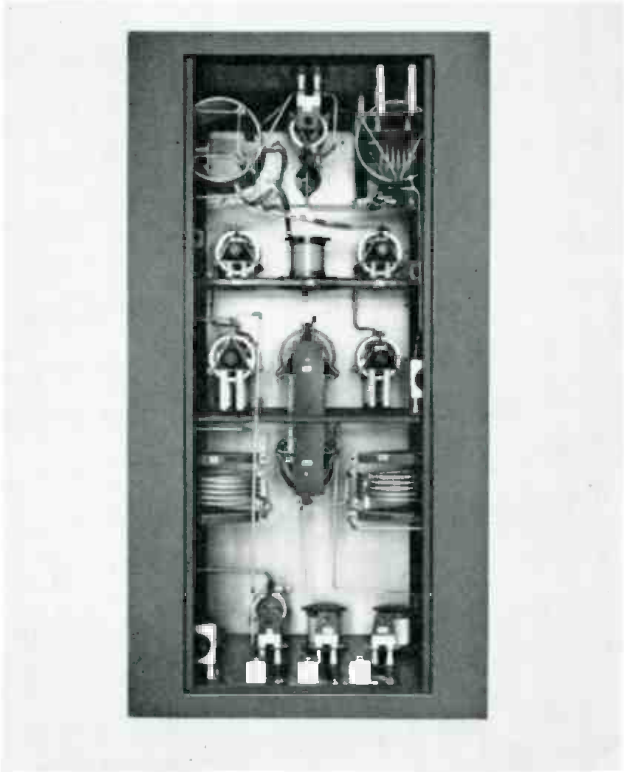
Where required, front panel controlled rotary coils provide independent current ampltiude control for each antenna, affording maximum flexibility. Lagging "T" networks are provided to properly phase the currents to the various antenna transmission lines. The two series legs of each phasing network consist of two ganged rotary coils with a single front-panel control. Networks provide independent phase adjustment for each antenna current over a wide range with precise impedance matching. When antenna currents do not require phase delay, RCA employs economical series resonant circuits with rotary coils to provide the proper phase adjustment.

Line Terminating Units are necessary to obtain exact impedance matching between transmission lines and antennas. RCA installations incorporate circuit components with generous values, resulting in exceptional flexibility which permits "on-the-spot" adjustments over a 2-to-1 impedance range.

Reliable switching facilities are indispensable for changing from day to night patterns, or from nondirectional to directional patterns. Pattern switching is accomplished by use of remotely controlled, positive-latching relays. This arrangement provides the switching of completely separate "day-and-night" power dividing and phasing networks, and changes the values of the network arms of the Line Terminating Units. Pattern-switching relays have pilot contacts which can be used to monitor the relay operation by means of indicator lights.

Equipment is available in a wide variety of arrangements. These custom equipments may be housed in one or more of the RCA stylized cabinets or may be installed on open

1-KW, 5-KW AND 10-KW PHASING AND BRANCHING EQUIPMENT



Phasing Cabinet showing simplicity of design and layout. Custom equipment provides maximum stability for dependable AM operation, for three tower, 10-KW stations.

panel type construction. The cabinets consist of end panels with front edges formed to provide control panels, mounted on a sturdy welded steel base. Rear access to each cabinet is provided by two interlocked removable panels.

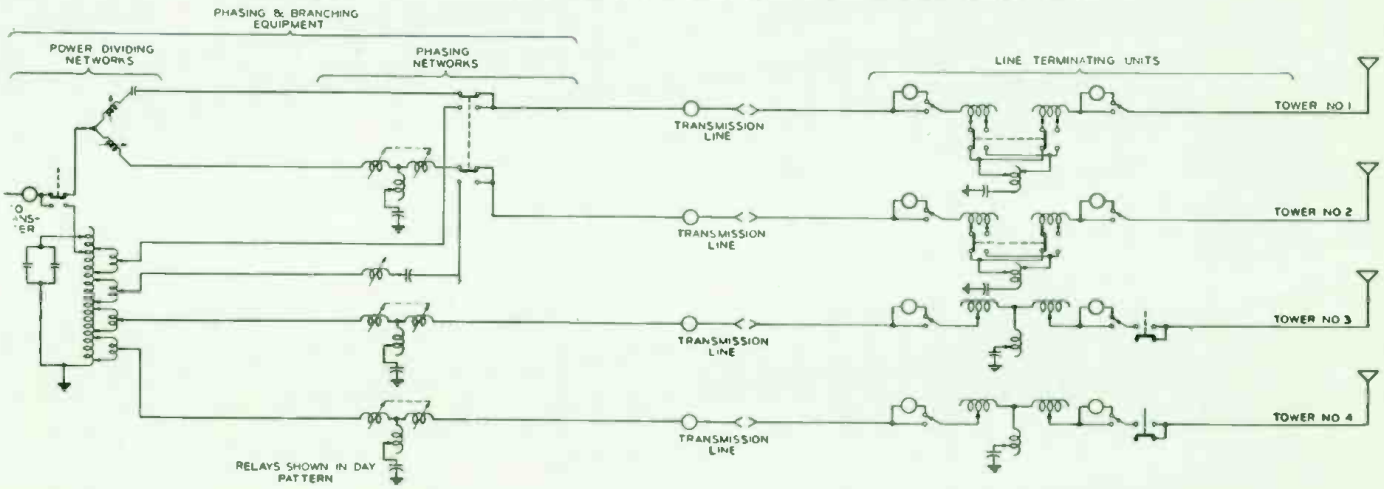
The doors of the cabinets are pleasingly styled and finished in tones of dark umber gray to match the color scheme of any broadcast station. The cabinet provides a matched wing for housing the phasing equipment when used with the RCA 1R1 or 5T, 5U/10U Transmitters. For complex antenna arrays, "side-by-side" matching cabinets are used to provide the additional mounting space required for properly housing the additional phasing and branching components.

In order to estimate floor space required for installation, the following cabinet requirement chart will prove helpful. Each cabinet measures 84-inches high, 34-inches wide, and 33-inches deep.

	Power	Two Tower	Three Tower	Four Tower
Directional Night	1-KW	(1)	(1)	(1 or 2)
and Non-Directional	5-KW	(1)	(1)	(2)
Day	10-KW	(1)	(1 or 2)	(2)
One Pattern	1-KW	(1)	(1)	(2)
Directional Day	5-KW	(1)	(1 or 2)	(2)
and Night	10-KW	(1)	(1 or 2)	(2)
Two Pattern	1-KW	(1 or 2)	(2)	(2 or 3)
Directional	5-KW	(1 or 2)	(2)	(3)
Day and Night	10-KW	(2)	(2)	(3)

Wall-mounted, Open-type Phasing Panels are also available for use in certain transmitter room installations where it is not possible or convenient to employ the "cabinet-type" equipment. In these cases, the wall-mounted design provides an economical arrangement which has the inherent advantages of flexibility and maximum accessibility.

Typical schematic diagram of antenna phasing equipment.



B.6650

1-KW, 5-KW AND 10-KW LINE TERMINATING UNITS

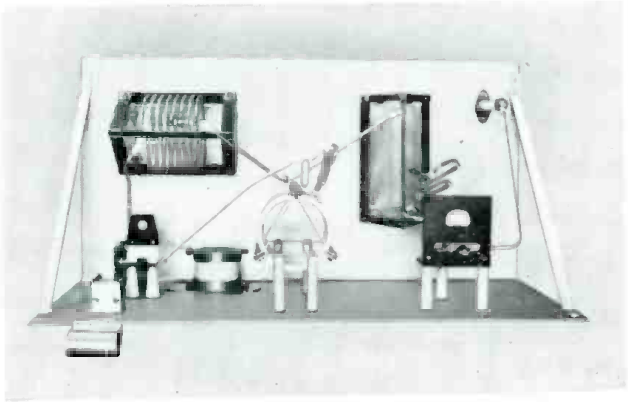
1 to 10-KW Line Terminating Units are provided to properly terminate transmission lines leading to the various towers of the antenna array. They are available in either metal weather-proof cabinets, or on open-type, wall-mounted panels. The weather-proof housing mounts upon a wooden platform or a steel angle support. Components of generous ratings are incorporated in a flexible design, permitting proper impedance transformation over a wide range of antenna impedances. R-F pattern switching relays are provided with contacts to permit remote indication of their operation. Pattern switching is completely coordinated with the transmitter control circuit from a centrolized switching operation. Antenna-current meters are provided with individual "make-before-break" switches that provide isolation of meters not being observed. Plug-in meter units, which permit complete removal of the meters, can also be provided. Equipment is shipped assembled for simple installation.

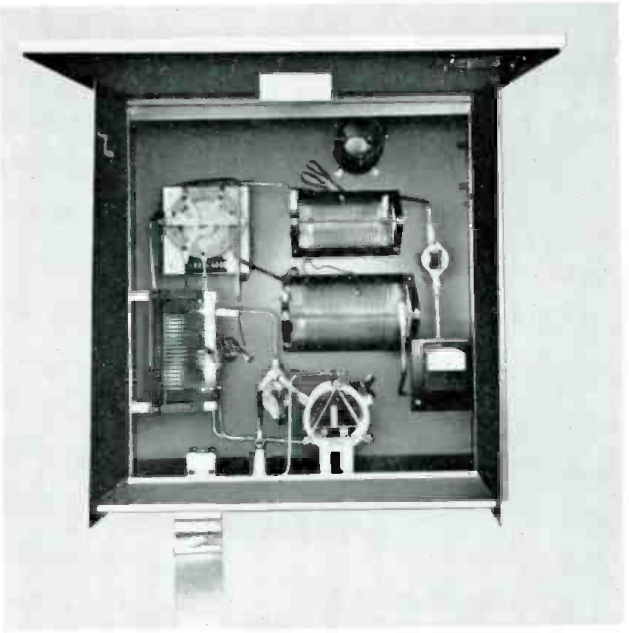
Open-Type Wall Units

RCA Open-type, Wall-mounted Panels as shown below, are ideal for mounting upon the wall of a tuning house at the antenna tower base and provide maximum accessibility for easy maintenance of Line Terminating Equipment. Remote metering kits can also be included for convenient remote indication of the antenna current.

Line Terminating units for transmitters up to 50 KW are available from RCA on a custom basis or as a complete kit of components for assembly by the radio station. Components include feed-through, bowl insulators, 6-inch r-f ammeters, meter panels, coils, capacitors and day-night pattern switching relays. Transmission line meters and antenna current meters are provided with individual "make-before-break" switches that provide isolation of meters not being observed. Pattern switching relays are provided with pilot contacts to permit coordination with the transmitter control circuits. Gas filled, vacuum, or Forodon mica capacitors are utilized. For greater ease in adjustment of critical circuits, variable components can be provided. The remote-control of motor driven variable components is another RCA custom feature that is available.

Line Terminating Unit installed on open panel.





Line Terminating Unit installed in weatherproof cabinet.

How To Order

The accurate preparation of a quotation for antenna phasing equipment and the custom design of such equipment requires that either the station or its engineering consultant supply the following data:

(a) Operating power, frequency and number of elements in proposed array.
(b) Description, spacing and self-impedance of proposed tower.
(c) Amplitude and phase of current required in each tower.
(d) Length and characteristic impedance of transmission lines from branching unit to each tower.
(e) Information on pattern switching requirements (non-directional daytime operation or different pattern night and day).
(f) Type of cabinet desired (5/10 KW equipment).
(g) Type antenna current sampling system desired.

AM Phasing Accessories

Extra Bowl Insulator, solid stud	MI-27723
Extra Bowl Insulator, hollow stud	MI-27724
SPDT RF Contactors (for use up to 17 kv at 2 mc at 25 amp.)	MI-27755-1
DPDT RF Contactors (for use up to 17 kv at 2 mc at 25 amp.)	MI-27755-2
SPDT RF Contactors (for use up to 22 kv at 2 mc at 25 amp.)	MI-27755-3
DPDT RF Contactors (for use up to 22 kv at 2 mc at 25 amp.)	MI-27755-4
3" Meter Panel and Switch for use with LTU Weatherproof Cabinet	MI-7486-B
3" Meter Panel and Switch for use with Open Panel LTU	MI-27760
3" Meter Panel and Switch for use with Open Panel LTU with DPDT Switch	MI-27761
Dial Counters for Variable Coil Inductors	MI-27762
Plug-in Meter Bracket Shorting Bar and Meter Plug	MI-27763
Horn Gap	MI-27771

Antenna Tuning Units

TYPES BPA-21A/B/C/D (1 kw)
BPA-5 & 10A/B (5-10 kw)
BPA-50 (50 kw)

FEATURES

- **Reliable operation**
- **Custombuilt arrangements available for any requirement**
- **Make-before-break switches avoid damage to antenna ammeter from static discharges**
- **Optional remote metering provisions**

DESCRIPTION

The RCA Type BPA Series of Antenna Tuning Units serve to match broadcast antennas to either concentric or open wire transmission lines and also aids in suppressing carrier harmonics. The units are custom built to meet customer requirements. When ordering specify: (1) Transmitter carrier power. (2) Transmitter frequency. (3) Antenna resistance and reactance or type and height. (4) Transmission line impedance.

In addition, Antenna Couplers for 1250-watt series fed or shunt fed tower antenna installations are available. Tower height and frequency should be specified when ordering the RCA couplers.

Four models of the 1 KW Antenna Tuning Unit are available: The MI-27767-A Basic Antenna Tuning Unit with no remote metering or lighting choke included; the MI-27767-B unit which adds to the "A" equipment, an MI-28027-A Remote Metering Pickup and Meter for remote metering of antenna current; an MI-27767-C unit which adds to the "B" equipment a two wire lighting choke with two filter capacitors; and the MI-27767-D unit adds to the "B" equipment, a three-wire lighting choke with four filter capacitors. All four models include an r-f antenna ammeter.

SPECIFICATIONS

Electrical Specifications

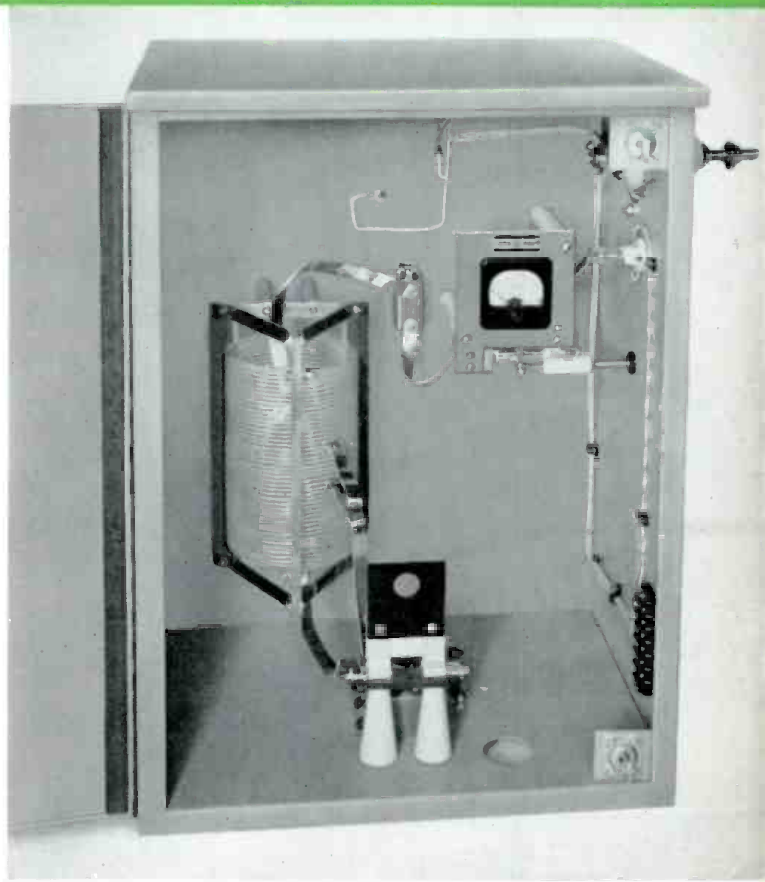
Frequency Range	*800 kc to 1600 kc
Transmitter Power (maximum)	1 kw
Antenna Resistance	20 to 250 ohms
Transmission Line Impedance	50 to 230 ohms
Antenna Reactance	+j200 to −j200 ohms

(Can be extended in the positive direction by the addition of series capacitance and in a negative direction if operated from a transmission line of lower impedance than the antenna resistance)

Mechanical Specifications

Height	28 1/16"
Width	22 1/8"
Depth	16 3/4"
Weight (net)	65 lbs.

* Low frequency limit may be extended to 540 kc on special order.
** Note: Select dash number to correspond with customer's antenna current requirements.



Basic 1 KW Antenna Tuning Unit, MI-27767-A.

Equipment Supplied

1 KW Antenna Tuning Unit, Including	ES-27250
1 Type BPA-21A Antenna Tuning Unit	MI-27767-A
or	
1 Type BPA-21B Antenna Tuning Unit with remote metering	MI-27767-B
or	
1 Type BPA-21C Antenna Tuning Unit with remote metering and two-wire lighting choke	MI-27767-C
or	
1 Type BPA-21D Antenna Tuning Unit with remote metering and three-wire tower lighting choke	MI-27767-D
1 Ammeter	**MI-7147-B

Accessories

250/1000 watt Antenna Tuning Unit less Remote Meter Kit and Remote Meter	MI-27725
Antenna Coupler, 1250 watts, for series feed, non-weatherproof	MI-27785
Antenna Coupler, 1250 watts, for shunt feed, non-weatherproof	MI-27786
Horn Gap	MI-27771
Insulator Bowl	MI-27798
Remote Meter Pick-up Unit	MI-28027-A
Double Winding R-F Antenna Lighting Choke Coil with 2 Capacitors	MI-27241
Triple Winding R-F Antenna Lighting Choke Coil with 4 Capacitors	MI-27242
Ammeter	**MI-7147-B
Remote Indicating Ammeter for 3-inch Case	**MI-28037-B
Remote Indicating Ammeter for 4-inch Case	**MI-28037-B

5-10 KW Antenna Tuning Units, Types BPA-5A/10A

DESCRIPTION

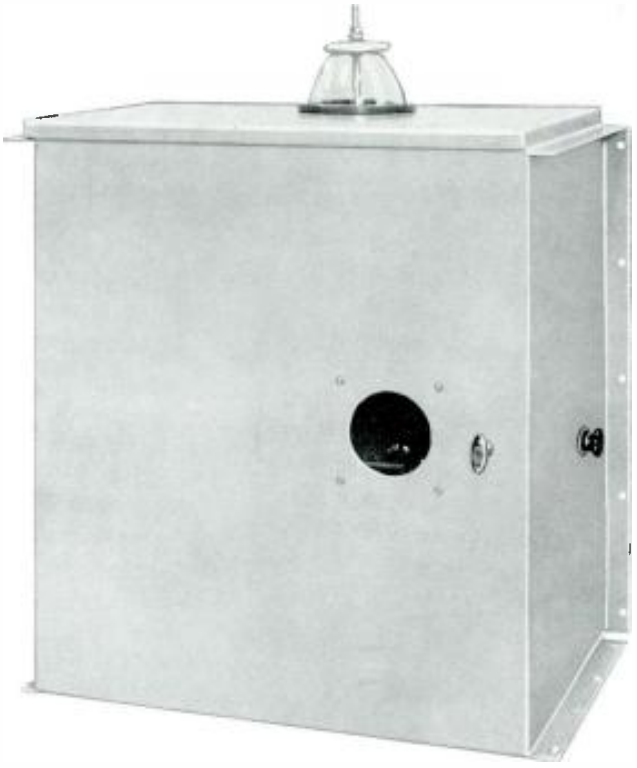
The BPA-5A (5 kilowatt) and BPA-10A (10 kilowatt) Antenna Tuning Units serve the double purpose of matching antennas of widely divergent characteristics to either concentric or open-wire transmission lines and of suppressing carrier harmonics.

All parts of this equipment are enclosed in a weatherproof metal housing equipped at the front with a door affording ready access to the interior. This door is provided with a lock. The unit is designed for mounting on a wooden platform or a steel angle cradle by means of side flanges at the bottom of the housing. Rear flanges are also provided to permit mounting the unit on two upright posts or on a wall. The antenna ammeter, which may be read through a circular window in the door, is protected from lightning surges by a SPDT switch operated by means of a knob extending through the side of the housing.

The circuit of the antenna tuning unit consists essentially of a single T-section low-pass filter which reduces the number of elements to a minimum. Two series inductors permit separate adjustments of the transmission line and antenna terminating impedances. The shunt capacitors are fixed at values determined by the station frequency. The tuning units are provided with a light which is useful for reading the antenna current meter at night and also serves as a heater to prevent accumulation of moisture in the unit.

An optional Remote R-F Pickup Unit, MI-28027-A or MI-27966 and a Remote Indicating Ammeter with a range corresponding to the tower base ammeter can be added to the tuning units to provide a means of observing the antenna current at a remote location (transmitter house).

The antenna lead-in insulator is located on the top of the unit and provision is made for mounting an insulator, MI-27723, or MI-27724 on the side of the housing in case an open-wire line is used. A hole is provided in the bottom of the cabinet for bringing in a concentric line. Ample space is provided in the weatherproof cabinet for mounting R-F Antenna Lighting Choke Coils, if desired.



Type BPA-5/10A Antenna Tuning Unit.

SPECIFICATIONS

Frequency Range	540 kc to 1700 kc
Transmitting Power (Moximum):	
BPA-5A	5 kw
BPA-10A	10 kw
Antenna Resistance:	
BPA-5	10 to 1100 ohms
BPA-10A	20 to 1100 ohms
Transmission Line Impedance	50 to 350 ohms
Antenna Reactance	+j500 to −j500 ohms
(Can be extended in the positive direction by the addition of a series capacitor, and in a negative direction if operated from a line of lower impedance than the antenna resistance.)	
Finish	Durable gray
Overall Dimensions	41" high, 34" wide, 23" deep
Weight (net)	330 lbs.

Ordering Information

BPA-5A	MI-27789-A
BPA-10A	MI-27790-A

Accessories

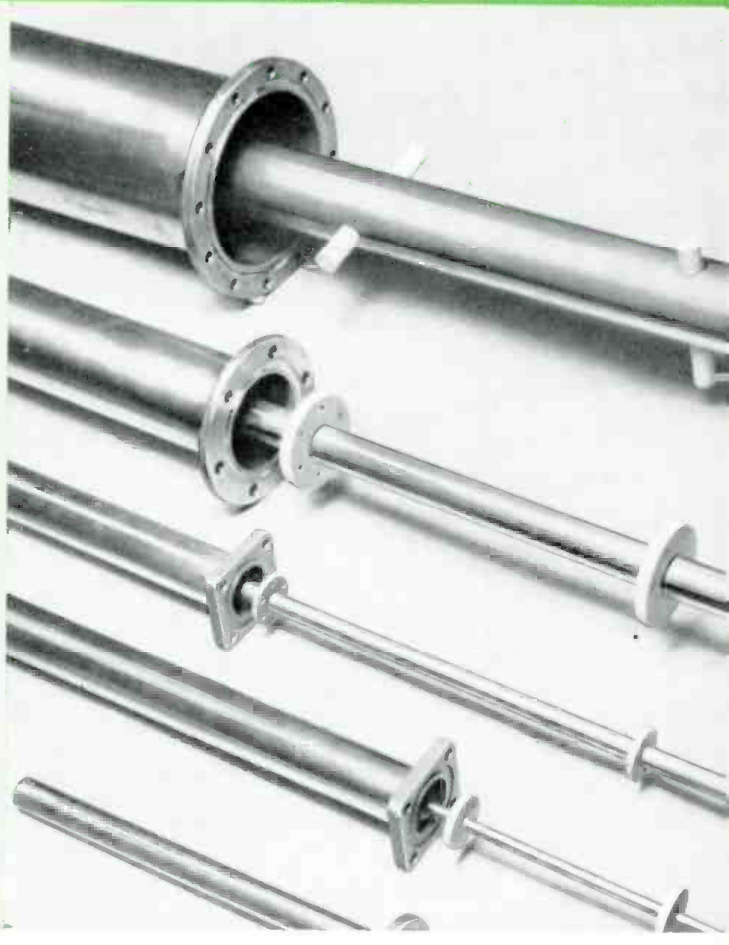
Insulator Bowl, complete with fittings, 10¼" solid stud and shield	MI-27723
Insulator Bowl, complete with fittings, hollow stud and shield	MI-27724
50 KW Remote R-F Pick-up Unit (less meter)	MI-28027-A
5 KW Remote R-F Pick-up Unit (less meter)	MI-27966
Remote Indicating Ammeter, 4-inch case, black scale	MI-28037
Remote Indicoting Ammeter, 3-inch case, black scale	MI-28037-B
Double Winding R-F Antenno Lighting Choke Coil with 2 capacitors	MI-27241
Triple Winding R-F Antenno Lighting Chake Coil with 4 capacitors	MI-27242

AM-FM Transmission Line

COAXIAL TYPES

FEATURES

- Provides efficient transfer of power for every broadcast application
- Maximum stability provided by low loss dielectrics
- Minimum attenuation—maximum efficiency —low standing wave ratio
- Excellent power handling capability
- Designed for precise, accurate assembly
- Complete line of fittings and accessories for installation versatility



DESCRIPTION

RCA coaxial transmission line provides an efficient means for transferring RF power to AM, and FM antennas. It is manufactured in various sizes and types to accommodate many different power and installation requirements.

RCA transmission line equipment features high efficiency plus time saving installation. Ease of installation is due to the RCA-developed flanged line which is now used in all types of radio installations. This line is supplied in convenient lengths with flanges already silver soldered to the ends. Thus, line sections can be quickly and easily bolted together. A specially designed connector which compensates for differential expansion and contraction is used for joining the inner conductors. No special tools, no torches or soldering are necessary. Mating flanges are automatically sealed for pressure by insertion of a neoprene O-ring gasket before assembly.

Each of the various types of RCA transmission line is designed for a particular application. The choice of line for an installation will depend principally upon the frequency in use and the power to be handled. Selection of the proper line will provide the most economical and efficient installation.

The comprehensive data table sets forth the general overall characteristics and specifications of RCA's complement of AM and FM tranmission lines. This should prove to be helpful to broadcast engineers and planners.

Before ordering transmission line or fittings, it is recommended that a dimensioned layout be made of the tower

or supporting structure (with antenna mounted), the routing of the transmission line between the tower and transmitter room, and routing of the lines within the transmitter room. This layout will give an idea as to what elbows and fittings will be needed and the length of line required. The standard length of transmission line is 20 feet. Shorter lengths may be obtained by ordering the desired lengths with flanges soldered on at the factory, or a 20-foot section may be cut and a flanged to un-flanged line adapter used. The RCA lines have a rolled groove in one end of each of the outer conductors to prevent the inner conductor from moving in one direction.

The opposite end is free to permit removal of the inner conductor and insulators, for inspection. The rolled groove supports the end insulator and also the inner conductor when the line is in a vertical position, and this end should always be placed in the lower position to prevent the inner conductor from dropping out. For horizontal runs, rolled groove is placed at alternate joints so that for each two adjacent sections the line is locked in position by the opposing rolled grooves.

Outdoor Runs

All RCA lines and fittings that are to be used outdoors should use the flange type line. The unflanged lines may be used inside buildings where gassing may not be necessary or where changes in transmission line connections are frequently made for tests. An O-ring gasket is supplied which fits into a groove of each mating flange of the flanged line. Also included are bolts, lock washers, and nuts made of silicon copper for each coupling. Care must be exercised when placing the gasket in the groove to avoid pinching the gasket. If the gasket is not assembled properly, a pressure leak may result. It is suggested that additional gaskets, bolts, and O-rings should be ordered to replace damage and loss during installation.

The gassed lines should be brought inside the buildings and connected to a gas stop. Assemble the gas stop with the pipe plug toward the gassed line. From the gas stop to the transmitter, flanged or unflanged line may be used.

There is a wide choice of fixed and expansion hangers for supporting the transmission line. See tables, photos and drawings in the Transmission Line Accessories catalog. For longer runs, a roller assembly is recommended. If it is necessary to run a line through a wall or building, make a hole large enough to clear the diameter of a transmission line flange and mount horizontal anchors on both sides of the wall securing same with bolts. A detailed description for each type hanger is given in the hanger section catalog.

Line Installation

Do not make up an installation in rainy or stormy weather unless the ends of the transmission line and fittings are protected from moisture. If it is necessary to stop work on an installation, cover both ends of the line to keep water out. If water gets into the line in cold weather, it may freeze and crack the line. This is very important since water can be trapped in low sections of line or antenna harnesses and it is difficult to purge from the line with the result that high standing wave ratios may be set up that will permanently damage the line or antenna. Even at normal temperature, if water gets in the line it is difficult to dry out the line by gas or air pressure. A cover plate may be used for closing off the line temporarily. After the complete installation, open up a bleeder valve at the antenna end and apply dry gas or dry air under pressure until all moisture has been blown out after which the bleeder valve must be closed. It is advisable to measure the insulation resistance with a voltohmyst and bleed the line until 80 megohms or more resistance is obtained. Care should be exercised not to drop the transmission line as the insulators may break. Do not bend the line more than that listed in the upper portion of the drawing on opposite page.

AM Installations

In AM installations the lines are usually anchored at the transmitter end. The expansion of the line occurs at the tower end. Make certain that sufficient flange to unflanged line adaptors are ordered for use at cut portions of the 20-foot length of line. Roller or swivel hangers are two methods used for supporting the line. These types of hangers leave the line free to expand or contract with temperature changes.

FM Installations

The method of installing an FM Transmission Line system is comparable to the method used in the TV installation shown on opposite page. Note that expansion hangers are required for supporting the vertical length except the top hanger which is a fixed hanger. The fixed hanger forces the expansion at the end of the line which is opposite the FM antenna to avoid damage to the antenna with temperature changes. The line is normally assembled starting from the fixed hanger.

If the FM tower is also used for AM broadcasting and the tower is base-insulated, it is necessary to prevent the transmission line from shorting the base insulator at the AM frequency. The FM line can be quarter-wave insulated utilizing insulated hangers. On short towers a resonating capacitance is required to compensate for lines of less than one-quarter wavelength.

TYPICAL INSTALLATION OF FM TRANSMISSION LINE ON TOWER

SINGLE LINE IS USED FOR FM

REFER TO TABLE BELOW FOR SYMBOL DESIGNATIONS

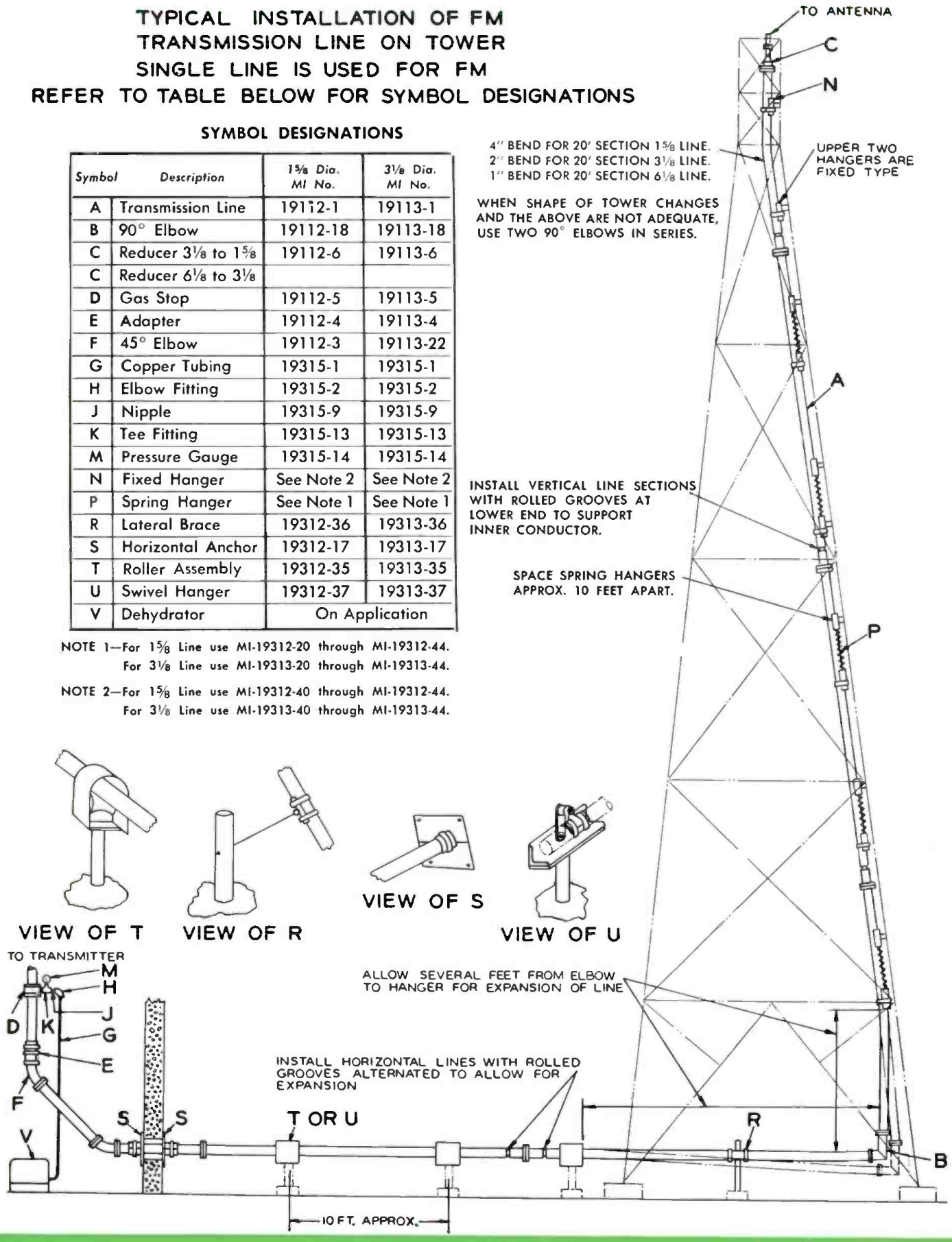
SYMBOL DESIGNATIONS

Symbol	Description	1⅝ Dia. MI No.	3⅛ Dia. MI No.
A	Transmission Line	19112-1	19113-1
B	90° Elbow	19112-18	19113-18
C	Reducer 3⅛ to 1⅝	19112-6	19113-6
C	Reducer 6⅛ to 3⅛		
D	Gas Stop	19112-5	19113-5
E	Adapter	19112-4	19113-4
F	45° Elbow	19112-3	19113-22
G	Copper Tubing	19315-1	19315-1
H	Elbow Fitting	19315-2	19315-2
J	Nipple	19315-9	19315-9
K	Tee Fitting	19315-13	19315-13
M	Pressure Gauge	19315-14	19315-14
N	Fixed Hanger	See Note 2	See Note 2
P	Spring Hanger	See Note 1	See Note 1
R	Lateral Brace	19312-36	19313-36
S	Horizontal Anchor	19312-17	19313-17
T	Roller Assembly	19312-35	19313-35
U	Swivel Hanger	19312-37	19313-37
V	Dehydrator	On Application	

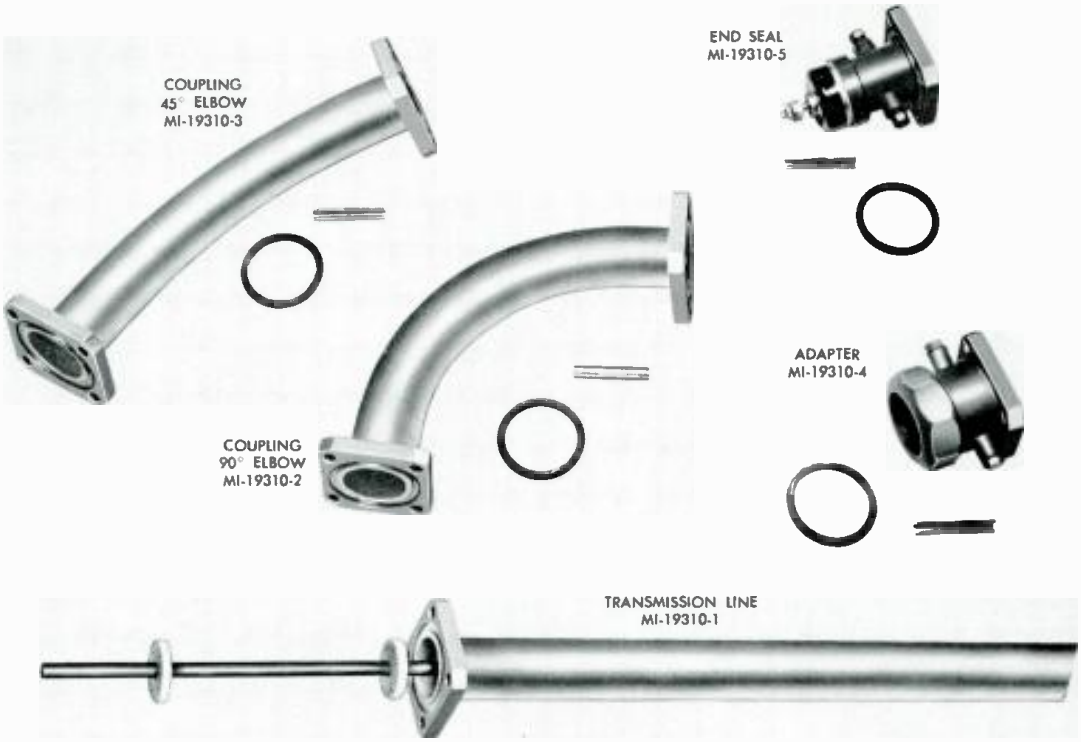
NOTE 1—For 1⅝ Line use MI-19312-20 through MI-19312-44.
For 3⅛ Line use MI-19313-20 through MI-19313-44.

NOTE 2—For 1⅝ Line use MI-19312-40 through MI-19312-44.
For 3⅛ Line use MI-19313-40 through MI-19313-44.

VIEW OF T VIEW OF R VIEW OF S VIEW OF U



1⅝-INCH 72-OHM HARD COPPER LINE AND FITTINGS, MI-19310



DESCRIPTIONS

RCA 1⅝-inch Steatite Transmission Line, Type MI-19310, is a hard-tempered coaxial line designed for installation where medium power is to be handled, and where the frequency to be used dictates use of a line with good efficiency.

MI-19310-1 TRANSMISSION LINE
This line is supplied in 20-foot lengths with flanges silver soldered to ends. The outer conductor is 1⅝-inch diameter with an inner conductor of ⅜-inch diameter using steatite insulators spaced 12 inches apart. The outer conductor is designed to allow for removing inner conductor for inspection. Line includes solderless inner connector, O-ring gasket and silicon copper hardware.

MI-19310-1-F TRANSMISSION LINE
Same as MI-19310-1 except one flange is omitted.

MI-19310-1-NF TRANSMISSION LINE
Same as MI-19310-1 except both flanges are omitted.

MI-19310-2 COUPLING (90° Elbow)
This elbow has one flange silver soldered. Opposite flange swivels to take care of any angle. Inner conductor is supported by 3 steatite insulators held in place. The elbow is furnished with solderless inner connector, O-ring gasket and hardware.

MI-19310-2-F COUPLING (90° Elbow)
Same as MI-19310-2 except the solid flange is omitted.

MI-19310-2-NF COUPLING (90° Elbow)
Same as MI-19310-2 except both flanges are omitted.

MI-19310-3 COUPLING (45° Elbow)
Same as MI-19310-2 except 45°.

MI-19310-3-F COUPLING (45° Elbow)
Same as MI-19310-3 except the solid flange is omitted.

MI-19310-3-NF COUPLING (45° Elbow)
Same as MI-19310-3 except both flanges are omitted.

MI-19310-4 ADAPTER COUPLING
Used for coupling a 1⅝-inch 72-ohm flanged line to a 1⅝-inch 72-ohm unflanged line. A 2-inch wrench is required for clamping the special gland nut for the unflanged line. Furnished with solderless inner connector, O-ring gasket and hardware.

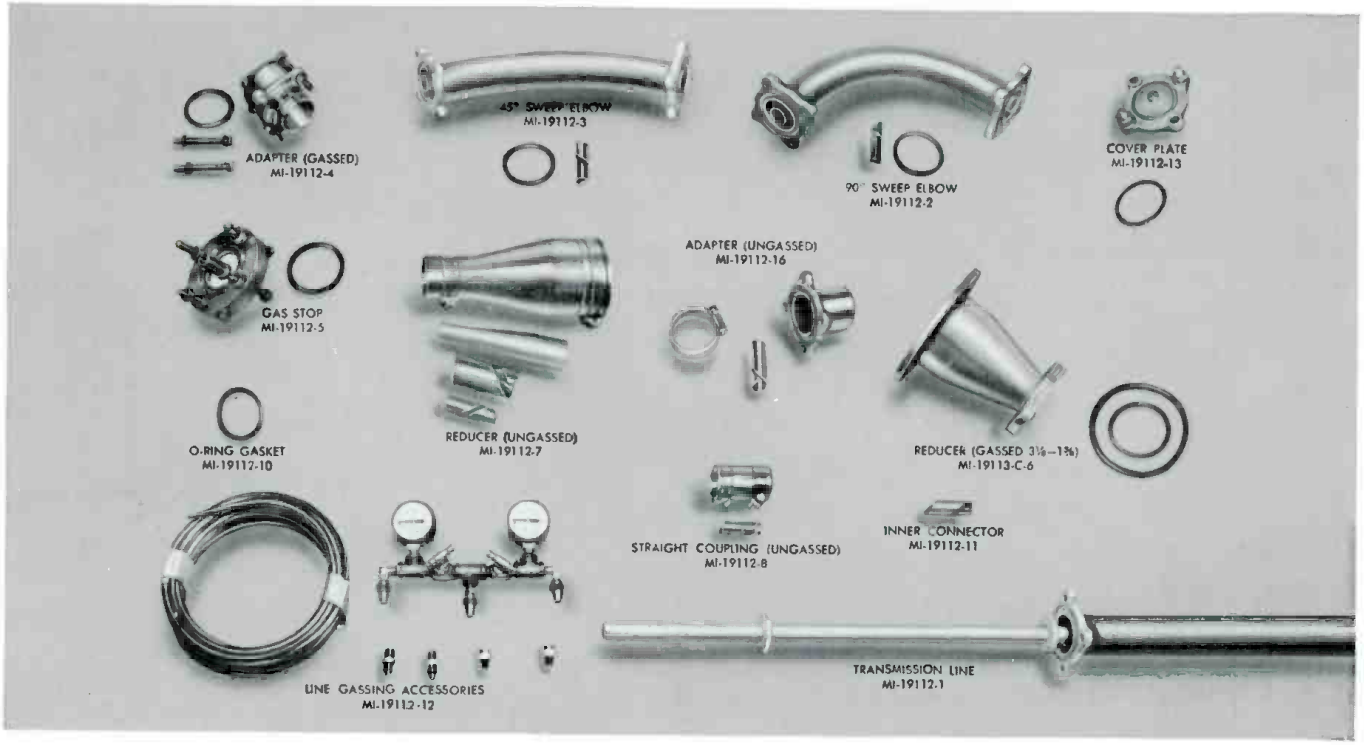
MI-19310-5 END SEAL
This end seal uses a steatite insulator that may be replaced by loosening the clamp nut which seals the insulator by means of an O-ring gasket. Has ⅛-inch IPS port for gas admission or bleeding the line. A screw terminal with lockwashers and nut is used for termination of center conductor. Furnished with solderless inner connector, O-ring gasket and hardware.

MI-19310-6 REDUCER COUPLING
Used for coupling 1⅝-inch 72-ohm flanged line to ⅞-inch, 72-ohm gassed line. Complete with outer and inner connectors, O-ring gaskets and hardware.

MI-19310-11 INNER CONDUCTOR CONNECTOR
Phosphor bronze bullet (0.250-inch dia.) for 1⅝-inch hard copper line.

MI-19310-55 FIELD FLANGE

1⅝-INCH 51.5-OHM HARD COPPER LINE AND FITTINGS, MI-19112



DESCRIPTION

RCA 1⅝-inch Steatite Transmission Line, Type MI-19112, is a hard-tempered copper line with a nominal impedance of 51.5 ohms. Because of its low impedance and good efficiency at VHF frequencies, this type line is widely used in TV as well as AM and FM installations.

MI-19112-1 TRANSMISSION LINE
This line is supplied in 20-foot lengths† with flanges silver-soldered to ends. The outer conductor is 1⅝-inch diameter with an inner conductor of ⅝-inch diameter using special low loss insulators spaced 12 inches apart. The outer conductor is designed to allow for removing inner conductor for inspection. Maximum power rating is 10 kw at 100 mc. Line includes solderless inner connector, O-ring gasket, and silicon copper hardware.

MI-19112-1-F TRANSMISSION LINE
Same as MI-19112-1 except one flange is omitted.

MI-19112-1-NF TRANSMISSION LINE
Same as MI-19112-1 except both flanges are omitted.

***MI-19112-2 COUPLING, 90° ELBOW**
Elbow with one fixed flange and opposite flange that swivels to take care of any angle. Inner conductor is supported by insulators spaced 12 inches apart. There is also a support for the inner conductor in the center of the elbow. Furnished with inner connector, O-ring gasket and silicon copper hardware.

***MI-19112-2-F COUPLING, 90° ELBOW**
Same as MI-19112-2 except the fixed flange is omitted.

***MI-19112-2-NF COUPLING, 90° ELBOW**
Same as MI-19112-2 except both flanges are omitted.

***MI-19112-3 COUPLING, 45° ELBOW**
Same as MI-19112-2 except 45 degrees.

***MI-19112-3-F COUPLING, 45° ELBOW**
Same as MI-19112-3 except the fixed flange is omitted.

***MI-19112-3-NF COUPLING, 45° ELBOW**
Same as MI-19112-3 except both flanges are omitted.

MI-19112-4 ADAPTER, FOR GASSED LINE
Used for adapting a flange type line to an unflanged line. Tools needed are wrenches for the flange hardware and screwdriver for tightening clamp. Furnished with inner connector, O-ring gasket and hardware.

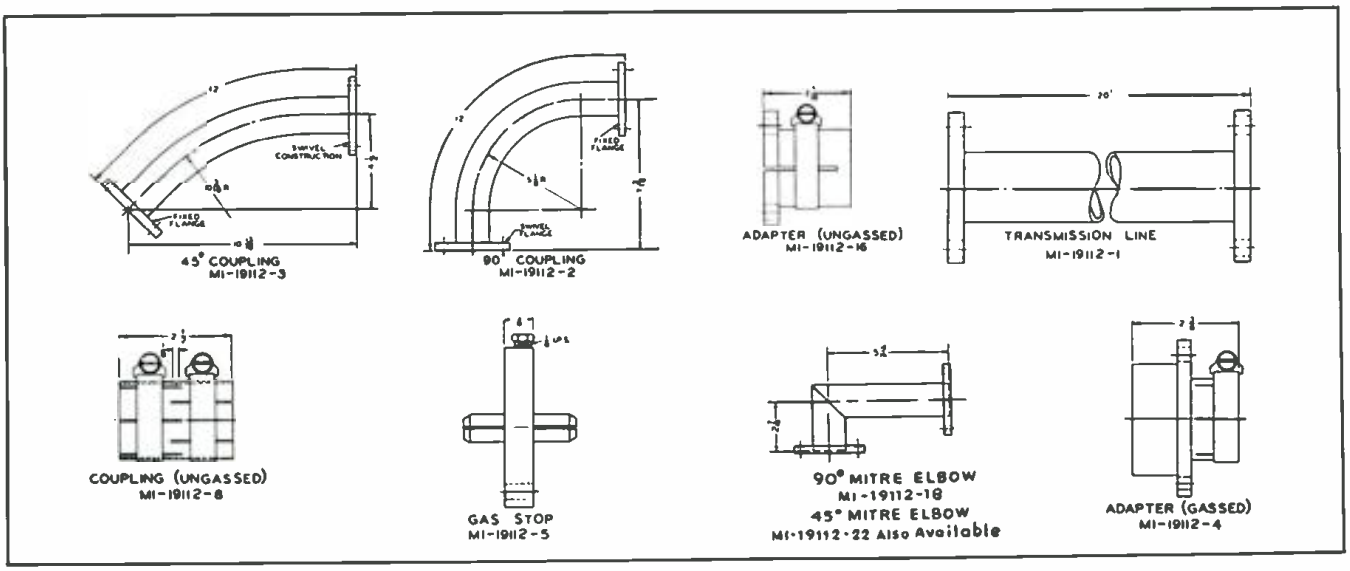
MI-19112-5 GAS STOP
To be inserted between two flanged sections of line to seal a gassed section from an ungassed section of line.

***MI-19112-7 REDUCER COUPLING**
Used for reducing from 3⅛-inch 51.5-ohm to 1⅝-inch 51.5-ohm ungassed line. Complete with outer and inner conductor and connectors and stainless steel clamps.

† May be ordered in lengths less than 20 feet. When line is to be used for television, it should be in multiples of feet. If length is not in multiples of feet, it is necessary to make up the difference by using .647 diameter conductor MI-19112-9. When ordering specify the MI-number and length required.

* Supplied as replacement part only. Do not order for new installations.

OUTLINE DIMENSIONS . . . 1⅝-INCH 51.5-OHM LINE AND FITTINGS
(MI-19112)



MI-19112-8 STRAIGHT COUPLING
Used for coupling two sections of 1⅝-inch 51.5-ohm unflanged lines. (Not to be used for gassed line.) Consists of outer and inner connectors, stainless steel clamps.

MI-19112-9 SPECIAL INNER CONDUCTOR
Used for splicing lengths of line which are cut at points between the supporting insulators (these are spaced 12 inches). Inner conductor as supplied is .645 O.D. x .569 I.D. x 12 feet long. The special inner conductor will fit inner connector MI-19112-11.

MI-19112-10 O-RING GASKET
A long-life synthetic rubber gasket for use between the flanges to make flange joints pressure tight.

MI-19112-11 INNER CONNECTOR
A specially designed solderless inner connector for joining inner conductors of 1⅝-inch 51.5-ohm line.

MI-19112-12 LINE GASSING ACCESSORIES
Consists of line pressure indicators, couplings, 25 feet of ¼-inch O.D. copper tubing and fittings.

MI-19112-13 EMERGENCY COVER PLATE
Used to cap 1⅝-inch line to keep moisture out during installation, or for other temporary capping of the line.

MI-19112-16 ADAPTER
An adapter (ungassed) to couple a flanged to an unflanged line. Furnished complete with inner connector, hardware and clamp.

MI-19112-17 END SEAL, FLANGE TYPE

MI-19112-18 COUPLING, 90° MITRE ELBOW
For use where tower structure configuration or space limitations prevent use of the MI-19112-2 sweep elbow —or wherever desirable. Constructed with Teflon dielectric insulators. Excellent VSWR characteristics.

MI-19112-18-F COUPLING, 90° MITRE ELBOW
Same as MI-19112-18 except one flange is omitted (on the long leg).

MI-19112-18-NF COUPLING, 90° MITRE ELBOW
Same as MI-19112-18 except both flanges are omitted.

MI-19112-19 HARDWARE KIT
Consists of four bolts, four nuts and four lockwashers for 1⅝-inch line.

MI-19112-20 FLANGE, FIXED
The same flange which is used as an integral part of MI-19112 Transmission Line. Used for adapting the end of a field-cut-length of line where the original silver-soldered flange has been removed in shortening the line. Installation is made by silver soldering.

MI-19112-21 FLANGE, SWIVEL
Similar to the flange MI-19112-20 except flange is free to rotate.

MI-19112-22, 22-F, 22-NF 45° MITRE ELBOW
Similar to MI-19112-18, 18-F, 18-NF except 45 degrees.

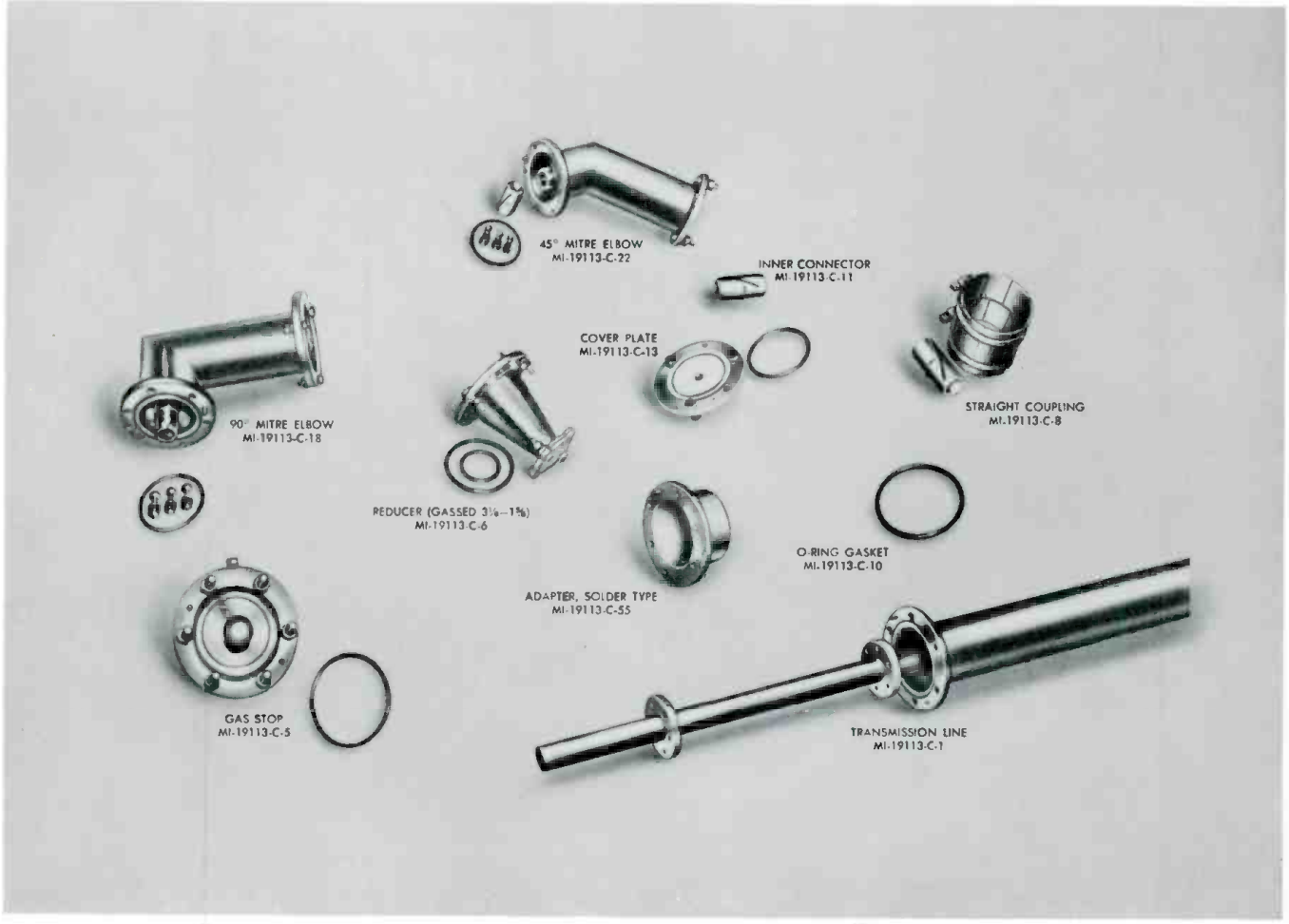
MI-19112-39 1⅝-INCH HOSE CLAMP

MI-19112-58 REDUCER, 1⅝-INCH UNGASSED
A cone reducer with a special built-in connector at one and a type "N" 51.5-ohm jack at the other. Supplied with special integral outer connector and special clamp.

MI-19112-59 REDUCER, 1⅝-INCH GASSED
Similar to MI-19112-58 with flange and O-ring for use on gassed coaxial line.

MI-19112-60 ADAPTER, FOR UNGASSED LINE
Serves similar purpose to MI-19112-4 except installed by soft soldering. Made in one piece—bolts not included. Used on ungassed coaxial line.

3⅛-INCH 51.5-OHM HARD COPPER LINE AND FITTINGS, MI-19113



DESCRIPTIONS

RCA ⅜-inch 51.5-ohm Steatite Transmission Line, Type MI-19113, is a hard-tempered copper line designed for use in Television installations. This type line has excellent VSWR characteristics on Channels 2-6.** Its efficiency on these channels is attributed to the use of a low loss dielectric. Components are ruggedly and precisely constructed. Mitre Elbows are fabricated with thick-wall tubing and Teflon dielectric inner conductor supports. A complete line of fittings and accessories provides installation versatility.

MI-19113-C-1 TRANSMISSION LINE

This line is supplied in 20-foot lengths† with flanges silver soldered to ends. The outer conductor is 3⅛-inch O.D. with an inner conductor of 1.200 diameter which is supported by Steatite insulators. The outer conductor is designed to allow for removing the inner conductor for inspection. Includes solderless inner connector, O-ring gasket, and silicon copper hardware.

MI-19113-C-1-F TRANSMISSION LINE

Same as MI-19113-C-1 except one flange is omitted.

MI-19113-C-1-NF TRANSMISSION LINE

Same as MI-19113-C-1 except both flanges are omitted.

*MI-19113-C-1-SF TRANSMISSION LINE

Same as MI-19113-C-1 except one of the two flanges is a swivel flange.

*MI-19113-C-2 COUPLING (90° MITRE ELBOW)

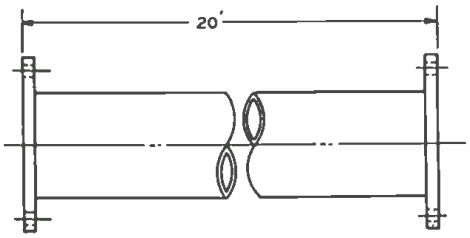
Elbow with one fixed flange and opposite flange that swivels to take care of any angle. Inner conductor is supported by insulators spaced 12 inches apart. There is also a teflon insulator for support in the center of the elbow. Furnished with inner connector. O-ring gasket and silicon copper hardware.

† May be ordered less than 20 feet. For television installations line sections should be in multiples of 1 foot whenever possible. Otherwise, the Special Conductor MI-19113-9 should be used to join these sections. When ordering transmission line, specify the MI-number and the length required.

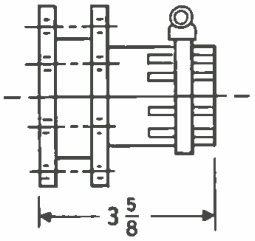
** Recommended for Channels 2-6 only.

* Supplied as replacement part only. Do not order for new installations.

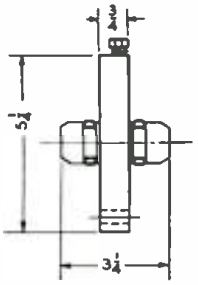
OUTLINE DIMENSIONS . . . 3⅛-INCH 51.5-OHM LINE AND FITTINGS
(MI-19113)



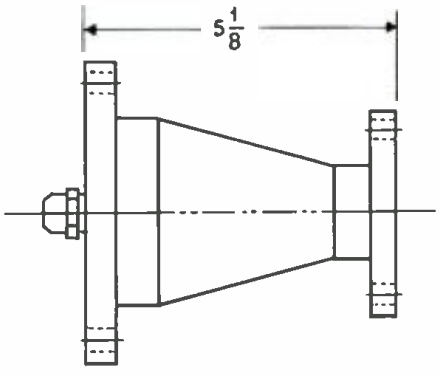
TRANSMISSION LINE
MI-19113-C-1



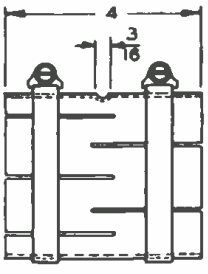
ADAPTER, CLAMP TYPE
MI-19113-C-4



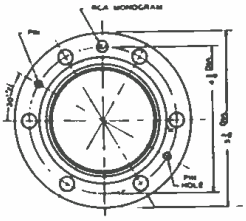
GAS STOP
MI-19113-C-5



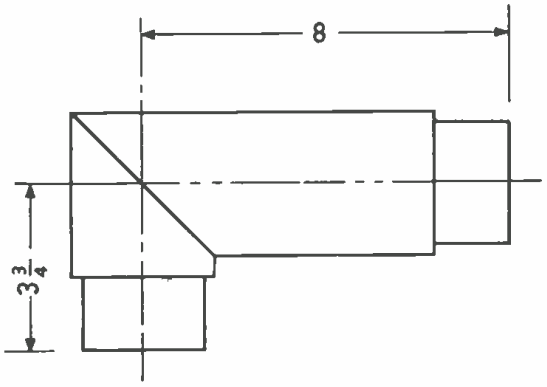
REDUCER (GASSED 3⅛—1⅝)
MI-19113-C-6



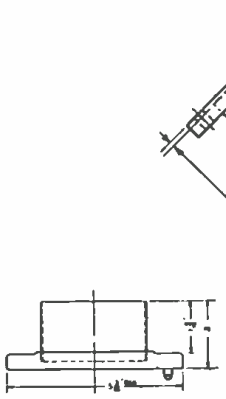
STRAIGHT COUPLING
MI-19113-C-8



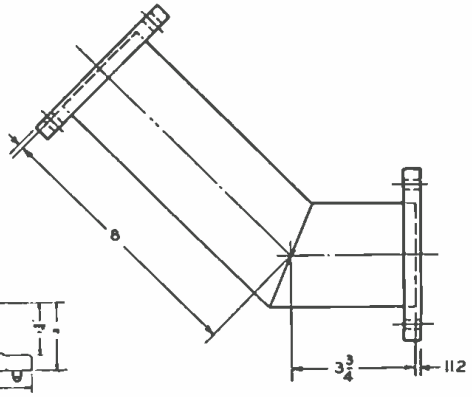
FIXED FLANGE
MI-19113-C-20
OR
SWIVAL FLANGE
MI-19113-C-21



90° MITRE ELBOW
MI-19113-C-18



ADAPTER, SOLDER TYPE
MI-19113-C-55



45° MITRE ELBOW
MI-19113-C-22

MI-19113-C-4 ADAPTER, FOR GASSED LINE
Used for adapting a flange type line to an unflanged line. The only tools necessary for installation are wrenches for the flange hardware and screwdriver for tightening clamp. Furnished with inner connector, O-ring gasket and hardware.

MI-19113-C-5 GAS STOP
To be inserted between two flanged sections of line to seal a gassed section from an ungassed section of line.

MI-19113-C-6 REDUCER COUPLING
Flanged coupling used for reducing from 3⅛-inch 51.5-ohm line. Complete with inner conductor and connectors, O-ring gaskets and hardware.

MI-19113-C-7 REDUCER COUPLING
Used for reducing from 3⅛-inch 51.5-ohm to 1⅝-inch 51.5-ohm ungassed line. Complete with outer and inner conductor and connectors and stainless steel clamps.

MI-19113-C-8 STRAIGHT COUPLING
Used for coupling two section of 3⅛-inch 51.5-ohm unflanged lines. (Not to be used for gassed line.) Consists of sleeve, inner connectors and two 3⅛-inch adjustable, stainless steel clamps.

MI-19113-C-8NB STRAIGHT COUPLING
Same as MI-19113-C-8 less inner connector.

MI-19113-C-9 SPECIAL INNER CONDUCTOR
Used for splicing lengths of line which are cut at points between the supporting insulators (these are spaced 12 inches). Inner conductor as supplied is 1.282 O.D. x 1.136 I.D. x 12 feet long. The special inner conductor will fit inner connector MI-19113-C-11.

MI-19113-C-10 O-RING GASKET
A long-life synthetic rubber gasket for use between the flanges to make flanged joints pressure tight.

MI-19113-C-11 INNER CONNECTOR
A specially designed solderless inner connector for joining inner conductors of 3⅛-inch 51.5-ohm Steatite (MI-19113) line.

MI-19113-C-13 COVER PLATE
Used to cap the end of 3⅛-inch line to keep moisture out during installation, of for other temporary capping of the line.

MI-19113-C-17 END SEAL
Except for size and impedance this end seal is similar to MI-19112-17. The overall length of 4½ inches.

MI-19113-C-18 COUPLING, 90° MITRE ELBOW
A 90° Mitre Elbow having unequal-length legs with swivel flanges which provide any rotational angle. Inner conductor is supported by Teflon insulators. Furnished with two connectors, O-ring gasket and silicon copper hardware.

MI-19113-C-18-F COUPLING, 90° MITRE ELBOW
Same as MI-19113-C-18 except the flange is omitted from the short leg.

MI-19113-C-18-NF COUPLING, 90° MITRE ELBOW
Same as MI-19113-C-18 except both flanges are omitted.

MI-19113-C-19 HARDWARE KIT
Consists of six bolts, six nuts and six lockwashers for 3⅛-inch line.

MI-19113-C-20 FLANGE, FIXED
The same flange which is used as an integral part of MI-19113 Transmission Line. Used for adapting the end of a field-cut-length of line where the original silver-soldered flange has been removed in shortening the line. Installation is made by silver soldering.

MI-19113-C-21 FLANGE, SWIVEL
Similar to the flange MI-19113-C-20 except flange is free to rotate.

MI-19113-C-22 COUPLING, 45° MITRE ELBOW
Same as MI-19113-C-18 except 45 degrees.

***MI-19113-C-22-F COUPLING, 45° MITRE ELBOW**
Same as MI-19113-C-22 except the flange is omitted from the short leg.

***MI-19113-C-22-NF COUPLING, 45° MITRE ELBOW**
Same as MI-19113-C-22 except both flanges are omitted.

MI-19113-C-51 CUT-OFF GAUGE
A specially-designed tool for cutting and dressing the end of the 1.282 O.D. inner conductor to insure a precision cut.

MI-19113-C-54 CUT-OFF GAUGE
Similar to MI-19113-C-51 except for use on 1.200 O.D. inner conductor.

MI-19113-C-55 ADAPTER, SOLDER-TYPE
Serves similar purpose to MI-19113-C-4 except installed by soft soldering. Made in one piece—bolts not included.

MI-19113-C-58 REDUCER
A cone reducer with a special built-in connector at one end and a type "N" 51.5-ohm jack at the other. Supplied with special integral outer connector and special clamp.

* Supplied as replacement part only. Do not order for new installations.

MI-19113-C-60 ADAPTER, FLANGED
Adapts unflanged piece of line to flanged section. Not pressure tight so use only with ungassed line. Adapter is 2 inches long.

MI-19113-C-61 REDUCER COUPLING
Flanged coupling used for reducing 3⅛-inch 51.5-ohm ungassed line to 1⅝-inch 51.5-ohm flanged line. Complete with inner conductor, connectors, O-ring gaskets and hardware.

AM POWER RATING DATA

MECHANICAL AND ELECTRICAL SPECIFICATIONS

The following power and attenuation ratings have been assigned to RCA Coaxial Transmission Lines. All power ratings are based on frequencies up to 20 megacycles and the attenuation ratings are calculated at 1 megacycle.

Size	Ordering Information	Impedance—Ohms	Voltage RMS 60 Cycles	KW Power Rating Based on 100% AM Modulation and Unity VSWR	Attenuation db./100 ft.	Velocity %
1⅝"	MI-19310	72	12,000	16	.0190	96.3
1⅝"	MI-19112	51.5	11,000	25	.0204	96.3
3⅛"	MI-19113	51.5	18,000	94	.0104	93.0

The above power ratings are based on a 100 percent amplitude modulated signal and a VSWR ratio of 1 to 1. The power ratings for any other VSWR may be obtained by dividing the power listed in the above chart by this ratio. For example, the average AM station will have a typical VSWR of 2 to 1. The above maximum ratings would then be divided by 2. The transmission line power ratings below 20 mc are limited by the flash-over voltage, rather than the temperature rise caused by heating. Voltage breakdown is relatively independent of frequency in this region. The 60-cycle flash-over voltage ratings listed in the above chart are based on an approximate safety factor of three.

The calculated attenuation values are based on 95 percent conductivity of the copper conductors. Losses in soft drawn semi-flexible cable are stated as calculated. However, all rigid transmission line losses as stated include a 10 percent derating factor which allows for contact resistance at the joints between the 20-foot sections.

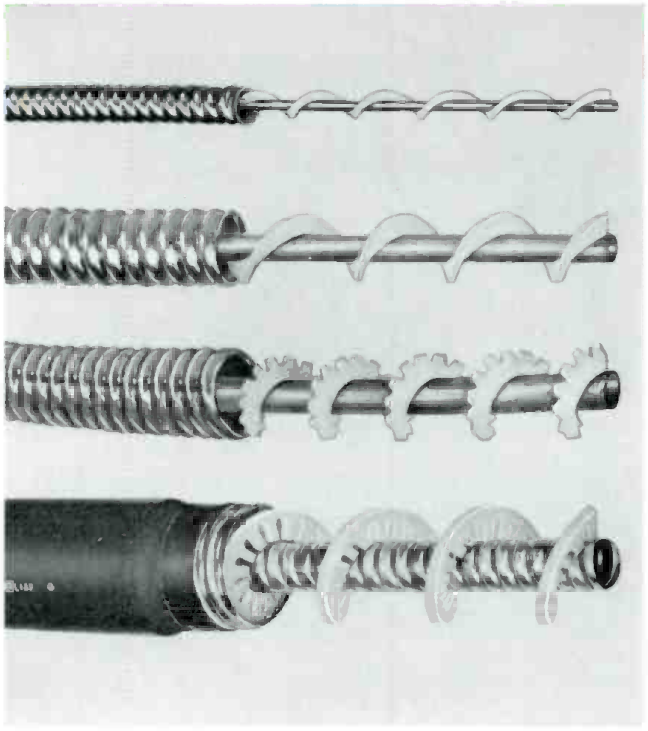
QUICK REFERENCE DATA

For broadcast installations, the line selected should have a power rating which equals or exceeds the power output of the transmitter. If power increases are contemplated, it will be economical to install larger line than initially required, thus saving the cost of a new installation at a later time. Choice between the use of soft line and hard line will be determined by the installation. Hard, flanged-type line is the preferred type for most cases because of its ease of installation and immunity to damage. It is also easier to replace in sections than soft line. On the other hand, soft, solder-type line readily lends itself to bending around obstructions, thus eliminating the need for elbows.

Size	Ordering Information	Description	Impedance	O.D. of Inner Conductor (in.)	I.D. of Inner Conductor (in.)	Insulators Type—Spacing (in.)		Wt. lbs. per 100 ft.	Class of Service	FM Power Rating (Average—100 mc)
1⅝"	MI-19310	Flanged fittings, pressurized, no solder	72 ohm	.375	.312	Steatite (Wafer)	12	120	AM broadcast lines	——
1⅝"	MI-19112	Flanged fittings, pressurized, no solder	51.5 ohm	.625	.569	Steatite (Wafer)	12	125	VHF Television and FM installations (up to 220 mc), AM lines	10 kw
3⅛"	MI-19113	Flanged fittings, no solder—pressurized	51.5 ohm	1.200	1.136	Steatite (Wafer)	12	250	VHF Television and FM installations (up to 108 mc), AM lines	42 kw

Flexible Transmission Line

HELIAX AIR DIELECTRIC CABLES



FEATURES

- Flexibility offers utmost convenience in installation
- Improved electrical characteristics—excellent VSWR
- Minimal weight per unit length
- Rugged corregated outer conductor
- Free from line problems associated with regularly spaced connections and insulators

DESCRIPTION

Andrew Heliax is a flexible air dielectric coaxial cable manufactured from high conductivity copper by a special process which offers unique properties, performance and strength. It is lighter weight and more rugged than rigid copper or semi-flexible aluminum cables.

Broadcast installations from coast to coast attest the ability of the r-f cable to withstand the physical abuses frequently associated with difficult installations. It offers a high degree of flexibility for convenience in installations, ability to withstand vibration, and to accommodate differential expansion between the cable and its support structure. Furthermore, it has been found to offer freedom from the electrical discontinuities and potential maintenance problems associated with regularly spaced connections and insulators.

Heliax lines show improved electrical characteristics, especially with respect to voltage standing wave ratio. It offers minimized weight per unit length and maximized utility of metal, being lighter in weight than semi-flexible aluminum cables of comparable size and performance. RCA offers the following type cables:

TYPE H3 HELIAX
A low loss ⅜-inch 50-ohm highly flexible cable suited for VHF communications, aircraft and missile applications, low power signal measurement, and r-f distribution and instrumentation systems.

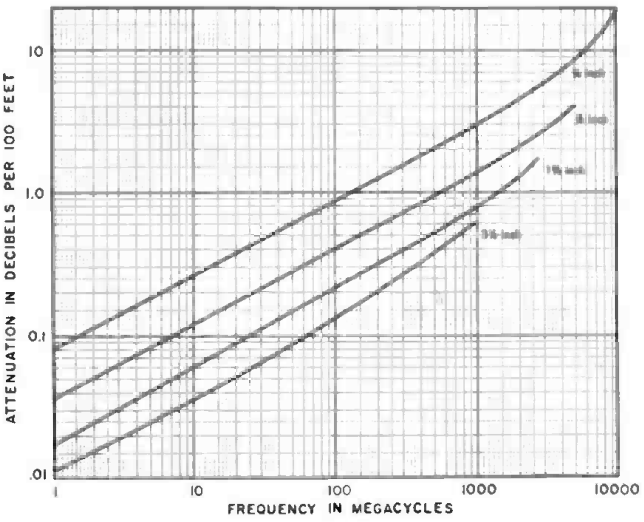
TYPE H5 HELIAX
A ⅞-inch preferred r-f cable for AM, FM, TV and microwave systems operating at frequencies up to 3000 mc. It is offered in 50, 75 and 100 ohm impedances, with or without black polyethylene jacket or with Teflon insulation.

TYPE H7 HELIAX
A low loss, 1⅝-inch 50, 75 or 100 ohm cable for medium power FM and high frequency antenna installataions. It is also popular at microwave frequencies due to its very low attenuation. Also available with black polyethylene jacket.

TYPE H2 HELIAX
A 3⅛-inch 50 or 75 ohm high power cable, yet is extremely flexible. It is especially favored for HF, FM and TV service. The outer conductor is corrugated copper-clad steel and the inner conductor is high conductivity copper tubing. The insulating Heliax is low-loss polyethylene. It has a continuous black polyethylene jacket.

SPECIFICATIONS AND ORDERING INFORMATION

Description									
Heliax Cable, without jacket	H3-50	H5-50	H5-75	HT5-100	H7-50	H7-75	H7-100	—	—
Heliax Cable with Polyethylene Jacket	HJ3-50	HJ5-50	HJ5-75	—	HJ7-50	HJ7-75	HJ7-100	H2-50	H2-75
Nominal size, inch	3/8	7/8	7/8	7/8	1 5/8	1 5/8	1 5/8	3 1/8	3 1/8
Characteristic impedance, ohms	50	50	75	100	50	75	100	50	75
Nominal frequency, mc	10800	5200	30	30	2800	30	30	1400	30
Velocity, percent	89.5	92.0	92.0	85.0	91.0	91.0	77.0	92.0	92.0
Peak power rating, kw	10.0	44.0	29.0	22.0	145	100	73	440	290
Attenuation (see curve)	—	—	—	—	—	—	—	—	—
Insulation	Poly-ethylene spiral	Poly-ethylene	Poly-ethylene	Teflon	Poly-ethylene	Poly-ethylene	Poly-ethylene	Poly-ethylene spiral	Poly-ethylene spiral
Copper Outer Conductor, Major diameter	0.500	1.005	1.005	1.005	1.830	1.830	1.830	3.75	3.75
Copper Inner Conductor, Solid, diameter	0.162	0.358	0.229	0.114	0.688	0.430	0.197	1.355	0.820
Minimum Bending Radius, inches	5.0	10.0	10.0	10.0	20.0	20.0	20.0	36.0	36.0
Weight, pounds per foot	0.234	0.421	0.410	0.430	0.875	0.718	0.750	3	3



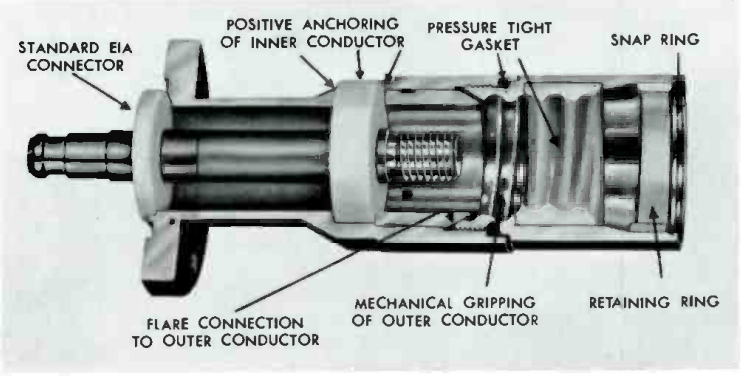
Attenuation of 50 ohm Heliax Cable.

H3 Accessories

Type N Jack, 50 ohm	73N
UHF Jack, 50 ohm	73U
Wraplock	12395-1

H5—H7—H2 Heliax Accessories

Description	*Ordering Information*		
	H5 Line (7/8-inch)	*H7 Line (1 5/8-inch)*	*H2 Line 3 1/8-inch)*
EIA Flange Connector, 50 ohm	75R	77R	22R
EIA Flange Connector, 75 ohm	75R-75	77R-75	22R-75
EIA Flange Connector, 100 ohm	—	77R-100	—
Type N Jack, 50 ohm	75N	77N	—
Type N Jack, 100 ohm	75N-100	—	—
UHF Jack, 50 ohm	75U	77U	—
UHF Jack, 75 ohm	75U-75	—	—
End Terminal, 50 ohm	75T	2061	2062
End Terminal, 75 ohm	75T-75	2071	2072
End Terminol, 100 ohm	75T-100	80799	—
Miter Elbow, 50 ohm	1060	1061	1062
Miter Elbow, 75 ohm	1070	1071	1072
Gas Barrier, 50 ohm	1260A	1261B	1262A
Gas Barrier, 75 ohm	—	1271	1272
Reducer Connector, 50 ohm	1860	77S	1862
Reducer Connector, 75 ohm	—	—	1861
Inner Connector, 50 ohm	18275	15069	23817
Inner Connector, 75 ohm	25385	24259	24530
Inner Connector Adaptor, 50 to 51.5 ohm	4850	4851	—
Inner Connector Adaptor, 50 to 75 ohm	25388	—	—
Hoisting Kit	19256A	24312	23146
Grounding Kit	24810	24811	23145
Hanger	—	—	22417
Insulated Hanger	11662-2	24622	22418
Wraplock	12395-1	12395-1	—
Automatic Dehydrator	1910A	1910A	1910A
Dry Air Pump	878A	878A	878A
Nitrogen Tank Fittings	858	858	858



Cutaway view showing typical features common to most Heliax connectors. For example, friction type inner connectors can separate due to differential expansion. This is prevented in Heliax connectors by means of an extra heavy teflon anchor. No special tools or skills are required to install Heliax connectors.

RG/U TYPE COAXIAL CABLES (Polyethylene Dielectric)

Precision plastic extrusion, accurate temperature control, constant process inspection, micrometer gauging standards and expert engineering result in superior cables of outstanding quality.

Polyethylene

The maximum dielectric qualities of polyethylene are fully utilized in RG type cables. The bending radius is ten times the outside cable diameter and is maintained over a large temperature range. The cross section of the polyethlene dielectric is accurately maintained to .005 to .015-inch tolerance. The RG type cable has a continuously solid and extremely uniform dielectric which is flexible and has low moisture absorption qualities.

Unity VSWR	Impedance	Power Rate	Attenuation Db/100 Ft. at 1 Megacycle
RG-8U	52 Ohm	1320 W	0.16
RG-11U	75 Ohm	920 W	0.18
RG-17U	52 Ohm	5150 W	0.060
RG-164U	72 Ohm	3760 W	0.064

100% Modulation at 1 mc
Ample Safety Factor
VSWR: 1:1

STYROFLEX COAXIAL CABLE

Consists of a solid or tubular copper center conductor, styroflex tape laminated helix, outer belt of styroflex tapes and tubular outer aluminum conductor.

Styroflex features perfect inner conductor centering during bending, negligible standing wave ratio, high strength helix continuously anchors inner conductor, extremely rugged to external pressures and complete line of associated components available.

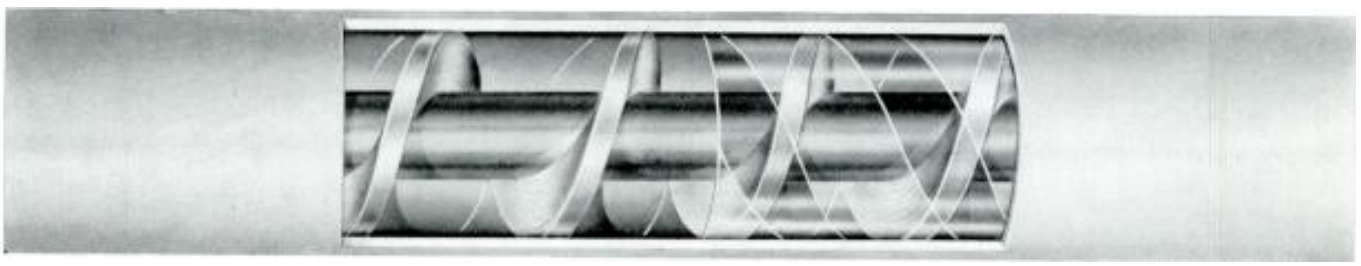
SPECIFICATIONS

Size	Impedance	Power Rating (Carrier)	Attenuation
3/8"	50 ohm	1 kw	.112 db/100 ft.
1/2"	50 ohm	2 kw	.079 db/100 ft.
1/2"	70 ohm	1.5 kw	.072 db/100 ft.

SPECIFICATIONS (Cont.)

Size	Impedance	Power Rating (Carrier)	Attenuation
3/4"	50 ohm	4.5 kw	.052 db/100 ft.
3/4"	70 ohm	3 kw	.048 db/100 ft.
7/8"	50 ohm	6.5 kw	.043 db/100 ft.
7/8"	70 ohm	4.5 kw	.040 db/100 ft.
1 1/8"	50 ohm	11 kw	.032 db/100 ft.
1 1/8"	70 ohm	7.5 kw	.031 db/100 ft.
1 5/8"	50 ohm	24 kw	.022 db/100 ft.
1 5/8"	70 ohm	16 kw	.0215 db/100 ft.
3 1/8"	50 ohm	89.5 kw	.0112 db/100 ft.
3 1/8"	70 ohm	61 kw	.010 db/100 ft.
6 1/8"	50 ohm	335 kw	.006 db/100 ft.

Styroflex and Spirofil rotings are based on the following factors.
100% Modulation at 1 mc
VSWR: 1:1
Safety Factor of 6 (max. voltage stress of 11.5 volts per mil).



SPIRAFIL COAXIAL CABLE

Consists of a solid copper center conductor, a solid polyethylene filament helix and a tubular outer aluminum conductor.

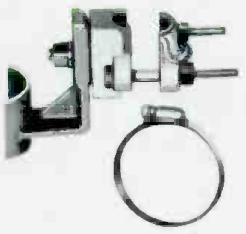
Spirafil has the following features: no radiation, low attenuation, excellent frequency response and uniform electrical properties over wide temperature range.

SPECIFICATIONS

Size	Impedance	Power Rating (Carrier)	Attenuation
3/8"	50 ohm	1 kw	.112 db/100 ft.
3/8"	70 ohm	.6 kw	.105 db/100 ft.
1/2"	50 ohm	2 kw	.080 db/100 ft.
1/2"	70 ohm	1.5 kw	.075 db/100 ft.

Transmission Line Accessories

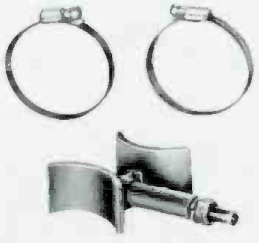
AM · FM



(CLAMP ON ROUND MEMBERS)
MI-19112-41-1⅝
MI-19113-41-3⅛
MI-19112-42-1⅝
MI-19113-42-3⅛

(MOUNT THROUGH HOLE)
MI-19112-47-1⅝
MI-19113-47-3⅛

(MOUNT THROUGH HOLE)
MI-19112-44-1⅝
MI-19113-44-3⅛



(MOUNT THROUGH HOLE)
MI-19112-15-1⅝
MI-19113-15-3⅛

(MOUNT THROUGH HOLE)
MI-19112-49-1⅝
MI-19113-49-3⅛

DESCRIPTION

RCA has a complete line of hangers designed for ⅞, 1⅝, and 3⅛-inch diameter AM-FM transmission lines. There are hangers for mounting both single and dual lines either vertically or horizontally to flat members, pipes, or angular members. These hangers consist of several general types, i.e., spring suspended expansion hangers (which permit differential thermal expansion of the line and tower), swivel hangers which provide for either horizonal or vertical mounting of the line, and lateral braces and direct mounting anchors. Of these there are short hangers for close mounting, long hangers to provide additional clearance, and insulated as well as noninsulated types. The direct mounting type of hanger requires drilling of a hole in the mounting surface, but no drilling is required for the other types.

The instructions supplied with each spring-suspension hanger should be closely followed for proper installation.

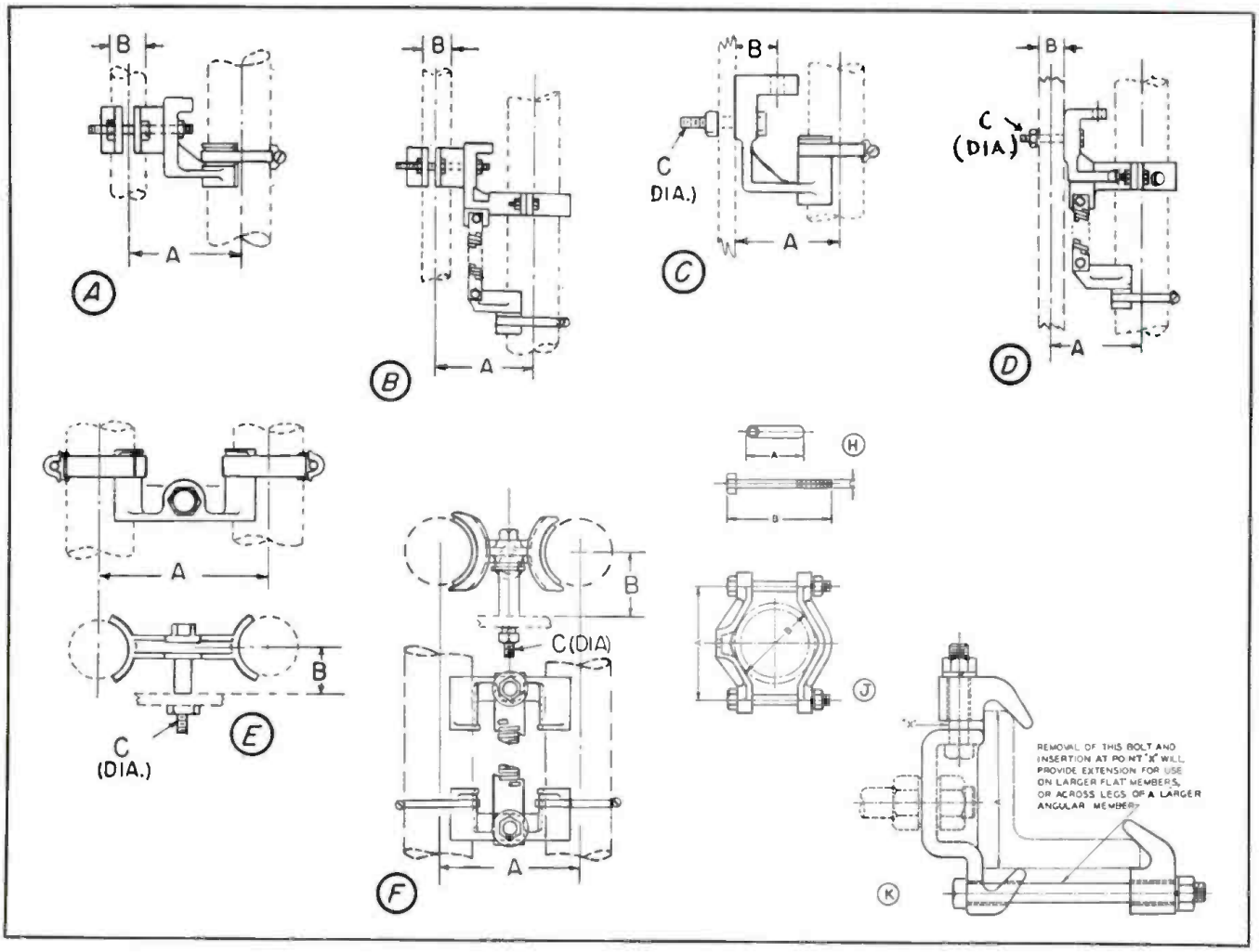
The practice is to space the hangers at approximate 10-foot intervals. The line section at the tower top is firmly secured by two fixed hangers, and the lower sections are suspended by spring hangers to allow for differential thermal expansion.

Descriptive information on individual fixed, expansion and miscellaneous type hangers is provided in the following tables where other pertinent information, including ordering information is set forth. Pictures of each type hanger and outline drawing keyed to the tables should be consulted.

DESCRIPTIONS AND SPECIFICATIONS FOR FIXED HANGERS

ITEM	DIMENSIONS (inches) A	B	C	GROUNDED OR INSULATED	LINE SIZE AND CAPACITY	ORDERING INFORMATION
FIXED HANGERS, CLAMP ON ROUND MEMBERS						
For fastening 1 line to round members. Supplied with 1 hose clamp. SEE OUTLINE DIMENSION "A"	4 - 4¾	1 - 2¼		grounded	1⅝ (1)	MI-19312-41
	4¾ - 6⅛	2½ - 5		grounded	1⅝ (1)	MI-19312-42
	4¾ - 5½	1 - 2¼		grounded	3⅛ (1)	MI-19313-41
	5½ - 6⅞	2½ - 5		grounded	3⅛ (1)	MI-19313-42
FIXED HANGERS, MOUNT THROUGH HOLE						
For direct mounting of 1 line. Requires mounting hole. Mounting bolt and hose clamp supplied. Type with B dimension may be suspended by moving mounting bolt to other hole. SEE OUTLINE DIMENSION "C"	2¾	1⅛	⅜	grounded	1⅝ (1)	MI-19312-44
	5¾	—	⅜	grounded	1⅝ (1)	MI-19312-47
	3½	1⅛	½	grounded	3⅛ (1)	MI-19313-44
	6½	—	½	grounded	3⅛ (1)	MI-19313-47
	5⅝	1⅛	⅝	grounded	6⅛ (1)	MI-19314-44
FIXED HANGER, MOUNT THROUGH HOLE						
For direct mounting of two lines. Requires mounting hole. Complete with hose clamps. SEE OUTLINE DIMENSION "E"	3¾	2-9/32	½	grounded	1⅝ (2)	MI-19112-15
	3¾	5	½	insulated	1⅝ (2)	MI-19112-49
	5½	3-1/32	½	grounded	3⅛ (2)	MI-19113-15
	5½	5	½	insulated	3⅜ (2)	MI-19113-49

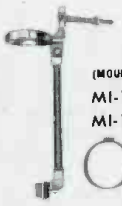
OUTLINE DRAWINGS—FIXED AND EXPANSION HANGERS



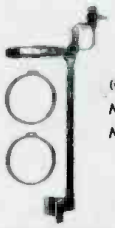
(CLAMP ON ROUND MEMBERS)
MI-19112-23-1⅝
MI-19113-23-3⅛
MI-19112-26-1⅝
MI-19113-26-3⅛

(CLAMP ON ROUND MEMBERS)
MI-19112-25-1⅝
MI-19113-25-3⅛
MI-19112-28-1⅝
MI-19113-28-3⅛

(MOUNT THROUGH HOLE)
MI-19112-32-1⅝
MI-19113-32-3⅛



(MOUNT THROUGH HOLE)
MI-19112-33-1⅝
MI-19113-33-3⅛

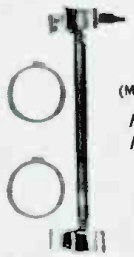


(MOUNT THROUGH HOLE)
MI-19112-34-1⅝
MI-19113-34-3⅛

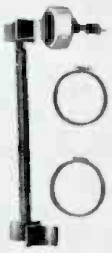
DESCRIPTION AND SPECIFICATIONS FOR EXPANSION HANGERS

ITEM	DIMENSIONS (inches) A	B	C	GROUNDED OR INSULATED	LINE SIZE AND CAPACITY	ORDERING INFORMATION
EXPANSION HANGERS, CLAMP ON ROUND MEMBERS Spring-suspended hanger for clamping single line to raund member. Complete with hose clamp. Spring must be pre-loaded at installation. SEE OUTLINE DIMENSION "A"	4⅛ - 4⅞	1 - 2¼		grounded	1⅝ (1)	MI-19312-23
	4⅞ - 6¼	2½ - 5		grounded	1⅝ (1)	MI-19312-26
	5¾ - 6½	1 - 2¼		insulated	1⅝ (1)	MI-19312-25
	6½ - 7 15/16	2½ - 5		insulated	1⅝ (1)	MI-19312-28
	4⅞ - 5⅝	1 - 2¼		grounded	3⅛ (1)	MI-19313-23
	5⅝ - 7	2½ - 5		grounded	3⅛ (1)	MI-19313-26
	6½ - 7¼	1 - 2¼		insulated	3⅛ (1)	MI-19313-25
	7¼ - 8 1/16	2½ - 5		insulated	3⅛ (1)	MI-19313-28
EXPANSION HANGERS, MOUNT THROUGH HOLE Spring-suspended hanger for mounting through single hole. Complete with hose clamp. Spring must be preloaded at installation. SEE OUTLINE DIMENSION "C"	2⅞	1" max.	⅜	grounded	1⅝ (1)	MI-19312-32
	5⅞	1" max.	⅜	grounded	1⅝ (1)	MI-19312-33
	5¼	1" max.	⅜	insulated	1⅝ (1)	MI-19312-34
	3⅝	1" max.	½	grounded	3⅛ (1)	MI-19313-32
	6⅝	4" max.	½	grounded	3⅛ (1)	MI-19313-33
	6	1" max.	½	insulated	3⅛ (1)	MI-19313-34
EXPANSION HANGERS, MOUNT THROUGH HOLE For spring-suspension of two lines. Requires mounting hole. Complete with hose clamps. Spring preloaded at installation. SEE OUTLINE DIMENSION "E"	3¾	2-5/32	½	grounded	1⅝ (2)	MI-19112-14
	3¾	5	½	insulated	1⅝ (2)	MI-19112-48
	5½	3⅛	½	grounded	3⅛ (2)	MI-19113-14
	5½	5	½	insulated	3⅛ (2)	MI-19113-48
EXTENSION KIT Extends the mounting of grounded dual hangers to align with insulated dual hangers. SEE OUTLINE DIMENSION "H"	4½	7½	½			MI-19113-16
CLAMP KITS (FOR ROUND MEMBERS) Adapts any direct-mounting (mount through hole) type of MI-19113 hanger to round members. SEE OUTLINE DIMENSION "J"	3¼	1 - 2¼				MI-19113-56
	5¾	2½ - 5				MI-19113-57
CLAMP KITS (FOR ANGULAR MEMBERS) Adapts any direct-mounting (mount through hole) type of MI-19113 hanger to angular members. SEE OUTLINE DIMENSION "K"	4 - 8					MI 19113-59

EXPANSION HANGERS FOR DUAL LINES



(MOUNT THROUGH HOLE)
MI-19112-14-1⅝
MI-19113-14-3⅛



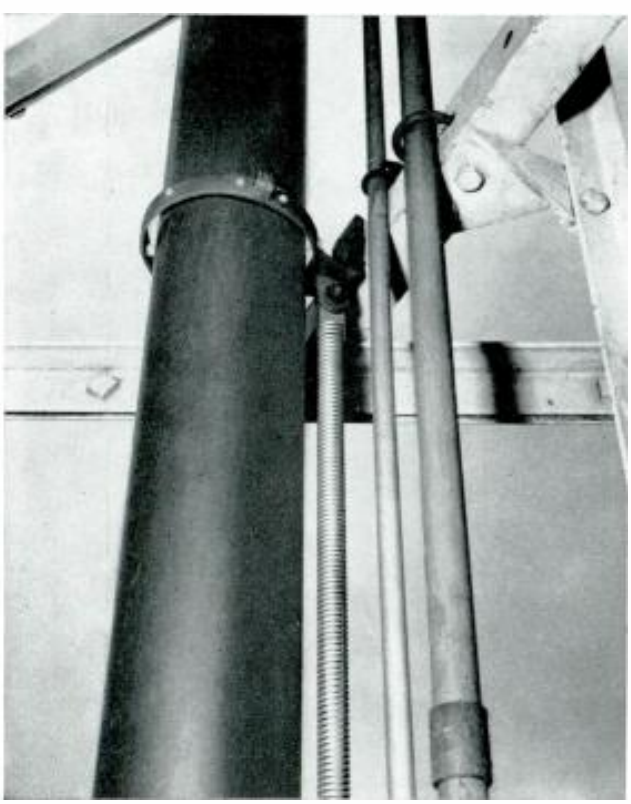
(MOUNT THROUGH HOLE)
MI-19112-48-1⅝
MI-19113-48-3⅛

HANGER INSTALLATION DATA

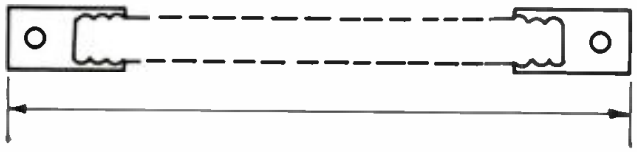
Due to the many precautions that surround transmission line installations, its assembly should be entrusted to only the most competent engineers. In using RCA fixed and expansion type hangers for single and dual runs. RCA engineers are prepared to recommend proper types for all horizontal or tower installations. The following tables on differential expansion should be taken into consideration when installing transmission line.

Differential expansion between line and tower is accommodated by suspending the line from spring hangers within the tower. Two hangers at the top of the tower are fixed so that the line can not move vertically through them. The rest of the hangers are of the spring type which permit the line to move vertically. Each hanger exerts an upward force equal to the weight of ten feet of line. The hangers are spaced at approximately ten foot intervals and hence there is no tension on the line under the average temperature condition.

Sliding type hangers are available to prevent lateral motion of line, and insulated hangers are used when the transmission line feeds an antenna mounted on an AM tower. Isolation of the transmission line in a tower used for medium frequency broadcasting is accomplished by using insulated hangers in the tower for a distance from the base equal to a quarter wavelength at the medium frequency.



Detail view showing transmission line hangers which secure line to structural members of antenna tower. Expansion type hangers shown above or fixed hangers are most commonly used to assure permanent, reliable installation.



Drawing showing points of measurement used in spring pre-loading tables for RCA expansion hangers. Charts give length in inches.

SPRING PRE-LOADING DIMENSIONS FOR EXPANSION HANGERS TYPE E

Hanger Installation Settings for MI-19112, 1⅝-inch Dual Transmission Line in Inches, 10-foot Average Spacing.*

DISTANCE DOWN FROM LOWEST FIXED HANGER—FT.	AMBIENT TEPERATURE DEGREES F AT TIME OF INSTALLATION				
	0-20	20-40	40-60	60-80	80-100
0-200	18⅝	18⅝	18⅝	18⅝	18⅝
200-400	18⅛	18⅜	18⅝	18⅞	19⅛
400-600	17¾	18¼	18⅝	19 1/16	19 7/16
600-800	17 7/16	18 1/16	18⅝	19 3/16	19¾
800-1000	17⅛	17⅞	18⅝	19 5/16	20 1/16
1000-1200	16 13/16	17¾	18⅝	19½	20⅜

Dimension Taken Over Spring as shown in diagram.

*For every 1 ft. difference of average hanger spacing, change the setting by 1 1/16 inch, adding if the spacing is greater than 10 ft., subtracting if less.

Hanger Installation Settings for MI-19113, 3⅜-inch Dual Transmission Line in Inches, 10-foot Average Spacing.*

DISTANCE DOWN FROM LOWEST FIXED HANGER—FT.	AMBIENT TEPERATURE DEGREES F AT TIME OF INSTALLATION				
	0-20	20-40	40-60	60-80	80-100
0-200	24⅜	24⅜	24⅜	24⅜	24⅜
200-400	23 7/8	24⅛	24⅜	24⅝	24 7/8
400-600	23 5/16	23 15/16	24⅜	24¾	25 5/16
600-800	23¼	23 13/16	24⅜	24 15/16	25½
800-1000	22 15/16	23⅝	24⅜	25⅛	25 13/16
1000-1200	22⅝	23½	24⅜	25¼	26⅛

Dimension Taken Over Spring as shown in diagram.

*For every 1 ft. difference of average hanger spacing, change the setting by 5/8 inch, adding if the spacing is greater than 10 ft., subtracting if less.

SPRING PRE-LOADING DIMENSIONS FOR HANGERS (Outline Types "B," "D," "F," and "G")

ELEVATION AND TEMPERATURE	LINE SIZE	SPRING LENGTH, EXPANDED
All	1⅝"	8½ inches
All	3⅛"	24 inches

Dehydrators For Coaxial Line

MI-27348 SERIES

FEATURES

- Compressor inoperative during most of re-activation period . . . providing economical operation and long life
- Attractive space-saving design
- Completely accessible for quick and easy maintenance
- Operates from 115 volt, 60 cycle source
- Convenient arrangement of operation indicating devices
- Choice of single or double desiccants.

DESCRIPTION

It is extremely important thot coaxial tronsmission lines feeding present day antennas be kept free of moisture. Because of their sectionalized construction, exposure to the effects of weather and temperature, and their comparative inaccessibility for maintenance, they are particularly susceptible to the entry of water, either directly or suspended in vapor drawn in by "breathing" of the line due to temperature change. Moisture in antenna systems can change the loading characteristics of the antenna and set up high standing wave ratios. The danger of arc-over is increased, with possible permanent damage to the antennas which can be corrected only by expensive rigger work and possibly a new antenna system. During sub-zero weather, the freezing water can fracture the lines.

To guard against such danger, all coaxial sections of the system should be pressurized with a moisture-free gas. Because the gas is vapor-free, condensation within the line is avoided, and the pressure acts to prevent the entry of water if small leaks develop. The pressurizing should be done only after the lines have been bled thoroughly and over a number of hours to insure that any trapped moisture has had an opportunity to be assimilated by the gas and discharged from the system.

Either nitrogen or dehydrated air is generally used to keep lines dry. The former may be procured locally in tanks. Special adapters and fittings may be secured from RCA. Except for short runs of line and very pressure tight systems, the use of nitrogen is awkward and uneconomical. Bleeding a system of re-pressurizing requires a considerable volume of gas and the constant drop in pressure due to even small leoks common to most systems is a constant drain on the source of the gas. As a consequence, the trend is toward the use of dehydrated air. Dehydrated air is obtained through the use of mechanical dehydrators. RCA makes available a wide range of such units.

The RCA MI-27348 Series of Automatic Dehydrator Equipment for coaxial transmission lines provide a choice of single desiccant or double desiccant automatic equipments that operate from a 115 volt, 60 cycle power source. The equipments are attractively housed in space-saving cabinets with sloping panel for control and indicating devices. They are completely accessible for quick, easy maintenance.

The single-desiccant automatic dehydrator automatically reactivates the desiccant according to a set time cycle of operation. Pressure is maintained constant except during reactivation, when no pressure is applied to the line.

The disadvantage of lack of pressure during reactivation time in the above type is overcome in the fully automatic type by the use of two desiccant chambers in conjunction with an electric program timer and solenoid valve arrangement. With this type equipment, pressure is maintained constant at all times and the reactivation is automatic.

1 CFM Single Desiccant Dehydrator

This unit contains a compressor and a single desiccant chamber. A program timer is located on the compressor to stop the compressor after 10 hours of operation. The compressor will operate only when the line pressure falls below a set amount. At the completion of 10 hours of compressor running time, the compressor is turned off by the program timer and a heating unit is turned on and reactivation begins. The heating unit remains on for 5 hours. During the last ½ hour of this 5 hour period, the compressor blows air through the desiccant chamber and out to the atmosphere. The compressor is then turned off and the desiccant chamber cools for 5 hours. At the end of this 10 hour period, the compressor is ready to start another 10 hour running cycle. This running period need not be continuous. For example: if the compressor runs ½ hour per day, the reactivation cycle will not start for 20 days. A solenoid valve switches the output of the compressor from the line to the atmosphere at the start of the reactivation cycle. This allows the compressor to pass the air through the desiccant chamber during the last ½ hour of the 5 hour heating cycle to the atmosphere rather than the line.

Double Desiccant Dehydrators

These units contains two desiccant chambers. After 10 hours of compressor running time, the output of the compressor is switched from the desiccant chamber being used to the opposite chamber. Reactivation then starts for the chamber previously used. The reactivation cycle is 5 hours heating and 5 hours cooling. During the last ½ hour of the heating cycle a solenoid valve opens and allows a portion of the compressor output to pass through the reactivating chamber to the atmosphere. Dry air is available to the line through the desiccant chamber being used at the same time that air is being passed through the reactivating chamber. Solenoid valves control the output of each chamber. These switch the outputs either to the line or to the atmosphere for reactivation or line pressurization.

SPECIFICATIONS

1 cu. ft. Double Desiccant

Power Consumption	900 watts
Compressor Output to Atmosphere	1 CFM
Weight	120 lbs.
Drain Connection	⅛" female pipe thread
Dew Points	—40° F.
Air Connection	Standard Schrader bicycle valve also 15' connecting hose with fittings
Maximum Operating Pressure	10 PSI
Serves up to	40,000 ft. ⅞" transmission line
	10,000 ft. 1⅝" transmission line
	2,500 ft. 3⅛" transmission line
	700 ft. 6⅛" transmission line
Stock Identification	MI-27348-1

1.5 cu. ft. Double Desiccant

Power Consumption	1700 watts
Compressor Output to Atmosphere	1½ CFM
Weight	200 lbs.
Drain Connection	⅛" female pipe thread
Dew Points	—40° F.
Air Connection	Standard Schrader bicycle valve also 15' connecting hose with fittings
Maximum Operating Pressure	10 PSI
Serves up to	20,000 ft. 1⅝" transmission line
	5,000 ft. 3⅛" transmission line
	1,500 ft. 6⅛" transmission line
Stock Identification	MI-27348-2

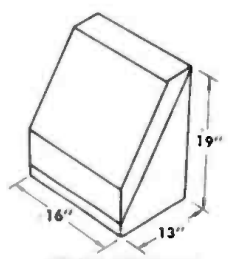
2 cu. ft. Double Desiccant

Power Consumption	2100 watts
Compressor Output to Atmosphere	2 CFM
Weight	375 lbs.
Drain Connection	⅛" female pipe thread
Dew Points	—40° F.
Air Connection	Standard Schrader bicycle valve also 15' connecting hose with fittings
Serves up to	40,000 ft. 1⅝" transmission line
	10,000 ft. 3⅛" transmission line
	3,000 ft. 6⅛" transmission line
Stock Identification	MI-27348-3

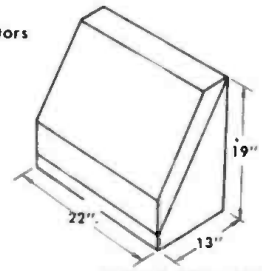
1 cu. ft. Single Desiccant

Power Consumption	900 watts
Compressor Output to Atmosphere	1 CFM
Weight	100 lbs.
Drain Connection	⅛" female pipe thread
Dew Points	—40° F.
Air Connection	Standard Schrader bicycle valve also 15' connecting hose with fittings
Maximum Operating Pressure	10 PSI
Reactivation Time	10 hours
Serves up to	40,000 ft. ⅞" transmission line
	10,000 ft. 1⅝" transmission line
	2,500 ft. 3⅛" transmission line
	700 ft. 6⅛" transmission line
Stock Identification	MI-27348-4

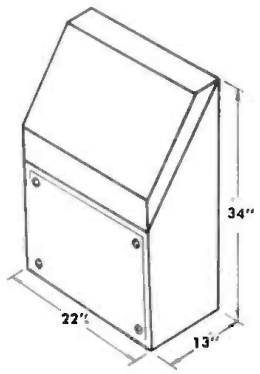
Outline Dimensions of RCA Dehydrators



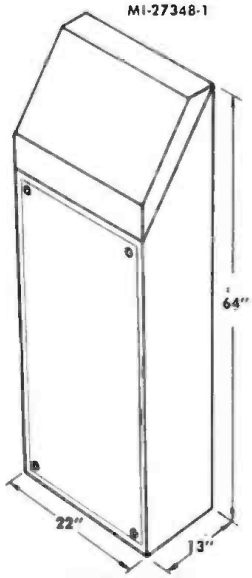
SINGLE DESICCANT
1 CU. FT. CAP.
MI-27348-4



DOUBLE DESICCANT
1 CU. FT. CAP.
MI-27348-1



DOUBLE DESICCANT
1.5 CU. FT. CAP.
MI-27348-2



DOUBLE DESICCANT
2 CU. FT. CAP.
MI-27348-3

Broadband FM Antenna

BFA SERIES

FEATURES

- Designed for both standard and multiplex FM broadcast service
- Low VSWR over entire 200 kc band (1.1/1 ratio achieved with field trimming)
- Highest gain at low weight and windloading
- Can be side mounted on existing towers
- Provisions for de-icing if desired
- Easy to install—minimum maintenance

DESCRIPTION

The RCA BFA Series of Broadband FM Antennas is designed for use in both standard and multiplex FM broadcast service. These antennas provide a low-standing wave ratio over a 200 kilocycle channel, assuring the perfect match essential for eliminating cross-coupling between standard and multiplex channels.

This new antenna features sectionalized construction and can be erected with as many sections as are required for a given application. Power gain is approximately equal to the number of sections. The spacing of sections is approximately one wavelength. The antennas are designated BFA-1, BFA-2, BFA-3, etc., depending upon the number of stacked sections provided.

The mechanical simplicity and low weight of the BFA Antenna permits quick and easy erection for side mounting on any type of existing tower. Top (pole) mounting on towers is also readily accomplished. Standard support brackets are supplied for side mounting on conventional towers. De-icing units are accessory equipment, and are strongly recommended where a possibility of icing exists.

Sectionalized Construction

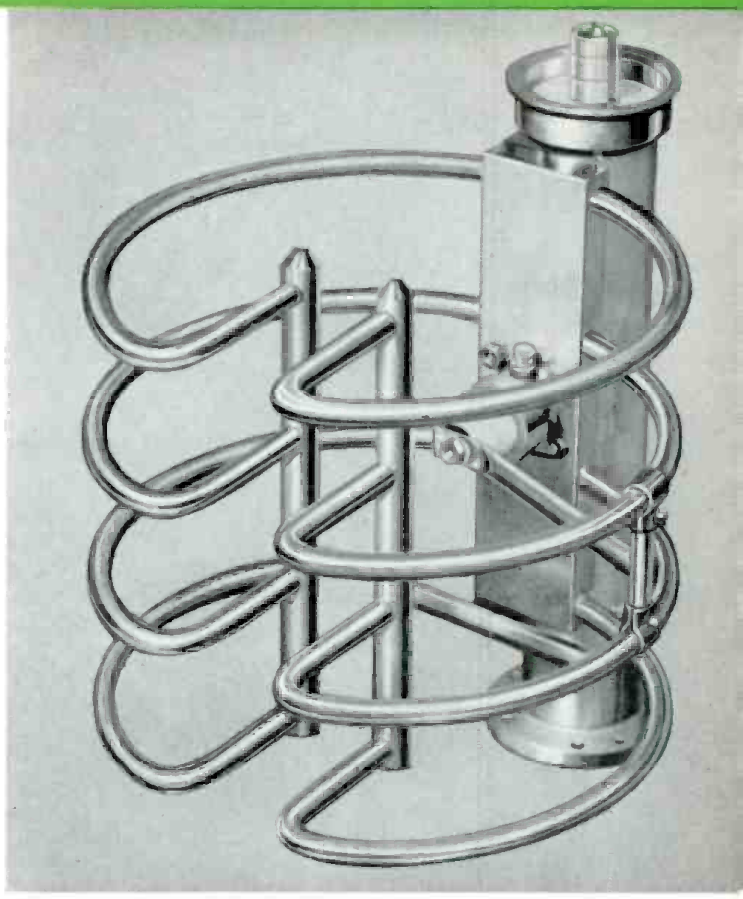
The RCA Type BFA Broadband FM Antenna is of sectionalized construction; each section consisting basically of four radiating rings attached to a supporting frame. An insulated feed assembly and a section of Universal 3⅛-inch, 50 ohm transmission line is provided with flange to fit 3⅛-inch coaxial feedlines. Adapters are available for other size lines. Standard antennas have power gains up to 12.5. Special designs are available on application. All BFA Antennas are factory tuned to any channel in the frequency range of 88 to 108 megacycles. In standard and multiplexing operations, a voltage standing wave ratio of 1.1 to 1 can be achieved with a minimum of field trimming. A transformer section is located near the input fitting.

The horizontal radiation pattern of the BFA is essentially omnidirectional for top mounting. The horizontal pattern in free space is within 1 db of circular. The extent of deviation from a circular pattern for a side mounted array is dependent on type and size of the tower face. It is recommended that the array be mounted, if possible, above the top set of guys on a guyed tower. Where this is not possible the guys in the immediate area of the antenna should be broken by insulators every 3½ feet for a distance of at least 14 feet. In additon, each guy in the vicinity of the antenna should be insulated at the point where it connects to the tower.

The low VSWR over a full 200-kc channel assures optimum linearity. Power handling of the BFA Antenna is 3 kw or 4.8 dbk for a single-section antenna, and up to 36 kw or 15.6 dbk for a 12 section antenna.

Mechanical Features

Mechanically, each section consists of four stainless steel rings stacked and equally spaced to form a height dimension of 12 inches. Each ring is made of ⅝-inch O. D. (3/32-inch wall) tubing of 13½-inch diameter, with a tuning gap measuring from 1½ to 5 inches depending on channel. The sections are mounted on 3⅛-inch coaxial line with an insulated feed stud energizing each radiating section. Only one inter-element transmission line is used to feed all sections of the antenna, and the individual radiating sections are identical mechanically and electrically. The radiators are both shunt fed and mechanically supported by this interconnecting feed-line which consists of modified lengths of RCA 3⅛-inch rigid coaxial transmission line. The BFA-1A through BFA-8A Antennas terminate mechanically in a pressurized top cap with bleed valve and a bottom 3⅛-inch input flange of either EIA or Marman type as specified for coupling the antenna to the desired type of transmission line. The Types BFA-10A and BFA-12A antennas are center fed through a matching tee. On these two latter antennas the lower and top radiators terminate mechanically in pressurized caps.

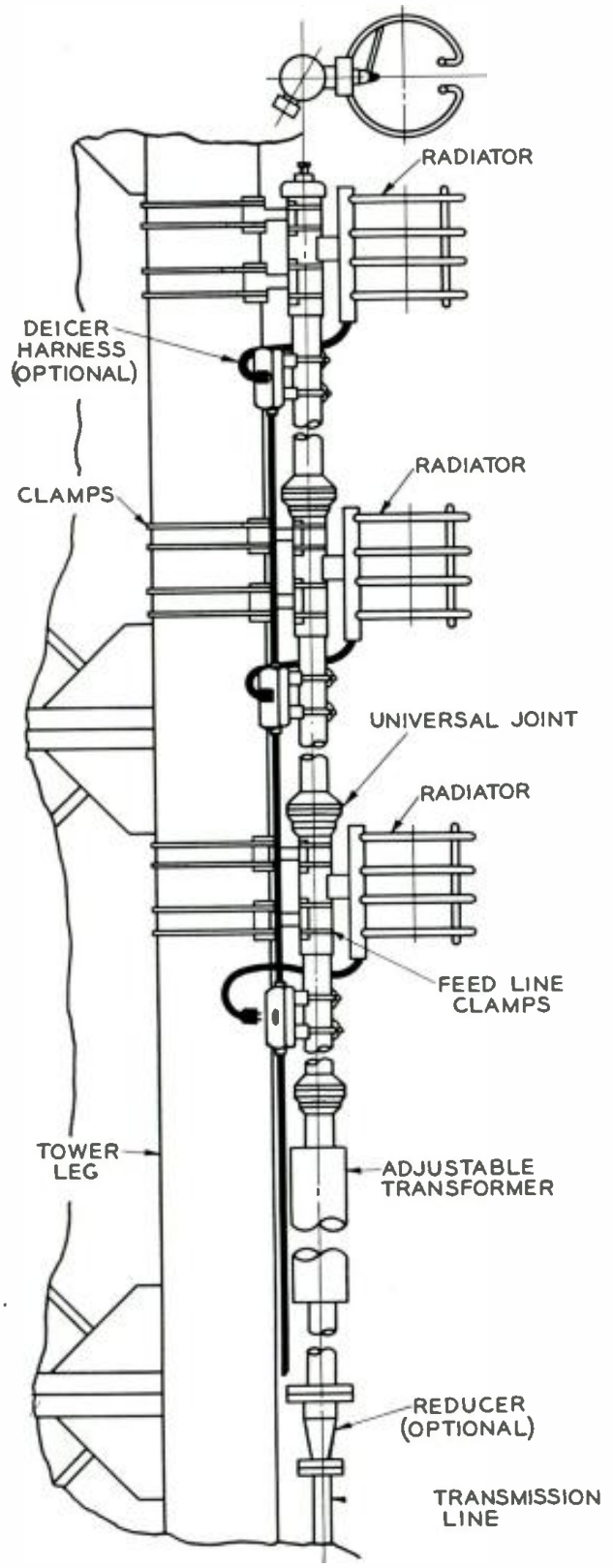


Single Section of BFA Broadband FM Antenna.

Each section may be equipped with internally mounted heating units which consist of insulated resistance wire. A mounting channel for installation of the heaters is 3 inches wide and is provided with a weather-tight cover.

In areas where icing conditions can occurr, even though very occasionally, it is strongly recommended that de-icing equipment be ordered. Since de-icers are installed at the factory, they must be ordered with the antenna.

An additional feature of the new RCA BFA Series FM antennas is the pressure-sealed swivel type mounting that joins the radiator sections at the feed point on the Universal Transmission Line. This permits initial orientation of radiators either in the conventional horizontal plane for maximum horizontal polarization of the radiated wave, or optional rotation of the radiator about it's horizontal axis to provide an increase in the vertically polarized component of radiators where desirable. The radiators may be re-oriented in the field at any time to achieve the required ratio of horizontal versus vertical component.



Type BFA FM Antenna shown side mounted on a typical uniform cross-section tower.

SPECIFICATIONS

Electrical Specifications

Frequency Range.....Factory tuned to any channel in 88-108 mc band

Power Gain.....Approximately equal to number of sections stacked (see table)

Polarization.....Horizontal (Vertical Component approximately 15%)

Horizontal Pattern.....Circularity ±1 db in free space

VSWR at Input (without field trimming):
- Top Mounting.....1.2/1 or better
- Side Mounting.....1.5/1 or better

VSWR at Input (with field trimming):
- Top or Side Mounting.....1.1/1 can be achieved over entire 200 kc channel

Input Impedance.....50 ohms

Power Input Rating.....3 kw per section

Mechanical Specifications

Windload.....50 psf for flat surfaces; 30 psf for cylindrical surfaces (based on true "extreme" velocity of 110 miles per hour. (see table of specific antenna windloads)

Section Dimensions:
- Height..... 12"
- Ring Diameter.....13½"
- Gap.....1½ to 5 inches (depending on channel)

Overall heights and radiation centers.—See Table

Weight
- Each Four-Ring Radiating Section.....13 lbs.
- Supporting 3⅛-inch Feedline.....2.8 pounds per foot (average)

Approximate deadweight of antennas:

BFA-1A	38 lbs.
BFA-2A	143 lbs.
BFA-3A	191 lbs.
BFA-4A	241 lbs.
BFA-5A	292 lbs.
BFA-6A	348 lbs.
BFA-7A	400 lbs.
BFA-8A	451 lbs.
BFA-10A	686 lbs.
BFA-12A	818 lbs.
BFA-14A	950 lbs.
BFA-16A	1025 lbs.

Add approximately 15% to above weight if deicing equipment is to be supplied with antenna.

Ordering Information

BFA Type Broadband FM Antenna complete with standard support brackets for side mounting on conventional towers. Order by stock number as follows:

BFA-1A, single section FM antenna	MI-27925-1
BFA-2A, two-section FM antenna	MI-27925-2
BFA-3A, three-section FM antenna	MI-27925-3
BFA-4A, four-section FM antenna	MI-27925-4
BFA-5A, five-section FM antenna	MI-27925-5
BFA-6A, six-section FM antenna	MI-27925-6
BFA-7A, seven-section FM antenna	MI-27925-7
BFA-8A, eight-section FM antenna	MI-27925-8
BFA-10A, ten-section center-fed, FM antenna	MI-27925-10
BFA-12A, twelve-section center-fed, FM antenna	MI-27925-12
BFA-14A, fourteen-section center-fed, FM Antenna	MI-27925-14
BFA-16A, sixteen-section center-fed, FM Antenna	MI-27925-16

Accessories

De-Icers	MI-27926-*
Adaptor, Flanged 3⅛" to 1⅝"—51.5 ohms	MI-19113-C6

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* De-Icers must be factory installed.

SPECIFICATIONS

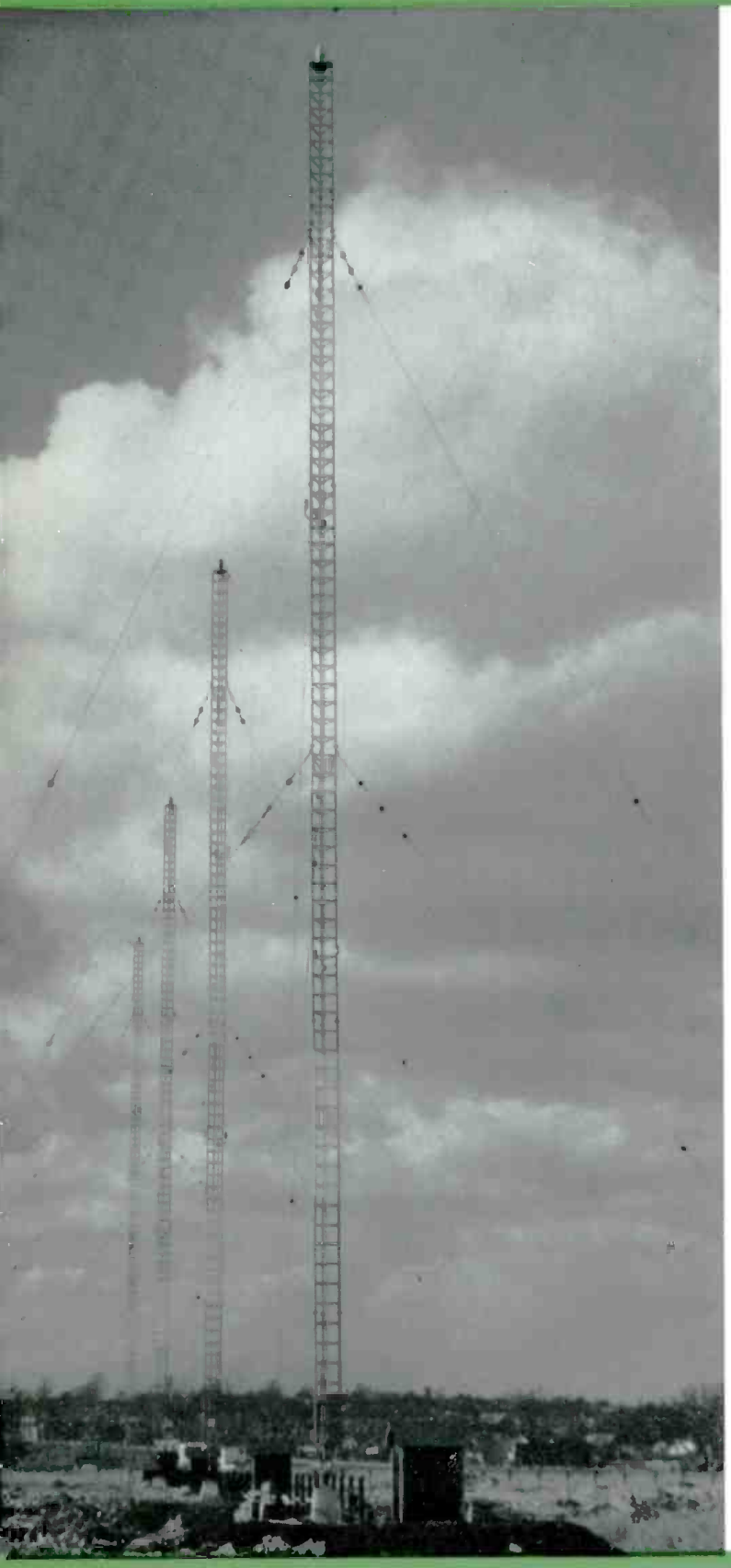
RCA Type	Electrical Data					Dimensions in Feet†				Horizontal Windload*	
	Gain		Power Rating								
	Power	Db	KW	Dbk	Freq. Mc	HC Top	HC Side	H Top	H Side	Less De-Icers	With De-Icers
					Interpolate for In-Between Frequencies						
BFA-1A	0.9	0.5	3	4.8	88	5.0	0.50	8.0	1.0	55	67
					98	5.0	0.50	8.0	1.0	55	67
					108	5.0	0.50	8.0	1.0	55	67
BFA-2A	1.9	2.8	6	7.8	88	10.0	5.55	18.1	11.1	215	261
					98	9.5	5.00	17.0	10.0	206	250
					108	9.1	4.60	16.2	9.2	200	242
BFA-3A	3.0	4.8	9	9.5	88	15.1	10.55	28.1	21.1	310	376
					98	14.0	9.55	26.1	19.1	294	356
					108	13.2	8.70	24.4	17.4	280	339
BFA-4A	4.0	6.0	12	10.8	88	20.1	15.60	38.2	31.2	406	492
					98	18.6	14.05	35.1	28.1	381	461
					108	17.3	12.80	32.6	25.6	361	436
BFA-5A	5.1	7.1	15	11.8	88	25.2	20.65	48.3	41.3	502	608
					98	23.1	18.60	44.2	37.2	469	567
					108	21.4	16.90	40.8	33.8	442	533
BFA-6A	6.3	8.0	18	12.6	88	31.6	27.10	61.2	54.2	620	752
					98	28.9	24.40	55.8	48.8	576	698
					108	26.7	22.20	51.4	44.4	541	654
BFA-7A	7.3	8.6	21	13.2	88	36.8	32.35	71.7	64.7	719	872
					98	33.6	29.15	65.3	58.3	667	808
					108	31.0	26.50	60.0	53.0	625	755
BFA-8A	8.4	9.2	24	13.8	88	42.2	37.70	82.4	75.4	819	994
					98	38.4	33.90	74.8	67.8	758	918
					108	35.3	30.80	68.6	61.6	709	856
BFA-10A	10.5	10.2	30	14.8	88	52.7	48.25	103.5	96.5	1407	1625
					98	47.9	43.45	93.9	86.9	1294	1492
					108	44.0	39.50	86.0	79.0	1201	1383
BFA-12A	12.5	11.0	36	15.6	88	63.4	58.90	124.8	117.8	1683	1943
					98	57.5	53.00	113.0	106.0	1552	1788
					108	52.6	48.10	103.2	96.2	1435	1652
BFA-14A	14.5	11.62	42	16.4	88	74.1	69.55	146.1	139.1	1959	2261
					98	67.1	62.55	132.1	125.1	1810	2084
					108	61.2	56.70	120.4	113.4	1669	1921
BFA-16A	16.5	12.18	48	17.4	88	84.8	80.20	167.4	160.4	2235	2579
					98	76.7	72.10	151.2	144.2	2068	2380
					108	69.8	65.3	137.6	130.6	1903	2190

† "Hc" (Top Mounting) Height of radiation center above top of tower.
"Hc" (Side Mounting) Height of radiation center above lowest part of bottom radiator.
"H" (Top Mounting) overall height of antenna above top of tower, not including obstruction lighting.
"H" (Side Mounting) Overall height of antenna measured from top of top radiator section to lowest part of bottom radiator section.

* Pounds based on 30 lb./ft.^{2} on projected areas of round surfaces.

AM-FM Antenna Towers

AND ACCESSORIES



FEATURES

- Wide selection of AM and FM Antenna Towers
- Self-supporting or guyed types of standard and custom designs
- Complete with tower lighting and other accessories
- Assistance in planning entire installation

DESCRIPTION

RCA is well-qualified to assist you in the planning and selection of proper AM towers and a qualified erector to complete your installation. Improper or insufficient tower designs and poor erection and installation techniques should be avoided since they can be very costly to the Broadcaster.

Tower Considerations

The following procedure may be helpful as a check list in considering your tower requirements.

1. Determine station location with respect to service area. This study which will involve among other things joint proximity to other stations, FAA approval, cost of land, zoning restrictions, local regulations, etc., will result in a decision to use:
   a. A self-supporting tower when land is unavailable as in city limits or on top of a building where total height of a tower is 500 feet or less.
   b. Or a guyed tower where land is available.
2. Determine design parameters:
   a. Wind load for area in which tower is located.
   b. Type of antenna which is to be supported (when FM).
   c. Ground system details.
3. Determine tower accessories such as:
   a. Ladders.
   b. Platforms.
   c. Railings.
   d. Lighting.
   e. Microwave dishes.

4. Determine method of routing transmission line if tower is used for FM taking into account:
   a. Accessibility.
   b. Location of structural members.
   c. Location of special networks below tower top.

Wide Variety of Types

A wide selection of towers is available for all applications . . . these include standard self-supporting and guyed designs as well as custom designs. In order to facilitate selection of the tower most suitable, and as an aid to the station in determining specific requirements, a sample questionnaire is included here.

ANTENNA TOWER QUESTIONNAIRE

LOCATION

City..... State.....

QUOTATIONS TO BE FURNISHED

(Check those required)

Number of Towers.....( )

Ground System .....( )

Tower Guyed.....( )

Self-supporting .....( )

Tower Lighting Equipment.....( )

Tower Erection:

Tower Installation .....( )

Transmission Line Installation (FM).....( )

SPECIFICATIONS

Tower Height: Ground to top of tower.....

Ground to top of base insulator.....

Tower Use: AM Radiator .....

Antenna support (when used for FM or TV).....

Channel or Frequency.....

FM or TV Antenna: Type.....

Description.....

Transmission Lines:

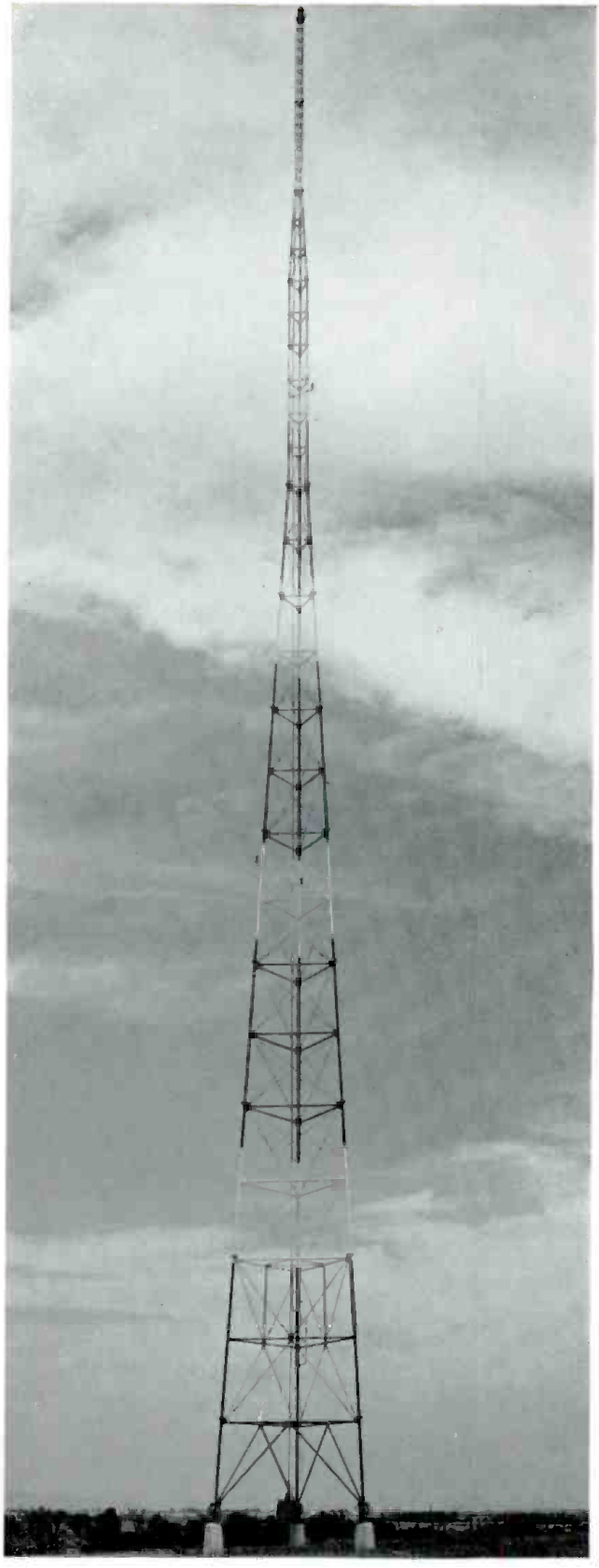
Size *No.*

Design Load: B-1 Open Country.....

B-2 Congested Area.....

Remarks:

(Special requirements, site accessibility, etc.)



Guyed Towers

Relatively flat country with low surrounding hills lends itself well to the installation of tall structures. Where land area permits, towers are usually guyed and the usual cross sectional shape is triangular so that three point guying can be used. Guyed tower costs are normally lower than for self-supporting structures because less steel is used. A useful method for estimating the land required for a guyed structure is to consider the distance to the farthest guy anchorage as being approximately 70 percent the tower height.

Self-Supporting Towers

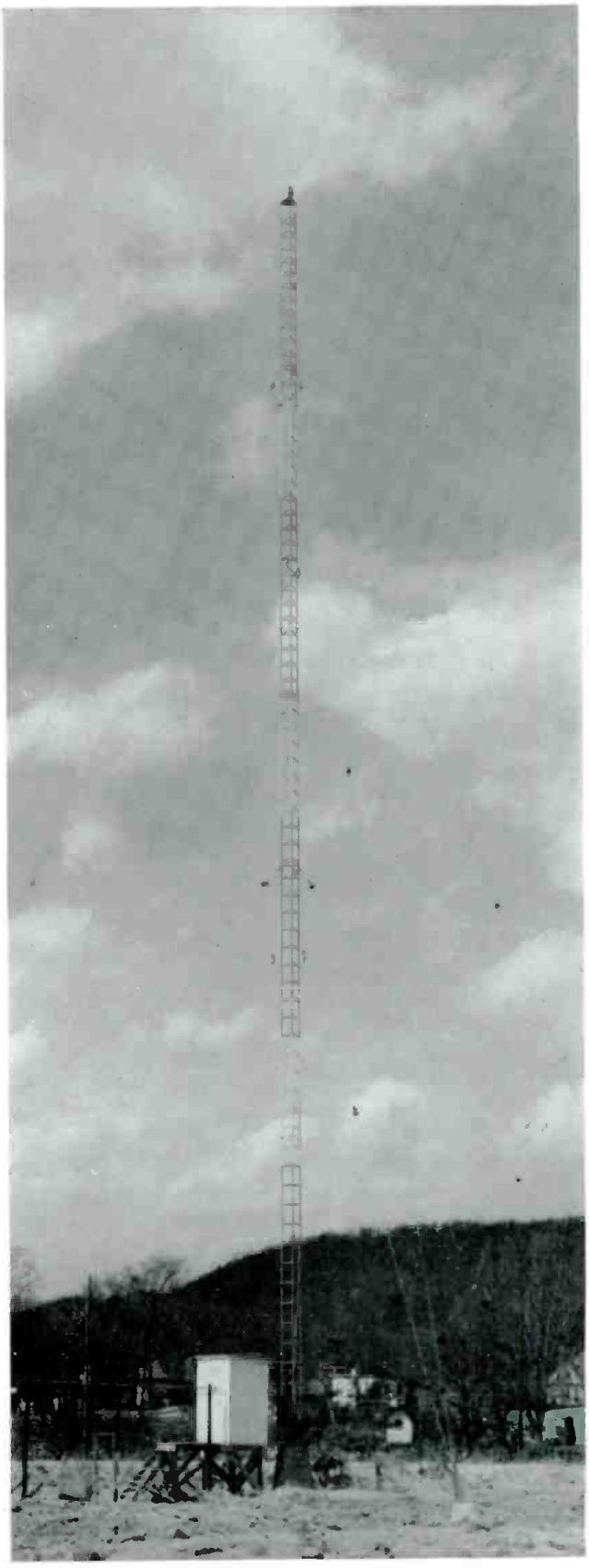
Self-supporting towers are especially advantageous in city and congested districts where land is expensive. For estimating required space for a self-supporting tower, the distance between tower legs can normally be considered as 1/8 the height of the structure.

Tower Construction

In both types of antenna systems a check for plumb and for proper guy tension should be made in order to obtain the required radiation patterns. Insofar as directional systems are concerned, the towers should be as nearly identical as possible with respect to guy wire, height, azimuth location, positioning of guy insulators, etc. No section of guy wire should be greater than a ⅛ wavelength of the operating frequency in order not to affect the radiation pattern. After the towers have been erected, all joints should be weld-bonded to assure a continuous steel radiator.

Steel towers may be hot dip galvanized, where corrosive action due to fumes, salt air, etc., are likely to occur. All towers should be painted to conform with FCC and FAA regulations.

Climbing ladders, when used, should be located inside the tower if at all possible and preferably near the tower legs. By placing the ladder within the tower, lattice braces form a safety cage for the serviceman. For FM the ladder is also an excellent support for transmission line runs as it is accessible at all times. The type of hangers (usually direct mounting) should be specified so that proper supporting members can be provided in the tower.



WIND VELOCITIES AND CORRESPONDING PRESSURES

TRUE "EXTREME" VELOCITY MILES PER HOUR (Note No. 1 V_n	FLAT SURFACES Pressure in Lbs./Sq. Ft. of Projected Area $P = 0.0042V_n^2$	CYLINDRICAL SURFACES Pressure in Lbs./Sq. Ft. of Projected Area $P = 0.0025V_n^2$
10	.42	.25
15	.95	.56
20	1.7	1.00
25	2.6	1.6
30	3.8	2.3
35	5.2	3.1
40	6.7	4.0
45	8.5	5.1
50	10.5	6.3
55	12.7	7.6
60	15.1	9.0
65	17.8	10.6
70	20.6	12.3
75	23.6	14.1
80	26.9	16.0
85	30.4	18.1
90	34.0	20.3
95	37.9	22.6
100	42.0	25.0
105	46.3	27.6
110	50.8	30.3
115	55.5	33.1
120	60.5	36.0
125	65.6	39.1
130	70.9	42.3
135	76.5	45.6
140	82.3	49.0
145	88.3	52.6
150	94.5	56.3
155	100.9	60.1
160	107.5	64.0
165	114.3	68.1
170	121.4	72.3
175	128.6	76.6
180	136.1	81.0
185	143.7	85.6
190	151.6	90.3
195	159.7	95.1
200	168.0	100.0
205	176.5	105.1
210	185.2	110.3
215	194.1	115.6
220	203.3	121.0
225	212.6	126.0

NOTE No. 1—Since 1932 published weather data based on 5 minute average known as "Maximum" and frequently on fastest mile known as "Extreme."

Wind Load

Towers must be designed and installed to safely withstand the maximum wind velocities that may be encountered. Experienced tower builders rarely design for less than a 30/20 lb. loading. This means that the tower members are designed to resist a horizontal wind pressure of 30 lbs. per square foot of projected area on all flat surfaces and 20 lbs. on round surfaces. This is the equivalent of an actual wind velocity of 85 miles per hour.

Specifications

Towers are designed in accordance with EIA specifications. Consultation with RCA Broadcast Representatives will help to determine your requirements. Call or write your nearest representative.

Tower Accessory Equipment

A number of tower accessories to complete the various type RCA AM and FM Broadcast Towers are available for all applications—these include tower grounding accessories, transmission lines and hangers, dehydrators, sampling lines, antenna feed lines, tower lighting equipment, hazard markers, weotherproof housings, and many miscelloneous items such as photo-cells, lighting transformers, and choke coils.

Ground Systems

Since the radiation pattern is computed on the basis of a perfectly conducting plane earth, and since earth's conditions deport radically from this assumption, a ground system of buried copper wires or ribbons must be installed in order to approoch this ideal os closely os possible. The FCC minimum requirements consist of buried radial wires at least ¼ wavelength long. They should be as evenly spaced as procticable ond in no event should less than 90 radials be used. This is a minimum FCC requirement and where possible a better ground system should be installed. A properly installed and adequate ground system can contribute much to the efficiency and stability of a radiation pattern and actual specifications for installation should be determined by the consultant.

It is suggested that a ground screen be used if high base currents are encountered. It should be placed in position at the base of the tower. This ground screen should be 23 gauge, expanded copper mesh, or equal. Each radial wire must be electrically bonded to the ground screen. There will be some installations in which the consultant will suggest the use of additional radials in lieu of the copper ground screen. They should be placed around the base of each tower and all radials used should be bonded to a heavy bus consisting of a copper ribbon three inches or more wide, or to a bundle of seven copper wires next

to the concrete base of the tower. The insulator base and the lightning gap are bonded to the screens or to the bus around the concrete tower base. It is recommended that a No. 10 soft drawn copper wire be utilized for the radials and for the bundle of wires making up the bus.

Transmission Lines and Hangers

Careful consideration should be given to the layout and support of transmission line. Outline drawings with dimensions are available for all types of transmission lines and should be used in making a layout. There are two types of transmission line hangers. One type can be wrap-locked to the tower member, another type is bolted to the tower members. (See RCA Transmission Line and Hanger Catalogs.)

Sampling Lines

Coaxial lines of either semirigid or flexible type may be employed for a sampling system. All lines should be the same electrical length, whichever type is employed, in order to obtain correct phase indication; i.e., all lines must be of the same length as the longest line from antenna to phase monitor. The excess line on the shorter runs may be coiled and stored at either the antenna or the phase monitor end. Alternatively, it may be folded back upon itself.

The characteristic impedance of the transmission line must be chosen to match the input impedance of the particular type of phase monitor employed. These transmission lines, either semirigid or flexible, can be buried in the ground or carried back in the same trough that supports the transmission line. If the semirigid type is used, suitable provision should be made for variations in length due to temperature changes. The semirigid type of concentric line utilizes dry air as the dielectric. The air in these lines must be kept dry and provision should be made so that dry air can be flushed through the line and held at a pressure recommended for the transmission line used. Sampling accessories and methods of sampling are described in the RCA Phasing Equipment Catalog.

If isolation coils are requested or required, sampling cable or air-dielectric coax can be wrap-locked to the tower members and then connected to the isolation coils maintained in the tuning house at the base of the tower. From the isolation coil, the cable is connected to the phase monitor in the transmitter building. The cold end of the isolation coil should be bonded to the ground system. Actual specification for method and type of sampling system and type of transmission line should be determined by the consultant.

Antenna Feed Line

Line-termintaing units can be connected to the tower by means of copper tubing. The line should be flattened at one end and drilled for connections to the antenna-tuning unit terminal. This line is then run through a feed-through insulator in the tuning-house wall and the line is attached to the tower by a bolt or by brazing. At a point between the tower and feed-through insulator, the line should be formed into a one or two-turn coil, 12 to 18 inches in diameter. This coil can be self-supporting and is intended to retard lightning and aid in the breakdown at the ball or horn gap provided at the tower base to keep lightning discharges from damaging the equipment. (See Antenna Feed Line Catalog.)

Tower Lighting

Lighting equipment must conform to FCC/CAA requirements as specified on the construction permit. All a-c lines can be buried or mounted on the poles carrying the transmission lines. It is recommended that isolation of lighting and r-f lines be obtained. In addition, further isolation of r-f and a-c power must be made when feeding the a-c to the tower lights. This can be provided by utilizing either an antenna lighting choke or Hughey & Phillips lighting transformer. Either device provides a means of supplying energy to the tower-lighting circuits and at the same time prevents any appreciable loss of r-f energy supplied to the tower by the radio transmitter.

Main beacon and side obstruction lights shown powered by use of either lighting transformer or lighting choke coil.

The Lighting Kits are engineered to meet FAA socket voltage requirements with a system voltage of 115/230 volts, 50/60 cycles. For ungrounded towers, provision must be made for isolation of lighting circuits over the base insulator. The beacons have approved red color filters as a marker light for obstructions to air navigation or can be provided with green or yellow color filters as an auxiliary identification aid at airports or other special applications. They are constructed of heavy aluminum castings with ventilated dome and concave base with drain port at lowest point to prevent accumulation of moisture from condensation. A hinged center frame provides easy access for inspection and lamp replacement. The optical system has four clear, heat-resistant lenses designed to provide correct beam distribution in accordance with FAA specifications.

Obstruction lights feature flanged Fresnel lenses seated against an especially compounded long life gasket cemented to the fixture base. Drain holes in the base prevent accumulation of condensation moisture within the unit. The housing is designed for use with 100 or 110-watt, 115-volt, medium screw base lamps and has a positive latch for easier maintenance on all models. Models with a choice of bottom or side entrance conduit fitting are available.

All lighting kits are provided with a beacon flasher designed to provide an intermittent source of electrical power for the flashing of Code and/or Hazard Beacons and a photo-electric control for automatic regulation of the beacon flasher. This electro-mechanical device is housed within a watertight hinged aluminum enclosure and features heavy duty components. The unit is factory adjusted to turn On at 35 foot-candles and Off at 58 foot-candles in accordance with FCC regulations. Adjustable controls are provided to permit changing the On and Off illumination level points. Use of Photo-Electric Control eliminates need for daily recording the time tower lights are turned on and off manually.

Tower Lighting Transformers

Hughey & Phillips Isolation Transformers provide an efficient, reliable method of current supply to tower lighting circuits. The transformer consists of ring type windings with a clear air gap between primary and secondary rings. This construction makes the transformer independent of radio frequency, thus requiring no tuning or adjustment. The primary and secondary rings are each equipped with a junction box having four bosses tapped for one inch pipe. These are used for mounting the transformer, the ball gap lightning protector, and entrance for the conductors. Two models are available in sizes of 1750 and 3500 watts.

SPECIFICATIONS

Tower Accessories

8' x 24' Section Expanded Copper Ground Screen	MI-27765
No. 10 Copper Wire	MI-28405-8
3" x .020 Ground Strap	MI-28405-A4
Double RF Antenna Lighting Choke	MI-7112-C
Triple RF Antenna Lighting Choke	MI-27726-A
Capacitor for Lighting Chokes	MI-27728-1
Weatherproof Housing	MI-27741
Triple Winding RF Antenna Lighting Choke with Four Capacitors	ES-27242
Double Winding RF Antenna Lighting Choke with two capacitors and Weatherproof Housing	ES-27243
Triple Winding RF Antenna Lighting Choke with four capacitors and Weatherproof Housing	ES-27244
3000-Watt Fisher Pierce Photo-Cell	
6000-Watt Fisher Pierce Photo-Cell	
Pierce Light Control Relays	
Hazard Markers (Set of 3 including instollation material)	
"Hot Dip" Galvanizing of Angle Frame Work for Individual Markers	

Tower Lighting Kits

Tower Height	*No. Beacons*	*No. Obstruction Lights*	*Order No.*
21' - 150'	0	1 double	A-1
151' - 300'	1	2	A-2
301' - 450'	1	4	A-3
451' - 600'	2	6 (8 on sq. towers)	A-4
601' - 750'	2	9 (12 on sq. towers)	A-5
751' - 900'	3	9 (12 on sq. towers)	A-6
901' - 1050'	3	12 (16 on sq. towers)	A-7
1051' - 1200'	4	12 (16 on sq. towers)	A-8
1201' - 1350'	4	15 (20 on sq. towers)	A-9
1351' - 1500'	5	15 (20 on sq. towers)	A-10

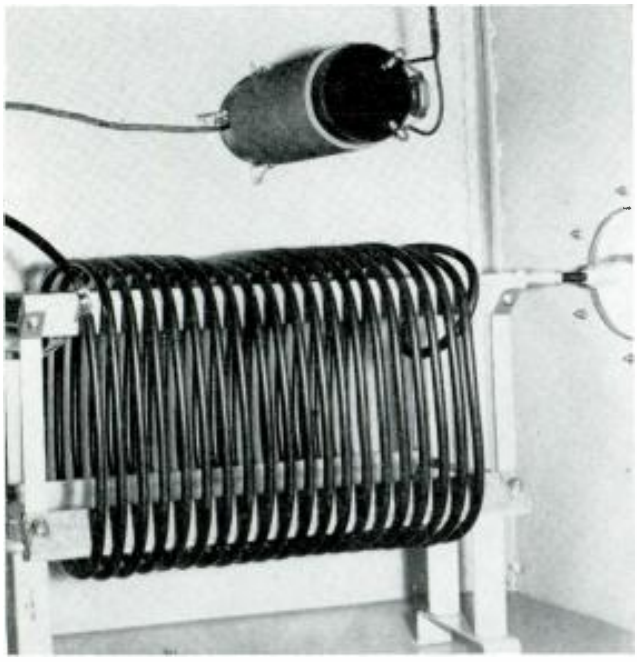
(Lighting Kits include all materials required to light and wire a tower of heights specified, such as original and 100 percent spare lamps, beacon flasher, photo-electric control, color coded wire, stainless steel wraplock tape condulets, locknuts, supporting arms, unions, pipe compound, installation print, and bill of materials in accordance with FCC, FAA and National Electric Code Requirements.)

Antenna Coupler, 1250-watt for Series Feed, non weatherproof	MI-27785
Antenna Coupler, 1250-watt for Shunt Feed, non weatherproof	MI-27786

Description	*Hughey & Phillips Model TI-2017*	*TI-2035*
Rating, secondary load	1750 W	3500 W
Primary voltage (and taps)	115V (2, 6% taps) 230V (4, 3% taps)	115V (2, 6% taps) 230V (4, 3% taps)
Secondary voltage (and taps)	117/120V	117/120V
Efficiency at rated load	94%	94%
Regulation, secondary voltage change, no load to full load	9%	9%
Primary to secondary capacity	25 mmfd.	32 mmfd.
Peak R-F breakdown, primary to secondary (approx.)	40 kv	50 kv
Dimensions, overall	28¾" x 13⅜" x 15¼"	31" x 15" x 17¼"
Weight	88 lbs.	138 lbs.
ORDERING INFORMATION	MI-28215-A1	MI-28215-A2

For other Antenna Accessories See RCA Catalogs on Antenna Tuning Units, AM-FM Phasing Equipment, Transmission Line, Hangers and Dehydrators.

ANTENNA LIGHTING CHOKE COILS



View showing MI-7112-C Antenna Lighting Choke Coil mounted above isolation coil in weatherproof housing. RCA Type BPA Antenna Tuning Units have provisions for mounting chokes in same housing.

DESCRIPTION

In broadcast transmitter installations where the tower itself forms the antenna, special transformers or radio-frequency choke coils must be employed to feed power to the lighting circuits on the tower. The MI-7112-C Double Winding Choke Coil and MI-27726-A Triple Winding Choke Coil have been designed for this purpose. Their electrical characteristics are such that they present a low impedance to commercial lighting frequencies and a high impedance to radio frequencies in the broadcast range. They, therefore, provide a means for supplying energy to the tower lighting circuits and at the same time prevent any appreciable loss of r-f energy supplied to the tower by the radio transmitter.

The coils consist of double or triple windings on a bakelite form, coated with an insulating varnish which binds the turns together and prevents moisture absorption. The coils must be protected from weather by installing them within some weatherproof enclosure. All windings that are not directly connected to the tower or ground should be properly bypassed by suitable capacitors.

SPECIFICATIONS

Maximum Continuous Current (50/60 cycles)	15 amperes
D-C Resistance (each winding)	Approx. 0.15 ohms
Inductance at 1 mc	360 microhenries
Length	11⅝"
Diameter	4"

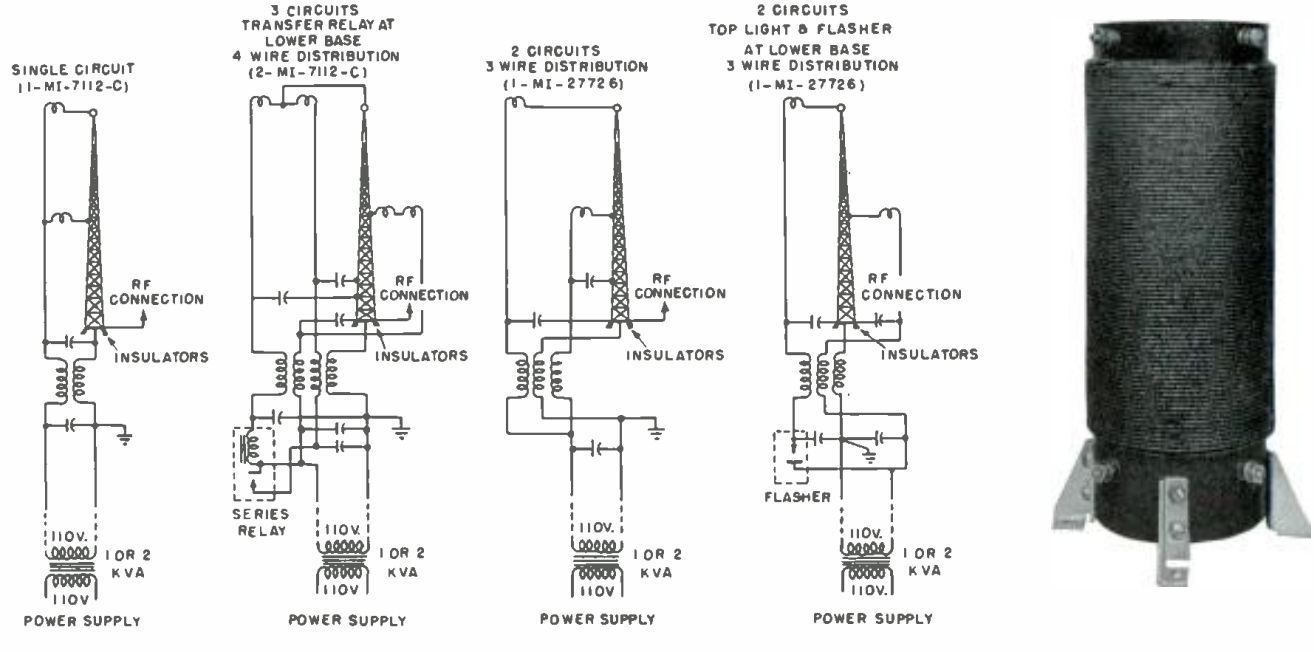
Ordering Information

Choke Coil, Double Winding	MI-7112-C
Choke Coil, Triple Winding	MI-27726-A

Accessories

Capacitors .01 MFD	MI-27728-1
Weatherproof Housing	MI-27741

Typical Antenna Tower Lighting System diagrams and close-up view of Choke Coil, MI-7112-C.



FOOTAGE TABLE FOR BROADCAST TOWER HEIGHTS

550 KC TO 1070 KC

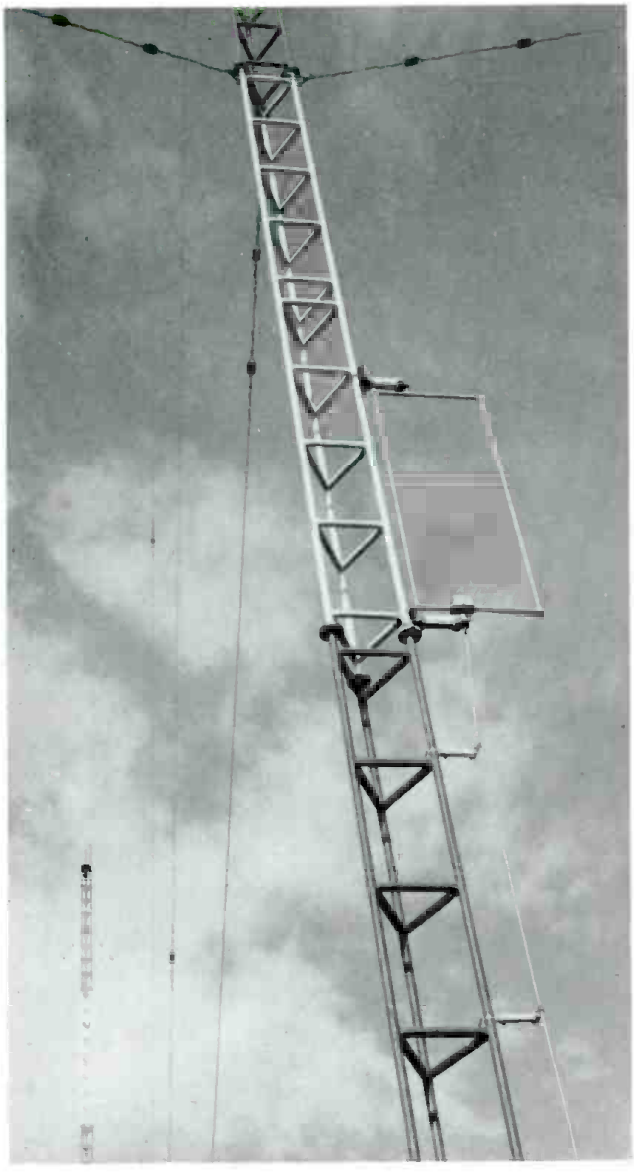
KC	METERS	1 WAVE	½ WAVE	¼ WAVE
550	545	1787.6	893.8	446.8
560	536	1758.0	879.0	439.5
570	526	1725.3	862.6	431.3
580	517	1695.7	847.8	423.9
590	509	1669.5	834.7	417.3
600	500	1640.0	820.0	410.0
610	492	1612.7	806.3	403.1
620	484	1587.5	799.7	396.8
630	476	1561.2	780.6	390.3
640	469	1546.3	773.1	386.5
650	462	1515.3	757.6	378.8
660	455	1492.4	746.2	373.1
670	448	1469.4	734.7	367.3
680	441	1446.4	723.2	361.1
690	435	1426.8	713.4	356.2
700	429	1407.1	703.5	351.2
710	423	1387.4	693.7	346.8
720	417	1367.7	683.8	341.9
730	411	1348.0	674.0	337.0
740	405	1328.4	664.2	332.1
750	400	1312.0	656.0	328.0
760	395	1295.6	647.8	323.4
770	390	1279.2	639.6	319.8
780	385	1262.8	631.4	315.7
790	380	1246.4	623.2	311.6
800	375	1230.0	615.0	307.5
810	370	1213.6	606.8	303.4
820	366	1200.4	600.2	300.1
830	361	1184.0	592.0	296.0
840	357	1170.9	585.4	292.7
850	353	1157.8	578.9	289.4
860	349	1144.7	572.3	286.1
870	345	1131.6	565.8	282.9
880	341	1118.4	559.2	279.6
890	337	1105.3	552.6	276.3
900	333	1092.2	546.1	273.0
910	330	1082.4	541.2	270.6
920	326	1069.2	534.6	267.3
930	323	1059.4	529.7	264.8
940	319	1046.3	523.1	261.5
950	316	1036.4	518.2	259.1
960	313	1026.6	513.3	256.6
970	309	1013.5	506.7	253.3
980	306	1003.6	501.8	250.9
990	303	993.8	496.9	248.4
1000	300	984.0	492.0	246.0
1010	297	974.1	487.5	243.7
1020	294.1	964.6	482.3	241.1
1030	291.3	955.3	477.6	238.8
1040	288.5	946.2	473.1	236.5
1050	285.7	937.1	468.5	234.2
1060	283.0	928.2	464.1	232.0
1070	280.4	919.7	459.8	229.9

1080 KC TO 1600 KC

KC	METERS	1 WAVE	½ WAVE	¼ WAVE
1080	277.8	911.1	455.5	227.7
1090	275.2	902.6	451.3	225.6
1100	272.7	894.4	447.2	223.6
1110	270.3	886.5	443.2	221.6
1120	267.9	879.0	439.5	219.7
1130	265.5	870.8	435.4	217.7
1140	263.2	862.6	431.3	215.6
1150	260.9	855.7	427.8	213.9
1160	258.6	847.8	423.9	211.9
1170	256.4	840.9	420.4	210.2
1180	254.2	834.7	417.3	208.6
1190	252.1	826.8	413.4	206.7
1200	250.0	820.0	410.0	205.0
1210	247.9	813.1	406.5	203.2
1220	245.9	806.3	403.1	201.5
1230	243.9	799.1	399.5	199.7
1240	241.9	793.7	396.8	198.4
1250	240.0	787.2	393.6	196.8
1260	238.1	780.9	390.4	195.2
1270	236.2	774.7	387.3	193.6
1280	234.4	768.8	384.4	192.2
1290	232.6	762.9	381.4	190.7
1300	230.8	757.0	378.5	189.2
1310	229.0	751.1	375.5	187.7
1320	227.3	746.2	373.1	186.5
1330	225.6	739.9	369.9	184.9
1340	223.9	734.7	367.3	183.6
1350	222.2	728.8	364.4	182.2
1360	220.6	723.2	361.1	180.5
1370	219.0	718.3	359.1	179.5
1380	217.4	713.4	356.2	178.1
1390	215.8	707.8	353.1	176.5
1400	214.3	703.5	351.2	175.6
1410	212.8	696.9	348.4	174.2
1420	211.3	693.7	346.8	173.4
1430	209.8	688.1	344.0	172.0
1440	208.3	683.8	341.9	170.9
1450	206.9	678.6	339.3	169.6
1460	205.5	674.0	337.0	168.5
1470	204.1	669.4	334.7	167.3
1480	202.7	664.2	332.1	166.5
1490	201.3	660.2	330.1	165.0
1500	200.0	656.0	328.0	164.0
1510	198.7	651.7	325.8	162.9
1520	197.4	647.8	323.4	161.7
1530	196.1	643.2	321.6	160.8
1540	194.8	639.6	319.8	159.9
1550	193.5	634.6	317.3	158.6
1560	192.3	631.4	315.7	157.8
1570	191.1	626.8	313.4	156.7
1580	189.9	623.2	311.6	155.8
1590	188.7	618.9	309.4	154.7
1600	187.5	615.0	307.5	153.7

AM Antenna Accessories

PHASE SAMPLING LOOPS



FEATURES

- Sampling loops and isolation coils
- Isolation filters
- AM dummy loads
- Remote antenna ammeters
- Bowl insulators

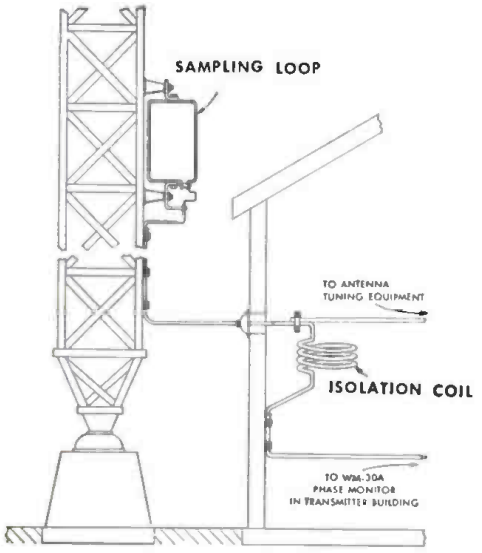
DESCRIPTION

Shielded Sampling Loop, Type 173-10, provides a sensitive and highly accurate method of sampling tower currents in directional antenna arrays. Completely shielded to eliminate electrostatic coupling, the loop responds only to the radiated magnetic field. In addition, it is unaffected by ice accumulation or other weather conditions. Consisting of two turns of insulated No. 10 copper wire enclosed and supported in a ⅞-inch copper tubing shield, the loop is mounted on two heavy porcelain standoff insulators. Sensitivity is adjusted by rotating the loop on a pivot bearing designed to lock in any position. Self impedance is not affected by rotation. The sampling line (70 ohm) enters the loop through the bottom pivot shaft and may be easily connected by removing the cover on the input housing. The loop may be used with pressurized, air insulated or solid dielectric line. Universal brackets permit mounting on any tower leg. The loop measures 72 inches high, 24 inches wide.

Standard Unshielded Loops

Sampling Loop, Type 173-11-1, is a three sided loop designed for grounding to the tower leg which serves as the fourth side. Sensitivity is adjusted by varying the distance between the outside leg of the loop and the tower. Construction is of heavily plated steel tubing. The assembly includes mounting clamps and all necessary hardware for mounting and for connecting 70 ohm sampling line. Shipped disassembled with instructions and special tools needed for assembly. Dimensions: 73 inches high by 30 inches maximum width.

Sampling Loop, Type 173-11-2, is a fully insulated loop with provision for sensitivity adjustment by varying the loop position in its mounting clamps. The insulated feature permits phase sampling without the use of an isolation filter on simple arrays and low impedance towers. Construction is plated steel and all hardware for mounting and connection of 70 ohm sampling line is furnished. Shipped disassembled with instructions and special tools. Dimensions 73 inches high by 41¼ inches wide.



Typical installation of Sampling Loop and Isolation Coil.

The Sampling Loop above provides a method of obtaining a voltage (proportional to the antenna current) for operation of the current sampling meter and phase monitor. Rugged copper tubing provides electrostatic shielding for the internal pickup conductor. The loop is insulated from the tower and may be rotated to permit adjustment of pickup sensitivity. The Isolation Coil is used to present a high impedance which avoids the short-circuiting of the antenna, and yet permits the transmission of the sampling voltage. It is required whenever the sampling line or pickup loop is bonded to the tower.

Ordering Information

Type 173-10-1 Shielded, Rotatable, Insulated Sampling Loop for use with RG Cable	MI-27729
Type 173-10-2 Shielded, Rotatable, Insulated Sampling Loop for use with RG Cable 8U/11U	MI-27759
Type 173-11-1 Unshielded, Grounded Sampling Loop for use with RG Cable	MI-27730
Type 173-11-2 Unshielded, Insulated Sampling Loop for use with RG Cable	MI-27731
Type 173-11-3 Sampling Loop, same as Type 173-11-1, but provided with an 881R Receptacle for use with RG Cable 8U/11U	On Request
Type 173-11-4 Sampling Loop, same as Type 173-11-2, but provided with an 813R Receptacle for use with RG Cable 8U/11U	On Request
Type 172-87 Isolation Inductor, 3/8" "Spirafil" Coax, 50 ohms, with Coupling, mounted on 4-inch stand-off insulators	On Request
Type 172-88 Isolation Inductor, 3/8" "Spirafil" Coax, 70 ohms, in Cabinet	On Request

ISOLATION FILTER INDUCTORS

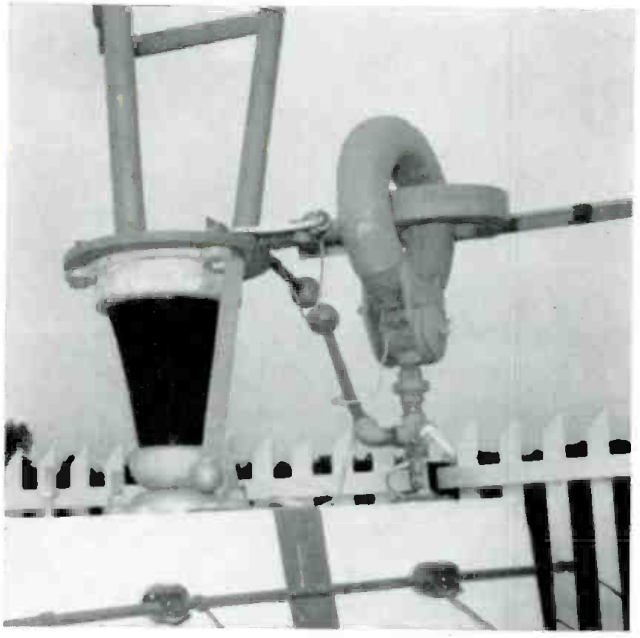
DESCRIPTION

Johnson isolation filters provide high efficiency transfer of a sampling current across the tower base insulator. Used on sampling line when tower is ¼ wave or higher, they present a high shunting impedance at the tower base.

Isolation Inductors consisting of helical winding of coaxial cable are available for isolating the tower sampling loop line from the AM tower. They prevent any appreciable loss of r-f energy supplied to the tower by the radio transmitter. The inductors can be provided with panel wall mounts of weatherproof housings.

Ordering Information

Isolation Inductor RG-11/U, 75 ohms (172-63)	MI-27756-1
Isolation Inductor RG-8/U, 52 ohms (172-64)	MI-27756-2
Isolation Inductor RG-11/U, 75 ohms, Panel Wall Mount (172-65)	MI-27756-3
Isolation Inductor RG-8/U, 52 ohms, Panel Wall Mount (172-66)	MI-27756-4
Isolation Inductor RG-11/U, 75 ohms, in Weatherproof Housing (172-47)	MI-27756-5
Isolation Inductor RG-8/U, 52 ohms, in Weatherproof Housing (172-48)	MI-27756-6
Isolation Inductor 3/8" Styroflex, 50 ohms	MI-27756-7
Isolation Inductor 3/8" Styroflex, 70 ohms	MI-27756-8
Isolation Inductor 3/8" Spirafil, 50 ohms	MI-27756-9
Isolation Inductor 3/8" Spirafil, 70 ohms	MI-27756-10



Typical installation of lighting transformer to isolate ac lighting circuit from rf.

AM Dummy Loads

DESCRIPTION

Ohm-spun Resistance Loads provide adjustable loads for testing meters, instruments, motors and relays in the field. They are used also in electrical laboratories and on Radio Transmitters where a non-inductive resistance is essential.

The resistors provide the necessary resistance for controlling current and may be mounted either in groups or banks or separately. Construction of the units permit the highest possible wattage dissipation with a minimum wire temperature, as the resistance wire is supported in open air. Ohm-spun units are woven with asbestos thread impregnated with heat resistance cement. The output is little affected by temperature as all the larger wattage units are woven with wire having practically zero temperature co-efficient of resistance.

The Resistance Loads are made in different ampere and voltage capacities to fit individual requirements. The following loads are supplied by RCA at any impedance of frequency specified by the customer:

½ KW AM Dummy Load.....Ohm-spun Type "WG"
1 KW AM Dummy Load.....Ohm-spun Type "WG"
5 KW AM Dummy Load.....Ohm-spun Type "WG"
10 KW AM Dummy Load.....Ohm-spun Type "WG"
50 KW AM Water Cooled Load.....MI-27029-3

FM Dummy Load,
MI-19024-A

The RCA 3-KW R-F Load and Wattmeter is designed for use with BTF-5 FM or VHF transmitters. It is a termination type unit supplied for operation in the 54 to 216 mc frequency range. Channel frequency must be included in ordering information since the equipment is calibrated and adjusted at the factory for a particular frequency. The power dissipating section consists of the load resistor, an intermediate coolant, a heat exchanger, and a flexible RG-19/U cable which fits a 1⅝-inch 51.5 ohm transmission line. The unit is cooled with tap water which enters and leaves the top of the unit through special ½-inch I.P.S. union connections. The unit is designed for wall or rack mounting.

Ordering Information

1 R-F Load Assembly, 1 Wattmeter, and 1 Cable, 10 feet long.....MI-19024-A

Accessory

Reducer, 3⅛" to 1⅝" Coaxial Line.....MI-19112-7

Bowl Insulators,
MI-27723 and MI-27724

For transmitter carrier powers up to and including 50 kilowatts. Bowl Insulator assemblies are ideal for taking r-f leads into or out of antenna tuner or phasing equipment. The bowls of heavy electrical glass measure have a maximum diameter of 6 15/16 inches and are 4⅜ inches high including cork gasket. The steel mounting flange is 7¾ inches in diameter and has six ⅜-inch mounting holes. The insulator comes complete with spun aluminum corona shield, threaded lead-in stud, and all mounting hardware.

The same bowl insulator is available with a hollow stud, for use where it is necessary to carry power lighting wires out of the tuner house on the same insulator which carries the r-f conductor.

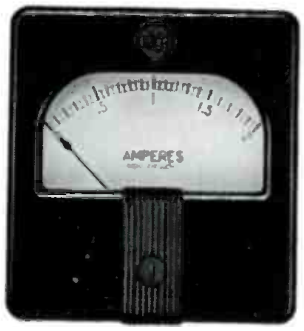
Ordering Information

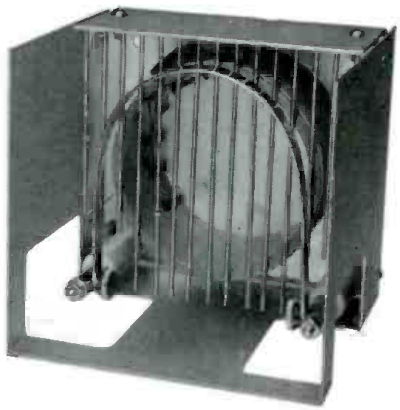
Bowl Insulator, complete with fittings, solid stud and shield.....MI-27723
Bowl Insulator, complete with fittings, hollow stud and shield....MI-27724

REMOTE METERING KITS

DESCRIPTION

RCA Remote Metering Kits provide a means of observing the antenna current at a remote location such as the transmitter house. It is also used with the Automatic Output Control to act as an r-f to d-c current transducer. The kits comprose a Remote R-F Pickup Unit which has been temperature compensated, and a Remote Antenna Meter. Remote R-F Pickup Unit, MI-28027-A, should be specified for metering of base currents up to 50-kw power, and MI-27966 Pickup Unit for metering of base currents up to 5-kw power. The Antenna Meters are black face 3- or 4-inch units in cases designed to match other RCA transmitter meters as specified in the ordering information. These meters have a 1 ma d-c movement, and are available in various scale ranges to match the scale of the antenna ammeter. When ordering, specify desired meter scale.





SPECIFICATIONS

REMOTE METERING KIT

Dimensions	7" high, 7⅜" wide, 5⅜" deep
Sensitivity:	
1-30 Amperes	At 1600 kc
3-30 Amperes	At 540 kc

METER

Dimension	3" and 4" rectangular case
Scale Ranges	0-2, 0-3, 0-5, 0-8, 0-10, 0-15, 0-20, 0-30 amps.
Sensitivity	1 ma. d-c movement

Ordering Information

Remote R-F Pickup Unit (less Meter):	
For base currents to 50-kw power	MI-28027-A
For base currents to 5-kw power	MI-27966
Remote Antenna Current Meter:	
3" Black Scale (for use with BTA-250M)	MI-28037-B
4" Black Scale (for use with BTA-1M, 5G, 10G, 5H, and 10H)	MI-28037
4" Black Scale (for use with BTA-500MX, 1MX, 500R, and 1R)	MI-27644
4" Black Scale (for use with BTA-1R1, 5T, 5U/10U)	MI-27644-A

R-F METERS

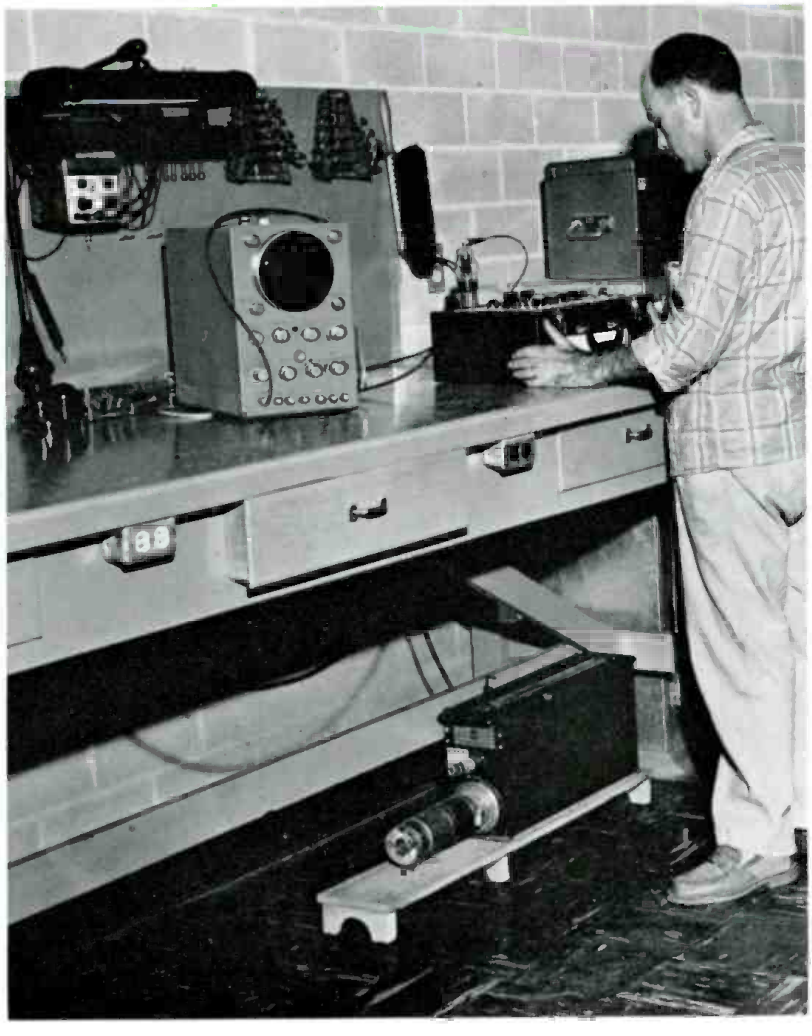
Spare R-F Ammeters furnished with an internal or external thermocouple provide a means of metering antenna base current and transmitter output line current. The meters are calibrated for mounting on ⅛-inch steel panel or housing such as the transmitter or antenna tuning unit.

Three series of meters are available. The MI-7147 Series provides a three-inch, white face meter in rectangular case with expanded scale ranges of 0-2 to 0-20 amperes. It has an internal thermocouple and is designed for use with the BPA Series of Antenna Tuning Units. The MI-28048 Meter Series is similar except for black face. The MI-7157-F Series of R-F Meters have a four-inch square case, black face, and expanded scale ranges of 0-2 to 0-25 amperes. The MI-7157-G Series are similar except cases measure 3½ inches square. Each meter has an external thermocouple. "F" Series meters match those used on the BTA-1M, 1R, and BTA-5H/10H transmitters, and "G" Series meters those on BTA-5U/10U Transmitters.

Ordering Information

3" R-F Meter, 0-2 amp, white face	MI-7147-2
3" R-F Meter, 0-3 amp, white face	MI-7147-3
3" R-F Meter, 0-5 amp, white face	MI-7147-5
3" R-F Meter, 0-8 amp, white face	MI-7147-8
3" R-F Meter, 0-10 amp, white face	MI-7147-10
3" R-F Meter, 0-15 amp, white face	MI-7147-15
3" R-F Meter, 0-20 amp, white face	MI-7147-20
3" R-F Meter, 0-2 amp, black face	MI-28048-2
3" R-F Meter, 0-3 amp, black face	MI-28048-3
3" R-F Meter, 0-5 amp, black face	MI-28048-5
3" R-F Meter, 0-8 amp, black face	MI-28048-8
3" R-F Meter, 0-10 amp, black face	MI-28048-10
4" R-F Meter, 0-2 amp, black face	MI-7157-F2/G2
4" R-F Meter, 0-3 amp, black face	MI-7157-F3/G3
4" R-F Meter, 0-5 amp, black face	MI-7157-F5/G5
4" R-F Meter, 0-8 amp, black face	MI-7157-F8/G8
4" R-F Meter, 0-10 amp, black face	MI-7157-F10/G10
4" R-F Meter, 0-15 amp, black face	MI-7157-F15/G15
4" R-F Meter, 0-20 amp, black face	MI-7157-F20/G20
4" R-F Meter, 0-25 amp, black face	MI-7157-F25/G25

Test and Measuring Recommendations



Selection of Test Equipment

High-quality meosuring, monitoring, ond service test equipment is an importont odjunct of AM, FM and Television stotion ond closed circuit focilities; ond mony items of such equipment are necessory to maintoin broodcast operotions and ossure compliance with FCC stondords. A diversified line of equipment is made ovoiloble by RCA to meet proctically every test and measurement requirement. It is recognized by RCA thot requirements vary in their scope in relotion to the type of operation.

In an effort to assist the Broadcaster in making a proper selection of test and monitoring equipment, typical equipment lists and station rack layouts are presented including basic minimum equipment requirements with helpful suggestions regording optionol ond occessory items.

Informotion in this section is offered only os a generol guide, since individuol requirements will dictote the final selection to be mode. The minimum test ond meosurement equipment suggested for a single AM, FM or television stotion will permit the stotion to perform most all the required measurements. Multiple studio ond control rooms, remote transmitter locotion, transmission link equipment ond other focilities moy demand a greoter voriety and/or additional items of the same equipment. RCA Broadcast Sales Engineers will gladly assist in planning equipment lists to handle the particular maintenance and test requirements for any station, large or small.

Audio Test Facilities for Broadcasting Systems

Test instruments required by the AM or FM Broadcast station to measure audio facilities are largely dictated by the "proof-of-performance" measurements required by the Federal Communications Commission. Such equipment must be sufficient to measure AM and/or FM output noise level, the audio frequency harmonic distortion, and the audio frequency response under normal program operation as defined by the FCC. In addition, the broadcast station will undoubtedly be equipped to make other measurements such as power output, carrier frequency stability, carrier shift, carrier noise level, output voltage, and other systems tests.

The major items of test equipment required to adequately make the above measurements are listed in Table II. It is assumed that the station has complete transmitter audio input and monitoring equipment (see Table I). It is essential to have a good modulation monitor which provides a low-distortion, audio output with sufficient level for feeding a noise and distortion meter.

Typical station layout showing rack of radio test equipment at transmitter.

An integrated test equipment system for performing audio measurements is shown in the accompanying block diagram. The FCC specifies that "all measurements shall be made with the equipment adjusted for normal program operation and shall include all circuits between the main studio microphone terminals and the antenna output, including telephone lines, pre-amplifier circuits and any equalizers employed except for microphones, and without compression, if a compression (limiting) amplifier is installed." The diagram presents such audio elements in the system immediately following the transmission line measuring set and preceding the transmitter.

WA-28A Audio Oscillator

As an audio oscillator in the system, RCA offers the Type WA-28A Low Distortion Push Button Oscillator which is capable of providing a quality tone source for distortion measurements and a power source for bridge measurements at audio frequencies. It features convenient push-button frequency selection, providing 27 frequencies between 20 and 15,000 cycles recommended by the FCC for distortion measurements on broadcast transmitters. Three output impedances are available, and the output voltage may be adjusted.

BI-11A Transmission Measuring Set

The Type BI-11A Transmission Measuring Set serves in the audio system as a calibrated adjustable attenuator, it is a simplified instrument capable of reading directly such system measurements as gain, loss, mismatch loss, frequency response, and measurements on bridging and matching devices, and complex circuits. It meets FCC accuracies and can be a useful device either in the master control room or at the transmitter.

WM-71A Distortion and Noise Meter

RCA's Type WM-71A Distortion and Noise Meter measures audio frequency distortion in transmitters, speech amplifiers, a-f generators, receivers and other devices employing audio frequencies in the range of 50 to 15,000 cycles. Hum and noise components can be measured from 30 to 45,000 cycles. This instrument when used with an oscilloscope identifies individual hum and distortion components, and with linear detectors such as the BW-66F AM monitor or GR-1184-A and HP-335-ER FM and TV modulation and frequency monitor measures distortion and noise characteristics of broadcast transmitters.

Input and Monitoring Equipment

It will be noted that the AM, FM and TV services require different frequency and modulation monitors, which must be selected with regards to the varying frequencies at which they are designed to operate. The RCA Standard BR-19A or BR-84 Rack as shown below contains all the essential equipment needed to fulfill FCC monitoring requirements and necessary input functions.

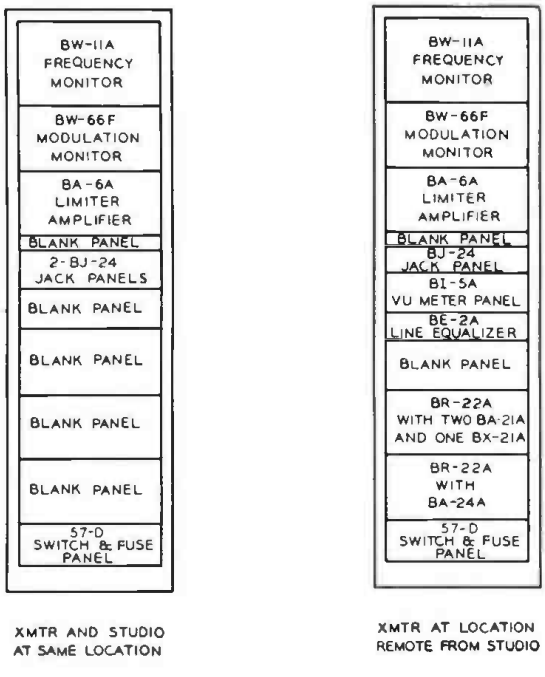
A typical RCA Input and Monitoring Rack may contain, depending on station's requirements:

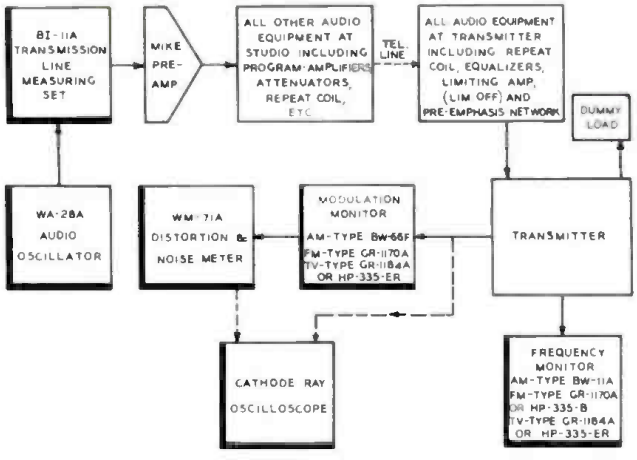
1. The RCA AM Frequency Deviation Monitor, Type BW-11A, which indicates continuously and directly in cycles-per-second any departure from the assigned frequency. It beors FCC approval Number 1471, for use in Stondord Broodcost stations. It has on accuracy of better than ±10 ports per million.

2. The RCA AM Modulation Monitor Type BW-66E gives continuous direct reading indication in percentage of carrier modulation. It will indicate program level, carrier shift, and provide demodulation for distortion and frequency response meosurements.

3. The RCA Limiting Amplifier Type BA-6A serving as an automatic meons of increosing program level while limiting peoks to prevent over-modulation, and adjacent channel interference. This amplifier provides for a more effective use of transmitter power by allowing the system to be operated as near maximum modulation as possible, thus permitting greater coverage at a fixed power input.

Typical rack set-up for station test equipment.





Test set-up for transmitter aural measurements.

4. The RCA Standard Jack Panel Type BJ-24, provided to improve the overall operating flexibility of a Broodcast Station. With the use of patch cords, many combinotions of input ond output circuits can be realized. It can be used freely in emergencies and for test purposes. Spacing of jack pairs prevents cross circuit patching.

5. The RCA Switch and Fuse Panel, Type 57-D, provides master switch and fuses for the rack mounted equipment with a 'power-on' indicator light and removable door for fuse access.

* If studio and transmitter are to be at the same location, some of the following equipments may be desired to increase the efficiency of your operation and can be installed in the Input and Monitoring Equipment Rack:

6. An additional RCA Standard Jack Panel Type BJ-12 or BJ-24.

7. An RCA Monitoring Amplifier Type SA-6A or BA-24A.

8. An RCA VU Meter Panel Type BI-5A.

9. An RCA Line Equalizer.

10. An RCA Utility Amplifier Type BA-12A or BA-21A.

** If Transmitter will be located remotely from your studio, some of the following equipment may be desired and can be installed in the Input and Monitoring Equipment Rack:

6. The RCA Remote Control System Receiver Type BTR-5A for unattended transmitter operation.

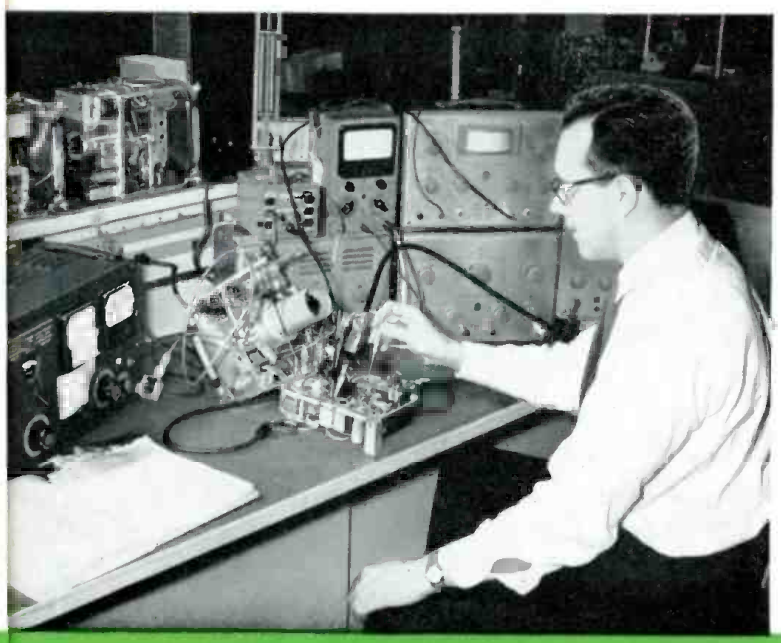
7. An RCA type Monitor Amplifier Type SA-6A or BA-24A.

Other Test Equipment

A suitable cathode-ray oscilloscope is also useful in making the audio measurements. The RCA Type WO-91A scope is recommended for the AM or FM station, but the larger, more versatile TO-524AD oscilloscope is strongly recommended for the TV station since it will generally find use in the video circuits as well as the audio. The scope is required for making measurements at the output of the transmitter as well as following the noise and distortion meter.

While many stations will rely on their consultant or an outside engineering service to run field intensity surveys, some stations may wish to include a good field intensity meter to sample signal strength in their area, and to perform their own measurements on spurious emissions and magnitude of r-f harmonics. A clamp-on ammeter or wattmeter, vaccum tube voltmeter, dummy loads, and r-f signal generator may also find a useful place in the station for making other audio measurements. The RCA Type WV-77C Junior VoltOhmyst is a must for the station test bench and it will be useful for the FM station with such accessories as the Type WG-264 Crystal-Diode Probe, Type WG-289 High Voltage Probe, Type WG-291 Crystal-Diode Demodulator Probe and a set of Multiplier Resistors for the high voltage probe.

Checking overall receiver alignment.



I. Transmitter Audio and Monitoring

Item No.	Quantity Studio	Quantity Remote	MI Number	Description
1.	1	1	30951-B84	Type BR-84B Cabinet Rack
2.	2	2	30566-G84	Single Trim Strip for BR-84B
*3.	1	1	30011-A	Type BW-11A AM Freq. Monitor
*4.	1	1	30066-B	Type BW-66F Mod. Monitor
5.	2	1	11645-A	Type BJ-24 Double Jack Panel
6.	1	—	11647-2	Double Jack Panel Mat
7.	—	1	11647-1	Single Jack Panel Mat
8.	1	1	11225	Type BA-6A Limiting Amplifier
9.	1	1	11289	Tube Kit for BA-6A
10.	1	1	11599	Shelf for BA-6A
11.	1	1	4395-G	Type 57-D Switch and Fuse Panel
12.	1	1	4570-A	Terminal Board Maunt. Bracket
13.	1	1	4568	Terminal Power Strip
14.	1	1	4569	Terminal Audio Block
15.	1000′	1000′	33	Inter. Cable (rack wiring)
16.	1000′	1000′	35	Inter. Cable (a-c and fil. circuits)
17.	3	—	4594-B	Blank Panel, 8¾″
18.	1	—	4592-B	Blank Panel, 5¼″
19.	1	—	4590-B	Blank Panel, 1¾″
20.	—	1	11247	Type BA-24A Monitoring Amp.
21.	—	1	11481	Tube Kit for BA-24A
22.	—	2	11244-A	Type BA-21A Pre-amplifier and Isolation Amplifier
23.	—	2	11482	Tube Kit for BA-21A
24.	—	2	11597	Type BR-22A Panel and Shelf
25.	—	1	11752	Type BE-2A Var. Line Equalizer
26.	—	1	11265-F	Type BI-5A VU Meter Panel
27.	—	1	4593-A	Blank Panel, 7″
28.	—	3	4652-2B	2′ Patch Cord
29.	—	1	11007	Type BK-1A Pressure Microphone
30.	—	1	11008	Type KS-11A Desk Stand
31.	—	1	4630-B	Microphone Cable Plug
32.	—	1	4624-A	Microphone Wall Receptacle
33.	—	1	11833-B	Type BQ-2B Trans. Turntable
34.	—	1	11885-A	Lightweight Tone Arm
35.	—	1	11874-4	1 mil Lightweight Pickup
36.	—	1	11874-5	2.5 mil Lightweight Pickup
37.	—	1	11888	Pickup Equalizer
38.	—	1	11406/11411-A	Type LC-1A Monitoring Speaker
39.	—	1	11317	BX-21A Power Supply

* When used for FM-TV, space occupied will be utilized for FM frequency and modulation monitor, Type GR-1184-A or HP-335-ER.

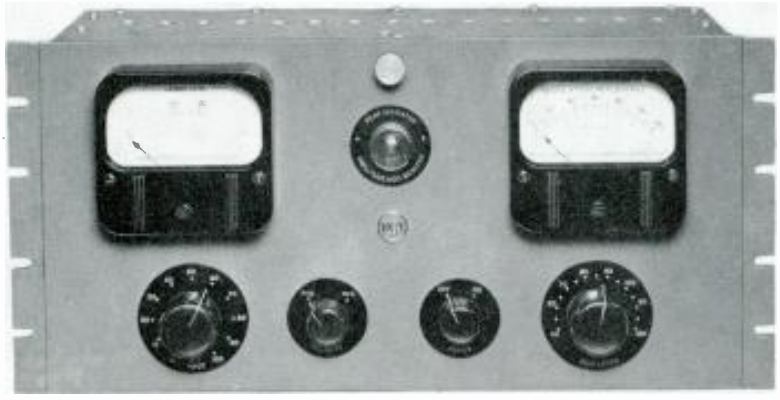
II. Broadcast Audio Test and Measuring

Item No.	Quan.	Type No.	MI Number	Description
1.	1	WA-28A	30028-A	Audio Push Button Oscillator
2.	1	BI-11A	11350	Transmission Measuring Set
3.	1	WM-71A	30071-A	Distortion and Noise Meter
4.	1			*Cathode-Ray Oscilloscope
5.	1	WV-77C		Junior VoltOhmyst
† 6.	1	WG-264		Crystal-Diode Probe
† 7.	1	WG-289		High-Voltage Probe
† 8.	1	WG-291		Crystal-Diode Demodulator Probe
† 9.	1 set			Multiplier Resistors for High Voltage Probe

† Items 6 through 9 are not required for AM testing and service.

AM Modulation Monitor

TYPE BW-66F



FEATURES

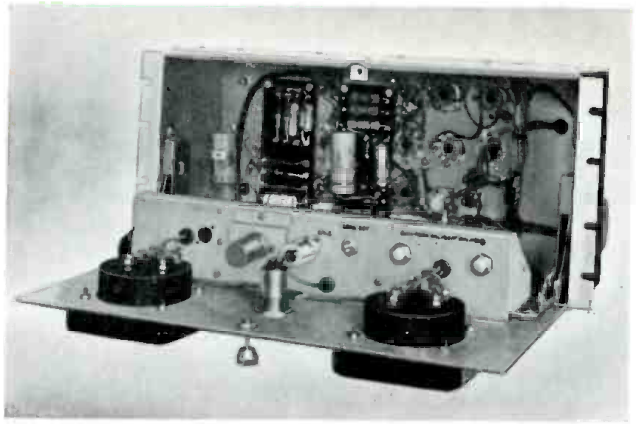
- Operates at low RF input power
- Indicates either positive or negative peaks in percentage modulation and in decibels
- Meets all FCC specifications
- Carrier amplitude shift with modulation can be measured
- High impedance, low distortion output circuit permits use of RCA WM-71A or 69-C Distortion and Noise Meter
- Low impedance, low distortion output circuit for aural monitoring
- Up to four remote meters can be used
- No input circuit to tune, avoiding side-clipping and distortion
- Can be serviced without removal from rack

DESCRIPTION

The RCA Type BW-66F, Modulation Monitor is designed to give continuous direct reading indications of percentage modulation in the carriers of broadcast or other transmitters operating in the range of 500 to 2500 kc. Up to four remote meters may be used for remote transmitter control operations. This Modulation Monitor performs the following specific functions:

1. Measurement of percentage of modulation on either positive or negative peaks.
2. Overmodulation indication.
3. Program level monitoring.
4. Measurement of carrier shift when modulation is applied.
5. Measurement of transmitter audio-frequency response.
6. Contains demodulation for distortion measurements.

The RCA BW-66F consists of three essential elements: (1) A linear diode rectifier which gives an instantaneous output voltage proportional to the carrier envelope, (2) a peak voltmeter which gives a continuous indication of the peak modulation, and (3) a trigger circuit which flashes



BW-66F AM Modulation Monitor with hinged front panel lowered.

a light whenever the modulation momentarily exceeds any previously set value.

The linear rectifier is designed for operation at a low power level, which greatly simplifies the coupling to the transmitter. In the output of the linear rectifier is a d-c meter, which indicates the carrier level at which the instrument is operating and also shows any carrier shift during modulation.

In addition, two auxiliary audio output circuits operating from a separate diode rectifier are provided. One of these at 600 ohms, is intended for audible monitoring; the other, a high-impedance circuit, gives a faithful reproduction of the carrier envelope with less than 0.2 percent distortion. The high impedance output circuit can be connected directly to the RCA WM-17A Distortion and Noise Meter, enabling overall fidelity and noise measurements to be made on the transmitter.

The BW-66F is designed for standard rack mounting. Panel meters indicote both the modulation percentage and the carrier level. Provision is made for connecting a remote alarm, or a counter for recording the periods when the percentage modulation exceeds that desired to be maintained by the station. An over-modulation alarm or flashing lamp is provided to give instant warning when the modulotion exceeds the established level.

The instrument has four conveniently disposed controls mounted upon the front panel. They are the R-F Input Control which is used for adjusting the signal input to the monitor, the Polarity Switch which allows either positive or negative peaks to be measured, depending upon the switch position, the Power Switch permitting the monitor to be turned on or off from the front panel, and the Peak Level Control which is calibrated from 50 to 120 percent modulation and is used for setting the lowest value of percent modulation at which it is desired to have the overmodulation alarm operate.

Two ponel mounting meters having illuminated scales are provided. The carrier meter includes a scale calibrated from 80 to 120 with a red mark at 100. Normal operation is obtained when the pointer is set at this mark and denotes the correct radio frequency input level. The Modulation Percentage Meter has a range of zero to 120 percent and is also calibrated in decibels using 100 percent modulation as zero db. A polarity switch is provided so that either the positive or negative peak values may be measured. The accuracy of measurement of percentage modulation is greater than that required by the FCC, which is ±2 percent at 100 percent modulation and ±4 percent of full scale at any other percentage of modulation. The frequency response of the modulation meter circuit is 30 to 15,000 cps ±½ db. Terminals are provided for connecting one to four remote modulation meters. Two r-f input terminals, a power receptacle and a terminal board for all other connections are mounted on the back of the chassis.

SPECIFICATIONS

Performance Specifications

Carrier Frequency Range	500 to 2500 kc	
Modulation Percentage Range:		
Negative Peaks	0 to 100%	
Positive Peaks	0 to 120%	
Meter Accuracy	Better than ±2% at 100% modulation, or ±4% at any other percentage	
Audio Frequency Response:		
Meter Indication, 30 to 15,000 cps	±0.5 db	
Meter Circuit, 50 to 15,000 cps	±0.1 db	
Audio Output Circuits:	*Monitoring*	*Measuring*
Source Impedance	600 ohms	20,000 ohms
Level at 100% Modulation	1 volt rms	3 volts rms
Response	±1 db, 30-15,000 cy.	±0.5 db, 30-45,000 cy.
Distortion	Less than 1%	Less than 0.2%
Noise Level Below 100% Modulation	Better than 60 db	Better than 70 db
R-F Input Power	0.35 watts min.; 6 watts max.	
R-F Input Impedance, Broadcast Band	Approx. 75 ohms	
Power Supply	110-125 volts, 50/60 cycles, single phase	
Power Input	110 watts	

Tube Complement

2—6AL5	2—884
1—6C4	2—OD3
1—6AQ5	1—5V4G
1—5814	2—1N97 Crystal Diodes

Dimensions	19" wide, 8¾" high, 11" deep
Weight	37 lbs.
Finish	Umber gray
FCC Approval Number	1559

Ordering Information

BW-66F AM Modulation Monitor including tubes in place, 8-foot power cord with plugs, and Instruction Book	MI-30066-B

Accessories

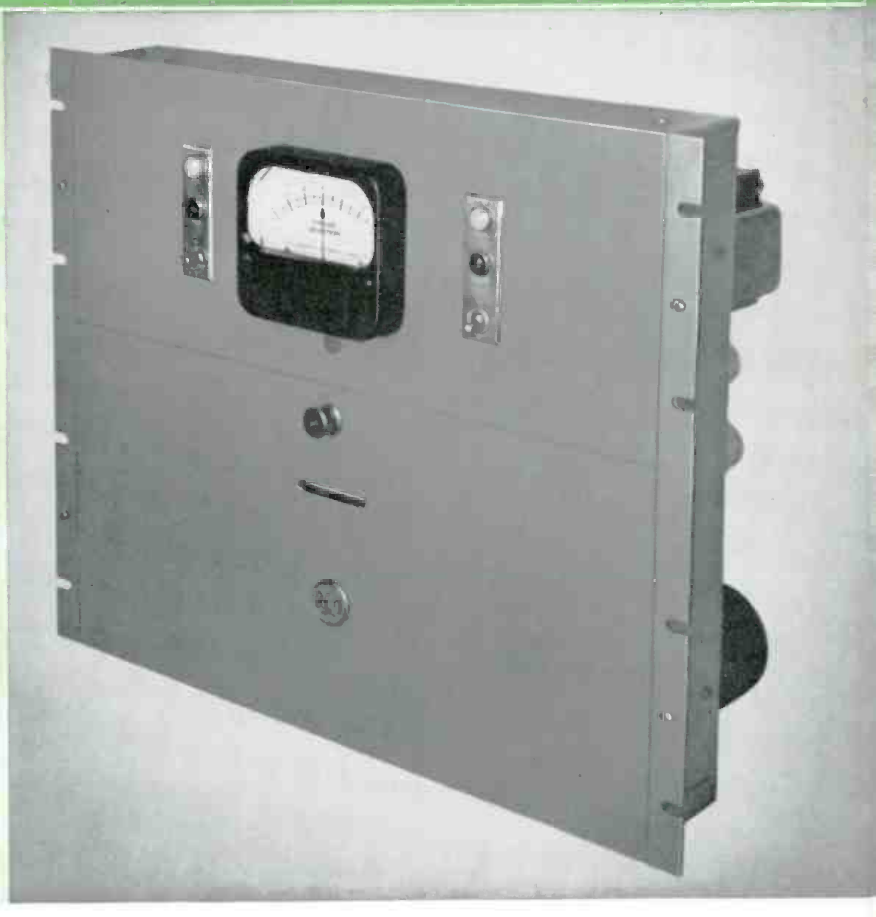
Spare Tube Kit for BW-66F	MI-30450
Remote Meter	Stock #59160

Frequency Monitors

AM TYPE BW-11A AND COLOR TV SUB-CARRIER TYPE BW-11AT

FEATURES

- Continuous reading deviation meter
- Wide input range
- Minimum accuracy at subcarrier frequency ±5 cycles for 1 year
- Protected trimmer adjustments for frequency calibration
- Warning lamp indicates failure of transmitter carrier or monitor crystal oscillator
- Provision for simultaneous operation of remote indicating or recording meter



DESCRIPTION

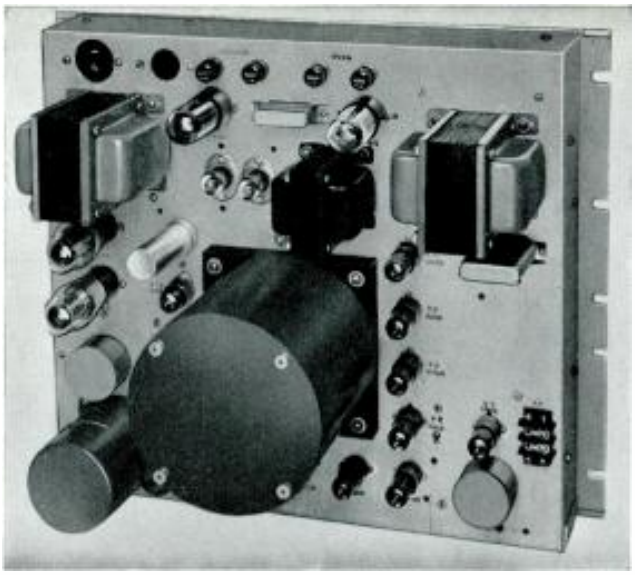
The RCA Frequency Deviation Monitors BW-11A and BW-11AT indicate continuously, and directly in cycles-per-second the magnitude and direction of any departure of the carrier signal from its proper frequency. The two models are used as follows:

1. Type BW-11A for AM broadcast stations to measure departure of the carrier from its assigned channel frequency.
2. Type BW-11AT for TV broadcast stations to measure departure of the color subcarrier from 3.579545 mc standard frequency.

The BW-11A monitor bears FCC approval for use in standard broadcast stations. The BW-11AT more than meets FCC requirement for subcarrier accuracy of ±10 cycles maximum and will provide an accurate and convenient method of calibrating and monitoring the color frequency standard now used by stations originating color programs.

The circuit arrangement of the BW-11A/11AT is shown in the accompanying block diagram. Voltage from a temperature-controlled piezo-electric oscillator (frequency f —1000 cycles) and the carrier to be monitored (frequency $f \pm \Delta f$) are amplified and fed to a converter tube from which their difference frequency (1000 $\pm \Delta f$) is obtained. This audio-frequency is converted to a constant amplitude square wave by means of a limiter amplifier and then restored to a constant amplitude sine wave of frequency (1000 cycles $\pm \Delta f$) by a filter stage. After power amplification the audio frequency is applied to a discriminator and rectifier circuit, from which d-c is obtained. The amplitude and polarity of the d-c is determined by the deviation from 1000 cps. Deviation is indicated on a linearly calibrated zero-center meter with a scale calibration of ±30 cps. A jack is provided for a remote indicating or recording meter, which can be operated simultaneously with the panel meter.

The monitor is a-c operated and is mounted on a single relay rack panel. Coupling of the BW-11A Monitor to the



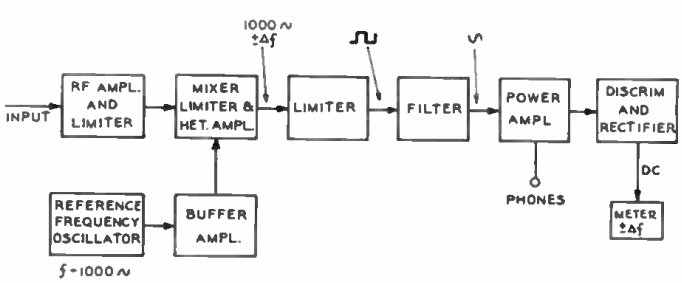
Rear view of BW-11A Frequency Monitor.

transmitter is obtained from a short length of wire attached to the input terminals to act as an antenna. The BW-11AT Monitor's input voltage is obtained by "looping through" a coaxial cable circuit carrying a subcarrier signal.

The oscillator crystal is maintained at a constant temperature by means of a mercury thermostat-controlled oven. Additional isolation against external influences is effected by the use of low heat conductivity wire to the crystal circuits and thermal cutout. No tuning adjustments are required other than the setting of a single capacitor. A wideband amplifier increases the crystal signal uniformly over the frequency range.

Circuits are designed so that wide variations in tube characteristics and line voltage cause negligible error in deviation indications. Negative feedback is used on the power amplifier, and in other circuits, limiting and voltage regulation minimize these effects.

Since the equipment is designed to operate continuously without adjustment, only two switches are provided on the front panel, the monitor toggle switch, and the check pushbutton switch. The monitor switch controls power for all circuits except the oven heater which is thermostatically controlled and functions whenever the power cable is connected to the a-c power source. The check pushbutton switch permits a quick check on all circuits. When the monitor is working normally, and this button is pressed, the meter deflection increases by approximately 5 cps. A change appreciably different from 5 cps indicates a defective circuit.



Schematic block diagram of Type BW-11A/11AT Frequency Deviation Monitor.

The oven thermometer is visible through a slot in the lower section of the front panel and it is illuminated for easy reading. Tubes and crystal oven, located on the back of the chassis, are easily accessible for servicing. The monitor is contained in a single unit which occupies a 15¾-inch vertical space in a standard 19-inch cabinet rack. To facilitate maintenance, the bottom section of the front panel may be lowered and the upper section raised. Lowering the bottom section exposes most of the monitor circuits for continuity checks, and all the routine maintenance controls. The equipment is shipped with all components in place except the crystal. An MI-7982-B Crystal Unit specially ground to 1000 cycles below the transmitter frequency is provided for the BW-11A, and MI-7962-C Crystal Unit especially ground for the subcarrier frequency is specified for the BW-11AT Monitor.

SPECIFICATIONS

Performance Specifications

	Model BW-11A	Model BW-11AT
Frequency Range	500 to 2000 kc	3.579545
Frequency Deviation Range (readable to 1 cycle)	±30 cycles	±30 cycles
Accuracy	±10 parts per million	±1 cy. for 30 days ±5 cy. for 1 year
R-F Input Voltage	Approx. 10 mv to 25 volts	Approx. 0.15 to 25 volts
Power Supply	105-130 volts, 50/60 cycles, single phase	
Power Input	120 watts	
Dimensions	19" wide, 15¾" high, 9⅜" deep	
Weight	60 lbs.	
Finish	Umber gray	
FCC Approval Number for BW-11A	1471	

Tube Complement

5—6AU6
1—6BE6
1—6V6-GT
3—6AL5
2—2D21
1—5Y3-GT
2—OC3/VR105

Ordering Information

BW-11A AM Broadcast Frequency Monitor, including Frequency Monitor (MI-30011-B), complete with tubes in place, 8-foot power cord with plugs, fuses, tuning tool, thermometer, thermostat, Crystal Unit (MI-34070), and instruction booklet ES-34042

BW-11AT Color TV Sub-Carrier Frequency Monitor, including Frequency Monitor (MI-30011-B), complete with tubes in place, 8-foot power cord with plugs, fuses, tuning tool, thermometer, thermostat, Crystal Unit (MI-34075), and instruction booklet ES-34040-A

Accessories

Remote Meter MI-93688
Tube Kit for BW-11A/11AT MI-8295

Frequency Monitor and Modulation Meter

TYPE 335-BR

FEATURES

- Provides accurate check that FM transmitter is operating within FCC specifications
- Operates reliably over long periods of time
- Compact size, requires minimum rack space
- External meters may be remotely located
- Simplified operation, no adjustments necessary during operation
- Continuous indication of broadcast frequency and modulation

DESCRIPTION

The Type 335-BR Frequency and Modulation Meter monitors FM transmitters reliably, accurately, over long periods of time. No adjustments are necessary during operation, and because the instrument does not depend on a tuned circuit, it is not necessary to re-set the carrier level or re-align circuits. The instrument is specifically designed to operate without adjustment week after week. It gives continuous indication of broadcast frequency and of modulation level at all times, and has FCC type approval.

A low-temperature co-efficient crystal, oscillating inside a temperature-controlled oven, provides a reference standard of approximately 5 mc. The output of this crystal oscillator is multiplied 20 times, and mixed with the transmitter frequency to form a 200 kc intermediate frequency. This frequency is fed into electronic counter circuits, which measure the intermediate frequency and thereby indicate th carrier deviation. The linear counter circuits also provide a measurement of percentage modulation as well as

an audio output signal for measurement and monitoring purposes.

The electronic counter circuits are unusually stable, are independent of signal level, tube characteristics and tube voltages, and require no adjustment except at long intervals. To check the accuracy of the counter circuits, a crystal-controlled oscillator at 200 kc is provided. This check is operated by a front-panel switch, and is usually only required at one-week intervals.

The 335-BR includes provision for operation of a remote modulation meter, as well as remote peak modulation indicator lamp. The percentage modulation at which the lamp flashes a warning is adjusted on the front panel.

An audio output signal, provided for measurement purposes, has residual distortion of less than 0.25 percent, and the noise level is at least 75 db below 100 percent modulation at low frequencies. Frequency response is flat within 0.5 db of standard de-emphasis curve, 20 cps to 20 kc. A demodulated signal for remote or local aural monitoring is also provided at 1 VU level.

Simple to install, compact in size, the 335-BR FM monitor can be supplied in a cabinet, or for relay rack mounting. Construction throughout is in accordance with engineering practices proven satisfactory for broadcast equipment. Components are rigidly mounted on bakelite cards; bathtub, mica and oil-filled condensers are used where voltages exceed 50 volts. Instrument is furnished in standard RCA umber gray finish.

SPECIFICATIONS

Frequency Monitor:
- Frequency Range: Any frequency, 88 mc to 108 mc. Supplied with crystal frequency matching customer's transmitter.
- Deviation Range: +3 kc to −3 kc mean frequency deviation
- Accuracy: Deviation indicator accuracy better than ±1000 cps (±.001%)
- Power Required: Approximately 2 watts. Operates satisfactorily at levels above and below 2 watts

Modulation Meter:
- Modulation Range: Meter reads full scale on modulation swing of 100 kc. Scale calibrated to 100% at 75 kc; 133% at 100 kc.
- Accuracy: Within 5% modulation percentage over entire scale
- Meter Characteristics: Meter damped in accordance with FCC requirements. Reads peak value of modulation peak of duration between 40 and 90 milliseconds. Meter returns from full reading to 10% of full value within 500 to 800 milliseconds.
- Frequency Response: Flat within ±½ db from 50 to 15,000 cps
- External Meters: Provision is made for installation of remote meter having full scale sensitivity of 400 microamperes. Scale should indicate 100% modulation at 300 microamperes. Extra meters can be supplied with unit.

Peak Limit Indicator:
- Peak Limit Range: From 50% to 120% modulation (75 kc = 100%). Provision for external peak limit indicators.

Audio Output:
- Frequency Range: 20 cps to 20 kc. Response flat within ±½ db. Equipped with standard 75 microsecond de-emphasis circuit.
- Distortion: Less than 0.25% at 100% modulation
- Output Voltage: 10 volts into 20,000 ohms, at low frequencies (at 100% modulation)
- Noise: At least 75 db below audio output level resulting from 100% modulation at low frequencies

Monitoring Output: 4.0 mw into 600 ohms, balanced, at 100% modulation (at low frequencies)

Tube Complement

2—6AC7	1—6SL7-GT	2—VR-75
1—7F8	1—2050	1—6Y6G
6—6V6	1—5R4GY	1—6SJ7

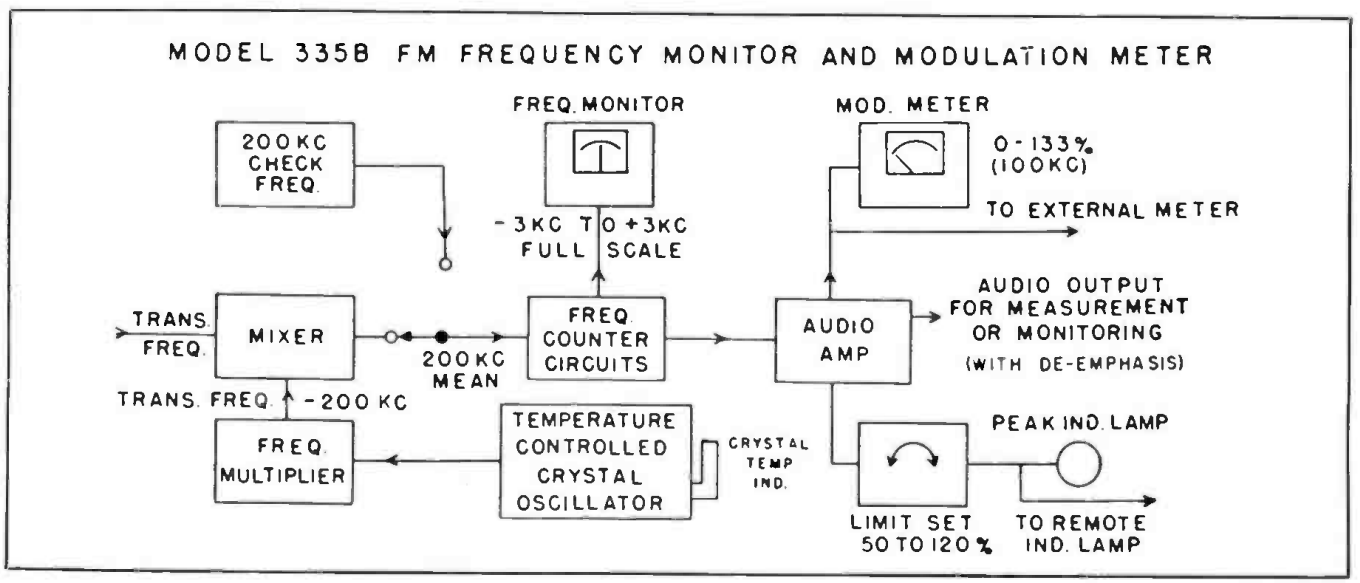
Dimensions (overall): 10½" high x 19" wide x 14½" deep
Weight: 45 lbs. net
Power: 115 volts, ±10 volts, 60 cps, 165 watts

Ordering Information

Hewlett-Packard FM Frequency Deviation and Modulation Monitor with RCA Umber Gray Finish (specify frequency) ..... Model 335-BR

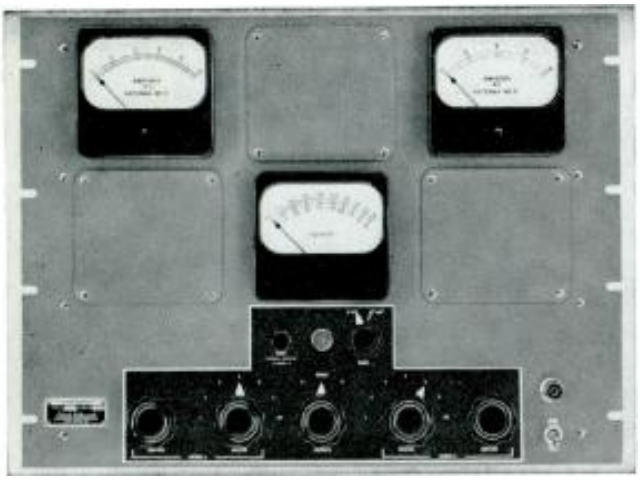
Accessory Equipment

Remote Modulation Meter HP-112-13



Phase Monitor

Model 108-E



FEATURES

- Includes remote antenna current meters
- Tailored to specific station requirements
- Unaffected by modulation
- Low power consumption
- Simplified operation
- Direct phase indication

DESCRIPTION

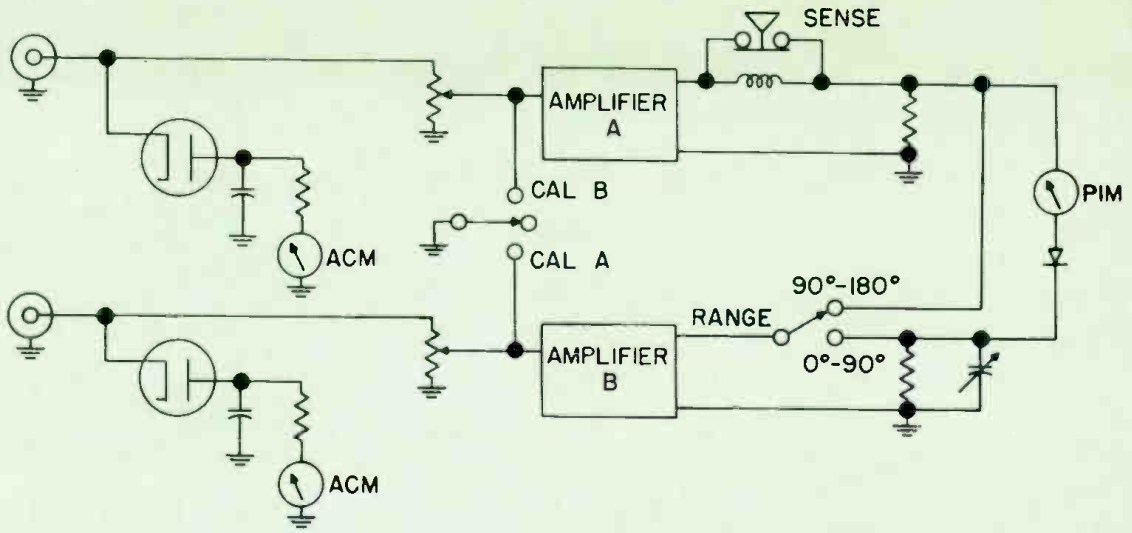
The Phase Monitor, Model 108-E, is an instrument designed to provide an indication of phase relationships in a directional antenna system. Each instrument is tailored for the particular installation and incorporates provision for indicating the relative amplitudes of the currents in the various antennas as well as the phase relation. It is particularly useful in checking the directional arrays to insure proper phasing. Hence proper field pattern can be maintained. The 108-E provides remote indication for arrays employing up to five elements. By using accessory meters it will monitor up to nine towers.

The operation of the instrument is simple. The two Selector switches are set to the two elements to be compared. The outputs of the amplifiers are adjusted to a red mark on the meter. The switch is thrown, and the phase difference is immediately indicated. This indication is not affected by modulation provided 100 percent modulation is not exceeded.

The Model 108-E Phase Monitor is designed to fit in a standard mounting rack. The unit measures 19 inches wide, 14 inches high, and 7 inches deep; and it weighs 20 pounds. When six or more towers are monitored the meters for the extra towers are mounted on a separate 3-meter panel, which adds an additional five inches to the height of the unit. The standard front panel color is umber gray.

Terminals having a nominal value of 51 ohms or 72 ohms, as specified by the user, are provided at the rear of the instrument for connection to the transmission lines from the sampling loops. These terminations are substantially resistive, having a nominal value of 72 ohms or 51 ohms as specified by the customer. The voltage appearing across the termination is rectified by the associated diode, and the direct current resulting from this rectification is metered by the remote antenna meter on the panel of the instrument. The constants of the circuit are so chosen that proportional relationship exists between the current in the regular antenna ammeter and the current flowing in the d-c instrument on the phasemeter panel. Linear rectifiers are employed, and the indication does not vary with modulation as is the case when thermoammeters are used.

By means of selector switches associated with the input to two amplifier channels, the voltage across the termination of any of the transmission lines can be fed to a potentiometer in the grid circuit of either channel's amplifier tube. These potentiometers are used to adjust the amplitudes of the amplifier inputs to provide for equal voltages across



Functional block diagram of the Model 108-E Phase Monitor.

the amplifier outputs. The two amplifier channels feed into a common voltmeter circuit which adds the voltages and gives an indication of the vector sum. Since the outputs of the amplifiers have been individually adjusted to the same value, the channel meter gives an indication directly in degrees. A switching circuit permits the equal outputs of the two amplifiers to be combined in either of two ways. With the Range switch set in the 0-90 degree position the outputs of the amplifiers are combined in series, and the voltmeter reads the vector sum under this condition. With the switch in 90-180 degree position the outputs of the two amplifiers are in parallel, and the meter reads the vector sum under this condition. Provision is made for indicating which one of the two elements being compared has a leading phase angle with respect to the other.

SPECIFICATIONS

Frequency Range	100 kc to 2 mc*
Phase Angle Range	0 to 360 degrees
Monitoring Accuracy	1 degree
Resolution	½ degree
Number of Antennas	2 to 5†
R-F Input Impedance	51 or 72 ohms nominal
R-F Voltage Range	1 to 7 volts
Tube Complement: 2—6AU6, 2—OB3, 1—5Y3, 3—6AL5	
Power Supply	105-125 volts, a-c, single phase
Power Consumption	80 watts
Dimensions	19" wide, 14" high, 7" deep
Weight	20 lbs.
Finish	Umber gray

Ordering Information

Clark Phase Monitor with one set of tubes but no cable plugs; 50 ohm or 70 ohm inputs ..... Model 108-E

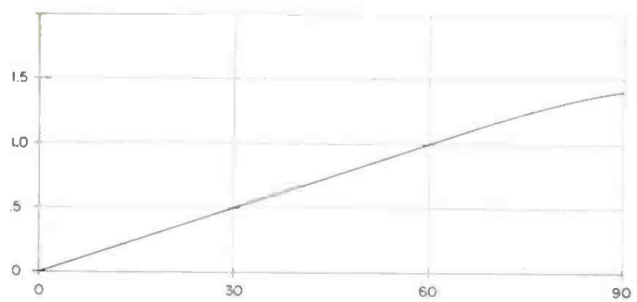
Accessories

Cable Plugs ..... Amphenol #831SP

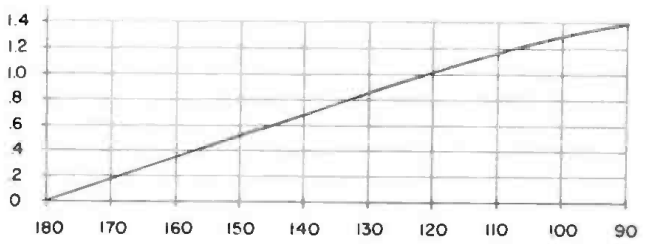
Antenna Meter Scale (order one for each antenna and specify frequency)

* Normally prepared for 540 to 1600 kc, but other ranges can be prepared on special order.

† 3-Meter Panels are available to monitor additional towers.



Voltage as a function of Phase Angle for 0°-90° Range.



Voltage as a function of Phase Angle for 180°-90° Range.

Field Intensity Meter

TYPE WX-2E

FEATURES

- Truly portable—weight, approximately 12½ lbs. including batteries—size approximately 12 x 8½ x 5½ inches
- Reads directly in microvolts per meter —no correction factor charts are needed
- Stable in operation—calibrates readily in presence of strong fields
- Wide sensitivity range—10 microvolts/meter to 10 volts/meter
- Accurate—built-in calibrating oscillator

DESCRIPTION

The type WX-2E Intensity Meter is a small, accurate and truly portable instrument, especially adapted for field use by Broadcast Station Engineers and Consultants. Designed for battery operation, it provides for a wide range of measurement (10 μv/meter to 10 v/meter) in conducting broadcast band (540 to 1600 kc) field intensity surveys. It makes possible close-in measurements on high-powered directional arrays, as well as interference studies where very low signal strengths are encountered.

The Type WX-2E Field Intensity Meter is direct reading in microvolts per meter without the aid or necessity of charts, curves, correction factors, or computations of any kind. In the WX-2E, a statically shielded, unbalanced loop is used as an integral part of the instrument cover. The loop has only a few turns, thus the natural resonant frequency is very much higher than the highest frequency in the operating range. The high side of the loop is loaded with a high "Q" coil to provide the total inductance required for the operating range. Injection of the calibrating voltage into the loop circuit is by means of a small toroidal-wound inductance. The "Q" of the loop circuit is approximately 100 at one megacycle. This high "Q", plus the use of a stage of radio frequency amplification, results in a very high order of image rejection. This feature is desirable since the large increase in the number of stations in some localities has made impractical the use of field intensity meters having insufficient front-end selectivity. By careful design, other spurious responses, such as i-f harmonics, have been greatly reduced. The use of crystal diodes for metering purposes eliminates the meter errors due to varying cathode voltages on thermionic rectifiers. The crystals are used in special circuits which swamp out variations due to temperature, etc. The meter will indicate accurately with filament voltages as low as one volt and plate voltages as low as 45 volts.

Ordinary flashlight cells, obtainable everywhere, are used for the filament. A 67-volt battery of the size in common use in small camera-type radios is used for plate supply. The total plate drain of the receiver is 8 ma. The filament drain is 300 ma. Separate batteries are used for the calibrating oscillator. All batteries are carried in a compartment accessible through a door in the rear of the instrument. Provision is made for checking battery voltages with the same meter as used for field intensity indication.

All tubes are quick-heating filamentary types so that the WX-2E stabilizes within a few seconds, thus it is not necessary to keep the instrument operating between readings. The direct reading feature of the WX-2E simplifies field intensity measurements and eliminates the needs of the usual attenuator readings, meter readings and multiplication factors. A wide sensitivity range, 10 volts per meter to 10 microvolts per meter, permits maximum flexibility of operation within the range of 540 to 1600 kc.

Despite its small size and compactness, nothing has been sacrificed in the way of quality or workmanship. Components of the highest quality are used throughout. The design is such that all components are accessible. Broadcast Station Engineers and Consultants will find that it offers extreme flexibility in use and fills a long-felt need for a light-weight, portable instrument.

SPECIFICATIONS

Performance Specifications

Frequency Range	540-1600 kc
Sensitivity	10 μv/m to 10 v/m (all frequencies)
Power Supply (not supplied with equipment)	2 67½ VB—5 1½ unit cells (RCA VS016)—(RCA VS036A)
Antenna	Built in loop with electro-static shield
Dimensions	9" high, 13" wide, 5¾" deep
Weight (including batteries)	12½ lbs.

Tube Complement

4—1T4 2—1R5

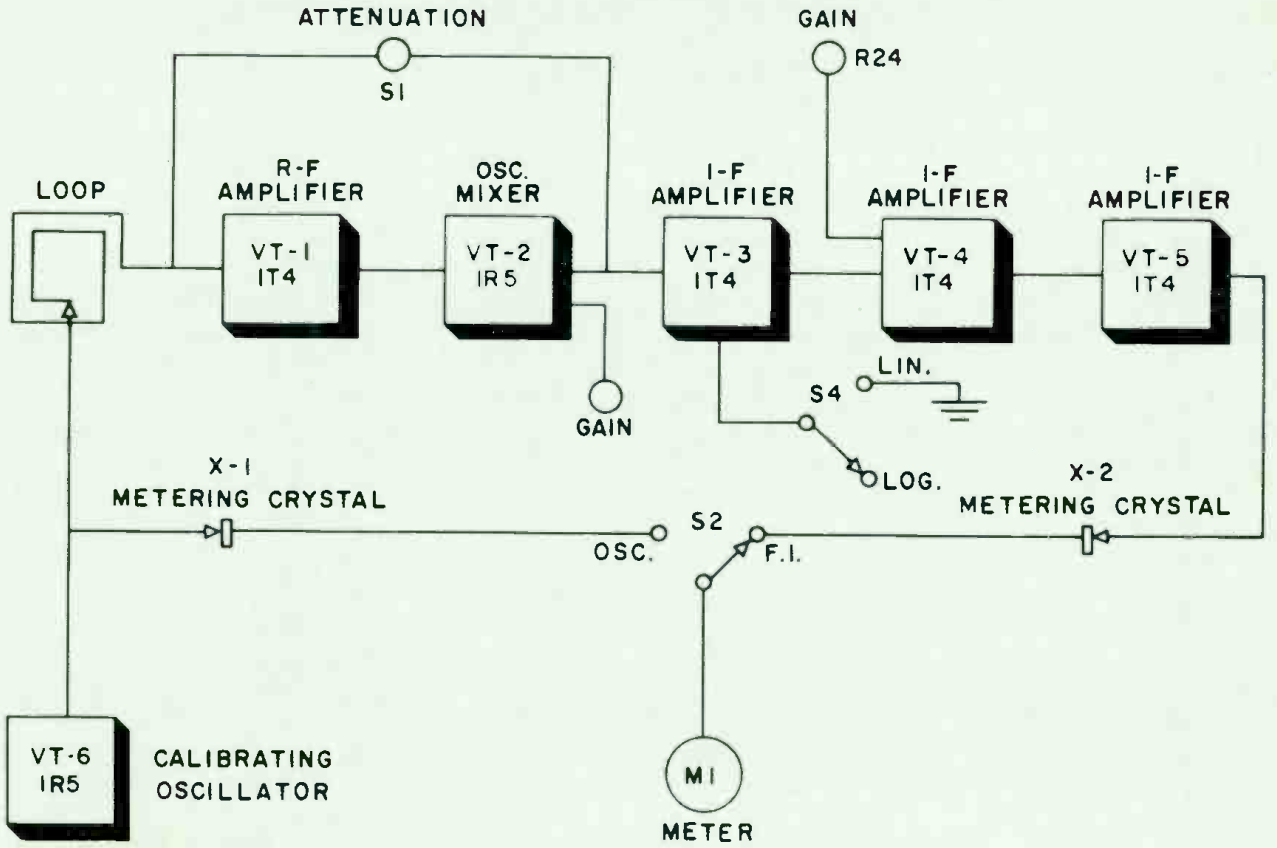
Ordering Information

WX-2E Field Intensity Meter (including electron tubes in place)	MI-30002-E

Accessory

Type 121 Recording Amplifier

Block Diagram, Field Intensity Meter, Type WX-2E.



FM Multiplex Monitor

TYPE BW-73A

FEATURES

- FCC type approved for main channel modulation monitoring
- Modulation meter indicates total modulation of stereo and SCA program material
- Positive and negative peak flasher indication
- Remote metering terminals provided
- Output for stereo adaptor provided
- Measures subcarrier deviation
- Complete station monitoring by addition of accessory frequency meter

DESCRIPTION

The Type BW-73A FM Multiplex Monitor is an RCA engineered test instrument capable of supplying the necessary information to assure the multiplex broadcaster of high quality transmission. The instrument is type approved as an FM Broadcast Modulation Monitor by the FCC (Approval Number 3-118). When used with the McMartin Model TBM-3000 Frequency Monitor, it provides a complete station monitor.

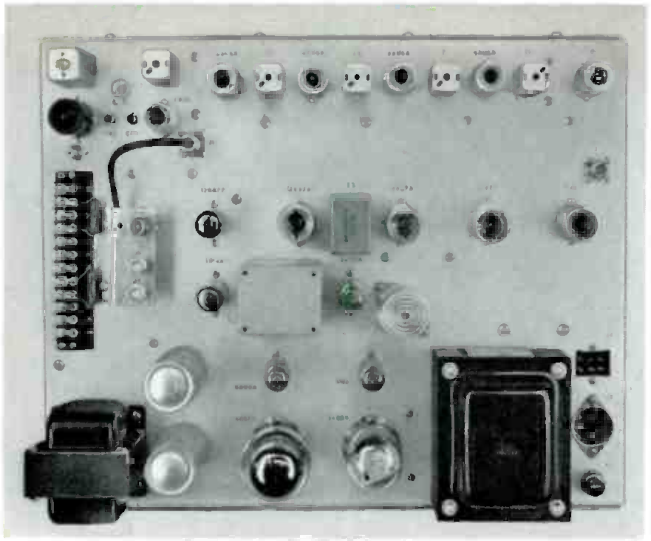
Specifically, the BW-73A will perfarm the fallawing functians: indicate total madulatian on the main carrier, the subcarrier(s) madulation af the main carrier, per cent pragram madulatian an each subcarrier, beep tane madulatian af main carrier, the swing an any external subcarrier, and will measure the RF input level to assure proper operating conditions in the monitor. A front panel flasher lamp with adjustable threshold will indicate modulation peaks in any of the above services. In addition, outputs are available for aural monitoring of the above through phones or station lines. The Monitor will give continuaus indication directly in per cent of main carrier deviation by the subcarrier.

Terminals are provided for the connection of external meters for remote monitoring of all metered functions. A separate output is provided for interconnection of the station's distortion and noise meter. With this set-up, accurate measurements may quickly be made of signal-to-noise, distortion and frequency response. Similarly, the BW-73A will measure main-to-subcarrier as well as subcarrier-to-subcarrier crosstalk.

The Type BW-73A FM Multiplex Monitor is designed to mount in a standard relay rack. The equipment is a self-contained unit mounted on a vertical chassis. All circuits are mounted on the chassis behind a hinged front panel which greatly facilitates maintenance and servicing. Tubes are accessible from the rear. The two meters (modulation and deviation), peak indicator lamp and operating controls are located on the front panel for ease of operatian and manitaring.

The RF input signal is injected on a 50 ohm line and the level adjusted according to meter indicatian. The input level chasen was such that the manitar would be capable af making averall transmitter measurements and yet be relatively insensitive to spurious or unwanted signals. The oscillator is crystal contralled and operates at 10.7 mc above the statian channel. The mixer stage is fallowed by broadband I.F. and discriminator circuitry. The succeeding amplifier output is switch selected for choice of monitoring mode. The subcarrier filters are plug-in units allowing fast convenient changes or additions of subcarriers should the need arise.

The subcarrier chain employs two double anode zener diodes in cascade guaranteeing the stability of the limiting level. At this point, the FM wave is applied to the pulse-counter detector where it is demodulated. Residual subcarrier is removed in the low pass filter and the remaining audio signal drives two separate stages. The first of these de-emphasizes the modulation, and it is this output which may be used for aural monitoring and distortion measure-



Rear View of BW-73A showing accessible components and power supply.

ments in conjunction with an auxiliary distortion and noise meter. The second stage is an amplifier for driving the peak modulation indicator stage and the vacuum tube voltmeter-type modulation meter. The VTVM stage is compensatetd against zero drift. The ballistics characteristics of the meter meet the requirements of the FCC. The electronically regulated power supply is self-contained.

SPECIFICATIONS

Electrical

RF Input:
- Frequency Range ..... 88-108 mc
- Impedance ..... 50 ohms unbalanced
- Sensitivity ..... 2 to 14 volts

Main Carrier:
- Frequency Response (30-15,000 cps) ..... ±0.5 db max.[1]
- Harmonic Distortion (30-15,000 cps) ..... 0.5% max.
- Noise Level ..... −65 db max.[2]
- Frequency Deviation for 100% Mod. ..... ±75 kc

Subcarrier:[3]
- Frequency Response (30-6,000 cps) ..... ±0.5 db max.[1]
- Harmonic Distortion ..... 1% max.
- Noise Level ..... −65 db max.[4]
- Center Frequency Range ..... 30 to 67 kc
- Frequency Deviation for 100% Mod. ..... ±7.5 kc

Outputs:
- Audio Monitoring Circuit:
  - Source Impedance ..... 150 ohms balanced/600 ohms balanced
  - Level ..... 1 volt
- Audio Distortion Meter Circuit:
  - Source Impedance ..... 20,000 ohms
  - Level (at 100% Mod.) ..... 4 volts
- Subcarrier Source Impedance ..... 680 ohms
- Subcarrier Level ..... 0.2 volt[5]
- Stereo Source Impedance ..... 600 ohms
- Power—DC ..... 250 volts regulated, 75 ma
- Power—AC ..... 6.3 volts, 3 amps

[1] Audio Frequency response referred to 75 microsecond de-emphasis curve.
[2] Referred to ±75 kc deviation, 100% modulation, at 400 cps.
[3] For precise measurement of frequency response and distortion above 400 cps, the shorting plug should be in the socket (XZ1 or XZ2) corresponding to the subcarrier under measurement.
[4] Referred to ±7.5 kc deviation, 100% modulation, at 400 cps.
[5] Subcarrier modulated 15% on main carrier.

Modulation Indication:
- Accuracy 5%
- Frequency Response (30 cps to 65 kc) ..... ±1.0 db
- Range ..... 0 to 133%; −10 to +2 db (0 db equal to 100%)

Deviation Indication:
- Accuracy 2%
- Range ..... 0 to 30%

Power Requirements ..... 105-125 volts ac, 50/60 cps single phase, 140 watts

Fuse ..... 3 amps, 3AG

Tube Complement:
1—6AS6, 5—6AU6A, 1—6C4, 3—12AT7, 1—OB2, 2—12AU7A, 2—12AX7A, 1—5814A, 1—5R4GY, 1—6AS7G

Mechanical Specifications

Mounting ..... Standard 19" rack
Dimensions ..... 19" wide, 14" high, 10" deep
Weight ..... 45 lbs.
Finish ..... Light Umber Gray

Equipment Supplied

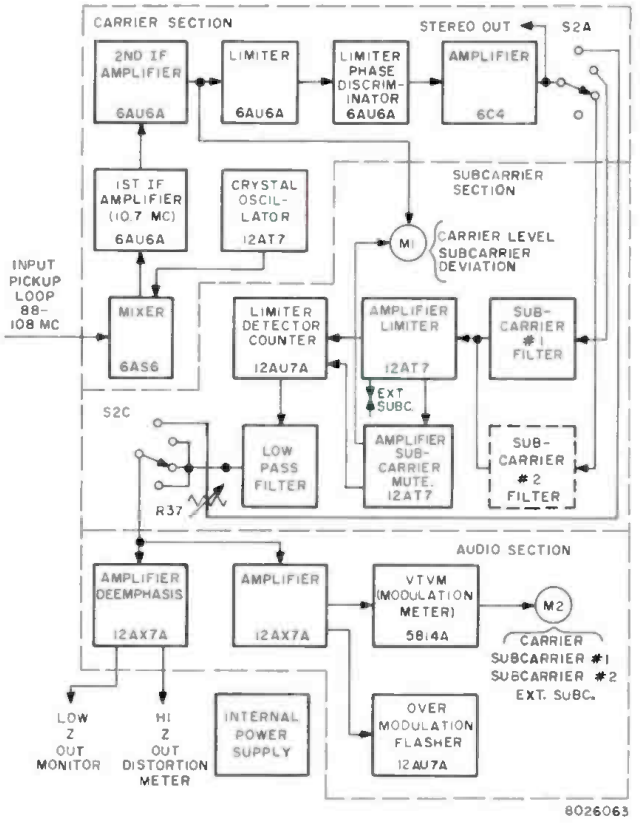
Type BW-73A FM Multiplex Monitor Complete ES-560200-A
Including the following:
- FM Multiplex Monitor MI-560310-A
- Crystal Unit MI-560311*
- Subcarrier Filter MI-560312*

(*Sales order to specify customer's main channel and SCA frequency. Additional subcarrier filter may be ordered separately.)

Accessories

Frequency Monitor ..... McMartin Model TBM-3000
Remote Deviation Meter MI-560313
Remote Modulation Meter MI-560314
Type WM-71A—Distortion and Noise Meter MI-30071-A
Type WA-28A—Push Button Low Distortion Oscillator MI-30028-A

Functional diagram of BW-73A Monitor.



FM Frequency Monitor

TYPE TBM-3000

FEATURES

- FCC type approved
- Separate frequency monitor
- Frequency range 88 to 108 mc
- Stable, accurate, trouble-free performance
- Provisions for external meter
- Provides complete station monitor when used with RCA BW-73A Monitor

DESCRIPTION

The McMartin Model TBM-3000 FM Frequency Monitor is designed to meet FCC requirements for measuring the frequency deviation of an FM broadcast transmitter from its assigned frequency in the range of 88 to 108 mc. The TBM-3000 Monitor, for the first time, provides a separate means of monitoring the frequency of an FM station, thus permitting its use in combination with modulation and deviation monitors of recent design for stereo and SCA use. The RCA BW-73A FM Multpilex Monitor, when used with the TBM-3000 provides a complete FCC approved station monitoring combination.

The TBM-3000 operates by a method wherein the transmitter is monitored by heterodyning the sample of the transmitter output to a standard frequency for measurement. This is done by means of an extremely accurate temperature controlled crystal at a frequency which is multiplied four times in the oscillator circuit. The final frequency is 200 kilocycles below the center frequency of the transmitter, resulting in a 200 kilocycle beat frequency which is limited and shaped to produce a square wave signal. This signal in turn is fed to a full-wave type of diode frequency counter circuit which actuates the frequency indicating meter.

Provisions are made for substituting a precise crystal controlled 200 kilocycle signal in place of the heterodyned transmitter signal to make possible the exact calibration of the frequency counter circuit and meter for zero indication. Then when the heterodyning oscillator is injected, the frequency indicating meter will show the deviation of the transmitter center frequency from zero or the assigned frequency.

The power supply is doubly regulated for stability of operation, and accuracy of measurements. The main power transformer furnishes the filament voltages and high voltages. It is a constant voltage type self-regulating transformer to protect against power line voltage changes effecting either the tube heaters or the high voltage. The high voltage rectifier is of the silicon diode type to obtain trouble-free long life. A single section LC type filter is followed by an electronic gas tube voltage regulator which further stabilizes the high voltages, and attenuates hum and noise from this source.

The entire monitor is accommodated on a chassis designed for standard rack mounting. The front panel accommodates the frequency meter, crystal temperature and power indicating lights, power on-off toggle switch, r-f input calibrate operate functions switch, crystal tuning knob, and a meter-zero control. A 50-ohm coaxial cable is connected from the transmitter monitoring pickup to the coaxial connector at the rear of the monitor. The monitor crystals are special cuts of synthetic crystals which have a very low temperature coefficient maintained at approximately 75 degrees C by the oven. All external connections are bypassed to eliminate stray r-f pickup. An extension meter is available as an optional item.

SPECIFICATIONS

Frequency Range	88 to 108 mc, fixed
Deviation Range	+4 kc to −4 kc of specified frequency
Accuracy	Better than 1000 cps at any frequency
Stability	75 to 150 cps within 24 hours
RF Input	1 to 5 volts at 50 ohms, ½ watt max.
Front Panel Indicators	Modulation meter, AC power (neon), Crystal oven (6 v. incandescent)
Outputs	Provisions for external remote meter optionally available
Tubes and Diodes:	3—6201, 2—6265, 1—5814A, 1—OB2, 1—OA2, 4—1N56
Rectifiers	4 silicon 750 ma at 600 volts
Power Requirements	100-130 volts, a-c, 60 cps, 55 watts
Dimensions Overall	19" wide, 8¾" high, 7½" deep
Weight	18 lbs.
Finish	RCA Umber gray

Ordering Information

FM Frequency Monitor (McMartin)	Type TBM-3000

5-Inch Cathode-Ray Oscilloscope

TYPE WO-91A

FEATURES

- Preset "V" and "H" sweep positions for speedy, automatic lock-in at vertical and horizontal frequencies
- Voltage-calibrated, frequency-compensated, 3-to-1 step attenuator for vertical amplifier
- Simplified, semi-automatic voltage calibration for simultaneous voltage measurement and waveshape display
- Vertical-polarity reversal switch for "upright" or "inverted" trace display
- Sturdy, single-unit, low-capacitance direct probe minimizes circuit loading
- Shielded vertical-input connector and shielded cable for minimizing hum and stray-field pick-up
- Positive-lock internal sync
- Z-Axis input facilities permit direct modulation of the cathode-ray-tube grid

DESCRIPTION

The RCA WO-91A 5-inch Cathode-Ray Oscilloscope is a new, low-cost instrument for use in production and servicing of both black-and-white and color television monitors and receivers. The general construction of the WO-91A makes it a readily portable instrument, useful in such applications as studio maintenance and trouble-shooting, general waveform analysis, adjustments of radio receivers and transmitters, square-wave and general testing of audio equipment, peak-to-peak voltage measurements and observation of vacuum-tube characteristics. The new oscilloscope is a versatile and reliable instrument, well-suited to applications which require a dependable 'scope for extended operating periods.

The WO-91A 5-inch Oscilloscope incorporates several circuit and operational features which greatly increase its versatility and help to speed up TV test and service operations. A primary feature is a front-panel bandwidth selector switch which changes the bandpass of the vertical-amplifier section from wide-band to narrow-band (high-sensitivity) operation. A voltage-calibrated, frequency-compensated vertical-input attenuator, an internal calibrating-voltage source, and a graph screen scaled directly in volts make it possible to use the WO-91A as a visual voltmeter. The unique system of calibrating the graph screen provides for scaling voltages directly from the screen. The measurement procedure is similar to that employed with a vacuum-tube voltmeter.

A feature of special value in television work is the presetting of the sweep positions to provide automatic lock-in on vertical- and horizontal-frequency signals. The sweep-frequency control also is continuously adjustable from 10 cps to 100 kc. The sweep oscillator has excellent stability at high sweep rates, a fast retrace, and adequate linearity throughout its frequency range. The overall frequency range of the oscillator is divided into four basic ranges; a vernier adjustment, which overlaps the basic sweep ranges, provides exact adjustment of the sweep frequency. The amount of sync signal fed to the sweep oscillator may

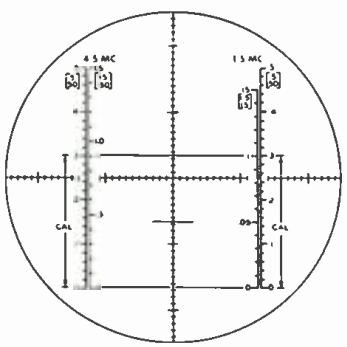
WG-300B Direct/Low Capacitance Probe and cable.

be adjusted by means of a front-panel control. Sweep synchronization is exceptionally stable throughout the sweep range of the oscillator.

A Z-Axis input terminal is provided on the front panel of the WO-91A to permit direct modulation of the control grid of the cathode-ray tube. This is useful in special applications requiring trace blanking and time calibration of the sweep trace. A control switch is also provided for reversing the vertical polarity of the trace. By means of this control, the trace may be displayed in an upright or inverted position.

To facilitate its use, the oscilloscope is equipped with a specially designed single-unit probe and input cable. This WG-300B Direct/Low-Capacitance Probe and Cable is provided with 48-inch long cable completely shielded from microphone connector to probe tip to minimize hum and stray field pick-up. A built-in switch provides instant selection of direct or low-capacitance operation. The probe has an input characteristic of 10 megohms resistance, less than 12.5 $\mu\mu$f capacitance in the low capacitance position. It comes complete with ground lead and clip. A convenient "slip-on" type high-frequency probe is available for use with the WG-300B Probe to permit visual signal tracing for rapid isolation of trouble in r-f, i-f, and v-f stages. It is the WG-302A RF/IF/VF Signal Tracing Probe.

New Graph Screen with "VTVM"-type scales simplifies voltage measurement. Here's how:



"Zero" base line corresponds to "Zero" on VTVM scales.

Vertical scales are multipurpose; full-scale points correspond to switch settings of "V" range control.

Scales are linear and are subdivided into voltage values.

SPECIFICATIONS

Performance Specifications

Frequency Response (reference frequency 10 kc):

Vertical Amplifier:

Wide-Band Positions 10 cps to 4.5 mc.....Within ±1 db

High-Sensitivity Positions 10 cps to 0.5 mc.....Within —1 db

High-Sensitivity Positions 10 cps to 1.5 mc.....Within —6 db

Horizontal Amplifier 10 cps to 500 kc.....Within —6 db

Deflection Sensitivity:

Vertical Amplifier:	*Wide-Band Positions* rms	p/p	*High-Sensitivity Positions* rms	p/p	
At V INPUT Connector.....	0.053	0.15	0.018	0.05	volt/in
With WG-300B set to "DIRECT"	0.053	0.15	0.018	0.05	volt/in
With WG-300B set to "LOW CAP"	0.53	1.5	0.18	0.5	volt/in

Horizontal Amplifier at H INPUT terminal.....0.15 rms volt/in

Average Rise Time (Vertical Amplifier):

4.5 MC Positions.....0.1 μsec

1.5 MC Positions.....0.5 μsec

Maximum A-C Input Voltage (in presence of 600 volts d-c).....600 p/p volts

Input Resistance and Capacitance:

Vertical Amplifier:

At V INPUT Connector.....1 megahm shunted by 40 $\mu\mu$f

With WG-300B set to "DIRECT".....1 megohm shunted by 75 $\mu\mu$f

With WG-300B set to "LOW CAP"..10 meghoms shunted by 11 $\mu\mu$f

Horizontal Amplifiers (at H INPUT terminal).....10 megohms shunted by 30 $\mu\mu$f

Sync Input Terminal.....0.5 megohm shunted by 35 $\mu\mu$f

Sweep-Circuit Frequency (variable).....10 to 100,000 cps

Z-Axis Input:

Minimum Input Voltage for Blanking.....12 rms volts

Frequency Response.....3 cps to 500 kc

Tube Complement

1—6AN8	1—12AT7	1—12AX7	1—1V2
2—6J6	1—12AU7	1—5Y3-GT	1—5UP1

Power Supply.....105-125 volts, 50/60 cycles

Power Input.....65 watts

Dimensions.....13½" high, 9" wide, 16½" deep Weight.....30 lbs.

Finish.....Blue-gray hammeroid case, brushed-aluminum panel

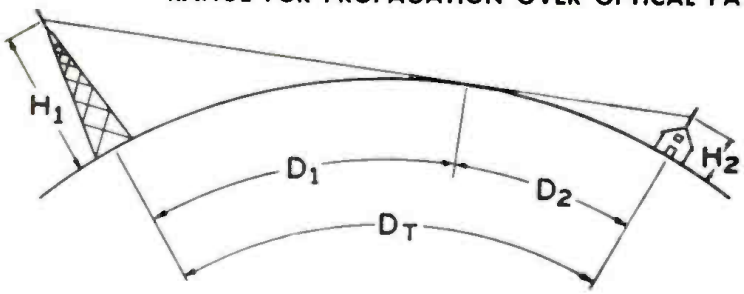
Ordering Information

Type WO-91A 5" Cathode-Ray Oscillascope, including tubes in place, WG-300B direct/low-capacitance probe and cable, alligator clip, clip insulator, ground cable, green groph screen, and instruction book.....MI-40439

Accessory

RF-IF-VS Signol-Tracing Probe for WO-91A.....WG-302A

RANGE FOR PROPAGATION OVER OPTICAL PATH HORIZON CALCULATIONS

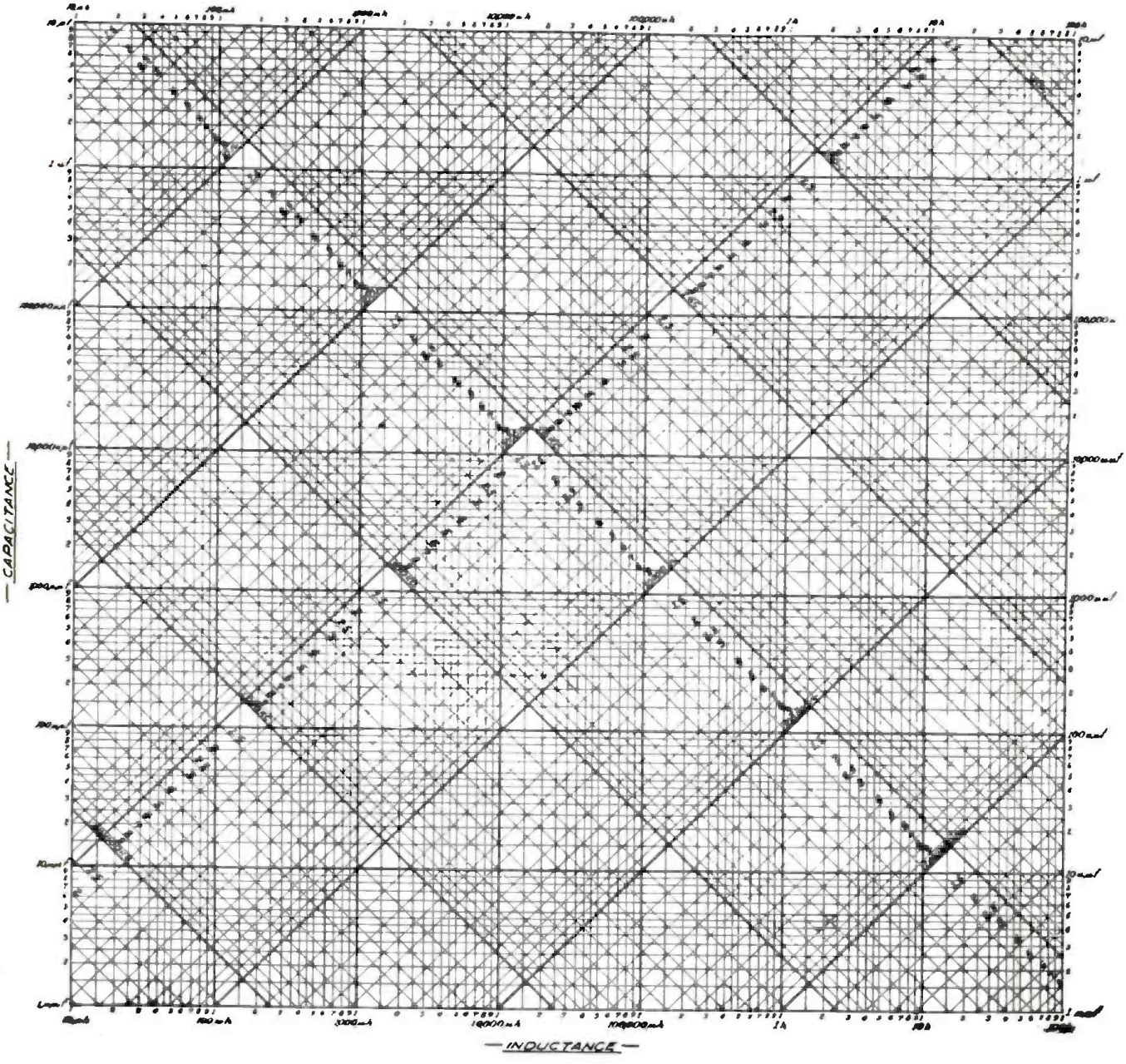


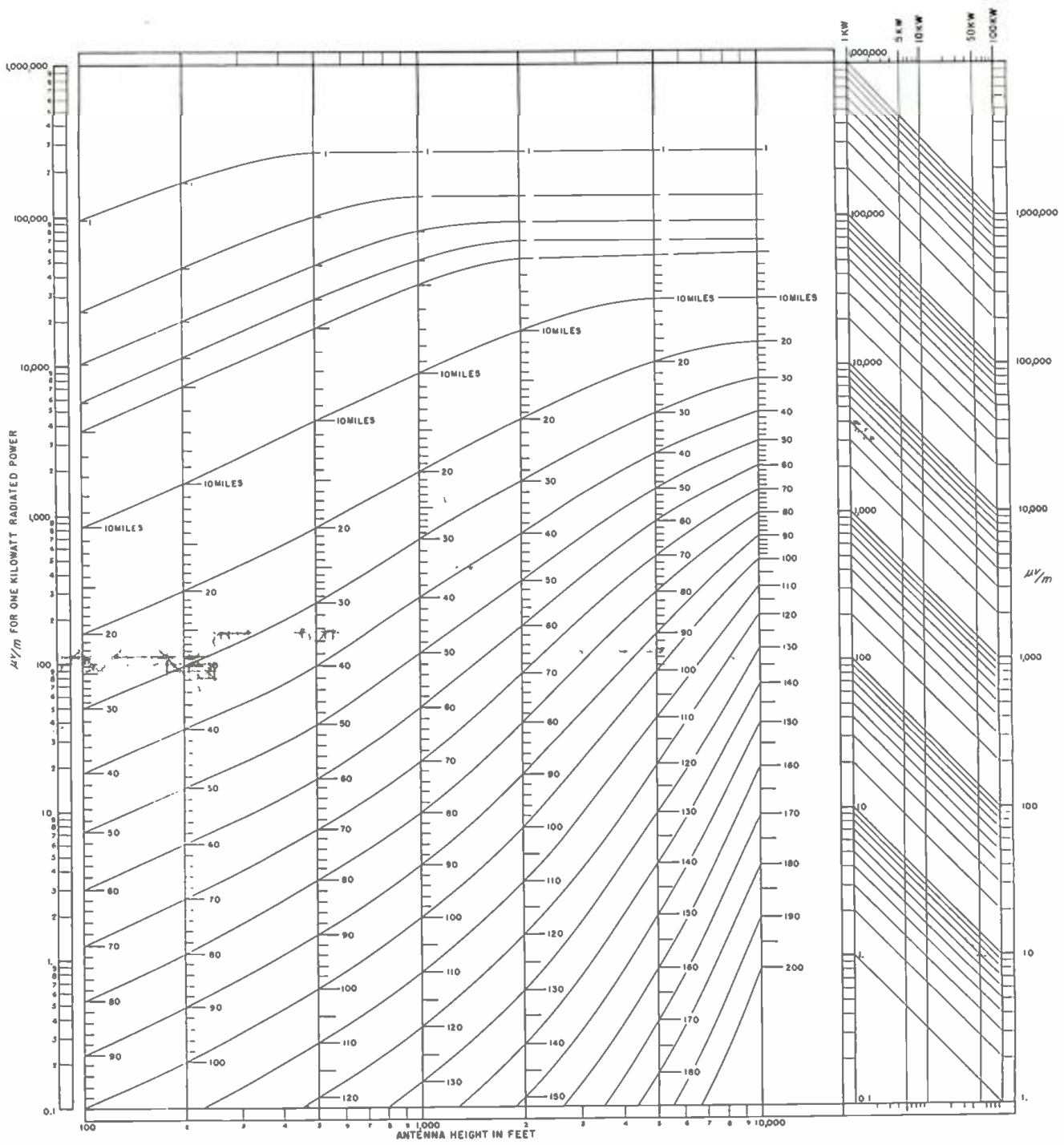
$$D_1 = K\sqrt{H_1} \qquad D_2 = K\sqrt{H_2}$$

$$D_T = D_1 + D_2 = K\left[\sqrt{H_1} + \sqrt{H_2}\right]$$

K = 1.22 WHERE "D" IS IN MILES AND "H" IS IN FEET
K = 3.57 WHERE "D" IS IN KILOMETERS AND "H" IS IN METERS
THE ABOVE FORMULAE NEGLECT REFRACTION AND DIFFRACTION

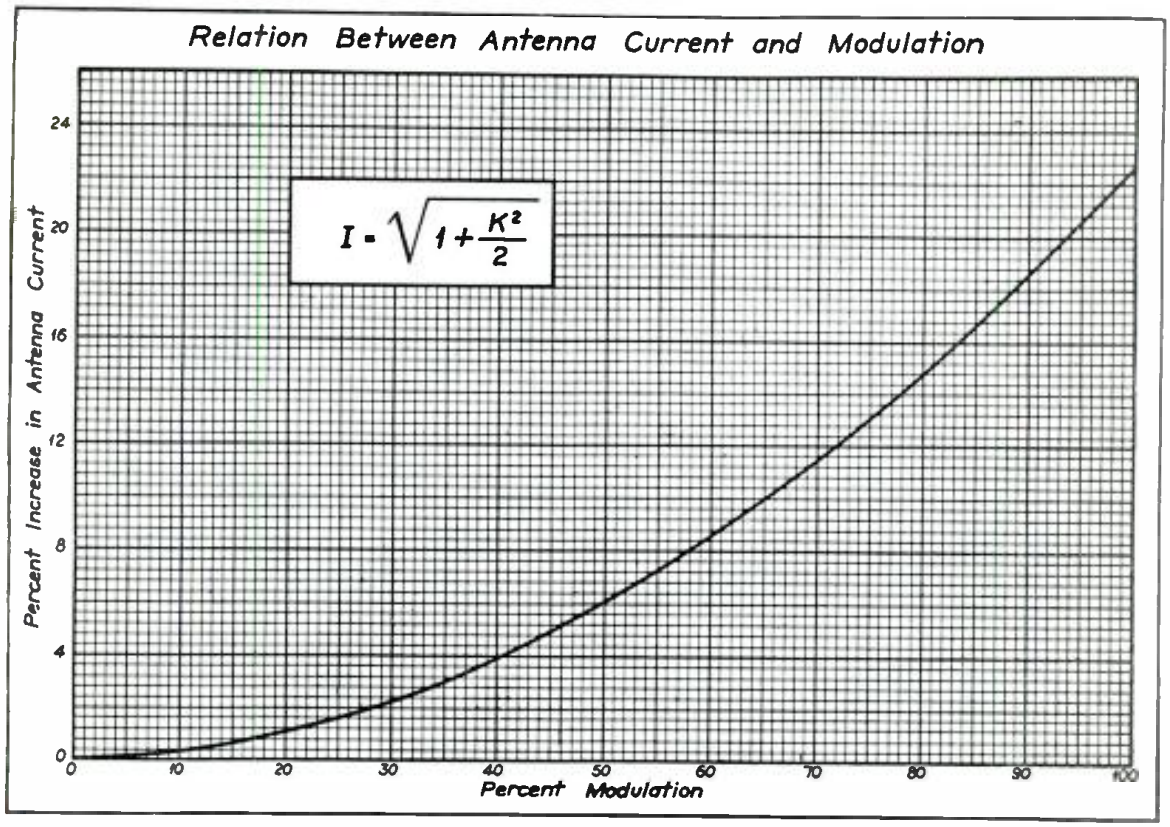
CHART of FREQUENCY or IMPEDANCE vs INDUCTANCE and CAPACITANCE

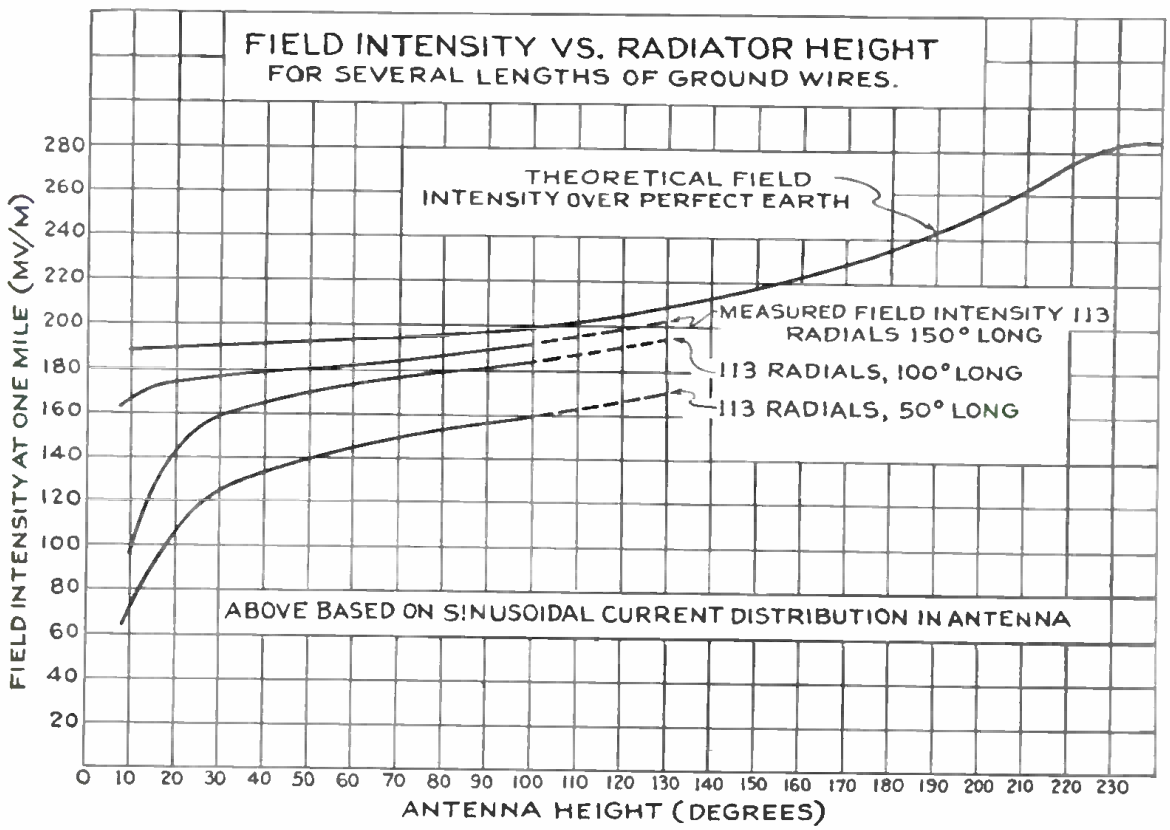




GROUND WAVE SIGNAL RANGE FOR FM BROADCASTING

98 mc, $\sigma = 5 \times 10^{-14}$ e.m.u., $\epsilon = 15$, RECEIVING ANTENNA HEIGHT 30 FEET
FOR HORIZONTAL (AND APPROX. FOR VERTICAL) POLARIZATION





EFFECT OF GROUND WIRES ON FIELD STRENGTH

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TEST AND MEASURING EQUIPMENT

DATA SECTION

RCA BROADCAST SALES OFFICES

Atlanta 3, Ga.
1121 Rhodes-Haverty Bldg., 524-7703

Austin 3, Texas
4605 Laurel Canyon Drive, Glendale 3-8233

Burbank, Calif.
2700 Olive Avenue, 849-6741

Dedham, Mass.
886 Washington Street, Davis 6-8850

Camden 2, N. J.
Front & Cooper Streets, Woodlawn 3-8000

Charlotte 4, N. C.
504 Charlottetown Mall, 333-3996

Chicago 54, Ill.
1186 Merchandise Mart Plaza, 467-5900

Cleveland 15, Ohio
1600 Keith Bldg., Cherry 1-3450

Dallas 35, Texas
7901 Carpenter Freeway, Melrose 1-3050

Plymouth, Mich.
41225 Plymouth Road, 427-9300

Indianapolis, Ind.
501 N. LaSalle Street, Melrose 6-5321

Kansas City 15, Mo.
7711 State Line Road, Emerson 1-6770

New York 20, N. Y.
36 W. 49th Street, MU 9-7200

Portland 12, Ore.
1841 N.E. Couch Street, Belmont 4-7297

San Francisco 2, Calif.
420 Taylor Street, Ordway 3-8027

Seattle 4, Wash.
2250 First Avenue, South, Main 2-8350

Washington 6, D. C.
1725 K Street, N. W., Federal 7-8500

West Palm Beach, Fla.
645 South Military Trail

RADIO CORPORATION OF AMERICA
BROADCAST & TELEVISION EQUIPMENT **CAMDEN, NEW JERSEY**

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