



**B R O A D C A S T**

# **TRANSMITTING**

**E Q U I P M E N T**

*for*

**AM and FM**



AM TRANSMITTERS

REMOTE CONTROL

PHASING

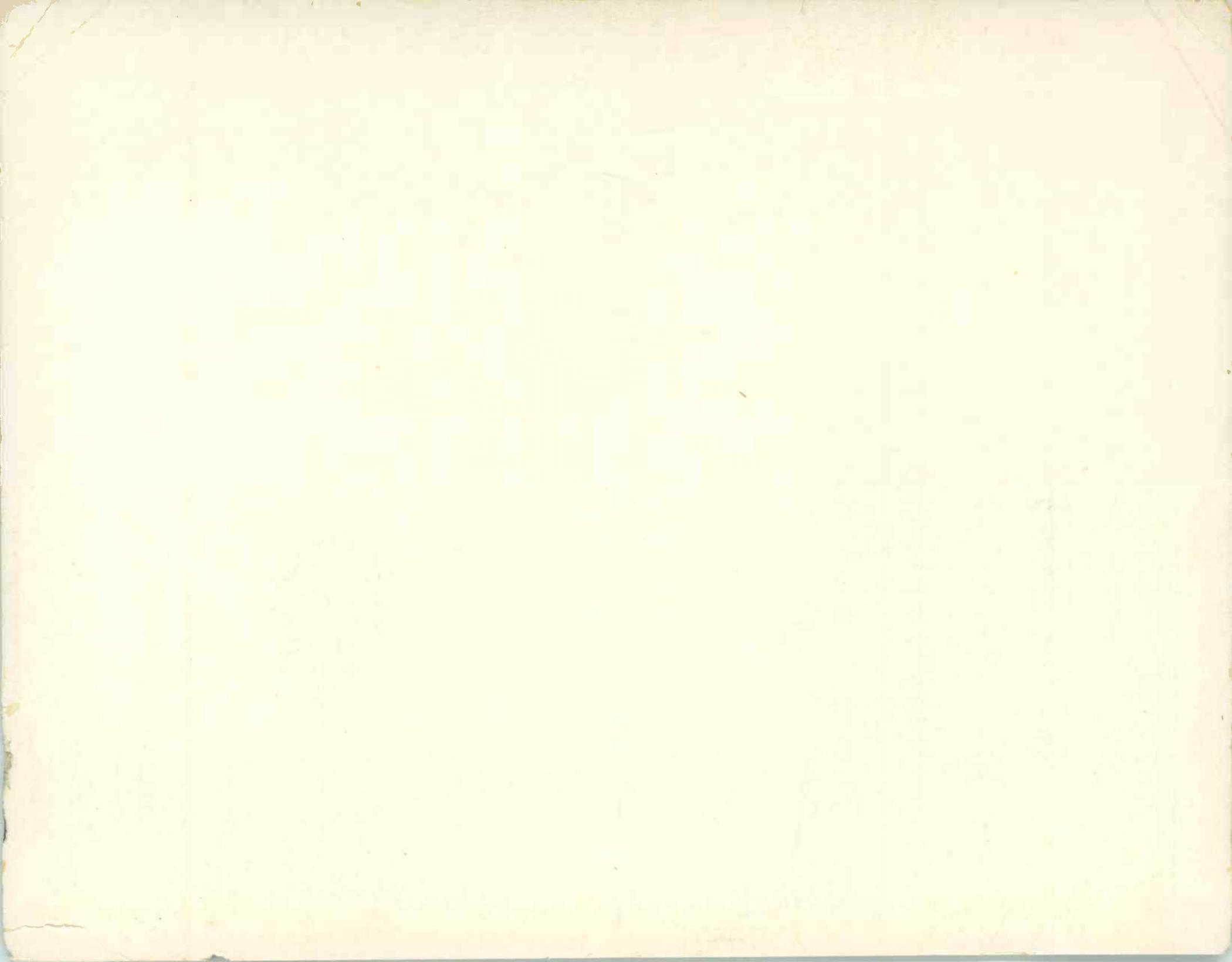
LINE TERMINATING

INPUT & MONITORING

TRANSMISSION LINES

TOWERS

ACCESSORIES



# **BROADCAST AM-FM TRANSMITTING EQUIPMENT CATALOG**

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BROADCAST EQUIPMENT SECTION

**RADIO CORPORATION OF AMERICA**

Engineering Products Division

Camden, N. J.

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## **ABOUT THIS CATALOG**

This Catalog is devoted solely to information on RCA Radio Broadcast equipment designed especially for broadcast station use. Other RCA Broadcast Equipment Catalogs contain similar information on video equipment, audio equipment, test equipment, TV transmitters, color TV equipment, antennas, transmission line equipment and accessories.

The information contained in this catalog is intended to serve as a buying guide for the users of this type of equipment. In the belief that broadcast engineers want facts, rather than generalities, the content has purposely been kept brief and factual. Readers who desire more information or individual bulletins on particular equipment items are invited to write to the RCA Broadcast Representative in the RCA Regional Office nearest them (see opposite page).

### **OTHER RCA TECHNICAL PRODUCTS**

The RCA equipment described in this catalog is specifically designed for broadcast station use. In similar manner RCA builds electronic equipment for many other industries. These include: a complete line of equipment for theatres; optical and magnetic film recording equipment; sound systems of all types; 16mm projectors and magnetic recorders; high-fidelity components for home music systems; 2-way radio and microwave communication equipment; industrial inspection equipment; scientific equipment, such as the electron microscope; industrial television systems; intercoms; tape recorders; TV Eye; Antenaplex systems; and many types of custom-built equipment for industry and the military services. Information, and catalogs or bulletins, describing these may be obtained from RCA Regional Offices.

# HOW TO ORDER

The RCA Radio Broadcast Equipment shown in this catalog is sold directly through RCA Broadcast Representatives, who are familiar with broadcast equipment and related problems. One or more of these RCA Representatives are located in each of the RCA Regional Offices listed below.

Orders for equipment shown in this catalog, or requests for additional information, should be directed to the nearest one of these offices. Complete information on the conditions under which RCA sells broadcast equipment is given on the following page.

## 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.

YOU CAN LOCATE YOUR NEAREST RCA REPRESENTATIVE FROM THIS LIST

## REGIONAL OFFICES

**ATLANTA 3, GEORGIA**  
522-533 Forsyth Building  
Lamar 7703

**CLEVELAND 15, OHIO**  
718 Keith Building  
Cherry 1-3450

**NEW YORK 20, NEW YORK**  
35 West 49th Street  
Circle 6-4030

**BOSTON 16, MASSACHUSETTS**  
200 Berkeley Street  
Hubbard 2-1700

**DALLAS 1, TEXAS**  
1907-11 McKinney Avenue  
Riverside 1371-2-3

**SAN FRANCISCO 3, CALIFORNIA**  
1355 Market Street  
Hemlock 1-8300

**CAMDEN 2, NEW JERSEY**  
Front and Cooper Streets  
Woodlawn 3-8000

**HOLLYWOOD 28, CALIFORNIA**  
1560 North Vine Street  
Hollywood 9-2154

**SEATTLE 4, WASHINGTON**  
2250 First Avenue, South  
Main 8350

**CHICAGO 11, ILLINOIS**  
666 North Lake Shore Drive  
Delaware 7-0700

**KANSAS CITY 6, MISSOURI**  
1006 Grand Avenue  
Harrison 6480-1-2

**WASHINGTON 6, D. C.**  
1625 K Street, N. W.  
District 7-1260

# BROADCAST EQUIPMENT SALES POLICY

## FOREWORD

The present statement sets forth basic conditions under which RCA sells broadcast equipment as described in our catalog, and notes certain supplemental information. This statement does not apply to the sale of tubes or sound film recording equipment, for which separate standard sales and lease policies are in effect.

RCA broadcast equipment is sold directly through RCA Regional Representatives, who are familiar with broadcast equipment and related problems.

## CONTRACT PROCEDURE

All sales based on orders for transmitters, antennas and custom built or special apparatus and on orders over \$5,000 are made in accordance with the conditions of the RCA Standard Proposal Form for the sale of broadcast equipment and with any agreement stipulated thereon for individual customers.

## PRICES

RCA broadcast equipment domestic prices are net f.o.b. factory or warehouse, which is Camden, New Jersey, for most items. These prices do not include any federal, state or local taxes based upon use or measured by sale or use and unless otherwise noted do not include federal excise tax. Any such taxes in effect at the time of shipment will be billed separately or will be included in the prices when required and will be due and payable upon delivery.

RCA's prices do not include installation or installation supervision unless specifically mentioned in a written condition or proposal. Purchaser assumes responsibility for installation and operation of the equipment as well as for obtaining all necessary licenses, permits, etc.

NOTE: The service of factory trained personnel who are specialists in the supervision of the installation of broadcast equipment and in its maintenance and repair may be obtained through an order placed with the RCA Service Company, Inc. It is recommended that the advantages of this service be considered at the time of purchase of any major broadcast equipment.

In the case of orders under the Standard Proposal Form the billing prices are based on those prices effective at the date of the order to the extent indicated in the final contract. In the case of orders not under the Standard Proposal Form the billing prices are those prices in effect on the date of shipment.

RCA endeavors to keep its published prices current; however, all published prices are subject to change without notice.

Prices for items marked with a symbol (e) in the price column are estimates only and are subject to adjustment to those in effect on the date of shipment.

In the event the estimated prices quoted herein are exceeded by more than 10% and the billing price cannot be established by mutual agreement prior to shipment, such items may be cancelled without liability to RCA or Purchaser by either party giving written notice to the other.

## PAYMENT

Terms of payment are subject to approval of RCA's Credit Department at Camden, New Jersey.

## DELIVERY

RCA's delivery of broadcast equipment will be f.o.b. factory or warehouse, which is Camden, New Jersey for most items. The Purchaser shall be responsible for all transportation charges, and shipments will normally be forwarded with shipping charges "collect". As an accommodation, when specifically requested to do so by the Purchaser's order, RCA will prepay transportation charges and invoice them to the Purchaser as a separate item.

Delivery will be made to a carrier specified by the Purchaser, unless none is specified, in which event it will be to common carrier selected by RCA. In the absence of specific routing instructions from the purchaser, RCA's judgment with respect to the selection of a route will be final.

As a special service with respect to shipments overland, by inland waterways or by air we carry All Risk Transportation Insurance for the benefit of our Broadcast Equipment customers, and your interests will be amply protected in all shipments of equipment while in transit by the methods indicated above, at no additional expense to you, pro-

vided that you inspect all shipments upon receipt and report any shortages or damages at once, in writing, to the carrier and to RCA.

RCA will endeavor to meet delivery schedules but it assumes no liability for damages of whatever kind for delays in delivery. No delays in delivery shall relieve the purchaser of his obligation of performance.

## PATENT LICENSES

RCA broadcast equipment is licensed for radio telephone or television broadcast transmission under United States patents owned by RCA or under United States patents under which RCA is licensed.

## PATENT PROTECTION

RCA, at its own expense, will defend any suit which may be brought against purchaser for infringement of United States patents by the equipment furnished when sold or used for radio telephone or television broadcast transmission, and in any such suit will satisfy any final award for such infringement. This is upon the condition that purchaser gives RCA prompt notice of such suit and full right and opportunity to conduct the defense thereof, together with full information and all reasonable cooperation, and upon the further condition that the claimed infringement does not result from the combination of the equipment furnished with other equipment, apparatus, or devices not furnished by RCA. No costs or expenses shall be incurred for the account of RCA without its written consent. If purchaser's sale or use of such equipment for radio telephone or television broadcast shall be prevented by permanent injunction, RCA shall substitute for the infringing equipment or parts other equally suitable equipment or parts, or at RCA's option obtain for purchaser the right to sell or continue the use of such equipment, or at RCA's option take back such equipment and refund any sums purchaser has paid RCA therefor, less a reasonable amount for use, damage and obsolescence.

## WARRANTY

We warrant the equipment of our manufacture (except electron tubes) purchased by you hereunder to be free from defects in material and workmanship under normal use and service for a period of one (1) year, our obligations under this warranty being limited to the repair or replacement of such parts which our examination shall disclose to our satisfaction to have been thus defective and to the shipment of the repaired or replacement part or parts to you f.o.b. our factory. This warranty shall not apply to, and RCA shall not be responsible for, any equipment or part which has been repaired or altered in any way that, in our judgment, affects its stability or its reliability, nor which has been subject to misuse, negligence or accident, nor which has had any serial number altered, defaced or removed. Electron tubes shall bear only the warranty accompanying them at the time of delivery to you and equipment furnished by us but listed herein as manufactured by another shall bear only the warranty given by such other manufacturer. No warranties other than those set forth in this paragraph are given or are to be implied with respect to the equipment furnished hereunder.

## REPAIRED AND RETURNED APPARATUS

Before an apparatus is returned to RCA for repairs or adjustments shipping instructions and an identifying number should be obtained from the nearest RCA Regional Office. RCA assumes no responsibility for unauthorized returns.

## EQUIPMENT MODIFICATIONS AND WITHDRAWALS

RCA reserves the right to make, without notice, modifications of the equipment described in this catalog without affecting its right to sell such equipment under orders based on the catalog description, provided, however, that the modifications shall not materially affect performance. These modifications of equipment may be made by RCA or its suppliers from time to time for reasons such as improvement in performance, simplification in design, or availability of material. RCA also reserves the right to withdraw from sale, without notice, any equipment described in our catalog.

## ACCEPTANCE OF ORDER

No order shall be binding upon RCA until accepted by it in writing at Camden, New Jersey, and the banking, negotiation or other use of the down payment shall not constitute an acceptance by RCA. Orders received by Regional Offices will be forwarded promptly to RCA's Camden office.

# 250 WATT AM BROADCAST TRANSMITTER

TYPE BTA-250M

## FEATURES

- Designed for High-Fidelity Operation
- Distortion-free Bi-Level modulation
- Minimum power requirement
- Fewer tubes—uses only ten
- Only three tube types
- Quiet operation—suitable for control-room installation
- Simple to operate—only one tuning control
- Excellent frequency stability
- Readily remote-controlled

## DESCRIPTION

One of a complete line of High-Fidelity AM Broadcast Transmitters, the BTA-250M is compact, reliable, and fulfills all FCC and RETMA specifications. It is simple to operate and economical to maintain.

Completely housed in a single cabinet exactly the size of a standard audio rack, the BTA-250M requires a minimum of floor space. Overall width including side panels is only 28 inches. Depth is 20 inches and height is 84 inches. Since the cabinet of the BTA-250M is identical in size to BR-84 series audio and monitoring racks, the transmitter can be installed adjacent to these racks after removal of one of the transmitter side panels which can then be placed on the opposite side of the audio rack. Electrical shields (see Accessory List on last page) should be placed between the transmitter and audio rack frames.

In the BTA-250M, no blowers are used—consequently, noise has been reduced to a minimum. Thus, the transmitter can be placed in the same room where announcements are made. These features also make the transmitter useful as emergency equipment, installed side-by-side with audio racks in master control rooms. Noise-free operation may save the expense of a partitioning wall or an additional room for transmitting equipment.



# EASILY INSTALLED AND SERVICED

## Circuits and Components

The BTA-250M is designed to operate at any frequency from 535 kc to 1620 kc. Nominal power output is 250 watts; however, the transmitter is capable of producing 275 watts to compensate for transmission line and antenna tuning equipment losses. The output network provides excellent harmonic attenuation and accommodates antenna or transmission line load impedances from 20 to 250 ohms.

Both front and rear cabinet doors are interlocked for protection of personnel. Most of the tubes and components are mounted on a single vertical chassis accessible from both front and rear. All controls can be operated through openings in the front door.

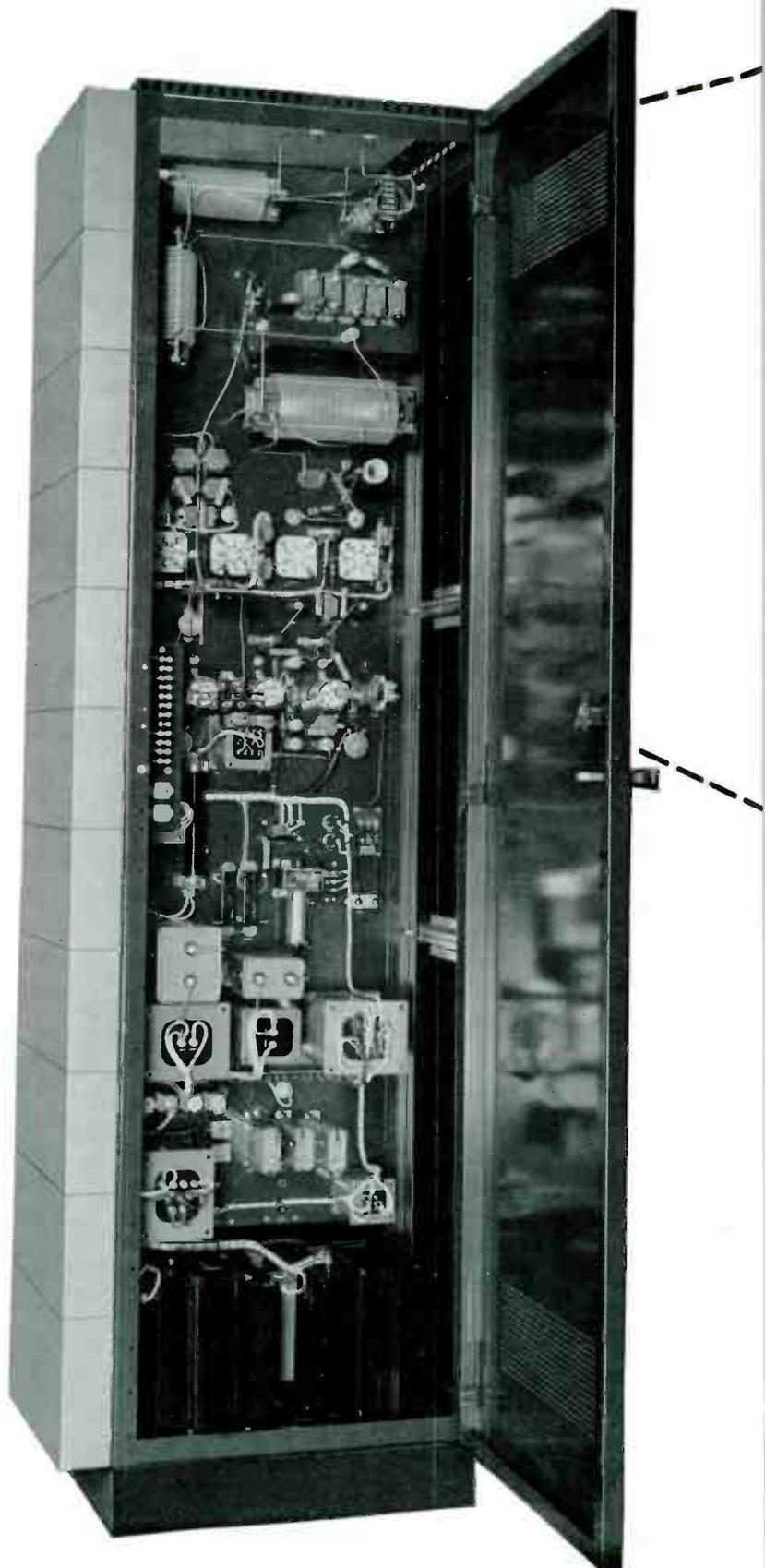
The BTA-250M Transmitter uses the UL-4392 Crystal Oscillator with the TMV-129B Temperature Controlled Crystal Unit which maintains the frequency constant to within plus or minus five cycles. The oscillator feeds a single type RCA-807 Tube operating as a buffer amplifier with a broadly tuned plate circuit which requires no tuning after initial set-up. The buffer, in turn, drives the power amplifier consisting of two type RCA-813 Tubes in parallel. The power amplifier tank circuit and output matching network have a circuit configuration such that the high-frequency distortion is greatly reduced. Neutralization is not required since all r-f stages use screen grid tubes.

The modulator consists of two type RCA-807 Tubes in push-pull resistance coupled to two type RCA-813 Modulator Tubes. The modulation transformer secondary is tapped to provide modulation of the buffer screen as well as the PA plate and screen, resulting in a very low order of distortion.

The power supply comprises: 1. A selenium rectifier for modulator bias; 2. A selenium rectifier for the 807 tubes (plates and screens) and the screens of the 813 modulator tubes; 3. A high-voltage rectifier using two RCA 866A tubes which supplies the plates of the modulator tubes and the plates and screens of the PA tubes.

Circuit protection is provided entirely by means of high speed magnetic circuit breakers. The circuit breakers also function as control switches and are located in the filament, plate, and PA and modulator cathode circuits. Delay of the plate voltages is provided by a mercury type time delay relay, the only relay in the transmitter.

Rear open door view shows clean wiring, adequate space and accessibility to all the components.



# CONVENIENT "REACH-IN" ACCESSIBILITY

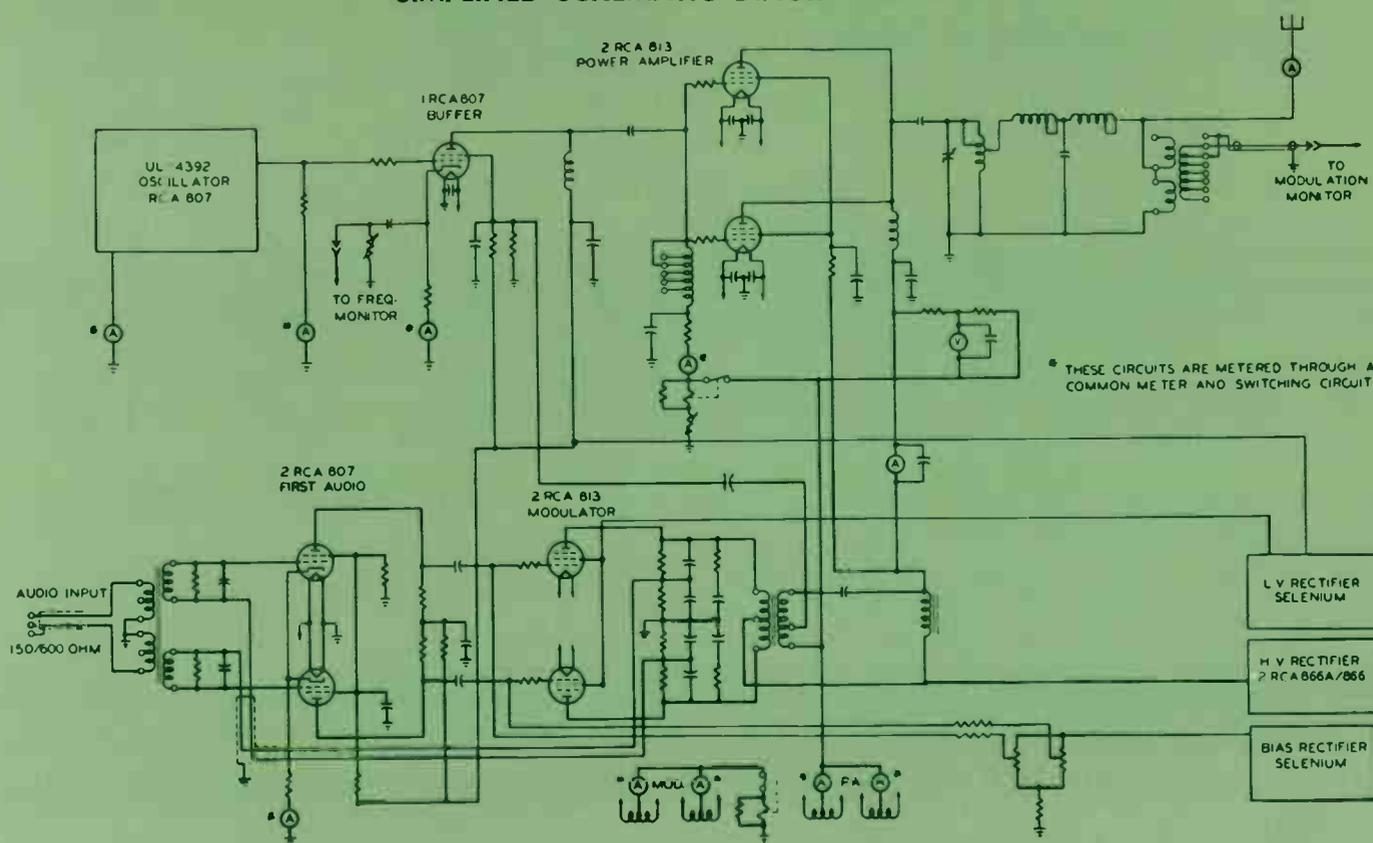
New circuit design in the BTA-250M simplifies transmitter adjustment and operation. There is only one tuning control and one power output control in the entire transmitter. The tuning control is a variable capacitor in the plate circuit of the power amplifier, and the power output control is a variable resistor in the cathode circuit. In the low level r-f stages, the Type RCA 807 Crystal Oscillator plate is fixed-tuned by an inductor with suitable taps to cover the broadcast band. The 807 Buffer Plate is also fixed-tuned.

## Better PA Linearity with Bi-Level modulation

Special design in the output network provides symmetrical loading on both sides of the carrier for modulating sum and difference frequencies—thus reducing distortion. Further reduction in distortion is effected by modulation of the r-f drive to the PA. This is accomplished by modulating the buffer screen as well as the plates and screens of the PA. By applying modulation to the buffer screens, the PA is supplied with additional driving power required during the modulating peaks. Thus the PA receives the proper drive during all portions of the audio cycle, greatly improving its linearity. Distortion rating is 2% or less over a range of 50 to 10,000 cycles. See curve on opposite page.

View at left shows power amplifier tank and output network components.

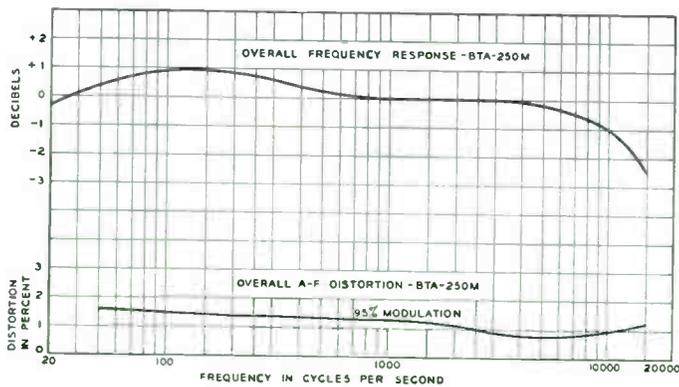
## SIMPLIFIED SCHEMATIC DIAGRAM—BTA-250M



**SPECIFICATIONS**

AF Input Impedance.....	150/600 ohms
AF Input Level (100% mod.).....	+10 ±2 dbm
AF Response:	
50-7,500 cycles .....	±1 db
30-10,000 cycles .....	±1.5 db
AF Distortion (95% mod.) 50-10,000 cycles.....	2%
Noise (below 100% mod.).....	-60 db
Frequency Range .....	535-1620 kc
Frequency Stability .....	±5 cycles
Type of Output.....	Single ended
Carrier Shift (0-100% mod.).....	2½%
Output Impedance .....	20-250 ohms
R-F Voltage (for freq. monitoring).....	10 v. RMS 75 ohms
R-F Voltage (for mod. monitoring).....	10 v. RMS 75 ohms
Power Output Capability.....	275 watts
Power Requirements.....	110/125 volts, single phase, 50-60 cycles
Power Consumption:	
No Modulation .....	1000 w. approx.
Average Program Modulation.....	1150 w. approx.
100% Modulation .....	1400 w. approx.
Power Factor .....	90%
Permissible Combined Line Voltage Variation and Regulation.....	±5%
Buffer Tuning.....	Fixed tuned
PA Tuning.....	Air capacitor (with dust cover)
Number of Oscillators.....	1
Provisions for Spare Crystals.....	1
Number of Meters.....	4
Circuits Metered .....	13
Overload Circuits.....	Filaments, plates, PA cathode, mod. cathode
Cabinet Dimensions.....	Height 84⅞", Width 28", Depth 20½" (Less door handle)
Overall Height .....	86⅝"
Weight (unpacked).....	Approx. 600 lbs.

**TYPICAL FREQUENCY RESPONSE  
AND  
DISTORTION CURVES**



**Tube Complement (ES-28049)**

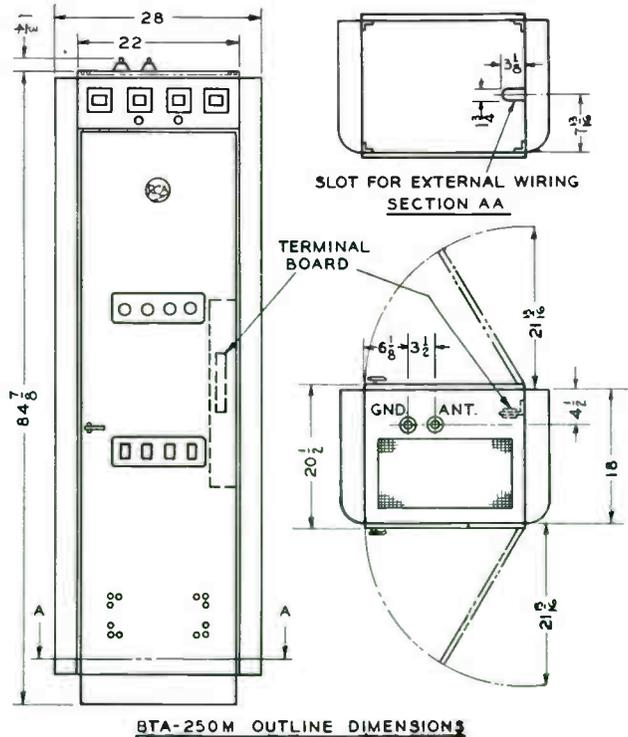
1 RCA 807 oscillator; 1 RCA 807 buffer; 2 RCA 813 power amplifier; 2 RCA 807 a-f amplifier; 2 RCA 813 modulator; selenium low voltage rectifiers; 2 RCA 866A high voltage rectifier.

**Equipment Supplied (ES-28937)**

Quan.	Description	Ref.
1	BTA-250M Transmitter Unit, Including 1 Type UL-4392 Oscillator.....	MI-28053
2	Side Panels .....	MI-30541-G84
1	Set of Tubes .....	MI-28049
1	Type TMV-129B Crystal Unit.....	MI-7467
1	Touch-up Finish Kit.....	MI-7443
2	Instruction Books .....	IB-30220
1	Nameplate .....	MI-28180-1
Choice of One:		
	R-F Output Ammeter.....	MI-28048
	Remote Antenna Ammeter.....	MI-28037-B

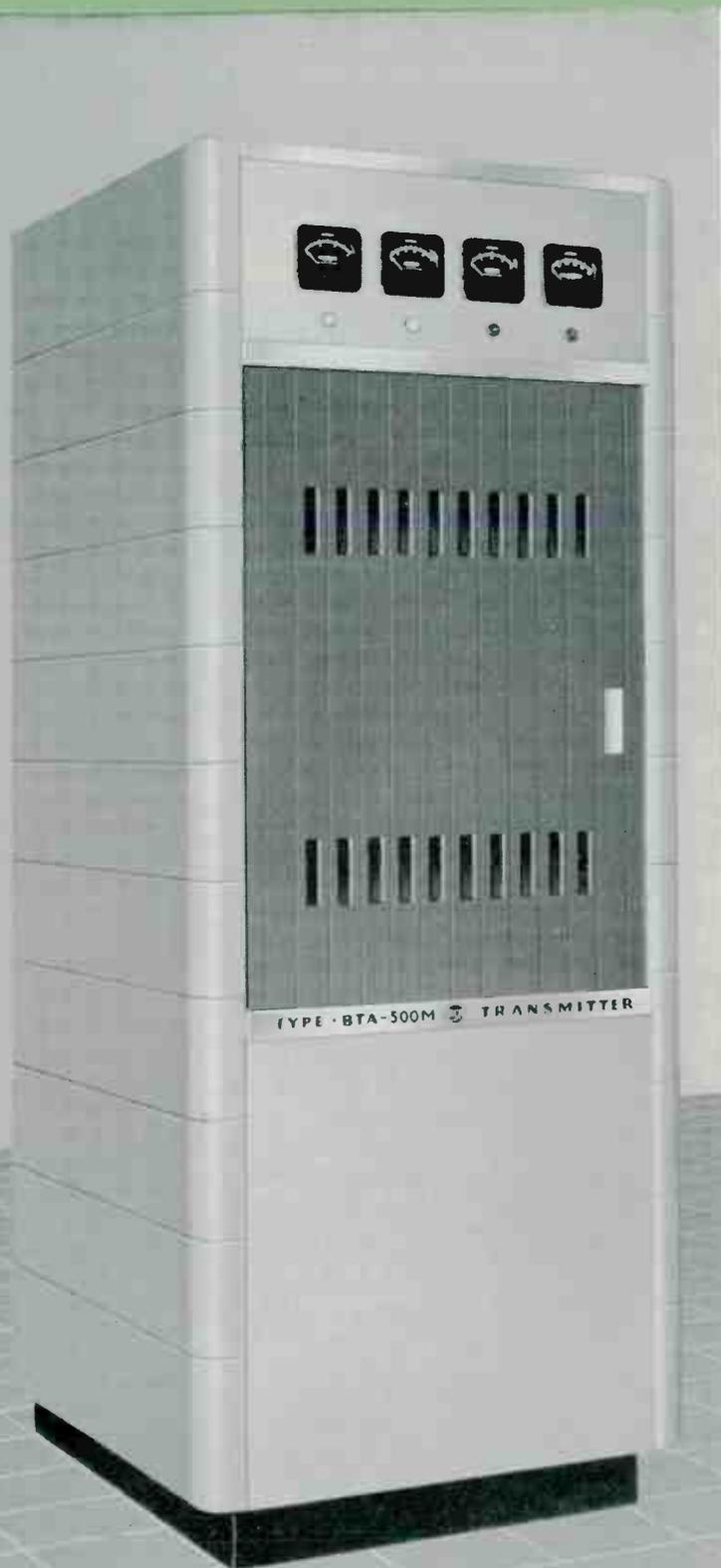
**Available Accessories**

Type BW-66E Modulation Monitor.....	MI-30066-A
Type BW-11A Frequency Monitor.....	MI-30011-A
Antenna Towers and R-F Transmission Line.....	On application
Type BPA-11A Antenna Tuner.....	ES-28906-A
BPM-1C Remote Metering Kit, Consisting of:	
Remote Metering Kit, Less Meter.....	MI-28027-A
Remote Meter for Transmitter Panel.....	MI-28037-B
Type BR-84C Audio Rack.....	MI-30951-C84
Double Trim Strip.....	MI-30568-G84
Single Trim Strip.....	MI-30566-G84
Electrical Side Shields per side—2 of.....	MI-30546-G28
1 of.....	MI-30546-G21
Operating Spare Tube Kit.....	MI-28049
FCC Spare Tube Kit.....	MI-28084



# 500 WATT AM BROADCAST TRANSMITTER

TYPE BTA-500M



## FEATURES

- Single control tuning
- Designed for high-fidelity operation
- Easily converted to 1 KW output
- Saves valuable floor space . . . occupies less than 7½ square feet
- Less power consumption than other 500 watt transmitters
- Bi-level modulation for lowest distortion
- Fewer tubes . . . only 4 types
- Easier to remote control

## DESCRIPTION

The complete BTA-500M Transmitter is housed in an attractive and practical lightweight aluminum cabinet with steel base. It is 84" high, 33" wide, 32½" deep and equipped with space-saving, horizontal sliding front and rear doors that never extend beyond the cabinet. The rear horizontal sliding door permits easy maintenance access—even when the transmitter is mounted in close proximity to a wall—a feature not attainable in other type transmitters. The sliding doors are interlocked with automatic high voltage grounding providing protection for operating personnel. Front and rear compartment lights are provided inside the cabinet. Vertical panel construction affords reach-in accessibility to components.

The BTA-500M Broadcast Transmitter is designed to operate on any frequency from 535 kc to 1620 kc with a normal rated output of 500 watts. The maximum transmitter output is 550 watts to compensate for transmission line and antenna tuning equipment losses. The transmitter operates from a single phase 208/230 volt, 60 cycle (50 cycle conversion kit is available) a-c power source, except for the crystal heater circuit which requires a single phase, 117 volt, 50/60 cycle source.

The BTA-500M is simple to tune. All transmitter operating controls are located on a panel which is exposed by sliding the front door to the left four inches. This is illustrated on following page. The interior cannot be reached until the door is opened further, operating interlock and grounding switches. The crystal oscillator trimmer can be adjusted through the front panel while the transmitter is in operation. Filament voltages on all transmitter tubes can be adjusted from the operating panel.

Only 14 tubes of four different types are used—RCA Type 807, 833-A, 866-A, and 8008. All tubes are visible through

## ECONOMICAL OPERATION



**SPACE-SAVING ACCESSIBILITY** is assured by rear horizontal sliding door which permits easy access when the transmitter is installed close to a wall.

### Description (Continued)

windows in the sliding doors to permit observation of operating conditions. All AF and RF tubes are metered by four meters on the top panel of the transmitter and the meter and associated circuit selector switch located on the operating panel. The transmitter is cooled by one blower mounted inside the cabinet.

The BTA-500M transmitter is supplied with a UL-4392 Oscillator Unit equipped with a TMV-129B Crystal Unit. A socket equipped with heater voltage supply is provided for a spare crystal unit. The oscillator maintains the frequency within plus or minus five cycles.

The buffer stage consists of two RCA 807 tubes in parallel. This stage does not require neutralization and is tuned by fixed components that do not require tuning after initial set-up.

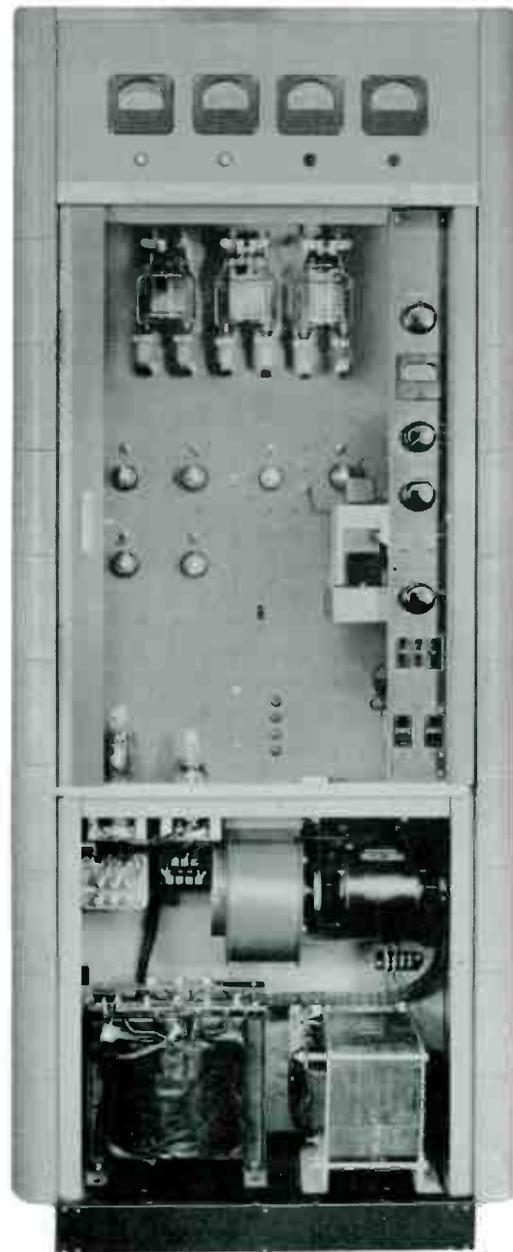
The buffer drives the final RF power amplifier consisting of one RCA 833-A tube. This stage is tuned by a variable slug-tuned inductor. Neutralization is accomplished by a broadband transformer which requires no adjustment over the operating range. The power amplifier tank circuit and output matching network form a symmetrical network that offers the same impedance to both sidebands. Adequate harmonic attenuation is also provided by this network. There are no air dielectric condensers in the transmitter, thus reducing arc-over possibilities due to dust collection. There is only one tuning control and one power output control. The power output control consists of a rheostat in the cathode circuit of the power amplifier. All RF stages operate Class C.

The audio amplifier-modulator has two RCA 807 tubes operating push-pull Class A—resistance coupled to two RCA 807 tubes as cathode followers in push-pull.

The cathode followers are directly coupled to two RCA 833-A modulator tubes operating Class B. Low audio dis-

ortion is achieved at all percentages of modulation. This is accomplished by improved audio circuit design, and by modulating the screen voltage of the buffer in addition to the plate voltage of the power amplifier. This improves the linearity of the power amplifier by varying the drive in proportion to the modulation. Hum and distortion is further reduced by utilizing inverse feedback from the modulator output to the audio input.

The high voltage power supply employs two RCA 8008 tubes. The low voltage rectifier utilizes two RCA 866-A



Front view of BTA-500M 500 Watt AM Transmitter with horizontal sliding door fully opened and lower front panel removed. Overall simplicity of component arrangement is apparent.

# EASILY CONVERTED TO 1 KW



**SIMPLE TO OPERATE**—Only one tuning control—located on an easy-to-reach vertical control panel which is exposed by sliding front door to the left 4 inches.

tubes, and the bias supply uses a selenium rectifier. All rectifiers employ single phase, full wave circuits.

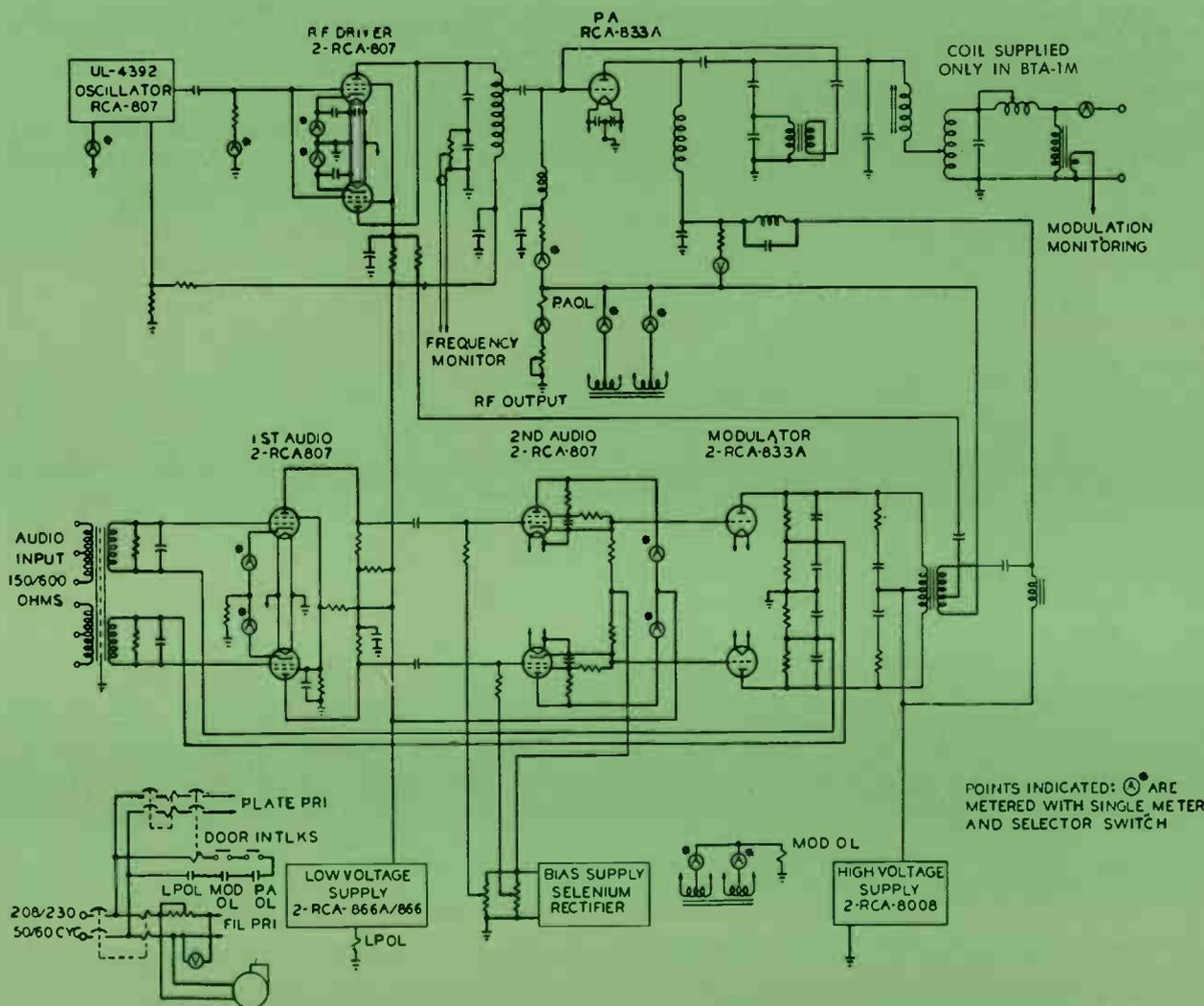
Circuit protection is provided by high speed circuit breakers and a plate contactor. The filament and plate circuit breakers serve as control switches. Circuit breakers in the cathode circuit of the power amplifier, modulator, and ground return of the low voltage and bias rectifier operate the plate contactor. All plate and bias voltages are removed when an overload occurs.

The plate contactor is prevented from closing until thirty seconds after the filaments are energized, to protect the rectifier tubes.

Provision is made for automatically and instantly returning the transmitter to the air after a power line interruption of up to two seconds duration. If the power interruption is over two seconds duration, the transmitter will return to the air automatically thirty seconds after the power line interruption is over.

A matching cabinet, or cabinets, are available to house the phasing and branching equipment if a directional antenna array is employed.

## SIMPLIFIED SCHEMATIC DIAGRAM — BTA-500M



EQUIPMENT SPECIFICATIONS

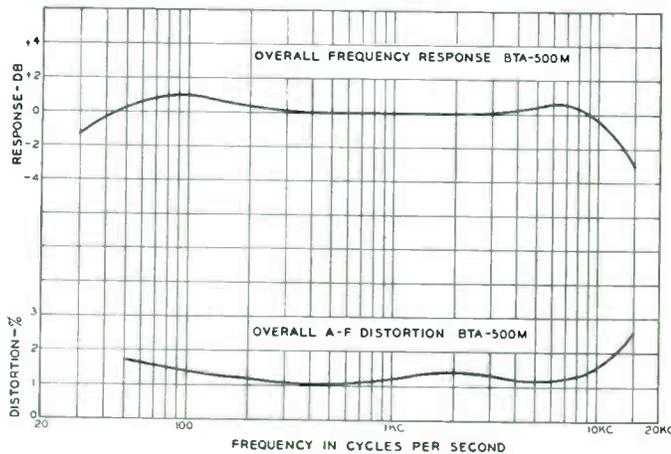
AF Input Impedance.....	150/160 ohms
AF Input Level (100% mod.).....	+10 ±2 dbm
AF Response:	
50-7500 Cycles.....	±1 db
30-10,000 Cycles.....	±1.5 db
AF Distortion (95% mod.), 50-10,000 Cycles.....	.2%
Noise, Unweighted (below 100% mod.).....	-60 db
Modulation.....	High level class B
Frequency Range.....	535-1620 kc
Type of Emission.....	A3
Frequency Stability.....	±5 cycles
Type of Output.....	Single ended
Carrier Shift (0-100% mod.).....	Less than 5%
Output Impedance.....	20-250 ohms
RF Voltage (for frequency Monitoring).....	10 v. RMS, 75 ohms
RF Voltage (for modulation Monitoring).....	10 v. RMS, 75 ohms
Rated Carrier Output.....	500 watts
Power Output Capability.....	550 watts
Maximum Ambient Operating Temperature.....	+45 degrees C.
Altitude Range.....	0-10,000 ft.
Power Supply.....	208/230 volts
Line Frequency.....	**60 cycles
Phase.....	1
Power Consumption (0% mod.).....	2300 watts (approx.)
(Average Program mod.).....	2600 watts (approx.)
(100% mod.).....	3000 watts (approx.)
Power Factor.....	90%
Permissible Combined Line Voltage Variation and Regulation.....	±5%
Crystal Heater Power Supply.....	117 volts
Crystal Heater Line Frequency.....	50/60 cycles
Crystal Heater Phase.....	1
Crystal Heater Power Consumption.....	30 watts (max.)
Transmitter Height.....	84"
Transmitter Width.....	33"
Transmitter Depth.....	32 1/2"
Transmitter Floor Space.....	7.5 sq. ft.
Transmitter Weight (Unpacked).....	1300 lbs. (approx.)

Tube Complement

Oscillator, 1 RCA 807; Buffer, 2 RCA 807; Power Amplifier, 1 RCA 833-A; First Audio, 2 RCA 807; Second Audio, 2 RCA 807; Modulator, 2 RCA 833-A; Low Voltage Rectifier, 2 RCA 866-A; High Voltage Rectifier, 2 RCA 800B; (Bias Rectifier, Selenium).

Circuits:

Buffer Tuning.....	Tapped inductor
PA Tuning.....	Slug-tuned inductor
PA Output Control.....	PA Cathode Rheostat
PA Neutralization.....	Broadband Transformer
Number of Meters.....	5
Tubes Metered.....	All AF and RF tubes
Number of Oscillators.....	1
Protection to Personnel.....	Door interlocks
	HV grounding switches



Typical Frequency Response and Distortion Curves.

Equipment Supplied (ES-28949)

Type BTA-500M Basic Transmitter Unit (including 1—Type UL-4392 Oscillator).....	MI-27090
1 Set, Power Determining Parts.....	MI-27092
Set of End Shields.....	MI-28061
Type TMV-129B Crystal Unit.....	MI-7467
Set Frequency Determining Parts.....	MI-27093
Set of Operating Tubes.....	MI-27094
Touch-up Finish Kit.....	MI-7474
Instruction Book.....	IB-30234
Nameplate.....	MI-28180-1
Choice of One:	
RF Output Ammeter.....	MI-7157-F
Remote Antenna Ammeter.....	MI-28037

Available Accessories

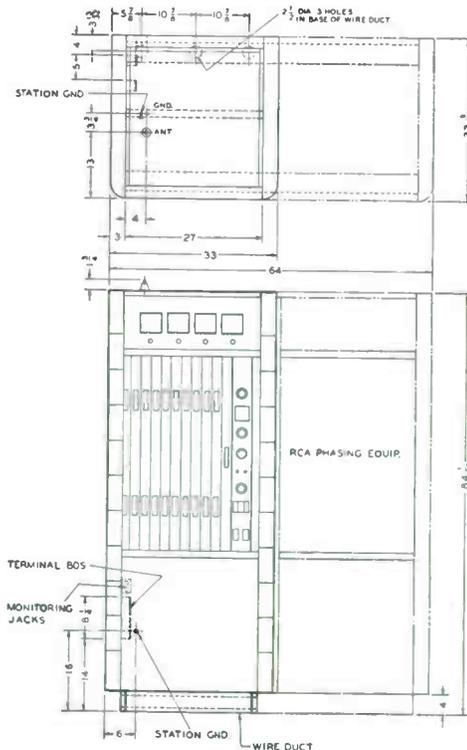
50 Cycle Conversion Kit.....	**MI-28098
Matching Wing Phasing Cabinet.....	ES-28927
Type BPA-11A Antenna Tuner, including:	
MI-28027-A Remote Metering Kit (less meter)	
MI-7147 Antenna Ammeter.....	ES-28906-A
Antenna Phasing Equipment.....	On application
Antenna Towers.....	On application
RF Transmission Line.....	On application
Line Voltage Regulator.....	On application
Test and Measuring Equipment.....	On application
Type BW-66E Modulation Monitor.....	MI-30066-A
Type BW-11A Frequency Monitor.....	MI-30011-A
Operating Spare Tube Kit.....	MI-28097
FCC Spare Tube Kit.....	MI-28094
1 Kilowatt Conversion Kit.....	On application

Recommended Test Equipment

Type WA-28A Low Distortion Audio Oscillator.....	MI-30028-A
Type WM-71A Distortion and Noise Meter.....	MI-30071-A
Type WV-97A VoltOhmyst.....	
Type WO-56A Cathode Ray Oscilloscope.....	

\*\* Accessory kit available for 50 cycle operation.

DIMENSIONS OF BTA-500M TRANSMITTER WITH ADJACENT PHASING CABINET



# 1 KW AM BROADCAST TRANSMITTER

TYPE BTA-1M



## FEATURES

- Horizontal sliding doors save valuable floor space—occupies less than 7½ square feet
- Designed for High-Fidelity operation
- May be installed close to a wall and still provide easy access to components
- Less power consumption than other 1-kw's
- Fewer tubes—uses only 15
- Fewer tube types—only four types to stock
- Simple to operate—only one tuning control

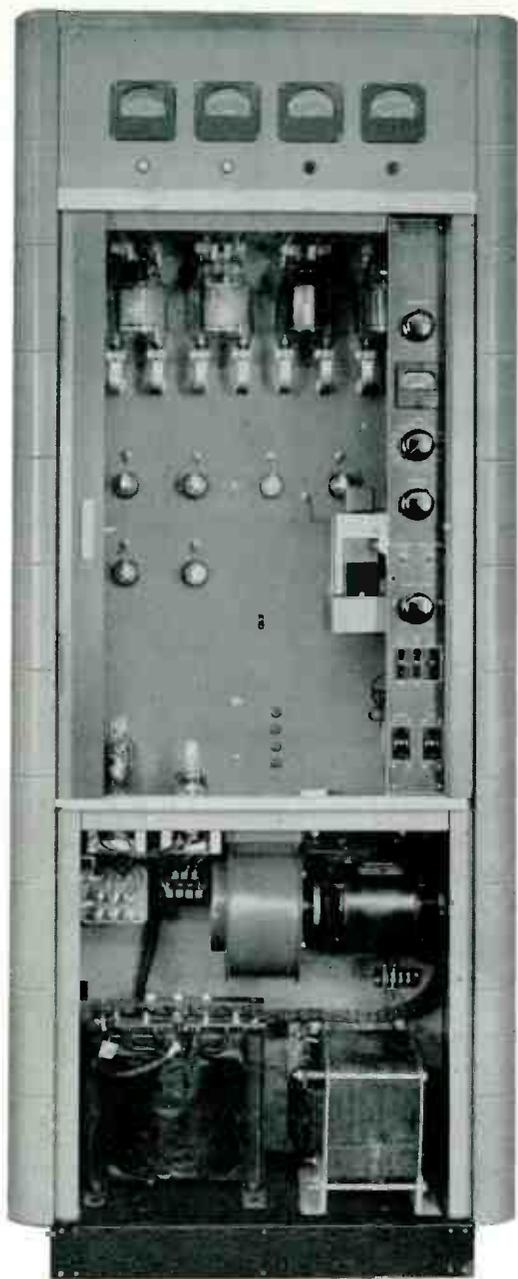
## DESCRIPTION

The complete BTA-1M Transmitter is housed in an attractive and practical lightweight aluminum cabinet with steel base. It is 84" high, 33" wide, 32 $\frac{3}{8}$ " deep and equipped with space-saving, horizontal sliding front and rear doors that never extend beyond the cabinet. The rear horizontal sliding door permits easy maintenance access—even when the transmitter is mounted in close proximity to a wall—a feature not attainable in other type transmitters. The sliding doors are interlocked with automatic high voltage grounding providing protection for operating personnel. Front and rear compartment lights are provided inside the cabinet. Vertical panel construction affords reach-in accessibility to components.

The BTA-1M Broadcast Transmitter is designed to operate on any frequency from 535 kc to 1620 kc with a normal rated output of one kilowatt. The maximum transmitter output is 1100 watts to compensate for transmission line and antenna tuning equipment losses. An MI-28099 Power Change Kit is available for 1000/500 watt or 1000/250 watt operation. The transmitter operates from a single phase 208/230 volt, 60 cycle (50 cycle conversion kit is available) a-c power source, except for the crystal heater circuit which requires a single phase, 117 volt, 50/60 cycle source.

The BTA-1M is simple to tune. All transmitter operating controls are located on a panel which is exposed by sliding the front door to the left four inches. This is illustrated on following page. The interior cannot be reached until the door is opened further, operating interlock and grounding switches. The crystal oscillator trimmer can be adjusted through the front panel while the transmitter is in operation. Filament voltages on all transmitter tubes can be adjusted from the operating panel.

# HALF THE SIZE . . .



Front view of BTA-1M 1 KW AM Transmitter with horizontal sliding door fully opened and lower front panel removed. Overall simplicity of component arrangement is apparent.

**SIMPLE TO OPERATE**—Only one tuning control—located on an easy-to-reach vertical control panel which is exposed by sliding front door to the left 4 inches.

## DESCRIPTION (Continued)

Only 15 tubes of four different types are used—RCA Type 807, 833-A, 866-A, and 8008. All tubes are visible through windows in the sliding doors to permit observation of operating conditions. All AF and RF tubes are metered by four meters on the top panel of the transmitter and the meter and associated circuit selector switch located on the operating panel. The transmitter is cooled by one blower mounted inside the cabinet.

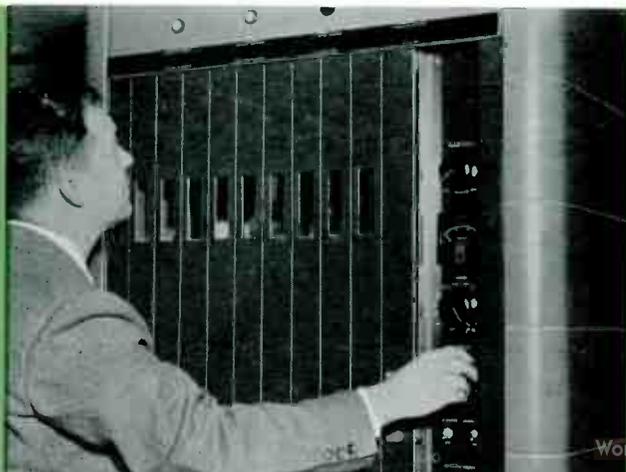
The BTA-1M Transmitter is supplied with a UL-4392 Oscillator Unit equipped with a TMV-129B Crystal Unit. A socket equipped with heater voltage supply is provided for a spare crystal unit. The oscillator maintains the frequency within plus or minus five cycles.

The buffer stage consists of two RCA 807 tubes in parallel. This stage does not require neutralization and is tuned by fixed components that do not require tuning after initial set-up.

The buffer drives the final RF power amplifier consisting of two RCA 833-A tubes in parallel. This stage is tuned by a variable slug-tuned inductor. Neutralization is accomplished by a broadband transformer which requires no adjustment over the operating range. The power amplifier tank circuit and output matching network form a symmetrical network that offers the same impedance to both sidebands. Adequate harmonic attenuation is also provided by this network. There are no air dielectric condensers in the transmitter, thus reducing arc-over possibilities due to dust collection. There is only one tuning control and one power output control. The power output control consists of a rheostat in the cathode circuit of the power amplifier. All RF stages operate Class C.

The audio amplifier-modulator has two RCA 807 tubes operating push-pull Class A—resistance coupled to two RCA 807 tubes as cathode followers in push-pull. The cathode followers are directly coupled to two RCA 833-A modulator tubes operating Class B. Low audio distortion

**SPACE-SAVING ACCESSIBILITY** is assured by rear horizontal sliding door which permits easy access when the transmitter is installed close to a wall.



# BETTER PERFORMANCE

## DESCRIPTION (Continued)

is achieved at all percentages of modulation. This is accomplished by improved audio circuit design, and by modulating the screen voltage of the buffer in addition to the plate voltage of the power amplifier. This improves the linearity of the power amplifier by varying the drive in proportion to the modulation. Hum and distortion is further reduced by utilizing inverse feedback from the modulator output to the audio input.

The high voltage power supply employs two RCA 8008 tubes. The low voltage rectifier utilizes two RCA 866-A tubes, and the bias supply uses a selenium rectifier. All rectifiers employ single phase, full wave circuits.

Circuit protection is provided by high speed circuit breakers and a plate contactor. The filament and plate circuit breakers serve as control switches. Circuit breakers in the

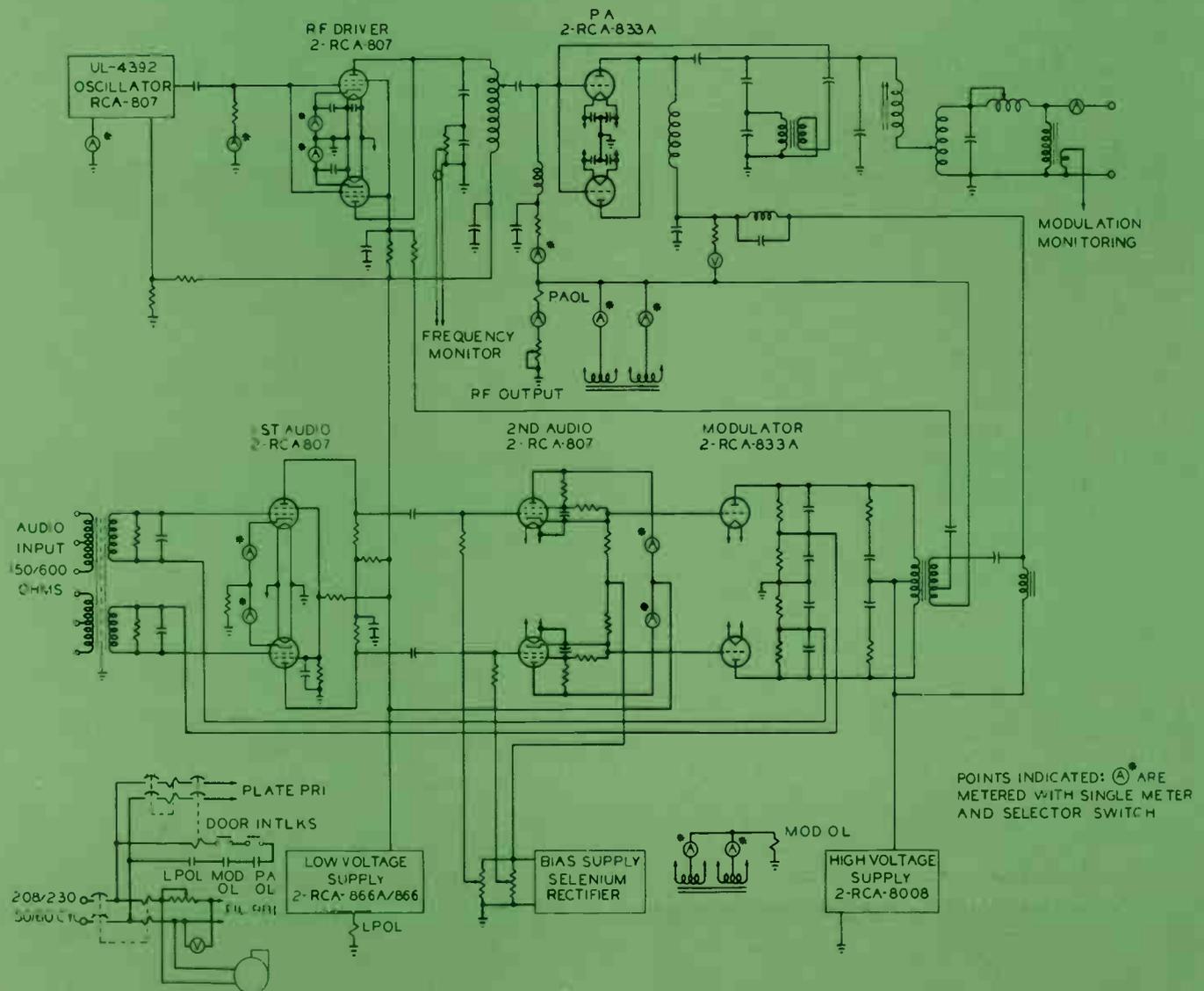
cathode circuit of the power amplifier, modulator, and ground return of the low voltage and bias rectifier operate the plate contactor. All plate and bias voltages are removed when an overload occurs.

The plate contactor is prevented from closing until thirty seconds after the filaments are energized, to protect the rectifier tubes.

Provision is made for automatically and instantly returning the transmitter to the air after a power line interruption of up to two seconds duration. If the power interruption is over two seconds duration, the transmitter will return to the air automatically thirty seconds after the power line interruption is over.

A matching cabinet, or cabinets, are available to house the phasing and branching equipment if a directional antenna array is employed.

## SIMPLIFIED SCHEMATIC DIAGRAM—BTA-1M



AF Input Impedance.....	150/600 ohms
AF Input Level (100% mod.).....	+10 ±2 dbm
AF Response:	
50-7500 Cycles.....	±1 db
30-10,000 Cycles.....	±1.5 db
AF Distortion (95% mod.), 50-10,000 Cycles.....	.2%
Noise, Unweighted (below 100% mod.).....	-60 db
Modulation.....	High level class B
Frequency Range.....	.535-1620 kc
Type of Emission.....	A3
Frequency Stability.....	±5 cycles
Type of Output.....	Single ended
Carrier Shift (0-100% mod.).....	Less than 5%
Output Impedance.....	20-250 ohms
RF Voltage (for frequency Monitoring).....	10 v. RMS, 75 ohms
RF Voltage (for modulation Monitoring).....	10 v. RMS, 75 ohms
Rated Carrier Output.....	*1000 watts
Power Output Capability.....	1100 watts
Maximum Ambient Operating Temperature.....	+45 degrees C.
Altitude Range.....	0-10,000 ft.
Power Supply.....	208/230 volts
Line Frequency.....	**60 cycles
Phase.....	.1
Power Consumption (0% mod.).....	.3200 watts (approx.)
(Average Program mod.).....	.3500 watts (approx.)
(100% mod.).....	.4250 watts (approx.)
Power Factor.....	.90%
Permissible Combined Line Voltage Variation and Regulation.....	±5%
Crystal Heater Power Supply.....	117 volts
Crystal Heater Line Frequency.....	50/60 cycles
Crystal Heater Phase.....	.1
Crystal Heater Power Consumption.....	.30 watts (max.)
Transmitter Height.....	84"
Transmitter Width.....	33"
Transmitter Depth.....	32 1/16"
Transmitter Floor Space.....	7.5 sq. ft.
Transmitter Weight (Unpacked).....	1500 lbs. (approx.)

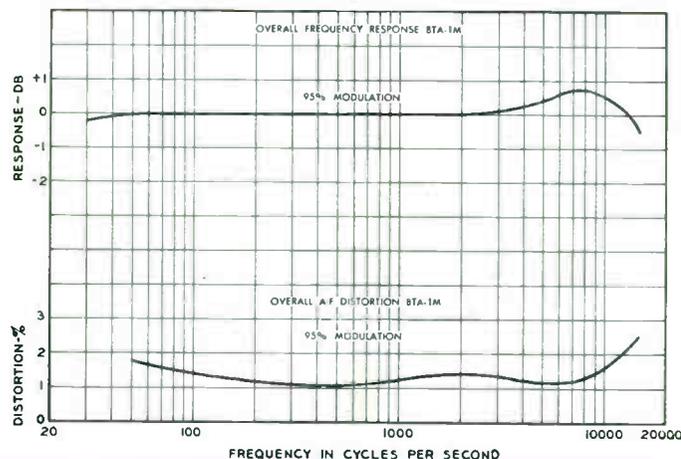
**Tube Complement (ES-28097)**

Oscillator, 1 RCA 807; Buffer, 2 RCA 807; Power Amplifier, 2 RCA 833-A; First Audio, 2 RCA 807; Second Audio, 2 RCA 807; Modulator, 2 RCA 833-A; Low Voltage Rectifier, 2 RCA 866-A; High Voltage Rectifier, 2 RCA 800B; (Bias Rectifier, Selenium).

**Circuits:**

Buffer Tuning.....	Tapped inductor
PA Tuning.....	Slug-tuned inductor
PA Output Control.....	PA Cathode Rheostat
PA Neutralization.....	Broadband Transformer
Number of Meters.....	.5
Tubes Metered.....	All AF and RF tubes
Number of Oscillators.....	.1
Protection to Personnel.....	Door interlocks
	HV grounding switches

**TYPICAL FREQUENCY RESPONSE AND DISTORTION CURVES**



**Equipment Supplied (ES-28939)**

Type BTA-1M Basic Transmitter Unit.....	MI-27090
(including 1—Type UL-4392 Oscillator).....	MI-27091
1 Set, Power Determining Parts.....	MI-28061
Set of End Shields.....	MI-7467
Type TMV-129B Crystal Unit.....	MI-28096
Set Frequency Determining Parts.....	MI-28097
Set of Operating Tubes.....	MI-7499-A
Touch-up Finish Kit.....	IB-30198
Instruction Books.....	MI-28180-1
Nameplate.....	
Choice of One:	
RF Output Ammeter.....	MI-7157-F
Remote Antenna Ammeter.....	MI-28037

**Available Accessories**

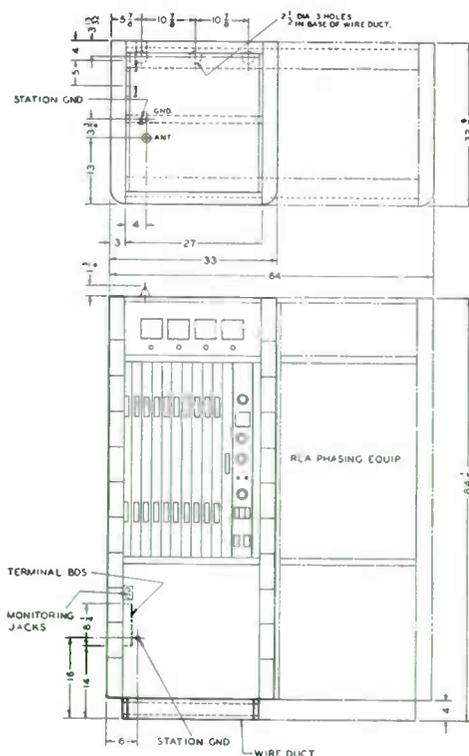
Power Change Kit (1000/500 or 1000/250 watts).....	*MI-28099
50 Cycle Conversion Kit.....	**MI-28098
Matching Wing Phasing Cabinet.....	ES-28927
Type BPA-11A Antenna Tuner, including:	
MI-28027-A Remote Metering Kit (less meter).....	ES-28906-A
MI-7147 Antenna Ammeter.....	On application
Antenna Phasing Equipment.....	On application
Antenna Towers.....	On application
RF Transmission Line.....	On application
Line Voltage Regulator.....	On application
Test and Measuring Equipment.....	On application
Type BW-66E Modulation Monitor.....	MI-30066-A
Type BW-11A Frequency Monitor.....	MI-30011-A
Operating Spare Tube Kit.....	MI-28097
FCC Spare Tube Kit.....	MI-28094

**Recommended Test Equipment**

Type WA-28A Low Distortion Audio Oscillator.....	MI-30028-A
Type WM-71A Distortion and Noise Meter.....	MI-30071-A
Type WV-97A VoltOhmyst.....	
Type WO-56A Cathode Ray Oscilloscope.....	

\* Accessory kit available for 1000/500 watt or 1000/250 watt operation.  
 \*\* Accessory kit available for 50 cycle operation.

**OUTLINE DIMENSIONS BTA-1M TRANSMITTER WITH ADJACENT PHASING CABINET**



# 5KW/10KW AM BROADCAST TRANSMITTERS

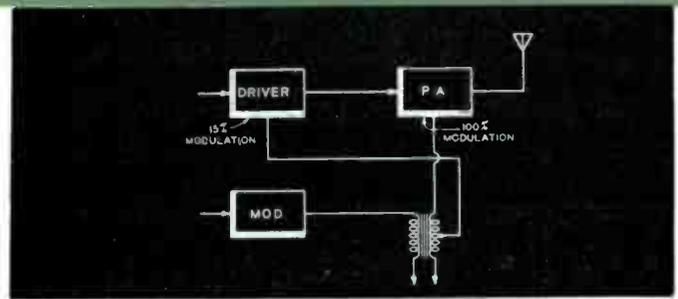
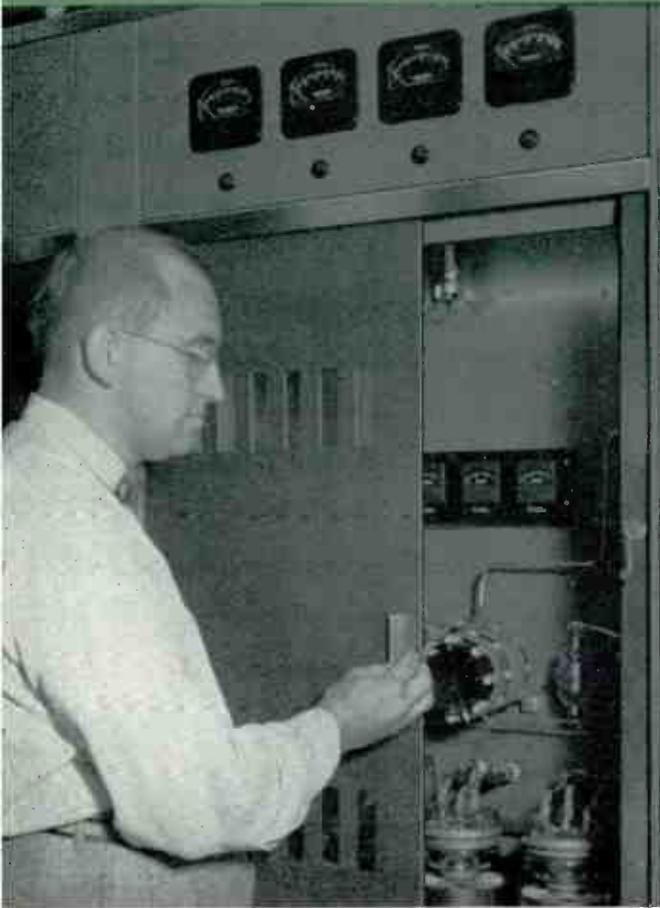
TYPES BTA-5H AND BTA-10H



## FEATURES

- Lowest operating cost for tubes and power
- Rugged construction—small size
- Lowest distortion
- Only two tuning controls
- Grid-controlled thyatron power supply—split-cycle overload protection
- Bi-level modulation
- Fewest tubes, fewest tube types
- True High-Fidelity frequency response
- Simple to install
- Lower voltage, higher dependability
- Easily remote-controlled
- Broad-band R-F tuning simplifies Conelrad shifting

# BTA-5H/10H OFFER MANY "PLUS" FEATURES . . . INCLUDING BI-LEVEL MODULATION



● **BI-LEVEL MODULATION**

Bi-level modulation, accomplished by adding a controlled amount of audio to the r-f driver increases efficiency, reduces power consumption and reduces distortion.

● **SPLIT-CYCLE OVERLOAD PROTECTION**

The BTA-5H and BTA-10H provide "split-cycle" overload or arc back protection through the use of new grid-controlled thyatron rectifiers. "Recycling" circuits work so fast that "off-air" breaks are not audible.

● **MAXIMUM COMPONENT ACCESSIBILITY**

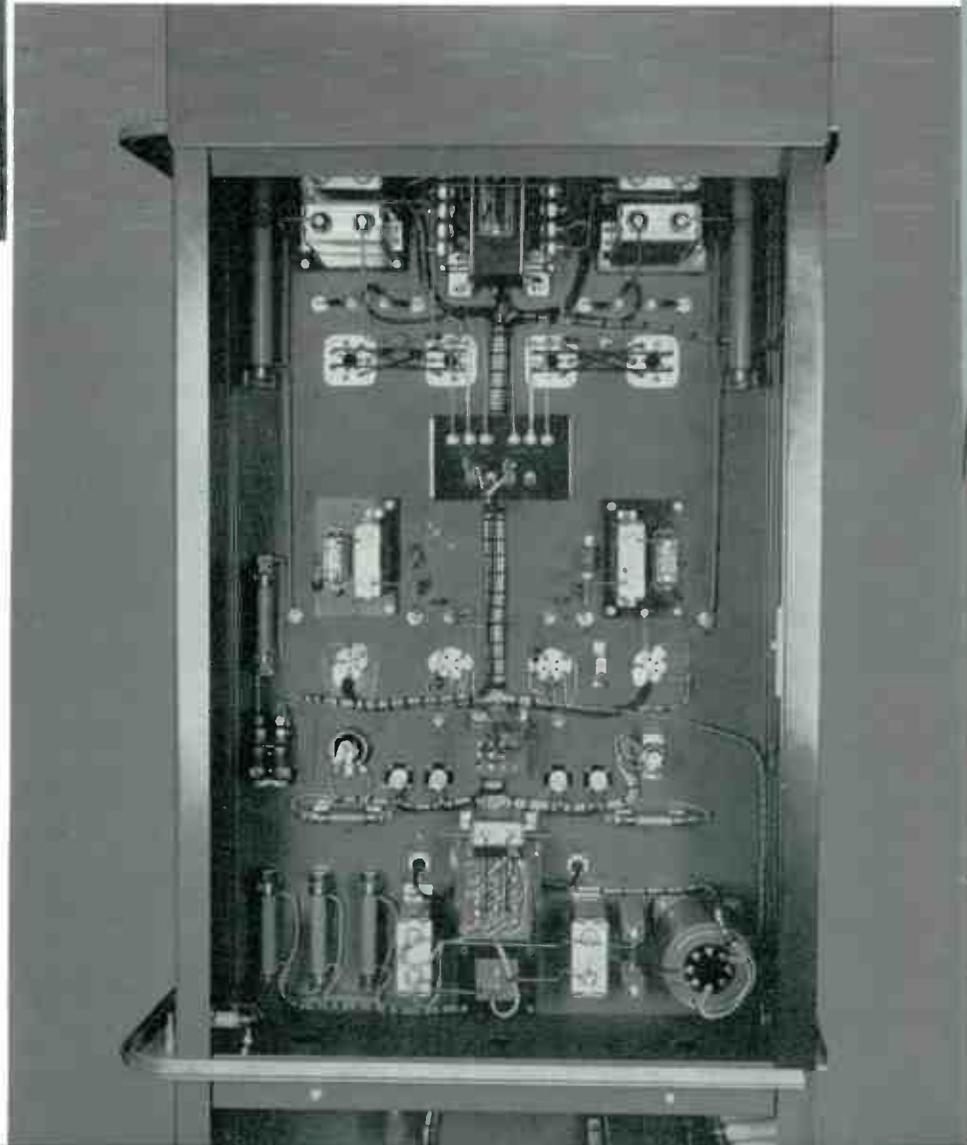
Complete accessibility to all "vertical-chassis" components and tubes is facilitated by the use of horizontally-sliding doors made of extruded aluminum slats. Doors slide back effortlessly on rubber caster assemblies.

● **EASY TO OPERATE**

The centralized grouping of the two tuning controls, convenient sliding doors with observation windows, and the generous metering provided make the BTA-5H easy and simple to operate and maintain.

● **LOW OPERATING COST**

BTA-5H has the lowest power consumption in its field. This feature plus long PA tube life makes it the most economical transmitter ever offered.



# AM's MOST ECONOMICAL 5/10 KW TRANSMITTERS

## DESCRIPTION

Ease of operation, all-around economy, and dependability are "standout" benefits provided by the BTA-5H and BTA-10H, 5 and 10-KW AM Broadcast Transmitters. Both utilize operating features "proved-in" by popular predecessors plus many new and novel ideas in design.

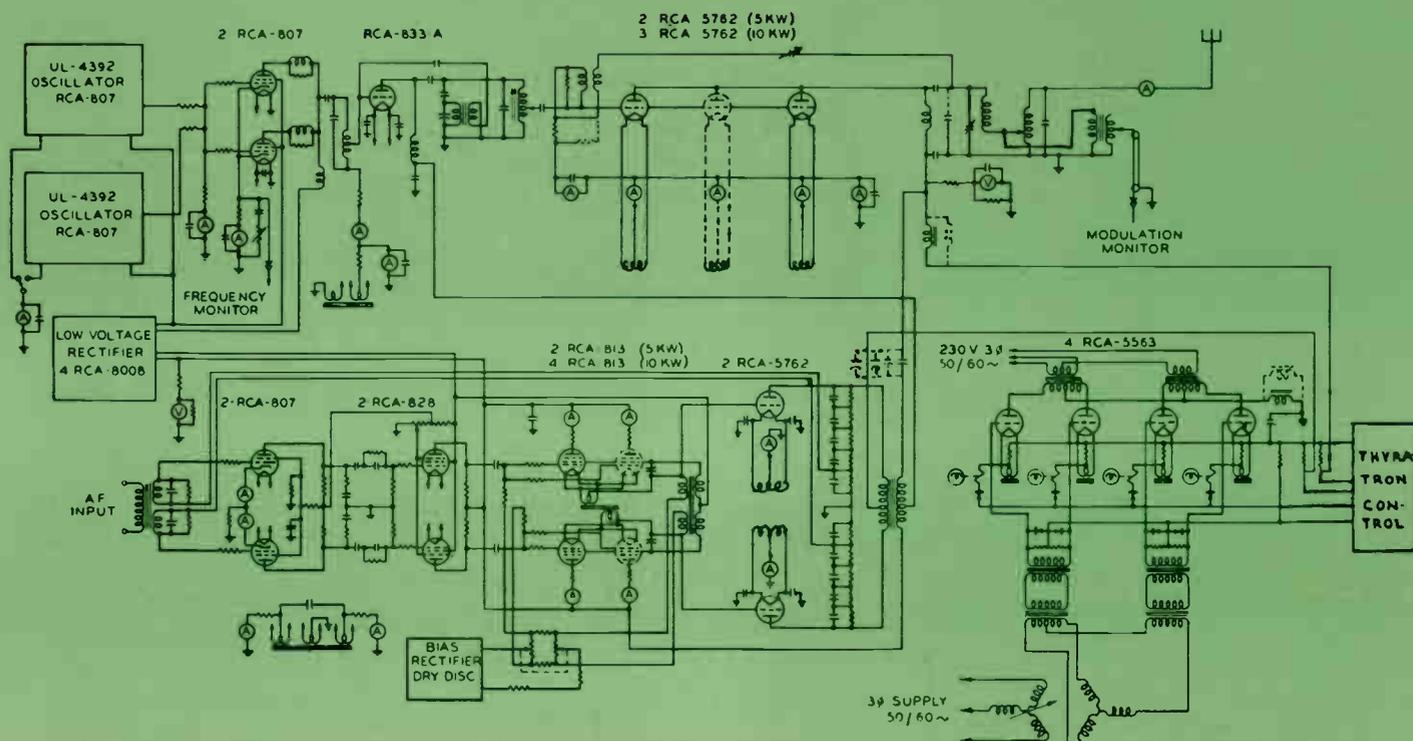
Smaller size, and new flush-mounted, horizontally-sliding or "rollback" doors result in considerably less "operating" floor area than other 5 KW's since no "door-swing" area is needed. Tubes and Components are mounted on vertical chassis within easy reach from front or rear. All tubes are visible through observation windows in the sliding doors. All a-f and r-f tubes are metered by a total of 23 meters to provide continuous indication of electrical operation. Controls are all conveniently grouped on a central panel strip for simplified fingertip operation.

Low power consumption and low tube costs result in substantial savings. Fewer tubes and fewer types plus the use of the same tube in "P. A." and Modulator contribute further to economical and dependable operation. All components are conservatively rated and increase to 10-KW

may be done easily and inexpensively without increasing cabinet or floor space.

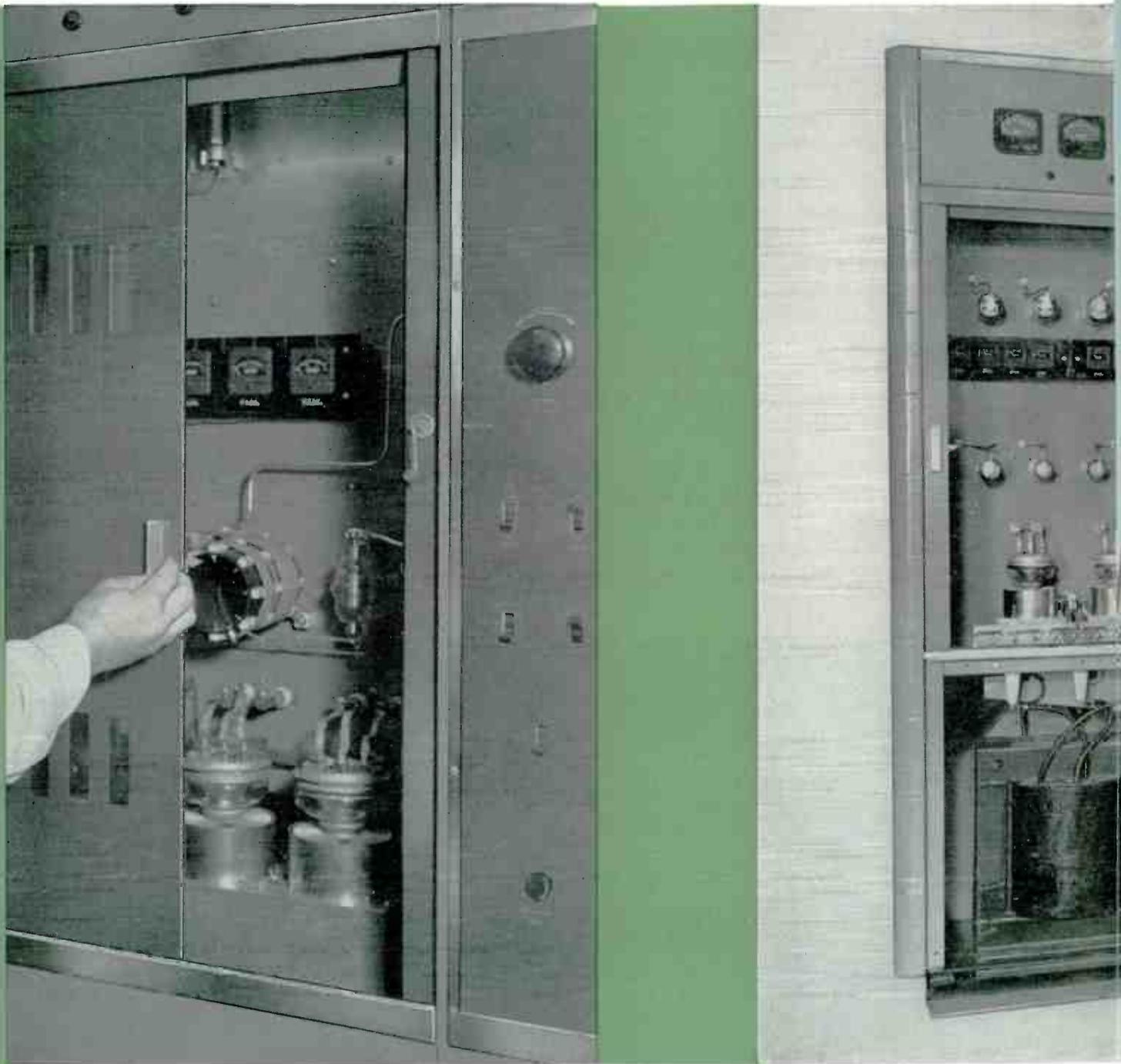
The entire transmitter consists of four rugged steel and aluminum cabinets; the exciter, the power amplifier, the modulator, and the power rectifier. These cabinets are installed side by side on two 4-inch wire troughs (supplied) which run the full length of the transmitter. These individual cubicles simplify shipping and installation of the transmitter and when assembled provide an attractive unified appearance. Matching left-wing cabinets are available to house the phasing and branching equipment if a directional array is employed. The externally located, air-cooled plate transformer is completely enclosed and shielded, and does not require a fireproof vault. Lightweight transmitter cabinets, self-contained components, and a preformed wiring cable supplied with the transmitter, simplify the installation and reduce time to a minimum. The transmitter is designed and wired to operate with the Type BTC-1B Universal Transmitter Control Console where this type of operation is desired; however, the transmitter is usually operated by use of centralized controls on the front panel.

## SIMPLIFIED SCHEMATIC DRAWING



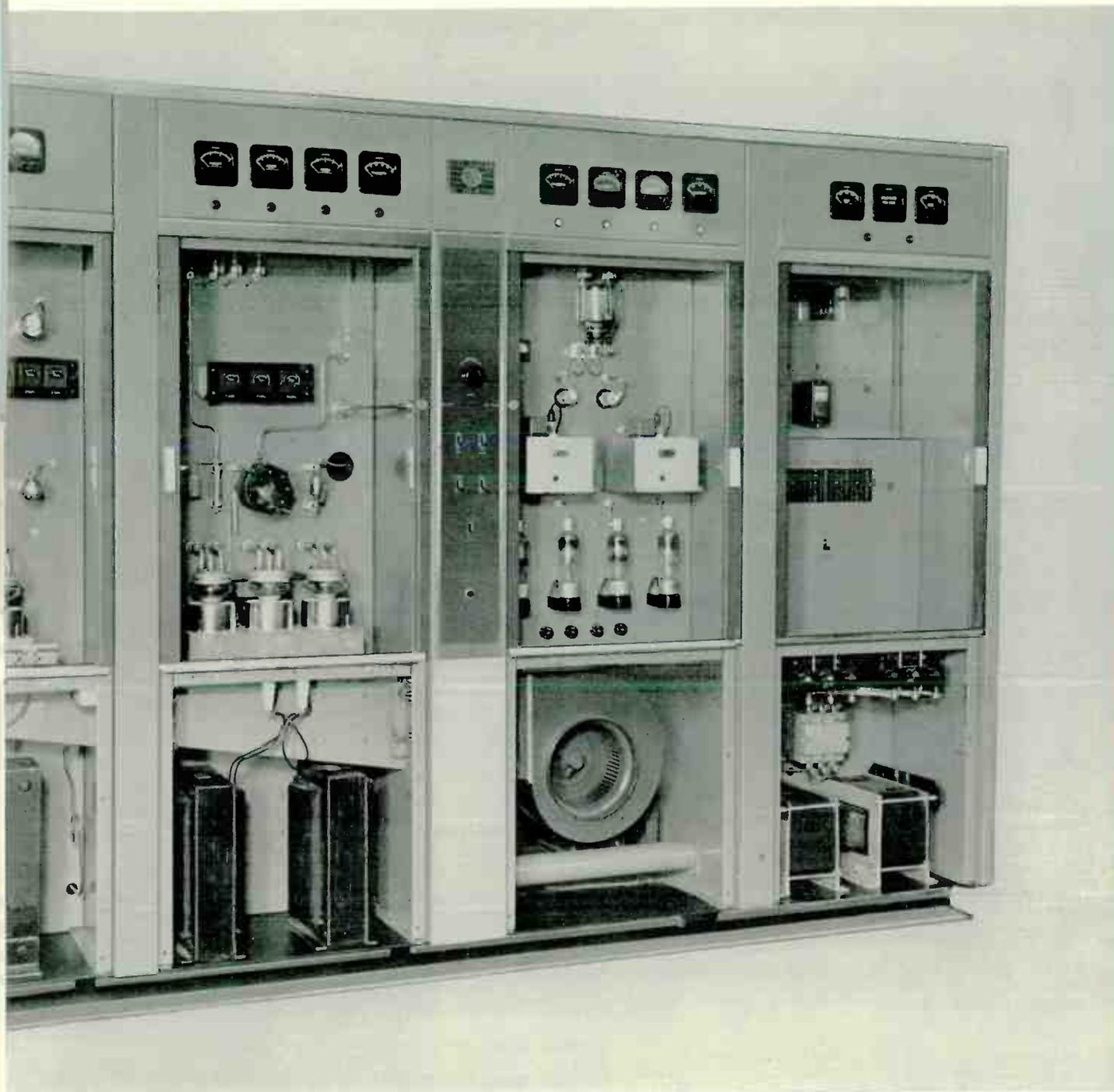
Simple, straightforward, circuit design reduces the number of stages, tubes and components to a minimum. Dotted lines indicate changes required for 10-KW operation.

## EASY "ROLL-BACK" ACCESSIBILITY



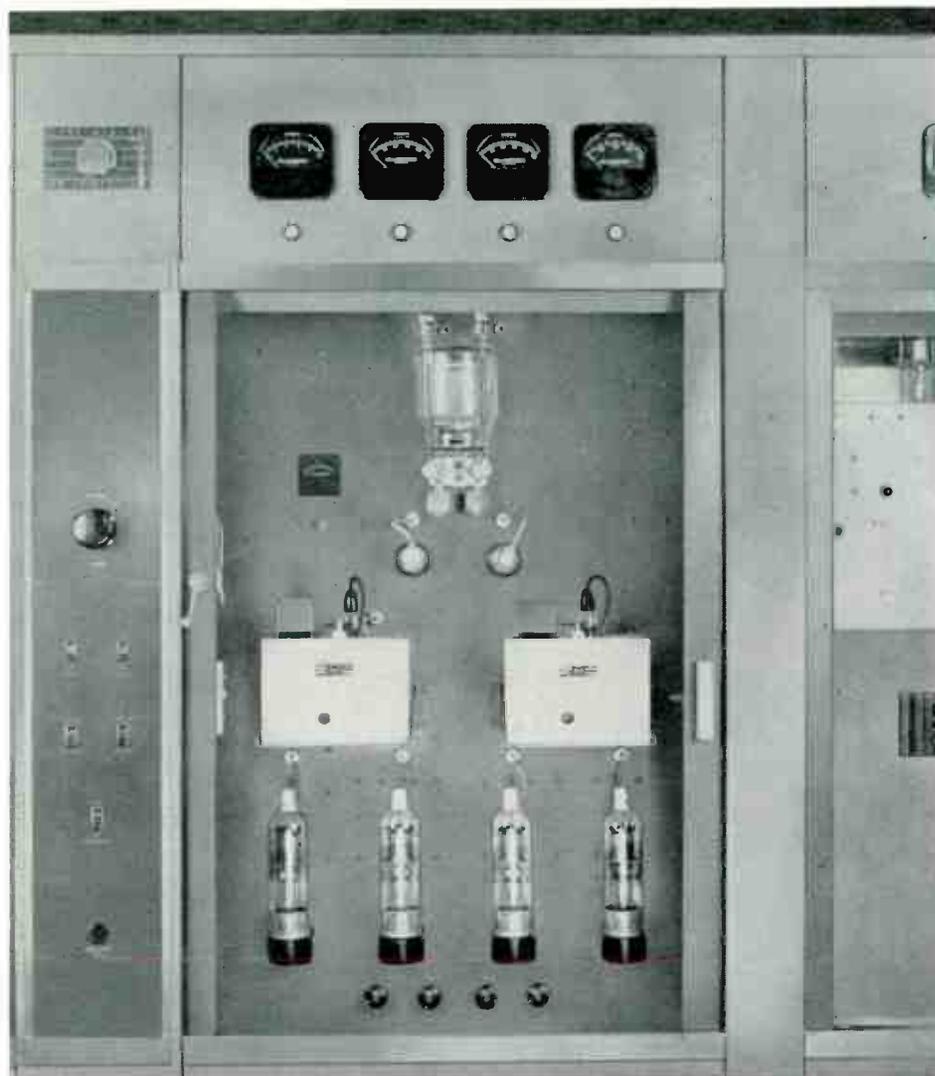
- Unique aluminum sliding-doors roll back on roller casters—complete accessibility to chassis components, front and rear
- Flush-mounted doors save operating floor space and provide more "walk-around" area in compact transmitter rooms

## SLIDING DOORS — FRONT AND REAR



- Only four lightweight cubicles—easily handled through doors and elevators. Full length wire ducts facilitate installation
- Vertical chassis construction provides utmost accessibility to all components, without disassembly

## R-F DRIVERS



**Closeup Front View of the R-F Driver or Exciter Cabinet. Sliding door is fully opened to show tubes, controls and components. Vertical chassis construction is employed throughout the BTA-5H and BTA-10H Transmitters.**

The BTA-5H and BTA-10H Transmitters are supplied with two UL-4392 Oscillator Units equipped with TMV-129B Crystal Units. To provide easy accessibility, the crystal units and tubes of the driver stages are located on the front of a single vertical chassis.

The crystal oscillator vernier frequency adjustments are readily accessible. Front panel oscillator switching is provided to enable selection of the auxiliary oscillator. These oscillators maintain the frequency within plus or minus five cycles. The crystal oscillator feeds two RCA 807 Tubes in parallel operating as a buffer amplifier. A tapped coil is utilized in the plate circuit of this stage. No neutralization is required, and the plate circuit does not require

tuning after initial set-up is made. The frequency monitor feed is taken from the cathode circuit of this buffer.

The buffer, in turn, excites the driver amplifier consisting of one RCA 833-A Tube utilizing a slug-tuned inductor in the plate circuit and broadband neutralization transformer. The slug-tuning is controlled by a vernier dial located on the front panel. The RCA 833-A drives the power amplifier.

Also housed in the lower portion of the exciter cabinet is the low-voltage rectifier utilizing four RCA 8008 Tubes. It supplies plate voltage to oscillators, buffers and audio stages.

## R-F OUTPUT

Front View of the R-F Output or Power Amplifier Cabinet showing the arrangement of RCA-5762\* Tubes, Controls and Components. Other circuit components and wiring are accessible by means of the rear sliding doors.



The Power Amplifier or r-f output stage consists of two RCA-5762\* Tubes, in the BTA-5H for 5-kw operation. A third RCA 5762 is added in the final of the BTA-10H for 10-kw operation.

The plate circuit of this modulated power amplifier is tuned by a variable vacuum capacitor which is controlled manually by a vernier dial located on the front panel. Neutralization is accomplished by means of a broadband transformer. The power amplifier tank circuit and output matching network form a symmetrical network so the load impedance is the same to both side bands, thus eliminating a possible source of distortion. The modulation monitor

feed is provided by a transformer across the output of the transmitter to provide faithful monitoring of transmitter output. There are no air dielectric condensers in the transmitter, thus reducing arc-over possibilities due to dust collection. There are only two tuning controls and one power output control in the transmitter. All r-f stages operate Class C.

Use of the RCA-5762 tubes in both the power amplifier and modulator stages not only reduces number of tube types, but makes possible interchange of tubes to increase useful life.

\* 25,000 hour life on RCA-5762 tubes has been common, even at FM frequencies. Stocking of FCC spares only is recommended.

## AUDIO AND MODULATOR STAGES



**Closeup View of the Audio and Modulator Cabinet showing the mechanical and electrical arrangement of major components. Long-life RCA 828's, 807's, 813's and RCA 5762's are employed in these stages. Bi-level modulation reduces distortion and increases fidelity to a new high in the BTA-5H.**

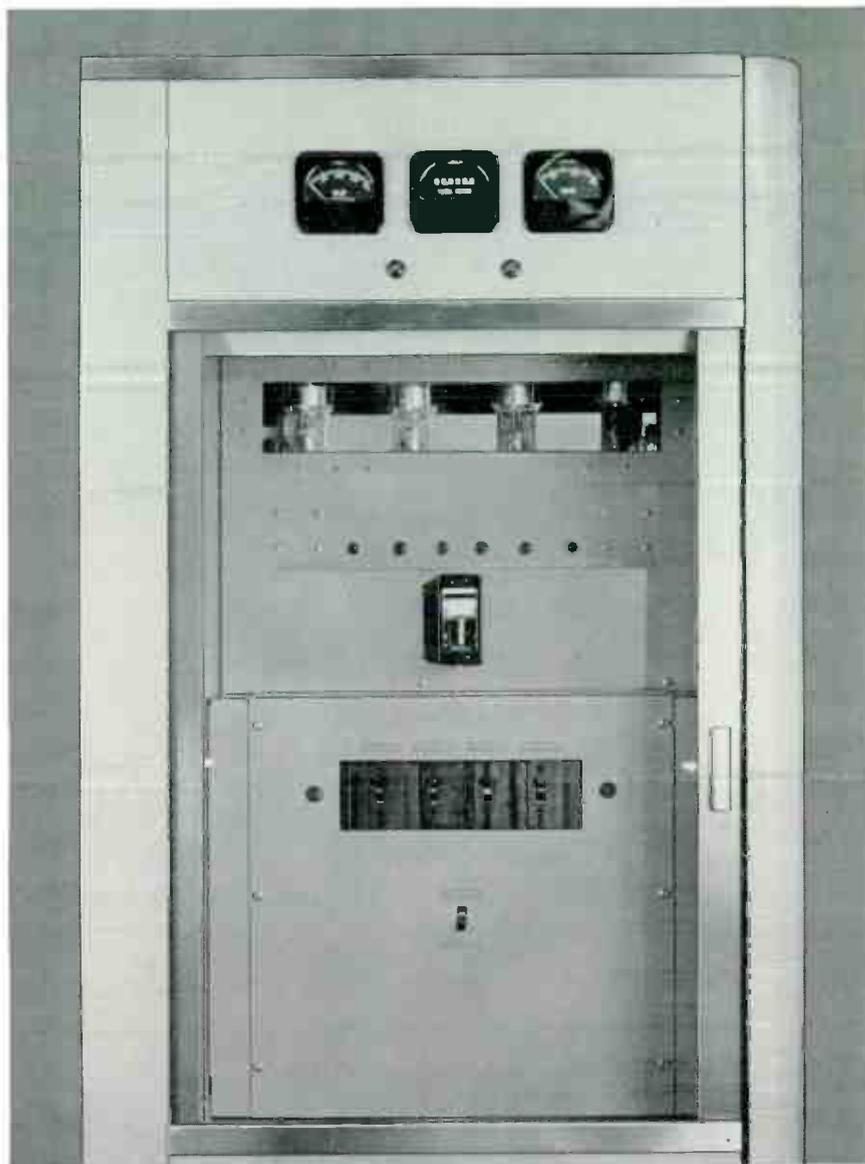
Low audio distortion at frequencies from 30 to 15,000 cycles per second is achieved. This is accomplished by improved audio circuit design, and by modulating the plate of the r-f driver as well as the power amplifier. Bi-level modulation improves the linearity of the power amplifier by varying the drive in proportion to the modulation. Hum and distortion is further reduced by utilizing inverse feedback in the audio section of the transmitter.

The audio amplifier consists of two RCA-807 Tubes operating push-pull Class A, resistance coupled to two RCA-828 Tubes, also operating push-pull Class A. These tubes are,

in turn, resistance coupled to two RCA-813 Tubes operating push-pull Class  $AB_1$ , in the BTA-5H. In the BTA-10H, two additional RCA 813's are added to form a push-pull parallel Class  $AB_1$  circuit. The sockets and circuitry for these tubes are already wired into the BTA-5H. The audio amplifier is direct coupled to the two RCA-5762 Modulator Tubes operating Class B, which provide high level plate modulation power to the r-f power amplifier. The bias for the Class  $AB_1$  driver and amplifier and modulator tubes is obtained from a long life selenium rectifier. Plate and screen voltages for the audio stages are obtained from the Low Voltage Rectifier.

# RECTIFIER AND POWER CONTROL SYSTEM

Shown here is the Thyatron Rectifier and Power Control Cabinet of the BTA-5H and BTA-10H Transmitters. Control is fully automatic and includes complete "split-cycle" overload protection and recycling features.



In the high-voltage rectifier and power control cabinet of the BTA-5H and BTA-10H are located the necessary relays, switches, controls, tubes, and power-rectifier components. The front compartment of the power-rectifier is accessible at all times and is not interlocked but fully protected, to permit operation of control switches. The rear compartment of this unit contains a special thyatron control circuit with components arranged on a hinged chassis. The thyatron rectifier tubes are visible through windows located on front of the transmitter door. A set of arc-back and overload indicator lamps are also mounted on the thyatron tube shelf and are visible through jewels mounted in the vertical chassis.

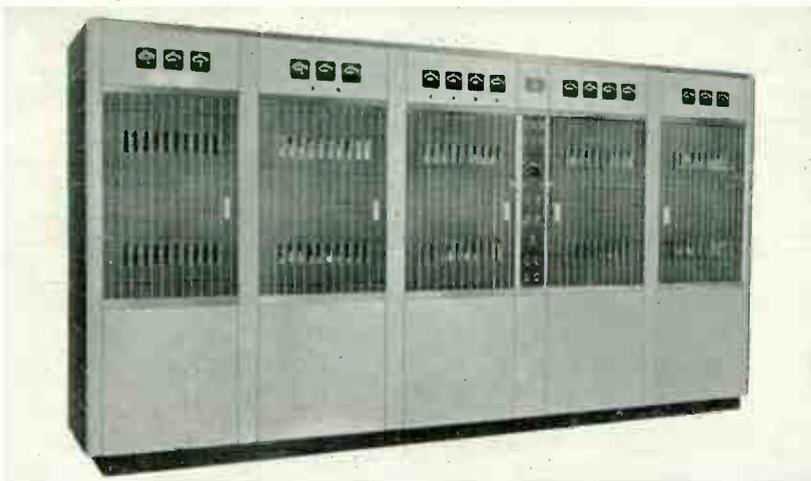
The plate voltages for the power-amplifier and modulator are obtained from the four-phase thyatron rectifier which employs four RCA-5563 Tubes. A manually operated selsyn motor, used as a phase-shifter, provides front panel control of the output plate voltage and a convenient means for power output control. No bulky contactors are required.

Split-cycle electronic overload or arc-back protection in the HV rectifier is provided, with positive arc-back indication. Automatic recycling of the overload and arc-back protective circuits is another incorporated feature.

ACCESSORIES AVAILABLE FROM ONE SOURCE

PHASING

BTA-5H/10H



PHASING EQUIPMENT

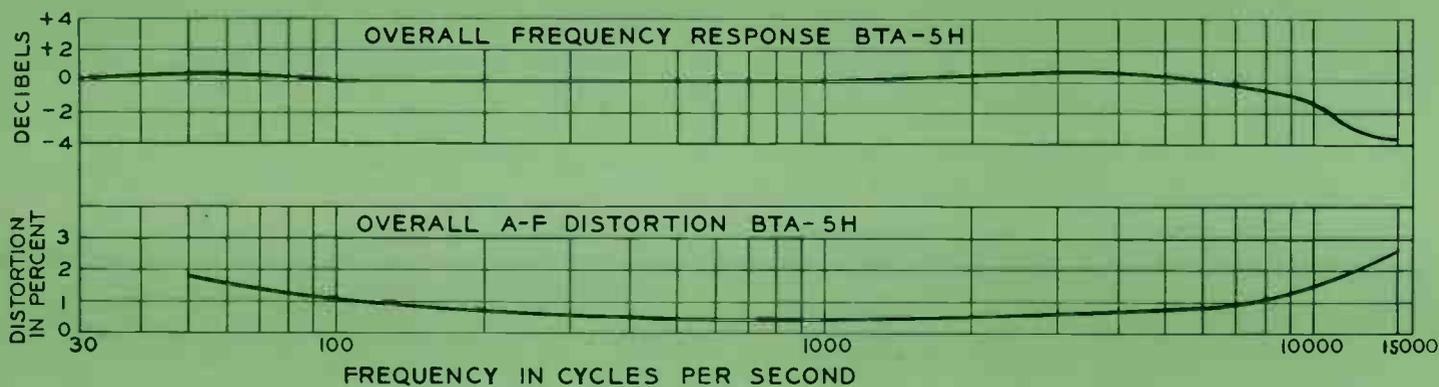
Provision has been made in the design of the BTA-5H/10H for the easy addition of matching left-wing cabinets available to house phasing and branching equipment.

SUPERVISORY CONSOLE, BTC-1B

The BTC-1B is available for use with the BTA-5H/10H and handles transmitter switching and audio mixing facilities required for supervisory control.



TYPICAL PERFORMANCE CURVES



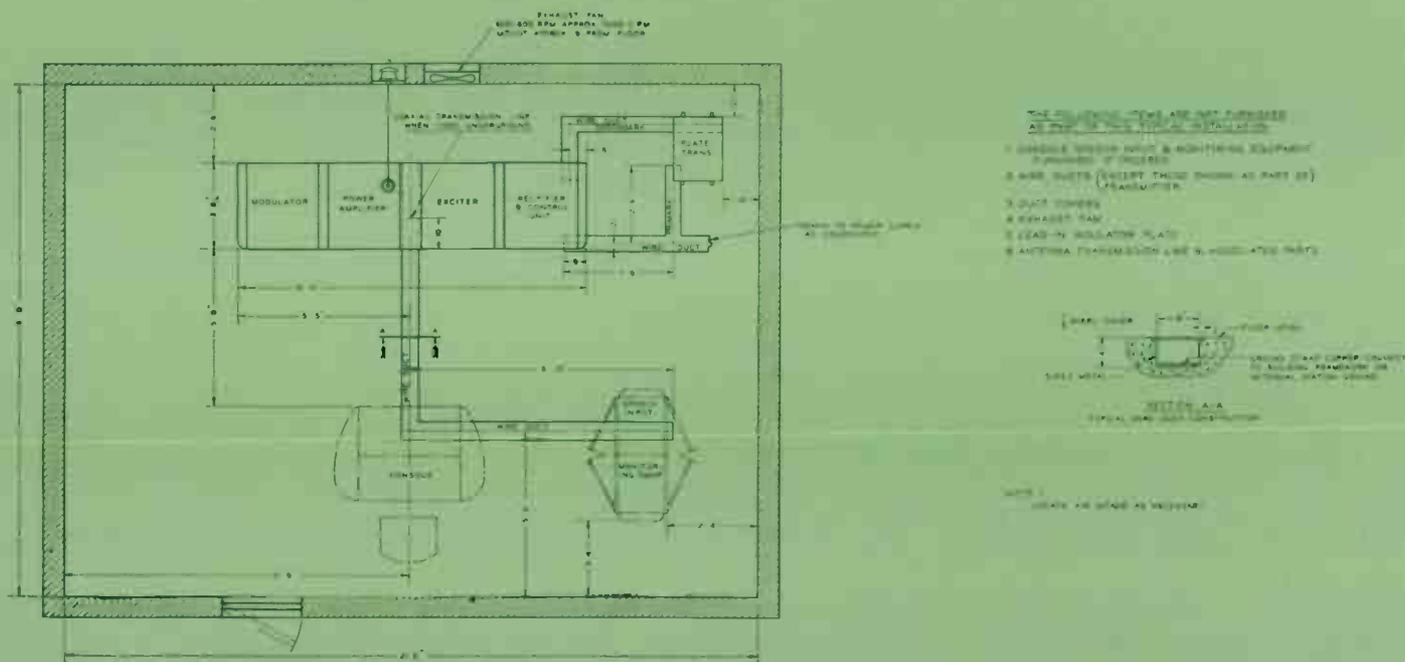
# EQUIPMENT SUPPLIED

Quan.	Description	Reference		Quan.	Description	Reference	
		BTA-5H (ES-28938-A)	BTA-10H (ES-28940-A)			BTA-5H (ES-28938-A)	BTA-10H (ES-28940-A)
1	Modulator Unit .....	MI-27061	MI-27061	1	Set of Freq. Determining Capacitors .....	MI-27071	MI-27072
1	Power Amplifier Unit.....	MI-27062	MI-27062	1	Touch-up Finish Kit.....	MI-7499-A	MI-7499-A
1	Exciter Unit, Including ? Type UL-4392 Oscillators.....	MI-27063	MI-27063	1	Miscellaneous Hardware Kit	MI-7474	MI-7474
1	Rectifier and Control Unit....	MI-27064	MI-27064	1	5 to 10 KW Conversion Kit (60 cycles) Including Plate Transformer .....	---	ES-28944
1	Control Panel, Installation Material Kit and Wiring Harness .....	MI-27065	MI-27065	2	Instruction Books .....	IB-30232	IB-30232
1	Set of End Shields (L & R)....	MI-28061	MI-28061	1	Set of Installation Plans.....	T-629608 E-311354 T-629612	T-629608 E-311354 T-629612
1	Plate Transformer .....	MI-27069	---	1	Nameplate .....	MI-28180-1	MI-28180-1
1	Set of Operating Tubes.....	ES-27073	ES-27073/27075	Choice of One:			
2	TMV-129B Crystal Units.....	MI-7467	MI-7467	RF Output Ammeter.....	MI-7157-F	MI-7157-F	MI-7157-F
				Remote Antenna Ammeter....	MI-28037	MI-28037	MI-28037

## AVAILABLE ACCESSORIES

Description	Reference		Description	Reference	
	BTA-5H	BTA-10H		BTA-5H	BTA-10H
Power Change Kit (10 KW-5 KW).....	---	MI-28092	Line Voltage Regulator.....	On Application	On Application
Power Change Kit (5 KW-1 KW).....	MI-28092-A	---	Audio and Monitoring Rack.....	On Application	On Application
50 Cycle Conversion Kit.....	MI-27066	MI-27066	Test and Measuring Equipment..	On Application	On Application
Matching Left Wing Phasing Cabinet .....	ES-28927	ES-28927	Type BW-11A Frequency Monitor .....	MI-30011-A	MI-30011-A
Type BTC-1B Universal Trans- mitter Control Console.....	MI-28950-A	MI-28950-A	Type BW-66E Modulation Monitor .....	MI-30066-A	MI-30066-A
Type BPA-10 Antenna Tuner.....	MI-28902-A	MI-28902-A	Operating Spare Tube Kit.....	ES-28941	ES-28941/28943
Antenna Phasing Equipment.....	On Application	On Application	FCC Spare Tubes.....	ES-27074	ES-27074/ MI-27082
Antenna Towers .....	On Application	On Application	5 to 10 KW Conversion Kit (less tubes .....	---	ES-28944
RF Transmission Line.....	On Application	On Application	5 to 10 KW Conversion Set of Tubes .....	---	ES-27075

## SUGGESTED STATION FLOOR PLAN



## PERFORMANCE SPECIFICATIONS

Description	Reference	
	BTA-5H	BTA-10H
AF Input Impedance.....	150/600 ohms	150/600 ohms
AF Input Level (100% mod.)....	+10 ±2 dbm	+10 ±2 dbm
AF Response		
50-7500 Cycles .....	±1 db	±1 db
30-10,000 Cycles .....	±1.5 db	±1.5 db
AF Distortion		
50-10,000 Cycles .....	2.5%	2.5%
Noise, Unweighted (below 100% mod.) .....	-60 db	-60 db
Modulation .....	High level class B**	High level class B**
Frequency Range .....	535-1620 kc	535-1620 kc
Type of Emission.....	A3	A3
Frequency Stability .....	±5 cycles	±5 cycles
Type of Output .....	Unbalanced	Unbalanced
Carrier Shift (0-100% mod.)....	Less than 3.9%	Less than 4.9%
Output Impedance .....	40-250 ohms	40-250 ohms
R.F. Voltage (for frequency monitoring) .....	10 v. RMS, 75 ohms	10 v. RMS, 75 ohms
R.F. Voltage (for modulation monitoring) .....	10 v. RMS, 75 ohms	10 v. RMS, 75 ohms
Power Output Capability.....	5500 watts	10,600 watts
Maximum Ambient Operating Temperature .....	+45 degrees C	+45 degrees C
Power Supply .....	208/230 volts	208/230 volts
Line Frequency .....	*60 cycles	*60 cycles
Phase .....	3	3
Power Consumption		
(0% mod.) .....	12 kw (approx.)	20 kw (approx.)
(Average) .....	13.5 kw (approx.)	23 kw (approx.)
(100% mod.) .....	18 kw (approx.)	33 kw (approx.)
Power Factor .....	85%	85%
Permissible Combined Voltage Variation and Regulation.....	±5%	±5%
Crystal Heater Power Supply....	117 volts	117 volts
Crystal Heater Line Frequency....	50/60 cycles	50/60 cycles
Crystal Heater Phase.....	1	1
Crystal Heater Power Consumption .....	30 watts	30 watts

### Mechanical Specifications

Transmitter Height .....	84"	84"
Transmitter Width .....	130"	130"
Transmitter Depth .....	32 $\frac{1}{16}$ "	32 $\frac{1}{16}$ "

\* Accessory kit available for 50-cycle operation.  
\*\* With bi-level technique.

Description	Reference	
	BTA-5H	BTA-10H
Transmitter Floor Space.....	29.4 sq. ft.	29.4 sq. ft.
Transmitter Weight (unpacked)..	5300 lbs. (approx.)	5500 lbs. (approx.)
Building Entrance Requirements .....	30" wide x 33" high	30" wide x 33" high
Plate Transformer Height.....	34"	45"
Plate Transformer Width.....	22"	22"
Plate Transformer Depth.....	31"	31 $\frac{1}{2}$ "
Plate Transformer Floor Space..	4.75 sq. ft.	4.8 sq. ft.

### Circuits and Tube Complements

Two Oscillators .....	2 RCA 807	2 RCA 807
Buffer .....	2 RCA 807	2 RCA 807
R.F. Driver .....	1 RCA 833-A	1 RCA 833-A
Power Amplifier .....	2 RCA 5762	3 RCA 5762
1st Audio .....	2 RCA 807	2 RCA 807
2nd Audio .....	2 RCA 828	2 RCA 828
3rd Audio .....	2 RCA 813	4 RCA 813
Modulator .....	2 RCA 5762	2 RCA 5762
LV Rectifier .....	4 RCA 8008	4 RCA 8008
HV Rectifier .....	4 RCA 5563-A	4 RCA 5563-A
Bias Rectifier .....	Selenium	Selenium
Buffer Tuning .....	Tapped coil	Tapped coil
Driver Tuning .....	Slug tuned inductor	Slug tuned inductor
PA Tuning .....	Variable vacuum capacitor	Variable vacuum capacitor
Driver and PA Neutralization....	Broad band transformer	Broad band transformer
Number of Meters.....	23	26
Tubes Metered .....	All RF and AF tubes	All RF and AF tubes
Number of Oscillators.....	2	2
HV Rectifier Circuit.....	4-phase thyratron	4-phase thyratron
HV Overload Circuit.....	Split-cycle electronic	Split-cycle electronic
Arc Back Protection.....	Split-cycle electronic	Split-cycle electronic
Protection to Personnel.....	Door interlocks HV grounding switches	Door interlocks HV grounding switches
Total Tubes .....	23	26
Total Tube Types.....	7	7

*In order to make improvements in design and effect economies in manufacture, RCA reserves the right to make changes in design, components and specifications published herein.*

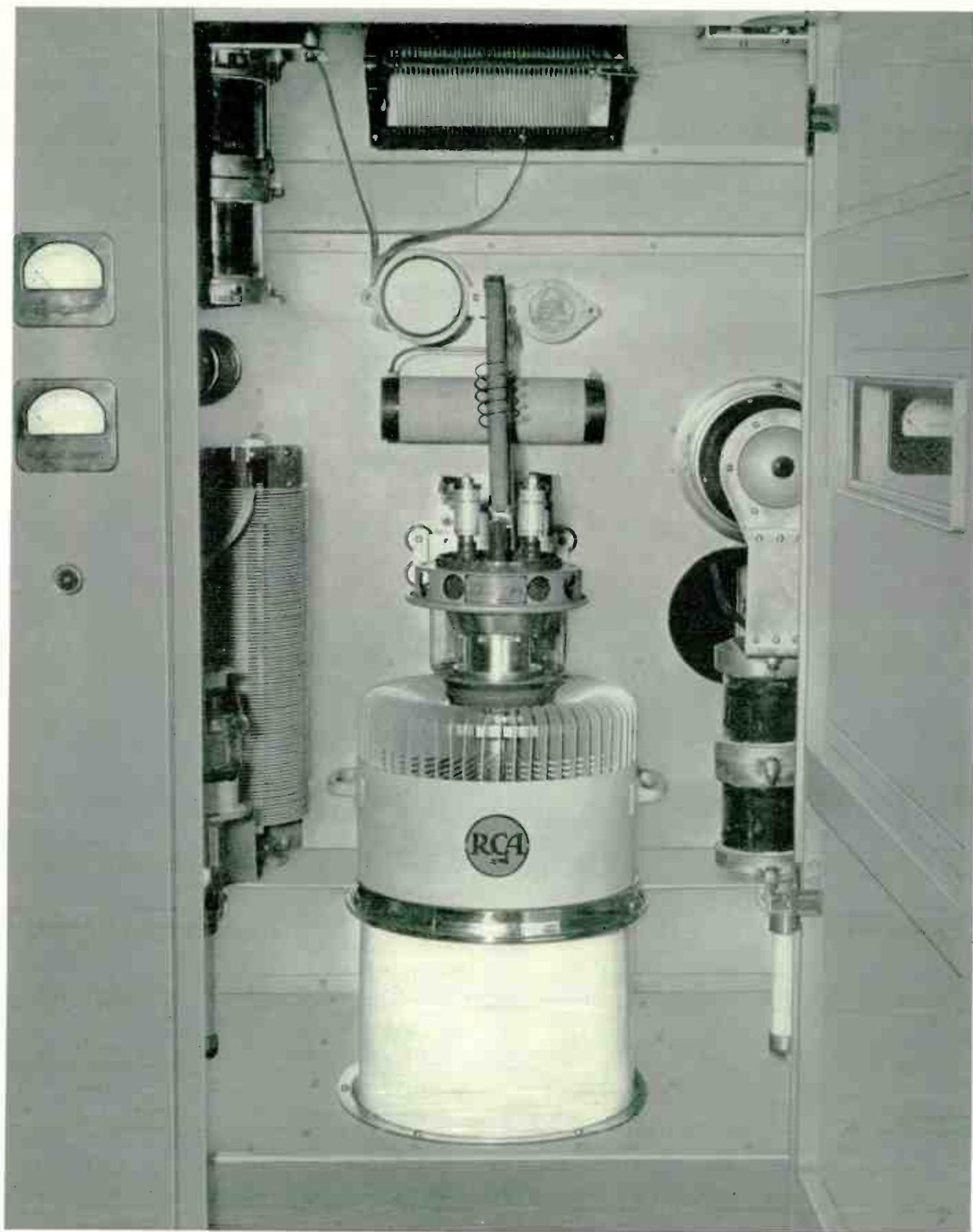
# 50 KW "AMPLIPHASE" AM BROADCAST TRANSMITTER

TYPE BTA-50G



## FEATURES

- Requires less than 80 square feet of floor space—smaller than many 5 kw transmitters
- Internal blowers—no air-ducts necessary
- Half the tube cost of other 50 kw transmitters
- Lowest operating cost ever offered in a 50 kw transmitter
- Low distortion, excellent frequency response
- Splatter-free modulation provided by new ampliphase design
- Long life RCA 5671 tubes used in the BTA-50G
- Designed to permit remote-control operation
- Uses fewer major components than any other transmitter of similar power for maximum dependability
- Extremely stable operation



OUTPUT STAGE

# SMALL SIZE PERMITS TRANSMITTER REPLACEMENT WITHOUT LOSS OF AIR-TIME

## DESCRIPTION

### Space-Saving Economy

The RCA "Ampliphase" 50 kw AM Broadcast Transmitter—Type BTA-50G, represents the most advanced development in AM transmitters. It is a unique space saving design, housed in only 4 cubicles—half the space required for other 50 kw equipments. This results in a transmitter which greatly reduces initial building costs when planning a completely new installation. As a replacement transmitter the BTA-50G yields valuable floor space for other uses; or, since it occupies so little space it may be installed in the present transmitter building keeping the former transmitter in operation during installation, or later utilizing it as a stand-by unit. Elimination of the need for under-floor cable trenches and considerable reduction in external air ducts, simplifies installation and reduces installation costs still further.

### Operational Economy

Completely air-cooled, the BTA-50G requires no external blowers. Also contributing to heat-reduction and economical operation is the minimum number of expensive power tubes required (the BTA-50G uses no costly modulator tubes). This feature contributes to vast savings in initial tube costs and in the number required by FCC for spares. Other items eliminated are bulky modulation transformers and reactors used in other type transmitters.

### Power Tube Savings

Two RCA 5671 triodes functioning as power amplifiers in the BTA-50G assure long-life performance. These tubes have logged up to 60,000 hours of dependable service during a seven year period of operation—and are "still going strong." Broadcasters can capitalize on the extra dividends of lower operating cost, lower capital investment—increased stability of operation and many other outstanding features of the BTA-50G.

### Ease of Operation and Flexibility

Many features provide ease of operation. The transmitter is simple to tune. It has generous, easy-to-read metering facilities for all major circuitry. Tubes are accessible from the front. All power tubes are visible during operation through wide-vision glass windows. The Ampliphase design combines the efficiency of high-level modulation at radio-frequency with the attendant economy of low-level modulation at audio frequency.

Ten kilowatt power cut-back provisions can be provided for day-to-night-time operation. The BTA-50G can be completely remote-controlled from console if desired. If this method is employed it is not necessary to make manual adjustments on the transmitter itself. Complete overload protection and visible overload indication are convenient protective features of the BTA-50G.

## CIRCUIT DESCRIPTION

The heart of this 50 KW Ampliphase transmitter is the low level exciter wherein a phase modulated signal is developed. This is represented in the block diagram as: A three-to-one frequency divider, 1-5693, following switchable duplicate UL-4392 crystal oscillator units; A buffer amplifier, 1-5693. One leading and one lagging 90 degree phase shift network which splits the 1/3 frequency signal into two channels; A phase modulated amplifier in each channel with 1-5693. The phase modulator itself is a single 5692. Good linearity of phase shift with program signal is assured by developing the phase modulated signal at 1/3 the final frequency; A cathode follower buffer, 1-5692 a frequency tripler amplifier, 1-5693 and a final buffer amplifier, 1-6146 in each channel to complete the low level equipment.

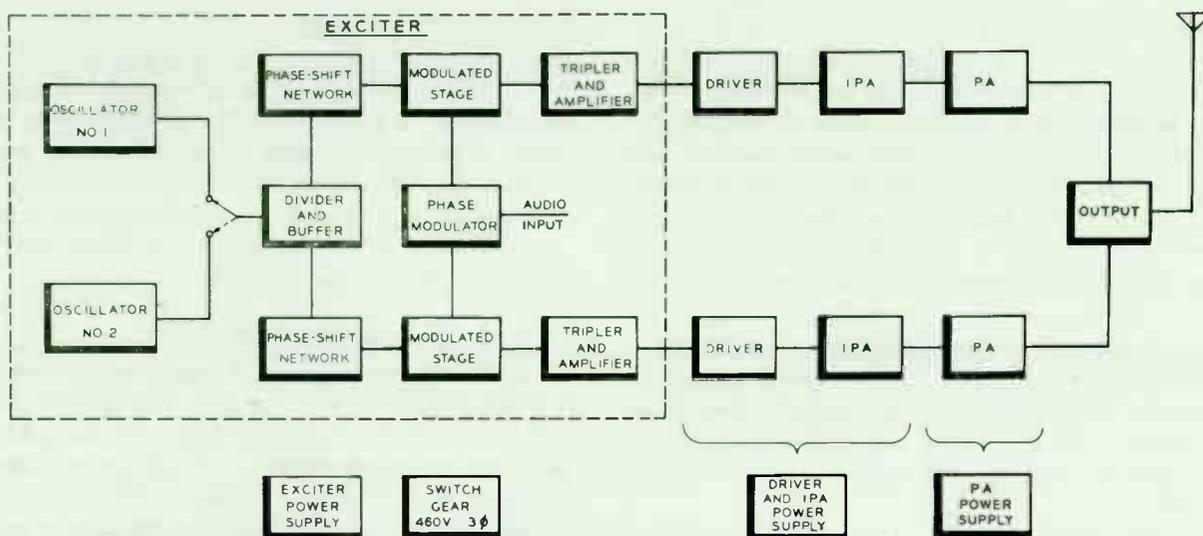
The BTA-50G r-f is generated by a crystal controlled oscillator, operating at carrier frequency. This frequency is divided and then separated into two channels differing in phase by 180 degrees. Each signal then passes through a phase shifting network so adjusted that a phase difference of approximately 135 degrees exists between the two signals. This phase difference represents unmodulated carrier power output. Modulation is applied at this point

to each r-f channel by a variable resistance type of phase modulator.

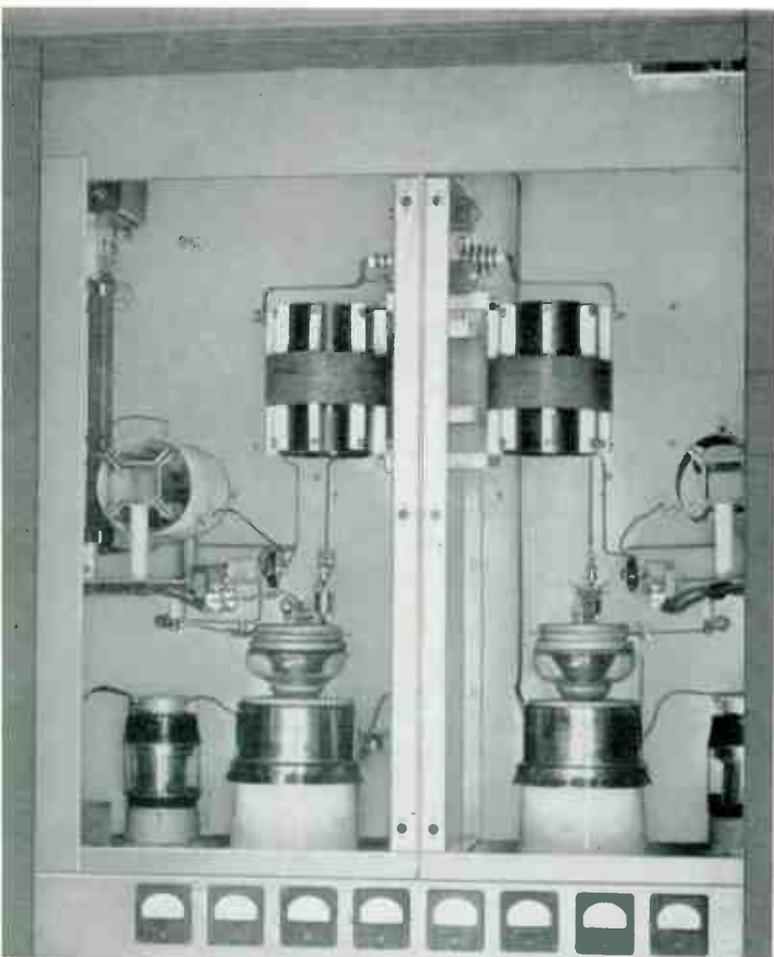
At the output of the phase modulator, the r-f signal has a phase excursion of approximately  $\pm 7.5$  degrees when modulated 100 percent. Due to this small angular excursion, a simple modulator using one half of a 5692 triode can be employed. The modulation process consists of the injection of a variable 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 a grounded grid cathode follower stage utilizing a 5692 triode.

The output of the modulated stage is then fed through a buffer stage using one half of a 5692 triode, thence to a tripler stage using the other half of the same triode. In the latter stage, the r-f frequency is returned to the output frequency, with a resultant gain in phase modulation to approximately  $\pm 22.5$  degrees. The power level after the 6146 amplifier is in the order of 5 watts, sufficient to adequately drive the following class C amplifier stage. This stage uses a 4-250 tetrode, which in turn drives a 5762 air cooled triode amplifier.

**SIMPLIFIED BLOCK DIAGRAM — BTA-50G TRANSMITTER**



**INTERMEDIATE R-F AMPLIFIERS**



**Ampliphase Principle of Operation**

To produce phase-to-amplitude modulation in the BTA-50G, a carrier wave is developed by a common exciter. This carrier wave is then split and fed to two separate amplifier chains through phase-shift networks that establish a carrier phase difference. These two signals are controlled so that each maintains a prescribed phase relationship with the other in accordance with the intensity of modulating signal. This controlled phase relationship enables the separate 25-kilowatt amplifiers, when feeding their outputs into a combining circuit, to produce a maximum level 50-kilowatt amplitude modulated signal.

**CIRCUIT DESCRIPTION (Continued)**

**The PA Stage**

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 set-up as a 90 degree network with the characteristic impedance required to convert the load resistance to the value required for optimum operation of the PA tube. Subsequent operational tuning is accomplished by adjusting the input shunt element, to provide a non-reactive load for the tube.

In line with recent concepts concerning degree of suppression of spurious radiation, a completely shielded low pass

filter is incorporated in the BTA-50G output. A two section low pass filter is used. Each section is a tee network, and each inductive series element is completely shielded. A tuned series is used to provide added attenuation for the second harmonic.

### Self-Protection Rectifiers

During periods of 100 percent modulation the 5671 power amplifier tubes require 15.0 KV DC at 7.5 amperes which is obtained by using 12 5563A mercury vapor thyratrons in a three phase double way rectifier circuit. Each pair of 5563A tubes is operated in parallel for two reasons. First, the 5563A is an economical rectifier tube with a good life record in more severe service. Secondly, the disturbing surge effects of tube arc starvation are greatly reduced since one tube would temporarily carry the total current if the other failed to fire. This self protection feature is particularly advantageous at the voltage level at which this rectifier operates. A further degree of self protection is assured by the control grid of each 5563A which, when connected to its cathode through a suitable resistor, will tend to prevent build up of destructive arcs.

Two other plate voltage supplies, 5.0 kv and 2.5 kv, are supplied by a three phase double way center tapped rectifier using 6 8008 tubes. Bias voltages for all tubes are supplied by a single phase full wave metallic rectifier, portions of which are regulated by VR tubes.

### High Power Distribution

The High Power distribution equipment for the transmitter consists of an electrically operated air circuit breaker, and a manually operated Delta-Wye switch which feed both the 15.0 KV rectifier and the 5.0/2.5 KV rectifier. The remaining transmitter power is distributed through a manually operated distribution circuit breaker to a 460 to 230 volt distribution transformer to voltage regulators and thence to the various low power distribution circuit breakers.

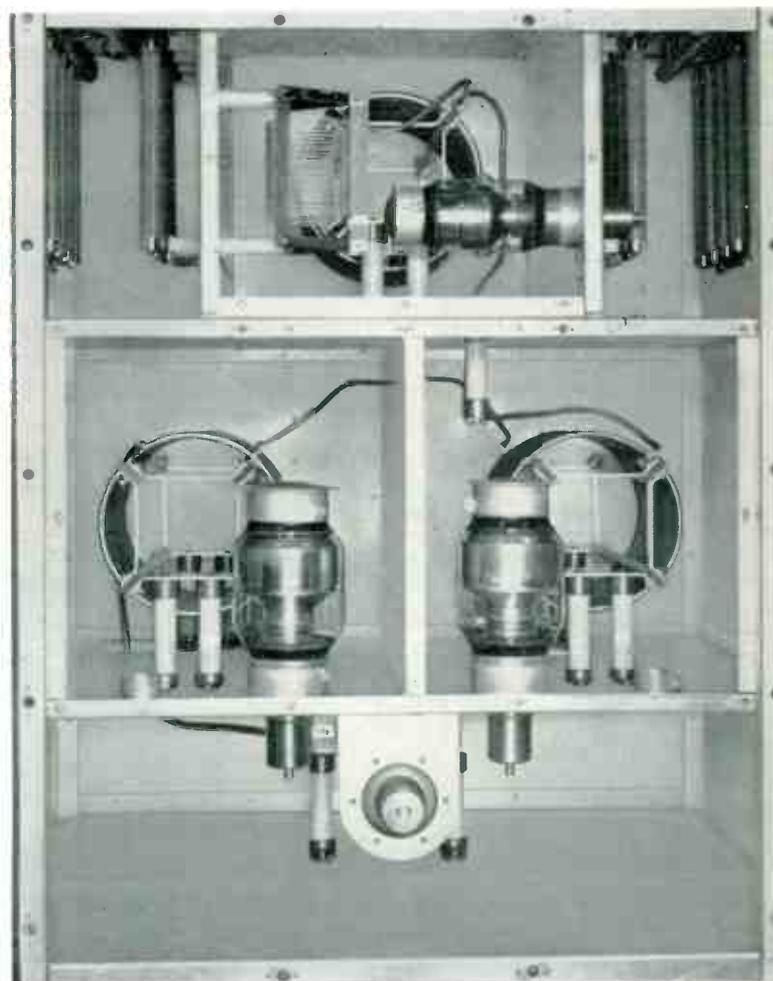
### Transmitter Control

The control of the transmitter is accomplished from the front of the Rectifier and Control cabinet with provisions made to allow control from a remote point. 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 transmitter 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, which are connected directly in the tube circuit and rectifier ground leads, and the thermal magnetic circuit breakers connected in the AC power leads used as convenient back up protection and disconnect switches. The transmitter circuitry is such that an overload will either lock out the plate circuit or allow a single reclosure which 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.

Other features of the control circuit are indicating lamps on each cabinet which indicate the status of the interlocks in that particular cabinet and a system of Carrier Off protection which does not operate the plate circuit breaker to the OFF position but instead biases off a low level stage momentarily to allow the radio frequency fault to clear itself.

HARMONIC FILTER



## MECHANICAL FEATURES

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, on opposite page, illustrates a typical layout of the complete equipment.

It is desirable to leave a passageway at the right end of the front line 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.

To make this transmitter adaptable to existing transmitter buildings, the main distribution components are wall mounted as shown on the overall floor plan (opposite page). The mounting of these components is not critical as to location. They can be mounted in existing power distribution areas if desired. These components are 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.

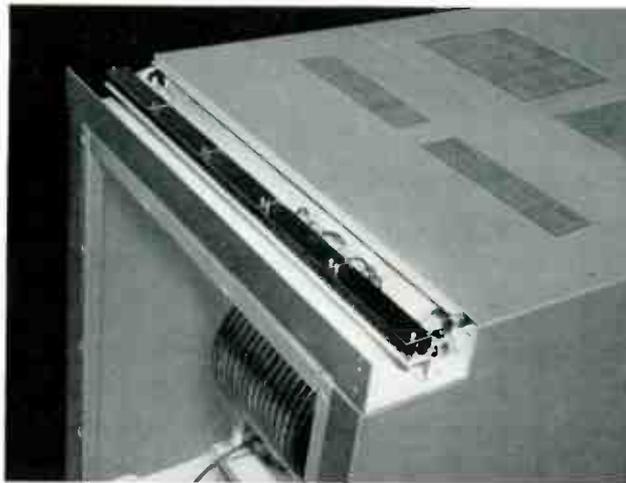
**Lighter-weight Cubicles**

Each of the four in line cabinets, 44 inches wide by 60 inches deep by 84 inches high, consists of an all aluminum cubicle erected on a welded steel base. This cubicle consists of a series of panels so fabricated and assembled that they form a rigid structure with good freedom of access. The use of aluminum eliminates unnecessary weight and gives excellent shielding to assure effective confinement of spurious energy. Front access to the cabinet is through a twenty-eight inch wide full length door 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 horizontal shelf into upper and lower compartments. This gives 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 each side of the front door, are also shielded.

**Built-in Wire Duct**

In the rear at the top of each cabinet there is a built-in wire duct which joins similar ducts of the adjacent cabinets, so as to form a continuous duct on the four front cabinets.



DETAIL OF COMPLETELY-SHIELDED INTERCONNECTION WIRE DUCT  
(Cover Removed)

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.

**PA Cubicles**

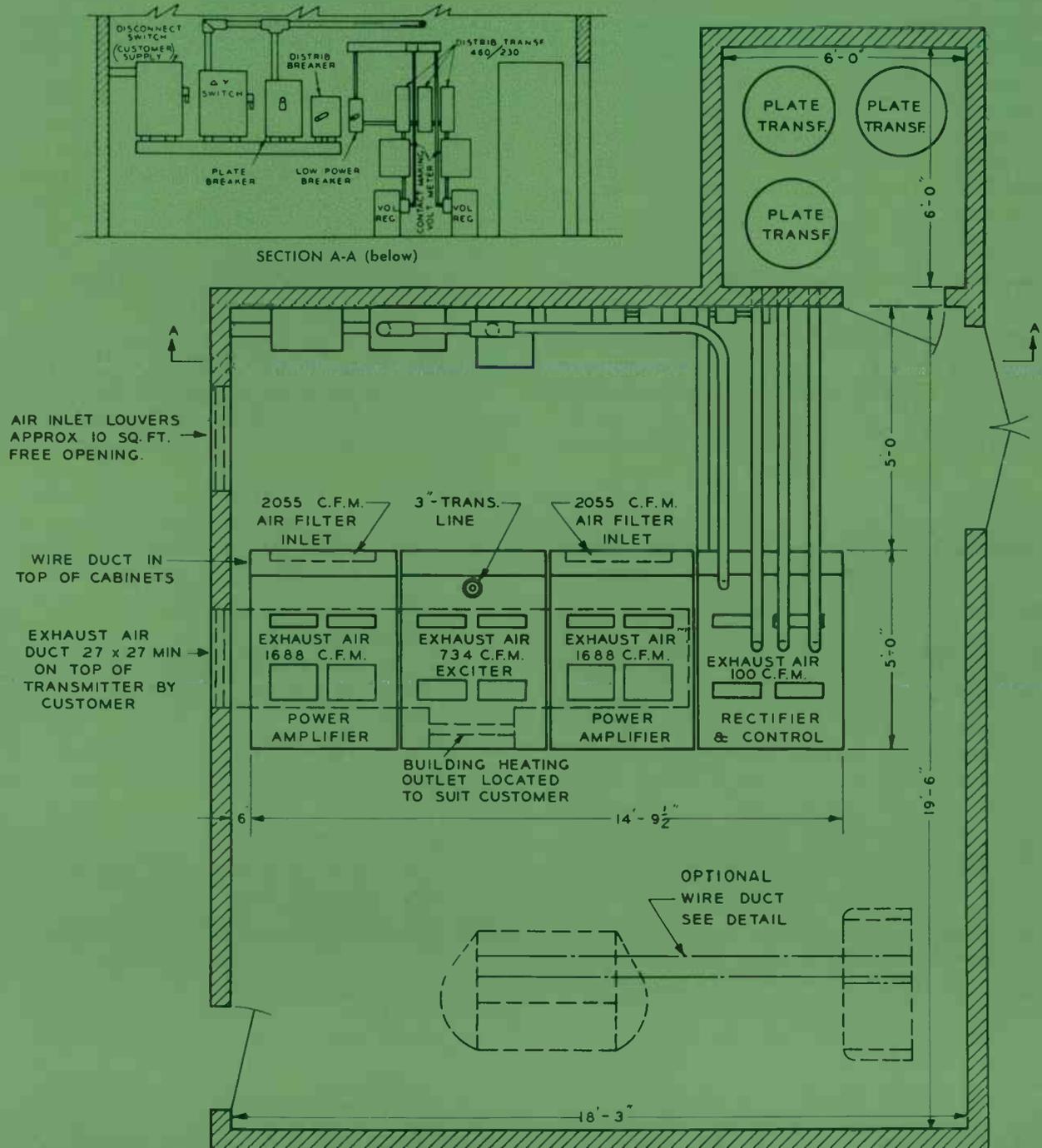
The left end cabinet and the third cabinet from the left end are identical and contain the final power amplifier stages. The 5671 tube and its grid circuits and part of the plate circuits are contained in the front portion of the cabinet. The upper rear section contains the plate tank coil, shielded filament transformer and grid leak resistors. The lower rear section contains a low noise blower which cools the 5671 tube and its cabinet and the adjacent half of the exciter cabinet. The lower rear panel contains an impingement type air filter for the blower. The PA cabinets are so constructed that the blowers and filters can be mounted externally to the cabinets, if so desired.

**Oscillator and 5762 Stages**

Located directly between the two power amplifier units is a cabinet which houses in its front section all the components from the oscillator through the 5762 stages. The separate branches are assembled as mirror images for symmetrical feed to the PA units at left and right. The rear section contains the 50 KW common output circuit and

# SIMPLIFIED INSTALLATION

## TYPICAL FLOOR PLAN



NOTE 1 - INLET EXHAUST LOUVERS TO BE THERMOSTATICALLY CONTROLLED TO SUIT CUSTOMERS BUILDING HEATING REQUIREMENTS

NOTE: The above Floor Plan is for idea of arrangement only. Secure more accurate engineering information before proceeding with building plans.

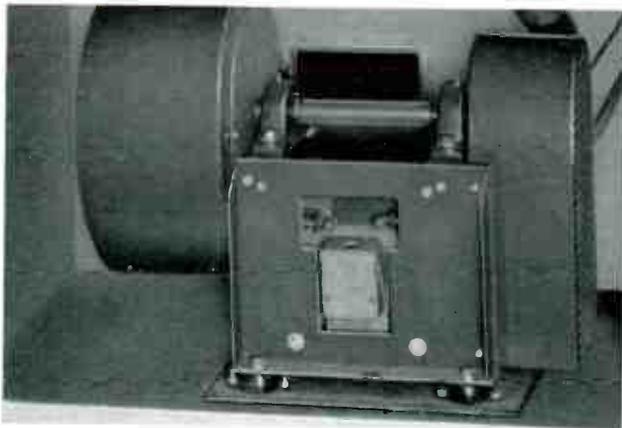
harmonic filter. Two 807 crystal oscillators are located at the bottom front of the cabinet and feed the exciter-modulator unit which is mounted on sliding rails directly above the oscillators. The exciter-modulator is a self-contained unit with the r-f and a-f components mounted on a vertical hinged panel which in turn is mounted on a horizontal chassis containing the power components for the exciter-modulator. A space is provided above this exciter-modulator for a complete duplicate unit if desired for utmost reliability. Above this space are two vertical sub-compartments behind interlocked doors which contain the 4-250 and 5762 stages. A meter panel for these stages is provided for at the bottom of these sub-compartments.

The common output capacitors of the 2 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 affected between the various sections of the filter and the output capacitor. The 5671 grid loading resistors are also located in separate compartments at the top of this cabinet. The lower rear section of this cabinet contains high voltage filter components.

### High Power Rectifier, Low Power Distribution, Control Components

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 15 KV rectifier tubes and filament transformers, the 5.0/2.5 KV rectifier tubes and filament transformers, the bias rectifier, high voltage grounding switches, surge suppressor relay and resistors, the 15 KV filter capacitors, and heating and cooling equipment to keep this section of the cabinet at the proper temperature level for best operation of the mercury vapor rectifiers. The top rear section of the cabinet contains the control relays, overload relays, distribution contactors, and low power distribution circuit breakers. The distribution breakers and overload relays are accessible without removing panels and recessed so that they will not be damaged or improperly operated. The bottom rear of the cabinet contains the 5.0 KV rectifier components including plate transformer. Operational control switches and status lights for the entire transmitter are located on the eight inch panels at each side of the door.

### SPECIFICATIONS



INTERNAL BLOWER

#### Electrical Specifications BTA-50G (ES-27221)

Power Line Requirements:

Line.....	460 volts, 60 cycles, 3 phase
Combined Regulation and Variation.....	Not more than $\pm 5\%$
Power Consumption.....	94 kilowatts (approx.) at zero modulation
Power Consumption.....	100 kilowatts (approx.) at average modulation
Power Factor.....	90%
Crystal Heaters.....	110 volts
Type of Emission.....	A3
Power Output (at transmitter terminals).....	53 kilowatts (max.)
Frequency.....	Any specified between 535 and 1620 kc
Frequency Stability.....	Assigned frequency $\pm 5$ cycles
Type Modulation.....	Phase to amplitude
Audio Input.....	+10 dbm
Audio Response.....	$\pm 1.5$ db 50-10,000 cycles
AF Distortion.....	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 Impedance.....	50 ohms nominal

#### Tube Complement (ES-27222)

Qty.	Function	Type
(AUDIO SECTION)		
1	Voltage Amplifier .....	5692
2	Drive Regulator .....	1614
2	Phase Modulator .....	5692
(R.F. SECTION)		
2	Oscillator .....	807
1	Frequency Divider .....	5692
1	Buffer .....	5693
2	Phase Modulated Amplifier .....	5693
2	Cathode Follower .....	5692
2	Tripler .....	5693
2	Buffer .....	1614
2	R.F. Amplifier .....	4-250-A/5D22
2	Intermediate Power Amplifier.....	5762
2	Power Amplifier .....	5671
(RECTIFIER SECTION)		
6	Intermediate Voltage Rectifier.....	8008
12	High Voltage Rectifier .....	5563-A
2	*Exciter Voltage Regulator.....	OD3

#### Mechanical Specifications

Cabinet Size.....	44" wide, 84" high, 60" deep
Overall Weight.....	12,000 lbs., approx.
Maximum Altitude.....	6,000 feet
Ambient Temperature.....	114°F maximum
Maximum Cabinet Weight.....	2,000 lbs., approx.
PA Cabinet Weights (each).....	3,200 lbs., approx.
Plate Transformer Weight (total).....	3,600 lbs., approx.
Rectifier Weight .....	2,000 lbs., approx.
Exciter Weight .....	1,500 lbs., approx.
Filter Reactor .....	1,500 lbs., approx.

\* Exciter power supply uses disc rectifier.

*In order to make improvements in design and effect economies in manufacture, RCA reserves the right to make changes in design, components and specifications published herein.*

# H. F. BROADCAST TRANSMITTER, BHF-1A

## 1 KW HIGH FREQUENCY BROADCAST TRANSMITTER

### FEATURES

- Complete transmitter in single cabinet
- Minimum floor space requirement
- Lightweight aluminum cabinet
- Fewer tubes—fewer types
- Low tube cost
- Low power consumption
- Vertical panel construction provides reach-in accessibility
- High fidelity
- Quick frequency change
- Balanced or single ended output

### DESCRIPTION

The RCA BHF-1A transmitter combines all the best features and accumulated knowledge of 25 years experience in the design, manufacture and operation of broadcast and high frequency transmitters.

The transmitter is compact, coming in ONE CABINET which requires 7.5 sq. feet (.7 sq. meters) floor space. The transmitter is completely tested at the factory. This REDUCES installation and test time in the field.

The only building requirements are:

Floor Area—Load requirements 200# sq. ft. or  
2140# sq. meters

Incoming power and audio lines

Outgoing R.F. transmission lines

The entire transmitter is housed in a lightweight aluminum cabinet with a steel base. This cabinet is 84" high, 33" wide and 32 $\frac{1}{2}$ " deep. It is equipped with sliding doors that never extend beyond the cabinet, thus minimizing floor space requirements. The sliding doors are interlocked. AUTOMATIC HIGH VOLTAGE GROUNDING is also provided for the protection of operating personnel.



### Shielding

All circuits are enclosed for personnel protection. SHIELDING is complete and no additional screening is required to SUPPRESS UNWANTED RADIATION.

### Power Circuits

The lower half of the cabinet contains three power supplies. The main rectifier tubes, 8008's, supply the high voltage for the PA and modulator tubes. The low voltage

rectifier utilizes two RCA 866A/866 tubes, and bias is supplied from a selenium bias rectifier. These rectifiers and the tube filaments require a 230-volt single phase supply.

**Overload Protection**

CIRCUIT PROTECTION is provided by HIGH SPEED CIRCUIT BREAKERS and a plate contactor. The filament and plate circuit breakers serve as control switches. Circuit breakers in the cathode circuit of the power amplifier, modulator, and ground return of the low voltage and bias rectifier, operate the plate contactor. All plate and bias voltages are removed when an overload occurs. Provision is made for automatic and instant return of the transmitter to the air after a power line interruption of up to two seconds duration. If the power interruption is over two seconds duration, the transmitter will return to the air automatically, thirty seconds after the power line interruption is over.

**Radio Frequency Circuits**

The frequency source contains a type 6AK5 oscillator, type 6AG7 buffer, 6AG7 multiplier. Five crystal frequencies may be pre-tuned and are then available for instant selection with a five-position switch.

The signal is amplified by a 6146 amplifier which provides ample drive for the two type 4-400A tubes in the power amplifier. Using tetrode tubes in all radio frequency amplifiers provides high power gain and eliminates the need for neutralization adjustments.

**Output Circuits**

A tank circuit of the pi-filter type provides sufficient harmonic suppression and impedance matching. If a balanced transmission line is used a balancing bridge is inserted between the pi-filter and the line.

**Modulator**

In the three modulator stages the program input signal is raised to the level needed to modulate the power amplifier. A push-pull voltage amplifier and a push-pull cathode follower use two 6146 tubes each. In the Class B modulator two type 833A triodes are employed. Output from the modulator is coupled to the power amplifier through the usual transformer-reactor combination. Inverse feedback is applied from the modulator plates through an R-C network to the grids of the input amplifier.

**Cooling**

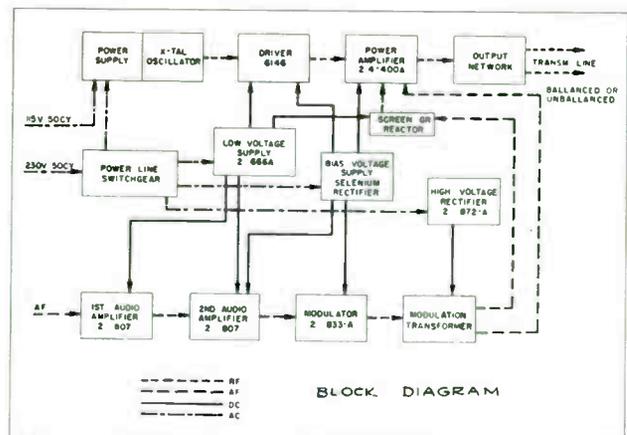
A single blower provides the pressure for the forced-air cooling of the power amplifier tubes and also ventilates the entire cabinet. An air-operated relay cuts all high voltages if the blower is not operating properly.

**SPECIFICATIONS**

Type of Emission.....	A 3
Output Frequency Range.....	3.9 to 26.1 mc/s
Rated Power Output at Transmitter Terminals.....	1 kw, carrier
Output Load Impedance.....	50 to 230 ohms unbalanced 300 to 600 ohms balanced
	Resistive ±J0.1R
Spurious Frequency Radiation.....	-40 db
Frequency Stability.....	0.003%
Type of Modulation.....	High-level Class B
Program Input Impedance.....	150/600 ohms
Program Input Level.....	+10 dbm ±2 dbm
Audio Frequency Response.....	±2 db, 30 to 10,000 cps (1000 cps, 60% reference)
<b>Modulation Capability:</b>	
400 cps.....	100%
50 to 7500 cps.....	90% minimum
Envelope Distortion (1000 cps, 90% mod.).....	4%
Noise Level, Unweighted (below 100% mod.).....	52 db
Carrier Shift Up to 100% Modulation.....	Less than 5%
<b>Power Consumption:</b>	
Unmodulated.....	2900 watts, approx.
40% Modulation.....	3100 watts, approx.
100% Modulation.....	3900 watts, approx.
Power Factor.....	.9
<b>Power Line Requirements:</b>	
Transmitter.....	230 volts, single-phase, 60 cy., available also for 50 cy.
Cabinet Lights.....	115 volts, single-phase, 50/60 cy.
Permissible Power Line Variation.....	5%
Ambient Temperature Range.....	+10° C to +45° C
Elevation.....	8000 feet maximum
Transmitter Height.....	.84"
Transmitter Width.....	.33"
Transmitter Depth.....	.32 1/16"
Transmitter Floor Space.....	7.5 sq. ft.
Transmitter Weight (Unpacked).....	1500 lbs. (approx.)

**Tube Complement—1 Set**

<b>FREQUENCY SOURCE</b>	
Crystal Oscillator.....	1-6AK5
Buffer.....	1-6AG7
Multiplier.....	1-6AG7
Voltage Regulator.....	1-VR150
<b>RADIO FREQUENCY AMPLIFIERS</b>	
Intermediate Amplifier.....	1-6146
Power Amplifier.....	2-4-400A
<b>AUDIO FREQUENCY AMPLIFIERS</b>	
Voltage Amplifier.....	2-6146
Cathode Follower.....	2-6146
Modulator.....	2-833A
<b>RECTIFIERS</b>	
Low Voltage Rectifier.....	2-866A
Main Rectifier.....	2-8008



# H. F. BROADCAST TRANSMITTER, BHF-10A

10 KW High Frequency Broadcast Transmitter



## FEATURES

- Rapid frequency change
- Few tuning elements
- No neutralizing adjustments
- Latest tetrode type, long life, power amplifier tube
- Minimum of tube types
- Smaller total number of tubes—high gain per stage
- Electronically controlled power supply with rapid fault cut-off and automatic re-application
- Economical floor space with maximum accessibility
- Sliding panel access doors
- Ease of installation—preformed interconnections
- All air cooled . . . high efficiency
- High level modulated for simplicity of adjustment
- Simplified radio frequency circuits
- Harmonic suppression circuits included
- Light weight, aluminum cabinets — completely shielded

## DESCRIPTION

The BHF-10A transmitter combines all the best features and accumulated knowledge of 25 years experience in the design, manufacture and operation of broadcast and high frequency transmitters. The four main cabinets, and external plate transformer contain all the elements functionally disposed to deliver a fine quality broadcast signal to a high frequency radiating system within a short time after unpacking and placement. The only building arrangements required prior to installation are (1) a floor area suitable for the load, (2) incoming power and program service and (3) outgoing radio frequency transmission lines.

### Power Circuits

The right hand cabinet houses power circuits and the electronically controlled main rectifier utilizing 4 high power, mercury vapor thyatrons, type 5563. Electronic control coordinates several functions (heretofore handled with cumbersome magnetic devices) into a smoothly operating system with the selective safety and back up protection using a sturdy contactor and a high speed breaker.

### Low Power Circuits

The right center cabinet houses intermediate voltage, direct current power supplies; the primary radio frequency

source\* and intermediate radio frequency amplifiers. Five crystal positions are available for instant selection with a 5 position switch. Buffer stages are integral with the frequency source unit which also contains its own direct current power supply. The two intermediate amplifiers, one 6146 and three 813's, provide stable, high gain amplification with ample output for driving the power amplifier.

**Power Amplifier**

Next in line to the left is the radio frequency power amplifier cabinet with two screen grid, type 6166, air cooled tubes. Use of this tetrode type tube provides a great advantage in highest power gain with stable operation. Elimination of neutralizing circuits is a further advantage resulting in fewer components subject to failure and reduction of power wasting and excessive radio frequency currents at the higher operating frequencies.

**Output Circuits**

Impedance matching of power amplifier output to transmission line along with harmonic attenuation is provided by a variable network. This circuit allows adjustment during operation to maintain constant output for variations of 10% from normal load impedance.

**Modulator**

The left hand cabinet contains all tubes and circuits associated with the Class B modulator. Program input is raised from a 10 milliwatt level to 6500 watts needed to modulate the power amplifier. Low power push pull stages include two voltage amplifiers and a cathode follower. Output from the two air cooled modulator tubes is coupled to the power amplifier through the familiar transformer-reactor combination. Approximately 20 db of feedback is applied from the modulator plates through a simple network to the grids of the input amplifier.

**Integral Auxiliaries**

All heavier components (plate transformer excepted) such as filament and intermediate power transformers, filters, modulation transformer and reactor, blower and filters are housed in the lower sections of the four cabinets. Front and rear, light weight, aluminum panels are quickly removable by hand for full accessibility to any of these components. Two finger operated locking lugs secure each panel. These lugs are accessible only after opening the corresponding upper section sliding door so that it is impossible for personnel to expose any high voltage circuits without first opening a door which operates interlock and grounding switches.

**Floor Space**

The four cabinets occupy a floor space of 11 feet 1 inch (340 cms.) front and rear by 2 feet 8½ inches (82.5 cms.) deep. The plate transformer which can be located where most convenient requires a floor space of 19 x 24 inches (49 x 64 cms.). Wire ducts are provided to run the interconnections between this transformer and the power supply cabinet.

**Optional Supervisory Console**

BTC-1A Universal Transmitter Console, MI-28950. This unit can be supplied where it is desired to combine program control functions and essential transmitter controls from a single location in front of the transmitter.

\* An external frequency source may be used.

**Other Accessories**

The RCA International Division can supply spare parts, program speech input cabinets, local studio equipment, measuring equipment, transmission lines, antennas, emergency power supplies and other items to equip a transmitter plant as a completely integrated installation.

**SPECIFICATIONS**

Type of Emission.....	A 3
Output Frequency Range.....	3.2 to 26.1 mcs
Power Output at Transmitter terminals.....	10 kw unmodulated
Output Load Impedance.....	350 to 650 ohms resistive ±JO.1R
Radio Frequency Harmonic Output.....	Less than 200 milliwatts
Frequency Stability.....	0.003%
Type of Modulation.....	High level, Class B
Program Input Impedance.....	150 or 600 ohms
Program Input Level (100% Modulation).....	+10 dbm ±2 db
Audio Frequency Response.....	±1.0 db 50 to 7,500 cycles ±2.0 db 30 to 10,000 cycles
Audio Frequency Distortion at 95% Modulation, 50 to 5,000 cycles.....	4.0% RMS maximum
Noise Level, Unweighted (below 100% Modulation).....	54 db
Carrier Regulation.....	Less than 5% up to 100% modulation
Power Consumption:	
Without Modulation.....	22 kw approx.
40% Modulation.....	28 kw approx.
100% Modulation.....	35 kw approx.
Power Factor.....	0.85
Power Line Requirements.....	230 volts, 3 phase, 3 wire, 50 cycles
Permissible Power Line Regulation.....	5% zero to full load
Permissible Power Line Combined Regulation and Variation Limits.....	±5%
Ambient Temperature.....	+45 degrees C max.
Elevation.....	8000 feet max.
Frequency Change Time:	
(a) 4 to 22 Megacycle Range.....	120 seconds max.
(b) Range (a) to 26.1 or 3.2 Megacycle Ranges.....	300 seconds max.

**Tube Complement**

**FREQUENCY SOURCE**

Crystal Oscillator.....	1—6AK5
Buffer.....	1—6AG7
Doubler.....	1—6146
Voltage Regulator.....	1—VR150

**RADIO FREQUENCY AMPLIFIER**

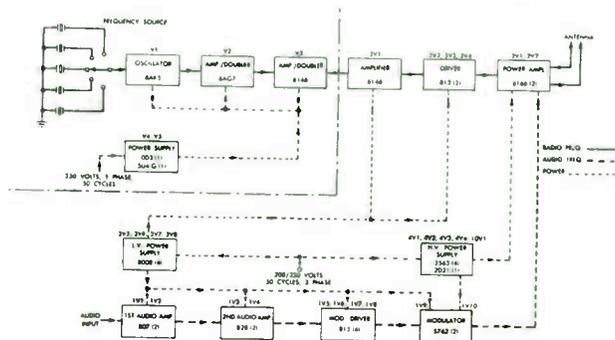
1st Intermediate Amplifier.....	1—RCA 6146
2nd Intermediate Amplifier.....	2—RCA 813
Power Amplifier.....	2—RCA 6166

**AUDIO FREQUENCY AMPLIFIERS**

Input Amplifier.....	2—RCA 807
1st Intermediate Amplifier.....	2—RCA 828
Cathode Follower.....	4—RCA 813
Modulator.....	2—RCA 5762

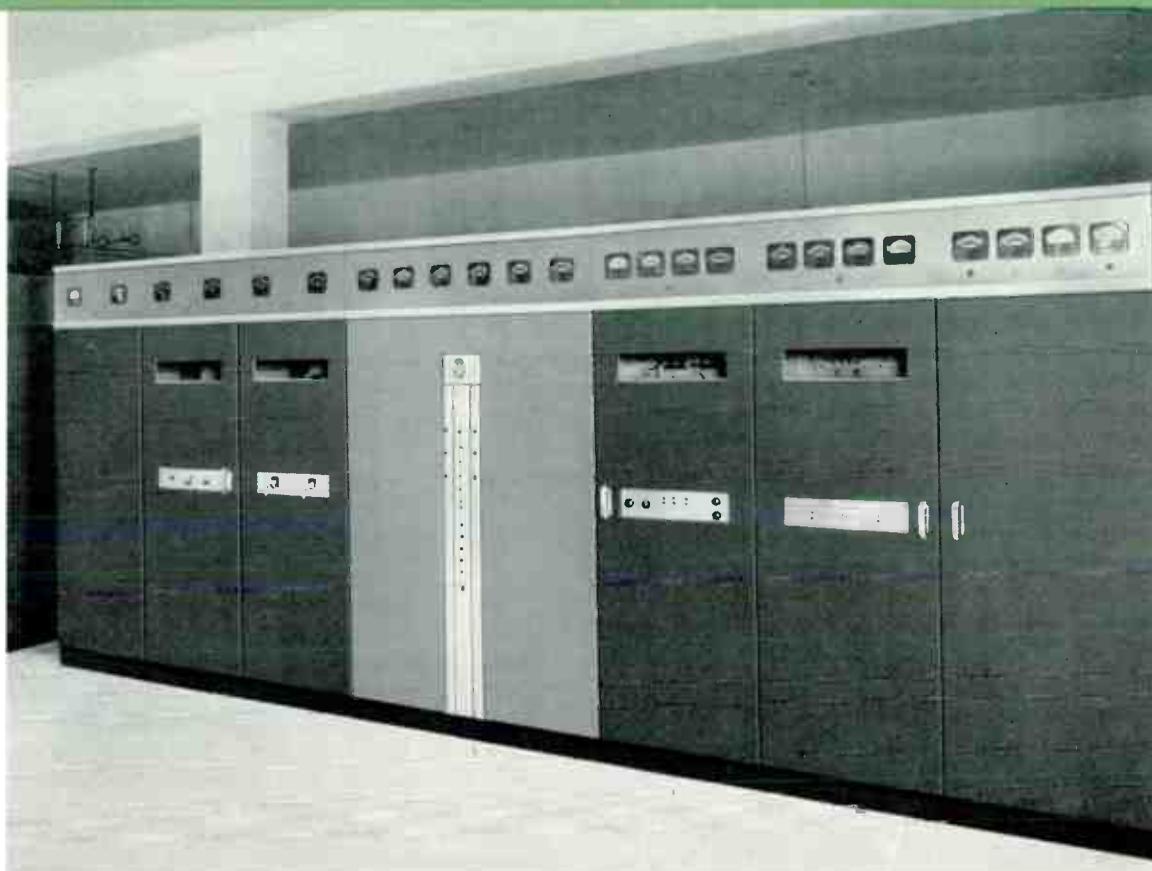
**POWER SUPPLY**

4700 Volt Thyatron Rectifier.....	4—RCA 5563
Intermediate Voltage Rectifier.....	4—RCA 8008
Control.....	1—RCA 2D21



# H. F. Broadcast Transmitter, Type BHF-50B

50 KW High Frequency Broadcast Transmitter



## FEATURES

- Entirely air cooled
- High stability grounded grid amplifiers
- Quick frequency change
- High level modulation by Class B modulator
- Low operating cost—low power consumption
- Conservative operation of all parts and tubes
- Small floor space requirements—reduces installation and building construction costs
- Built in wiring ducts—minimizes conduit and wire trenches—low installation cost
- Simplified effective control with high speed air circuit-breakers
- Simplified power supply—only one main mid-voltage tap rectifier, one auxiliary and one metallic bias rectifier
- Single phase filament heating of all vacuum tubes
- Motor driven tuning—essential circuit metering
- Breaks down into small units for ease of transportation and installation
- Sectional fault indication on front panel enclosure
- Non-critical, low distortion performance obtained by audio feedback in connection with a cathode follower driver for the modulator
- Attractive appearance achieved by functional styling
- Vertical chassis construction for accessibility and maximum ventilation
- Supervisory control console constructed of build-up sections

DESCRIPTION

General

The new RCA type BHF-50B transmitter is an all air cooled 50-kw amplitude modulated shortwave broadcast transmitter featuring a number of RCA's latest developments, as well as time tested features which have proven their worth. Of particular interest is the use of a grounded grid power amplifier with consequent circuit simplicity and stability. Two of the outstanding features are the small floor space requirements and ease of installation of the transmitter. The transmitter is designed for high fidelity transmission in the frequency band of 3.9 to 22 megacycles and the frequency band of 25.6 to 26.1 megacycles. Radio stations of this class usually have long operating schedules which permit minimum time off for servicing and maintenance. This point has been given careful consideration in the layout and design of the BHF-50B.

Mechanical Design

The general arrangement of the transmitter consists of a series of self-supporting chassis in line with a front enclosure to form a unified front panel. A typical floor plan (refer to plan view) permits installation of the radio frequency portion of the transmitter in a space sixteen and one-half feet long by nine feet deep. With such an arrangement, the blower and power equipment can be installed as indicated on the referenced drawing. Other disposition of the power equipment and blower may be made to make the optimum use of existing building space. All equipment is dead-front constructed, with doors in the front enclosure allowing free access to the driver and P.A., R.F. cabinets, modulator and to the transmitter area. With the transmitter "on the air", station personnel can walk behind the enclosure and around the individual units for close inspection without fear of coming in contact with dangerous voltages.

Single Unit

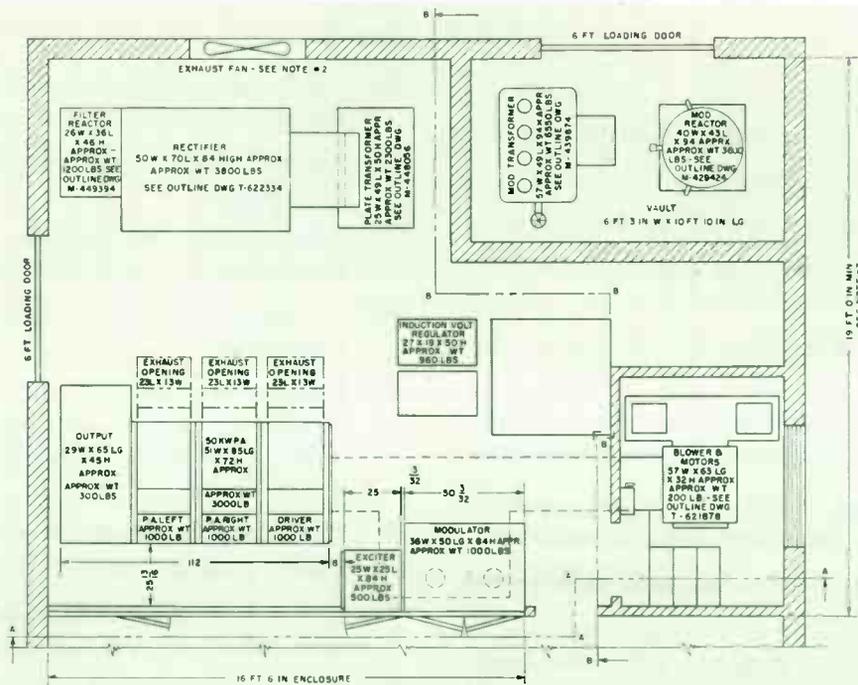
All incoming power supply and high power rectifier switch-gear along with lower power distribution circuits, contactors, and control relays are centralized in a single unit. This unit also contains the filament voltage regulator and distribution transformers.

For installation, the transmitter can be broken down into units no larger than 50 x 52½ x 84 inches, with the exception, in height, of the modulation transformer and reactor, which will be approximately 92 inches high.

Operational controls, indicating instruments, indicator lights and tuning controls are located on the front panel at appropriate intervals. Tuning operations required for normal daily adjustments are remotely controlled by front panel key switches controlling motor drives on the tuning elements. Power amplifier tuning controls are conveniently located with respect to the corresponding meters for easy viewing of d-c power input and R.F. output during tuning operations.

Control Console

The supervisory control console is designed to be set up in a convenient position in front of the transmitter. Essential operational controls and indicator lamps are duplicated on the R.F. turret of the console. The audio turret of the console has all controls for program handling. Space and mounting convenience has been provided in the R.F. turret for mounting three 4-inch meters in a recessed position behind the front panel, the choice of the meters being left to the discretion of the station personnel. The control console is of the sectionalized type which provides for adding further sections for associated usage, such as antenna switching controls, another HF, MF or FM transmitter control, paralleling controls, etc.



Plan View.

### Frequency Source

Most customers prefer to supply their own frequency source. In some cases transmitters are driven from a central control room. A Frequency Source, therefore, has not been included in the equipment supplied with the transmitter. RCA can supply an external Frequency Source to drive the transmitter and lists one under the accessories.

### Mechanically Operated Tube Hoist

Tube changing in the driver and power amplifier and modulator is facilitated by the use of a mechanically operated tube hoist, solidly mounted in a swivel supporting structure and suitably located for easy access to the high power tubes. Swivel supports are provided. The hoist can be easily lifted from one support to the other, depending upon which tube is to be removed. Minimum tube change time is assured by use of quick opening clamp type filament connectors.

### Radio and Audio Frequency Circuit Design

Simplified single ended circuits are used throughout. An output circuit consisting of a capacity tuned, single turn primary and a capacity tuned, double turn secondary is used to control the power amplifier loading and to convert the unbalanced output of these amplifiers to balanced output. Radiation cooled, shielded grid type tubes are used in the low power r-f and a-f stages while forced air cooled triodes are used in all subsequent stages above the 250 watt r-f level and the modulator. High stability grounded grid amplifiers are used for all r-f stages above the 250 watt level. Only three tube types are used in the r-f amplifiers. Completely shielded construction in the higher power stages and use of grounded grid circuits leads to complete stability and freedom from operation discrepancies. The complete shielding of the r-f stages and the design

of the power amplifier tank circuit and output coupling network reduces harmonic radiation to a minimum.

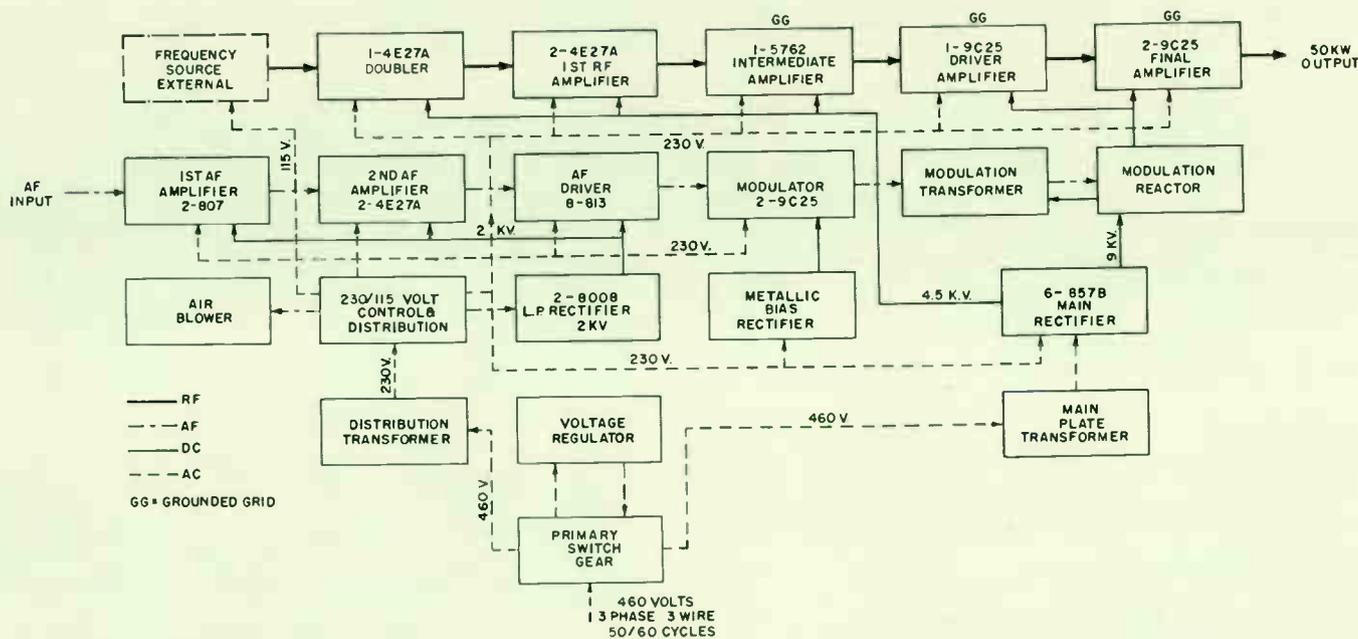
The audio section of the transmitter employs push pull circuits throughout with fixed overall audio feedback. This design results in a very stable system having excellent fidelity characteristics with very low distortion and noise level. A total of three stages of audio amplification are employed, the third of which is a highly efficient cathode follower circuit. High level, Class B modulation is employed resulting in further economy of equipment and operation.

All filaments are heated with power frequency a-c voltage and filament voltages are maintained within specified limits by means of an automatic induction regulator. Single phase filaments are used in all tubes resulting in greater tube life. All high power tubes have thoriated tungsten filaments, with subsequent saving in filament power.

### Rectifiers

A total of three rectifiers are employed in the BHF-50B.

- (1) A single phase full wave unit, using two mercury vapor rectifier tubes to supply plate and screen voltage for the low power a-f tubes.
- (2) A single phase bridge connected unit, using two metallic rectifier sections to supply bias voltage for the cathode follower and modulator tubes.
- (3) A three phase full wave, high voltage rectifier, with a mid-voltage tap, which supplies plate and screen voltage for all r-f screen type tubes and plate voltage for all triode r-f power tubes and the modulator tubes. This rectifier has a preheated spare tube which may be switched into the circuit manually. The plate transformer is an air cooled three-phase unit with extended windings on the primary to provide reduced voltage for test and tune-up purposes.



Simplified Block Diagram.

**Metering**

All essential indicating instruments are located along the top front of the enclosure and are the 4-inch square faced type meters with black background. Less important meters are located behind the enclosure and may be viewed through windows while the transmitter is in operation.

High-speed air circuit breakers of the hum free mechanical latch type are employed in all high power switchgear. Overload protection consists of a selective relay system combining high speed tripping on d-c overloads and short circuit faults, with time delay tripping on nominal a-c system overcurrent and under-voltage faults.

The control system is carefully engineered to provide proper starting sequence and automatic protection against most operating faults. Circuit indicator lamps provide a quick means for analyzing and localizing transmitter, tube or line faults, etc. A reclosing system will return full power automatically if the plate voltage is removed due to operation of overload devices on rectifier backfires, vacuum tube gas arcs, antenna flash-overs or other causes. This operation is repeated three times. If the fault persists on the third re-application of plate voltage, the recloser will lock out until reset manually.

All power circuits are doubly protected by high speed overload relays and air circuit breakers. In addition, a special hold-in circuit is provided which permits the trans-

mitter to return instantly to the air in case of a momentary power line failure, thus avoiding the delay required for the plate time-delay relay to operate.

**Installation**

Ease of installation and good utilization of building space is a feature of the BHF-50B. Being air cooled, no plumbing is required, and its design is such that virtually no wiring trenches or conduit need be used. All interconnections are made in either built in or overhead ducts or conduits, so that the only conduits or trenches required are those for the supervisory console and incoming power. While the plan view shows an under floor air duct and depressed level blower room, both the air duct and blower may be above floor level with only slight inconveniences on accessibility to units located to the rear. Units are designed as sub-groups for economy of floor space and wiring materials, leading to economy of installation labor as well.

**Safety**

All possible precautions have been taken to provide maximum safety to operating personnel. All doors permitting access to high voltage circuits or equipment are interlocked to remove high voltage and to operate a grounding switch on the high voltage bus. In addition, grounding sticks are provided in each enclosure where high voltage is present.

**SPECIFICATIONS**

**Electrical Characteristics**

Type of Emission.....	A 3 (telephone)
Output Frequency Range.....	Any frequency within the ranges 3.9 to 22.0 mc; and 25.6 to 26.1 mc
Stability.....	Determined by frequency source
RF Power Required from External Frequency Source.....	2 watts minimum
Power Output.....	Not less than 50 kw for frequency range of 3.9 to 22.0 mc Not less than 40 kw for frequency range of 25.6 to 26.1 mc
Modulation.....	High level Class B
Capability:	
400 Cycles.....	Not less than 100 per cent
50 to 7500 Cycles.....	Not less than 90 per cent
Audio Frequency Response.....	±2 db 30 to 10,000 cycles (Input reference level corresponding to 60 per cent modulation at 1000 cycles)
Residual Modulation.....	56 db below 100 per cent modulation
Envelope Distortion.....	Less than 4.0 per cent rms (with 90 per cent modulation at 1000 cycles)
Input Impedance.....	600 ohms
Input Level Required for Full Modulation (400 cycles).....	+10 ±2 dbm
R-F Output Load Impedance.....	300 to 600 ohms resistive
Power Sources:	
For Main Supply.....	460 volts, 50 cycles, 3 phase, 3 wire. Allowable regulation 5.0 per cent. Allowable total voltage variation including regulation, 46 volts.
For Auxiliary Supply.....	115 volt, 50 cycle, single phase, approximately 500 watts
Power Consumption (less Auxiliaries):	
0% Modulation.....	110 kw
30% Modulation.....	125 kw
100% Modulation.....	165 kw
Power Factor (at 100% Modulation).....	At least 90 per cent

**Tube Complement** (less Frequency Source)

5—RCA 4E27A	8—RCA 813
1—RCA 5762	2—RCA 8008
5—RCA 9C25	6—RCA 857B
2—RCA 807	

**Available Accessories**

Frequency Source .....	MI-22619
Set Small Tubes.....	MI-8480
Set Large Tubes.....	MI-8481
Supervisory Console .....	MI-28950
Installation Materials Kit .....	MI-8476
Recommended Spare Parts .....	MI-8471
60 Cycle Conversion Kit.....	MI-22620

**Equipment Supplied**

Following is a condensed list of equipment included as a complete BHF-50B Transmitter ES-8460:

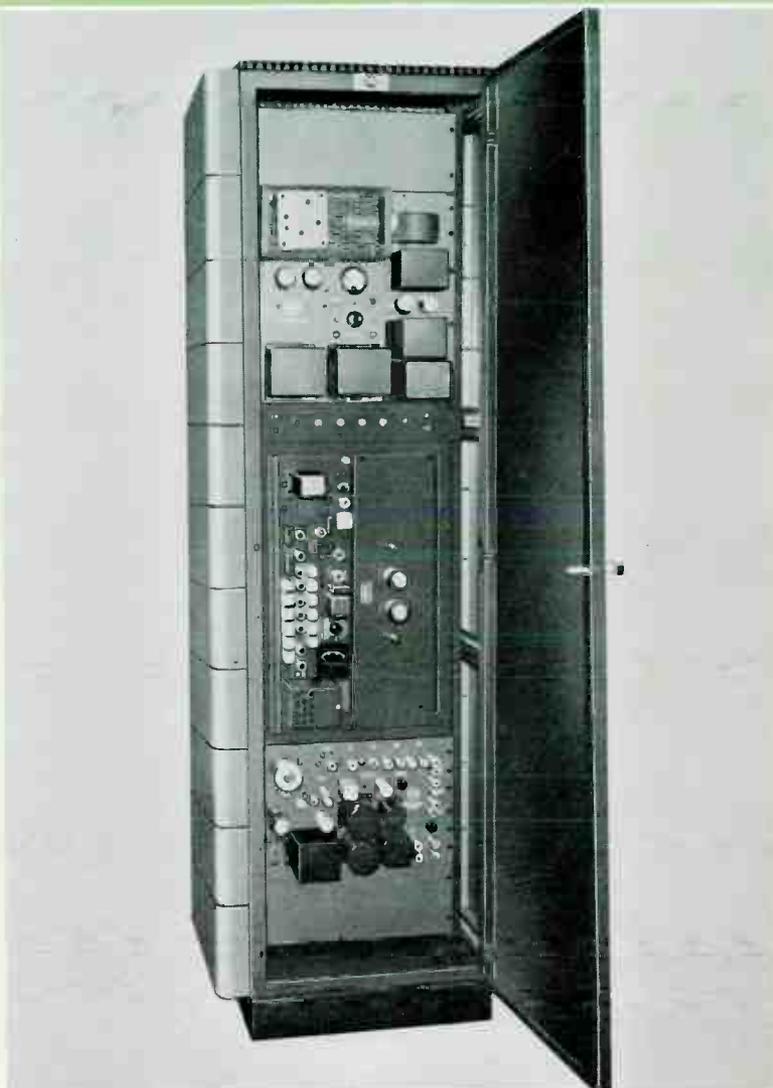
RCA Reference	Description	Approx. Weight (Pounds)	Approx. Dimensions (Inches)	Height	Width	Depth
1 MI-8461	Exciter	500	84	25	25	25
1 MI-8462	Power Amplifier	3300	72	112	65	65
1 MI-8463	Modulator	1000	84	50	36	36
1 MI-8467-B	Control, Distribution, and Switchgear Unit	3800	84	82	48	48
1 MI-8464	Rectifier	3800	84	70	50	50
1 MI-8465-A	Plate Transformer	2300	50	25	49	49
1 MI-28236	Filter Reactor	1200	46	26	36	36
1 MI-7344-1	Modulation Transformer	6550	94	49	57	57
1 MI-7344-2	Modulation Reactor	3600	94	43	40	40
2 MI-8466-A	Voltage Regulator	800	46	16	22	22
1 MI-8468	Enclosure	800	84	198	6	6
1 MI-28237	Blower and Accessories	200	32	57	63	63
1 MI-8479	Set Doors	560	85	30	30	30
2 MI-7382-3	Modulation Capacitor	125	24	18	12	12
1 MI-8473	Modulation Capacitor Unit	110	24	24	24	24
2 MI-28204	Tube Dolly	100	24	24	24	24
2	Instruction Books	—	—	—	—	—
1 MI-7474	Miscellaneous Hardware Kit	—	—	—	—	—

# STUDIO TRANSMITTER LINK EQUIPMENT

## TYPE BTL-1B

### FEATURES

- High quality broadcast transmission from 890 to 960 mc
- Standard phase modified exciter as used in all RCA VHF TV transmitters
- Highly directive propagation up to 35 miles, depending on terrain
- Low tube cost replacement — no costly klystrons or magnetrons
- Coax connection to standard or high gain parabolic reflectors
- Service channel available
- Provision for fault indication

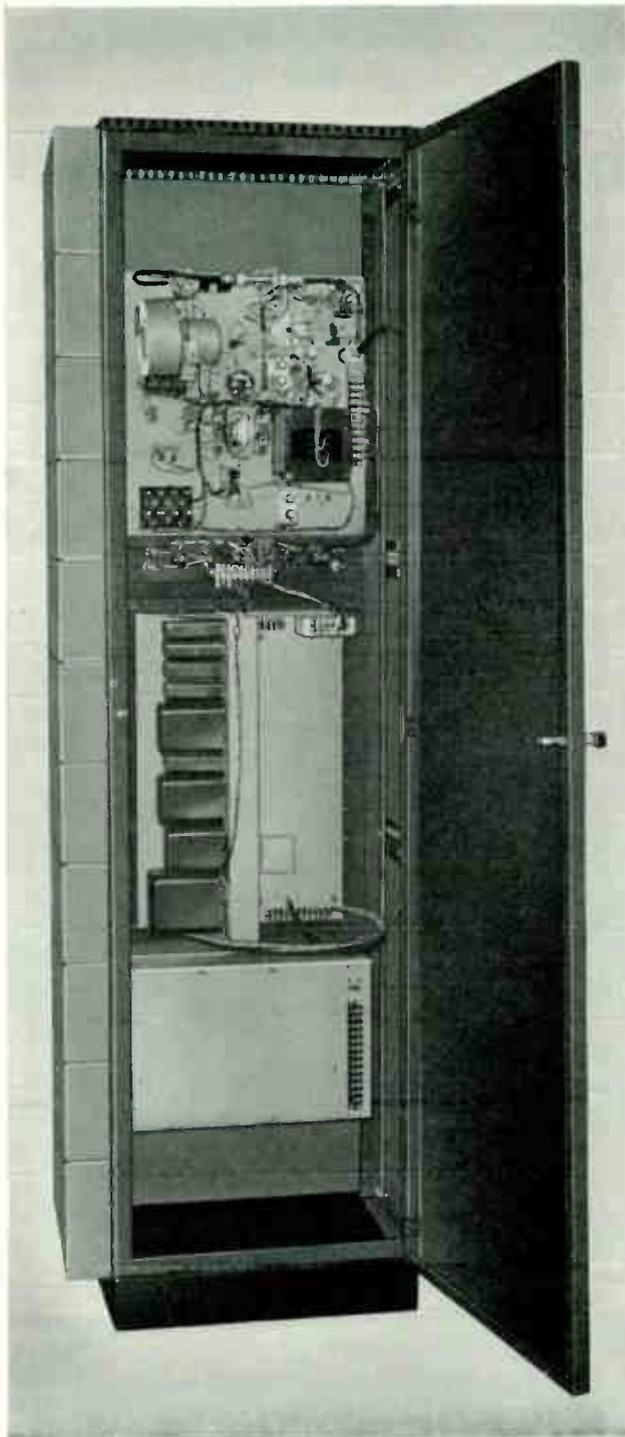


### USES

The RCA type BTL-1B STL Equipment provides a high-quality studio transmission link with overall fidelity equal to that required for television and radio applications. It may be utilized in the 890-911 mc band for TV aural channels; by AM stations in the shared service band of 925-940 mc; and by FM stations in the 940-952 mc band, to relay aural portions of the transmission. The STL equipment is utilized to replace existing wire or carrier-current systems for reasons of dependability, accessibility, or economy. Such microwave radio systems are also used to maintain independence between aural and visual portions of TV transmission as contrasted to those microwave systems that transmit visual and aural intelligence on the same

carrier and risk failure of complete transmission by interruption in common relay link.

The BTL-1B is a high-quality, crystal-controlled studio transmitter that offers an overall service range up to 35 miles but dependent upon terrain characteristics (free space line of sight), propagation conditions, and type of transmission line used. The complete system fully complies with FCC regulations established for this service. With the addition of channeling equipment, the system is capable of carrying a number of supervisory control, facsimile, teletype, telemetering, and voice transmission channels over a single radio circuit. Such multiplexing is especially useful to broadcast stations for purposes of low quality order service.



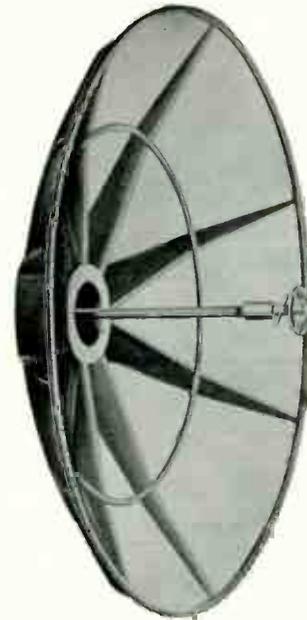
**DESCRIPTION**

The BTL-1B is a uni-directional transmission system designed to operate in the 890-960 mc frequency band and consisting of a crystal-controlled transmitter and receiver with associated FM exciter, power supply and power switching panel. The equipment is housed in a standard Broadcast Cabinet Rack, finished in two-tone umber gray, which matches all RCA transmitters and studio equipment.

Both the transmitting and receiving antennas use a 1/2 wave dipole and 48 or 72-inch parabolic reflector type antenna, each providing a gain of 18 db and 22 db respectively. Connection to the antenna is made by means of a 7/8-inch styroflex line or RG-17U cable. The exact type of transmission line to be used may be determined from the typical service range charts.

Both the transmitter and receiver units are crystal-controlled for high frequency stability. Unique transmitter design in-

◀ Rear view of studio transmission link with door open showing wiring details and equipment components.

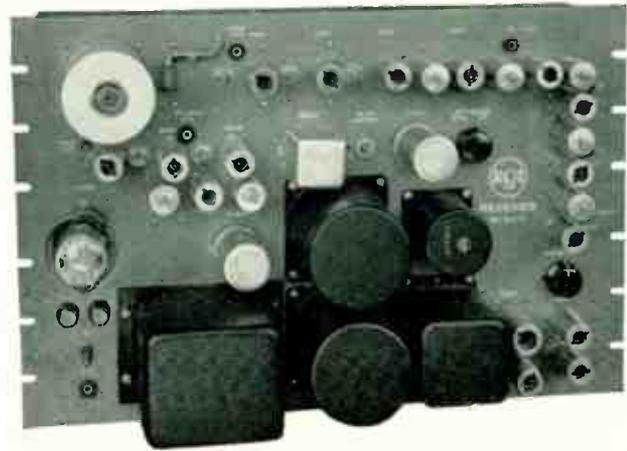


▲ Both the BTL-1B Transmitting and Receiving Antennas employ a half-wave dipole and a sturdy reflector. The 4' antennas provide a gain of 18 db, the 6' antennas a gain of 22 db.

**TRANSMITTER**



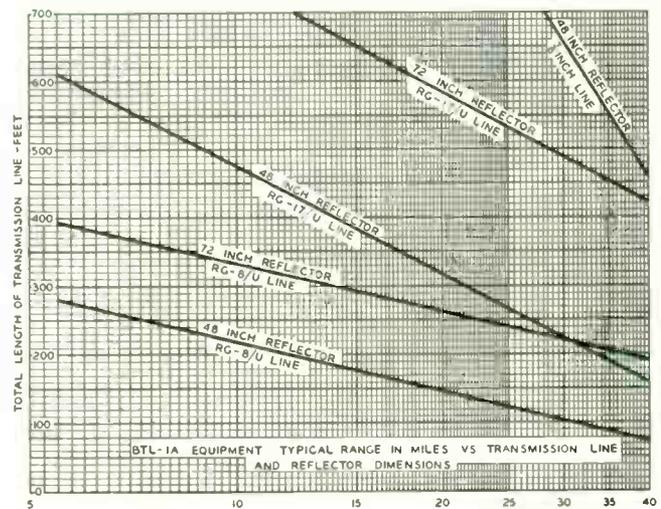
cludes a modified version of the standard RCA exciter unit as supplied in all RCA VHF TV transmitters. The exciter output of approximately 50 mc merely requires one stage of doubling followed by two stages of tripling. The last tripler stage utilizes an air-cooled 4X150-A power tetrode. The use of a conventional tuning circuit and standard tubes presents a transmitter with the highest degree of dependability, simplified maintenance, and low replacement costs. The receiver is of the double superheterodyne-type with crystal controlled heterodyne frequencies and a self-contained power supply. The audio output may be strapped to provide a pre-emphasized or de-emphasized output level of +10 dbm to the FM transmitter. The unit is contained in a 19-inch chassis requiring a 12¼-inch panel space, which may be mounted in the cabinet rack in the transmitter control room.



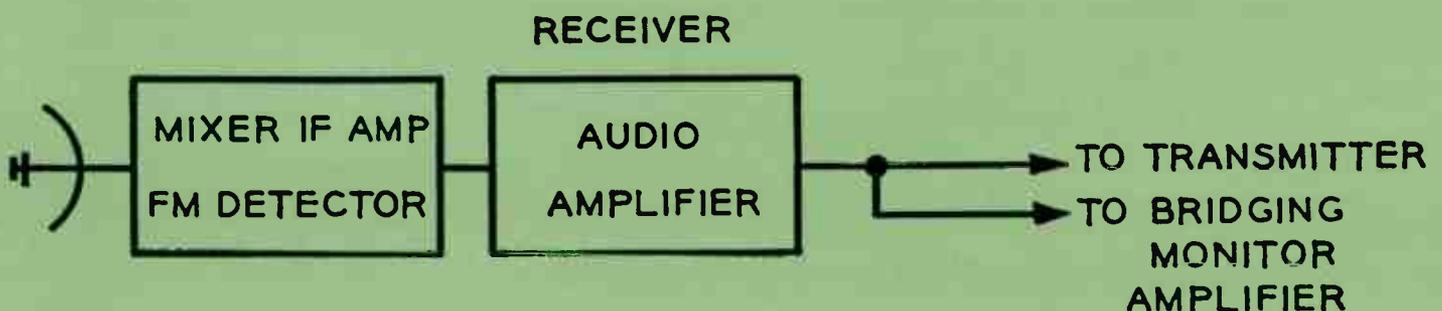
The BTL-1B Crystal-controlled Receiver is complete with built-in power supply—and suitable for standard cabinet rack mounting.



Hinged construction of the Exciter unit is a service and maintenance feature of new RCA STL equipment.



The BTL-1B cabinet rack may be installed flush with the wall or placed adjacent to other racks in the control room. The front and rear doors are ventilated, and the rear door is interlocked to insure complete protection against high voltages. Electrical side shields are available if desired. The antenna reflectors should be installed in such a manner as to permit a line-of-sight path clearance of at least fifty feet over all obstructions including trees, buildings, etc.



## SPECIFICATIONS

## Performance Specifications

System Audio Frequency Response.....	±1 db 30 to 15,000 cps
System Audio Distortion.....	Less than 1% 100-7500 cycles Less than 1.5% 50-100 cps and 7500-15,000 cps
System Signal-to-Noise Ratio.....	Better than 65 db below 100% modulation
System Transmission Loss Rating.....	100 db
Emission .....	"Direct FM"
Carrier Frequency Range.....	890-960 mc
Carrier Frequency Stability.....	Better than ±.002%
Carrier Modulation.....	±150 kc
Transmitter Power Output.....	2 watts
Antenna Gain (48" Diameter Reflectors) (over 1/2 wave dipole).....	18 db each (Trans. and Receiver)
(72" Diameter Reflectors) (over 1/2 wave dipole).....	22 db
Transmission Line Impedance (Trans. and Receiver).....	52 ohms
Transmitter Audio Input Level.....	+10 ±2 dbm
Transmitter Audio Input Impedance.....	600 ohms
Receiver Load Impedance.....	600 ohms (150-ohm output can be provided where necessary)
Receiver Program Output Level.....	+10 dbm
Receiver Monitor Output.....	0.5 watts max.
Receiver I.F. Frequencies.....	19 mc (high) 115.8-123.5 mc (high)

## Electrical Specifications

Transmitter Power Consumption (115/230 v., single phase, 60 cps).....	900 watts
Receiver Power Consumption (115 v., 1 phase, 60 cps).....	100 watts

## Tube Complement

## Receiver:

1 5R4GY	1 6J6	1 12AU7
8 6AG5	1 6AL5	
4 6AK5	1 6AQ5	

## Transmitter:

1 2E26	1 829B
3 5R4GY	1 4X150A

## FM Exciter and Power Supply:

5 12AT7	1 6146	1 OA2
5 6AU6	1 12AX7	1 OB2
1 5763	1 12AU7	2 5R4GY

## Mechanical Specifications

Transmitter Rack Dimensions (incl. doors and handles).....	84" high, 28" wide, 24 1/4" deep
Transmitter Weight (packed).....	550 lbs.
Receiver Weight (packed).....	50 lbs.
Antenna Weight (48").....	64 lbs.
(72") .....	150 lbs.

## Equipment Supplied

BTL-1B Studio Transmitter Link Equipment.....	ES-28953-A including unassembled items as follows:
1 Transmitter, including in place:.....	MI-31465-A
1 FM Exciter, less tubes.....	MI-19326-A
1 Power Supply, less tubes.....	MI-19327
1 Power Switching Panel.....	MI-27146
1 Transmitter Unit, less tubes.....	MI-31474*
(*Sales Order must specify customer's operating frequency)	
1 Receiver, with RCA type RC-9 Crystal (MI-16263-B) installed and tested, and 1 set of tubes in place.....	MI-31470
1 Type TMV-129-G Crystal Unit.....	MI-19450-A*
(* Sales Order must specify crystal requirements to suit customer's operating frequency)	
2 Side Panels .....	MI-30541-G84
2 Instruction Books .....	IB-30231

## Optional and Accessory Equipment

48" Antenna .....	MI-31045-B1
72" Antenna .....	MI-31045-C1
Antenna Pole Mounting.....	MI-31041-A
Antenna Wall Mounting .....	MI-31041-W
Set of Electron Tubes for Exciter and Power Supply.....	MI-27117
Set of Electron Tubes for Transmitter Unit .....	MI-31467
Set of Spare Electron Tubes for Receiver.....	MI-31472

## STL TRANSMISSION LINE ITEMS

Transmission Line, Type RG-17/U.....	MI-47
7/8" to Type "N" Adaptor.....	MI-31038-5
RG-17/U to "N" Male Adaptor.....	MI-31657-2
RG-17/U to "N" Female Adaptor.....	MI-31654-2
60" Jumper Cable with "N" Male Plugs.....	MI-31031-60
Wraplock Kit .....	MI-31032-10

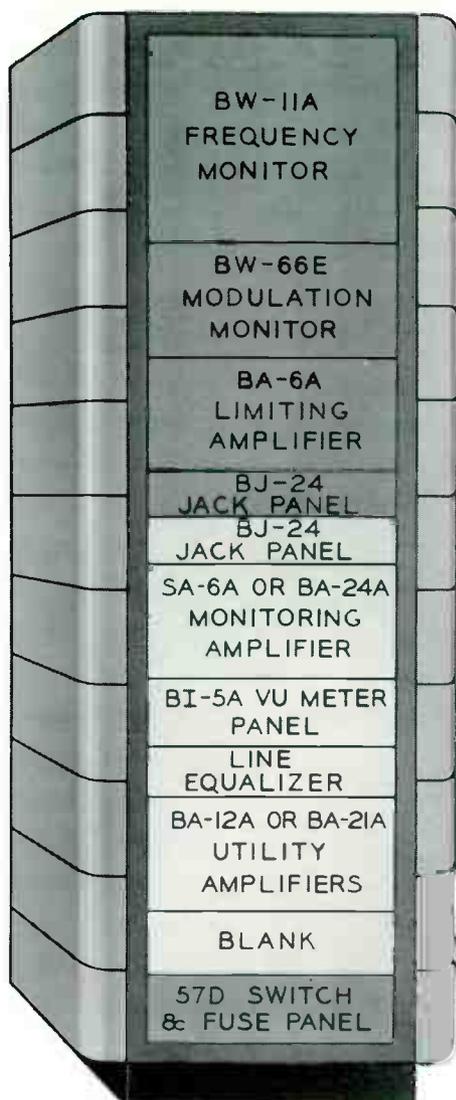
## STYROFLEX TRANSMISSION LINE ITEMS

*7/8" Styroflex Transmission Line.....	MI-13317
Flanged Adaptor to 7/8" Styroflex Line.....	13-516
Styroflex Line to Type "N" Adaptor.....	20-516
Line Pressurizing Fittings .....	MI-31038-10
Transmission Line, Type RG-8/U.....	MI-74-A
Dry Air Pump.....	MI-31487

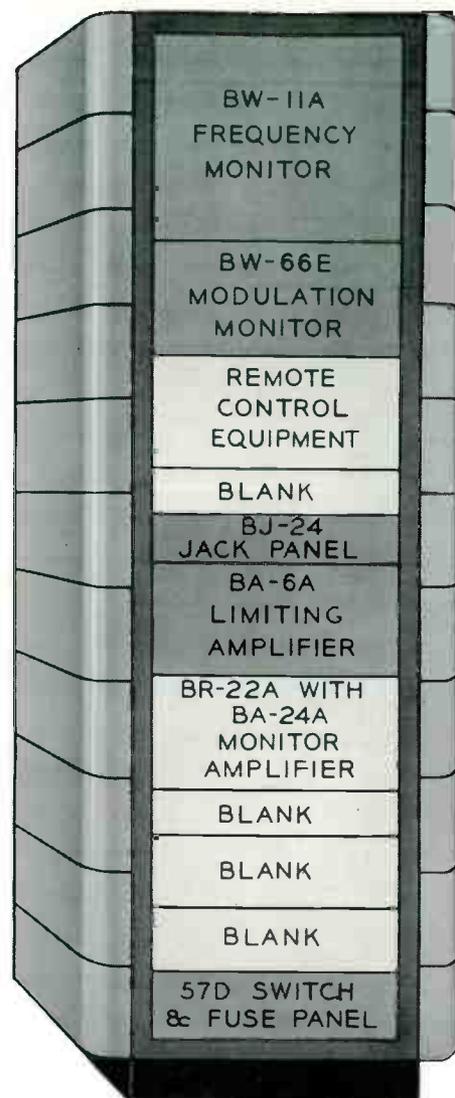
\* Note: When ordering Styroflex line, specify length required in order that proper flange can be installed on line before shipment.

# INPUT AND MONITORING EQUIPMENT

(AM BROADCAST)



◀ FOR USE WITH TRANSMITTER AND STUDIO AT SAME LOCATION the rack at left contains suggested equipment. The dark shaded items represent essential equipment . . . the white open areas show optional equipment.



▶ FOR USE WITH TRANSMITTER REMOTE FROM STUDIO the rack at right contains suggested equipment. The dark shaded items represent essential equipment . . . the white open areas show optional equipment.

## FEATURES

- Cabinets are same height as RCA transmitters
- All essential units may be contained in one rack
- Reserve space in rack for optional equipment
- Attractively styled to blend with all control room installations
- Suitable for fitting in a flush position to a side or rear wall
- Drilled and tapped for standard 19" panels

**USES**

The RCA Standard BR-19A or BR-84 Rack as shown contains all the essential equipment needed to fulfill FCC monitoring requirements and necessary input functions.

**DESCRIPTION**

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 bears FCC approval Number 1471, for use in Standard Broadcast stations. It has an accuracy of better than  $\pm 10$  parts 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 measurements.
3. The RCA Limiting Amplifier Type BA-6A serving as an automatic means of increasing program level while limiting peaks 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.
4. The RCA Standard Jack Panel Type BJ-24, provided to improve the overall operating flexibility of a Broadcast Station. With the use of patch cords, many combinations of input and 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.

**SPECIFICATIONS**

Complete detailed specifications on each of these approved Input and Monitoring Equipments may be found in the RCA Audio Equipment Catalog or the RCA Test and Measuring Equipment Catalog.



A typical Input and Monitoring Rack adjacent to an RCA 250 Watt Transmitter (BTA-250M). Rack can be located separately in any transmitter set-up.

# UNIVERSAL TRANSMITTER CONSOLE

## TYPE BTC-1B



### FEATURES

- Add-a-unit or "block-build" construction allows easy addition of control turrets and desk sections for one or more transmitters of any type
- Transmitter power switches and indicating lamps on turret for transmitter control
- Provides a VU meter, and facilities for mounting three remote indicating meters
- Eight position monitor selector switch and monitor gain control
- Mixing and switching for six audio inputs: two lines, two turntables, one microphone; one utility input for oscillator or remote

### DESCRIPTION

The BTC-1B, Universal Transmitter Supervisory Console is one of the most flexible and versatile consoles ever engineered for broadcast transmitter service. It provides complete centralized control of primary switching and audio mixing operations required for AM and FM transmitters. It is suitable for use with any transmitter which is contactor controlled.

Unique "add-a-unit" or "block-build" construction enables the simple addition of turrets and desk sections when expanding facilities to accommodate one or more AM or FM transmitters.

The BTC-1B includes one transmitter control turret and one audio control turret—mounted on an attractive two-section desk having removable end sections. Control-turret front panels have a satin chrome finish and the desk proper is two-tone umber gray with a durable black linoleum top. All meters are recessed and each meter panel is hinged for easy adjustment. Rear turret covers may be removed

to facilitate installation. End sections contain shelves for storing station logs, records, etc.

#### Transmitter Control Turret

The *transmitter-control* turret contains all power control switches and pilot lights for normal operation of the transmitter; transmitter start, transmitter plate voltage, overload reset, time delay by-pass, manual-automatic control, day-night power switching, tower lights, and an extra switch and pilot lamp which may be connected as desired. And there is convenient space provided for mounting a choice of three remote indicating meters. The associated RCA transmitter monitor and amplifier rack, MI-11623, may be added to boost a-f gain from program line to transmitter, and facilitate overall station monitoring and control.

#### Audio Control Turret

The *audio-control* turret includes: a standard VU meter and range switch, an 8-position selector switch that permits

**Description (Continued)**

monitoring all important circuits, a master monitor gain control, and individual bridging pads for equalizing the level of the signal sources. With the BTC-1B, control is provided for six different inputs—one microphone-oscillator or remote, two different lines, and two separate turntables—with three high-quality mixers and associated transfer keys. A microphone key cuts off the signal to the monitor amplifier—and prevents feedback when the microphone is in use. A line transfer key removes equalization and connects the telephone to the particular line not in use.

Accessory audio and monitoring equipment is available in a factory-wired assembly (MI-11623). It is supplied in a BR-84 series cabinet rack, finished to match companion equipment. It is suited for co-ordinated operation with the BTC-1B console and facilitates transmitter operation. It also provides extreme flexibility by the termination of all audio units in jack strips.

**SPECIFICATIONS**

**Performance**

- Power Required:**  
 Indicator Lights.....220 volts a-c, 50-60 cycles  
 Meter Lights (6.3 volts from transformer).....110 volts a-c, 50-60 cycles
- Input Impedances:**  
 Lines 1 and 2.....600 ohms, balanced  
 Microphone and Turntable.....600 ohms, balanced  
 Audio Oscillator or Remote Line.....600 ohms, balanced  
 VU Meter .....7500 ohms  
 Monitor .....Bridging
- Output Impedances:**  
 Lines 1 and 2, Microphone and Turntable  
 Mixer Circuit.....600 ohms, balanced  
 Microphone and Turntable Controls.....600 ohms  
 Lines 1 and 2 Control.....600 ohms
- Insertion Losses (lines, microphone, and turntable mixer circuit).....18 db
- Volume Controls:**  
 Microphone and Osc./Remote Control.....600/600 ohms, 20 steps, 2 db per step, last step infinite, tapered; insertion loss 6 db; balanced.  
 Lines 1 and 2 Control.....600/600 ohms, 30 steps, 1 db per step, last step infinite, tapered; insertion loss 6 db; balanced.  
 Turntable Control.....600/600 ohms, 20 steps, 2 db per step, last step infinite, tapered; insertion loss 6 db; balanced.  
 Monitor Control.....600/600 ohms, 20 steps, 2 db per step, last step infinite, tapered; insertion loss 32 db; balanced.  
 VU Attenuator Rheostat.....800 ohms, 10 steps, 0.1 db per step, linear
- Noise Level:** Circuits are isolated so that residual noise will not exceed the aggregate noise level of the associated amplifiers.

**Mechanical Specifications**

- Overall Dimensions:**  
 Width .....56½"  
 Depth .....36"  
 Height, including Turret (turret extends approx. 11" above desk top).....39"  
 Weight (approx.).....300 lbs.
- 45° Wing Turrets.....10¾" high, 19" deep, 4¾" wide (front), 19" wide (rear)
- Control Turrets.....10¾" high, 19" deep, 19" wide (front and rear)
- Straight Desk Sections.....28¾" high, 36" deep, 19" wide (front and rear)
- 90° Desk Sections.....28¾" high, 38 11/32" deep, 3¾" wide (front), 54⅛" wide (rear)



**Equipment Furnished**

The RCA Type BTC-1B (MI-28950-A) Universal Transmitter Control Console is composed of the following:

- 1 Transmitter Control Turret.....MI-28420-A
- 1 AM/FM Audio Control Turret.....MI-28410
- 2 Console Desk Sections.....MI-28401-1
- 1 Console End Section (left-hand).....MI-26265-1
- 1 Console End Section (right-hand).....MI-26265-2

Space is available on the MI-28420-A turret for mounting three 4" square-case meters which may be purchased on separate order from the list under "Accessories" below.

**Available Accessories**

- AM/FM Audio Control Turret.....MI-28410
- Universal Transmitter Control Turret.....MI-28420-A
- Basic Desk Section.....MI-28401-1
- 90° Desk Section.....MI-28401-2
- Complete Turret with Blank Panel.....MI-28403-1
- Wing Turret with Blank Panel.....MI-28404-1

**Remote Meters for AM Equipment**

- 1 Remote Limiting Meter, for use with RCA Type BA-6A Limiting Amplifier.....MI-11225
- 1 Remote Meter, for use with RCA Type BW-66E AM Modulation Monitor.....Stock No. 59160
- 1 Remote Meter, for use with RCA Type BW-11A AM Frequency Monitor.....Stock No. 93688

**Remote Meters for FM Equipment**

- 1 Remote Meter (carrier deviation), for use with General Radio FM Monitor Type 1170-A.....MI-19116-2
- 1 Remote Meter (percentage modulation), for use with General Radio FM Monitor Type 1170-A.....MI-19116-3
- 1 Remote Meter (percentage modulation), for use with Hewlett-Packard FM Monitor Type 335-B.....HP-112-13
- 1 Remote Meter (percentage output), for use with RCA FM Transmitters Types BTF-250A, BTF-1C, BTF-3B, BTF-5A, BTF-10B, BTF-50A.....Stock No. 56412

Space is also available and mounting holes are provided in the MI-28410 turret for one line transformer, MI-11713.

The following related equipment which is recommended, may be obtained on separate order:

# AM-FM REMOTE CONTROL SYSTEM

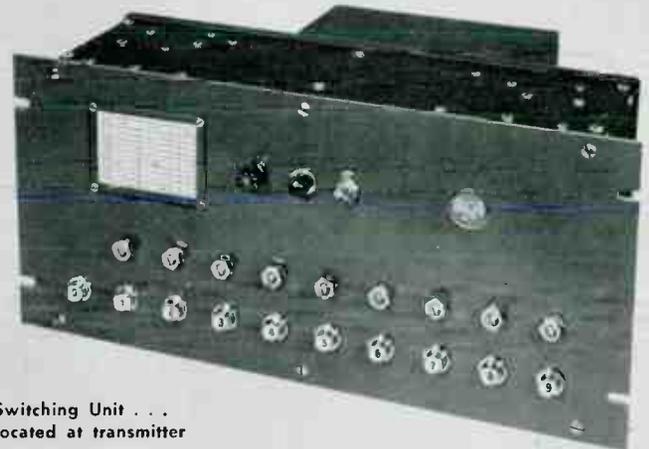
## TYPE BTR-5A

### FEATURES

- A d-c system with proved dial telephone principle
- Operates without vacuum tubes, amplifiers, oscillators or tuned circuits
- Operates with lowest line rental . . . lowest power consumption
- Reasonably priced . . . available for prompt delivery
- A complete system with self-contained basic units



Control Unit . . .  
located at control point



Switching Unit . . .  
located at transmitter

### DESCRIPTION

From any desired control point, regardless of Transmitter design or power, RCA Remote Control equipment can provide facilities to switch program lines, adjust plate or filament voltage, operate a line variac, control an emergency transmitter, do Conelrad switching, operate any power contactor and reset manual overload breakers.

RCA Remote Control Systems consist of three principal units and a set of accessory units carefully coordinated on "building block" principles. Each system contains an RI-108-0 Control Unit, an RI-108-1 Transmitter Unit and equipment for obtaining frequency and modulation mon-

itor readings. If future requirements call for additional capacity, it may be built into the system—up to 11 control functions and 9 meter readings. To add capacity, the required additional accessories may be wired into the system at moderate cost. No alterations or expensive additions to the basic units are needed. Each of the three principal units is entirely self-contained, ready to plug into a convenient 115 volt, 60 cycle a-c outlet. There are no complicated interconnections or bulky power supplies. This assures minimum rack wiring and saves valuable space. In the event of new transmitter installation, transition is simple and economical.

SPECIFICATIONS

Metering Circuit

A metering circuit is required from the Control Unit at the remote control point to the Transmitter Unit. This circuit is to be a low grade telephone pair with a total d-c loop resistance of 4000 ohms maximum. This circuit must furnish a d-c path and no simplex or grounds of any type are permissible. Circuit carries only d-c.

Maximum Voltage Line to Line.....0.5 volts  
 Maximum Current through Circuit.....200 micro-amperes  
 Line Termination Protection.....250 ma fuses and Thyrite protectors to ground

Maximum Voltage Line to Ground.....100 volts  
 Maximum Current with Line Shorted.....Approx. 10 ma

Control Circuit

A control circuit is required from the Control Unit at the remote control point to the Transmitter Unit. This circuit is to be a low grade telephone circuit with a total d-c loop resistance of 4000 ohms maximum. This circuit must furnish a d-c path and no simplex or grounds of any type are recommended. Circuit carries only pulsed d-c (10 pulses per second).

Maximum Voltage Line to Line.....100 volts  
 Maximum Current through Circuit.....15 milliamperes  
 Line Termination Protection.....250 ma fuses  
 Maximum Current with Line Shorted.....82 ma

Typical AM Station Dial Functions on the Control Unit

DIAL	CONTROL	METER
0		(Set meter full scale)
1	Tower lights on-off	Tower lighting current
2	Filaments on-off	Filament line voltage
3	Plates on-off	Final stage plate voltage
4	Final stage tuning	Final stage plate current
5	Output power control	Antenna current
6	Additional positions for future requirements	
7		
8		
9		
0		

DESCRIPTION OF SYSTEM SHOWN BELOW

When Switch S is closed on the control unit, power supply A through voltage divider B and telephone dial C normally supplies 12 volts d-c to the control line. Operation of the "lower" switch in unit B increases this voltage to 35 volts and operation of the "raise" switch in unit B increases this voltage to 100 volts. Telephone dial C interrupts the line voltage with a number of impulses corresponding to the number dialed. Stepping system D with its power supply E controls indicating lights showing the number dialed.

In the transmitter unit, relays F, G, and H are bridged across the control line. Relay F is picked up when Switch S is closed and follows the dial impulses. Relay F operates slow relay N which does not release during dial impulses. Relay N controls transmitter power so that in the event the control line voltage fails, the transmitter is taken off the air.

Relay G is picked up when the "lower" switch is operated, and relays G and H are picked up when the "raise" switch is operated.

Relay F operates stepping system I, which controls indicating lights showing the number dialed, and also connects the "raise" and "lower" relays to any one of ten external operating units, consisting of reversible motors or control relays.

Stepping system I also connects the metering line to any one of nine external metering elements which convert any desired a-c or d-c potential or current being measured.

The entire metering system is calibrated against a standard source of voltage on position "O", accurately compensating for any variation in telephone line resistance with temperature changes.

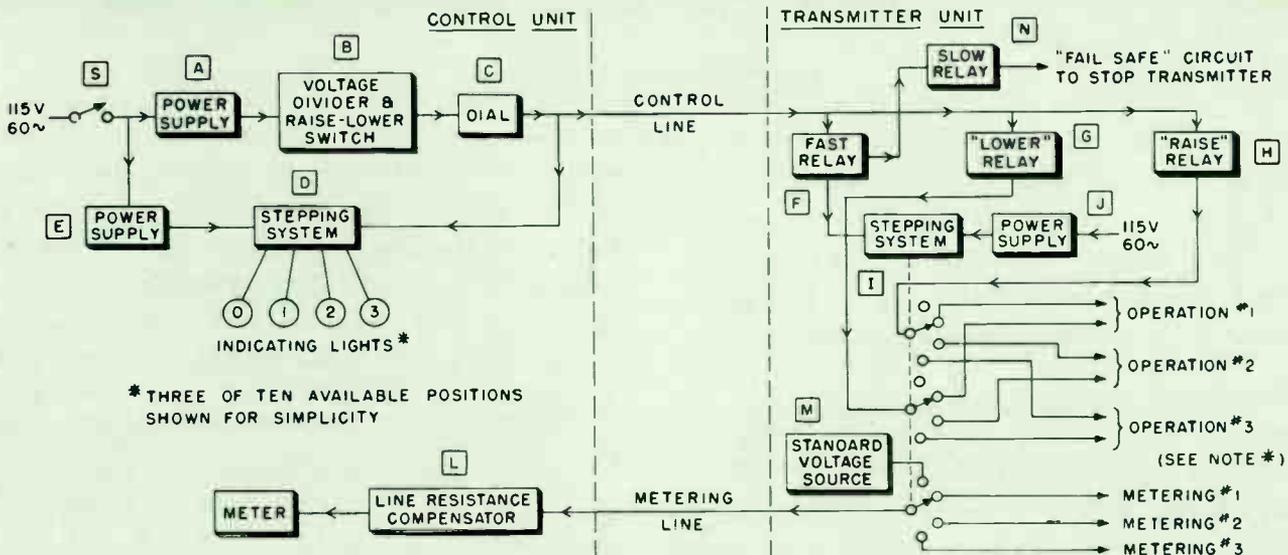


Diagram of System Operation.

# ANTENNA TUNING UNITS

TYPES BPA-11A/B(1KW), BPA-10(5-10KW), BPA-50(50KW)

## FEATURES

- Conservatively rated design for respective carrier powers
- Make-before-break switches avoid damage to antenna ammeter from static discharges
- Reliable operation
- Equipment housed in weatherproof metal cabinet with hinged door and lock
- Custombuilt arrangements available for any requirement

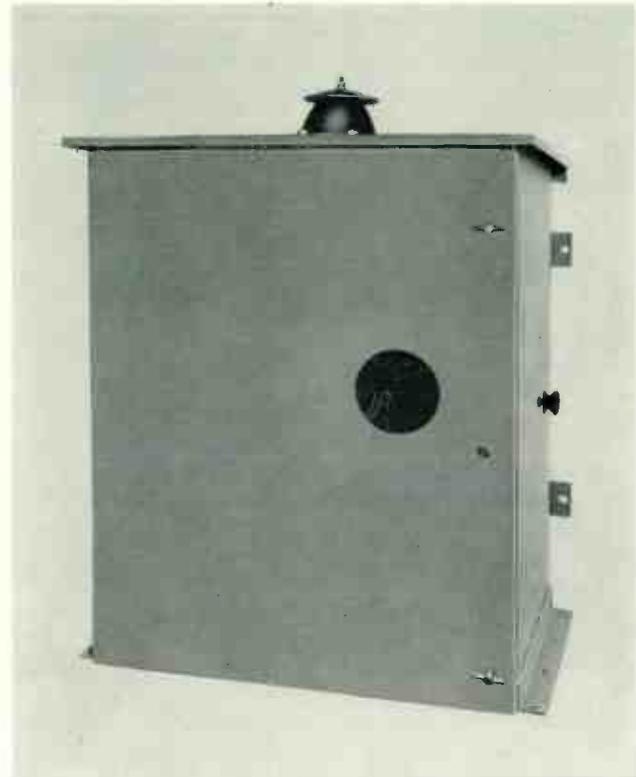
## Type BPA-11A/B

### USES

The Type BPA-11A/B Antenna Tuning Unit serves to match broadcast antennas to either concentric or open wire transmission lines and also aids in suppressing carrier harmonics.



TYPE BPA-11A ANTENNA TUNING UNIT



## DESCRIPTION

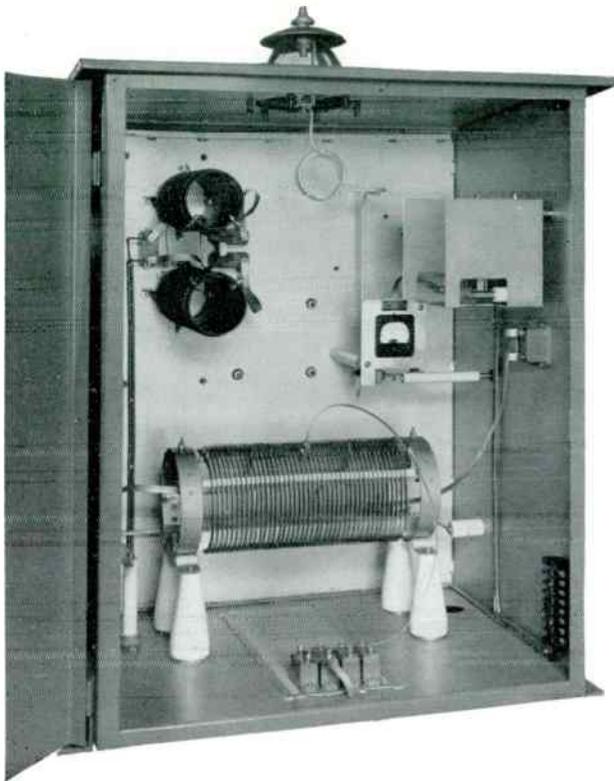
The BPA-11A/B consists essentially of line terminating and antenna-tuning elements housed in a weatherproof metal cabinet. Access to the interior and component parts of the tuning unit may be gained through the front door which is provided with a lock, keys and two pivoting clamps. An opening is provided in the bottom of the housing for entrance of a coaxial transmission line, but the unit may also be used with an open wire type of line by addition of a bowl insulator, MI-19406. Electrically, the unit consists of a low-pass impedance-matching filter using a "T" type network.

The BPA-11A does not include series antenna feed line capacitor or lighting chokes and capacitors.

The BPA-11B includes a series capacitor and one lighting choke and two associated capacitors for a two wire tower lighting circuit. Provisions are made for mounting an additional lighting choke and capacitor for three wire tower lighting circuit.

When ordering specify: (1) Transmitter carrier power. (2) Transmitter frequency. (3) Antenna resistance and reactance or type and height. (4) Transmission line impedance.

## BPA-11A/B (Continued)



TYPE BPA-11B ANTENNA TUNING UNIT

## 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 .....	44"
Width .....	34"
Depth .....	23"
Weight (net).....	330 lbs.

#### Stock Identification:

BPA-11A .....	ES-28906-A
BPA-11B .....	ES-28906-B

\* Low frequency limit may be extended to 540 kc on special order.

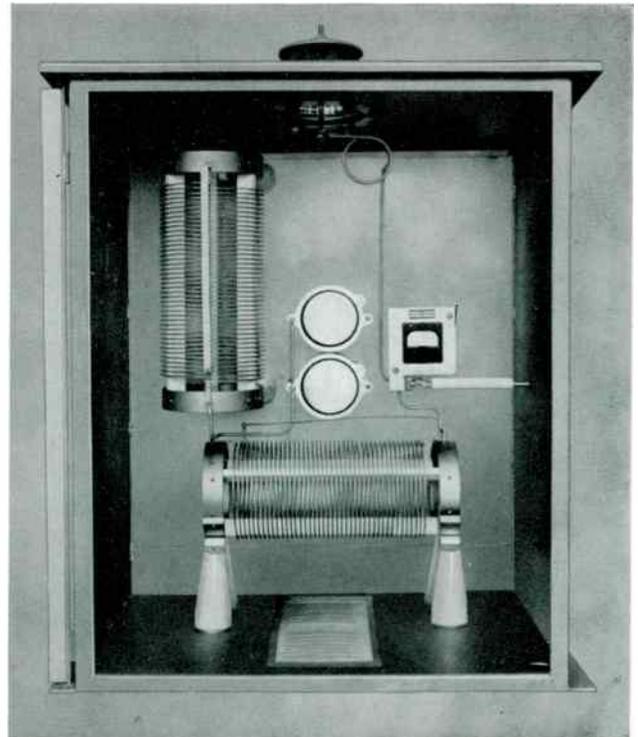
## Type BPA-10, (5-10KW) Antenna Tuning Unit

### USES

The Type BPA-10 Antenna Tuning Unit serves the double purpose of matching broadcast antennas of widely divergent characteristics to either concentric or open-wire transmission lines and of suppressing carrier harmonics.

### DESCRIPTION

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 mounting strips also are provided to permit mounting the unit on two upright posts. The antenna ammeter may be read through a circular window in the door. This switch is operated by means of a knob extending through the side of the housing. Electrically, the unit consists of a low-pass impedance matching filter using a "T" type network.



## BPA-10 (Continued)

The antenna lead-in insulator is located on the top of the unit, and provision is made for mounting a similar insulator (MI-19413-1 bowl insulator) on the left hand 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. When ordering specify:

1. Transmitter carrier power
2. Frequency
3. Antenna resistance and reactance
4. Transmission line impedance

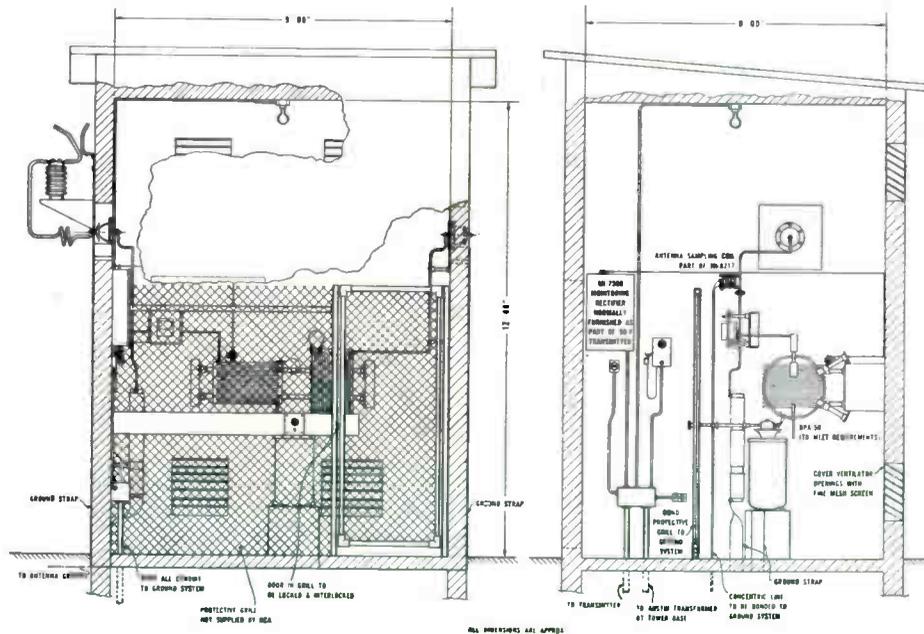
## SPECIFICATIONS

<b>Operating Limits:</b>	
Carrier Frequency.....	540 to 1700 kc
Transmitting Power (maximum).....	10 kw
<b>Input Impedance (unbalanced open wire or concentric line).....</b>	
	40-350 ohms
Antenna Resistance (approximately).....	20 to 1100 ohms
Antenna Reactance.....	+j500 to -j500
(Can be extended in a positive direction by the addition of a series capacitor; and in a negative direction if operating from a line of lower impedance than the antenna resistance)	
Type Antenna Meter (scale range determined at time of installation).....	Weston Model 425
<b>Dimensions:</b>	
Height .....	44"
Width .....	34"
Depth .....	23"
Weight (unpacked) .....	330 lbs.
Finish .....	Durable gray
Stock Identification .....	MI-28902-A

## Accessory

1 Bowl Insulator (required for open wire lines).....	MI-19413-1
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## Type BPA-50 Antenna Tuning Unit



## USES

The type BPA-50 antenna tuning equipment serves to match broadcast antennas of widely divergent characteristics to either concentric or open-wire transmission lines at powers up to 50 kw.

## DESCRIPTION

The type BPA-50 antenna tuning equipment is designed to be mounted in a tuner house at the base of the antenna tower. The tuning equipment does not include the tuner house, but all the necessary electrical components, brack-

## BPA-50 (Continued)

ets, wiring material and hardware are supplied. Complete blueprints, diagrams and instructions for assembly of the tuner are also included.

Electrically, the BPA-50 consists of a low-pass impedance-matching filter using a "T" type network. The large series arm coils are made of heavy silver-plated copper tubing, and are conservatively rated. The shunt leg capacitors are normally of the gas or vacuum variety, although mica capacitors are used when very large capacitance values are required.

The antenna ammeter is protected from lightning surges by a double-throw switch which cuts the meter out of the circuit.

## SPECIFICATIONS

### TUNER

#### Operating Limits:

Carrier Frequency.....	550-1700 kc
Transmitter Power (maximum).....	50 kw
Input Impedance (unbalanced open wire or concentric line).....	40 to 350 ohms
Antenna Resistance (approximately).....	20 to 1100 ohms
Antenna Reactance .....	+j500 to -j500
(Can be extended in a positive direction by the addition of a series capacitor; and in a negative direction if operating from a line of lower impedance than the antenna resistance)	
Space Requirements.....	Approximately 70 sq. ft. floor area with 10 ft. ceiling
Net Weight (approx.).....	500 lbs.
Stock Identification:	
For 230 Ohm Line.....	MI-28903-A
For 70/51.5 Ohm Line.....	MI-28903-B

### Accessory

Extra Bowl Insulator .....	MI-19413-1
----------------------------	------------

## Bowl Insulator, MI-19413-1/3



out of the tuner house on the same insulator which carries the r-f conductor.

For transmitter carrier powers up to and including 50 kw, this insulator assembly is ideal for taking r-f leads into or out of antenna tuner or phasing equipment.

The insulator comes complete with corona ring, 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

## SPECIFICATIONS

### For Solid Stud Insulator

#### Dimension:

Flange Diameter .....	8¾"
Bolt Circle Diameter.....	7¾"
No. of Mounting Studs.....	6 spaced equidistantly
Lead-in Stud Size.....	¾" diameter, 8½" long
Height (approx.) .....	6"
Unpacked Weight .....	11¾ lbs.
Stock Identification .....	MI-19413-1

### For Hollow Stud Insulator

#### Dimension:

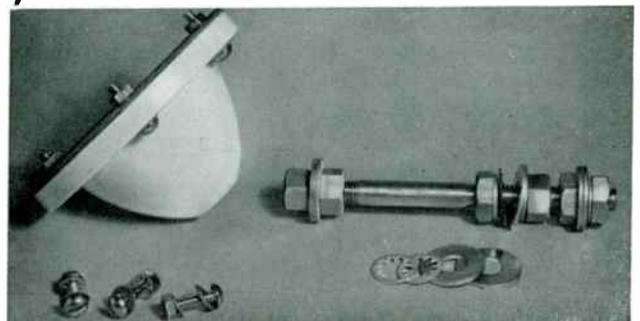
Same as MI-19413-1 except the stud is made from ¾" 14 NPSL-4 pipe nipple. This stud is 3" long with a 1" O.D. and .8" I.D.	
Stock Identification .....	MI-19413-3

## Bowl Insulator, MI-19406

This insulator is recommended for antenna tuner or phasing equipment r-f lead-ins for carrier powers up to and including 1 kw. The insulator comes complete with all mounting hardware and lead-in stud.

## SPECIFICATIONS

Flange Diameter .....	5¼"
Bolt Circle Diameter.....	4⅝"
No. of Mounting Studs.....	6 equally spaced
Lead-in Stud Size.....	½" diameter, 6" long
Unpacked Weight .....	2⅛ lbs.
Stock Identification .....	MI-19406



# 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
- Several types of cabinets and mounting methods available

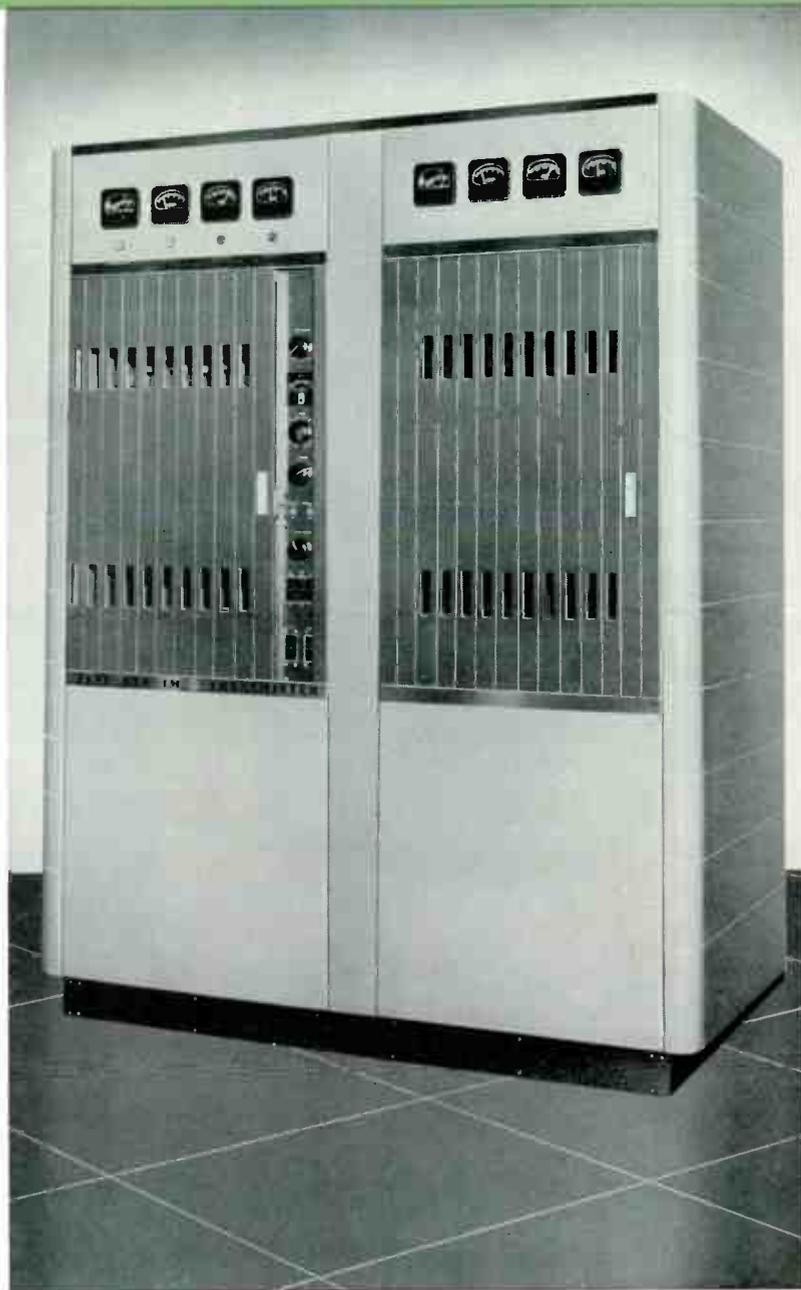
## DESCRIPTION

RCA Phasing and Branching Equipment is custom-built to provide precise coverage patterns to fully meet the requirements of both the Broadcaster and the FCC. This "custom" equipment is designed for use with its companion antenna array to assure "tailored" patterns for optimum day and night coverage, and is available in a wide selection of cabinets. 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.

Front panel controlled rotary coils, one for each tower, provide independent current amplitude 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



BTA-1M Transmitter with matching right-wing phasing cabinet.

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. The pilot contacts can also be connected in the transmitter interlock and control circuits to provide a single control of pattern change.



Front View of RCA Phasing Cabinet used with 1-KW, 5-KW and 10-KW Transmitters. Note modern, sliding-door cabinet design with convenient meters provided at top of cabinet for continuous performance checks.

A wide variety of arrangements for 1-KW, 5-KW and 10-KW Phasing and Branching Equipment is available. Shown here are the new exclusive RCA "roll-back" horizontal sliding door cabinets. This type of cabinet provides a matched wing for housing phasing equipment when used with the RCA BTA-1M (1-KW) Transmitter or the BTA-5G and 10G (5 and 10-KW) Transmitters. The horizontal sliding door cabinet eliminates door-swing areas and thus greatly minimizes floor space requirements.

With RCA 1-KW, 5-KW, and 10-KW Transmitters and Phasing Equipment, the same type sliding doors are used at the rear of the cabinet to provide easy access for inspection and maintenance. The horizontal sliding doors

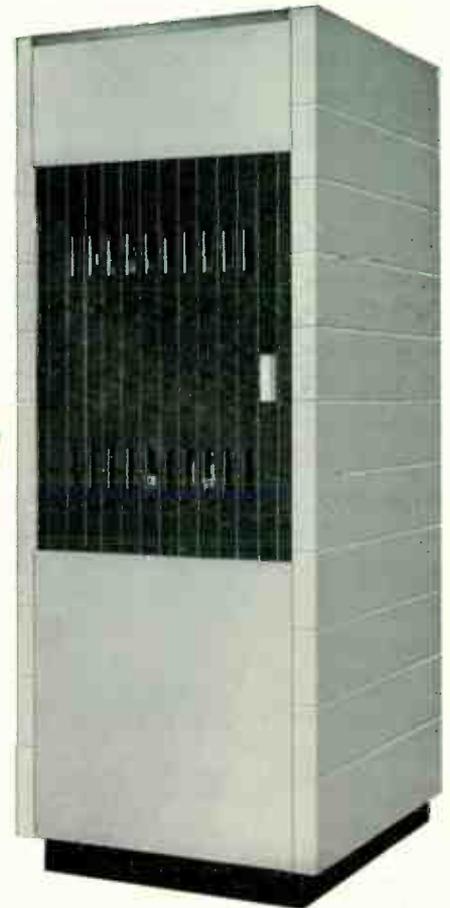


Phasing equipment installed at Radio Station KSOO is housed in the new type horizontal sliding door cabinets. Cabinet at right contains the power and current dividing networks for each tower and day-night pattern-change relay.

afford further space-saving by permitting installation close to a wall.

Cabinets are pleasingly styled and finished in two-tone umber gray with stainless steel door handles and trim. Components for phasing and controls are mounted on sub-panels behind the front door. Common point and transmission-line meters are mounted on insulated panels behind dummy meters.

For complex antenna arrays, "side-by-side" matching cabinets are used to provide the additional mounting space required for properly housing additional phasing and branching components. Individual cabinets can also be furnished with finished ends for mounting separately from the transmitter, if desired.



▲ Rear view of RCA Phasing Cabinet used with 1-KW, 5-KW and 10-KW Transmitters. Note that use of sliding doors (not provided in ordinary cabinetry), front and rear, permit easy access to components.



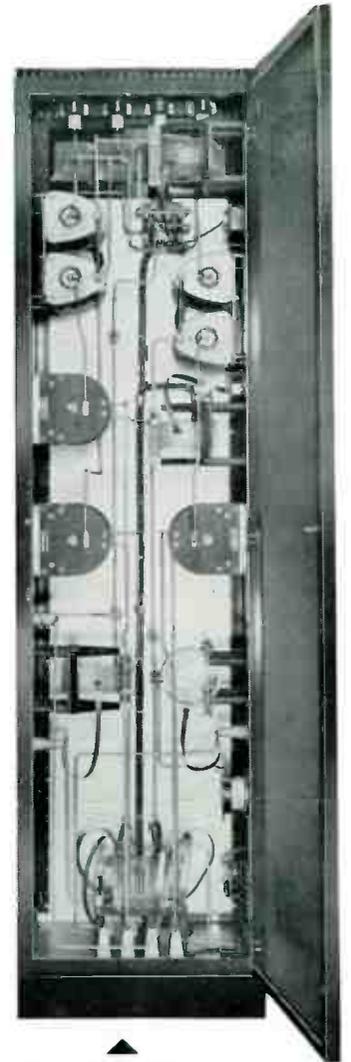
◀ Cabinet at left contains the phasing networks for each of five towers. Each transmission line has its own meter. Note the "twin-ganged" rotary coils used for the series of arms of the phasing network.

# ALTERNATE 1-KW, 5-KW AND 10-KW ANTENNA PHASING AND BRANCHING EQUIPMENT



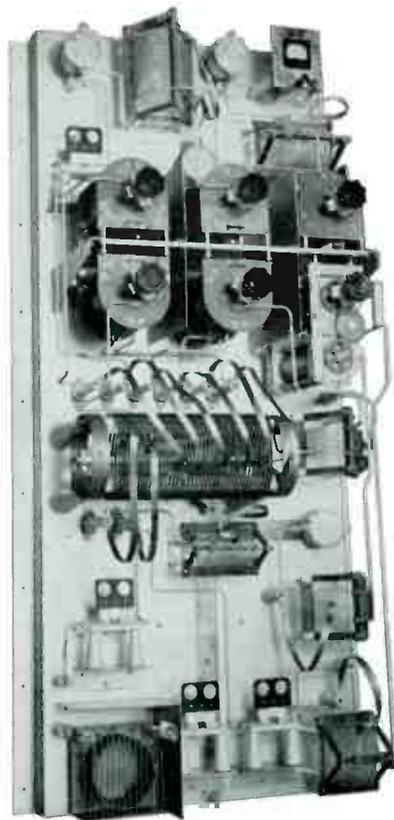
▲  
Attractively styled BR-84 Rack Cabinet for housing 1-KW, 5-KW and 10-KW Phasing Equipment.

**PHASING AND BRANCHING EQUIPMENT** for 1-KW, 5-KW and 10-KW installations may be economically housed in the standard BR-84 Rack Cabinet (at left and at right). This type of cabinet is suitable for simple antenna phasing systems where cabinet matching may not be a requisite and where cabinets are located separately from the transmitter. Finished in two-tone umber gray with stainless steel door handles and trim, styling blends with companion equipment. Welded and bolted steel construction provides a sturdy cabinet of one standard height and width. Height is 84", width is 28" (with side panels). Depth including doors and handles is 24 $\frac{1}{4}$ ". A glass window is provided at the top of the cabinet for maximum visibility of the common point and transmission line meters. Ample cabinet space permits a "roomy" mechanical layout for all components. For more complex phasing equipment, individual cabinets can be bolted together on a common base, thus providing additional component-mounting space.



▲  
The BR-84 Rack provides easy access to components and is completely ventilated at top.

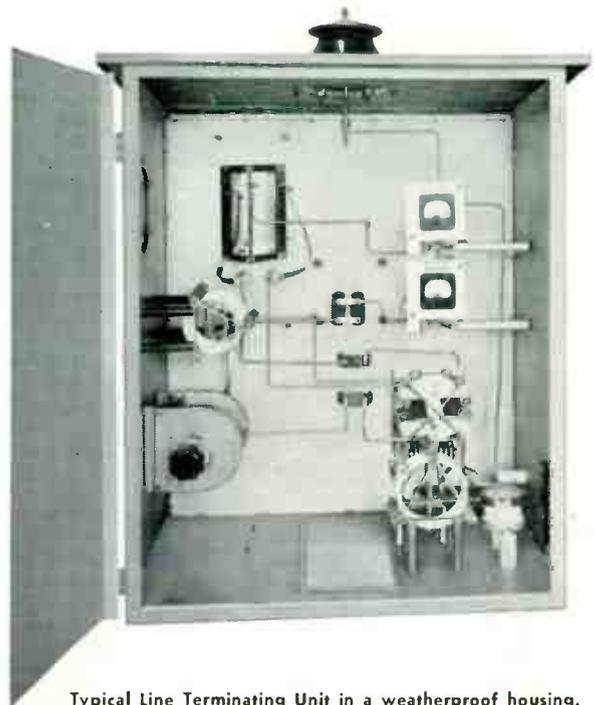
**WALL-MOUNTED, OPEN-TYPE PHASING PANELS** are also available for use in certain transmitter room installations where it is not possible or convenient to employ the "cabinet-type" equipment. In these cases, the wall-mounted design provides an economical arrangement which has the inherent advantages of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



◀ Wall-mounted, open-type phasing panel.

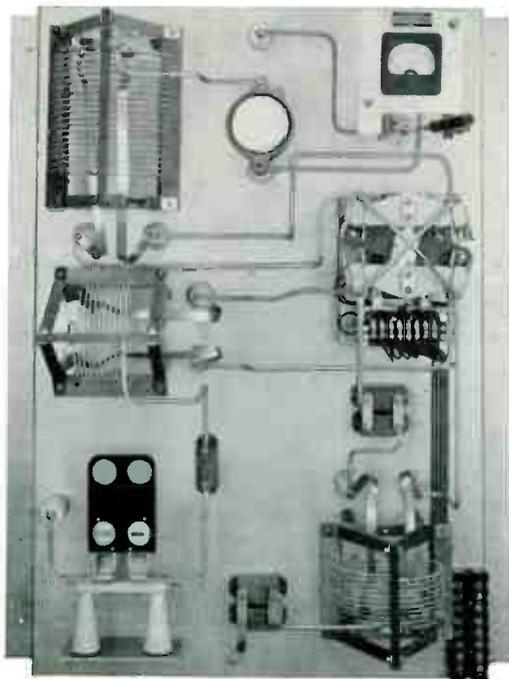
# 1-KW, 5-KW AND 10-KW LINE TERMINATING UNITS

**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 values 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 pilot contacts to permit remote indication of their operation or to be connected in special, fail-safe, interlock circuits. Pattern switching is completely coordinated with the transmitter control circuit for a centralized switching operation. Transmission line meters and 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.



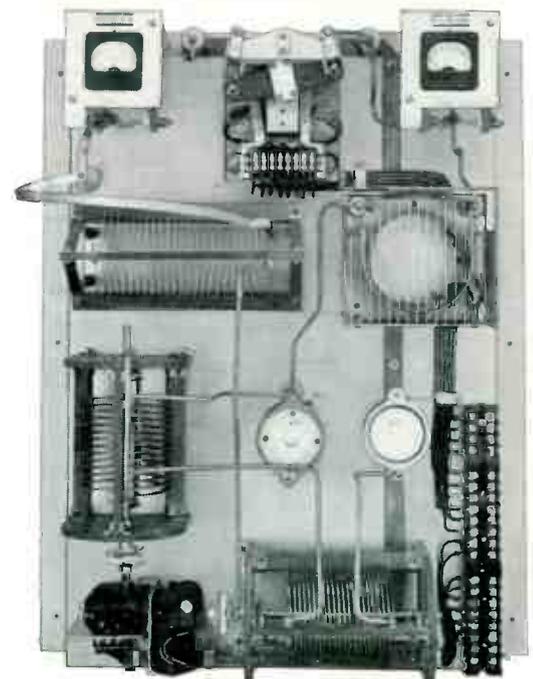
Typical Line Terminating Unit in a weatherproof housing.

## 1-KW, 5-KW AND 10-KW OPEN-TYPE WALL-MOUNTED LINE TERMINATING UNIT PANELS



Typical open panel, wall-mounted Line Terminating Unit.

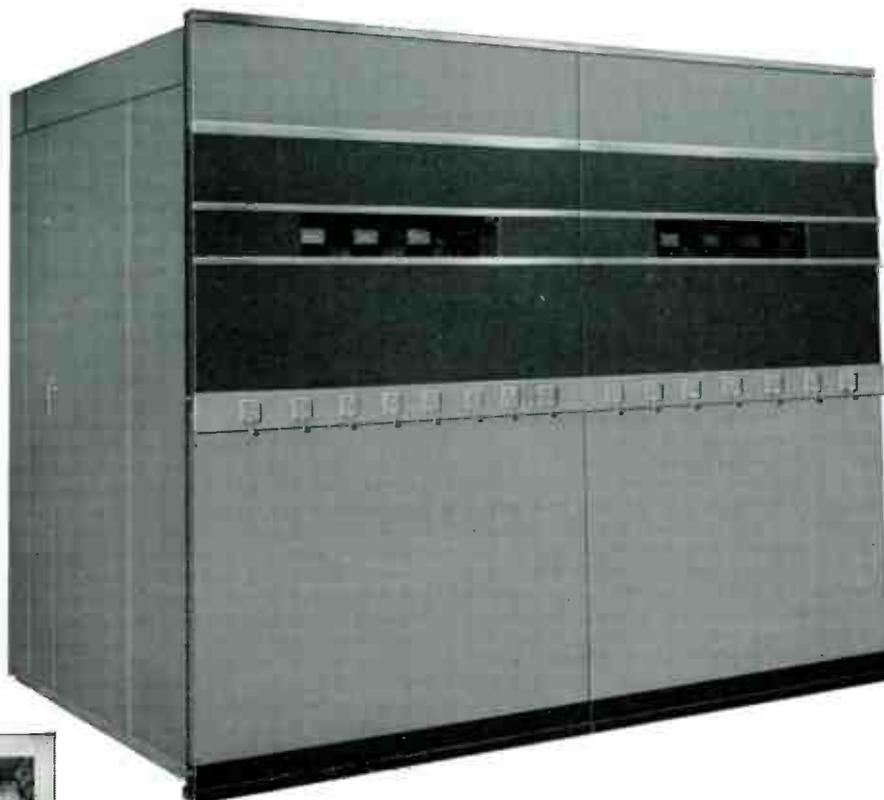
**OPEN-TYPE, WALL-MOUNTED PANELS** are ideal for mounting upon the wall of a tuning house at the antenna tower base and provide maximum accessibility for easy maintenance of Line Terminating Equipment. For complex arrays, either hand-driven or remotely-controlled, motor-driven rotary coils can be provided in Line Terminating Units for further convenience in equipment tune-up. Remote metering kits can also be included for convenient remote indication of the antenna current.



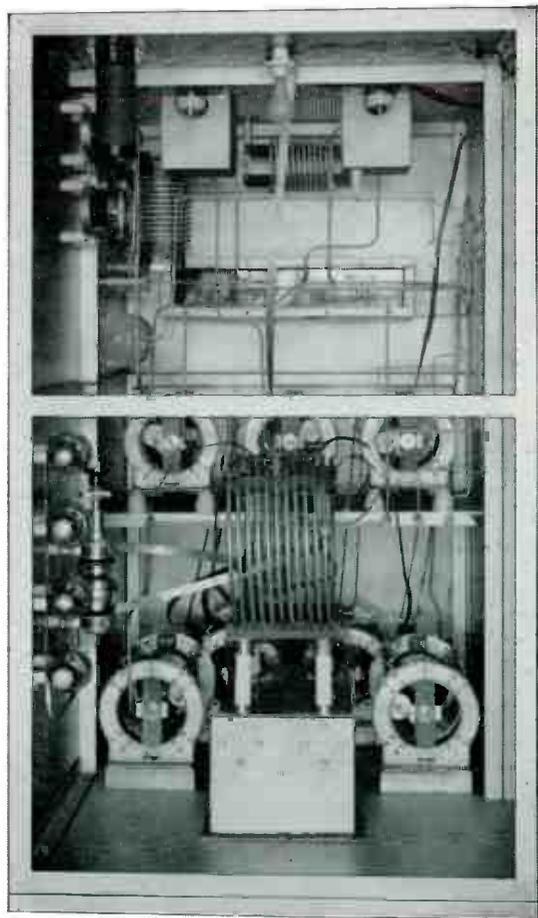
Open panel Line Terminating Unit utilizing remotely-controlled, motor-driven tuning.

## 50-KW PHASING AND BRANCHING EQUIPMENT

50-KW Phasing and Branching Equipment mounted in an MI-7485-J Cabinet which matches RCA Transmitters. ▶



Rear View of a typical 50-KW Phasing and Branching installation showing a section of the above cabinet. Note that all components are completely accessible and provided with rugged mountings. ▼

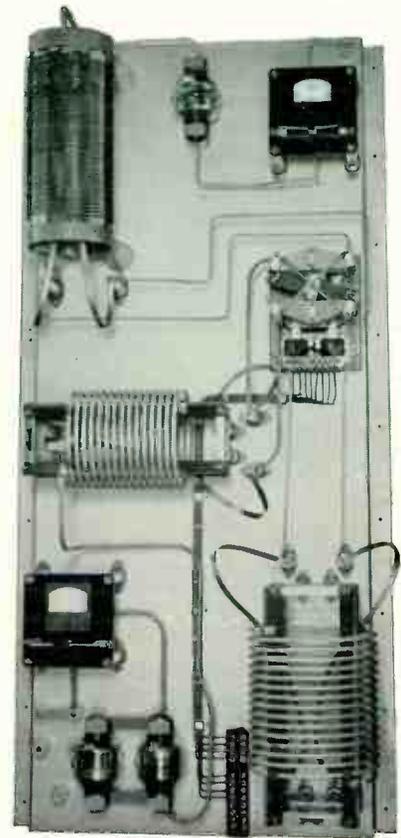


The cabinet shown above is the type used to house 50-KW phasing and branching equipment. This cabinet may be used to form a "styled-to-match" left-wing extension for RCA 50-KW series Transmitters. An interlocked door on the "left-end" side of the cabinet provides protection for operating personnel. Expanded scale, four-inch R-F ammeters are mounted on a sub-panel for easy reading through a glass observation window.

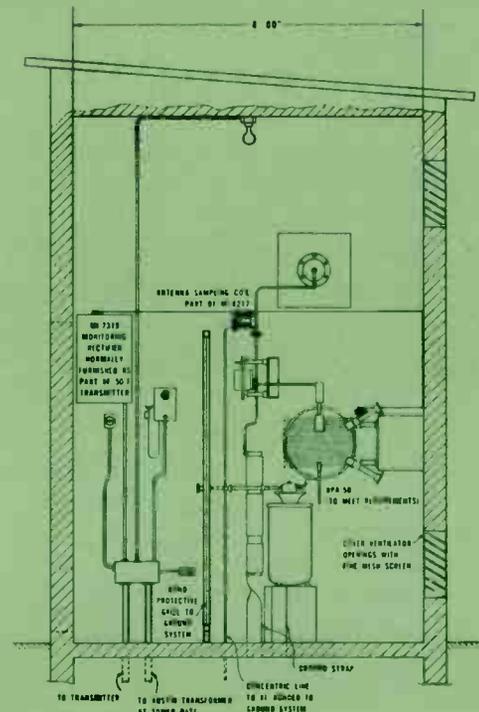
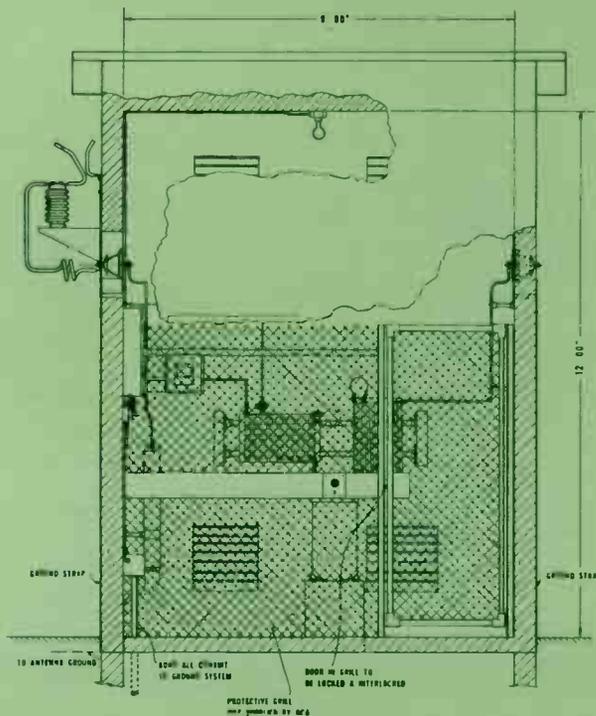
Phasing adjustments are made from the front panel by use of crank handles. Cranks are removable to prevent accidental de-tuning. A counter, calibrated to 1/10 turn, indicates the correct setting of each control. Motor tuning may be controlled from a push button on the front panel or at the supervisory control console. Rotary coils, used in the phase shift networks, are so arranged that one control operates both coils in each network. Coils are provided which permit a wide range of phase shift without impedance variation. Rotary coils are also provided in the power dividing network for independent control of the current amplitude in each tower. Vacuum, gas-filled, and Faradon Mica capacitors are used throughout. Where desired, variable capacitors, either gas or vacuum are used for maximum life and efficiency.

# 50-KW LINE TERMINATING UNITS

50-KW Line Terminating Units are supplied completely assembled on open wall-mounted panels, or as a complete kit of components for assembly by the radio station. The open-panel, Line Terminating Units are particularly suitable for any towers which have operating power of 25 KW or less. Components include feed-through, bowl insulators, 6" 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 Faradon 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.

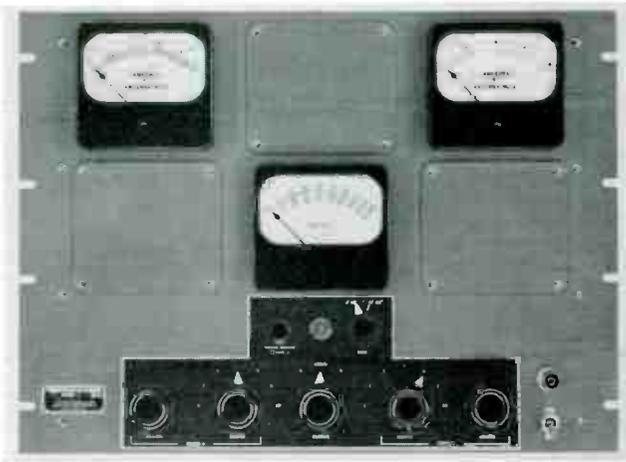


50-KW Open Panel Wall-mounted Line Terminating Unit.



Typical arrangement of components in a 50-KW Line Terminating Unit.

## MODEL 108 PHASEMETER



- Complete with remote antenna current meters
- Tailored to your specific requirements
- Unaffected by modulation
- Low power consumption
- Simplified operation

### USE

The Model 108 Phasemeter is an instrument designed to provide an indication of the phase relations in directional antenna systems. Each instrument is tailored for the particular installation and usually incorporates provision for indicating the relative amplitudes of the currents in the various antennas, as well as the phase relation. The Model 108 Phasemeter has found its principal use in broadcast stations employing

directional antennas, but its wide frequency range makes it readily adaptable for other applications.

### DESCRIPTION

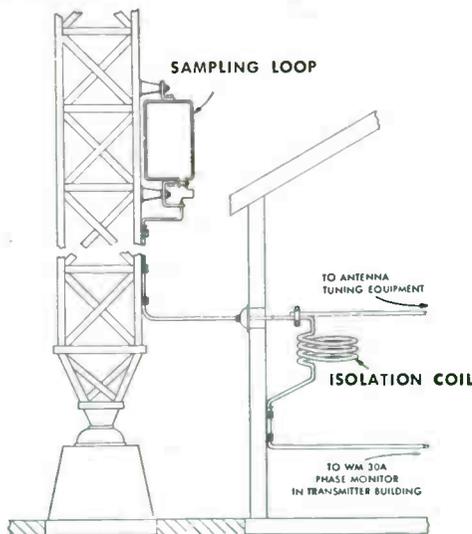
The type 108 Phasemeter provides a simple means of accurately measuring phase differences between currents in the various towers of an antenna array. It is particularly useful in checking the directional arrays to insure proper phasing and hence proper field pattern can be measured. The 108 Phasemeter can be used to adjust the phase shifting networks, to measure impedances of arrays and to monitor directional array operation. The 108 Phasemeter provides remote indication of both relative amplitude and phase of antenna currents in arrays employing up to five elements.\*

Terminals having a nominal value of 70 ohms or 50 ohms, as specified by the user, are provided at the rear of the instrument for connection to the transmission lines from the sampling loops. 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% modulation is not exceeded.

\* Type 108 Phasemeter will monitor up to nine towers by using accessory meters.

### SPECIFICATIONS

Frequency Range.....	100 kc to 2 mc
Phase Angle Range.....	0 to 360 degrees
Monitoring Accuracy.....	.1 degree
Resolution.....	1/2 degree
R-F Input Impedance.....	50 or 70 ohms nominal
R-F Voltage Range.....	.1 to 7 volts
Tube Complement.....	2 6AU6, 2 OB3, 1 5Y3, 3 6AL5
Power Supply.....	105 to 125 volts
Power Consumption.....	80 watts
Dimensions.....	14" x 19" x 7"
Weight.....	20 lbs.

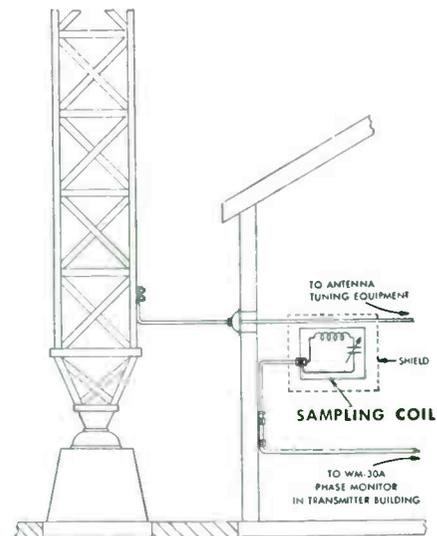


Typical installation of Sampling Loop and Isolation Coil.

**ISOLATION COIL.** This inductor 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.

◀ **SAMPLING LOOP.** 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.

▶ **SAMPLING COIL.** Provides an alternate method of obtaining a voltage (proportional to the antenna current) for operation of the Sampling Current Meter and Phase Monitor. The Sampling Coil (MI-8217A) consists of a shielded pick-up coil resonated by a variable capacitor. Tower-mounted installations are avoided and greater accessibility for maintenance is provided.



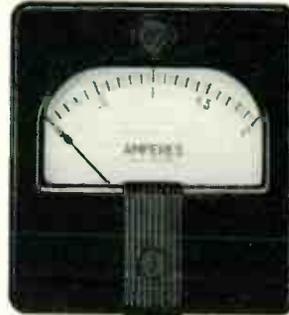
Typical installation of MI-8217-A Sampling Coil.

### REMOTE METERING KITS, BPM-1B, 1C, 1D

#### DESCRIPTION

The BPM-1 series of Remote Metering Kits provides a means of observing the antenna current at a remote location (transmitter house). Basically the unit is an electrostatically shielded current transformer with an adjustable loop primary coil and a tapped secondary coil in series with a germanium crystal and loading resistor. The taps provided on the secondary coil and the adjustable coupling between that coil and the primary loop provide coarse and vernier control of the remote meter indication. A wide range of antenna currents (approximately 1 ampere to 30 amperes) can be metered depending on the operating frequency. The unit has been designed for installation in antenna tuner housings employed with transmitters of 50 kw or less, depending on the voltage and displacement between the primary circuit and grounded Faraday shield.

The kit is intended to be used with MI-28037-A, MI-28037-B or MI-28037 Remote Ammeter; the "A" series meter is a 3" rectangular cased meter while the latter series is a 4" rectangular cased meter. 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, 7 $\frac{3}{8}$ " wide, 5 $\frac{3}{8}$ " deep  
 Sensitivity:  
 1-30 Amperes.....At 1600 kc  
 3-30 Amperes.....At 540 kc  
 Stock Identification .....MI-28027-A

##### 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  
 Stock Identification:  
 3" White Scale .....MI-28037-A  
 3" Black Scale .....MI-28037-B  
 4" White Scale .....MI-28037

### FIELD INTENSITY METER, WX-2D

#### DESCRIPTION

The type WX-2D 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 v/meter to 10 uv/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.

Type WX-2D 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-2D, a statically shielded, unbalanced loop is used as an integral part of the instrument cover. By careful design, spurious responses, such as IF 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.

#### SPECIFICATIONS

Frequency Range.....540-1600 kc  
 Sensitivity.....10 uv/m to 10 v/m (all frequencies)  
 Power Supply  
 (not supplied with equipment)....2 67 $\frac{1}{2}$  VB-5 1 $\frac{1}{2}$  unit cells  
 (RCA VS016)-(RCA VS001)  
 Antenna.....Built in loop with electro-static shield  
 Weight .....12.6 lbs.  
 Size.....9" high, 13" wide, 5 $\frac{3}{4}$ " deep  
 Stock Identification .....MI-30002-D



1. CARRIER FREQUENCY

- (a) Present 1000 KC
- (b) Proposed 1000 KC

2. TRANSMITTER EQUIPMENT

- (a) Type Transmitter BTA-10H Mfr. RCA
- (b) Operating Power: Day 10,000 watts Night 5,000 watts

3. TRANSMISSION LINES IMPEDANCE: 230 ohms

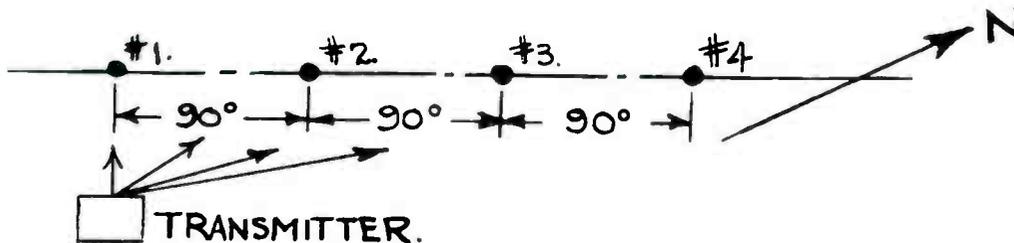
4. GROUND SYSTEM:

(Include full description for each radiator)

- (a) Number of radials 120
- (b) Average length 0.4

5. ANTENNA DATA:

	(South West) No. 1 Tower	(South Center) No. 2 Tower	(North Center) No. 3 Tower	(North East) No. 4 Tower	No. 5 Tower	No. 6 Tower
(a) Resistance	<u>34</u>	<u>37</u>	<u>35</u>	<u>32</u>	<u>---</u>	<u>---</u>
(b) Reactance (Indicate + or -)	<u>+20</u>	<u>+17</u>	<u>+21</u>	<u>+17</u>	<u>---</u>	<u>---</u>
(Above are self impedances; if operating impedances are available, append them as a part of this specification.)						
(c) Type radiator	<u>Blaw Knox—Uniform Cross-Section—Single Guy Level (Guyed or self-supporting).</u>					
(d) Height	<u>250'</u>	<u>250'</u>	<u>250'</u>	<u>250'</u>	<u>---</u>	<u>---</u>
(e) Base spread (if self-supporting)	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
(f) Relative Field						
Day	<u>1</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
Night	<u>1.0</u>	<u>1.7</u>	<u>1.7</u>	<u>1.0</u>	<u>---</u>	<u>---</u>
(g) Phase angle						
Day	<u>0°</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
Night	<u>0°</u>	<u>+76°</u>	<u>+142°</u>	<u>-163°</u>	<u>---</u>	<u>---</u>
(h) Power division	<u>386W</u>	<u>1890W</u>	<u>2460W</u>	<u>264W</u>	<u>---</u>	<u>---</u>
(i) Lengths of transmission lines from phasing cabinet to	<u>95°</u>	<u>130°</u>	<u>197°</u>	<u>255°</u>	<u>---</u>	<u>---</u>
(j) Plot plan of array showing distances and angles between towers: (Use last page if additional space is required)						



SUPPLY SKETCH OF DATA SHOWING POSITION OF TOWERS AND TRANSMITTERS (See Above).

## TYPICAL SPECIFICATIONS (Continued)

6. PHASING EQUIPMENT:

- (a) Location with respect to transmitter—  
Indoor X Outdoor ---
- (b) Distance from transmitter Adjacent
- (c) Type Mounting desired:  
1. Standard Rack ---  
2. Transmitter Wing (5/10 KW Transmitter only) X  
3. Unstyled outdoor or wall-mounted housing ---
- (d) Are rotary inductors required:  
1. In line terminating units? Yes --- No X  
Remotely-controlled motor-driven? Yes --- No ---  
2. In power distribution equipment? Yes X No ---  
Remotely-controlled motor-driven? Yes --- No X

7. METERING DESIRED:

- (a) Current (RF) phase indicator, Clarke Model 108 Yes X No ---
- (b) Phase monitor pick-up units. Base Coils X Tower Loops ---  
If tower loops, are base insulator isolating coils required? Yes --- No ---
- (c) Remote indicating antenna ammeters. Yes X No ---
- (d) Line current ammeters at terminating equipment. Yes X No ---
- (e) Line current ammeters at distribution point. Yes X No ---

8. TOWER LIGHTING SYSTEM:

- (a) Will RCA furnish the tower lighting feed system? Yes X No ---
- (b) Type of feed. RF Choke Coils --- Toroidal Transformers X

9. TOWER TUNING HOUSES:

- (a) Are tuning houses to be constructed at each tower? Yes X No ---

10. SUPPLY ANY PATTERN DATA AVAILABLE: Engineering report attached.

11. SPECIAL REQUIREMENTS, PREFERENCES (capacitors, relays, etc.) AND REMARKS:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NOTE: RCA's quotation and custom equipment design will be based upon the data contained herein. Accuracy and completeness are essential for a properly executed proposal and satisfactory equipment design.

Date: Dec. 1, 195-

John Doe  
(Signed)

Chief Engineer

(Title)

**MECHANICAL SPECIFICATIONS**

Matching Phasing Cabinet.....	Stock Identification 28927-B
Height .....	84"
Width (with End Shields).....	33"
Depth .....	32 $\frac{1}{16}$ "
Line Terminating Unit Housing.....	Stock Ident. 7444-F
Height (to top of Bowl Insulator).....	44 $\frac{1}{2}$ "
Width .....	35"
Depth .....	23 $\frac{3}{4}$ "
Open Panel Line Terminating Unit.....	Custom built
Height .....	36" (approx.)
Width .....	28" (approx.)
Depth .....	15" (approx.)

(Dimensions can be varied for special requirements)

**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 day-time operation or different pattern night and day).



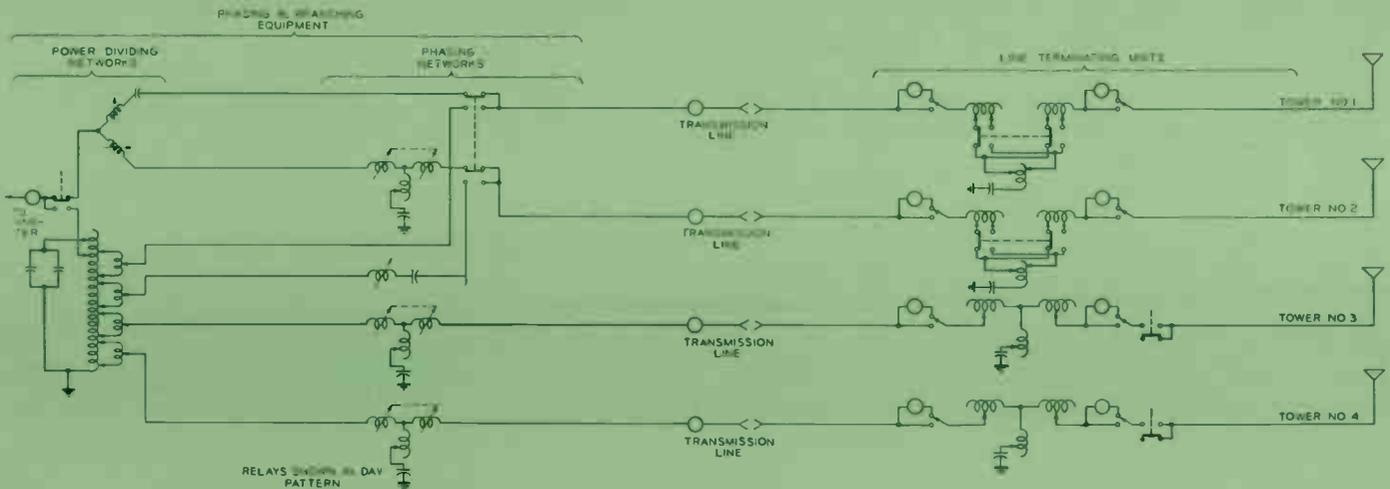
Engineer checks current ratios and phase at phase monitor. Push-button controls for remotely-controlled tuning motors and supervisory lights for the pattern-change relays are shown.

(f) Type of cabinet desired (5/10 KW equipment).

(g) Type antenna current sampling system desired.

A single specification form for the convenient listing of the above data is shown below. Copies are available at all RCA regional offices.

**TYPICAL SCHEMATIC DIAGRAM OF ANTENNA PHASING EQUIPMENT**



# AM, FM CRYSTAL UNITS

TYPES TMV-129-B, TMV-129-F, TMV-129-G, RC-9

## FEATURES

- Operation directly from 115 volt source without need for step-down transformer
- Heater adequate to keep crystal at constant temperature—even when room temperatures are 80° C below crystal operating temperature
- Excellent frequency stability and freedom from aging effects
- Frequencies available from 325 kc to 3000 kc
- Precision type bi-metal thermostat
- External contact for pilot light to indicate thermostat cycling
- Plug-in units, impossible to insert incorrectly in sockets



## USES

The RCA Type TMV-129-B Crystal Unit was designed especially for stable frequency control of transmitters operating in the AM broadcast band. However, in addition to covering the standard range from 550 to 1600 kc, these precision units are also available for frequencies as low as 325 kc and as high as 3000 kc. The units may be employed in any type of equipment within the applicable frequency range, where maximum frequency precision and high crystal activity are essential.

## DESCRIPTION

Each TMV-129-B unit employs an AT-cut low-temperature coefficient quartz plate. The crystals are pre-dimensioned to provide the maximum freedom from spurious responses. Each plate is nearly one-inch square and has a thickness depending upon frequency. In the low portion of the frequency range the crystals are relatively heavy, as much as  $\frac{1}{8}$  inch thick. In spite of this they oscillate with excellent freedom.

A patented lower electrode is employed in each TMV-129-B crystal unit, furnishing a small fixed air gap be-

neath the central area of each crystal. This construction minimizes the wear of the very hard quartz plate on its seating surface, and gives assurance of positive starting and long life. The two electrodes are of low-porosity monel metal. The crystal unit also contains a patented feature comprising a blocking condenser and shunting 10-megohm resistor to avoid accumulation of d-c charges on the crystal faces, which otherwise would cause frequency jumps.

Each crystal is a six-pin base plug-in unit which may quickly be inserted in its oscillator circuit. Each unit is mounted within a 14-watt heater employing a thermostat, patented temperature compensator and outer aluminum case.

## SPECIFICATIONS

Frequency Range.....	325 to 3000 kc
Ambient Temperature Range.....	-20°C to +55°C
Operating Temperature.....	+60°C (temperature controlled)
Frequency Stability.....	±10 cycles maximum (normally within ±2 cycles)
Quartz Plate Size.....	1.000" x .938", predimensioned
Heater Power.....	14 watts from a 110 volt a-c/d-c source
Stock Identification.....	MI-7467

## AM CRYSTAL UNIT, TMV-129F

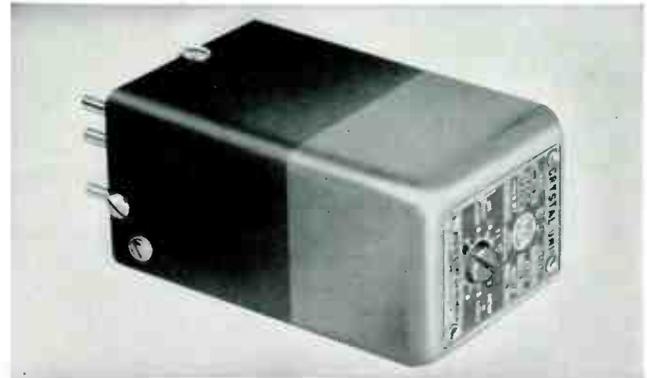
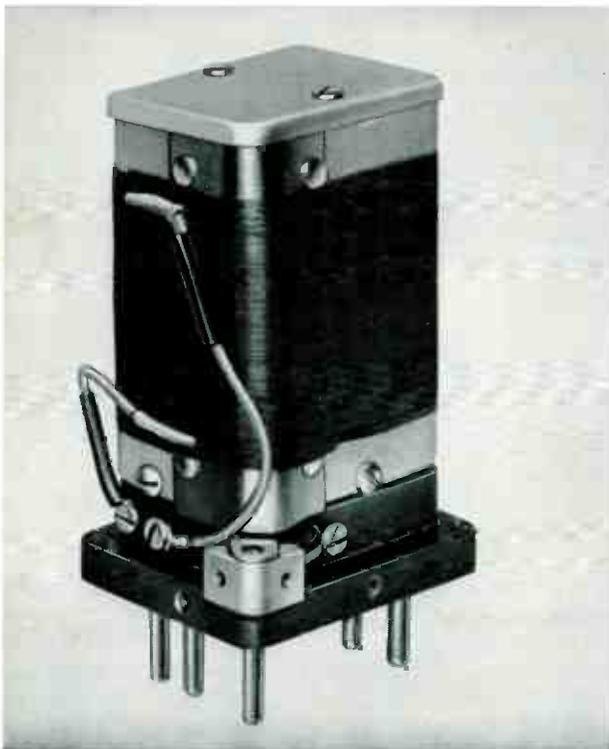
### USES

The RCA type TMV-129-F Crystal Unit was designed for use in such applications as international broadcast transmitters or medium frequency communications equipment. The unit is provided with a variable frequency control. This feature has been found most valuable in international and foreign broadcast transmitters where intentional jamming of signals has been encountered. The transmitter channel may be cleared instantly by a slight rotation of the adjustment shaft. The RCA TMV-129-F unit is primarily intended for use with fundamental AT-cut or BT-cut crystals only. Hence, the recommended frequency range is limited to 1.8 mc to 8.5 mc.

### DESCRIPTION

The quartz plates employed in the TMV-129-F units are approximately 1-inch square, pressure air-gap mounted between nickel silver electrodes. This assembly is mounted in low-loss ceramic steatite brackets which are in turn firmly secured to a sturdy metal riser located centrally within the heater oven. The air-gap between the upper face of the

A TMV-129 type Crystal Unit with outer case removed to show 14-watt heater and mounting base.



quartz plate and the top electrode is variable, and operable by rotation of a specially designed shaft provided with a screw-driver slot to facilitate adjustment under actual operating conditions. As the air-gap is varied to change the operating frequency, the crystal activity is also slightly affected. The recommended usable range of this variation in frequency is in terms of a crystal activity variation not exceeding 10% from the maximum.

A micrometer scale on the cover permits exact setting of the adjustment shaft. This provision is useful either to set the oscillator circuit to exact frequency, or deliberately to shift the frequency by a sufficient amount to avoid carrier interference with another station. The user also may employ the adjusting shaft at will to compensate for aging effects.

Where maximum frequency adjustment is desired, such as between  $\pm 0.03\%$  to  $\pm 0.04\%$ , an AT-cut quartz plate must be employed. In the higher frequency range between approximately 4 and 8.5 mc, a BT-cut crystal is normally employed where the desired frequency shift does not exceed  $\pm 0.01\%$ . Even in this higher frequency range a large percentage increase may be realized by specifying the use of an AT-cut crystal. Even greater shift is possible if crystal activity can be sacrificed more than the conventional 10% from the maximum.

### SPECIFICATIONS

Frequency Range.....	1.8 to 8.5 mc
Ambient Temperature Range.....	-20°C to +55°C
Operating Temperature.....	+60°C (other temperatures on special order)
Frequency Adjustment:	
AT-cut Plates.....	Nominal $\pm 0.03\%$
BT-cut Plates.....	Nominal $\pm 0.01\%$
Frequency Stability.....	$\pm 0.005\%$ or better
Crystal Mounting.....	Variable pressure air gap
Heater Power.....	14 watts from 110 volt a-c/d-c source
Stock Identification .....	M1-19400-A

## FM CRYSTAL UNIT, TYPE TMV-129G

### USES

The TMV-129-G Crystal Units are specifically designed for low frequencies between 70 kc and 350 kc as required for FM aural exciter units. The unit is widely employed in frequency modulation transmitters and for low-frequency, precision electronic equipment of all types. Although optimum performance is realized at frequencies between 70 and 125 kc, this unit may be employed with very satisfactory performance as high as 350 kc. The frequency stability approaches that of a primary frequency standard and under normal operating conditions the maximum frequency variation will not exceed one or two cycles.

### DESCRIPTION

The TMV-129-G employs a silver plated CT- or DT-cut quartz crystal mounted in a glass-bonded mica yoke by centrally located pressure pins. The pins are fabricated with extreme care and have lapped contacting surfaces to avoid pin-point contacts, which might cause microscopic crystal fractures. The mounting yoke and crystal assembly are thermally insulated from the heater oven base by a

specially treated thermosetting bracket. The entire assembly is mounted within an air-tight compartment consisting of a metal base and a steel cylindrical shell. Although not hermetically sealed, the crystal and its mounting yoke are protected from contamination by the metal cover with its effective gasket seal. The normal operating temperature of this low-frequency crystal unit is 70°C. However, it is available for operation at any temperature between 50° and 85°C. It is recommended, however, that the specified operating temperature be as low as possible.

### SPECIFICATIONS

Frequency Range.....	70 to 350 kc using either CT-cut or DT-cut quartz plates
Ambient Temperature Range.....	-10°C to +65°C
Operating Temperature .....	+70°C
Frequency Stability .....	±2 cycles
Frequency Calibration.....	Zero beat in customer's circuit with trimmer capacitor
Heater Power.....	14 watts from 110 volt a-c/dc source
Stock Identification .....	MI-19450-A

The TMV-129 series of precision temperature controlled crystal units reveal several types of quartz plate mountings after removal of 14-watt heater and outer aluminum case. Shown below, left to right are the RCA types TMV-129-B, 129-C, 129-F and 129-G.



## STL CRYSTAL UNIT, TYPE RC-9

### USES

The RCA type RC-9 Crystal Unit was designed for use in high frequency communications equipment. It has been used in the receiver unit of FM Studio Transmitter Link Equipment, Type BTL-1B. Output frequencies as high as 1000 mc may be obtained by use of not more than three frequency multiplier stages.

Excellent frequency stability is feature of RCA's Type RC-9 Crystal Unit used in high frequency communications equipment.



### DESCRIPTION

The RC-9 crystal unit comprises a cylindrical metal case containing a circular, unplated AT-cut crystal, pressure air-gap mounted between low-loss ceramic electrodes which are silver plated to provide the essential conducting areas. The main cylindrical body is only  $\frac{1}{8}$ " in diameter and  $\frac{3}{8}$ " long. The two concentric end terminals are each  $\frac{1}{16}$ " diameter by  $\frac{3}{16}$ " long. The two end bells are shaped to contain a generous volume of glass insulation between the central pins and the metal case, making for low capaci-

tance and freedom from mechanical strains within the glass beads themselves. The entire unit length, from tip to tip, is  $1\frac{1}{8}$ ".

### SPECIFICATIONS

Frequency Range.....15 mc to 50 mc  
 Temperature Range.....-55°C to +90°C  
 Frequency Stability.....±.005% or ±.01% max.  
 Stock Identification .....MI-16263

### Convenient Summary of RCA Type TMV-129 Crystal Units

Type	Use	Frequency	Stock Identification	Type	Use	Frequency	Stock Identification
TMV-129-B	AM Broadcast transmitters Any type equipment requiring maximum frequency precision and high crystal activity within frequency range	325 kc to 3000 kc	MI-7467	*TMV-129-Q4	RCA TV transmitters, type TT-10AL, TT-10AH, TT-25BL, TT-20BH and TT-50AH High frequency transmitters for frequency range indicated	9.0 mc to 14.0 mc employing 3rd overtone	MI-19400-J4
*TMV-129-C	VHF television broadcast transmitters High frequency transmitters Receivers requiring precision fixed frequency reception	2000 kc to 20000 kc	MI-19400	TMV-129-F	International broadcast transmitters Medium frequency communications equipment Equipment requiring variable frequency control within range indicated	1.8 mc to 8.5 mc	MI-19400-A
*TMV-129-C1	RCA TV transmitters, type TT-5A, TT-25AL, and TT-20AH High frequency transmitters for frequency range indicated	3.7 mc to 7.1 mc	MI-19400-J1	TMV-129-G	VHF and UHF television transmitters as aural exciter units FM aural transmitters Low-frequency, precision electronic equipment of all types	70 kc to 350 kc	MI-19450-A
*TMV-129-C2	RCA TV transmitters, type TT-500A and TT-2AL High frequency transmitters for frequency range indicated	3.7 mc to 7.1 mc	MI-19400-J2	*TMV-129-P	UHF television transmitters High frequency monitors	20 mc to 45 mc employing 3rd overtone	MI-19400-H
*TMV-129-C3	RCA TV transmitters, type TT-500B and TT-2AH High frequency transmitters for frequency range indicated	3.8 mc to 5.9 mc	MI-19400-J3				

\* For description of TMV-129C, C1, C2, C3, Q4, and TMV-129-P Refer to Crystals in Television Transmitting Equipment Catalog.

# AM-FM TRANSMISSION LINE AND FITTINGS

## COAXIAL AND OPEN-WIRE TYPES

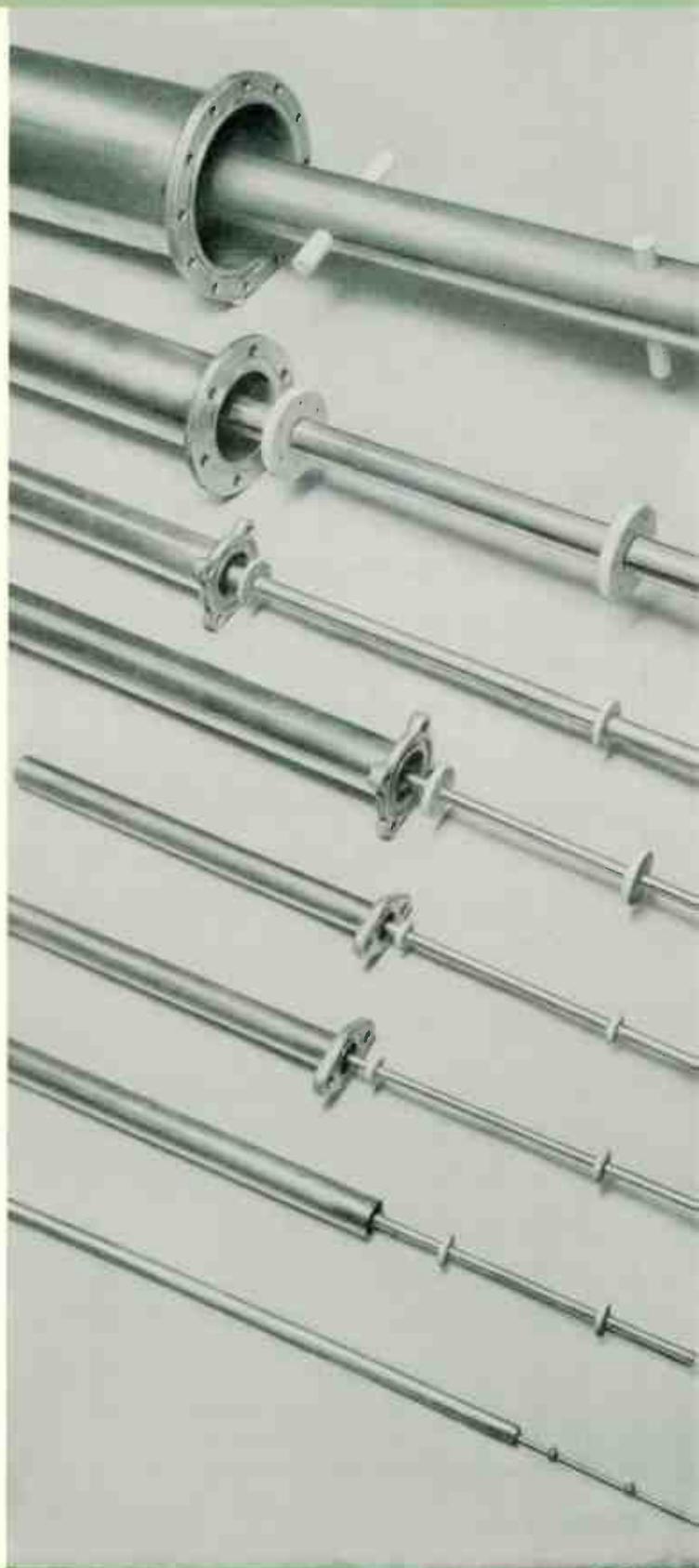
### FEATURES

- 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 the high efficiency with which it transmits RF energy, plus the time that can be saved in its installation. Ease of installation is due to the RCA-developed flanged line which is now used in all types of radio and television installations. This line is supplied in convenient lengths with flanges 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.



Size	Stock Identification	Description	Impedance	Power (average)	O.D. of Inner Conductor (in.)	I.D. of Inner Conductor (in.)	Insulators Type—Spacing (in.)	Wt. lbs. per 100 ft.	Class of Service
3/8"	MI-19306	Solder fittings, pressurized or unpressurized	72 ohm	620 watts max. 1 mc	.081	Solid	Steatite (Beaded) 1 3/4	16	Sampling and frequency checking in AM broadcast systems, mobile, aircraft
7/8"	MI-19307	Solder fittings, pressurized	72 ohm	4.5 kw. max. 1 mc	.250	.187	Steatite (Wafer) 4	60	AM broadcast lines, phase sampling
7/8"	MI-19308	Flanged fittings, no solder—pressurized	72 ohm	4.5 kw. max. 1 mc	.250	.187	Steatite (Wafer) 6	60	AM broadcast lines, phase sampling
7/8"	MI-19309	Flanged fittings, no solder—pressurized	51.5 ohm	4.5 kw. max. 50 mc 3 kw. max. 100 mc 2 kw. max. 200 mc	.312	.250	Steatite (Wafer) 6	62	AM and FM broadcast line, phase sampling
7/8"	MI-19305	Solder fittings, pressurized	51.5 ohm	6.5 kw. max. 1 mc	.312	.250	Steatite (Wafer) 6	60	AM and FM broadcast lines, phase sampling
1 5/8"	MI-19310	Flanged fittings, pressurized, no solder	72 ohm	16 kw. max. 1 mc	.375	.312	Steatite (Wafer) 12	120	AM broadcast lines
1 5/8"	MI-19112	Flanged fittings, pressurized, no solder	51.5 ohm	16 kw. max. 50 mc 10 kw. max. 100 mc 7 kw. max. 200 mc	.625	.569	Steatite (Wafer) 12	125	VHF Television and FM installations (up to 220 mc), AM lines
3 1/8"	MI-19111	Unflanged fittings, no solder—unpressurized	72 ohm	36 kw. max. 50 mc 24 kw. max. 100 mc 15.5 kw. max. 200 mc	.875	.812	Steatite (Wafer) 12	230	For VHF Television use within the transmitter building
3 1/8"	MI-19089	Flanged fittings, no solder—pressurized	50 ohm	21.5 kw. 400 mc 16.5 kw. 600 mc 11.5 kw. 900 mc	1.315	1.231	Teflon (Wafer) —	270	Designed for UHF Television installations. Can be used for VHF
3 1/8"	MI-19113	Flanged fittings, no solder—pressurized	51.5 ohm	62 kw. max. 50 mc 42 kw. max. 100 mc 27 kw. max. 200 mc	1.200	1.136	Steatite (Wafer) 12	250	VHF Television and FM installations (up to 108 mc) AM lines
3 1/8"	MI-19313	Flanged fittings, no solder—pressurized	51.5 ohm	62 kw. max. 50 mc 44 kw. max. 100 mc 31 kw. max. 200 mc	1.281	1.232	Teflon (Wafer) —	270	VHF Television (up to 220 mc) and FM installations
6 1/8"	MI-19314	Flanged fittings, no solder—pressurized	51.5 ohm	235 kw. max. 50 mc 166 kw. max. 100 mc 118 kw. max. 200 mc	2.500	2.435	Steatite (Pin Type) 12	730	VHF Television (up to 220 mc) and FM installations. For high power, high efficiency and exceptionally long runs
6 1/8"	MI-19387	Flanged fittings, no solder—pressurized	75 ohm	110 kw. max. 400 mc 78 kw. max. 600 mc 53 kw. max. 900 mc	1.711	1.661	Teflon (Wafer) —	720	For UHF Television installations—higher power requirements and less attenuation on long runs

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.

There is a comprehensive data table included above which should be helpful to the reader. Broadcast engineers and planners, by referring to this "Quick Reference Chart", can study the general overall characteristics and specifications of RCA's entire complement of transmission lines. In this manner, the reader can select the particular transmission line meeting his application requirements and refer to the proper pages in the Transmission Line catalog for additional data and information.

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.

Various types of flexible coaxial cable may be found on Page 95 of this catalog.

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	Stock No.	Impedance	Voltage RMS 60 Cycles	Power Rating Based on 100% AM Modulation and Unity VSWR	Attenuation db./100 ft.	Velocity %
3/8"	MI-19306	72 ohms	2,500	0.6 kw	.0868	87%
7/8"	MI-19307	72 ohms	7,000	4.5 kw	.0343	90%
7/8"	MI-19308	72 ohms	7,000	4.5 kw	.0381	93.2%
7/8"	MI-19309	51.5 ohms	5,000	6.5 kw	.0402	93.2%
7/8"	MI-19305	51.5 ohms	5,000	6.5 kw	.0360	90%
1 5/8"	MI-19310	72 ohms	12,000	16 kw	.0190	96.3%
1 5/8"	MI-19112	51.5 ohms	11,000	25 kw	.0204	96.3%
3 1/8"	MI-19113	51.5 ohms	18,000	94 kw	.0104	93%
6 1/8"	MI-19314	51.5 ohms	30,000	380 kw	.0051	98.7%

The above power ratings are based on a 100% 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 break-

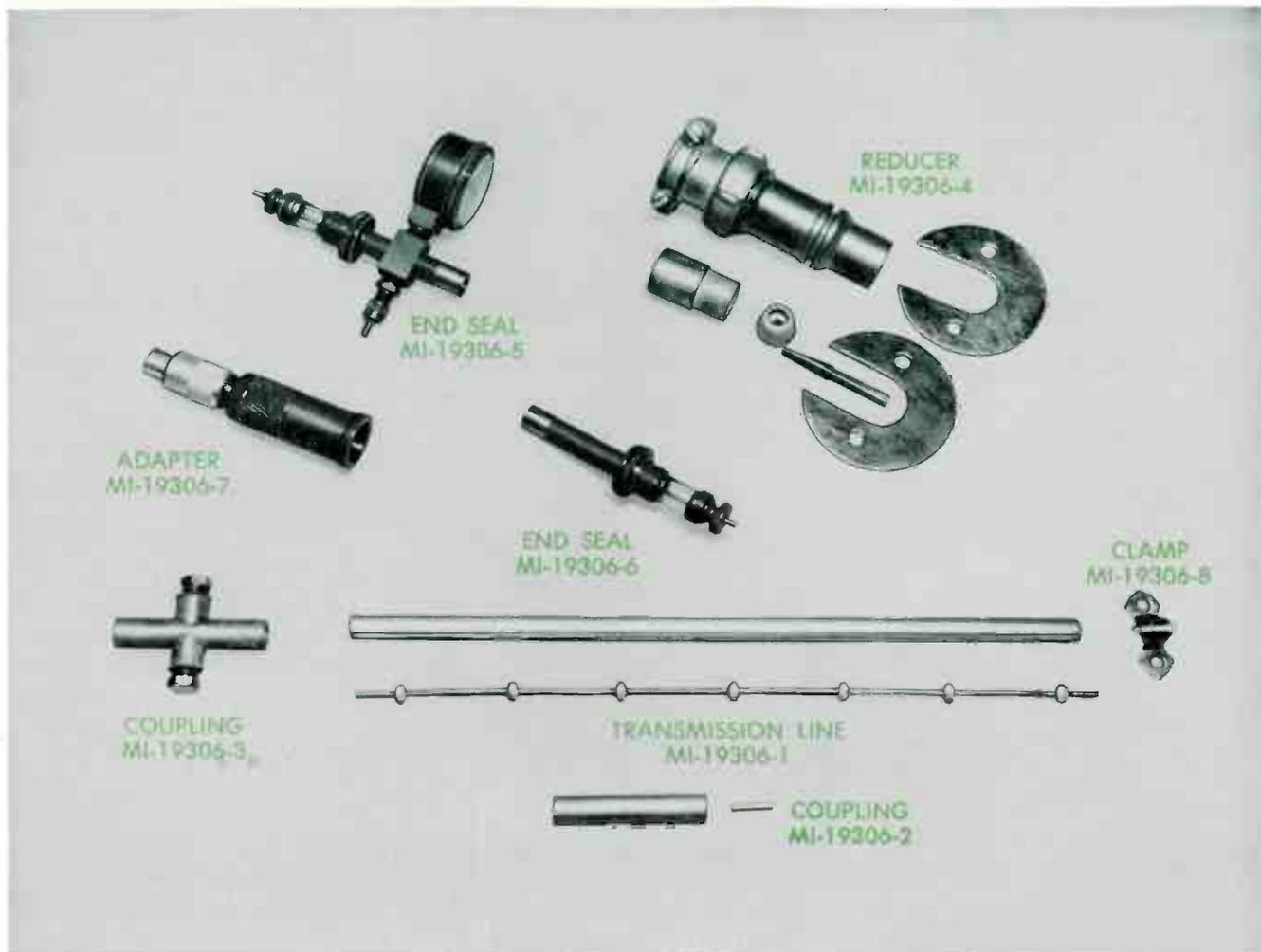
down is relatively independent of frequency in this region. The 60-cycle flash-over voltage ratings listed in the above chart are based on an approximate safety factor of three.

The calculated attenuation values are based on 95% 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% derating factor which allows for contact resistance at the joints between the 20-foot sections.

## ADDITIONAL INFORMATION . . . 6 1/8" LINES, ACCESSORIES, ETC.

Although this catalog describes transmission lines for AM and FM use, many of the lines described here have television applications. The catalog entitled "Broadcast Transmission Line Equipment for Television, AM, FM" (#2J8965)

provides additional information on coaxial lines, curves, charts, tables, system layouts, information on 6 1/8" lines, supporting hangers and other accessories such as directional couplers and power switching.



## DESCRIPTIONS

RCA 3/8" Beaded Steatite Transmission Line, Type MI-19306, is a soft copper 72-ohm coaxial line designed for uses where the power and frequency to be handled are relatively low, and where line efficiency is not too important a factor. This type line is widely used to carry phase sampling voltages for directional AM arrays, to feed frequency measuring equipment, etc. It is also used in mobile and aircraft communication installations.

This solder-type, soft line is available with a complete complement of couplings, adapters, end seals, clamps, and reducers. The line lends itself readily to bending around obstructions and therefore requires no elbows.

### MI-19306-1 TRANSMISSION LINE

This line is furnished to specified length on 36"-diameter reels which contain up to 250 feet, or on larger returnable reels which contain up to 5000 feet. The coils are hermetically sealed. Orders should specify which is desired. Insulators are spaced 1 3/4" apart allowing a bending radius of 8" without shorting or loss of concentricity. Capable of handling 250 w. nominal and 1 kw maximum power.

### MI-19306-2 STRAIGHT COUPLING

This item includes solder type inner and outer conductors.

### MI-19306-3 COUPLING (Straight Gas Servicing)

Outer conductor has two 1/8" IPS ports for gas admission with pipe plugs. Item includes solder type inner conductor.

### MI-19306-4 REDUCER COUPLING

Used for reducing 7/8" diameter MI-19309 hard drawn transmission line to 3/8" diameter soft line for soldering. Includes 2 steel locking plates for mounting to flat surface.

### MI-19306-5 END SEAL

Solder type including two 1/8" IPS ports for gas admission with pipe plugs. Furnished with nut for clamping to mounting surface.

### MI-19306-7 ADAPTER

Used for coupling RG 11 U Cable to End Seals MI-19306-5 or MI-19306-6.

### MI-19306-8 CLAMP

Used for clamping 3/8" diameter line. Has 2 holes for number 10 screws. Mount one clamp approximately every 4 feet.

# 7/8" SOFT COPPER LINE AND FITTINGS, MI-19307, MI-19305

(72-OHM)

(51.5-OHM)

## DESCRIPTIONS

RCA 7/8" Steatite Transmission Line, MI-19307, is used for AM Broadcast lines and phase sampling. It is a soft-tempered copper coaxial line with a nominal impedance of 72 ohms. This line is also supplied with an impedance of 51.5 ohms for FM or AM Broadcast applications. The 51.5-ohm soft line is identified by MI-19305. List of accessory items and dimensions for MI-19305 are identical to MI-19307 except O.D. of the inner conductor.

### MI-19307-1 (MI-19305-1) TRANSMISSION LINE

Furnished in 48" diameter coils hermetically sealed. Insulators are spaced 4" apart allowing a bending radius of 30" without shorting or loss of concentricity. The 51.5 ohm line is

rated at 4.5 kw input at 50 mc with a 92% efficiency for 100 feet. Weight is 60 pounds per 100 feet.

### MI-19307-2 (MI-19305-2) STRAIGHT COUPLING

Includes solder type inner and outer conductors.

### MI-19307-3 (MI-19305-3) STRAIGHT COUPLING

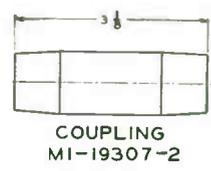
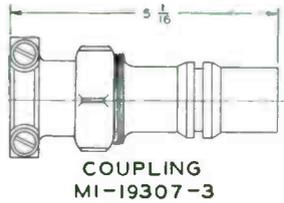
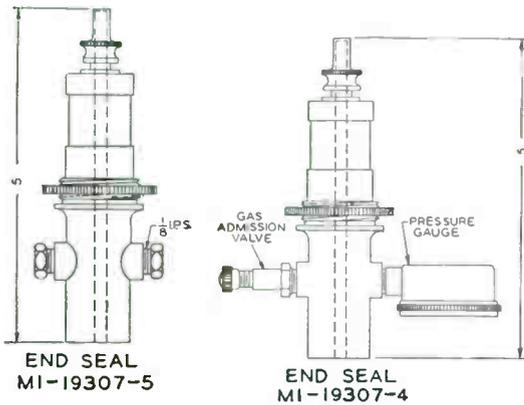
Used for connecting 7/8" diameter (MI-19309) hard drawn transmission line to 7/8" diameter soft solder-type line. Includes two steel locking plates for mounting to flat surface. Inner connector is solderless type.

### MI-19307-4 (MI-19305-4) END SEAL

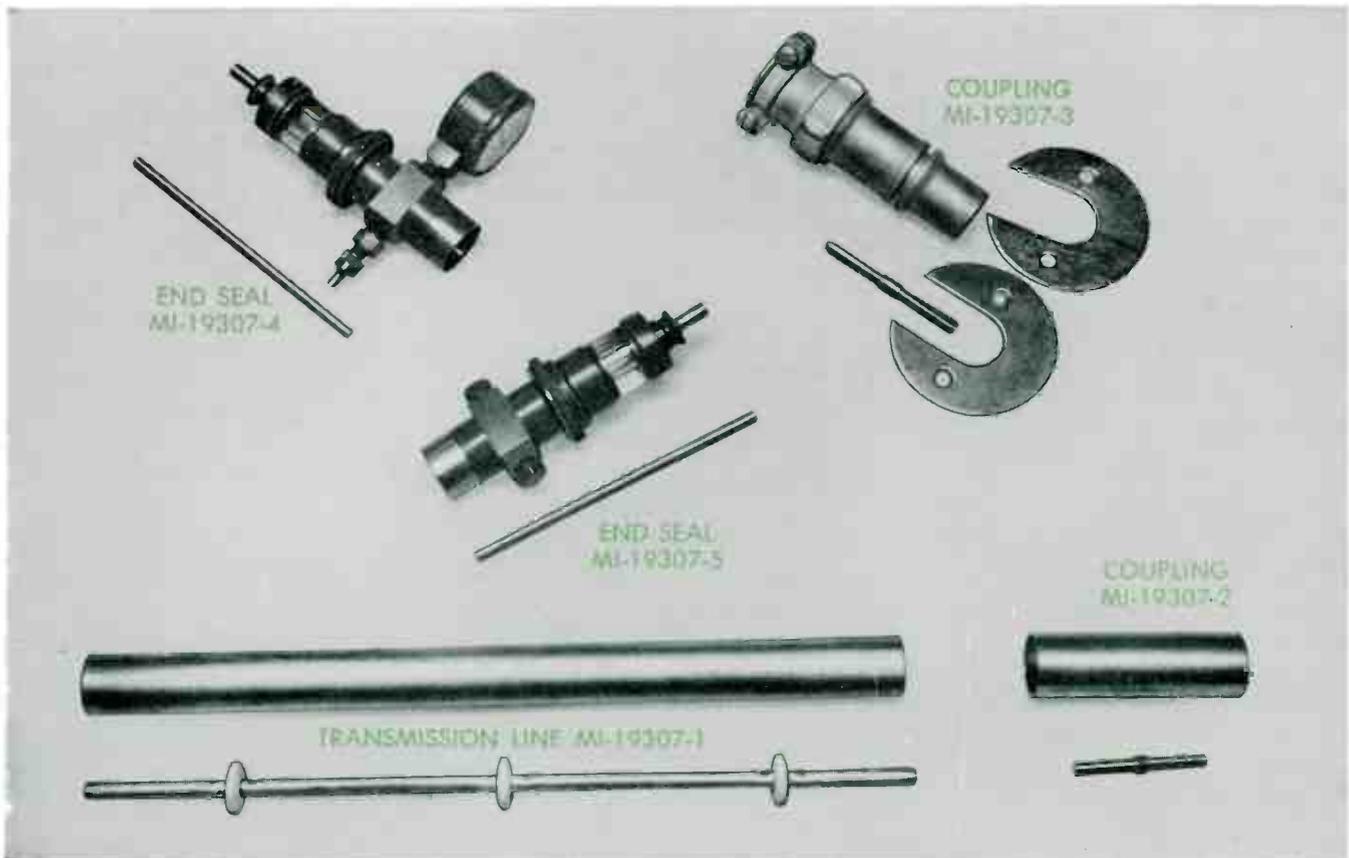
Solder-type fitting with two ports. Includes 30-pound pressure gauge and gas admission valve. End Seal is furnished with nut for clamping to mounting surface.

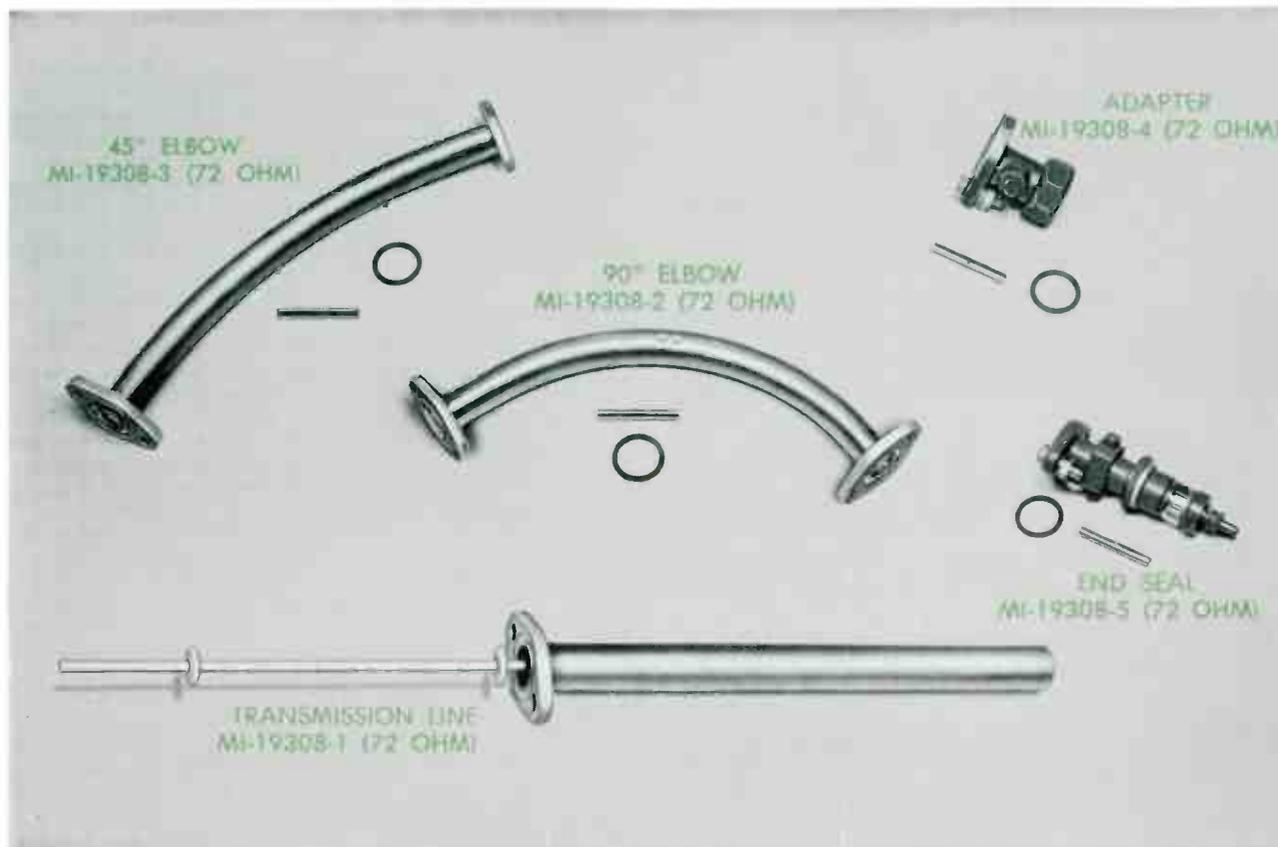
### MI-19307-5 (MI-19305-5) END SEAL

Solder-type fitting with two 1/8" IPS gas admission ports and pipe plugs. Furnished with nut for clamping to mounting surface.



Dimensions for 7/8" Soft Line and Fittings



**7/8" 72-OHM HARD COPPER LINE AND FITTINGS, MI-19308****DESCRIPTIONS**

RCA 7/8" Steatite Transmission Line, Type MI-19308, is a hard-tempered coaxial line with a nominal impedance of 72 ohms. This line operates with good efficiency on the low, medium and high frequencies, and is widely used for AM installations of 5 kw and less.

**MI-19308-1 TRANSMISSION LINE**

This line is supplied in 20-foot length with a flange silver soldered to each end. The inner conductor is 1/4" diameter with steatite insulators spaced 6" apart. The outer conductor is designed to allow for removing inner conductor for inspection. Power rating is 1 kw nominal with 90% efficiency for 100 feet. Line includes solderless inner connector, O-ring gasket and silicon copper hardware.

**MI-19308-1-F TRANSMISSION LINE**

Same as MI-19308-1 except one flange is omitted.

**MI-19308-1-NF TRANSMISSION LINE**

Same as MI-19308-1 except both flanges are omitted.

**MI-19308-2 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 conductor, O-ring gasket and hardware.

**MI-19308-2-F COUPLING (90° Elbow)**

Same as MI-19308-2 except the fixed flange is omitted.

**MI-19308-2-NF COUPLING (90° Elbow)**

Same as MI-19308-2 except both flanges are omitted.

**MI-19308-3 COUPLING (45° Elbow)**

Same as MI-19308-2 except 45°.

**MI-19308-3-F COUPLING (45° Elbow)**

Same as MI-19308-3 except the fixed flange is omitted.

**MI-19308-3-NF COUPLING (45° Elbow)**

Same as MI-19308-3 except both flanges are omitted.

**MI-19308-4 ADAPTER COUPLING**

Used for coupling a 7/8" 72-ohm flanged line to a 7/8" 72-ohm unflanged line. A 1 1/2" wrench is required for clamping the special gland nut on the unflanged line. Furnished with solderless inner connector, O-ring gasket and hardware.

**MI-19308-5 END SEAL**

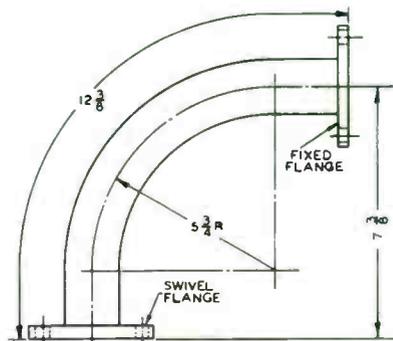
This sturdy end seal uses Pyrex as an insulator. It is fitted with two 1/8" IPS port and brass plugs for gas admission or bleeding the line. A clamp nut is supplied for mounting. A screw terminal with locking nut is used for the termination of inner conductor. No soldering is necessary for installing. Furnished with O-ring gasket and solderless inner connector.

**MI-19308-6 ADAPTER**

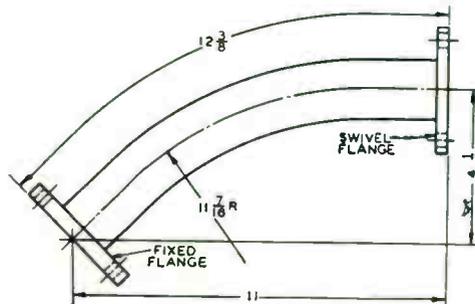
Adapts a flange using two bolts on 1 3/4"-bolt circle to a flange using three bolts on same bolt circle. Furnished complete with solderless inner conductor and O-ring gaskets.

# OUTLINE DIMENSIONS . . . 7/8" 72-OHM LINE AND FITTINGS

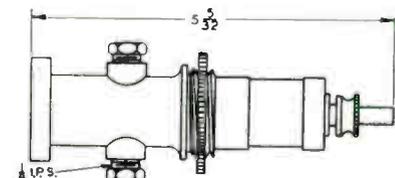
(MI-19308)



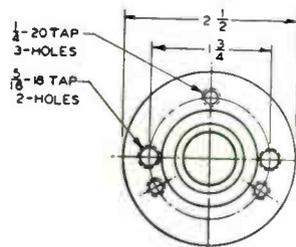
**90° COUPLING  
MI-19308-2**



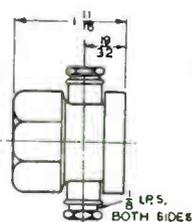
**45° COUPLING  
MI-19308-3**



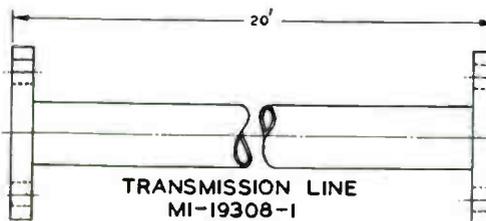
**END SEAL  
MI-19308-5**



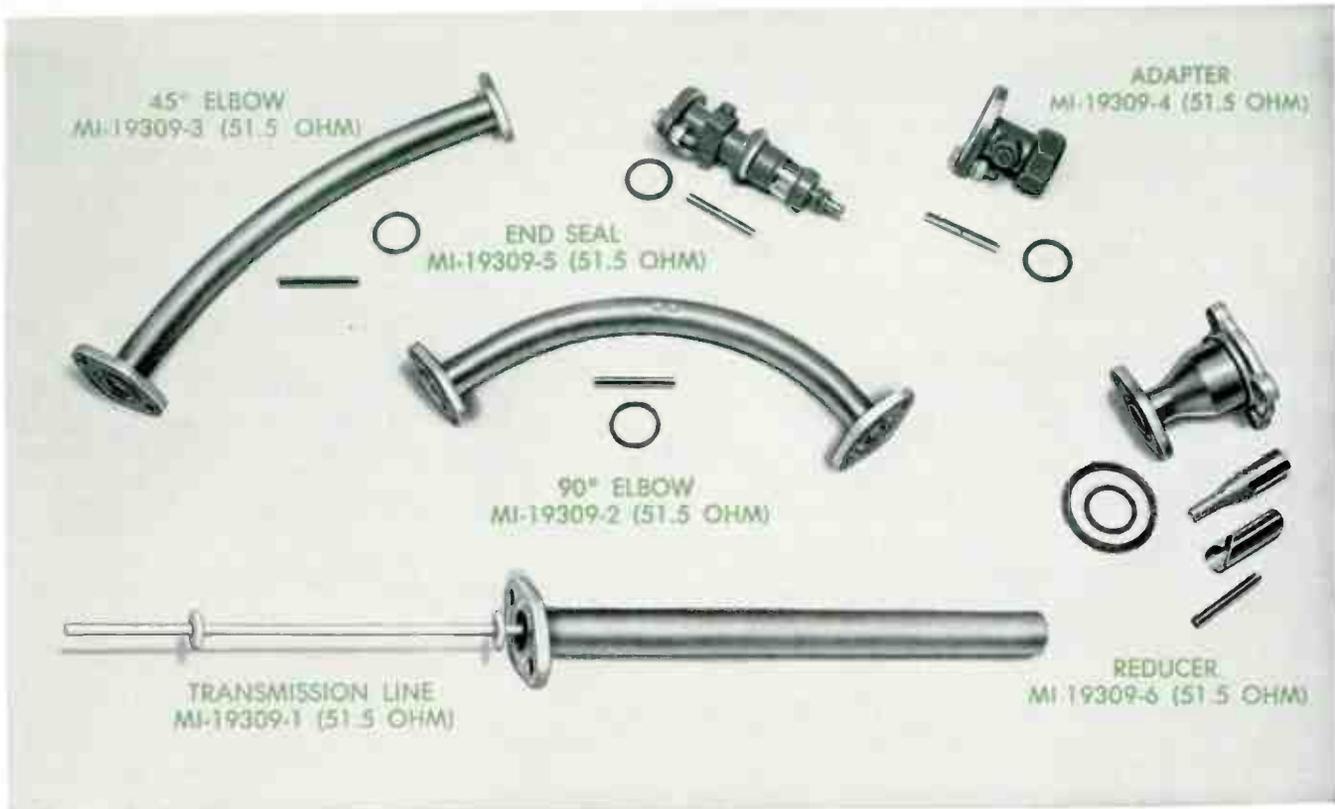
**FLANGE ADAPTER  
MI-19308-6**



**ADAPTER  
MI-19308-4**



**TRANSMISSION LINE  
MI-19308-1**



## DESCRIPTIONS

RCA 7/8" Steatite Transmission Line, Type MI-19309, is a hard-tempered coaxial line with a nominal impedance of 51.5 ohms. This line operates with good efficiency on low, medium and high frequencies. It is for AM and FM uses.

### MI-19309-1 TRANSMISSION LINE

This line is supplied in 20-foot lengths with a flange silver soldered to each end. The inner conductor is 3/16" diameter with steatite insulators spaced 6" apart. The outer conductor is designed to allow for removing inner conductor for inspection. Power rating is 3 kw at 100 mc with 90% efficiency for 100 feet. Line includes solderless inner connector, O-ring gasket and silicon copper hardware.

### MI-19309-1-F TRANSMISSION LINE

Same as MI-19309-1 except one flange is omitted.

### MI-19309-1-NF TRANSMISSION LINE

Same as MI-19309-1 except both flanges are omitted.

### MI-19309-2 COUPLING (90° Elbow)

This elbow has one flange silver soldered to outer conductor. 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 conductor, O-ring gasket and hardware.

### MI-19309-2-F COUPLING (90° Elbow)

Same as MI-19309-2 except the fixed flange is omitted.

### MI-19309-2-NF COUPLING (90° Elbow)

Same as MI-19309-2 except both flanges are omitted.

### MI-19309-3 COUPLING (45° Elbow)

Same as MI-19309-2, except 45°.

### MI-19309-3-F COUPLING (45° Elbow)

Same as MI-19309-3 except the fixed flange is omitted.

### MI-19309-3-NF COUPLING (45° Elbow)

Same as MI-19309-3 except both flanges are omitted.

### MI-19309-4 ADAPTER COUPLING

Used for coupling a 7/8" 51.5-ohm flanged line to a 7/8" 51.5-ohm unflanged line. A 1 1/2" wrench is required for clamping the special gland nut on the unflanged line. Furnished with solderless inner connector, O-ring gasket and hardware.

### MI-19309-5 END SEAL

This sturdy end seal uses Pyrex as an insulator. It is fitted with two 1/8" IPS ports and brass plugs for gas admission or bleeding the line. A clamp nut is supplied for mounting. A screw terminal with locking nut is used for the termination of inner conductor. No soldering is necessary for installing. Furnished with O-ring gasket and solderless inner connector.

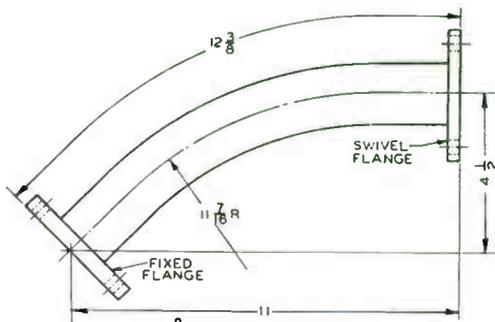
### MI-19309-6 REDUCER COUPLING

Used for reducing from 1 1/8" 51.5-ohm to 7/8" 51.5-ohm gassed line. Complete with outer and inner conductor, inner connectors, O-ring gaskets and hardware.

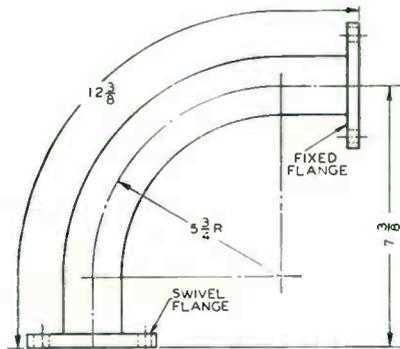
# OUTLINE DIMENSIONS . . . 7/8" 51.5-OHM LINE AND FITTINGS

(MI-19309)

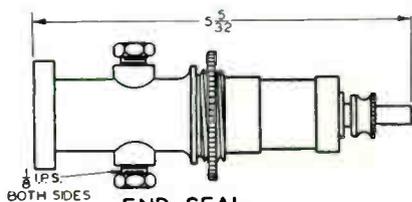
TRANSMISSION LINE



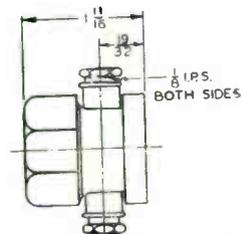
45° COUPLING  
MI-19309-3



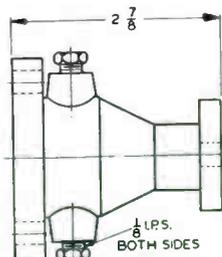
90° COUPLING  
MI-19309-2



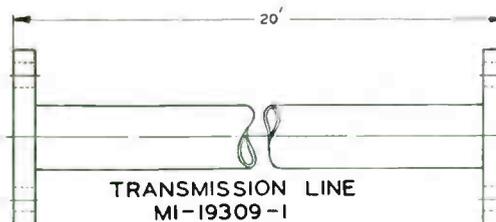
END SEAL  
MI-19309-5



ADAPTER  
MI-19309-4

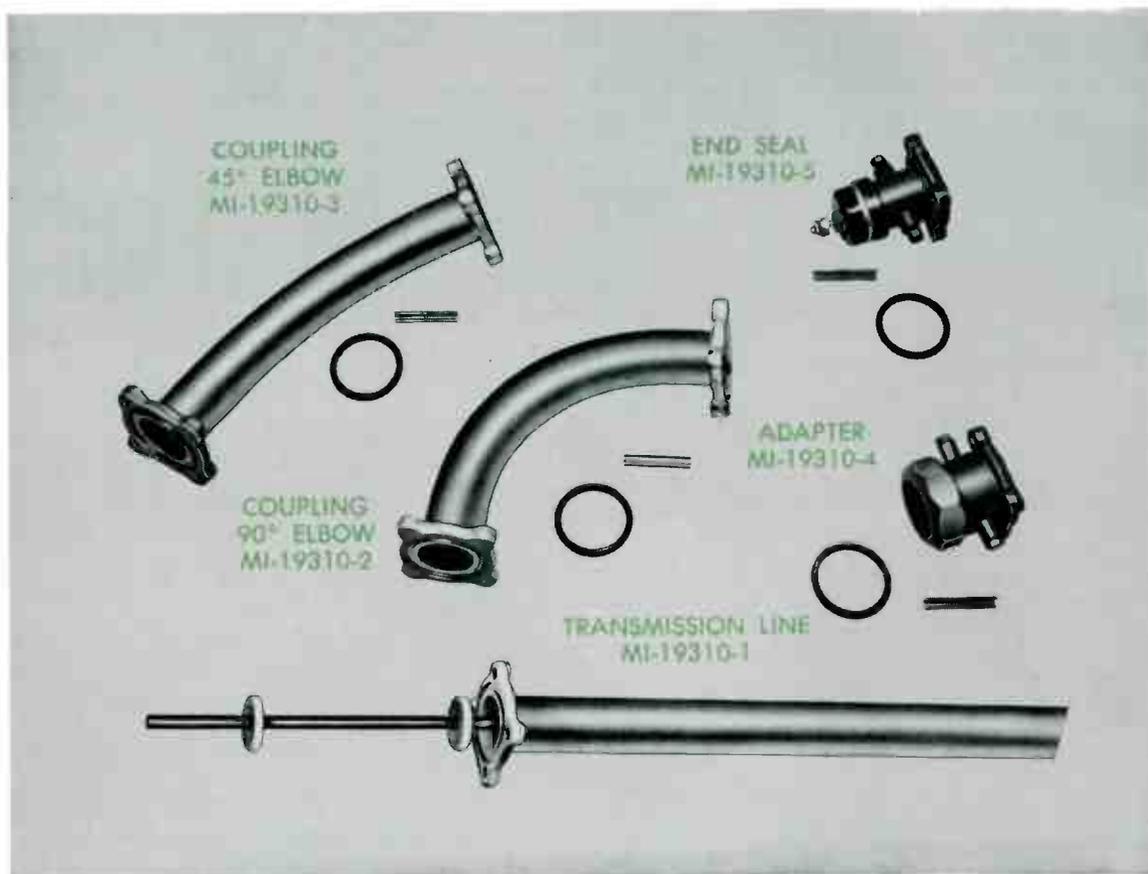


REDUCER  
MI-19309-6



TRANSMISSION LINE  
MI-19309-1

## 1-5/8" 72-OHM HARD COPPER LINE AND FITTINGS, MI-19310



## DESCRIPTIONS

RCA 1-5/8" 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. This line operates with good efficiency in the FM band where the runs to be made are not exceptionally long.

**MI-19310-1 TRANSMISSION LINE**

This line is supplied in 20-foot lengths with flanges silver soldered to ends. The outer conductor is 1-5/8" diameter with an inner conductor of 3/8" diameter using steatite insulators spaced 12" apart. The outer conductor is designed to allow for removing inner conductor for inspection. Power rating is 10 kw maximum with 95% efficiency for 100 feet. 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 conductor, 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**

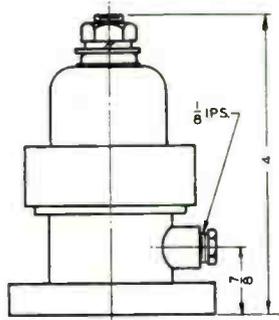
Used for coupling a 1-5/8" 72-ohm flanged line to a 1-5/8" 72-ohm unflanged line. A 2" wrench is required for clamping the special gland nut for the unflanged line. Furnished with solderless inner connector, O-ring gasket and hardware.

**MI-19310-5 END SEAL**

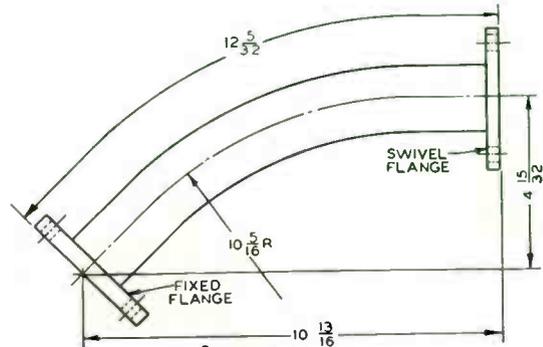
This end seal uses a steatite insulator that may be replaced by loosening the clamp nut which seals the insulator by means of an O-ring gasket. Has 1/8" I.P.S. port for gas admission or bleeding the line. A screw terminal with lockwashers and nut is used for termination of center conductor. Furnished with solderless inner conductor, O-ring gasket and hardware.

# OUTLINE DIMENSIONS . . . 1-5/8" 72-OHM LINE AND FITTINGS

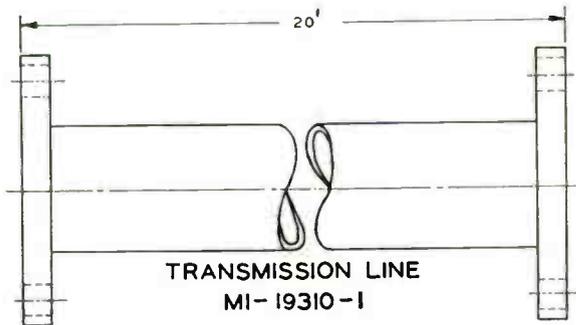
(MI-19310)



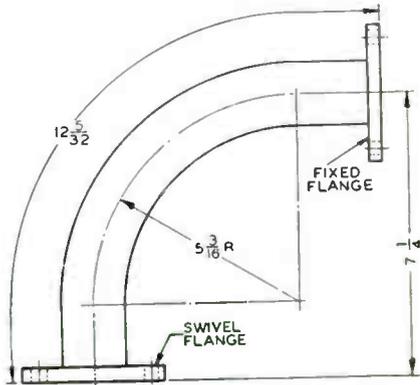
**END SEAL**  
MI-19310-5



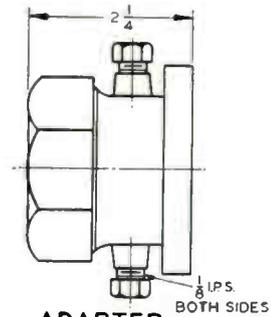
**45° COUPLING**  
MI-19310-3



**TRANSMISSION LINE**  
MI-19310-1

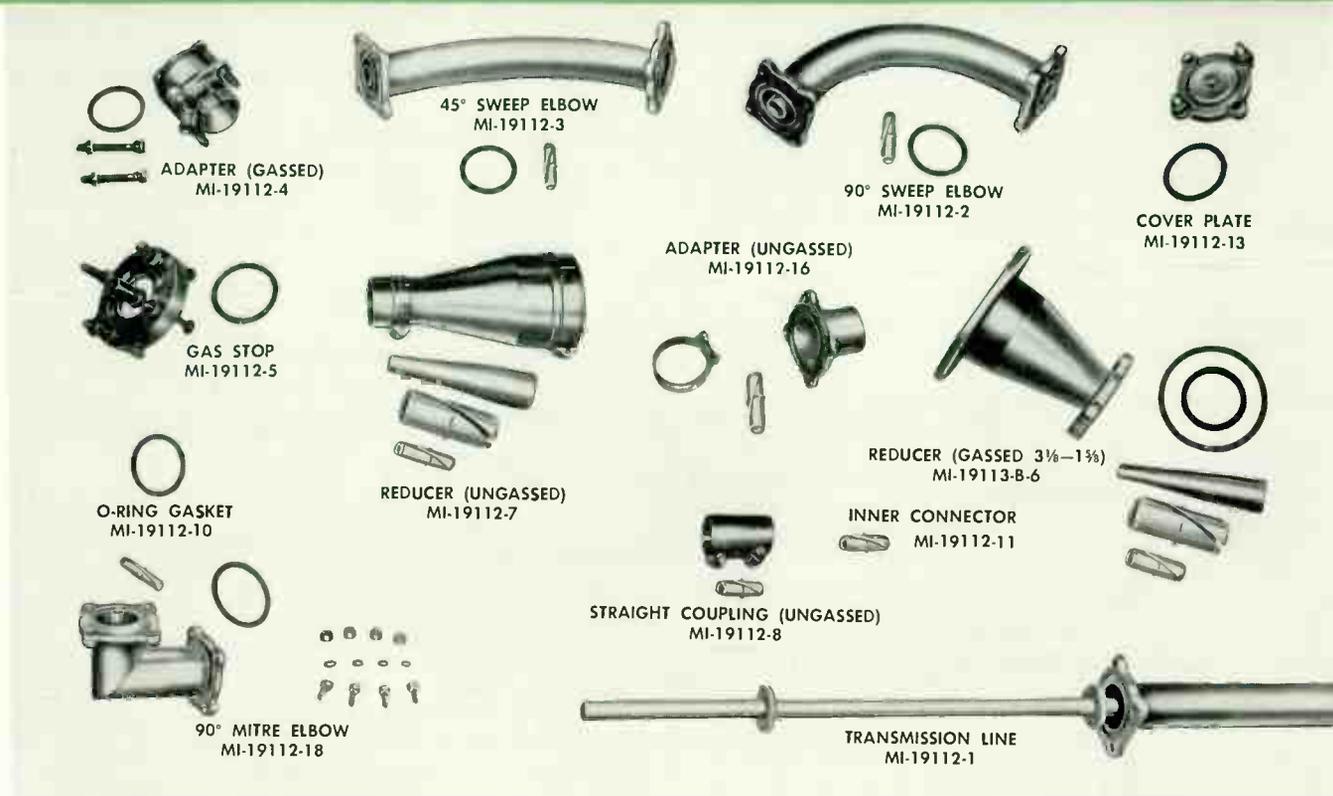


**90° COUPLING**  
MI-19310-2



**ADAPTER**  
MI-19310-4

## 1-5/8" 51.5-OHM HARD COPPER LINE AND FITTINGS, MI-19112



## DESCRIPTIONS

RCA 1 5/8" 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 1 5/8" diameter with an inner conductor of 5/8" diameter using special low loss insulators spaced 12" 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.

\* 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.

**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" 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°.

**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**

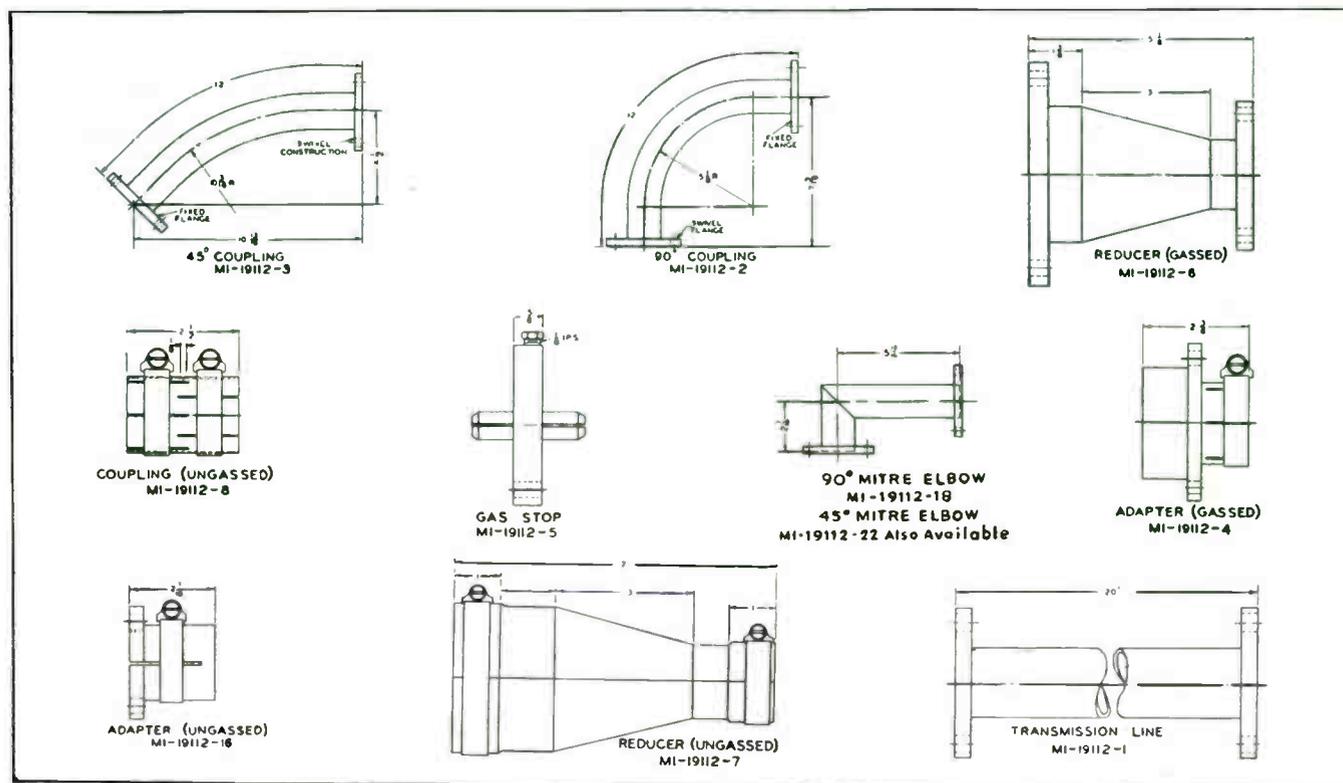
Same as MI-19112-3 except both flanges are omitted.

**MI-19112-4 ADAPTER**

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 silicon copper hardware.

## OUTLINE DIMENSIONS . . . 1 5/8" 51.5-OHM LINE AND FITTINGS

(MI-19112)

**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-19112-6 REDUCER COUPLING**

Flanged coupling used for reducing from 3 1/8" 51.5-ohm to 1 5/8" 51.5-ohm gassed line. Complete with inner conductor and connectors, O-ring gaskets and hardware.

**MI-19112-7 REDUCER COUPLING**

Used for reducing from 3 1/8" 51.5-ohm to 1 5/8" 51.5-ohm ungassed line. Complete with outer and inner conductor and connectors and stainless steel clamps.

**MI-19112-8 STRAIGHT COUPLING**

Used for coupling two sections of 1 5/8" 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"). 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 flanged joints pressure tight.

**MI-19112-11 INNER CONNECTOR**

A specially designed solderless inner connector for joining inner conductors of 1 5/8" 51.5-ohm line.

**MI-19112-12 LINE GASSING ACCESSORIES**

Consists of indicators, couplings, 25 ft. of 1/4" O.D. copper tubing and fittings. For indicating line pressure.

**MI-19112-13 EMERGENCY COVER PLATE**

Used to cap 1 5/8" 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**

Identical to MI-19310-5 except made for 51.5 ohms. No photo is shown. For dimensions refer to MI-19310-5.

**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**

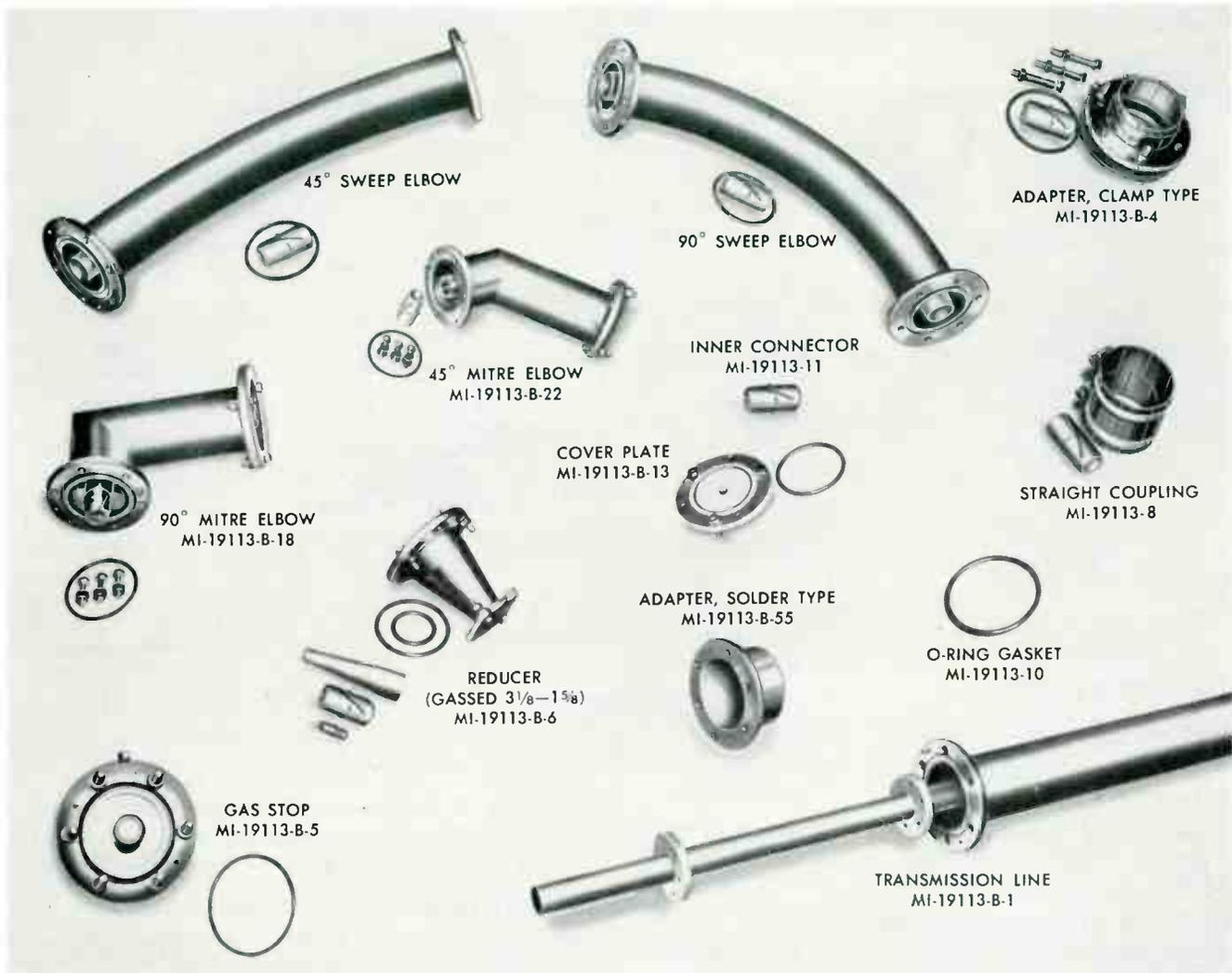
Same as MI-19112-18 except one flange is omitted (on the long leg).

**MI-19112-18-NF COUPLING, 90° MITRE ELBOW**

Same as MI-19112-18 except both flanges are omitted.

**MI-19112-22, 22-F, 22-NF 45° MITRE ELBOW**

Similar to MI-19112-18, 18-F, 18-NF except 45°.

**3-1/8" 51.5-OHM HARD COPPER LINE AND FITTINGS, MI-19113****DESCRIPTIONS**

RCA 3-1/8" 51.5 ohm Steatite Transmission Line, Type MI-19113, is a hard-tempered copper line designed for use in AM or FM installations. This type line has excellent VSWR characteristics to 110 mcs. Its efficiency is greatly 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 provide installation versatility.

**MI-19113-B-1 TRANSMISSION LINE**

This line is supplied in 20-foot lengths\* with flanges silver soldered to ends. The outer conductor is 3-1/8" O.D. with an inner conductor of 1.200 diameter which is sup-

\* 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.

ported 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-B-1-F TRANSMISSION LINE**

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

**MI-19113-B-1-NF TRANSMISSION LINE**

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

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

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

**COUPLING (90° Sweep Elbow)**

Elbow with one fixed flange and opposite flange that swivels to take care of any angle. Also supplied with solid flange omitted or both flanges omitted. Furnished on special order only.

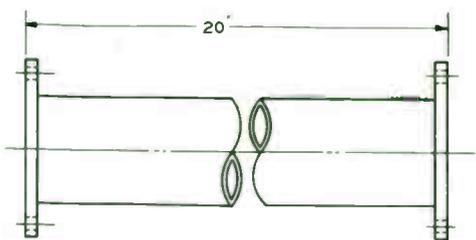
**COUPLING (45° Sweep Elbow)**

Same as above except 45°. Also furnished on special order only.

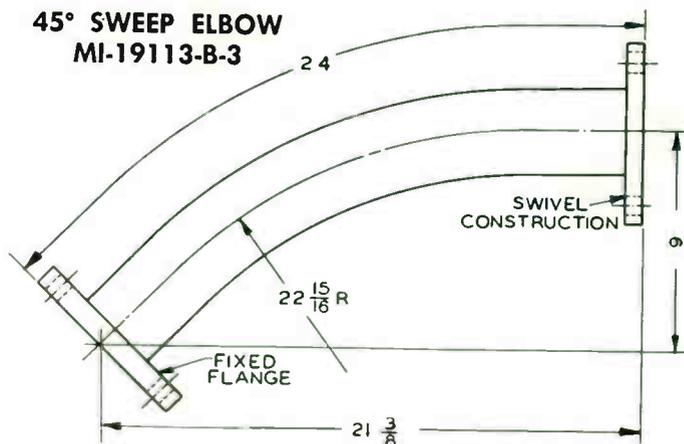
# OUTLINE DIMENSIONS . . . 3 1/8" 51.5-OHM LINE AND FITTINGS

TRANSMISSION LINE

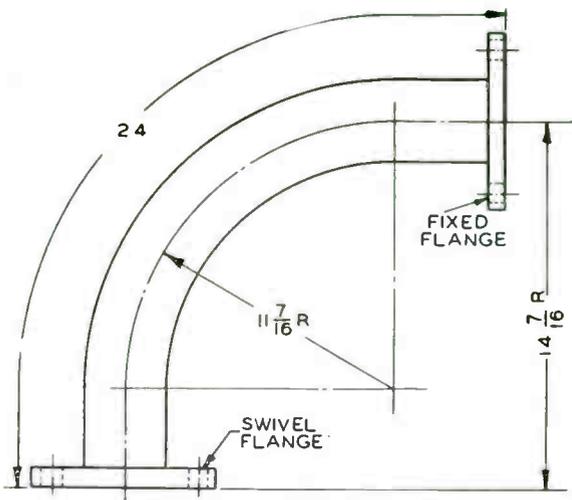
(MI-19113)



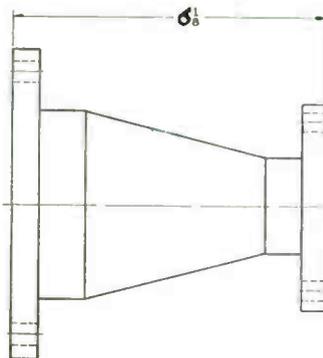
**TRANSMISSION LINE  
MI-19113-B-1**



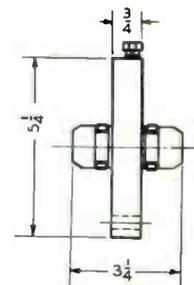
**45° SWEEP ELBOW  
MI-19113-B-3**



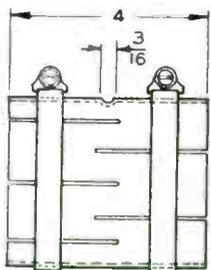
**90° SWEEP ELBOW  
MI-19113-B-2**



**REDUCER (GASSED 3/8-1/8)  
MI-19113-B-6**



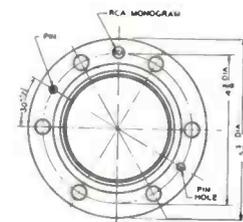
**GAS STOP  
MI-19113-B-5**



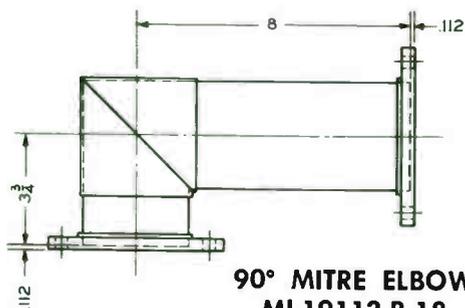
**STRAIGHT COUPLING  
MI-19113-8**



**ADAPTER, CLAMP TYPE  
MI-19113-B-4**



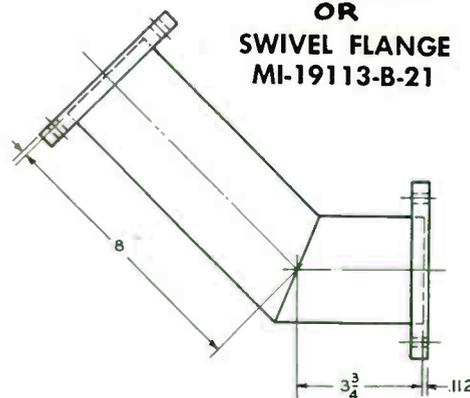
**FIXED FLANGE  
MI-19113-B-20  
OR  
SWIVEL FLANGE  
MI-19113-B-21**



**90° MITRE ELBOW  
MI-19113-B-18**



**ADAPTER, SOLDER TYPE  
MI-19113-B-55**



**45° MITRE ELBOW  
MI-19113-B-22**

**MI-19113 LINE (continued)****MI-19113-B-4 ADAPTER**

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-B-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-B-6 REDUCER COUPLING**

Flanged coupling used for reducing from 3 $\frac{1}{8}$ " 51.5-ohm line to 1 $\frac{5}{8}$ " 51.5-ohm line. Complete with inner conductor and connectors. O-ring gaskets and hardware.

**MI-19113-8 STRAIGHT COUPLING**

Used for coupling two sections of 3 $\frac{1}{8}$ " 51.5-ohm unflanged lines. (Not to be used for gassed line.) Consists of outer and inner connectors with stainless steel clamps.

**MI-19113-9 SPECIAL INNER CONDUCTOR**

Used for splicing lengths of line which are cut at points between the supporting insulators (these are spaced 12"). 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-19113-11.

**MI-19113-10 O-RING GASKET**

A long-life synthetic rubber gasket for use between the flanges to make flanged joints pressure tight.

**MI-19113-11 INNER CONNECTOR**

A specially designed solderless inner connector for joining inner conductors of 3 $\frac{1}{8}$ " 51.5-ohm Steatite (MI-19113) line.

**MI-19113-B-13 COVER PLATE**

Used to cap the end of 3 $\frac{1}{8}$ " line to keep moisture out during installation, or for other temporary capping of the line.

**MI-19113-17 END SEAL**

Except for size and impedance this end seal is similar to MI-19310-5. The overall length is 4 $\frac{1}{2}$ ".

**MI-19113-B-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-B-18-F COUPLING, 90° MITRE ELBOW**

Same as MI-19113-B-18 except the flange is omitted from the short leg.

**MI-19113-B-18-NF COUPLING, 90° MITRE ELBOW**

Same as MI-19113-B-18 except both flanges are omitted.

**MI-19113-19 HARDWARE KIT**

Consists of six bolts, six nuts and six lockwashers for 3 $\frac{1}{8}$ " line.

**MI-19113-B-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-B-21 FLANGE, SWIVEL**

Similar to the flange MI-19113-B-20 except flange is free to rotate.

**MI-19113-B-22 COUPLING, 45° MITRE ELBOW**

Same as MI-19113-B-18 except 45°.

**MI-19113-B-22-F COUPLING, 45° MITRE ELBOW**

Same as MI-19113-B-22 except the flange is omitted from the short leg.

**MI-19113-B-22-NF COUPLING, 45° MITRE ELBOW**

Same as MI-19113-B-22 except both flanges are omitted.

**MI-19113-B-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-19313-B-53 TRANSFORMER, 51.5 OHM TO 50.5 OHM, CHANNEL 7-13**

Used for correct impedance match for Steatite line when used on Channels 7 to 13. Supplied with same hardware as MI-19113-B-1.

**MI-19113-B-54 CUT-OFF GAUGE**

Similar to MI-19113-B-51 except for use on 1.200 O.D. inner conductor.

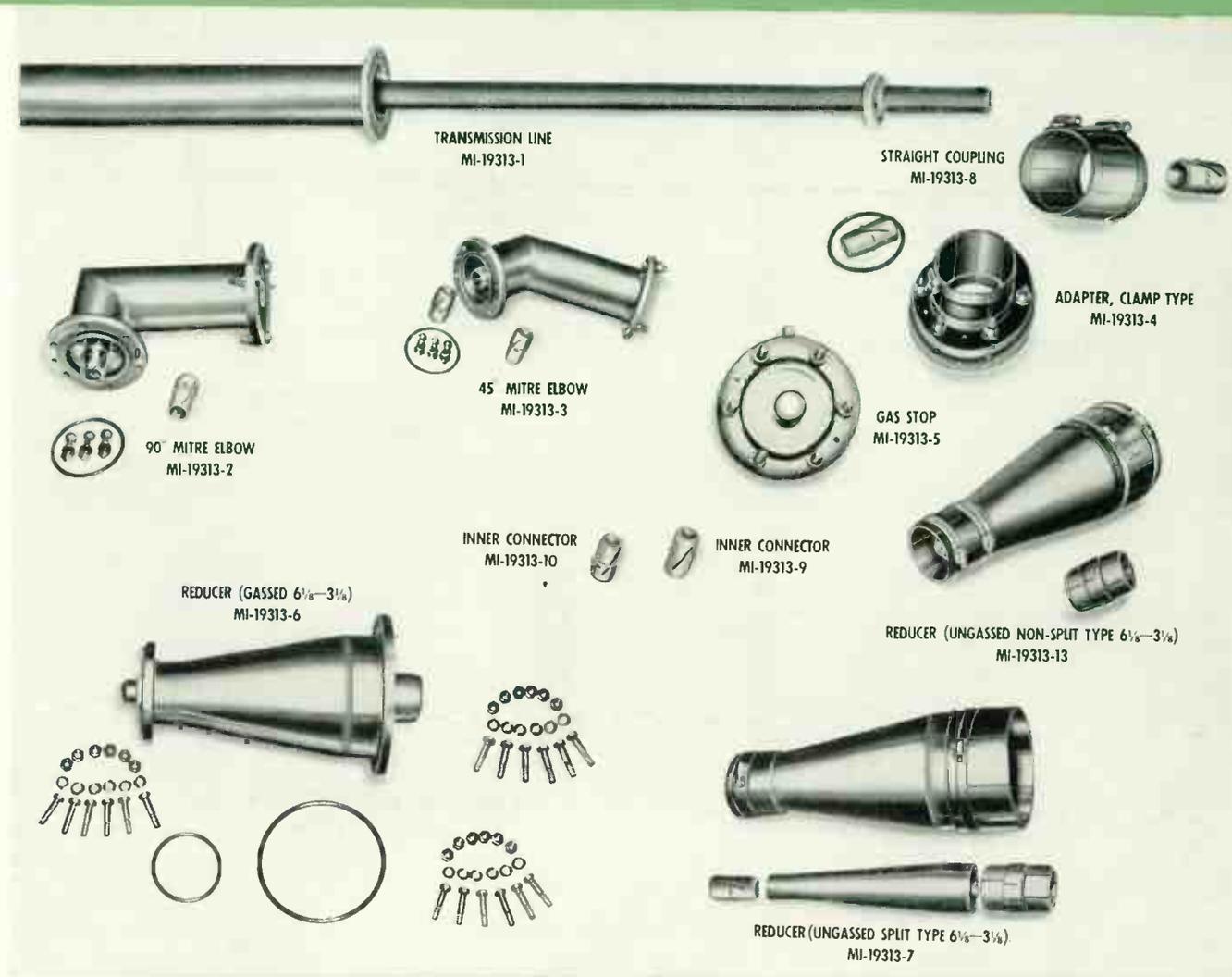
**MI-19113-B-55 ADAPTER, SOLDER-TYPE**

Serves similar purpose to MI-19113-B-4 except installed by soft soldering. Made in one piece—bolts not included.

**MI-19113-B-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.

# 3-1/8" 51.5-OHM HARD COPPER LINE AND FITTINGS, MI-19313



## FEATURES

- Teflon transmission line . . . developed by RCA
- Maximum stability provided by low loss Teflon dielectric
- Mitre elbows for versatile installation and convenience in crowded locations
- Minimum attenuation—maximum efficiency—low VSWR
- Complete line of fittings and accessories for installation versatility

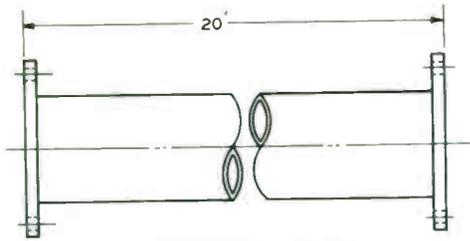
## DESCRIPTIONS

RCA 3 1/8" 51.5 ohm Teflon Transmission Line, Type MI-19313, is a hard-tempered copper line. This type line has excellent VSWR characteristics and operates very efficiently including VHF frequencies. Its high efficiency is greatly attributed to the use of low loss Teflon dielectric. Components are ruggedly and precisely constructed. Mitre Elbows are fabricated with thick-wall tubing. A complete line of fittings and accessories provide installation versatility.

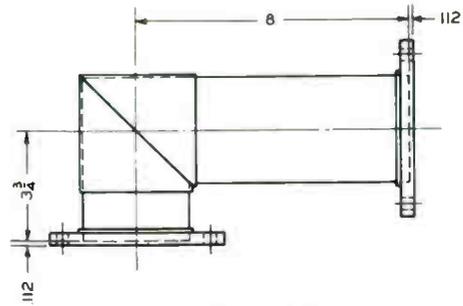
### MI-19313-1 TRANSMISSION LINE

This line is supplied in 20-foot lengths with flanges silver soldered to ends. The outer conductor is 3 1/8" O.D. with an inner conductor of 1.281 diameter which is supported by Teflon insulators. The outer conductor is designed to allow for removing the inner conductor for inspection.

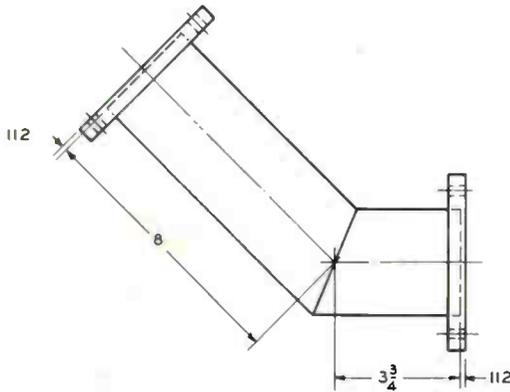
**OUTLINE DIMENSIONS . . . 3 1/8" 51.5-OHM LINE AND FITTINGS**  
(MI-19313)



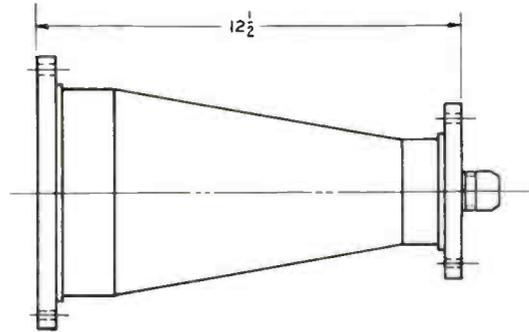
**TRANSMISSION LINE  
MI-19313-1**



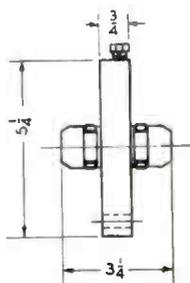
**90° MITRE ELBOW  
MI-19313-2**



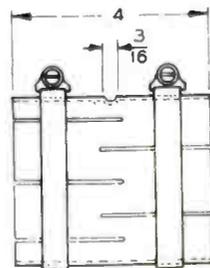
**45° MITRE ELBOW  
MI-19313-3**



**REDUCER (GASSED 6 1/8-3 1/8)  
MI-19313-6**



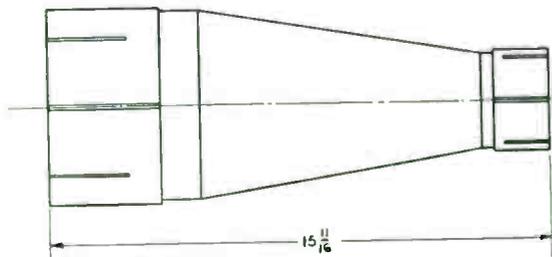
**GAS STOP  
MI-19313-5**



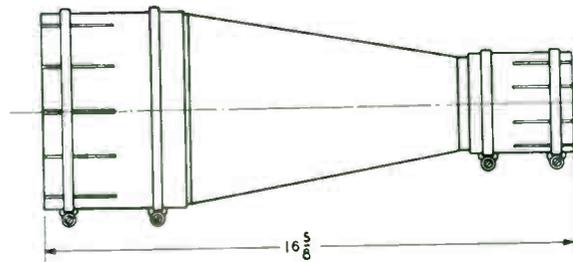
**STRAIGHT COUPLING  
MI-19313-8**



**ADAPTER, CLAMP TYPE  
MI-19313-4**



**REDUCER (UNGASSED SPLIT TYPE 6 1/8-3 1/8)  
MI-19313-7**



**REDUCER (UNGASSED NON-SPLIT TYPE 6 1/8-3 1/8)  
MI-19313-13**

**MI-19313 LINE (continued)**

Includes solderless inner connector, O-ring gasket, and silicon copper hardware.

**MI-19313-1-F TRANSMISSION LINE**

Same as MI-19313-1 except one flange is omitted.

**MI-19313-1-NF TRANSMISSION LINE**

Same as MI-19313-1 except both flanges are omitted.

**MI-19313-1-SF TRANSMISSION LINE**

Same as MI-19313-1 except one of the two flanges is a swivel flange.

**MI-19313-2 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-19313-2-F COUPLING, 90° MITRE ELBOW**

Same as MI-19313-2 except the flange is omitted from the short leg.

**MI-19313-2-NF COUPLING, 90° MITRE ELBOW**

Same as MI-19313-2 except both flanges are omitted.

**MI-19313-3 COUPLING, 45° MITRE ELBOW**

Same as MI-19313-2 except 45°.

**MI-19313-3-F COUPLING, 45° MITRE ELBOW**

Same as MI-19313-3 except the flange is omitted from the short leg.

**MI-19313-3-NF COUPLING, 45° MITRE ELBOW**

Same as MI-19313-3 except both flanges are omitted.

**MI-19313-4 ADAPTER (Clamp Type)**

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. See last item MI-19113-55 for soft solder type.

**MI-19313-5 GAS STOP**

To be inserted between two flanged sections of line to seal a gassed section from an ungassed section of line.

**MI-19313-6 REDUCER COUPLING (Gassed)**

A Flanged Coupling used for reducing from 6 $\frac{1}{8}$ " 51.5 ohm Steatite line to 3 $\frac{1}{8}$ " 51.5 ohm Teflon line. Complete with inner conductor and connectors, O-ring gaskets and hardware.

**MI-19313-7 REDUCER COUPLING (Ungassed)**

Used for reducing from 6 $\frac{1}{8}$ " 51.5 ohm Steatite line to 3 $\frac{1}{8}$ " 51.5 ohm Teflon ungassed line. Outer conductor is split in two pieces, providing a very convenient assembly. Complete with outer and inner conductors and connectors, also stainless steel clamps.

**MI-19313-8 STRAIGHT COUPLING**

Used for coupling two sections of 3 $\frac{1}{8}$ " 51.5 ohm unflanged line. (Not to be used for gassed line.) Consists of outer and inner connectors and stainless steel clamps.

**MI-19313-9 INNER CONNECTOR**

A solderless inner connector for joining inner conductors of 3 $\frac{1}{8}$ " 51.5 ohm Teflon line.

**MI-19313-10 INNER CONNECTOR**

A specially designed solderless inner connector for joining the 1.282 diameter inner conductor of MI-19313 Teflon line with the 1.200 diameter inner conductor of MI-19113 Steatite line.

**MI-19313-11 INSERT BUSHING**

Used to reduce the inside diameter of the MI-19313 Teflon line inner conductor to accommodate the inner connector of MI-19113 Steatite line.

**MI-19313-13 REDUCER COUPLING (Ungassed)**

Used for reducing from 6 $\frac{1}{8}$ " 51.5 ohm Steatite line to 3 $\frac{1}{8}$ " 51.5 ohm Teflon ungassed line. Outer and inner conductors are the solid non-split type. Complete with stainless steel clamps.

**MI-19113-B-55 ADAPTER, SOLDER TYPE**

Serves similar purpose to MI-19313-4 except installed by soft soldering. Made in one piece—bolts not included.

## FEATURES

- **Simplicity**
- **Low maintenance cost**
- **Open for constant inspection**
- **Requires no auxiliary apparatus (dehydrators, gas, etc.)**
- **High power handling capacity at low cost**

## USES

The six wire open line is intended for transmission of RF power from the transmitter to the antenna. The six wire line may be used for either phased arrays or non-directional antennas. It is suitable for use at any standard broadcast frequency and is designed for use in all weather conditions.

## DESCRIPTION

Open wire transmission lines when properly designed and constructed, provide high power handling capabilities at low cost. The open wire line is reliable and may be serviced easily. The various open-wire line kits simplify the installation of an efficient line suitable for RF powers up to 150 KW. Radiation is made negligible by using a six wire line consisting of two central power conductors surrounded by four grounded conductors. By use of this line configuration, with appropriate spacing between conductors, a characteristic impedance of 230 ohms is obtained which results in an economy of phasing and terminating equipment.

## SPECIFICATIONS

### Transmission Line Bayonet Insulator

Bayonet Insulator Assembly for supporting line, to be spaced at 50 feet, with supporting bracket and post insulator "U" bolts.

Stock Identification .....L-13852

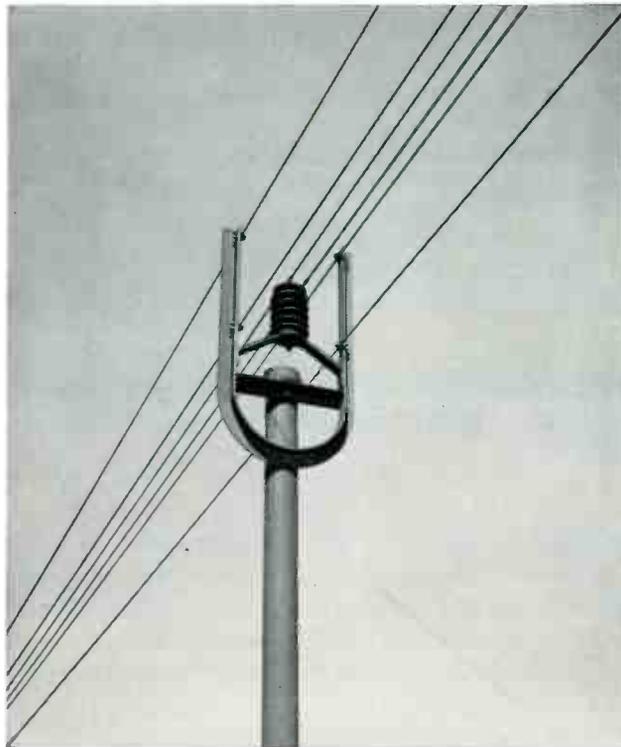
### Transmission Line Wire

Building Dead End Kit for terminating line at building, strain insulators, turnbuckles, grounding strap, line connectors.

Stock Identification .....L-13853

Pole Dead End Kit, fittings needed to terminate line, strain insulators, turnbuckles, line connectors, grounding strap, guy material, guy anchor brackets.

Stock Identification .....L-13854



Lead In Kit, fittings needed to run line through building wall at transmitter or tuning house. Lead in bowl and mounting plate, lightning horn gap, lightning reactor, grounding materials.

Stock Identification .....L-13855

Number 6 Hard Drawn Copper Wire, for transmission line conductors. Weight 79.4 lbs./1000 ft.

Stock Identification .....MI-28010

MI-28013 Transmission Line pole and cap. 4" diameter steel pole, 20' long with cap to close the upper end. May be drilled at installation for use with either L-13852 Bayonet Insulator, or L-13854 Building Dead End Kit.



## 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 polyethylene dielectric is accurately maintained to .005" to .015" 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.

### Styroflex

Size	Impedance	Power Rate	Attenuation
1/2"	50 ohm	2 kw	.079 db
1/2"	70 ohm	1.5 kw	.072 db
3/4"	50 ohm	4.5 kw	.052 db
3/4"	70 ohm	3 kw	.048 db
7/8"	50 ohm	6.5 kw	.043 db
7/8"	70 ohm	4.5 kw	.040 db

Styroflex and Spirafil ratings 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 atten-

uation, excellent frequency response and uniform electrical properties over wide temperature range.

### Spirafil

Size	Impedance	Power Rate	Attenuation
3/8"	50 ohm	1 kw	.112 db/100 ft.
3/8"	70 ohm	.6 kw	.100 db/100 ft.



# INSTALLATION AND LAYOUT OF TRANSMISSION LINES

## GENERAL

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. Reference to Page 97 will aid in determining a check list of items to be ordered. 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.

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 hangers for supporting the transmission line. See tables, photos and drawings in the Transmission Line and Accessories catalog . . . B.5050. For longer runs, the roller assembly, MI-19312-35, MI-19313-35 or MI-19314-35, 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 MI-19312-17 or -18, MI-19313-17 or -18, MI-19314-48 or MI-19314-52 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 B.5050.

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, MI-19112-13, MI-19113-13 or MI-19314-8, 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 volt-ohmyst 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. The line must be free to expand as the 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 Type BAF-14A AM/FM Isolation Unit may be used for powers up to 5 kw or the FM line can be quarter-wave insulated utilizing insulated hangers such as MI-19309-22, 19312-22 or 19313-22.

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	1 5/8 Dia. MI No.	3 1/8 Dia. MI No.	6 1/8 Dia. MI No.
A	Transmission Line	19112-1	19113-1	19314-1
B	90° Elbow	19112-18	19113-18	19314-18
C	Reducer 3 1/8 to 1 5/8	19112-6	19113-6	
C	Reducer 6 1/8 to 3 1/8			19314-4
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 (see pg. 99)		

12" BEND FOR 20' SECTION 1 5/8 LINE.  
6" BEND FOR 20' SECTION 3 1/8 LINE.  
1" BEND FOR 20' SECTION 6 1/8 LINE.

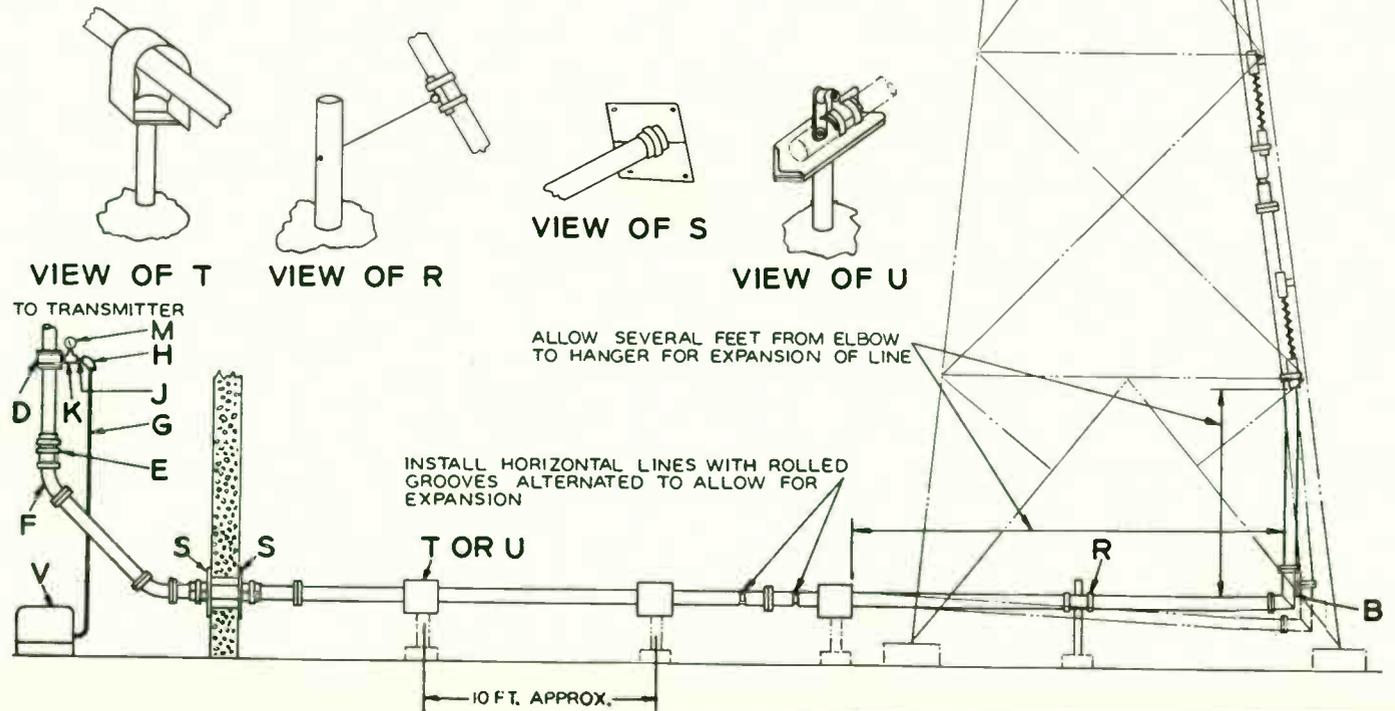
WHEN SHAPE OF TOWER CHANGES AND THE ABOVE ARE NOT ADEQUATE, USE TWO 90° ELBOWS IN SERIES.

INSTALL VERTICAL LINE SECTIONS WITH ROLLED GROOVES AT LOWER END TO SUPPORT INNER CONDUCTOR.

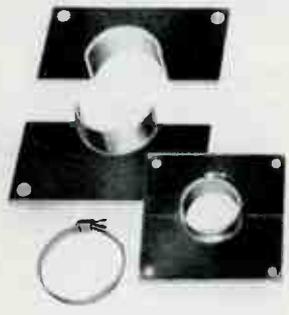
SPACE SPRING HANGERS APPROX. 10 FEET APART.

NOTE 1—For 1 5/8 Line use MI-19312-20 through MI-19312-44.  
For 3 1/8 Line use MI-19313-20 through MI-19313-44.

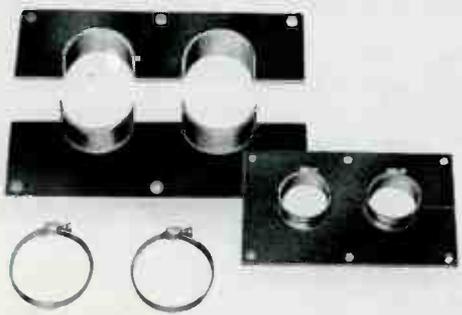
NOTE 2—For 1 5/8 Line use MI-19312-40 through MI-19312-44.  
For 3 1/8 Line use MI-19313-40 through MI-19313-44.



**MISCELLANEOUS ACCESSORIES**



HORIZONTAL ANCHOR FOR SUPPORTING SINGLE LINE  
 M1-19312-17-1 5/8  
 M1-19313-17-3 3/8  
 M1-19314-48-6 1/8



HORIZONTAL ANCHOR FOR SUPPORTING OVAL LINES  
 M1-19312-18-1 5/8  
 M1-19313-18-3 3/8  
 M1-19314-52-6 1/8



HORIZONTAL ROLLER ASSEMBLY  
 M1-19312-35-1 5/8  
 M1-19313-35-3 3/8  
 M1-19314-35-6 1/8



LATERAL BRACE  
 M1-19312-36-1 5/8  
 M1-19313-36-3 3/8  
 M1-19314-36-6 1/8



SWIVEL HANGER FOR SUPPORTING SINGLE LINE  
 M1-19312-37-1 5/8  
 M1-19313-37-3 3/8



SWIVEL HANGER FOR SUPPORTING OVAL LINES  
 M1-19312-38-1 5/8  
 M1-19313-38-3 3/8



LINE SPREADER  
 M1-19312-19-1 5/8  
 M1-19313-19-3 3/8

## FEATURES

- Compressor inoperative during most of reactivation period . . . providing economical operation and long life
- Attractive space-saving design
- Completely accessible for quick, easy maintenance
- Simple, rugged construction
- Operates from common 115 volt, 60 cycle source
- Convenient arrangement of operation indicating devices

## DESCRIPTION

### 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, usually 11 lbs. At the completion of 10 hours of compressor running time, the compressor is turned off by the program timer and a kelrod unit is turned on and reactivation begins. The kelrod unit remains on for 5 hours. At the last 1/2 hour of this 5 hour period, the compressor starts and blows air through the desiccant chamber and out to the atmosphere. The compressor is then turned off again and the desiccant chamber cools for 5 hours. At the end of this 10 hour period, the compressor is again ready to start another 10 hour running cycle. The 10 hours may or may not be a continuous cycle, if the compressor runs 1/2 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 1/2 hour of the 5 hour heating cycle to the atmosphere rather than the line.

### 1 CFM, 1.5 CFM, 2 CFM Double Desiccant Dehydrators

These units contain 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. The last 1/2 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 for 1/2 an hour. 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 during the last 1/2 hour of the 5 hour heating cycle. Solenoid valves also control the output of each chamber. These serve to switch the outputs either to the line or to the atmosphere for reactivation or line pressurization.

## SPECIFICATIONS

### 1 cu. ft. Single Desiccant

Power Consumption.....	900 watts
Compressor Output to Atmosphere.....	1 CFM
Weight .....	100 lbs.
Drain Connection.....	1/8" 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. 7/8" transmission line 10,000 ft. 1 5/8" transmission line 2,500 ft. 3 1/8" transmission line 700 ft. 6 1/8" transmission line
Dimensions.....	16" wide, 13" deep, 19" high
Stock Identification .....	MI-27348-4

### 1 cu. ft. Double Desiccant

Power Consumption.....	900 watts
Compressor Output to Atmosphere.....	1 CFM
Weight .....	120 lbs.
Drain Connection.....	1/8" 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. 7/8" transmission line 10,000 ft. 1 5/8" transmission line 2,500 ft. 3 1/8" transmission line 700 ft. 6 1/8" transmission line
Dimensions.....	22" wide, 13" deep, 19" high
Stock Identification .....	MI-27348-1

# DEHYDRATOR EQUIPMENT

## SPECIFICATIONS (continued)

### 1.5 cu. ft. Double Desiccant

Power Consumption.....	1700 watts
Compressor Output to Atmosphere.....	1½ CFM
Weight .....	200 lbs.
Drain Connection.....	1/8" 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.....	2,000 ft. 1 5/8" transmission line 5,000 ft. 3 1/8" transmission line 1,500 ft. 6 1/8" transmission line
Dimensions.....	22" wide, 13" deep, 34" high
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.....	1/8" 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. 1 5/8" transmission line 10,000 ft. 3 1/8" transmission line 3,000 ft. 6 1/8" transmission line
Dimensions.....	22" wide, 13" deep, 64" high
Stock Identification .....	MI-27348-3

## GENERAL

It is extremely important that coaxial transmission 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 over a number of hours to make certain 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 or re-pressurizing requires a considerable volume of gas and the constant drop in pressure due to even small leaks 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, from hand operated to completely automatic types.

## AUTOMATIC DEHYDRATORS

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 there is no pressure on 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, pressure is maintained constant at all times and the reactivation is automatic.

# AM-FM ANTENNA TOWERS

## FEATURES

- Wide selection of AM or FM Antenna Types
- Self-supporting or guyed types of standard or custom-made designs
- RCA also furnishes tower lighting and other accessories
- RCA will help you plan your entire installation

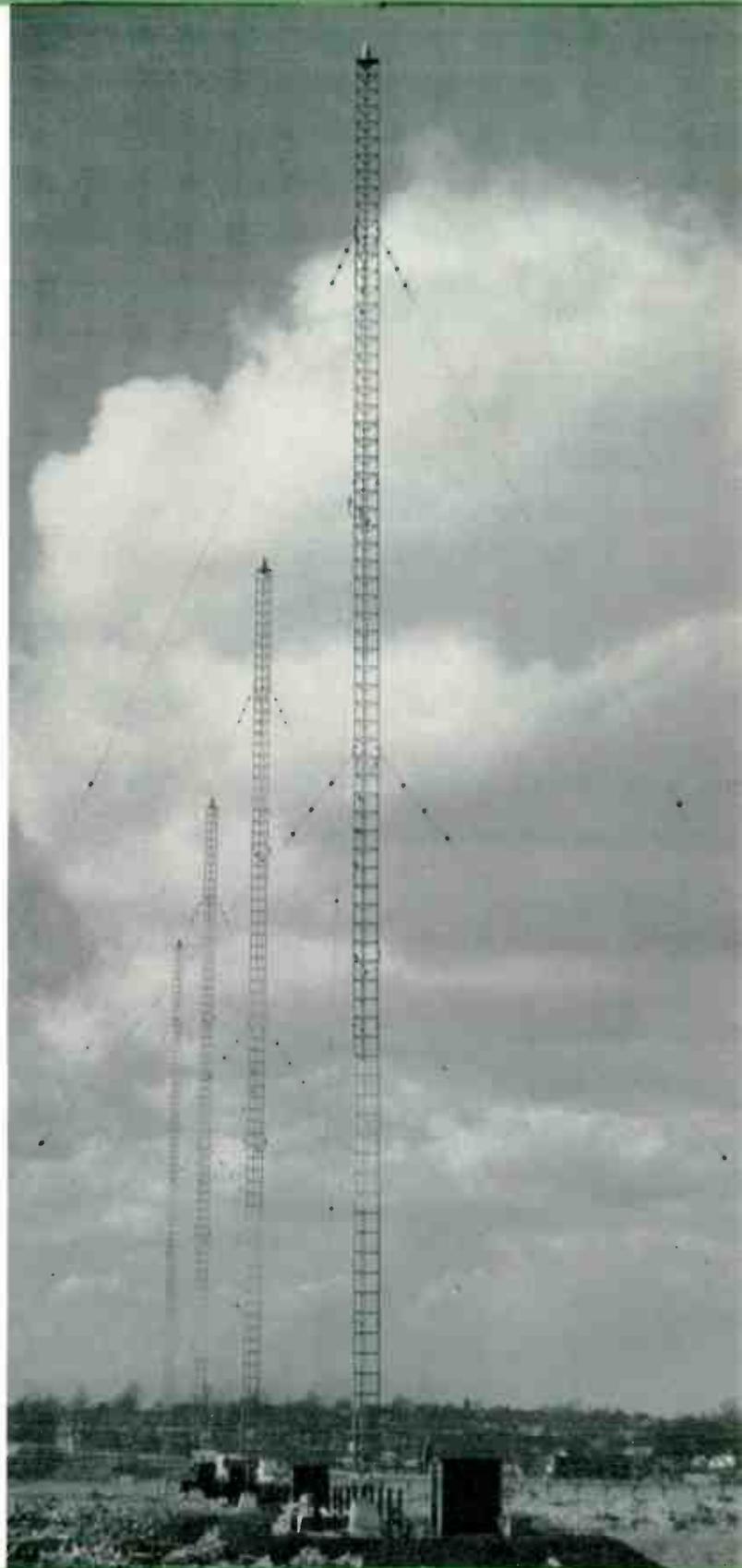
## DESCRIPTION

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, CAA 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.

**ANTENNA TOWER QUESTIONNAIRE**

LOCATION

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

QUOTATIONS TO BE FURNISHED

*(Check those required)*

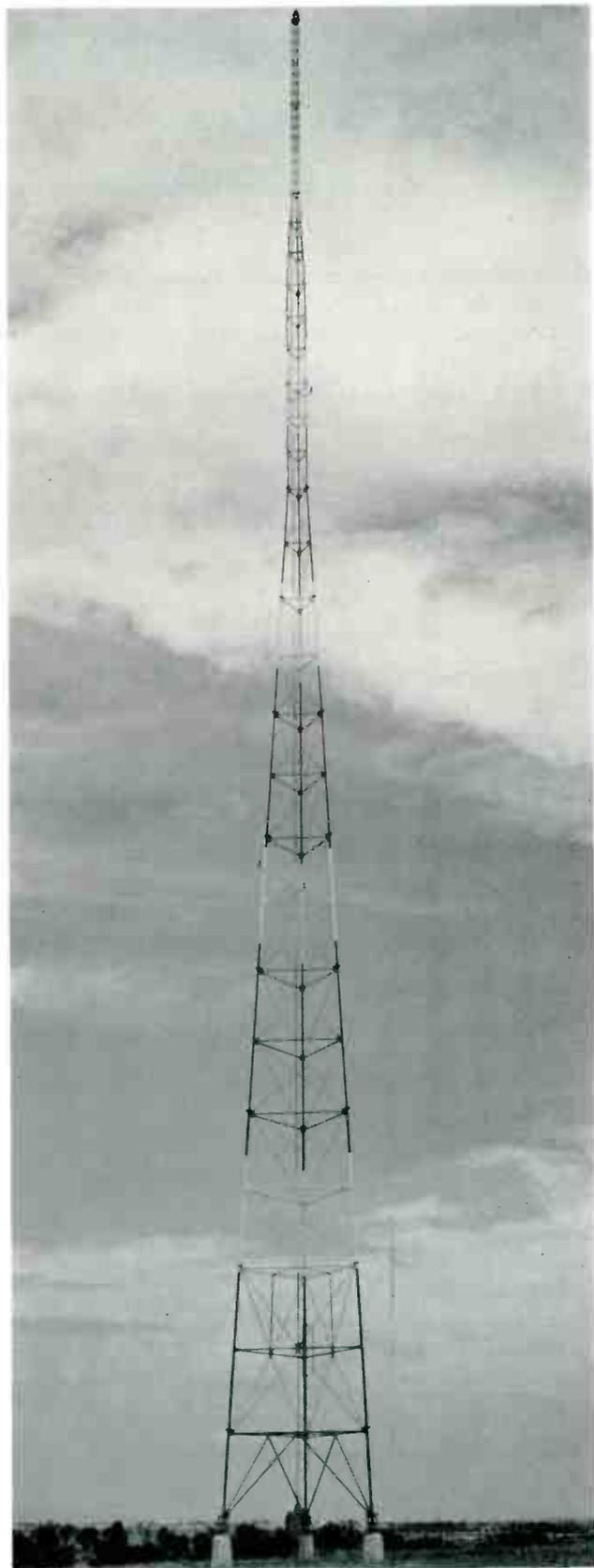
- Number of Towers..... ( )
- Ground System ..... ( )
- Tower           Guyed..... ( )
- Self-supporting..... ( )
- Tower Lighting Equipment..... ( )
- Tower Erection:
- Tower Installation ..... ( )
- Transmission Line Installation (FM)..... ( )

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.)

**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.



### 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% the tower height.

### Self-Supporting Towers

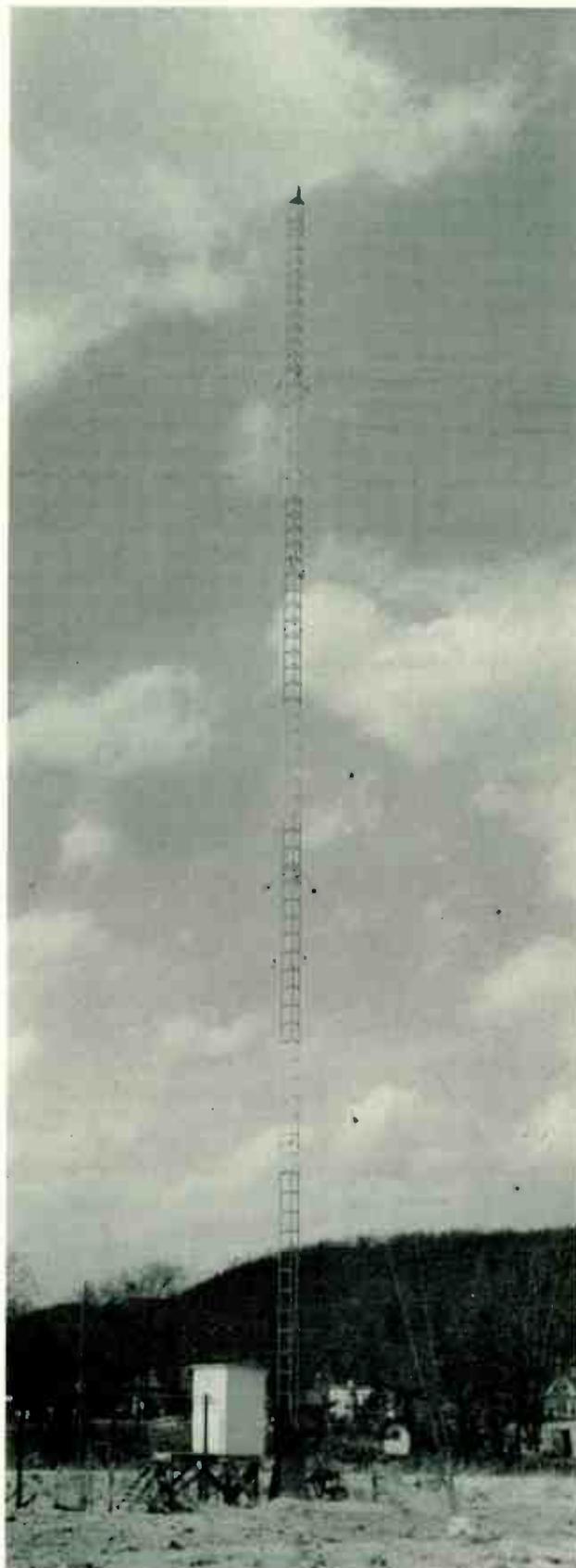
Self-supporting towers are especially advantageous in city and congested districts where land is expensive. For estimating required space for a self-supporting tower, the distance between tower legs can normally be considered as  $1/8$  the height of the structure.

### Transmission Lines

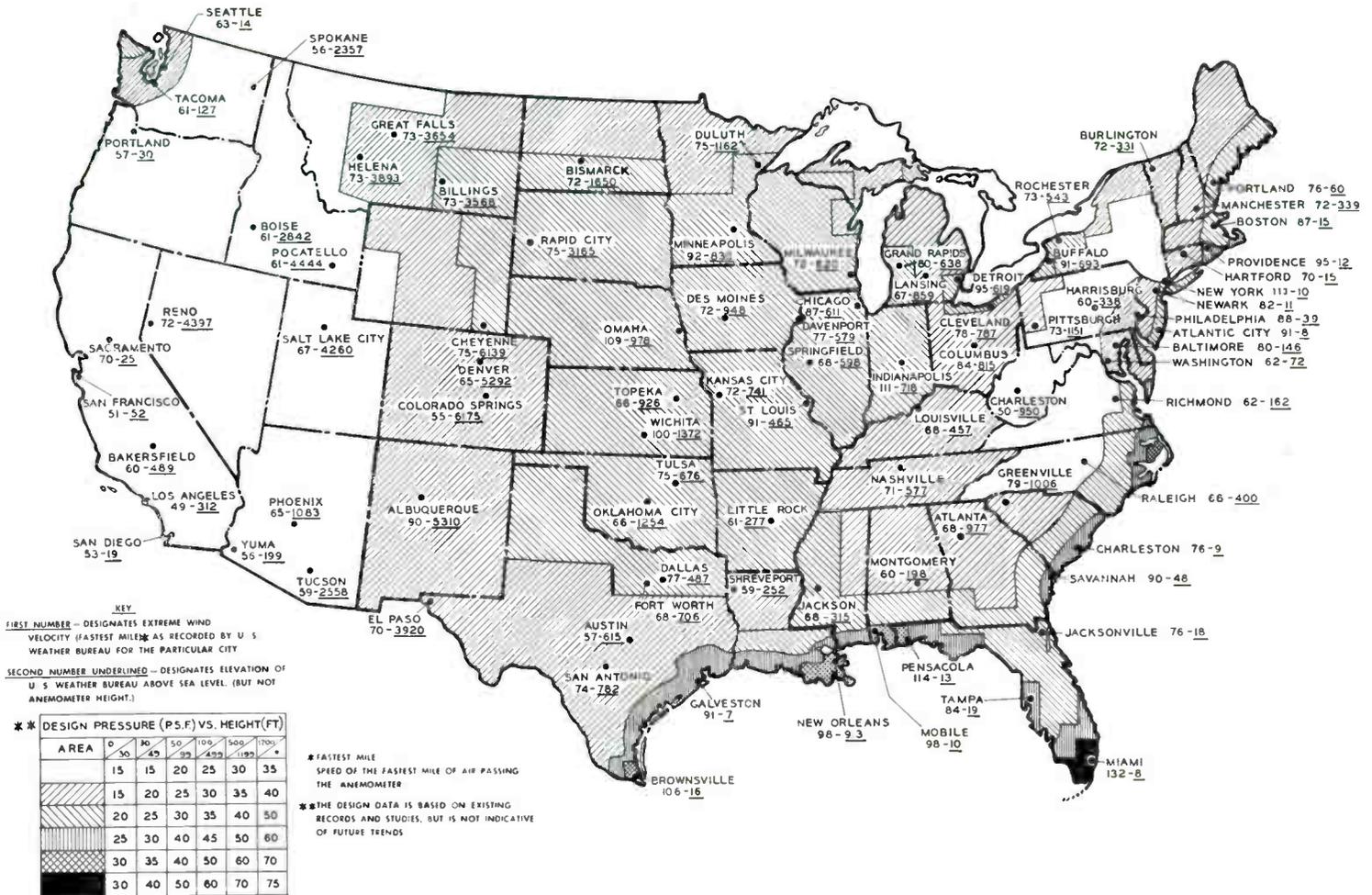
Careful consideration should be given to the layout and support of transmission line. For FM, the tower manufacturer should consult with RCA engineers to be sure there is adequate support for the line down the tower. The tower company must also supply supports for spring hangers from the top to the base of the tower. Outline drawings with dimensions are available for all types of transmission lines and should be used in making a layout. These are shown in the Transmission Line Section of this Catalog.

### Tower Construction

Steel towers may be hot dip galvanized, where corrosive action due to fumes, salt air, etc., are likely to occur. When CAA regulations require painting, galvanizing can be omitted if the tower sections are heavy and painting is done frequently. 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 VELOCITY AND PRESSURE MAP



Published records of the U. S. Weather Bureau are given as "maximum" (5 minute average velocity) or "extreme" (the speed of the fastest mile of air passing the anemometer). The selection of design loads should be based on "extreme" velocity. If no data is available on "extreme", the published "maximum" figures should be increased by approximately 20%.

The plotted areas shown on the map are derived from careful studies made by authorities in this field and the information is based on monthly and yearly average velocities, frequency of occurrence, probability of extremes, topographical conditions, etc.

Installations on mountain tops and areas subject to heavy icing conditions should be given special consideration. Building codes and zoning ordinances should also be carefully investigated.

## Wind Load

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 RETMA specifications. Consultation with RCA Broadcast Representatives will help to determine your requirements. Call or write your nearest representative.

## WIND VELOCITIES & CORRESPONDING PRESSURES

TRUE "EXTREME" VELOCITY MILES PER HOUR (NOTE No. 1)	FLAT SURFACES PRESSURE IN LBS./SQ. FT. OF PROJECTED AREA		CYLINDRICAL SURFACES PRESSURE IN LBS./SQ. FT. OF PROJECTED AREA		INDICATED VELOCITY MILES PER HOUR (NOTE No. 2)
	ASA	RETMA	ASA	RETMA	
	$P = .0042 V_{ii}^2$	$P = .004 V_{ii}^2$	$P = .0025 V_{ii}^2$	$P = .0026 V_{ii}^2$	
$V_{ii}$					$V_i$
10	.42	.4	.25	.26	11
15	.95	.9	.56	.58	17
20	1.7	1.6	1.00	1.0	23
25	2.6	2.5	1.6	1.6	30
30	3.8	3.6	2.3	2.3	37
35	5.2	4.9	3.1	3.2	44
40	6.7	6.4	4.0	4.2	50
45	8.5	8.1	5.1	5.3	57
50	10.5	10.0	6.3	6.6	64
55	12.7	12.1	7.6	7.3	71
60	15.1	14.4	9.0	9.5	78
65	17.8	16.9	10.6	11.2	85
70	20.6	19.6	12.3	12.9	91
75	23.6	22.5	14.1	14.9	98
80	26.9	25.6	16.0	17.0	105
85	30.4	28.9	18.1	19.0	112
90	34.0	32.4	20.3	21.4	118
95	37.9	36.1	22.6	23.8	125
100	42.0	40.0	25.0	26.4	132
105	46.3	44.1	27.6	29.1	138
110	50.8	48.4	30.3	31.9	145
115	55.5	52.9	33.1	34.9	152
120	60.5	57.6	36.0	38.0	159
125	65.6	62.5	39.1	41.3	166
130	70.9	67.6	42.3	44.6	173
135	76.5	72.9	45.6	48.1	180
140	82.3	78.4	49.0	51.7	187
145	88.3	84.1	52.6	55.5	194
150	94.5	90.0	56.3	59.4	201
155	100.9	96.1	60.1	63.4	208
160	107.5	102.4	64.0	67.6	215
165	114.3	108.9	68.1	71.7	222
170	121.4	115.6	72.3	76.3	229
175	128.6	122.5	76.6	80.9	236
180	136.1	129.6	81.0	85.5	243
185	143.7	136.9	85.6	90.4	250
190	151.6	144.4	90.3	95.3	257
195	159.7	152.1	95.1	100.4	264
200	168.0	160.0	100.0	105.6	271

THESE FIGURES ARE NOT SUBSTANTIATED BY ACTUAL TESTS BUT ARE EXTRAPOLATED

NOTE No. 1—Since 1932 published weather data based on 5 minute average known as "Maximum" and frequently on fastest mile known as "Extreme." Selection of antenna loads should be based on Extreme (increase "Maximum" by 20% if no data on Extreme).

NOTE No. 2—RCA bases strength of antennas on True Velocities, not Indicated. Indicated Velocities are those given by the Robinson 4 Cup Anemometer (now obsolete).

# AUSTIN TOWER-LIGHTING TRANSFORMERS

## FEATURES

- Independent of frequency—no tuning adjustments
- No housing required—eliminates leakage losses
- Dependable operation under all conditions
- Excellent regulation and efficiency

## USES

The Austin insulating transformer is a device for supplying a-c power to the lighting circuits of an insulated or sectionalized radio tower. Being independent of frequency, the same transformer may be used for any radio frequency and for a wide range of transmitting power.

## DESCRIPTION

The Austin insulating transformer provides an efficient, reliable method of supplying current to tower lighting circuits. The transformer consists of ring type windings with a clear air gap between primary and secondary rings. This type of construction makes the Austin transformer independent of radio frequency, thus requiring no tuning or adjustment. Since the windings are fully enclosed, no transformer housing is required, and the air gap between primary and secondary rings eliminates the possibility of surface leakage which may be appreciable in the housing covering other types. The total capacity added at the tower insulating zone is of the order of a very few micro-microfarads which produces only a slight effect upon the radio frequency circuit, and is constant under all weather conditions.

Installation is simplified since the Austin transformer requires no housing, chokes or filters. The primary of the transformer is usually attached to the base of the tower insulator or pier supporting the insulator. The secondary is supported by a conduit attached to the top of the insulator or to the tower above the insulator.

Austin tower-lighting transformers are available in sizes ranging from 700 watts to 7 kw. The larger sizes may be used to furnish extra energy for lighting neon or other signs on the tower, or for de-icing.

## SPECIFICATIONS

Type	Primary Voltage	Secondary Voltage	Capacity	Secondary Taps	Net Weight
A-2101	115/230	115	1 to 1.75 kv.	None	85 lbs.
A-1971	115/230	115	2 to 3 kv.	10% over volt.	201 lbs.
A-2815	115/230	115/230	3 to 7 kv.	None	300 lbs.

### Stock Identification:

A-2101	MI-28215-1
A-1971	MI-28215-2
A-2815	MI-28215-3



Typical installation of an Austin Tower-Lighting Transformer

# ANTENNA LIGHTING CHOKE COIL

## USES

In the 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. Type BPC-1A antenna lighting choke coil has been designed for this purpose. Its electrical characteristics are such that it presents a low impedance to commercial lighting frequency and a high impedance to the radio frequency in the broadcast range. It, therefore, provides a means for 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.

## DESCRIPTION

The coil consists of a double winding on a bakelite form. The windings are coated with an insulating varnish which binds the turns together and prevents moisture absorption. This coil, however, must be protected from the weather by installing it within some weatherproof enclosure. Such an enclosure or housing is not provided with the unit. The natural resonant frequency of the coil is well removed from any frequency within the broadcast band. Its characteristics, therefore, are such that it presents a relatively high impedance in the order of several hundred ohms to all broadcast frequencies. All windings that are not directly connected to the tower or ground should be properly bypassed by suitable capacitors as illustrated.

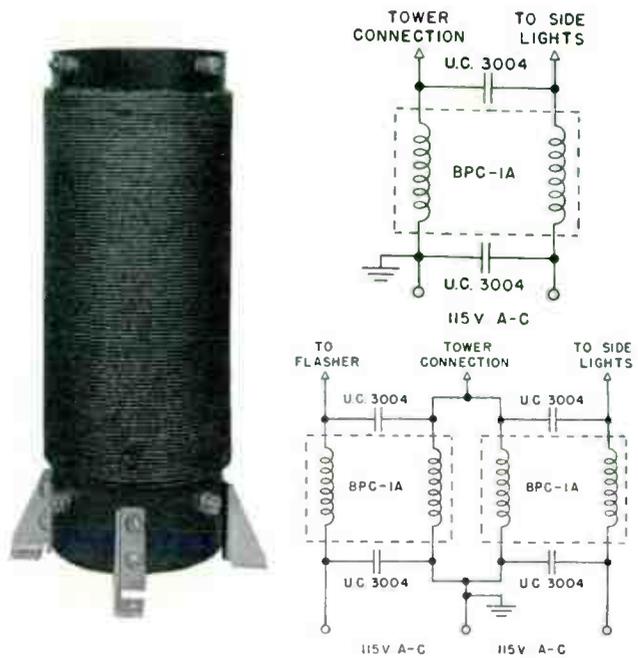
## SPECIFICATIONS

Maximum Continuous Current (50/60 cycles).....	15 amperes
D-c Resistance (total both windings).....	Approx. .314 ohms
Inductance at 1 mc.....	360 microhenries
Length .....	11 5/8"
Diameter .....	4"
Stock Identification .....	MI-7112-A

### Accessories

Capacitors .01 MFD.....	UC3004
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View showing main beacon and side obstruction lights powered by use of either lighting transformer or lighting choke coil.



## TABLE FOR BROADCAST TOWER HEIGHTS

550 KC TO 1070 KC					1080 KC TO 1600 KC				
KC	METERS	FEET	1/2 WAVE	1/4 WAVE	KC	METERS	FEET	1/2 WAVE	1/4 WAVE
550	545	1787.6	893.8	446.8	1080	277.8	911.1	455.5	227.7
560	536	1758.0	879.0	439.5	1090	275.2	902.6	451.3	225.6
570	526	1725.3	862.6	431.3	1100	272.7	894.4	447.2	223.6
580	517	1695.7	847.8	423.9	1110	270.3	886.5	443.2	221.6
590	509	1669.5	834.7	417.3	1120	267.9	879.0	439.5	219.7
600	500	1640.0	820.0	410.0	1130	265.5	870.8	435.4	217.7
610	492	1612.7	806.3	403.1	1140	263.2	862.6	431.3	215.6
620	484	1587.5	799.7	396.8	1150	260.9	855.7	427.8	213.9
630	476	1561.2	780.6	390.3	1160	258.6	847.8	423.9	211.9
640	469	1546.3	773.1	386.5	1170	256.4	840.9	420.4	210.2
650	462	1515.3	757.6	378.8	1180	254.2	834.7	417.3	208.6
660	455	1492.4	746.2	373.1	1190	252.1	826.8	413.4	206.7
670	448	1469.4	734.7	367.3	1200	250.0	820.0	410.0	205.0
680	441	1446.4	723.2	361.1	1210	247.9	813.1	406.5	203.2
690	435	1426.8	713.4	356.2	1220	245.9	806.3	403.1	201.5
700	429	1407.1	703.5	351.2	1230	243.9	799.1	399.5	199.7
710	423	1387.4	693.7	346.8	1240	241.9	793.7	396.8	198.4
720	417	1367.7	683.8	341.9	1250	240.0	787.2	393.6	196.8
730	411	1348.0	674.0	337.0	1260	238.1	780.9	390.4	195.2
740	405	1328.4	664.2	332.1	1270	236.2	774.7	387.3	193.6
750	400	1312.0	656.0	328.0	1280	234.4	768.8	384.4	192.2
760	395	1295.6	647.8	323.4	1290	232.6	762.9	381.4	190.7
770	390	1279.2	639.6	319.8	1300	230.8	757.0	378.5	189.2
780	385	1262.8	631.4	315.7	1310	229.0	751.1	375.5	187.7
790	380	1246.4	623.2	311.6	1320	227.3	746.2	373.1	186.5
800	375	1230.0	615.0	307.5	1330	225.6	739.9	369.9	184.9
810	370	1213.6	606.8	303.4	1340	223.9	734.7	367.3	183.6
820	366	1200.4	600.2	300.1	1350	222.2	728.8	364.4	182.2
830	361	1184.0	592.0	296.0	1360	220.6	723.2	361.1	180.5
840	357	1170.9	585.4	292.7	1370	219.0	718.3	359.1	179.5
850	353	1157.8	578.9	289.4	1380	217.4	713.4	356.2	178.1
860	349	1144.7	572.3	286.1	1390	215.8	707.8	353.1	176.5
870	345	1131.6	565.8	282.9	1400	214.3	703.5	351.2	175.6
880	341	1118.4	559.2	279.6	1410	212.8	696.9	348.4	174.2
890	337	1105.3	552.6	276.3	1420	211.3	693.7	346.8	173.4
900	333	1092.2	546.1	273.0	1430	209.8	688.1	344.0	172.0
910	330	1082.4	541.2	270.6	1440	208.3	683.8	341.9	170.9
920	326	1069.2	534.6	267.3	1450	206.9	678.6	339.3	169.6
930	323	1059.4	529.7	264.8	1460	205.5	674.0	337.0	168.5
940	319	1046.3	523.1	261.5	1470	204.1	669.4	334.7	167.3
950	316	1036.4	518.2	259.1	1480	202.7	664.2	332.1	166.5
960	313	1026.6	513.3	256.6	1490	201.3	660.2	330.1	165.0
970	309	1013.5	506.7	253.3	1500	200.0	656.0	328.0	164.0
980	306	1003.6	501.8	250.9	1510	198.7	651.7	325.8	162.9
990	303	993.8	496.9	248.4	1520	197.4	647.8	323.4	161.7
1000	300	984.0	492.0	246.0	1530	196.1	643.2	321.6	160.8
1010	297	974.1	487.5	243.7	1540	194.8	639.6	319.8	159.9
1020	294.1	964.6	482.3	241.1	1550	193.5	634.6	317.3	158.6
1030	291.3	955.3	477.6	238.8	1560	192.3	631.4	315.7	157.8
1040	288.5	946.2	473.1	236.5	1570	191.1	626.8	313.4	156.7
1050	285.7	937.1	468.5	234.2	1580	189.9	623.2	311.6	155.8
1060	283.0	928.2	464.1	232.0	1590	188.7	618.9	309.4	154.7
1070	280.4	919.7	459.8	229.9	1600	187.5	615.0	307.5	153.7

# FM RING ANTENNAS

## TYPE 37M SERIES

### FEATURES

- **Simplicity of design—very low weight and windload**
- **Be side mounted on tower or mounted on pole at tower top**
- **Wide choice of gains and power ratings available**
- **Low VSWR due to inherently high stability of tuning system**
- **Radiation pattern essentially circular**
- **Provisions for de-icing**

### USES

FM Ring Antennas, Type 37M Series, are designed for use with FM transmitters having a frequency range of 88-108 mc, and power ratings up to 20 kw. The 37M's are regularly available with power gains from 1 to 8, but higher gains can be supplied on special order. Ring Antenna arrays may be mounted on either 1½ inch or 3¼ inch transmission line.

### DESCRIPTION

All FM antennas of the 37M Series consist of two basic parts: (1) radiating rings and (2) connecting inter-ring transmission line. Any number of rings, either odd or even, may be employed, providing maximum flexibility in available power gains for the requirements of the particular installation. Only one inter-element transmission line is required to feed all rings in the multiple element array. The individual radiating rings are identical mechanically and electrically. They are both shunt fed and mechanically supported by a single interconnecting feed line which consists of modified lengths of standard RMA specification rigid coaxial transmission line of suitable size for the transmitter power being employed. The antenna terminates in a standard RMA 51.5 ohm flange connection on the bottom element of the array for coupling directly to the transmission line.

The side-mounting type of antenna may be attached to a corner leg of the broadcasting tower. Towers, either guyed or self-supporting, which previously have been considered incapable of supporting any FM antenna will in nearly all cases handle the lightweight side mounting 37M Series. Towers which support top mounting TV antenna arrays,



increase their usefulness with the addition of a side mounting 37M array. Any number of rings may be side mounted, obviating the necessity of modifying the top of the tower or disturbing in any way the tower lighting equipment, top mounting TV radiator, or the tower proper.

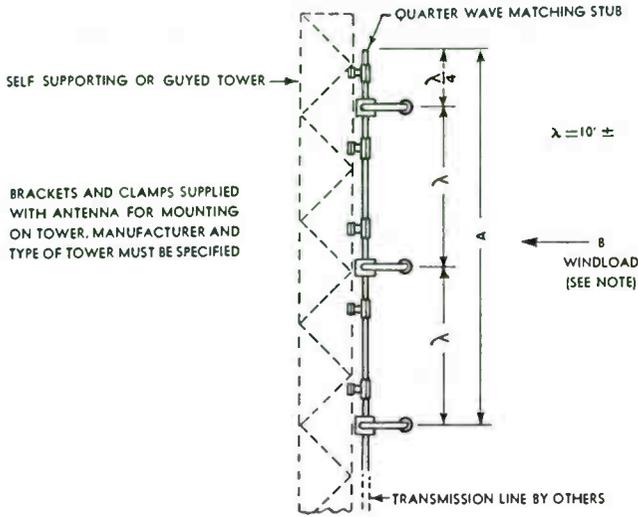
The top or pole mounting design is available on special order for installation on towers where no TV antenna is present or planned. This design employs a steel pole that supports the transmission line with the attached rings and provides the maximum in height and coverage. The light weight and windloading of the top mounting array allow erection on most guyed and self-supporting towers without extensive tower modification. Support brackets are specially fabricated for each installation to match the tower and mounting arrangement specified by the purchaser, thus minimizing erection problems at the site.

The voltage standing wave ratio of the 37M Series Antennas can be maintained at better than 1.1 to 1 due to the inherently high stability of the tuning system. Adequate band width virtually eliminates detuning effects caused by changes in atmospheric conditions. Another important advantage is the inherent mechanical stability. Undue oscillating and weaving of the tower and antenna are eliminated by the low weight and windload which result in reduced strain on the supporting structure as well as reduction in tower maintenance costs.

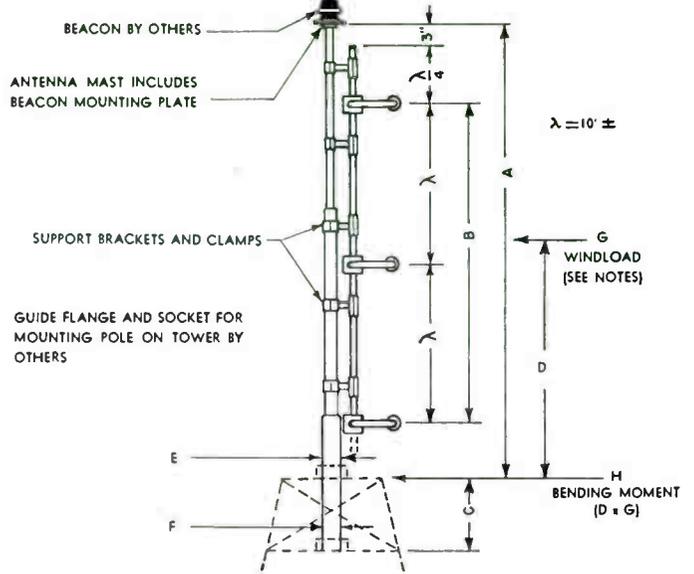
The compactness and simplicity of the antenna allows the maximum efficiency in ice and sleet removal. Each ring may be equipped with an internally mounted heating unit which consists of a cartridge type element inside each of the tuning condenser plates and an additional flexible heating element extending the full circumference on the inside of the ring.

# SPECIFICATIONS

**SIDE MOUNTING**



**TOP MOUNTING**



**SIDE MOUNTING**

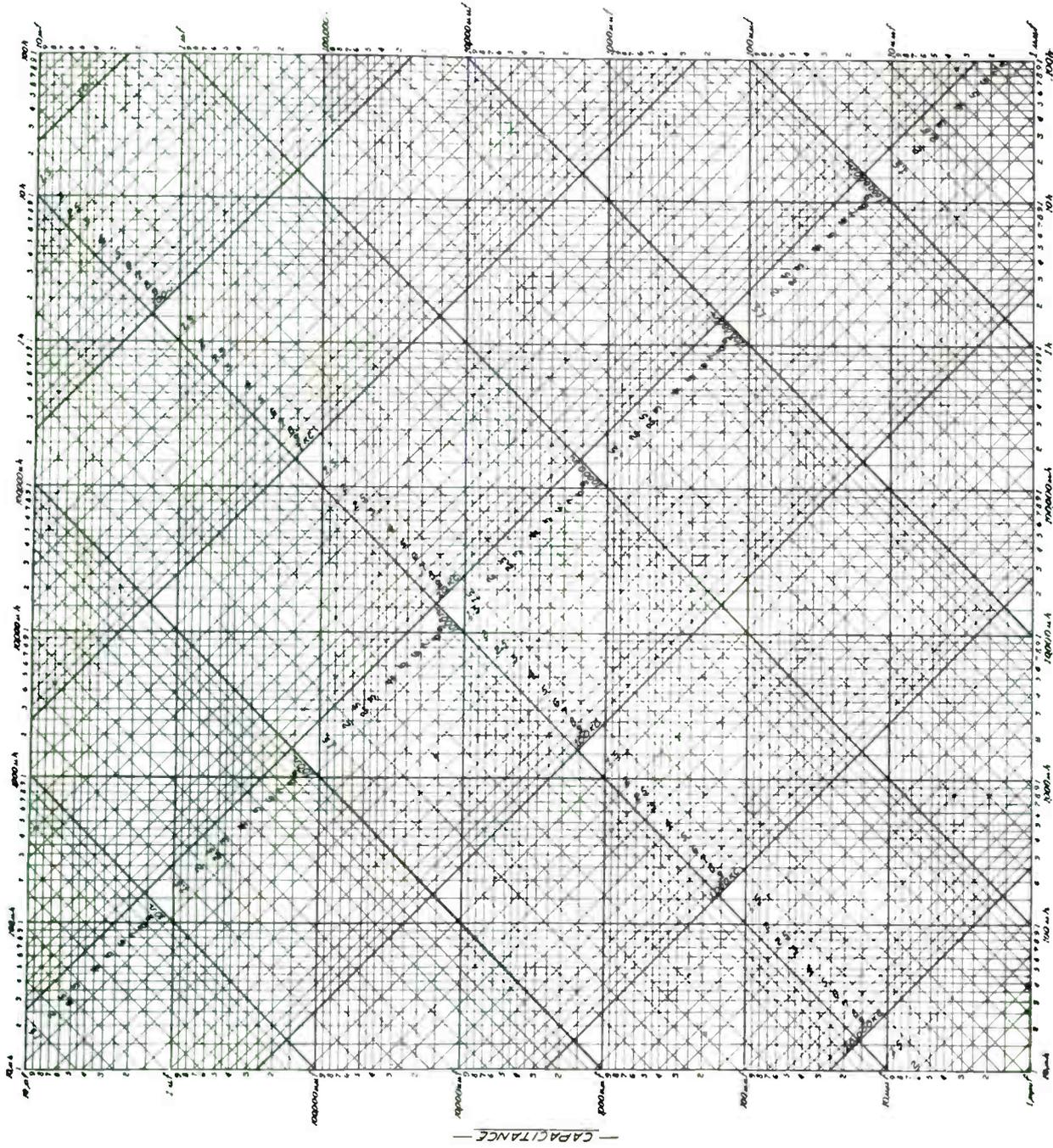
Type	No. of Rings	Power Gain	Field Gain	A Feet	On 1 5/8" Line		On 3 1/8" Line	
					B	Weight	B	Weight
37M-1	1	.9	.95	2-6±	24	23	32	46
37M-2	2	2.0	1.41	12-6±	68	55	100	100
37M-3	3	3.0	1.73	22-6±	114	86	170	175
37M-4	4	4.1	2.02	32-6±	160	119	240	240
37M-5	5	5.2	2.28	42-6±	206	152	310	305
37M-6	6	6.3	2.51	52-6±	252	185	380	370
37M-7	7	7.3	2.70	62-6±	298	218	450	435
37M-8*	8	8.4	2.90	72-6±	344	251	520	500

**TOP MOUNTING**

Type	No. of Rings	Pwr. Gain	A Ft.	B Ft.	C Ft.	On 1 5/8" Line						On 3 1/8" Line					
						D Ft.	E Dia.	F Dia.	G Lbs.	H Ft.-Lbs.	Dead Wt.	D Ft.	E Dia.	F Dia.	G Lbs.	H Ft.-Lbs.	Dead Wt.
37M-1	1	.9	6		3	4-7	3 1/8"	3 1/8"	50	230	223	4-7	3 1/8"	3 1/8"	68	312	250
37M-2	2	2.0	16	10±	4	10	4 1/2"	4 1/2"	239	2,390	305	12-3	4 1/2"	4 1/2"	291	3,565	360
37M-3	3	3.0	26	20±	7	14-5	6 5/8"	6 5/8"	403	5,803	736	14-4	6 5/8"	6 5/8"	486	6,950	825
37M-4	4	4.1	36	30±	10	19	7 5/8"	7 5/8"	564	10,716	1169	18-9	7 5/8"	7 5/8"	678	12,713	1290
37M-5	5	5.2	46	40±	12	23	8 5/8"	7 5/8"	747	17,181	1652	22-8	9 5/8"	9 5/8"	919	20,769	2128
37M-6	6	6.3	56	50±	14	27-2	9 5/8"	8 5/8"	951	25,867	2285	26-7	10 3/4"	9 5/8"	1173	31,260	2770
37M-7	7	7.3	66	60±	15	31	10 3/4"	8 5/8"	1175	36,425	3218	31-3	10 3/4"	8 5/8"	1388	43,375	3485
37M-8*	8	8.4	76	70±	16-6	34-9	11 3/4"	9 5/8"	1417	49,241	4051	34-8	12 3/4"	11 3/4"	1696	58,682	4650

\* Antennas with more than 8 rings quoted upon request.

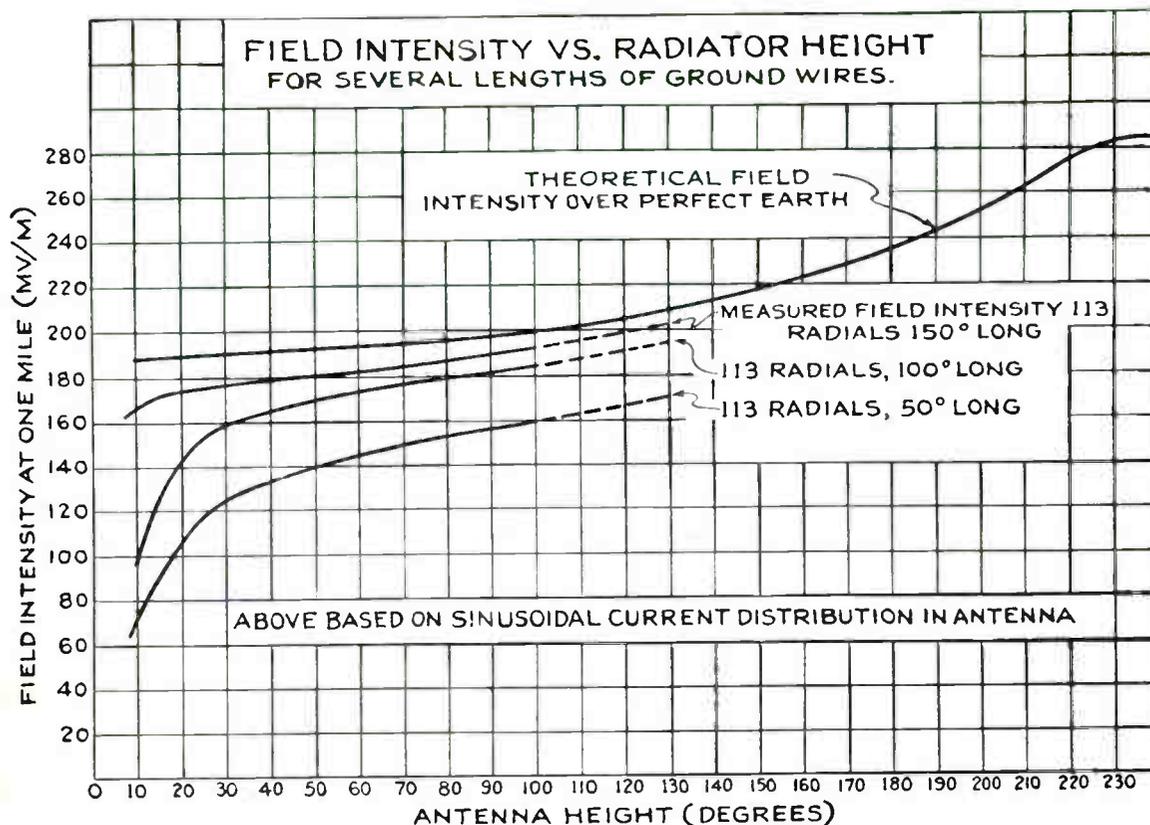
1. Windloads based on 20 pounds per square foot on projected areas of cylindrical surfaces with all sections considered round.
2. Power gains compared to half wave dipole.
3. Antenna assemblies on 1 5/8 inch line are rated for power inputs at base of antenna up to 3 kilowatts for a single ring array; 6 kilowatts for two or more rings.
4. Antenna assemblies on 3 1/8 inch line are rated for power inputs up to 3 kilowatts per ring at base of antenna; with maximum of 20 kilowatts for seven or more rings.
5. Antennas for power inputs in excess of 20 kilowatts incorporate the use of a Tee feed at center of array.



~ CHART of FREQUENCY or IMPEDANCE ~

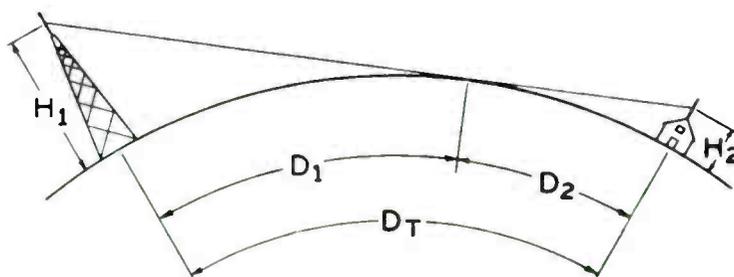
~ VS ~

~ INDUCTANCE AND CAPACITANCE ~



EFFECT OF GROUND WIRES ON FIELD STRENGTH

**RANGE FOR PROPAGATION OVER OPTICAL PATH**  
**HORIZON CALCULATIONS**



$$D_1 = K\sqrt{H_1}$$

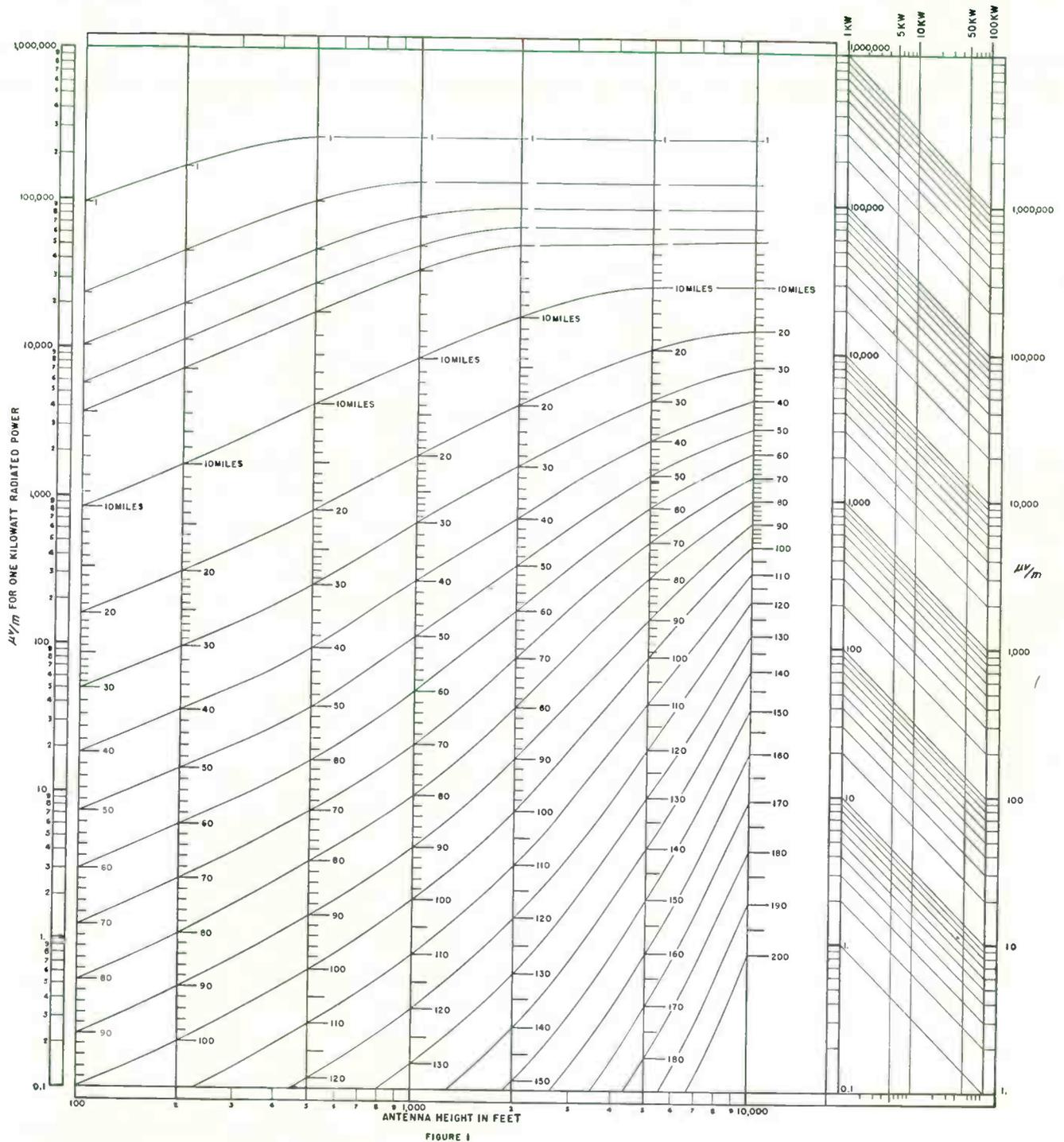
$$D_2 = K\sqrt{H_2}$$

$$D_T = D_1 + D_2 = K [\sqrt{H_1} + \sqrt{H_2}]$$

$K = 1.22$  WHERE "D" IS IN MILES AND "H" IS IN FEET

$K = 3.57$  WHERE "D" IS IN KILOMETERS AND "H" IS IN METERS

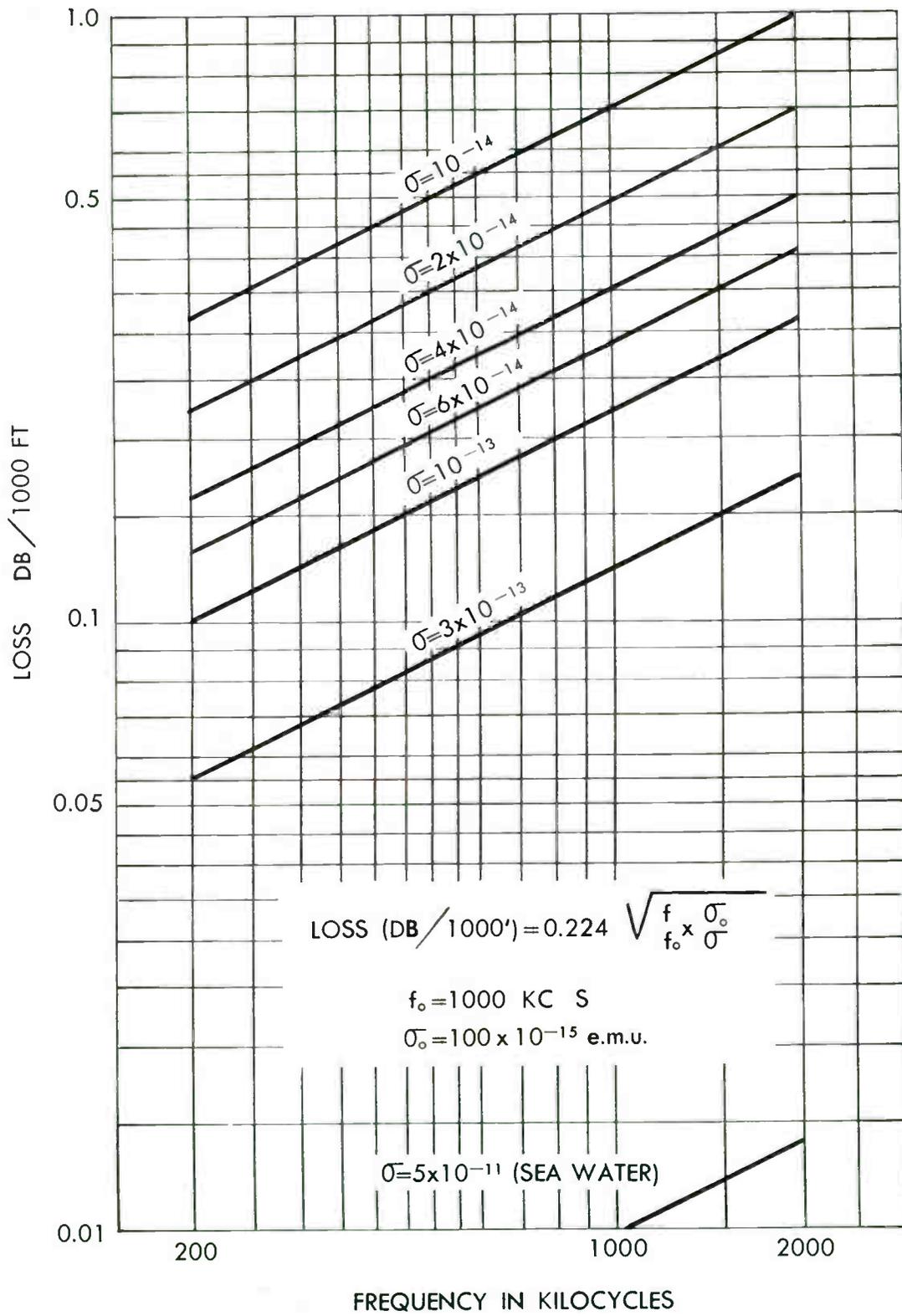
THE ABOVE FORMULAE NEGLECT REFRACTION AND DIFFRACTION



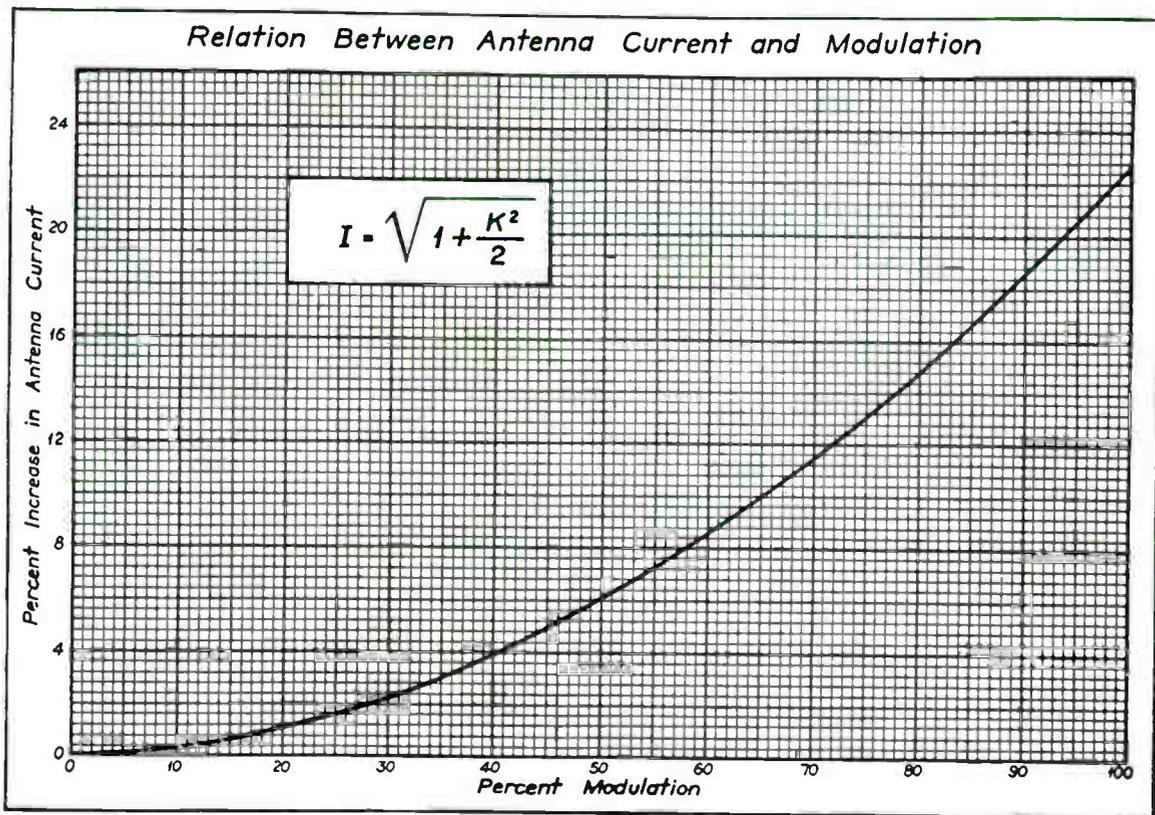
GROUND WAVE SIGNAL RANGE FOR FM BROADCASTING

98 mc,  $\sigma = 5 \times 10^{-16}$  s.m.u.,  $\epsilon = 15$ , RECEIVING ANTENNA HEIGHT 30 FEET  
 FOR HORIZONTAL (AND APPROX. FOR VERTICAL) POLARIZATION

83911



LOSS (DB PER 1000 FT.) OF RCA 6 WIRE TRANSMISSION LINE  
 LINE HEIGHT 12', WIRE SPACING 15", WIRE SIZE #8,  $Z_0 = 230 \Omega$



<b>TRANSMITTERS</b>			
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8	.....	Tube Kit for BTA-250M.....	MI-28049
8	.....	Frequency Response and Distortion Curves of BTA-250M	
8	.....	Accessories for the BTA-250M	
8	.....	Mechanical Dimensions of BTA-250M	
9-12	<b>BTA-500M</b>	500 Watt AM Broadcast Transmitter.....	ES-28949
11	.....	Simplified Schematic Diagram of BTA-500M	
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		BTA-10H .....	ES-27073/75
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80	.....	90° Sweep Elbow, same as MI-19308-2 except fixed flange omitted.....	MI-19308-2-F
80	.....	90° Sweep Elbow, same as MI-19308-2 except both flanges omitted.....	MI-19308-2-NF
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82	.....	90° Sweep Elbow, same as MI-19309-2 except both flanges omitted	MI-19309-2-NF
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82	.....	45° Sweep Elbow, same as MI-19309-3 except both flanges omitted	MI-19309-3-NF
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84	.....	90° Sweep Elbow	MI-19310-2
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84	.....	90° Sweep Elbow, same as MI-19310-2 except both flanges omitted	MI-19310-2-NF
84	.....	45° Sweep Elbow	MI-19310-3
84	.....	45° Sweep Elbow, same as MI-19310-3 except solid flange omitted	MI-19310-3-F
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