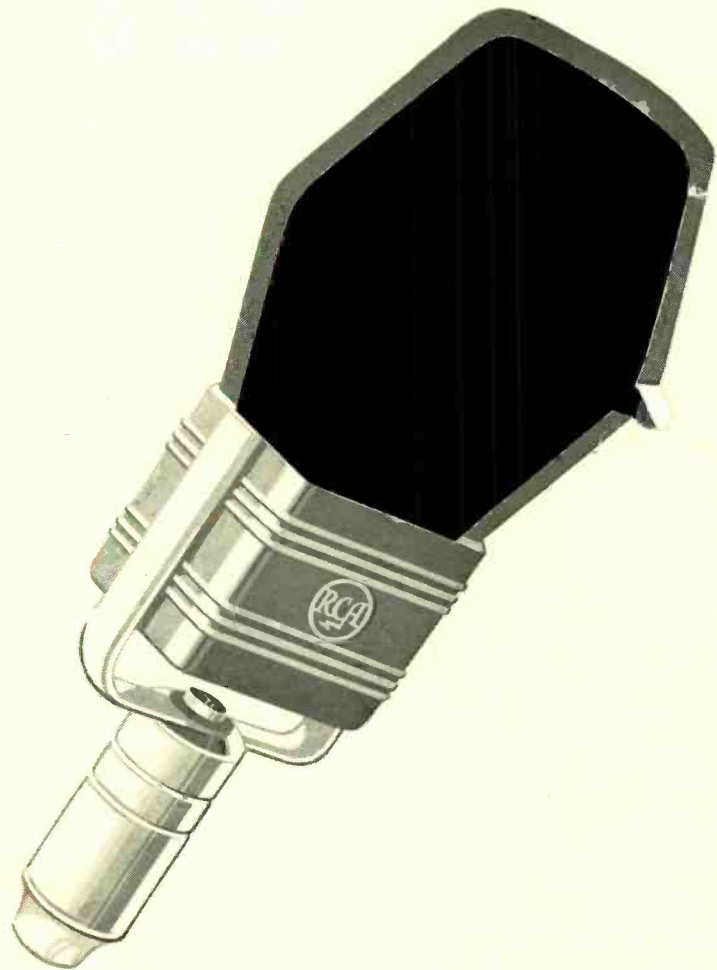




# BROADCAST FM • TELEVISION • AM EQUIPMENT



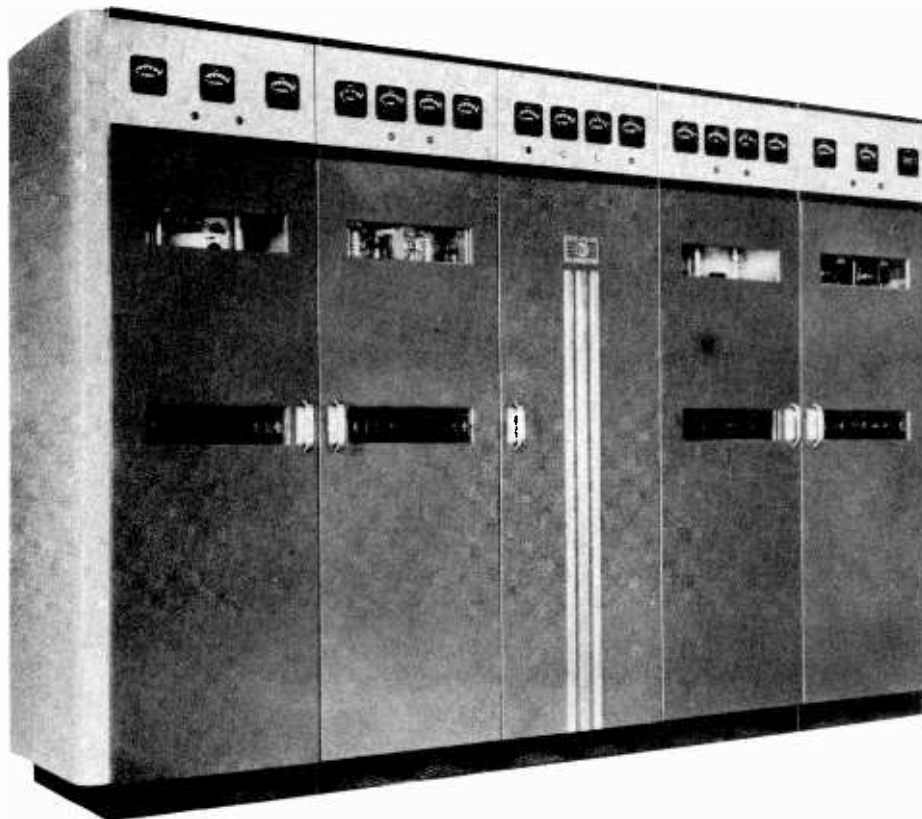
**RADIO CORPORATION OF AMERICA**  
**ENGINEERING PRODUCTS DEPARTMENT, Camden, N. J., U. S. A.**

**10 KW  
FM Transmitter  
Type  
BTF-10B  
Equipment  
Specification**

**AS-5928**

**EFFECTIVE JULY, 1947**

# 10 KW FM TRANSMITTER TYPE BTF-10B



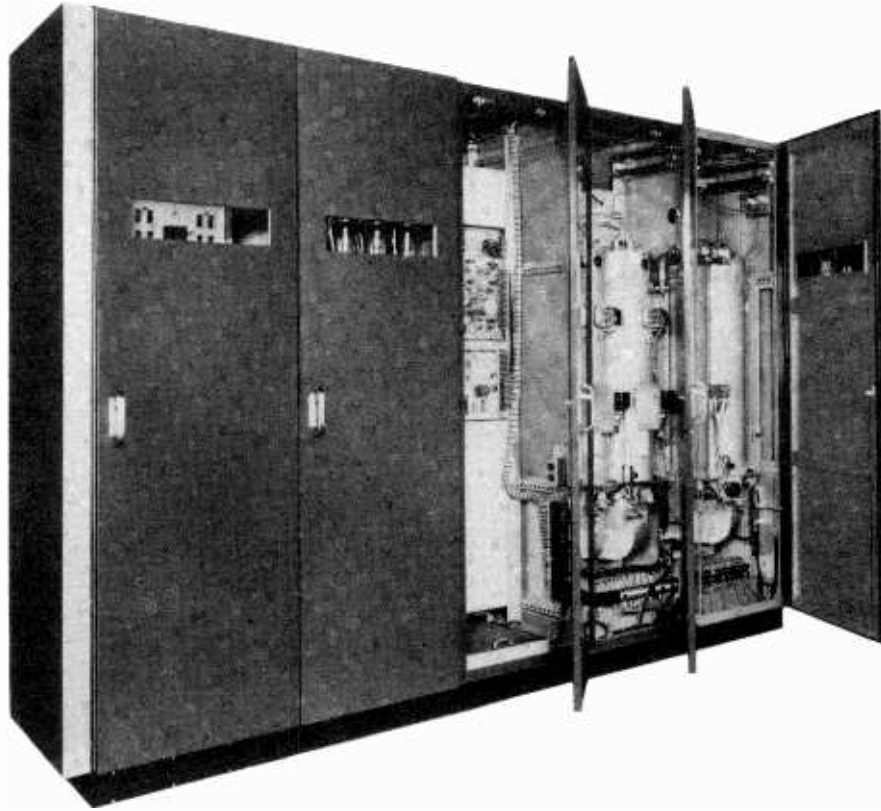
## DESCRIPTION

### GENERAL

The RCA type BTF-10B is an air-cooled 10 KW FM transmitter incorporating the latest RCA developments in FM transmitter design. Among the outstanding features of the BTF-10B are low operating cost, grounded grid amplifiers and RCA's newly developed "direct FM" system. This transmitter will supply 10,000 watts at any specified frequency in the 88 to 108 Mc. band.

### EXCITER

In the exciter unit of the BTF-10B, frequency modulation is produced by push-pull reactance tubes connected directly across the frequency determining circuit of the modulated oscillator. Center frequency stability is maintained by an automatic frequency control circuit which is completely independent of the modulator circuit. This control circuit operates by comparing a sub-harmonic of the modulated signal with a standard developed by a temperature controlled precision ground quartz crystal oscillator. Any difference between the mean frequency of the modulated signal and that of the standard actuates a frequency compensating condenser which is connected across the tuned circuit of the modulated oscillator. This condenser is driven by a two phase motor in which the information supplied by a beat frequency between the above two signals determines the position. Two quartz-crystal units are furnished for the frequency standard oscillator; the stand-by crystal is maintained at operating temperature and is connected into the oscillator circuit by the flick of a switch.



Rear View of the BTF-10B With Doors Open to Show Driver and Final Tank Assemblies

## RF SECTION

Simplified single ended amplifiers operating Class "C" and comprising a minimum of variable elements form the RF section of the BTF-10B. High stability grounded grid circuits using RCA type 7C24 tubes are employed in the last three stages and shielded grid tubes are used in the stages of lower power. This circuit arrangement eliminates the need for neutralization and gives high overall efficiency. The number of different tube types used in the BTF-10B has been reduced to a minimum. Reference to the schematic diagram will reveal the extent to which the same tube is employed in several stages. This is an important item when considering spare tube requirements.

Variable output coupling with front panel control permits adjusting the power output into the transmission line over the range from 3,000 to 10,000 watts. A fixed tuned harmonic attenuator designed to effectively reduce all harmonics is located in the output circuit and is provided as standard equipment. An externally mounted transmission line monitor acts as a watchman over the antenna and transmission line system. Any unwarranted change in standing wave ratio, such as might result from an arc in the transmission line or a fault in the antenna itself, actuates this monitor which removes plate voltage from the transmitter to prevent damage.

## RECTIFIERS

A single high power rectifier supplies all anode voltages to the RF stages. Six RCA type 673 tubes are used in a full wave, three phase circuit. The plate transformer is a three phase air-cooled unit with a Delta-Wye switching arrangement on the primary side to provide a reduced power position for tune-up and emergency operation. A 15% reduced voltage tap on the secondary permits operation with

lower plate voltage when full 10 KW output is not required. Screen voltage for the low power stages is supplied by a rectifier using one RCA type 5U4G, which is located in the low power RF chassis. The exciter unit contains its own regulated power supply and uses three RCA type 5U4G rectifier tubes.

#### POWER CONTROL AND OVERLOAD PROTECTION

The control system is carefully engineered to provide proper starting sequence and automatic protection against most operating faults. Both manual and automatic sequence starting are provided. When in the automatic position, a three-shot recycling sequence is provided by the control "brain center" which automatically returns the transmitter to the air up to three times in case of repeated overloads. If the overload condition persists, the transmitter is automatically shut down. A special hold-in circuit permits the transmitter to instantly return to the air in case of momentary power line failure, thus avoiding the thirty second delay normally required for the plate time delay relay to close.

All high power circuits are doubly protected by high speed overload relays backed up by magnetic trip circuit-breaker type switches. Similar circuit-breaker type switches are used to connect blowers, filament and low power circuits to the power line. The only fuses used in the entire transmitter are located in the crystal heater circuits of the FM exciter. Door interlocks are provided where required for the safety of operating personnel. High voltage components are equipped with mechanically operated grounding bars which are automatically released when a door is opened. Dead front construction is employed on all operating controls.

#### ANTENNA CUT-BACK

To provide for continuous broadcast service with a minimum of lost air time, an antenna cut-back kit is available as optional equipment. When it is incorporated in the BTF-10B, the antenna can be instantly switched to the intermediate power amplifier output. At the same time, power amplifier plate voltage is removed and the plate circuit is grounded. PA tube changes or necessary servicing in the power amplifier compartment can then be carried out in complete safety while program continuity is maintained through the driver.

#### GENERAL

The entire transmitter is housed in five fabricated steel frames which are bolted to base frames. Each compartment is equipped with both front and rear doors which are provided with windows for observation of the transmitter while in operation. End shields and meter panels complete the cabinet-type enclosure which has been styled functionally and presents a pleasing and dignified appearance. Filtered air for cooling the type 7C24 tubes is supplied by an external blower. Individual, internal blowers are available as optional equipment for those cases where installation space is at a premium. Exhaust fans in the low power cabinets draw air through individual air inlet filters provided in the base frame. This use of filtered air greatly reduces the possibility of arc-over and service interruption due to dust pile-up. The warm air from the transmitter is expelled from the top of the transmitter into the transmitter room so, therefore, an auxiliary building ventilating system will be required to remove the heat produced.

For ease in shipment and installation, the equipment is partially disassembled. To facilitate handling in confined spaces, the largest unit, when uncrated, is 25 x 28 x 80 inches. Referring to the photograph on sheet one of this specification and reading from left to right, each door opens into the following compartments: Power amplifier, low-power RF, FM exciter, main rectifier and control and distribution. The exciter compartment has provision for housing two complete exciter units including their power supplies and an exciter transfer panel. The transmitter is furnished with one FM exciter. The second unit plus a transfer panel is available as optional equipment. With dual exciters, instantaneous transfer of operation from one unit to the other is accomplished by the flick of a switch. All meters and indicator lights are grouped together at the top of the transmitter for quick observation of the electrical performance of the several circuits. Tuning controls and switches necessary for normal operation of the transmitter are situated on the control strips conveniently located at hand height above the floor.

## FEATURES

- Low installation cost—small floor space requirements.
- Low operating cost—low power input.
- Grounded grid amplifiers reduce overall transmitter, tube and maintenance costs and assure stable operation.
- Direct FM system requires fewer tubes and parts, assures low distortion and requires minimum attention.
- Motor driven tuning for high power stages plus essential circuit metering.
- Equipment protected against transmission line or antenna failure.
- Instant carrier return after momentary power failure.
- Vertical chassis construction for maximum accessibility and ventilation.
- Antenna cut-back permits uninterrupted service.
- Fixed tuned harmonic attenuator.
- Space provided for dual exciter units with instantaneous transfer panel.
- Cabinets with similar styling available for housing audio, monitoring and test equipment.
- Terminal facilities provided for control console.

## SPECIFICATIONS

Frequency range .....	88 to 108 mc.
Power output (into transmission line) .....	3,000 to 10,000 watts
RF output impedance .....	51.5 ohms (standing wave ratio 1.75 to 1 or less)
Carrier frequency stability .....	Deviation less than $\pm 1,000$ cycles
Modulation capability .....	$\pm 100$ KC
Method of Modulation .....	Reactance tubes
Audio input impedance .....	600/150 ohms
100% Modulation level* .....	$\pm 10 \pm 2$ dbm
Audio frequency response**	
30 to 15,000 cycles .....	$\pm 1$ db
Audio frequency distortion***	
30 to 15,000 cycles (including all harmonics up to 30 KC/s at $\pm 75$ KC swing) .....	Less than 1%
FM noise level, below 75 KC swing*** .....	Not more than -65 db
AM noise level, below 100% amplitude modulation*** .....	Not more than -50 db
Power line requirements .....	Transmitter
Line voltage .....	208/230 volts
Phase .....	3
Frequency (50 cycles equipment available at slightly higher cost) .....	60 cycles
Instantaneous regulation and variation .....	5%
Power consumption (approx.) .....	22.5 KW
Power factor (approx.) .....	90%
Power line requirements .....	Crystal heaters
Line voltage .....	100 to 130 volts AC or DC
Power consumption (one exciter)* .....	28 watts

\* Level at input of 600 ohm pre-emphasis network. Insertion loss of this network is approximately 24 db.

\*\*For pre-emphasized response, the pre-emphasis filter (MI-4926A) is provided to be inserted in the 600 ohm audio input line at the most effective point.

\*\*\* Distortion and noise is measured following a standard 75 microsecond de-emphasis network.

## TUBE COMPLEMENT

The following is a list of one complete set of tubes for the BTF-10B transmitter less Power Amplifier requirements:

### For the FM Exciter—

Modulators .....	2	RCA-6V6
Modulated Oscillator .....	1	RCA-6V6
1st Buffer-Multiplier .....	1	RCA-6V6
2nd Buffer-Multiplier .....	1	RCA-2E26
3rd Buffer-Amplifier .....	1	RCA-2E26
1st Frequency Divider .....	1	RCA-6AC7
2nd Frequency Divider .....	1	RCA-6AC7
3rd Frequency Divider .....	1	RCA-6AC7
4th Frequency Divider .....	1	RCA-6AC7
Motor Tubes .....	4	RCA-1614 or 6L6
Crystal Frequency Divider .....	1	RCA-6AC7
Crystal Oscillator .....	1	RCA-6SH7
Cathode Ray Indicator .....	1	RCA-2BP-1

### For the Exciter Power Supply—

Low Voltage Rectifier .....	2	RCA-5U4G
High Voltage Rectifier .....	1	RCA-5U4G
Voltage Regulators .....	2	RCA-OD3/VR150
Voltage Regulator .....	1	RCA-OC3/VR105

### For the Low Power RF Unit—

Doubler .....	1	Eimac 4-125A
1st RF Amplifier .....	2	Eimac 4-125A
2nd RF Amplifier .....	1	RCA-7C24
Intermediate Power Amplifier .....	1	RCA-7C24

For the Power Amplifier ..... 2 RCA-7C24

For the Low Power Rectifier ..... 1 RCA-5U4G

For the Main Rectifier ..... 6 RCA-673

### For the Transmission Line Monitor—

RF Rectifier .....	1	RCA-6AL5
Thyratron .....	1	RCA-2D21

## MECHANICAL SPECIFICATIONS

### Dimensions in Inches

Overall Length* (Transmitter only) .....	131-3/8
Overall Height (Transmitter only) .....	84
Overall Depth (including Door Handles) .....	31-1/16
Plate Transformer .....	26 wide x 25 high x 40 long
Building Entrance Requirements .....	25 x 28 x 80

No allowance for clearances for sides, opening doors and space for transformer and blower in rear. See suggested floor plan Dwg. W-309219.

### Weight in Pounds (unpacked)

Transmitters* .....	5000
Plate Transformer .....	650

\* For shipment, the transmitter may be partially disassembled so that the overall dimensions per section is approximately 25 x 28 x 80 excluding packing. The weight of the largest section of the transmitter would then be approximately 500 pounds.

### Ventilation Requirements

Air Required for Cooling Transmitter Room .....	6000 cfm
Maximum Velocity (equivalent to 4.5 square feet of unobstructed opening) .....	500 ft/min
Maximum Ambient Temperature .....	45° C
Heat Dissipation (approximate) .....	12500 watts or 712 BTU/Min
Finish .....	Two-tone umber gray with brushed chrome trim and fittings

### EQUIPMENT LIST

The BTF-10B FM Broadcast Transmitter, as herein specified, is complete including the transmitter interconnection wiring kit. Speech input equipment, monitoring and test equipment, antennas and transmission line, and connections between the transmitter and such items are not furnished as part of this equipment and should be specified and ordered separately if required.

RCA Type BTF-10B FM Broadcast Transmitting Equipment is identified as MI-28914 and consists of the following:

Item	Qty.	Description
1	1	Power Amplifier Unit
2	1	Low Power RF Unit
3	1 (See Note 1)	FM Exciter Unit
4	1	Control Unit
5	1	Power Unit
6	1	Base, R.H.
7	1	Base, Center
8	1	Base, L.H.
9	1	Meter Panel, L.H.
10	1	Meter Panel, L. Center
11	1	Meter Panel, Center
12	1	Meter Panel, R. Center
13	1	Meter Panel, R.H.
14	1	Set of Shields
15	1	Set of Trim and Filler Strips
16	1	Set of Doors
17	(See Note 2)	TMV-129G Crystal Unit
18	(See Note 3)	Set of Operating Tubes
19	1	Harmonic Attenuator
20	1	Plate Transformer
21	1	Pre-emphasis Filter (600 ohms)
22	1	Transmission Line Monitor
23	1	Hardware Kit
24	1	Installation Material
25	1	Installation Wiring Kit
26	1	Touch-up Kit
27	2	Instruction Books
28	1	Installation Plans

Note 1—When dual FM Exciters are to be specified, order in addition to item 3 above, the spare FM Exciter Kit, MI-7015, listed under accessories.

Note 2—Order 2 TMV-129G Crystal Units and specify the carrier frequency when ordering.

Note 3—Order one or more sets as desired.



**ACCESSORIES (CONSULT LOCAL RCA OFFICE FOR PARTICULARS)**

Spare FM Exciter Unit and Transfer Panel .....	MI-7015
Set of operating tubes for spare FM Exciter .....	MI-7020
Set of operating tubes for the BTF-10B .....	On Application
Antenna Cutback Equipment .....	MI-28175
Modification Kit for 50 cycle power source .....	MI-28178
Installation Material (wiring, etc.) .....	On Application
Spare Parts .....	On Application
Supervisory Control Console .....	On Application
Antennas and RF Transmission Line .....	On Application
Speech Input Equipment .....	On Application
Frequency and Modulation Monitor .....	Type WF-72-A
Test and Measuring Equipment .....	On Application

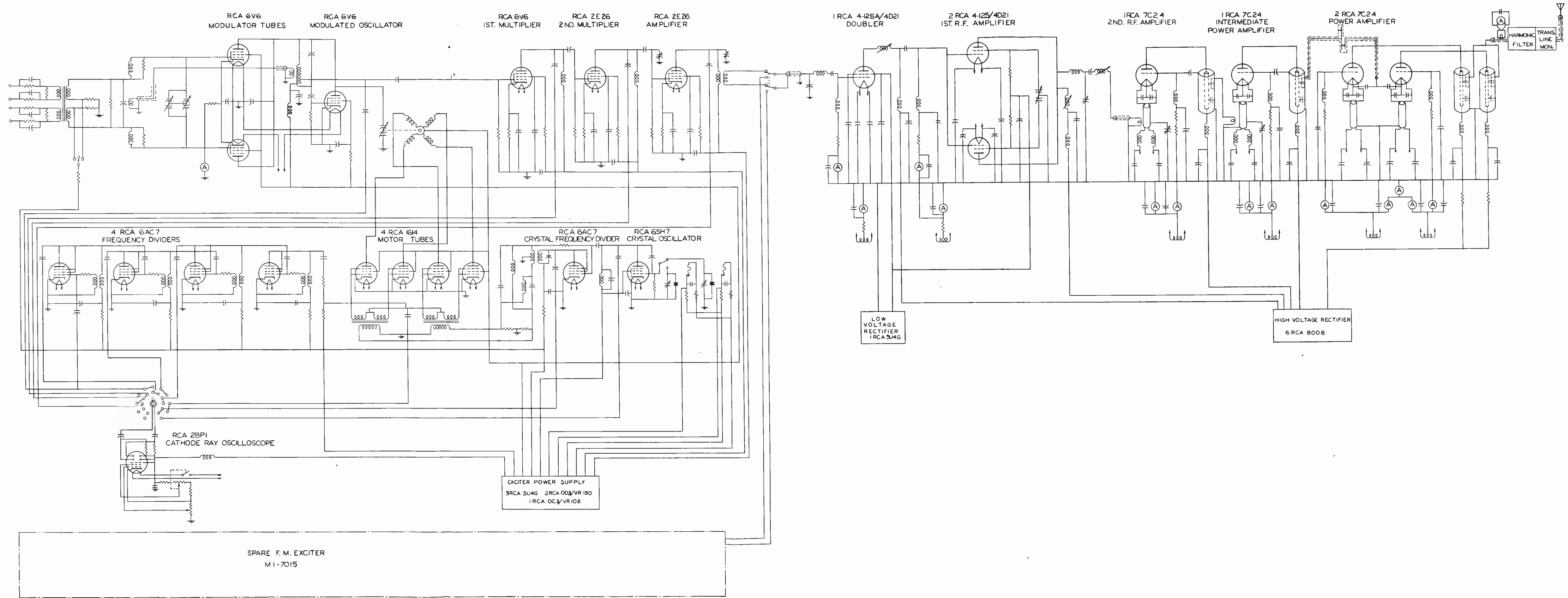
**INSTALLATION**

Installation engineering services are not included as a part of this specification but can be furnished separately if required. RCA Service Company of the Radio Corporation of America maintains a staff of broadcast equipment specialists who are available for supervising the station installation, tuning-up the transmitting equipment and servicing such equipment.

**CHANGE IN DESIGN**

In order to make improvements in design and to effect economies in manufacture, the RCA Victor Division of the Radio Corporation of America reserves the right to change the design of its products at any time, and in accordance with its sole judgment, while adhering in good faith to the intent of these specifications.





Simplified Schematic Drawing #309546

