



here is what you want  
in your 250 watt  
**AM TRANSMITTER**

**Raytheon**

**MANUFACTURING COMPANY**

# Simplified ... More Reliable

RAYTHEON's new RA-250 is a precision engineered, completely modern broadcast transmitter which incorporates many important improvements in a simplified circuit design.

Better program quality is achieved by specially designed audio transformers and triode type tubes having an inherently lower distortion level. The noise level is over 60 db below 100% modulation and the frequency response is flat between 30 and 10,000 cycles per second.

Simplified circuits, highest quality components which operate at well below their capacity, and triode type tubes give a more positive guarantee than ever before against program interruption. Even a feed-back failure does not put this transmitter off the air.

All controls are centralized on the front panel; all circuits are completely metered and instantly tested. It is necessary to tune only two stages, the RF drive amplifier and the power amplifier. Low speed motor tuning gives a positive micrometer adjustment of these stages.

Maintenance functions are made easy. Vertical type chassis, full length double rear doors and hinged full length side panels give instant accessibility to all wiring and component parts. Every part is directly accessible without having to first remove several others. Safety interlocks and a dead front panel protect operating personnel at all times.

Our broadcast engineers, experienced in the engineering and programing requirements of the modern broadcast station, have, we believe, achieved all the qualities most desired in an AM transmitter. You will note, too, that no quality has suffered for the good of another.



*View showing control panel*

# Ten Important Improvements

**Simplified, More Efficient Circuits**—A high level modulation system eliminates the necessity of complicated and critical adjustment of linear amplifiers and reduces harmonic distortion to a minimum. Low tube cost and considerably lower power consumption are added advantages of this system.

**Increased Operating Efficiency**—The use of most modern improved components which are operated at well below their maximum capacity together with simplified circuit design greatly increases overall operating efficiency.

**Greater Dependability**—Due to the use of Triode type tubes, feedback failure will not cause a complete breakdown and the signal quality will still be good. Feedback is actually unnecessary, in this simplified circuit, to put a signal on the air but its inclusion further improves the quality of the signal.

**Simple, Speedy and Accurate Tuning**—All operational controls are centralized on the front panel; it is not necessary to make any adjustments inside the transmitter. Every circuit is completely metered and instantly checked. Only two stages are tuned, the RF drive amplifier and the power amplifier. A clutch equipped low speed motor makes micrometer adjustment of these stages very simple.

**Silent Operation**—Natural air cooling means complete freedom from blower noise, permitting the use of microphones in the same room with the transmitter. This silent operation is especially appreciated by stations planning to locate their transmitter in their studio, or where it is advantageous in early or late programs to have the transmitter operator double as an announcer at the transmitting station.

**Low Audio Distortion**—Triode type tubes used in the audio stages of this transmitter have an inherently lower distortion level. Specially designed audio transformers reduce the audio distortion still further.

**Low Noise Level**—The noise level of the RA-250 far exceeds the minimum F.C.C. requirement. It is actually better than minus 60 db below 100% modulation.

**Easy Servicing**—Symmetrical mechanical layout and complete accessibility through double rear doors and hinged side panels make the RA-250 a favorite with broadcast engineers. Any component may be replaced and wiring checked with a minimum of time and effort. Full length hinged side panels swing open to expose all chassis cabling; double rear doors open the full height of the chassis.

**Quiet, Natural Air Cooling**—The RA-250 is so designed that natural ventilation adequately cools the transmitter at all times. Vertical chassis construction plus door and ceiling louvres allow free circulation of convective air currents. All danger of fire or other damage due to a blower failure is eliminated.

**Easily Meets All F.C.C. Requirements**—All electrical characteristics easily meet all requirements of the F.C.C. Each transmitter is completely *performance tested* and tuned to the correct operating frequency before it is shipped. All connections necessary for installation are clearly indicated and easy to make.

STRAIGHTFORWARD simplicity of design is readily apparent from the above schematic.

The RF circuit shows the 6J5 crystal oscillator with two crystal sockets either of which may be connected from a front panel switch. The plate circuit of the oscillator is made broad-band to eliminate tuning and reaction on the crystal frequency. The 807 buffer is operated as a class A stage with broad-band untuned plate circuit which insures complete isolation of the oscillator stage. An 813 operating well below maximum ratings drives the push-pull 810 final amplifier with a large reserve of driving power.

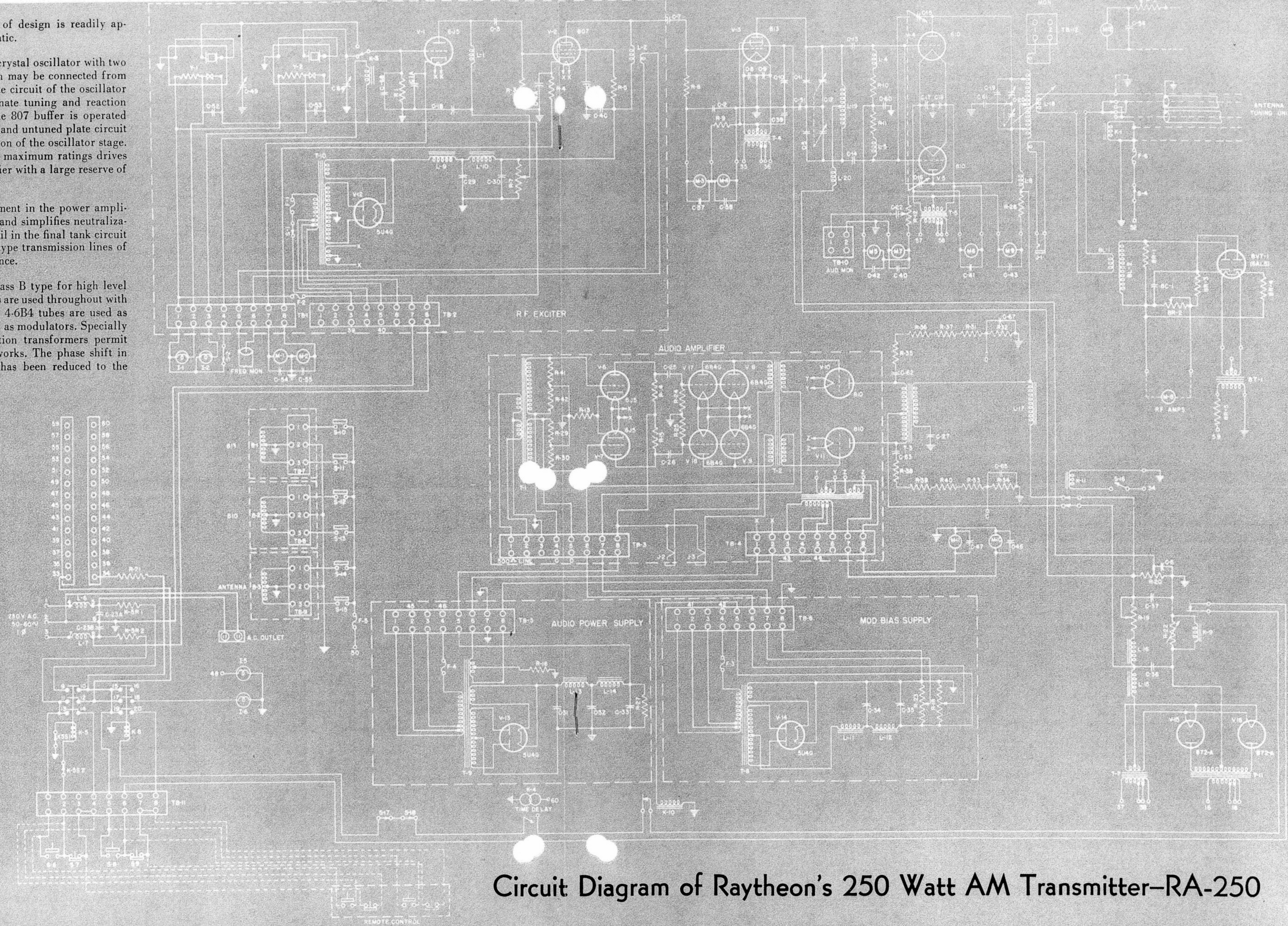
Use of the push-pull arrangement in the power amplifier reduces harmonic output and simplifies neutralization. The adjustable output coil in the final tank circuit is designed to feed standard type transmission lines of from 70 to 250 ohms impedance.

The audio system is of the class B type for high level modulation. Push-pull circuits are used throughout with 2-6J5 tubes in the first stage, 4-6B4 tubes are used as audio drivers and 2-810 tubes as modulators. Specially designed driver and modulation transformers permit proper use of feed-back networks. The phase shift in the modulation transformer has been reduced to the point where effective feedback is possible over the entire audio range of the transmitter. Distortion and noise are thus held to a minimum. Separate bias controls permit matching of modulator tubes for best operation.

The main power supply has been designed to provide ample margin for all percentages of modulation with excellent regulation. A separate bias supply is provided with interlock relay for the protection of the high power tubes.

Control, interlock and power starting circuits are designed for protection of the equipment and operating personnel as well as ease of operation and maintenance.

All component parts have been chosen to provide a good safety factor for long continued operation without failure.



Circuit Diagram of Raytheon's 250 Watt AM Transmitter-RA-250

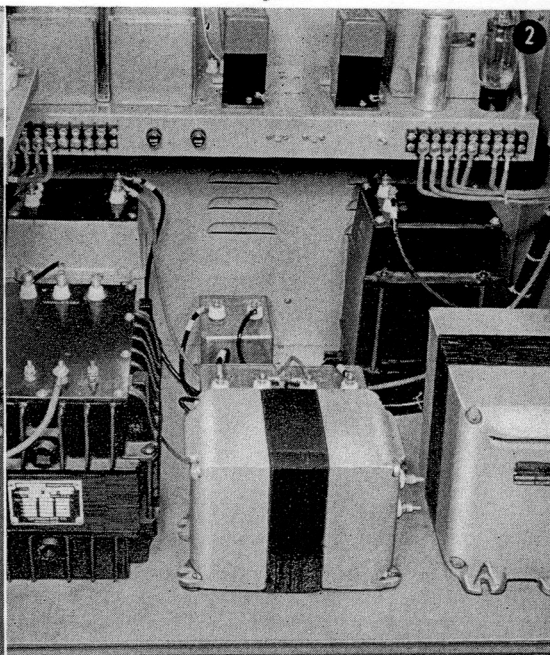
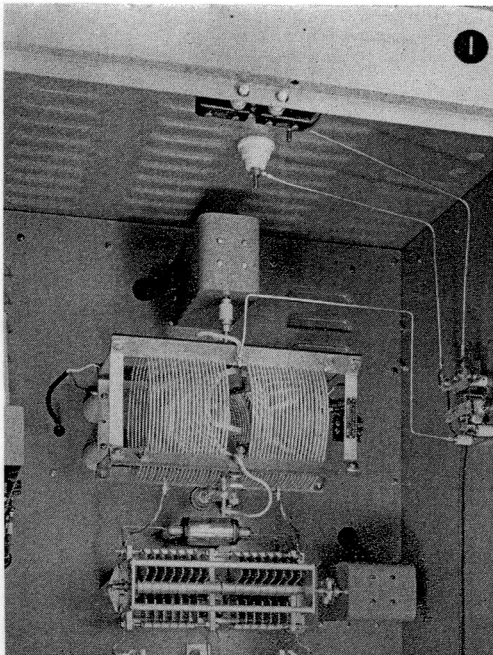
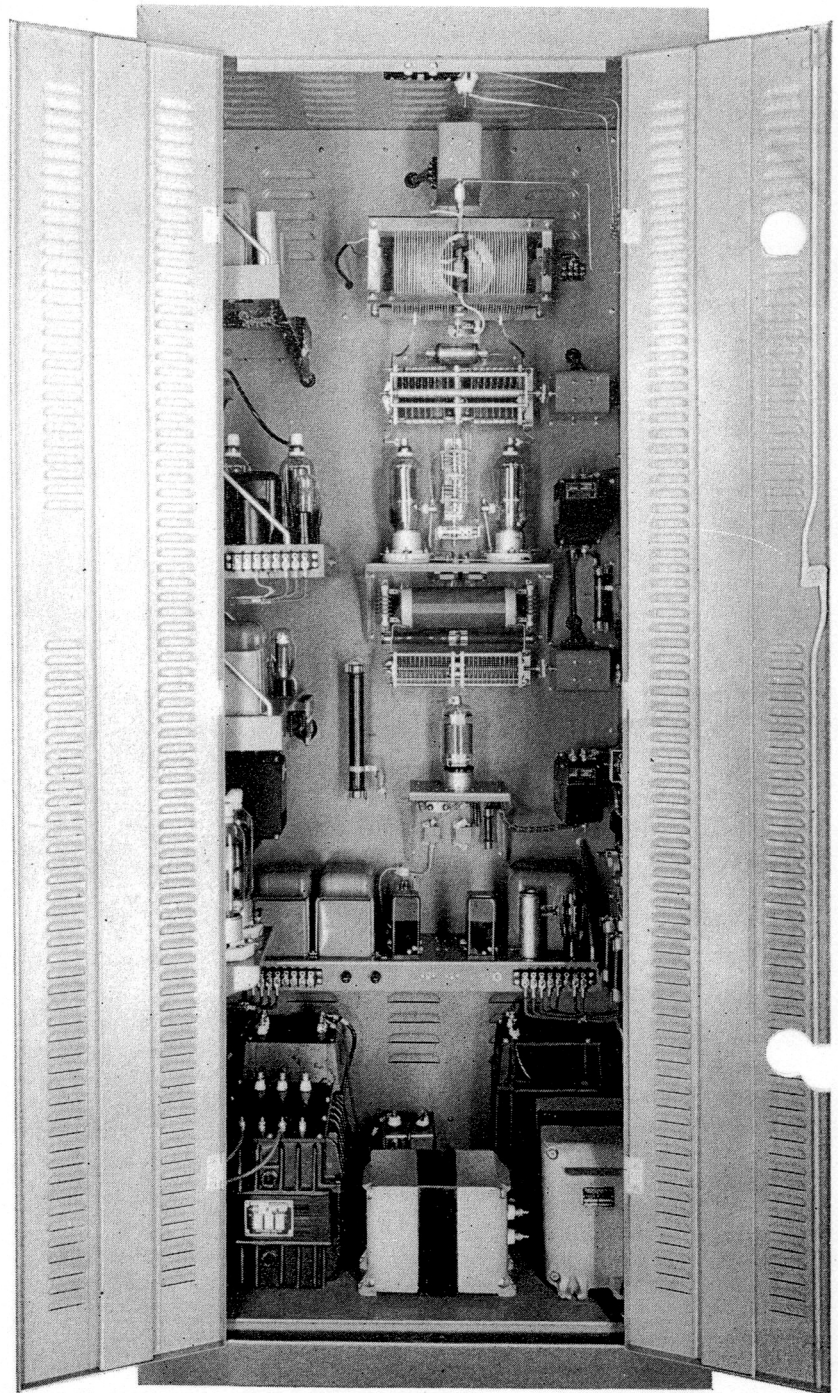
# MODERN VERTICAL CHASSIS CONSTRUCTION

THIS FULL LENGTH interior view shows the clean, modern vertical type of construction used in this transmitter. This type construction gives complete accessibility to all component parts, greatly simplifying maintenance and servicing. Circuit symmetry and highest efficiency have been achieved in the layout of all parts. Complicated gear or flexible shaft drive for tuning have been replaced with modern motor drive. Grouping of all controls on a single recessed panel located for convenience and operating ease is thus readily accomplished.

Using two full length doors, in place of one as commonly used, allows the transmitter to be placed much closer to a wall or partition without sacrificing accessibility. High voltage interlocks are, of course, provided on each door. A locking type door handle prevents unauthorized entry into the cabinet.

Placement of parts is evident from the picture. The large power and audio components are placed on a heavy sheet at the bottom of the cabinet. Facing the rear, the right hand wall carries all of the control relays and contractors. The front wall carries the radio frequency circuits starting with the oscillator and buffer chassis immediately above the power units followed by the 813 driver stage and the 810 output stage. The left wall carries several small chassis for rectifier tubes, bias supply, audio amplifier and modulation stages and low voltage power supply.

Openings are provided through the base and in the rear for conduit and wiring entrances. If coaxial line is used this may be brought in either overhead or through the base. An open wire line connection is furnished in the top only.



## 1. Symmetrical Layout Increases Efficiency

This view shows, in more detail, the RF output stage and the modulator chassis. Cleanness, accessibility and symmetrical layout are immediately evident.

## 2. Transformers and Buffer Chassis

The crystal oscillator and the buffer chassis is located immediately above the power units. This location keeps the unit away from heat generated by the rectifier and high power tubes.

# Specifications

## 250 Watt AM Transmitter—RA-250

### ELECTRICAL CHARACTERISTICS:

Nominal Carrier Output	250 Watts
Frequency Range	530 KC to 1600 KC
Power Supply	208/230 volts, 3 wire, single phase, 50-60 Cycles
Power Consumption	1700 Watts
Radio Frequency Stability	±10 Cycles
Modulation	100% High Level
Audio Input (500/600 ohm source) for 100% Modulation (1 Milliwatt Reference Level)	0 db
Average Program Level	-5 db (1 Milliwatt Reference Level)
Audio Frequency Response	±1 db from 30-10,000 Cycles
Audio Distortion (50-7500 Cycles) 1.8% or less with 85% Modulation	2.0% or less with 95% Modulation
Noise Level	60 db below 100% Modulation

### TUBE COMPLEMENT:

Oscillator	6J5
Buffer	807
R-F Driver	813
R-F Final	2 810's Push-Pull
Audio Amplifier	2 6J5's Push-Pull Triodes
Audio Driver	4 6B4G Push-Pull Parallel Triodes
Audio Modulator	2 810's Push-Pull Class B
R-F Low Voltage Power Supply Rectifier	350 Volt 200 ma 1-5U4G
Modulator Low Voltage Power Supply Rectifier	350 Volt 200 ma 1-5U4G
Modulator Bias Power Supply Rectifier	35 Volt 240 ma 1-5U4G
High Voltage Power Supply Rectifier	1500 Volt 700 ma 2-872a's

### MECHANICAL SPECIFICATIONS:

Weight	1200 Lbs.
Size	32 $\frac{5}{8}$ " Wide; 29" Deep; 80" High

## FCC FILING DATA

Applicants intending to use the Raytheon RA-250 Transmitter, in applying for a construction permit, are required to fill in the following technical information on pages 28, 29 and 30 of FCC Form No. 301.

*Paragraph 18 should be filled in as follows:*

- |   |   |
|---|---|
| (a) Raytheon Manufacturing Company Type RA-250                                    | (k) Should be filled in by applicant  |
| (b) (c) On file   | (l) Plate voltage meter, on file. Serial number should be supplied by applicant on installation of transmitter. Plate ammeter—same as plate voltage meter. Antenna ammeter—same as plate voltage meter. |
| (d) On file (except for last paragraph where "not applicable" should be inserted) | (m) On file   |
| (e) (f), (g) On file  | (n) 300 watts   |
| (h) Not applicable  | (o) 250 watts   |
| (i) On file   |   |
| (j) Should be filled in by applicant  |   |

*Paragraph 19 should be filled in as follows:*

- |  |  |
|--|--|
| (a) Raytheon Manufacturing Company part of Type RA-250 | and Third lines—Applicant must insert frequency in kilocycles at 60° centigrade. |
| (b) On file  | (d) (e), (f), (g), (h), (i), (j), (k), (l), (m) On file                          |
| (c) First line insert "Manufacturer," Second           |  |