

Instruction Book

242F-2
VHF TRANSMITTER



COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA

520 5031 010

Original Issue 1 August 1954

Revised 1 December 1955

GUARANTEE

The equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory, transportation prepaid, provided

- (a) Notice of the claimed defect is given Collins within one (1) year from date of delivery and goods are returned in accordance with Collins' instructions.
- (b) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins' designs are subject to only such adjustments as Collins may obtain from the supplier thereof.
- (c) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal or proper manner.

Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins or its authorized service center.

No other warranties, expressed or implied, shall be applicable to any equipment sold hereunder, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

HOW TO RETURN MATERIAL OR EQUIPMENT. If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. (With respect to tubes we suggest that your adjustments can be speeded up if you give notice of defect directly to the tube manufacturer.) Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

INFORMATION NEEDED:

- (A) Type number, name, and serial number of equipment
- (B) Date of delivery of equipment
- (C) Date placed in service
- (D) Number of hours of service
- (E) Nature of trouble
- (F) Cause of trouble if known
- (G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
- (H) Item or symbol number of same obtained from parts list or schematic
- (I) Collins' number (and name) of unit sub-assemblies involved in trouble
- (J) Remarks

HOW TO ORDER REPLACEMENT PARTS. When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

INFORMATION NEEDED:

- (A) Quantity required
- (B) Collins' part number (9 or 10 digit number) and description
- (C) Item or symbol number obtained from parts list or schematic
- (D) Collins' type number, name, and serial number of principal equipment
- (E) Unit sub-assembly number (where applicable)

TABLE OF CONTENTS

| <u>Paragraph</u> | | <u>Page</u> |
|-----------------------------|---|-------------|
| SECTION I | | |
| GENERAL DESCRIPTION | | |
| 1-1 | Purpose of Instruction Book | 1-1A |
| 1-2 | Purpose of Equipment | 1-1A |
| 1-3 | Equipment Supplied | 1-2 |
| 1-4 | Equipment Required but Not Supplied | 1-2 |
| 1-5 | Accessory Equipment Available | 1-4 |
| 1-6 | Description of Equipment | 1-4 |
| 1-7 | Technical Data | 1-6 |
| 1-8 | Tube Complement | 1-9A |
| 1-9 | Fuse Complement | 1-10A |
| SECTION II | | |
| INSTALLATION AND ADJUSTMENT | | |
| 2-1 | Unpacking | 2-1A |
| 2-2 | Location and Mounting of Transmitter | 2-1A |
| 2-3 | Location and Mounting of 35D-2 Filter | 2-6 |
| 2-4 | Transmitter Connections | 2-7 |
| 2-5 | Tube Placement | 2-9A |
| 2-6 | Crystal Placement | 2-11A |
| 2-7 | Adjustment | 2-11A |
| SECTION III | | |
| OPERATION | | |
| 3-1 | General | 3-0 A |
| 3-2 | Controls and Indications | 3-0 A |
| 3-3 | Operating Procedure | 3-1A |
| SECTION IV | | |
| THEORY OF OPERATION | | |
| 4-1 | General | 4-1 |
| 4-2 | R-F Unit | 4-1 |
| 4-3 | Modulator | 4-7 |
| 4-4 | Power Supply | 4-13 |
| 4-5 | Control Circuits | 4-15A |
| 4-6 | 35D-2 Low Pass Filter | 4-18A |

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT)

| <u>Paragraph</u> | | <u>Page</u> |
|------------------|---|-------------|
| SECTION V | | |
| MAINTENANCE | | |
| 5-1 | General | 5-1 |
| 5-2 | Test Equipment Required for Maintenance | 5-1 |
| 5-3 | Preventive Maintenance | 5-1 |
| 5-4 | Corrective Maintenance | 5-5A |

SECTION VI

PARTS LIST

| | | |
|-----|---|-------|
| 6-1 | Parts List for 242F-2 Transmitter | 6-1A |
| 6-2 | Parts List for 35D-2 Filter | 6-16A |

SECTION VII

ILLUSTRATIONS

LIST OF TABLES

| <u>Table</u> | | <u>Page</u> |
|--------------|---|-------------|
| 1-1 | Equipment Supplied | 1-2 |
| 1-2 | Equipment Required but Not Supplied | 1-2 |
| 1-3 | Accessory Equipment Available | 1-4 |
| 1-4A | 242F-2 Transmitter Tube Complement | 1-9A |
| 1-5A | 242F-2 Transmitter Fuse Complement | 1-10A |
| 2-1 | Tuning Procedure for 242F-2 Transmitter | 2-12A |
| 3-1A | Controls | 3-0A |
| 3-2A | Indicators | 3-1A |
| 3-3 | Normal Readings of Tuning Meter | 3-2A |

LIST OF ILLUSTRATIONS

| <u>Figure</u> | | <u>Page</u> |
|---------------|---|-------------|
| 1-1A | Collins Type 242F-2 VHF Transmitter | 1-0A |
| 1-2A | Collins Type 35D-2 Low Pass Filter | 1-1A |
| 2-1 | Type 242F-2 R-F Unit, Outline and Mounting Dimensions | 2-2 |
| 2-2 | Type 242F-2 Modulator Unit, Outline and Mounting Dimensions | 2-3 |

LIST OF ILLUSTRATIONS (CONT)

| <u>Figure</u> | | <u>Page</u> |
|---------------|---|-------------|
| 2-3 | Type 242F-2 Filter and Bias Supply Unit, Outline and Mounting Dimensions | 2-4 |
| 2-4 | Type 242F-2 Rectifier and Control Unit, Outline and Mounting Dimensions | 2-5 |
| 2-5 | Type 242F-2 Transmitter, Interconnections Diagram | 2-6 |
| 2-6 | Interconnecting Cable for 242F-2 Transmitter | 2-9A |
| 2-7A | Exploded View of Power Amplifier Assembly | 2-10A |
| 2-8 | Oscilloscope Harness for 242F-2 Transmitter | 2-14 |
| 4-1 | Type 242F-2 VHF Transmitter, Block Diagram | 4-0 |
| 4-2A | Oscillator Frequency Doubler, Simplified Schematic Diagram | 4-2A |
| 4-3A | Frequency Tripler and Doubler, Simplified Schematic Diagram | 4-2A |
| 4-4A | R-F Driver, Simplified Schematic Diagram | 4-3A |
| 4-5A | Power Amplifier, Simplified Schematic Diagram | 4-4A |
| 4-6 | Tuning Meter Circuit, Simplified Schematic Diagram | 4-6 |
| 4-7 | Audio Input Circuits and Audio Preamplifier, Simplified Schematic Diagram | 4-7 |
| 4-8 | Audio Limiter, Simplified Schematic Diagram | 4-8 |
| 4-9 | Audio Amplifier, Simplified Schematic Diagram | 4-8 |
| 4-10 | Audio Driver and Modulator, Simplified Schematic Diagram | 4-10 |
| 4-11 | Modulator Meter Circuit, Simplified Schematic Diagram | 4-10 |
| 4-12 | High Voltage Supply, Simplified Schematic Diagram | 4-12 |
| 4-13 | Low Voltage Supply, Simplified Schematic Diagram | 4-12 |
| 4-14 | Bias Supply, Simplified Schematic Diagram | 4-14 |
| 4-15 | Filament Circuits, Simplified Schematic Diagram | 4-14 |
| 4-16A | Control Circuits, Simplified Schematic Diagram | 4-16A |
| 4-17A | Type 35D-2 Low Pass Filter, Simplified Schematic Diagram | 4-18A |
| 5-1A | Trouble-Shooting Chart for Type 242F-2 Transmitter | 5-3, 5-4 A |
| 5-2A | Type 242F-2 R-F Unit, Voltage and Resistance Measurements Diagram | 5-7A |
| 5-3 | Type 242F-2 Modulator Unit, Voltage and Resistance Measurements Diagram | 5-8 |
| 7-1A | Type 242F-2 R-F Unit, Front View | 7-1A |
| 7-2A | Type 242F-2 R-F Unit, Rear View, Dust Cover Removed | 7-2A |
| 7-3A | Type 242F-2 R-F Driver Subchassis, Rear View, Shield Removed | 7-3A |
| 7-4A | Power Amplifier Assembly, Plate Cover Removed | 7-3A |
| 7-5A | Power Amplifier Assembly, Grid Cover Removed | 7-4A |
| 7-6 | Type 242F-2 Modulator Unit, Front View | 7-5 |
| 7-7 | Type 242F-2 Modulator Unit, Rear View, Dust Cover Removed | 7-6 |
| 7-8 | Type 242F-2 Filter and Bias Supply Unit, Front View | 7-7 |
| 7-9 | Type 242F-2 Filter and Bias Supply Unit, Rear View, Dust Cover Removed | 7-8 |
| 7-10 | Type 242F-2 Rectifier and Control Unit, Front View | 7-9 |
| 7-11A | Type 242F-2 Rectifier and Control Unit, Rear View, Dust Cover Removed | 7-10A |
| 7-12 | Type 242F-2 Transmitter, Rear View, Dust Cover On | 7-11 |
| 7-13A | Type 35D-2 Low Pass Filter, Cover Removed | 7-12A |
| 7-14A | Type 242F-2 VHF Transmitter, Complete Schematic Diagram | 7-13A |

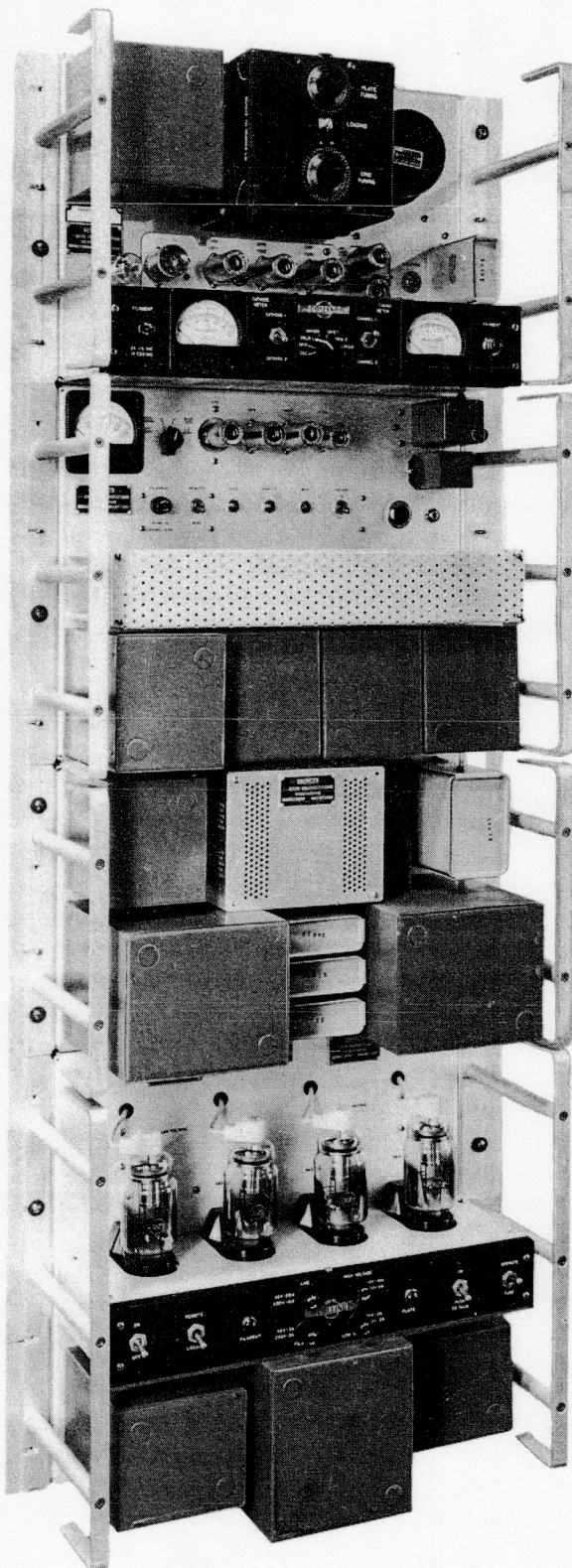


Figure 1-1A. Collins Type 242F-2 VHF Transmitter

SECTION I

GENERAL DESCRIPTION

1-1. PURPOSE OF INSTRUCTION BOOK.

This instruction book has been prepared to assist in the installation, adjustment, operation, and maintenance of the Collins Type 242F-2 VHF Transmitter. It also contains information on the 35D-2 Low Pass Filter, which is supplied with the transmitter.

1-2. PURPOSE OF EQUIPMENT.

The 242F-2 equipment, shown in figure 1-1A, is a crystal controlled, 200-watt, VHF Ground-Station Transmitter. It is designed for continuous duty operation on a single channel in the 108 to 152 mc. frequency range. It is capable of non-simultaneous operation on two channels if the channel separation is within 0.3% of the frequency to which the transmitter is tuned.

The 242F-2 is capable of either cw or amplitude-modulated cw operation. It may be used either as a point-to-point communications transmitter or as the transmitter section of a VOR installation.

The 35D-2 Low Pass Filter, shown in figure 1-2A, is included with the 242F-2 equipment. This filter, when connected between the transmitter output terminal and the transmission line to the antenna, attenuates harmonic frequencies which fall in the UHF band between 216 and 456 mc.

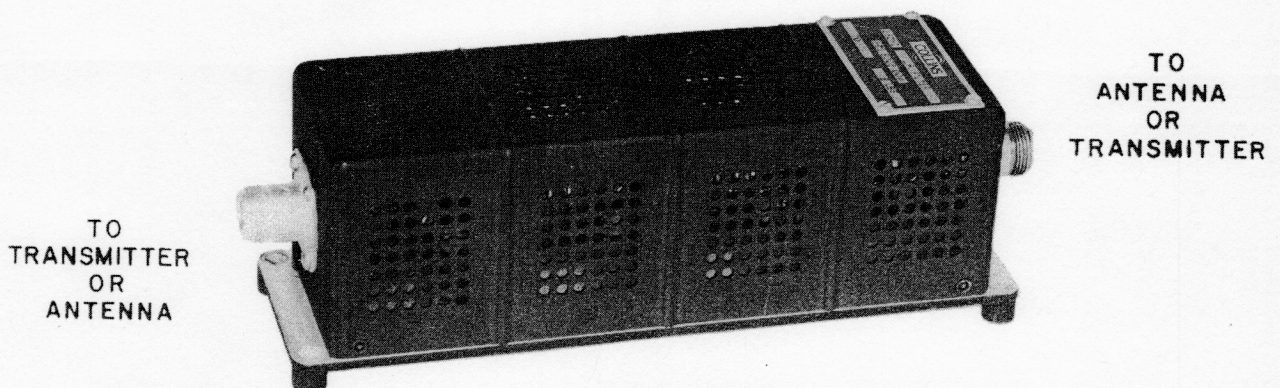


Figure 1-2A. Collins Type 35D-2 Low Pass Filter

1-3. EQUIPMENT SUPPLIED.

TABLE 1-1
EQUIPMENT SUPPLIED

| NAME OF UNIT | COLLINS PART NUMBER | DIMENSION (INCHES) | WEIGHT (POUNDS) |
|---------------------------------------|------------------------|--------------------------------|-----------------|
| 242F-2 R-F Unit | 561 1085 004 | 19 W x 12-1/4 H x 7 12 D | 42 |
| 242F-2 Modulator Unit | 561 1086 004 | 19 W x 14 H x 12 D 8 | 55 |
| 242F-2 Filter and Bias Supply Unit | 561 1087 004 | 19 W x 10-1/2 H x 6 12 D | 88 |
| 242F-2 Rectifier and Control Unit | 561 1088 004 | 19 W x 15-3/4 H x 9 12 D | 79 |
| 35D-2 Low Pass Filter | 522 8028 004 | 7-1/4 L x 2-3/8 W x 2-3/8 H | 2 |
| A-C Cable (W101) | 561 1406 002 | | |
| A-C Cable (W102) | 561 1407 002 | | |
| D-C Interconnecting Cable (W103) | 561 1408 005 | | |

1-4. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

The following equipment is required in a normal installation of the 242F-2 Transmitter but is not supplied by Collins Radio Company as a part of the 242F-2 equipment.

TABLE 1-2
EQUIPMENT REQUIRED BUT NOT SUPPLIED

| ITEM | TYPE | FUNCTION | DESCRIPTION |
|----------|-----------------------|-------------------------------------|--|
| Crystals | MIL Type CR - 27/U | Control frequency of r-f output. | One crystal is required. The frequency must be within the range 9.000 to 12.667 mc. (The output frequency of the transmitter is the twelfth multiple of the crystal frequency.) Two crystals may be used, if de- |

TABLE 1-2 (CONT)

EQUIPMENT REQUIRED BUT NOT SUPPLIED

| ITEM | TYPE | FUNCTION | DESCRIPTION |
|--|--|---|--|
| Crystals (Cont) | MIL Type CR - 27/U | Control frequency of r-f output. | sired; the second crystal may provide the same output frequency as the first, and thus serve as a spare, or it may provide an output frequency separated up to 0.3% from the first, and thus provide for two-channel operation. With the transmitter tuned to the first frequency, the r-f power loss at the second one is less than 0.5 db. |
| Coaxial Cable | RG - 8/U | Connects ANT output connector of transmitter to 35D-2 input, and 35D-2 output to antenna. | 52 ohm. |
| Type N Connectors | UG-21B/U | Connect coaxial cable to receptacles on transmitter, 35D-2 filter, and antenna. | Four connectors are required. |
| Antenna | | | 52 ohm, VHF. |
| Microphone | Either a high-impedance dynamic, or a carbon type. | | <u>Dynamic:</u> must have push-to-talk button. <u>Carbon:</u> T-17 or equivalent. (25 ma. button current is available.) Must have push-to-talk button. |
| Telephone Lines (for Remote Control) | | Connect Remote Control Unit to Modulator Unit. | One or more pair are required, depending on the installation. Total resistance of each loop must be less than 1200 ohms; (attenuation of one pair must be less than 15 db.) |

1-5. ACCESSORY EQUIPMENT AVAILABLE.

The following equipments are available from Collins Radio Co. as accessories to the 242F-2 Transmitter equipment.

TABLE 1-3

ACCESSORY EQUIPMENT AVAILABLE

| NAME OF UNIT | COLLINS PART NUMBER | DIMENSIONS (INCHES) |
|--|------------------------|---------------------|
| 10-1/2" Front Dust Cover* | 561 1931 003 | 19 W x 10-1/2 H |
| 12-1/4" Front Dust Cover* | 561 1930 003 | 19 W x 12-1/4 H |
| 14" Front Dust Cover* | 561 1932 003 | 19 W x 14 H |
| 15-3/4" Front Dust Cover* | 561 1929 003 | 19 W x 15-3/4 H |
| 10-1/2" Mounting Bracket, Recessed* | 561 1262 003 | |
| 12-1/4" Mounting Bracket, Recessed* | 561 1316 003 | |
| 14" Mounting Bracket, Recessed* | 561 1274 003 | |
| 15-3/4" Mounting Bracket, Recessed* | 561 1290 003 | |

*NOTE: 10-1/2" units are for 242F-2 Filter and Bias Supply Unit
 12-1/4" units are for 242F-2 R-F Unit
 14" units are for 242F-2 Modulator Unit
 15-3/4" units are for 242F-2 Rectifier and Control Unit

1-6. DESCRIPTION OF EQUIPMENT.

a. 242F-2 TRANSMITTER.

(1) MECHANICAL. - The 242F-2 Transmitter is composed of four physical units: The R-F Unit, the Modulator Unit, the Filter and Bias Supply Unit, and the Rectifier and Control Unit. The chassis of each unit is designed for vertical mounting on a standard 19 inch mounting rack. The tubes and main components are mounted on the front of the chassis; the wiring and the smaller components are mounted on the rear. The fronts of the chassis are left open in order that convection cooling may take place; the rears are covered by individual, removable, dust covers. A control panel along the bottom of the front of the R-F Unit holds the meters, fuses, switches, and indicators associated with that unit. A control panel along the center of the Rectifier and Control Unit holds the fuses, switches, and indicators associated with that unit. The meter, fuse, and switches associated with the Modulator Unit are mounted on the front of the chassis of that unit. A four-pole, flush-mounted connector and a three-pole jack, also on the Modulator Unit chassis, provide for connecting the dynamic microphone and the carbon microphone, respectively, to the transmitter.

All electrical connections to the transmitter, other than the microphone ones, are made through receptacles mounted on flanges at the rear of the four chassis. The a-c power connections are made through five two-pole receptacles along the right sides of the chassis. The high-voltage d-c connections are made through six single-contact connectors along the left sides of the chassis. The other d-c connections and all the control signal connections are made through five Jones connectors along the left sides. The r-f connections are made through two Type N coaxial receptacles located on the right flange of the R-F Unit chassis. The lower receptacle provides for connecting the transmitter output to the antenna; the upper one provides for connecting the receiver to the antenna during non-transmitting periods.

A subchassis, mounted on the rear side of the R-F Unit chassis, holds the oscillator, frequency multiplier, and driver circuits. The components of this assembly are enclosed by an easily removable shield. The controls and tubes are accessible from the front of the equipment through a cutaway area of R-F Unit chassis. Electrical connections to the circuits are made through a receptacle mounted at the rear of the subchassis and accessible through a cutaway area of the shield.

(2) ELECTRICAL. - The r-f output of the transmitter is controlled by a MIL type CR-27/U crystal located in a temperature controlled oven. The output frequency of the transmitter is the twelfth multiple of the crystal frequency. Accommodations are provided for a second crystal to be placed within the same oven. The second crystal may provide the same output frequency as the first one, and thus serve as a spare, or it may provide an output frequency which is within 0.3% of the first one, and thus provide for operation on a second channel. One or the other crystal is at all times connected to the r-f oscillator circuit, the selection being made by a switch on the R-F Unit front panel.

The output of the selected crystal is successively doubled, tripled, and doubled, then applied to the grids of a straight-through push-pull driver. The output of the driver is applied to the grids of a power amplifier, consisting of two parallel 4x250B tetrodes operating in coaxial grid and plate circuits. The power amplifier supplies r-f energy, in the frequency range 108 to 152 mc, to the antenna through the 35D-2 filter. The output of the 35D-2 consists of at least 200 watts of r-f power.

The modulator portion of the equipment receives audio signals from one of three sources: a high-impedance dynamic microphone, a carbon microphone, or a pair of telephone lines. The signals are amplified, then applied to the grids of a push-pull audio driver stage. The output of the driver is applied to the grids of a push-pull modulator stage. The modulator stage superimposes the audio signals upon the d-c voltages supplied to the plates and screens of the power amplifier tubes.

A limiting circuit, composed of two diode clippers, a low pass filter, and an audio amplifier, may be connected into the modulator circuits by means of a toggle switch on the front of the Modulator Unit chassis. The limiter clips the audio signals at a manually adjustable level; it thus automatically limits the per cent modulation of the carrier to the desired level. The limiter is useful for those operating conditions where the operator is not able to manually monitor the audio level.

b. 35D-2 LOW PASS FILTER.

(1) MECHANICAL. - The 35D-2 Low Pass Filter is enclosed in a rectangular brass

case 8-1/8 inches long by 2-3/8 inches wide by 2-5/8 inches high. All components are accessible, for maintenance, upon removal of the base plate. The interior is divided into four equal shielded compartments by three brass dividers. The inside of the case is silverplated while the outside has a black wrinkle finish. The r-f connections to the filter are made through two Type N coaxial receptacles, one mounted at either end of the case.

(2) ELECTRICAL. - The 35D-2 is designed for use with transmitters with output frequencies up to 152 mc and output powers up to 250 watts CCS. Either an unbalanced 52 ohm transmission line or a balanced line, with a Balun transformer, may be used. The filter consists of four L-C sections connected in cascade. Each section is enclosed within one of the shielded compartments of the case. The filter provides an attenuation of less than 0.8 db (10 watts loss for a 50 watt filter output) to signals in the frequency range 108 to 152 mc and an attenuation of at least 60 db to signals in the frequency range 216 to 456 mc.

1-7. TECHNICAL DATA.

a. GENERAL.

- | | |
|-------------------------------|--|
| (1) Ambient Temperature Range | -35°C to +55°C. For operation below +25°C, type 3B25 rectifiers should be substituted for 866A rectifiers. |
| (2) Ambient Humidity Range | 0 to 90% relative humidity. |
| (3) Altitude | Sea level up to 7000 feet. |
| (4) Duty Cycle | Continuous commercial service. |
| (5) Power Source | 105-115 or 210-230 VAC, 50 or 60 cycles, single phase with a standby power requirement of 400 watts and a full load transmit power requirement of 1500 watts. The unit can be operated from 105 or 115 VAC with the primary windings of the power transformers connected in parallel and from 210 or 230 VAC with the windings connected in series. Special taps on the windings adapt the transformers for 105 and 210 VAC operation. |
| (6) Power Factor | 90% lagging. |

b. R-F SECTION.

- | | |
|-----------------------|---|
| (1) Frequency Range | 108 to 152 megacycles. |
| (2) Frequency Control | CR-27/U crystal, the frequency of which is 1/12 the output frequency. |

- (3) Frequency Stability $\pm 0.001\%$ under any natural combination of service conditions.
- (4) Channels The transmitter is designed for single-channel operation. A second channel may be provided without retuning by adding a second crystal which provides an output frequency within 0.3% of the operating frequency.
- (5) R-F Power Output For channel to which transmitter is tuned: At least 200 watts, over frequency limits, delivered into 52-ohm resistive load through 10 feet of RG-8/U cable.
- (6) Loss of Power Output for Second Channel Less than 0.5 db for frequency 0.3% off tuned frequency. 1.0 db for frequency 0.4% off tuned frequency.
- (7) R-F Output Impedance 52 ohms, nominal. The transmitter will operate into a load connected through a 52 ohm transmission line having a standing wave ratio of 2 to 1 or less.
- (8) Harmonics and Other Spurious Production Harmonics are at least 40 db below carrier level. All other spurious productions are at least 80 db below carrier level. Additional harmonic attenuation may be obtained by the addition of a Collins Type 35D-2 Low Pass Filter.

c. MODULATOR SECTION.

- (1) Modulation Type High level amplitude modulation is obtained through use of a plate and screen modulation transformer.
- (2) Modulation Percentage At least 90% modulation is obtained from 300 to 3750 cps or 300 to 10,000 cps, depending upon the application.
- (3) Carrier Shift The power output decreases less than 10% over the range of 0 to 90% modulation.

(4) Audio Frequency Distortion

The audio frequency distortion is less than 10% with a modulation level of 90% without clipping.

(5) Audio Input

A microphone input circuit is designed to operate from a 100 ohm carbon microphone, having an output of at least 0.25 volts rms, or a dynamic high-impedance microphone. An input circuit for a pair of 600-ohm telephone lines is also provided for remote operation. When operating remote, the same pair of lines which carries the balanced audio carries two control signals which turn the unit on and operate the plate supply, respectively.

(6) Audio Frequency Response

The audio frequency response of the unit is flat to ± 3 db with respect to 1000 cps over a range of 300 to 3750 cps and flat to ± 4 db up to 10,000 cps. The variation in response at 9960 ± 500 cps will be less than ± 0.5 db. For communication only, the frequency response can be made flat to ± 2 db with respect to 1000 cps over a range of 300 to 3750 cps and attenuated at least 10 db above 7500 cps by connection of a single jumper in the unit. This is measured at a level for 90% modulation without clipping.

(7) Noise Level

The noise level is more than 40 db below 100% modulation, without clipping.

1-8. TUBE COMPLEMENT.

TABLE 1-4A
242F-2 TRANSMITTER TUBE COMPLEMENT

| SYMBOL | TYPE | FUNCTION |
|--------|----------------|--------------------|
| V-101 | 866A or 3B25 ✓ | Rectifier |
| V-102 | 866A or 3B25 ✓ | Rectifier |
| V-103 | 866A or 3B25 ✓ | Rectifier |
| V-104 | 866A or 3B25 ✓ | Rectifier |
| V-201 | 5686 ✓ | R-f Oscillator |
| V-202 | 5686 ✓ | R-f Tripler |
| V-203 | 5686 ✓ | R-f Doubler |
| V-204 | 5686 ✓ | R-f Driver |
| V-205 | 5686 ✓ | R-f Driver |
| V-206 | 4x250B | Power Amplifier |
| V-207 | 4x250B | Power Amplifier |
| V-301 | 5751 | Audio Preamplifier |
| V-302 | 5814 ✓ | Audio Amplifier |
| V-303 | 5726 ✓ | Audio Limiter |
| V-304 | 5814 ✓ | Audio Amplifier |
| V-305 | 6B4G | Audio Driver |
| V-306 | 6B4G | Audio Driver |
| V-307 | 811A ✓ | Audio Modulator |
| V-308 | 811A ✓ | Audio Modulator |

1-9. FUSE COMPLEMENT.

TABLE 1-5A
242F-2 TRANSMITTER FUSE COMPLEMENT

| SYMBOL | SIZE | LOCATION | TITLE |
|--------|--|----------------------------|--------------|
| F-101 | 115 V a-c: 20A ✓ 230 V a-c: 10A | Rectifier and Control Unit | LINE |
| F-102 | 115 V a-c: 5A ✓ 230 V a-c: 3A | Rectifier and Control Unit | FILAMENT |
| F-103 | 115 V a-c: 10A 8 230 V a-c: 5A | Rectifier and Control Unit | HIGH VOLTAGE |
| F-104 | 115 V a-c: 5A ✓ 230 V a-c: 3A | Rectifier and Control Unit | LOW VOLTAGE |
| F-105 | 115 V a-c: 0.250A ✓ 230 V a-c: 0.125A | Rectifier and Control Unit | BIAS |
| F-201 | 115 V a-c: 3A 2 230 V a-c: 2A | R-F Unit | FILAMENT |
| F-301 | 115 V a-c: 1A ✓ 230 V a-c: 0.5A | Modulator Unit | FILAMENT |

SECTION II

INSTALLATION AND ADJUSTMENT

2-1. UNPACKING.

Unpack the equipment carefully. Remove the packing material and lift the units out of their cartons. Inspect each component for apparent damage. Check all switches and control knobs for proper mechanical operation; inspect the meters for broken panel glass. All claims for damage should be filed promptly with the transportation company. If a claim is to be filed, the original packing carton and the packing material must be preserved.

2-2. LOCATION AND MOUNTING OF TRANSMITTER.

a. LOCATION. - The following factors should be considered during the selection of a permanent location for the transmitter installation:

(1) TRANSMISSION LINE. - The transmitter should be located close to the antenna to minimize transmission line losses. (Since RG-8/U cable has an attenuation loss of approximately 2.5 db/100 feet in the frequency range of the transmitter, it is apparent that one-half of the transmitter output power will be lost in approximately 120 feet of RG-8/U cable.)

(2) VENTILATION. - Since all of the transmitter tubes except the 4x250Bs are convection cooled, the area in which the transmitter is located must be well ventilated.

(3) ACCESSIBILITY. - At least three feet of clearance should be allowed in front of and behind the transmitter for servicing and adjustment.

b. MOUNTING. - The transmitter is designed for vertical mounting on a standard 19 inch rack. In order that the interconnecting cable will fit, the units must be mounted in the following order, from top to bottom: R-F Unit, Modulator Unit, Filter and Bias Supply Unit, Rectifier and Control Unit. Figures 2-1, 2-2, 2-3, and 2-4, respectively, show the outline and mounting dimensions of the four units. A flange on either side of each chassis provides the means for attaching it to the rack. Twenty-eight number 10 screws are required for mounting.

When the transmitter is mounted normally, all of the chassis are flush with the mounting rack. The components on the front of the chassis protrude a maximum of seven inches, those on the back a maximum of ten inches (including the connecting cables). If the transmitter must be mounted so that there is no forward protrudance, special recessed mounting brackets must be used. These brackets, available from Collins Radio Company under the parts numbers listed in Table 1-3, mount the equipment so that there is no forward protrudance, but seventeen inches rearward protrudance.

The transmitter is designed for operation with the fronts of its units open. For ambient temperatures below +45°C, however, front covers may be used to protect

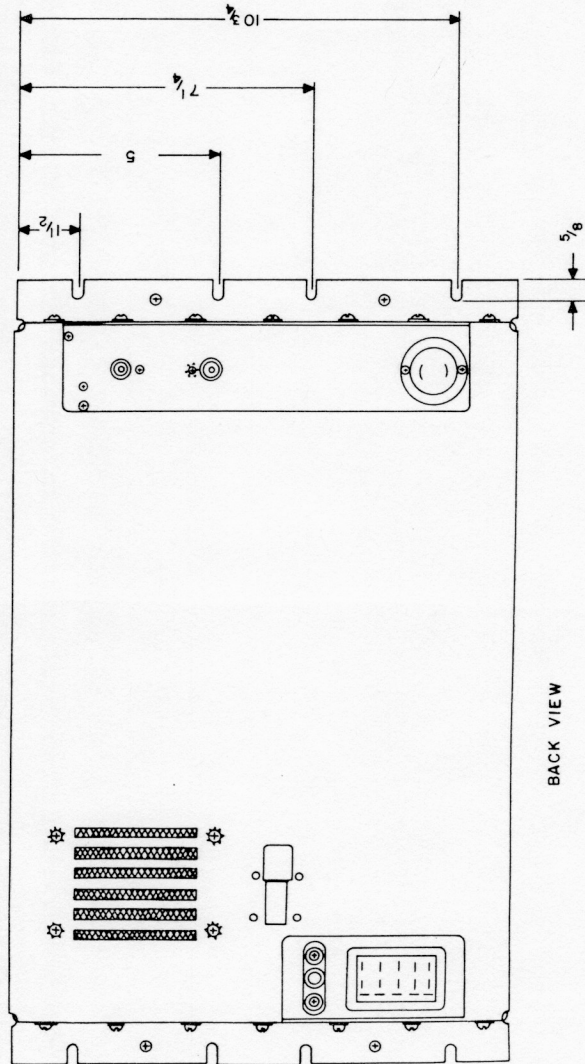
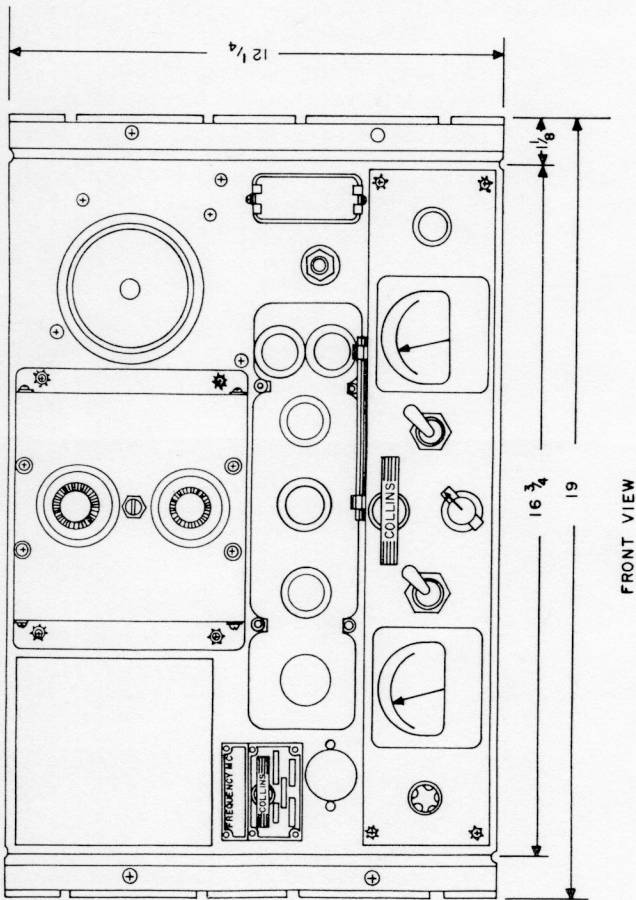
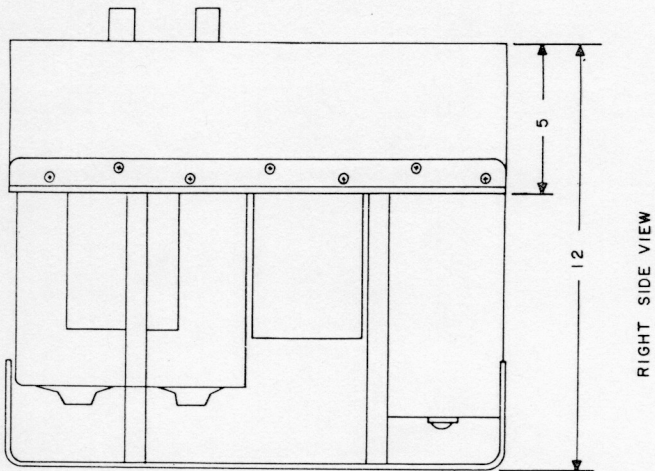


Figure 2-1. Type 242F-2 R-F Unit, Outline and Mounting Dimensions

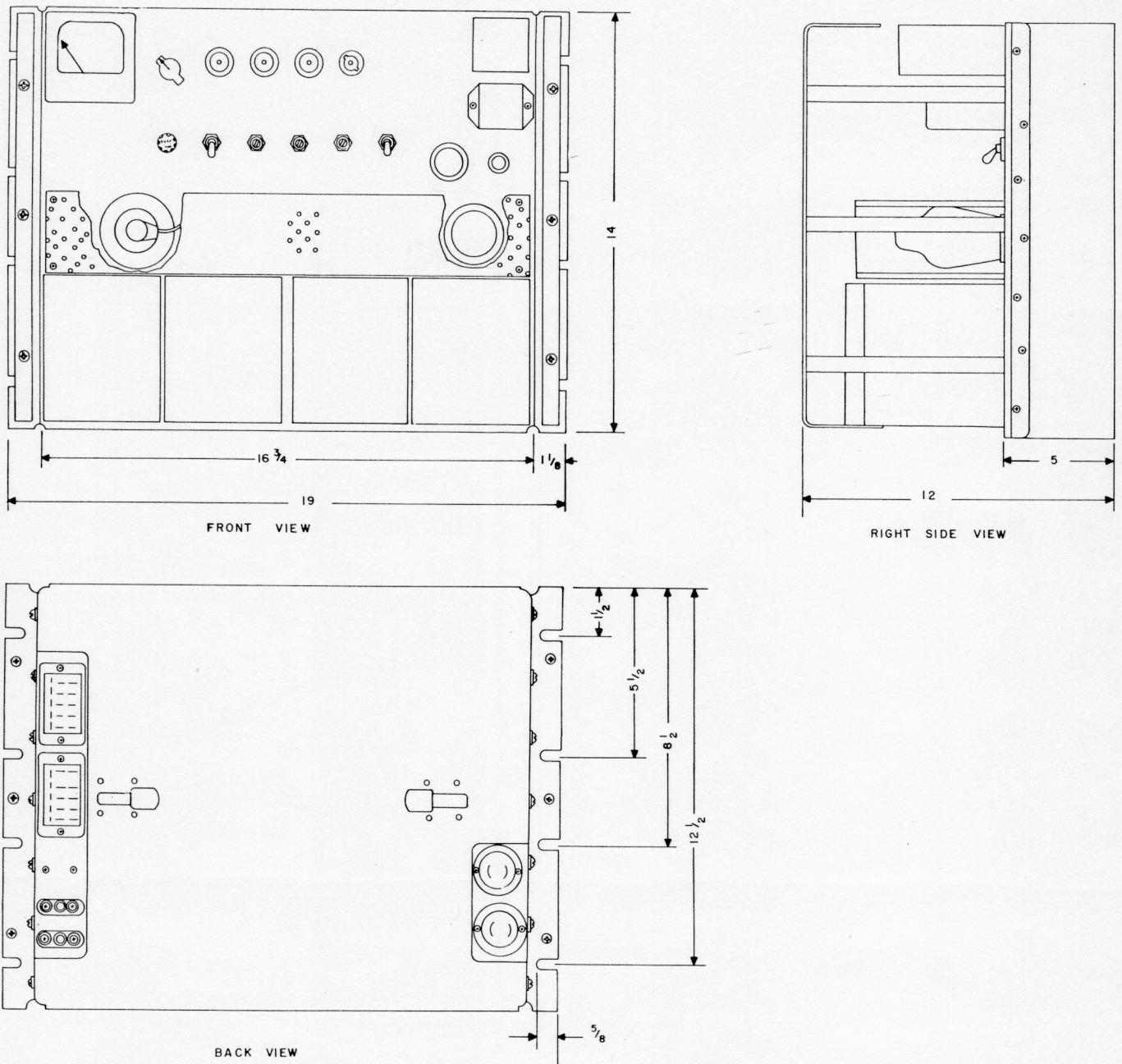


Figure 2-2. Type 242F-2 Modulator Unit, Outline and Mounting Dimensions

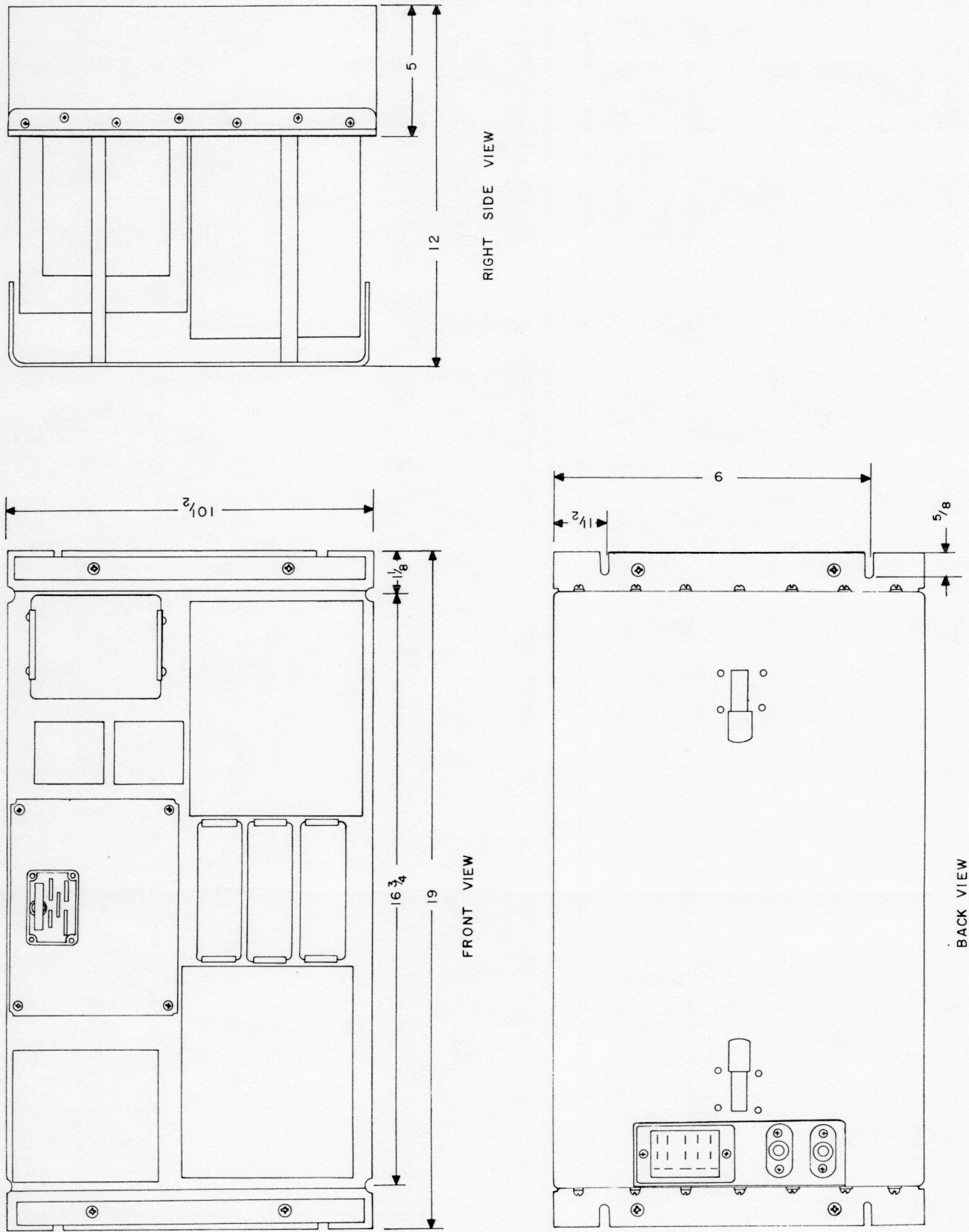


Figure 2-3. Type 242F-2 Filter and Bias Supply Unit, Outline and Mounting Dimensions

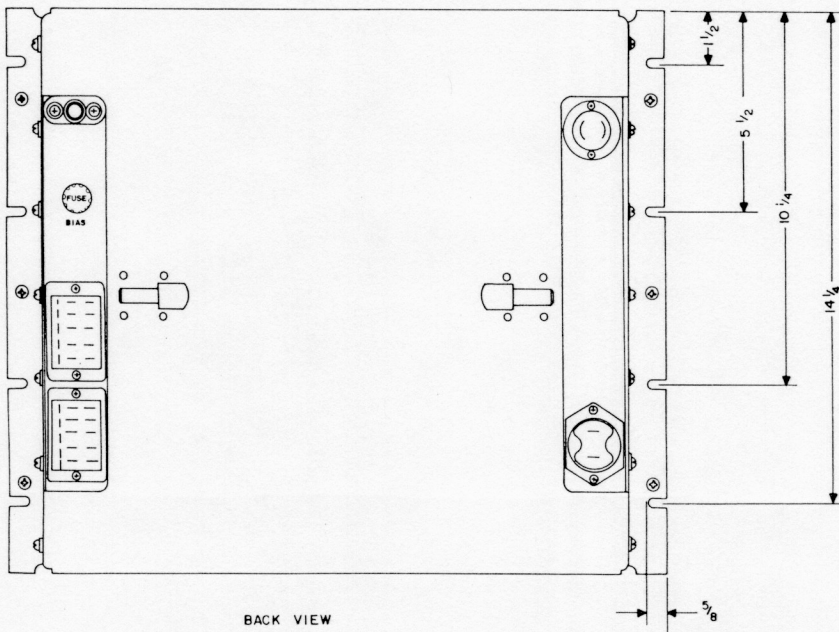
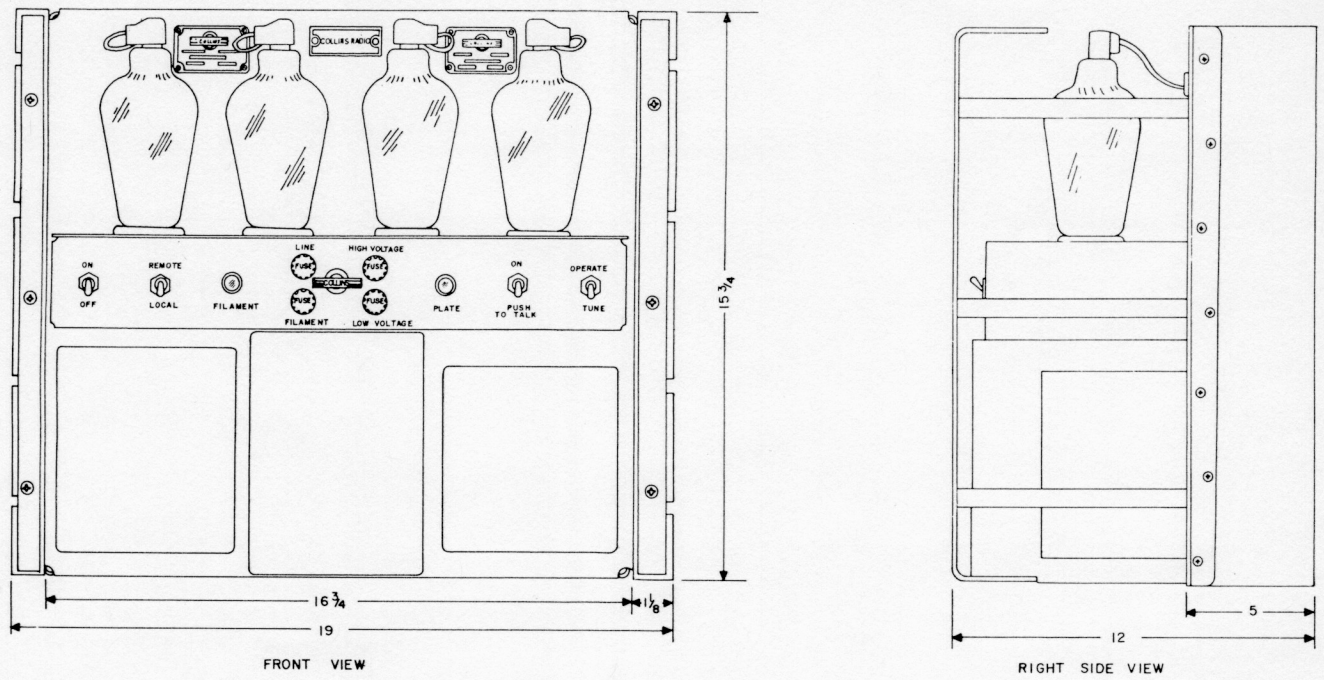


Figure 2-4. Type 242F-2 Rectifier and Control Unit, Outline and Mounting Dimensions

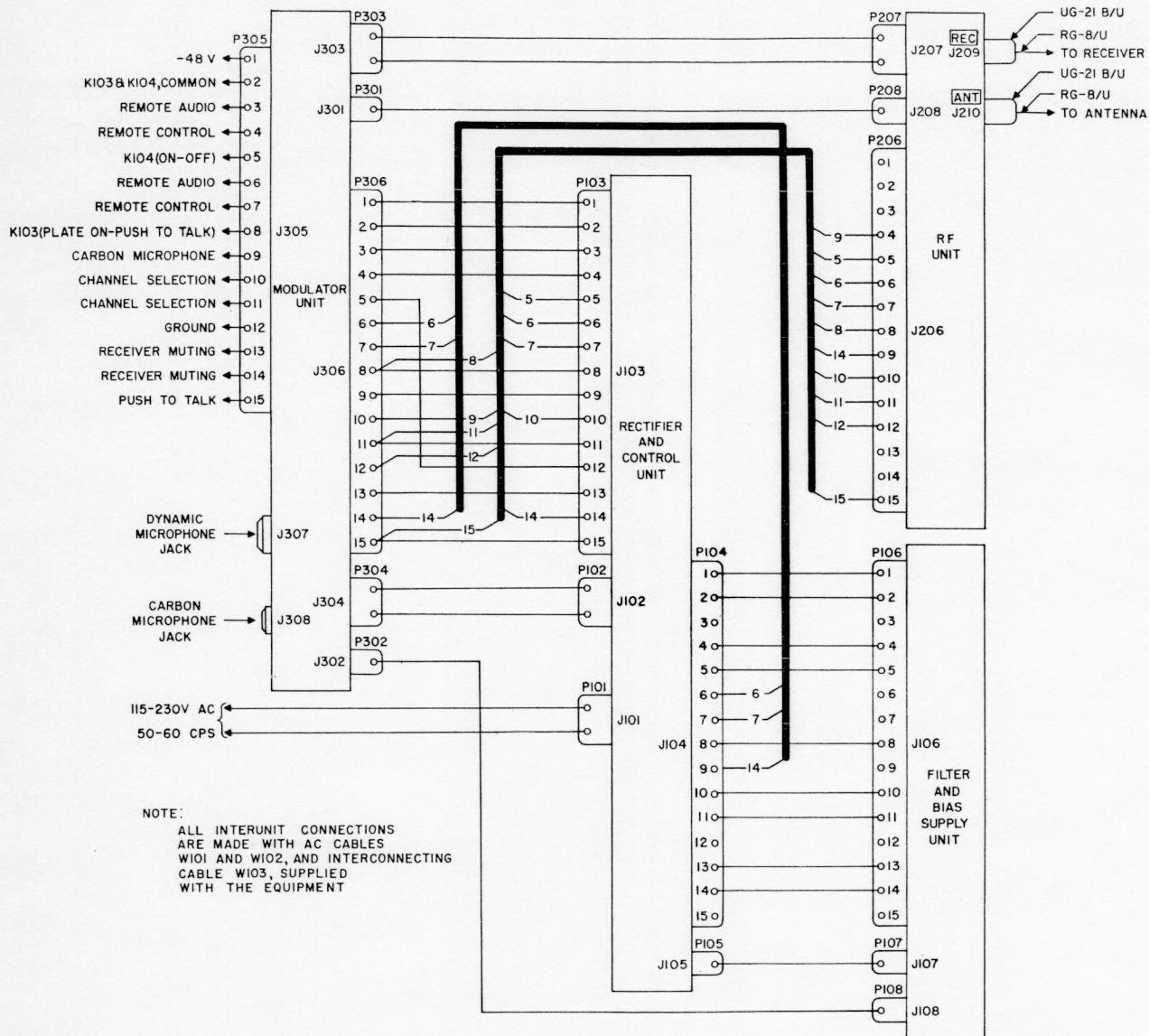


Figure 2-5. Type 242F-2 Transmitter, Interconnections Diagram

the controls and tubes. These covers are available as accessory equipment to the transmitter. They may be ordered from Collins Radio Company under the parts numbers listed in Table 1-3.

2-3. LOCATION AND MOUNTING OF 35D-2 FILTER.

a. LOCATION. - The 35D-2 Filter may be mounted on any available bracket close to the transmitter. To prevent unnecessary r-f loss, the filter should intercept the normal transmission line path between the transmitter and the antenna.

b. MOUNTING. - The cover of the 35D-2 extends approximately one-half inch from either end of the filter case to form two mounting flanges. Four number 8 mounting holes, on 2 x 7-11/16 inch centers, are provided. Use appropriately sized screws to mount the filter to its support.

2-4. TRANSMITTER CONNECTIONS. (Refer to figure 2-5.)

a. EXTERNAL CONNECTIONS.

(1) PRIMARY POWER. - A two-pole, recessed, male receptacle, J101, is provided on the right rear flange of the Rectifier and Control Unit chassis to receive the primary power input. The transmitter is normally wired to take 115 volts ac, 50/60 cycles. For 105, 210, or 230 volts ac operation, some minor modifications of the wiring to transformers T101, T102, T103, T104, T201, and T304 must be made. First, remove the jumpers between terminals 1 and 3, and 2 and 4, of the transformers. For 105 volt a-c operation, jumper terminals 1 and 9, and 8 and 4, of T101, T102 and T104; jumper terminals 1 and 12, and 11 and 4, of T103 and T304; jumper terminals 1 and 10, and 9 and 4, of T201. For 210 volt a-c operation, jumper terminals 8 and 9 of T101, T102, and T104; jumper terminals 11 and 12 of T103 and T304; jumper terminals 9 and 10 of T201. For 230 volt a-c operation, jumper terminals 2 and 3 of each of the transformers.

(2) MICROPHONES. - Two microphone connectors are provided on the front of the Modulator Unit chassis. J307, a four-contact, flush-mounted receptacle, receives the dynamic microphone plug; J308, a three-conductor microphone jack, receives the carbon microphone plug.

(3) R-F CONNECTIONS. - Two Type N coaxial receptacles are mounted on the right rear flange of the R-F Unit chassis. These receptacles form part of coaxial relay K201. Connect the lower one, designated ANT, to the INPUT receptacle (J101) of the 35D-2 filter. Connect the upper one, designated REC, to the receiver. Connect the OUTPUT receptacle (J102) of the 35D-2 to the transmission line to the antenna. For all of these r-f connections, use RG-8/U coaxial cable, or the equivalent, and type UG-21B/U plugs.

(4) REMOTE CONTROL CONNECTIONS. - All remote control connections to the 242F-2 are made via J305, a fifteen-contact, Jones receptacle mounted on the left rear flange of the Modulator Unit. The transmitter is designed for adaptability to a variety of remote control connections. The remote control circuits, instead of being interconnected within the transmitter, are brought out to the various terminals of J305. The operator must connect jumpers between appropriate ones of the terminals to develop a circuit which is tailored to the desired remote control setup.

A single pair of telephone lines may be used to carry the remote audio signals and the REMOTE ON-OFF and REMOTE PLATE ON-PUSH TO TALK control signals from the Remote Control Unit to the transmitter. A third line must connect the ground of the Remote Control Unit to the ground of the transmitter, a fourth must carry the PUSH TO TALK signal and a fifth the REMOTE CHANNEL SELECTION signal. All of these telephone lines are connected to the transmitter via appropriate terminals of J305. Either ground or ± 48 volts d-c may be used as the REMOTE ON-OFF, REMOTE PLATE ON-PUSH TO TALK, and REMOTE CHANNEL SELECTION signals. If ground is used, the energizing current for relays K103, K104, and K202, within the transmitter, must be supplied by the 242F-2 bias supply. If ± 48 volts d-c is used, the energizing current for relays K103, K104, and K105 must be supplied by the Remote Control Unit.

(a) REMOTE CONTROL CONNECTIONS USING 242F-2 BIAS SUPPLY.

1. Connect the audio telephone lines between terminals 3 and 6 of J305.

Connect the line which carries the REMOTE ON-OFF signal to terminal 3, the line which carries the REMOTE PLATE ON-PUSH TO TALK signal to terminal 6.

2. Connect the common ground line to terminal 12 of J305.

3. Connect the PUSH TO TALK line to terminal 15 of J305.

4. Connect the REMOTE CHANNEL SELECTION line to terminal 10 of J305.

5. Connect jumpers between the terminals of J305, as follows: jumper terminals 1 and 2; jumper terminals 4 and 5; jumper terminals 7 and 8.

(b) REMOTE CONTROL CONNECTIONS USING REMOTE POWER SUPPLY.

1. Connect the audio telephone lines between terminals 3 and 6 of J305. Connect the line which carries the REMOTE ON-OFF signal to terminal 3, the line which carries the REMOTE PLATE ON-PUSH TO TALK signal to terminal 6.

2. Connect the common ground line to terminal 12 of J305.

3. Connect the PUSH TO TALK line to terminal 15 of J305.

4. Connect the REMOTE CHANNEL SELECTION line to terminal 11 of J305.

5. Connect jumpers between the terminals of J305, as follows: jumper terminals 2 and 12; jumper terminals 4 and 5; jumper terminals 7 and 8.

b. INTERUNIT CONNECTIONS

(1) PRIMARY POWER. - Four two-pole, twist-lock connectors, J102, J303, J304, and J207, provide for the interunit connection of primary power. The connectors are mounted on the left rear flanges of the various chassis. J102, on the Rectifier and Control Unit, and J303, on the Modulator Unit, are flush-mounted, female receptacles. J304, also on the Modulator Unit, and J207, on the R-F Unit, are recessed, male receptacles. Use a-c cable W101, supplied with the equipment, to connect J102 to J304. Use a-c cable W102, also supplied with the equipment, to connect J303 to J207.

(2) D-C AND SIGNAL VOLTAGES. - Five fifteen-contact Jones connectors, J103, J104, J106, J206, and J306, and six single-contact high-voltage connectors, J105, J107, J108, J301, J302, and J208, provide for the interunit connections of d-c and signal voltages. All of the jacks are mounted on the left rear flanges of the chassis. J103, J104, and J105 are on the Rectifier and Control Unit; J106, J107 and J108 are on the Filter and Bias Supply Unit; J303, J304, and J306 are on the Modulator Unit; J206 and J208 are on the R-F Unit.

The interconnecting cable, W103, is supplied with the equipment for making all the necessary interunit connections. This cable, shown in figure 2-6, consists of five interconnected, fifteen-contact, Jones plugs and six interconnected single-contact, high-voltage plugs. Insert P103, at one end of the cable, into J103, on the Rectifier and Control Unit. Proceeding towards the top of the installation, insert each successive plug into the next successive jack on the chassis. In each case, the number of the plug, identified in figure 2-6, matches the number of the jack into which it is inserted.

c. MODIFICATION OF EQUIPMENT FOR COMMUNICATIONS USE. - If the transmitter is being used for communications purposes, use a short length of wire to connect together the two open terminals of the mounting strip at the rear of the Modulator Unit. For VOR use of the transmitter, these terminals must be left open.

2-5. TUBE PLACEMENT.

Insert all tubes into the proper sockets on each chassis, referring to the tube type designation adjacent to each socket. Before the 4x250B tetrodes can be inserted into their sockets, the power amplifier assembly must be removed from the R-F Unit chassis and opened. The following procedure is involved; (Refer to exploded view of power amplifier assembly, figure 2-7A.)

a. Disconnect the eight-contact connector P202 from jack J202, at the rear of the assembly.

b. Disconnect the high-voltage connector P203 from jack J203, at the rear of the assembly.

c. Disconnect coaxial connectors P204 and P205 from their respective jacks J204, on the coaxial relay, and J205, on the power amplifier assembly.

d. Remove the canvas duct between the blower and the power amplifier.

e. Remove the assembly from the chassis by unscrewing, from the front of the chassis, the four screws in the corners of the mounting flanges.

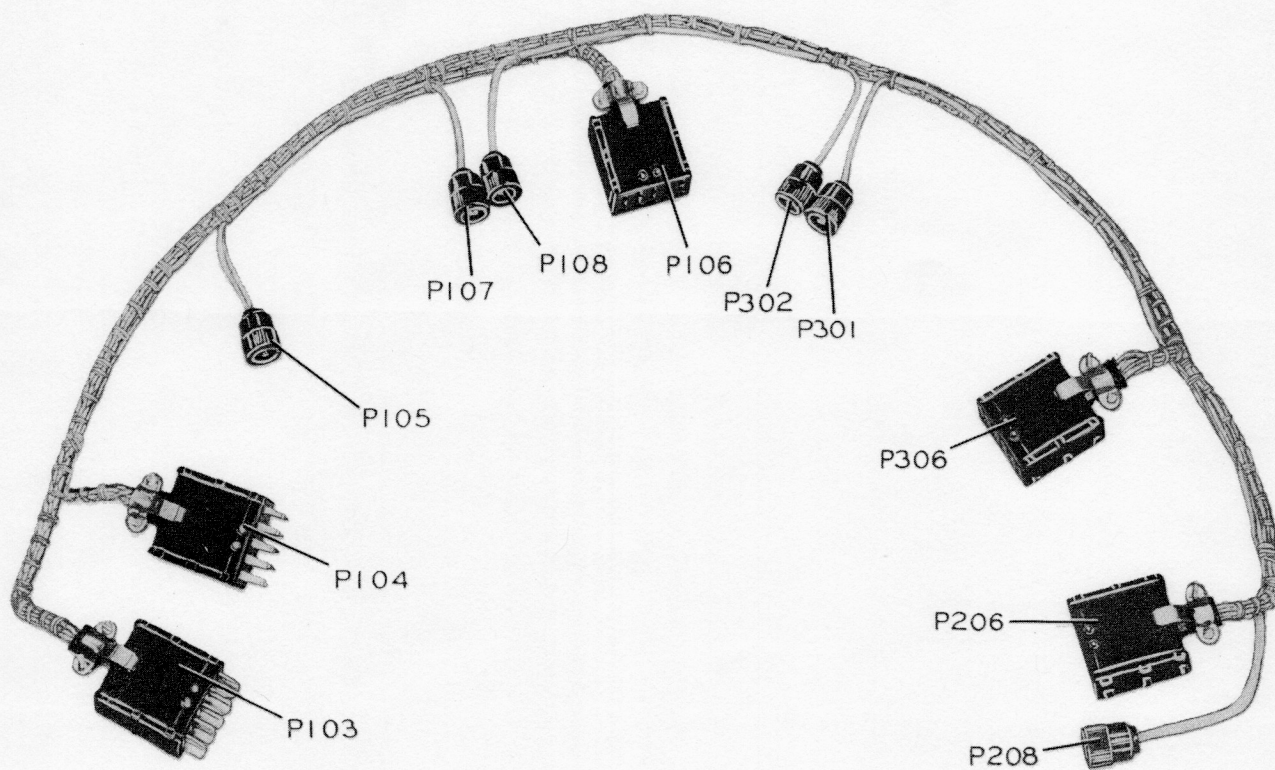


Figure 2-6. Interconnecting Cable for 242F-2 Transmitter

Revised 1 December 1955

- f. Remove the top cover from the assembly by unscrewing the ten smaller PBH screws and unloosening the two larger ones.
- g. Remove the tube connecting bracket.
- h. Place a chimney over each of the 4x250B tube sockets. Insert the 4x250B tubes into their sockets through the chimneys.
- i. Replace the tube connecting bracket, taking care that all contact fingers are on the outside of the tube flanges.
- j. Replace the cover and refasten the assembly to the chassis. Connect the can-

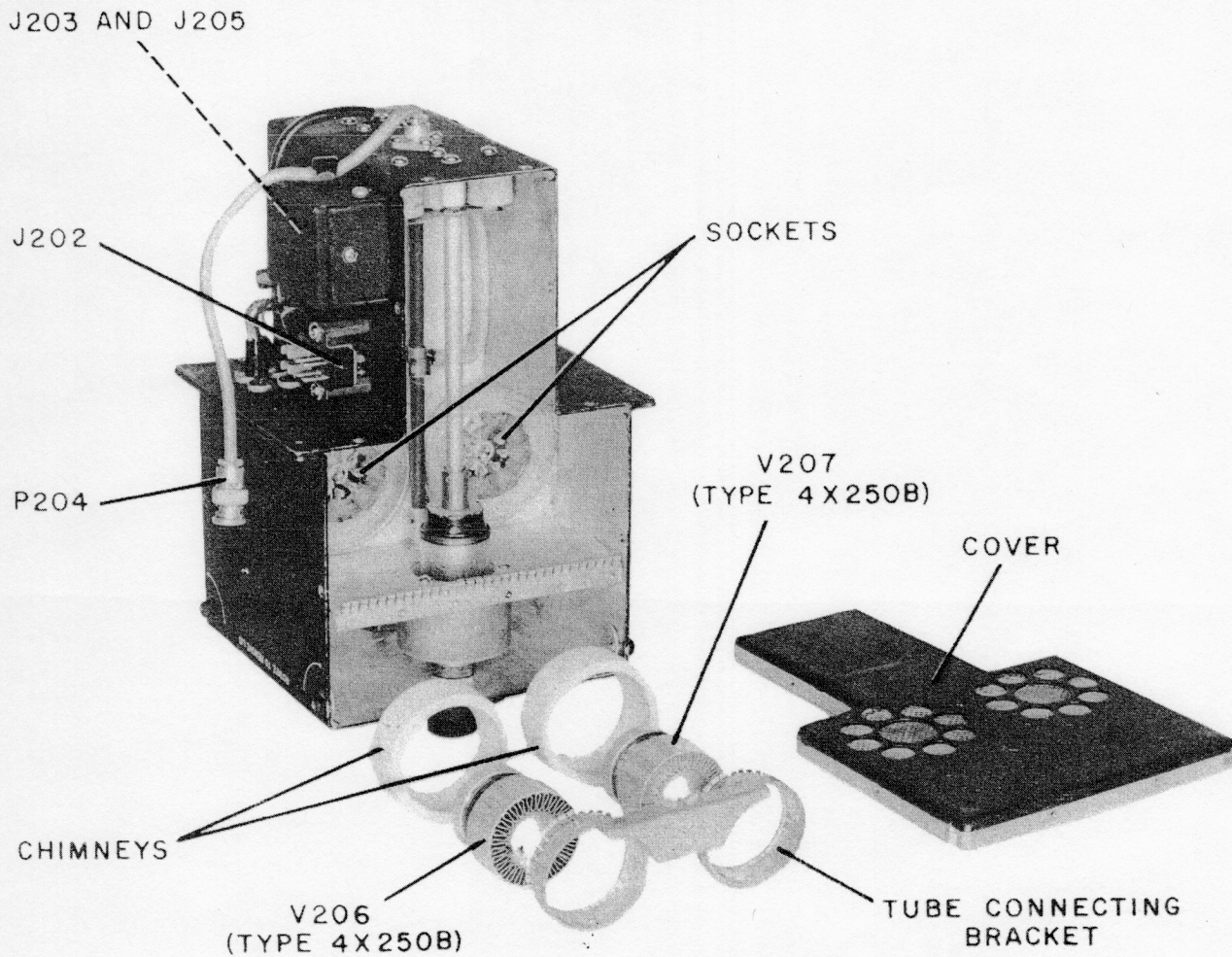


Figure 2-7A. Exploded View of Power Amplifier Assembly

vas duct between the blower and the power amplifier. Insert plugs P202, P203, P204, and P205 into their respective jacks.

2-6. CRYSTAL PLACEMENT.

The crystal oven is inserted into the eight-hole socket designated Z201, on the front of the R-F Unit subchassis. Remove the oven from the socket and open it by loosening the three set screws and removing its cover. Connect the crystal for Channel 1, Y201, between pins four and six, inside the oven. Connect the spare crystal (or the crystal for Channel 2), Y202, between pins two and eight. After these connections have been made, close the oven and replace it in its socket.

2-7. ADJUSTMENT.

a. GENERAL. - After all the installation procedures described in the preceding paragraphs have been performed, the transmitter is ready for operational adjustments. For these adjustments, connect either the antenna or a 52-ohm resistive load capable of at least 250 watts dissipation to the ANT coaxial connector of the transmitter.

CAUTION

Do not operate the transmitter unloaded, since the high voltages likely to be developed may injure the 4x250Bs.

Set the ON-OFF switch to its ON position and the LOCAL-REMOTE switch to its LOCAL position. Allow the crystal oven several minutes to reach its operating temperature.

CAUTION

The blower motor must be running and the chimneys must be in place around the 4x250Bs at all times the transmitter is operating. If ventilation stops, the 4x250Bs will be ruined in a short time.

b. R-F Unit. - Set the CHANNEL 1-CHANNEL 2 switch to its CHANNEL 1 position. Perform the tuning procedure outlined in Table 2-1A. If abnormal meter readings are obtained for any step of the procedure, refer to Section 5 for the trouble-shooting procedures to locate the trouble.

NOTE

For two channel operation of the transmitter, the R-F Unit may be tuned to a "compromise" frequency, half-way between the two channel frequencies, instead of tuned to the CHANNEL 1 frequency. This type of tuning will provide for increased power output at the CHANNEL 2 frequency at the expense of proportionately less power output at the CHANNEL 1 frequency. To compromise tune the R-F Unit, perform the tuning procedure as indicated but adjust each stage for identical meter readings at the two settings of the CHANNEL 1-CHANNEL 2 switch instead of maximum (or minimum) readings at the CHANNEL 1 frequency.

TABLE 2-1A

TUNING PROCEDURE FOR 242F-2 TRANSMITTER

- | Step | Procedure |
|------|---|
| 1 | (a) Make an approximate adjustment of the seven slug adjusting screws on the front of the R-F Unit. For an operating frequency of 108 mc, the screws must be at the end of their travel in the clockwise direction; for one of 152 mc, they must be at the end of their travel in the counterclockwise direction. Interpolate the approximate tuning slug positions using these two known points and the desired operating frequency. (b) Set BALANCE potentiometer to the middle of its range. (c) Set OPERATE-TUNE switch to TUNE position. |
| 2 | Set PLATE ON-PUSH TO TALK switch to its PLATE ON position. |
| 3 | Set METER SELECTOR switch to OSC position. The TUNING METER indication should be approximately 0.1 ma. |

NOTE

Keep all the slugs in the same positions relative to their possible travel during the tuning procedures which follow, adjusting them alternately, a little each time.

4. Set METER SELECTOR switch to TRIP position and adjust tuning slugs L202 and L203 until the current peak is obtained. The TUNING METER indication should be not less than 0.5 ma.

CAUTION

The tripler tunes in the frequency range 54 to 76 mc. It may be possible to tune it to the fourth harmonic of the highest frequencies or the eighth harmonic of the lower frequencies although these frequencies fall outside the normal tuning range of the stage. If all the slugs are kept in the same relative positions, the stage cannot be tuned to the wrong harmonic.

- 5 Set METER SELECTOR switch to DBLR position and adjust tuning slugs L205 and L206 until the current peak is obtained. The TUNING METER indication should be not less than 0.5 ma.
- 6 Set METER SELECTOR switch to DRIVER position and adjust tuning slugs L207 and L208 until the current peak is obtained. The TUNING METER indication should be not less than 0.5 ma.
- 7 Set METER SELECTOR switch to GRID 1 position and adjust tuning slug L214 and the PA GRID tuning capacitor, C234, until the current peak is obtained. Some experimentation may be required to perform this step, since the cavity

Table 2-1A (Cont)

Tuning Procedure for 242F-2 Transmitter

| Step | Procedure |
|------|--|
| | circuit tunes rather sharply. The TUNING METER indication should be not less than 0.4 ma. |
| 8 | Set METER SELECTOR switch to ANT position and CATHODE 1-CATHODE 2 switch to CATHODE 1 position. Adjust PA LOADING thumbscrew and PA PLATE tuning capacitor for critical coupling as follows: Starting with LOADING thumbscrew in its extreme clockwise position, rotate the thumbscrew in small increments, adjusting the PLATE capacitor for cathode current dip each time. Continue the adjustments until the current peak is obtained on the TUNING METER. The CATHODE METER indication should be approximately 200 ma. |

CAUTION

The CATHODE METER indication must not exceed 230 ma or damage to the 4x250B may result.

- 9 Set CATHODE 1-CATHODE 2 switch to CATHODE 2 position. Compare the two cathode currents. If they are not equal, or nearly so, adjust BALANCE potentiometer R221 to make them equal.
- 10 Set OPERATE-TUNE switch to OPERATE position. Set METER SELECTOR switch to GRID 1 position and readjust PA GRID tuning capacitor for the current peak.
- 11 Set METER SELECTOR switch to ANT position and readjust PA LOADING thumbscrew and PA PLATE tuning capacitor for critical coupling. Repeat this step twice to be sure the ANT indication is the highest obtainable with the cathode current dipped.
- 12 Repeat steps 6, 5, and 4, in that order, for fine tuning of the transmitter. Then set METER SELECTOR switch to ANT position and adjust the PA GRID and PA PLATE tuning capacitors, and the PA LOADING thumbscrew, for maximum TUNING METER indication. If a power output other than maximum is desired, connect a wattmeter across the antenna or dummy load and adjust the PA LOADING thumbscrew for the desired power.

c. MODULATOR UNIT. - Connect an oscilloscope (see paragraph 5-2) into the transmission line between the 35D-2 and the antenna (or the dummy load), using a harness composed of coaxial cable and "T" adapters, as shown in figure 2-8. If no audio limiting is desired, set the LIMITER IN-OUT switch to its OUT position and adjust the modulation level for each audio input device in the manner described in paragraph (1) below. If limiting is desired, set the LIMITER IN-OUT switch to its IN position, and adjust the modulation levels as described in paragraph (2). In installations where rapid attenuation of frequencies above 3000 cycles, but no limiting, is desired, set the LIMITER IN-OUT switch to its IN position and perform the adjustments described in paragraph (3).

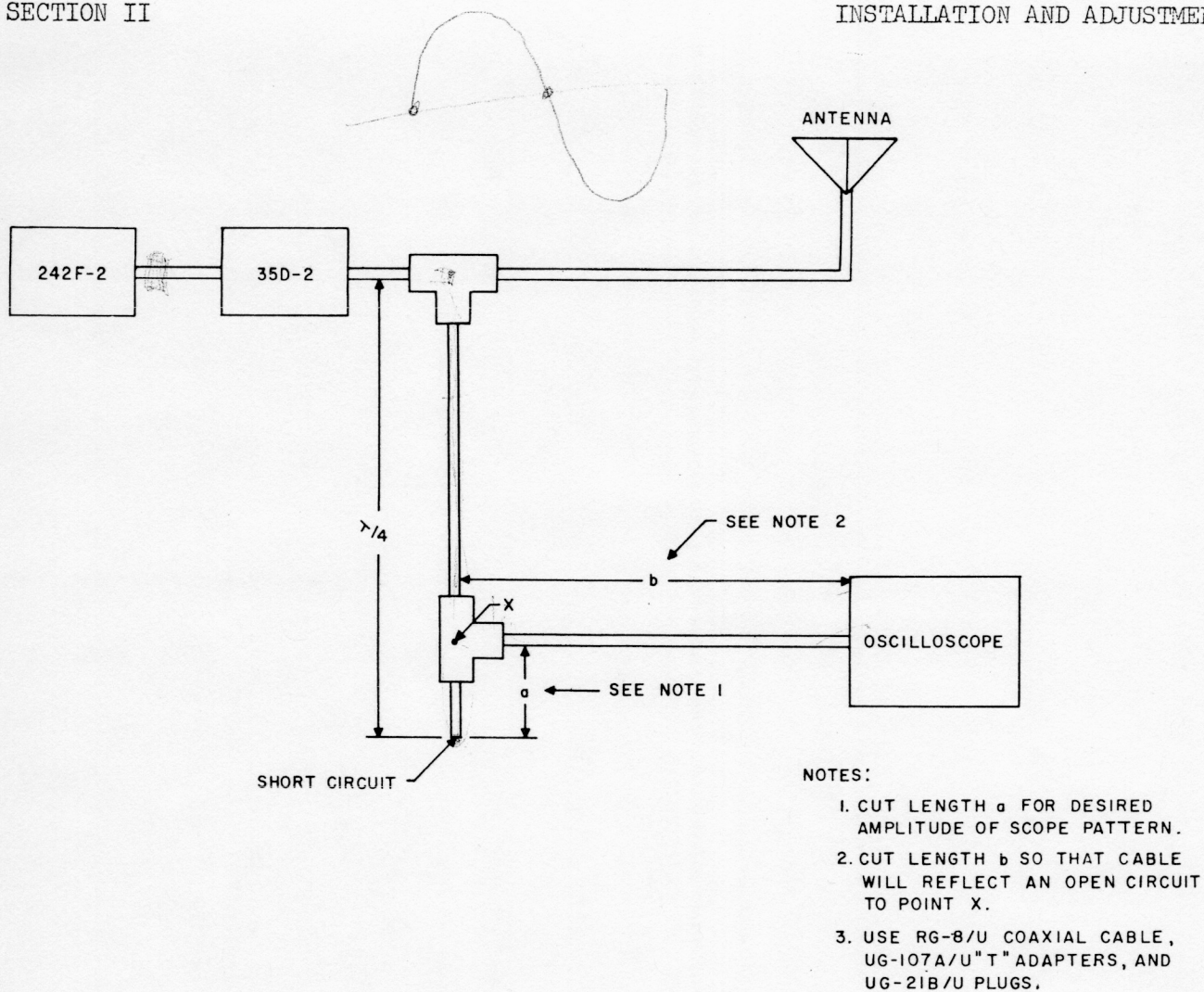


Figure 2-8. Oscilloscope Harness for 242F-2 Transmitter

NOTE

If an oscilloscope is not available for the following adjustments, the gain controls can be adjusted to produce a 250 ma indication on the MOD scale of the Modulator Meter.

(1) OPERATION WITH NO AUDIO LIMITING.

(a) DYNAMIC MICROPHONE. - Set the MIKE-REMOTE switch to its MIKE position. While speaking into the dynamic microphone, adjust the MIKE potentiometer, R308, until the oscilloscope pattern indicates approximately 90% modulation on voice peaks. (The spoken word "four" represents the highest peaks likely to be encountered.)

(b) CARBON MICROPHONE. - Set the MIKE-REMOTE switch to its REMOTE position. While speaking into the carbon microphone, adjust the REMOTE potentiometer, R301, until the oscilloscope pattern indicates approximately 90% modulation on voice peaks.

(c) TELEPHONE LINES. - Set the MIKE-REMOTE switch to its REMOTE position.

Feed a zero-level audio signal, as indicated by the Remote Control Unit, into the telephone lines from the remote location. Adjust the REMOTE potentiometer, R301, until the oscilloscope pattern indicates approximately 90% modulation on voice peaks.

(2) OPERATION WITH AUDIO LIMITING.

NOTE

Operation of the limiter in such a manner as to cause continual high-percentage limiting will produce a higher background noise and increased distortion. This type of operation is not recommended.

(a) DYNAMIC MICROPHONE. - Set MIKE REMOTE switch to MIKE position. Rotate MIKE potentiometer to extreme clockwise position. While speaking into the dynamic microphone, adjust the MOD potentiometer, R317, until the oscilloscope pattern indicates approximately 90% modulation. Rotate the MIKE potentiometer in counterclockwise direction until 90% modulation is reached only on loud speech.

(b) CARBON MICROPHONE. - Set MIKE-REMOTE switch to REMOTE position. Rotate REMOTE potentiometer to extreme clockwise position. While speaking into the carbon microphone, adjust MOD potentiometer until the oscilloscope pattern indicates approximately 90% modulation. Rotate MIKE potentiometer in counterclockwise direction until 90% modulation is reached only on loud speech.

(c) TELEPHONE LINES. - Set MIKE-REMOTE switch to REMOTE position. Rotate REMOTE potentiometer to extreme clockwise position. Feed a zero-level audio signal, as indicated by the Remote Control Unit, into the telephone lines from the remote location. Adjust MOD potentiometer until the oscilloscope indicates approximately 90% modulation. Rotate REMOTE potentiometer in counterclockwise direction until 90% modulation is reached only on loud speech.

(3) OPERATION WITH ATTENUATION BUT NO LIMITING. - Rotate the MOD potentiometer to its extreme clockwise position. For each audio input device, perform the adjustments described for no audio limiting in the respective paragraphs (1) (a), (1) (b), and (1) (c), above. One hundred per cent modulation will occur before the input to the limiter reaches a level that will activate the clipper tubes.

SECTION III

OPERATION

3-1. GENERAL.

The 242F-2 transmitter may be operated either locally, from the control panels of the respective units, or remotely, from the control panel of the 278E-1 Remote Control Unit. This section discusses the controls available at each location and the procedures involved in each type of operation.

3-2. CONTROLS AND INDICATIONS.

a. CONTROLS. - A list of the controls, their functions, and their locations is presented in Table 3-1A.

TABLE 3-1A

CONTROLS

| CONTROL | FUNCTION | LOCATION |
|-----------------------|---|---|
| ON-OFF | Controls application of primary power to transmitter. | Rectifier and Control Unit; 278E-1 Remote Control Unit |
| REMOTE-LOCAL | Provides for local-remote control selection. | Rectifier and Control Unit |
| PLATE ON-PUSH TO TALK | Provides for selection of either continuous or intermittent operation of transmitter. | Rectifier and Control Unit; 278E-1 Remote Control Unit |
| OPERATE-TUNE | Provides means for reducing PA screen voltage during tuning, thus protecting 4x250Bs against loss of drive. | Rectifier and Control Unit |
| CHANNEL 1-CHANNEL 2 | Provides for channel selection | R-F Unit; 278E-1 Remote Control Unit. |
| REMOTE-MIKE | When in REMOTE position switch connects modulator to telephone lines and carbon microphone; when in MIKE position, switch connects modulator to dynamic microphone. | Modulator Unit. |

TABLE 3-1A(CONT)

CONTROLS

| CONTROL | FUNCTION | LOCATION |
|----------------|--|----------------|
| MIKE | Controls gain of signals from dynamic microphone. | Modulator Unit |
| REMOTE | Controls gain of signals from telephone lines and carbon microphone. | Modulator Unit |
| MOD | Controls gain of signals from limiter. | Modulator Unit |
| LIMITER IN-OUT | Inserts or removes limiter from modulator. | Modulator Unit |

b. INDICATORS. - A list of the indicators, their functions, and their locations is presented in Table 3-2.

TABLE 3-2A

INDICATORS

| INDICATOR | FUNCTION | LOCATION |
|-----------|--|----------------------------|
| FILAMENT | Indicates that power is being supplied HV and LV filament transformer T103. | Rectifier and Control Unit |
| PLATE | Indicates that power is being supplied HV plate transformer T101. | Rectifier and Control Unit |
| FILAMENT | Indicates that voltage is being supplied the filaments of the 4x250B tetrodes. | R-F Unit |

3-3. OPERATING PROCEDURE.

CAUTION

Be certain that all the initial connections and adjustments described in Section 2 have been made before the transmitter is placed into operation. The transmitter output must be properly connected to the antenna, or damage to the equipment may result.

a. ENERGIZING THE EQUIPMENT.

(1) LOCAL OPERATION.

(a) Set the LOCAL-REMOTE switch to the LOCAL position.

(b) Set the ON-OFF switch to the ON position. Allow several minutes for the crystal oven to reach its operating temperature.

(c) Set the CHANNEL 1-CHANNEL 2 switch to the CHANNEL 1 position.

(d) Set the PLATE ON-PUSH TO TALK switch to the PLATE ON position.

(e) Check the readings of the TUNING METER for all positions of the METER SELECTOR switch. The readings should agree with those normal readings listed in Table 3-3.

TABLE 3-3

NORMAL READINGS OF TUNING METER

| Setting of METER SELECTOR switch | TUNING METER reading (ma) |
|----------------------------------|---------------------------|
| OCS | 0.1 or more |
| TRIP | 0.5 or more |
| DBLR | 0.5 or more |
| DRIVER | 0.5 or more |
| GRID 1 | 0.4 or more |
| GRID 2 | 0.4 or more |
| SCREEN | 0.6 nominal |
| ANT | 0.4 to 0.5 |

(f) Note the CATHODE METER readings. The normal value for each current is 200 ma.

CAUTION

If either of the CATHODE METER indications exceeds 230 ma, damage to the respective 4x250B may result.

(g) For CHANNEL 2 operation, set the CHANNEL 1-CHANNEL 2 switch to the CHANNEL 2 position.

(h) For PUSH TO TALK operation, set the PLATE ON-PUSH TO TALK switch to its PUSH TO TALK position.

(2) REMOTE OPERATION.

(a) At the transmitter location:

1. Set the LOCAL-REMOTE switch to the REMOTE position.
2. Set the ON-OFF switch to the ON position.

(b) At the remote location:

1. Set the ON-OFF switch to the ON position. Allow several minutes for the crystal oven to reach its operating temperature.
2. Set the CHANNEL 1-CHANNEL 2 switch to the desired channel.
3. Set the PLATE ON-PUSH TO TALK switch to the desired mode of operation.

b. OPERATING THE EQUIPMENT.

(1) PUSH TO TALK. - Plug the microphone into the proper jack at the local or remote location. Press the PUSH TO TALK button on the microphone and speak.

(2) PLATE ON. - No further procedures are necessary for PLATE ON operation.

c. DE-ENERGIZING THE EQUIPMENT.

(1) LOCAL OPERATION. - Set the ON-OFF switch on the Rectifier and Control Unit to its OFF position.

(2) REMOTE OPERATION. - Set the ON-OFF switch on the Remote Control Unit to its OFF position.

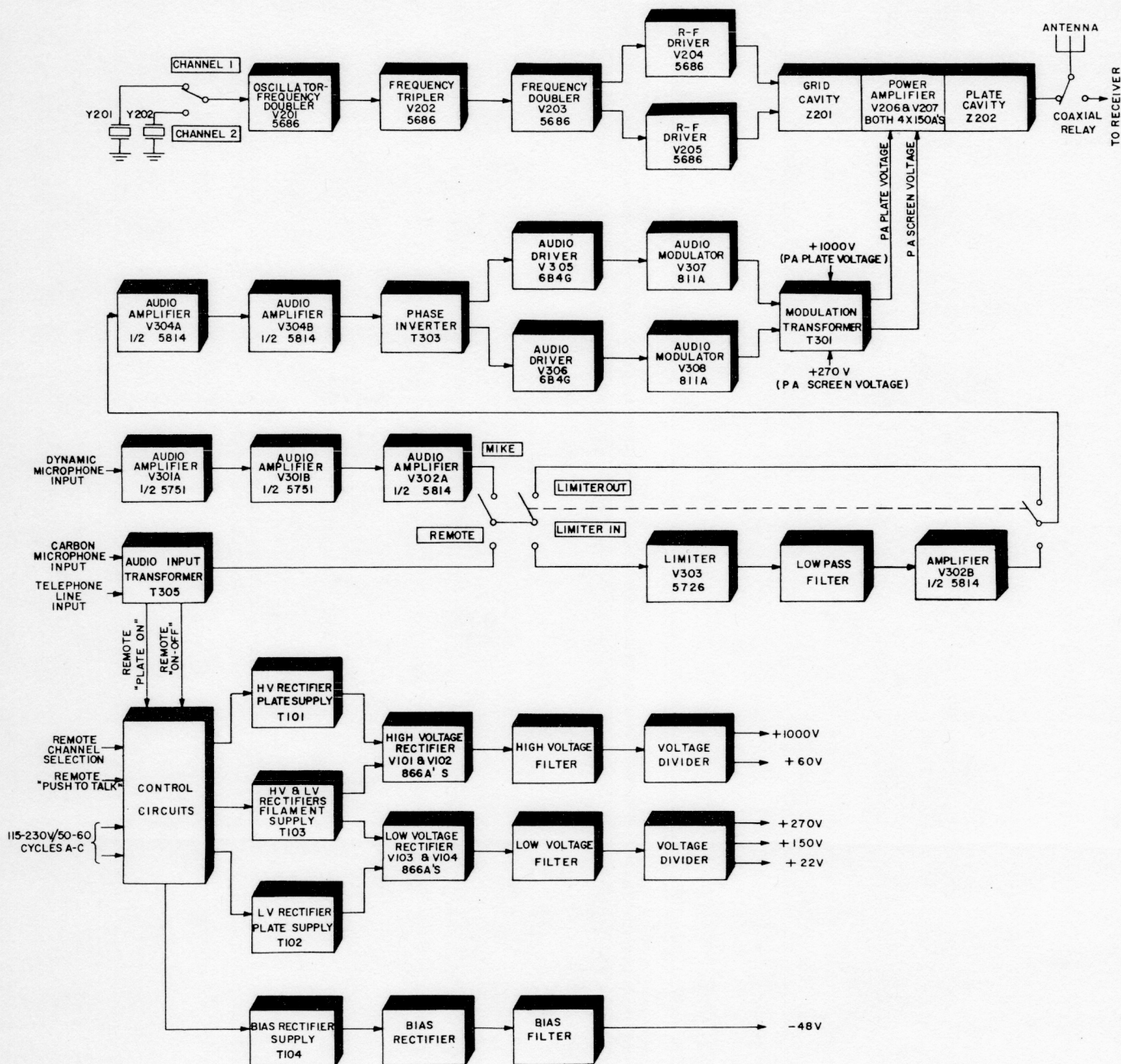


Figure 4-1. Type 242F-2 VHF Transmitter, Block Diagram

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

The 242F-2 VHF Transmitter, shown in block form in figure 4-1, is composed of four principal sections, as follows:

a. R-F UNIT. - Generates sufficient r-f power, at a fixed frequency within the range 108 to 152 mc, to supply 200 watts at the output terminal of the transmitter.

b. MODULATOR. - Amplifies the audio signals from a dynamic microphone, a carbon microphone, or a pair of telephone lines and superimposes them upon the d-c plate and screen voltages supplied the r-f power amplifier.

c. POWER SUPPLY. - Converts the a-c primary power into the d-c voltages required by the other sections of the equipment.

d. CONTROL CIRCUITS. - Provide the means for both local and remote control of the operation of the transmitter.

The following paragraphs describe each of the transmitter sections in detail. In each case, a discussion of the over-all features of the section is followed by a detailed description of the circuits of that section. The circuit theory of the 35D-2 Low Pass Filter is presented in the final paragraph of this section.

4-2. R-F UNIT.

The R-F Unit is composed of an oscillator-frequency doubler, followed by a frequency tripler, a frequency doubler, a push-pull driver, and a power amplifier. The crystal-controlled oscillator generates the fundamental r-f voltage, in the range 9.000 to 12.667 mc. The frequency multipliers generate an output voltage that is the twelfth harmonic of the fundamental. The driver and power amplifier provide the necessary voltage and power amplification to deliver 200 watts of r-f power, in the frequency range 108 to 152 mc, to the transmission line.

For tuning and trouble shooting, a tuning meter is built into the R-F Unit that provides indications (but not the actual values) of the grid current of each tube in the R-F Unit, the screen current of the power amplifier, and the output voltage of the transmitter.

a. OSCILLATOR-FREQUENCY DOUBLER. - (Refer to figure 4-2A.) The oscillator uses the cathode, grid, and screen of V201, a type 5686 pentode, connected in a modified Colpitts-type circuit. The screen, serving as the plate of a triode, is held at r-f ground by C205. The crystal is connected between the grid and ground or, effectively, between the grid and screen. Feedback is provided by C203, connected between the cathode and grid. R202 is connected in series with grid leak resistor R201 to provide an indication of the oscillator grid current for the tuning meter.

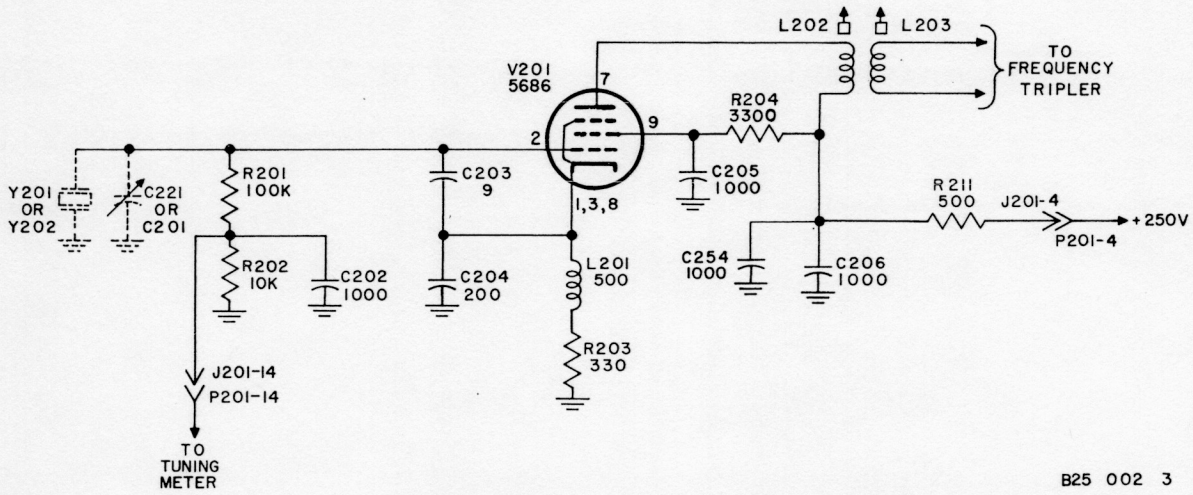


Figure 4-2A. Oscillator Frequency Doubler, Simplified Schematic Diagram

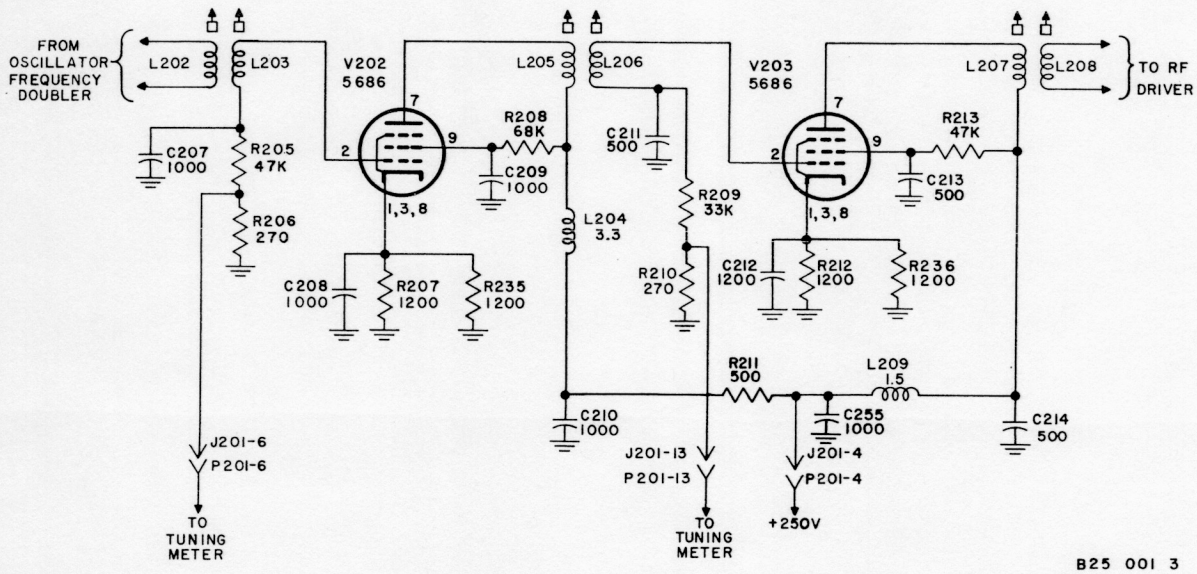
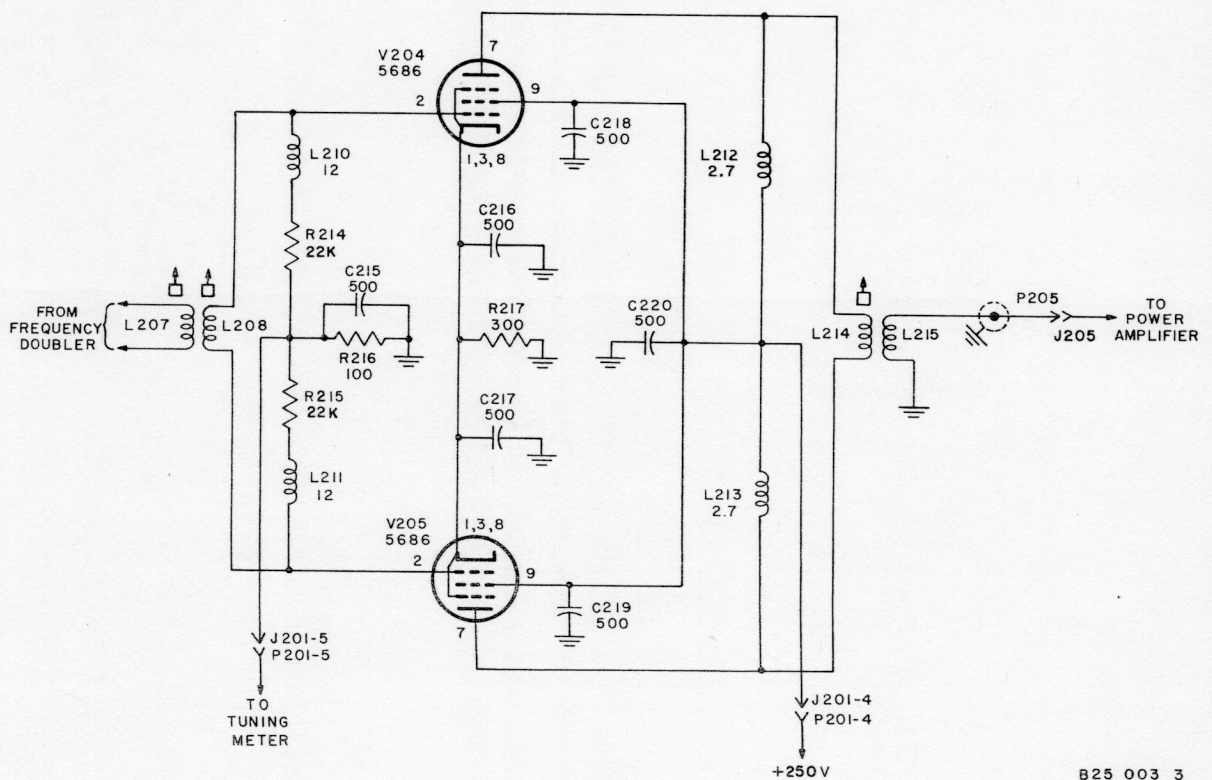


Figure 4-3A. Frequency Tripler and Doubler, Simplified Schematic Diagram

The cathode, grid, and plate of V201 are used in a frequency multiplier circuit. The output of the oscillator is coupled through the electron stream to the plate of V201. Inductors L202, in the plate circuit of V201, and L203, in the grid circuit of V202, are tuned to the second harmonic of the crystal frequency. Tuning is accomplished by positioning a powdered iron slug, held by a threaded stud, within each coil. The slug adjusting screws are available at the front of the R-F Unit. As the slug is inserted into the field of the coil (clockwise rotation of the adjusting screw), the effective coil inductance is increased and the frequency of tuning is decreased. As the slug is removed from the coil (counterclockwise rotation of the adjusting screw), the effective coil inductance is decreased and the frequency of tuning is increased. The r-f voltage developed across L203, in the frequency range 18.000 to 25.333 mc, is applied directly to the grid of frequency tripler V202.

b. FREQUENCY TRIPLER AND DOUBLER. - (Refer to figure 4-3A.) The second harmonic voltage from the oscillator-frequency doubler is tripled in the plate circuit of V202, a type 5686 pentode. Inductors L205 and L206 are tuned by powdered iron slugs to the sixth harmonic of the crystal frequency. The r-f voltage developed across L206, in the frequency range 54.000 to 76.000 mc., is applied to the grid of V203.

The sixth harmonic voltage from the frequency tripler is doubled in the plate circuit of V203, also a type 5686 pentode. Inductors L207 and L208 are tuned by combination powdered iron and brass slugs to the twelfth harmonic of the crystal frequency. One-half of the combination slug is powdered iron, the other half is brass. The two halves are separated by a phenolic spacer. As the iron portion of the slug is inserted into the coil (clockwise rotation of the adjusting screw),



B25 003 3

Figure 4-4A. R-F Driver, Simplified Schematic Diagram

Revised 1 December 1955

4-3A

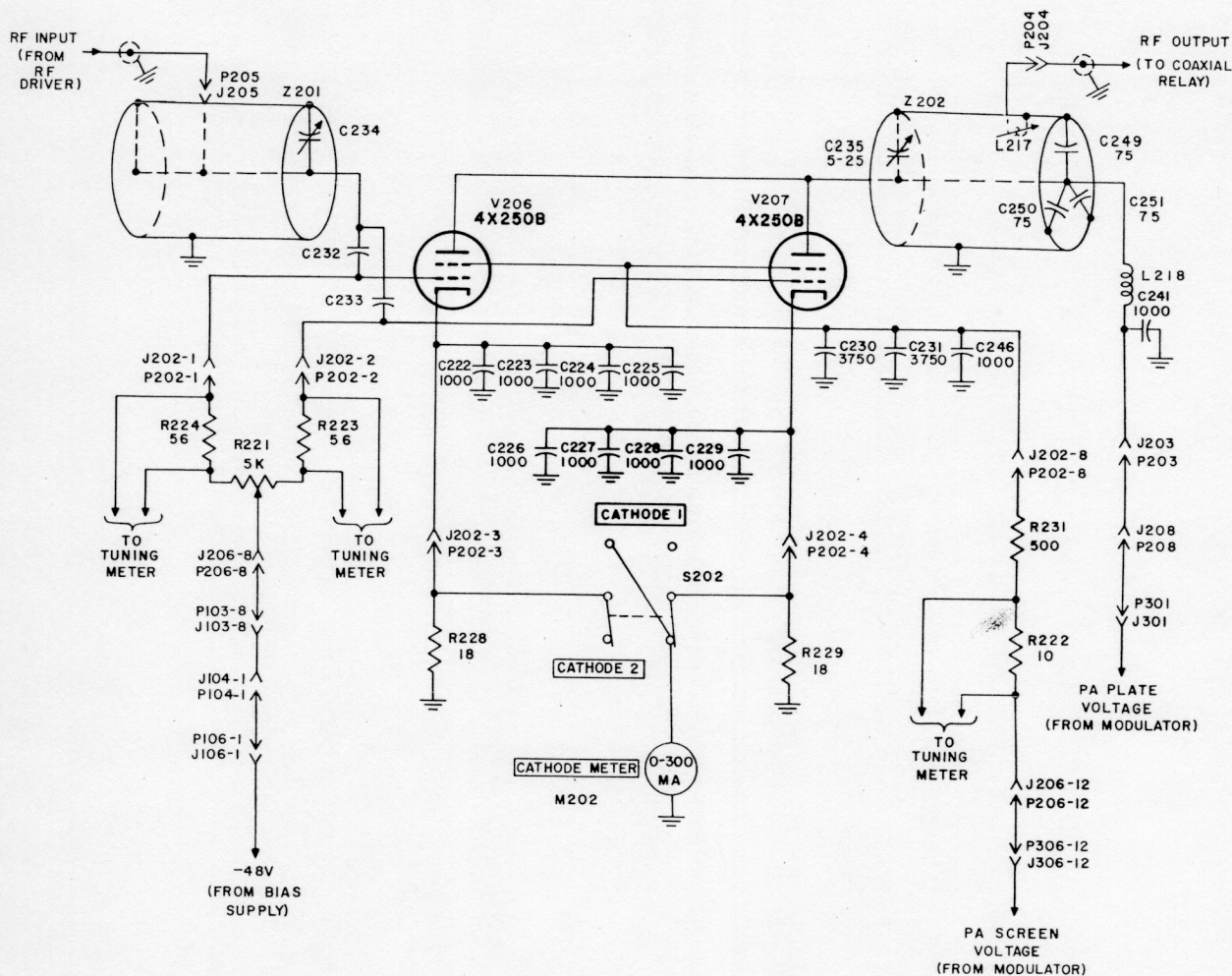


Figure 4-5A. Power Amplifier, Simplified Schematic Diagram

the inductance is increased and the frequency of tuning is decreased. As the brass portion is inserted into the coil (counterclockwise rotation of the adjusting screw), the inductance is decreased and the frequency of tuning is increased. The r-f voltage developed across L208, in the frequency range 108 to 152 mc., is applied to the grids of drivers V204 and V205.

c. R-F DRIVER. - (Refer to figure 4-4A.) The r-f driver amplifies the r-f voltage generated by the frequency multipliers and supplies it as driving voltage to the power amplifier. The driver is composed of V204 and V205, both type 5686 pentodes, connected in a push-pull amplifier circuit. Inductor L214, in the driver plate circuit, is tuned by a combination iron and brass slug to the twelfth harmonic of the crystal frequency. L215, a one-turn link encircling L204, couples the driver output to the power amplifier input connector, J205. A length of RG-58/U Teflon cable is used for this connection.

d. POWER AMPLIFIER. - (Refer to figure 4-5A.) The power amplifier is composed of V206 and V207, both type 4x250B tetrodes, and two quarter-wave, coaxial-type cavities, Z201 and Z202. V206 and V207 are connected in parallel for r-f. Z201 is

connected between the grids and cathodes of the two tubes while Z202 is connected between the plates and cathodes. Both cavities act as parallel resonant circuits.

The outer conductors of the two cavities are grounded for both d-c and r-f. The center conductor of Z201 is shorted to the outer conductor at one end and is connected to the grids of V206 and V207 via capacitors C232 and C233, respectively, at the other. One end of the center conductor of Z202 is connected to the plate flanges of V206 and V207 by the tube connecting bracket; the other end is connected to the outer conductor via paralleled capacitors C249, C250, and C251.

Bias voltage is applied directly to the grids of the tubes via BALANCE potentiometer R221. The -48 volt output of the bias supply is connected to the wiper arm of the potentiometer; one end of its resistance unit is connected to the grid of V206, the other end to the grid of V207. R224, in series with the potentiometer and the grid of V206, provides the TUNING METER with an indication of the grid current of that tube; R223, in series with the potentiometer and the grid of V207, provides the meter with an indication of the grid current of that tube.

The modulated (or unmodulated) plate voltage from the Modulator Unit is connected to the center conductor of Z202 via an r-f decoupling circuit composed of L218 and C241. The voltage is applied to the plates of V206 and V207 via the tube connecting bracket.

The cathodes of V206 and V207 are connected to ground for d-c via metering resistors R228 and R229, respectively. The CATHODE 1-CATHODE 2 switch connects the CATHODE METER across one or the other of the resistors at all times. When the switch is in its CATHODE 1 position, the meter shunts R228 and provides an indication of the cathode current of V206; when the switch is in its CATHODE 2 position, the meter shunts R229 and provides an indication of the cathode current of V207. The cathode of V206 is grounded for r-f via capacitors C222, C223, C224, and C225, connected in parallel; the cathode of V207 is grounded for r-f via capacitors C226, C227, C228, and C229, connected in parallel.

The r-f voltage from the driver is applied to the grid cavity via a tap on its center conductor. The maximum r-f voltage is developed across the open, or grid, end of the cavity while the minimum is developed across the shorted end. Tuning condenser C234, connected between the center and outer conductors at the open end, permits adjustment of the resonant frequency of the cavity.

The maximum r-f voltage within the plate cavity is developed across the plate end. C235, across this end, permits adjustment of the resonant frequency. R-f power is removed from the plate cavity by L217, an adjustable loop located between the two conductors. The LOADING thumbscrew, on the front of the cavity, provides for adjusting the coupling of the loop. When this screw is rotated counterclockwise, the loop is pushed further into the cavity and the coupling is increased. The loop is connected to the coaxial relay, K201, via a length of RG-58/U Teflon cable.

Cooling of the power amplifier is accomplished by blower B201, which forces a stream of air into the grid cavity, around the 4x250Bs and out the screened vents of the plate cavity. The function of the ceramic chimneys is to direct the stream of air through the fins of the 4x250Rs, so that maximum cooling of the tube will take place.

This page intentionally blank in original.

Scanned by Patrick Jankowiak KD5OEI

Contact information for this effort, and any other efforts at documenting and making freely available the manuals for the old laboratory classics, can be found at <http://www.bunkerofdoom.com> Please visit us.

Finally, this scan is provided free of charge to download. The original material, even though it is quite old, still belongs to the manufacturer, and it should be assumed there may still be a copyright. While we hope they will not mind home usage and sharing of the old manuals by electronics hobbyists who may own or wish to study the equipment, we insist that this material not be sold or bundled with any materials for sale (such as ebay, online stores, etc).