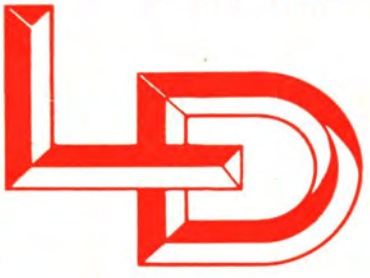
VHF COMMUNICATION EQUIPMENT

RCA

Instructions

RADIO CORPORATION OF AMERICA, Industrial Electronic Products

TYPE CMCT-60A2T,-60A2F
MOBILE STATIONS



150

148-174 MEGACYCLES
12 VOLTS ONLY

IB-33542

VHF COMMUNICATION EQUIPMENT

INSTRUCTIONS

MI-17401 Mobile Stations

TYPE CMCT-60A2T (TRUNK MOUNT)
TYPE CMCT-60A2F (DASH MOUNT)

12 VOLT SOURCE ONLY — NEGATIVE GROUND ONLY
148–174 MEGACYCLES

RADIO CORPORATION OF AMERICA
COMMUNICATION PRODUCTS DEPARTMENT, CAMDEN, NEW JERSEY

PRINTED IN U.S.A.
DU 680

IB-33542

FIRST AID

WARNING!

Operation of electronic equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside the equipment with voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors, etc. To avoid casualties, ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

ABOUT FIRST AID

Personnel engaged in the installation, operation and maintenance of this equipment or similar equipment are urged to become familiar with the following rules both in theory and in the practical application thereof. It is the duty of every radioman to be prepared to give adequate First Aid and thereby prevent avoidable loss of life.

FIRST DEGREE BURN

SKIN REDDENED. Temporary treatment—Apply baking soda or Unguentine.

SECOND DEGREE BURN

SKIN BLISTERED. Temporary treatment—Apply baking soda, wet compress, white petroleum jelly, foille jelly, olive oil, or tea.

THIRD DEGREE BURN

FLESH CHARRED. Temporary treatment—Apply baking soda, wet compress, white petroleum jelly, or foille spray. Treat for severe shock.

BACK PRESSURE—ARM LIFT METHOD OF ARTIFICIAL RESPIRATION

(Courtesy of the American Red Cross)

1. Position of the subject (See Fig. 1)

Place the subject in the face down, prone position. Bend his elbows and place the hands one upon the other. Turn his face to one side, placing the cheek upon his hands.

FIGURE 1

2. Position of the operator (See Fig. 2)

Kneel on either the right or left knee at the head of the subject facing him. Place the knee at the side of the subject's head close to the forearm. Place the opposite foot near the elbow. If it is more comfortable, kneel on both knees, one on either side of the subject's head. Place your hands upon the flat of the subject's back in such a way that the heels lie just below a line running between the armpits. With the tips of the thumbs just touching, spread the fingers downward and outward.

FIGURE 2

3. Compression phase (See Fig. 3)

Rock forward until the arms are approximately vertical and allow the weight of the upper part of your body to exert slow, steady, even pressure downward upon the hands. This forces air out of the lungs. Your elbows should be kept straight and the pressure exerted almost directly downward on the back.

4. Position for expansion phase (See Fig. 4)

Release the pressure, avoiding a final thrust, and commence to rock slowly backward. Place your hands upon the subject's arms just above his elbows.

FIGURE 3

5. Expansion phase (See Fig. 5)

Draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the subject's shoulders. Do not bend your elbows, and as you rock backward the subject's arms will be drawn toward you. Then lower the arms to the ground. This completes the full cycle. The arm lift expands the chest by pulling on the chest muscles, arching the back, and relieving the weight on the chest.

THE CYCLE SHOULD BE REPEATED 12 TIMES PER MINUTE AT A STEADY, UNIFORM RATE. THE COMPRESSION AND EXPANSION PHASES SHOULD OCCUPY ABOUT EQUAL TIME; THE RELEASE PERIODS BEING OF MINIMUM DURATION.

FIGURE 4

Additional related directions:

It is all important that artificial respiration, when needed, be started quickly. There should be a slight inclination of the body in such a way that fluid drains better from the respiratory passage. The head of the subject should be extended, not flexed forward, and the chin should not sag lest obstruction of the respiratory passages occur. A check should be made to ascertain that the tongue or foreign objects are not obstructing the passages. These aspects can be cared for when placing the subject into position or shortly thereafter, between cycles. A smooth rhythm in performing artificial respiration is desirable, but split-second timing is not essential. Shock should receive adequate attention, and the subject should remain recumbent after resuscitation until seen by a physician or until recovery seems assured.

FIGURE 5

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

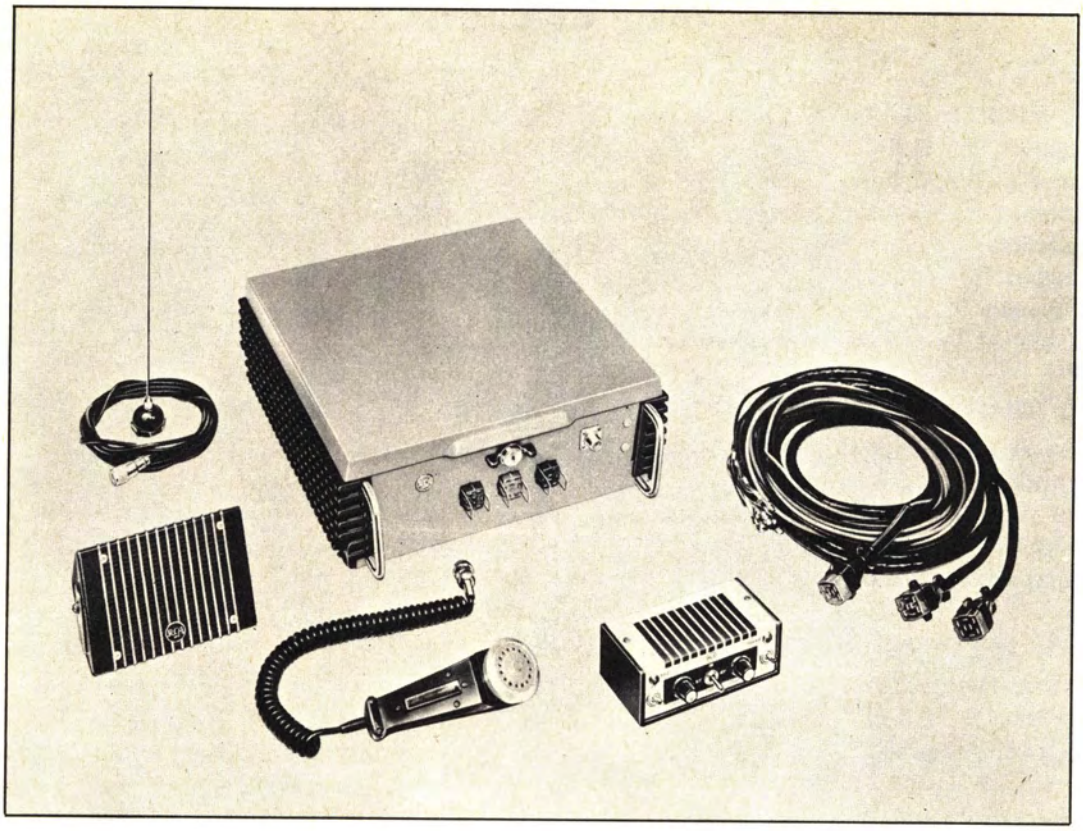


Figure S-1—Type CMCT-60A2T Mobile Equipment

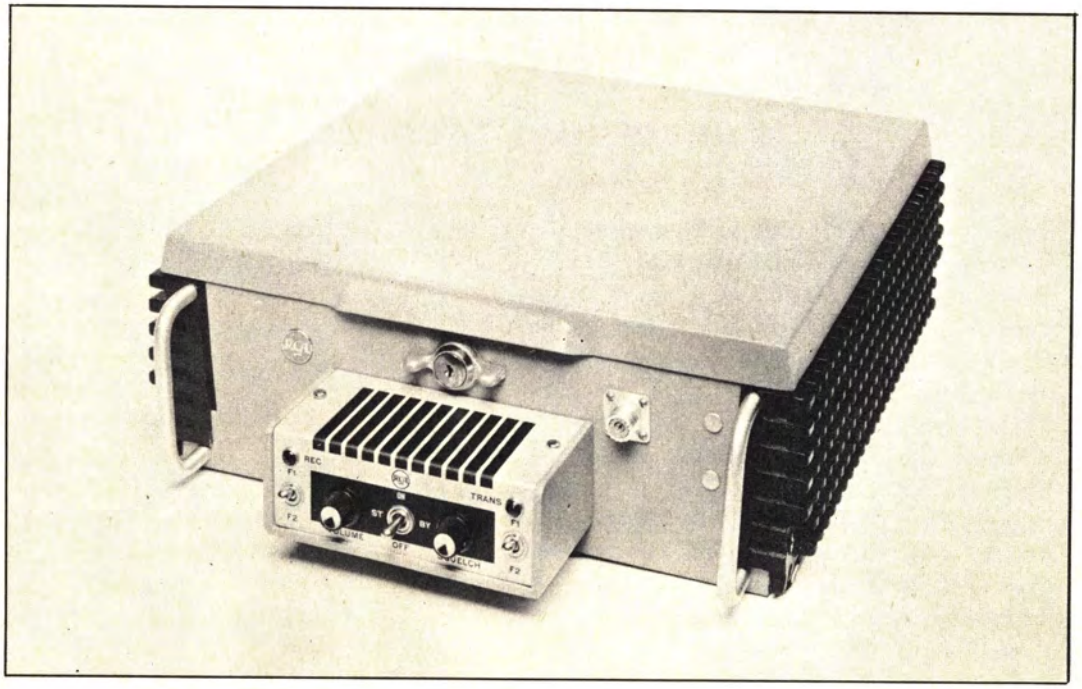


Figure S-2—T-R Unit with Control Unit on Front Panel

GENERAL TECHNICAL DATA[1]

Operating Frequency Range

148 to 174 mc

Transmitter Power Output

50–60 watts depending on the frequency

Channel Width[2]

Split Channel, 20 kc bandwidth

Total Current Drain and Voltages at Battery (Single Frequency)

Standby (Receive only):	2.5 amps at 13.8 v
On:	5.0 amps at 13.8 v
Transmit:	20.7 amps at 13.4 v

Duty Cycle

Continuous for receive, intermittent (EIA) for transmit

Tube Complement

1 6AK5
1 6360
1 6883
1 7054
1 7055
5 7056 (6 when transmitter has two frequencies)
1 7058
2 7059 (3 when receiver has two frequencies)

Transistor Complement

2 2N218
4 2N247
2 2N301
2 2N443
3 2N647

Main Fuse (in external fuseholder and relay assembly)

25 amp (MI-31266-7)

Control Circuit Fuse (in fused lead from control unit)[3]

6 amp 3 AG

Dimensions and Weight

	Transmitter Receiver (T-R) Unit	*Control Unit*	*Loud-speaker*
Height, inches	5-1/2	2-3/8	4-15/16
Width, inches	15-1/2	6-1/4	2-9/16
Depth, inches	15-1/4	3-3/4[5]	6-15/16
Weight, pounds	32[4]	1-1/2	1-1/4

[1] Detailed technical data for transmitter, receiver and power supply is given in the individual sections on these units.
[2] Equipment can be adapted for wide band operation (40KC bandwidth).
[3] For additional fuses in power supply see power supply section.
[4] Shipping weight—45 pounds.
[5] Including knobs.

EQUIPMENT SUPPLIED

Description	*RCA Reference No.*
1 T-R Unit with tubes and crystals in place which includes:	MI-17401
1 Transmitter	8949997-503
1 Receiver	8978510-501
1 Power Supply	8979948-503
1 Case	363413-501
1 Set of Cables and Accessories for Trunk Mount Installation*	MI-17526
or	
1 Set of Cables and Accessories for Dash Mount Installation**	MI-17527
1 Set of Universal Brackets for Dash Mount Installation**	MI-17411
1 Fuse, 25 amp.	MI-31266-7
1 Control Unit, Single Frequency***	MI-17524
1 Loudspeaker	MI-17462-C
1 Antenna, Roof Mounting	MI-31431-A
1 Microphone, Transistor	MI-12028-A2

* Supplied with Type CMCT-60A2T Equipment only.
** Supplied with Type CMCT-60A2F Equipment only.
*** In the CMCT-60A2F equipment the control unit is mounted on the front panel of the T-R unit. In the CMCT-60A2T, control unit is separate.

OPTIONAL EQUIPMENT

Description	*RCA Reference No.*
Control Unit, Dual Frequency	MI-17523
Quiet Channel Unit	8980696-501
Microphone Hangup Switch for Quiet Channel Operation	MI-31545-E
Carbon Microphone, Hand Type	MI-12025-A2
Re-entrant speaker, 5-inch	MI-6317-D4
Re-entrant speaker, 8-inch	MI-6440-4

DESCRIPTION

The CMCT-60A2T, F mobile stations permit two-way communication on pre-selected frequencies in the 148 to 174 megacycle band. Circuit design and construction of the equipment permit adjacent channel operation and give consistently good radio coverage of urban areas with minimum power drain. The transmitter is phase modulated and provides a minimum power output of 50 to 60 watts depending on frequency. The receiver has a stage of r-f amplification and a double superheterodyne circuit which affords high selectivity and sensitivity. The low i-f, discriminator, and audio stages of the receiver are completely transistorized and use printed circuits.

The power supply has a self-driven transistor switching circuit which converts a battery input of 12 volts (nominally 13.8 volts during reception and 13.0 volts during transmission) to the voltages required for the transmitter and receiver, without use of a vibrator or dynamotor.

Frequency stability is assured by precision crystal control of the oscillators in the transmitter and receiver. Two separate crystal oscillators are used for the first and second frequency conversions in the receiver. This circuit arrangement produces fixed high and low i-f frequencies and makes it unnecessary to realign the i-f sections of the receiver when changing frequencies.

IMPORTANT: The equipment is designed for use only in a vehicle with the negative side of the battery grounded.

Station Components

The equipment consists basically of a T-R unit, control unit, loudspeaker, roof-mounting antenna, transistor microphone, and a set of cables and mounting accessories. The T-R unit consists of a case containing the transmitter, receiver, and power supply chassis. The control unit is a small box containing the operating controls. Two different sets of cables and mounting accessories are available: the MI-17526, which permits a trunk mount installation, and the MI-17527 which permits a dash mount installation. In the trunk mount installation the T-R unit is mounted in the trunk or rear of the car and the control unit on the dashboard, and the two units are interconnected by a 19-foot cable. In a dash mount installation the control unit is mounted directly on the front panel of the T-R unit and the entire assembly is installed beneath the dashboard on a set of brackets attached to the dashboard and the floor. (See *Installation* section for details.)

Dual Frequency Operation

The equipment normally supplied has a single-frequency transmitter and receiver. However dual frequency units and kits which permit converting the equipment to dual-frequency operation are available.

Quiet Channel Operation

When quiet channel operation is desired, the equipment may be ordered with a quiet channel unit installed on the power supply chassis. Detailed information on the quiet channel unit and the changes made in the transmitter-receiver at installation of the unit is provided in a separate instruction book.

NOTE: In a radio system using quiet channel operation, the carrier is modulated by a low-pitched tone which unsquelches the receiver at the desired station. Since all receivers are silent in the absence of the tone, skip distance interference is eliminated; also when different tones are assigned to several groups of stations on the same radio channel, one group will not be disturbed by communications between stations of another group.

Control Units

The control unit supplied with single-frequency stations (MI-17524) has a receiver SQUELCH control, a VOLUME control, an ON-STANDBY-OFF switch, a green ON lamp and red TRANSMIT lamp on the front panel. The control unit supplied with dual-frequency systems (MI-17523) also contains two toggle-switches for selecting transmitter or receiver frequencies.

Construction of the Equipment

T-R Unit (See Figure S-3, Assembly Diagram). The case of the T-R unit consists of a mounting base, a center section, and a top cover. A handle in the center of the front panel controls a latch and bolt assembly which locks the three sections of the case together. The case is locked when the handle is horizontal, and unlocked when the handle is turned about 30 degrees counterclockwise. The handle itself can be locked in place with either of the two keys provided.

The transmitter, receiver, and power supply are on individual chassis which are bolted to the center portion of the case and are interconnected by cables and plugs. As seen from the front, the receiver is mounted on the left, the power supply, in the center, and the transmitter, on the right. The transistors of the power supply are mounted on a separate plate attached to the rear of the case. The printed board and small transistors of the receiver are mounted on a vertical subchassis on top of the main receiver chassis. The two audio output transistors of the receiver are mounted in a heat sink attached to the left side of the chassis. Radiators are provided on the back, left, and right sides of the case to prevent overheating the transistors. Six color-coded pin jacks on the transmitter chassis and three on the receiver chassis permit connecting a VoltOhmyst or 20,000 ohms-per-volt meter to the required test points during alignment or trouble shooting.

A coaxial antenna jack, and a red, a green, and a blue eight-contact receptacle are mounted on the front panel. In trunk-mount installations the interconnection cable from the control unit is connected

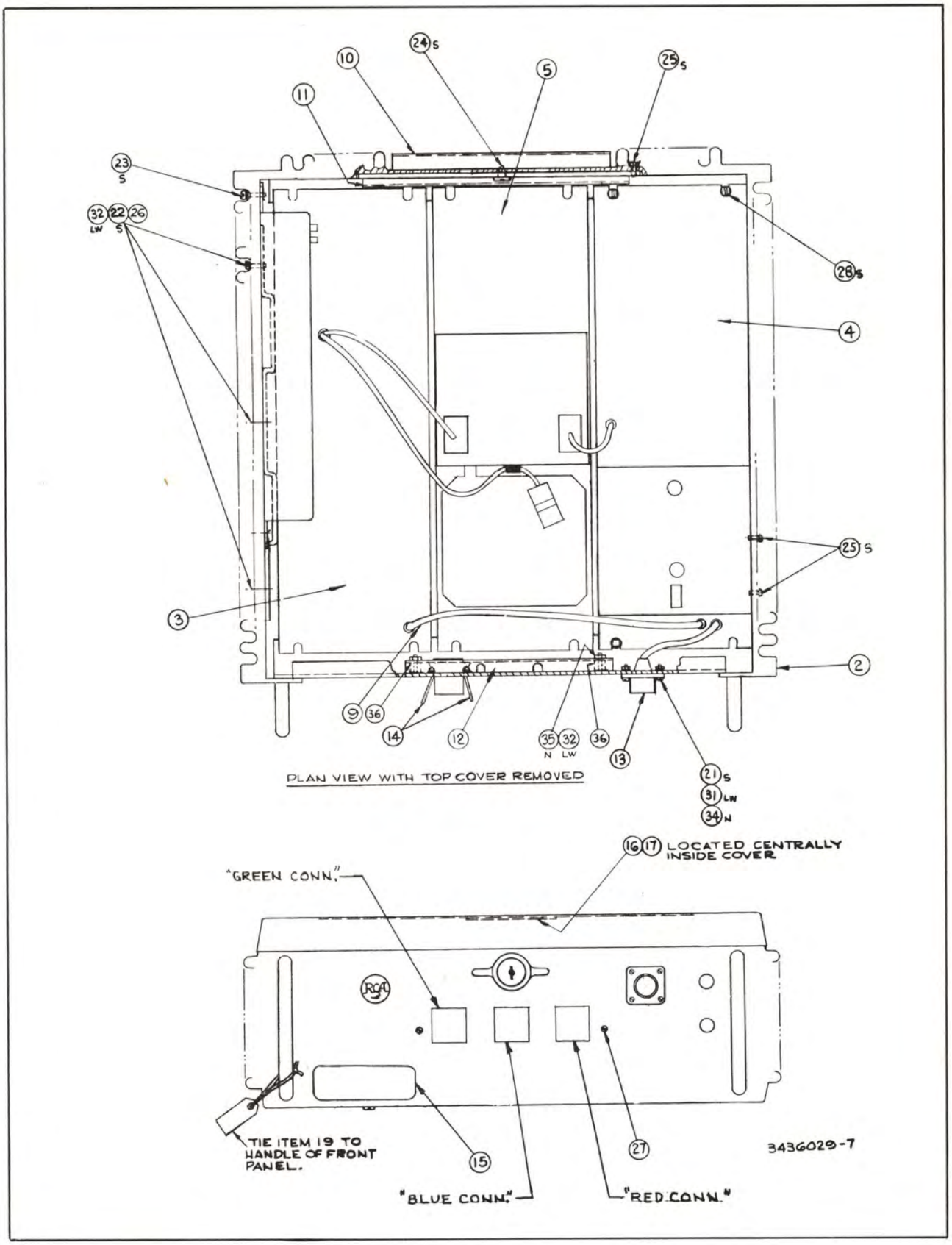


Figure S-3—Assembly Diagram, T-R Unit

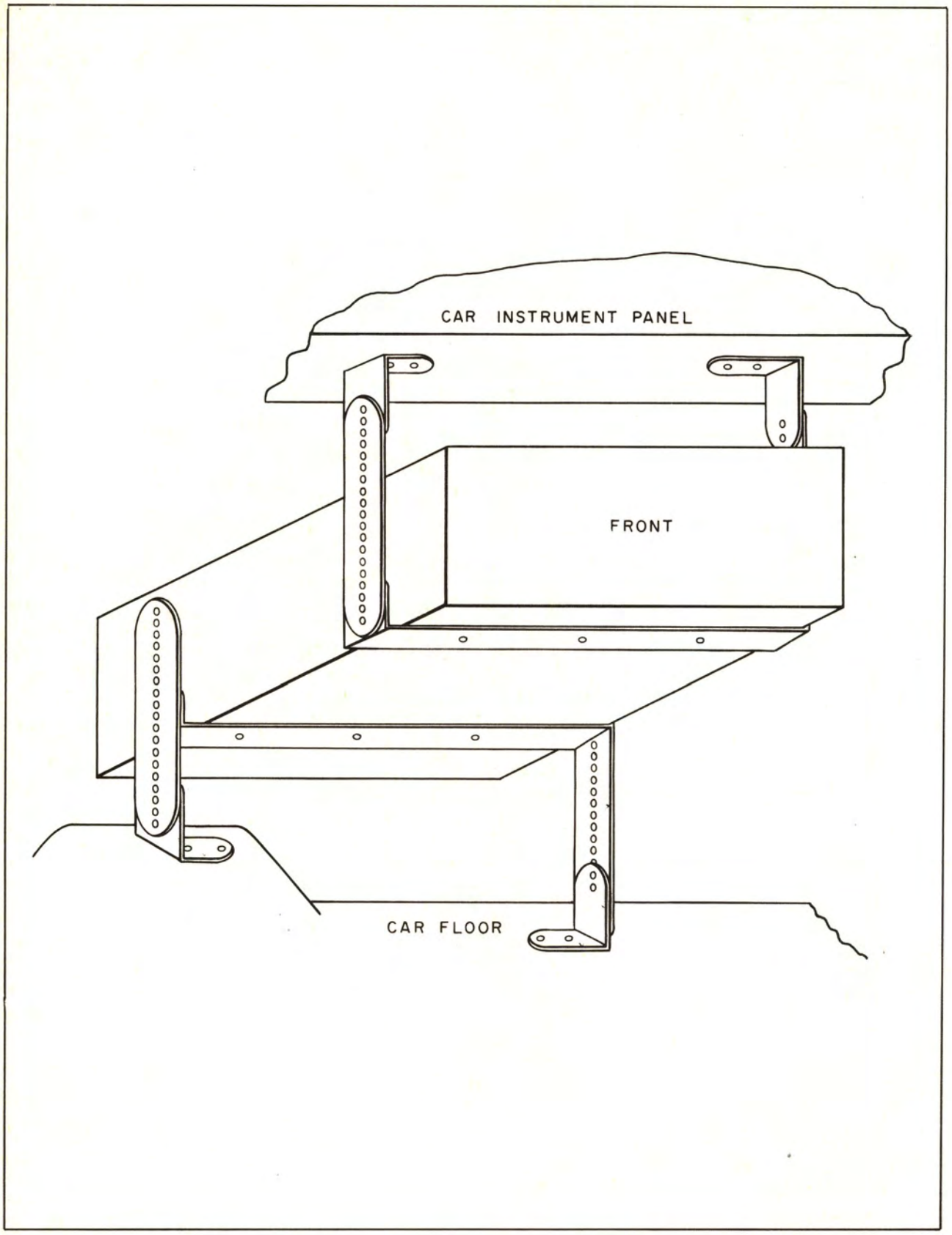


Figure S-4—Mounting Diagram, Dash Mount Installation

to the red and green receptacles. In dash-mount installations the control unit is mounted on the front panel and the plugs of the control unit are inserted directly in the red and green receptacles. The power cable is inserted in the blue receptacle, in either type of installation.

Control Unit. The control unit is a small rectangular case containing the operating controls. The case consists of a base section comprising the bottom and sides, and an L-shaped section comprising the top and the front panel. Two screws in the top fasten the sections together.

All circuit connections are brought out in four short cables which extend from the back of the front panel. One cable terminates in a microphone jack which is mounted in the bottom of the box. The other three terminate respectively in a red, a white, and a green, eight-contact receptacle.

The set of cables and accessories supplied with the trunk-mounting version of the equipment (CMCT-60A2T) includes a back plate for the control unit and a bracket for mounting the control unit on the dashboard. At installation, the red, white, and green receptacles of the control unit are inserted into plastic shells mounted on the plate and the plate is fastened to the back of the control unit with two Tinnerman clips. The leads of the interconnection cable from the T-R unit are individually inserted in the contacts of the red and green receptacles. The leads from accessory equipment such as the loudspeaker, microphone hang-up switch (if used), and the fuseholder and relay assembly are inserted in the white receptacle. The U-shaped bracket is then mounted on the dashboard, the box is inserted in the bracket, and two machine screws are inserted through the sides of the bracket into threaded holes in the box.

In dash-mount installations the control unit, without a back plate, is mounted on the front panel of the T-R unit and the red and green plugs of the control unit are inserted directly into the corresponding connectors on the front panel of the T-R unit. The power cable and the leads from accessories are inserted through a cut-out in the bottom of the control unit. The power cable is then plugged into the blue connector on the panel and the accessory leads are individually inserted in the white receptacle of the control unit.

Relay Fuse Unit. The relay-fuse unit consists of a bracket containing a relay, a fuseholder, and a silicon diode rectifier. During installation the unit is mounted inside the engine compartment near the battery, and a 25 ampere cartridge fuse is inserted in the fuseholder. The relay coil, the diode rectifier, and the ON-STBY-OFF switch on the control unit are connected in series between the hot side of the 12-volt source and ground. The diode is polarized so that current will flow through the coil only when the negative side of the battery is grounded. When the switch on the control unit is placed in either the ON or STBY position, the relay contact closes and connects the hot side of the battery, through the fuse, to the power supply.

Circuit

For circuit information refer to the individual sections on the transmitter, receiver, and power supply. A schematic diagram of each unit is provided at the back of each section. The *Interconnection Diagram* shows the interconnections and the control circuits.

INSTALLATION

Unpacking

Carefully unpack all items, examine the material for damage and check it against the packing list. Remove and discard the drive screw in the bottom of the T-R unit near the left side and the front. (This screw is provided only to fasten the base securely to the center section of the case during shipment and must be removed to permit disassembling the case). Unlock the handle of the T-R unit with one of the keys provided. Turn the handle counterclockwise about 30 degrees to release the latch and bolt. Remove the top cover by sliding it forward, and detach the base of the unit from the center section. Inspect the top and bottom of the chassis for shipping damage.

Mounting Transmitter-Receiver (Dash-Mount Installation Only)

In equipment intended for dash mounting the T-R unit is supplied with the control unit mounted on the front panel, and a set of brackets, braces, straps, and hardware is provided to permit mounting the unit beneath the dashboard. Details of the installation are shown in figure S-4. To mount the unit proceed as follows:

1. Remove the base of the T-R unit.

2. Attach the front brace to the base of the unit with three 1/4-20 x 1/2 machine screws, split lockwashers, and hex nuts. Mount the rear brace in the same way.

3. Fasten a strap to each side of the front brace by inserting a 1/4-20 thumb screw through one of the holes in the strap and the threaded hole in the brace. Attach a bracket to the end of each strap by

inserting a 1/4-20 x 1/4 machine screw through a hole in the strap and the threaded hole in the bracket.

4. Attach a strap to each side of the rear brace by passing a 1/4-20 x 1/2 machine screw through a hole in the strap and the unthreaded hole in the brace and putting a speednut on the end of the screw. Attach a bracket to the end of each strap by passing a 1/4-20 x 1/4 machine screw through a hole in the threaded hole in the bracket.

5. Place the assembly in the desired position as shown in figure S-4 with the top brackets against the bottom of the dashboard and the bottom brackets on the floor. Adjust the height of the straps by moving the screws to adjacent holes until the assembly fits the available space. If desired cut the straps to the required length. It may be necessary to place the chassis of the T-R unit on the base, and the top cover on the chassis to make certain that the adjustment is satisfactory. Note that the rear brace pivots with respect to the rear straps to permit tilting the unit to the desired angle.

6. With the assembly exactly in position use the top and bottom brackets as templates and mark centers for mounting holes in the dashboard and floor. Two holes are required for each bracket. Remove the assembly and cut the holes with a number 7 drill.

7. Remove the chassis from the base for ease of handling. Fasten the bottom brackets to the floor with 1/4-20 x 1 self tapping screws. Detach the front straps from the brace by removing the thumb screws, and attach the two bracket and strap assemblies to the dashboard with 1/4-20 x 1 self tapping screws.

8. Place the chassis of the T-R unit on the base. Do not install the top cover or refasten the front brace to the straps beneath the dashboard until connections and initial adjustments are completed.

9. Remove the two screws in the top of the control unit mounted on the front panel of the T-R unit. Lift out the top and front panel assembly of the control unit sufficiently to permit access to the cable connectors on the front panel of the T-R unit.

10. A power cable terminating in a blue 8-contact connector is supplied in the set of cables and accessories. Insert the end of this cable through the cutout in the bottom section of the control unit, from the top, and pull the cable through until only a short section remains inside the box. Insert the blue connector on the cable into the blue receptacle in the front panel of the T-R unit.

11. Check to see that the red and the green plugs of the control unit are firmly inserted in the red and green receptacles on the front panel of the T-R unit. Insert the white plug of the control unit into the white plastic shell supplied with the cables and accessories. The white plug is used only for connections to the leads from accessories and must not be connected to the T-R unit. Do not re-assemble the control unit until all connections to the white plug have been made as directed under *Connections to Control Unit.*

Omit the next section of the text which applies only to trunk mount installations, and complete the installation as directed in the following sections.

Mounting Transmitter-Receiver and Control Unit (Trunk Mount Installations Only)

In a trunk mount installation select a location for the T-R unit that will permit removal of the chassis from the case and provide room for plugging in the interconnection and antenna cables. Allow enough space to permit removing the top cover and reaching the tubes, tuning adjustments, and metering jacks with the chassis in the case. In this type of installation the usual practice has been to locate the T-R unit in the trunk, but the unit can be mounted in any other available place such as a shelf behind the front seat.

Use the base member of the case as a template and drill four holes with a number 10 drill to permit mounting the unit in the location selected. Fasten the base securely with the number 14 self-tapping screws provided. Grounding of the case is not necessary because the power cable provides a heavy ground return to the battery. This feature improves reliability of the installation.

With the center handle on the front panel in the unlocked position (30 degrees counterclockwise) slide the chassis of the T-R unit onto the base. Do not install the top cover until interconnections and control adjustments are completed.

> *CAUTION: If the equipment is to be mounted in the luggage compartment be careful not to drill through the gasoline tank.*

Lay the control and power cables loosely in place. If the transmitter-receiver is at the rear of the car, run the cable flat beneath the carpets to the front of the car. In general, cable installations beneath the car floor should be avoided. When this type of installation is necessary, all cables below the floor should be run in armored flexible conduit to provide sufficient mechanical protection.

Insert the green connector on one branch of the interconnection cable in the green receptacle on the front panel of the T-R unit, and the red connector

on the other branch in the red receptacle. Insert the blue connector of the power cable in the blue receptacle. Make certain that the spring clips on the sides of the receptacles hold the connectors firmly in place.

Select a convenient position for the control unit at the lower edge of the dashboard. Allow clearance for mounting the microphone bracket near the control unit.

A U-shaped mounting bracket and a back plate for the control unit are provided in the set of cable connectors and accessories. To install the control unit use the bracket as a template and drill two holes in the lower edge of the dashboard with a number 28 drill, to match the two slots in the bracket. Mount the bracket with two number eight self tapping screws. Insert the red, white, and green plugs of the control unit respectively into the red, blue, and green shells in the back plate. (The plugs are keyed to fit in only one position.) Place the plate against the back of the control unit so that the two studs extend through the holes at the left and right sides of the plate. Press the two Tinnerman spring clips onto the studs. Remove the two screws on the sides of the control unit. Place the unit inside the mounting bracket and insert the two screws through the holes in the sides of the bracket and the control unit.

Microphone and Loudspeaker

The microphone holder (or microphone hang-up switch in quiet channel systems) can readily be located at any convenient point on the dash by using it as a template and drilling the necessary holes. Fasten the holder with the hardware supplied with the microphone.

Hang the microphone on its holder, then connect the plug to the microphone jack in the bottom of the control unit.

The loudspeaker may be mounted either on the firewall underneath the dash or above the dashboard grill. The mounting brackets of the speaker box may be swung 90 degrees to suit the installation. Using the two holes in the brackets as a template mark the location of the two mounting holes. Drill holes large enough to clear a number 8 machine screw. Mount the speaker with the 8-32 screws, nuts and lockwashers supplied.

Connections to Control Unit

In trunk mount installations individually insert the ends of the control cable leads in the contacts of the green and red receptacles and the back plate of the control unit as shown in the *Block Connection Diagram,* figure S-5. Each lead has a numbered label that indicates the contact to which it should be connected. Insert the leads from the loudspeaker and the microphone hang-up switch (if used), the fused lead, and the red #20 lead provided with the cables and accessories, into the white receptacle. The labels on these leads are lettered from "A" to "H".

If the equipment is to be interlocked with the ignition switch, connect the six-ampere fused lead to the coil side of the ignition switch or to the accessory terminal if one is available. If interlocking is not desired, connect the fused lead to any convenient source of battery voltage, such as the hot side of the ignition switch, cigarette lighter, or light switch.

> NOTE: It is recommended that the fused lead be connected to the accessory terminal of the ignition switch so that the radio will be off when the starter is on. If this is not done, high transient voltages which appear across the battery line when the starter is cranked may damage the transistors.

In dash mount installations it is only necessary to insert the leads marked A to H through the cutout in the bottom of the control unit and to connect them to the white plug as directed in the preceding paragraphs. After all the leads are connected re-assemble the control box by inserting the two screws in the top.

Mounting the Fuseholder and Relay Assembly

Locate the fuseholder and relay assembly so that it can be connected to the battery or hot side of the starter solenoid with the 42-inch jumper provided. Firewall mounting may be used, although a point on the fenders inside the engine compartment may be more convenient. The unit should preferably be mounted in the position of an inverted "L" so that the top of the chassis will act as a cover.

Using the chassis as a template drill three mounting holes in the engine side of the firewall or fender with a number 28 drill. Mount the unit with the three number 8 x 3/4 self tapping screws and lockwashers provided or with the three 8-32 x 5/8 machine screws, nuts, washers and lockwashers. Install the 25-ampere cartridge fuse in the fuseholder.

Cable Connections to Fuseholder and Relay Assembly, and Battery

Drill one or two holes in the firewall large enough to pass the two heavy leads of the power cable and the red #20 lead connected to contact "E" of the control unit. Line the holes with the grommets supplied and run the three wires through the holes. Connect the heavy black lead to the chassis frame as close to the battery ground lead as possible. The best place to make this connection is at the battery terminal or under the bolt that grounds the battery

cable. With the short braided strap supplied, either bond the motor block to the chassis or bond the battery ground terminal to the chassis.

Connect the heavy red lead of the cable to the contact (center) terminal of the relay in the fuseholder and relay assembly and the red number 20 lead to the coil (end) terminal of the relay. Connect the red number 10 jumper from the fuse to the hot side of the starter solenoid or relay. If the chassis of the fuseholder and relay assembly is not fastened to a common ground connect the black number 10 36-inch jumper between one mounting screw of the chassis and a common ground point.

NOTE: The red jumper can be connected directly to the hot (ungrounded) battery terminal instead of the solenoid; however, this connection is undesirable because it will corrode rapidly.

CAUTION: Keep leads as far away from the car ignition system as possible, especially from the spark plugs. Do not coil excess cable under hood.

Install the ignition suppressor by pulling out the center lead of the vehicle's distributor at the distributor cap. Cut the lead approximately three inches from the cap end, screw one end of the suppressor on the end of the long piece of cut wire, screw the short piece of wire into the other end of the suppressor, then replace the distributor wire.

IMPORTANT: The equipment is designed for use only in a vehicle with the negative side of the battery grounded. However, if the incorrect polarity is accidentally impressed on the battery leads the equipment will not be damaged because the rectifier on the fuseholder and relay assembly will prevent operation of the relay.

Antenna

Mount the antenna on the roof of the vehicle in accordance with the instructions supplied with the antenna. Run the antenna cable to the transmitter-receiver and connect the plug to the coaxial ANTENNA jack on the front panel. Make certain that the antenna connection at the antenna base provides good shielding.

Installing Cable Clamps

To complete the installation check all connections carefully and then attach the power cable and interconnection cable (in trunk mount installation) to the car chassis and frame at convenient points using the clamps provided. Make certain the cable does not rest against unprotected sharp edges of the car structure.

If the cable is too long for the installation coil the excess cable close to the T-R unit and secure it so that it will not be damaged and will not interfere with other fittings in the car. Allow a loop at the T-R unit, so the chassis can be removed for servicing without straining or binding the cable over a small radius. In dash mount installations allow enough cable to permit unfastening the T-R unit from the straps attached to the dashboard and lowering it to the floor on the rear pivot screws.

Do not replace the transmitter-receiver cover until all the initial adjustments have been made.

Initial Adjustments

The equipment is shipped with all adjustments made to within ± 30 cycles of the frequency of the crystal specified by the customer. At the time of installation the only adjustments that should be necessary are antenna loading and PA tuning of the transmitter, and setting the chassis volume control of the receiver. Frequency checks of the transmitter and receiver should also be made. Before operating the equipment make these adjustments and checks as directed under *Initial Adjustments* in the individual instruction sections on the transmitter and receiver.

After completing all adjustments turn the center handle on the front panel of the T-R unit counterclockwise, slide the cover onto the T-R unit and push it back as far as possible. Turn the handle to the horizontal position and lock it with one of the keys provided.

Noise Suppression

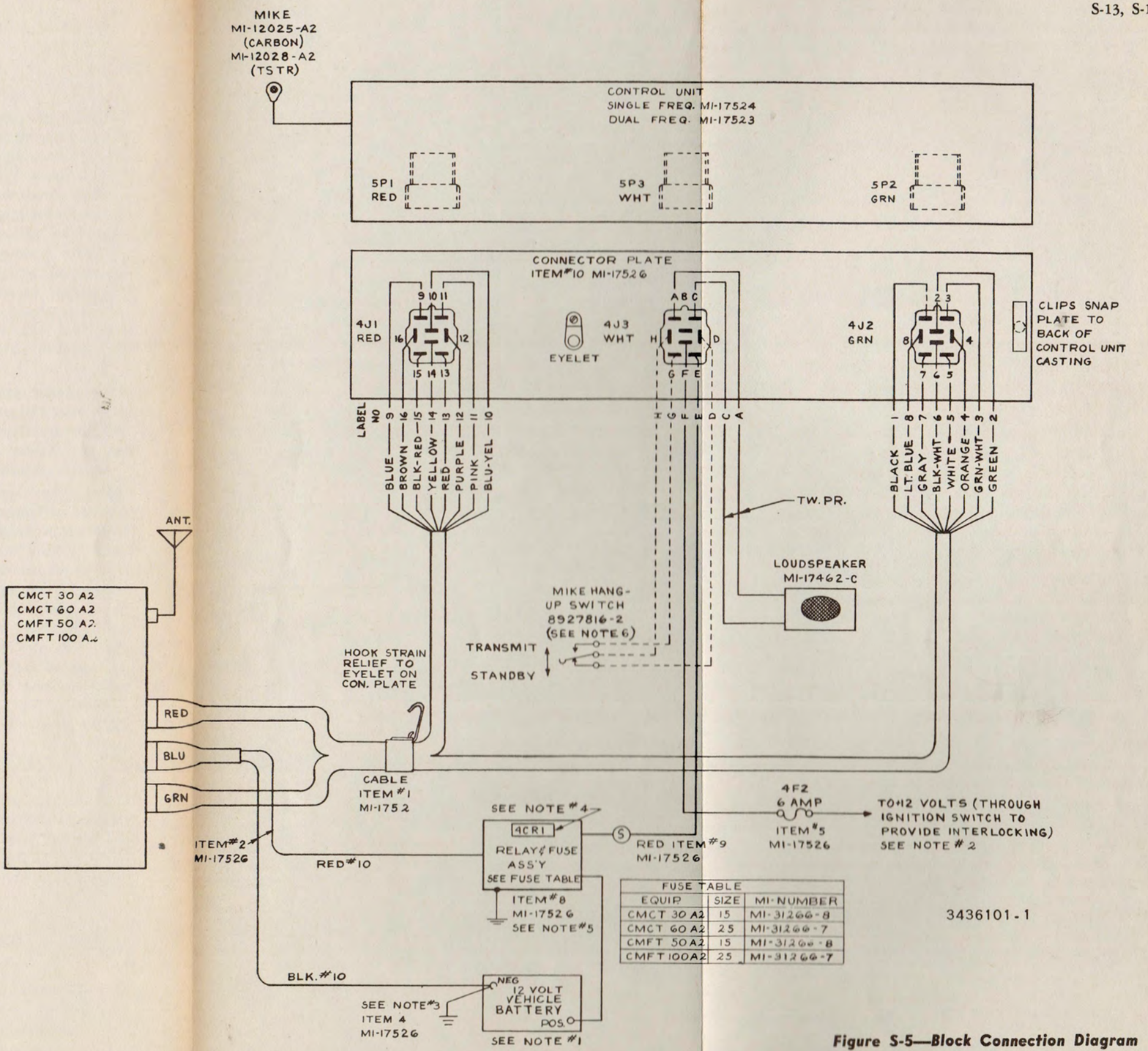
Some form of noise suppression is required whenever a receiver is installed in a motor vehicle. Since the receiver is sensitive to very small electrical disturbances, it is important that unwanted disturbances be eliminated. Such disturbances are produced by the ignition system, electrically operated accessories, and static discharge (between the front wheels and their bearings, between the rods, or between other parts of the vehicle which are in intermittent contact).

All of the noise elimination procedures which follow will probably not be necessary in any single installation. Procedures which produce satisfactory results in one installation may be of no help in another. The effectiveness of any procedure can be determined only by trial. A suppressor should always be installed in the high-tension lead to the distributor, as directed under *Cable Connections to Fuseholder and Relay Assembly, and Battery.*

In operating areas where the signal strength is low, proceed as follows:

NOTES:

1. THIS EQUIPMENT WILL OPERATE ONLY IN VEHICLES WITH NEG. TERM. OF BAT. GROUNDED TO CHASSIS. RED #10 WIRE IS ALWAYS CONNECTED TO THE POS TERM. OF BAT. & WHEN EVER POSSIBLE THIS LEAD SHOULD BE CONNECTED TO THE BAT. SIDE OF STARTER RELAY.
2. WHEN INTERLOCKING OF RADIO EQUIP. THRU IGNITION SWITCH IS DESIRED, CONNECT 6 AMP FUSED LEAD TO THE COIL SIDE OF THE IGNITION SWITCH OR ACCESSARY TERM. WHEN AVAILABLE.
3. TO INSURE A GOOD GRD. BETWEEN BAT. & FRAME, THIS STRAP IS TO BE CONNECTED DIRECTLY BETWEEN THE BAT. GRD TERM. & THE CAR FRAME, OR BETWEEN ACCESSIBLE POINTS ON THE MOTOR BLOCK & CAR FRAME. AT THE CAR FRAME IT MAY BE NECESSARY TO DRILL A HOLE, AFTER WHICH THE STRAP CAN BE ATTACHED USING THE 5/16 BOLT & HARDWARE PROVIDED IN THE CABLE PACKAGE.
4. THE DIODE 4CR1 IS IN THE POLARITY PROTECTOR CIRCUIT TO INSURE APPLICATION OF PROPER POLARITY TO STATION UNIT. THE DIODE WILL NOT CONDUCT & SYSTEMS RELAY WILL NOT CLOSE, UNLESS RED WIRE "S" HAS POSITIVE VOLTAGE ON IT.
5. WHEN SYSTEM FUSE & RELAY ASSEMBLY BRACKET IS NOT FASTENED TO A COMMON GROUND, A 36 IN. LG. BLK. #20 AWG WIRE IS SUPPLIED IN CABLE MI-17526 TO PROVIDE A GROUND BETWEEN MOUNTING SCREW OF ASSEMBLY BRACKET & COMMON GROUND.
6. MICROPHONE HOLDER (WITH SWITCH) IS USED WHEN QUIET CHANNEL KIT IS INCORPORATED INTO EQUIPMENT. PHANTOM LINES ARE CONTROL UNIT CONNECTIONS FOR SWITCH.



FUSE TABLE		
EQUIP.	SIZE	MI-NUMBER
CMCT 30 A2	15	MI-31266-8
CMCT 60 A2	25	MI-31266-7
CMFT 50 A2	15	MI-31266-8
CMFT 100 A2	25	MI-31266-7

3436101-1

Figure S-5—Block Connection Diagram

a. Energize the ignition system of the motor vehicle but do not start the motor.

b. Energize the receiver and tune it to a weak signal, then individually jar each electrically operated accessory such as the oil pressure gauge, gas gauge, etc. If noise is produced in the receiver when any of the accessories are jarred, install a one microfarad paper capacitor across the terminals of that device.

c. Start the motor, and with the receiver tuned to a weak signal recheck for noise caused by ignition pickup or generator sparking.

Ignition pickup can be minimized by installing a flexible bond as "Belden" braid between the hood and the frame of the vehicle. This bond should be firmly attached to both surfaces near the hood hinge and should be no longer than necessary to allow the hood to be raised. In some cases it may also be necessary to connect a 0.01 microfarad mica capacitor across the low voltage breaker points on the distributor. Occasionally it may also be necessary to install resistor type spark plugs. If the ignition coil has a bakelite case, it may be necessary to install a metallic shield around it.

Generator sparking is usually caused by uneven contact of the brushes against the commutator. This is frequently caused by dirt, pitting, or worn bearings.

A dirty commutator may be cleaned by means of sandpaper, (other abrasives should not be used) held against it with a thin strip of wood. If the commutator is pitted it should be turned down. Worn bearings should be replaced.

A high pitched sound (heard only when the motor is running) can, in most cases, be eliminated by connecting a one microfarad paper capacitor between the output terminal on the generator and the motor block. If generator noise persists, it is recommended that a filter (made by close winding 22 turns of No. 12 enamel wire on a 1-1/8-inch diameter form) be connected in series with the generator output. Each end of this filter should be bypassed to the motor block through a 1500 mmf mica capacitor.

It is frequently necessary to install static eliminators on the front wheels of the vehicle. Occasionally noise is generated by voltage build-up in or static discharge between metallic surfaces which rub against each other when the vehicle is in motion. A frequent source of noise is the exhaust pipe. The end of this pipe should be bonded to the frame of the vehicle. Bonding of other surfaces should be resorted to only after all other sources of noise have been eliminated.

To utilize the maximum performance of the mobile receiver full ignition suppression is recommended on all spark plugs using one of the following methods.

1. Resistor type spark plugs.
2. High resistance ignition cable.

OPERATION

Single Frequency Stations

To start the equipment turn both the VOLUME and SQUELCH knobs on the front panel of the control unit to the extreme clockwise position. Place the ON-STBY-OFF switch in the ON position. After about 30 seconds background noise should be heard in the loudspeaker. While the engine is running and no signal is being received, turn the SQUELCH knob counterclockwise until the background noise just ceases. (Do not turn the control too far counterclockwise or weak signals may not be heard.) The equipment will then be ready to receive signals on the assigned frequency. When a signal is received adjust the VOLUME control for the desired sound intensity.

To transmit press the push-to-talk button on the microphone and speak directly into the microphone in a normal tone of voice. The red lamp will glow when the push-to-talk button is pressed and will become extinguished when the button is released.

To reduce battery drain during standby periods power may be removed from the transmitter filaments by placing the ON-STBY-OFF switch in the STBY position. Choice of the STBY or ON position during normal operation depends largely on the type of radio operation required. If an immediate reply is necessary from the mobile unit the switch should normally be in the ON position. However, if the reply can be delayed by approximately 30 seconds, several amperes of battery drain can be saved by keeping the switch in the STBY position. When STBY position is normally used it will be necessary to switch to the ON position and wait 30 seconds before making a transmission.

Dual Frequency Stations

Operating procedure for dual-frequency stations is the same as for single-frequency stations except that the XMTR and REC toggle switches on the dual frequency control unit must be placed in the position corresponding to the desired transmitter or receiver frequency, F1 or F2.

MAINTENANCE

Routine Checks

The equipment can easily be maintained at peak performance if adequate inspection schedules are established. The frequency of such inspections should be determined by operating conditions.

Routine checks should include the following items:

Cleanliness. Periodically remove all dust and dirt from the equipment with a brush or dry air blast. In particular, remove all dust from terminal boards and relay terminals.

Tubes. Check tubes and replace weak ones. The simplest way to test a tube is to replace it with a good tube of the same type.

Power Supply. Adequate voltage for operating the equipment must be available at all times. The battery and generator should be kept in good operating condition by frequent inspection. Water level in the battery should be kept at proper height and generator output should be adjusted to suit load on battery.

Frequency and Modulation Checks. Check frequency of the transmitter and receiver, and modulation as directed under *Initial Adjustments* in the sections on the transmitter and receiver. These checks are particularly important when the equipment is to be operated on adjacent channels. Although the equipment is designed for adjacent channel use, correct carrier frequency and modulation must be maintained to permit successful operation.

Trouble Shooting and Alignment

Detailed trouble shooting and alignment instructions are given in the individual sections on the transmitter, receiver and power supply. For measurements at the metering jacks on the chassis and the contacts of the plugs that connect the transmitter and receiver to the power supply, refer to the *Interconnection Diagram.* Voltages at the tube sockets are given in the individual schematic diagrams. For interconnections between the various units, and control circuits refer to the *Interconnection Diagram.*

To Remove Receiver Chassis for Servicing

Most servicing can be accomplished without removing the individual chassis from the case. However, the receiver chassis must be removed when it is necessary to reach the printed circuit board on the subchassis or the output transistors. To permit removal of the chassis unscrew the five round-head drive screws in the left side of the case, from the outside, and the four hex-head screws on top of the chassis.

REPLACEMENT PARTS LISTS FOR ACCESSORIES

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
		CASE ASSEMBLY (363413-501)	
	219239	8444221-1	Latch: cabinet, key lock cam actuated
	219238	8444222-501	Latch: cabinet sliding latch assembly, bolt assembly
	219240	8982840-1	Lock: cabinet with 2 keys
	219241	3400507-1	Spring: flat beryllium copper, slide latch tension
	219242	8831068-4	Washer: spring, beryllium copper, 49/64 I.D. x 29/32 O.D. x 0.035 thick
		CABLES WITH ACCESSORIES FOR TRUNK MOUNT, MI-17526 AND 17526-A	
	219338	8702794-6	Boot: black plastic, connector boot only
	219334	8702772-1	Cable: control, 16 conductor, 19 ft. lg. with red and green connectors and 16 terminals assembled
	219335	8442112-1	Cable: power, 2 conductor, 19 ft. lg. with blue connector and 2 terminals assembled
	207105	8835356-1	Capacitor: paper, 0.5 μf ±20%, 200 v (Suppressor)
	219337	8702794-5	Clamp: cable, 2 piece with screws, nuts and washers
	219349	8702794-3	Contact: female, connector contacts for #22 to #18 gauge wire only (15 per stock no.)
	219350	8702794-4	Contact: female, connector contacts for #16 to #14 gauge wire only (15 per stock no.)
	219347	8702794-1	Contact: male, connector contacts for #22 to #18 gauge wire only (15 per stock no.)
	219348	8702794-2	Contact: male, connector contacts for #16 to #14 gauge wire only (15 per stock no.)
	12958	Pt. of 8980665-1	Fuse: cartridge, 6 amp, 32 v

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
			SPEAKER, MI-17462-C
	215828	8430405-1	Gasket: speaker, sponge rubber
	213986	769110-2	Grille: speaker, plastic
	102634	460292-1	Speaker: P.M. 4 X 6 elliptical
			FUSE, MI-31266-7
			Fuse: cartridge, 25 amp, 250 v
			CONTROL UNIT, SINGLE FREQUENCY, MI-17524
5DS1, 5DS2	13952	61114-20	Lamp: pilot, 12 v, 0.1 amp, Type #53
5J1	95186	8982843-1	Connector: female, 4 contact, chassis mtg. (microphone)
5P1		Pt. of 8442120-2	Connector: male, 8 contact, "Red"
5P2		Pt. of 8442120-1	Connector: male, 8 contact "Green"
5P3		Pt. of 8442120-3	Connector: male, 8 contact "Natural"
	219341	8702794-103	Shell: "Green" plastic cable connector shell only, for "male" contacts only (Part of 5P2)
	219339	8702794-101	Shell: "Red" plastic connector shell only for "male" contacts only (Part of 5P1
	219342	8702794-104	Shell: "Natural" plastic, cable connector shell only for "male" contacts only (Part of 5P3)
	219347	8702794-1	Contact: male connector contacts for #22 to #18 gauge wire only (15 per stock no.) (Part of 5P1, 5P2, 5P3)
5R1	219265	737887-28	Resistor: variable, composition, 25,000 ohm ±20%, ½ w
5R2	219266	737847-52	Resistor: variable, wire wound, 20 ohm ±10%, 2 w
5R3	213637	8980601-37	Resistor: fixed, wire wound, 3 ohm ±10%, 5 w
5S1	219267	8982804-1	Switch: toggle, D.P.D.T., "off-on-on"
5XDS1		380951-8	Pilot Light Assembly "Green" (on-off)
5XDS2		380951-7	Pilot Light Assembly "Red" (Xmtr.)
	57761	Pt. of 380951-7 or 8	Socket: pilot light socket only, less lamp and jewel
	48997	Pt. of 380951-8	Jewel: pilot light "Green" jewel only less lamp and socket
	94456	Pt. of 380951-7	Jewel: pilot light "Red" jewel only less lamp and socket
			Miscellaneous:
	219268	8980604-1	Knob: control, black phenolic with chrome insert (volume and squelch)
	219262	8007074-1	Panel: control box front
			BUTTON-UP MATERIAL, KIT OF PARTS (3400161-501)
		8982823-501	Cable Assembly (Antenna, transmitter to case)
		8982824-501	Cable Assembly (Antenna, transmitter to receiver)
	51800	727215-3	Connector: female, coaxial, chassis mtg. (Antenna)
	78269	8848262-1	Connector: male, coaxial, phone type, cable mtg.

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
		8444205-501	Fuse Holder and Relay Assembly (Systems)(less fuse)
	216815	8842489-2	Holder: fuse (Systems)
	99876	8886251-18	Lead: battery "Red" single #10 stranded conductor, 42" lg.
	219336	8980665-1	Lead: fused lead assembly, including 6 amp, 32 v fuse
		8442194-501	Plate Assembly
	217682	8819229-8	Relay: (Systems) 12 V.D.C., contacts, S.P.S.T., N.O.
		99126-54	Resistor: fixed, composition, 220 ohm ±10%, 2 w
	219340	8702794-102	Shell: "Blue" plastic cable connector shell only for male contacts only
	219345	8702794-203	Shell: "Green" plastic, cable connector shell for female contacts only
	219341	8702794-103	Shell: "Green" plastic, cable connector shell only for male contacts only
	219346	8702794-204	Shell: "Natural" plastic, cable connector shell for female contacts only
	219343	8702794-201	Shell: "Red" plastic, cable connector shell only for female contacts only
	219339	8702794-101	Shell: "Red" plastic, cable connector shell for male contacts only
	204657	8865863-1	Strap: ground, flat braided wire 24" lg.
	205815	8448250-2	Suppressor: automotive type, distributor spark suppressor
CABLE ASSEMBLY WITH ACCESSORIES FOR DASH MOUNT, MI-17527 and 17527-A			
4F2	12958	Pt. of 8980665-1	Fuse: cartridge, 6 amp, 32 v
			Miscellaneous:
	219338	8702794-6	Boot: black plastic, connector, boot only
	219335	8442112-2	Cable: power, 2 conductor, 19 ft. lg. with "Blue" connector and 2 terminals assembled
	207105	8835356-1	Capacitor: paper, 0.5 μf ±20%, 200 v suppressor
	219337	8702794-5	Clamp: cable, 2 piece, with screws and nuts
	219348	8702794-2	Contact: male connector contacts for #16 to #14 gauge wire only (15 per stock no.)
		8444205-501	Fuse: holder and relay assembly (Systems) (Less Fuse)
	216815	8442489-2	Holder: fuse (Systems)
	99876	8886251-18	Lead: battery, "Red" single #10 stranded conductor, 42" lg.
	219336	8980665-1	Lead: fused lead assembly, including 6 amp, 32 v fuse
	217351	8972372-1	Rectifier: silicon
	217682	8819229-7	Relay: (Systems) 12 V.D.C., contacts, S.P.S.T., N.O.
		99126-54	Resistor: fixed, composition, 220 ohm ±10%, 2 w
	219340	8702794-102	Shell: "Blue" plastic, cable, connector shell only, for male contacts only
	219346	8702794-204	Shell: "Natural" plastic, cable connector shell only, for female contacts only
	204657	8865863-1	Strap: ground, flat braided wire 24" lg.
	205815	8448250-2	Suppressor: automotive type, distributor spark suppressor
MOBILE ROOF TOP ANTENNA, MI-31431-A			
	93483		Connector: male single contact, cable mtg. type
	57295		Gasket: rubber, mobile antenna weather seal
	57225		Rod: antenna 16-9/16" lg. stainless steel with threaded coupling lower end

VHF COMMUNICATION EQUIPMENT

INSTRUCTIONS

50-60-Watt Transmitter

148-174 MC
(DWG. 8949997-503)

- TECHNICAL DATA
- CIRCUIT DESCRIPTION
- INITIAL ADJUSTMENTS
- MAINTENANCE INSTRUCTIONS

RADIO CORPORATION OF AMERICA
COMMUNICATION PRODUCTS DEPARTMENT, CAMDEN, NEW JERSEY

PRINTED IN U.S.A.
DU 680

IB-33543

TECHNICAL DATA

Carrier Frequency Range
148 to 174 mc

Filament Power Required
12.8 v at 2.6 A.

Plate Power Required
400 v at 300 ma
275 v at 140 ma

Fixed Bias Required
−45 v at 17 ma

Operating Temperature Range
−30 to +60°C ambient

R-F Power Output
50 to 60 watts depending on frequency

Crystal Frequency Range
12.33 to 14.5 mc

Crystal Frequency Multiplication
12 times

Frequency Stability (−30° to +60°C)
±.0005%

Frequency Swing for 100% Modulation at 1000 Cycles
±5 kc (standard band)
±15 kc (wide band)

Number of Carrier Frequencies
Standard version has one frequency. Dual frequency version is available on special order.

Antenna Load Impedance
50 ohms up to 2:1 VSWR

Maximum Frequency Difference for Two-Frequency Operation
1 mc — more difference possible at reduced output power.

Audio Input Impedance
100 ohms

Neutralization
Fixed

Audio Input for Limiting
0.6 volt at 1000 cps

Audio Response
Within +1 and −3 db from a true 6 db per octave pre-emphasis characteristic from 300 to 3000 cps.

Maximum Distortion
5% at 1000 cps

Spurious Emission
Down at least 70 db outside the band
Down at least 100 db in the band

Frequency Adjustment
Nominal frequency ±.005%

Tube Complement
1 6360 Second Doubler
2 6883 Power Amplifier
1 7054 First Doubler
1 7055 Limiter
1 7056 Oscillator (2 for dual frequency units)
1 7058 Audio Amplifier
1 7059 Phase Modulator and Tripler

DESCRIPTION

The CMCT-60A2 phase modulated transmitter permits transmission on any pre-selected frequency in the 148- to 174-megacycle band at a power output of 50 to 60 watts depending upon frequency. The unit may be used in either standard band (20 kc bandwidth) or wide band (40 kc bandwidth) systems. In standard systems the modulation control, 2R23, is adjusted for a peak deviation of ±5 kc. In wide band systems 2R23 is adjusted for a peak deviation of ±15 kc.

The transmitter chassis is available with either a single crystal oscillator, or with two oscillators for dual-frequency operation. In addition, single-frequency units can be converted to dual-frequency operation by installing a kit on the chassis.

Transmitter Circuit

The transmitter uses a crystal with a fundamental between 12.33 and 14.5 megacycles. To produce the output frequency, a tripler stage and two doubler stages multiply the crystal fundamental by 12. (See *Schematic Diagram.*) The exact crystal frequency for any carrier in the band (148 to 174 mc) may thus be calculated by dividing the output frequency by 12.

The crystal is connected in a modified Pierce oscillator circuit using a pentode tube, 2V1. Trimmer capacitor 2C1 in the crystal circuit permits a minimum

frequency variation of ±.005% which allows the oscillator to be set exactly on frequency. The crystal is contained in a temperature controlled plug-in crystal oven, 2E1.

Dual frequency units have an additional crystal oscillator, 21V1, connected as shown in dotted lines on the schematic diagram. The desired frequency is selected by grounding the cathode of the appropriate oscillator through a switch on the control panel.

Phase modulator 2V2A shifts the phase of the oscillator output in accordance with the audio signal applied to its control grid (pin 9). The network between the grid and plate of 2V2A is specially designed to permit a maximum phase swing of approximately ±90 degrees without tuning adjustments.

The band of frequencies developed in the phase modulator is multiplied by a tripler, 2V2B, and two doubler stages, 2V3 and 2V4. Tuning of these stages is accomplished by adjusting the cores of coils 2L3 to 2L7. The output of 2V4, which is in the 148 to 174 mc band, is coupled through coils 2L19 and 2L20 to the grids of the push-pull output tubes 2V5 and 2V8. Variable capacitor 2C23 in series with coil 2L19 is a tuning adjustment. To prevent overloading due to grid excitation failure, the power output stage and the second doubler stage use combined grid-leak and fixed bias. The fixed bias (−45 volts) is obtained from the power supply through pin 5 of plug 2P1.

The output of 2V5 is coupled to the antenna by two tuned lines, 2L22 and 2L21, and a filter, 2Z3. PA plate capacitor, 2C52, and ANT TUNE capacitor, 2C29, are tuning adjustments. The low-pass filter, 2Z3, consists of three constant K sections and one M derived section and provides an overall attenuation of 70 db to frequencies above the carrier. The entire filter is compactly assembled on a small bracket and requires no tuning.

The output of 2Z3 is connected to the contacts of antenna relay 2K1. The coil of this relay is connected in series with the 275-volt plate supply. When the microphone push-to-talk switch is closed, the relay becomes energized and connects the transmitter output to the antenna jack, 2J2. When the switch is open, the relay becomes de-energized and connects the antenna jack to a coaxial cable which goes to the receiver input.

The audio section of the transmitter uses a twin triode, 2V6, and a dual diode, 2V7. The microphone output from pin 1 of plug 2P1 is fed to the grid of the first section of audio amplifier 2V6 through a pre-emphasis network consisting of capacitor 2C38 and resistor 2R29. The amplified signal is fed to the dual diode, which acts as a clipper. Signals having an amplitude below the clipping level are unaffected, but those which exceed the clipping level are clipped at both the top and bottom. The circuit is designed so that some clipping of peaks will occur for normal signal levels. The output of the clipper is fed through a de-emphasis capacitor 2C35, which restores the overall flat frequency response, and then through the MOD GAIN potentiometer, 2R23, to the second section of audio amplifier 2V6. The modulation level, or peak frequency swing of the carrier is determined by the setting of 2R23. When the station equipment includes a quiet channel unit the low-frequency tone from the quiet channel unit is added to the voice signal at the grid of the second section of 2V6. The output of this tube is fed through a low-pass filter network which attenuates frequencies above 3000 cycles, to the grid of the phase modulator, 2V2-A.

Color-coded pin jacks are provided on top of the chassis to permit connection of a VoltOhmyst or 20,000 ohms-per-volt meter to the transmitter circuits during tuning and trouble shooting. The green pin jacks, 2TP1 to 2TP4, are connected to the grids of the tripler, first and second doubler, and power amplifier stages, and the red jack, 2TP5, to the plate of the power amplifier. The black pin jack, 2TP6, is connected to a 5-ohm resistor, 2R43, which is in series with the ground return lead of the high voltage power supply. This arrangement permits measuring the plate current of the power amplifier by connecting a voltmeter across the resistor, and makes it unnecessary to insert a milliammeter directly into the circuit. The plate current in milliamperes is equal to the voltage across the resistor multiplied by 200.

A TUNE-OPERATE switch, 2S1, is provided on the chassis to permit reducing the plate current of the power amplifier to a safe value during tune-up. When the switch is in the TUNE position it reduces the screen voltage of the power amplifier by inserting resistor 2R38 in the screen supply circuit.

INITIAL ADJUSTMENTS

Before shipment, the transmitter is tuned and loaded into a 52-ohm resistive antenna load, the frequency deviation is adjusted for a maximum of ±5 kc (±15 kc in wide band units), and the carrier frequency is adjusted to within ±30 cycles of the frequency specified by the customer. At installation only PA tuning, antenna loading and frequency checking should be required. To make these adjustments the following equipment is needed:

1. Voltmeter having a sensitivity of at least 20,000 ohms per volt, such as the RCA LM-1A or Simpson 260.

2. RCA CX-8A Frequency and Deviation Meter, or similar unit calibrated for the desired carrier frequency. (Receiver at fixed station may be used.)

3. Field Intensity Meter (Optional).

4. Insulated screwdriver.

NOTE: Under the F.C.C. ruling all tuning adjustments on the transmitter must be made by, or under the supervision of, a holder of a SECOND CLASS or higher Radio Telephone Operator's License.

Antenna Loading and PA Tuning

With the power off set the ANT TUNE capacitor, 2C29, to maximum capacity. Reduce the coupling between the PA plate line, 2L22, and the antenna coupling loop, 2L21, by inserting the insulated screwdriver through the slot in the top of the cage and pushing the loop away from the PA plate line. Place the TUNE-OPERATE switch, 2S1, in the TUNE position.

Connect the positive lead of the meter to the chassis, and the negative lead to the PA GRID jack, 2TP4 (green). Turn the power switch on the control panel to the ON position and allow about 30 seconds for the filaments to reach operating temperature. Energize the transmitter by pressing the switch on the microphone. (If the control unit is out of reach, disconnect the microphone from the control unit and connect it to the microphone jack on the power supply chassis). Adjust the 2ND DOUBLER PLATE capacitor, 2C23, for maximum meter reading.

Connect the negative meter lead to the PA PLATE CURRENT jack, 2TP6 (black) and adjust PA PLATE capacitor 2C52 for minimum meter reading. Place the TUNE-OPERATE switch in the OPERATE position. Connect the negative meter lead to the PA GRID jack, 2TP4, and retune the 2ND DOUBLER PLATE capacitor for maximum meter reading.

Connect the positive meter lead to the chassis, and the negative lead to the PA PLATE CURRENT jack (black). Set the meter on a low range (about 2 volts). Adjust ANT TUNE capacitor 2C29 for maximum meter reading. Retune PA PLATE capacitor for resonance (minimum current) and note this reading. Normal plate current is 300 ma (0.3 amp). If the current is too high, reduce the coupling between the plate line 2L22 and antenna coupling loop 2L21. If the current is too low, increase the coupling. To read the plate current in amperes, divide the voltage reading by 5. (1.5 volts = 0.3 amperes).

WARNING

APPROXIMATELY 400 VOLTS IS APPLIED TO THE METER LEAD WHEN IT IS CONNECTED TO RED JACK 2TP5. AVOID CONTACT WITH LEADS OR METER TERMINALS WHEN POWER IS ON.

It may be easier to make these adjustments if a means of measuring the field intensity is available. Place the field intensity meter in a convenient spot near the antenna and repeat the adjustments until maximum power output is obtained at the rated plated current of 300 ma.

Frequency Check

The crystal trimmer capacitor 2C1 is adjusted at the factory to the frequency stated on the license label. However, when initially setting up the transmitter or after changing the crystal, the frequency should be checked and adjusted if necessary. On dual frequency transmitters the alternate frequency should also be checked and corrected by adjusting capacitor 2C1. Either of the following methods may be used:

Method 1. Frequency Meter. Energize the transmitter as previously directed. Observe the frequency of the unmodulated carrier on a frequency meter such as the CX-8A, and adjust 2C1 (or 21C1), if necessary until the exact frequency is obtained.

Method 2. Station Receiver. The output frequency of the transmitter can be set exactly on the station receiver frequency as follows:

1. Connect a high-impedance voltmeter (Volt-Ohmyst, or 20,000 ohms-per-volt meter) to the discriminator output metering point of the station receiver.

2. Have a person read the meter and report its reading to the one who is adjusting the transmitter.

3. Alternately start and stop the transmitter. If the transmitter is exactly on frequency, the meter reading will not change when the carrier is switched on and off (with no modulation). If necessary, adjust 2C1 (or 21C1) in small steps until this condition is obtained. The meter reading should be very near zero.

Modulation Check

The MOD GAIN control, 2R23 has been correctly set at the factory and should not require adjustment unless a component of the modulation circuits is replaced. However, if a modulation meter, such as the CX-8A meter is available, the modulation can be checked as follows:

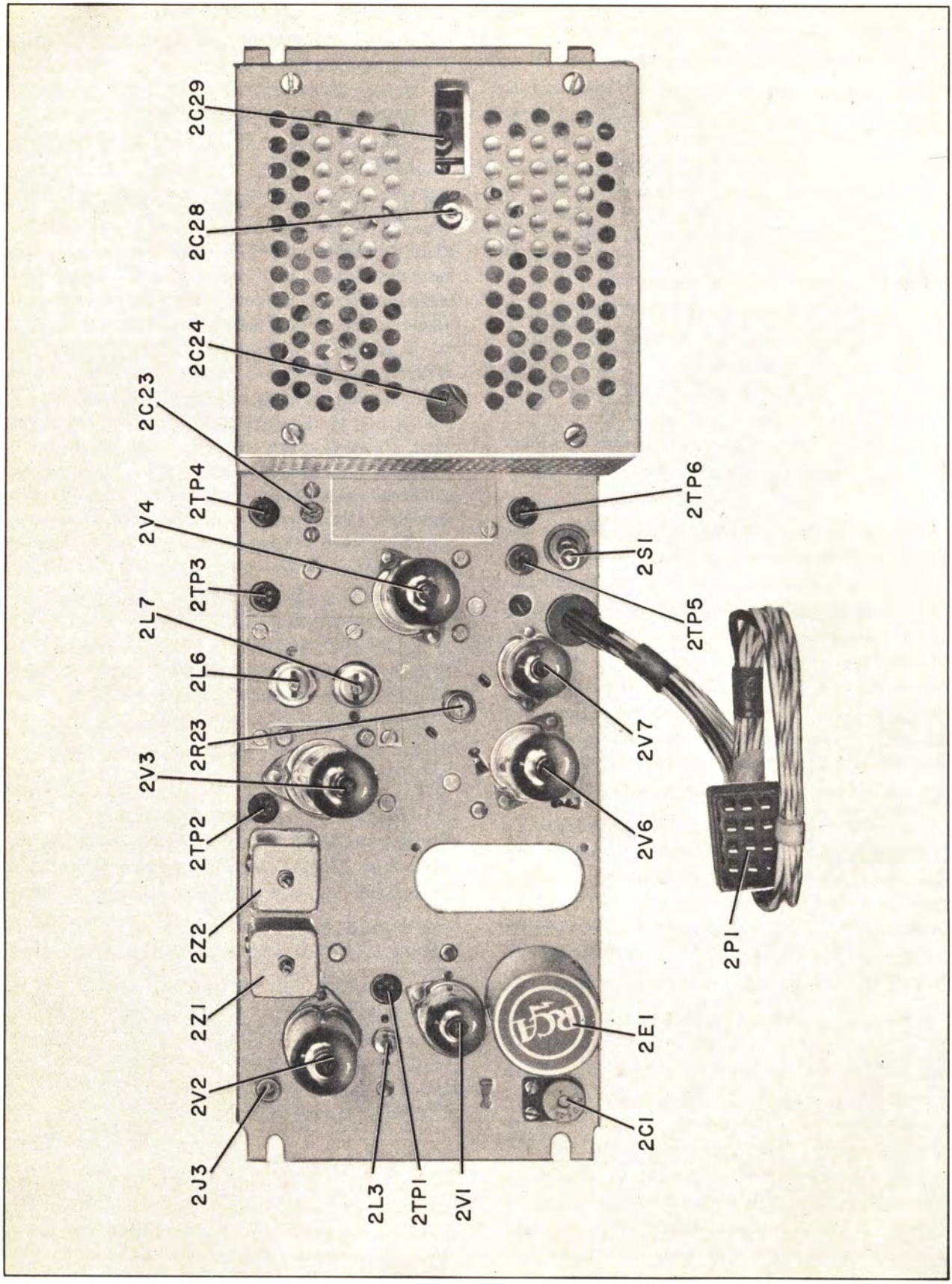


Figure- T-1—Transmitter, Top View

Hold down the press-to-talk switch and speak closely into the microphone in a normal tone. Then shout into the microphone. The peak frequency deviation should be ±5 kc (±15 kc for wide band units) when speaking in a normal tone and not more than ±5 kc (or ±15 kc) when shouting. If necessary, adjust 2R23 until this condition is obtained.

CAUTION: Do not adjust the MOD GAIN control without an accurate means of checking modulation level.

MAINTENANCE

Trouble Shooting

Most troubles can be found by a systematic process of elimination. The faulty stage can usually be located by checking voltages at the pin jacks against those given in the schematic diagram. Then the defective part can be isolated by checking voltages directly in the circuits.

Testing Multiplier Stages. To check operation of the multiplier stages take readings at pin jacks 2TP1, 2, 3, and 4, with a voltmeter having a resistance of at least 20,000 ohms per volt. If no reading is obtained at any of these jacks trouble is probably due to a blown fuse or failure of the power supply. If readings are obtained that do not agree with the schematic diagram the stage feeding the grid at which incorrect reading appears is probably defective.

Testing Power Amplifier Stage. To check the power amplifier stage connect the positive lead of the voltmeter to the chassis and the negative lead to jack 2TP6 (black). Normal plate current is about 0.3 amperes as indicated by a reading of 1.5 volts. Lower values may be caused by low plate voltage, a defective tube, improper antenna loading (see *Initial Adjustments*), or insufficient grid drive. To check the plate voltage of the power amplifier set the meter on a high range (at least 500 volts), connect the negative meter lead to the chassis, and the positive lead to pin jack 2TP5 (red). The meter should read about 400 volts.

NOTE: To calculate power input to the final stage in watts, measure the final amplifier plate current and plate voltage, convert the readings to amperes and volts and multiply the two readings together. The nominal power input of this transmitter filed with the F.C.C. is 120 watts on the basis of 0.3 amperes and 400 volts.

Checking Microphone and Modulation Circuits. To test the modulation circuits follow the procedure under *Modulation Check* in the *Initial Adjustments* section. If modulation is weak and cannot be brought up to normal by adjusting the MOD GAIN control, 2R23, the trouble may be in the microphone, tube 2V6, or tube 2V7.

Transmitter Alignment

The transmitter has been completely aligned at the factory to the frequency indicated on the license label. If a frequency determining component is replaced, realign only the circuit involved. When it is desired to change the carrier frequency, complete realignment is necessary, Equipment required for aligning the transmitter is listed under *Initial Adjustments.*

To align the transmitter, proceed as follows:

1. Plug in the correct crystal corresponding to the desired carrier frequency. (Crystal frequency equals carrier frequency divided by 12). On two-frequency transmitters use the higher frequency crystal.

2. Set the crystal frequency adjusting capacitor 2C1 (or 21C1) to one-half its maximum value.

NOTE: The ceramic button type variable capacitors used in this equipment are at maximum value when the little indentation on the ceramic is positioned midway between the two mounting holes.

3. Place the TUNE OPERATE switch in the TUNE position. Turn the ANT TUNE capacitor, 2C29, to maximum capacity. Insert the insulated screwdriver in the slot of the PA compartment and move the antenna coupling loop, 2L21, away from the plate line, 2L22.

4. Turn the switch on the control unit to the ON position and allow about 30 seconds for the filaments to warm up. During each adjustment energize the transmitter by closing the switch on the microphone. The microphone may be connected either to the socket on the control unit or the one on the power supply chassis. Do not keep the transmitter energized for prolonged periods or it may overheat.

5. Connect the positive lead of the voltmeter to the chassis, and the negative lead to the TRIP GRID pin jack, 2TP1, (green). Adjust 2L3 (TRIP GRID) for maximum meter reading.

6. Connect the negative meter lead to jack 2TP2 (1ST DOUBLER GRID) and adjust 2Z1 (TRIP PLATE) and 2Z2 (1ST DOUBLER GRID) for peak meter reading.

7. Connect the negative meter lead to jack 2TP3 (2ND DOUBLER GRID) and adjust 2L6 (1ST DOUBLER PLATE) and 2L7 (2ND DOUBLER GRID) for maximum meter reading.

8. With the meter still connected to 2TP3 adjust capacitor 2C23 (2ND DOUBLER PLATE) for a dip

in the meter reading. Then connect the negative meter lead to jack 2TP4 (PA GRID) and adjust capacitors 2C23 (2ND DOUBLER PLATE) for maximum meter reading.

NOTE: The PA grid drive at jack 2TP4 should be −30 volts dc when capacitor 2C23 is adjusted for maximum meter reading. When the transmitter frequency has been changed it may be necessary to vary the coupling between coils 2L19 and 2L20 (beneath the chassis) until this value is obtained. Remove power from the transmitter and move the coils farther apart if the frequency has been lowered, or closer together if the frequency has been raised. After each coupling adjustment energize the transmitter and retune capacitor 2C23 for maximum meter reading at 2TP4.

9. With the antenna or a 52-ohm dummy load connected to the ANT jack perform the adjustments given under *Antenna Loading and PA Tuning* in the *Initial Adjustments* section.

10. Perform the *Frequency Check* given under *Initial Adjustments* and if necessary adjust the crystal trimmer, 2C1. On dual frequency units, also check the alternate frequency and adjust 21C1 if necessary.

REPLACEMENT PARTS LIST

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
TYPE CMCT-60A2 TRANSMITTER (8949997-503)			
			CAPACITORS:
2C1	204811	8977217-1	Variable, ceramic, 5-25 μμf
2C2	205660	8811182-3	Ceramic, 1500 μμf +100 −20%, 500 v
2C3	215197	757607-231	Mica, 68 μμf ±5%, 500 v
2C4	205660	8811182-3	Ceramic, 1500 μμf +100 −20%, 500 v
2C5	213496	757607-127	Mica, 47 μμf +100 −20%, 500 v
2C6	218586	757607-9	Mica, 6 μμf ±0.5 μμf, 500 v
2C7	205660	8811182-3	Ceramic, 1500 μμf +100 −20%, 500 v
2C8	213496	757607-227	Mica, 47 μμf ±5%, 500 v
2C9	215678	8979931-9	Electrolytic, 20 μf, 25 v
2C10	218587	757607-214	Mica, 10 μμf ±5%, 500 v
2C11, 2C12	205660	8811182-3	Ceramic, 1500 μμf +100 −20%, 500 v
2C13			Part of 2Z1
2C14	71504	99327-11	Headed lead, 0.68 μμf ±10%, 500 v
2C15			Part of 2Z1
2C16, 2C17			Part of 2Z2
2C18, 2C19	205020	8864187-1	Ceramic, 1000 μμf ±20%, 500 v
2C20 to 2C22	218588	8864187-4	Ceramic, 250 μμf ±20%, 500 v
2C23	218787	8439864-2	Variable, air, 2.8-26.0 μμf
2C24			Not Used
2C25 to 2C27	218588	8864187-4	Ceramic, 250 μμf ±20%, 500 v
2C28			Not Used
2C29	218786	8439864-1	Variable, air, 2.5-15.5 μμf
2C30	218589	8949977-1	Ceramic, 250 μμf ±20%, 500 v
2C31	218590	8924416-213	Mica, 1300 μμf ±2%, 500 v
2C32	205656	8811182-5	Ceramic, 0.01 μf +100 −20%, 450 v
2C33	217350	8977211-6	Electrolytic, 10 μf, 15 v
2C34	205656	8811182-5	Ceramic, 0.01 μf +100 −20%, 450 v
2C35	218591	8979936-1	Film, 0.039 μf ±10%, 200 v
2C36	218592	8979936-3	Film, 0.047 μf ±20%, 400 v
2C37	217350	8977211-6	Electrolytic, 10 μf, 15 v
2C38	218593	757607-243	Mica, 220 μμf ±5%, 500 v
2C39	218594	8979937-1	Electrolytic, 4 μf, 350 v
2C40	218788	8949991-1	Ceramic, 14 μμf ±5%, 600 v (Part of 2Z3)
2C41, 2C42	218790	8949991-3	Ceramic, 28 μμf ±5%, 600 v, (Part of 2Z3)
2C43	218789	8949991-2	Ceramic, 22 μμf ±5%, 600 v (Part of 2Z3)
2C44	213939	757607-11	Ceramic, 7 μμf ±0.5 μμf, 500 v (Part of 2Z3)
2C45	205660	8811182-3	Ceramic, 1500 μμf +100 −20%, 500 v
2C46	218595	757607-245	Mica, 270 μμf ±5%, 500 v
2C47	54405	8845610-1	Mica, 250 μμf ±10%, 500 v
2C48, 2C49	205660	8811182-3	Ceramic, 1500 μμf +100 −20%, 500 v
2C50	218595	757607-245	Mica, 270 μμf ±5%, 500 v
2C51	54405	8845610-1	Mica, 250 μμf ±10%, 500 v
2C52	219136	8842165-1	Variable, air, 2 section, 2.7-14.0 μμf
2C53		735715-125	Paper, 0.1 μf ±20%, 600 v
2C54, 2C55	218595	757607-245	Mica, 270 μμf ±5%, 500 v
2E1		8439837-1	Crystal Oven
2J1 to 2J4	104039	8848262-2	Connector: female, single contact, phono type
2K1	218791	8863548-2	Relay: coil, 300 ohm, S.P.D.T. contacts

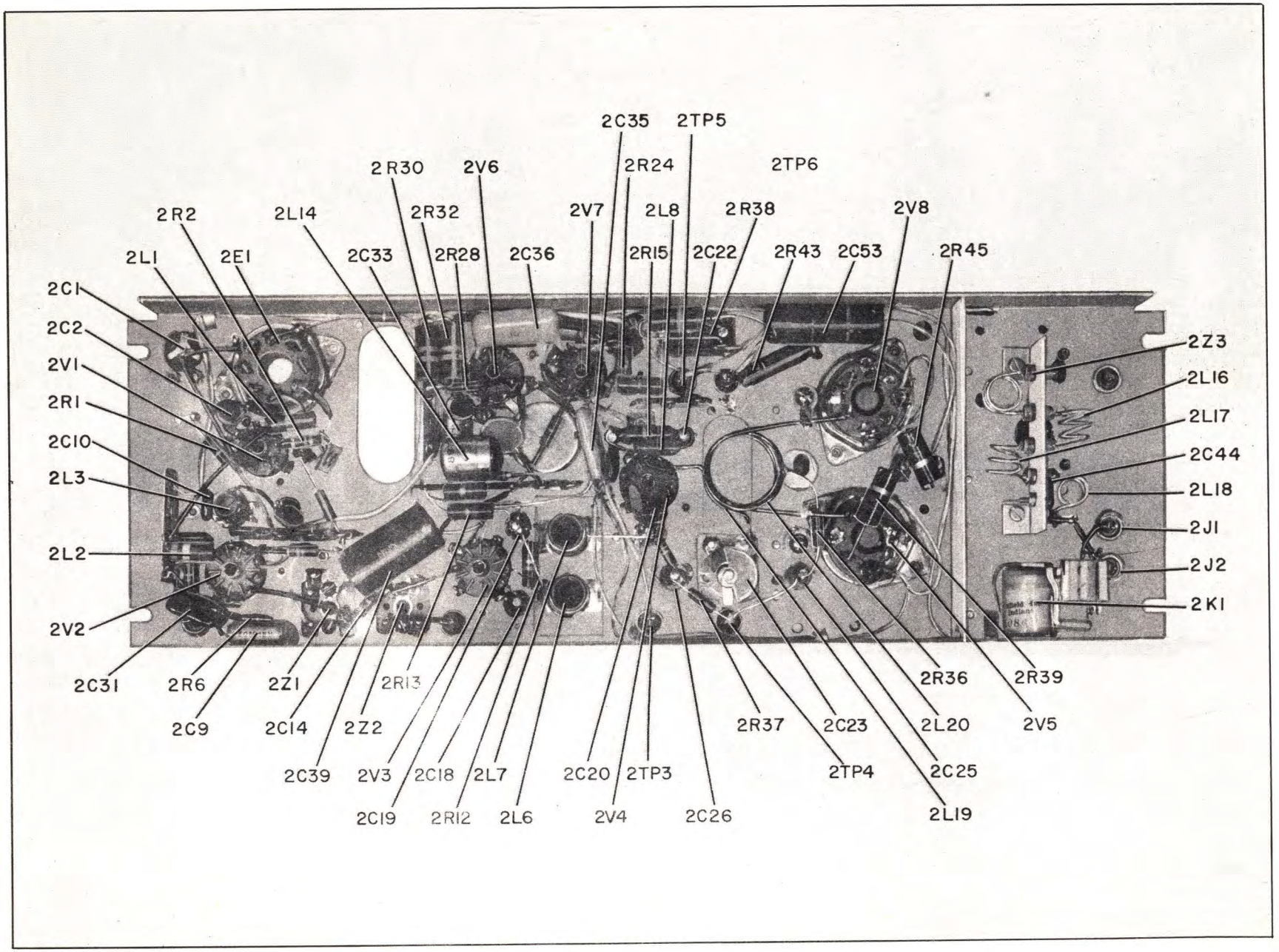
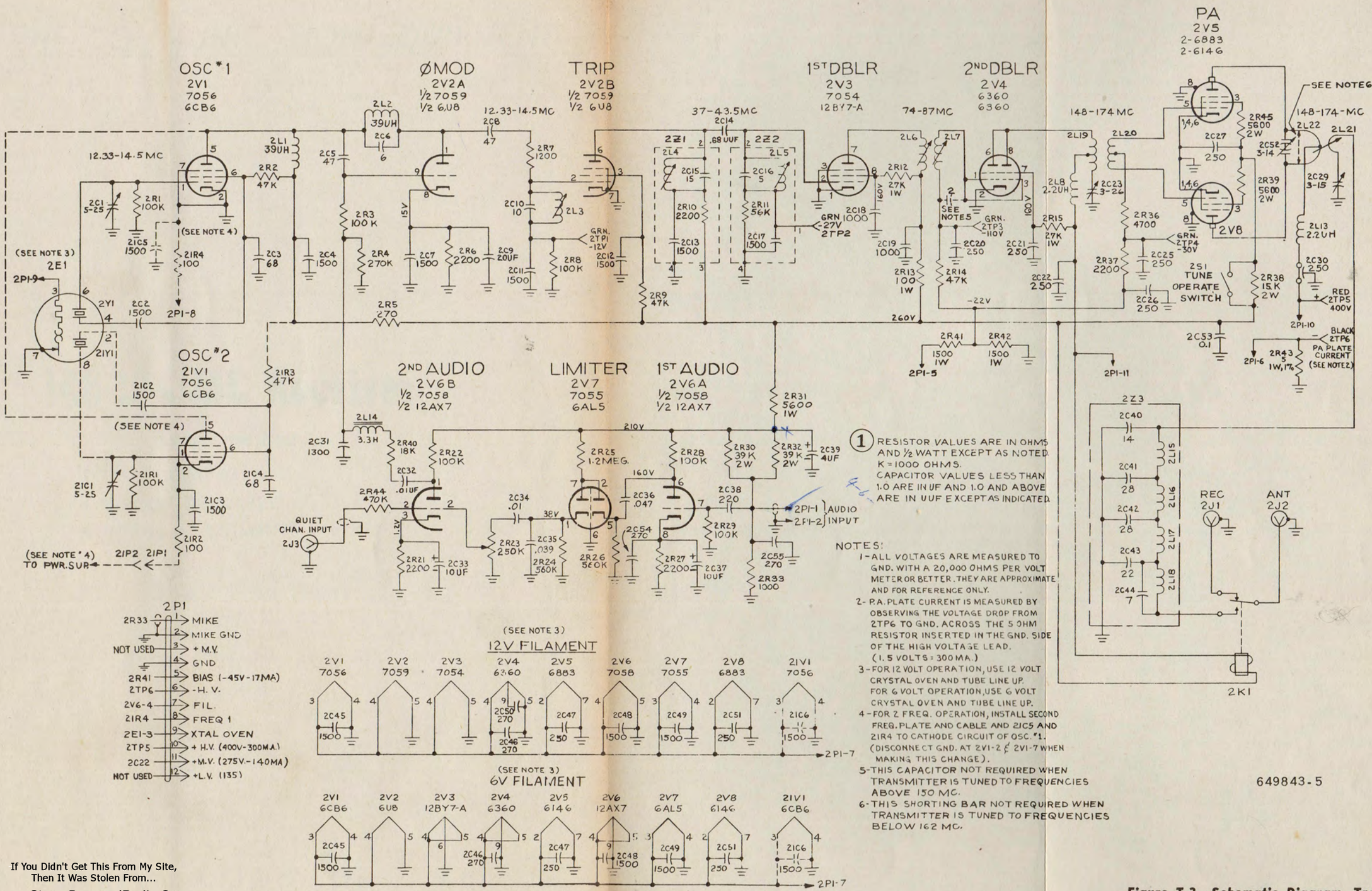


Figure T-2—Transmitter, Bottom View

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
2L1, 2L2	218596	941524-263	Reactor: R.F. choke, 39 microhenries, ±10%, 500 MA
2L3	218792	8949992-501	Coil: R.F., 1st tripler grid
2L4			Part of 2Z1
2L5			Part of 2Z2
2L6	218794	8978536-501	Coil: R.F., 1st doubler plate
2L7	218793	8978536-502	Coil: R.F., 2nd doubler
2L8	218079	941524-133	Reactor: R.F. choke, 2.2 microhenries, 1000 MA
2L9 to 2L12			Not Used
2L13	218079	941524-133	Reactor: R.F. choke, 2.2 microhenries, 1000 MA
2L14	217640	8972938-3	Reactor: R.F. choke, 3.3 henrys, 1.0 MA
2L15		480404-5	Coil: 2-3/4 turns of 0.0508 dia. tinned copper wire, (Part of 2Z3)
2L16, 2L17		480404-4	Coil: 3 turns of 0.0508 dia. tinned copper wire (Part of 2Z3)
2L18		480404-6	Coil: 1-3/4 turns of 0.0508 dia. tinned copper wire (Part of 2Z3)
2L19		8979974-1	Coil: 2nd doubler plate, 2-1/4 turns of 0.0641 dia. magnet wire, insulated
2L20		8979974-2	Coil: P.A. grid, 1-1/2 turns of 0.0641 dia. magnet wire, insulated
2L21		8439873-5	Coil: antenna coupling, "U" shaped, 0.0808 dia., magnet wire, insulated
2L22		8439873-6	Coil: P.A. plate, "U" shaped, 0.102 dia., tinned copper wire
2P1	218797	8949996-802	Connector: male, 12 contact cable, mtg. (Red.)
			RESISTORS
			Fixed, Composition - unless otherwise specified
2R1		82283-86	100,000 ohm ±10%, ½ w
2R2		82283-82	47,000 ohm ±10%, ½ w
2R3		82283-86	100,000 ohm ±10%, ½ w
2R4		82283-91	270,000 ohm ±10%, ½ w
2R5		82283-55	270 ohm ±10%, ½ w
2R6		82283-66	2200 ohm ±10%, ½ w
2R7		82283-63	1200 ohm ±10%, ½ w
2R8		82283-86	100,000 ohm ±10%, ½ w
2R9		82283-82	47,000 ohm ±10%, ½ w
2R10			Part of 2Z1
2R11			Part of 2Z2
2R12		90496-79	27,000 ohm ±10%, 1 w
2R13		90496-50	100 ohm ±10%, 1 w
2R14		82283-82	47,000 ohm ±10%, ½ w
2R15		90496-79	27,000 ohm ±10%, 1 w
2R16 to 2R20			Not Used
2R21		82283-66	2200 ohm ±10%, ½ w
2R22		82283-86	100,000 ohm ±10%, ½ w
2R23	218451	8439847-1	Variable, comp, 250,000 ohm ±30%, ¼ w
2R24		82283-95	560,000 ohm ±10%, ½ w
2R25		82283-99	1.2 meg ±10%, ½ w
2R26		82283-95	560,000 ohm ±10%, ½ w
2R27		82283-66	2200 ohm ±10%, ½ w
2R28, 2R29		82283-86	100,000 ohm ±10%, ½ w
2R30		99126-81	39,000 ohm ±10%, 2 w
2R31		90496-71	5600 ohm ±10%, 1 w
2R32		99126-81	39,000 ohm ±10%, 2 w
2R33		88223-62	1000 ohm ±10%, ½ w
2R34, 2R35			Not Used
2R36		82283-70	4700 ohm ±10%, ½ w
2R37		82283-66	2200 ohm ±10%, ½ w
2R38		99126-76	15,000 ohm ±10%, 2 w
2R39		99126-71	5600 ohm ±10%, 2 w
2R40		82283-77	18,000 ohm ±10%, ½ w
2R41		90496-64	1500 ohm ±10%, 1 w
2R42		90496-64	1500 ohm ±10%, 1 w
2R43	94886	8980675-1	Wire wound, 5.0 ohm ±1%, 1 w
2R44		82283-94	470,000 ohm ±10%, ½ w
2R45		99126-71	5600 ohm ±10%, 2 w
2S1	48791	8979981-1	Switch: toggle, S.P.S.T.

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
2TP1 to 2TP4	218441	8974620-5	Connector: tip jack (Green)
2TP5	218785	8974620-2	Connector: tip jack (Red)
2TP6	215295	8974620-1	Connector: tip jack (Black)
2V4	215204		Tube: vacuum
2XV1	208256	8436746-3	Socket: tube, 7 pin min.
2XV2 to 2XV4	57852	8436747-3	Socket: tube, 9 pin min.
2XV5	68590	8977216-1	Socket: tube, octal
2XV6	57852	8436747-3	Socket: tube, 9 pin min.
2XV7	208256	8436746-3	Socket: tube, 7 pin min.
2XV8	68590	8977216-1	Socket: tube, octal
2XY1	68590	8977216-1	Socket: crystal, octal
2Y1		8949998	Crystal: (As specified by Sales)
2Z1	218796	8978521-505	Transformer: R.F. 1st tripler plate
2Z2	218795	8978521-506	Transformer: R.F. 1st doubler grid
2Z3		8439865-501	Filter: R.F. harmonic, not stocked complete, for parts see 2C40 to 2C44, 2L15 to 2L18
			Miscellaneous:
	12118	8980606-1	Connector: grid cap (For 2V5 and 2V8)
	211423	426765-3	Insulator: steatite, 3/8" dia. x 1/2" lg.
	79813	93605-108	Washer: "C" (2L21 tuning rod retaining)
	102915	860618-59	Washer: vellutex, 0.147 x 3/8" O.D. x 1/16 thick (Insulator mtg.)
SECOND FREQUENCY TRANSMITTER KIT (8980636-501)			
21C1	204811	8977217-1	Capacitor: variable, ceramic, 5-25 $\mu\mu$f NPO
21C2, 21C3	205660	8811182-3	Capacitor: ceramic, 1500 $\mu\mu$f -20 +100%, 500 v
21C4	215197	757607-231	Capacitor: mica, 68 $\mu\mu$f ±5%, 500 v
21C5, 21C6	205660	8811182-3	Capacitor: ceramic, 1500 $\mu\mu$f -20 +100%, 500 v
21P1		Not Stocked	Connector: female, orange, (for transmitter cable)
21P2		Not Stocked	Connector: male, orange, (for power supply cable)
21R1		82283-86	Resistor: fixed, comp., 100,000 ohms, ±10%, ½ w
21R2		82283-50	Resistor: fixed, comp., 100 ohms, ±10%, ½ w
21R3		82283-82	Resistor: fixed, comp., 47,000 ohms, ±10%, ½ w
21R4		82283-50	Resistor: fixed, comp., 100 ohms, ±10%, ½ w
21XV1	208256	8436746-3	Socket: tube, 7 pin min.
21Y1		8949998-1	Crystal: (As specified by Sales)
			Miscellaneous:
		3420011-501	Cable Assembly: 14-1/2" lg.
		3420011-502	Cable Assembly: 9" lg.



(1) RESISTOR VALUES ARE IN OHMS AND ½ WATT EXCEPT AS NOTED. K=1000 OHMS. CAPACITOR VALUES LESS THAN 1.0 ARE IN UF AND 1.0 AND ABOVE ARE IN UUF EXCEPT AS INDICATED.

NOTES:

1- ALL VOLTAGES ARE MEASURED TO GND. WITH A 20,000 OHMS PER VOLT METER OR BETTER. THEY ARE APPROXIMATE AND FOR REFERENCE ONLY.

2- P.A. PLATE CURRENT IS MEASURED BY OBSERVING THE VOLTAGE DROP FROM 2TP6 TO GND. ACROSS THE 5 OHM RESISTOR INSERTED IN THE GND. SIDE OF THE HIGH VOLTAGE LEAD. (1.5 VOLTS = 300 MA.)

3- FOR 12 VOLT OPERATION, USE 12 VOLT CRYSTAL OVEN AND TUBE LINE UP. FOR 6 VOLT OPERATION, USE 6 VOLT CRYSTAL OVEN AND TUBE LINE UP.

4- FOR 2 FREQ. OPERATION, INSTALL SECOND FREQ. PLATE AND CABLE AND 2IC5 AND 2IR4 TO CATHODE CIRCUIT OF OSC. *1. (DISCONNECT GND. AT 2V1-2 & 2V1-7 WHEN MAKING THIS CHANGE).

5- THIS CAPACITOR NOT REQUIRED WHEN TRANSMITTER IS TUNED TO FREQUENCIES ABOVE 150 MC.

6- THIS SHORTING BAR NOT REQUIRED WHEN TRANSMITTER IS TUNED TO FREQUENCIES BELOW 162 MC.

649843-5

Figure T-3—Schematic Diagram, Transmitter

VHF COMMUNICATION EQUIPMENT

148-174 MC Receiver

(DWG. 8978510-501)

- TECHNICAL DATA
- CIRCUIT DESCRIPTION
- INITIAL ADJUSTMENTS

RADIO CORPORATION OF AMERICA
COMMUNICATION PRODUCTS DEPARTMENT, CAMDEN, NEW JERSEY

PRINTED IN U.S.A.
DU 680

IB-33540

TECHNICAL DATA
(SINGLE-FREQUENCY OPERATION)

Carrier Frequency Range
148 to 174 mc

Power Required
Plate Voltage: 150 v dc
Filament Voltage: 13.6 v dc at 1.5 amps

Type of Circuit
Double superheterodyne using separate crystals for first and second oscillator.

Number of Carrier Frequencies
Standard version has single frequency. Dual frequency version is available.

Maximum Separation Between Carriers in Two-Frequency Receivers
1.0 mc

Crystal Frequencies
First Osc. Mult.: 11.2 to 13.4 mc
Second Osc. Mixer: 13.91 mc

Crystal Frequency Multiplication
First Mixer: 12
Second Mixer: 1 (crystal fundamental)

Intermediate Frequencies
High I-F: Fixed 13.455 mc
Low I-F: Fixed 455 kc

Selectivity
100 db down at ±35 kc from center frequency (standard channel).
100 db down at 17.5 kc from center frequency (split channel).

Sensitivity
0.6 μv input max. from 50 ohm source for 20 db noise quieting.

Squelch Range
0.15 μv max. to 0.55 μv min.

Oscillator Stability* (−30°C to +60°C Ambient)
±.0005%

Audio Frequency Response
300–3000 cps

Audio Output
5 watts

Output Impedance
3.2 ohms

Antenna Input Impedance
50 ohms

Operating Temperature Range
−30°C to +60°C Ambient

Tube Complement
1 6AK5
3 7056
2 7059

Transistor Complement

4 2N247	3 2N647
2 2N218	2 2N301

DESCRIPTION

The receiver is designed for f-m communication on any preselected frequency in the 148 to 174 megacycle band. Normally, the receiver has only one frequency, but dual-frequency units are also available. A conversion kit, complete with installation instructions may be ordered separately to permit converting single-frequency units to dual-frequency operation.

The circuit is a double superheterodyne using two separate crystal oscillators to obtain fixed high and low i-f frequencies. All stages after the second mixer are transistorized. The audio output stage uses two 2N301 transistors in a push-pull Class B circuit. Class B operation greatly reduces average battery drain because the stage draws practically no current while no signals are being received. Thermistors are used in the audio output and squelch circuits to stabilize the operating points of the transistors over a wide temperature range. Alignment of the receiver is simplified because no tuning adjustments are provided in the low i-f section. Low i-f selectivity is provided by a sealed filter which is tuned at the factory and requires no adjustment in the field.

Stages using tubes and conventional wiring are mounted on the main chassis of the receiver. A printed circuit board containing the low i-f, discriminator, squelch, and first two audio stages is on a vertical subchassis on top of the main chassis. A heat sink attached to the left side of the main chassis contains the two audio output transistors.

RECEIVER CIRCUIT

The incoming signal is fed through antenna jack 1J1 to the grid of r-f amplifier 1V1 and then through the three tuned circuits to the grid of the first mixer tube 1V2. AGC voltage for the grid of 1V1 is obtained by rectifying the output of the second low i-f amplifier.

The output frequency of the first crystal oscillator 1V5 is tripled in the plate circuit and then doubled in each of the two multiplier sections of 1V6. The output of 1V6 at 12 times the crystal frequency is heterodyned with the output of r-f amplifier 1V1 to provide a fixed high i-f of 13.455 megacycles. Consequently, the crystal frequency, Fc, of the first oscillator may be calculated for any signal frequency, Fs, by the following formula:

$$F_c = \frac{(F_s - 13.455)\ mc}{12}$$

After amplification by 1V3 the 13.455 mc high i-f is converted to a fixed low i-f of 455 kc by the second oscillator and mixer stage 1V4. The crystal in this stage, 1Y2, has a fixed frequency of 13.91 megacycles. The signal is then fed through a coaxial cable to the 455 kc selector 12Z1 on the subchassis, 1A1. To provide the required selectivity, 12Z1 consists of a 12 section filter which is tuned and sealed at the factory.

The output of 12Z1 is amplified by four transistor low I-F amplifiers, 10Q1, 2, 3, 4 and then fed through the limiter transistor 10Q5 to the discriminator transformer 12Z2. The discriminator circuit uses two germanium diodes, 10CR2 and 10CR3 to convert frequency modulation into audio signals which appear across capacitor 10C22. The audio is fed through resistors 10R38 and 10R39 to the DISCR. METERING pin jack, 1TP3. The signal at the junction of 10R38 and 10R39 is fed through a cable to pin 4 of plug 12P5. This plug is provided for connection to a quiet channel unit. When a quiet channel unit is not used a jumper plug 12P4, which connects pin 4 to pin 6 is inserted in 12P5. Pin 6 is connected to the volume control, 12R1, which controls the input to the first audio stage, 10Q8.

A squelch and noise amplifier circuit is used to silence the receiver during no-signal periods. This circuit consists of a squelch gate, 10Q7, a rectifier, 10CR4 and a noise-amplifier, 10Q6. The discriminator output is fed through capacitor 10C24 to the input of the noise amplifier. When no signal is being received, considerable noise voltage is developed in the discriminator output. When a signal is received, the noise output of the discriminator is greatly reduced and very little signal is applied to the noise amplifier. As a result, the cut-off bias developed by rectifier 10CR4 is removed and the squelch gate conducts. This returns the emitter circuit of 10Q8 to ground and the audio stage conducts.

The audio signals are then amplified by the second audio stage 10Q9 and fed through transformer 12T3 to the push-pull output transistors, 1Q1 and 1Q2, which are mounted in a heat sink attached to the left side of the chassis. The maximum output of the receiver may be set by volume control 12R1. Volume and squelch adjustments during normal operation are made with controls on an associated external control unit or control panel.

Three color coded pin jacks are provided on the chassis to permit connecting a CX-7B test meter. VoltOhmyst or 20,000 ohms-per-volt meter to the circuits during alignment and trouble shooting. The white jack, 1TP1, is connected to the grid of the second multiplier. The yellow jack, 1TP2 is connected to the AGC rectifier, 10CR1, in the output circuit of the second i-f amplifier. The green jack, 1TP3 is connected to the discriminator output.

NOTE: When using CX-7B, set meter switch to position 8 and connect a 100,000-ohm resistor in series with the plus lead. Meter is now a 20,000 ohms/volt meter reading 5 volts full scale.

INITIAL ADJUSTMENTS

The receiver is accurately aligned at the factory. At the time of installation only the following operational checks should be required.

Peaking Antenna Coil

Connect a CX-7B test meter, a VoltOhmyst or 20,000 ohms-per-volt meter to the AGC pin jack 1TP2 (yellow). With the antenna used during normal operation connected to the receiver and while a normal signal is being received adjust the core of coil 1L1 for maximum meter reading.

Oscillator Frequency Check

To check the receiver frequency, measure the voltage between the green pin jack 1TP3 and ground with a CX-7B test meter or a VoltOhmyst or 20,000 ohms-per-volt meter. With no signal, the reading should be no more than ± 1.0 volt on the VoltOhmyst or ± 0.5 volts on 20,000 ohms-per-volt meter or CX-7B test meter. If the reading is not within these limits adjust the top core of discriminator transformer 12Z2 for a reading as close to zero as possible. Next, pick up an unmodulated carrier from the transmitter with which the equipment is to be used and observe the

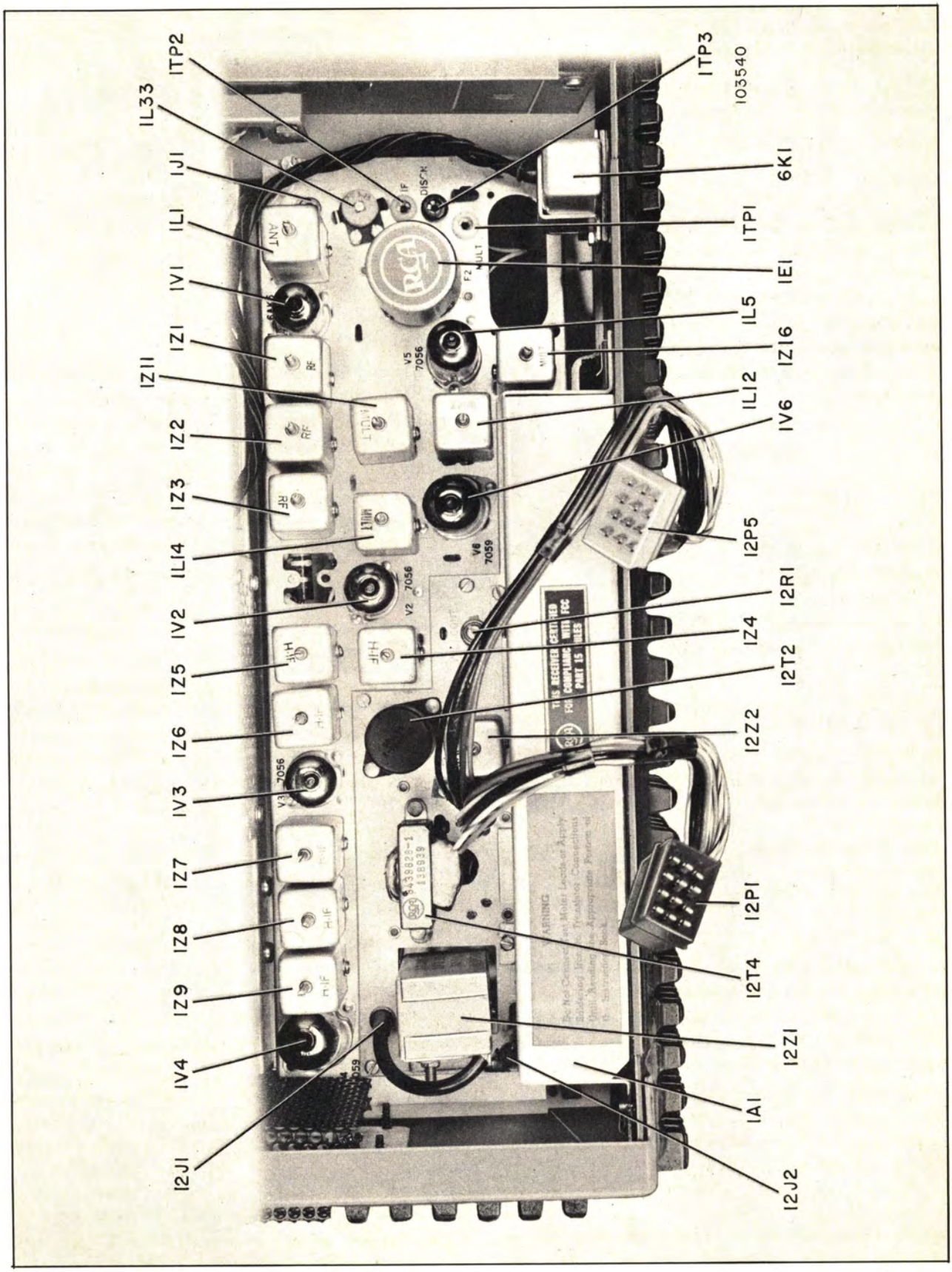


Figure R-1—Receiver, Top View

meter. Adjust trimmer 1C33, if necessary, to obtain the same meter reading as was obtained under no-signal conditions.

If the receiver has two frequencies, first check frequency number 1 as in the preceding paragraph and if necessary adjust trimmer 1C33. Then, pick up an unmodulated carrier on the second frequency and adjust trimmer 11C3 if required.

Chassis Volume Control Adjustment

Place the volume control on the control box in the maximum clockwise position and then adjust chassis volume control 12R1 for a volume no louder than will normally be required. For best audio quality and minimum noise do not set 12R1 too far clockwise. During operation, use the volume control on the control unit.

MAINTENANCE

Meter Readings

The following table lists typical readings at each of the three pin jacks on a VoltOhmyst and a 20,000 ohms-per-volt meter.

APPROXIMATE METER READINGS AT RECEIVER PIN JACKS (NO. SIG. INPUT)

Jack No.	*Circuit Tested*	*Simpson 260 20,000 ohm/volt meter or CX-7B meter*	*RCA VoltOhmyst*
1TP1 (white)	Second Mult. Grid	0.6 v	−3.0 v
1TP2 (yellow)	AGC Voltage	0	−0.2 v
1TP3 (green)	Discr. Output	0	0 v

RF, Multiplier and First Oscillator Alignment (Changing Receiver Frequency)

Alignment of these stages should be required only if the receiver frequency is changed or a frequency determining component has been replaced. The following equipment will be required:

a. CX-7B test meter, VoltOhmyst or 20,000 ohm-per-volt meter

b. Accurate signal generator providing r-f carrier frequency, preferably crystal controlled.

Make the adjustments as follows:

1. Insert a first-oscillator crystal of the correct frequency in socket 1E1. Compute the crystal frequency F_c from the desired carrier frequency F_s as follows:

$$F_c = \frac{(F_s - 13.455)\ mc}{12}$$

2. Connect the meter to the second multiplier grid jack, 1TP1 (white).

3. Tune 1Z10 and 1L12 for maximum meter reading.

4. Connect meter to the AGC pin jack 1TP2 (yellow).

5. Connect a signal generator providing the correct frequency to the receiver antenna jack 1J1.

6. Tune 1Z11 and 1L14 for maximum meter reading.

7. Carefully tune 1Z3, 1Z2 and 1Z1 for peak meter reading. Reduce generator output as necessary to maintain a reading of 1.0 volt on VoltOhmyst, or .3 v on 20,000 ohms-per-volt meter or CX-7B test meter.

8. As directed under *Initial Adjustments* check the first oscillator frequency and adjust crystal trimmer 1C33 (and trimmer 11C3 in dual-frequency receivers). Also adjust antenna coil 1L1 as directed under *Initial Adjustments*.

NOTE: In dual frequency receivers align the r-f and multiplier stages for the higher of the two carrier frequencies.

Alignment of High I-F and Discriminator Stages

The high i-f and discriminator transformer have been accurately aligned at the factory. These stable elements should not require readjustment unless it is necessary to replace a damaged transformer. After replacements, alignment of the stage repaired will usually be sufficient.

For aligning these stages, the following equipment is required.

1. Accurate signal generator (preferably crystal controlled) providing a frequency of 13.455 megacycles for high i-f alignment, or 455 kc for discriminator alignment.

2. .01 mf capacitor in series with hot lead of signal generator (if blocking capacitor is not built into signal generator).

3. CX-7B test meter, VoltOhmyst or 20,000 ohms-per-volt meter.

4. Non-metallic screwdriver.

High I-F Alignment

1. Connect signal generator tuned to the exact high i-f frequency (13.455 mc) to the first mixer grid, pin 7 of tube 1V2. (If discriminator is known

to be correctly aligned, this frequency may be obtained by connecting the high-impedance voltmeter to the discriminator metering jack 1TP3 (green) and tuning the test oscillator for a reading as close to zero as possible. Be careful not to tune the test oscillator to the image frequency which is 910 kc higher than the high i-f frequency.

2. Connect the voltmeter to the AGC metering jack 1TP2 (yellow). Set signal generator output level for a reading of 2 volts on VoltOhmyst or 20,000 ohms-per-volt meter on 10 volt scale, or CX-7B test meter.

3. Adjust the cores of 1Z9, 1Z8, 1Z7, 1Z6, 1Z5 and 1Z4 for maximum response while decreasing the signal generator output as necessary to keep meter reading constant.

Discriminator Alignment

1. Connect meter to discriminator metering jack, 1TP3 (green).

2. Connect signal generator tuned to exactly 455 kc to the grid of the second mixer stage, pin 2 of tube socket 1X4. Adjust generator for high output.

3. Turn the top core of discriminator transformer 12Z2 to the maximum counterclockwise position. Tune the bottom core of 12Z2 for maximum response, and then rotate the bottom core in 1-1/2 turns.

4. Connect the meter to the discriminator metering jack 1TP3 (green). Adjust the top core of 12Z2 for a reading as close to zero as possible.

NOTE: Alignment of 455 kc selector 12Z1 should never be required. If trouble occurs in 12Z1 replace it with a new unit.

Replacement of Components on Printed Circuit Board

To simplify trouble shooting the printed circuit board, the symbol numbers of all parts and a reproduction of the printed wiring are stencilled on the front of the board. When a part must be replaced care should be observed in the handling of the printed circuit board and the proper connection of components into the circuit. Suggested procedures are given in the following paragraphs.

Remove the defective component by snipping the leads off on the component side of the board as close to the component as possible. If the old leads have been left long enough bend each lead into a loop and solder the leads of the new component to the loops with a small 25-watt soldering iron. However, if the leads are too short, solder the new components into the circuit as follows:

1. Using a small 25-watt soldering iron, heat the leads and remove them from the printed wiring side of the board. Be careful not to apply too much heat or force, to avoid damage to the copper conductors.

CAUTION: When soldering to the printed board, do not apply excessive heat.

2. Clean and preform the leads of the new component and insert them through the same holes until the body is close to the board.

3. On the circuit side of the board grasp each lead with a pair of long nosed pliers and bend it over in the direction of the circuit pattern.

4. Crimp the wire tightly against the board and cut off the excess lead. Leave about 1/16-inch of wire protruding.

5. Heat the lead and apply rosin core solder. DO NOT USE PASTE OR ACID FLUX. Remove excess rosin from the joint with alcohol.

CAUTION:

1. While checking the transistor circuits be careful to avoid shorting the base to ground. Always use an isolating capacitor between a low-impedance test instrument (such as an audio or R-F signal generator) and the base of a transistor.

2. When an ohmmeter is used to check transistors the voltage between the test leads must be no greater than 12 volts.

Checking the Transistors

The following simplified description of transistor operation should assist in trouble shooting the transistor circuits. Basically, a transistor can be considered as two diodes joined back-to-back. Since the back-to-back connection can be made in two ways (either at the anodes or the cathodes) there are two types of transistors, called the NPN and the PNP. In the NPN type (negative-positive-negative) the anodes are joined and the cathodes are free, while in the PNP type (positive-negative-positive) the cathodes are joined and the anodes are free. In both types the terminal at the junction of the two diodes is called the base, one of the free terminals, the emitter, and the other free terminal, the collector. On the schematic diagram the base is indicated by a short vertical line, the emitter by an arrow pointing in the direction of positive current flow (towards the base in the PNP type; away from the base in the NPN type) and the collector by a bent line.

The three terminals are connected to the source of voltage so as to bias the emitter-to-base diode in the direction of maximum current flow (forward direction) and the base-to-collector diode in the

direction of minimum current flow (backward direction). Consequently, in the NPN type the emitter is returned to ground, and the collector to A+, while in the PNP type the collector is returned to ground and the emitter to A+. In both types the base is connected to a point on a voltage divider having a potential between ground and A+. Since the impedance between the emitter and base is low, the voltage between the emitter and base is also low (about 0.2 volts).

Since most transistor failures are caused by shorts or open circuits, the transistors can be checked by measuring the forward and backward resistances of the diodes with an ohmmeter. Four different transistors are used in the receiver, three of the PNP type (2N247, 2N218, 2N301) and one of the NPN type (2N647). The resistances of all except the 2N301 transistors can be measured with the transistors in the circuit and the power off. The leads must be unsoldered from the 2N301 transistors before checking them because they are connected across transformer windings having low resistance.

To measure the resistance of a transistor proceed as follows:

1. If the transistor is to be checked in the circuit remove all power from the receiver.

2. Connect the negative lead of an ohmmeter having a battery no larger than 12 volts to the base of the transistor.

3. Connect the positive lead of the ohmmeter to the collector and then to the emitter. For the PNP transistors (2N247, 2N218, 2N301) both readings should be less than 50 ohms on the lowest scale. For the NPN transistors (2N647) both readings should be high.

4. Connect the positive lead of the ohmmeter to the base. Connect the negative lead to the collector and then to the emitter. The readings should be low for type NPN and high for type PNP.

5. If the readings in step 4 were the same as in step 3 (both high or both low) the transistor is defective and should be replaced.

6. Measure the resistance between the emitter and collector. Both the forward and backward resistance should be high. A very low reading indicates a short between the emitter and the collector.

Trouble Shooting

When a receiver unit fails completely or performance falls off, a systematic check will increase the chances of locating the trouble quickly. The following procedure is suggested: In the order given in the table of *Receiver Trouble Shooting Procedure* check the receiver for the trouble indications listed. When the listed indication is not present, or the suggested measures do not correct the trouble proceed to the next step in the table.

RECEIVER TROUBLE SHOOTING PROCEDURE

Trouble Indication	*Probable Cause*	*What To Do*
A. Noisy, distorted reception.	Receiver off frequency of desired transmitter or chassis volume control too high.	Adjust frequency or volume control as directed under *Initial Adjustments.*
B. No supply voltages.	Power supply trouble.	1. Check fuses. If a fuse is blown check for shorts and replace fuse. 2. Check for broken connections between receiver and power supply.
C. Low supply voltages.	Low battery voltage or defective power supply.	1. Check battery voltage. 2. Trouble shoot power supply.
D. No voltage or very low voltage at white pin jack, 1TP1.	Failure of tube 1V5, crystal 1Y1, or associated circuits.	1. Measure voltage between 1TP1 and ground. Normal reading is about −3 volts on a VoltOhmyst or −0.6 volts on a CX-7B test meter. 2. Replace 1V5. 3. Rotate the tuning studs of 1Z10 and 1L12 back and forth through two or three turns. If the meter reading does not change return studs as closely as possible to their original positions. 4. Replace crystal 1Y1. If this corrects the condition retune 1Z10 and 1L12 and reset trimmer 1C33. 5. Circuit check wiring around 1V5, 1Z10, and 1L12 for open connections, shorts or broken or burned parts. After correcting trouble retune 1Z10 and 1L12. Replace original crystal, 1Y1.

RECEIVER TROUBLE SHOOTING PROCEDURE (Continued)

Trouble Indication	*Probable Cause*	*What To Do*
E. No voltage or very low voltage at grid of third multiplier.	Failure of tube 1V6 or associated circuits.	1. Measure voltage between grid, pin 2, of 1V6 and ground with a VoltOhmyst in series with a 1 megohm resistor or CX-7B with a 560 K-ohm resistor. Normal reading is about −2.8 volts on the VoltOhmyst or −.2 volt on the CX-7B. 2. Replace 1V6. If this corrects the condition retune 1Z11 and 1L14. 3. Check tuning of 1Z11 (as described under D-3). 4. Circuit check wiring around 1V6 and 1Z11 (as described under D-5). After correcting trouble retune 1Z11 and 1L14.
F. Low Sensitivity.	Failure in r-f or high i-f sections. Receiver not properly tuned to transmitter. Failure in installation (antenna cable, antenna, or battery).	1. Connect an output meter having a decibel scale across the secondary of the audio output transformer, 12T4. Connections to the secondary can be made by inserting meter leads terminating in thin probes into contacts 10 and 11 of the green plug, 12P1 (on the cable that connects the receiver to the power supply) from the back of the plug. The connection can also be made to contacts 2 and 3 of the green receptacle, 3J2, on the front panel of the T-R unit, or to contacts A and C of the white plug, 5P3, on the control unit. 2. Feed an unmodulated carrier signal from a reliable signal generator into the antenna jack. Increase the signal amplitude until the meter reading drops 20 db below that obtained with no signal. When the sensitivity is normal an r-f amplitude of 0.6 μv will produce a 20 db drop. 3. If the sensitivity is normal go through the procedures recommended under *Initial Adjustments,* and check the antenna and antenna cable for shorts or open connections. 4. If the sensitivity is low notice whether the filaments of tubes 1V1, 1V2, and 1V3 are lit. If not replace the defective tube. 5. Check voltages on these tubes. Look for a large discrepancy such as would be caused by an open or shorted connection or component. If changes are made realign any associated transformer. 6. Circuit check the wiring around these tubes for broken parts and open or shorted connections. 7. Connect a VoltOhmyst between the yellow pin jack, 1TP2, and ground. Feed an r-f signal into the antenna jack at a level high enough to obtain an appreciable reading. (If no reading can be obtained proceed to step G.) Replace 1V1, 1V2, 1V3 one at a time with tubes known to be good. Retune the connected transformers as each tube is replaced. if any transformer is erratic or does not peak up properly, investigate and if necessary replace the transformer. 8. Tune 1L14. 9. Check antenna relay and cable.
G. Very low or no agc voltage at yellow jack, 1TP1, with large r-f input to antenna.	Failure in second oscillator-mixer. Defective 455 KC selector, 12Z1. Shorted or open transistor, 10Q1, 2. Faulty connection or component on printed circuit board.	1. Replace tube 1V4. 2. Replace crystal 1Y2. 3. Circuit check wiring associated with 1V4. 4. Remove receiver chassis from case and shield from printed circuit board. Check voltages on the emitters and collectors of transistors 10Q1, 2 against those given on the schematic diagram.

RECEIVER TROUBLE SHOOTING PROCEDURE (Continued)

Trouble Indication	*Probable Cause*	*What To Do*
		5. Check the printed circuit board and associated circuits for broken or shorted parts and connections. 6. Check the resistance of the transistors as instructed in the text. 7. Unplug the cable connecting 455 KC selector 12Z1 to the printed circuit board. Connect a 455 KC signal generator to the base of transistor 10Q1 *through a .01 μf capacitor.* 8. Connect a VoltOhmyst with a crystal probe across coil 10L2. 9. Adust the output of the signal generator for a reading of 1 volt on the VoltOhmyst. If the generator output is less than 0.1 volt the first i-f stage is normal. 10. Connect the VoltOhmyst to the collector of 10Q2, and adjust the signal generator output for a reading of 1 volt. If the generator output is less than 0.01 volts the first two i-f stages are normal. 11. Replace selector 12Z1.
H. Noise audible but very low when squelch is turned to maximum counterclockwise position.	Failure in third or fourth low i-f stages, discriminator, or audio stages.	1. Measure voltage between terminal 3 of discriminator transformer, 12Z2, and ground with a VoltOhmyst. If voltage is normal (7 or 8 volts) check audio stages as directed under I. 2. If discriminator voltage is low check the third and fourth low i-f stages, 10Q3 and 10Q4 and discriminator stage 10Q5 as directed under G-4, 5 and 6. 3. Connect signal generator as in G-7. Connect VoltOhmyst with crystal probe successively to the collectors of 10Q3 and 10Q4. Each time adjust output of signal generator for a reading of 1 volt on VoltOhmyst. If stages are normal the generator output required to produce a reading of 1 volt will be less than 1.0 millivolt for 10Q3, and less than 0.1 millivolt for 10Q4. 4. Connect 455 kc signal generator to the base of discriminator transistor 10Q5 *through a .01 mf capacitor.* Connect VoltOhmyst to measure dc voltage at discriminator metering jack 1TP3 (green). 5. Adjust the signal generator output to 0.5 volts at 455 kc. The VoltOhmyst should read less than 1 volt. 6. Tune the signal generator to 470 kc. The voltage should be at least +5 volts. 7. Tune the generator to 440 kc. The voltage should be at least −5 volts and within 20% of the voltage at 470 kc. 8. Try to align discriminator transformer as directed in text. If circuit checks indicate that all other components of discriminator are normal, and alignment of transformer does not correct trouble, replace transformer.
I. No noise audible when squelch is in maximum clockwise position.	Failure in audio section.	1. Check audio stages 10Q8, 10Q9, 1Q1, 1Q2 as directed under G-4, 5, 6. Note that the leads must be unsoldered from output transistors 1Q1 and 1Q2 to permit checking their resistance. 2. Disable the squelch circuit by connecting a clip between the collector of 10Q7 and ground.

RECEIVER TROUBLE SHOOTING PROCEDURE (Continued)

Trouble Indication	*Probable Cause*	*What To Do*
		3. Disconnect the loudspeaker at the control box and connect a 3-ohm, 10-watt resistor across the audio output terminals (contacts A and C of the white plug on the control unit, contacts 2 and 3 of the green receptacle 3J2 on front panel of T-R unit, or contacts 10 and 11 of the green plug 12P1, that connects the resistor to the power supply). Connections to the receptacles can be made without unplugging them by inserting leads terminating in thin probes into the contacts from the back. 4. Connect an audio voltmeter across the 3-ohm resistor, and an audio generator to the primary of transformer 12T2. When the audio stages are normal an audio signal of about .03 volts at 1000 cycles will produce an output of 3.8 volts across the 3-ohm resistor (5 watts). 5. Circuit check the components of the audio stages.
J. Noise not muted when squelch is in maximum clockwise position.	Failure in squelch section.	1. Check noise amplifier 10Q6 and squelch gate 10Q7 as directed under G-4, 5, 6. 2. Connect an audio generator across capacitor 10C22 in the output of the discriminator stage. Turn the squelch control to the maximum counterclockwise position (maximum resistance). 3. Connect a VoltOhmyst or CX-7B to measure the dc voltage on the collector of squelch gate stage 10Q7. 4. Short circuit the output of the audio generator. The VoltOhmyst or CX-7B should read less than 0.5 volts. 5. Adjust the generator for an output of no more than 1 volt at 10,000 cycles. The VoltOhmyst or CX-7B should read at least 10 volts. 6. Circuit check the components of stages 10Q6 and 10Q7. NOTE: When the set is working normally, with no signal present and the squelch control in the maximum counterclockwise position, at least 3 volts of noise can be measured across coil 10L1, with an audio voltmeter, and at least 10 volts dc can be measured on the collector of 10Q7 with a VoltOhmyst or CX-7B. When the squelch control is turned to the clockwise position the voltage on the collector of 10Q7 should drop to less than 0.5 volts.

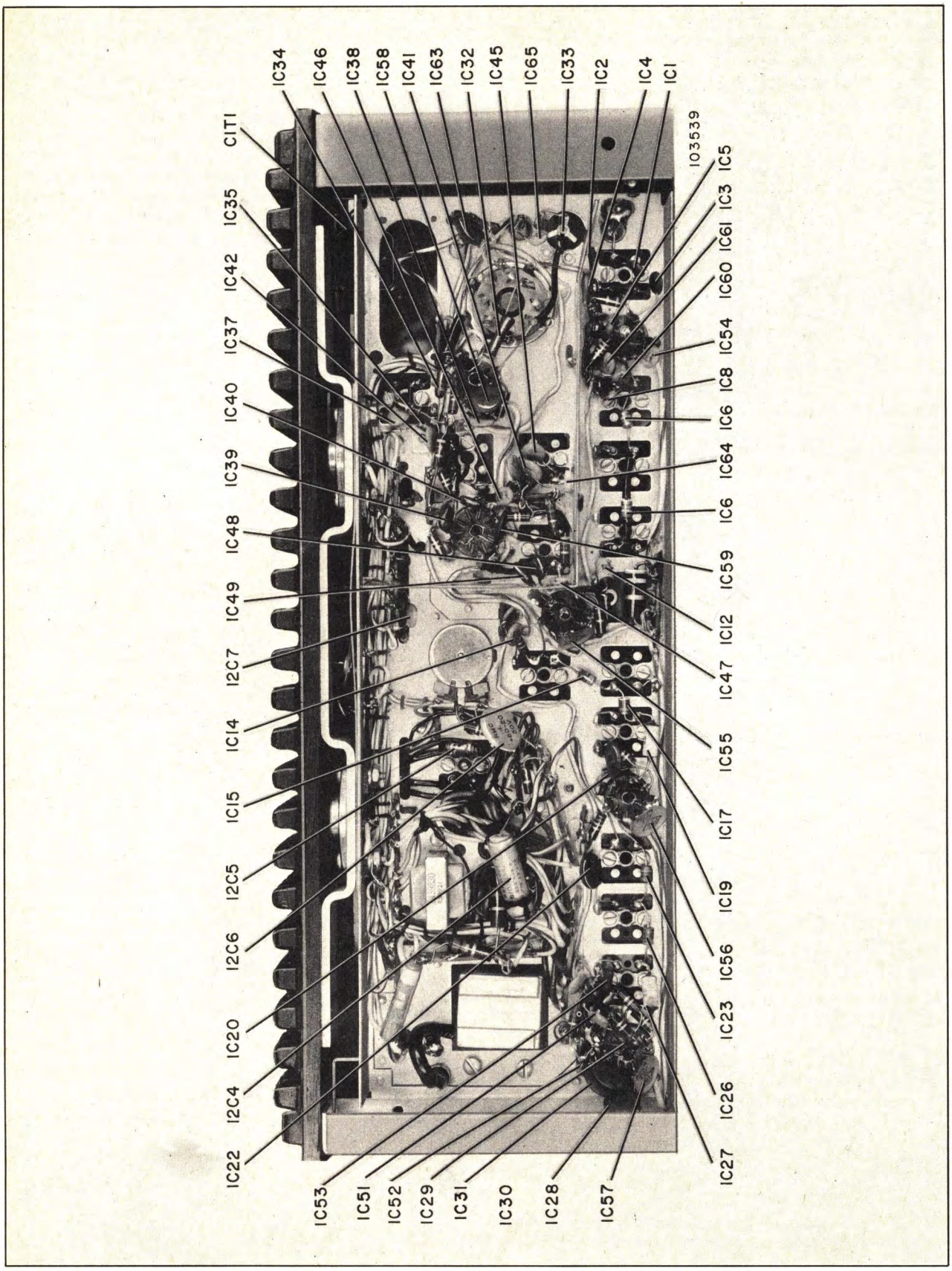


Figure R-2—Bottom View of Receiver, with Capacitors Identified

REPLACEMENT PARTS LIST

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
HYBRID MOBILE RECEIVER (148-174 MC) (8978510-501)			
1A1		8978594-501	I.F. and Audio Sub Assembly
			CAPACITORS:
1C1	104177	8436708-208	Ceramic, 7 μμf ±5%, 500 v
1C2	218430	8436708-215	Ceramic, 15 μμf ±5%, 500 v
1C3	104915	8436708-219	Ceramic, 22 μμf ±5%, 500 v
1C4, 1C5	102084	8811182-1	Ceramic, 820 μμf +100 -20%, 500 v
1C6	218431	442905-8	Ceramic, 0.39 μμf ±10%, 500 v
1C7			Part of 1Z1
1C8	102084	8811182-1	Ceramic, 820 μμf +100 -20%, 500 v
1C9			Part of 1Z2
1C10	218431	442905-8	Ceramic, 0.39 μμf ±10%, 500 v
1C11			Part of 1Z3
1C12	103010	735717-621	Ceramic, 22 μμf ±20%, 500 v
1C13			Part of 1Z4
1C14	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
1C15	71504	99327-11	Headed lead, 0.68 μμf ±10%, 500 v
1C16			Part of 1Z5
1C17	211752	442905-5	Ceramic, 0.22 μμf ±5%, 500 v
1C18			Part of 1Z6
1C19		757607-225	Mica, 39 μμf ±5%, 500 v
1C20	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
1C21			Part of 1Z7
1C22	205656	8811182-5	Ceramic, 0.01 +100 -20%, 450 v
1C23	211752	442905-5	Ceramic, 0.22 μμf ±5%, 500 v
1C24			Part of 1Z8
1C25	218431	442905-8	Ceramic, 0.22 μμf ±5%, 500 v
1C26			Part of 1Z9
1C27		757607-225	Mica, 39 μμf ±5%, 500 v
1C28 to 1C31	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
1C32	75610	735717-343	Ceramic, 1500 μμf +100 -20%, 500 v
1C33	204811	8977217-1	Variable, ceramic, 5-25 μμf
1C34	218221	757607-233	Mica, 82 μμf ±5%, 500 v
1C35	218432	442905-2	Ceramic, 0.12 μμf ±10%, 500 v
1C36			Part of 1Z11
1C37, 1C38	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
1C39	217379	757607-229	Ceramic, 56 μμf ±5%, 500 v
1C40	213496	757607-227	Mica, 47 μμf ±5%, 500 v
1C41, 1C42	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
1C43	215197	757607-231	Mica, 68 μμf ±5%, 500 v
1C44			Part of 1Z12
1C45	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
1C46	102084	8811182-1	Ceramic, 820 μμf +100 -20%, 500 v
1C47	218779	8980628-15	Ceramic, stand-off, 1000 μμf ±10%, 500 v
1C48	218433	757607-13	Mica, 9 μμf ±0.5 μμf, 500 v
1C49	218434	757607-226	Mica, 43 μμf ±5%, 500 v
1C50, 1C51	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
1C52	218221	757607-233	Mica, 82 μμf ±5%, 500 v
1C53	215198	757607-223	Mica, 33 μμf ±5%, 500 v
1C54	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
1C55 to 1C59	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
1C60	102084	8811182-1	Ceramic, 820 μμf +100 -20%, 500 v
1C61, 1C62	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
1C63	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
1C64	218779	8980628-15	Ceramic, stand-off, 1000 μμf ±10%, 500 v
1C65, 1C66	102084	8811182-1	Ceramic, 820 μμf +100 -20%, 500 v
1C67	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
1C68		8924416-313	Mica, 1300 μμf ±5%, 500 v
1E1		8439837-1	Crystal Oven
1J1	104039	8848262-2	Connector: female, single contact phono type
1L1	218435	8978521-501	Coil: R.F. (antenna)
1L2			Part of 1Z1

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
1L3			Part of 1Z2
1L4			Part of 1Z3
1L5			Part of 1Z4
1L6			Part of 1Z5
1L7			Part of 1Z6
1L8			Part of 1Z7
1L9			Part of 1Z8
1L10			Part of 1Z9
1L11			Part of 1Z10
1L12	218436	8978521-502	Coil: R.F., multiplier
1L13			Part of 1Z11
1L14	218437	8978521-522	Coil: R.F., multiplier
1Q1, 1Q2			Transistor: RCA 2N301
			RESISTORS:
			Fixed, Composition - Unless otherwise specified
1R1		82283-98	1.0 meg ±10%, ½ w
1R2			Not Used
1R3		82283-80	33,000 ohm ±10%, ½ w
1R4		82283-70	4700 ohm ±10%, ½ w
1R5		82283-102	2.2 meg ±10%, ½ w
1R6		82283-67	2700 ohm ±10%, ½ w
1R7		82283-79	27,000 ohm ±10%, ½ w
1R8		82283-90	220,000 ohm ±10%, ½ w
1R9		82283-62	1000 ohm ±10%, ½ w
1R10		82283-79	27,000 ohm ±10%, ½ w
1R11		82283-91	270,000 ohm ±10%, ½ w
1R12		82283-64	1500 ohm ±10%, ½ w
1R13		82283-88	150,000 ohm ±10%, ½ w
1R14		82283-80	33,000 ohm ±10%, ½ w
1R15		82283-66	2200 ohm ±10%, ½ w
1R16		82283-86	100,000 ohm ±10%, ½ w
1R17		82283-74	10,000 ohm ±10%, ½ w
1R18		82283-70	4700 ohm ±10%, ½ w
1R19		82283-95	560,000 ohm ±10%, ½ w
1R20		82283-90	220,000 ohm ±10%, ½ w
1R21		82283-84	68,000 ohm ±10%, ½ w
1R22		82283-90	220,000 ohm ±10%, ½ w
1R23		82283-87	120,000 ohm ±10%, ½ w
1R24		82283-70	4700 ohm ±10%, ½ w
1R25		82283-67	2700 ohm ±10%, ½ w
1R26		82283-83	56,000 ohm ±10%, ½ w
1R27		82283-86	100,000 ohm ±10%, ½ w
1R28		82283-83	56,000 ohm ±10%, ½ w
1R29		99126-45	39 ohm ±10%, 2 w
1R30		82283-80	33,000 ohm ±10%, ½ w (Used in wide band only)
1R31		82283-102	2.2 meg ±10%, ½ w
1R32		82283-62	1000 ohms ±10%, ½ w
1RT1	218438	8439831-2	Resistor: temperature compensating, 10 ohms at 25°C ±10%, 1.58 ohms at 80°C ±20%
1TP1	218439	8974620-7	Connector: tip jack, "White" (Mult. Metering)
1TP1	218440	8974620-4	Connector: tip jack, "Yellow" (3rd I.F. Metering)
1TP1	218441	8974620-5	Connector: tip jack, "Green" (Discr. Metering)
1XV1 to 1XV3	208256	8436746-3	Socket: tube, 7 pin min.
1XV4	94926	8436747-5	Socket: tube, 9 pin min.
1XV5	208256	8436746-3	Socket: tube, 7 pin min.
1XV6	57852	8436747-3	Socket: tube, 9 pin min.
1XY1	68590	8977216-1	Socket: octal, (crystal)
1Y1		8979915	Crystal (As specified by Sales.)
1Y2	218442	8978597-2	Crystal: fixed frequency, 13.91 M.C. (2nd Osc.)
1Z1	218443	8978521-519	Transformer: R.F.
1Z2	218444	8978521-520	Transformer: R.F.
1Z3	218445	8978521-521	Transformer: R.F.
1Z4	218446	8978521-513	Transformer: Hi I.F.
1Z5 to 1Z9	218447	8978521-514	Transformer: Hi I.F.

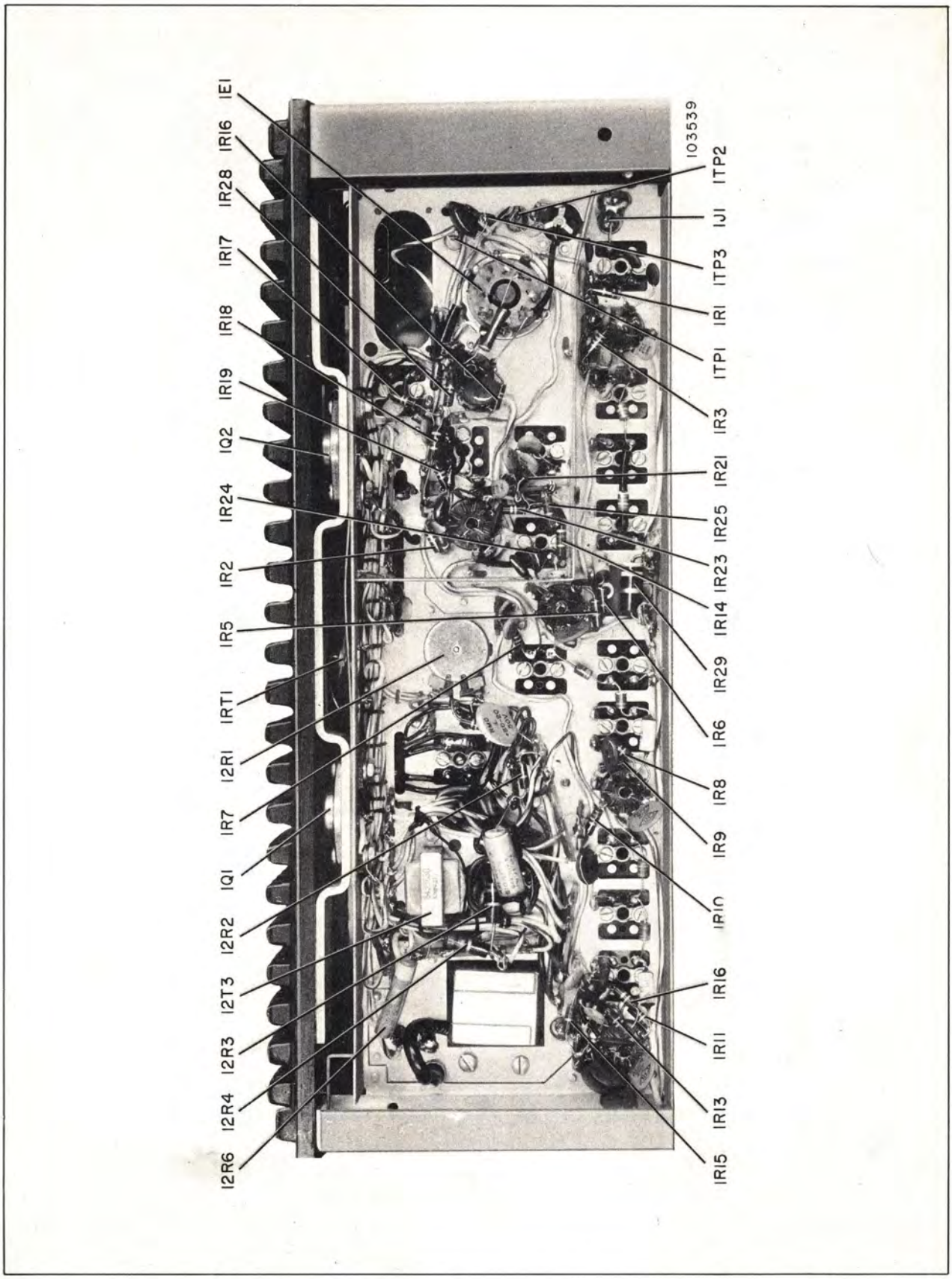


Figure R-3—Bottom View of Receiver, with Resistors Identified

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
1Z10	218448	8978521-523	Transformer: R.F. (multiplier)
1Z11	218449	8978521-511	Transformer: R.F.
			Miscellaneous:
	215567	8946978-1	Insulator: mylar (1Q1, 1Q2 Insulating)
	56359	99395-2	Shield: tube, 9 pin min. (For 1V4)
			I.F. and Audio Sub-Assembly
12A1	218450	8978555-501	Circuit: printed, I.F., audio and squelch
12C1 to 12C3			Part of 12Z2
12C4	79784	8977211-10	Capacitor: electrolytic, 100 μf, 15 v
12C5	77364	90581-361	Capacitor: ceramic, 6 μμf ±0.5 μμf, 500 v
12C6	215231	8982805-7	Capacitor: ceramic, 0.1 μf +80 -20%, 50 v
12J1, 12J2	104039	8848262-2	Connector: female, single contact, phono type
12P1	218782	8949996-804	Connector: male, 12 contact, cable mtg. (Green)
12P2, 12P3			Part of 12Z1
12P4	218783	8949996-707	Connector: female, 12 contact, chassis mtg. (White)
12P5	218784	8949996-807	Connector: male, 12 contact, cable mtg. (White)
			RESISTORS:
			Fixed, Composition - Unless otherwise specified
12R1	218451	8439847-1	Variable, comp, 250,000 ohm ±30%, ¼ w
12R2		82283-38	10 ohm ±10%, ½ w
12R3		90496-55	270 ohm ±10%, 1 w
12R4	57182	8949995-1	Wire wound, 5.6 ohm ±10%, ½ w
12R5		82283-82	47,000 ohm ±10%, ½ w
12R6	76684	867971-306	Wire wound, 0.47 ohm ±10%, 1 w
12R7	53749	8825410-71	Wire wound, 4500 ohm ±10%, 10 w
12T1			Part of 12Z2
12T2	218452	8439829-2	Transformer: A.F., input
12T3	218453	8439830-1	Transformer: A.F., driver
12T4	218454	8439828-1	Transformer: A.F., output
12Z1	218455	8439882-1	Filter: I.F., 455 KC
12Z2	218456	8978521-504	Transformer: I.F., discriminator
			Circuit: Printed I.F., Audio and Squelch
			CAPACITORS:
10C1	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
10C2	218895	8949978-3	Ceramic, 0.47 μf +80 -20%, 12 v
10C3	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
10C4	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
10C5	218461	8949978-2	Ceramic, 0.2 μf +80 -20%, 12 v
10C6, 10C7	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
10C8, 10C9	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
10C10	218457	8949978-1	Ceramic, 0.1 μf +80 -20%, 12 v
10C11	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
10C12	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
10C13	218457	8949978-1	Ceramic, 0.1 μf +80 -20%, 12 v
10C14	102084	8811182-1	Ceramic, 820 μμf +100 -20%, 500 v
10C15	205660	8811182-3	Ceramic, 1500 μμf +100 -20%, 500 v
10C16	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
10C17	218457	8949978-1	Ceramic, 0.1 μf +80 -20%, 12 v
10C18 to 10C20			Not Used
10C21	218458	8436708-227	Ceramic, 47 μμf ±5%, 500 v
10C22	217806	8978533-2	Ceramic, 470 μμf ±20%, 1000 v
10C23	218459	8978533-3	Ceramic, 820 μμf ±20%, 1000 v
10C24	218460	8978533-1	Ceramic, 220 μμf ±20%, 1000 v
10C25	217806	8978533-2	Ceramic, 470 μμf ±20%, 1000 v
10C26	205656	8811182-5	Ceramic, 0.01 μf +100 -20%, 450 v
10C27	218457	8949978-1	Ceramic, 0.1 μf +80 -20%, 12 v
10C28	217350	8977211-6	Electrolytic, 10 μf, 15 v
10C29	106735	8977211-7	Electrolytic, 15 μf, 15 v
10C30 to 10C32	205656	8811152-5	Ceramic, 0.01 μf +100 -20%, 450 v

Symbol No.	Stock No.	Drawing No.	Description
10C33	218780	8977211-9	Electrolytic, 50 μf, 15 v
10C34	218457	8949978-1	Ceramic, 0.1 μf +80 -20%, 12 v
10C35, 10C36	218780	8977211-9	Electrolytic, 50 μf, 15 v
10C37	218895	8949978-3	Ceramic, 0.47 μf +80 -20%, 12 v
10C38, 10C39	218780	8977211-9	Electrolytic, 50 μf, 15 v
10CR1 to 10CR4	219283		Rectifier: germanium diode, 1N67A
10L1	218462	8957202-502	Reactor: filter (squelch)
10L2			Not Used
10L3	218463	8979933-501	Reactor: R.F. choke, 180 microhenry
10Q1 to 10Q4			Transistor: RCA 2N247
10Q5, 10Q6			Transistor: RCA 2N218
10Q7 to 10Q9			Transistor: RCA 2N647
			RESISTORS:
			Fixed, Composition - Unless otherwise specified
10R1		82283-71	5600 ohm ±10%, ½ w
10R2		82283-72	6800 ohm ±10%, ½ w
10R3		82283-76	15,000 ohm ±10%, ½ w
10R4		82283-62	1000 ohm ±10%, ½ w
10R5			Not Used
10R6		82283-71	5600 ohm ±10%, ½ w
10R7		82283-72	6800 ohm ±10%, ½ w
10R8		82283-76	15,000 ohm ±10%, ½ w
10R9		82283-62	1000 ohm ±10%, ½ w
10R10			Not Used
10R11		82283-95	560,000 ohm ±10%, ½ w
10R12		82283-70	4700 ohm ±10%, ½ w
10R13		82283-71	5600 ohm ±10%, ½ w
10R14		82283-74	10,000 ohm ±10%, ½ w
10R15		82283-76	15,000 ohm ±10%, ½ w
10R16, 10R17		82283-62	1000 ohm ±10%, ½ w
10R18		82283-71	5600 ohm ±10%, ½ w
10R19		82283-74	10,000 ohm ±10%, ½ w
10R20		82283-76	15,000 ohm ±10%, ½ w
10R21, 10R22		82283-62	1000 ohm ±10%, ½ w
10R23		82283-78	22,000 ohm ±10%, ½ w
10R24		82283-71	5600 ohm ±10%, ½ w
10R25		82283-74	10,000 ohm ±10%, ½ w
10R26		82283-62	1000 ohm ±10%, ½ w
10R27, 10R28		82283-83	56,000 ohm ±10%, ½ w
10R29		82283-74	10,000 ohm ±10%, ½ w
10R30			Not Used
10R31		82283-71	5600 ohm ±10%, ½ w
10R32		82283-78	22,000 ohm ±10%, ½ w
10R33		82283-69	3900 ohm ±10%, ½ w
10R34		82283-62	1000 ohm ±10%, ½ w
10R35		82283-79	27,000 ohm ±10%, ½ w
10R36		82283-68	3300 ohm ±10%, ½ w
10R37, 10R38		82283-82	47,000 ohm ±10%, ½ w
10R39		82283-91	270,000 ohm ±10%, ½ w
10R40			Not Used
10R41		82283-73	8200 ohm ±10%, ½ w
10R42			Not Used
10R43		82283-50	100 ohm ±10%, ½ w (Early equipments only)
10R44		82283-66	2200 ohm ±10%, ½ w
10R45			Not Used
10R46, 10R47		82283-62	1000 ohm ±10%, ½ w
10R48		82283-67	2700 ohm ±10%, ½ w
10R49		82283-62	1000 ohm ±10%, ½ w
10R50		82283-61	820 ohm ±10%, ½ w
10R51, 10R52		82283-62	1000 ohm ±10%, ½ w
10R53		82283-66	2200 ohms ±10%, ½ w
10RT1	218464	8439831-6	Resistor: temperature compensating, 10,000 ohm at 25°C ±10%, 1250 ohm at 80°C ±20%
10RT2	218781	8439831-7	Resistor: temperature compensating, 1000 ohm at 25°C ±10%, 158 ohm at 80°C ±20%

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
SECOND FREQUENCY RECEIVER KIT (8980640-501)			
11C1	75610	735717-343	Capacitor: ceramic, 1500 μμf ±20%, 500 v
11C2	218221	757607-233	Capacitor: mica, 82 μμf ±5%, 500 v
11C3	204811	8977217-1	Capacitor: variable, ceramic, 5-25 μμf NPO
11C4, 11C5	102084	8811182-1	Capacitor: ceramic, 820 μμf -20 +100%, 500 v
11C6	205660	8811182-3	Capacitor: ceramic, 1500 μμf -20 +100%, 500 v
11R1		82283-86	Resistor: fixed, comp., 100,000 ohms, ±10%, ½ w
11R2		82283-83	Resistor: fixed, comp., 56,000 ohms, ±10%, ½ w
11XV1	208256	8436746-3	Socket: tube, 7 pin min.
11Y1		8979915-	Crystal

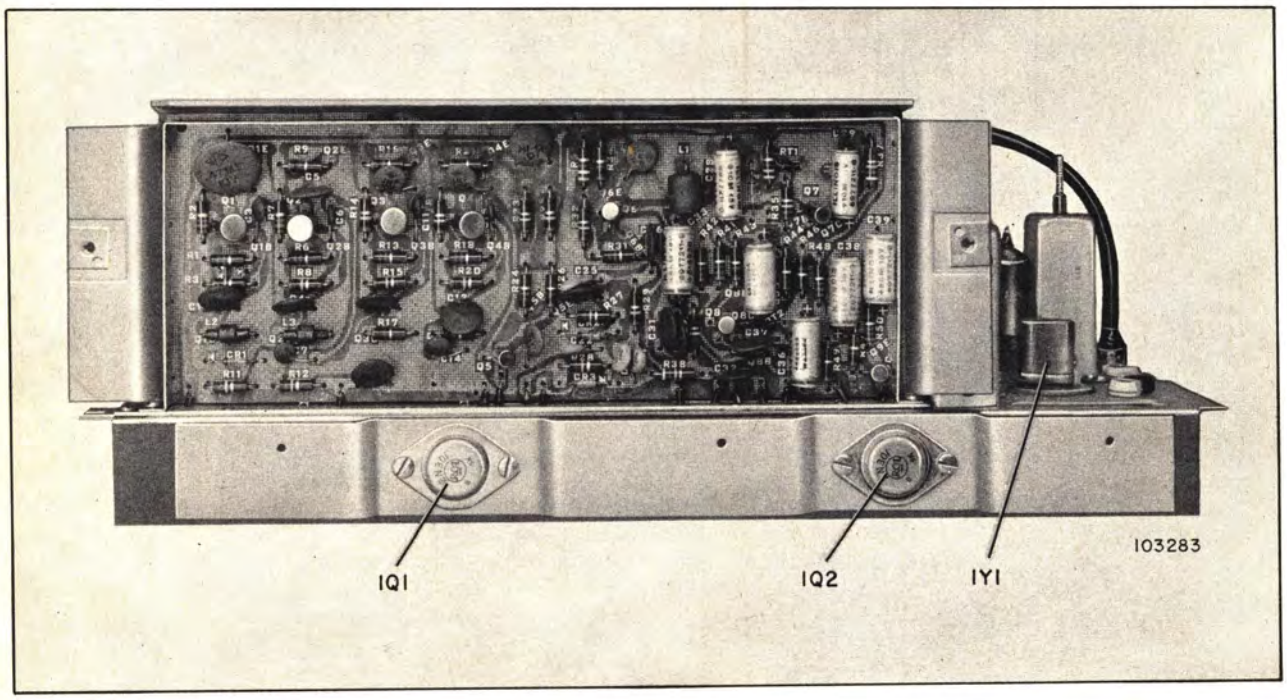
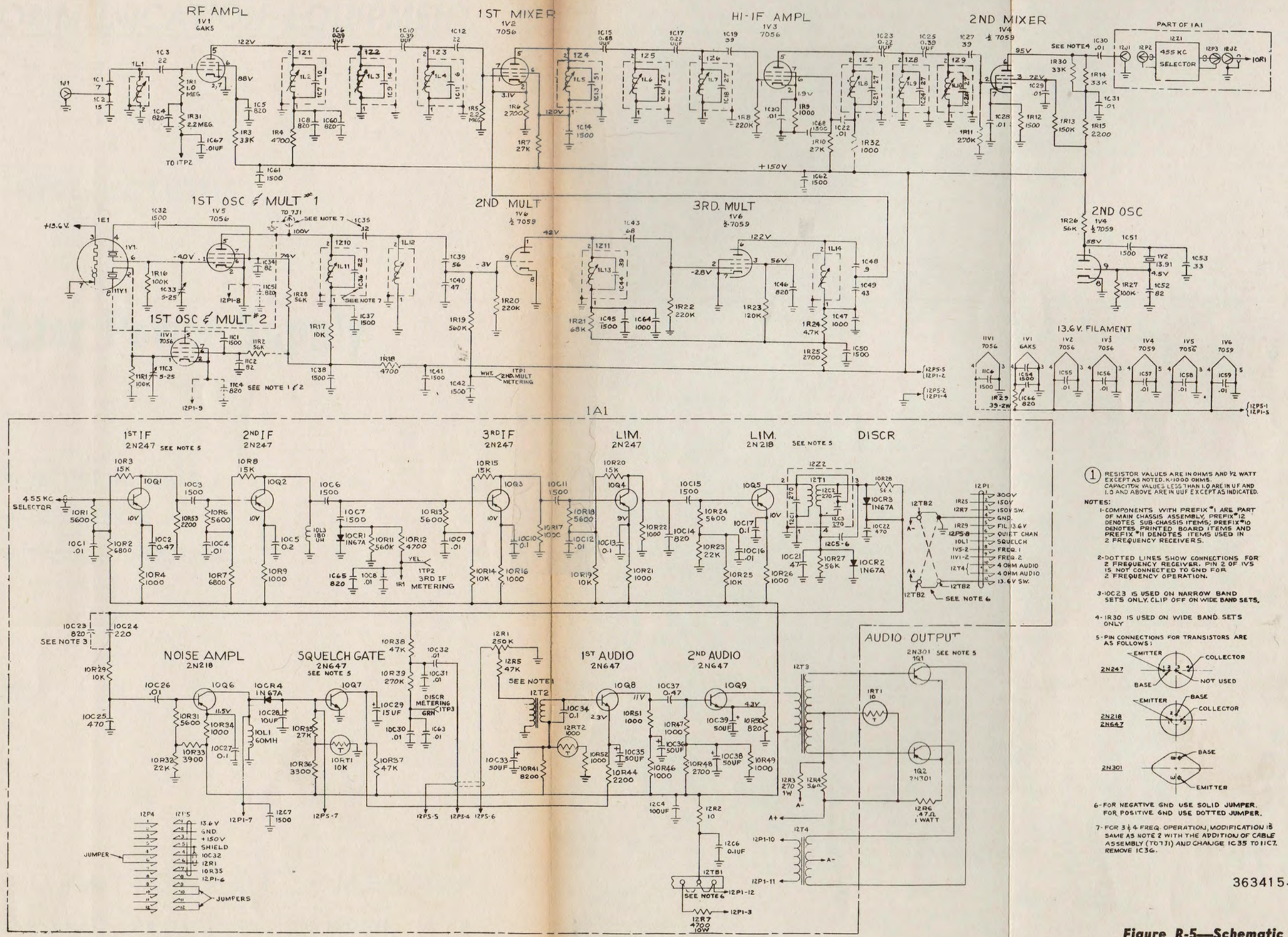


Figure R-4—View of I-F and Audio Sub-Assembly Showing Printed Circuit Board



1. RESISTOR VALUES ARE IN OHMS AND ½ WATT EXCEPT AS NOTED. K=1000 OHMS. CAPACITOR VALUES LESS THAN 1.0 ARE IN UF AND 1.0 AND ABOVE ARE IN UUF EXCEPT AS INDICATED.

NOTES:

1-COMPONENTS WITH PREFIX "1 ARE PART OF MAIN CHASSIS ASSEMBLY, PREFIX "12 DENOTES SUB-CHASSIS ITEMS; PREFIX "10 DENOTES PRINTED BOARD ITEMS AND PREFIX "11 DENOTES ITEMS USED IN 2 FREQUENCY RECEIVERS.

2-DOTTED LINES SHOW CONNECTIONS FOR 2 FREQUENCY RECEIVER; PIN 2 OF 1V5 IS NOT CONNECTED TO GND FOR 2 FREQUENCY OPERATION.

3-10C23 IS USED ON NARROW BAND SETS ONLY. CLIP OFF ON WIDE BAND SETS.

4-1R30 IS USED ON WIDE BAND SETS ONLY

5-PIN CONNECTIONS FOR TRANSISTORS ARE AS FOLLOWS:

6-FOR NEGATIVE GND USE SOLID JUMPER. FOR POSITIVE GND USE DOTTED JUMPER.

7-FOR 3 & 4 FREQ. OPERATION, MODIFICATION IS SAME AS NOTE 2 WITH THE ADDITION OF CABLE ASSEMBLY (TO7J1) AND CHANGE 1C35 TO 11C7. REMOVE 1C36.

363415-13

Figure R-5—Schematic Diagram, Receiver

INSTRUCTIONS

Transistor Power Supply

- TECHNICAL DATA
- DESCRIPTION
- TROUBLE SHOOTING

RADIO CORPORATION OF AMERICA

INDUSTRIAL ELECTRONIC PRODUCTS, CAMDEN, N. J.

PRINTED IN U.S.A.
DU-660

IB-33544

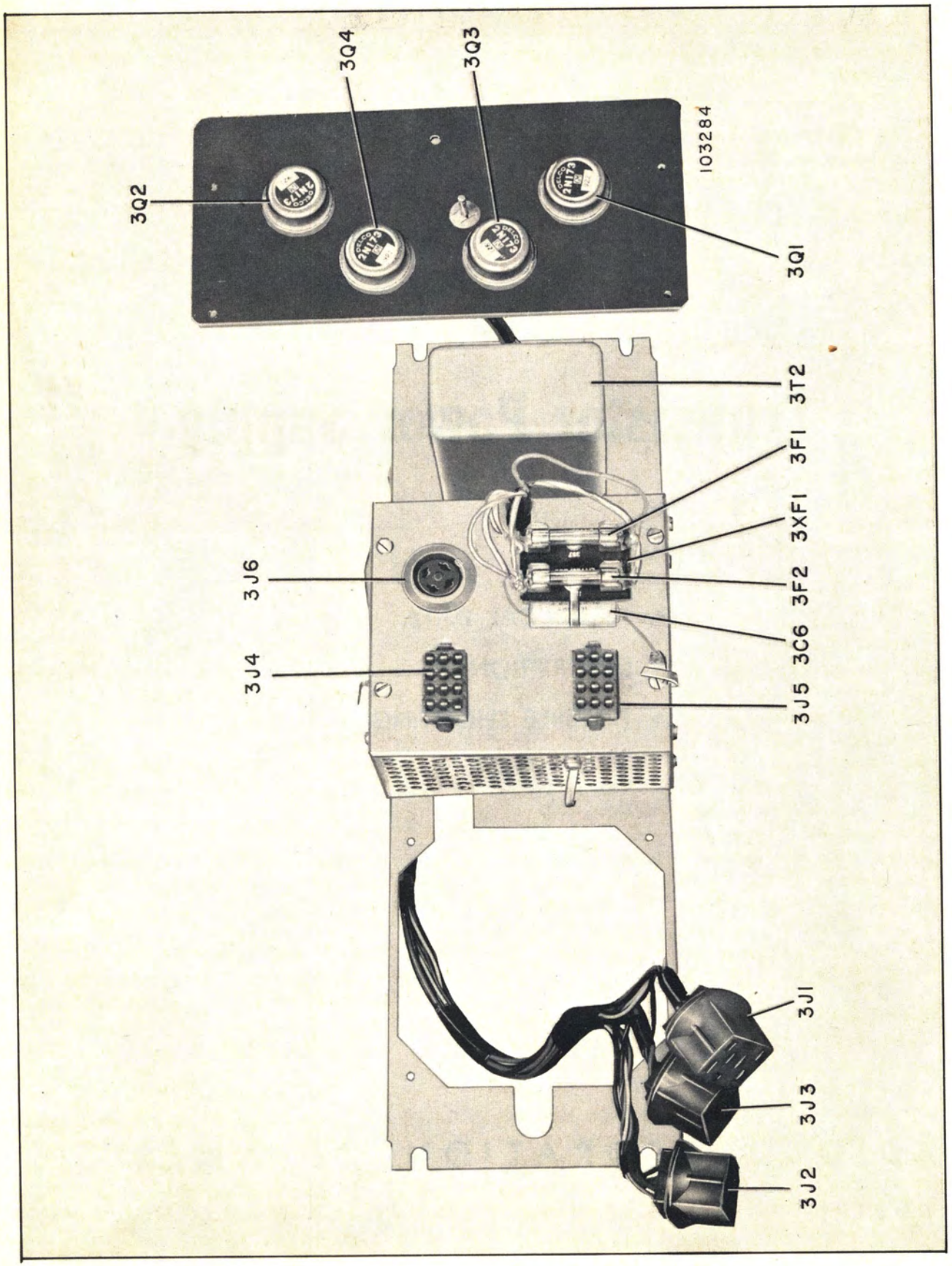


Figure P-1—Transistor Power Supply

TECHNICAL DATA

Voltage Required (at power supply input)

Standby: 13.6 v dc
Transmit: 12.6 v dc

Duty Cycle

Continuous for receive
Intermittent (EIA) for transmit

Transmitter B+ Voltages Supplied

Pin No.	*Voltage*
3J4-10	400 v
3J4-11	275 v
3J4-12	135 v

Transmitter Bias Voltage Supplied

−40 v approx. at 3J4-5

Receiver B+ Voltages Supplied

Pin No.	*Voltage*
3J5-1	300 v
3J5-2	150 v
3J5-3	150 v*

Receiver Transistor Voltage Supplied

−13.6 v dc*

Filament Voltage Supplied

13.6 v dc

Fuses

3F1 6 amps (transmitter filaments)
3F2 5 amps (receiver filaments)

Dimensions and Weight (Cha only)

Length—13-1/2 inches
Height—4-1/4 inches
Width—4-3/8 inches

Weight—4-3/4 pounds

* Voltage is removed when unit is in transmit condition.

DESCRIPTION

The Mobile Power Supply consists of a transistor oscillator and silicon rectifier circuit designed to convert a 12 volt battery input (13.0 v at power supply unit under transmit conditions) to the voltages required for a high powered transmitter and a partially transistorized receiver. Advantages of the transistor circuit over conventional vibrators or dynamotors include lower battery drain, longer life, and greater reliability. The unit contains a relay that switches the unit from the receiving to the transmitting condition when the switch on the microphone is closed. Two fuses, 3F1 and 3F2 are mounted on top of the rectifier box. Fuse 3F1 (6 amps) protects the transmitter filaments and 3F2 (5 amps), the receiver filaments.

Output Terminal Boards and Cable Connector

Connections to the control unit and voltage source are made through three cables terminating in a red, a blue and a green eight-contact connector, which mount on the front panel of the transmitter-receiver case. A red and a green connector are mounted on top of the rectifier box. The cable from the transmitter plugs into the red connector (3J4) and the cable from the receiver, into the green connector (3J5).

The four transistors, 3Q1, 3Q2, 3Q3, and 3Q4 are mounted on a plate fastened to the back radiator of the transmitter-receiver case. This arrangement protects the transistors from heat developed by the tubes of the transmitter and receiver.

Ground Polarity

The power supply is designed for use only in vehicles with the negative side of the battery grounded.

Microphone Jack

A microphone jack, 3J6, mounted on the rectifier box permits testing the transmitter directly from the power supply chassis.

Provisions for Quiet Channel Unit

Space for mounting a Quiet Channel Unit is provided on top of the power supply chassis. Information on the quiet channel unit is provided in a separate instruction book.

Transistor Oscillator Circuit

As shown in the schematic diagram, the oscillator consists of a push-pull circuit. Because of the high power requirements of the transmitter, four transistors are used. Two transistors conduct simultaneously on each half of the operating cycle. (Although the collector circuits feed separate primary windings of the transformer, 3Q1 is effectively in parallel with 3Q3, and 3Q2 is effectively in parallel with 3Q4.)

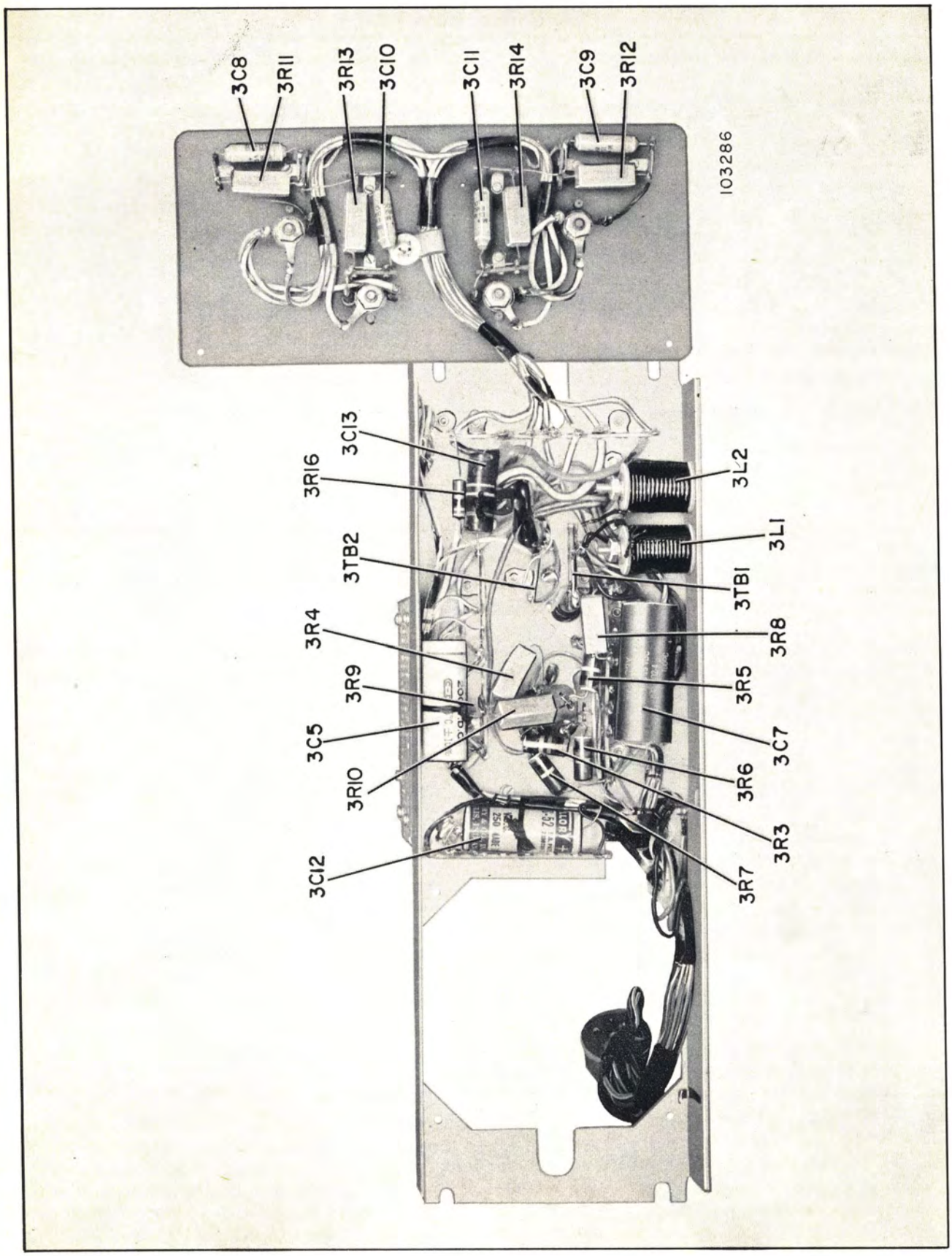


Figure P-2—Bottom View of Power Supply

Transformer 3T2 provides feedback to the bases of the transistors and has a saturable core which determines the oscillator frequency.

When the power switch on the associated control unit is placed in the STBY position relay 4L1 on the associated relay and fuse assembly becomes energized and applies source voltage to the ON-OFF pilot lamp in the control unit, the receiver filaments and the transistor oscillators. When the switch is placed in the OPERATE position, power is also applied to the transmitter filaments through a separate circuit. (See *Interconnection Diagram,* figure S-7.) Negative bias voltage applied to the bases of the transistors from the junction of resistors 3R8 and 3R9 causes all transistors to conduct. Because of inherent unbalance in the transistors and in the two halves of the primary circuit, the currents through the two transistors in each section are unequal. As the currents build up, a voltage is induced in the feedback winding. Since the ends of this winding are connected with the correct polarity to apply a forward bias to the more heavily conducting transistors and a reverse bias to the other transistors, the current through the first pair of transistors continues to increase, while the second pair becomes cut-off. Eventually the core of the transformer becomes saturated and, since the magnetic flux no longer increases fast enough to sustain the voltage across the feedback winding, a cumulative action rapidly causes the magnetic field to collapse and the feedback to reverse polarity. The first pair of transistors then cuts off and the second conducts. The switching action repeats itself and produces a square wave of voltage in the primary windings. This voltage is stepped up by three secondary windings and applied to the rectifier circuits.

Rectifier Circuits

When the switch on the associated control unit is in the STBY position (or when it is in the ON position and the microphone switch is not closed) transmit-receiver relay 3K1 is de-energized. As a result, contact 5 of the relay connects the 13.6 volt source through pin 12 of connector 3J5 to the transistor circuits of the receiver. B+ voltage for the receiver tubes is obtained from the 150-volt output of full-wave bridge rectifier 3CR6, 7, 8, 9, and is applied continuously to pin 2 of 3J5.

When the switch on the control unit is in the ON position and the microphone push-to-talk switch is closed, the relay becomes energized and accomplishes the following:

1. Contact 5 disconnects the 13.6 volt source from pin 12 of 3J5 to disable the receiver.

2. Contact 4 short circuits resistor 3R8 to increase the transistor base current.

3. Contact 1 connects the 275-volt output of 3CR6, 7, 8, 9 to pin 11 of connector 3J4, and contact 2 connects the 135-volt output to pin 12 of 3J4. These voltages are applied to all plate and screen circuits of the transmitter except the plate of the final amplifier.

4. Contact 6 connects the 400-volt output of voltage doubler 3CR2, 3, 4, 5 to pin 5 of 3J4. This voltage is fed to the plate of the transmitter final amplifier.

Negative bias voltage (−40 volts) for the grids of the second doubler and final amplifier stages of the transmitter is obtained by feeding the output of the top secondary of transformer 3T1 through a half-wave rectifier, 3CR1. This voltage is fed directly to pin 5 of 3J4 and is applied continuously during transmission and reception.

When the switch on the associated control unit is in the STBY position, it disconnects the source voltage from the transmitter filaments and the coil of relay 3K1. Consequently the transmitter cannot be energized until the switch is restored to the ON position and a waiting period of about 30 seconds is allowed for the tube filaments to warm up.

POWER SUPPLY TROUBLE SHOOTING CHART

Condition	*Probable Cause*	*Procedure*
No receiver and transmitter voltages.	1. No input voltage. 2. Open connection in main circuit.	1. Check battery cable, and battery. 2. Check fuse in series with lead to control unit, and ON-STBY-OFF switch in control unit.
All voltages low.	1. Low source voltage. 2. High contact resistance.	1. Check battery. 2. Check battery connections, contacts of relay in relay and fuse unit, and contacts of plug 4P3 on power cable.

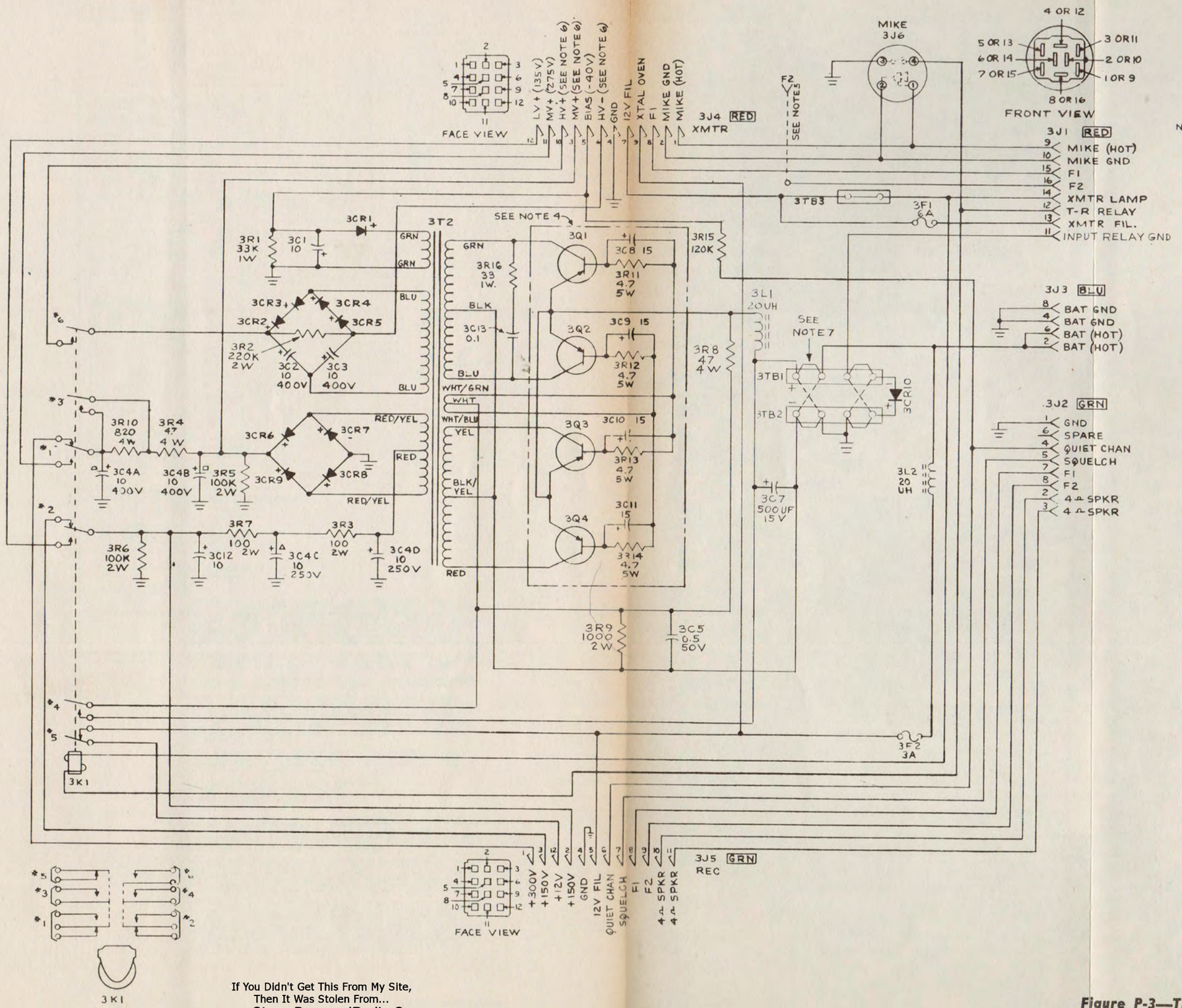
POWER SUPPLY TROUBLE SHOOTING CHART (Continued)

Condition	*Probable Cause*	*Procedure*
No voltages except transmitter filament voltage.	1. Fuse 4F1 in associated relay and fuse unit blown. 2. Failure of relay 4L1 in relay and fuse unit. 3. Polarity of battery leads reversed.	1. Check fuse 4F1. 2. Check coil of 4L1. 3. Check to see that negative terminal of battery is grounded.
No transmitter filament voltage. Normal transmitter voltages.	1. Fuse 3F1 blown. 2. Power switch on control unit in STBY position.	1. Check transmitter for short circuits and replace 3F1. 2. Place switch in ON position when it is desired to transmit.
No receiver filament voltage. Normal transmitter voltages.	Fuse 3F2 blown.	Check receiver for short circuits and replace 3F2.
No transmitter B+ voltage. Other voltages normal.	Relay 3K1 defective.	Check coil of 3K1.
Receiver or transmitter B+ voltages low. Normal filament voltages.	Faulty silicon rectifier.	Replace defective rectifier.
All voltages normal but high ripple in B+ causing hum.	1. Filter capacitor defective. 2. One or more silicon rectifier elements open causing half-wave rectification.	1. Replace capacitor. 2. Replace defective rectifiers.

LIST OF PARTS

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
TRANSISTOR POWER SUPPLY (8979948-503)			
			CAPACITORS:
3C1	219181	8982802-1	Electrolytic, 10 μf, 50 v
3C2, 3C3	219182	8982800-1	Electrolytic, 10 μf, 400 v
3C4A/D	219183	8980686-1	Electrolytic, 10/10/10/10 μf, 400/400/250/250 v
3C5	219250	990786-33	Film, 0.47 μf ±20%, 50 v
3C6			Not Used
3C7	219185	8982802-4	Electrolytic, 500 μf, 15 v
3C8 to 3C11	219186	8982802-2	Electrolytic, 15 μf, 15 v
3C12	219276	8982800-2	Electrolytic, 10 μf, 200 v
3C13		735715-75	Paper, 0.1 μf ±10%, 200 v
3CR1 to 3CR10	RCA 3583	3430063-1	Rectifier: silicon diode, 280 v, 500 MA
3F1	28463	990157-14	Fuse: cartridge, 6 amp, 250 v
3F2	37883	990157-13	Fuse: cartridge, 5 amp, 250 v
3J1		3400758-501	Connector: female, 8 contact, red
3J2		3400758-502	Connector: female, 8 contact, green
3J3		3400758-504	Connector: female, 8 contact, blue
	219343	8702794-201	Shell - "Red" plastic, connector shell only less female contacts, (Pt. of 3J1)
	219345	8702794-203	Shell - "Green" plastic, connector shell only, less female contacts, (Pt. of 3J2)
	219344	8702794-202	Shell - "Blue" plastic, connector shell only, less female contacts, (Pt. of 3J3)
	219349	8702794-3	Contact - female, connector contacts for #22 to #18 gauge wire only (Pt. of 3J1 and 3J2) (15 per stk.#)
	219350	8702794-4	Contact - female, connector contacts for #16 to #14 gauge wire only (Pt. of 3J1 to 3J3) (15 per stk.#)
3J4	218749	8980629-501	Connector: female, 12 contact, chassis mtg. "Red"

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
3J5	218750	8980629-502	Connector: female, 12 contact, chassis mtg. "Green
3J6	95186	8982843-1	Connector: female, 4 contact, chassis mtg. (micro-phone)
3K1	218748	8979989-1	Relay: coil, 12 v D.C. (trans.-rec. switching)
3L1	57862	8886236-1	Reactor: 2 microhenry, input filter
3L2	57862	8886236-1	Reactor: 2 microhenry, receive hash filter
3Q1 to 3Q4	218751		Transistor: type 2N173
			RESISTORS:
			Fixed, Composition - Unless otherwise specified
3R1		90496-22	33,000 ohm ±20%, 1 w
3R2		99126-27	22,000 ohm ±20%, 2 w
3R3		99126-7	100 ohm ±20%, 2 w
3R4	107229	945310-17	wire wound, 47 ohm ±10%, 4 w
3R5, 3R6		99126-25	100,000 ohm ±20%, 2 w
3R7		99126-7	100 ohm ±20%, 2 w
3R8	107229	945310-17	Wire wound, 47 ohm ±10%, 4 w
3R9		99126-13	1000 ohm ±20%, 2 w
3R10	74213	945310-47	Wire wound, 820 ohm ±10%, 4 w
3R11 to 3R14	218752	8980601-42	Wire wound, 4.7 ohm ±10%, 5 w
3R15		82283-87	120,000 ohm ±10%, ½ w
3R16		90496-44	33 ohms ±10%, 1 w
3T1			Not Used
3T2	218798	8980614-1	Transformer: power, torroid (high power)
3TB1		990004-1	Board: 3 terminal, tie point
3TB2		990004-2	Board: 3 terminal, tie point
3TB3		990003-20	Board: 2 terminal, tie point
3XF1, 3XF2	95528	8872217-1	Holder: fuse, for 3F1 and 3F2
			Miscellaneous:
	219483		Kit: hardware kit for mtg. 3Q1 to 3Q4, including mica insulators and insul. bushing



NOTES:

1- ALL RESISTOR VALUES GIVEN IN OHMS AND ALL CAPACITOR VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED.

2- VOLTAGES INDICATED ARE APPROXIMATE AND MEASURED TO GROUND WHEN ASSOCIATED TRANSMITTER AND RECEIVER (PROPERLY TUNED) ARE CONNECTED TO 3J4 AND 3J5, AND PROPER INPUT VOLTAGES ARE APPLIED BETWEEN TRANSISTOR EMITTERS AND GROUND AS LISTED BELOW.
RECEIVE +13.6 VOLTS.
TRANSMIT+12.6VOLTS.

3- RELAY IS SHOWN IN UN-ENERGIZED (RECEIVE) POSITION.

4- COMPONENTS SHOWN SCHEMATICALLY INSIDE PHANTOM BOX ARE PHYSICALLY ON TRANSISTOR MOUNTING PLATE, WHICH SHOULD BE FASTENED TO A SUITABLE HEAT RADIATOR (SUCH AS BACK RADIATOR OF EQUIPMENT CASE)

5- WHEN USED WITH 2 FREQUENCY TRANSMITTERS, ADDITIONAL WIRE AND SINGLE CONTACT PLUG IS ADDED AS SHOWN DOTTED.

6- VOLTAGE AT 3J4-10 CAN BE EITHER APPROX. +685V OR APPROX. +400V, DEPENDING ON WHICH ASSOCIATED TRANSMITTER IS USED. TRANSMITTERS REQUIRING +685VOLTS AT 3J4-10 ELECTRICALLY CONNECT 3J4-6 (HV-) TO 3J4-3 (MV+) IN TRANSMITTER UNIT. TRANSMITTERS REQUIRING +400VOLTS, CONNECT 3J4-6 (HV-) TO GROUND THROUGH A METERING RESISTOR.

7- FOR NEGATIVE GROUND OPERATION USE SOLID JUMPERS.
FOR POSITIVE GROUND OPERATION USE DOTTED JUMPERS.

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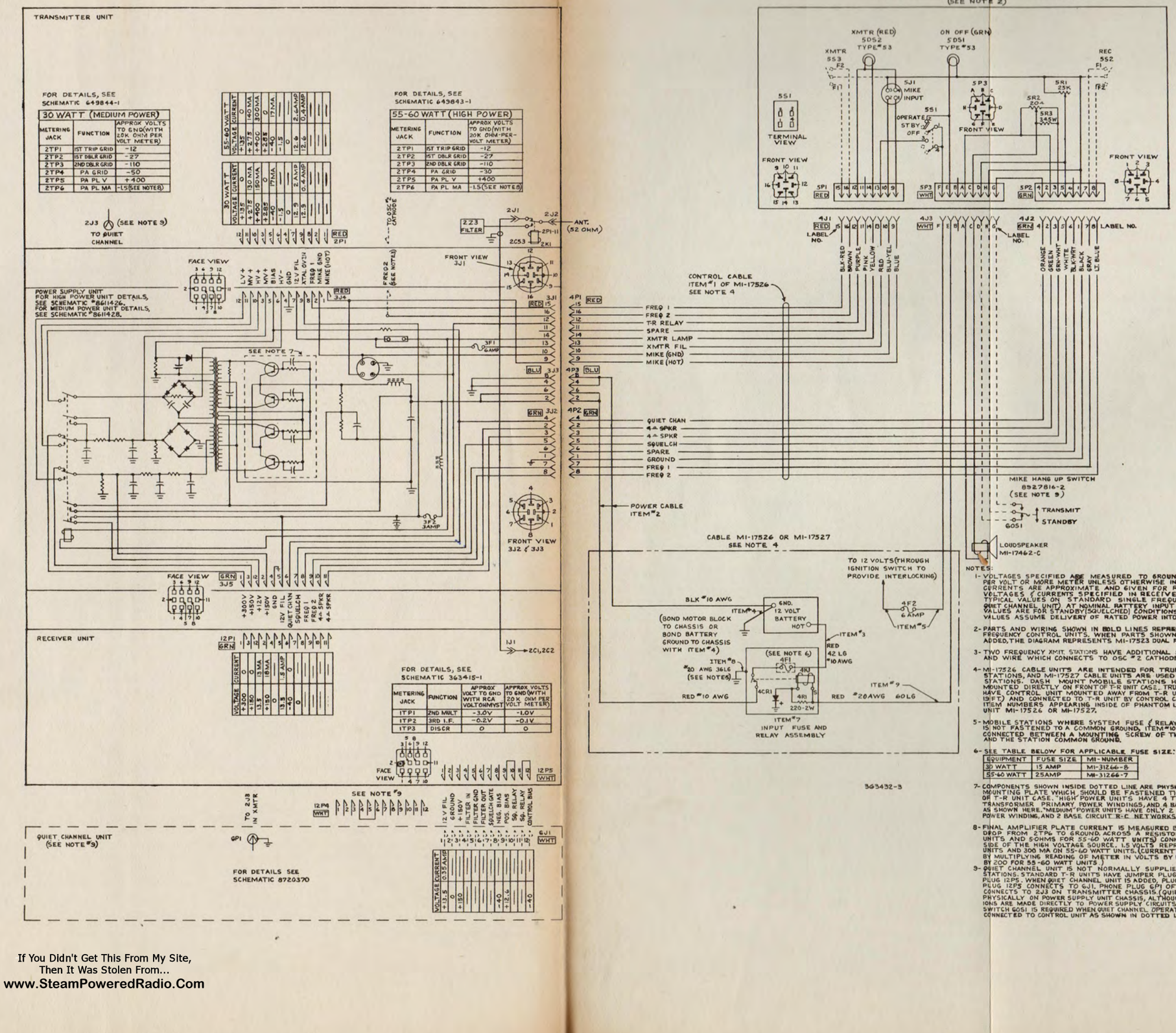
Figure P-3—Transistor Power Supply Schematic Diagram



NOTES:

1- VOLTAGES SPECIFIED ARE MEASURED TO GROUND WITH A 20,000 OHM PER VOLT OR MORE METER UNLESS OTHERWISE INDICATED. VOLTAGES AND CURRENTS ARE APPROXIMATE AND GIVEN FOR REFERENCE ONLY. VOLTAGES & CURRENTS SPECIFIED IN RECEIVER & TRANSMITTER ARE TYPICAL VALUES ON STANDARD SINGLE FREQUENCY UNITS (WITHOUT QUIET CHANNEL UNIT) AT NOMINAL BATTERY INPUT VOLTAGE. RECEIVER VALUES ARE FOR STANDBY (SQUELCHED) CONDITIONS, AND TRANSMITTER VALUES ASSUME DELIVERY OF RATED POWER INTO A 52 OHM ANTENNA LOAD.

2- PARTS AND WIRING SHOWN IN BOLD LINES REPRESENT MI-17524 SINGLE FREQUENCY CONTROL UNITS. WHEN PARTS SHOWN IN DOTTED LINES ARE ADDED, THE DIAGRAM REPRESENTS MI-17523 DUAL FREQUENCY UNITS.

3- TWO FREQUENCY XMIT. STATIONS HAVE ADDITIONAL SINGLE CONTACT PLUG AND WIRE WHICH CONNECTS TO OSC #2 CATHODE AS SHOWN HERE.

4- MI-17526 CABLE UNITS ARE INTENDED FOR TRUNK MOUNT MOBILE STATIONS, AND MI-17527 CABLE UNITS ARE USED IN DASH MOUNT STATIONS. DASH MOUNT MOBILE STATIONS HAVE THE CONTROL UNIT MOUNTED DIRECTLY ON FRONT OF T-R UNIT CASE. TRUNK MOUNT STATIONS HAVE CONTROL UNIT MOUNTED AWAY FROM T-R UNIT LOCATION (WITHIN 19 FT.) AND CONNECTED TO T-R UNIT BY CONTROL CABLE (ITEM "1 OF MI-17526) ITEM NUMBERS APPEARING INSIDE OF PHANTOM LINE REFER TO CABLE UNIT MI-17526 OR MI-17527.

5- MOBILE STATIONS WHERE SYSTEM FUSE & RELAY ASSEMBLY BRACKET IS NOT FASTENED TO A COMMON GROUND, ITEM "10 IS REQUIRED TO BE CONNECTED BETWEEN A MOUNTING SCREW OF THE FUSE & RELAY BRACKET AND THE STATION COMMON GROUND.

6- SEE TABLE BELOW FOR APPLICABLE FUSE SIZE:

EQUIPMENT	FUSE SIZE	MI-NUMBER
30 WATT	15 AMP	MI-31266-8
55-60 WATT	25AMP	MI-31266-7

7- COMPONENTS SHOWN INSIDE DOTTED LINE ARE PHYSICALLY ON TRANSISTOR MOUNTING PLATE WHICH SHOULD BE FASTENED TIGHTLY TO BACK RADIATOR OF T-R UNIT CASE. "HIGH" POWER UNITS HAVE 4 TRANSISTORS, TWO TRANSFORMER PRIMARY POWER WINDINGS, AND A BASE CIRCUITS R-C NETWORKS AS SHOWN HERE. "MEDIUM" POWER UNITS HAVE ONLY 2 TRANSISTORS, ONE PRIMARY POWER WINDING, AND 2 BASE CIRCUIT R-C NETWORKS.

8- FINAL AMPLIFIER PLATE CURRENT IS MEASURED BY OBSERVING THE VOLTAGE DROP FROM 2TP6 TO GROUND ACROSS A RESISTOR (10 OHMS FOR 30 WATT UNITS AND 5 OHMS FOR 55-60 WATT UNITS) CONNECTED IN THE NEGATIVE SIDE OF THE HIGH VOLTAGE SOURCE. 1.5 VOLTS REPRESENTS 150 MA ON 30 WATT UNITS AND 300 MA ON 55-60 WATT UNITS. (CURRENT IN MA CAN BE COMPUTED BY MULTIPLYING READING OF METER IN VOLTS BY 100 FOR 30 WATT UNITS AND BY 200 FOR 55-60 WATT UNITS.)

9- QUIET CHANNEL UNIT IS NOT NORMALLY SUPPLIED FOR STANDARD MOBILE STATIONS. STANDARD T-R UNITS HAVE JUMPER PLUG 12P4 CONNECTED INTO PLUG 12P5. WHEN QUIET CHANNEL UNIT IS ADDED, PLUG 12P4 IS NOT USED AND PLUG 12P5 CONNECTS TO 6J1. PHONE PLUG 6P1 OF QUIET CHANNEL UNIT CONNECTS TO 2J3 ON TRANSMITTER CHASSIS. (QUIET CHANNEL UNIT MOUNTS PHYSICALLY ON POWER SUPPLY UNIT CHASSIS, ALTHOUGH NO ELECTRICAL CONNECTIONS ARE MADE DIRECTLY TO POWER SUPPLY CIRCUITS.) MICROPHONE HANGUP SWITCH 6S1 IS REQUIRED WHEN QUIET CHANNEL OPERATION IS DESIRED, AND IS CONNECTED TO CONTROL UNIT AS SHOWN IN DOTTED LINES.

Interconnection Diagram

2+ 6
H-1 - Grnd 1
D5- 7

Hup DH short

clay bar turntable
choke covering
2100 cps & crossover
filtering equal
out of units on 2-way
freq

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