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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RADIO RECEIVER R-274/FRR

DEPARTMENT OF THE ARMY • MAY 1952

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WARNING

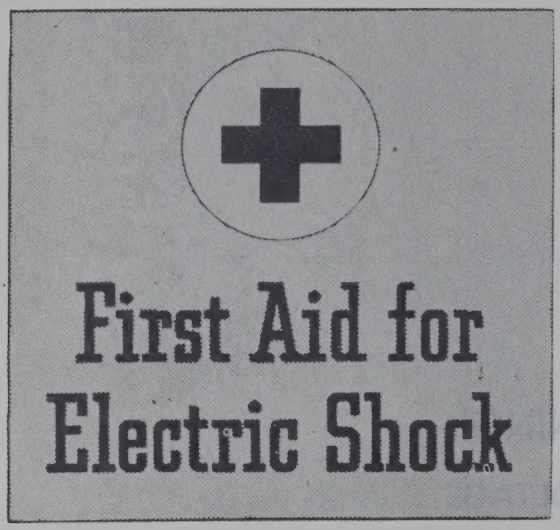
HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

Be careful not to contact 175-volt connections or 115-volt a-c input connections when working on or near this equipment.



First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(2) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(3) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(4) the operator's elbows are straight and locked.

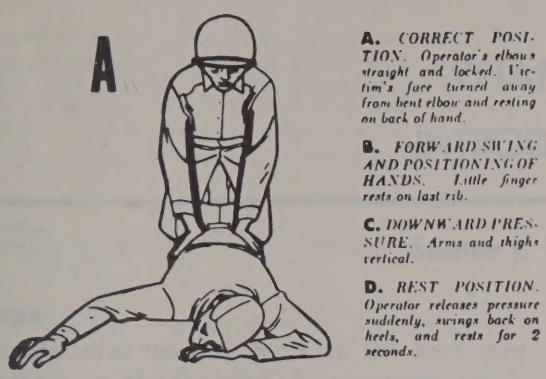
f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(2) Swing back, suddenly releasing pressure, and sit on the heels.

(3) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4



A. *CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.*

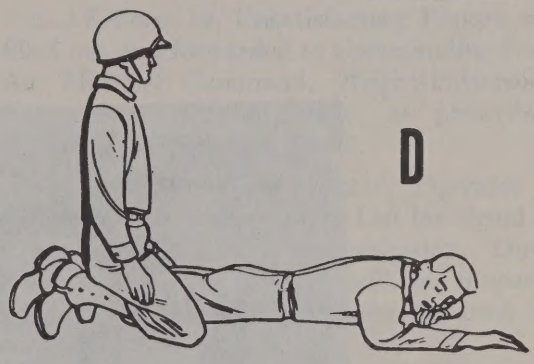
B. *FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.*

C. *DOWNWARD PRESSURE. Arms and thighs vertical.*

D. *REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.*







seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

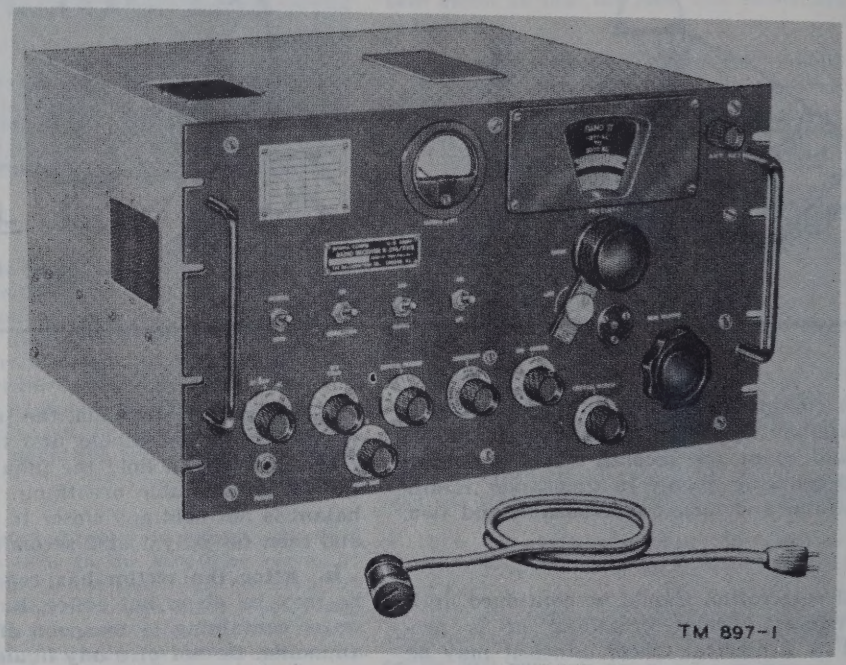


Figure 1. Radio Receiver R-274/FRR.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual contains the necessary instructions for the installation, operation, maintenance, and repair of Radio Receiver R–274/FRR. There are also two appendixes consisting of a list of references and an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army matériel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA AGO Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

e. DA AGO Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Radio Receiver R–274/FRR (fig 1) is a superheterodyne receiver intended for use in a semipermanent or fixed location. The receiver is adaptable for desk, table, or rack mounting. When used on a desk or table, the receiver may be installed within a metal case (Cabinet CY–699 ( )/FRR). The rectifier power supply and filament supply are contained within the unit. The receiver does not have a built-in speaker; therefore, external equipment is necessary for reproducing the audio signal.

b. The receiver is designed to receive a-m (amplitude-modulated) signals. It can be adjusted for reception of both c-w (continuous-wave) and mcw (modulated continuous-wave) (voice or tone) signals. A connection is provided to allow a carrier-shift type of radioteletype signal to be taken off and fed to terminal radioteletype equipment such as Radioteletype Terminal Equipment AN/FGC–(*) or Dual Diversity Converter CV–31(*)/TRA–7. Another connection can be made to inject audio signals into the a-f (audio-frequency) amplifiers to make use of only the audio section of the receiver. Stand-by operation is permitted when the receiver is used in conjunction with a radio transmitter or some other type of equipment.

c. The receiver frequency ranges are selected by means of a turret type switch. This permits frequencies from .54 to 54 mc (megacycles) to be received. The entire tuning range is divided into six bands selected by the turret.

d. The types of reception are c-w, icw (interrupted continuous-wave) (tone), and carrier-shift radioteletype signals. An automatic noise limiter

(ANL) is included for use in any type of operation for reduction of man-made electrical interference. Either agc (automatic gain control) or manual gain may be used for all types of reception. Relative signal strengths can be determined by the use of the CARRIER LEVEL meter on the front panel of the receiver.

4. Technical Characteristics

Frequency range: .54 to 54 mc.

BAND I	540 to 1,270 kc (kilocyles).
BAND II	1.27 to 3 mc.
BAND III	3 to 7 mc.
BANDIV	7 to 13.8 mc.
BAND V	13.8 to 29.7 mc.
BAND VI	29.7 to 54 mc.
Crystal-controlled channels.	Six channels in 1.5- to 29.7-mc range.
Receiver type	Superheterodyne, single or double conversion.
Types of signals which can be used.	C-w, icw, mcw (tone and voice), and carrier-shift radioteletype.
Number of tubes	19.
Intermediate frequencies.	455 kc and 6 mc.
Dial calibration accuracy.	Within .2 percent.
Power input	95/105/117/130/190/210/234/260 volts, 50- to to 60-cps (cycles per second), single-phase. Approximately 120 watts.
Antenna input	Balanced antenna input: 50 to 200 ohms.
Antenna	Balanced double or single wire and ground.
Weight	58 pounds.

5. Packaging Data

Radio Receiver R–274/FRR and its spare parts are packed for export shipment in a wooden box. Between the receiver and wooden box, protection from water, mositure, and vapors is obtained by two barrier packages and two cartons. The arrangement of these protective layers is shown in figure 4. The front panel of the receiver is protected by a padded wooden frame. All sides of the receiver are padded with corrugated cardboard. Bags of silica gel are placed within the inner covering of the receiver to absorb any moisture locked in when the receiver is packed. Electrical Power Cable Assembly CX–1855/U (W1) also is placed within the inner carton with the receiver. A separate carton contains the spare parts, all of which are packed individually. The size, weight, and volume of the export crate are indicated in the following chart:

Number of crate	Height (in.)	Width (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
1	13⅝	21⅞	27	4. 64	105

6. Table of Components

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Radio Receiver R–274/FRR	1	10 15/32	18⅛	19	2. 04	58
Electrical Power Cable Assembly, CX–1855/U	1			72		
Instruction book	2	8	¾	10½		
Total					2. 04	58

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

7. Description of Radio Receiver R–274/FRR

Radio Receiver R–274/FRR is a 19-tube, superheterodyne receiver capable of receiving a-m radio signals in the frequency range of from .54 mc to 54 mc. This range is covered in six bands by a turret type band selector. The set is designed for reception of c-w, mcw (tone and voice), and carrier-shift radioteletype signals. On the h-f (high-frequency) bands, a double superheterodyne circuit is used to increase the image rejection ratio. An automatic noise limiter (ANL) is provided for reduction of impulse noise such as is caused by man-made interference. Variable selectivity is provided by use of a crystal filter circuit and variable bandwidth i-f (intermediate-frequency) stages. The audio output may be fed to either a speaker or headset, which is not provided with the radio receiver. The tuning controls are accessible on the front panel which is standard size for 19-inch relay rack

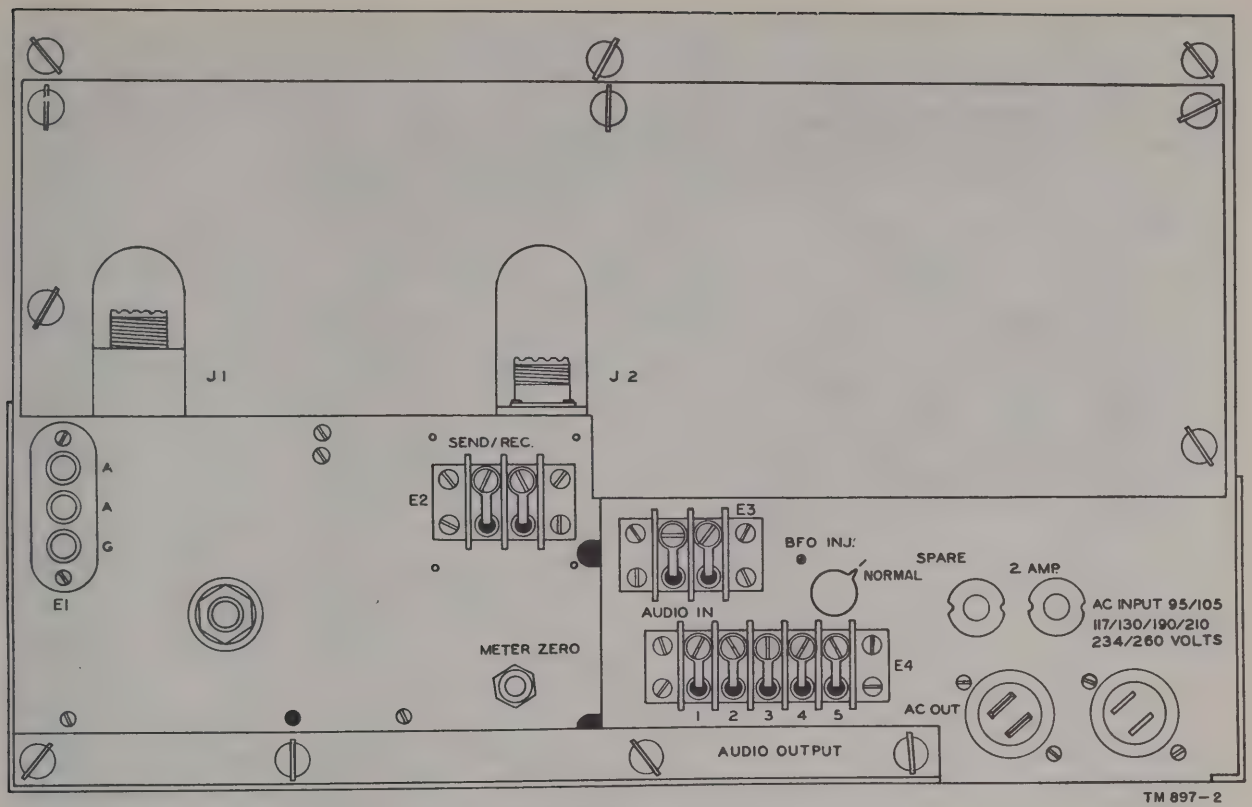


Figure 2. Radio Receiver R–274/FRR, rear view.

mounting. The panel has slots on the sides so that it may be mounted in the rack by means of machine screws. Two handles are provided on the front panel for easy carrying or handling. All connections, such as power, antenna, speaker, and terminals for connection to radioteletype equipment, are located at the rear of the receiver. Access to the tubes, internal controls, antenna, and terminals is made by removing the top and/or rear dust covers which are retained by the use of Dzus fasteners. Power is supplied to the receiver by means of Electrical Power Cable Assembly CX–1855/U which is attached to the rear of the receiver. An a-c (alternating-current) power receptacle is located on the rear of the receiver to supply power to associated equipment. The output of this outlet is not controlled by the line switch of the receiver.

8. Description of Electrical Power Cable Assembly CX–1855/U

Electrical Power Cable Assembly CX–1855/U is used to connect Radio Receiver R–274/FRR to a power source. The power end of cable W1 has a standard male plug. The receiver end has a female receptacle which connects to plug P1 at the rear of the radio receiver. A heavy rubber covering on the outside of the cable prevents damage due to flexing and other abuse.

9. Running Spares

A group of running spares (fig. 3) is supplied with each Radio Receiver R–274/FRR. Spares are provided for normally expendable items, such as tubes, pilot lamps, and fuses. The following is a list of running spares:

2 tubes 6AG5	1 tube 5U4G
8 tubes 6BA6	1 tube 6C4
2 tubes 6BE6	1 tube OC3, VR105
2 tubes 6AL5	2 Lamps LM–52, 6.3-volt
1 tube 6AT6	2 lamps C7, 7-watt, 120-volt
1 tube 6Y6G	1 fuse, type 3AG, 2-ampere

10. Additional Equipment Required

Radio Receiver R–274/FRR does not have a built-in speaker. Therefore, it is necessary to provide an external speaker or headset when listening to c-w or mcw reception. Radioteletype terminal equipment is required to transfer signals from the receiver to the teletypewriter equipment.

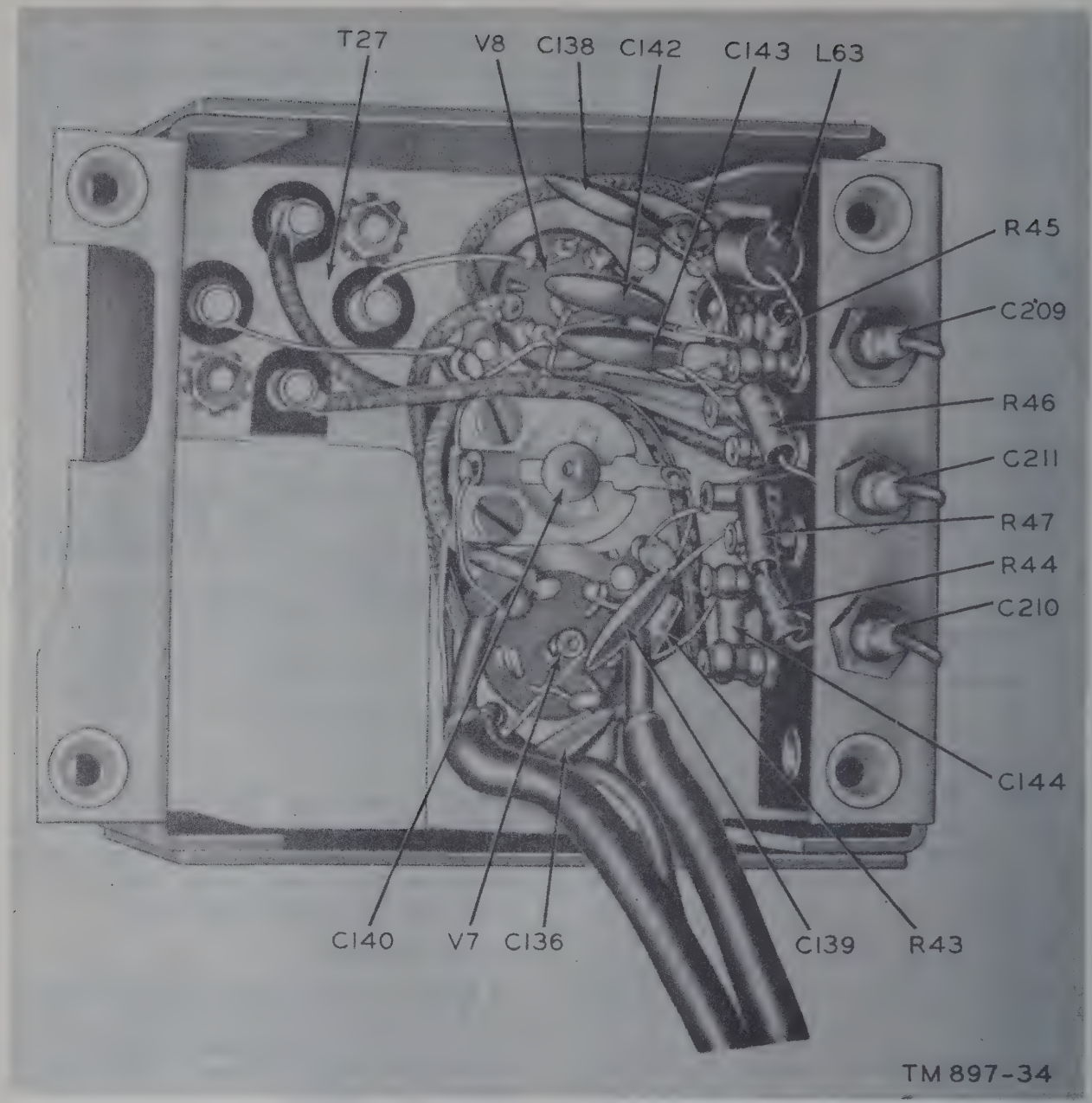


Figure 3. Running spares for Radio Receiver R–274/FRR.

The following equipment is required in the above instances:

1—Loudspeaker LS–3 (and matching transformer)
1—Loudspeaker LS–2
1—Headset HS–30
1—Headset Assembly CW–49507 (Navy) with Headset Extension Cord CW–49534
1—Radioteletype Terminal Equipment AN/FGC–(*)
1—Dual Diversity Converter CV–31(*)/TRA–7

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATÉRIEL

11. Siting

The receiver should be located so that the front and rear panels are easily accessible. In a permanent installation where it is not necessary to change connections on the rear of the receiver frequently, the receiver may be located with just enough clearance to give adequate rear ventilation, leaving the front panel accessible. Unless an extension power cord is available, the rear of the receiver will have to be placed within 6 feet of the power source outlet. If possible, keep the receiver away from sources of electrical interference or mechanical vibration. Antenna location also will determine the receiver site. The receiver is designed for indoor or sheltered use. Protection should be given it when conditions of excessive moisture or extreme temperature exist. If the receiver is a component of a larger equipment, place the receiver in a convenient location for easy operation with the above factors considered.

12. Uncrating, Unpacking, and Checking New Equipment

Caution: Be extremely careful during the unpacking process so that no damage occurs to the receiver or spare parts. Dropping the unit (crate) or poking through the container with a sharp instrument could cause severe damage to the inclosed pieces. Take the packages apart in such a manner that no undue force is placed upon the contents. If possible, unpack the receiver in a location which is dry and free from dust and dirt. Figure 4 indicates the sequence in which the containers are placed around the receiver and spare parts. Follow the unpacking instructions in the order given to provide the most rapid means of safely removing the receiver and spare parts from the crate.

a. Unpacking.

(1) Cut the metal bands which encircle the wooden box. Use a pair of tin snips or a large pair of diagonal cutting pliers rather than forcing the band off by some other method.

(2) Pry open the top cover, being careful not to force the prying instrument too far into the package. Remove the top cover and save it for possible repacking (save *all* the packaging material for this reason).

(3) Take out the package containing the two instruction books.

(4) Lift out the waterproof bag containing the receiver and spare parts cardboard boxes. (The spare parts may be removed from their carton by opening the flaps at one end and taking out the spare parts packages.)

(5) Open the gum seal on the waterproof bag and remove the spare parts carton and the outer carton containing the receiver.

(6) Open the flaps on the top of the corrugated cardboard receiver carton.

(7) Remove the moisture and vaporproof bag and slit it open along the edge of the seal.

(8) Take out the inner corrugated cardboard carton and open the top flaps.

(9) Remove the corrugated fiberboard pads from the top and sides of the receiver.

(10) Remove the receiver from the carton.

(11) Remove the wooden blocking assembly from the front panel of the receiver.

(12) The power cord (W1) can be found coiled up and taped near the front of the receiver.

(13) The unpacking procedure is complete and the receiver is ready for installation.

b. Checking. Always check equipment for possible damage which may have occurred during shipment. Make sure that all equipment that is listed on the packing slip has been unpacked.

c. Repacking. To repack the receiver and spare parts, reverse the procedure given for unpacking.

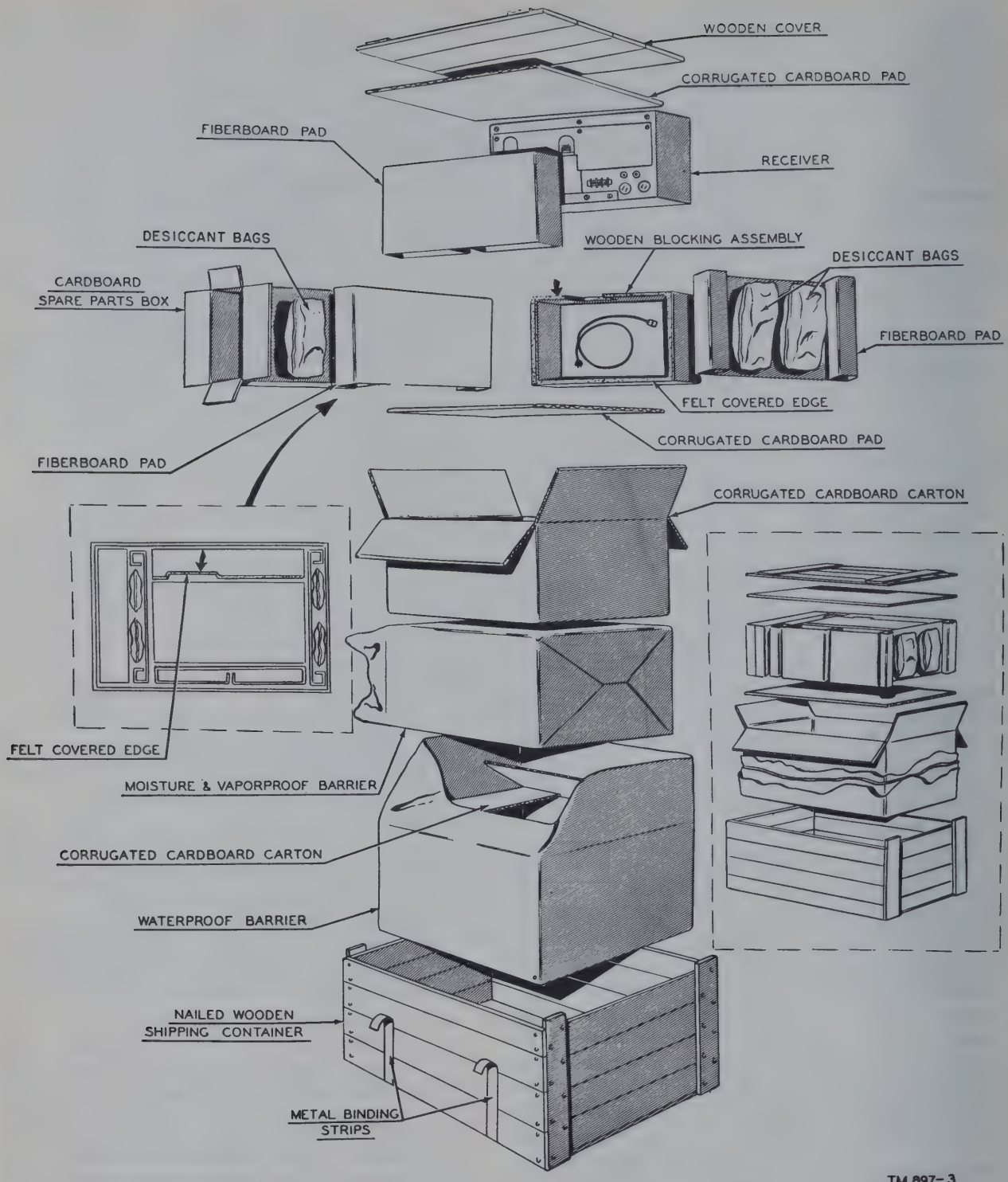


Figure 4. Packaging and packing of Radio Receiver R-274/FRR.

13. Installation of Equipment

a. When unpacking Radio Receiver R–274/FRR and components, be careful not to drop or bend any part of the receiver. This could cause inaccuracy in the dial calibrations or binding of some of the controls.

b. Remove the top and rear dust covers by unfastening the Dzus fasteners.

c. Place tubes V17, V18, V19, and ballast tube R80 in their respective sockets (fig. 5). The tubes have octal bases making it necessary to position the tubes correctly while inserting them. To do this, place the tube locating key lightly against the tube socket and rotate the tube. When the tube locating key is alined with the socket keyway, the tube may be pushed into the socket. The tube retaining spring clips will firmly hold the tube in place.

d. Remove the crystal cover located in front of V5 (fig. 31) by taking out the two cover screws.

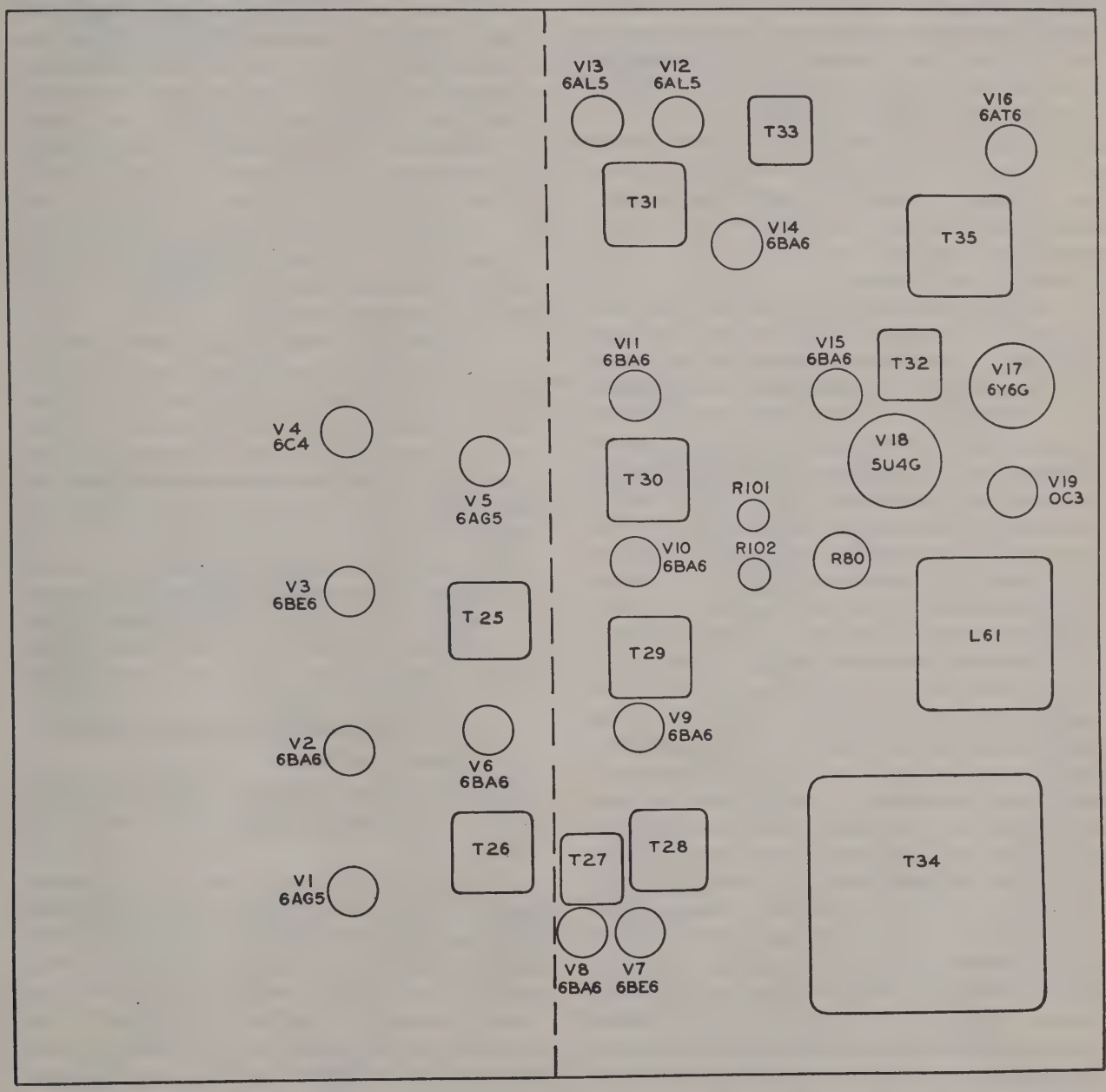


Figure 5. Radio Receiver R–274/FRR, tube location.

Insert crystals Y1 through Y6, covering the six desired frequencies between 1.5 and 29.7 mc.

e. Make connections for the antenna, ground, power, and external equipment (par.14).

14. Connections

The external connections to Radio Receiver R–274/FRR are determined by the equipment with which it is being used. However, there are certain connections that will have to be made, such as the antenna and power input, no matter what type of equipment is being used in conjunction with the radio receiver. For radioteletype operation, the output of the receiver is fed to radioteletype terminal equipment. This connection can be made with a coaxial cable that is not supplied with the radio receiver. For listening purposes, a speaker or headset may be connected to the receiver. The following instructions should be followed as nearly as possible in making the receiver connections:

a. Determine whether a speaker (such as Loudspeaker LS–2 or LS–3) and/or some other type equipment is required to be connected to the output of the receiver. Connect the speaker, if used, to the AUDIO OUTPUT terminal strip (E4) on the rear of the chassis (fig. 2). The audio output is designed to match either a 150- or 600-ohm load by connecting the secondary speaker windings of the audio output transformer, T35, in series or just using one of the secondary windings. Normally, when matching a speaker to a line, the 600-ohm output is preferred. In this case, the secondary may be connected in series by connecting a jumper wire across terminals 2 and 4 on the AUDIO OUTPUT terminal strip (E4). If a speaker of the permanent magnet type is used with a low-impedance voice coil (3 to 50 ohms), a matching transformer should be used between the receiver audio output and the speaker. A headset, such as Headset HS–30, may be plugged into the PHONES jack J3 on the front panel. Other types of headphones may be used, such as Headset Assembly CW–49507 (Navy) and Headset Extension Cord CW–49534. Radioteletype equipment is connected through RF Cable Assembly CG–562/U (not supplied) to jack J2 on the top rear of the chassis. Connect a 600-ohm 2-watt load resistor across terminals 1 and 5 of the AUDIO OUTPUT strip E4 if no external equipment is to be connected to this output, and place a jumper wire across terminals 2 and 4.

b. Attach a single wire antenna and ground or a balanced antenna and ground to antenna terminal strip E1. A coaxial cable connector J1 is provided for use with twin coaxial cable lead-ins. The external ground connection should consist of a good earth ground, approximately 6 feet below the surface. To satisfy this requirement, a metallic pipe or stake driven into the earth or a connection to a part of a metallic underground water system should be used.

c. To provide a remote connection for a stand-by switch, the connecting wires must be connected to the SEND/REC. terminal strip E2 on the rear of the chassis (fig. 2). To make connections to this terminal strip, the terminal strip cover must be removed by taking out the two retaining screws.

d. Sometimes it will be desirable to use the audio amplifier of the receiver without using the rest of the receiver. To do this, the audio signal is fed into the AUDIO IN terminal strip E3, which is the audio input to the 1st a-f amplifier. Hum reduction can be accomplished by using a shielded lead for this connection.

e. Plug the female receptacle of power cord W1 to the AC INPUT plug P1 located on the rear of the chassis. Connect the other end of the power cord to a single-phase 50- to 60-cps power source which can supply the correct voltage for the receiver input. The receiver can be used with the following voltages: 95/105/117/130/190/210/234/260 volts.

Caution: Make sure the receiver power transformer T34 primary is set to the same voltage as the power source. Refer to the schematic diagram (fig. 43) for the proper connections. The location of transformer T34 is shown in figure 33.

15. Service Upon Receipt of Used or Reconditioned Equipment

a. Refer to the instructions given in paragraph 12 when unpacking used or reconditioned equipment.

b. If used equipment is received for service, check for tags or other sources of information regarding the condition of the equipment. When the condition is doubtful and no information is available, submit the equipment to the final testing procedures described in chapter 5, section IV. A thoroughly reconditioned piece of equipment may be considered to be in the same condition as new equipment, and the instructions for the operation given in chapter 2 may be followed.

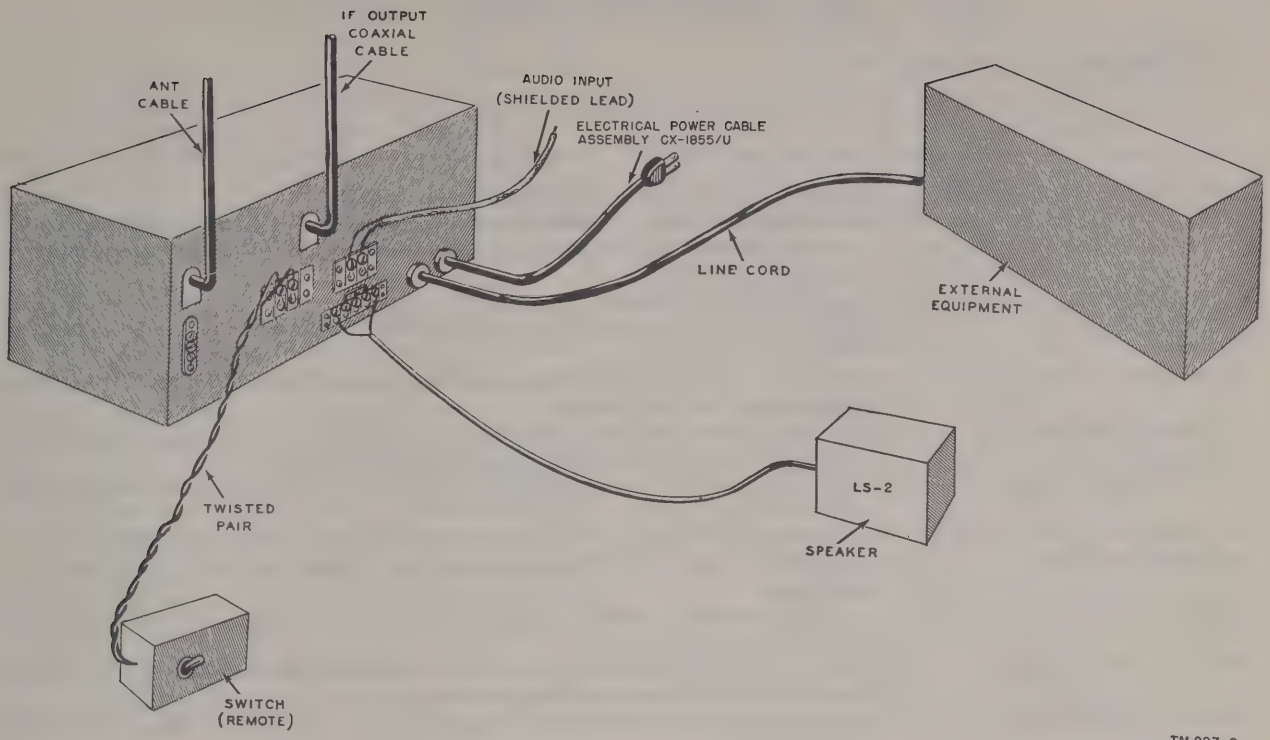


Figure 6. Connections for operating Radio Receiver R–274/FRR.

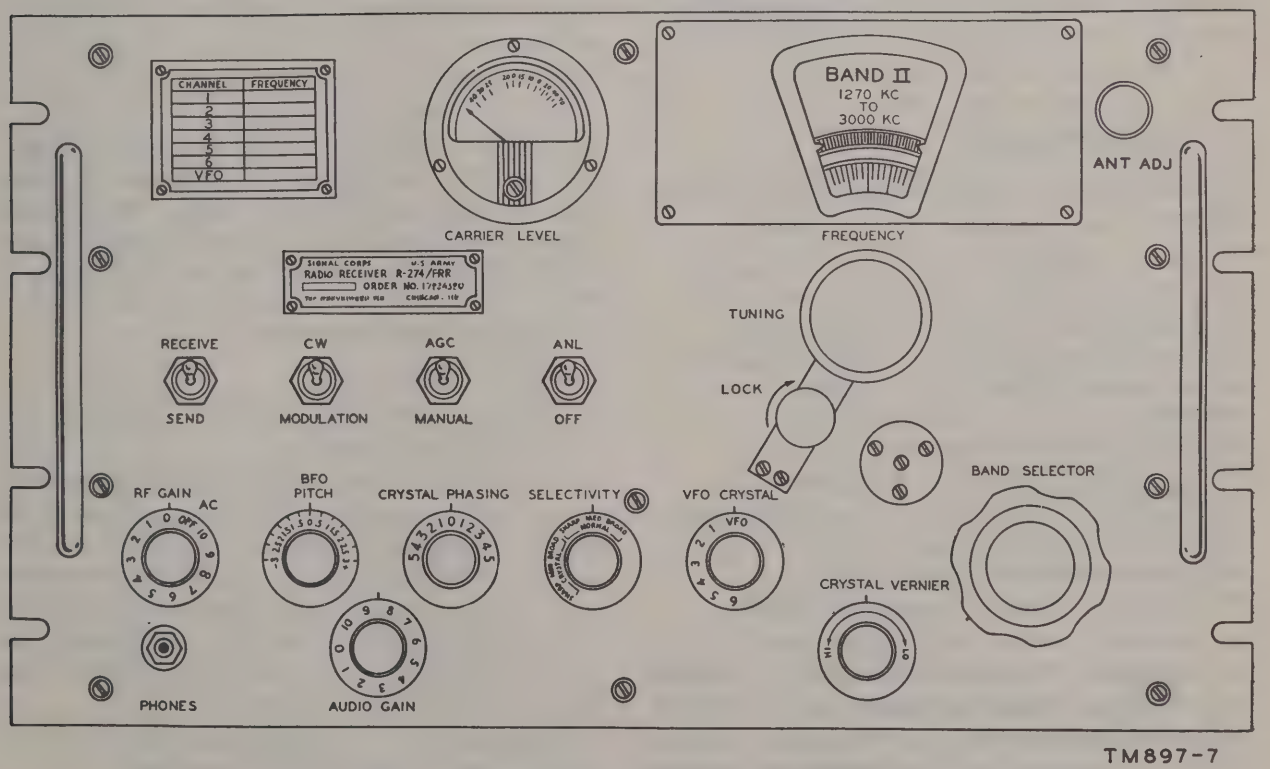


Figure 7. Radio Receiver R–274/FRR, front panel view.

Section II. OPERATION UNDER USUAL CONDITIONS

16. Controls and Their Uses

Control	Function
BAND SELECTOR (turret)	Selects the band containing the desired frequency.
TUNING (C1)	Selects desired frequency by means of a dial mechanism and ganged tuning capacitor. A scale indicates the frequency. It has a dial LOCK to prevent any change in frequency after once set.
ANT ADJ (C22)	Tunes secondary of antenna transformer.
ANL-OFF (S3)	Switches a series type automatic noise limiter into the circuit to reduce noise peaks of electrical interference.
AGC-MANUAL (S4)	Selects either AGC or MANUAL operation and places CARRIER LEVEL meter in operation in the AGC position.
CW-MODULATION (S5)	Turns the bfo (beat-frequency oscillator) on in the CW position to provide a beat note which can be heard when receiving an unmodulated carrier.
RECEIVE-SEND (S6)	Stand-by switch which makes or breaks screen B+ to the r-f (radio-frequency) and i-f sections of the receiver.
RF GAIN AC (R83, S7)	Turns the AC power on and OFF and also controls the r-f gain of the receiver.
BFO PITCH (C183)	Varies the bfo signal +3,000 cps, consequently varying the audio signal from 0 to 3,000 cps.
CRYSTAL PHASING (C161)	Tunes out unwanted interference of signals when the SELECTIVITY switch is in any of the crystal positions.
SELECTIVITY (S1)	A gang switch selects different degrees of i-f expansion in band-width and also inserts an i-f crystal filter in the crystal positions.
VFO CRYSTAL (S2)	Switches to either vfo or crystal h-f oscillator, and also selects one of six crystals in the crystal position.
CRYSTAL VERNIER (C125)	Varies the frequency of the crystal hfo slightly (±.005%) to compensate for crystal tolerances.
AUDIO GAIN (R94)	Adjusts the audio level to the audio amplifiers.
PHONES (J3)	Provided to allow the use of a headset when desired.
CARRIER LEVEL meter (M1)	Indicates in db (decibels) the input signal strength. (Zero reference is 50-uv (microvolt) input signal.)

17. Starting Procedure

a. Preliminary. Set the front panel controls as follows:

Control	Position
RECEIVE-SEND	RECEIVE
CW-MODULATION	MODULATION
AGC-MANUAL	AGC
ANL-OFF	OFF
BFO PITCH	0
AUDIO GAIN	5
CRYSTAL PHASING	0
SELECTIVITY	NORMAL MED
VFO CRYSTAL	VFO
CRYSTAL VERNIER	mid
ANT ADJ	As required

b. Starting. Turn the RF GAIN-AC control fully clockwise to turn on the receiver. The pilot lights will light, and in approximately 2 minutes noise will be heard from the headset or speaker. If no noise is heard or the pilot lights do not light, refer to the equipment performance checklist (par. 37), and determine the reason. When indications are obtained that the receiver is in proper working order, operate with the reception desired.

18. Radiophone Reception

a. VFO Operation.

(1) Turn the VFO-CRYSTAL switch to the VFO position.

(2) Set the BAND SELECTOR to the band which contains the frequency range of the signal to be received. When the desired band is selected, the band number will appear at the top of the tuning dial above the frequency calibrations on BANDS I, II, and III, and below on BANDS IV, V, and VI.

(3) Place the CW-MODULATION switch in the MODULATION position.

(4) The desired frequency is tuned in by turning the TUNING control. The frequencies for each band are read directly from the dial scale. Tune the ANT ADJ until the maximum output is obtained from the receiver. (The CARRIER LEVEL meter will indicate peak if the AGC-MANUAL switch is in the AGC position.)

(5) The AGC-MANUAL switch may be used as desired with this type of operation. When the switch is in the AGC position, the CARRIER LEVEL meter is connected in the circuit; but when the switch is in the MANUAL position, the meter circuit is open. The CARRIER LEVEL meter gives an approximate indication of the input level of various tuned signals as they are received from the antenna. The meter is graduated in db and adjusted so that a 50-uv input at the antenna will produce a reading of 0 db on the meter. An adjustment for 0 db is obtained by setting METER ZERO potentiometer R87 (par. 87). Reference levels of other r-f signal inputs may then be read directly on the meter. With no signal being received, the CARRIER LEVEL meter needle will have a tendency to move off the left-hand side of the scale. An input level of 3 uv will produce a sufficient d-c (direct-current) voltage change in the agc circuit to bring the needle on the CARRIER LEVEL meter up to the beginning of its scale. Other indications on the scale will be dependent on the amount of voltage developed in the agc circuit and, therefore, on the incoming r-f signal strength.

(6) If noise is present along with the received signal, place the ANL–OFF in the ANL position.

(7) Bandwidth of the receiver may be varied by means of the SELECTIVITY switch. The crystal positions should not be used for anything but c-w operation; otherwise, the bandwidth will be so narrow that speech will be unintelligible.

(8) When the receiver is used in conjunction with a transmitter, the RECEIVE-SEND switch (S6) can be used as a stand-by switch for the receiver during transmission; therefore, the receiver is always ready for instant use. For convenience, a remote control switch may be used for this action. Connect the SPST (single-pole, single throw) switch across the SEND/REC. terminal board E2 and maintain RECEIVE-SEND switch S6 in the SEND position.

(9) Adjust the AUDIO GAIN control, R94, to obtain the desired output for the headset, loudspeaker, or other external equipment being used.

b. Crystal Operation.

(1) Turn the VFO CRYSTAL switch from the VFO position to one of the six crystal positions.

(2) Six crystal channels may be used to facilitate receiver tuning to regularly assigned frequencies for any particular area of operation. The frequencies which will be assigned lie within the range of 1,500 kc to 29.7 mc. When a frequency is assigned, choose a crystal which will produce a beat frequency with the incoming frequency to set up the desired i-f in the output of the 1st mixer (V3). The crystal oscillator frequency to be used, whether it is the fundamental or a second or third harmonic, always must be above the incoming signal frequency by a difference equal to the i-f. For example, if the incoming signal frequency is between 1.5 mc and 7 mc, the crystal oscillator must produce a frequency 455 kc higher than the signal frequency. If the incoming signal frequency is between 7 mc and 29.7 mc, the crystal oscillator must produce a frequency 6 mc higher than the incoming frequency. The maximum fundamental Crystal Unit CR–18/U frequency used is 11.9 mc. See paragraph 45*b* for further details on choosing a crystal.

(3) Continue with the same procedure used for vfo (variable frequency oscillator) operation, starting with *a*(2) above.

(4) The CRYSTAL VERNIER control is used to tune the crystal oscillator to the correct frequency. It can vary the crystal frequency slightly, either higher or lower than the resonant frequency of the crystal. The correct procedure in using the control is to get the desired

signal, and then use the CRYSTAL VERNIER control to obtain a peak output.

19. C-W Reception

a. Code reception (c-w) is very similar to radiophone reception. However, a beat signal within the receiver must be supplied in order to hear the c-w signal.

b. The procedure for listening to c-w reception with either vfo or crystal operation is the same as the procedure used in receiving radiophone reception, except for the following differences:

(1) Turn the CW-MODULATION switch to the CW position.
(2) Adjust the BFO PITCH control to obtain the desired tone.
(3) Place the AGC-MANUAL switch in the MANUAL or AGC position.
(4) The SELECTIVITY control can be set to the position giving the clearest signal with the least interference. When using the crystal positions, the CRYSTAL PHASING control will further adjust the band width and tune out unwanted signals or interference. In the CRYSTAL-SHARP position, the CRYSTAL PHASING control is very critical.
(5) The other controls can be adjusted in the same manner used for radiophone reception.

20. Stopping Procedure

To stop operation of the receiver, turn the RF GAIN-AC control fully counterclockwise until a click is heard. This is the OFF position of the a-c power switch, S7.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

21. General

The operation of Radio Receiver R–274/FRR may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of these unusual operation conditions.

22. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the receiver is not in a heated enclosure, construct an insulated box for the receiver. Turn the RF GAIN-AC control clockwise until a click is heard. Leave it in this position for several minutes as a time to allow the tube filaments to warm up the inside of the receiver. If necessary, the receiver should be left on continuously with the RECEIVE-SEND switch, S6, in the SEND position.

c. Wear a knitted woolen cap over the earphones when operating in the open air with headsets that do not have rubber earpieces. Frequently, when headsets without rubber earpieces are worn, the edges of the ears may freeze without the operator being conscious of this condition. Never flex rubber earcaps since this action may render them useless. If water gets into the receivers, or if moisture condenses within them, it may impede the actuation of the diaphragm. When this happens, remove the bakelite cap and remove the ice and moisture from the receiver.

d. When equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

23. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground and when it is set up in swampy areas, moisture conditions are more acute than normal in the tropics. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs under the equipment.

24. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem which arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of radio equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of the tent with sand to prevent flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Be careful that the equipment is as free from dust as possible. Make frequent preventive maintenance checks (ch. 3). Pay close attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

25. Tools Supplied with Equipment

Most of the repair or maintenance may be made with the tools found in the average tool kit. Only two additional tools are supplied to supplement the necessary tools; these tools are Allen wrenches for use with No. 8–32 and No. 6–32 Allen screws. They may be used when it is necessary to tighten the BAND SELECTOR knob or make adjustments of the shaft couplings or gears. The wrenches are held by clips near the top of the chassis partition on the r-f stage side of the receiver.

26. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair, since its object is to prevent certain troubles from occurring (AR 750–5).

27. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) Clean all parts, except electrical contacts, with a cloth or brush moistened with solvent, dry cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a cloth.

(3) To clean turret contacts, insert a piece of clean paper while turning the turret to the next position. Then pull the paper from between the contacts. Do this for all six bands.

c. If available, dry compressed air may be used at line pressures not exceeding 60 pounds per square inch to remove dust from nonaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on prevention maintenance techniques, refer to TB SIG 178.

28. Performing Preventive Maintenance

There are certain items which must be checked periodically. The following lists indicate hov often the items are to be checked and what you should look for.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken. Be especially careful of any screws which screw into a plastic or bakelite material, since the threads may be stripped easily in this material.

DAILY

What to check	How to check
1. Exterior of receiver	1. Keep free of dirt and grease.
2. Dial lights (E5 and E6)	2. Should operate with receiver on.
3. CARRIER LEVEL meter (M1).	3. Receiver power off, needle is resting at the line at the extreme left of the scale.
4. Knobs	4. Check for tightness.

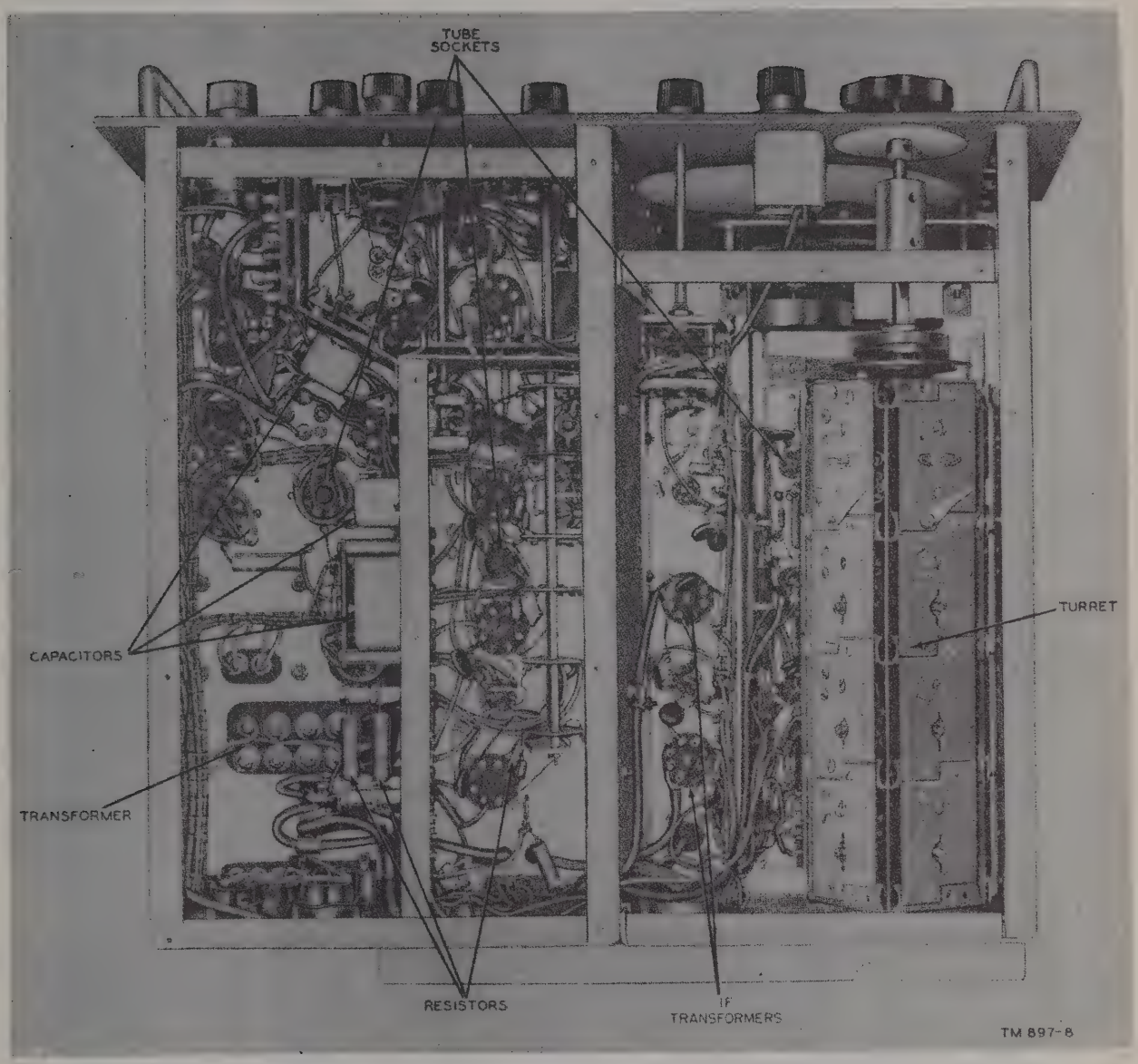


Figure 8. Radio Receiver R-274/FRR, bottom view showing typical preventive maintenance items.

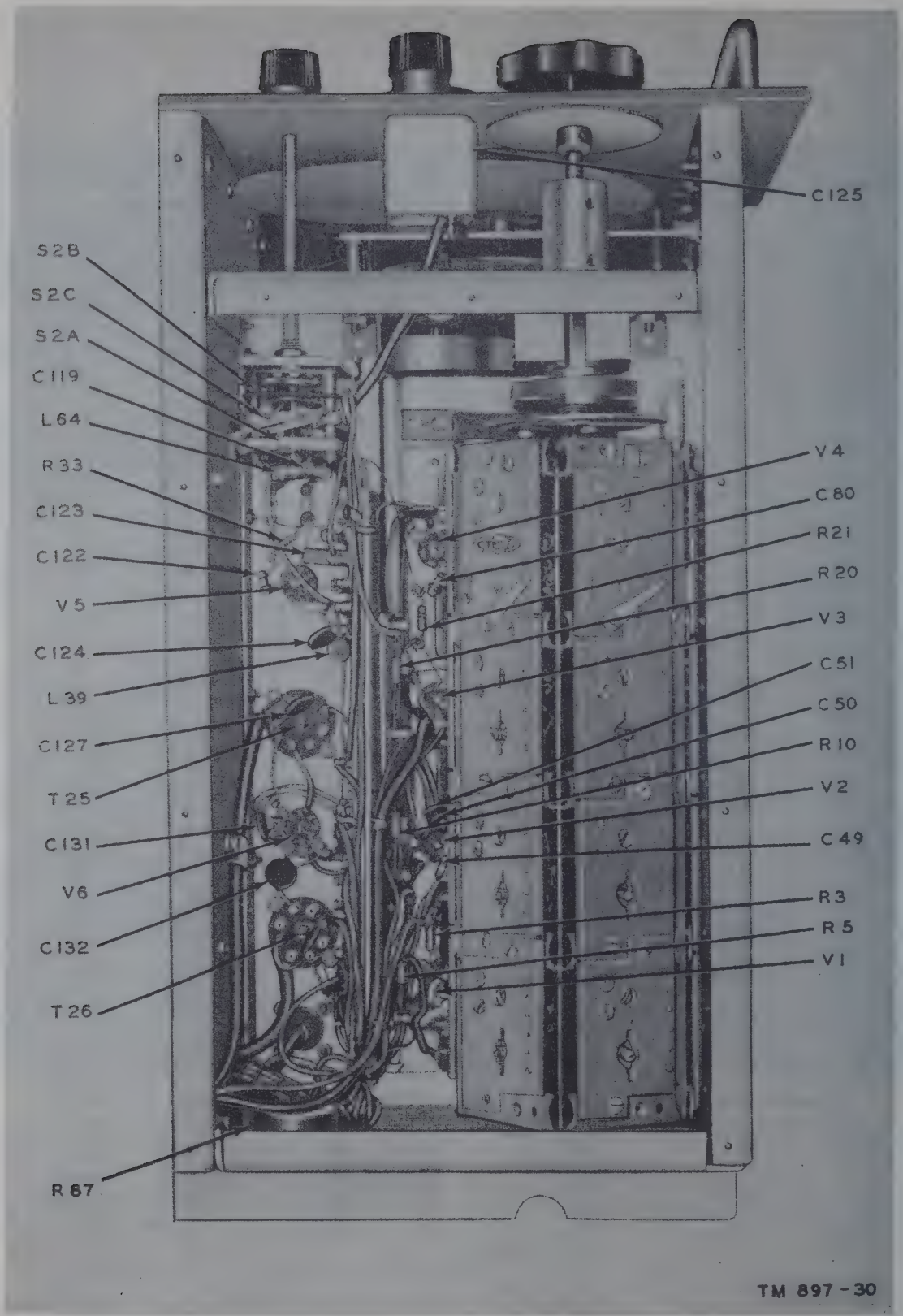


Figure 9. Radio Receiver R–274/FRR, top view showing typical preventive maintenance items

WEEKLY

Caution: Disconnect power from receiver before making the following checks. Upon completion, reconnect power and check for satisfactory operation.

What to check	How to check
1. Exterior of receiver	1. Clean front panel and outside of chassis inclosure.
2. Filter capacitors C192 and C193.	2. Look for signs of heating and for leaking of dielectric.
3. Power transformer T34 and filter choke L61.	3. Feel for excessive heating.
4. Fuse F1 and fuse holder	4. Check for corrosion, cracks, and proper tension on contacts.
5. CARRIER LEVEL meter (M1).	5. Check for bent needle and adjustment to line.

MONTHLY

Visually inspect the following. Tighten and clean if necessary.

What to check	How to check
1. Tubes, crystals, and their sockets.	1. Look for loose contacts or pins, dirt and corrosion, or cracked glass. Replace vacuum tubes if necessary. Be careful not to bend the small pins on the miniature tubes.
2. Primary taps on power transformer T34.	2. Look for looseness or corrosion on connections.

MONTHLY—Continued

What to check	How to check
3. Resistors	3. Look for blistering, cracks, discoloration or other evidence of overheating.
4. Switches S1 through S7.	4. Look for dirt, corrosion, loose contacts and poor mechanical action.
5. Wires and cables	5. Look for cracked, cut, and frayed insulation.
6. Terminal boards	6. Look for cracks, dirt, and loose terminal connections.
7. Potentiometers R82, R83, and R94.	7. Look for unsatisfactory electrical and mechanical operation.
8. Mountings, machine screws, and nuts.	8. Look for mechanical looseness.
9. All visible terminals	9. Inspect for loose connections and corrosion.
10. MFP coatings	10. Look for breaks. (Retouch with a brush, if necessary.)
11. Painted finish	11. Inspect for scratches and bare spots. (Retouch, if necessary.)
12. Unshielded variable capacitors C1, C2, and C22.	12. Look for dirt, corrosion, and damaged plates.
13. R-f turret contacts	13. Look for corrosion and wear. Clean with soft cloth or replace strip of section that is faulty.
14. Chokes L39, L64, and L65.	14. Inspect for dirt, corrosion, and damaged turns.
15. Feed through capacitors and insulators.	15. Look for cracks and dirt.
16. Relay contacts of K1	16. Inspect for pits and buildups and for improper alinement.

Section II. LUBRICATION

29. General Lubrication Instructions

a. Several factors determine the frequency that parts in the receiver need to be lubricated. These factors are as follows:

(1) After a certain length of time most lubricants become waxy and cake up in spots so that they will not give the proper lubrication. In these cases, the old lubricant should be cleaned off and new lubricant should be applied.

(2) The receiver may be operated in a location where extreme temperature changes occur so that the lubricant will be hard due to low temperatures when the receiver is not in operation and extremely soft or liquid when the receiver is operating and the temperature rises. Where the temperature change is great, the condition of the lubricants must be inspected frequently.

(3) Some locations where the receiver may be installed might not be protected from foreign material carried by air currents. The foreign materials present in the air may be dirt, sand, smoke, metal filings, or gases which will mix with the lubricant and form a grit or decompose the lubricant. If grit is formed, it will act as an abrasive and cause serious wear. Here

the old lubricant should be cleaned away thoroughly with solvent (SD) and fresh lubricant should be applied.

(4) Although the receiver is protected against humidity, a certain amount of moisture may enter and injure the moving parts. A tendency toward gathering of moisture is especially noted at times when the temperature drops quickly and the relative humidity is high. If the receiver is not operating during this period, the moisture will condense on the parts of the receiver and may penetrate where proper lubrication procedure is not practiced. If such a condition occurs near an ocean or salty body of water, upon evaporation of the moisture a salt will be left which will cause corrosion.

b. The amount of lubricant applied is very important. Excessive lubrication may cause just as much harm as not enough lubrication. Lubricating material may drip or spread to portions of the receiver where it can cause poor electrical contact and instability of operation. Sometimes, a lubricant cannot be forced between two moving parts. To apply a lubricant to these parts, it is necessary to disassemble, lubricate, and then reassemble the parts. The best time to do this is when the parts are being reassembled after repairs or when they are being replaced. Common sense and experience will indicate the best lubrication procedures for the type of installation and location being used.

30. Parts to be Lubricated

a. Dial Mechanism. Figure 10 shows a cutaway view of the dial mechanism and indicates the places to be lubricated and the types of lubricant to be used. To lubricate the mechanism properly, the gear teeth should be evenly coated with grease (GL). To do this, it is best to rotate the tuning shaft and apply the lubricant (with an instrument, such as the blade of a screw driver) to the moving teeth to obtain the desired results. Be sure to lubricate all the teeth.

b. R-F Turret. The detent of the turret, which stops the turret in each of six positions, may be lubricated without removing the turret. Enough lubricant should be placed on the edge of the detent to allow the detent roller to ride smoothly when the turret is turned. Apply a small amount of grease (GL) to the shaft of the detent roller. To lubricate the shaft bearings on the turret, the turret must be removed from the chassis (par. 78*e*). After the turret is removed, apply a light coating of grease (GL) to the surface which is in contact with the bearing, then replace the turret.

Caution: Do not apply any lubricant to the turret contacts in the process of lubrication. If lubricant does get on these contacts, remove it with a soft cloth moistened with solvent (SD).

c. Gang Switches. Figure 11 shows the points on the gang switches to be lubricated. Apply just enough grease (GL) to make the switches operate smoothly.

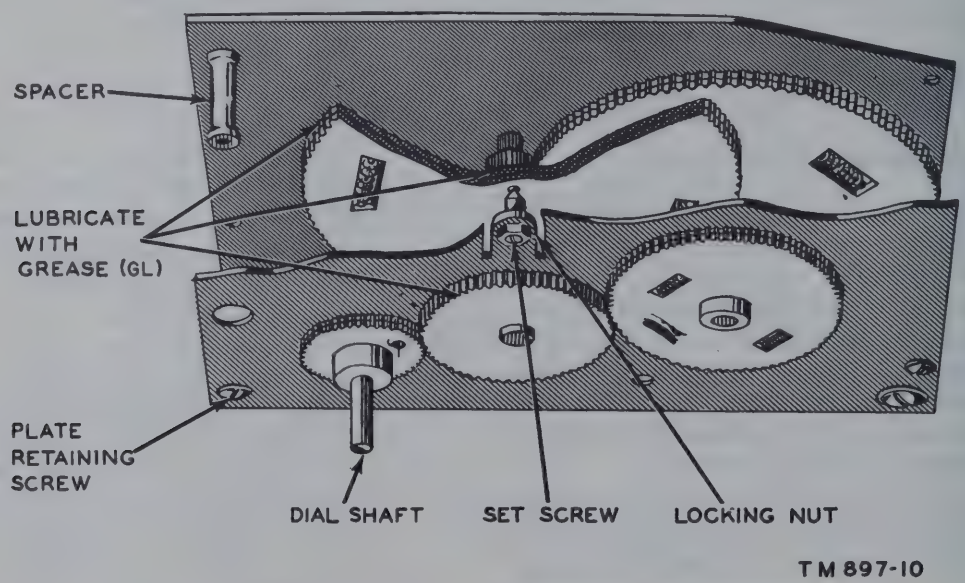


Figure 10. Lubrication of dial drive mechanism.

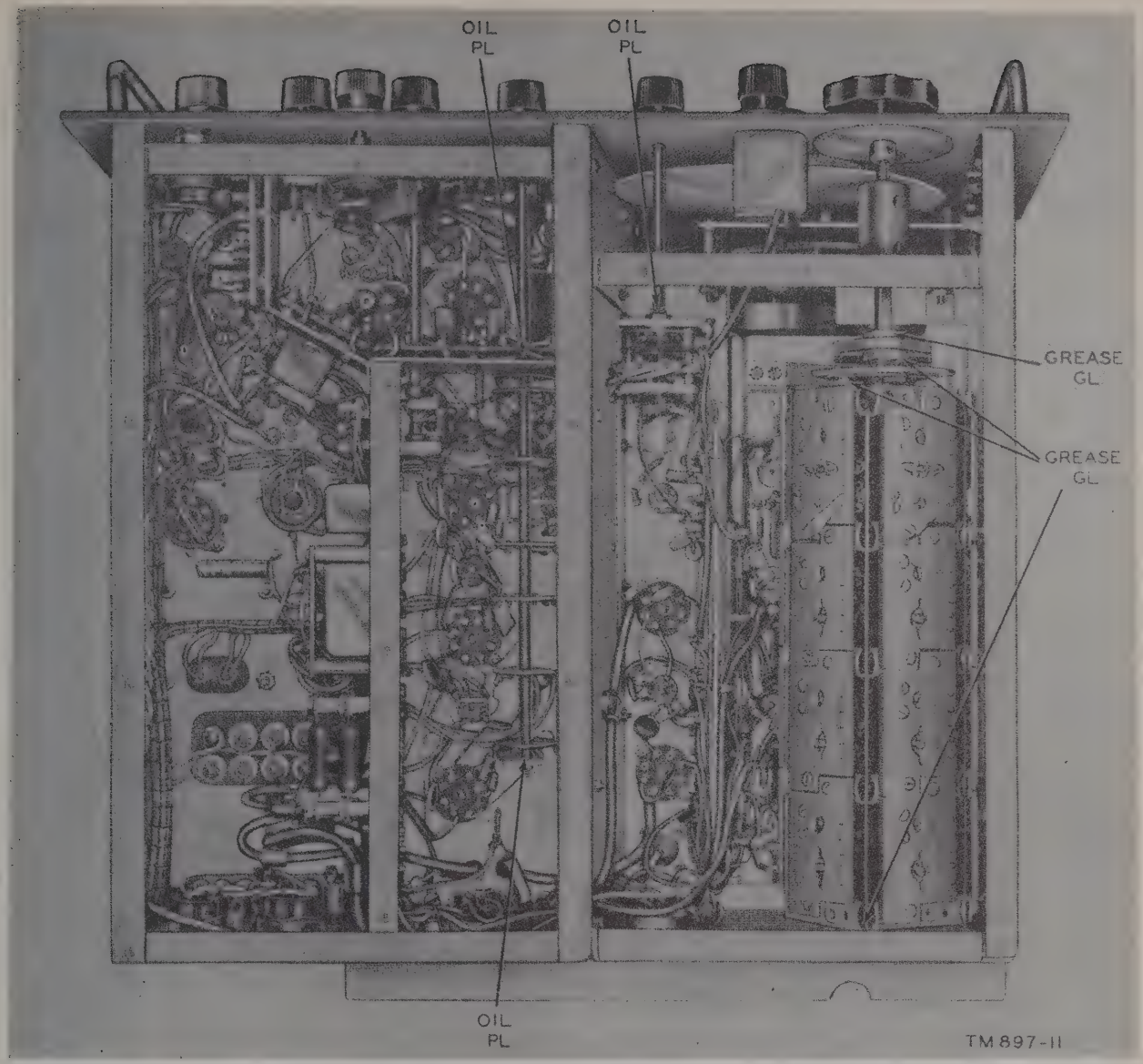


Figure 11. Lubrication of shafts, bottom of chassis.

d. Gang Tuning Capacitors. The bearings of tuning capacitors C1 and C2 require frequent lubrication, since they are probably the most used parts in the receiver. Figure 12 is a top view of the chassis, showing the points to be lubricated with grease. Dirt in these bearings may possibly cause noisy operation of the receiver.

31. Lubrication under Unusual Conditions

a. Arctic Regions. Lubricants which are satisfactory at moderate temperatures stiffen and solidify at subzero temperatures; as a result, moving parts bind or become inoperative. Consult the key on the lubrication order for the proper grade of lubricant for operating the equipment in arctic regions. When preparing the equipment for low-temperature operation, see that lubricants used for moderate temperatures are thoroughly removed. Even small amounts of such lubricants, if allowed to remain, may impair the operation of moving parts. Be sure to use the lubricant specified for low-temperature operation.

b. Tropical Regions. High temperatures and moisture due to rain, condensation, etc., may cause lubricants which are normally satisfactory

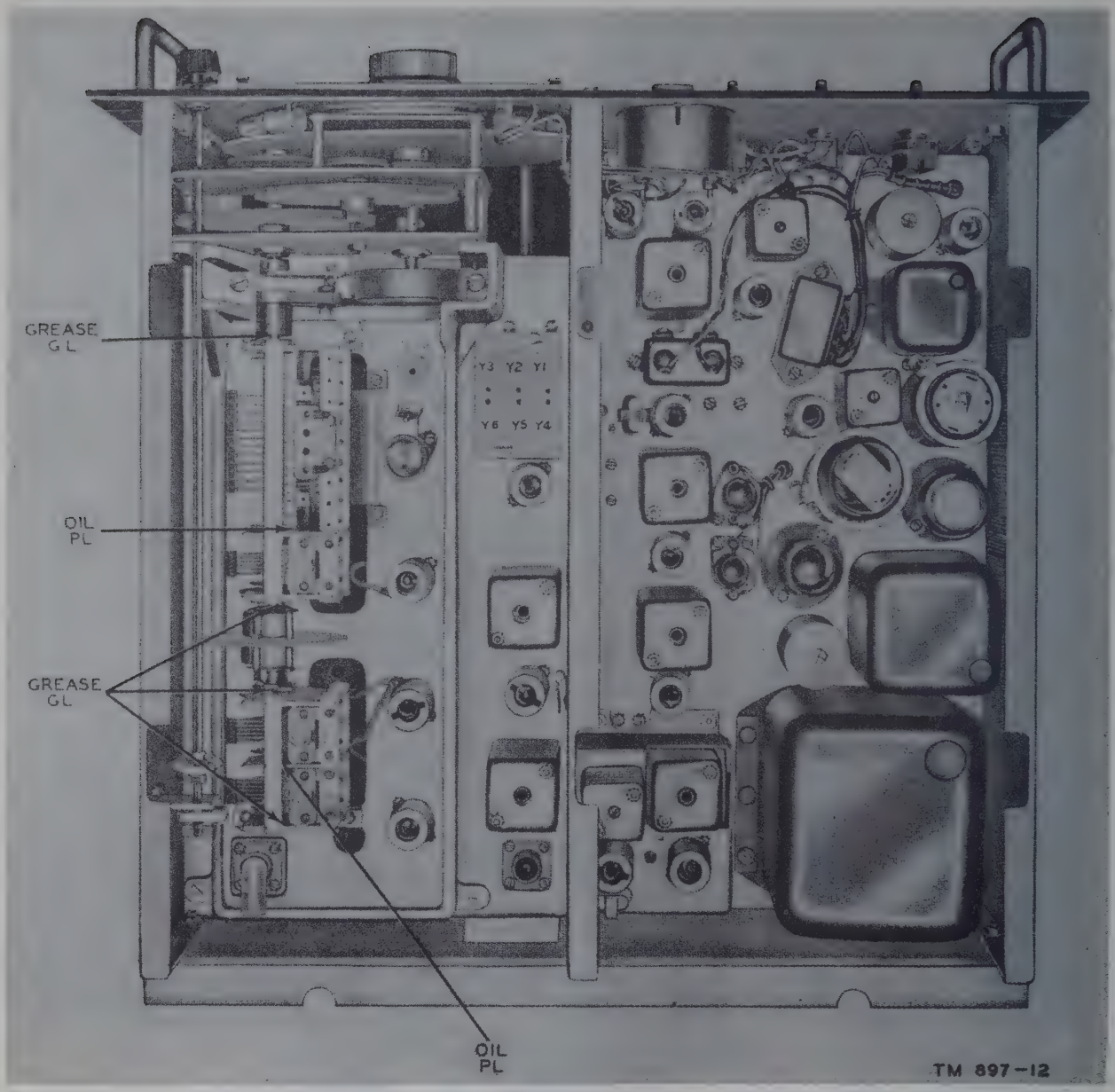


Figure 12. Lubrication of shafts, top of chassis.

to flow from moving parts and other surfaces. These bearing surfaces will wear excessively, and hinges, fasteners, and other parts will be damaged or destroyed by rust and corrosion. Inspect the equipment daily and lubricate it as required to insure efficient operation, using lubricants suitable for high temperatures.

c. Desert Regions. Dust and sand infiltration into the equipment causes grit in the lubricants which will seriously impair and damage the moving parts of the set. Hot, dry temperatures cause the lubricants to flow from the moving parts, and conditions similar to those described in *b* above will result. Use lubricants suitable for high temperatures. Inspect and clean the equipment daily.

Section III. WEATHERPROOFING

32. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moisture-profing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

e. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat. Refer to paragraphs 29–31 for detailed instructions.

33. Rustproofing and Painting

a. A badly scarred or damaged front panel may be touched up so that its bared surface will not corrode. To clean the panel down to the bare metal use No. 00 or No. 000 sandpaper; obtain a smooth metallic finish.

Caution: Do not use steel wool. Minute particles may enter the receiver and cause harmful internal shorting or grounding of circuits.

b. Apply the touch-up paint to the surface with a small brush. Before doing so, remove any rust or corrosion from the metal surface by cleaning with solvent (SD). In severe cases, it may be necessary to use solvent (SD) and sandpaper to soften and remove the rust before the metal may be painted. Paint used will be authorized and consistent with existing regulations.

Section IV. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

34. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. The paragraphs which follow in this section help in determining which of the stages is defective and in localizing the fault in that stage to the defective item, such as a tube or fuse.

35. Visual Inspection

a. Equipment troubles may be caused by one or more of the following conditions:

(1) Loose or unconnected power source cable.
(2) Worn, broken, or disconnected condition of cable plugs.
(3) Burned-out fuse.
(4) Shorted antenna input.
(5) Defective tubes.
(6) Inactive (dirty or cracked) crystal. (Check by switching to vfo operation.)
(7) Improper connections to primary power transformer (par. 14).

b. When a failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the receiver. If possible obtain information from the operator of the equipment regarding performances at the time the trouble occurred.

c. Check anything that seems to have an abnormal color which may have been caused by overheating or corrosion.

36. Trouble Shooting, Using Equipment Performance Checklist

a. General. The equipment performance checklist (par. 37) will help the operator to locate trouble in the equipment. The list gives the item to be

checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. *In using this list, perform the checks in the sequence indicated.*

b. Action or condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the table to chapter 5 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

37. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indication	Corrective measure
PREPARATORY	1	Antenna	Lead-in wire or wires connected.		
	2	Loudspeaker	Speaker cord connected to terminals 1 and 5 of E4 strip. Short across terminals 2 and 4. (Match to 600 ohms.)		
	3	Line cord	Line cord W1 connected to receiver and power source.		
	4	RECEIVE-SEND switch.	Set at RECEIVE position.		
	5	CW-MODULATION	Set at MODULATION position.		
	6	ANL-OFF	Set at OFF position.		
	7	RF GAIN-AC	Set at OFF position.		
	8	BFO PITCH	Set at 0.		
	9	CRYSTAL PHASING	Set at a center position.		
	10	SELECTIVITY	Set at NORMAL MED.		
	11	VFO-CRYSTAL	Set at VFO.		
	12	CRYSTAL VERNIER.	Set at a center position.		
	13	AUDIO GAIN	Set at 5.		
	14	AGC-MANUAL	Set at AGC position.		
START	15	RF GAIN-AC	Turn fully clockwise	Dial lamps light	Check fuse F1 on rear of chassis. Check line cord connections. Check tap connections of power transformer for correct voltage setting.
				Rushing noise or signal heard in speaker.	Check tubes in receiver. Check speaker cord and connections.

37. Equipment Performance Checklist—Con.

	Item No.	Item	Action or condition	Normal indication	Corrective measure
EQUIPMENT PERFORMANCE	16	TUNING	Set the BAND SELECTOR at any desired position. Tune across entire band by rotating TUNING control. Use dial lock to hold TUNING control in place after once set.	Signals heard in loudspeaker. CARRIER LEVEL meter shows relative strength of signals.	Signals are received normally, but CARRIER LEVEL meter indication is abnormal, trouble shooting is necessary. If signals are not obtained, or if they are weak, check the antenna connections at the antenna terminals of the receiver. When a long wire antenna is in use, be sure that one of the terminals is connected to ground. Check the tubes in the receiver.
	17	ANT ADJ	Adjust for maximum reading on CARRIER LEVEL meter.	Signal strength will vary with adjustment.	Signals are received normally, but CARRIER LEVEL meter indication is abnormal, trouble shooting is necessary. If signals are not obtained or if they are weak, check the antenna connections at the antenna terminals of the receiver. When a long wire antenna is in use, be sure that one of the terminals is connected to ground. Check the tubes in the receiver.
	18	BAND SELECTOR	Check each of the tuning ranges. Use procedure given in step 16 above.	CARRIER LEVEL meter will indicate a maximum when TUNING and CRYSTAL VERNIER controls are properly adjusted.	Check crystal oscillator tube V5. Check crystals Y1 through Y6. Refer to chapter 5.
	19	VFO-CRYSTAL switch.	Turn control from VFO to one of six crystal positions that contains a frequency where a signal can be received. Turn the BAND SELECTOR to the correct range. Tune to the proper frequency with the TUNING control.		

37. Equipment Performance Checklist—Con.

	Item No.	Item	Action or condition	Normal indication	Corrective measure
EQUIPMENT PERFORMANCE	20	CRYSTAL VERNIER	Use this control for crystal tuning with operation as indicated in step 19 above.	Signal can be tuned by rotating control in either one direction or the other.	Refer to chapter 5.
	21	PHONES jack	Insert phone plug into PHONES jack.	Signals heard in loudspeaker are audible in phones.	Check phones, cord, and plug.
	22	RF GAIN–AC control.	Tune in any signal by rotating the TUNING control. Rotate the RF GAIN control in either direction.	Strength of signal increases or decreases.	Refer to chapter 5.
	23	AUDIO GAIN control.	Rotate control in either direction.	Strength of signal increases or decreases.	Refer to chapter 5.
	24	RECEIVE-SEND	Turn to the SEND position. (When check is completed, return to RECEIVE position.)	No sound is heard in loudspeaker or in phones.	Refer to chapter 5.
	25	AGC-MANUAL switch	Turn to MANUAL position.	Strength of signal may or may not increase. CARRIER LEVEL meter becomes inoperative.	Refer to chapter 5.
	26	SELECTIVITY control.	Tune receiver to a modulated signal and then rotate SELECTIVITY control from the NORMAL MED position to the NORMAL, SHARP, and BROAD positions, and also to the CRYSTAL positions (SHARP, MED, and BROAD).	The tuning is broader in the broad and medium positions, and the high-frequency response (audio) increases in the broad position. Tuning is very sharp in the crystal positions, and CRYSTAL SHARP cuts off most of the audio above a few hundred cycles.	Check crystal Y8. Refer to chapter 5.
	27	CRYSTAL PHASING	Normal position is at 0. Turn the control in either direction.	Turning either direction when SELECTIVITY control is in crystal position will vary bandwidth.	Refer to chapter 5.
	28	ANL-OFF switch	Man-made interference may be present. Turn switch to ANL position.	Noise peaks are reduced in amplitude.	Refer to chapter 5.
	29	CW-MODULATION	Turn switch to CW and tune in a c-w carrier.	Beat-frequency audio signal is heard in loudspeaker or phones.	Check bfo tube V14.
	30	BFO PITCH control	Obtain a beat note of c-w carrier as explained in step 29 above. Rotate the BFO PITCH control on either side of 0.	A change in the pitch of the audio tone is noted.	Refer to chapter 5.
STOP	31	RF GAIN-AC control	Turn counterclockwise to OFF position.	Dial lamps go out. No noise or signals are heard in loudspeaker.	

CHAPTER 4
THEORY

38. Introduction

a. This chapter will aid the repairman in understanding the functions of certain circuits which may be slightly unconventional or appear complex in the complete schematic. With this knowledge, trouble shooting will be made easier and the repair work will be done more efficiently.

b. Radio Receiver R-274/FRR is of the superheterodyne type, having a frequency range of 540 kc to 54 mc. From 540 kc to 7 mc, it is a single superheterodyne receiver with a 455-kc intermediate frequency. From 7 mc to 54 mc, it is a double superheterodyne receiver, having both 6 mc and 455-kc intermediate frequencies. Provision is made for six crystal-controlled h-f oscillator frequencies from 1.5 mc to 29.7 mc.

c. An output terminal strip is included to which either one or more external speakers can be connected. There is also a jack for plugging phones into the output. Neither speakers nor phones are included with the basic equipment.

d. This receiver uses two stages of r-f amplification, one stage of 6-mc i-f amplification, three stages of 455-kc i-f amplification, and two stages of a-f amplification. It is capable of receiving and detecting both a-m waves and icw. Output from the 455-kc intermediate frequency is provided for use with other communications equipment, such as radioteletype, when necessary.

39. Block Diagram

(fig. 13)

a. The signal path through Radio Receiver R-274/FRR is shown in the block diagram (fig. 13). Study this block diagram and fix in mind the sequence of stages through which the incoming signal will pass before it reaches the output terminals.

b. The signal from the antenna is coupled to the 1st r-f amplifier (V1) through antenna transformer T6. After amplification, it is impressed on the grid of the 2d r-f amplifier (V2). The use of two pentode stages of r-f amplification gives sufficient gain for a good signal-to-noise ratio, and also provides for the maximum image and i-f rejection ratios. From the 2d r-f amplifier (V2), the signal goes to the 1st mixer (V3) where it is combined with the signal from either the vfo (V4) or crystal h-f oscillator V5, depending on the position of the VFO CRYSTAL switch. In the signal frequency range of 540 kc to 7 mc, the frequency of the vfo is always 455 kc higher than the signal frequency, so that the output of the 1st mixer (V3), which is the result of the combination, contains a 455-kc signal. This signal goes to the grid of the 1st 455-kc i-f amplifier (V9). From the frequency range of 7 mc to 54 mc, a better image rejection ratio can be obtained if the intermediate frequency is increased. Therefore, in this frequency range, the vfo is always 6 mc above the signal frequency. Thus, the output of the 1st mixer (V3) (in which the signal and the output of the vfo are combined) contains a 6-mc signal.

c. When the receiver is tuned to a frequency in the range of 7 mc to 54 mc, the i-f switch-over relay (K1) feeds the 6-mc output of the 1st mixer (V3) to the grid of the 6-mc i-f amplifier (V6) where it is amplified and where sufficient selectivity is provided to give a high degree of image rejection. However, more amplification and greater selectivity are required before detection. Therefore, the output of the 6-mc i-f amplifier (V6) goes to the 2d mixer (V7). The output of a 6.455 mc crystal-controlled oscillator (V8) also is injected into this 2d mixer (V7). As a result of the combination of these two signals, the output of the 2d mixer (V7) contains a 455-kc signal. This output then is fed through the i-f switch-over relay (K1) to the grid of the 1st 455-kc i-f amplifier (V9) for further amplification. Note that when the receiver is tuned to a signal in the frequency range from 540 kc to 7 mc, the output of the 1st mixer (V3) goes directly to the grid of the 1st 455-kc i-f amplifier (V9) so that when the signal reaches this point, the operation

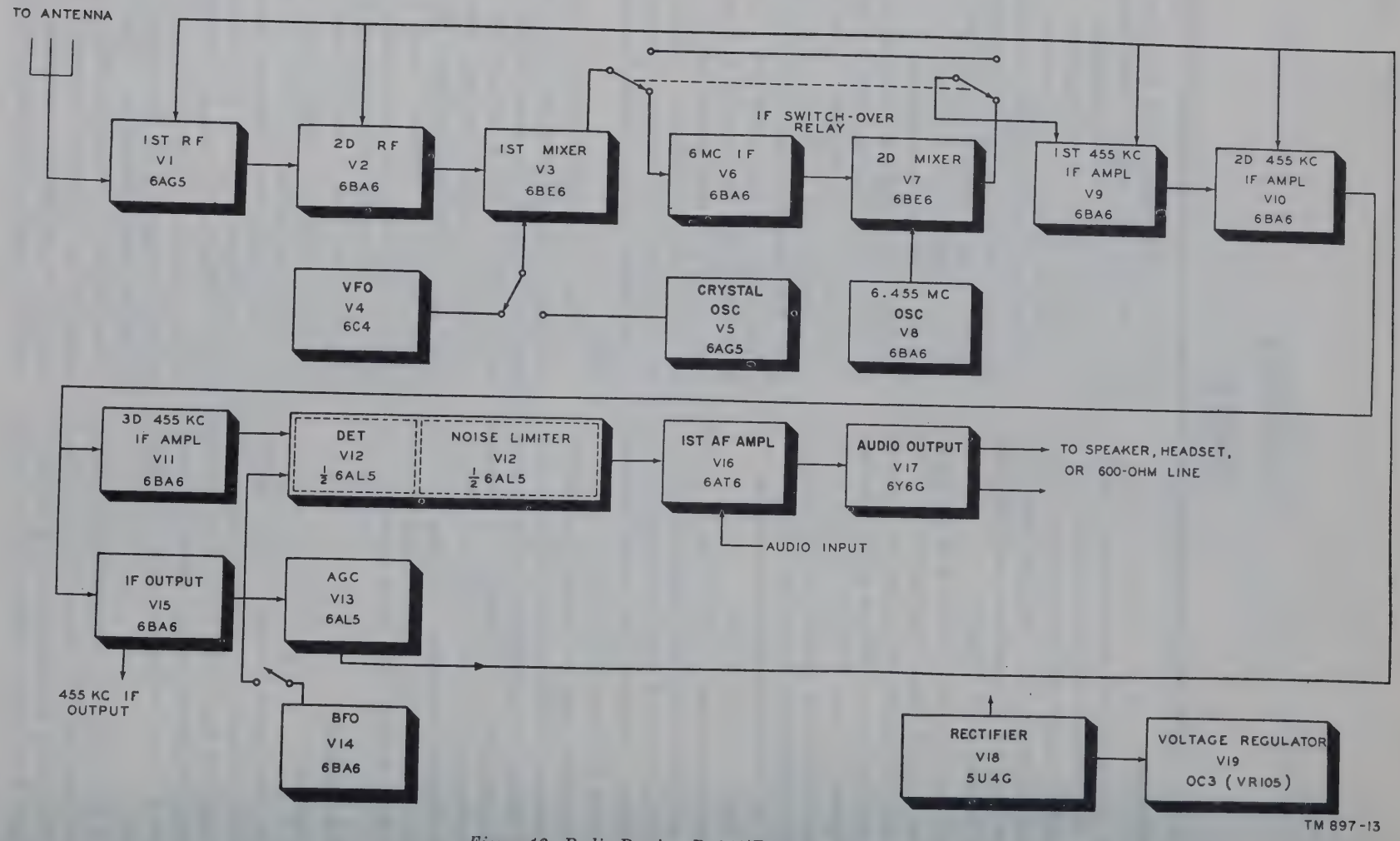


Figure 13. Radio Receiver R–274/FRR, block diagram.

is the same regardless of the frequency to which the receiver is tuned.

d. The 455-kc signal which goes to the 1st 455-kc i-f amplifier (V9) is amplified successively by the 1st (V9), 2d (V10), and 3d (V11) 455-kc i-f amplifier stages which provide the proper degree of selectivity. Provision has been made for variation of this selectivity according to the requirements at hand.

e. After it has passed through the 3d 455-kc i-f stage (V11), the amplified signal is sent to the audio detector (½ of V12) where it is demodulated and fed into the 1st a-f amplifier (V16). The output of V16 is coupled to the a-f output stage (V17) which amplifies the signal with power enough to actuate headphones or speakers, or to feed a 600-ohm audio transmission line. The noise limiter (½ of V12) can be switched in between the audio detector (½ of V12) and the 1st a-f amplifier (V16) when the reduction of static pulses or other electrical disturbances is desirable.

f. In order to have a good agc system without causing audio distortion, an agc duo-diode (V13) is connected in such a position in the circuit that it is isolated from the normal signal channels. The output of the 2d 455-kc i-f amplifier stage (V10) is transformer-coupled to the grid of the 3d 455-kc i-f amplifier stage (V11) and also to the grid of the i-f output stage (V15). The output of this tube, which couples into the agc system, also is isolated from the normal signal channel. The agc tube (V13) couples the negative bias, which the operator selects with the RF GAIN-AC control (R83), to the control grids of tubes V1, V2, V9, and V10. The rectified i-f signal superimposes additional negative voltage on the grid input circuit when a strong signal is tuned. The stronger the incoming signal, the greater the negative bias. Conversely, a small signal strength allows the over-all amplification to be greater. This produces a self-balancing arrangement in which the audio output voltage is held fairly constant even though the r-f signal strength varies greatly from station to station.

g. In order to hear c-w signals, a bfo (V14) is used. It generates a signal which is combined with the i-f signal at the audio detector (½ of V12) which detects both to produce an audio beat note which is amplified by the audio amplifiers (V16 and V17). The frequency of bfo V14 can be varied slightly above and below 455 kc to give the most effective audio note. During the silent periods between transmitter pulses, no 455-kc signal will be present at the detector input, and no beat note will be sent through the audio stages.

h. Some communication equipment, for example radioteletype, with which Radio Receiver R–274/FRR can be used, requires i-f output facilities. To give this service, a separate i-f amplifier stage (V15) has been provided. The signal from the 2d 455-kc i-f amplifier (V10) goes to the grid of V15 where it is amplified. The output is transformer-coupled to a low-impedance level so that it can be connected by coaxial cable to the external equipment. The i-f output stage also furnishes a signal to the agc circuit (*f* above).

i. A meter (M1) is provided to help in tuning and to give an approximate indication of the relative strength of the incoming signal. The meter circuit measures the voltage in the agc circuit when the AGC-MANUAL switch is in the AGC position. The meter circuit is not connected when the switch is in the MANUAL position. The amount of current through the meter is proportional to the average magnitude of the incoming signal.

j. The receiver operates from an a-c source (50 to 60 cycles) only. Source voltages of 95 through 260 volts can be used by the selection of the proper tap on the power transformer (T34). Rectifier tube V18 is a full-wave rectifier which supplies d-c plate power to the other tubes in the receiver. V19 is a regulator tube which provides constant plate voltage (regardless of the normal power source voltage fluctuations) to the critical circuits. Resistor R80 (ballast tube) provides constant filament voltage.

Note. Figures 14 through 20 are keyed to paragraphs 40 through 48 and assume operation with the turret switch in BAND VI. These connections are typical of operation in BAND VI or V and may be construed as typical of operation in BAND I, II, or III, except that the i-f switch-over relay (K1) is not actuated and the 6-mc strip (V6, V7, and V8) does not operate for BAND I, II, or III. By assuming operation in BAND VI, the theory of operation within the 6-mc strip may be included logically.

40. 1st R-F Amplifier

(fig. 14)

a. The r-f amplifiers must operate over the entire frequency range of the receiver. Because of the wide frequency range, a band selection arrangement must be used. This is accomplished by use of a four-section, six-position turret which makes

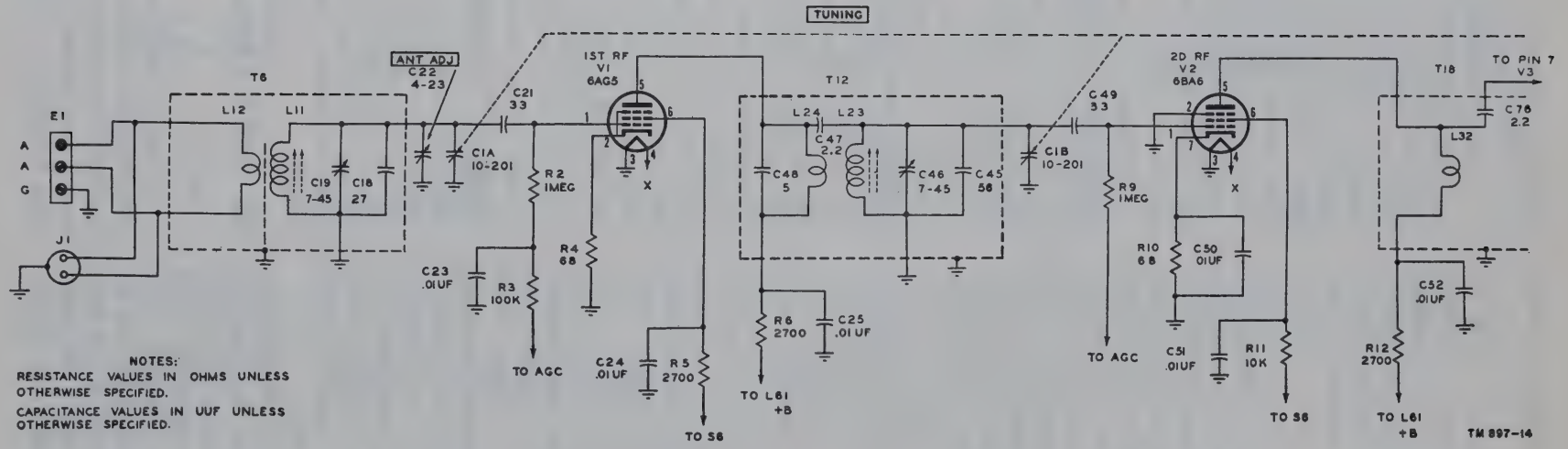


Figure 14. Radio Receiver R-274/FRR, functional diagram of 1st and 2d r-f amplifier.

all r-f and vfo coils easily available. All positions of this turret are shown in the complete schematic of figure 43, and one position corresponding to BAND VI is shown in figure 14.

b. In the partial circuit diagram of figure 14, it can be seen that the coupling of the antenna to the 1st r-f stage is through r-f transformer (T6) when the turret switch is in the BAND VI position. Note that the low-impedance (50-200 ohms) primary winding of T6 is designed to connect to a balanced, spaced-pair, twin-conductor, coaxial transmission line. The primary winding also is designed so that an unbalanced, single-conductor coaxial transmission line or single-wire lead-in from an antenna can be used by connecting terminal G of E1 to ground and the antenna lead to terminal A of E1. Capacitor C22 (ANT ADJ) is a front panel adjustment which compensates for variable antenna characteristics that cause detuning of the antenna input transformer. The secondary of T6 is tuned by capacitor C1A, and the signal is coupled to V1 by capacitor C21. Capacitors C18 and C19 limit the highest frequency to which the secondary of transformer T6 will tune. Tracking at the high end of the band is accomplished by adjustment of C19. Tracking at the low end of the band is made possible by means of the adjustable powdered-iron core inside transformer T6. Resistor R2 feeds age voltage to the grid of V1. Resistor R3 and capacitor C23 form a filter which prevents any r-f or i-f signals of other amplifier stages from getting into the grid circuit of V1 through the age line. R4 is the cathode resistor of V1 which limits its cathode current to a safe value when no age voltage is being developed. Resistor R5 aids in decoupling the screen of V1, and capacitor C24 bypasses the screen to ground at the radio frequencies. Note that no screen voltage is applied when switch S6 is in the SEND position (fig. 29). In figure 43, resistor R1 is connected to a pair of turret contacts. These contacts are arranged so that R1 is connected across antenna transformer T5 (which is the BAND V transformer) when the turret is in the BAND VI position. This is to prevent any interaction between the transformer in use and the transformer for the next lower frequency band.

c. The output of the 1st r-f amplifier (V1) goes to the primary of r-f transformer T12. The low side of this primary winding is connected to +B through resistor R6. Resistor R6, in combination with capacitor C25, forms a filter which effectively prevents any r-f or i-f signals of other amplifier stages from getting into the plate circuit of V1. V1 is a type 6AG5 pentode tube, selected to give the best possible signal-to-noise ratio in this circuit.

41. 2d R-F Amplifier

(fig. 14).

a. The circuit of the 2d r-f amplifier, when the turret switch is in BAND VI position, also is shown in figure 14. The signal from VI goes to transformer T12, the secondary of which is tuned to the signal frequency by variable gang capacitor C1B. Capacitors C45 and C46 limit the highest frequency to which T12 can be tuned. Tracking at the h-f end of the band is accomplished by adjusting of C46. Tracking at the low end of the band is accomplished by means of the adjustable powdered-iron core inside of transformer T12 to improve gain. Capacitor C47 adds capacitive coupling to the inductive coupling between the primary and secondary of r-f transformer T12. It is used to increase the gain of transformer T12 at the high end of BAND VI. If this capacitor were not used, the gain would be different at the two ends of BAND VI. Capacitor C48 resonates the primary of transformer T12 at a frequency below the lowest frequency in BAND VI, and thereby improves the image rejection ratio.

b. The signal from r-f transformer T12 is coupled to the grid of the 2d r-f amplifier (V2) through coupling capacitor C49, which prevents the age voltage from being grounded through the secondary of T12. Resistor R9 feeds the age voltage to the grid of V2, a type 6BA6 pentode tube. This tube can be used because the 2d r-f amplifier (V2) does not have as much effect on signal-to-noise ratio as does the 1st r-f amplifier (V1). Resistor R8 is across a pair of turret switch contacts (fig. 43) which connect to BAND V r-f transformer (T11) when the turret switch is in the BAND VI position. It eliminates any reaction between the r-f transformer in use and the transformer for the next lower frequency band. R10 is the cathode resistor for V2, which limits its cathode current to a safe value, and capacitor C50 is the cathode bypass which effectively grounds the cathode of V2 insofar as r-f signals are concerned. R11 is the screen voltage-dropping resistor for V2, and screen bypass capacitor C51 grounds any screen r-f signals. No screen voltage is applied when switch S6 is in the SEND position (fig. 43).

c. The amplified signal in the plate circuit of V2 goes to the primary of r-f transformer T18 which is connected to +B through resistor R12. Resistor R12 and capacitor C52 form a filter which prevents r-f or i-f signals in other stages from getting into the plate circuit of V2 by means of the +B lead.

42. 1st Mixer

(fig. 15)

a. The 1st mixer stage, V3, is of the electron-coupled type (6BE6) which minimizes the effect of the r-f circuits on the vfo frequency stability.

b. The signal from the 2d r-f amplifier goes to r-f transformer T18, the secondary of which is resonated to the signal frequency by capacitor C2A. Capacitors C74 and C75 limit the highest frequency to which transformer T18 will tune. Tracking at the high end of BAND VI is accomplished by adjusting capacitor C75. Tracking at the low end of BAND VI is accomplished by adjusting the powdered-iron core inside transformer T18. Capacitor C76 adds capacitive coupling between the primary and secondary of transformer T18 to make the h-f end gain of the transformer as great as the l-f end gain. Capacitor C77 resonates the primary of T18 below the lowest frequency of BAND VI to improve the image rejection ratio.

c. The signal is coupled directly to the signal grid of the 1st mixer tube (V3). No agc voltage is applied to this tube because it would reduce the frequency stability of the vfo.

d. Resistor R17 is across a pair of turret switch contacts which connect to the BAND V mixer transformer (T17). It eliminates any reaction between the mixer transformer in use and the transformer for the next lower frequency band. R18 is the cathode resistor for V3 which limits the cathode current to a safe value. Capacitor C78 is the cathode bypass which effectively grounds the cathode where r-f or i-f signals are concerned. R20 is the screen voltage-dropping resistor for V3, and capacitor C79 is the screen r-f bypass capacitor. The screen voltage source for V3 is regulated to improve the frequency stability of the vfo.

e. Resistor R19 is the vfo injection grid resistor which permits the proper operating bias to be developed on the injection grid of V3 by the vfo signal. Coupling from the vfo is accomplished through the series combination of capacitor C80 and resistor R21. Capacitor C80 prevents injection grid resistor R19 from being shorted by the vfo circuits, and resistor R21 improves the isolation between the 1st mixer tube (V3) and the vfo circuits.

f. The signal in the plate circuit of V3 is always at the intermediate frequency of the receiver, since it is the result of mixing the r-f signal and the output of the vfo. When the receiver is tuned to any frequency between 540 kc and 7 mc (BANDS I, II, and III), the output of the 1st mixer contains a 455-kc signal, and it goes to the 455-kc i-f amplifiers. However, the image rejection ratio of the receiver would be very poor if an intermediate frequency of 455 kc were used when the receiver is tuned to higher frequencies. Therefore, when the receiver is tuned to frequencies between 7 mc

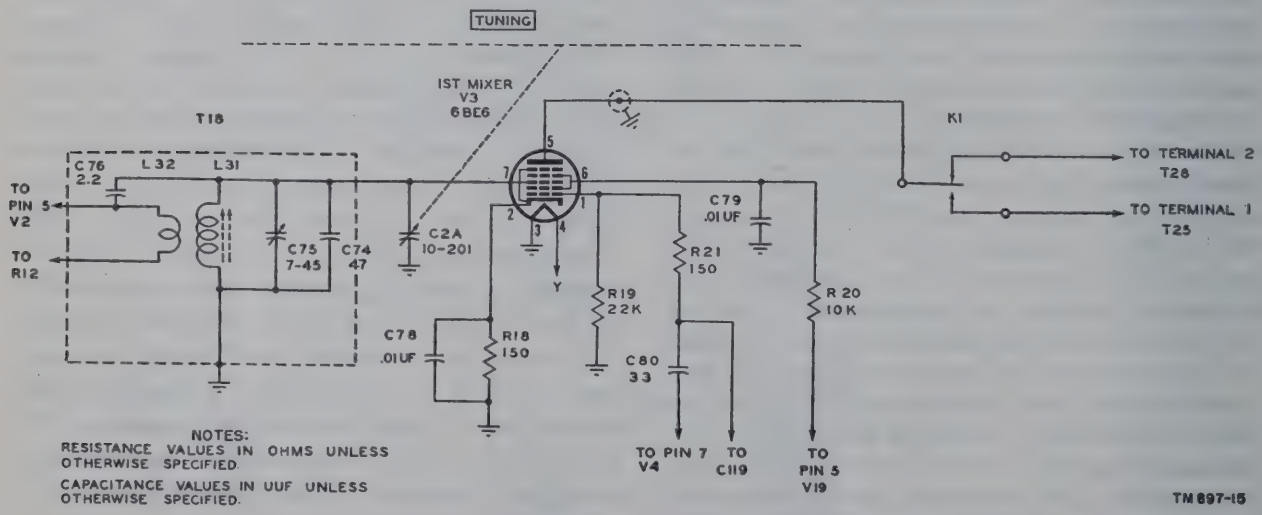


Figure 15. Radio Receiver R–274/FRR, functional diagram of 1st mixer stage.

and 54 mc (BANDS IV, V, VI), an additional i-f system is used. In these bands, the output of the 1st mixer tube (V3) contains a frequency of 6 mc which is sent to the 6-mc i-f amplifier. The switch-over is accomplished automatically by relay K1.

43. I-f Switch-Over Relay

(fig. 16)

a. Switch-over relay K1 has two sets of double-throw contacts and automatically switches the output of the 1st mixer tube (V3) into the proper i-f channel. When the receiver is operating in BAND I, II, or III, the i-f output of the 1st mixer tube (V3) is 455 kc and connections are made from the plate of the 1st mixer tube (V3) directly into transformer T28, from which the signal goes to the grid of the 1st 455-kc i-f amplifier (V9). Any signal which might be picked up in the 6-mc i-f amplifier (V6) or the 2d mixer tube (V7), or any spurious oscillation which may occur in these stages, will be shorted out because of the low-impedance ground circuit at the plate of the 2d mixer tube (V7). About −24 volts of bias is applied to the grid of the 6.455-mc oscillator (V8), and this prevents the tube from oscillating or conducting. When the receiver is operating on BAND IV, V, or VI, the i-f output of the 1st mixer tube (V3) is 6 mc, and connections are made from the plate of the 1st mixer tube (V3) to transformer T25, from which the signal goes to the grid of the 6-mc i-f amplifier (V6). A ground connection between the coil of relay K1 and the grid of the 6.455-mc oscillator (V8) removes the large bias (−24 volts) from the oscillator and allows it to operate on BANDS IV, V, and VI. The 455-kc output of the 2d mixer (V7) then is fed to transformer T28, from which it is fed to the grid of the 1st 455-kc i-f amplifier (V9).

b. The coil of relay K1 energizes when −24 volts from the main power supply of the receiver is applied. When BAND I, II, or III is in use, the −24-volt potential is applied to one terminal of the relay coil, but an open ground return at the other terminal prevents the relay from energizing. When BAND IV, V, or VI is in use, the open terminal of the relay coil is grounded directly, and the relay energizes, transferring both sets of contacts.

c. The −24 volts is produced between ground and the center tap of the plate voltage winding of the power transformer. The circuit consists of resistors R81 and R82, the series combination of R111 and R83, and R35 all connected in parallel. When the relay coil is switched into the circuit (energized), the coil replaces resistor R35 in the circuit, and R35 is open-circuited.

d. Four coaxial cables are involved in the i-f switching arrangement. One connects the output of the 1st mixer (V3) to the relay contacts. A second cable connects the output of the 2d mixer (V7) to the relay contacts. A third cable connects the output of the relay contacts to the 1st 455 kc i-f transformer (T28). A fourth cable connects the output of the 1st mixer at the contacts of relay K1 to the primary of 6-mc transformer T25. Each of these four cables has its shield grounded at one end only to prevent undesirable ground currents which would interfere with normal circuit operation.

44. Variable-Frequency Oscillator

(fig. 17)

a. A partial schematic showing the vfo connected in BAND VI is shown in figure 17. A type 6C4 tube (V4) is used in a Hartley oscillator circuit. The grid of the tube is connected to a tap on the oscillator transformer to improve the frequency stability, on all bands except V and VI. On bands V and VI, the grid is connected to the high, or *hot*, end of the oscillator transformer. R27 is the grid resistor which develops operating bias for the tube. Resistor R27 is bypassed by capacitor C111 at radio frequencies.

b. The cathode of the vfo tube (V4) is connected to the tap of the oscillator coil, and the low end of the coil is grounded through a turret switch contact. The cathode r-f voltage is coupled out of the vfo stage through capacitor C80 and resistor R21 to the control grid input of the 1st mixer tube (V3).

c. The plate is connected to the low end of oscillator transformer T24 through capacitor C118. Plate voltage comes from the +105-volt regulated supply through VFO CRYSTAL switch S2 SECT. 2. Note that plate voltage is furnished to the vfo tube when switch S2 is in the VFO position only. When the switch is in any CRYSTAL position, the vfo does not function, but is replaced by the crystal oscillator, V5 (par. 45).

d. C2B is the variable capacitor used for tuning the vfo stage, and is ganged directly with tuning capacitors C1A, C1B, and C2A. C112 is the tracking capacitor which helps keep the oscillator

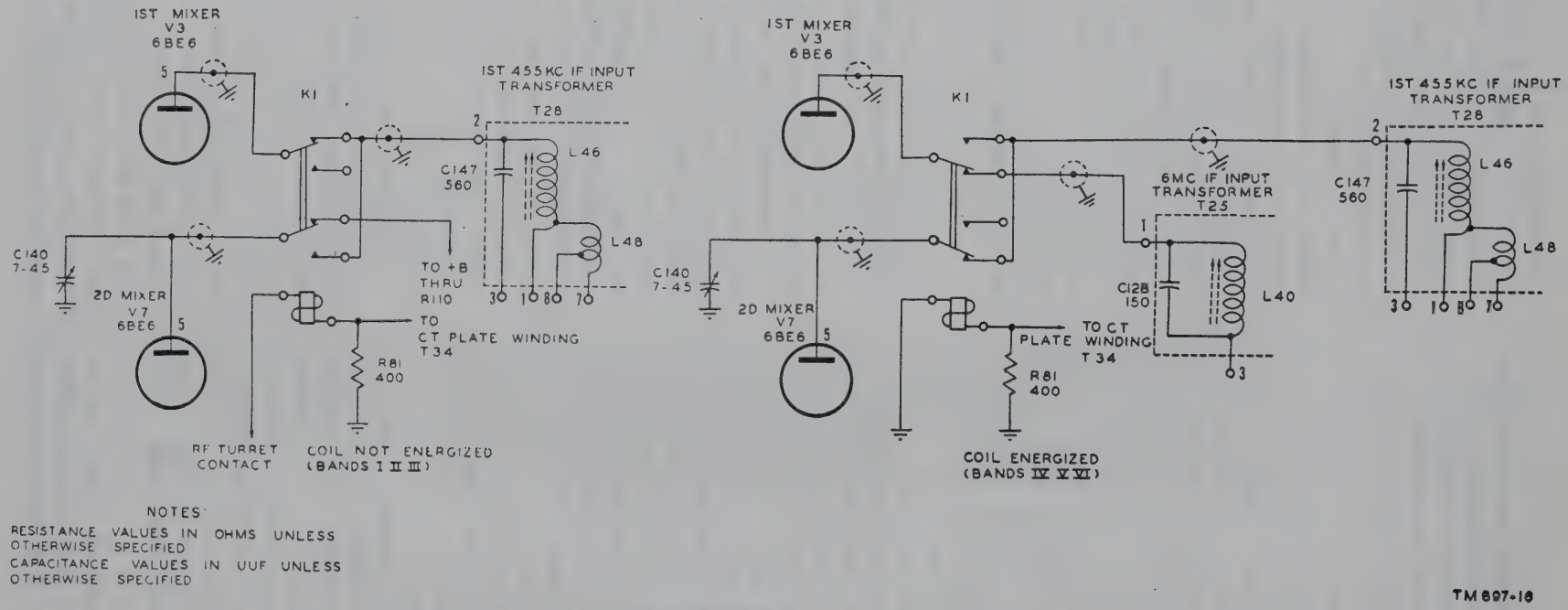


Figure 16. Radio Receiver R-274/FRR, simplified i-f switch-over relay operation.

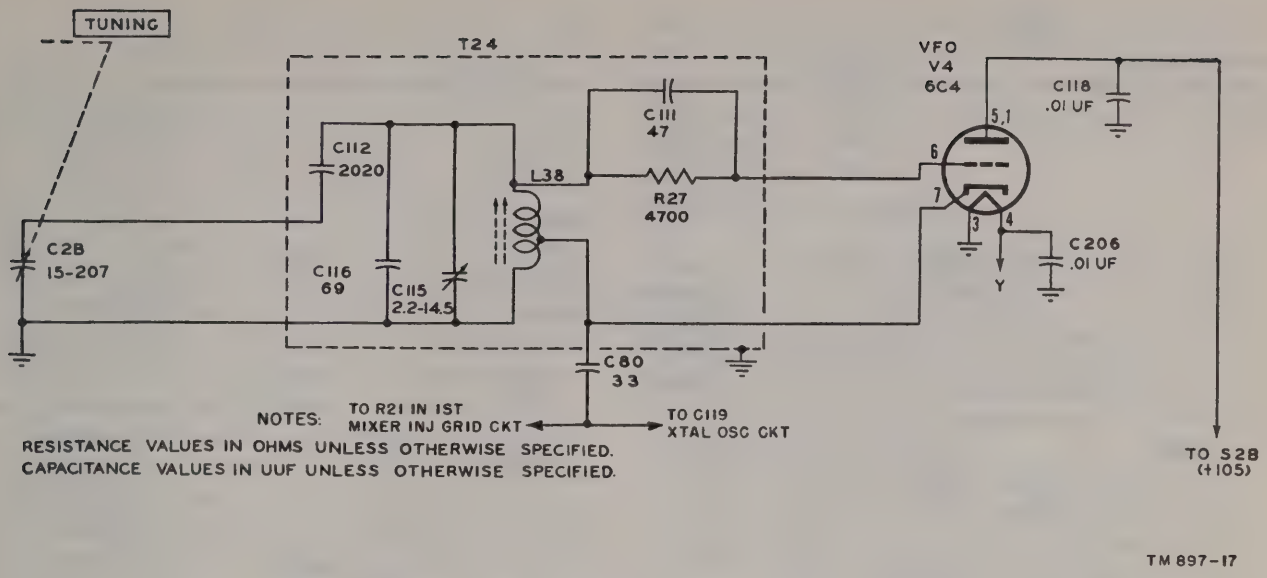


Figure 17. Radio Receiver R–274/FRR, functional diagram of vfo stage.

frequency exactly 6 mc above the signal frequency. C115 is the trimmer capacitor which assists in tracking and acts together with capacitor C116 to limit the highest frequency to which the stage may be tuned on BAND VI. Capacitor C116 is a temperature compensator which corrects the effects of temperature changes on the other oscillator circuit components. The 1-f adjustment is made by means of the powdered-iron core inside coil L38.

e. When the turret switch is set for operation in BAND VI, resistor R28 is connected across the BAND V oscillator coil in T23. This prevents the oscillator coil of the next lower band from absorbing any energy from the BAND VI oscillator coil.

45. Crystal Oscillator

(fig. 18)

a. A crystal oscillator using a type 6AG5 pentode tube (V5) may be used as an alternate h-f oscillator input for the 1st mixer tube (V3). It serves the same function as the vfo (V4), and replaces this stage when the VFO CRYSTAL switch (S2) is placed in any of its six numbered positions. Switch S2 SECT. 1 connects the output of the oscillator to the input of the 1st mixer tube (V3) in any of the crystal positions, and opens this circuit in the VFO position. Switch S2 SECT. 2 connects the plate of the variable frequency oscillator (V4) to +B regulated voltage when the switch is in the VFO position or the plate and screen of the crystal oscillator (V5) to the ordinary +B circuit in any crystal position. Switch S2 SECT. 3 is open in the VFO position or connects one crystal into the oscillator circuit in any of the six numbered positions.

b. There is a crystal socket provided for each of the six crystals. The crystals (Crystal Unit CR–18/U) are not furnished with the receiver but are provided (when requisitioned) for specified frequencies which will be set up as standard channels for normal communication operations within a specific area. Each crystal must operate at such a frequency that it will provide a beat frequency against the transmitted frequency to produce the proper intermediate frequency for amplification in the i-f stages of the receiver. The oscillator frequency always is above the incoming signal frequency. For example: if the frequency being received is 1,500 kc, the oscillator must be operating at 1,955 kc to produce a 455-kc i-f in the heterodyne action. Up to 7 mc, BAND III, the i-f is 455 kc, and the oscillator will operate at the incoming frequency plus 455 kc. Above 7 mc, the intermediate frequency in use is 6 mc, so the oscillator will operate at the incoming frequency plus 6 mc. Because of the selectivity of the r-f amplifier stages, the receiver has to be tuned manually to the incoming frequency. The frequency range reception for which the crystal oscillator may be used is 1.5 to 29.7 mc in BANDS II through V. The highest Crystal Unit CR–18/U frequency used is 11.9 mc. These units may be used as follows: For signal frequencies from 1.5 mc through 7 mc in BANDS II and

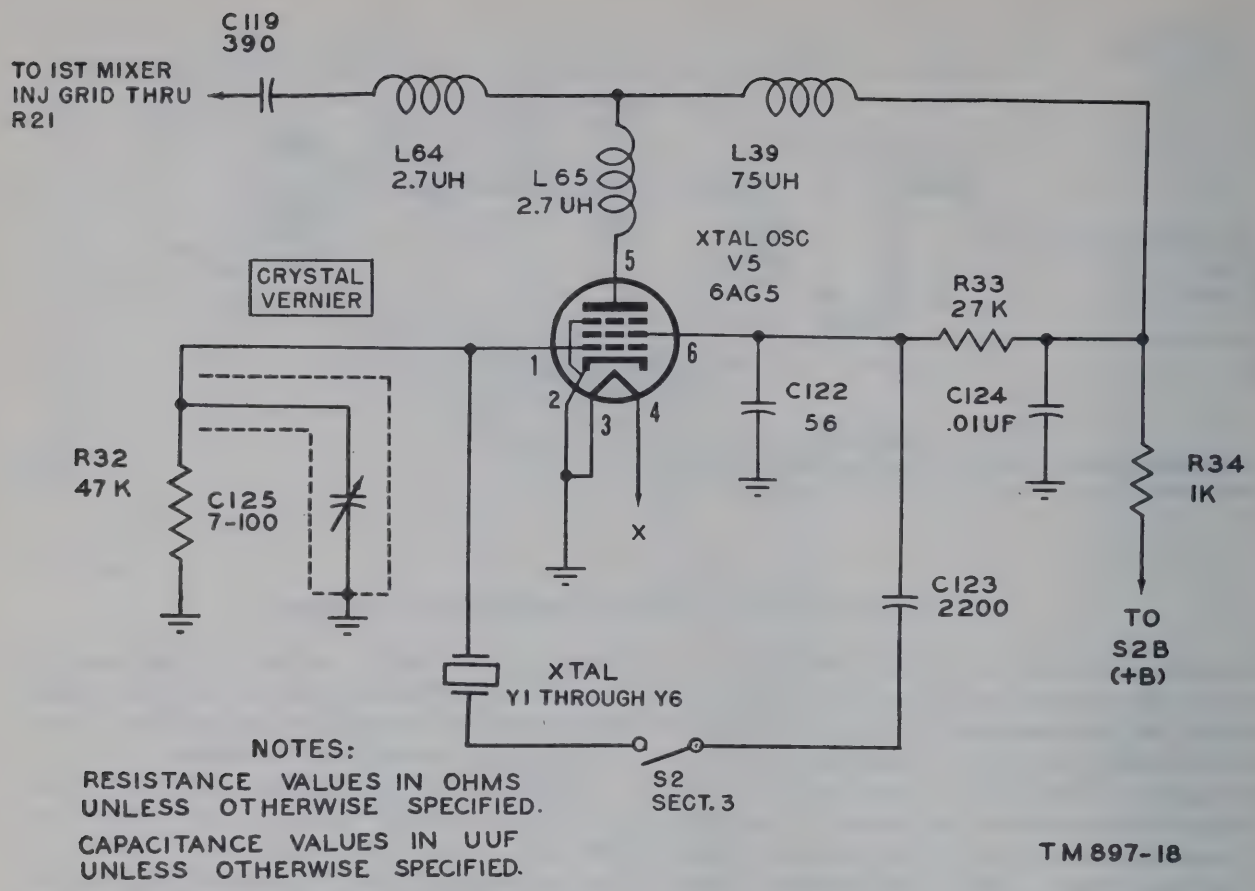


Figure 18. Radio Receiver R-274/FRR, functional diagram of crystal oscillator stage.

III, the fundamental crystal frequency is used. In the range from 7 mc through 13.8 mc in BAND III, crystals will be used at their 2d harmonic frequencies (two times the fundamental frequency). In the range from 13.8 mc through 29.7 mc, crystals will be used at their 3d harmonic. To determine the crystal frequency which should be chosen for use with an assigned incoming frequency, use the following formulas:

Fx=crystal fundamental frequency

Fs=signal frequency

IF=intermediate frequency

(1) For the signal frequency range of 1.5 mc through 7 mc (BANDS II and III), the intermediate frequency is 455 kc and

$$Fx=Fs+IF$$

Example: Determine the crystal to be used for an incoming signal of 1.8 mc.

$$Fx=1.8+.455=2.255 \text{ mc}$$

(2) For the signal frequency range from 7 mc through 13.8 mc (BAND IV), the intermediate frequency is 6 mc and

$$Fx=\frac{Fs+IF}{2}$$

Example: Determine the crystal frequency to be used for an incoming signal frequency of 11.15 mc.

$$Fx=\frac{11.15+6}{2}=8.575 \text{ mc}$$

(3) For the signal frequency range from 13.8 mc through 29.7 mc (BAND V), the intermediate frequency is 6 mc and

$$Fx=\frac{Fs+IF}{3}.$$

Example: Determine the crystal frequency to be used for an incoming signal frequency of 27.6 mc.

$$Fx=\frac{27.6+6}{3}=11.2\text{mc}.$$

c. The crystal oscillator stage is connected as an electron-coupled oscillator. The crystal (Y1, Y2, Y3, Y4, Y5, or Y6) is connected from the control grid to the screen grid of the tube (V5) through switch S2, SECT. 3, when the switch is set in one of its six numbered positions. Note that each switch position number matches a crystal number (position 1 connects crystal Y1, etc.). The screen grid of the tube is the effective plate for the oscillator circuit. Capacitor C123 couples the crystal to the screen grid at the frequencies involved. Capacitors C122 and C125 are in series and assist the screen to control grid capacity to provide feedback for oscillation. Note that C125 is variable and is marked CRYSTAL VERNIER on the front panel. By changing the setting of this control, a limited variation of the crystal frequency can be effected (±50 cycles per mc). Grid leak resistor R32 will develop the proper operating bias for the stage. Screen voltage-dropping resistor R33 returns the screen to +B and limits screen grid current to a safe value.

d. The suppressor grid is tied to the cathode to minimize any secondary emission effects. The crystal oscillator radio frequency appearing at the plate of tube V5 is fed through inductors L65 and L64, capacitor C119, and resistor R21 to the injection grid of the 1st mixer tube (V3). Inductors L65 and L39 connect the plate to +B through R34 and prevent the oscillator radio frequency from feeding back into the +B circuit. Capacitor C124 is used for further bypassing this r-f variation to ground in both the screen and plate circuits.

46. 6-MC I-F Amplifier

a. The simplified diagram showing the 6-mc i-f amplifier which uses a type 6BA6 pentode tube amplifier V6 is shown in figure 19. Note that the input to this stage comes from the contacts of relay K1 (fig. 43), and that there is an input only when the proper contacts are closed, which occurs on BANDS IV, V, and VI.

b. The 6-mc signal is fed from the relay contacts of K1 to the primary of transformer T25. The signal is inductively coupled to the secondary from which it is fed through coupling capacitor C113 to the grid of V6. R114 is the grid resistor. Capacitor C128 resonates the primary of transformer T25 to 6 mc, and capacitor C129 resonates the secondary to the same frequency. Both of these capacitors are fixed; tuning is accomplished by means of powdered-iron cores inside transformer T25.

c. R39 is the cathode resistor for tube V6 which regulates the tube current to a safe value and develops the grid bias necessary for correct operation. Capacitor C131 is the cathode bypass which effectively grounds the cathode at the

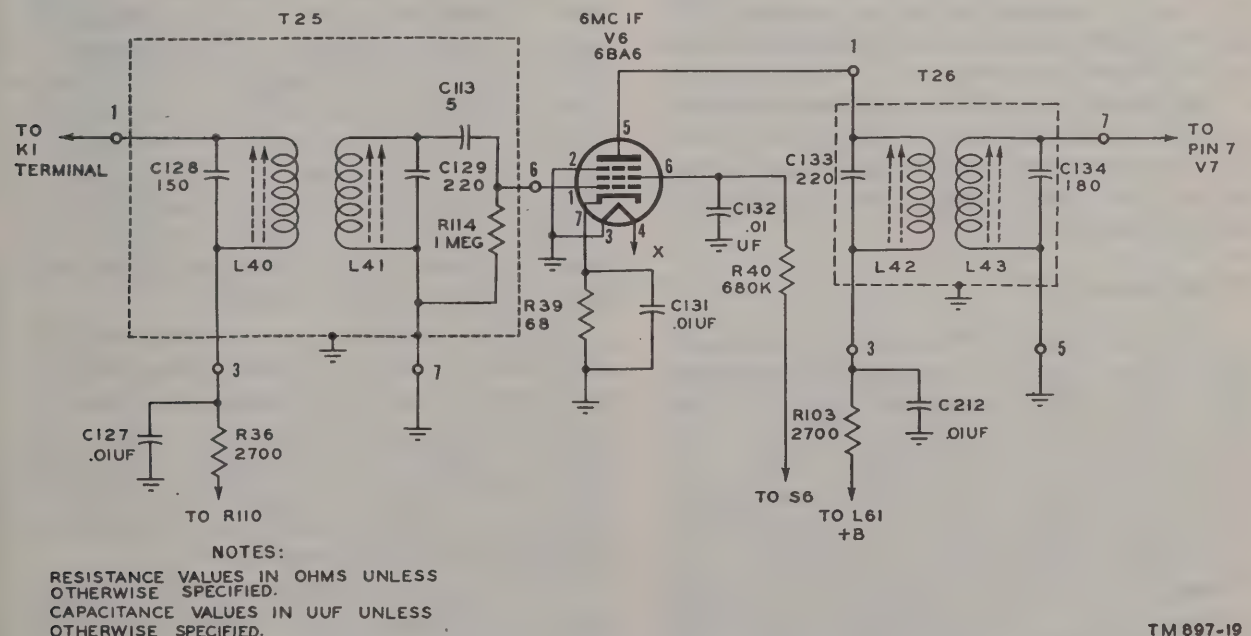


Figure 19. Radio Receiver R–274/FRR, functional diagram of 6-mc i-f stage.

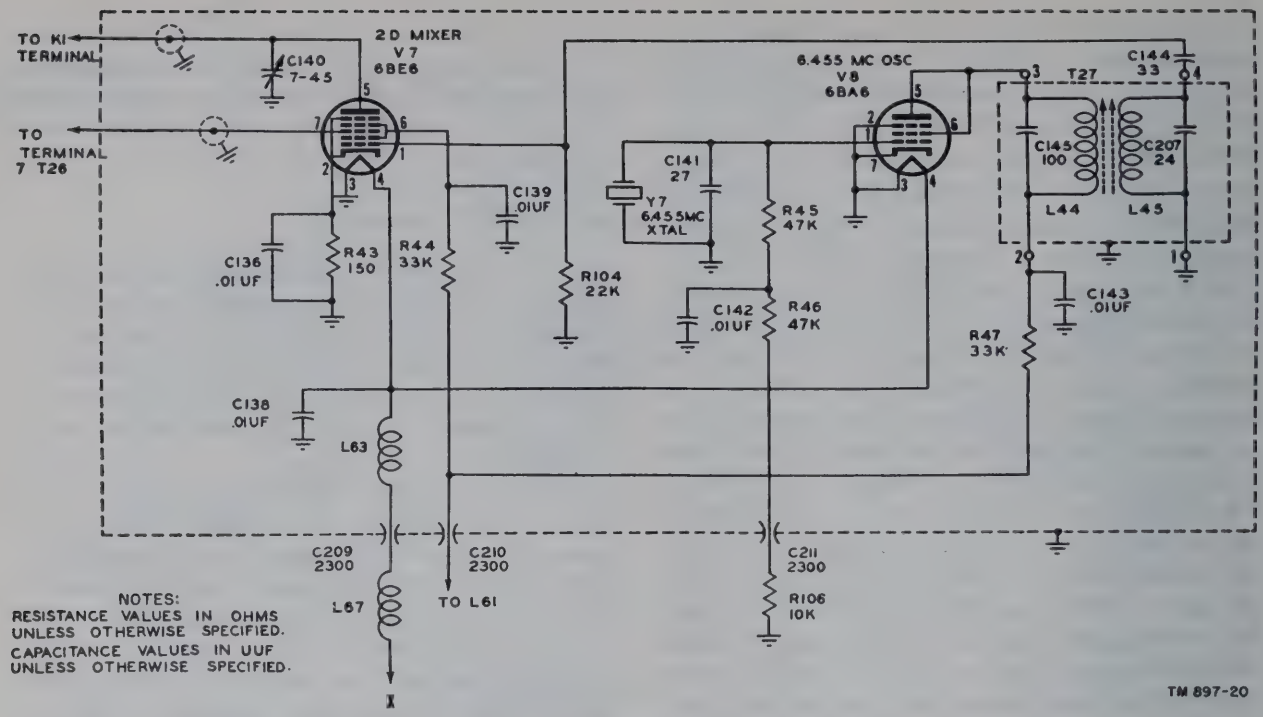


Figure 20. Radio Receiver R–274/FRR, functional diagram of 2d mixer and 6.455-mc oscillator.

intermediate frequency. R40 is the screen-dropping resistor which limits the screen current to a safe value. Note that no screen voltage is applied when switch S6 (fig. 43) is in the SEND position. Capacitor C132 effectively grounds the screen for intermediate frequencies.

d. The output of V6 is fed into the primary of T26, which is resonated to 6 mc by capacitor C133 and is tuned by means of a powdered-iron core inside the primary winding (L42). The lower end of L42 returns to +B through resistor R103. Capacitor C212 and resistor R103 form a filter which prevents any signal voltage from getting into the +B circuit, through which it could be fed into other stages.

47. 2d Mixer V7

a. The 2d mixer circuit is shown in figure 20. The 2d mixer tube (V7) is a type 6BE6 pentagrid converter tube which combines the 6-mc i-f signal with a signal coming from the 6.455-mc oscillator (V8) to produce a 455-kc signal. This 455-kc output then can be fed into the 455-kc i-f amplifier circuit for further amplification. In BANDS I, II, and III, the plate is shorted directly to +B without a load. Any spurious signals occurring at the plate of the tube are bypassed to ground through the power supply filter capacitors. In BANDS IV, V, and VI, the plate circuit includes the primary of the 1st 455-kc i-f transformer T28. This switching is accomplished automatically through the contacts of relay K1 (par. 43). The mixer tube plate current flows when the relay contacts are in either position.

b. The 6-mc i-f signal developed across the primary of transformer T26 (fig. 19) is inductively coupled to the secondary. The secondary is resonated to 6 mc by capacitor C134, and is tuned by means of a powdered-iron core inside the coil (L43). The 6-mc signal is fed from the secondary of transformer T26 directly into the signal injection grid of the 2d mixer tube (V7) through a coaxial cable. The purpose of the shield is to prevent any other signals from being picked up and fed into this grid.

c. R43 is the cathode resistor which limits the cathode current to a safe value. Capacitor C136 is the cathode bypass which effectively grounds the cathode at the signal frequencies. The screen (grid 6) of tube V7 is connected to +B through resistor R44 which limits the screen current to a safe value. Capacitor C139 effectively grounds the screen at the signal frequencies.

d. The output of the 6.455-mc crystal oscillator (V8) is fed through capacitor C144 into the first grid of tube V7. R104 acts as a grid leak re-

sistor in this injection circuit and develops the bias under which the circuit operates.

e. In BANDS IV, V, and VI, which are the bands using the 6-mc i-f strip, the output of tube V7, containing a 455-kc signal frequency, is fed into the primary of the 1st 455-kc i-f transformer (T28). The increased amount of coaxial cable used to connect the 2d mixer (V7) to transformer T28, over that used to connect the 1st mixer (V3) to transformer T28, upsets the tuning of the primary of transformer T28. Variable capacitor C140 is adjusted to compensate for this tuning shift in transformer T28.

f. Two choke coils (L63 and L67) are placed in the filament supply lead to reduce any tendency for signal frequencies to be reflected through the filaments of other tubes. These coils are common to the filament lead of the 6.455-mc crystal oscillator (V8).

48. 6.455-mc Crystal Oscillator V8

a. The functional diagram of the 6.455-mc crystal oscillator is shown in figure 20. It is a crystal-controlled oscillator using a type 6BA6 pentode tube (V8) connected as a triode. The output is fed to the first grid of the 2d mixer (V7) to be mixed with the 6-mc i-f signal to produce a 455-kc i-f signal at the plate of V7. In BANDS I, II, and III, the oscillator (fig. 43) has −24 volts of bias applied, and does not function. In BANDS IV, V, and VI, this bias is removed, allowing the stage to oscillate as required.

b. The crystal (Y7) is connected from the control grid to the cathode of the tube (V8). The cathode is grounded and the grid return, consisting of resistors R45, R46, and R106 in series, is grounded through the contacts of the turret switch when the receiver is operating in BAND IV, V, or VI. Operation in BAND I, II, or III opens the grounded connection and causes the grid to be returned to −24 volts dc through the coil of relay K1. Capacitor C141 is placed in parallel with the crystal to assist in stabilizing the frequency of oscillation and in minimizing the effects which might occur in changing crystals due to the variable amounts of capacity across various crystal holders. Capacitor C142 is an i-f bypass to prevent any 6.455-mc oscillation from being carried out of the subchassis which incloses the 2d mixer and 6.455-mc oscillator stages.

c. The screen grid tied to the plate of the tube (V8) is used as the plate of the oscillator circuit. The effective plate is connected to +B through the primary of transformer T27 in series with resistor R47. Capacitor C145 and inductor L44 form a fixed tuned tank circuit with a resonant frequency of 6.455 mc. The oscillator output is developed across this tank and is inductively coupled to the secondary coil (L45). Capacitor C207 broadly tunes the secondary coil of T27 to the output signal of the oscillator. Coupling to the 2d mixer is accomplished through capacitor C144. Capacitor C143 and resistor R47 form a filter to isolate the oscillator frequency from the +B circuit.

d. The suppressor of the tube (V8) is tied to the cathode and ground. This helps to stabilize the output of the tube.

e. Inductors L63 and L67 provide r-f isolation in the filament supply lead (par. 47*f*).

49. 1st 455-kc I-f Amplifier V9

The circuit of the 1st 455-kc i-f amplifier is shown in figure 21.

a. The 455-kc i-f amplifier stages are used at all times because they provide most of the amplification and control the receiver selectivity. When the set is tuned in BAND I, II, and III, the signal to the 1st 455-kc i-f amplifier comes from the 1st mixer (V3) through the contacts of relay K1. When the receiver is in BAND IV, V, or VI, the signal comes from the 2d mixer (V7) through relay K1.

b. The 455-kc i-f signal is fed to the primary of i-f transformer T28. The signal is coupled inductively to the secondary of transformer T28, and then goes to the grid of the 1st 455-kc i-f amplifier (V9) through coupling capacitor C148. Capacitor C148 prevents the agc voltage which is fed to the grid of tube V9 through resistor R51 from being shorted to ground through the secondary of transformer T28. Capacitor C147 resonates the primary of transformer T28 to 455 kc, and capacitor C149 resonates the secondary to 455 kc. Both of these capacitors are fixed; the tuning adjustments are the powdered-iron cores inside the transformer (T28). Since both the primary and secondary of transformer T28 are tuned, a high degree of selectivity can be obtained.

c. The tapped tertiary winding L48 (fig. 21) can be put in series with the primary of transformer T28 by means of switch S1 SECT. 1. This arrangement provides variable selectivity. There are six positions of switch S1 SECT. 1,

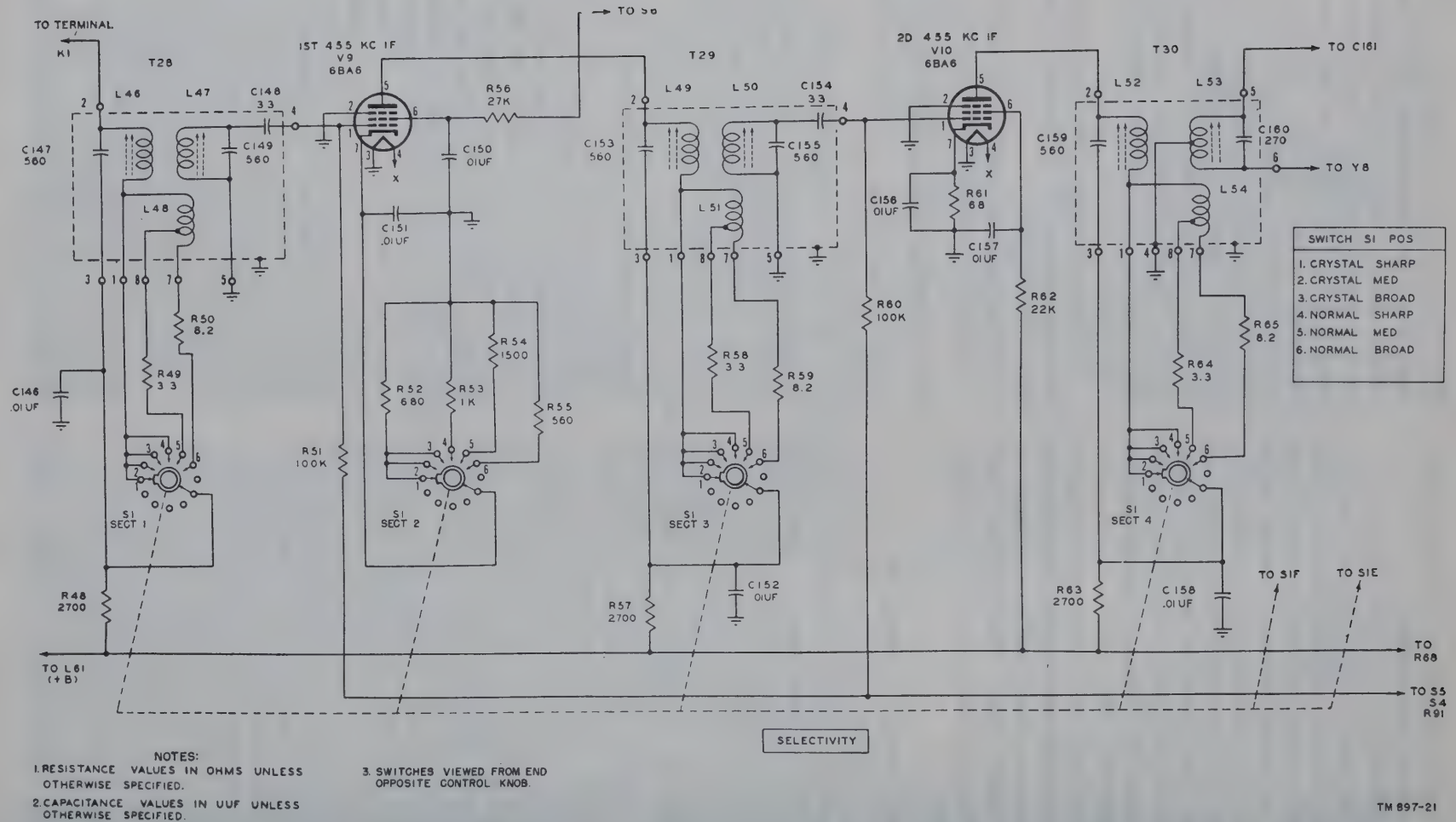


Figure 21. Radio Receiver R-274/FRR, functional diagram of 1st and 2d 455-kc i-f stages.

four of which have no effect on the 1st 455-kc i-f amplifier. In these four positions tertiary winding L48 is out of the circuit. In the fifth position of S1 SECT. 1, however, a part of L48 is in series with L46, the main portion of the primary, and in the sixth position, entire winding L48 is in the primary circuit. Physically, L48 consists of only a few turns of wire located very close to the secondary of T28. The inductance of L48 is so small that it does not appreciably change the tuning of the primary when switched into the circuit, but it greatly increases the coupling between the primary and secondary and consequently, increases the band width. The action of S1 SECT. 1 is as follows: The first three positions are for three degrees of crystal selectivity (par. 51*b*). The 1st 455-kc i-f amplifier circuit is the same for these three positions as for the fourth, which is the NORMAL SHARP position. The band width of the receiver in this position is about 3.25 kc. The fifth position of S1 SECT. 1 is the NORMAL MEDIUM position, and the band width is about 8.25 kc. In this position, a part of L48 is in the primary circuit. Damping resistor R49 also is in the primary circuit and prevents double peaks in the selectivity curve. The sixth position of S1 SECT. 1 is the NORMAL BROAD position, and the band width is about 14 kc. All of L48 is in the primary circuit, and damping resistor R50 prevents double peaks in the selectivity curve.

d. Since the primary of transformer T28 is connected to the plate of either tube V3 or V7, depending on which band is being used, the low side must return to +B. This return is made through resistor R48, which with capacitor C146, forms a filter preventing signals in the plate circuit of tube V9 from getting into other circuits of the receiver. R56 is the screen voltage-dropping resistor for tube V9, and capacitor C150 bypasses the screen to ground at 455 kc. No screen voltage is furnished when switch S6 is in the SEND position.

e. The cathode of tube V9 goes to ground through a resistor selected by switch S1 SECT. 2. Note that for the three crystal positions of switch S1 SECT. 2 resistor R52 is used. Resistor R53 is used in the NORMAL SHARP position, resistor R54 is used in the NORMAL MEDIUM position, and resistor R55 is used in the NORMAL BROAD position. This arrangement is made to compensate for the change in i-f amplifier gain which occurs when the coupling of the i-f transformers is changed. It also compensates for the difference in the audio signal out of the receiver, due to the change in band width. Capacitor C151 effectively grounds the cathode at 455 kc.

f. The output of tube V9 goes to the primary of the second 455-kc i-f transformer (T29) which is resonated by capacitor C153. Alinement of transformer T29 is made by means of adjustable powdered-iron cores. Transformer T29 has a tapped bandwidth expansion winding L51, which is switched in or out of this primary circuit in the same way as coil L48 in transformer T28. Damping resistors R58 and R59 are used to prevent double peaks in the selectivity curve of T29. The primary of transformer T29 returns to +B through resistor R57, which, with capacitor C152, forms a filter to prevent signals in the plate circuit of tube V9 from getting into other circuits through the +B lead.

50. 2d 455-kc I-f Amplifier V10

a. The 2d 455-kc i-f amplifier is shown in figure 21. The signal is coupled inductively from the primary of transformer T29 to the secondary which is tuned to 455 kc by capacitor C155. From the secondary of transformer T29, the signal goes through coupling capacitor C154 to the grid of the 2d 455-kc i-f amplifier tube (V10). Capacitor C154 prevents the age voltage (which is fed to the grid of tube V10 through resistor R60) from being shorted to ground through the secondary winding of transformer T29. R61 is the cathode resistor for tube V10. It prevents the cathode current from exceeding safe limits when there is no age voltage on the grid. Capacitor C156 is the cathode r-f bypass at intermediate frequencies. R62 is the screen voltage-dropping resistor for tube V10 which limits the screen current to a safe value, and C157 is the screen bypass capacitor.

b. The output of tube V10 goes to the primary of the 3d 455-kc i-f transformer (T30). This primary circuit is the same as the primary circuits for transformers T28 and T29. It is resonated to 455 kc by capacitor C159, and has the tapped expansion winding L54 which is controlled by switch S1 SECT 4. R64 and R65 are damping resistors which prevent double peaks in the selectivity curve. The primary of transformer T30 returns to +B through resistor R63, which with capacitor C158, forms a filter to prevent signals in the plate circuit of tube V10 from getting into other circuits through the +B lead.

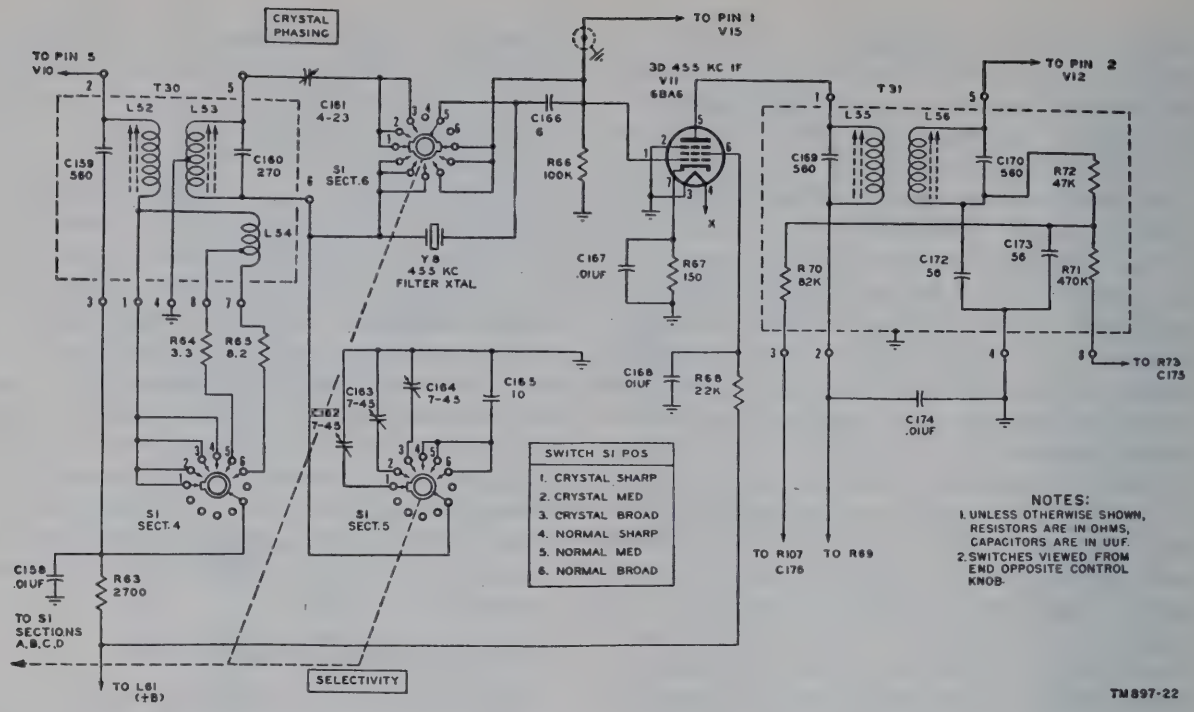


Figure 22. Radio Receiver R–274/FRR, functional diagram of 3d 455-kc i-f stage and crystal filter.

51. 3d 455–kc I-f Amplifier V11

a. General.

(1) The 3d 455-kc i-f amplifier circuit is shown in figure 22. R66 is shown as the grid leak resistor for tube V11. Resistor R67 is the cathode resistor which keeps the total cathode current within safe limits and develops the bias under which the tube operates. Capacitor C167 is the cathode bypass which effectively grounds the cathode at intermediate frequencies. R68 is the screen voltage-dropping resistor, and capacitor C168 effectively grounds the screen of tube V11 at intermediate frequencies. The output of tube V11 goes to primary L55 of the 4th 455-kc i-f transformer T31. This primary circuit is resonated by capacitor C169. It is returned to +B through resistor R69, which with capacitor C174, forms a filter which prevents the signal in the plate circuit of tube V11 from getting into other circuits of the receiver.

(2) The signal in the primary of transformer T30 is coupled inductively to the secondary which is resonated to 455 kc by capacitor C160. Note that this secondary (L53) is different from the secondary circuits for the preceding i-f transformers in that it is tapped, and the tap is connected to ground. This arrangement is used because this secondary drives the crystal filter when the latter is being used. The action of these circuits can be described best by considering the conditions when the crystal filter is in in use, and the normal or noncrystal mode of operation.

b. Crystal Operation. Switch S1 SECT. 5 and SECT. 6 (fig. 22) determine whether the operation includes or bypasses the 455-kc filter crystal. The total voltage across the secondary (L53) of transformer T30 can be thought of as two separate voltages. The first is the voltage from ground to the top portion of L53. This voltage sends i-f current through capacitor C161, through the parallel combination of resistor R66 and the input capacities of tubes V11 and V15, and back to ground. The second voltage is that from ground to the lower end of L53. This voltage sends a signal through crystal Y8 through R66 in parallel with the input capacities of tubes V11 and V15, and back to ground. At signal frequencies different from its series resonant frequency, crystal Y8 acts like a pure capacity. Therefore, since the

two secondary voltages (in L53) are opposite in phase, the two currents through resistor R66 tend to cancel each other. In fact, when the phasing capacitor (CRYSTAL PHASING) C161, is adjusted accurately, these currents do cancel, and the voltage at the grids of tubes V11 and V15 is zero. Near series resonance, crystal Y8 does not behave like a high capacitive reactance but rather like a relatively low resistance. Therefore, the two currents will have a smaller phase difference as well as a considerable difference in amplitude, and some signal voltage will be developed in the input circuits of tubes V11 and V15. Because its Q is high, the losses in crystal Y8 are very small and therefore, the frequency range over which the voltage unbalance occurs is quite small. This is the reason for the high degree of selectivity of a crystal filter. To some extent, the equivalent resistance in the secondary circuit of transformer T30 affects the operation of the crystal filter. When this resistance is high (as it is when inductance L53 and capacitor C160 are *exactly* resonant at the series resonant frequency of crystal Y8), the selectivity curve is broadened, because the effective circuit Q is lowered. The bandwidth of the crystal filter circuit can be varied by the degree of mistuning of the secondary circuit of transformer T30. This is done to vary the bandwidth from 200 cycles to 500 cycles to 1,500 cycles as the selectivity switch is changed from CRYSTAL SHARP to CRYSTAL MEDIUM to CRYSTAL BROAD. When selectivity switch S1 SECT. 5 is in the CRYSTAL SHARP position (fig. 22), capacitor C162 is across part of the secondary of transformer T30. It is adjusted so that the secondary is mistuned just enough that the bandwidth is 200 cps. In the CRYSTAL MEDIUM position, capacitor C163 is in the circuit, adjusted to a different capacity, and the bandwidth is 500 cps. In the CRYSTAL BROAD position, capacitor C164 is in the circuit, and the mistuning of the secondary of T30 is very slight, therefore, the bandwidth is 1,500 cps. In actual operation of the receiver, the phasing control (capacitor C161) can be adjusted to give a high degree of rejection at a frequency slightly different from that at which maximum response occurs. Furthermore, the exact frequency at which this rejection occurs can be varied. This characteristic can be used to reject an undesirable signal which is at a frequency close to the frequency of the desired signal.

c. Normal (Noncrystal) Operation. The simplified equivalent of the 3d 455-kc i-f amplifier circuit (crystal filter), together with SECTS. 5 and 6 of S1, when the selectivity switch is in NORMAL SHARP position, can be pictured by considering all the sections of switch S1 to be placed in position 4 (NORMAL SHARP) (fig. 22). The voltage in the lower part of L53 is sent to the grid of tube V11 through capacitor C166. Capacitor C166 has a low value (6 uuf (micromicrofarad)) so that the gain under noncrystal conditions will be in the proper proportion to the gain under crystal operation. Capacitor C165 replaces variable capacitors C162, C163, and C164 which were in the circuit for crystal operation.

52. I-F Output

a. The simplified circuit diagram of the i-f output circuit is shown in figure 23. This circuit provides sufficient power at 455 kc to operate auxiliary devices such as radioteletype equipment. The i-f output circuit is designed to provide an approximate .25-volt output across a 70-ohm load with 2 uv r-f input signal. This circuit also feeds a signal through C171 to the agc diode (1/2 of V13). The amplitude of this signal depends on the amplitude of the carrier signal fed into the receiver at the antenna.

b. As seen in figure 23, the grid of the 455-kc i-f output tube, V15, is connected in parallel with the grid of the 3d 455-kc i-f amplifier tube V11. Thus, the same signal which drives tube V11 also drives tube V15. The output of tube V15 goes to the primary of transformer T32 which is resonated to 455 kc by capacitor C180. The secondary coil of transformer T32 is of the low-impedance type, that is, it consists of only a few turns, and it is not tuned. The output of this low-impedance secondary coil is connected to i-f output jack J2.

c. The low side of the primary of transformer T32 and the screen of tube V15 are connected to +B through resistor R75, which, with capacitor C179, form a filter which prevents signals in the plate and screen circuits of tube V15 from getting into other circuits of the receiver through the +B lead. R74 is the cathode bias resistor of tube V15. C178 is the cathode bypass capacitor which effectively grounds the cathode at intermediate frequencies.

d. The tuned primary of transformer T32 adds very little to the selectivity of the system. This means that any signal which gets into the grid of tube V15 is available at output jack J2.

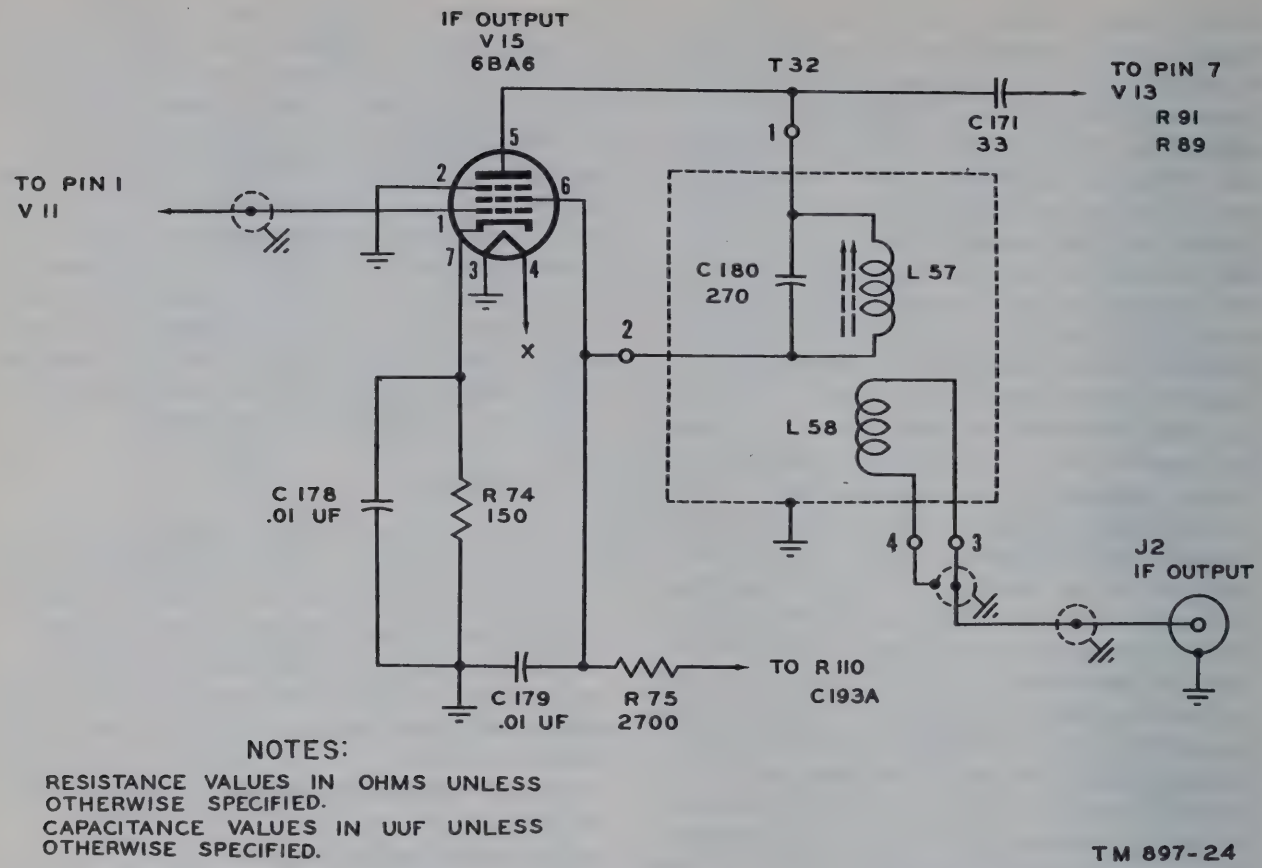
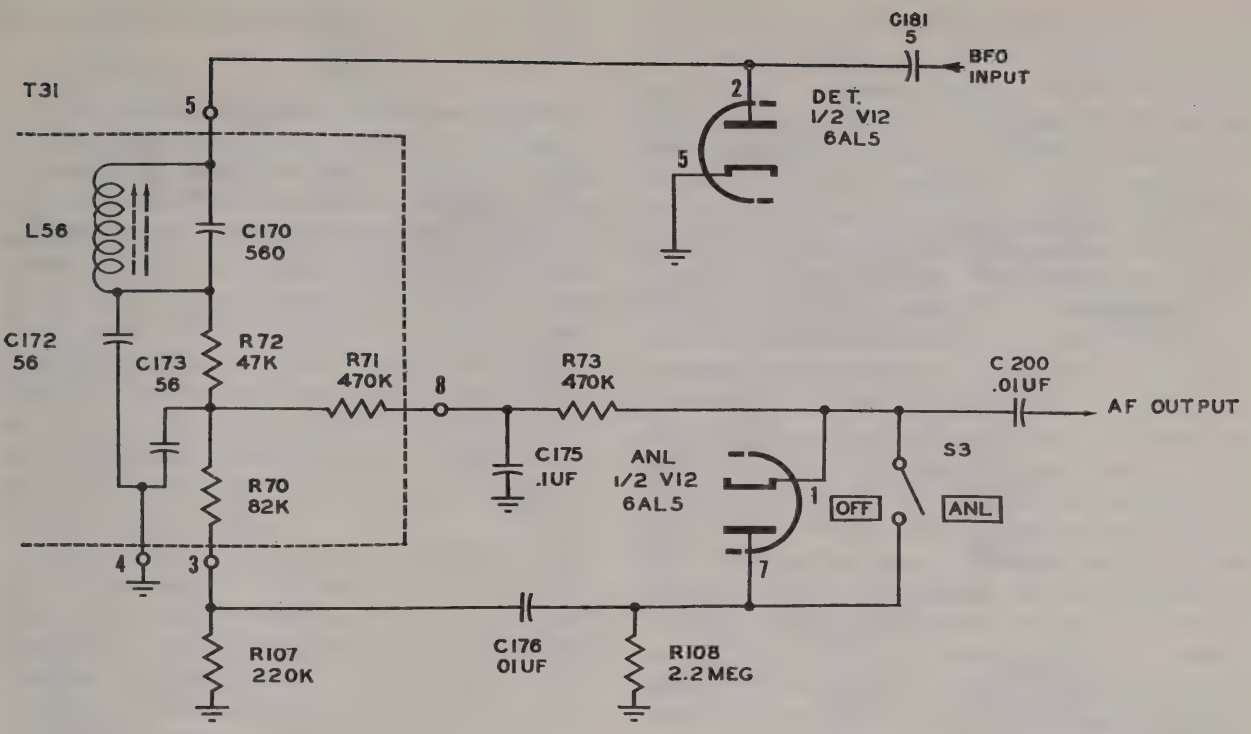


Figure 23. Radio Receiver R–274/FRR, functional diagram of i-f output stage.

53. Audio Detector

The simplified circuit diagram for the audio detector is shown in figure 24. It is a standard diode detector circuit which uses ½ of tube V12 (6AL5) for the diode. The signal in the primary of the 4th 455-kc i-f transformer (T31) is coupled inductively to the secondary which is resonated to 455 kc by capacitor C170. This voltage is impressed on the plate of the audio detector (½ of V12) and when this plate is driven positive with respect to the cathode, current flows through resistors R72, R70, and R107. No current flows during the negative half of the alternating voltage swing. The current through this path is a pulsating unidirectional flow. Capacitors C172 and C173 store up electrical energy during the passage of current and release it between pulses so that the actual current through the resistors is very nearly a smooth, direct current. Since the amplitude of the voltage impressed on the audio detector (½ of V12) varies with voice modulation, the amplitude of current pulses through the resistance paths also varies with modulation. Capacitors C172 and C173 are small; therefore, energy is not stored over the long periods of time required by the a-m frequencies, which are all much lower than the intermediate frequency. Therefore, the current through resistor R107 is direct current in nature (negative with respect to ground), and varying in magnitude according to the audio modulation. If the current through this resistor varies with modulation, then the voltage across it also must vary in the same way. This audio voltage is coupled through capacitor C176 and developed across resistor R108. The a-f voltage across resistor R108 may be coupled directly through coupling capacitor C200 to the input of the 1st a-f amplifier (V16), or it may have to pass through the automatic noise limiter (the second half of tube V12) before reaching the input to the audio amplifier. Switch S3, in the OFF position, sends the audio signal directly to the audio amplifier or, in the ANL position, sends the signal through the ANL (automatic noise limiter) before it goes to the audio amplifier.



NOTES:
RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
CAPACITANCE VALUES IN UUF UNLESS OTHERWISE SPECIFIED.

TM 897-23

Figure 24. Radio Receiver R–274/FRR, functional diagram of the audio detector and anl stages.

54. Automatic Noise Limiter

The simplified ANL circuit diagram is shown in figure 24. When the ANL-OFF switch (S3) is in the ANL position, the audio signal must pass through the ANL diode (½ of tube V12) before it can reach the audio amplifier. The cathode of this diode is tied to the junction of resistors R72 and R70 in the audio detector circuit through series resistors R73 and R71. Resistors R71 and R73, together with capacitor C175, form a filter network to provide a smoothed-out negative d-c voltage to the cathode of the ANL which varies with the average level of the a-f signal. The audio voltage developed across resistor R108 is applied to the plate of the ANL when no noise is present. This audio voltage always will be positive with respect to the reference voltage at the cathode of the diode, and the signal will be coupled through to the audio amplifier input. Noise, due to static interference, will result in sharp peaks of negative voltage across resistors R107 and R108. Because of the time constant in the ANL cathode circuit, these pulses will not reach the cathode. When the noise pulse tends to feed through the audio circuit, the diode plate of the ANL tube (½ of V12) will be more negative than its cathode, and the noise pulse will be blocked before it reaches the audio amplifier.

55. Beat-Frequency Oscillator

(fig. 25)

a. For the reception of c-w signals, it is necessary to have a bfo. In this receiver, the bfo operates near 455 kc and is coupled directly to the audio detector input. The simplified schematic of the bfo circuit is shown in figure 25.

b. It can be seen in figure 25 that the bfo tube (V14) is connected in a Hartley type oscillator with the cathode connected to a tap on the oscillator transformer (T33). R76 is the grid resistor which permits bias to be developed on the grid, and capacitor C184 is the means of coupling the grid to the high side of the oscillator transformer (T33). The oscillator transformer is resonated to 455 kc by capacitor C185 which has a fairly high value (680 μuf) so that the circuit will have good frequency stability. Capacitor C177 has a negative temperature coefficient so that the

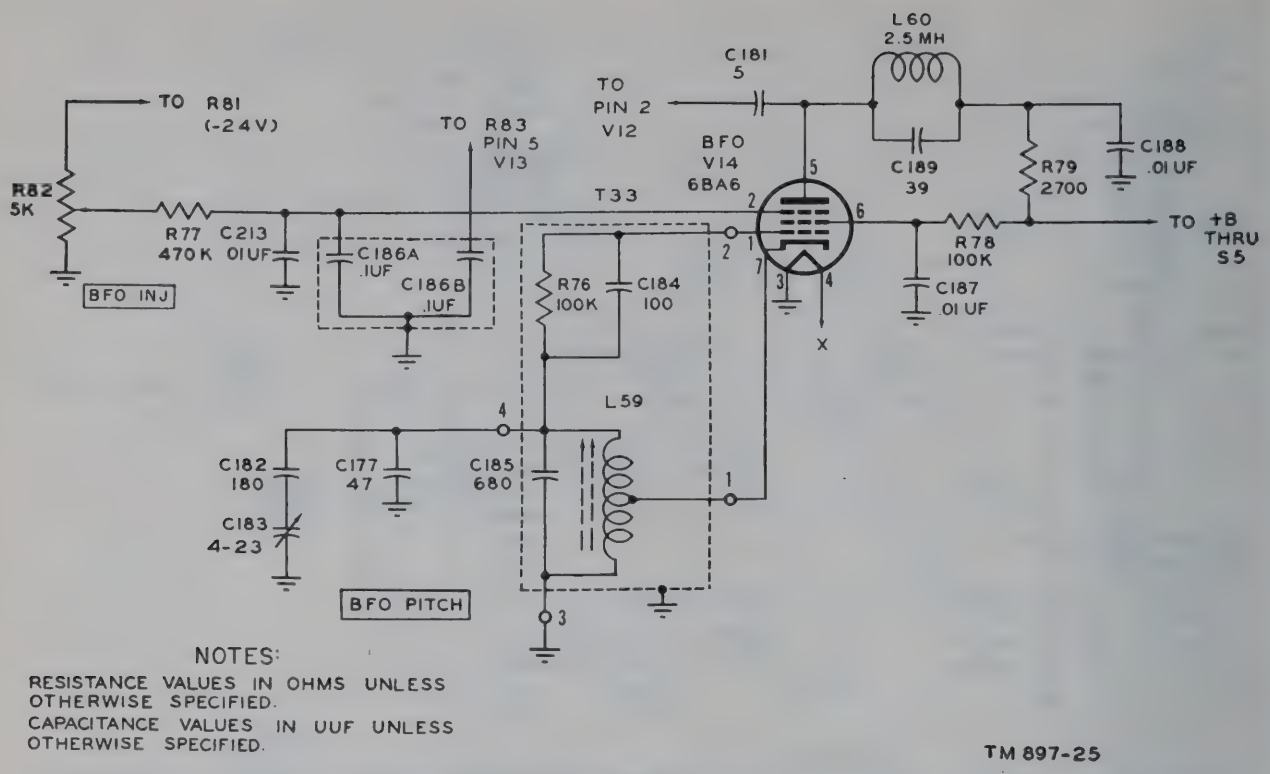


Figure 25. Radio Receiver R–274/FRR, functional diagram, bfo stage.

frequency of the oscillator will not change as the receiver warms up or as the ambient temperature changes. Capacitor C183 is the BFO PITCH control by which the frequency of the bfo can be varied above or below 455 kc. Capacitor C182 limits the ability of C183 to change the oscillator frequency, and its value of 180 μuf was chosen so that C183 would change the frequency by plus or minus 3.5 kc of 455 kc.

c. The screen grid of V14 is the effective plate of the tube in the Hartley oscillator circuit. Since both the grid and the cathode are above ground, the *plate* can be grounded so far as the oscillator frequency is concerned. This is done by screen bypass capacitor C187. Screen grid voltage-dropping resistor R78 is of such a value that the amplitude of oscillation will be right for optimum mixing in the audio diode detector (½ of V12) circuit.

d. The output of the bfo is electron-coupled to the plate circuit of tube V14, where the voltage is developed across the parallel combination of r-f choke L60 and capacitor C189 which are broadly resonant to 455 kc. This output voltage is coupled by capacitor C181 to the plate (pin 2) of the signal audio diode detector (½ of V12) where it is mixed with the c-w signal to give an audio note. The small value of capacitor C181, plus the fact that the bfo circuit is of the electron-coupled type, results in a minimum of *pulling* of the bfo by strong signals.

e. The low side of L60 is connected to +B through resistor R79, which with capacitor C188 form a filter which prevents the bfo signal from getting into other circuits of the receiver. The CW-MODULATION switch S5 also is in this screen and plate return so that the bfo can be switched off during reception of a-m signals.

f. Sometimes, it is desirable to adjust the amplitude to the bfo output to give optimum mixing in the audio detector circuit. This is done by means of the BFO INJ control (R82) on the rear of the chassis. This adjustment varies the amount of negative bias applied to the suppressor of tube V14 and thus, effectively varies the degree of electron coupling between the beat-frequency oscillator and its output circuit, permitting an approximate ten-to-one variation of bfo injection to the audio detector. A filter composed of resistor R77 and capacitors C186A and C213 is used to eliminate any tendency for hum to be introduced into the suppressor of tube V14. The suppressor of V14 is bypassed to ground at the bfo frequency by capacitors C213 and C186A.

56. Automatic Gain Control

(fig. 26)

a. The automatic gain control operates in conjunction with the r-f gain control to provide a negative bias voltage for tubes V1, V2, V9, and V10, to control the over-all amplification of the receiver. When switch S4 (AGC-MANUAL) is in the MANUAL position, the RF GAIN-AC control (R83) acts alone to provide this bias. When switch S4 is in the AGC position, strong incoming signals will work through the agc tube (V13) to increase the bias beyond the amount selected by the manual RF GAIN-AC control (R83) and reduce amplification so that the a-f output will remain fairly constant for a variety of input signal strengths.

b. For a simplified schematic diagram of the bias voltage source with switch S4 set in the MANUAL position, refer to figure 26A. A regulated +105-volt source connects to resistor R84. Resistors R84, R86, R87, and R88 in series, form a voltage divider network to ground which results in creating a steady +10-volt value at the junction of resistors R84 and R86. Another network, using resistors R89 and R91 in series, connects the +10-volt junction to the slider arm on RF GAIN-AC control R83. When the RF GAIN-AC is turned fully clockwise, the tap is at the grounded end of resistor R83, and when the control is turned as far as possible counterclockwise (without turning off the a-c power), the tap is at the −18-volt d-c end of resistor R83. There is a 6-volt drop across resistor R111. C195 is a l-f bypass capacitor. The bias voltage output lead is connected to the movable tap on RF GAIN-AC control R83. Capacitors C58 and C186B smooth out the action of the RF GAIN-AC control. The voltage appearing as bias for tubes V1, V2, V9, and V10 is the same as that appearing at the movable tap of RF GAIN-AC control R83.

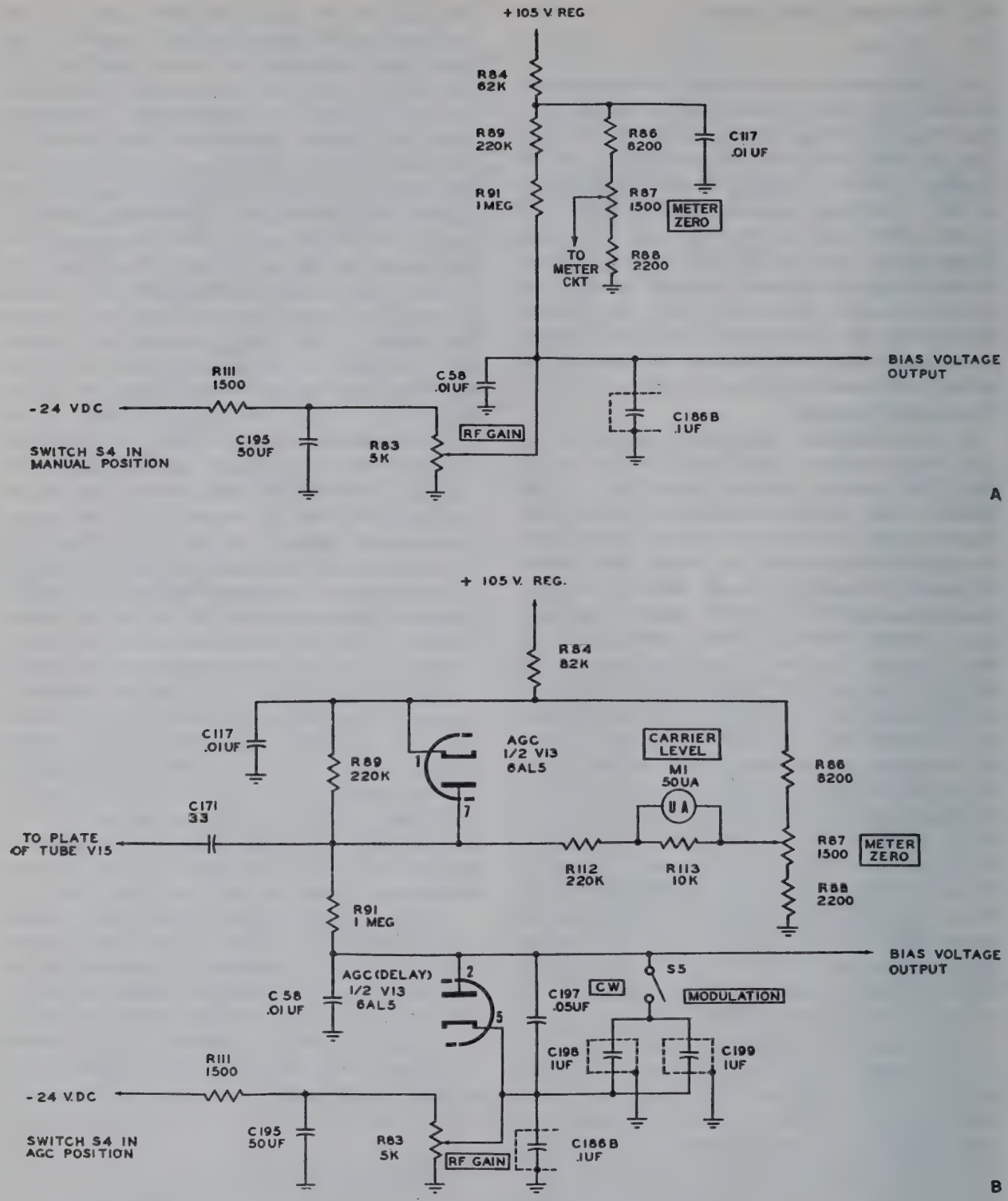
c. For a simplified schematic showing the bias voltage source with switch S4 set in the AGC position, refer to figure 26B. The bleeder network, consisting of resistors R84, R86, R87, and R88, from +105 volts regulated to ground, acts the same as explained in *b* above, with +10 volts direct current appearing at the junction of resistors R84 and R86. The second voltage network, using resistors R89 and R91 also is connected as explained in *b* above, except that an agc (delay) diode (½ of V13) is in series. The i-f signal at the plate of the tube (V15) is coupled through capacitor C171 to the agc diode plate (pin 7). The amplitude of this signal will be indicative of the input signal voltage to the 1st r-f amplifier (V1). The agc tube (½ of V13) is in parallel with resistor R89, which acts as the diode load. This circuit shifts the voltage appearing at the junction of resistors R89 and R91 in a negative direction. The larger the signal becomes, the greater the negative voltage will be. The voltage tapped on the RF GAIN-AC control (R83) is connected to the cathode of the agc (delay) tube (½ of V13). As long as the voltage at the junction of resistors R89 and R91 is more positive than the voltage at the cathode of the diode, the diode will conduct and will cause the voltage appearing at its plate to be the same as the voltage tapped on the RF GAIN-AC control (R83). This voltage is connected to the bias voltage output. As soon as the negative voltage developed at the junction of resistors R89 and R91 is the same as that tapped on the RF GAIN-AC control (R83), all current stops flowing through the agc (delay) tube (½ of V13), and any greater negative voltage developed at the junction of resistors R89 and R91 will be connected through resistor R91 to the bias voltage output. Since the plate voltage on the agc (delay) diode (½ of V13) is more negative than its cathode voltage, it will be cut off until signal strength is reduced. The values of resistor R91 and capacitors C58 and C197, which form a filter, prevent sudden changes in the automatic bias developed. For c-w operation, switch S5 connects capacitors C198 and C199 into the filter to increase the time constant and reduce any tendency to change the bias during periods of silence (spaces) between transmission times for this type of reception.

d. When switch S4 is set in the AGC position (fig. 26B), the CARRIER LEVEL meter is connected between the junction of resistors R89 and R91 and a tap on the METER ZERO potentiometer (R87). As the stronger signals are tuned, a corresponding change of voltage at the junction of resistors R89 and R91 ,changes the voltage applied to the meter circuit and, therefore, the current through it.

57. Carrier Level Meter

(fig. 26B)

a. The carrier level meter (M1) is a 50 microammeter with its scale marked in decibels. It shows the relative strength of the signal tuned by the receiver. It also may be used as a tuning



NOTES:

RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
CAPACITANCE VALUES IN UUF UNLESS OTHERWISE SPECIFIED.

TM 897-27

Figure 26A and B. Radio Receiver R-274/FRR, functional diagram, agc and meter circuits.

meter if each incoming signal is tuned for maximum deflection of meter M1. Switch S4 must be in the AGC position for the meter to operate.

b. With a 2- to 3-uv input from the antenna to the antenna terminals, the voltages applied at the two ends of the meter circuit will be identical and no current will flow through the meter (M1). For adjustment instructions, refer to paragraph 87. When a stronger signal is tuned, the voltage at the junction of resistors R89 and R91 becomes more negative than the voltage at the tap on the METER ZERO potentiometer (R87), and a current will flow through the meter circuit. Resistor R112, in series with meter M1, limits the maximum flow of current to a safe value. The combination of resistor R112, in series and resistor R113, which is in parallel with meter M1, regulate the quantity of current which flows through the meter with respect to the voltage applied to the circuit.

c. Under normal conditions, with no tuned signal input to the 1st r-f amplifier, the voltage at the junction of resistors R89 and R91 will be a little more positive than the voltage tapped on METER ZERO potentiometer R87, and a small amount of current will flow through meter M1 in the direction opposite to normal, and the meter needle will deflect to the left-hand side of the scale. No damage will result since the force is very slight.

58. 1st A-f Amplifier

a. The 1st a-f amplifier (V16) is a resistance-coupled triode type 6AT6 tube, in which the diode plates are grounded and not used. The simplified circuit diagram is given in figure 27.

b. The audio signal from the diode detector and anl circuits is fed to the high side of the AUDIO GAIN control (R94) through coupling capacitor C200 which blocks off the d-c voltage from the anl load. A part of this audio voltage, depending on the setting of the AUDIO GAIN control, is sent to the grid of tube V16 where it is amplified. The output voltage appears across resistors R96 and R117 in the plate circuit of tube V16. Capacitor C196 improves the frequency response of the audio amplifier. The plate circuit is connected to +B through resistor R97. Capacitors C194A and C194B form a filter, with the aid of resistor R97, to prevent any audio frequencies from entering the power supply circuits.

c. R95 is the cathode resistor for tube V16 and provides the proper d-c bias between grid and cathode so that a minimum of audio distortion will be introduced by tube V16. Capacitor C202 is a bypass across R95 so that the cathode of V16 will be at ground potential insofar as the signal frequencies are concerned.

d. The receiver is provided with 2 terminals (AUDIO IN) so that external audio signals can be introduced to the audio section of the receiver and be amplified. One of these terminals is connected to the chassis, and the other is connected to the high side of the AUDIO GAIN control through coupling capacitor C201 which prevents d-c voltages from being impressed on the grid of tube V16.

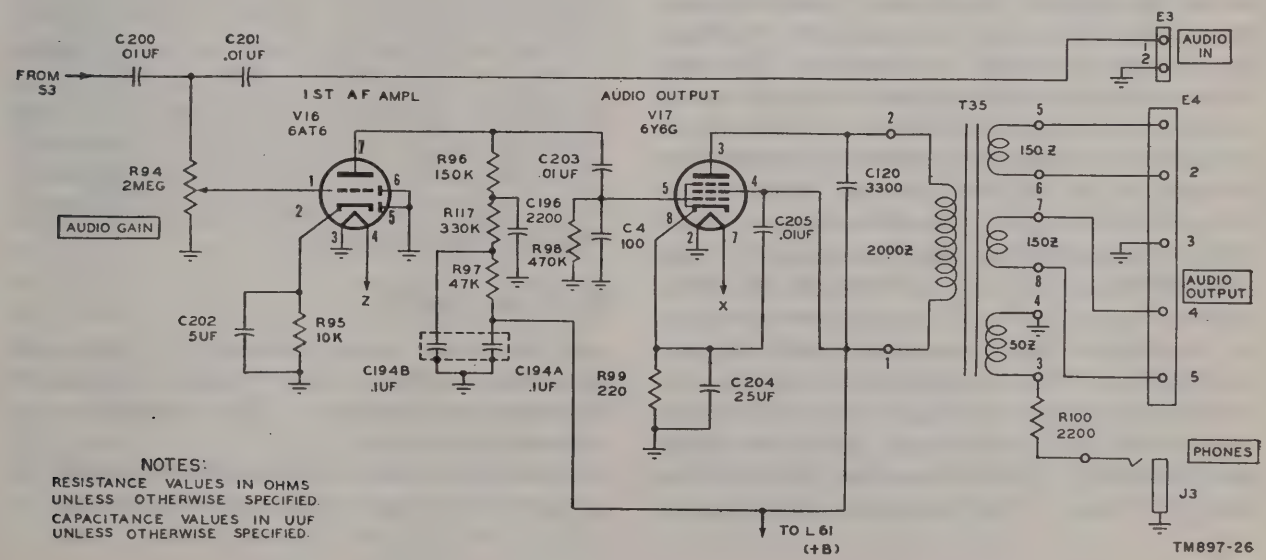


Figure 27. Radio Receiver R-274/FRR, functional diagram of the audio stages.

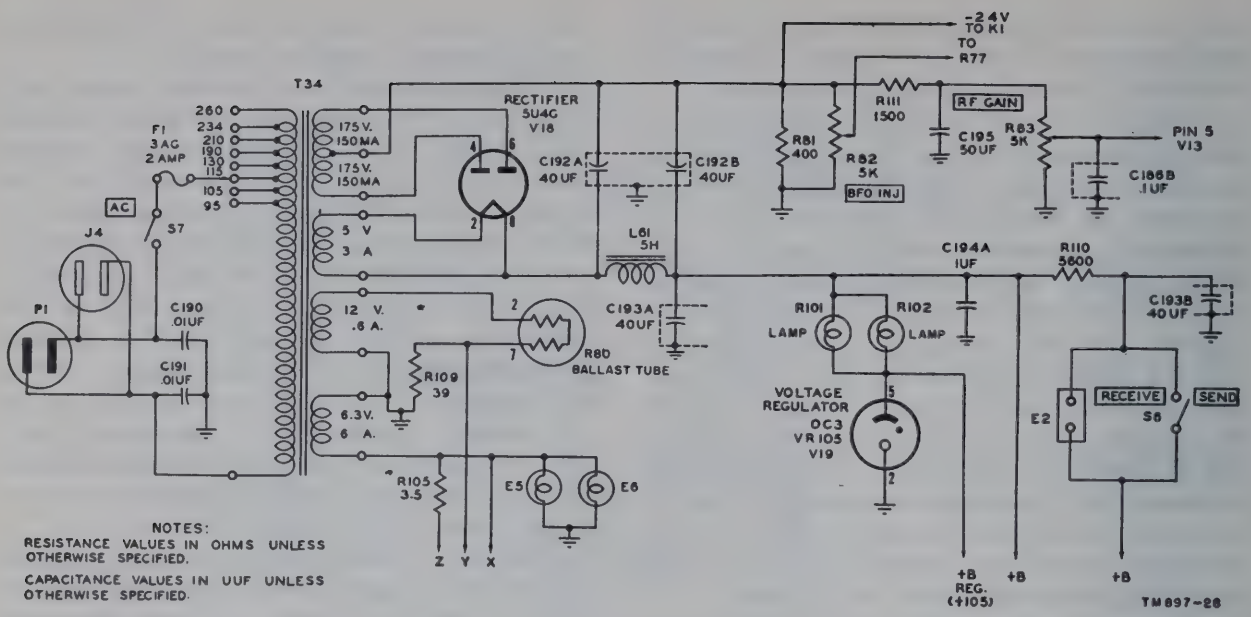


Figure 28. Radio Receiver R–274/FRR, functional diagram of the power supply.

59. Audio Output Amplifier

a. The a-f amplifier (V17) is capable of providing two watts of undistorted audio output. The simplified circuit is shown in figure 27.

b. The audio signal from tube V16 is fed to the grid of tube V17 through coupling capacitor C203 which prevents the d-c plate voltage of V16 from appearing on the grid of V17. Resistor R98 is the grid return of V17. Capacitor C4 is an r-f bypass, used to short out any spurious r-f voltages. The audio signal on the grid of V17 is amplified and goes to the primary of the audio output transformer T35 which has three secondary windings. Two of the secondary windings on T35 are 150-ohm windings and are connected to the audio output terminal board at the rear of the receiver. A ground terminal 3 also is provided. With this arrangement, a 600-ohm output load, either balanced or unbalanced, can be matched. Also, since the two secondaries constituting the 600-ohm output circuit are individually wired to the audio output terminal board (E4), a d-c control system can be connected to the output circuit without causing any interference with the a-f output.

c. The third output winding on transformer T35 is connected to PHONES jack J3 on the front panel, through a 2,200-ohm resistor R100. This circuit is designed so that phones or either high or low impedance can be plugged into PHONES jack (J3) without changing the power output to the 600-ohm load. If J3 is short-circuited, the output power to the 600-ohm load is reduced by less than 1 db.

d. R99 is the cathode resistor for Tube V17 and provides the proper bias between grid and cathode for minimum audio distortion. It also limits the plate and screen currents to safe values. Capacitor C204 is the cathode bypass which effectively grounds the cathode of V17 insofar as a-f signals are concerned. Capacitor C205 suppresses spurious oscillations in V17. Since V17 (JAN 6Y6G) is a beam-power amplifier, such oscillations might occur if the screen were not bypassed directly to the cathode. The screen grid of tube V17 is connected directly to +B, and the plate is connected to +B through the primary winding of transformer T35. Capacitor C120 improves the frequency response of the audio output.

60. Power Supply

a. The power supply provides d-c plate and bias voltages and a-c heater voltage to all the circuits previously described. The simplified circuit is shown in figure 28.

b. Power for Radio Receiver R–274/FRR is brought in through power socket P1, which is

connected in parallel with AC OUT receptacle J4. One side of P1 is connected to the common terminal of the power transformer T34; the other side goes through the power RF GAIN-AC switch S7, on the RF GAIN-AC control (R83), then through the 2-ampere fuse (F1) to the proper tap on the power transformer (T34) primary. The taps are connected to binding posts on the base of transformer T34. These binding posts are located under the chassis and are identified with the following markings: 260, 234, 210, 190, 130, 115, 105, and 95. Determine the value of a-c power voltage and connect the flexible lead to the binding post marked with the value which most nearly approximates the value of input voltage. The transformer (T34) is designed for operation at 50 or 60 cycles. C190 and C191 are filter capacitors which prevent unwanted r-f signals from getting into the receiver through the power supply.

c. The h-v (high-voltage), center tapped secondary of transformer T34 is connected to the two plates of power rectifier V18 (5U4G). The rectifier filament is connected to the 5-volt rectifier filament winding of T34. The center tap of the h-v secondary of T34 is connected to ground through the paralleled resistors R81, R82, R111, R83, and R35, so that approximately −24 volts direct current appears between the high side of these resistors and ground. One side of the filamentary cathode of tube V18 is connected through filter choke L61 to the various B+ load circuits. Capacitors C192A and C192B filter out the a-c ripple voltage across the entire B+ rectifier system, and capacitor C193 further reduces the ripple or hum voltage from B+ to ground. Capacitor C194A assists in the filtering of the B+ lead, since electrolytics are inefficient at higher frequencies. Capacitor C195 filters the ripple across the bias voltage resistors R81, R82, R111, R83, and R35. Since it is desirable to stabilize (against normal power source voltage fluctuations) the voltage on the variable frequency oscillator plate, the 1st mixer screen, the bfo screen and plate, and the CARRIER LEVEL meter circuits, a voltage regulator, V19 (OC3, VR105) is included in the power supply. This is connected to +B through the parallel combination of R101 and R102, each of which is a 7-watt, 110-volt lamp. If one should fail, the other will permit operation of the receiver until a replacement can be obtained. In order to desensitize the receiver under some operating conditions, switch S6 (SEND-RECEIVE) has been incorporated in the +B lead to the screens of tubes V1, V2, V6, and V9. This permits the receiver to be desensitized without stopping the oscillators. The SEND REC terminal board (E2) which is connected in parallel with S6 can be used to desensitize the receiver from a remote position. Set switch S6 to the SEND position before using a remote control switch.

d. The negative 24 volts across the parallel combination of resistors R81, R82, R111, R83, and R35 is used for three purposes. First, by means of the RF GAIN-AC control, R83, any desired portion of this voltage to −18 volts can be impressed on the grids of the r-f and i-f amplifier tubes through the agc and bias voltage lead, thereby, controlling the gain of the receiver. Secondly, by means of the BFO INJ control (R82), any desired portion of the −24 volts can be impressed on the suppressor grid of the bfo tube (V14) through resistor R77. This acts as a bias to regulate the degree of electron coupling to the plate of the bfo tube, regulating the amplitude of bfo signal to the plate of the audio diode detector. The third use for −24 volts is to provide cut-off bias to the 6.455-mc oscillator (V8) when the turret switch is set in BAND I, II, or III, or actuating voltage for relay K1 when the turret switch is set in BAND IV, V, or VI.

e. The heater circuits of tubes V1, V2, V5, V6, V7, V8, V9, V10, V11, V13, V14, V15, and V17 are connected directly to the 6.3-volt winding of the power transformer, T34. Tubes V12 and V16 are important from the standpoint of hum in the audio amplifier. Hum can be reduced by reducing the heater voltage of a tube. Therefore, the voltage on the heaters of V12 and V16 is reduced by resistor R105 to approximately 5.5 volts. The heater voltage regulation of the vfo tube (V4) and on the 1st mixer tube (V3) has an important bearing on the frequency stability of the receiver and must be maintained without reflecting any line voltage variations. Therefore, these two heaters are connected to a separate 12-volt winding in T34 through regulating resistor R80. This resistor drops the heater voltage on V3 and V4 to 6.3 volts, and, in addition, maintains a nearly constant current through these tubes regardless of line voltage fluctuations. The two pilot lights (E5 and E6) are connected directly to the 6.3-volt winding on the power transformer (T34).

61. Control Circuits

Terminal board E2, with connections which parallel the SEND-RECEIVE switch (S6), may be used to connect a switch at a remote position to activate or desensitize the receiver. The remote switch should be a SPST switch. It should be insulated from ground because of the power supply voltage furnished through the switch for screen grid voltage on tubes V1, V2, V6, and V9. When the switch is closed, the voltage is applied to the screen grid circuits and the receiver is activated. This corresponds to the RECEIVE position of switch S6. When the remote switch is open, the screen grids receive no voltage and the receiver is desensitized without stopping the oscillators. This corresponds to the SEND position of switch S6. Note that switch S6 must be in the SEND position before the remote switch has any control on circuit operation. Note also, that the remote switch must be open before switch S6 has control of circuit operation.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Warning: There are certain points in the radio receiver that operate at voltages above 250 volts. These points are located in the vicinity of the power supply section and should not be touched while power is applied to the receiver. Be careful when handling or testing any part of the receiver while it is connected to the power source.

62. Trouble-Shooting Procedures

a. General. The first step in servicing a defective radio receiver is to sectionalize the fault. Sectionalization means tracing the fault to the *major component or circuit* responsible for the abnormal operation of the receiver. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults such as burned-out resistors, arcing, and shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by *checking voltages and resistances.*

b. Component Sectionalization and Localization. A group of tests are listed below which are arranged to simplify and reduce unnecessary work in tracing a trouble to a specific component. The easy tests are used first; those that follow are more complex. Follow the sequence given. Remember that servicing procedure should cause no further damage to the receiver. In general, the trouble is traced to a section of the receiver; then the bad component in that section is located and the trouble remedied. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 35) is to locate any visible trouble. Through inspection alone, the repairman may frequently discover the trouble or determine the stage in which the trouble exists. This inspection is valuable in forestalling future failures and in avoiding additional damage to the receiver which might occur through improper servicing methods.

(2) *Input resistance measurements.* These measurements (par. 66) prevent further damage to the receiver from possible short circuits. Since this test gives an indication of the condition of the filter circuits, its function is more than preventive.

(3) *Operational test.* The operational test (par. 68) is important, because it frequently indicates the general location of trouble. In many instances, the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.

(4) *Trouble-shooting chart.* The trouble symptoms listed in this chart (par. 69) will aid greatly in localizing trouble.

(5) *Signal substitution.* The principal advantage of the signal substitution method (pars. 72 through 75) is that it usually enables the repairman to localize a trouble accurately and quickly to a given stage when the location is not immediately evident from the above tests.

(6) *Stage gain charts.* These charts (par. 76) can be used to localize obscure, hard-to-find troubles

(7) *Intermittents.* In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the receiver. It is possible that some external connection may cause the intermittent trouble. Test whatever can be tested in this case.

63. Trouble-Shooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following trouble-shooting data:

Fig. No.	Title
5	Radio Receiver R–274/FRR, tube location.
31	Radio Receiver R–274/FRR, chassis, top view.
32	Radio Receiver R–274/FRR, r-f chassis, bottom view.
33	Radio Receiver R–274/FRR, i-f and audio chassis, bottom view.
34	Radio Receiver R–274/FRR, 2d mixer and 6.455-mc oscillator chassis, bottom view.
35	Radio Receiver R–274/FRR, voltage and resistance measurements.
37	I-f switch-over relay connections.
43	Radio Receiver R–274/FRR, schematic diagram.

64. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting Radio Receiver R–274/FRR is listed below. The technical manuals associated with the test equipment are also listed.

Test equipment	Publication
Signal Generator AN/URM–25 (range 10 kc to 50 mc).	Navships 91379
Signal Generator TS–497A/URR (range 2 to 400 mc).	TM 11–5030
Audio Oscillator TS–382A/U	TO 16–35TS382–2
Tube Testers I–177 and I–177–A	TM 11–2627
Frequency Meter Set SCR–211–(*) (range 125 kc to 20 mc).	TM 11–300
Frequency Meter TS–174B/U (range 20 to 280 mc).	TM 11–5044
Electronic Multimeter TS–505/U	TM 11–5511
Electronic Multimeter ME–6A/U	Navships 91269
Multimeter TS–352/U	TM 11–5527
Output Meter TS–585A/U	TM 11–5017

65. General Precautions

Observe the following precautions very carefully whenever servicing the radio receiver:

a. Be careful when the bottom cover is removed; dangerous voltages are exposed.

b. Use a cloth or tube puller when removing tubes; otherwise the hand or fingers may be burned.

c. When working on the top of the chassis, be careful not to bend the tuning gang capacitor plates; this could cause a short or a change of alinement.

d. Do not overtighten screws going through or threaded into plastic materials. This might strip the threads or produce cracks.

e. When changing a component that is held by screws or nuts, always replace the lockwashers.

f. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the receiver, since they may cause short circuits.

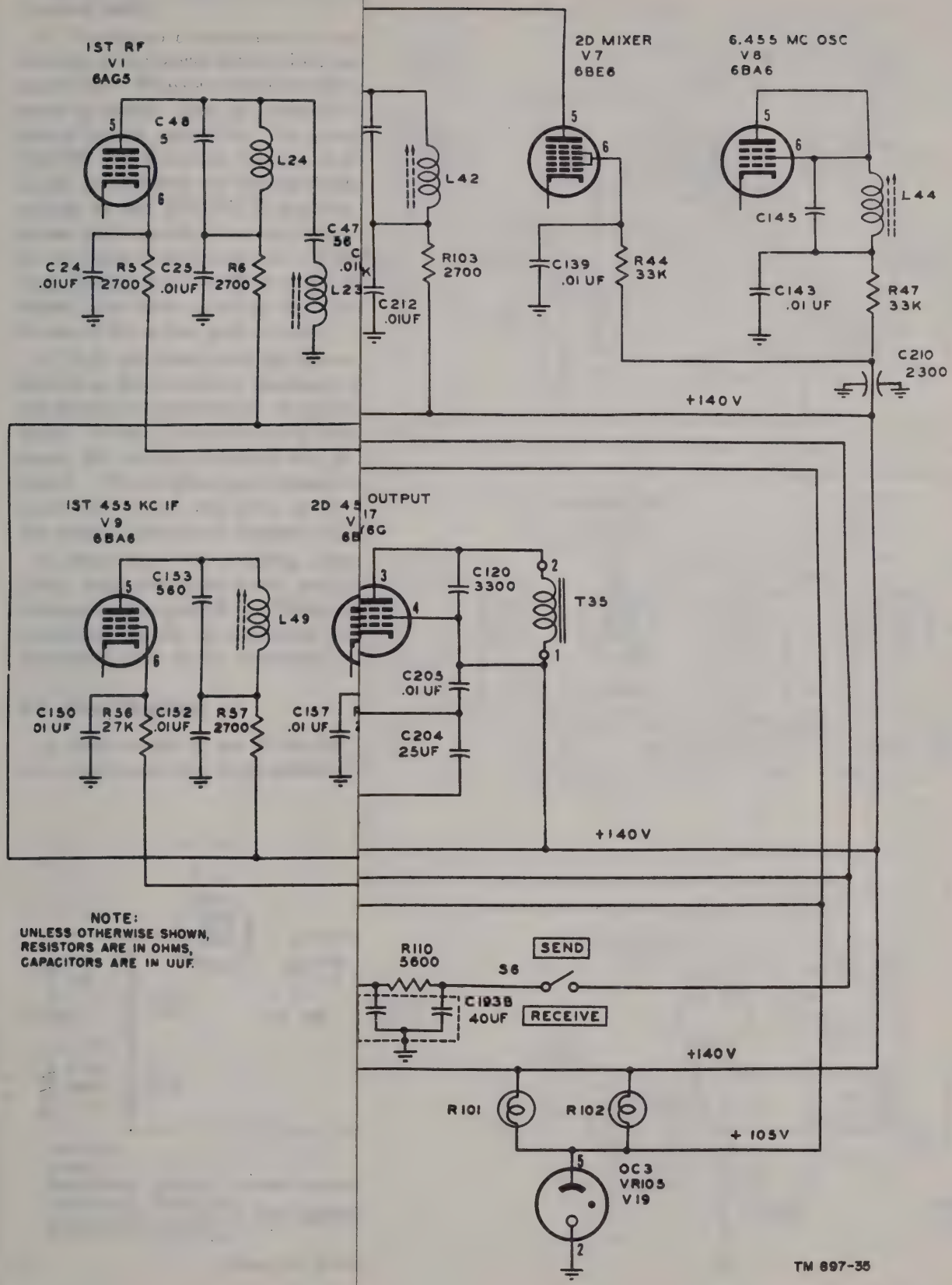
(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

(5) When a part is replaced in r-f or i-f circuits, it must be placed exactly as the original one was. A part which has the same electrical value but different physical size may cause trouble in h-f circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly oscillation of the circuit.

(6) Do not disturb the adjustment of METER ZERO control R87 or any of the alinement adjustments.

66. Checking B+ Circuits for Shorts

a. Many times a short circuit in the B+ line can disable the entire receiver; however, sometimes just one or a few stages will be affected. If the receiver is operated with a short circuit, other components may become overheated due to the increased current flow; sooner or later they will become defective. To check for these troubles without the danger of causing more damage, a resistance check should be made. Figure 29 is a simplified diagram of the B+ distribution throughout the receiver. In it are the paths which could offer short circuits. By using this diagram, in conjunction with the voltage and resistance c[1]



NOTE:
UNLESS OTHERWISE SHOWN,
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CAPACITORS ARE IN UUF.

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d. Do not overtighten screws going through or threaded into plastic materials. This might strip the threads or produce cracks.

e. When changing a component that is held by screws or nuts, always replace the lockwashers.

f. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the receiver, since they may cause short circuits.

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(5) When a part is replaced in r-f or i-f circuits, it must be placed exactly as the original one was. A part which has the same electrical value but different physical size may cause trouble in h-f circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly oscillation of the circuit.

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a. Many times a short circuit in the B+ line can disable the entire receiver; however, sometimes just one or a few stages will be affected. If the receiver is operated with a short circuit, other components may become overheated due to the increased current flow; sooner or later they will become defective. To check for these troubles without the danger of causing more damage, a resistance check should be made. Figure 29 is a simplified diagram of the B+ distribution throughout the receiver. In it are the paths which could offer short circuits. By using this diagram, in conjunction with the voltage and resistance c[1]

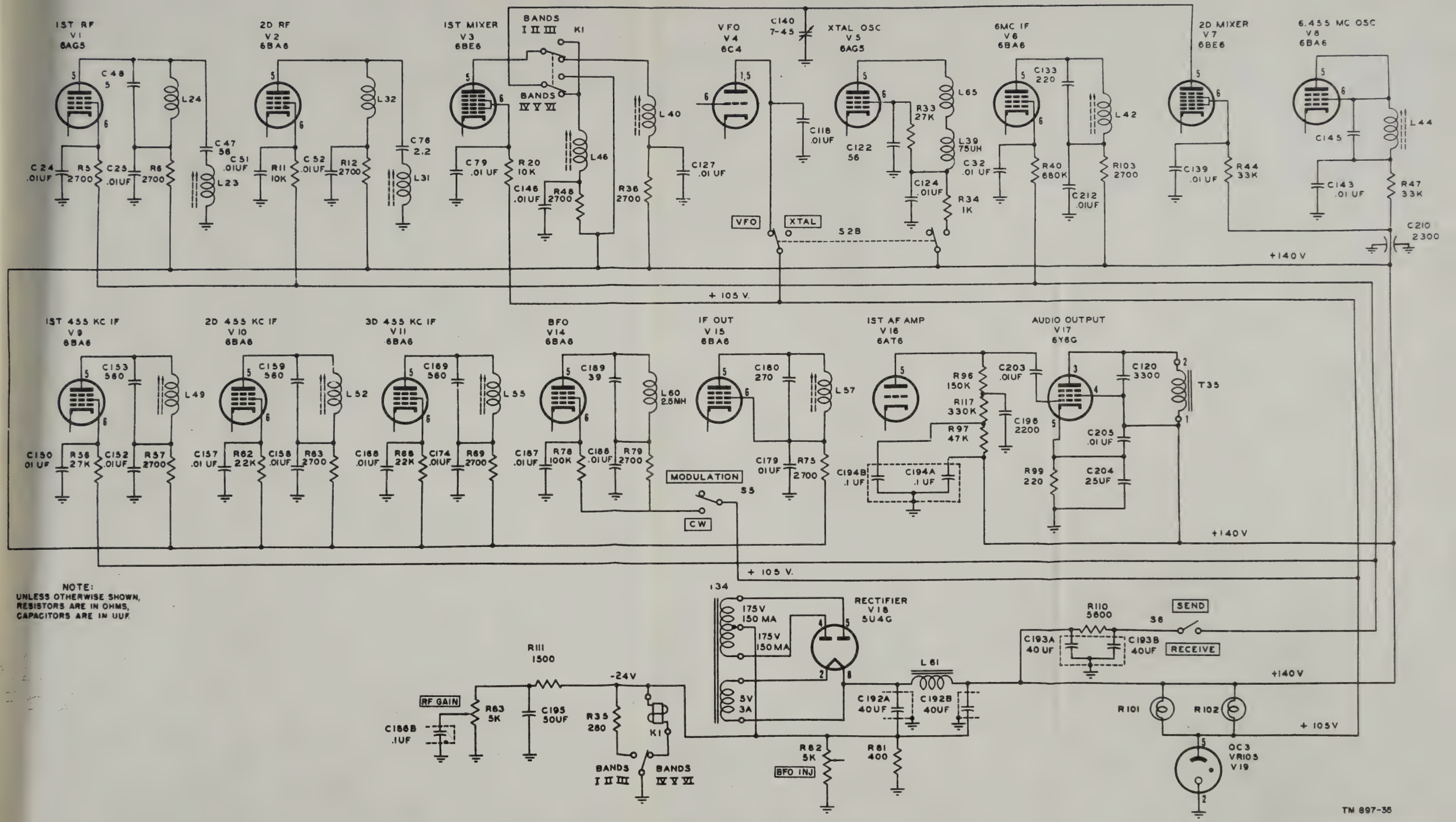
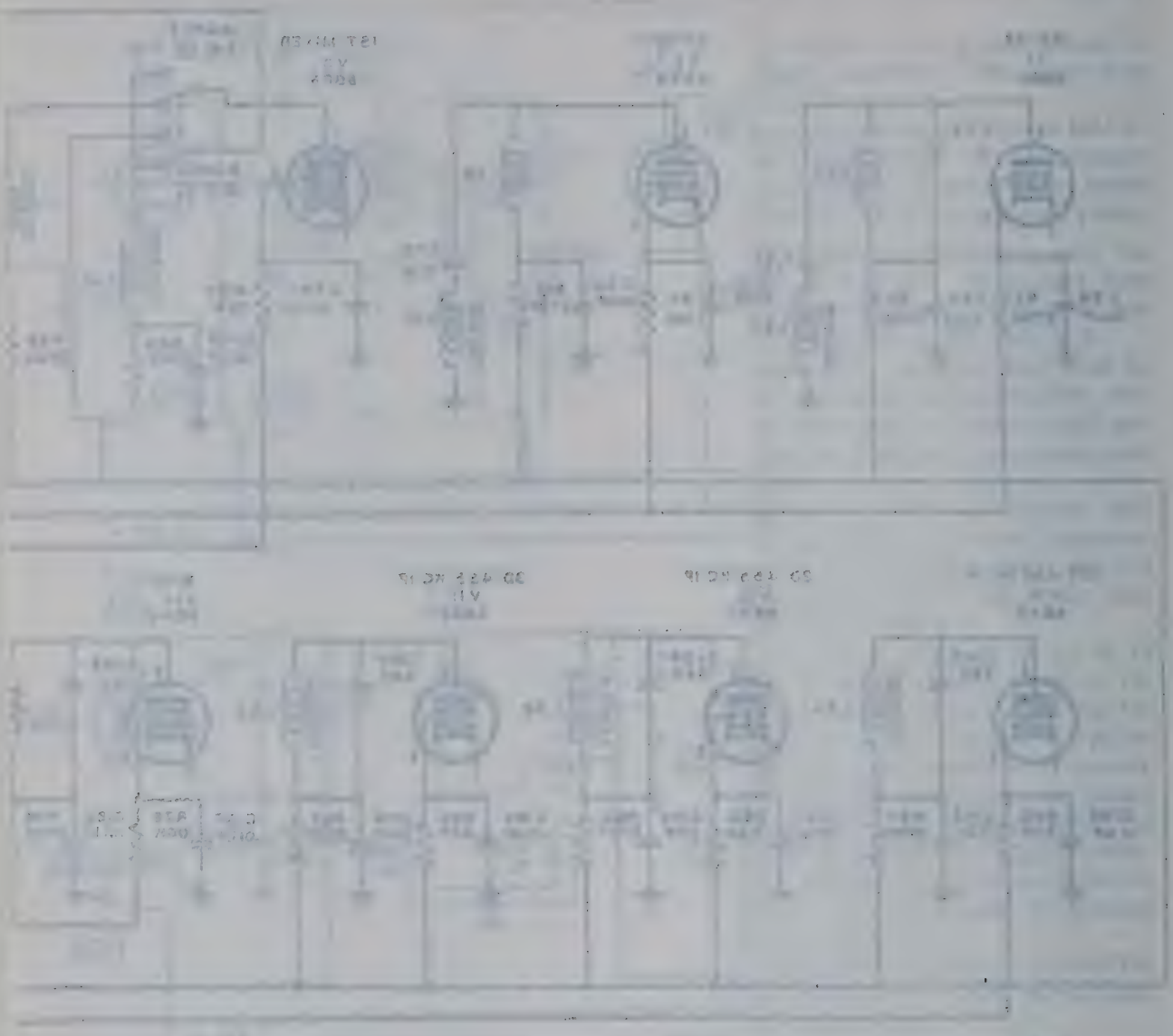


Figure 29. Radio Receiver R-274/FRR, +B voltage distribution.



of figure 35, the typical causes for trouble can be checked easily.

b. Tracing to a component is accomplished by starting at the power supply filter capacitors, C192 and C193. When a reading of only a few hundred ohms is found, there is probably trouble in the power supply capacitors. By switching the RECEIVE-SEND switch, S6, on and off, the location of the trouble may be verified further. With the switch in the RECEIVE position (closed), the screen grid circuits of several tubes are connected to the point of measurement. If the short indication disappears when S6 is in the SEND position (open), the short is not in the power supply but in one of the screen grid circuits.

c. Only one position of the turret is shown connected in the schematic diagrams; however, they are similar in construction except for minor differences. When a short circuit is found on only one band, the trouble probably will be traced to the turret. The coupling and bypass capacitors in the inoperative band will have to be checked using the over-all schematic diagram (fig. 43).

d. Sometimes the coupling capacitors become leaky (high resistance short) and place a positive voltage on the grid of the following tube. These capacitors should be measured with the highest resistance scale of the ohmmeter.

67. Agc Checking

A short circuit of one of the agc bypass capacitors could cause loss of agc action and poor control of the RF GAIN-AC control. Figure 30 shows a simplified circuit of the agc distribution. A shorted capacitor will prevent any change in voltage between ground (B—) and the control grid of the tube that it bypasses. This allows the tube to operate at maximum gain and could cause serious overloading.

68. Operational Test

The operational test consists of actually using the radio receiver to pick up signals. Try using all the controls. Select different bands, tune across them, and listen for noise and signals. Tune in a c-w signal and turn on the bfo to see whether an audio note is produced. Refer to the equipment performance checklist (par. 37) to check for the general location of the trouble that might be encountered.

69. Trouble-Shooting Chart

The following chart is supplied as an aid in locating trouble in the radio receiver. It lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. *The chart also indicates how to localize trouble quickly to the audio, i-f, or r-f stage of the receiver.* The signal substitution tests outlined in paragraphs 72, 73, 74, and 75 can then be used to supplement this procedure and to determine the defective stage. After the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit should ordinarily be sufficient to isolate the defec-

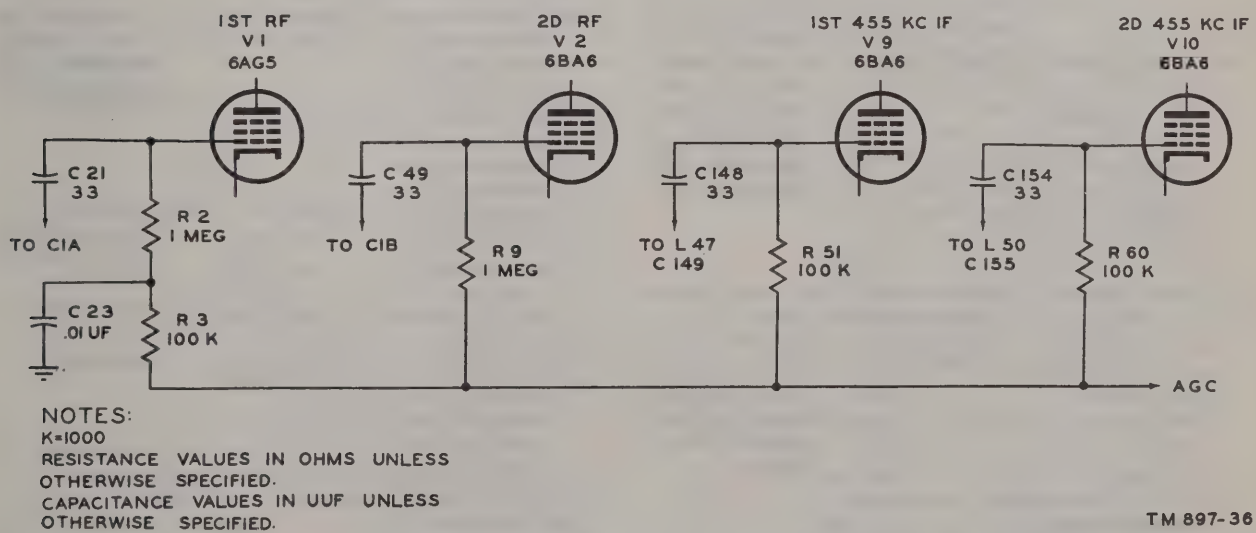


Figure 30. Radio Receiver R–274/FRR, agc and bias voltage distribution.

tive parts. Normal voltage and resistance measurements are given in figure 35.

69. Trouble-Shooting Chart—Continued

Symptom	Probable trouble	Correction
1. RF GAIN-AC switch turned fully clockwise. Receiver fails to operate and dial lamps do not light.	1. Open fuse F1 on rear of receiver.	1. Replace fuse. If it blows again, check filter capacitors C192A, C192B, C193, and C194A.
	Connecting leads to fuseholder broken.	Repair leads.
	Power transformer T34 primary tap connection incorrect or poorly made.	Set tap to correct voltage position. Tighten tap connection.
2. No receiver output. With AGC-MANUAL switch at AGC, and RF GAIN-AC control at 10, CARRIER LEVEL meter dips and rises as TUNING dial is rotated.	2. Defect exists between detector and a-f output stages.	2. Use headphones, with .1-uf capacitor in series with one lead, across grid and plate circuits of successive audio stages to localize defective stage. Test tube in this stage, and then, if necessary, make voltage and resistance measurements to locate defective part. An alternate method is to use signal substitution in audio stages (par. 72).
3. Receiver inoperative. CARRIER LEVEL meter does not deflect as receiver is tuned. Dial lamps light.	3. Open filament regulator tube R80.	3. Replace filament regulator tube R80.
	Failure of B+ supply.	Check rectifier tube V-8. Remove bottom dust color and check voltage across capacitor C193. If voltage is low, or zero, check for leaky or shorted filter capacitors C192A, C192B, C193A, and C193B.
	Defect exists between antenna terminal and detector stage.	See symptoms 4 and 5 below.
4. A-f circuit satisfactory but no receiver output is obtained when modulated, 455-kc, i-f signal is applied through a .01-uf (microfarad) capacitor to the top stator connection of tuning capacitor C2A.	4. Faulty i-f stage.	4. Use signal substitution in i-f stages (par. 74) to locate defective stage. Test tubes and make tube socket voltage and resistance tests.
5. A-f circuit satisfactory, but no receiver output is obtained when modulated, 6-mc, i-f signal is applied through a series capacitor to stator of C2A. (BAND SELECTOR is set to IV, V, or VI.) Receiver functions all right on BANDS I, II, and III.	5. Faulty 6.455-mc oscillator V8. Faulty 2d mixer stage V7.	5. Test tube. Replace 6.455-mc crystal. Use signal substitution in i-f stages (par. 74). Test tube. Make tube socket voltage and resistance tests. Refer to chapter 5.
	Failure of i-f switch-over relay K1.	Test continuity of relay coil. If it is open, replace the relay. Check turret contacts. Clean them if necessary. Check relays for poor contacts.
6. A-f and i-f circuits satisfactory but no output is obtained when r-f modulated signal is applied to antenna terminals and receiver is tuned to this signal.	6. Faulty r-f stage.	6. Use signal substitution in r-f stages (par. 75) to locate defective stage and the faulty component.
7. A-f and i-f circuits satisfactory but no output is obtained when r-f modulated signal is applied to antenna terminals and receiver is tuned to this signal. Receiver operates normally when VFO-CRYSTAL switch is in a CRYSTAL position but not in the VFO position.	7. Faulty vfo oscillator stage V4.	7. Test tube V4. Make tube socket voltage and resistance tests.
8. A-f and i-f circuits satisfactory, but no output is obtained when r-f modulated signal is applied to antenna terminals and when receiver is tuned to this signal. Receiver operates normally when VFO CRYSTAL switch is in VFO position but not in a CRYSTAL position.	8. Faulty crystal oscillator stage V5.	8. Test tube V5. Check six crystal positions; if only one does not work, replace that crystal. Make tube socket voltage and resistance tests.
9. A-m signals received but no beat note obtained when CW-MODULATION signal switch is turned to CW. Beat note heard when i-f c-w signal is applied to terminal 1 of V11.	9. Defective bfo stage V14.	9. Test V14 and its tube socket resistances and voltages. Check adjustment of BFO INJ. control R82.
10. Reception weak. With no signal tuned in, roaring noise is not heard when AUDIO GAIN and RF GAIN-AC controls are turned to maximum setting and SELECTIVITY switch is at NORMAL MED. With a signal tuned in, CARRIER LEVEL meter does not rise to customary peaks for reception of known stations.	10. Weak tubes.	10. Check tubes.
	Low plate or screen voltage due to shorted capacitor in plate or screen return circuit.	Check voltages and make resistance checks.
	Receiver not properly alined.	Realine receiver.

69. Trouble-Shooting Chart—Continued

Symptom	Probable trouble	Correction
11. No control of gain	11. Shorted or leaky agc capacitor.	11. Make resistance check of each agc capacitor. Replace defective capacitor.
12. Reception distorted	12. Open grid resistor or leaky capacitor in audio circuits (especially when AUDIO GAIN control is turned past 2).	12. Use headset, with .1-uf capacitor in series with one lead to localize faulty stage. Check grid circuit for positive grid voltage.
13. Noisy and fading reception.	13. Faulty gain controls. Faulty antenna circuit	13. Check for dirty controls R83 and R94. Check antenna installations for leakage paths to ground and for loose connections.
14. Objectionable hum in output.	14. Leaky or open filter capacitors in power supply unit.	14. Check each capacitor by disconnecting positive lead from each section and charging each, then discharging by shorting to chassis with screw driver, the handle of which is insulated from the blade. Capacitors which do not seem to store sufficient charge, as indicated by size of discharge spark, may be faulty. Check by connecting new equivalent capacitor for comparison.
	Shorted turns in power supply choke. Short between winding and core in filter choke.	Check for shorted turns by measuring resistance of L61. Check for open circuit between filter choke terminal and case. If circuit is not open, replace choke.
15. Intermittent noise	15. Defective tube, resistor, or capacitor.	15. With an insulated probe, gently tap and slightly move all tubes, resistors, capacitors, and soldered connections to locate loose elements in tubes or loose connections to any component.
16. Oscillation (indicated by whistle or howl).	16. Defective tube, poor shielding, interstage coupling, or high-resistance soldered-chassis return.	16. Check tubes and shunt bypass capacitors with capacitors of equal value.
17. Selectivity not sharp in any of crystal position of SELECTIVITY switch.	17. Defective crystal or circuit component.	17. Check crystal Y8. Make voltage and resistance measurements of filter circuit.

69. Trouble-Chooting Chart—Continued

Symptom	Probable trouble	Correction
18. CARRIER LEVEL meter does not indicate properly. (No reading or off-scale readings.)	18. Wrong adjustment of METER ZERO control R87. Defective tube V13 Defective meter M1.	18. Readjust R87. Check and replace V13. Check meter M1 for open coils; replace, if necessary.

70. D-c Resistances of Transformers and Coils

The d-c resistances of the transformer windings and the coils in the receiver are listed below:

a. Coils and Transformers not in R-F Turret.

Transformer or coil	Terminals or winding	Resistance (ohms)
T25 and T26	Primary and secondary	Less than .5
T27	Primary 2 and 3	Less than .5
	Secondary 1 and 4	2
T28 and T29	Primary and secondary	2.5
	Tertiary 1 and 7	Less than .5
T30	Primary	2.5
	Secondary 7 and 8	1
	Secondary 1 and 7	3
T31	Primary and secondary	2.5
T32	Primary 1 and 2	10
	Secondary 3 and 4	Less than .5
T33	Terminal 1 and 3	.75
	Terminal 3 and 4	2
T34	Primary 0-volt terminal to 95-volt terminal.	2
	Primary 0-volt terminal to 105-volt terminal.	2.5
	Primary 0-volt terminal to 115-volt terminal.	3
	Primary 0-volt terminal to 130-volt terminal.	3.5
	Primary 0-volt terminal to 190-volt terminal.	8.5
	Primary 0-volt terminal to 210-volt terminal.	10
	Primary 0-volt terminal to 234-volt terminal.	12.5
	Primary 0-volt terminal to 260-volt terminal.	15
	Secondary 5-volt filament winding.	Less than .5
	Secondary 6.3-volt filament winding.	Less than .5
	Secondary 12-volt filament winding.	1
	Secondary h-v winding—measured across winding.	65
	Secondary h-v winding—center tap to either end.	33

a. Coils and Transformers not in R-F Turret. —Continued

Transformer or coil	Terminals or winding	Resistance (ohms)
T35	Primary 1 and 2	200
	Secondary 3 and 4	5.5
	Secondary 5 and 6	38
	Secondary 7 and 8	35
K1	Across winding	280
L39	Measured across coil	12.5
L60	Measured across coil	40
L62	Measured across coil	2
L63	Measured across coil	Less than .5
L64	Measured across coil	2.2
L65	Measured across coil	2.2
L66	Measured across coil	2
L67	Measured across coil	Less than .5

b. D-C Resistance of Turret Coils.

(1) *Antenna turret.*

Transformer	Winding	Resistance (ohms)
T1	Secondary L1	3
T1	Primary L2	1
T2	Secondary L3	4
T2	Primary L4	.5
T3	Secondary L5	1
T3	Primary L6	Less than .5
T4	Secondary L7	Less than .5
T4	Primary L8	Less than .5
T5	Secondary L9	Less than .5
T5	Primary L10	Less than .5
T6	Secondary L11	Less than .5
T6	Primary L12	Less than .5

(2) *R-f turret.*

Transformer	Winding	Resistance (ohms)
T7	Secondary L13	3.5
T7	Primary L14	11
T8	Secondary L15	6
T8	Primary L16	8
T9	Secondary L17	1
T9	Primary L18	3.5
T10	Secondary L19	Less than .5
T10	Primary L20	3.5
T11	Secondary L21	Less than .5
T11	Primary L22	Less than .5
T12	Secondary L23	Less than .5
T12	Primary L24	1

b. D-C Resistance of Turret Coils—Continued

(3) *Mixer turret.*

Transformer	Winding	Resistance (ohms)
T13	Secondary L25	3.5
T14	Secondary L26	6
T15	Secondary L27	1
T16	Secondary L28	Less than .5
T16	Primary L62	3
T17	Secondary L29	Less than .5
T17	Primary L30	2.5
T17	Primary L66	3
T18	Secondary L31	Less than .5
T18	Primary L32	1

(4) *Oscillator turret measured from grounded end to tap indicated.*

Transformer	Coil	K tap	Grid tap	Top
T19	L33	2	4.5	7
T20	L34	1	2	4
T21	L35	.5	1	2
T22	L36	Less than .5	Less than .5	Less than .5
T23	L37	Less than .5		Less than .5
T24	L38	Less than .5		Less than .5

71. Tuning Control Troubles

a. The couplings connecting the dial drive mechanism are held in place by two Allen-head screws per coupling. If these screws become loose, the dial scale may turn without turning the tuning capacitors. Sometimes slight looseness will cause a jumpy action in the dial. Make sure all coupling screws are securely tightened.

b. Coupling between the BAND SELECTOR shaft and the turret shaft is accomplished by means of a nylon coupling. If the turret should bind, the nylon coupling might crack and thereafter allow slippage between shafts. Do not overtighten the setscrews on this coupling.

72. Signal Substitution Notes

a. Signal substitution requires a source of audio, i-f, and r-f signals. Use a signal generator which will produce each of the desired signals required in any specific signal substitution test.

b. In addition, a headset or permanent-magnet speaker is necessary. Plug the headset into

PHONES jack J3, or connect the speaker (with a matching transformer, if necessary) to terminals of AUDIO OUTPUT terminal strip E4.

c. An analyzer and tube tester are also needed to isolate the defective part after the faulty stage has been indicated by signal substitution.

d. In the tests indicated in paragraphs 73, 74, and 75, ground one side of the signal generator output to the receiver chassis, and connect the other side through a capacitor (about .01 μf) to the receiver point as directed.

e. Note the volume, and listen for serious distortion from the loudspeaker or headset at the various points in the signal substitution procedure. When working back from the output to the input stages, decrease the output of the signal generator as much as possible. If possible, compare with a receiver known to be in good condition.

f. Check the wiring and soldering in each stage during the procedure.

Caution: Do not remove the shield can of the tuned unit until the trouble has been traced to that particular unit. Do not damage the wiring by pushing it back and forth during inspection. Be careful to prevent damage to the receiver in any other way.

g. Misalinement of one or more stages of the receiver will cause reduced output. Misalinement of the vfo may prevent any output.

h. When trouble is localized in a given stage, first test the tube if such a test is indicated; then measure the voltage; and finally, measure the resistance at the tube socket of the stage.

i. Trouble in a circuit or stage may not cause changes in voltage and resistance measurements at the tube socket. The instructions in this paragraph are merely a guide and should suggest other procedures, such as voltage and resistance measurements on individual parts.

j. Remove only *one* tube at a time when testing. Check the number of the tube, test the tube, and, if it is not defective, return it to its proper socket before another tube is removed.

k. At each step, it is assumed that all previous steps were completed satisfactorily. Isolate and clear any trouble located before proceeding with any succeeding steps.

73. A-F Tests

a. Terminal 3 of V17 (Plate of A-F Output). Apply an audio signal through a series capacitor (approximately .05μf) to terminal 3 of V17. Listen for the signal in the headset which is connected to jack J3. The volume will be very low. If a speaker is connected to the AUDIO OUTPUT terminal strip, E4, a low volume signal should be heard. If no signal is heard, inspect the leads to transformer T35 and PHONES jack J3 and terminal strip connections.

b. Terminal 5 of V17 (Grid of A-F Output). Place the audio signal on terminal 5 of V17. Listen for an increased output in the headset (or the speaker, if used). If the volume does not show an increase, test tube V17. If no signal is heard, check resistor R98 and capacitor C4. Also check the plate and screen grid voltages.

c. Terminal 7 of V16 (Plate of 1st A-F Amplifier). Introduce the signal at terminal 7 of V16 and listen for the signal. If there is no signal, coupling capacitor C203 may be open. Check for an open circuit by paralleling C203 with another .01-μf capacitor.

d. Terminal 1 of V16 (Grid of 1st A-F Amplifier). Place the audio signal on terminal 1 of V16 with AUDIO GAIN control R94 set at 3 or higher. The volume of the audio output should be increased. If the volume does not show an increase, test tube V16. If no signal is heard, check resistors R96, R117, and R97 and capacitors C196 and C194B. Also check the plate voltage.

e. Terminal 3 on 4th 455-KC, I-F Transformer T31. Introduce the audio signal at terminal 3 on the 4th 455-kc, i-f transformer, T31. If no signal is heard, capacitor C176 or C200 may be open. Check for an open circuit by paralleling with another .01-μf capacitor. If a signal is heard with ANL-OFF switch S3 in the OFF position, but no signal is heard in the ANL position, check tube V12.

74. I-F Tests

a. 455-KC I-F Tests.

(*1*) *Control settings.* Set the controls as follows:

Control	Setting
CW-MODULATION	MODULATION
AGC-MANUAL	MANUAL
ANL-OFF	OFF
AUDIO GAIN	MAXIMUM
CRYSTAL PHASING	0
SELECTIVITY	NORMAL BROAD

(2) *Terminal 5 of V11 (3d 455-kc i-f plate).* Apply a modulated 455-kc signal to pin 5 of V11. The audio modulation note should be heard in the phones or speaker. If no sound is heard, check tube V12. If the test shows the tube to be satisfactory, return it to its socket. There may be an open circuit in inductor L55 or L56, resistor R72 or R70, or a shorted capacitor, C169, C170, C172, C173, or C174. If an audio output can be heard with the ANL-OFF switch, S3, in the OFF position, but no output can be heard with switch S3 in the ANL position, resistor R71 or R73 may be open. or capacitor C175 may be shorted.

(3) *Terminal 1 of V11 (grid of 3d 455-kc i. f.).* Inject the modulated signal at the grid of V11 (terminal 1). The volume of audio output should increase. If the volume does not increase, remove tube V11 and test it. If the test shows the tube to be satisfactory, replace the tube in the socket. Resistor R66 might be open. Check voltage and resistance at the tube socket.

(4) *Bfo (V14).* Turn off the modulation in the signal generator, and apply the unmodulated 455-kc signal to terminal 1 of V11. Set the CW-MODULATION switch, S5, at CW. An audio beat note should be heard at the speaker or phones. Vary the BFO PITCH control, C183, and note the change of af. If no audio note is heard, remove tube V14 and test it. If the tube is satisfactory, return it to its socket and check the voltage and resistance measurements. Capacitor C181 may be open. Parallel it with another 5-$\mu\mu$f capacitor to check for an open circuit.

Note. Return switch S5 to the MODULATION position after the bfo has been checked. Turn on the modulation in the signal generator again.

(5) *Terminal 5 of V10 (plate of 2d 455-kc i. f.).* Inject the modulated 455-kc signal at the plate (terminal 5) of V10 and listen for an audio output. If no audio is heard, check for continuity across transformer T30 (terminals 2 to 7 and 5 to 6).

(6) *Terminal 1 of V10 (grid of 2d 455-kc i. f.).* Inject the modulated 455-kc signal at terminal 1 of V10. Set RF GAIN-AC control R83 to 10. The audio output volume should be increased. If there is no audio output, test tube V10. If the tube is satisfactory, replace it in its socket. Resistor R60 may be open. Check the socket terminals for voltage and resistance.

(7) *Terminal 5 of V9 (plate of 1st 455-kc i. f.).* Connect the modulated 455-kc signal to terminal 5 of V9. An audio output should be heard. If no sound is heard, check transformer T29 for continuity (terminals 2 to 7). Capacitor C154 may be open. Parallel it with another 33-$\mu\mu$f capacitor to check it.

(8) *Terminal 1 of V9 (grid of 1st 455-kc i. f.).* Inject the modulated 455-kc signal at terminal 1 of V9. The audio output volume should be increased. If it is not, test tube V9. If tube V9 proves satisfactory, replace it in the socket. Check resistor R51 to be sure it is not open. Check tube socket voltages and resistances. Be sure that the SEND-RECEIVE switch, S6, is in the RECEIVE position.

(9) *Terminal 2 of transformer T28 (input to 1st 455-kc i-f transformer).* Inject the modulated 455-kc signal at terminal 2 of the 1st 455-kc i-f transformer, T28. The audio signal should be heard in the speaker or phones. If no signal is heard, there may be an open primary or secondary coil in transformer T28 or in capacitor C148. Capacitor C147 or C149 may be shorted, or the coaxial lead from the i-f switchover relay, K1, may have been damaged and shorted.

(10) *Terminal 5 of V3 (plate of 1st mixer).* With the BAND SELECTOR in the BAND I, II, or III position, inject the modulated 455-kc signal at the plate of the 1st mixer. The audio signal should be heard in the phones or speaker. If no signal is heard, check for continuity from terminal 5 of V3 through the contacts of realy K1 to terminal 2 of transformer T28.

b. 6–MC I-F Tests.

(1) *Control settings.* Set the controls as follows:

Control	Setting
RECEIVE-SEND	RECEIVE
CW-MODULATION	MODULATION
AGC-MANUAL	MANUAL
ANL-OFF	OFF
RF GAIN-AC	5
AUDIO GAIN	5
SELECTIVITY	NORMAL BROAD
BAND SELECTOR	BAND IV, V, or VI

(2) *Terminal 5 of V7 (plate of 2d mixer).* Inject a modulated 455-kc signal into terminal 5 of tube V7. An audio output should be heard in the phones or speaker. If no audio output is heard, check to see that relay K1 is actuated. Capacitor C140 may be shorted out. The coaxial lead from the plate of V7 to the relay contacts may be damaged and shorted.

(3) *Terminal 7 of V7 (signal grid of 2d mixer).* Reset the signal generator to produce a 6-mc r-f output modulated with an audio frequency. Inject this modulated 6-mc signal (still through a series .05-μf capacitor) into terminal 7 of tube V7. An audio output should be heard. If it is not, test tubes V7 and V8 (one at a time to prevent accidentally interchanging the types). Return each tube to its socket if it proves satisfactory. Check that the 6.455-mc crystal fits snugly in its socket. Check for an open resistor, R104, R43, R45, R46, or R106, or open capacitor C144. Check for a shorted capacitor, C134, C139, C141, C145, or C207. Check the voltages and resistances at the tube sockets for V7 and V8.

(4) *Terminal 5 of V6 (plate of 6-mc i-f).* Inject the modulated 6-mc signal into terminal 5 of tube V6. The audio signal should be heard in the phones or speaker. If no signal is heard, check capacitor. C133 for a short circuit and the primary and secondary coils of transformer T26 for open circuits.

(5) *Terminal 1 of V6 (grid of 6-mc i. f.).* Inject the modulated 6-mc signal to the grid of V6. An increase in the audio output volume should be noticed. If no audio output is heard, remove and test tube V6. If tube V6 is satisfactory replace it in the socket. Check for an open resistor, R114 or R39, or a shorted capacitor, C132 or C212. Check voltages and resistances at the tube socket of V6.

(6) *Terminal 1 of T25 (input of 1st 6-mc i-f transformer).* Inject the modulated 6-mc signal at terminal 1 of transformer T25. If no audio signal is heard in the phones or speaker, check for an open coil, L40 or L41, in transformer T25 or a shorted capacitor, C128 or C129. Capacitor C113 may be open. The coaxial lead from the plate of the 1st mixer, V3 to the contacts of relay K1 may be damaged and shorted.

(7) *Terminal 5 of V3 (plate of 1st mixer).* Inject the modulated 6-mc signal at the plate of the 1st mixer. An audio signal should be heard in the phones or speaker. If no audio signal is heard, see whether there is continuity through the contacts of relay K1.

75. R-f Tests.

a. Terminal 7 of V3 (Signal Grid of 1st Mixer).

(1) *Vfo operation.* Set up the signal generator to produce a modulated r-f signal within the range of the receiver (540 kc to 54 mc). Using the BAND SELECTOR and the TUNING control, tune the receiver to the selected signal. Set the VFO CRYSTAL switch, S2, in the VFO position. An audio output should be heard in the phones or speaker. If no audio output is heard, test tubes V3 and V4. Remove, test, and replace one tube at a time to prevent interchanging the tubes during replacement. If the tubes are satisfactory, replace them in their sockets. Check for an open circuit in resistor R18, R19, R21, or R22, or in capacitor C80, C81, or C118. Check tube socket voltages and resistances for tubes V3 and V4. If the vfo does not appear to be functioning, test by applying to terminal 1 of V3 the unmodulated output of a second signal generator tuned to the incoming rf from the first signal generator plus the i. f. in use (455-kc i. f. used below 7 mc, or 6-mc i. f. used above 7 mc). If an audio output is now heard, the vfo stage, V4 is not functioning. To check the vfo further, tune the receiver and signal

generator to one of the six frequencies specified for crystal operation; set the VFO CRYSTAL switch, S2, in the corresponding crystal position; an audio output now identifies a nonfunctioning vfo.

(2) *Crystal operation.* Select a modulated r-f signal with the signal generator to match the frequency for which any crystal channel has been assigned. Set the VFO CRYSTAL switch, S2, in the position corresponding to the channel selected. An audio output should be heard in the phones or speaker. if no audio output is heard, check the operation of the crystal oscillator, V5, by setting the VFO CRYSTAL switch, S2, in the VFO position; an audio output now indicates malfunctioning of the crystal oscillator, V5. Remove and test tube V5. If it proves satisfactory, replace it in the socket. Check the crystal socket for loose connections. Check for shorted capacitor C125, open resistor R32, open choke coil L64, or open capacitor C119. Check tube socket voltages and resistances.

b. Terminal 5 of V2 (Plate of 2d R-F). Use either the VFO position or a CRYSTAL position for switch S2. Set the modulated r-f output of the signal generator at the frequency to which the receiver is tuned. Set the RF. GAIN-AC and AUDIO GAIN controls both at 3. Inject the output of the signal generator at terminal 5 of V2. The audio modulation should be heard in the phones or speaker. If no output is heard, check for an open coupling capacitor in the mixer transformer in use or a shorted capacitor, C52.

c. Terminal 1 of V2 (Grid of 2d R-F). Inject the modulated r-f signal into terminal 1 of V2. The audio volume should be increased noticeably in the phones or speaker. If there is no audio output, remove tube V2 and test it. If the tube is satisfactory, return it to the socket and check the tube socket voltages and resistances. Retune the signal generator and the receiver to a signal in another band if the mixer transformer appears to be defective.

d. Terminal 5 of V1 (Plate of 1st R-F). Inject the signal at the plate of V1. The audio modulation should be heard in the phones or speaker. If no audio is heard, check for a shorted capacitor, C25 or C1B, or for poor contact at the turret connections. Other checks will suggest themselves according to which r-f transformer is in use.

e. Terminal 1 of V1 (Grid of 1st R-F). Inject the modulated r-f signal at the grid of the 1st r-f tube, V1. The audio modulation should appear with an increased volume in the phones or speaker If there is no audio output, remove and test tube V1. If the tube is satisfactory, return it to the socket. Check voltages and resistances at the tube socket. If the tests show the receiver to be satisfactory at this point, but the receiver still will not operate with the normal antenna input, check the antenna and lead-in cable. Check the turret contacts and transformer coils in use.

76. Stage Gain Charts

a. General. Stage gain measurements allow a check on how much amplification is occurring in each amplifier of the receiver. In trouble shooting, the measurements serve to locate the defective stage. The signal voltages injected by the signal generator will provide a voltage across the detector diode load resistor, R107, for the output measurement. The voltage across resistor R107 is kept constant by varying the signal generator output to establish this condition. As the signal generator is moved from each test point toward the antenna terminals, the input signal becomes smaller in amplitude, thereby indicating more amplification and providing a means of gain measurement. The a-f stage gains are measured by the amount of power developed in a 600-ohm load placed across the 600-ohm AUDIO OUTPUT terminals 1 and 5 (2 and 4 tied together). The front panel controls are in the following positions for stage gain measurement unless otherwise specified:

Control	Position
BAND SELECTOR	BAND I.
TUNING	Low frequency end of dial.
ANT ADJ	Peaked for measurement through antenna terminals.
ANL-OFF	OFF.
AGC-MANUAL	MANUAL.
CW-MODULATION	MODULATION.
RECEIVE-SEND	RECEIVE.
RF GAIN-AC	MAXIMUM.
BFO PITCH	0.
CRYSTAL PHASING	0.
SELECTIVITY	NORMAL MED.
VFO CRYSTAL	VFO.
CRYSTAL VERNIER	Mid-position.
AUDIO GAIN	Maximum.

b. Audio Gain Chart.

Signal generator	Input connection	Input voltage	Output watts (secondary of T35)	Stage gain
400 cps	Pin 5 V17	7	1	3.5
400 cps	Pin 1 V16	.3	1	23.3

c. Detector sensitivity.

Signal generator	Input connection	Input voltage	Output watts (secondary of T35)
455 kc modulated 30% at 400 cps.	Pin 2 of V12 through .1-μf capacitor.	2	.6

d. 3d 455-KC I-F Stage Gain Chart (Audio Gain Maximum).

Signal generator	Input connection	Input voltage	Output volate across R107	Stage gain
455 kc modulated.	Pin 1 of V11.	30,000 microvolts.	------	(*)
30% at 400 cps.	----------	300,000 microvolts.	------	33

*30,000 μv input produces .6 watt at output. 300,000 μv (produces more than required output (2 watts)). Therefore, AUDIO GAIN must be reduced to give 2 watts (undistorted power).

e. 2d and 1st 455-KC I-F Stage Gain Chart. The output voltage is measured across detector load resistor R107. The SELECTIVITY control has an effect on the gain of the 1st and 2d 455-kc i-f stages; therefore, gains are listed for all six positions.

Position of SELECTIVITY control	Signal generator output connection		
	455 kc unmodulated to pin 1 of V10 through a .01μf.	455 kc unmodulated to pin 1 of V9 through a .01μf.	455 kc unmodulated to pin 7 of V3 through a .01μf.
	Microvolts input	Microvolts input	Microvolts input
CRYSTAL SHARP	18,000	720	100
CRYSTAL MED	21,000	800	240
CRYSTAL BROAD	32,000	1200	130
NORMAL SHARP	22,000	3200	930
NORMAL MED	20,000	4300	750
NORMAL BROAD	30,000	3200	700

Note. The above input voltages are those needed to maintain 10 volts d-c across the detector.

f. 2d Mixer Stage Gain. The gain of the 6-mc i-f and the 2d mixer, V7, is measured on BAND IV with NORMAL MED selectivity. TUNING is set to 7 mc.

Signal generator	Input connection	Microvolts input	Output voltages across R107
455 kc unmodulated	Terminal No. 7 on T26 through a .01μf.	1000	10
6 mc unmodulated	Terminal No. 7 on T26 through a .01μf.	1500	10
6 mc unmodulated	Pin 1 of V6 through a .01μf.	170	10
6 mc unmodulated	Pin 7 of V3 through a .01μf.	120	10

g. 1st Mixer and R-F Stage Gains. The BAND SELECTOR is set to the desired band. Measurements made at antenna terminals require the ANT ADJ control to be peaked. Apply signals to the antenna terminals on A and G (ground) with the other A terminal connected to G.

Band	Freq. (mc)	Signal generator connection				
		Antenna terminals through a 100-ohm dummy load	1st rf. Pin 1 of V1 through .01 μf.	2d rf. Pin 1 of V2 through .01 μf.	1st mixer Pin 7 of V3 through .01 μf.	
		Microvolts input				Voltage across R107
I	.57	3	15	170	920	10
	1.24	3	40	180	1300	10
	.9	3	*NM	*NM	*NM	10
II	1.35	1.5	12	310	750	10
	2.9	2	25	250	1000	10
	2.1	3	*NM	*NM	*NM	10
III	3.2	3	15	250	700	10
	6.8	3	20	160	900	10
	5	5	*NM	*NM	*NM	10
IV	7.3	4	16	80	135	10
	13.3	3	13	45	120	10
	10.8	3	*NM	*NM	*NM	10
V	14.5	4	13	60	140	10
	28	2.5	9	35	115	10
VI	*NM	*NM	*NM	*NM	*NM	*NM

*No measurements taken.

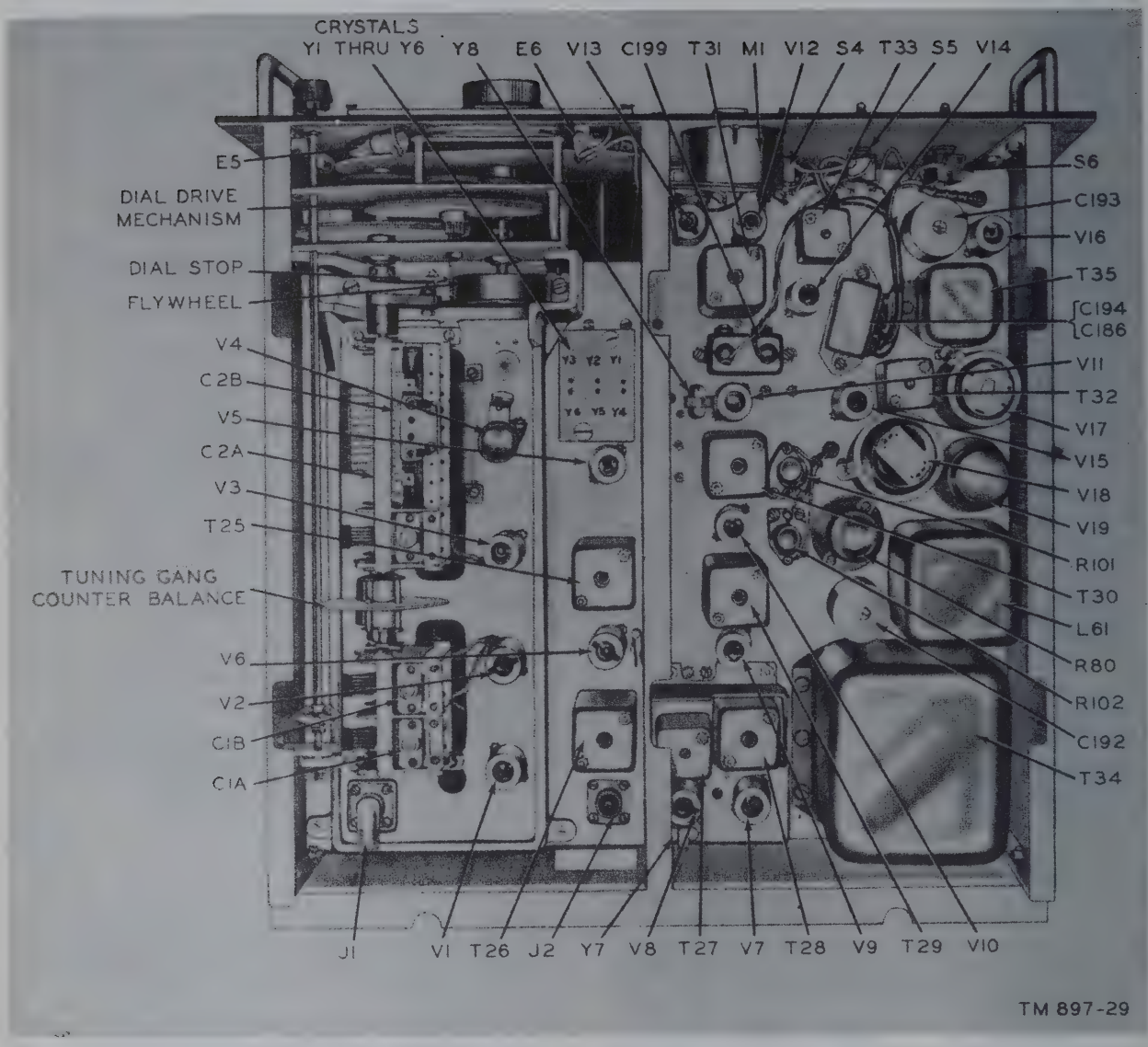


Figure 31. Radio Receiver R–274/FRR, chassis, top view.

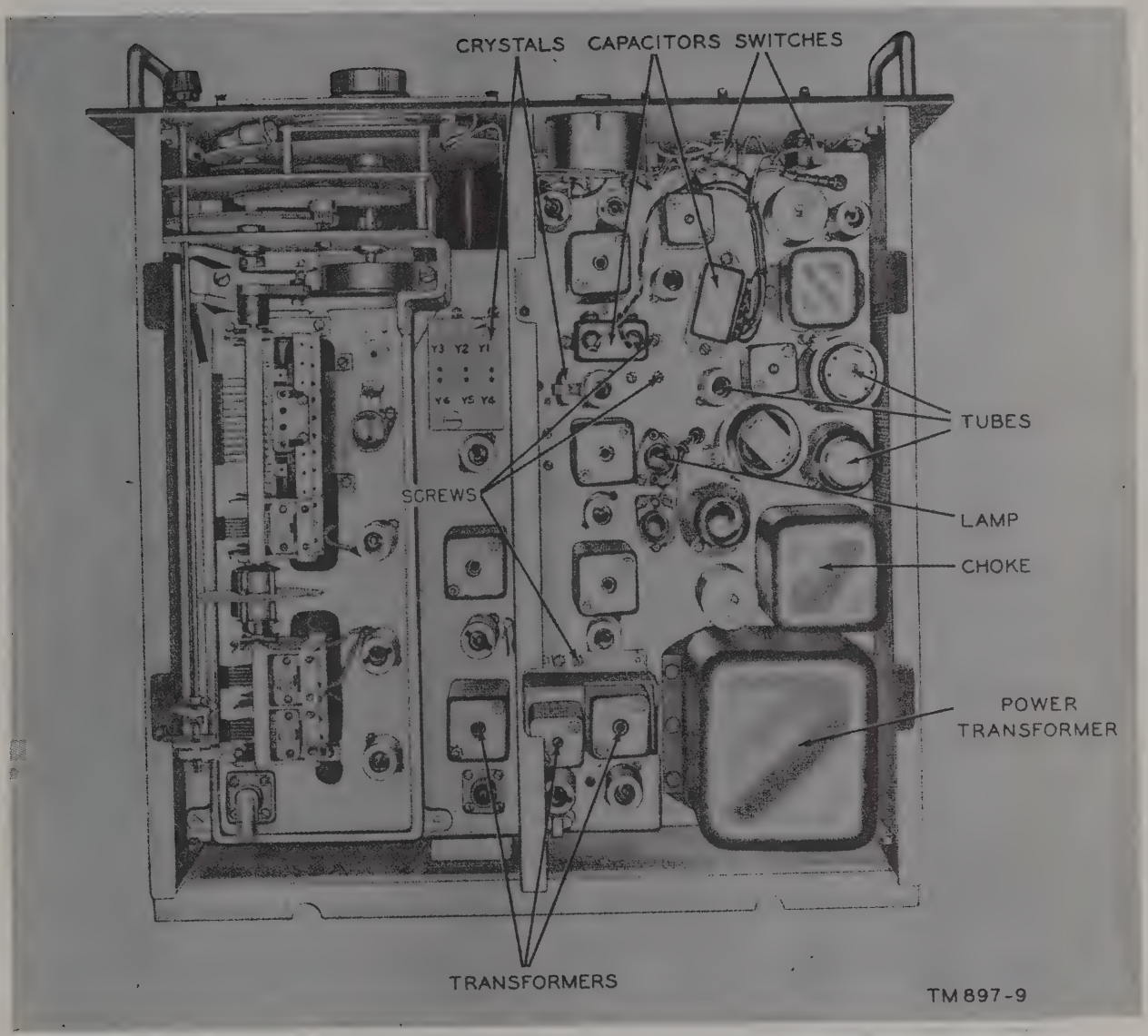


Figure 32. Radio Receiver R–274/FRR, r-f chassis, bottom view.

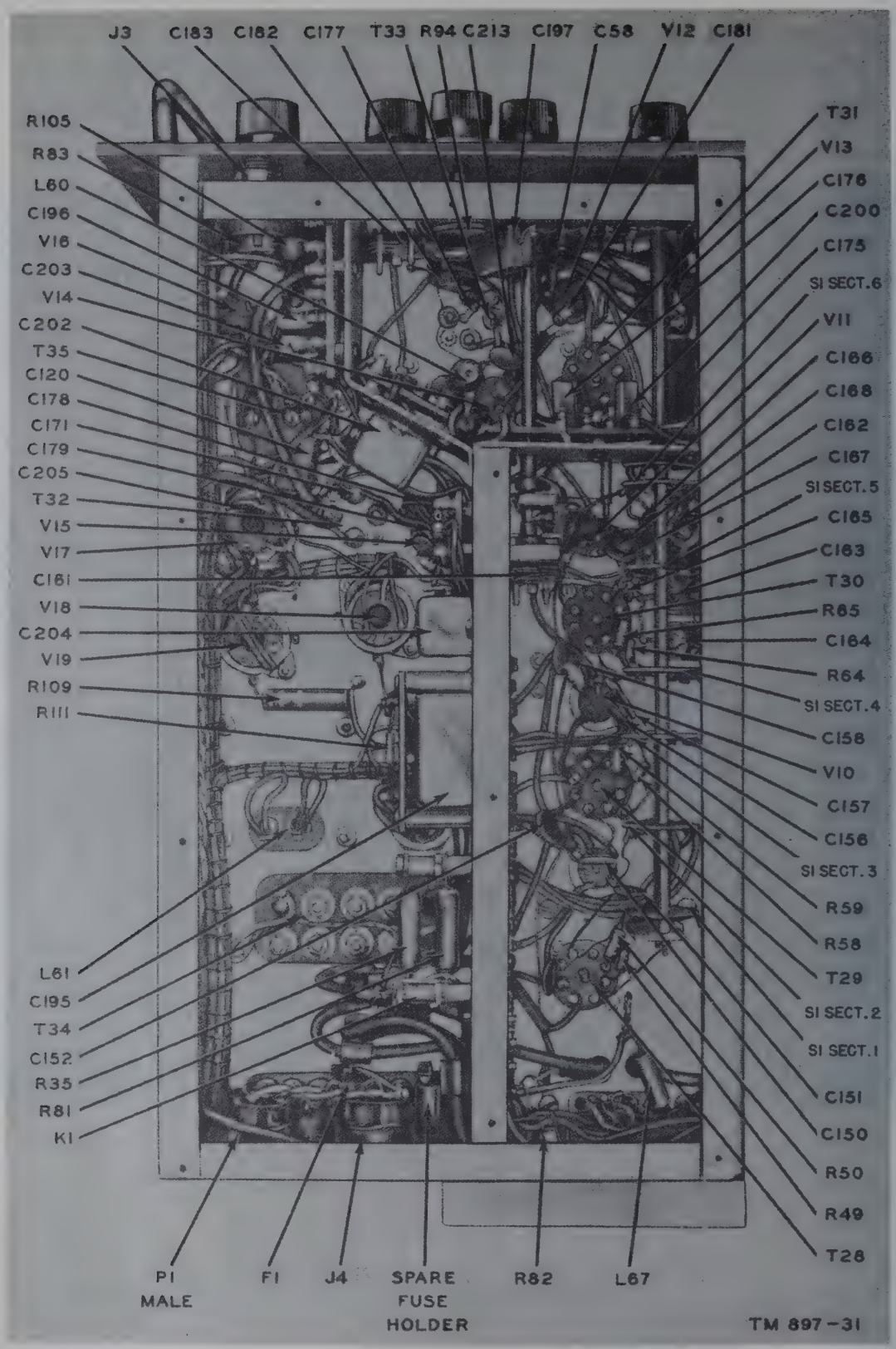


Figure 33. Radio Receiver R-274/FRR, i-f and audio chassis, bottom view.

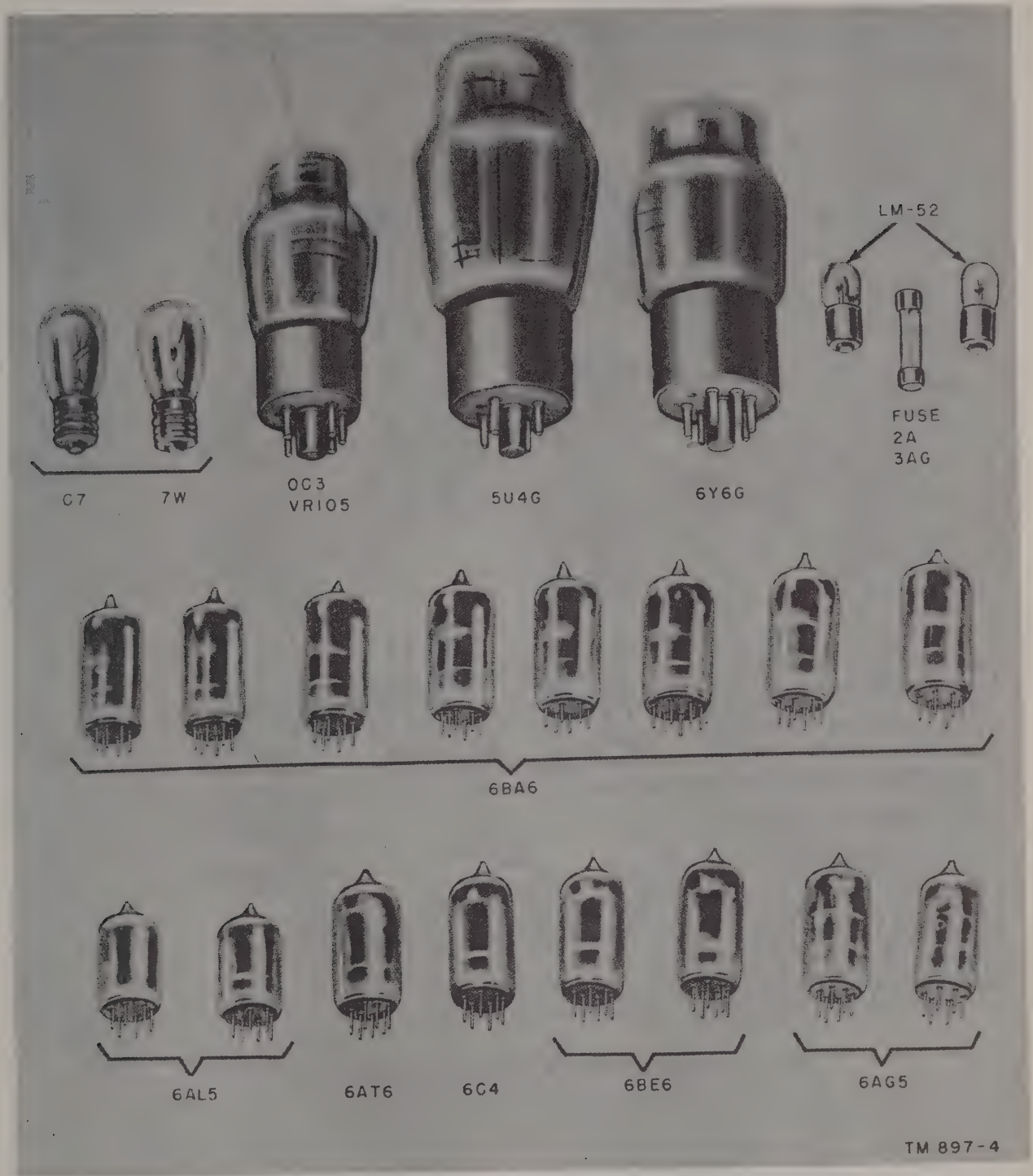
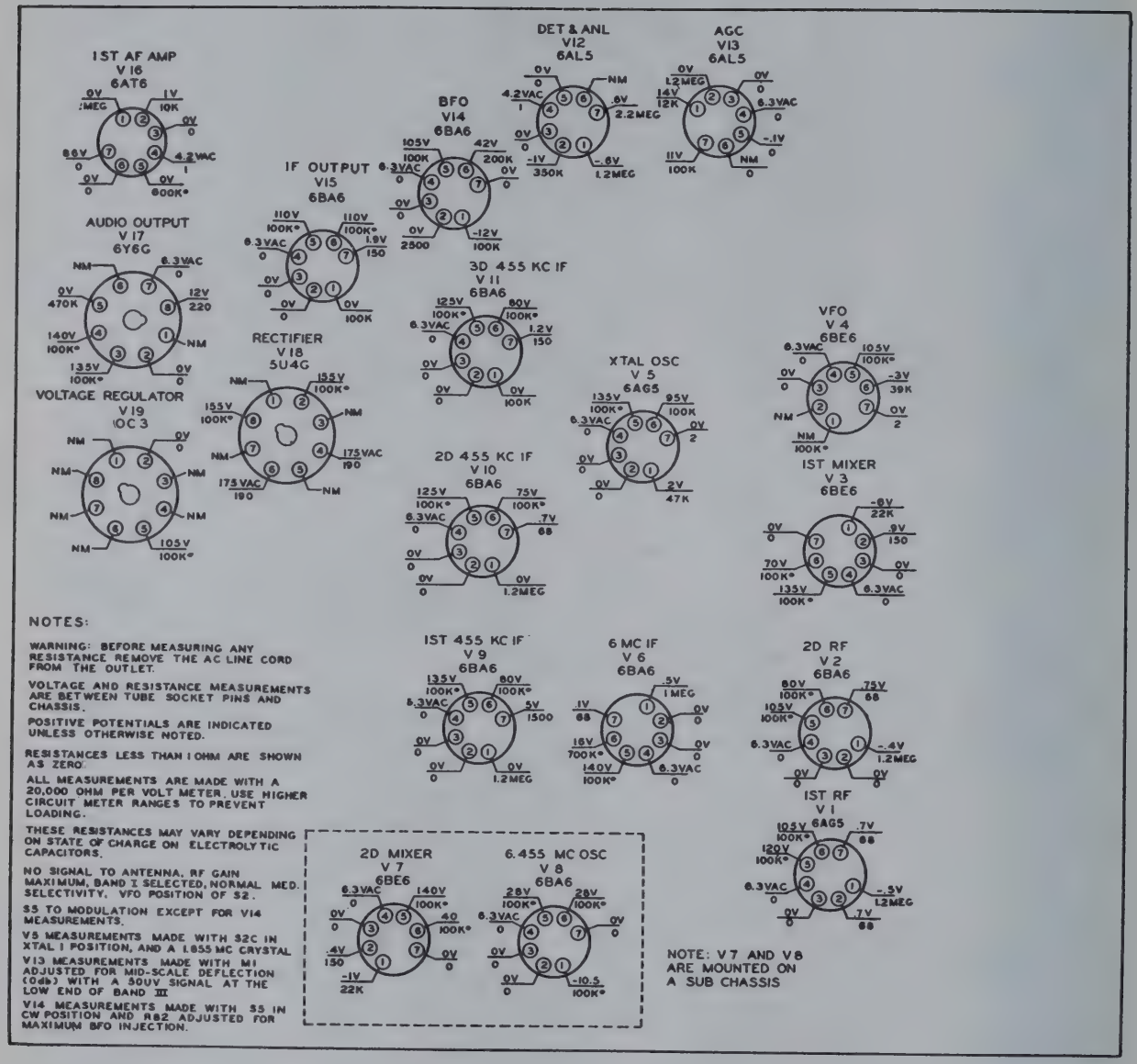


Figure 34. Radio Receiver R–274/FRR, 2d mixer and 6.455-mc oscillator, bottom view.



TM 897-32

Figure 35. Radio Receiver R-274/FRR, voltage and resistance measurements.

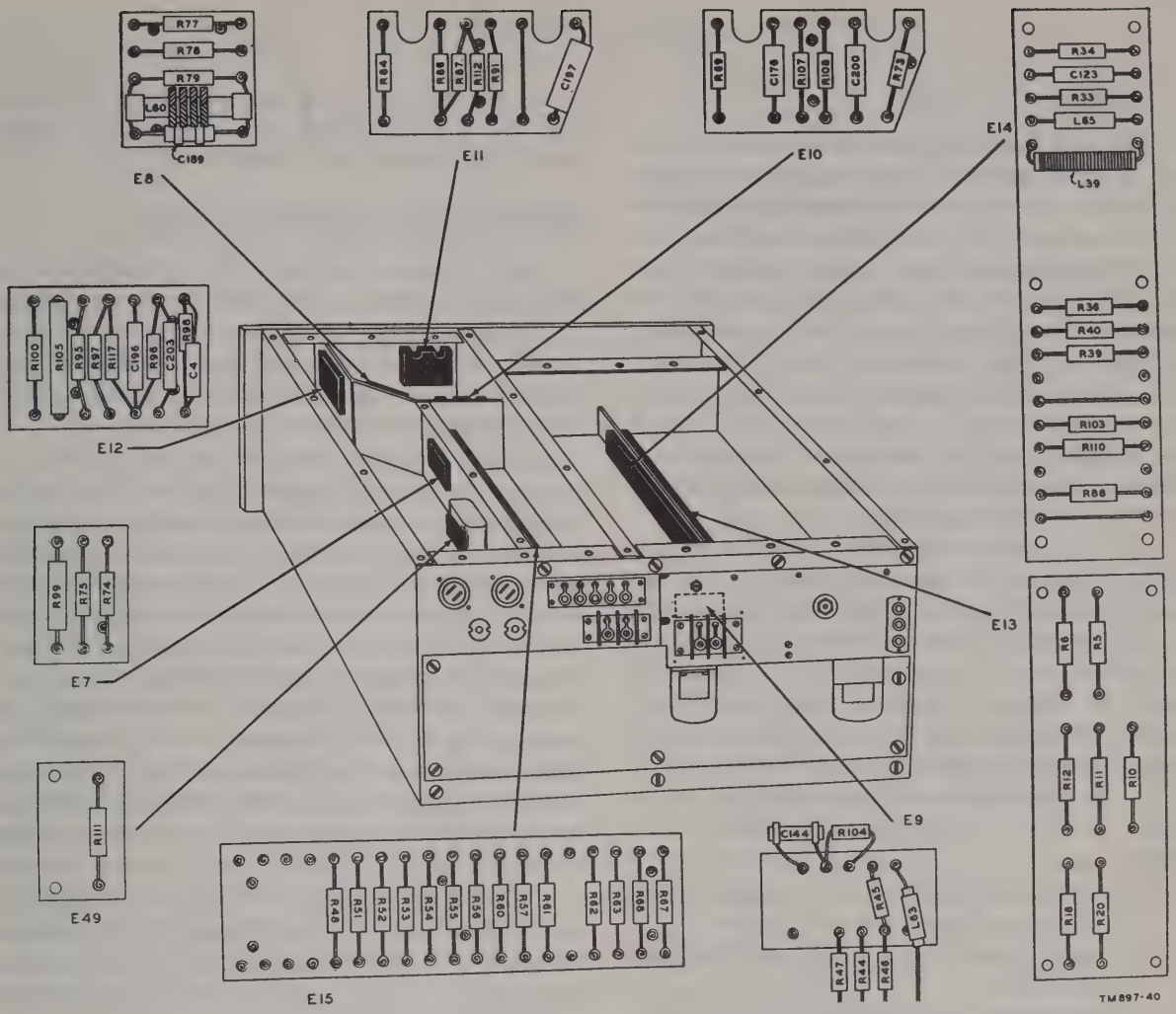


Figure 36. Radio Receiver R–274/FRR, resistor-capacitor board, location diagram.

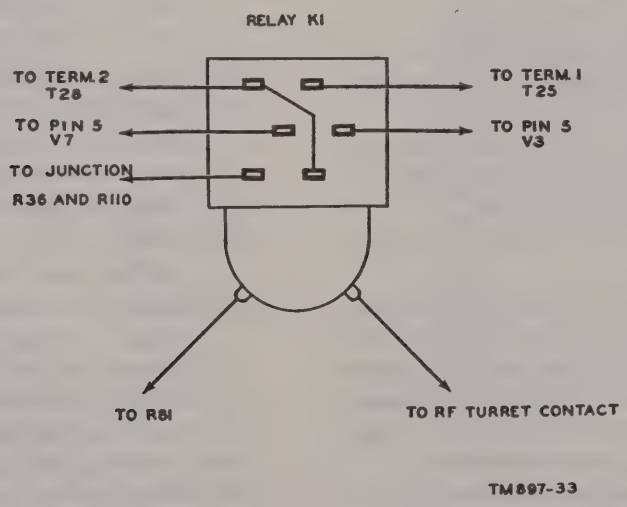


Figure 37. I-f switch-over relay connections.

Section II. REPAIRS

77. Replacement of Parts

a. Little explanation is necessary for the removal of most parts. However, there are some parts which require a special removal and replacement procedure. Be careful in handling the miniature tubes to prevent bending the base pins. If the pins become bent and a pin straightener is available, straighten the pins before reinserting the tubes in their sockets. The crystals are held in place either by spring clips or by a spring-loaded retaining plate. Two screws hold down the retaining plate of the crystal oscillator crystals. A sliding panel on the top dust cover provides access to this retaining plate.

b. The top dust cover is held in place by flat springs. Remove the cover by pulling it to the rear about an inch to release the springs and lifting it upward to take it from the receiver. The bottom cover is fastened by 27 No. 6–32 binder head screws. All screws must be removed in order to remove the cover. The rear dust cover is removed by releasing the Dzus fasteners.

c. The front panel must be removed for some repairs. The correct removal procedure is as follows:

(1) Remove all knobs with a special Allen type wrench provided.
(2) Remove all switch nuts and also PHONES jack J3 nut.
(3) Disconnect CARRIER LEVEL meter M1 by removing the terminal nuts. Leave meter fastened to panel.
(4) Unsolder dial lamp socket leads.
(5) Loosen the dial mask gear coupling.
(6) Loosen the two setscrews on the front end of the coupling to the turret shaft.
(7) Loosen setscrews on capacitor C22 coupling to allow removal of the shaft.
(8) Remove all front panel screws.
(9) Pull the front panel away from the chassis.

d. Capacitors C183, C125, C161, and C22 are all removed in the same manner: Unsolder the connecting leads and remove the knob. Loosen the shaft coupling setscrews. Remove the mounting nut or screws. Move the capacitor away from its mounting to remove it from the chassis.

e. The crystal oscillator gang switch, S2, is removed by unsoldering the connecting wires and removing the knob, and then completely unscrewing the shaft bushing nut. Slide the switch toward the rear of the chassis.

78. Disassembly of Complex Parts

This paragraph contains the procedures to be followed for removing the tuning gang capacitors, dial-drive mechanism, r-f turret, selectivity gang switch, second mixer, and 6-mc oscillator subchassis. Follow these procedures carefully; otherwise, damage to some parts may result.

a. Tuning Gang Capacitors (fig. 31). First, remove capacitors C1A and C1B (1st and 2d r-f sections). Disconnect the leads and ground straps. Loosen the two setscrews on the rear end of the shaft coupling with the Allen wrench supplied with the receiver. Next, remove the three chassis-mounting screws and slide the gang to the rear. It may now be taken from the chassis. To replace, reverse the above procedure. The coupling remaining on the end of capacitor C2A (mixer section) shaft is also a disk mounting for counterbalance weights. Capacitors C2A and C2B are removed in the same manner as capacitors C1A and C1B.

b. Dial-Drive Mechanism (figs. 10 and 12). To remove the dial-drive mechanism, it is necessary to remove the top and bottom covers and the front panel. The dial-drive assembly is removed as follows:

(1) Remove the springs from the coupling between the tuning gang capacitor shaft and dial-drive mechanism.
(2) Remove the dial pointer and dials.
(3) Remove the three screws which hold the dial drive to the chassis. Openings in the front plate are provided to gair access to these screws.
(4) Slide the drive forward and upward, pulling away from the chassis.
(5) To replace the assembly, reverse the above steps. Do not use too much force on any of the shafts. Forcing may result in bending the component parts. The dial-drive mechanism requires special adjustment to assure alinement of the dial scale with the tuning gang. See paragraph 80*b* for the instructions.

c. Selectivity Switch (fig. 33). Selectivity switch S1 is disassembled from the bottom of the chassis as follows:

(1) Remove the top and bottom dust covers.
(2) Disconnect all the leads to the switch gang terminal.
(3) Remove the four screws which hold the terminal board through which the shaft passes.
(4) Remove the nut on the shaft mounting bushing by using a ½-inch open-end wrench.
(5) Remove the screws in the bracket which hold the rear end of the switch to chassis. This is done by unscrewing the two No. 6-32 screws from the top of the chassis. Leave the bracket fastened to the switch.
(6) Slide the switch toward the rear of the chassis and lift it out. Use caution to prevent breakage of other components.
(7) Replace the switch by reversing the above steps. Be careful not to break the leads.

d. Second Mixer and 6.455-MC Oscillator Chassis (fig. 34). All the components of the 2d mixer and 6.455-mc oscillator are mounted on a subchassis located at the rear of the i-f section of the main chassis. A cut-out on the rear makes voltage and resistance measurements possible. Remove the subchassis in the following manner:

(1) Disconnect the 2d mixer plate coaxial cable, relay, and disconnect the lead at the 6-mc transformer (T26) (fig. 31), terminal 7. Also, unsolder the ground connection. Use a small soldering iron, if possible, to prevent melting of the cable dielectric.
(2) Unsolder the three leads to the feed-through capacitors C209, C210, and C211 (fig. 34).
(3) Remove the four No. 8-32 screws from the edge of the subchassis.
(4) Slide the subchassis upward and, at the same time, feed the coaxial cables through the holes.
(5) Replace the subchassis by reversing the above procedure.

e. R-F Turret (fig. 32). The removal of the turret from the chassis is easily accomplished by two men. Take out all the individual coil sections before removing the turret; this will prevent serious damage to these sections. The turret is fastened to a shaft at the front and rear. Remove the turret from the chassis as follows:

Note. By taking off the side panel adjacent to the turret, removal of the turret will be made easier; however, this is not necessary.

(1) Loosen the two setscrews on the dial mask drive gear which is fastened on the extension shaft near the front panel.
(2) Loosen all the setscrews on the nylon shaft coupling.
(3) Pull the knob and extension shaft out from the front panel.
(4) Loosen the end play adjustment nut on the shaft bushing (unscrew toward the front of the chassis).
(5) Rotate the turret by hand until it is possible to loosen the two holding steel screws at each end of the turret shaft. Remove these screws.
(6) While one man holds the turret to prevent the stationary contacts from being bent or broken, the second man should tap the shaft until it protrudes from the back of the chassis. The detent spring will have a tendency to push the turret away from the chassis. The turret should be held in the normal position until the shaft is completely removed from the back of the chassis.
(7) Lift the turret from the chassis, taking care not to bump it against any of the chassis components.

f. R-F Turret Reassembly. Carefully replace the turret as follows:

(1) Hold the turret in its normal position, and insert the shaft. Pressure must be exerted on the forward part to depress the detent spring so that the shaft will pass through the bushing.
(2) Insert and tighten the two steel screws at each end of the turret.
(3) The turret should have very little end-play when the adjustment nut is brought close to the detent plate.
(4) Slip the nylon coupling on the shaft and tighten the two rear setscrews.
(5) Hold the dial mask drive gear in place while the extension shaft is inserted through the front panel into the coupling.
(6) Tighten the setscrews on the dial mask drive gear.
(7) Contact centering is explained in paragraph 80, and adjustment of dial mask is explained in paragraph 81.

79. Refinishing

Instructions for refinishing badly marred panels are given in TM 9–2851. A quick-drying grey lacquer, matching the original finish, is recommended.

80. Mechanical Adjustments

a. Adjustment of Tuning Dial Clutch. The clutch is located inside the TUNING dial knob. Remove the snap-on cap, using a knife or a thin-blade screw driver. Tighten or loosen the self-locking nut to adjust the spring tension. Do not adjust for too much friction, since this clutch protects the dial-drive mechanism by slipping when the gears jam.

Caution: Undue pressure on the dial-drive shaft can distort the shaft or gears.

b. Setting Dial Scale With Tuning Gang. The dial scale must be set to read the correct frequency as the tuning gang tunes the receiver. Turn the TUNING knob counterclockwise until it hits the stop (reference lines on the dial should be under the pointer). In this position, a space of .062 inch should separate the bar on top of the stator plates and the fiber strip across the rotor plates. If the space is not correct, it should be adjusted as follows:

(1) Loosen the setscrews on the front section of the tuning gang shaft coupling.
(2) Place a .062-inch gage between the stator and rotor plate stops, and move the rotor to cause a tight fit for the gage.
(3) Tighten the coupling setscrews.

Caution: Do not use undue force on the dial mechanism or tuning gang shafts; this could cause distortion of the shafts or gears.

c. Centering of Turret Contacts. The turret contacts touch the stationary contacts when the turret is stopped in any one of the six positions. The purpose of the detent is to stop the turret contacts in the center area of the fixed contacts. The detent spring may be slid back or forward to achieve this position of the contacts. Loosen the two screws that hold the spring, and, with the detent roller in a notch, turn the turret until the contacts are in perfect alinement; then tighten the screws. If too much or too little turret shaft end-play is encountered, adjust the shaft bushing nut for more or less clearance between the nut and detent plate.

81. Adjustment of Dial Mask

The band number and mask opening should be centered horizontally when the turret is in a detent position. Ajdustment may be made in the following manner if the mask is not set correctly.

a. Loosen the two Allen-head setscrews on the dial mask drive gear (located on the bottom of the chassis on the front panel and of the turrent extension shaft).

b. Place the turret in a detent position.

c. Turn the dial mask drive gear until the dial mask is positioned correctly.

d. Retighten the drive gear setscrews.

e. A small circular plate located directly under the TUNING knob is the positioning guide for the dial mask idler gear. If the mask binds or does not operate smoothly, the idler gear may need adjustment. Slightly loosen the three screws on the circular plate, and move the plate until satisfactory operation is obtained. Retighten the screws to secure the plate in this position.

Section III. ALINEMENT AND ADJUSTMENT PROCEDURES

82. Test Equipment Required for Alinement

a. Signal Generator. The signal generator required for alinement must cover a frequency range of from 450 kc to 55 mc, unless more than one generator is used. It should be possible to modulate it 30 percent with an af of 400 cps with either an external or internal a-f oscillator. The output must be continuously variable from zero to .5 volt (500,000 uv) with a low impedance connection (50 ohms or less).

b. Output Meter. A visual indication of the receiver output signal is necessary for alinement. A power output meter provides this indication, and also supplies the proper 600-ohm load across the secondary of audio output transformer T35. Power Output Meter TS–585(*)/U is satisfactory for this purpose. Terminals 2 and 4 on E4 should be shorted together, and the meter should be connected to terminals 1 and 5. Set the meter to read approximately 50 mw at ¼ or ½ scale. An alternate method of indicating the output is by the use of an a-c reading output meter, such as Multimeter TS–352(*)/U. For this method, a 600-ohm load resistor must be connected in place of the

power output meter. The a-c output meter is connected across the resistor and the 10-volt scale is used. The signal generator should be turned up to indicate 5 or 6 volts input to the meter. This represents approximately 50 mw output.

c. Headset and Speaker. When alinement of the bfo is made, either a speaker or headset is used to listen to the beat frequencies to determine when a null is approached. The headset may be plugged into the PHONES jack (J–3) provided on the front panel. A speaker can be connected to the AUDIO OUTPUT terminals (E–4) on the rear of the receiver. Short terminals 2 and 4 together and connect the speaker to terminals 1 and 5.

d. Frequency Meter. Very accurate h-f oscillator settings may be made by the use of a frequency meter in conjunction with the signal generator. A frequency meter such as frequency meter set SCR–211 of Frequency Meter TS–174(*)/U, is satisfactory to use as a frequency standard with the signal generator.

e. Alinement Tool. A standard fiber or phenolic alinement tool with a screw-driver end may be used for most of the circuit adjustments. The top of some of the i-f transformer coils have a larger hollow-screw adjustment. These may be adjusted with a screw driver with a suitable size blade. Use a phenolic rod for the bottom slug adjustment when going through top adjusting screw.

83. Alinement Procedures

a. If the instructions contained in this paragraph are followed, complete alinement may be made from the top of the receiver. To accomplish this, the receiver must be removed from its mounting (rack, case, etc.). Remove the top dust cover by sliding it to the rear of the chassis and lifting it off. Refer to figures 38 and 39 for location of the necessary alinement adjustments. Be careful in making these adjustments; damage to the cores of the coils can result if adjustments are forced past their limits. To make some of the adjustments it will be necessary to use a long insulated type screw driver tool. It is recommended that the alinement be made in the order given; otherwise, false readings or unsatisfactory alinement may result. Allow about 15 or 20 minutes for the receiver and test equipment to warm up prior to alinement. In connecting the r-f signal generator to the antenna input terminal E1, the output impedance of the signal generator must be known. This is required because it is imperative that the dummy load, including the series resistance of the signal generator, be exactly 100 ohms (example: signal generator impedance 50 ohms, plus dummy antenna 50 ohms, equal 100 ohms). A very low output impedance of the signal generator, about .75 to 1 ohm, is best suited for alinement of this receiver. Always begin by feeding a signal into the receiver using a small signal to start with and then increasing it after an indication is seen on the output meter. This will prevent either overloading the receiver or damage to the output meter. As the adjustments are peaked, sufficient output may be obtained to move the meter needle off scale. Reduce the output from the signal generator or damage to the meter may result. Normally, a center-scale reading on the meter is preferred for a reference setting. Since the receiver is very sensitive, any electrical interference in the immediate vicinity may cause erratic signal indication when alinement is being made. If this is the case, alinement should be made in a well-shielded grounded room, such as a standard screen room used for radio testing purposes. The construction of the i-f transformers is such that both the top and bottom tuning slugs may be adjusted from the top of the shield can. The top slug adjustments require a wide-blade screw driver. The bottom requires a phenolic rod which is narrow enough to fit through the hole in the top adjustment. The bottom adjustment is the primary on all the transformers, while the secondary is the top adjustment.

b. Set the front panel controls to the following positions before attempting to aline the receiver:

(1) SELECTIVITY (S1)	NORMAL SHARP.
(2) RECEIVE-SEND (S6)	RECEIVE.
(3) CW-MODULATION (S5)	MODULATION.
(4) AGC-MANUAL (S4)	MANUAL.
(5) ANL-OFF (S3)	OFF.
(6) BAND SELECTOR	BAND I.
(7) VFO CRYSTAL (S2)	VFO.
(8) AUDIO GAIN (R94)	Approximately half clockwise rotation.
(9) CRYSTAL PHASING (C161)	0.
(10) BFO PITCH (C183)	0.

(11) TUNING (C1 and C2)..... Lowest frequency indicated on tuning dial.
(12) RF GAIN-AC (R83, S7)..... Full clockwise rotation.
(13) ANT ADJ..... As required.

Note. Any changes in the above settings will be given in the particular procedure requiring those changes.

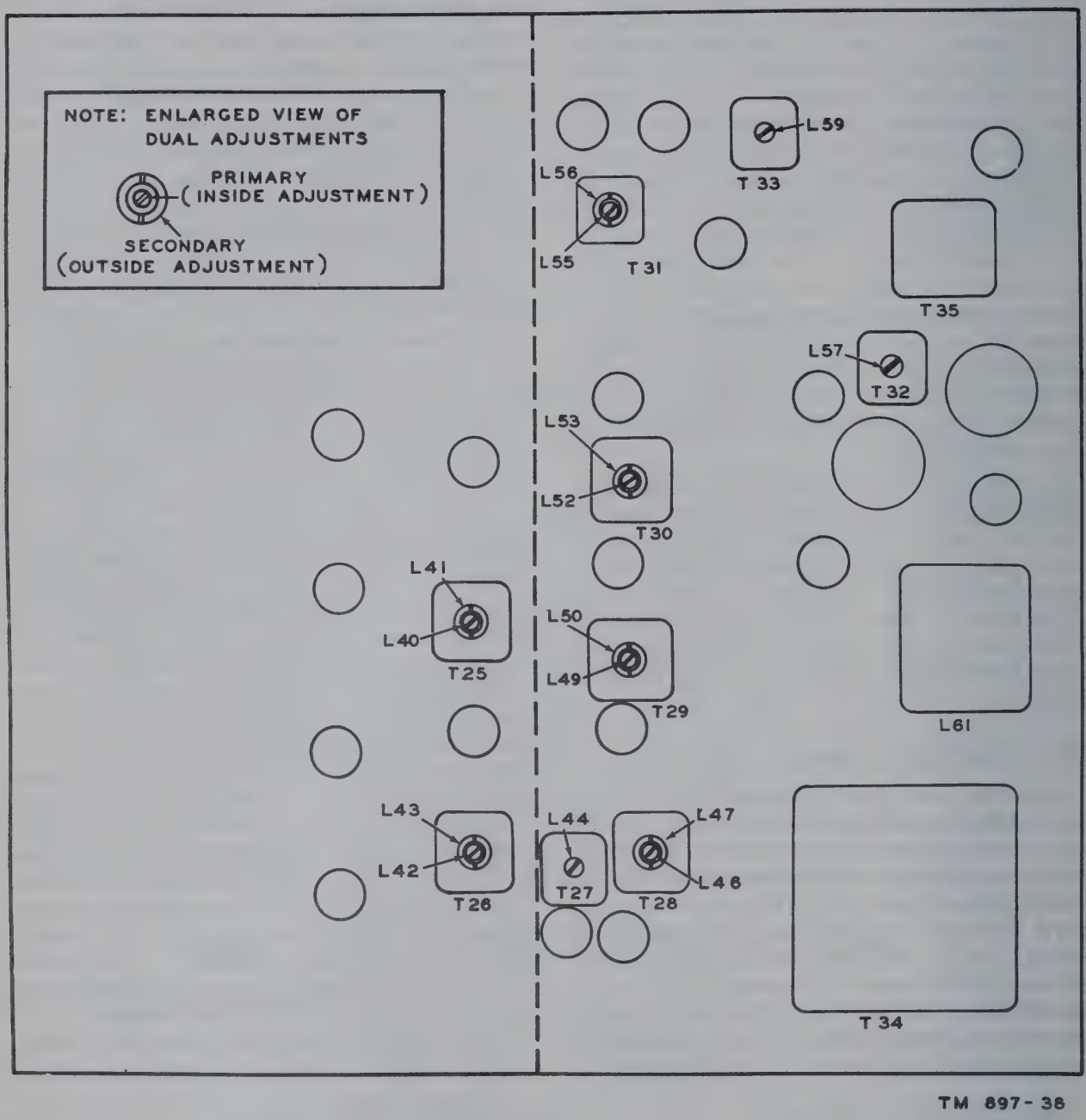


Figure 38. Radio Receiver R–274/FRR, i-f stage alinement diagram.

84. I-f Alinement Procedure

The alinement is made with the signal generator connected at the first mixer grid. The adjustments are made, starting from the second detector and working toward the 2d mixer.

Caution: The 455-kc i-f stage alinement is necessary before any other alinement is attempted. If this alinement is not performed correctly, all the alinement thereafter will be in error, and the receiver will have to be completely realined before calibration and operation will be correct

a. 455-KC I-F Alinement Chart.

Band selector is set to	Signal generator frequency	Dummy load	Connect signal generator to	Adjust for maximum (in given order)
BAND I	455 kc (400 csp, modulation 30%).	600-ohm load across terminals 1 and 5 of E4. Also connect 2 and 4 together.	Stator C2A mixer grid circuit V3 (top of chassis).	L56, L55, L53, L52, L50, L49, L47, and L46.

b. I-F Output Alinement. After the 455-kc i-f alinement is complete, the 455-kc i-f output should be alined. Connect a 72-ohm coaxial cable with a connector to jack J2. Place a 72-ohm terminating resistor across the open end of the cable. Connect a sensitive a-c type vtvm (vacuum-tube voltmeter) across the resistor. Apply a 455-kc signal as was used for the 455–kc i-f alinement; do not use modulation. Set the signal generator to give a reading on the meter of from .1 to .2 volt. Tune L57 for a maximum reading on the meter. Do not allow the output to go above .25 volt, since this may overload the i-f system, thereby making the adjustment of L57 sluggish and inaccurate. An alternate method of correctly alining the i-f output without the use of a sensitive a-c vtvm is accomplished as follows:

(1) Place the AGC-MANUAL switch to the AGC position.
(2) Apply a strong 455-kc signal (approximately 10,000 uv) to the first mixer grid.
(3) Adjust L57 for a maximum indication on the CARRIER LEVEL meter.

c. Bfo Alinement.

(1) Connect a speaker or headset to the receiver.
(2) Change CW-MODULATION switch, S5, to the CW position.
(3) Set BFO PITCH control, C183, to 0.
(4) Apply a 455-kc signal as was used for the 455-kc i-f alinement.
(5) If an audio note is heard, tune L59 until a zero beat is obtained.
(6) Check the bfo by turning BFO PITCH control, C183, in either direction. An audio note which changes frequency with rotation should be heard each side of the zero mark if the bfo is correctly alined.
(7) Turn the BFO INJ. control, R82, located on the rear of the chassis, to its normal setting.

d. Adjustment of I-F Bandwidth in Crystal Position. Ordinarily, it should not be necessary to adjust the bandwidth of the 455-kc i-f stages (fig. 41). However, if adjustment is necessary, care must be taken because it is a very tedious operation. The adjustment consists of setting three capacitors (C162, C163, and C164) which are used when the SELECTIVITY switch is in one of the CRYSTAL positions. The correct procedure is as follows:

(1) Set the ANL-OFF switch to ANL.
(2) Connect a d-c vtvm from either terminal on the ANL-OFF switch to ground (on top of chassis).
(3) Apply a 455-kc unmodulated signal. Adjust the amplitude to about +10 volts on the vtvm.
(4) Adjust signal generator frequency to give 5 volts on each side of maximum, and note difference frequency on signal generator. (The signal generator must have a vernier, or a frequency meter must be used to select these points.)
(5) Adjust the proper capacitor and note bandwidth. Repeat until the 6-db down bandwidth is as follows:

CRYSTAL SHARP (C162)—between 170 and 230 cps.
CRYSTAL MED (C163)—between 425 and 575 cps.
CRYSTAL BROAD (C164)—between 1,200 and 1,500 cps.

e. 6-MC I-F Alinement. Place the BAND SELECTOR switch in the BAND IV position. The 6,455-mc oscillator, V8, must be oscillating before the 6-mc i-f alinement can be made. To check this, place a d-c vtvm from ground (chassis) to the junction of R106 and C211 (feedthrough capacitor) (fig. 43). Approximately minus 1 volt should be read on the meter when the stage is oscillating. If no voltage is present, T27 should be tuned. Unscrew the core until the circuit falls out of oscillation. Now screw the core in until the circuit just starts oscillating again, then turn in another one-quarter turn from this position to insure stable oscillation.

f. 6-MC Alinement Chart. In making the 6-mc alinement, you should first determine whether the 455-kc i-f stages are functioning properly. If they do not appear to be operating properly, realine them according to the instructions in the preceding paragraph. Make sure that the BAND SELECTOR is set to BAND IV, which is the

lowest double-superheterodyne band. Tune C140 first, since this is a coaxial cable compensator. Then work from the output end of the 6-mc stages toward the 1st mixer.

BAND SELECTOR is set to	Signal generator frequency (mc)	Dummy load	Connect signal generator to—	Adjust for maximum (in given order)
BAND IV (TUNING switch set to low end of band).	6	600-ohm load across terminals 1 and 5 of E4 with 2 and 4 shorted.	Stator C2A mixer grid circuit V3.	C140, L43, L42, L41, and L40.

86. R-F Turret Alinement Chart

Figure 39 shows the location and layout view of the turret r-f adjustments. In making the r-f alinement, the signal generator and the receiver TUNING dial are set to the desired frequency as indicated in the alinement chart. First, vary the oscillator l-f (low-frequency) adjustment which is a core in the coil. After the adjustment is peaked, continue down the turret (this is down each column on the chart) and adjust all the l-f adjustments in order from the mixer to the antenna. After the l-f end of each band is tuned, the dial and signal generator should be set to the high end

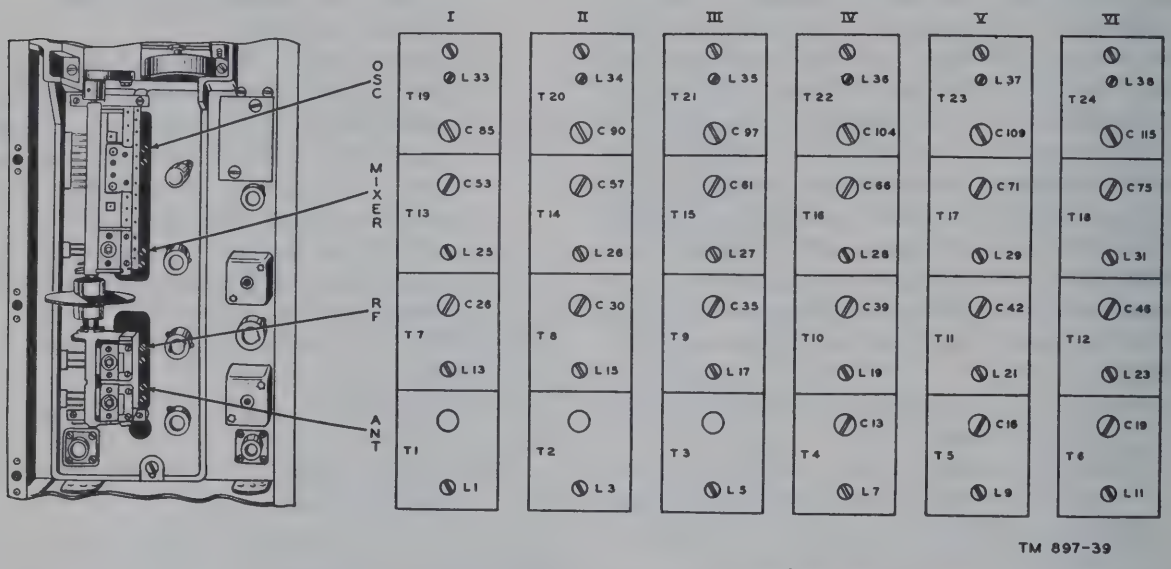


Figure 39. Radio Receiver R–274/FRR, r-f stage alinement diagram.

85. R-F Alinement

Connect one terminal A of antenna terminal strip E1 to ground. Connect the signal generator through a 100-ohm dummy antenna from ground to the other terminal A of E1. It may be necessary to repeat the alinement adjustments several times.

Note. The 100-ohm dummy antenna should include the generator impedance

of the band and the correct adjustments peaked at that end. It may be necessary to readjust the band at both ends several times before the alinement at either end will not affect the alinement at the opposite end of any band. The h-f ends of BANDS I, II, and III do not have trimmers. Therefore, in order to get a maximum indication, the ANT ADJ control on the front panel must be tuned. Do not disturb any other adjustments on the turret; these are factory-set trimmers and padders to compensate for production tolerances.

	End of band						
BAND No.		I	II	III	IV	V	VI
Tuning frequency	Low	570 kc	1.35 mc	3.20 mc	7.30 mc	14.5 mc	29.0 mc
	High	1.24 mc	2.9 mc	6.80 mc	13.3 mc	28.0 mc	54.0 mc
Signal generator frequency	Low	570 kc	1.35 mc	3.2 mc	7.3 mc	14.5 mc	29. mc
	High	1.24 mc	2.9 mc	6.8 mc	13.3 mc	28. mc	54. mc
Oscillator adjustments to be peaked.	Low	L33	L34	L35	L36	L37	L38
	High	C85	C91	C97	C104	C109	C115
1st mixer adjustments to be peaked.	Low	L25	L26	L27	L28	L29	L31
	High	C53	C57	C61	C66	C71	C75
R-f adjustments to be peaked	Low	L13	L15	L17	L19	L21	L23
	High	C26	C30	C35	C39	C42	C46
Antenna adjustments to be peaked	Low	L1	L3	L5	L7	L9	L11
	High*				C13	C16	C19

*On BANDS I, II, and III, no adjustments are to be made.

Note. Oscillator adjustments are peaked above the signal frequency. The second harmonic of the hfo (high-frequency oscillator) is used on BAND VI.

87. CARRIER LEVEL Meter Adjustment

CARRIER LEVEL meter M1 must be adjusted under certain conditions to allow a fairly accurate reading to be obtained as far as measurement of received signal strength is concerned. These are the conditions under which the meter adjustment should be checked:

a. With the set turned off, the meter needle should be at rest on the last dial scale marking on the left end of the scale. A mechanical adjusting screw is provided on the front of the meter to make this condition possible.

b. With the set on and the AGC-MANUAL switch in the AGC position, the RF GAIN-AC control at maximum, the SELECTIVITY switch at the NORMAL MED position, and the receiver tuned to a 50-uv signal (signal generator output injected through 100-ohm resistance at antenna terminals), the needle should indicate 0 db on the meter scale. The METER ZERO control (R87) on the rear of the chassis is used to adjust the meter reading for this condition. The above adjustment should be made on BAND III, 5.0 mc.

Section IV. FINAL TESTING

88. General

This section is intended as a guide to be used in determining the quality of a repaired Radio Receiver R–274/FRR. The minimum test requirements outlined in paragraphs 90 through 100 may be performed by maintenance personnel with adequate test equipment and the necessary skills. The receiver must meet the minimum standards required of Signal Corps Class A equipment. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

89. Test Equipment Required for Final Testing

The instruments needed for testing the repaired equipment are listed below:

a. R-F Signal Generator. The r-f signal generator should be capable of covering the same frequencies tuned by the receiver, and also the i-f of 455 kc. A signal generator that covers the range of from 450 kc to 67 mc is recommended. It should have an r-f output of approximately .5 volt (500,000 uv) with a calibrated variable attenuator to control the output from zero to maximum amplitude. If provision is not incorporated for internal audio modulation ranging from 250 to 5,000 cps, an external audio oscillator covering this range must be used in conjunction with the signal generator. Thirty percent modulation with the audio frequencies must be obtainable.

b. Output Meter. Two types of output meters may be used for final testing: an audio power output meter and an a-c voltmeter.

(i) The audio power meter is best suited, since it has a built-in load to match the receiver 600-ohm output. The scales are marked in watts and db. The meter

may be connected directly to the receiver AUDIO OUTPUT terminals 1 and 5 of E4 (connect terminals 2 and 4 together).

(2) An a-c voltmeter, such as contained in Test Equipment IE–9C, Test Set I–56–(*), or Multimeter TS–352(*)/U is also satisfactory. The meter should have an input resistance greater than 500 ohms per volt. To use the a-c voltmeter type input meter, a parallel 600-ohm load-resistor is necessary. The parallel combination of resistor and meter is placed across terminals 1 and 5 of E4 (connect terminals 2 and 4 together).

90. Test Conditions

a. To provide a basis for testing the performance of this receiver, it is recommended that the tests be made under standard test condition. This will allow testing to be done at a more rapid rate with a minimum of changing of the front panel controls. In preparing the receiver for final testing, a minimum of 20 minutes for receiver warm-up is necessary for full stability. A one-hour warm-up is preferred.

b. These are the standard test conditions:

(1) A-f output is 10 mw (milliwatt).

(2) Signal-plus-noise to noise ratio is 10 to 1 (10 db).

(3) Output a-f load is 600-ohm resistive.

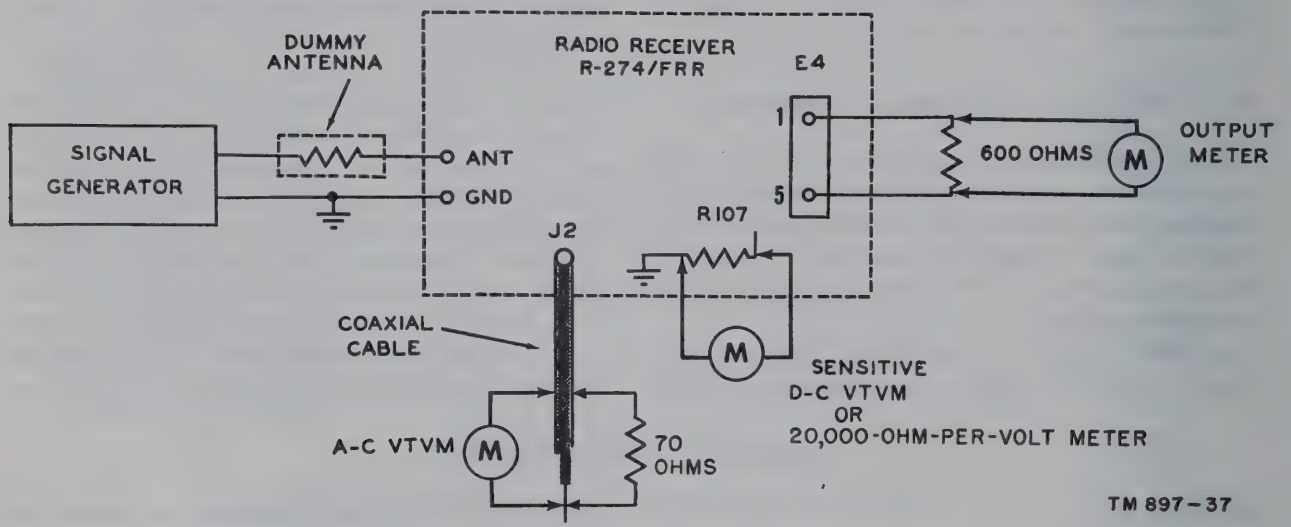


Figure 40. Over-all test set-up.

c. A-C Electronic Voltmeter. When measuring the voltage output of the i-f output stage, a sensitive a-c voltmeter is necessary. Since the i-f output is approximately 200 mv (millivolts), a meter sensitivity of at least 1,500 mv is required. An electronic type meter, such as the Ballantine model No. 300 or Electronic Multimeter TS–505(*)/U, is satisfactory for measuring output. In using the meter, a short length of Radio Frequency Cable RG–58/U with a coaxial connector to fit the i-f output connector, J2, is required. This coaxial cable must be terminated in a 70-ohm resistor at the meter end.

(4) Dummy antenna (including signal generator impedance) is 100-ohm resistive.

(5) I-f output dummy load is 70-ohm resistive.

(6) R-f test signals modulated 30 percent at 400 cps.

(7) Line voltage 117 volts a-c $\pm$ volt.

(8) The bandwidth must be set for 8 kc in a-m tests, and 3 kc in c-w tests.

(9) The above conditions may be modified by the specific test to be used.

c. Place the controls in the following positions unless otherwise specified.

Control	Setting
TUNING	As specified.
BAND SELECTOR	As specified.
RF GAIN-AC	Fully clockwise (maximum).
AUDIO GAIN	As required.
BFO PITCH	0.
CRYSTAL PHASING	0 (center position).
RECEIVE-SEND	RECEIVE.
AGC–MANUAL	MANUAL.
CW-MODULATION	MODULATION.
ANL-OFF	OFF.
VFO-CRYSTAL	VFO.
CRYSTAL VERNIER	0.
SELECTIVITY	NORMAL-MED.

91. Beat-frequency Oscillator

a. Inject an unmodulated r-f signal through the dummy antenna to the receiver antenna terminals.

b. Set the CW-MODULATION switch to CW and tune in the r-f signal.

c. When the receiver is tuned to the incoming signal, there should be a zero beat.

d. Vary the BFO PITCH in either direction to obtain beat frequencies up to at least 3,000 cps but less than 4,000 cps.

e. If the two foregoing steps do not give the proper indications, the bfo internal adjustment (L59) may need correction (par. 84*c*).

92. Dial Calibration Accuracy

a. This test checks the accuracy of the dial scale reading of the incoming tuned signal.

b. The controls are set to standard test positions with these exceptions:

Control	Position
RF GAIN-AC	As required.
AUDIO GAIN	As required.
AGC-MANUAL	AGC.
GW-MODULATION	CW.
BFO PITCH	0.

c. Apply at least a 100-uv signal through a dummy antenna to the antenna terminals. Use an oscilloscope with an a-f signal generator and an a-f counter at the audio output to determine the accuracy of the tuning dial calibration. When the signal generator and receiver are both set to exactly the same frequency, check the calibration at 100-kc intervals on BANDS I, II, and III and at 500-kc intervals on BANDS IV, V, and VI. Adjust the RF GAIN-AC control and the AUDIO GAIN control to supply the necessary audio output.

d. The accuracy in the entire range of 540 kc to 54 mc should be within .2 percent of the correct settings.

93. Sensitivity

a. The sensitivity of the receiver is measured at three frequencies (both ends and center) of each band. Sensitivity is defined as the amount of input signal (number of microvolts) necessary to produce a certain output with at least a 10 to 1 (10 db) signal-plus-noise to noise ratio.

b. In the sensitivity measurement of Radio Receiver R–274/FRR, the receiver must be able to supply 2 watts a-f output as determined by the tests in paragraph 98.

c. After the minimum requirements have been satisfied, reduce the setting of the AUDIO GAIN control, R94, to a position which will give an output power value of 50 mw as read on the output meter, with a 30 percent modulated 2-uv signal fed into the antenna input terminals.

d. Measure the sensitivity of a receiver (known to be in good operating condition) at three frequency points in each of the six frequency bands. The nominal sensitivity is the number of microvolts of input required to produce an audio output of 50 mw. Prepare a chart giving the readings on this typical receiver. The chart will be useful in determining the relative sensitivity of the receivers under test.

94. I-F Output Voltage

a. The i-f output voltage is measured at the coaxial connector, J2, on the rear of the chassis. A short piece of coaxial cable is soldered to a coaxial connector to deliver the output voltage to a meter. An a-c vtvm with a sensitivity of at least 1,500 mv should be used for the measurement.

b. Connect a 70-ohm terminating resistor across the open end of the output cable. Place the meter across this terminating resistor. Apply an unmodulated signal under standard test conditions to the antenna terminals and read the i-f output on the meter.

c. With a 2-uv signal input, the i-f output must be at least 200 mv (.2 volt).

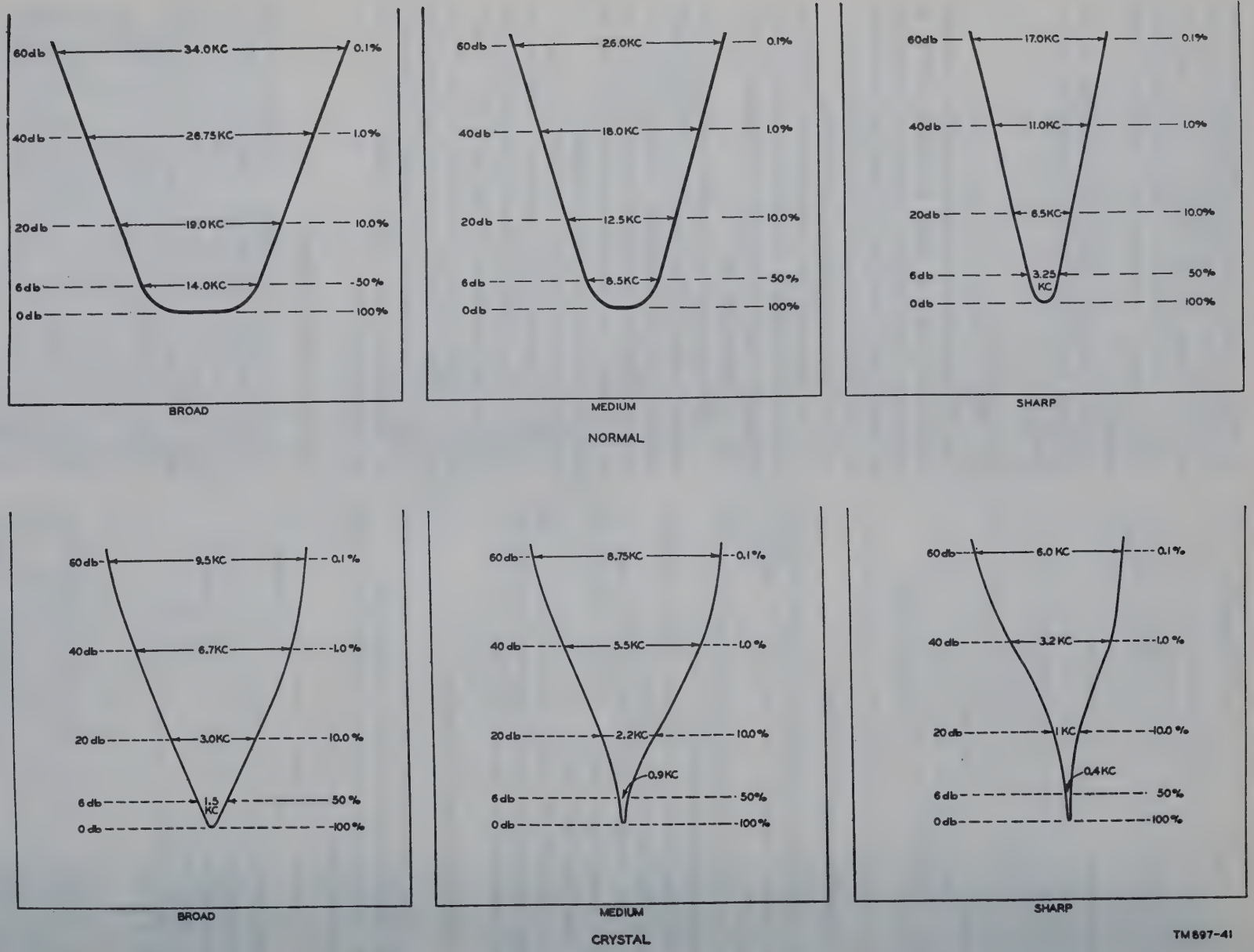


Figure 41. Selectivity curves for different positions of SELECTIVITY control.

95. Over-all Selectivity

The over-all selectivity of the receiver is a measure of the band-pass characteristics from the antenna terminals through the receiver to the output terminals. Since the audio stages have a fixed response, measurements are taken at the detector load resistor, R107. Figure 41 shows the over-all curves for all six positions of the SELECTIVITY switch, S1. These curves are representative of the curves to be expected in making the over-all selectivity test.

a. Procedure.

(1) Insert a 10-uv unmodulated test frequency signal at the antenna terminals. Connect a sensitive d-c type meter across detector load resistor R107. The test is made under standard test conditions for control settings. Note the voltage indication on the meter; if it is over 10 volts, turn the RF GAIN-AC control counterclockwise until a 10-volt level is reached. This will prevent overloading the i-f stages. Accurately adjust the TUNING knob until the signal is peaked on the meter. Readjust the RF GAIN-AC control, if necessary, to bring the reading back to 10 volts on the meter.

(2) Tune the signal generator to one side of the test frequency setting and increase the generator output. A 10-volt reading on the meter should be maintained throughout the test. Continue to deviate from the test frequency until it is necessary to supply 10,000 uv to the receiver for a 10-volt meter reading. Duplicate the same procedure for the other side of the test frequency setting. The frequency diœerence between these two settings on each side of the test frequency is the bandwidth.

(3) The procedure in (1) and (2) above may be used for testing all positions of the SELECTIVITY switch; however, for these tests, it is necessary to use only the noncrystal positions.

b. Minimum Requirements.

Selectivity control setting	Test frequency (mc)	Bandwidth (kc)
NORMAL SHARP	.54	3
NORMAL MED	1.5	8
NORMAL BROAD	3.45	14

96. Image Rejection Ratio

a. Besides receiving a signal to which it is tuned, the receiver will also receive a greatly attenuated signal at a frequency which is equal to the tuned frequency plus two times the i-f. The additional frequency that is picked up is called the image frequency. This receiver is designed to attenuate the image frequency to a great extent. In Radio Receiver R–274/FRR, double superheterodyne action is needed to reduce the image frequency response on frequencies above 7 mc. Therefore, in computing the image frequencies, two different intermediate frequencies will have to be taken into consideration. On BANDS I, II, and III, the image frequency will be equal to the test frequency plus two times 455 kc (i-f). (Example: 1,000 kc plus (2×455 kc)=1,910 kc.) For the frequencies above 7 mc, that is, BANDS IV, V, and VI, the image frequency is the test frequency plus 2 times 6 mc (i-f). (Example: 30 mc plus (2×6 mc)=42 mc.)

b. The following table lists the minimum image rejection ratio requirements.

Test frequency (mc)	Rejection ratio
1.27 (high end BAND I)	100,000 to 1.
3.0 (high end BAND II)	10,000 to 1.
7.0 (high end BAND III)	10,000 to 1.
13.8 (high end BAND IV)	100,000 to 1.
29.7 (high end BAND V)	100,000 to 1.
54.0 (high end BAND VI)	10,000 to 1.

c. Follow the standard test condition (par. 90) with the following exception: AUDIO GAIN adjusted as needed to set the output level.

d. Insert an r-f test signal of 5 uv to the receiver antenna terminals (through dummy an-

tenna). Adjust the receiver TUNING control to this test frequency. Set the AUDIO GAIN to obtain a 50-mw reading on the output meter. Without changing any of the receiver controls, insert an r-f signal of the image frequency instead of the test frequency. Increase the signal generator output until the same 50-mw reading is indicated on the output meter. The ratio between the input needed at the image frequency and the 5-uv input is the image rejection ratio. To find the image rejection ratio, divide the number of microvolts input needed at the image frequency by 5 uv.

Note. At frequencies above 20 mc, many signal generators exhibit strong frequency modulation of the r-f carrier; it is recommended, therefore, that tests be conducted on a c-w basis with the carrier unmodulated and the BFO PITCH control adjusted for a 1,000-cps reference beat note. This method will result in more reliable measurements.

97. I-F Rejection Ratio

Any signals developing voltages in the antenna at 455 kc or 6 mc, which are the intermediate frequencies in use in Radio Receiver R–274/FRR, may have a tendency to force through the receiver as interference to normal reception. The two stages of r-f amplification, V1 and V2, included in this receiver are intended to provide a high rejection ratio of the signal frequencies at 455 kc and 6 mc with respect to the frequency to which the receiver is tuned. A ratio between the number of microvolts of input at the i. f. (output of the signal generator modulated 30 percent with 400 cps) required to produce 10 volts dc across diode load resistor R107 and the number of microvolts of input at the tuned frequency required to produce 10 volts dc across resistor R107 is known as the i-f rejection ratio.

a. Use standard test conditions (par. 90) when measuring the i-f rejection ratio.

b. Eighteen test frequencies constitute one set of tests; three tests are made in each of the six bands. The three frequencies in each band are at the low end, center, and high end, respectively, of the tuning range of the band.

c. Adjust the signal generator to produce the frequency tuned by the receiver. Apply a 5-uv signal, modulated 30 percent with 400 cps, to the antenna terminals (A and A on terminal board E1) through the dummy antenna.

d. Adjust the RF GAIN-AC control, R83, until the voltmeter, connected across resistor R107, reads 10 volts dc.

e. Without changing the receiver controls of the signal generator connections, set the signal generator to produce the i. f. modulated 30 percent with 400 cps. The i-f is 455 kc for BANDS I, II, and III or 6. mc for BANDS IV, V, and VI. Increase the output of the signal generator until the voltmeter across resistor R107 again reads 10 volts.

f. Calculate the i-f rejection ratio by dividing the number of microvolts of signal generator output required in *e* above by 5 (the number of microvolts required in *c*).

g. Use a shielded screen room if any i-f interference is expected.

h. The minimum requirements are listed below:

Test frequency (mc)	Rejection ratio (db)
.54 to 54	100

98. Agc Characteristics

a. The agc voltage that is developed by the incoming signal automatically adjusts the bias on certain tubes to provide a substantially constant audio output with variations of signal strength. The purpose of this test is to see whether the above condition is met by the repaired receiver.

b. Standard test conditions will prevail with the exception that the AGC-MANUAL switch will be in the AGC position. A test frequency in BAND I and BAND V will be used for the test. Apply a 2-uv modulated signal to the antenna terminals and adjust the AUDIO GAIN control for an output of 10 mw. The input is then increased to .2 volt (200,000 uv) with spot checks at 10, 100, 100, 10,000, and 100,000 uv. After the .2-volt point is reached, the output should *not decrease* when the input signal is increased to .5 volt.

c. The minimum requirements are as follows:

Signal input	Test frequency 2.2 mc (BAND II)	Test frequency 22 mc (BAND V)
2 uv to .2 volt.	Not more than a 13-db increase in ouput (from 10 mw to 200 mw).	Not more than a 13-db increase in output (from 10 mw to 200 mw).
.2 volt to 1 volt.	Power output shall not decrease.	Power output shall not decrease.

99. Power Output to Speaker

a. The power output to speaker test is used to determine the power output capabilities of the receiver.

b. Use standard test conditions with the AUDIO GAIN control turned fully clockwise (maximum gain). Select a test frequency in the center of each band. Apply a 2-uv signal modulated 30 percent with a 1,000 cps audio signal to the antenna terminals.

c. The power output must be at least 2 watts across 600 ohms with a 2-uv input signal.

100. Frequency Response

The over-all frequency response of the receiver favors voice communication. The h-f response is limited by the position of the selectivity control. Two settings of this control are used to provide test measurements of the response. One is NORMAL MED and the other is NORMAL BROAD.

a. Apply a 50-mv input, r-f signal of 10 mc modulated 30 percent to the antenna terminals. The signal generator must be externally modulated at a depth of 30 percent with an audio oscillator. Place the AGC-MANUAL switch in the AGC position.

b. Adjust the agc to give a 0-db indication on the output meter when the signal generator is modulated with 1,000 cps. Keep the percent of modulation of the signal generator constant at all other modulation frequencies. Apply different audio modulation frequencies at these points: 200 cps, 300 cps, and at 200 cps intervals to 4,000 cps to obtain an audio frequency response which conforms closely to the curves shown in figure 42.

c. The minimum requirements are listed in the following table:

Audio frequency (cps)	Change in output measured in db	
	NORMAL MED	NORMAL BROAD
300	Less than 1 db down.	Less than 1 db down.
1,000	0	0.
3,500	Less than 3 db down.	Less than 1 db down.

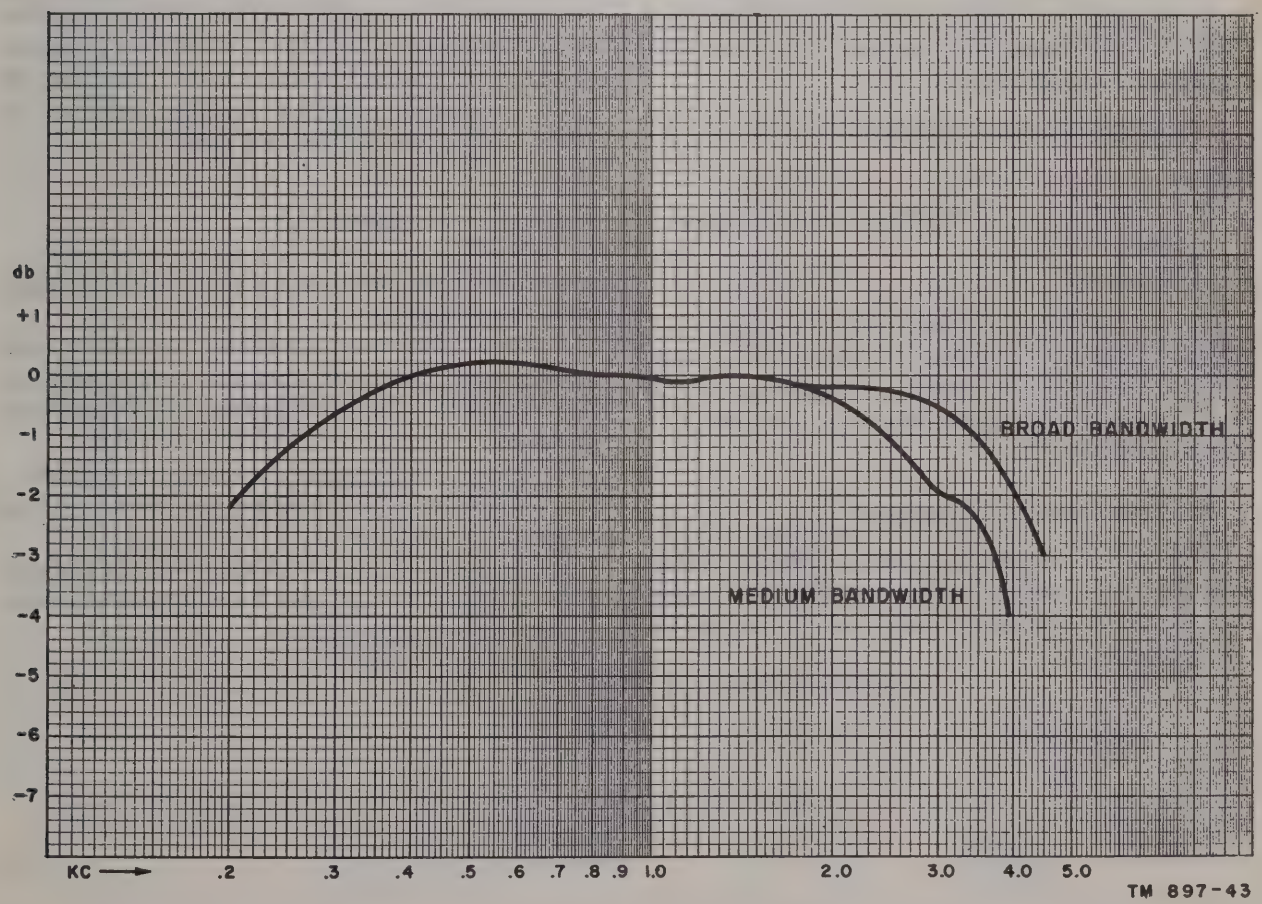


Figure 42. Typical a-f response curve.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

101. Disassembly

The circumstances involved in shipment and storage vary, therefore no definite procedure for repacking can be given. The following instructions are recommended as a guide for preparing the radio receiver for transportation and storage.

a. Turn the RF GAIN AC switch to OFF.

b. Remove power plug.

c. Disconnect antenna and ground from the receiver. Remove the headset plug from the receiver PHONES jack.

d. Remove receiver from rack.

102. Repacking for Shipment or Limited Storage

a. The exact procedure used in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 12 and reverse the unpacking instructions as far as practicable.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the chests. Protect the chests with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding between the paper barrier and the packing case.

Section II. Demolition of Materiel to Prevent Enemy Use

103. General

The demolition procedures outlined in paragraph 104 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only on order of the commander.

104. Destruction of Equipment

a. Smash. Smash the crystals, controls, tubes, coils, switches, capacitors, and transformers, using sledges, axes, handaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut cords and wiring, using axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, cabinet, and chassis.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy everything.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3 and SR 310–20–4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalog pamphlets.

1. Army Regulations

AR 380–5	Safeguarding Military Information.
AR 750–5	Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Publications

SIG 1	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 7 & 8	Organizational Maintenance Allowances and Field and Depot Maintenance Stockage Guide.
SB 11–76	Signal Corps Kit and Materials for Moisture-and-Fungi-Resistant Treatment.

3. Publications on Auxiliary Equipment and Test Equipment

TM 11–300	Frequency Meter Sets SCR–211–(*).
TM 11–303	Test Sets I–56–C, I–56–D, I–56–H, and I–56–J.
NAVSHIPS 91379.	Signal Generator AN/URM–25.
TM 11–307	Signal Generators I–72–G, H, J, K, and L.
TM 11–5030	Signal Generator TS–497A/URR.
TM 11–321	Test Set I–56–E.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–2524	Oscillators I–151–A and I–151–E.
TO 16–35TS382–2	Audio Oscillator TS–382A/U.
TM 11–2613	Voltohmmeter I–166.
TM 11–2624B	Voltohmmeters TS–294/U, TS–294B/U, TS–294C/U.
TM 11–2626	Test Units I–176, I–176–A, and I–176–B.
TM 11–5017	Output Meter TS–585A/U.
TM 11–2627	Tube Testers I–177 and I–177–A.
TM 11–5044	Frequency Meter TS–174B/U.
TM 11–5527	Multimeter TS–352/U.
TM 11–5511	Electronic Multimeter TS–505/U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TB SIG 212	Low Temperature Lubricants for Meteorological Equipment.
TM 9–2851	Painting Instructions for Field Use.

5. Camouflage

FM 5–20	Camouflage, Basic Principles.

6. Decontamination

TM 3–220	Decontamination.

7. Demolition

FM 5–25	Explosives and Demolitions.

8. Other Publications

FM 24–18_____ Field Radio Techniques.
FM 72–20_____ Jungle Warfare.
SR 310–20–3____ Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Army Training Tests, Graphic Training Aids, Joint Army-Navy-Air Force Publications, Combined Communications Board Publications, and Army Communications Publications).
SR 310–20–4____ Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700–45–5____ Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5____ Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army).
TB SIG 4_____ Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 25_____ Preventive Maintenance of Power Cords.
TB SIG 66_____ Winter Maintenance of Signal Equipment.
TB SIG 72_____ Tropical Maintenance of Ground Signal Equipment.
TB SIG 75_____ Desert Maintenance of Ground Signal Equipment.
TB SIG 123_____ Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178_____ Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219_____ Operation of Signal Equipment at Low Temperatures.
TB SIG 223_____ Field Expedients for Wire and Radio.
TB 11–499–( )*_ Basic Radio Propagation Predictions.
TM 9–2857_____ Storage Batteries Lead-Acid Type.
TM 11–314_____ Antennas and Antenna Systems.
TM 11–453_____ Shop Work.
TM 11–455_____ Radio Fundamentals.
TM 11–466_____ Radar Electronic Fundamentals.
TM 11–476_____ Radio Direction Finding.
TM 11–483_____ Suppression of Radio Noises.
TM 11–486_____ Electrical Communication Systems Engineering.
TM 11–681_____ Electrical Fundamentals (Alternating Current).
TM 11–496_____ Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets.
TM 11–499_____ (Preliminary) Radio Propagation Handbook.
TM 11–660_____ Introduction to Electronics.
TM 11–661_____ Electrical Fundamentals (Direct Current).
TM 11–4000_____ Trouble Shooting and Repair of Radio Equipment.

*A new TB in this series is issued monthly which gives propagation predictions 3 months in advance.

9. Abbreviations

a-c_____ alternating-current.
a-f_____ audio-frequency.
agc_____ automatic gain control.
a-m_____ amplitude-modulated.
anl_____ automatic noise limiter.
bfo_____ beat-frequency oscillator.
cps_____ cycles per second.
c-w_____ continuous-wave.
db_____ decibel.
dbm_____ decibels relative to 1 milliwatt.
d-c_____ direct-current.
hfo_____ high-frequency oscillator.
h-v_____ high-voltage.
icw_____ interrupted continuous wave.
i-f_____ intermediate-frequency.
kc_____ kilocycle.
l-f_____ low-frequency.
mc_____ megacycle.
mcw_____ modulated continuous waves.
mv_____ millivolt.
mw_____ milliwatt.
r-f_____ radio-frequency.
SPST_____ single-pole, single-throw.
μf_____ microfarad.
μμf_____ micromicrofarad.
uv_____ microvolt.
vtvm_____ vacuum-tube voltmeter.
vfo_____ variable-frequency oscillator.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O & E, T/A, SIG 7 & 8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8 R–274/FRR. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

2. Identification Table of Parts for Radio Receiver R–274/FRR

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	RADIO RECEIVER R–274/FRR: A-M, C-W and mcw signals; for comm; .54–54 mc continuous in 6 bands; input 95–260 v, 50/60 cyc, single ph, 130 w; w/std 19" rack panel; 19" lg x 10 15/32" h x 18⅛".		2C4180–274
	RADIO RECEIVER R–274A/FRR: A1, A2, and A3 reception; for comm; 540 kc to 54 mc freq range in 6 bands; 95–260 v ac (8 taps), 50/60 cyc, single ph, 130 w; table mtg; 21⅜" lg x 12¾" h x 17⅛" d; 20 tubes superheterodyne ckt; turret mtd coils; built-in xtal filter; beat freq osc; dual conversion above 7.4 mc; 6 xtal positions available for fixed freq operation.		2C4180–274A
	TECHNICAL MANUAL TM 11–897		Order through AGO.
O13	BEARING, roller: single row radial; .063" shaft dia, .250" OD, .328" wd.	Roller bearing for detent	3H321–95
O18	BEARING, sleeve: for dial mask idler gear; .375" lg, bead slotted .031" wd x .031" d x .312" dia x .046" lg, body .2495" dia x .265" lg, end shoulder .187" dia x .062" lg, undercuts, next to head and shoulder .015" wd x .010" d, end tapped 4–40 x 3/16" d.	Bearing for dial mask idler gear	2Z581–34
O15, O16	BEARING, sleeve: for phasing capacitor shaft; 7/16" lg, ½" hex. head, 1/16" thk, .252" ID, threaded ⅜"–32 SAE extra fine std thd x 21/64" lg; ctb .261" dia, 5/16" d from threaded end.	O15: Bearing for SELECTIVITY switch shaft. O16: Bearing for VFO CRYSTAL switch shaft.	2Z581–36
O14, O26	BEARING, sleeve: for phasing capacitor shaft; .437" lg, ½" hex. head, 1/16" thk, .252" ID, threaded ⅜"–32 NEF–2 thd x 21/64" lg, ctb .261" dia, 5/16" d from threaded end.	O14: Bearing for phasing capacitor shaft. O26: Bearing for antenna adjustment shaft.	2Z581–37

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O19	BEARING, sleeve: turret shaft brg; ⅝″ lg, ⅞″ hex. head .078″ thk, 1/32″ from 1 end, .3755″ ID, threaded ½″–28 EF x ¼″ lg, body sect. ½″ OD, undercut next to head 1/32″ wd x 1/64″ d.	Rear bearing for BAND SELECTOR turret shaft.	2Z581–35
O17	BEARING, sleeve: turret shaft brg; .812″ lg, ¾″ hex. head .062″ thk, .3449″ ID, threaded ½″–28 EF–2 x .266″ lg and 9/16″–24 EF–2 x .171″ lg, .4995″ dia x ¼″ lg body sect. between thd; undercut next to head 3/64″ wd x 1/32″ d.	Front bearing for BAND SELECTOR turret shaft.	2Z581–33
W2	CABLE, RF: Radio Frequency Cable RG–58/U; coax; 53.5 ohms nom impedance, 28.5μμf per ft.	455-kc and 6-mc transmission line.	1F425–58
W1	CABLE ASSEMBLY, power: Electric Power Cable CX–1855/U; two #16 AWG stranded cond; 6′ lg excluding term.	Power input	3E7350.1–72.28
C32, C36, C43, C47, C67, C76	CAPACITOR, fixed: ceramic dielectric; 2.2μμf ±20%; 500 vdcw.	C32: Couples V1 to V2, T8 C36: Couples V1 to V2, T9 C43: Couples V1 to V2, T11. C47: Couples V1 to V2, T12. C67: Couples V2 to V3, T16. C76: Couples V2 to V3, T18.	3D9002E2–1
C28, C55, C59, C63	CAPACITOR, fixed: ceramic dielectric; 3.3μμf ±20%; 500 vdcw.	C28: Couples V1 to V2, T7 C55: Couples V2 to V3, T13. C59: Couples V2 to V3, T14 C63: Couples V2 to V3, T15.	3D9003E3
C181	CAPACITOR, fixed: ceramic dielectric; 5μμf ±.5μμf; 500 vdcw; JAN type CC20UJ–050D.	Couples BFO to V12	3D9005–111
C34, C48, C62	CAPACITOR, fixed: ceramic dielectric; 5μμf ±1μμf; 500 vdcw; JAN type CC20UJ050F.	C34: H-f padder, T9 C48: Gain equalizer, T12. C62: H-f padder, T15.	3D9005–124
C166	CAPACITOR, fixed: ceramic dielectric; 6 μμf ±.5μμf; 500 vdcw; JAN type CC20UJ–060D.	C166: Couples switch S1, section 6, to GRID of V11.	3D9006–26
C91, C98	CAPACITOR, fixed: ceramic dielectric; 10μμf ±.25μμf; 500 vdcw; JAN type CC20TJ–100D.	C91: Temperature compensator, T20. C98: Temperature compensator, T21.	3D9010–200
C44, C73, C165	CAPACITOR, fixed: ceramic dielectric; 10μμf ±.5μμf; 500 vdcw; JAN type CC20UJ100F.	C44: H-f padder, T11 C73: H-f padder, T17. C165: Balance capacitor normal positions of switch S1, section 5.	3D9010–118
C72	CAPACITOR, fixed: ceramic dielectric; 12μμf ±10%; JAN type CC20UJ120K.	C72: ANTENNA PADDER, T5	3D9012–49
C3, C9, C12, C41, C70	CAPACITOR, fixed: ceramic dielectric; 15μμf ±10%; 500 vdcw; JAN type CC20UJ150K.	C3: Antenna balance, T1 C9: Antenna balance, T3. C12: Antenna balance, T4. C41: H-f padder, T11. C70: H-f padder, T17.	3D9015–69
C86	CAPACITOR, fixed: ceramic dielectric; 18μμf ±5%; 500 vdcw; JAN type CC20SH180J.	H-f padder, T19	3D9018–31
C6	CAPACITOR, fixed: ceramic dielectric; 18μμf ±10%; 500 vdcw; JAN type CC20UJ180K.	Gain equalizer, T2	3D9018–10

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C110	CAPACITOR, fixed: ceramic dielectric; 22$\mu\mu$f ±2%; 500 vdcw; JAN type CC30LH220G. *Note.* Capacitor JAN type CC30PH270G, 27μ, should be requisitioned and connected in parallel with this item for maximum efficiency.	Temperature compensator, T23	3D9022–59
C103	CAPACITOR, fixed: ceramic dielectric; 22$\mu\mu$f ±2%; 500 vdcw; JAN type CC30PH220G. *Note.* Capacitor JAN type CC30LH330G, 33μ, should be requisitioned and connected in parallel with this item for maximum efficiency.	Temperature compensator, T22	3D9022–58
C81, C87, C93, C99	CAPACITOR, fixed: ceramic dielectric; 22$\mu\mu$f ±5%; 500 vdcw.	C81: R-f bypass, grid V4, T19 C87: R-f bypass, grid V4, T20 C93: R-f bypass, grid V4, T21. C99: R-f bypass, grid V4, T22.	3D9022–55
C38, C65	CAPACITOR, fixed: ceramic dielectric: 22$\mu\mu$f ±10%; 500 vdcw; JAN type CC20UJ220K.	C38: H-f padder, T10 C65: H-f padder, T16.	3D9022–19
C18, C141	CAPACITOR, fixed: ceramic dielectric; 27$\mu\mu$f ±10%; 500 vdcw; JAN type CC20UJ270K.	C18: H-F padder, T6 C141: 6.455-mc crystal load capacitor.	3D9027–22
C100	CAPACITOR, fixed: ceramic dielectric; 33$\mu\mu$f ±5%; 500 vdcw; JAN type CC20TH330J.	Tracking capacitor for T22	3D9033–39
C21, C40, C49, C80, C144, C171	CAPACITOR, fixed: ceramic dielectric; 33$\mu\mu$f ±10%; 500 vdcw; JAN type CC20UJ330K.	C21: Coupling to V1 C40: Gain equalizer, T10. C49: Coupling to V2. C80: Coupling to V3, T19. C144: Coupling from V8 to V7. C171: 455-kc coupling to AGC tube V13.	3D9033–19
C189	CAPACITOR, fixed: ceramic dielectric; 39$\mu\mu$f ±10%; 500 vdcw; JAN type CC20UJ390K.	BFO plate circuit network	3D9039–18
C177	CAPACITOR, fixed: ceramic dielectric; 47$\mu\mu$f ±5%; 500 vdcw; JAN type CC20UJ470J.	BFO temperature compensator on tuned circuit, T33.	3D9047–58
C105, C111	CAPACITOR, fixed: ceramic dielectric; 47$\mu\mu$f ±5%; 500 vdcw; JAN type CC30CH470J.	C105: R-f bypass, grid V4, T23 C111: R-f bypass, grid V4, T24.	3D9047–43
C82	CAPACITOR, fixed: ceramic dielectric; 47$\mu\mu$f ±5%; 500 vdcw; JAN type CC30RH470J.	Temperature compensator, part of tracking capacitor of T19.	3D9047–65
C54	CAPACITOR, fixed: ceramic dielectric; 47$\mu\mu$f ±10%; 500 vdcw; JAN type CC20UJ470K.	Part of 6-mc trap, T17	3D9047–29
C45, C74	CAPACITOR, fixed: ceramic dielectric; 56$\mu\mu$f ±10%; 500 vdcw .400″ lg x .200″ dia; Centralab #CC20UJ560K.	C45: H-f padder, T12 C74: H-f padder, T18.	3D9056–46
C122	CAPACITOR, fixed: ceramic dielectric; 56$\mu\mu$f ±10%; 500 vdcw; JAN type CC25UJ560K.	Screen bypass, V5	3D9056–44
C68, C69	CAPACITOR, fixed: ceramic dielectric; 56$\mu\mu$f ±10%; 500 vdcw; JAN type CC30UJ560K.	C68: Part of 6-mc trap of T16 C69: H-f padder, T16.	3D9056–39
C106	CAPACITOR, fixed: ceramic dielectric; 100$\mu\mu$f ±5%; 500 vdcw; JAN type CC30UJ101J.	Temperature compensator, part of tracking capacitor of T23.	3D9100–230
C4	CAPACITOR, fixed: ceramic dielectric; 100$\mu\mu$f $\mu\mu$f ±10%; 500 vdcw; JAN type CC25UJ-101K.	H-f bypass, V17	3D9100–185

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C64	CAPACITOR, fixed: ceramic dielectric; 100μμf ±10%; 500 vdcw; JAN type CC30UJ-101K.	Part of plate load, V2	3D9100–246
C89	CAPACITOR, fixed: ceramic dielectric; 120μμf ±5%; 500 vdcw; JAN type CC32TH-121J.	Temperature compensator, T20	3D9120–39
C182	CAPACITOR, fixed: mica dielectric; 180μμf ±5%; 500 vdcw; JAN type CM20C181J.	BFO frequency deviation network capacitor.	3K2018132
C33, C37, C60	CAPACITOR, fixed: ceramic dielectric; 180μμf ±5%; 500 vdcw; JAN type CC32UJ-181J.	C33: Gain equalizer of T8 C37: Gain equalizer of T9. C60: Gain equalizer of T14.	3D9180–31
C84	CAPACITOR, fixed: mica dielectric; 220μμf ±2%; 500 vdcw; JAN type CM20D221G.	Tracking capacitor, T19	3K2022143
C56	CAPACITOR, fixed: ceramic dielectric; 220μμf ±5%; 500 vdcw; JAN type CC32UJ221J.	Gain equalizer of T13	3D9220–38
C102	CAPACITOR, fixed: mica dielectric; 270μμf ±2%; 500 vdcw; JAN type CM20D271G.	Tracking capacitor, T22	3D9270–22
C96	CAPACITOR, fixed: ceramic dielectric; 270μμf ±5%; 500 vdcw; JAN type CC32UJ271J.	Temperature compensator, T21	3D9270–21
C108	CAPACITOR, fixed: mica dielectric; 390μμf ±5%; 500 vdcw; JAN type CM20D391J.	Tracking capacitor, T23	3K2039142
C119	CAPACITOR, fixed: ceramic dielectric; 390μμf ±10%; 500 vdcw; JAN type CC35UJ391K.	Coupling between V5 and V3	3D9390–25
C88	CAPACITOR, fixed: mica dielectric; 560μμf ±2%; 500 vdcw; JAN type CM25D561G.	Tracking capacitor, T20	3D9560–16
C29	CAPACITOR, fixed: mica dielectric; 820μμf ±10%; 500 vdcw; JAN type CM25D821K.	Gain equalizer, T7	3K2582141
C94	CAPACITOR, fixed: mica dielectric; 1200μμf ±2%; 500 vdcw; JAN type CM30D122G.	Tracking capacitor, T21	3K3012243
C123	CAPACITOR, fixed: mica dielectric; 2200μμf ±10%; 500 vdcw; JAN type CM30B222K.	D-c blocking capacitor, VFO crystal.	3K3022221
C209, C210, C211	CAPACITOR, fixed, ceramic dielectric; 2300μμf −20% +50%; 500 vdcw.	C209: Feedthrough bypass, filament of V7. C210: Feedthrough bypass, for B+ of V7 and V8. C211: Feedthrough bypass, grid of V8.	3DA2.300–1
C120	CAPACITOR, fixed: mica dielectric; 3300μμf ±10%; 500 vdcw; JAN type CM30B332K.	H-f audio bypass, V17	3K3033221
C176, C190, C191, C200, C201., C203	CAPACITOR, fixed: paper dielectric; 10,000μμf ±20%; 600 vdcw; JAN type CN35E103M.	C176: ANL network V12 C190: A-c input filter, P1. C191: A-c input filter, P1. C200: Audio coupling, grid V16. C201: Audio coupling, jack E3. C203: Audio coupling, V17.	3DA10–435

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C23, C24, C25, C50, C51, C52, C58, C78, C79, C117, C118, C124, C127, C131, C132, C136, C138, C139, C142, C143, C146, C150, C152, C156, C157, C158, C167, C168, C174, C178, C179, C187, C188, C205, C206, C212, C213	CAPACITOR, fixed: ceramic dielectric; 10,000$\mu\mu$f +80% −20%; 450 vdcw.	C23: AGC bypass, V1 C24: Screen bypass, V1. C25: Plate return bypass, V1. C50: Cathode bypass, V2. C51: Screen bypass, V2. C52: Plate return bypass, V2. C58: AGC filter. C78: Cathode bypass, V3. C79: Screen bypass, V3. C117: R-f filter, AGC. C118: Part of plate tank, V4. C124: Plate circuit decoupling, V5. C127: Plate circuit decoupling, V3, 6-megacycle position. C131: Cathode bypass, V6. C132: Screen bypass, V6. C136: Cathode bypass, V7. C138: Filament bypass, V7. C139: Screen bypass, V7. C142: Grid return bypass, V8. C143: Plate circuit decoupling, V8. C146: Plate circuit decoupling, V7. Reference T28. C150: Screen bypass, V9. C152: Plate circuit decoupling, V9. C156: Cathode bypass, V10. C157: Screen bypass, V10. C158: Plate circuit decoupling, V10. C167: Cathode bypass, V11. C168: Screen bypass, V11. C174: Plate circuit decoupling, V11. C178: Cathode bypass, V15. C179: Screen bypass, V15. C187: Screen bypass, V14. C188: Plate circuit decoupling, V14. C205: Screen bypass, V17. C206: Filament bypass, V4. C212: Plate circuit decoupling, V6. C213: Suppressor bypass, V14.	3DA10–514
C197	CAPACITOR, fixed: paper dielectric; 50,000$\mu\mu$f ± 10%; 300 vdcw; JAN type CN42 E-503K.	AGC time constant capacitor	3DA50–365
C175	CAPACITOR, fixed: paper dielectric; 100,000$\mu\mu$f ± 20%; 400 vdcw; JAN type CN43 E-104M.	Noise filter, V12	3DA100–838
C202	CAPACITOR, fixed: paper dielectric; 500,000$\mu\mu$f ± 10%; 600 vdcw; JAN type CP53 B1F-F504K.	Cathode bypass, V16	3DA500–468

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C186A, C186B, C194A, C194B	CAPACITOR, fixed: paper dielectric; 2 sect.; 100,000 μμf ±15% ea sect.; 600 vdcw; JAN type CP53B4DF104L.	C186A: Suppressor bypass, V14 C186B: R-f gain control, R83, bypass. C194A: B+r-f filter, V16. C194B: Plate circuit decoupling, V16.	3DA100–760
C198, C199	CAPACITOR, fixed: paper dielectric; 1μf +20% −10%; 600 vdcw; JAN type CP53-B1FB105V.	C198: AGC time constant C199: AGC time constant.	3DB1–355
C204	CAPACITOR, fixed: electrolytic; 25μf; 25 vdcw; JAN type CE63C250F.	Cathode bypass, V17	3DB25–79
C195	CAPACITOR, fixed: electrolytic; 50μf; 50 vdcw; JAN type CE63C500G.	B− filter	3DB50–78
C192A, C192B, C193A, C193B	CAPACITOR, fixed: electrolytic; 2 sect.; 40μf ea sect.; 350 vdcw; JAN type CE42-C400P.	C192A: B+input filter C192B: B+output filter. C193A: B+filter. C193B: B+filter.	3DB10–81
C8, C11, C14, C17	CAPACITOR, variable: ceramic dielectric; 1.5–9μμf.	C8: Antenna balance adjustment, T2. C11: Antenna balance adjustment, T3. C14: Antenna balance adjustment, T4. C17: Antenna balance adjustment, T5.	3D9009V–22
C85, C92, C97, C104, C109, C115	CAPACITOR, variable: air dielectric; plate meshing type, 1 sect.; 2.2–14.5μμf.	C85: Trimmer adjustment, T19 C92: Trimmer adjustment, T20. C97: Trimmer adjustment, T21. C104: Trimmer adjustment, T22. C109: Trimmer adjustment, T23. C115: Trimmer adjustment, T24.	3D9014VE58
C26, C30, C35, C53, C57, C61	CAPACITOR, variable: ceramic dielectric; 2.5–13μμf; 500 vdcw; JAN type CV11B130.	C26: Trimmer adjustment, T7 C30: Trimmer adjustment, T8. C35: Trimmer adjustment, T9. C53: Trimmer adjustment, T13. C57: Trimmer adjustment, T14. C61: Trimmer adjustment, T15.	3D9013V–4
C183	CAPACITOR, variable: air dielectric; single sect. plate meshing type; 3.5μμf min to 25μμf max cap.; 1 3/32″ lg x 15/16″ wd x 1 7/32″ h excluding shaft; nonlocking shaft .250″ dia extends 1 13/32″ beyond mtg bushings.	BFO pitch control	3D9023V–13
C161, C22	CAPACITOR, variable: air dielectric; single sect. plate meshing type; 3.5μμf min to 25μμf max cap.	CRYSTAL PHASING control	3D9023V–14
C13, C16	CAPACITOR, variable: ceramic dielectric; 4.5 −25μμf; 500 vdcw; JAN type CV11A250.	C13: Trimmer adjustment, T4 C16: Trimmer adjustment, T5.	3D9025V–82
C125	CAPACITOR, variable: air dielectric; single sect. plate meshing type; 7μμf min to 100μμf max cap.	CRYSTAL VERNIER control	3D9100V–84
C19	CAPACITOR, variable: ceramic dielectric; 7–45μμf; 500 vdcw; JAN type CV11C150.	Trimmer adjustment, T6	3D9045V–15

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C39, C42, C46, C66, C71, C75, C83, C90, C95, C101, C107, C140, C162, C163, C164	CAPACITOR, variable: ceramic dielectric; 7–45$\mu\mu$f; 500 vdcw; JAN type CV11D450.	C39: Trimmer adjustment, T10 C42: Trimmer adjustment, T11. C46: Trimmer adjustment, T12. C66: Trimmer adjustment, T16. C71: Trimmer adjustment, T17. C75: Trimmer adjustment, T18. C83: Tracking adjustment, T19. C90: Tracking adjustment, T20. C95: Tracking adjustment, T21. C101: Tracking adjustment, T22. C107: Tracking adjustment T23. C140: Compensating on 455-kc i-f 6-mc position V7. C162: CRYSTAL SHARP bandwidth adjustment. C163: CRYSTAL MED bandwidth adjustment. C164: CRYSTAL BROAD bandwidth adjustment.	3D9045V–22
C1A, C1B	CAPACITOR, variable: air dielectric; plate meshing type 2 sect.; ea sect. 10–201$\mu\mu$f.	C1A: TUNING C1B: TUNING.	3D9218V
C2A, C2B	CAPACITOR, variable: air dielectric; plate meshing type 2 sect.; mixer sect. 10–211 $\mu\mu$f, osc sect. 15–222.5$\mu\mu$f.	C2A: TUNING C2B: TUNING.	3D9223V
C116	CAPACITOR ASSEMBLY: 2 capacitors, JAN type CC20PH180G and CC30LH-470G in parallel.	Temperature compensator, T24	3DE47
C112	CAPACITOR ASSEMBLY: c/o 2 capacitors, 1 Hallicrafters #47B239, 350$\mu\mu$f $\pm$5%; 500 vdcw, 1 Hallicrafters #47B238, 1670$\mu\mu$f $\pm$ 2%, 500 vdcw, connected in parallel.	Temperature compensator, T24	3DEA1.670
H8 through H11	CLAMP: cable; holds 5/16" OD rigid tube		8P1–101–2
H2 through H5	CLAMP: cable; holds 1/4" OD rigid tube		8P1–101–1
H1	CLAMP: cable; holds 3/8" OD rigid tube.		2Z2642.366
H35	CLAMP: electron tube; accom 3/4" dia tube	For V4	2Z2642.397
H37	CLAMP: electron tube: accom ST-12 envelopes.	For V17	2Z2642.398
H36	CLAMP: electron tube: accom ST–14 and ST–16 envelopes.	For V18	2Z2643.138
O11, O12	CLIP: Fahnestock; 3/32" max jaw opening	Allen-head wrench holders	3Z1371–1.1
L62, L66	COIL, RF: choke; unsheilded	6-mc i-f rejection trap	3C375–56
L64, L65	COIL, RF: choke; unshielded; 2.7 uh $\pm$10%, 280 ma, 2.2 ohms $\pm$10%.	Crystal oscillator plate impedances	3C323–212B
L63, L67	COIL, RF: choke; unshielded; 42 turns #28 E single celanese covered copper wire, distributed cap. 1.0$\mu\mu$f $\pm$20%.	Filament chokes, V7 and V8	3C375–55
L39	COIL, RF: choke; unshielded; 75 uh at 2.5 mc.	Crystal oscillator plate impedance	3C375–54
O20, O21, O27 through O30.	COLLAR, spacing: capacitor mtg spacer		2Z2935–102
P3	CONNECTOR, plug: 2 parallel blade male cont; straight.		6Z1727
P2	CONNECTOR, plug: Radio Frequency Plug UG–102/U; 2 rd male cont; straight.	Antenna input	2Z7390–102

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
J2	CONNECTOR, receptacle: Socket SO–239; rd female phosphor bronze cont, silver pl; straight; 1″ sq x 1 1/16″ lg o/a; Amphenol 83–1R.	455–kc, i-f output	2Z8799–239
J1	CONNECTOR, receptacle: Radio Frequency Receptacle UG–103/U; 2 rd female cont; straight.	Antenna input	2Z7390–103
J9	CONNECTOR, receptacle: 2 flat parallel female cont; straight; 1 3/16″ OD x 1 1/4″ lg.		2Z3083–15
P1	CONNECTOR, receptacle: 2 flat parallel blades male cont; straight.	A-c power input	6Z8364
J4	CONNECTOR, receptacle: 2 rectangular female cont; straight.	A-c convenience outlet	6Z7784–4
E16	CONTACT ASSEMBLY, turret coil: ant sect., active ckt, fixed cont.	Contact assembly, antenna section.	2Z3197A–57
E20	CONTACT ASSEMBLY, turret coil: ant sect., fixed shorting cont.	Contact assembly, antenna shorting.	2Z3197A–55
E21, E22	CONTACT ASSEMBLY, turret coil: mixer and r-f sect., fixed shorting cont.	E21: Contact assembly, r-f shorting. E22: Contact assembly, mixer.	2Z3197A–54
E23	CONTACT ASSEMBLY, turret coil: osc sect., fixed shorting cont.	Contact assembly, oscillator shorting.	2Z3197A–53
E17, E18, E19	CONTACT ASSEMBLY, turret coil: osc, mixer, and r-f sect. active ckt, fixed cont.	E17: Contact assembly, r-f section. E18: Contact assembly, mixer section. E19: Contact assembly, oscillator section.	2Z3197A–56
O8, O35, O36	COUPLING, flexible: ant adj shaft	Connects extension shaft to CRYSTAL PHASING control capacitor.	2ZK3290–11
O7	COUPLING, flexible: coupling main tuning capacitor sect.	Connects tuning capacitors	2Z3295–149
O34	COUPLING, rigid: coupling, ins		2Z3273–237
Y7	CRYSTAL UNIT CR–18/U: single quartz plate in Crystal Holder HC–6/U; nom xtal freq 6455 kc.	Double conversion oscillator crystal	2X209–6455
Y8	CRYSTAL UNIT, quartz: in Crystal Holder HC–6/U; nom freq 455 kc.	455-kc filter crystal	2X222.2–455
I1	DIAL: BFO pitch control	BFO PITCH control	2Z3723–235
I5	DIAL: R-f gain control	RF GAIN-AC control	2Z3723–239
I7	DIAL: selectivity control	SELECTIVITY control	2Z3723–241
I3	DIAL: very fine osc xtal sw	VFO CRYSTAL switch	2Z3723–237
I2	DIAL: xtal phasing control	CRYSTAL PHASING control	2Z3723–236
I4	DIAL: xtal vernier control	CRYSTAL VERNIER control	2Z3723–238
I6	DIAL: audio gain control	AUDIO GAIN control	2Z3723–240
O22	DRIVE, dial: main tuning drive		2Z3876.133
V18	ELECTRON TUBE: JAN type 5U4G	Rectifier	2J5U4G
V1, V5	ELECTRON TUBE: JAN type 6AG5	V1: 1st radio frequency V5: Crystal oscillator.	2J6AG5
V12, V13	ELECTRON TUBE: JAN type 6AL5	V12: DET and ANL V13: AGC.	2J6AL5
V16	ELECTRON TUBE: JAN type 6AT6	1st A-f amplifier	2J6AT6

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
V2, V6, V8 through V11, V14, V15	ELECTRON TUBE: JAN type 6BA6	V2: 2d radio frequency V6: 6-mc intermediate frequency. V8: 6.455-mc oscillator. V9: 1st 455-kc intermediate frequency. V10: 2d 455-kc intermediate frequency. V11: 3d 455-kc intermediate frequency. V14: BFO. V15: I-f output.	2J6BA6
V3, V7	ELECTRON TUBE: JAN type 6BE6	V3: 1st mixer V7: 2d mixer.	2J6BE6
V4	ELECTRON TUBE: JAN type 6C4	V4: VFO	2J6C1
V17	ELECTRON TUBE: JAN type 6Y6G	Audio output	2J6Y6G
V19	ELECTRON TUBE: JAN type OC3W	Voltage regulator	2J0C3W
F1	FUSE FU-27: 2 amp	A-c line	3Z1927
	GEAR: spur type; dial mask mtg gear; 80 teeth; 2.5624″ OD, .6875″ bore, .125″ thk.		2Z1872–212
	GEAR: spur type; idler gear for driving dial mask; 64 teeth; 2.0624″ OD, .250″ bore, .065″ thk, ctb $2\frac{1}{32}$″ dia x .031″ d.		2Z1872–210
	GEAR: spur type; dial mask drive gear; straight teeth.		2Z4872–211
H15, H16	HANDLE: rec lifting; steel nickel pl		2Z4928–85
E26	INSULATOR, bushing: rd; plastic per JAN–P–79; .100″ lg x ⅜″ OD o/a.	In coupling to main TUNING capacitor shaft.	3G100–75
E50, E51	INSULATOR, plate: rectangular; $1\frac{3}{16}$″ lg x ½″ wd x .062″ thk; 2 mtg holes .221″ dia, .375″ c to c, ea hole $\frac{7}{32}$″ from edge and ¼″ from top.		3G320–269
J3	JACK JJ–034: tp; for 2 cond ¼″ dia plug; 1¼″ lg x 1″ wd x ¾″ h; Sig dwg SC–D–2339.	PHONES jack	2Z5534
	KNOB: rd; black plastic; for ¼″ dia shaft; w/integral pointer.		2Z5821–4.1
	KNOB: rd; molded black plastic, incl flat .032″ thk 2″ dia SS locking plate attached to brass hub; for ¼″ dia shaft.		2Z5822–494
	KNOB: rd; black bakelite; for $\frac{9}{32}$″ dia shaft; line marking.		2Z5822–578
	KNOB: rd fluted; black molded plastic; for ⅜″ dia shaft.		2Z5822–495
E5, E6	LAMP LM–27: 6–8 v, ¼ amp; miniature bayonet base.	Dial illumination	2Z5927
R101, R102	LAMP, incandescent: 120 v, 7 w; candelabra screw base.	Series resistors, V19	6Z6825. 1
J7, J8	LAMPHOLDER: candelabra screw base	J7: Socket for R101 J8: Socket for R102.	6Z8336–2
J5, J6	LAMPHOLDER: miniature bayonet	J5: Socket for E5 J6: Socket for E6.	2Z5883–350
H18	LOCK: radio dial lock		2Z6195. 20
H17	MASK, dial: band and freq indicator mask		2Z6505–15
M1	METER, ammeter: dc; range 0–50 ua	CARRIER LEVEL indicator	3F865–25
H19 through H34	NUT, anchor: strap nut; #4–40	For X1 through X16	6L2714–40C–3

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
N1	PLATE, identification: channel freq inscribed "CHANNEL" and "FREQUENCY", under "CHANNEL" inscribed "1", "2", "3", "4", "5", "6", and "VFO".		2Z7091–371
H38	POINTER, indicator	Indicates frequency	2Z7258. 104
L61	REACTOR, filter choke: 5 hy, 150 ma; 65 ohms d-c resistance; HS metal case.	B+ filter choke	3C317–75
K1	RELAY, armature: single wnd coil, 24 v dc, .125 amp, 300 ohms, inductive, coil ins.	I-f selector for single or double conversion.	2Z7599A–274
R49, R58, R64	RESISTOR, fixed: comp; 3.3 ohms ±10%; ½ w.	R49: Overcoupling prevention for T28 in medium position. R58: Overcoupling prevention for T29 in medium position. R64: Overcoupling prevention for T30 in medium position	3Z5993C3–2
R50, R59, R65	RESISTOR, fixed: comp; 8.2 ohms ±10%; ½ w.	R50: Overcoupling prevention for T28 in broad position. R59: Overcoupling prevention for T29 in broad position. R65: Overcoupling prevention for T30 in broad position.	3Z5998B2–1
R109	RESISTOR, fixed: comp; 39 ohms ±10%; 1 w; JAN type RC30BF390K.	Filament stabilizer for R80 ballast tube.	3RC30BF390K
R4, R10, R39, R61	RESISTOR, fixed: comp; 68 ohms ±10%; ½ w; JAN type RC20BF680K.	R4: Cathode bias, V1 R10: Cathode bias, V2. R39: Cathode bias, V6. R61: Cathode bias, V10.	3RC20BF680K
R115	RESISTOR, fixed: comp; 100 ohms ±10%; ½ w; JAN type RC20BF101K.	Gain equalizer antenna circuit BAND 1.	3RC20BF101K
R18, R21, R43, R67, R74	RESISTOR, fixed: comp; 150 ohms ±10%; ½ w; JAN type RC20BF151K.	R18: Cathode bias, V3 R21: Injection voltage equalizer, V3. R43: Cathode bias, V7. R67: Cathode bias, V11. R74: Cathode bias, V15.	3RC20BF151K
R99	RESISTOR, fixed: comp; 220 ohms ±10%; 2 w; JAN type RC42BE221K.	Cathode bias, V17	3RC42BE221K
R1, R8, R17, R28	RESISTOR, fixed: comp; 470 ohms ±10%; ½ w; JAN type RC20BF471K.	R1: Shorting resistor to prevent suck-outs in antenna stage. R8: Shorting resistor to prevent suck-outs in r-f stage. R17: Shorting resistor to prevent suck-outs in mixer stage. R28: Shorting resistor to prevent suck-outs in oscillator stage.	3RC20BF471K
R55	RESISTOR, fixed: comp; 560 ohms ±10%; ½ w; JAN type RC20BF561K.	Cathode bias, V9, NORMAL BROAD position.	3RC20BF561K
R52	RESISTOR, fixed: comp; 680 ohms ±10%; ½ w; JAN type RC20BF681K.	Cathode bias, V9, all 3 crystal positions.	3RC20BF681K
R7, R34, R53	RESISTOR, fixed: comp; 1000 ohms ±10%; ½ w; JAN type RC20BF102K.	R7: Plate load, V1 R34: Plate circuit filter, V5. R53: Cathode bias, V9, NORMAL SHARP position.	3RC20BF102K
R54, R111	RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; JAN type RC20BF152K.	R54: Cathode bias, V9, NORMAL MED position. R111: Hum filter, RF GAIN circuit.	3RC20BF152K

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R13 through R16, R88, R100	RESISTOR, fixed: comp; 2200 ohms ±10%; ½ w; JAN type RC20BF222K.	R13: Plate load, V2, T13 R14: Plate load, V2, T14. R15: Plate load, V2, T15. R16: Plate load, V2, T16. R88: Part of meter network. R100: Audio dropping for PHONES jack.	3RC20BF222K
R5, R6, R12, R36, R48, R57, R63, R69, R75, R79, R103	RESISTOR, fixed: comp; 2700 ohms ±10%; ½ w; JAN type RC20BF272K.	R5: Screen dropping, V1 R6: Plate isolation, V1. R12: Plate isolation, V2. R36: Plate isolation, V3. R48: Plate isolation, V7 or V8. R57: Plate isolation, V9. R63: Plate isolation, V10. R69: Plate isolation, V11. R75: Plate isolation, V15. R79: Plate isolation, V14. R103: Plate isolation, V6.	3RC20BF272K
R26, R27	RESISTOR, fixed: comp; 4700 ohms ±10%; ½ w; JAN type RC20BF472K.	R26: Grid leak, V4, T23 R27: Grid leak, V4, T24.	3RC20BF472K
R110	RESISTOR, fixed: comp; 5600 ohms ±10%; 1 w; JAN type RC30BF562K.	B+ hum filter	3RC30BF562K
R86	RESISTOR, fixed: comp; 8200 ohms ±10%; ½ w; JAN type RC20BF822K.	Meter network	3RC20BF822K
R11, R20, R24, R25, R95, R106, R113	RESISTOR, fixed: comp; 10,000 ohms ±10%; ½ w; JAN type RC20BF103K.	R11: Screen dropping, V2 R20: Screen dropping, V3. R24: Grid leak, V4, T21. R25: Grid leak, V4, T22. R95: Cathode bias, V16. R106: Grid return, V8. R113: Meter shunt.	3RC20BF103K
R19, R62, R68, R104	RESISTOR, fixed: comp; 22,000 ohms ±10%; ½ w; JAN type RC20BF223K.	R19: Grid resistor, V3 R62: Screen dropping, V10. R68: Screen dropping, V11. R104: Grid #1 bias, V7.	3RC20BF223K
R33, R56	RESISTOR, fixed: comp; 27,000 ohms ±10%; ½ w; JAN type RC20BF273K.	R33: Screen dropping, V5 R56: Screen dropping, V9.	3RC20BF273K
R44, R47	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w; JAN type RC20BF333K.	R44: Screen dropping, V7 R47: Plate dropping, V8.	3RC20BF333K
R22, R23	RESISTOR, fixed: comp; 39,000 ohms ±10%; ½ w; JAN type RC20BF393K.	R22: Grid leak, V4, T19 R23: Grid leak, V4, T20.	3RC20BF393K
R32, R45, R46, R97	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K.	R32: Grid resistor, V5 R45: Grid isolation, V8. R46: Grid isolation, V8. R97: Plate decoupling, V16.	3RC20BF473K
R84	RESISTOR, fixed: comp; 82,000 ohms ±10%; 1 w; JAN type RC30BF823K.	AGC voltage divider, V13	3RC30BF823K
R3, R51, R60, R66, R78	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K.	R3: AGC isolation, V1 R51: Grid bias, V9. R60: Grid return, V10. R66: Grid return, V11. R78: Screen dropping, V14.	3RC20BF104K
R96	RESISTOR, fixed: comp; 150,000 ohms ±10%; ½ w; JAN type RC20BF154K.	Plate dropping, V16	3RC20BF154K

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R89, R107, R112	RESISTOR, fixed: comp; 220,000 ohms ±10%; ½ w; JAN type RC20BF224K.	R89: Diode load, V13 R107: Diode load, V12. R112: Carrier level equalizer.	3RC20BF224K
R117	RESISTOR, fixed: comp; 330,000 ohms ±10%; ½ w; JAN type RC20BF334K.	Plate dropping, V16	3RC20BF334K
R73, R77, R98	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K.	R73: ANL time constant, V12 R77: Suppressor grid isolation, V14. R98: Grid return, V17.	3RC20BF474K
R40	RESISTOR, fixed: comp; 680,000 ohms ±10%; ½ w; JAN type RC20BF684K.	Screen dropping, V6	3RC20BF684K
R2, R9, R91, R114	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; JAN type RC20BF105K.	R2: Grid return, V1 R9: Grid return, V2. R91: Diode load, V13. R114: Grid return, V6.	3RC20BF105K
R108	RESISTOR, fixed: comp; 2.2 megs ±10%; ½ w; JAN type RC20BF225K.	ANL time constant, V12	3RC20BF225K
R81	RESISTOR, fixed: WW; 400 ohms ±5%; 4 w; JAN type RW20E401.	B— Voltage divider	3RW21910
R35	RESISTOR, fixed: WW; 280 ohms ±5%; 4 w; JAN type RW 20E281.	Current limiting, K1	3RW21010
R105	RESISTOR, fixed: WW; 3.5 ohms ±5%; 2 w; JAN type RW 55E3R5.	Filament dropping for V12 and V16.	3RW9604
R80	RESISTOR, thermal: maintains cur between .58 and .625 amp over the voltage range of 4.3–9.7 v; designed for dc; T–9 bulb 2⅞″ lg o/a.	Current regulator, V3 and V4	3Z6925–3.19
R87	RESISTOR, variable: WW; 1500 ohms ±10%; 2 w; JAN type RA20A1SA152AK.	METER ZERO adjustment	3RA6004
S7, R83	RESISTOR, variable: comp; 5000 ohms ±20%; 2.25 w; 3 solder lug term.; SPST sw; enclosed metal case; 1 1/16″ dia x 9/16″ lg; Hallicrafters #25B886.	RF GAIN-AC control	3Z7350–137
R82	RESISTOR, variable: comp; 5000 ohms ±20%; 2.25 w; enclosed metal case, 1 1/16″ dia x 9/16″ lg; Hallicrafters #25B884.	BFO INJ control	3Z7350–125
R94	RESISTOR, variable: comp; 2 meg ±20%; 2.25 w; enclosed metal case, 1 1/16″ dia x 9/16″ lg; Hallicrafters #25B883.	AUDIO GAIN control	3Z7499–2.50
O3, O4	RETAINER, crystal holder	For crystals Y7 and Y8, respectively.	2Z7780–124
O23, O24	RING, retainer: shaft retaining ring	For CRYSTAL PHASING shaft	2Z7858–156
	SCALE: freq indicator		2Z8076–163
	SCALE: vernier dial		2Z8076–162
O32	SHAFT: ant, adj		2Z8203–596
O33	SHAFT: extension shaft		2Z8203–597
O25	SHAFT: extension shaft	For C161	2Z8203–520
O31	SHAFT: turret shaft		2Z8203–595
O39	SHELL, connector: Radio Frequency Hood UG–106/U; coax socket shielding hood, provides convenient method of connecting cable shielding to receptacle.		2Z7390–106
E48, E44	SHIELD, electron tube: bayonet type mtg; .810″ ID x 1.375″ h; JAN type TS102U01.	E44: For V13 E48: For V12.	2Z8304.57

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

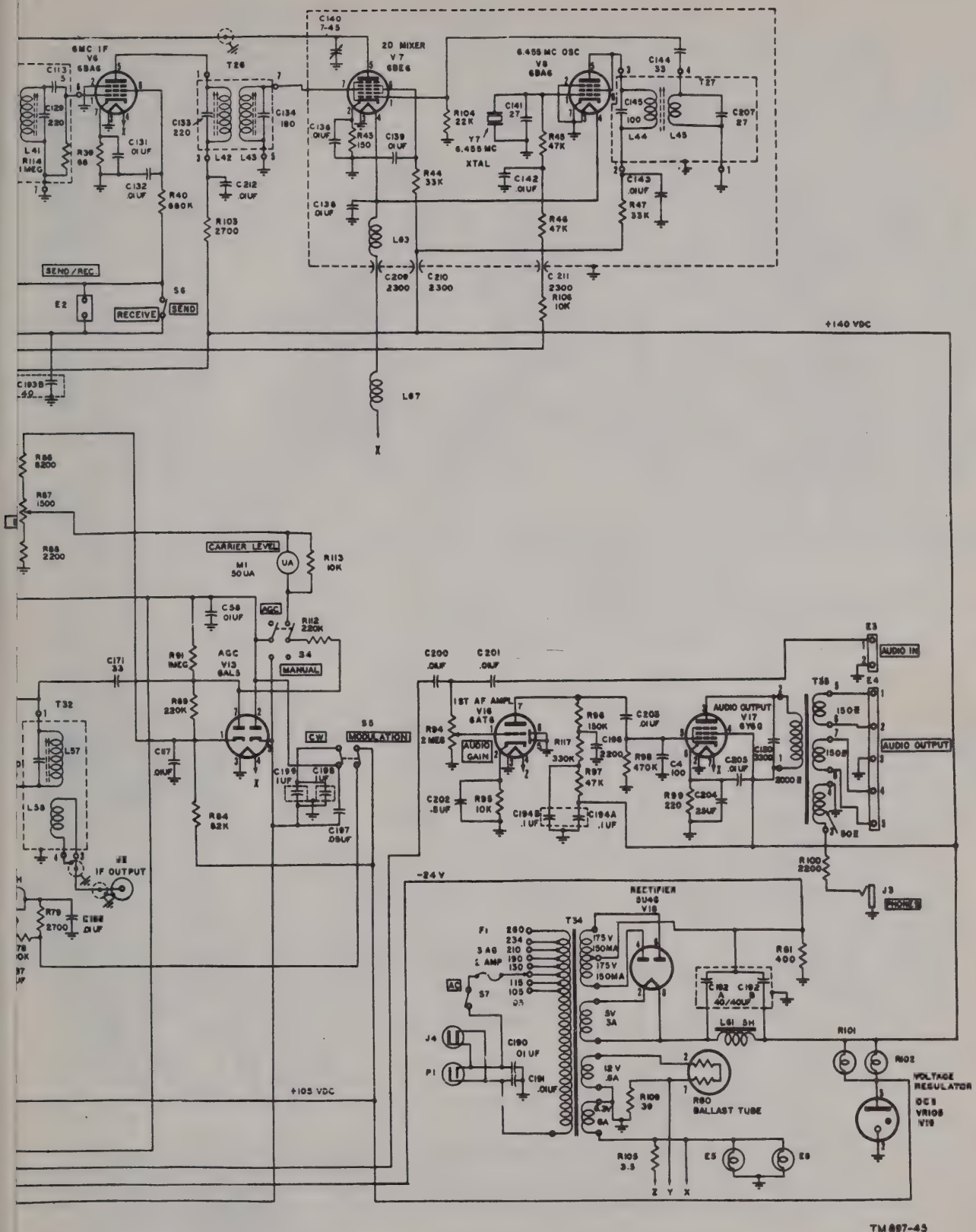
Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E33, E34, E35, E37 through E43, E45, E46, E47	SHIELD, electron tube: bayonet type mtg; .810″ ID x 1¾″ lg; JAN type TS102U02.	E33: For V1 E34: For V2. E35: For V3. E37: For V5. E38: For V6. E39: For V7. E40: For V8. E41: For V9. E42: For V10. E43: For V11. E45: For V14. E46: For V15. E47: For V16.	2Z8304.154
O37, O38	SHIELD, light: ea		2Z8301–36
X21 through X28	SOCKET, crystal: 5⁵⁄₆₄″ lg x ⅜″ wd x 4³⁄₆₄″ h; Eby #9006.	For crystals Y1 through Y8, respectively.	2Z8761–60
X6 through X16	SOCKET, electron tube: 7 cont miniature; 1 piece saddle mtg; JAN type TS102P01.	X6 through X16: for V6 through V16, respectively.	2Z8677.94
X1, X2, X3, X5	SOCKET, electron tube: 7 cont miniature: 1 piece saddle mtg; JAN type TS102C01.	For V1, V2, V3, and V5, respectively.	2Z8677.99
X4	SOCKET, tube: 7 cont miniature; 1 piece saddle mtg.	For V4	2Z8677.166
X17 through X20	SOCKET, tube: octal; saddle mtg	For V17, V18, V19, and R80, respectively.	2Z8678.46
O9, O10	SPRING: helical extension type; for use in conjunction w/coupling main tuning capacitorgear drive; ¾″ lg x 3⁄16″ OD o/a; 11 complete turns close wnd.	Part of coupling between gear drive and main TUNING capacitor.	2Z8877.428
H38, H40, H41	STUD: ⅞″ lg o/a x 3⁄16″ dia body, 1⁄16″ dia term. and #4–40 threaded stud; #4–40 threaded stud at 1 end, 3⁄16″ lg.		3Z12101–28
S1A through S1F	SWITCH, rotary: 6 positions; 6 sect	SELECTIVITY switch	3Z9825–36.5
S2A, S2B, S2C	SWITCH, rotary: 7 positions; 3 sect	VFO-CRYSTAL selector	3Z9825–62.544
S3, S6	SWITCH, toggle: SPST; JAN type ST42A	S3: ANL-OFF S6: RECEIVE-SEND.	3Z9863–42A
S5	SWITCH, toggle: DPST; JAN type ST52K	CW-MODULATION	3Z9863–52K
S4	SWITCH, toggle: DPDT; JAN type ST52N	AGC-MANUAL	3Z9863–52N
E28, E29	TERMINAL BOARD: general purpose: 1 brass solder lug term.; ¾″ lg x ½″ wd x 1¹⁄16″ h o/a.	Binding post strips	3Z770–1.18
E49	TERMINAL BOARD: general purpose; 1 brass solder lug term.; ¾″ lg x ½″ wd x 2³⁄32″ h o/a.		3Z770–1.21
E2, E3	TERMINAL BOARD: general purpose; 2 brass nickel pl screw type term. w/lugs for below chassis feedthru; 1⅝″ lg x 1⅛″ wd x ½″ h, w/lugs 15⁄16″ h.	E2: RECEIVE-SEND E3: AUDIO IN.	3Z770–2.81
E30	TERMINAL BOARD: general purpose; 2 brass solder lug term.; 1 integral w/mtg lug: ¾″ lg x ½″ wd x ¾″ h o/a.	Binding post strip	3Z770–2.82
E31, E32	TERMINAL BOARD: general purpose; 2 brass solder lug term.; 1⅛″ lg x ½″ wd x 1¹⁄16″ h o/a.	Binding post strips	3Z770–2.83
E52	TERMINAL BOARD: r-f gain isolation; 2 brass turret type term.; 2½″ lg x 1″ wd x 3⁄32″ thk, w/term. ⅝″ thk.		3Z770–2.100

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E1	TERMINAL BOARD: ant. and gnd binding post strip; three #6–32 NC-2 x ¼" lg; nickel pl brass knurled thumbscrew term. on top and 3 lug term. on bottom; 2 1/16" x 1 1/16" wd x ⅞" h o/a.		3Z770–3.50
E4	TERMINAL BOARD: general purpose; 5 brass nickel pl screw type term. w/lugs for below chassis feedthru; 2 15/16" lg x 1⅜" wd x ½" h; w/lugs 1 5/16" h.	AUDIO OUTPUT	3Z770–5.28
E7	TERMINAL BOARD: resistor mtg; 6 brass silver pl turret type term.; 1⅞" lg x 1⅛" wd x 3/32" thk, w/term. and insert ⅝" thk.	455-kc output	3Z770–6.84
E9	TERMINAL BOARD: general purpose binding strip post; 8 brass silver pl turret type term.; 2¾" lg x 13/16" wd x 3/32" thk, w/term. and inserts ⅝" thk.	Resistor, choke, and capacitor mounting (6.445-mc crystal oscillator).	3Z770–11.18
E8	TERMINAL BOARD: resistor and choke mtg; 10 brass silver pl turret type term.; 1⅞" sq x 3/32" thk, w/term, and inserts ⅝" thk.	For BFO	3Z770–10.54
E10	TERMINAL BOARD: resistor and capacitor mtg; 12 brass silver pl turret type term.; 2 rows of 6 term., 1½" between rows, ea row of ctr 4 term. has term. spaced ⅜" apart and two opposite end term. spaced 1" from nearest term.; 3½" lg x 1⅞" wd x 3/32" thk, w/term. and inserts ⅝" thk.	For ANL	3Z770–12.83
E11	TERMINAL BOARD: resistor and capacitor mtg; 12 brass silver pl turret type term.; 3½" lg x 1⅞" wd x 3/32" thk, w/term. and inserts ⅝" thk.	For 2d detector	3Z770–12.84
E13	TERMINAL BOARD: resistor mtg; 14 brass silver pl turret type term.; board 6⅝" lg x 2¼" wd x 3/32" thk, w/term. 7/16" thk.	For r-f and oscillator chassis	3Z770–18.53
E12	TERMINAL BOARD: resistor and capacitor mtg; 14 brass silver pl turret type term.; 2⅝" lg x 1⅞" wd x 3/32" thk, w/term. and inserts ⅝" thk.	For 1st audio	3Z770–14.57
E14	TERMINAL BOARD: resistor, choke and capacitor mtg; 30 brass silver pl turret type term.; 8⅞" lg x 1⅞" wd x 3/32" thk, w/term. 7/16" thk.	For 6-mc intermediate frequency	3Z770–30.15
E15	TERMINAL BOARD: resistor mtg; 38 brass silver pl turret type term.; 7⅛" lg x 1⅝" wd x 3/32" thk, w/term. and inserts ⅝" thk.	For 455-kc i-f chassis	3Z770–38.10
T35	TRANSFORMER, AF: plate coupling type; pri 2000 ohms impedance; secd #1, 50 ohms impedance; secd #2, 150 ohms impedance; secd #3, 150 ohms impedance; max d-c cur rating .075 amp, 500 v test; HS metal case.	Audio output	2Z9635.38
T33	TRANSFORMER, IF: 455 kc; bfo	Bfo	2Z9644.32
T32	TRANSFORMER, IF: output 455 kc	455-kc output	2Z9642.137
T31	TRANSFORMER, IF: 455 kc; output 455 kc IF.	4th 455-kc intermediate frequency	2Z9642.136
T28	TRANSFORMER, IF: 455 kc; input 455 kc, 1st IF.	1st 455-kc intermediate frequency	2Z9642.133
T29	TRANSFORMER, IF: 455 kc; interstage 2d IF.	2nd 455-kc intermediate frequency	2Z9642.134

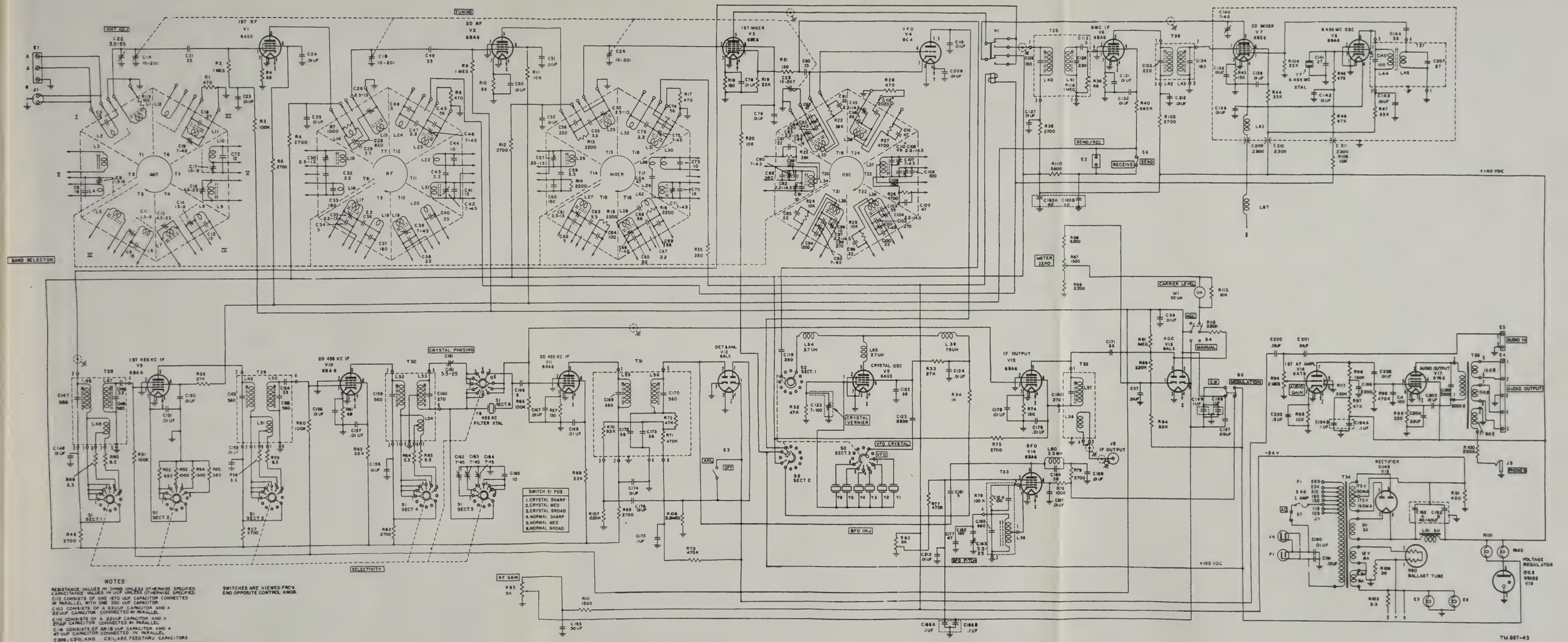
2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T30	TRANSFORMER. IF: 455 kc; interstage 3d IF.	3rd 455-kc intermediate frequency	2Z9642.135
T25	TRANSFORMER. IF: 6 mc	6-mc input	2Z9643.389
T26	TRANSFORMER, IF: 6 mc; output	6-mc output	2Z9643–390
T27	TRANSFORMER. IF: 6.455 mc xtal oscillator.	6.455-mc crystal oscillator	2Z9643–391
T34	TRANSFORMER, power fil and plate type; input 95/105/117/130/190/210/234/260/v ac. 60 cyc single ph; secd #1, 6.3 v at 6.3 amp, secd #2, 5.0 v at 3.0 amp, secd #3, 350 v ac. at .150 amp CT, secd #4, 12.0 v at .6 amp; HS metal case.	Power	2Z9608–124
T1	TRANSFORMER, variable RF: unshielded	Turret band #1 antenna	2Z9629–276
T13	TRANSFORMER, variable RF: unshielded	Turret band #1 mixer	2Z9629–288
T19	TRANSFORMER, variable RF: unshielded	Turret band #1 oscillator	2Z9629–294
T7	TRANSFORMER, variable RF: unshielded	Turret band #1 rf	2Z9629–282
T2	TRANSFORMER, variable RF: unshielded	Turret band #2 antenna	2Z9629–277
T20	TRANSFORMER, variable RF: unshielded	Turret band #2 oscillator	2Z9629–295
T14	TRANSFORMER, variable RF: unshielded	Turret band #2 mixer	2Z9629–289
T8	TRANSFORMER, variable RF: unshielded	Turret band #2 rf	2Z9629–283
T3	TRANSFORMER, variable RF: unshielded	Turret band #3 antenna	2Z9629–278
T15	TRANSFORMER, variable RF: unshielded	Turret band #3 mixer	2Z9629–290
T21	TRANSFORMER, variable RF: unshielded	Turret band #3 oscillator	2Z9629–296
T9	TRANSFORMER, variable RF: unshielded	Turret band #3 rf	2Z9626–284
T4	TRANSFORMER, variable RF: unshielded	Turret band #4 antenna	2Z9629–279
T16	TRANSFORMER, variable RF: unshielded	Turret band #4 mixer	2Z9629–291
T22	TRANSFORMER, variable RF: unshielded	Turret band #4 oscillator	2Z9629–297
T10	TRANSFORMER, variable RF: unshielded	Turret band #4 rf	2Z9629–285
T5	TRANSFORMER, variable RF: unshielded	Turret band #5 antenna	2Z9629–280
T17	TRANSFORMER, variable RF: unshielded	Turret band #5 mixer	2Z9629–292
T23	TRANSFOGMER, variable RF: unshielded	Turret band #5 oscillator	2Z9629–298
T11	TRANSFORMER, variable RF: unshielded	Turret band #5 rf	2Z9629–286
T6	TRANSFORMER, variable RF: unshielded	Turret band #6 antenna	2Z9629–281
T18	TRANSFORMER, variable RF: unshielded	Turret band #6 mixer	2Z9629–293
T24	TRANSFORMER, variable RF: unshielded	Turret band #6 oscillator	2Z9629–299
T12	TRANSFORMER, variable RF: unshielded	Turret band #6 rf	2Z9629–287


6MC IF
V6
6BA6
T26
2D MIXER
V7
6BE6
6.455 MC OSC
V8
6BA6
T27
Y7
6.455 MC
XTAL
L41
L42
L43
L44
L45
L63
L67
SEND/REC.
S6
RECEIVE
SEND
E2
+140 VDC
CARRIER LEVEL
M1
50 UA
R113
10K
AGC
S4
MANUAL
R112
220K
AGC
V13
6AL5
CW
S5
MODULATION
1ST AF AMPL
V16
6AT6
AUDIO GAIN
AUDIO OUTPUT
V17
6V6G
E3
AUDIO IN
E4
T38
AUDIO OUTPUT
J3
PHONES
E1
IF OUTPUT
-24 V
RECTIFIER
5U4G
V18
T34
S7
AC
J4
P1
C190
.01 UF
+105 VDC
R80
BALLAST TUBE
VOLTAGE
REGULATOR
OC3
VR105
V19
E5
E6
TM 897-45

2. Identification Table of Parts for Radio Receiver R–274/FRR—Continued

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T30	TRANSFORMER. IF: 455 kc; interstage 3d IF.	3rd 455-kc intermediate frequency	2Z9642.135
T25	TRANSFORMER. IF: 6 mc	6-mc input	2Z9643.389
T26	TRANSFORMER, IF: 6 mc; output	6-mc output	2Z9643–390
T27	TRANSFORMER. IF: 6.455 mc xtal oscillator.	6.455-mc crystal oscillator	2Z9643–391
T34	TRANSFORMER, power fil and plate type; input 95/105/117/130/190/210/234/260/v ac. 60 cyc single ph; secd #1, 6.3 v at 6.3 amp, secd #2, 5.0 v at 3.0 amp, secd #3, 350 v ac. at .150 amp CT, secd #4, 12.0 v at .6 amp; HS metal case.	Power	2Z9608–124
T1	TRANSFORMER, variable RF: unshielded	Turret band #1 antenna	2Z9629–276
T13	TRANSFORMER, variable RF: unshielded	Turret band #1 mixer	2Z9629–288
T19	TRANSFORMER, variable RF: unshielded	Turret band #1 oscillator	2Z9629–294
T7	TRANSFORMER, variable RF: unshielded	Turret band #1 rf	2Z9629–282
T2	TRANSFORMER. variable RF: unshielded	Turret band #2 antenna	2Z9629–277
T20	TRANSFORMER. variable RF: unshielded	Turret band #2 oscillator	2Z9629–295
T14	TRANSFORMER. variable RF: unshielded	Turret band #2 mixer	2Z9629–289
T8	TRANSFORMER, variable RF: unshielded	Turret band #2 rf	2Z9629–283
T3	TRANSFORMER, variable RF: unshielded	Turret band #3 antenna	2Z9629–278
T15	TRANSFORMER, variable RF: unshielded	Turret band #3 mixer	2Z9629–290
T21	TRANSFORMER, variable RF: unshielded	Turret band #3 oscillator	2Z9629–296
T9	TRANSFORMER, variable RF: unshielded	Turret band #3 rf	2Z9626–284
T4	TRANSFORMER, variable RF: unshielded	Turret band #4 antenna	2Z9629–279
T16	TRANSFORMER, variable RF: unshielded	Turret band #4 mixer	2Z9629–291
T22	TRANSFORMER, variable RF: unshielded	Turret band #4 oscillator	2Z9629–297
T10	TRANSFORMER, variable RF: unshielded	Turret band #4 rf	2Z9629–285
T5	TRANSFORMER, variable RF: unshielded	Turret band #5 antenna	2Z9629–280
T17	TRANSFORMER, variable RF: unshielded	Turret band #5 mixer	2Z9629–292
T23	TRANSFOGMER, variable RF: unshielded	Turret band #5 oscillator	2Z9629–298
T11	TRANSFORMER, variable RF: unshielded	Turret band #5 rf	2Z9629–286
T6	TRANSFORMER, variable RF: unshielded	Turret band #6 antenna	2Z9629–281
T18	TRANSFORMER, variable RF: unshielded	Turret band #6 mixer	2Z9629–293
T24	TRANSFORMER, variable RF: unshielded	Turret band #6 oscillator	2Z9629–299
T12	TRANSFORMER, variable RF: unshielded	Turret band #6 rf	2Z9629–287



NOTES:

RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED. CAPACITANCE VALUES IN UUF UNLESS OTHERWISE SPECIFIED.

C112 CONSISTS OF ONE 1870 UUF CAPACITOR CONNECTED IN PARALLEL WITH ONE 330 UUF CAPACITOR

C103 CONSISTS OF A 33UUF CAPACITOR AND A 22UUF CAPACITOR CONNECTED IN PARALLEL

C110 CONSISTS OF A 22UUF CAPACITOR AND A 27UUF CAPACITOR CONNECTED IN PARALLEL

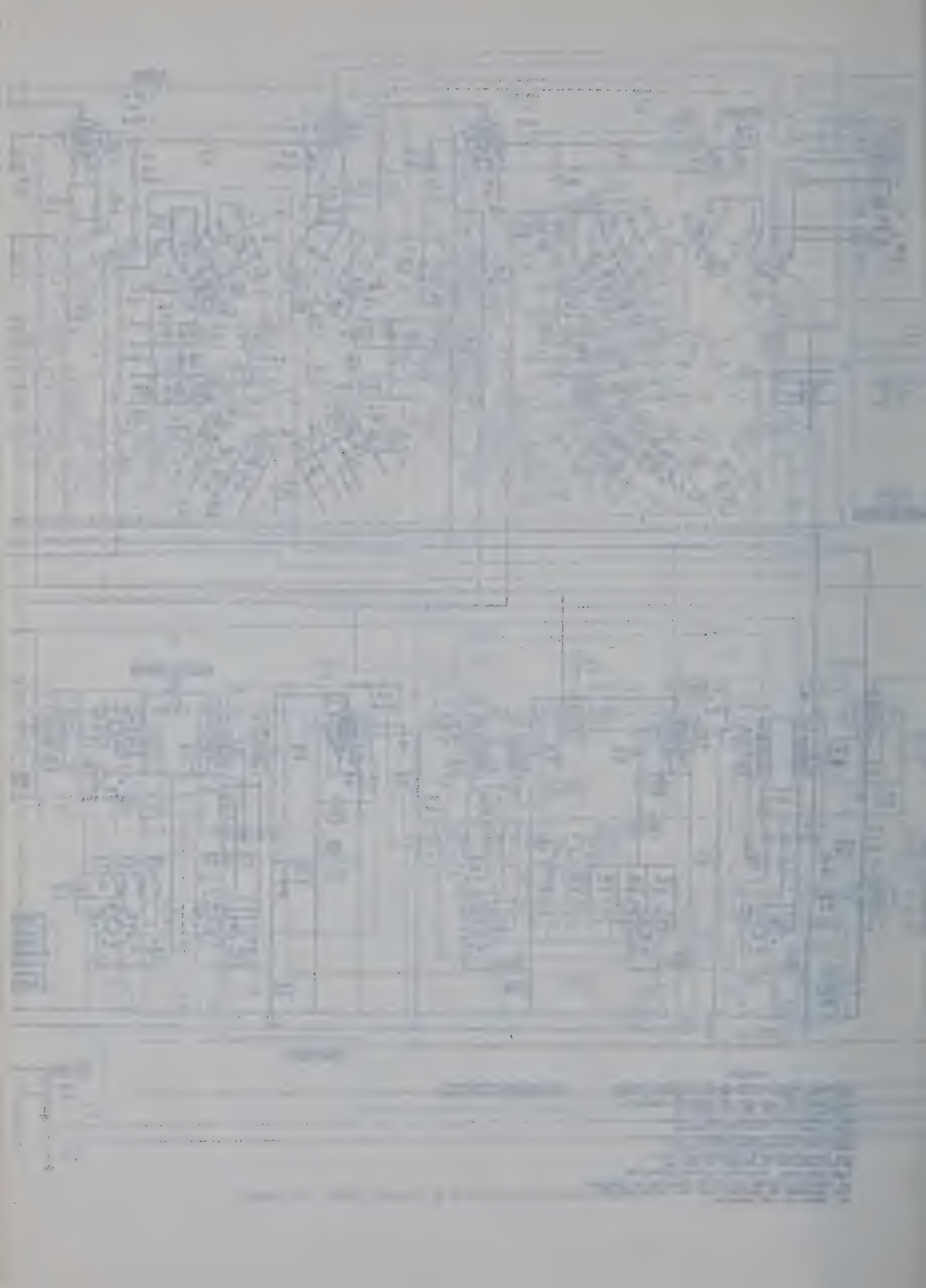
C18 CONSISTS OF AN 18 UUF CAPACITOR AND A 47 UUF CAPACITOR CONNECTED IN PARALLEL

C209, C210, AND C211, ARE FEED THRU CAPACITORS

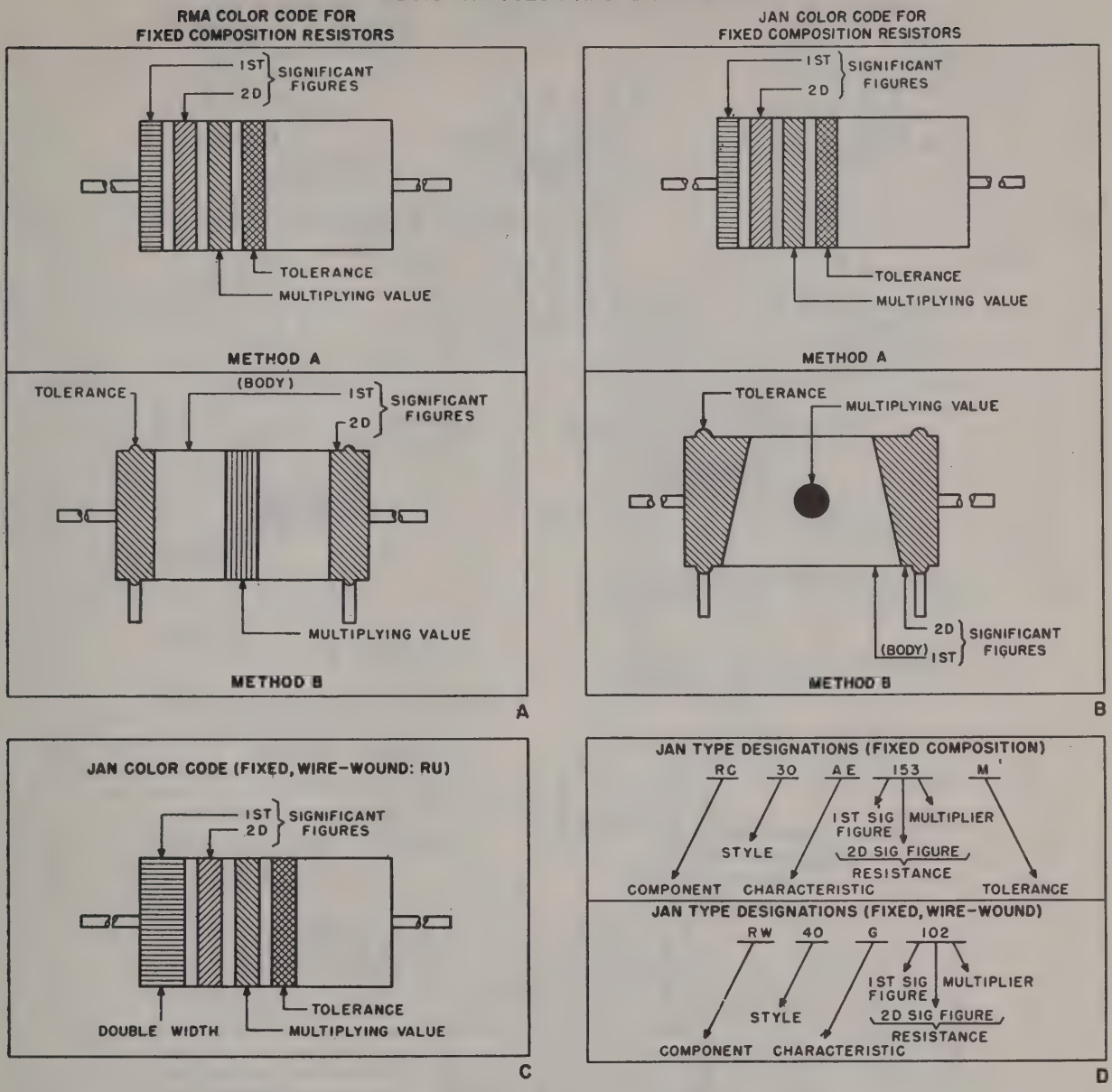
A6 TURRET IS TURNED CLOCKWISE (INDICATED BY ARROWS) THE SEQUENCE OF BAND SETTING WILL BE I THRU XI AS SHOWN IN VFO POSITION

SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.

Figure 43. Radio Receiver R-274/FRR, schematic diagram.



RESISTOR COLOR AND LETTER CODE



STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	–	–
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	–
YELLOW	4	10,000	± 4	–
GREEN	5	100,000	± 5	–
BLUE	6	1,000,000	± 6	–
VIOLET	7	10,000,000	± 7	–
GRAY	8	100,000,000	± 8	–
WHITE	9	1,000,000,000	± 9	–
GOLD	–	0.1	± 5	J
SILVER	–	0.01	±10	K
NO COLOR	–	–	±20	M

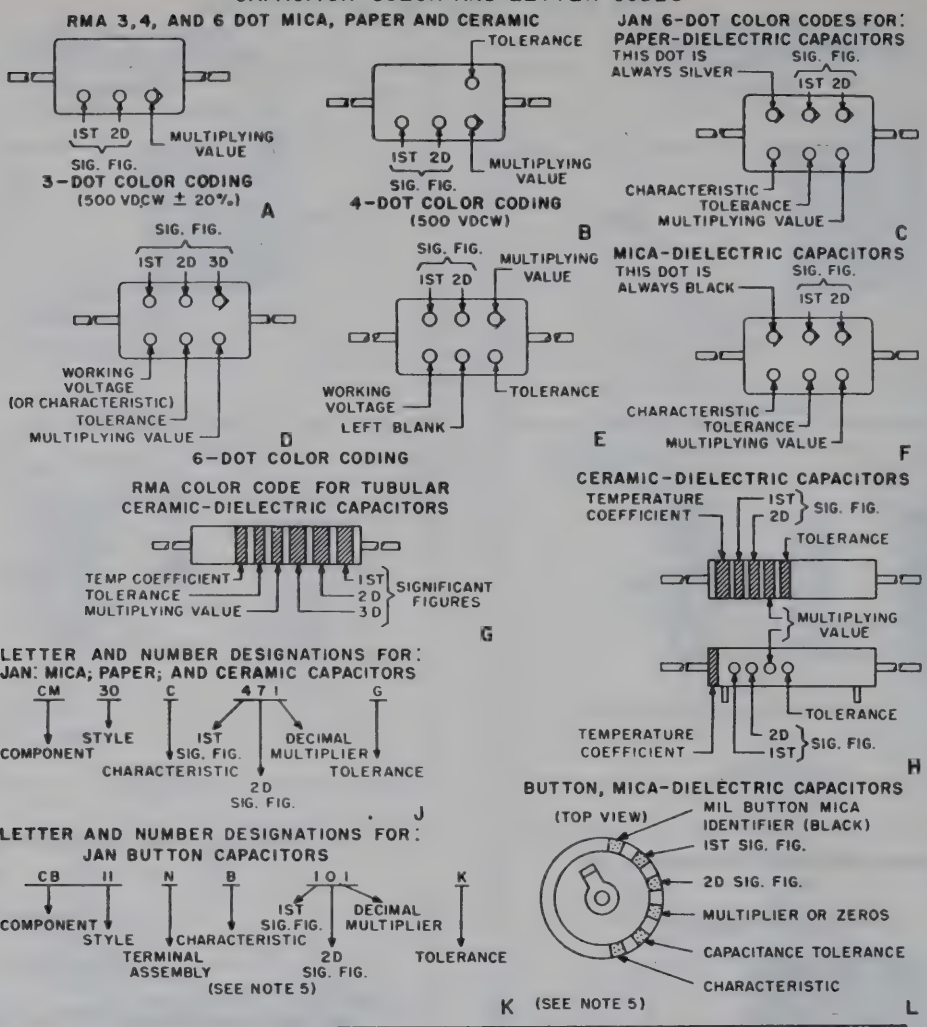
NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

Figure 44. Resistor color codes.

CAPACITOR COLOR AND LETTER CODES



- STANDARDS -					JAN MICA-CM		JAN PAPER-CM		JAN CERAMIC-CC					
										CAP. TOL. FOR MORE THAN 10 UUF		CAP. TOL. FOR 10 UUF OR LESS		
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARAC-TERISTIC	LETTER TOL.	CHARAC-TERISTIC	DEC. MULT.	%	LETTER DESIG-NATION	UUF	LETTER DESIG-NATION	CHARAC-TERISTIC
BLACK	0	1	±20	500	M	A	M	A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-		±20	500	-	-	-	-	-	-	-	-	-	-

* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±3%

NOTES

JAN: JOINT ARMY-NAVY
RMA: RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   CP MICA BUTTON: *CC* CERAMIC; *CM* MICA MOULDED: *CN* PAPER MOULDED

TM CC.

Figure 45. Capacitor color codes.

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