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# TM 11-877

**DEPARTMENT OF THE ARMY TECHNICAL MANUAL**



# RADIO RECEIVER R-520/URR




*DEPARTMENT OF THE ARMY · 12 JANUARY 1954*

TECHNICAL MANUAL
No. 11-877

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *12 January 1954*

# RADIO RECEIVER R-520/URR

## WARNING

**HIGH VOLTAGE**
is used in the operation
of this equipment.

**A DANGEROUS SHOCK**
may result if operating personnel fail
to observe safety precautions.

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Be careful not to contact external power source input connections when working on or near this equipment.

# ARTIFICIAL RESPIRATION

## GENERAL PRINCIPLES

1. Seconds count! Begin at once! Don't take time to move the victim unless you must. Don't loosen clothes, apply stimulants or try to warm the victim. Start resuscitation! Get air in the lungs! You may save a life!
2. Place the victim's body in a prone position, so that any fluids will drain from the respiratory passages. The head should be extended and turned sideward *never flexed forward;* the chin shouldn't sag, since obstruction of the respiratory passages may occur.
3. Remove any froth or debris from the mouth with your fingers. Draw the victim's tongue forward.
4. Begin artificial respiration. Continue it rhythmically and without any interruption until natural breathing starts or the victim is pronounced dead. Try to keep the rhythm smooth. Split-second timing is not absolutely essential.
5. When the victim starts breathing, or when additional help is available loosen the clothing; remove it, if it's wet; keep the victim warm. Shock should receive adequate attention. Don't interrupt the rhythmical artificial technique for these measures. Do them only when you have help or when natural breathing has started.
6. When the victim is breathing, adjust your timing to assist him. Don't fight his efforts to breathe. Synchronize your efforts with his. After resuscitation, keep him lying down until seen by a physician or until recovery seems certain.
7. Don't wait for mechanical resuscitation! If an approved model is available, use it, but, since mechanical resuscitators are only slightly more effective than properly performed "push-pull" manual technique, *never* delay manual resuscitation for it.

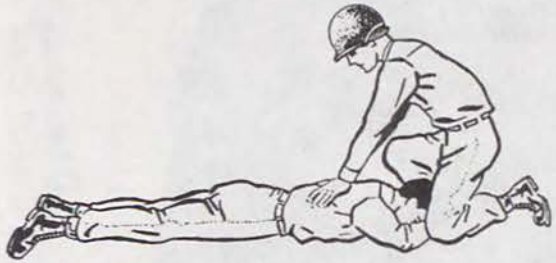
## BACK-PRESSURE ARM LIFT METHOD

1. *Position of Victim.* Place the victim in the prone (face-down) position. Bend his elbows; place one hand upon the other. Turn his face to one side, placing his cheek upon his hands.
2. *Position of Operator.* Kneel on your left or right knee, at the victim's head, facing him. Your knee should be at the side of the victim's head close to his forearm, your foot should be near his elbow. Kneel on both knees if you find it more comfortable, with one knee on each side of the head. Place your hands on the flat of the victim's back so that their heels are just below the lower tip of his shoulder blades. With the tip of your thumbs touching spread your fingers downward and outward. (See A).

3. *Compression Phase.* Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert a slow, steady, even, downward pressure upon your hands. This forces air out of the lungs. Keep your elbows straight and press almost directly downward on the back. (See B).
4. *Expansion Phase.* Release the pressure, avoid any finish thrust, and commence to rock backward slowly. Place your arms upon the victim's arms just above the elbows, and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders. Don't bend your elbows. As you rock backward, the victim's arms will be drawn toward you. (The arm lift expands the chest by pulling on the chest muscles, arching the back and relieving the weight on the chest.) Drop the arms gently to the ground or floor. This completes the cycle. (See C and D). Now, repeat the cycle.
5. *Cycle Timing and Rhythm.* Repeat the cycle 10 to 12 times per minute. Use a steady uniform rate of Press, Release, Lift, Release. Longer counts of about equal length should be given to the "Press" and "Lift" steps of the compression and expansion phases. Make the "Release" periods of minimum duration.
6. *Changing Position or Operator.*

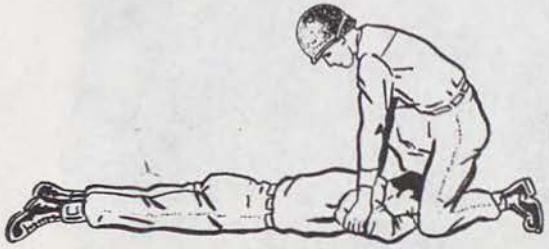
(a) Remember that you can use either or both knees or can shift knees during the procedure, provided you don't break the rhythm. Observe how you rock forward with the back-pressure and backward with the arm-lift. The rocking motion helps to sustain the rhythm and adds to the ease of operation.

(b) If you tire and another person is available, you can "take turns." Be careful not to break the rhythm in changing. Move to one side and let your replacement come in from the other side. Your replacement begins the "Press-Release" after one of the "Lift-Release" phases, as you move away.

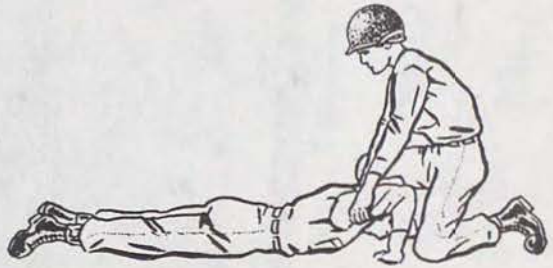


**A** Position of operator and victim

**B** Compression phase



**C** Expansion phase (arm lift)



**D** Expansion phase (arm release)

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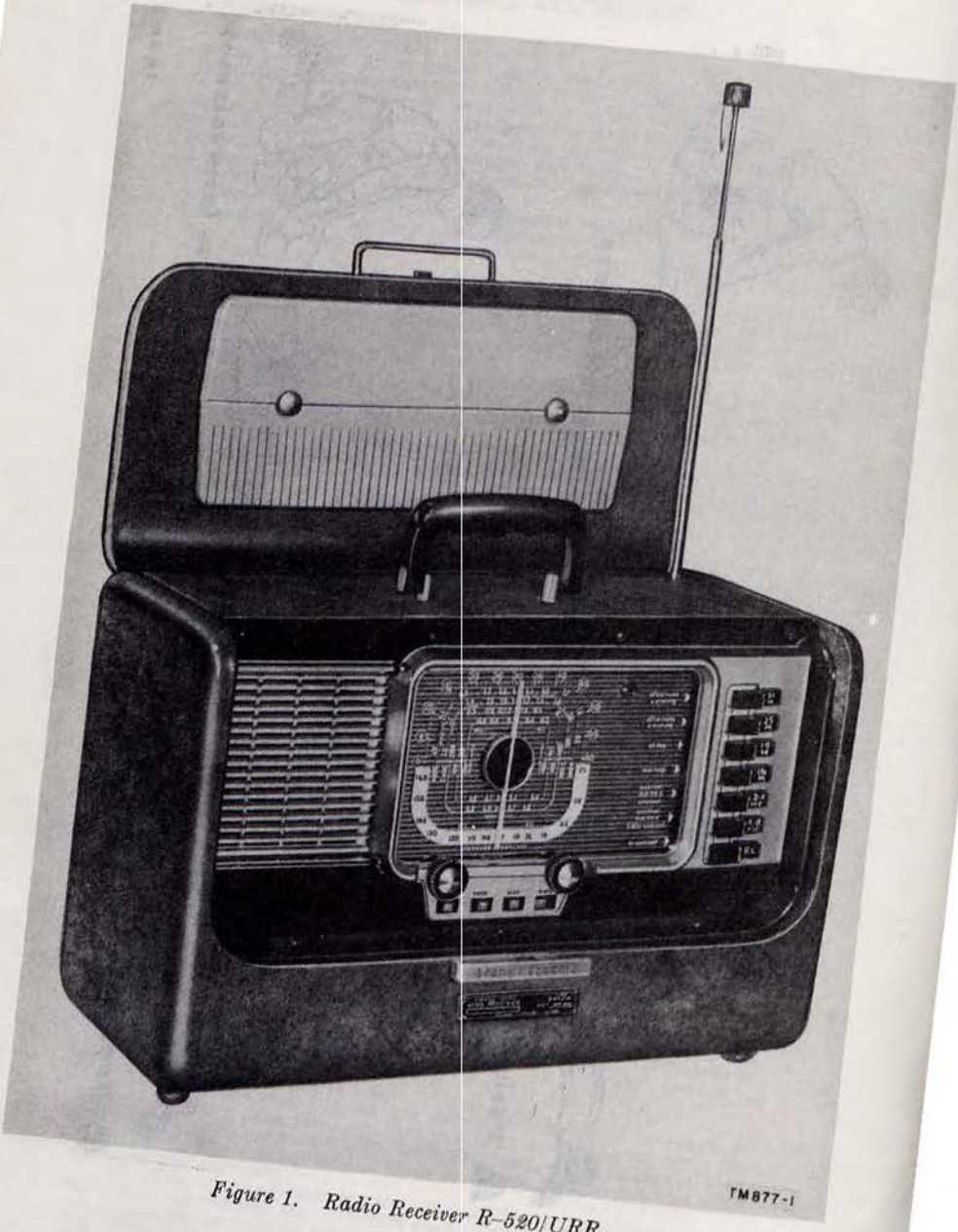



*Figure 1. Radio Receiver R–520/URR.*

# CHAPTER 1
# INTRODUCTION

## Section I. GENERAL

### 1. Scope

This technical manual contains a description, a detailed theory of operation, and necessary instructions for the installation, operation, field maintenance, and repair of Radio Receiver R–520/URR. In addition, a chapter on the disassembly and repacking of the receiver for shipment or limited storage is included. There are two appendixes covering a list of references and an identification table of parts.

### 2. Forms and Records

The following standard forms will be used for reporting unsatisfactory conditions of Army materiel and equipment and in performing preventive maintenance:

*a.* DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5.

*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.* DA 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 (fig. 12).

*d.* DA 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 form (fig. 13).

*e.* Use other forms and records as authorized.

## Section II. DESCRIPTION AND DATA

### 3. Purpose and Use

*a.* Radio Receiver R–520/URR (fig. 1), is a portable superheterodyne radio receiver designed for troop information. It is contained in a luggage-type carrying case. The receiver will operate either a loudspeaker, contained within the unit, or a low-impedance headset connected externally.

*b.* Radio Receiver R–520/URR is designed to receive a-m (amplitude-modulated) signals covering frequency ranges from 540

kc (kilocycles) to 1600 kc, 2 mc (megacycles) to 4 mc, 4 mc to 8 mc, 9.4 mc to 9.8 mc, 11.6 mc to 12 mc, 14.9 mc to 15.5 mc, and 17.5 mc to 18.1 mc. The corresponding wave lengths in M (meters) for these frequencies are given in paragraph 4. The receiver will operate from dry batteries or from an external a-c (alternating-current) or d-c (direct-current) source. The types of batteries and external power on which the receiver will operate are listed in paragraphs 4, 12, and 13.

## 4. Technical Characteristics

| | |
|---|---|
| Band: | *Frequency range* |
| Broadcast | 540 kc to 1600 kc (555 M to 187 M). |
| 2–4 MC | 2 mc to 4 mc (150 M to 75 M) |
| 4–8 MC | 4 mc to 8 mc (75 M to 37-½ M). |
| 31 M | 9.4 mc to 9.8 mc. |
| 25 M | 11.6 mc to 12 mc. |
| 19 M | 14.9 mc to 15.5 mc. |
| 16 M | 17.5 mc to 18.1 mc. |
| Receiver type | Superheterodyne. |
| Type of signal that can be received | A-m. |
| Intermediate frequency | 455 kc. |
| Number of tubes | 5. |
| Rectifier | Selenium. |
| Thermal resistor | Glass-inclosed. |
| Power input (battery): | |
| A battery | 9 volts at 67 ma. |
| B battery | 90 volts at 17 ma. |
| Power input (power line): | |
| 117 volts ac | 10 watts. |
| 117 volts dc | 7.5 watts. |
| 230 volts ac | 20 watts. |
| 230 volts dc | 15 watts. |
| Antennas: | |
| Loop | Fastened to inside of front cover. Removable to provide reception in steel buildings and vehicles. Used on the broadcast band. |
| Whip | 61 inches long (extended). Consists of eight telescoped sections. Switched into the antenna circuit when any one of the shortwave buttons is pressed. |
| Long wire | Antenna and ground terminals provided on rear of receiver for connecting external antenna (not supplied) and ground, to assure maximum signal pickup in very weak signal areas. |
| Headset | Jack on rear of speaker accommodates Plug PL–55 for low-impedance headset connection (plug, cord, and headset not supplied). |
| Band selector | Seven band-selector buttons on the front panel provide a means of selecting the band covering the desired frequency range. |

| | *Frequency range* |
|---|---|
| Tone control | Four tone-control buttons located below the dial scale on the front panel permit selection of 16 different tonal combinations. |
| Weight | 20 pounds, less batteries. |
| Battery | Zenith type Z985 (not supplied). Single battery pack consisting of nine volts A and 90 volts B supply. |
| Signal Corps batteries | One 90-volt B Battery BA–423/U.<br>Three 3-volt A Batteries BA–407/U. |
| or | |
| Signal Corps batteries | Three 90-volt B Batteries BA–270/U.<br>Six 1.5-volt A Batteries BA–30/U. |

*Note.* For Signal Corps battery combinations, see paragraph 13.

## 5. Packaging Data and Components

(fig. 2)

*a.* Radio Receiver R–520/URR is shipped without batteries. When it is packaged for export or domestic shipment, two large bags and one small bag of silica gel are placed in the battery compartment of each receiver. The receiver is placed in an inner carton and sealed. This carton is covered by a water-vaporproof bag which is placed in an outer carton and sealed with pressure-sensitive, water-resistant tape. Four of these outer cartons are packed in a wooden crate. The outside dimensions are listed in the following table:

| Item | Height (in.) | Width (in.) | Depth (in.) | Volume (cu ft) | Unit weight (lb) |
|---|---|---|---|---|---|
| Inner carton, 200-lb test, corrugated paper. | 14¼ | 19¼ | 10⅛ | 1. 6 | 26 |
| Outer carton, corrugated paper | 15⅜ | 20 | 10½ | 1. 9 | 29½ |
| Wooden crate | 33 | 22¼ | 21½ | 9. 1 | 156 |

*Note.* Items may be packaged in a manner different from that shown, depending on the supply channel.

*b.* The following list indicates the contents of each wooden crate. See the packing list attached to each crate for exact contents.

| Crate dimensions (in.) | Contents | Notes |
|---|---|---|
| 33 x 22¼ x 21½ | Four packaged cartons, each containing one receiver. | Receivers shipped without batteries.<br>Spare parts and accessories are contained within the receiver. |

*c.* Radio Receiver R–520/URR is the only component of the radio set. The receiver measures 11$\frac{1}{16}$ inches high by 7$\frac{31}{32}$ inches deep by 17$\frac{5}{16}$ inches long. It weighs 20 pounds, less batteries.

## 6. Description of Radio Receiver R–520/URR

*a.* Radio Receiver R–520/URR (fig. 1) is a five-tube (plus selenium rectifier and glass-inclosed thermal resistor), portable, superheterodyne radio receiver designed to receive a-m signals on broadcast and shortwave bands. The front panel (fig. 8) contains all the controls required for the operation of the receiver. These include the *volume* control and the *on-off* switch, the *tone* switch assembly, the *tuning* control, and seven *band selector* buttons which permit any one of seven bands to be selected. When a band selector pushbutton is depressed, it catches and is held until another pushbutton is partially depressed, at which time the first pushbutton releases and the selector mechanism is disengaged. The broadcast range (540 to 1,600 kc) is covered by one band. The frequency range from 2 to 8 mc is covered in two bands; one band covers the frequency range from 2 to 4 mc and the other band covers the frequency range from 4 to 8 mc. These two bands are referred to as the *continuous coverage* bands. Four spread bands cover the frequencies from 17.5 mc to 18.1 mc, from 14.9 to 15.5 mc, from 11.6 to 12 mc, and from 9.4 to 9.8 mc. The receiver uses directly heated filament-type tubes and will operate on dry batteries (9 volts A and 90 volts B) 117 volts ac or dc, and 230 volts ac or dc. External antenna and ground terminals are provided for connecting an external antenna and ground in extremely weak signal areas. The external antenna is effective on all bands.

*b.* The receiver is built into a luggage-type carrying case, complete with handle. A loop antenna for broadcast reception is fastened to the inside of the front cover. The loop antenna can be removed and connected by an antenna extension cable to provide reception in steel buildings and vehicles. For shortwave reception, the receiver has a telescopic whip antenna that retracts into the cabinet. The rear cover is hinged for access to spares, accessories, batteries, tubes, headset jack, power adapter switch, and antenna connections. A latch near the top edge of the door holds the rear cover in the closed position.

*c.* The chassis is removable from the carrying case for repair and maintenance. Refer to paragraph 64 for chassis removal instructions.

## 7. Accessories and Running Spares

*a.* Included inside the cabinet of Radio Receiver R–520/URR are the loop antenna extension cable and suction cups, four power cord adapter plugs, the battery cable assemblies (contained in a bag), a nylon alinement wrench, and an instruction book.

*b.* Running spares are provided for all normally expendable items such as tubes, pilot lamps, fuses, and the glass-inclosed thermal resistor. Following is a list of running spares:

5 fuses, 3/16 ampere, Sig C stock No. 3Z2592–1.

1 neon pilot bulb, Sig C stock No. 2Z5888–5.

2 tubes, 1U4.
1 tube, 1L6.
1 tube, 1U5.
1 tube, 3V4.
1 glass-inclosed thermal resistor.

## 8. Additional Equipment

The following material is *not* supplied as part of Radio Receiver R–520/URR, but is required for certain operating conditions: 35-foot antenna wire; low-impedance headset; and headset Plug PL–55.

***Caution:*** Do not make connections to the antenna and the ground terminals (fig. 10) while the set is connected to the power line.

*a.* Two terminals, marked A and G, are provided at the left rear of the chassis for external antenna and ground connections. These are for use in areas of extremely low signal strength. When an external antenna and ground are connected to these terminals, signals previously unobtainable are received in many cases (par. 18*c*).

*b.* Under certain conditions, it may be advantageous to use a headset (such as Headset HS–30–(*)) with a Plug PL–55 connected. The speaker is disconnected automatically when the plug is inserted into jack J3, located to the rear of the speaker (par. 51).

# CHAPTER 2

# OPERATING INSTRUCTIONS

## Section I. SERVICE UPON RECEIPT OF EQUIPMENT

### 9. Siting

*a. External Requirements.* The best location for radio equipment depends on local conditions, such as the type of housing available and the terrain. Radio Receiver R–520/URR will have a greater receiving range if the unit is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor locations for radio reception because the surrounding high terrain absorbs r-f (radio-frequency) energy. Weak or otherwise undesirable signals may be expected if the set is operated under or close to steel bridges, steel buildings, underpasses, power lines, hospitals, or power units. Choose, if possible, a location on a hilltop or an elevation. Normally, reception over water is better than over land.

*b. Interior Requirements.* If possible, keep the receiver away from sources of electrical interference or mechanical vibrations. Take precautions to prevent conditions of extreme temperatures or excessive moisture. In a permanent installation, locate the receiver to provide access to the front panel; leave enough clearance for ventilation and leave space above the unit to extend the whip antenna for shortwave reception. For operation from external power, the receiver must be located within 6 feet of the power source outlet unless an extension power cable is available.

### 10. Uncrating, Unpacking, and Checking New Equipment

*Note.* For used or reconditioned equipment, refer to paragraph 14.

*a. General.* Equipment may be shipped in oversea or domestic packing cases and, sometimes, in its own carrying case. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the permanent or semipermanent installation of the equipment. The instructions in *e* below apply to equipment in domestic packing cases. Be sure all carrying cases are present and the equipment is undamaged. No special unpacking and uncrating procedures are necessary for equipment shipped in carrying cases.

***Caution:*** Be careful not to damage the equipment by careless uncrating, unpacking, or handling. Damage may necessitate a complete overhaul or render the equipment useless.

*b. Step-By-Step Instructions for Uncrating and Unpacking Export Shipments* (fig. 2).

(1) Place the packing case as near the operating position as convenient.

(2) Cut and fold back the steel straps.

(3) Remove the nails with a nail puller. Remove the top of the wooden packing case. Do not attempt to pry off the sides; the equipment may become damaged.

(4) Remove the moistureproof barrier and any excelsior or corrugated paper covering the equipment inside the wooden packing case.

(5) Remove one of the four cartons from the wooden packing case and place it on the workbench or near its final location.

(6) Inspect the equipment for possible damage incurred during shipment.

*c. Opening Cardboard Carton and Waterproof Barrier.* No special instructions are needed for opening the waterproof barrier and removing the equipment from the cardboard carton.

*d. Checking.* Check the contents against the packing slip.

*e. Unpacking Domestic Packing Cases.* Radio equipment may be received in domestic packing cases. The instructions given in *b* above apply also to unpacking domestic shipments. Open the cartons that protect the equipment; if heavy wrapping paper has been used, remove it carefully and take out the components. Check the contents of the packing case against the packing slip.

*Note.* Save the original packing cases and containers from both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

## 11. Installation of Receiver

Radio Receiver R–520/URR is shipped with the tubes, the power supply adapter, the fuse, and the pilot lamp installed. The receiver is shipped without batteries and is ready to operate from a 230-volt, a-c power source. For operation from a 230-volt d-c or 117-volt a-c or d-c source, refer to paragraph 12. Running spares and accessories are included on the inside of the receiver case (fig. 3).

## 12. Connections for Power Line Operation

Reach through the finger grip, located near the center of the rear door of the cabinet, and release latch A7 (fig. 3) by pushing upward. While holding the latch in the released position, open the door by pulling outward on the finger grip. Be sure that the power supply adapter switch, located on power supply adapter Z1 (fig. 4), is in the correct position to conform to the type of power from which the set is to be operated. To move power supply adapter switch S5, loosen

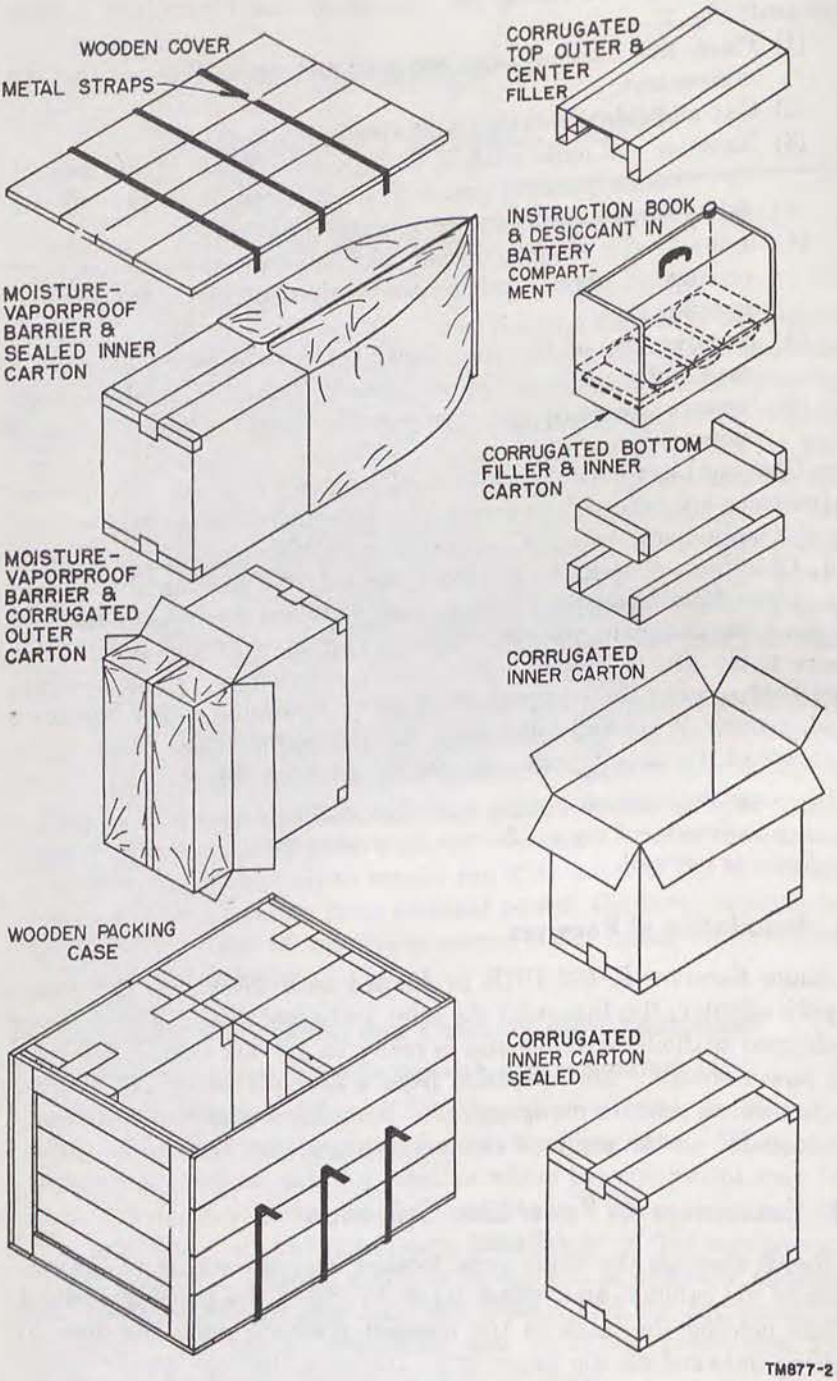



*Figure 2. Packing and packaging of Radio Receiver R-520/URR.*

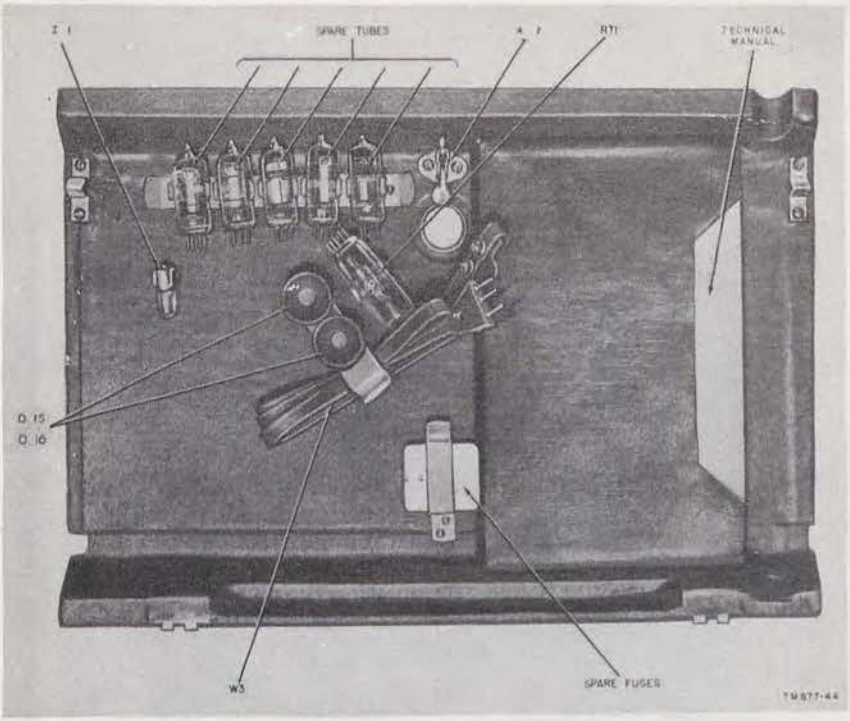



*Figure 3. Spare parts and accessories.*

knurled thumb bolt H3, that holds switch positioning plate N2 (fig. 5). Move the switch to the desired position and tighten the bolt.

*a.* The following table lists the types of external power from which the receiver will operate and indicates the proper power supply adapter switch position for each type.

| Type of power | S5 adapter switch positions |
|---|---|
| 105 to 130 volts ac | 110 V. AC-DC. |
| 105 to 130 volts dc | 110 V. AC-DC. |
| 205 to 230 volts dc | 220 V. DC. |
| 205 to 230 volts ac | 220 V. AC. |

*b.* Remove the fuseholder cap at the rear of the receiver and examine fuse F1. Use only a 3/16-ampere 1¼- by ¼-inch fuse.

***Warning:*** Do not use a fuse rated higher than 3/16 ampere; the receiver may become seriously damaged.

*c.* Determine whether the power source outlet socket can supply the correct voltage for the receiver (*a* above). Determine whether the power line cord plug will fit the power source outlet socket. If the plug will not fit into the socket, select one of the four power line

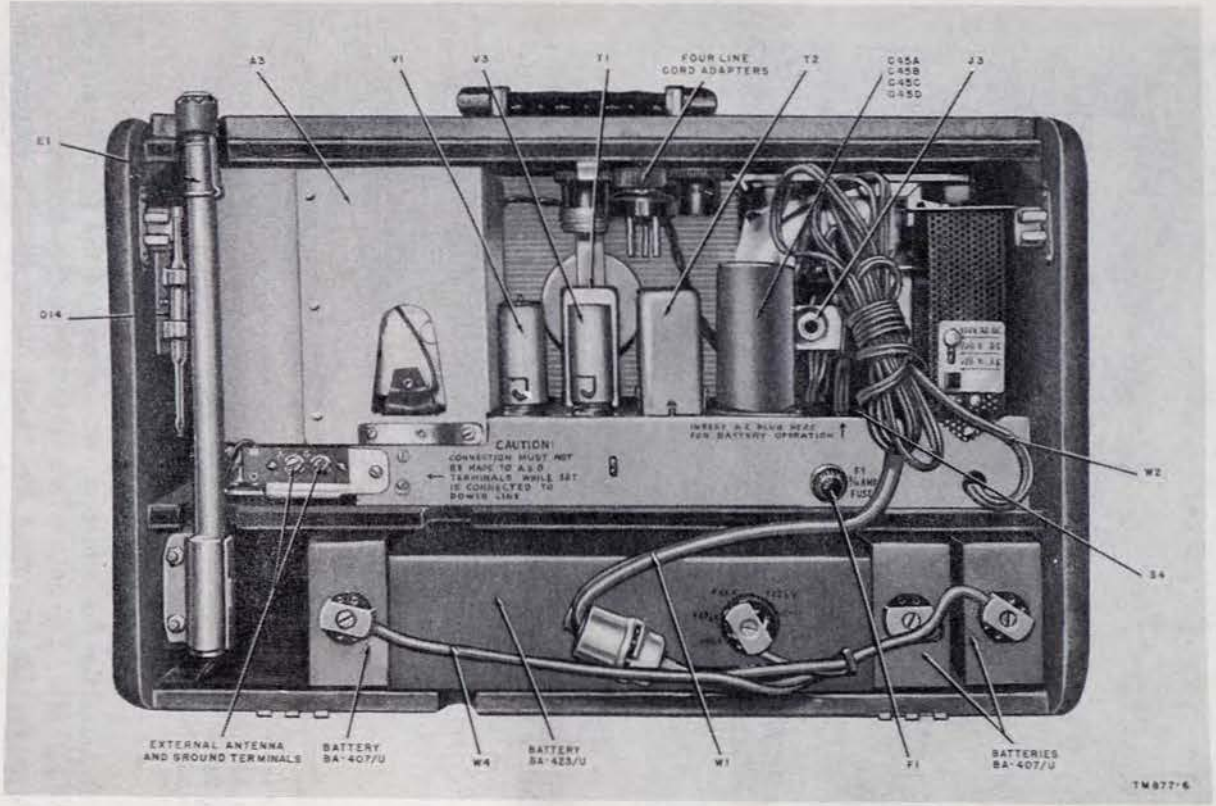



*Figure 4. Radio Receiver R–520/URR, rear view, back cover open, showing typical battery complement.*

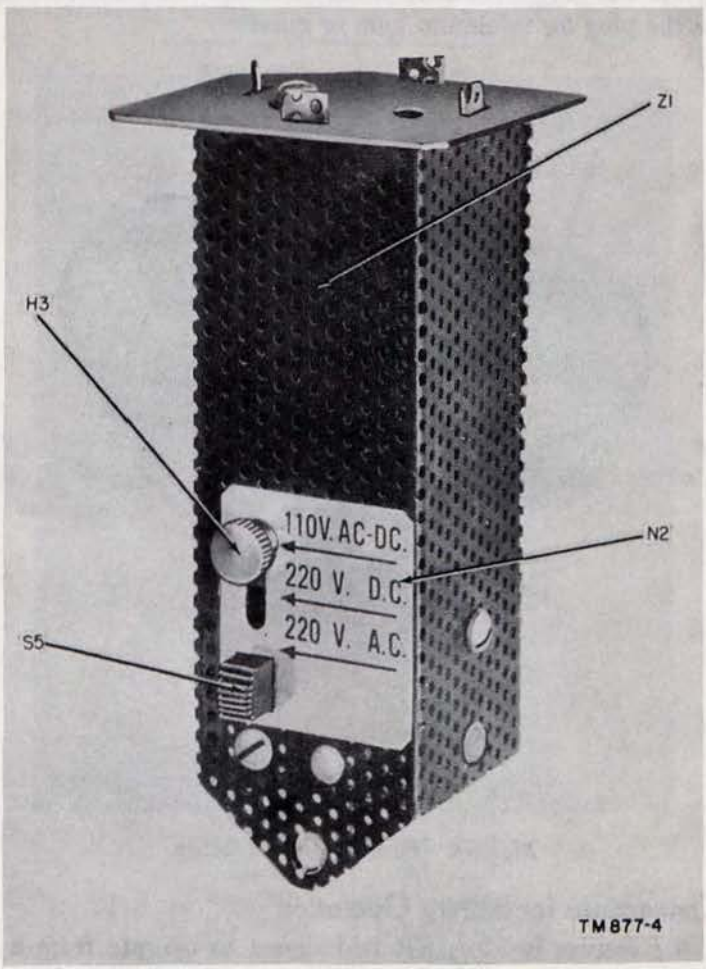



*Figure 5. Power supply adapter Z1.*

cord adapters located inside the case that will fit into the outlet socket (fig. 4). Figure 6 shows the power line cord adapters in detail. Plug the power line cord into the adapter before making connection to the power source outlet.

*d.* On direct current, the receiver will operate with the plug in one position only. If the receiver fails to operate after having been turned on, reverse the plug. On alternating current, it may be necessary to reverse the plug for minimum hum or noise.

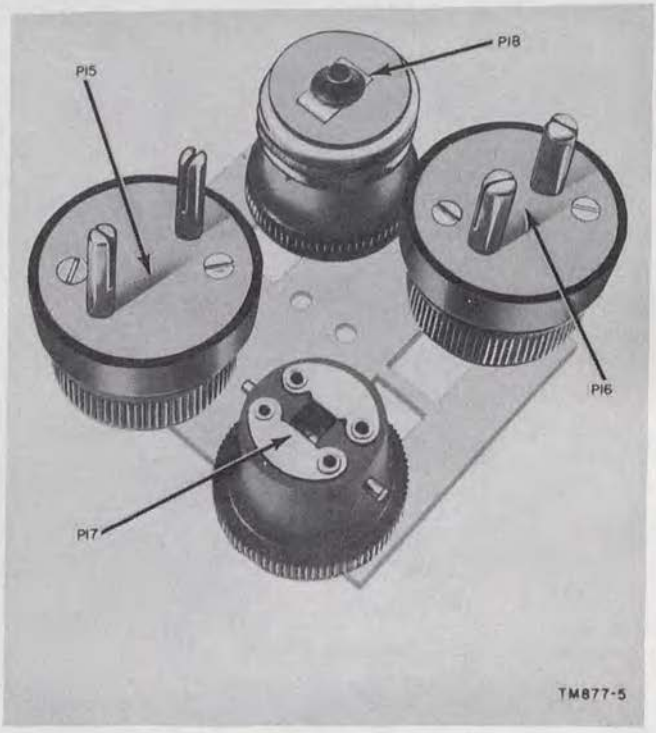



*Figure 6. Power line cord adapters.*

## 13. Connections for Battery Operation

Radio Receiver R–520/URR is designed to operate from a single self-contained battery pack (Zenith Z985, not supplied) or from one of several combinations of commonly available Signal Corps batteries. Several combinations of Signal Corps batteries permit operation with the batteries that are self-contained, while other combinations permit operation with the batteries that are located outside the case.

*a.* Place a Zenith battery pack Z985, if available, in the battery compartment located below the receiver chassis and insert the plug of battery cable W1 into the receptacle on the battery. Insert the plug of line cord W2 into battery switch socket S4, on the top rear of the chassis. Stow excess cord as shown in figure 4.

*b.* Red harness W4 (contained in the cloth bag inside the battery compartment) can be used with the Signal Corps battery complement shown in figure 4. One 90-volt B Battery BA–423/U and three 3-volt A Batteries BA–407/U are used. Insert the harness between receiver battery cable W1 and the four Signal Corps batteries. In addition, red harness W4 will accommodate the following listed alternate battery complements within the battery compartment of the set.

| Three batteries | One battery |
|---|---|
| BA–407/U | BA–419/U |
| BA–407/U | BA–416/U |
| BA–407/U | BA–415/U |
| BA–406/U | BA–423/U |
| BA–406/U | BA–419/U |
| BA–406/U | BA–416/U |
| BA–406/U | BA–415/U |
| BA–408/U | BA–415/U |
| BA–409/U | BA–415/U |

*c.* The following battery combinations permit operation of the receiver, in conjunction with red harness W4, with the batteries located outside the case:

| Three batteries | One battery |
|---|---|
| BA–406/U | BA–420/U |
| BA–406/U | BA–424/U |
| BA–407/U | BA–420/U |
| BA–407/U | BA–423/U |
| BA–408/U | BA–416/U |
| BA–408/U | BA–419/U |
| BA–408/U | BA–420/U |
| BA–408/U | BA–423/U |
| BA–408/U | BA–424/U |
| BA–409/U | BA–416/U |
| BA–409/U | BA–419/U |
| BA–409/U | BA–420/U |
| BA–409/U | BA–423/U |
| BA–409/U | BA–424/U |
| BA–410/U | BA–415/U |
| BA–410/U | BA–416/U |
| BA–410/U | BA–419/U |
| BA–410/U | BA–420/U |
| BA–410/U | BA–423/U |
| BA–410/U | BA–424/U |
| BA–411/U | BA–415/U |
| BA–411/U | BA–416/U |
| BA–411/U | BA–419/U |
| BA–411/U | BA–420/U |

| Three batteries | One battery |
|---|---|
| BA–411/U | BA–423/U |
| BA–411/U | BA–424/U |
| BA–412/U | BA–415/U |
| BA–412/U | BA–416/U |
| BA–412/U | BA–419/U |
| BA–412/U | BA–420/U |
| BA–412/U | BA–423/U |
| BA–412/U | BA–424/U |

*d.* Figure 7 shows the batteries that are connected by yellow harness W5 in the general position they occupy within the receiver battery compartment. This harness is connected permanently to battery case E23, which is supplied with the set. It is located at the front end of the battery compartment and permits operation with the Signal Corps batteries contained within the receiver case. To insert six A Batteries BA–30/U into battery case E23, follow the directions given on the decal next to the removable end cover E24. To remove the batteries, press down with the palm of the hand and turn clockwise. Place the three B Batteries BA–270/U into position in the battery compartment and connect cable W5 to them. Insert plug P10 into the receptacle of receiver battery cable W1.

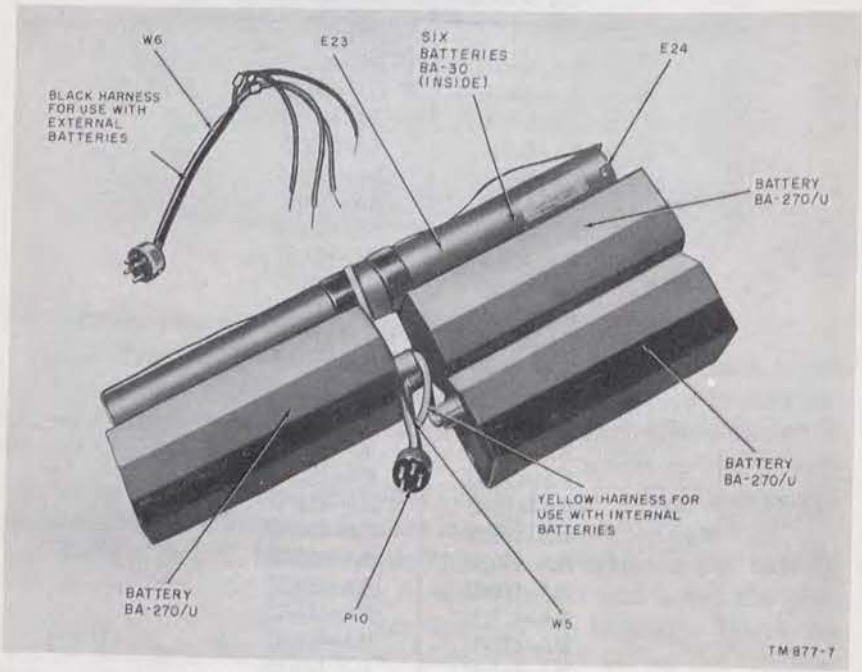



*Figure 7. Signal Corps battery pack connections.*

*e.* With black harness W6, any external battery source can be used that has a 9-volt, d-c A supply and a 90-volt, d-c B supply. The four connecting leads are tagged, showing the voltages required (fig. 7).

***Caution:*** Be sure to connect the A battery first to avoid the possibility of accidently placing the B battery across the tube filaments and causing a burnout.

*Note.* Insert the battery cables that are not being used into the cloth bag and place the bag in the battery compartment.

### 14. Service Upon Receipt of Used or Reconditioned Equipment

*a.* Follow the instructions in paragraph 10 for uncrating, unpacking, and checking the equipment.

*b.* Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note the change in this technical manual (along with the serial and order numbers of the modified equipment), preferably on the schematic diagram.

*c.* Check the operating controls for ease of rotation. If lubrication is required, refer to the lubrication instructions (par. 35).

*d.* Perform the installation and connection procedures given in paragraphs 11, 12, and 13.

## Section II. CONTROLS

### 15. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of the equipment is discussed in paragraphs 17 through 23.

### 16. Controls and Their Uses

(fig. 8)

| Control | Function |
|---|---|
| On-off switch | Turns receiver on and off. |
| Volume control | Varies volume of audio output. |
| Band selector buttons | Selects the band covering the desired frequency. |
| Tuning control | Selects desired frequency by means of a dial mechanism and ganged tuning capacitor. |
| Switch assembly tone control. | Adjusts tone of the receiver to listener's individual preference by means of the four tone buttons below the dial. The combination of these four buttons in either of their two positions offers 16 possible tone combinations. |

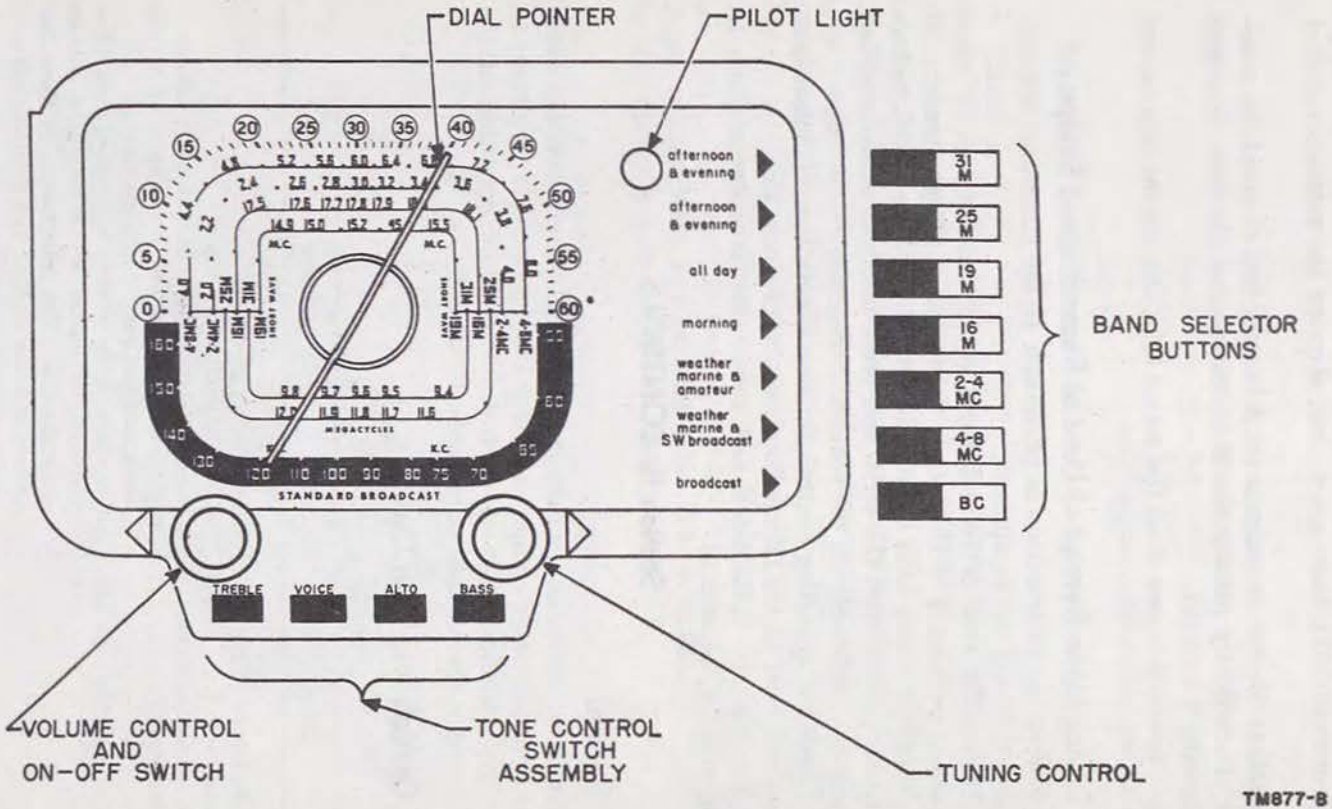



*Figure 8. Radio Receiver R-520/URR, front panel.*

## Section III. OPERATION UNDER USUAL CONDITIONS

### 17. Starting Procedure

*Note.* If, during the starting procedure, an abnormal result is obtained, refer to paragraph 41, the equipment performance checklist.

*a.* Prepare the receiver for operation from the power source from which the set is to be operated (pars. 12 and 13).

*b.* Turn the volume control on-off switch knob clockwise until it clicks and the neon pilot light glows (fig. 8). Continue to turn the knob clockwise until the desired volume is obtained. When tuning for very weak signals, it may be necessary to turn the volume control to the maximum clockwise position.

*c.* Choose the band of operation and press the band selector button that covers the desired frequency (par. 4). The color of the letters and numerals on each band selector button is the same color as the corresponding scale on the dial.

### 18. Standard Broadcast Reception

The broadcast band portion of the dial scale is the buff-colored section indicated by the lower half of the pointer. This section is calibrated in kilocycles with the last zero deleted for convenience (fig. 8).

*a. Normal Conditions.*

(1) Press the buff-colored band selector switch button marked BC.

(2) Tune with the tuning control knob (fig. 8). Turn the knob back and forth slowly to obtain a clear signal.

(3) After a station has been tuned in, readjust the volume control to the desired volume.

(4) Adjust the tone control buttons for the desired tone.

*b. Steel Structures and Vehicles.*

(1) Remove the knurled brass nuts that hold loop antenna E2 in position on the inside of the front cover (fig. 9). Remove the antenna and replace the knurled nuts to prevent their loss.

***Caution:*** Do not make connections to antenna and ground terminals while the set is connected to the power line.

(2) Open the rear door of the cabinet and remove loop extension cable W3, and suction cups O15 and O16.

(3) Remove plug P1 from the loop antenna socket (fig. 10). Insert three-pronged plug P8, located on one end of loop extension cable W3, into receptacle J1 (fig. 28). Snap the other end of cable W3 on the loop antenna and snap the suction cups on the two remaining loop antenna snap fasteners.

(4) Moisten the suction cups and apply the loop antenna to a corner of a window.

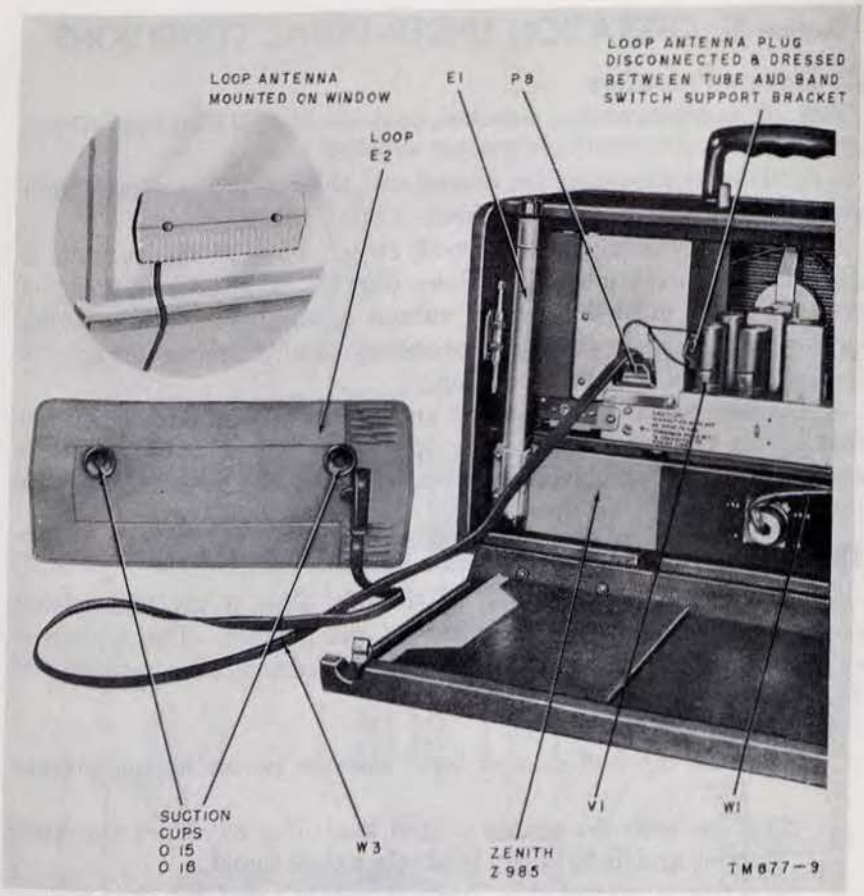



*Figure 9. Extension cable connected to loop antenna.*

(5) Continue with the procedure for operating the receiver outlined in paragraph 17 and in *a* above.

(6) Experiment for best reception and minimum noise by placing the loop antenna in various positions on the windows.

*c. Antenna and Ground* (fig. 10). Two terminals, marked A and G, are provided at the left rear of the chassis for external antenna and ground connection. These are for use in areas of extremely low signal strength. By connecting an external antenna and ground to these terminals, signals previously impossible to obtain are received in many cases. Ordinary field wire, such as Wire WD–1/TT or W–110–B, may be used. Erect an external antenna at least 35 feet in length and as high as possible above the ground and the surrounding terrain. Bring down the insulated lead-in wire and connect it to the A terminal. Under some conditions, it may be necessary to connect a good ground to the G terminal. The external antenna and ground are connected automatically to the proper standard or shortwave circuit when the operator presses the band selector buttons.

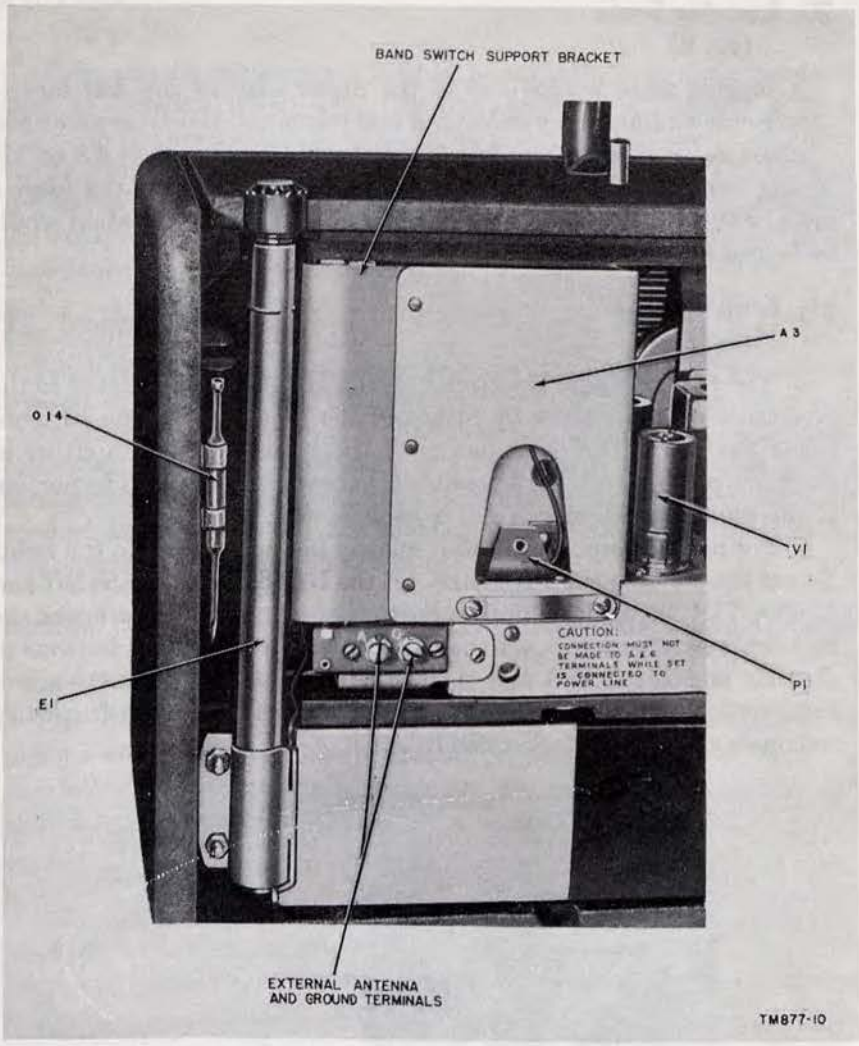



*Figure 10. Antenna and ground terminals.*

## 19. Shortwave Reception

The six shortwave bands are spread and calibrated on the dial in mc. Four bands are located on the upper half of the dial and two on the lower half. Read with the upper half or lower half of the pointer, depending on the location of the scale in use. For shortwave operation, proceed as follows:

*a.* Raise the front cover to an upright position.

*b.* Turn the button on top of the telescopic whip antenna E1 until it snaps up. Extend the antenna to its full length.

*c.* Press the desired shortwave band selector button.

*d.* Continue with the procedure for operating the receiver outlined in paragraph 17.

## 20. Logging Scale
(fig. 8)

A logging scale is provided in the upper edge of the dial face to assure ease and accuracy in logging and relocating shortwave stations.

*Example:* A station heard at 6.9 mc would be logged at 6.8 on the tuning band, and the number of divisions occurring on the logging scale, which, in this case, would be 40. Therefore, the station would be logged as 6.8 (40).

## 21. Tone Control
(fig. 8)

*a.* The tone of Radio Receiver R–520/URR may be regulated to the preference of the listener by means of the four button tone switches below the dial. The combination of these four buttons in either of their two positions offers 16 possible tonal combinations. The portion of the tonal range is shown above each button.

*b.* For normal response, all tone control buttons are set to the right. To cut the low-frequency response, set the BASS button to the left and ALTO, VOICE, and TREBLE buttons to the right. To lower the high-frequency response, set the VOICE and/or TREBLE buttons to the left and the BASS and ALTO buttons to the right. Various combinations of tone control button settings will result in frequency responses suited to different conditions.

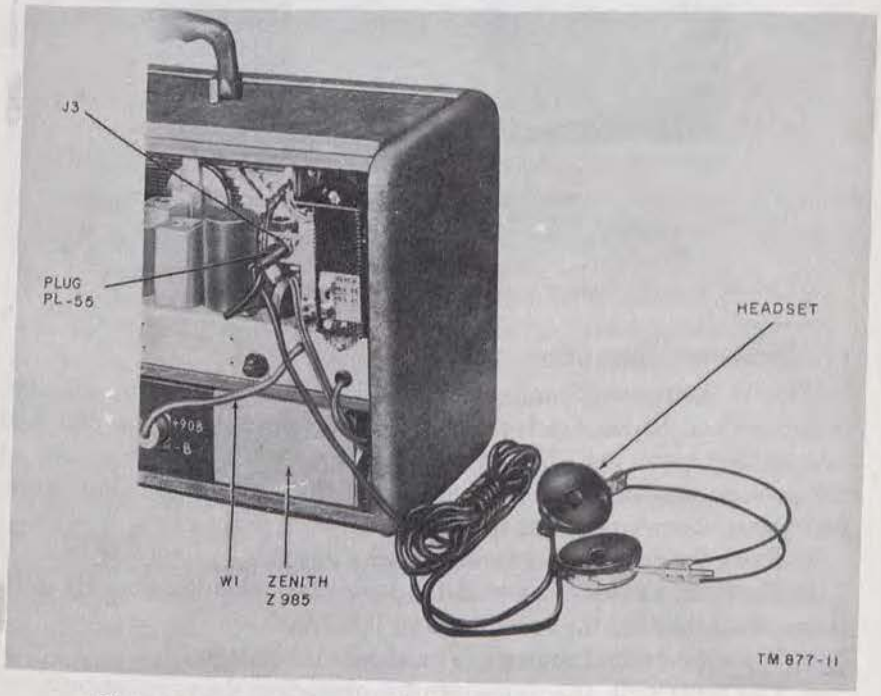



*Figure 11. Radio Receiver R–520/URR, with headset connected.*

## 22. Headset

(fig. 11)

Under certain conditions it may be advantageous to use a headset such as Headset HS–30–(*). To use the headset, connect a Plug PL–55 to the headset leads, open the back cover of the case, and insert the plug into jack J3 (located to the rear of the speaker). The speaker is disconnected automatically when the plug is inserted. Best results are achieved by using a low-impedance headset; however, an exact impedance match is not necessary.

## 23. Stopping Procedure

When the set is not in use, make sure that the power is off by turning the left control knob fully counterclockwise until a *click* is heard and the neon pilot light goes out. Rotate the tuning control knob counterclockwise until the dial pointer is at the low-frequency end of the tuning range. This insures that the tuning capacitor plates are fully meshed and are afforded the maximum protection from mechanical injury while the reciever is not in use.

# Section IV. OPERATION UNDER UNUSUAL CONDITIONS

## 24. General

The operation of Radio Receiver R–520/URR may be difficult in regions of extreme cold, heat, humidity, sand, mud, snow, etc. In the following paragraphs instructions are given on procedures for minimizing the effect of these unusual operating conditions.

## 25. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather may affect the efficient operation of the 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 set is not in a heated inclosure, construct an insulated box for the set.

*c*.. Wear a knitted woolen cap over the headset when operating in the open air with a headset that does not include rubber earpieces. Frequently, when a headset without rubber earpieces is worn, the edges of the ears may freeze without the operator being conscious of this condition. Never flex rubber ear caps; this action may render them useless. If water gets into the receiver portions of the headset, or if moisture condenses within them, it may freeze and impede the action of the diaphragms. When this happens, remove the bakelite cap and remove the ice and moisture.

*d*. When equipment that has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature.

This condition also arises when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

*e.* Use any improvised means to protect dry batteries, because they will fail if not protected against the cold. Preheat the batteries. To prevent heat loss, place them in bags lined with kapok, spun glass fiber materials, animal skins, or woolen clothing.

## 26. 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. 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 close to the rear of the equipment (with the back cover removed).

## 27. 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 that arises with equipment operation in desert areas is the large amount of sand or dirt and dust that enters the moving parts of radio equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since 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 tents with sand to prevent their flapping in the wind.

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

*d.* Be careful to keep the equipment as free of dust as possible. Make frequent preventive maintenance checks (pars. 30 through 37). Pay particular attention to the lubricants.

# CHAPTER 3

# ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

## Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

### 28. Tools and Materials Used with Radio Receiver R–520/URR

Most of the repair and maintenance may be performed with the tools found in Tool Equipment TE–41. The tools and equipment contained in Tool Equipment TE–41 are listed in the Department of the Army Supply Manual SIG 6–TE–41. The only tool supplied with the receiver is nylon alinement wrench O 14 (fig. 4).

*a. Tools.*

Tool Equipment TE–41.
Alinement wrench O 14.

*b. Materials.*

Orange stick.
Carbon tetrachloride.*
Cheesecloth, bleached, lint-free.*
Paper, sand, flint No. 000.*
Solvent, Dry-Cleaning (SD) (Fed spec No. P–S–661a).

### 29. Special Tool Supplied with Radio Receiver R–520/URR

Alinement wrench O 14 is the only special tool supplied with the radio set. One end of the wrench has a hexagonal shaft which is used for the adjustment of the i-f (intermediate-frequency) cores. This design allows the wrench to slip through or engage the i-f transformer primary or secondary coil core so that alinement can be performed from the top of the chassis. The other end has a spade tip and is used for adjustment of the antenna, r-f and oscillator coil cores. *Do not use the alinement wrench as a screwdriver to turn trimmer capacitors.*

## Section II. PREVENTIVE MAINTENANCE SERVICES

### 30. 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 condition to avoid breakdowns and needless interruptions in service. Preventive maintenance differs from troubleshooting and repair, because its object is to prevent certain troubles from occurring. (Refer to AR 750–5.)

*Part of Tool Equipment TE–41.

## 31. General Preventive Maintenance Techniques

*a.* Keep the interior of the set clean. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

*b.* Inspect the equipment for faults just beginning to show, and make the necessary repairs. Locate and tighten loose mechanical parts, reconnect broken leads, tape frayed cables and wires. Locate and replace parts that appear ready to fail (scorched resistors, leaking capacitors). Be sure that all pluck-out items (tubes, fuses, adapters) are seated firmly in their sockets.

*c.* Clean the band selector switch contacts with carbon tetrachloride only if absolutely necessary. Be careful not to get the carbon tetrachloride solution on the coils. It may cause a deposit of wax on the switch contacts and result in erratic operation.

***Caution:*** Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Be sure adequate ventilation is provided.

*Note.* 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 careful when tightening screws in plastic or bakelite material because the threads in this material are stripped easily. For further information on preventive maintenance techniques, refer to TB SIG 178.

## 32. Use of Preventive Maintenance Forms

(figs. 12 and 13)

*a.* The decision as to which items on DA Forms 11–238 and 11–239 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communications officer chief or his designated representative, and, in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

*b.* Circled items in figures 12 and 13 are partially or totally applicable to Radio Receiver R–520/URR. References in the ITEM block refer to paragraphs in text which contain additional maintenance information.

## 33. Performing Exterior Preventive Maintenance

*a.* Check the radio set for completeness and satisfactory condition. The components of the radio set are listed in paragraphs 5 and 7, and are illustrated in figures 1, 3, 4, 6, and 7.

*b.* Check suitability of location and installation for normal operation (par. 9).

*c.* Remove dirt and moisture from the antenna, headset jack, plugs and carrying case (figs. 4, 7, 9, and 11).

*d.* Inspect the seating of accessible pluck-out items: tubes, pilot light, fuse F1, and the four adapter connectors (figs. 4, 5, 6, and 28).

*e.* Inspect tone control switches, tuning control, volume control,

and band selector switches for binding, scraping, excessive looseness, misalinement, and positive action (fig. 8).

*f.* Check to verify normal operation (par. 41).

*g.* Inspect the line cord, battery cables, and wire, for cuts, breaks, fraying, deterioration, kinks, and strain (par. 13 and figs. 4 and 7).

*h.* Inspect the loop and whip antennas for corrosion and loose fit (figs. 9, 10, and 33).

*i.* Inspect for looseness of accessible items, tone control switches, tuning and volume control knobs, band selector switches, jack J3, connectors, transformer T3, capacitor C45, and pilot light assembly (figs. 4, 8, 28, and 30).

*j.* Clean the dial window and neon pilot light assembly (figs. 1 and 28).

*k.* Inspect the shelters and covers for adequacy of weatherproofing (par. 9).

## 34. Performing Interior Preventive Maintenance

***Caution:*** Disconnect all power before performing the following operations. After completion, reconnect the power, and check for satisfactory operation.

*a.* Inspect the electron tubes for loose envelopes, cracked sockets, bent pins, and insufficient socket spring tension; remove dust and dirt carefully; check the emission of tubes.

*b.* Inspect fixed capacitors C25 and C45 for leaks, bulges, and discoloration (figs. 29 and 30).

*c.* Inspect variable tuning capacitor C2 for dirt, moisture, misalinement of plates, and loose mountings (fig. 28).

*d.* Inspect the resistors for cracks, chipping, blistering, discoloration, and moisture (fig. 29).

*e.* Clean and tighten the switches and interiors of chassis and cabinets not readily accessible (par. 63).

*f.* Lubricate the equipment in accordance with applicable Department of the Army lubrication order (par. 35 and fig. 14).

*g.* Clean and tighten the connections and mountings for loudspeaker LS1, transformer T3, and potentiometers (par. 63 and figs. 28 and 29).

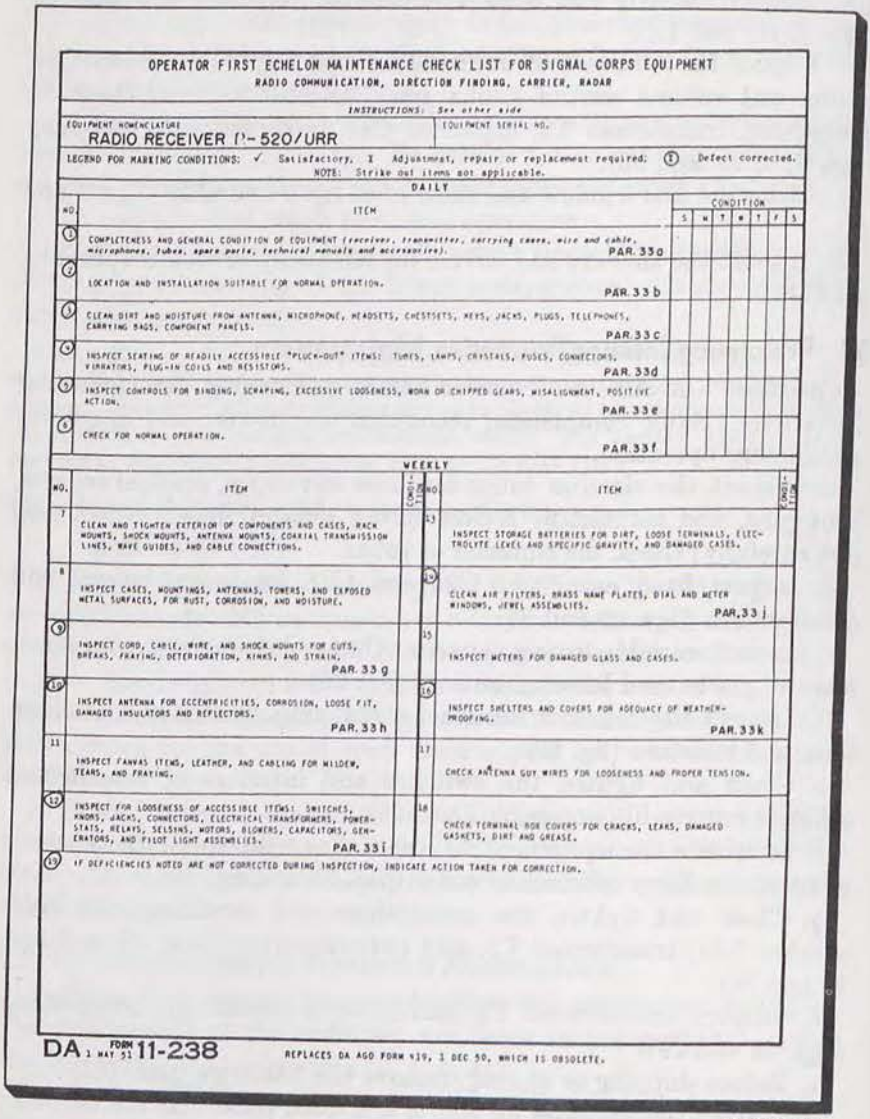
*h.* Inspect transformer T3 and potentiometers for overheating (figs. 28 and 29).

*i.* Before shipping or storing, remove the batteries (par. 103).

*j.* Inspect the batteries for shorts and dead cells. (If the batteries are swelling or oozing, replace them immediately.) If the neon pilot light does not glow on battery operation, insufficient B+ voltage is indicated. Replace the B battery pack.

*k.* Check for adequacy of moisture-fungiproofing (par. 36).

*l.* If deficiencies noted are not corrected during inspection, indicate what action was taken.



OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: RADIO RECEIVER R-520/URR
EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory, X Adjustment, repair or replacement required; (T) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

| NO. | ITEM | CONDITION S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|---|---|
| 1 | COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories). PAR. 33a | | | | | | | |
| 2 | LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 33b | | | | | | | |
| 3 | CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 33c | | | | | | | |
| 4 | INSPECT SEATING OF READILY ACCESSIBLE "PLUG-IN" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 33d | | | | | | | |
| 5 | INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 33e | | | | | | | |
| 6 | CHECK FOR NORMAL OPERATION. PAR. 33f | | | | | | | |

WEEKLY

| NO. | ITEM | CONDITION | NO. | ITEM | CONDITION |
|---|---|---|---|---|---|
| 7 | CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. | | 13 | INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. | |
| 8 | INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. | | 14 | CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 33j | |
| 9 | INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 33g | | 15 | INSPECT METERS FOR DAMAGED GLASS AND CASES. | |
| 10 | INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 33h | | 16 | INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 33k | |
| 11 | INSPECT FANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. | | 17 | CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. | |
| 12 | INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 33i | | 18 | CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. | |

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 877-12

*Figure 12. DA Form 11–238.*

## SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

*INSTRUCTIONS: See other side*

EQUIPMENT NOMENCLATURE: RADIO RECEIVER R-520/URR

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (1) Defect corrected.
NOTE: Strike out items not applicable.

| NO. | ITEM | CORRECTION LISTED |
|---|---|---|
| 1 | COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 33 a | |
| 2 | LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 33 b | |
| 3 | CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 33 c | |
| 4 | INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 33 d | |
| 5 | INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 33 e | |
| 6 | CHECK FOR NORMAL OPERATION. PAR. 33 f | |
| 7 | CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. | |
| 8 | INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. | |
| 9 | INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 33 g | |
| 10 | INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 33 h | |
| 11 | INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. | |
| 12 | INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 33 i | |
| 13 | INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. | |
| 14 | CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 33 j | |
| 15 | INSPECT METERS FOR DAMAGED GLASS AND CASES. | |
| 16 | INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 33 k | |
| 17 | CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. | |
| 18 | CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. | |
| 19 | ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR. 34 g | |
| 20 | INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION. | |
| 21 | INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 34 b | |
| 22 | INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. | |
| 23 | INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 34 c | |
| 24 | INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 34 d | |
| 25 | INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. | |
| 26 | CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 34 e | |
| 27 | INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. | |
| 28 | CHECK SETTINGS OF ADJUSTABLE RELAYS. | |
| 29 | LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER. PAR. 34 f | |
| 30 | INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR. | |
| 31 | CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 34 g | |
| 32 | INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 34 h | |
| 33 | BEFORE SHIPPING OR STORING - REMOVE BATTERIES. PAR. 34 i | |
| 34 | INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS. | |
| 35 | INSPECT BATTERIES FOR SHORTS AND DEAD CELLS. PAR. 34 j | |
| 36 | INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS. | |
| 37 | MOISTURE AND FUNGIPROOF. PAR. 34 k | |
| 38 | IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. | |

DA FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 439, 1 DEC 50, WHICH IS OBSOLETE.

TM877-13

*Figure 13. DA Form 11-239.*

## Section III. LUBRICATION AND WEATHERPROOFING

### 35. Lubrication Instructions

(fig. 14)

***Caution:*** Avoid contacting lubricating oil or grease with material such as rubber, paint, and certain plastics on which the lubricant may have a solvent effect. Avoid contacting lubricant with the dial drive cords.

*a.* Because Radio Receiver R–520/URR uses a dial drive system of simple design, little lubrication is necessary. If the three-section ganged tuning capacitor becomes stiff and causes the dial cord to slip, remove any grit between the capacitor and drive shaft bearing surfaces. Lubricate by applying Grease, Aircraft and Instruments (GL) to

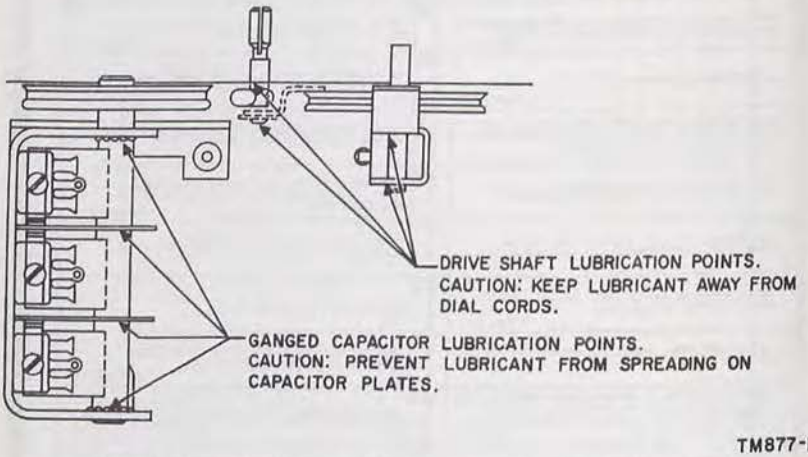



*Figure 14. Lubrication points for Radio Receiver R–520/URR.*

these parts. Do not allow lubricant to spread on capacitor plates or dial cord.

*b.* Grease (GL) contains a rust and corrosion inhibitor. It can be used in regions where the temperature ranges from −70° F. to +160° F.

### 36. Weatherproofing Instructions

*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 moistureproofing 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. The equipment is moistureproofed

and fungiproofed at the factory and it is necessary to use this treatment only when parts are replaced or repaired.

*c. 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.

*d. 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.

*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 paragraph 35 for detailed instructions.

### 37. Cabinet Finish

Clean the outside of the cabinet with a mild solution of soap and water. Touch up scuffs and scratches with a good paste-type wax shoe polish of the proper color.

## Section IV. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

### 38. Scope

*a.* The troubleshooting and repair work that can be performed at the organizational manitenance level (operators and repairmen) are necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, troubleshooting 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 following paragraphs in this section help in determining which of the components are at fault and in localizing the fault in each component to the defective stage or item, such as a tube or fuse.

### 39. Visual Inspection

*a.* Failure of this equipment to operate properly usually will be caused by one or more of the following faults:

(1) Improperly connected battery cable or power line cord plug.
(2) Worn, broken, or disconnected cords or plugs.
(3) Burned-out fuse.
(4) Broken wires caused by excessive vibration.
(5) Defective tubes.

*b.* When failure is encountered and the cause is not immediately apparent, check as many of these items as is practicable before starting a detailed examination of the component parts of the system. If

possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

## 40. Troubleshooting by Using Equipment Performance Checklist

*a. General.* The equipment performance checklist (par. 41) will help the operator to locate trouble in the equipment. The list gives the items 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. *To use this list, follow the items in numerical sequence.*

*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 the operator should perceive when the items are checked. If the indications are not normal, the operator should apply the recommended corrective measures.

*d. Corrective Measures.* The corrective measures listed are those which 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 troubleshooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, troubleshooting is necessary.

## 41. Equipment Performance Checklist

*a. Power Line Operation.*

| | Item No. | Item | Action or condition | Normal indications | Corrective measures |
|---|---|---|---|---|---|
| PREPARATORY | 1 | Volume control and on-off switch. | Set to off position (maximum counterclockwise position). | | |
| | 2 | Loop antenna | Swing front cover of case up into operating position. | | |
| | 3 | Whip antenna | Extend antenna to maximum height. | | |
| | 4 | Power supply adapter | Set switch S5 on adapter for line voltage to be used. | | |
| | 5 | Power line cord | Plug cord into proper line voltage source. | | |
| START | 6 | Volume control and on-off switch. | Set volume control to maximum clockwise position. | Neon pilot light is illuminated. | Check fuse. Replace dial light. Reverse line cord plug. |

| | Item No. | Item | Action or condition | Normal indications | Corrective measures |
|---|---|---|---|---|---|
| | 7 | Tone control | Set all tone control switches to the right (normal operation). | Normal frequency response. | |
| EQUIPMENT PERFORMANCE | 8 | Band selector switches | Press each of seven band selector switches, turn tuning control. | Signals heard in loudspeaker. | If signals are weak or not obtained, check power line voltage and battery pack condition; replace tubes in receiver. |
| | 9 | Tone control switches | Operate each switch | Tonal variations | If no tonal variations are noticed, check switches (chs. 4 and 5). |
| | 10 | Volume control | Turn counterclockwise | Volume decreases | Check volume control (chs. 4 and 5). |
| | 11 | Headsets | Headsets plugged into jack J3 | Speaker becomes inoperative; signals heard in headsets. | If headsets do not operate, check jack J3 contacts. |
| | 12 | External antenna | Connect to antenna terminal. (For power line operation, disconnect power cord plug from line while making connection.) | Increased signal pickup on bc and sw bands. | Check antenna. |
| | 13 | External ground | Connect to ground terminal. (For power line operation, disconnect power cord plug from line while making connection.) | Minimum line noise and hum pickup. | Check ground connection. Reverse line cord plug. |

| | | | | | |
|---|---|---|---|---|---|
| S<br>T<br>O<br>P | 14 | Volume control and on-off switch. | Turn to off position (full counterclockwise position of volume control). | No signals are heard. Pilot light goes out. | |
| | 15 | Power line cord | Roll up and stow cord near headset jack J3 so that back cover of case will close firmly. | | |
| | 16 | Tuning control | Rotate tuning control knob counterclockwise until dial pointer is at low-frequency end of tuning range. | | |

*b. Battery Operation.*

| | Item No. | Item | Action or condition | Normal indications | Corrective measures |
|---|---|---|---|---|---|
| PREPARATORY | 1 | Volume control and on-off switch. | Set to off position (maximum counterclockwise position). | | |
| | 2 | Loop antenna | Swing front cover of case up into operating position. | | |
| | 3 | Whip antenna | Extend antenna to maximum height. | | |
| | 4 | Power line cord | Plug power line cord into switch S4 (fig. 4). | | |
| | 5 | Batteries | Connect batteries (par. 13) | | |
| START | 6 | Volume control and on-off switch. | Set volume control to maximum clockwise position. | Neon pilot light glows | Replace batteries. Replace dial light. |

*Note.* For EQUIPMENT PERFORMANCE and STOP checklist, see items No. 7 through 16 in *a* above.

# CHAPTER 4
# THEORY

## 42. Block Diagram
(fig. 15)

Radio Receiver R–520/URR is a portable superheterodyne receiver designed to receive a-m signals in the broadcast and shortwave bands. The frequency ranges are given in paragraph 4. Figure 40 is a complete schematic diagram of this receiver. The tuning system consists of an antenna section, an r-f stage which uses a 1U4 tube, and a 1L6 pentagrid converter which operates as a combination mixer and h-f (high-frequency) oscillator. A different mode of tuning and tracking is used on each of the three groups of bands (broadcast band, continuous coverage shortwave bands, and the spread bands). The block diagram, which shows the signal path through the receiver, is discussed in *a* through *e* below.

*a. First R-F Amplifier.* The signal is fed from the antenna to tuned r-f amplifier tube V1. The r-f amplifier serves to increase the signal voltage, provides isolation between the oscillator section of tube V2 and the antenna, and also stops unwanted signals (at image frequencies) from entering the converter.

*b. Converter.* The signal from the r-f amplifier is fed to the mixer section of combination mixer and oscillator tube V2. The oscillator section of tube V2 produces an h-f oscillator voltage that is 455 kc higher than the signal frequency on the broadcast and the two continuous coverage bands, and 455 kc lower on the four spread bands. This voltage is combined with the received signal in the mixer section of tube V2 to produce a difference beat frequency of 455 kc, which then is amplified by i-f amplifier tube V3.

*c. I-F Amplifier.* The i-f amplifier is a high-gain circuit which is fixed-tubed to the frequency difference between the h-f oscillator and the incoming r-f signal, and is thus a constant, single-frequency amplifier that operates on 455 kc. Most of the signal amplification occurs in the i-f amplifier.

*d. Detector and First A-F Amplifier.* The amplified signal from the i-f amplifier is fed to detector tube V4 for demodulation. V4 is a dual tube, which serves as a detector and a first a-f (audio-frequency) amplifier. The detector stage also produces the avc (automatic volume control) voltage which automatically controls the gain of the

receiver by regulating the bias voltage to the grids of tubes V1, V2, and V3.

*e. Final Audio Power Amplifier.* The audio signal from V4 is fed to audio-output stage V5 for power amplification. The output of power amplifier V5 is applied across an impedance-matching output transformer which permits the use of headsets (not supplied) or the loudspeaker.

## 43. Tuning Circuits

Tuning for the receiver is provided by a three-gang variable capacitor in conjunction with other circuit components. The components required to tune the receiver through a desired band are selected when the correct band selector button is pressed. This action connects the correct tuned circuits to the antenna, r-f, and oscillator stages. Where practicable, switching is simplified by shunting the desired circuit components across the unused circuit components. Most of the unused coils are shorted to prevent any undesirable resonant effects. The tuning methods used for the three different types of bands are described in *a* through *c* below. Additional details on the receiver tuned circuits are given in paragraphs 44 through 48.

*a.* The tuning range of the broadcast band is from 540 to 1,600 kc. Tuning is provided by means of ganged tuning capacitor C2, sections A, C, and E. Figure 16 shows the r-f and converter stages for broadcast operation when BC pushbutton S1A is pressed. The switch sections actually are arranged in line (fig. 34), but are shown rearranged in figure 16 to facilitate circuit discussion (pars. 44, 45, and 46).

*b.* The tuning ranges of the two continuous coverage bands are from 2 to 4 mc and 4 to 8 mc, and tuning is provided by means of the same gang tuning capacitor as used on the broadcast band. Both continuous coverage bands have similar antenna, r-f, and converter circuits. Figure 17, which is used to facilitate discussion (par. 47), shows the r-f and converter stages for 4- to 8-mc operation (pushbutton S1B pressed). Figure 35 shows the circuit with the sections of S1B drawn in line.

*c.* The tuning ranges of the four spread bands are from 9.4 to 9.8 mc (31 M), 11.6 to 12 mc (25 M), 14.9 to 15.5 mc (19 M), and 17.5 to 18.1 mc (16 M). Tuning is provided by means of the same ganged tuning capacitor used on the broadcast band. All four spread bands have similar antenna, r-f, and converter circuits. Figure 18, which is used to facilitate discussion (par. 48), shows the r-f and converter stages for 16 M operation (pushbutton S1D pressed). Figure 36 shows the circuit with the sections of S1D drawn in line.

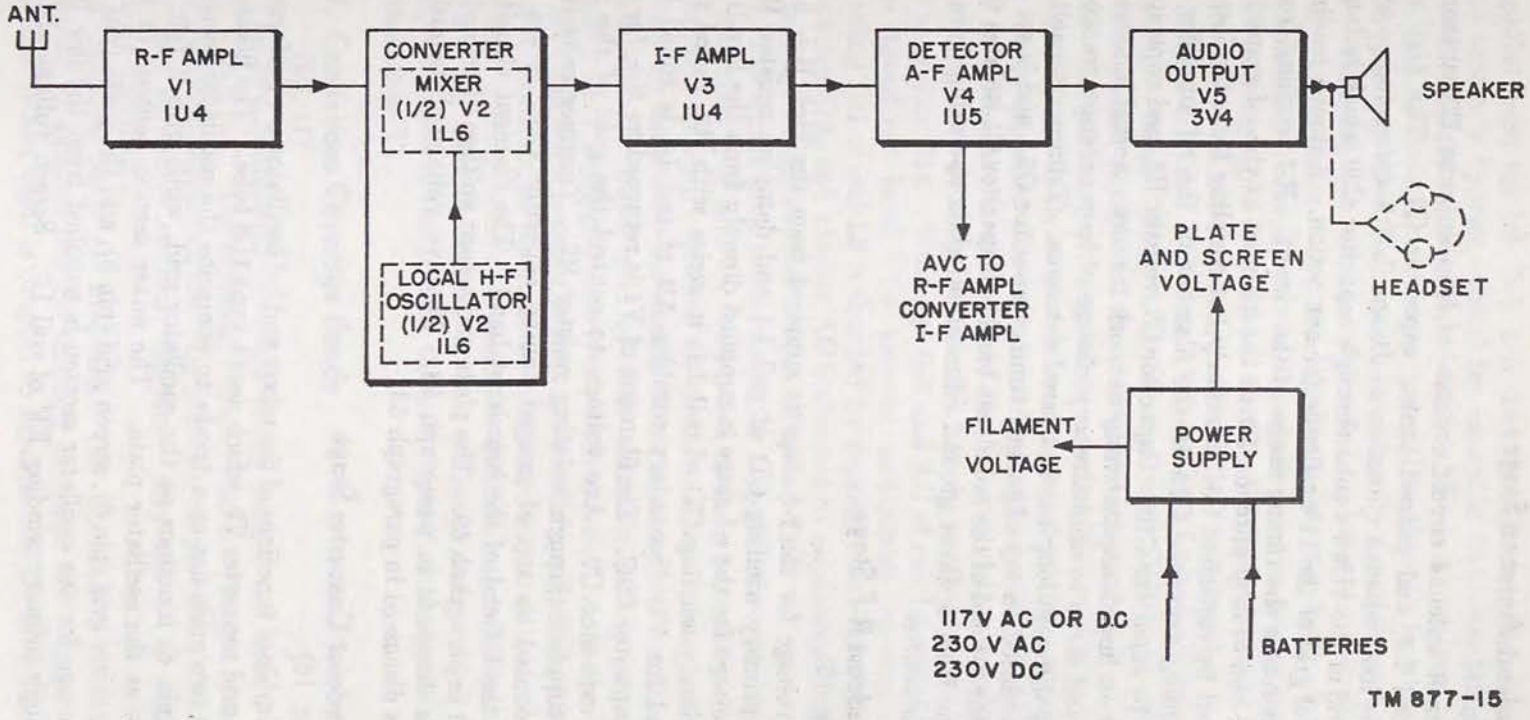



*Figure 15. Radio Receiver R-520/URR, block diagram.*

## 44. Broadcast Antenna Stage

(fig. 16)

The tuned antenna circuit consists of loop antenna E2, antenna loading coil L4, and ganged tuning capacitor C2A. The high r-f end of the loop antenna (junction of J1 and L4) is connected to the control grid of the 1U4 r-f tube through capacitor C30 which isolates the control grid of the 1U4 r-f tube for avc action. Antenna loading coil L4 increases the tuning range of the circuit. R-f coupling from the lower end of loop antenna E2 to the filament of the r-f amplifier is provided by capacitor C3. Similarly, r-f coupling from the lower end of tuning capacitor C2A to the filament of the r-f amplifier is provided by capacitor C10. Capacitor C3, resistor R1, and capacitor C10 form an impedance-matching network for any external long-wire antenna and serve to minimize any change of loop antenna tracking caused by different lengths of external antennas. Trimmer capacitor C2B is mounted on top of ganged tuning capacitor C2A and is set to track at the h-f end of the broadcast band. Capacitor C1 isolates the power line from a direct ground connection when operating from a power line source.

## 45. Broadcast R-F Stage

(fig. 16)

Plate voltage for the r-f stage is supplied from the high B+ bus through primary winding CD of coil L1 and damping resistor R3. Screen voltage for the r-f stage is supplied directly from the low B+ bus. Primary winding CD of coil L1, in series with R3, forms the plate load for V1. Secondary winding AB of coil L1 is tuned by ganged capacitor C2C. The filament of V1 is returned to B— for r-f through capacitor C9. Avc voltage to control the gain of the r-f stage is supplied through isolating resistor R2. Trimmer capacitor C2D, mounted on top of ganged tuning capacitor C2C, is set to track at the h-f end of the broadcast band. The filament circuit is discussed in paragraph 59. The plate and screen voltage distribution system is discussed in paragraph 58. The avc voltage distribution system is discussed in paragraph 53.

## 46. Broadcast Converter Stage

(fig. 16)

The combined functions of the mixer and h-f oscillator are performed by pentagrid converter V2, which uses a type 1L6 tube. The filament and first two grids act as a triode to comprise the oscillator section. Grid 1 (pin 4) functions as the oscillator grid, while grid 2 (pin 3) functions as the oscillator plate. The mixer section consists of the filament, mixer grid (pin 6), screen grid (pin 5), and the plate (pin 2). Plate voltage for the oscillator section is supplied from the low B+ bus through primary winding EF of coil L2. Screen voltage also is

supplied from the low B+ bus, but through dropping resistor R7. The screen is bypassed for rf by capacitor C11. Grid leak bias is provided by the combination of C12 and R6. Avc voltage to control the gain of the converter stage is supplied through isolating resistor R26 (par. 53). The filament is returned to B— for r-f through capacitor C9. Paragraph 59 contains a discussion of the filament circuit.

*a.* The oscillator is the tuned-grid, plate-tickler, feedback type and its operating frequency on the broadcast band is 455 kc higher than the incoming signal frequency. Section EF of coil L2 is the oscillator plate feedback winding and section DB is the tuned-grid winding. Windings GH and AC of coil L2 and coil L3 are not used on the broadcast band. Ganged tuning capacitor C2E is in series with 600-kc padder capacitor C13, and both capacitors shunt grid winding DB. Temperature compensating capacitor C15 and trimmer capacitor C2F are both in parallel with ganged tuning capacitor C2E. Trimmer capacitor C2F is mounted on top of capacitor C2E and is set to calibrate the oscillator at the h-f end of the broadcast band. Coupling from winding DB of coil L2 to the oscillator grid is provided by capacitor C14. Windings GH and AC of coil L2 are not used on the broadcast band. To prevent undesirable resonance effects, winding GH of coil L2 is shunted by capacitor C42 through a section of switch S1A, and winding AC is shunted by capacitors C38 and C14, in series, through another section of switch S1A.

*b.* The signal from the r-f amplifier is applied through capacitor C7 to the mixer grid (pin 6). A portion of the r-f amplifier output also is applied through capacitor C8 to the oscillator plate (pin 3) which effectively neutralizes the interelectrode capacity between the oscillator plate and the mixer grid so that oscillator *pulling* is minimized. *Pulling* in a pentagrid converter, such as the 1L6, is the tendency of the oscillator frequency to shift toward the applied signal frequency, and it produces an incorrect i-f frequency in the output of the converter. Mixing action between the oscillator and r-f signals occurs within the electron stream of the converter tube. The difference frequency (i-f) is taken from the plate (pin 2) and applied to the i-f transformer T1.

## 47. Continuous Coverage Bands

(fig. 17)

The two continuous coverage tuning ranges are from 2 to 4 mc and 4 to 8 mc. The antenna, r-f, and converter stages are tuned by ganged tuning capacitor C2. Both tuning ranges have similar antenna r-f, and converter circuits; therefore, only the 4- to 8-mc circuit will be discussed.

*a. Antenna Stage (4- to 8-mc).* The telescopic whip antenna is coupled to antenna coil L5 through capacitor C27, and an external antenna (when used) is coupled to antenna coil L5 through capacitor

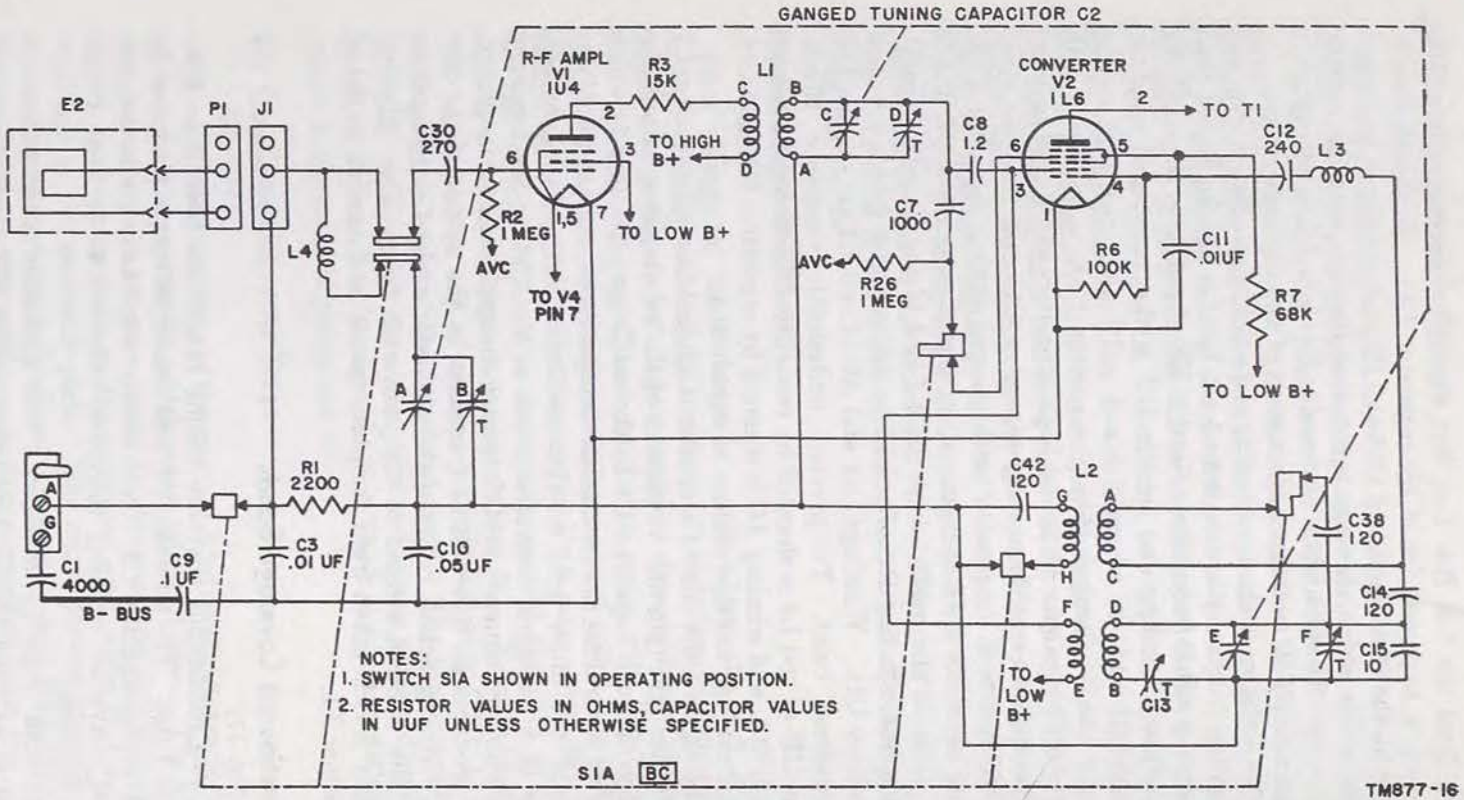



*Figure 16. Broadcast band antenna, r-f amplifier, and converter circuits.*

C28. The antenna circuit consists of coil L5 shunted by tuning capacitor C2A and trimmer C2B. Coupling to the control grid of the 1U4 r-f tube V1 is provided by capacitor C30. Coil L5 is set to track at the l-f (low-frequency) end of the tuning range. Trimmer capacitor C31A in series with parasitic suppressor R24 is set to track at the h-f end of the tuning range. Capacitor C1 isolates the chassis from direct ground connection when operating from a power line source.

*b. R-f Stage (4- to 8-mc).* Plate, screen, and avc voltages for the r-f amplifier are supplied as described in paragraph 45. The r-f stage is coupled inductively to the converter stage by r-f coil L1 and is coupled capacitively by capacitor C6. R-f coil L12 is effectively shunted across the secondary of broadcast coil L1 through a section of band selector switch S1B and capacitors C34 and C10. Tuning is provided by gang tuning capacitor C2C. Coil L12 is set to track at the l-f end of the tuning range and trimmer capacitor C35A is set to track at the h-f end of the tuning range. The filament circuit is discussed in paragraph 59.

*c. Converter Stage (4- to 8-mc).* When the 4–8 mc continuous coverage band is selected by section S1B of the band selector switch, oscillator coil winding L18A is shunted effectively across the primary of broadcast oscillator coil EF through series capacitors C37 and C39. At the same time oscillator coil winding L18B is shunted across the secondary of broadcast oscillator coil DB through fixed oscillator padder capacitor C39. Windings GH and AC of coil L2 are not used on the 4–8 mc band. To prevent undesirable resonance effects, winding GH of coil L2 is shunted by capacitor C42 through a section of switch S1B, and winding AC is shunted by capacitors C38 and C14, in series, through another section of switch S1B. Coil L3 is a high-impedance loading coil that improves the operation of the h-f oscillator on shortwave. Oscillator plate voltage is supplied through winding EF of coil L2. Screen voltage is supplied through dropping resistor R7. The screen is bypassed for r-f by capacitor C11. The filament circuit is discussed in paragraph 59. Tuning is provided by ganged tuning capacitor C2E. The core of coil L18A, L18B is set to calibrate at the l-f end of the 4–8 mc band. Trimmer capacitor C40A is set to calibrate at the h-f end of the band. The signal from the r-f amplifier is coupled to the mixer grid (pin 6) through capacitor C6 and also through coil L1 and capacitor C7. A portion of the r-f amplifier is applied through capacitor C8 to the oscillator plate (pin 3) which effectively neutralizes the interelectrode capacity between the oscillator plate and the mixer grid so that oscillator *pulling* is minimized. The oscillator frequency is 455 kc higher than the incoming signal frequency. The oscillator and r-f signals are mixed within the electron stream of the converter. The difference frequency (i-f) is taken from the plate (pin 2) and applied to the i-f transformer T1.

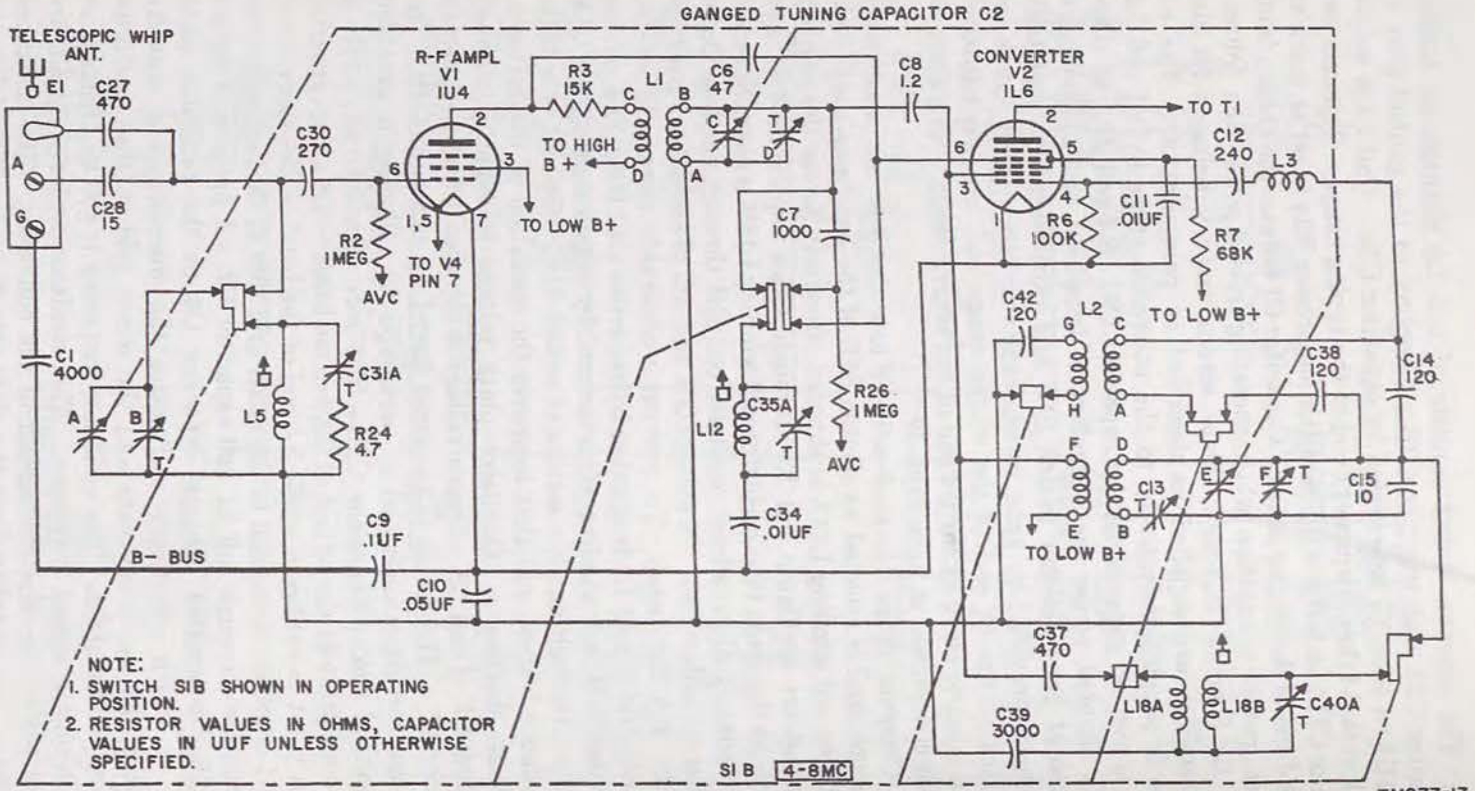



*Figure 17. Typical continuous coverage band (4 to 8 mc), antenna, r-f amplifier, and converter circuits.*

## 48. Spread Bands

(fig. 18)

The four spread bands tune as follows: 31 M (9.4 to 9.8 mc), 25 M (11.6 to 12 mc), 19 M (14.9 to 15.5 mc), and 16 M (17.5 to 18.1 mc). The antenna, r-f, and converter stages are similar in operation on each of the four spread bands and therefore only the 16 M circuit will be discussed.

*a. Antenna Stage (16 M).* The antenna circuit is made up of antenna coil L7 shunted by two series capacitors C32 and C33. Tuning capacitor C2A with its trimmer, C2B, is shunted across capacitor C32 to provide band spreading over a narrow frequency range. This circuit is coupled to the control grid of 1U4 r-f amplifier tube V1 through capacitor C30. Antenna coil L7 is set to track at the center of the tuning range. The telescopic whip antenna is connected through coupling capacitor C27 to the high side of antenna coil L7. When an external antenna is used, coupling to the high side of the antenna coil is provided by capacitor C28. Capacitor C1 isolates the chassis from direct ground connection when operating from a powerline source.

*b. R-F Stage (16 M).* Plate, screen, and avc voltages for the r-f amplifier are supplied as described in paragraph 45. The r-f circuit consists of r-f coil L14 in series with isolating capacitors C34 and C36. The coil is set to track at the center of the band. The circuit is not tuned by ganged capacitor C2C. The plate of the 1U4 r-f tube is coupled to the control grid of converter tube V2 through capacitor C6 and the high side of r-f coil L14 is tied to this same point through capacitor C36. L11 is an r-f choke coil which acts as a fixed grid on spread-band operation. It is shunted across r-f coil L14 through capacitors C34 and C36. Since it has a low d-c resistance and a high impedance to shortwave frequencies, it creates a high-loading effect to the shortwave frequencies, and its low d-c resistance prevents the control grid of the 1L6 converter tube from accumulating any grid charge. The filament circuit is discussed in paragraph 59.

*c. Converter Stage (16 M).*

(1) When the 16 M spread band is selected by section SID of the band selector switch, no avc voltage is applied to the converter stage, since the mixer grid (pin 6) is returned directly to the filament through coil L11. This allows the converter to operate at the point of maximum sensitivity and avoids the possibility of h-f oscillator shift which might result when avc voltage is applied to a converter stage. Oscillator plate voltage is supplied through winding EF of coil L2. Screen voltage is supplied through dropping resistor R7. The screen is bypassed for rf by capacitor C11. The filament circuit is discussed in paragraph 59.

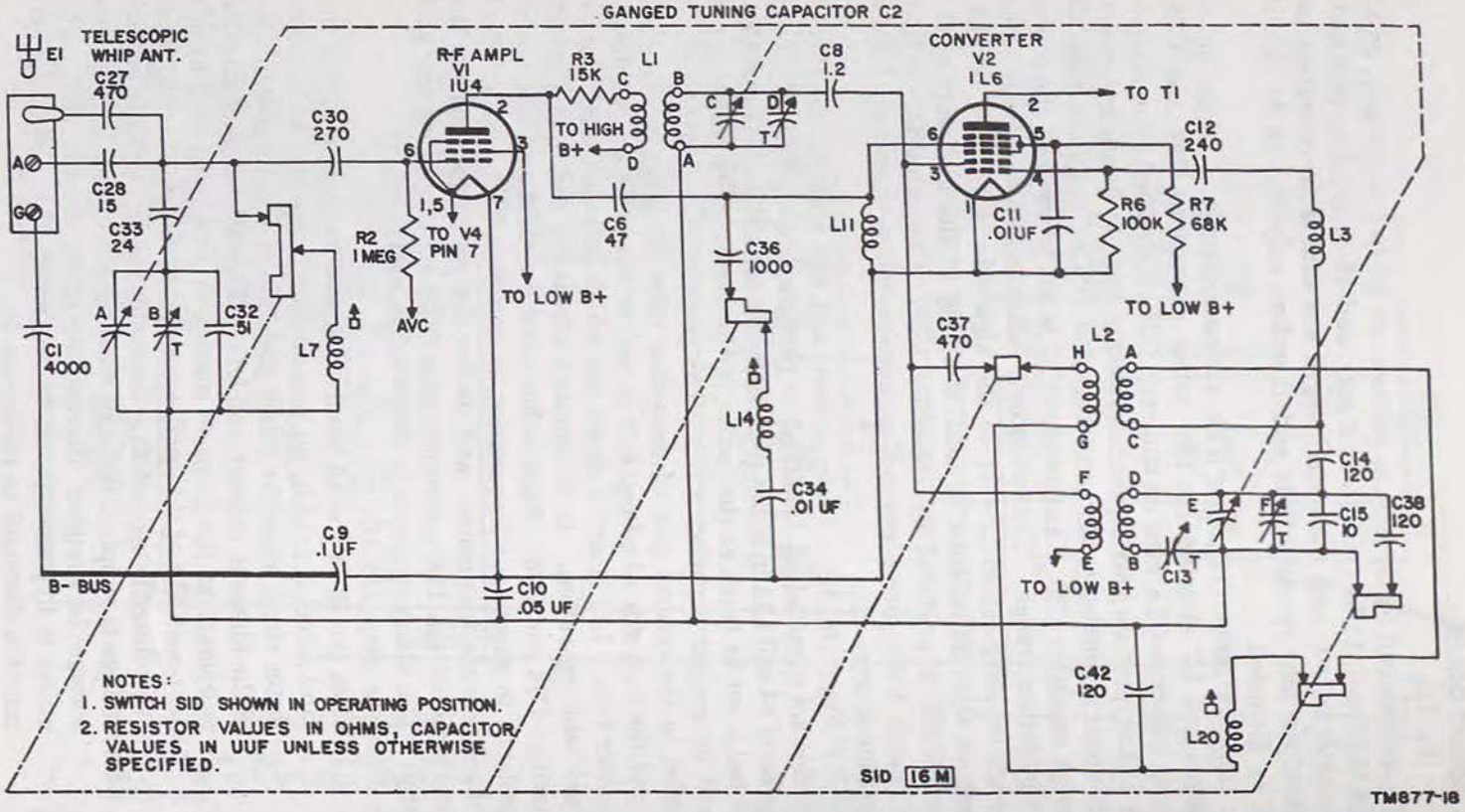



*Figure 18. Typical spread band (16 M) antenna, r-f amplifier, and converter circuits.*

(2) The basic oscillator circuit is a modified tuned-grid, plate-tickler, feedback type. Oscillator coil L20 is in series with shortwave secondary winding AC of coil L2. Both coils are shunted across broadcast coil secondary BD through fixed padder capacitors C14 and C42. Coupling to the oscillator grid is provided by capacitor C12. The series shunt combination of capacitors C14, C15, C38, C42, and gang tuning capacitor C2E with trimmer C2F results in band spreading over a narrow frequency range. Coil L3 is a high-impedance loading coil that improves the operation of the h-f oscillator on shortwave. The broadcast oscillator coil secondary BD is left in the circuit to simplify band switching and does not affect circuit operation. On shortwave frequencies, broadcast primary winding EF acts as a plate choke for the oscillator section. Oscillator coil L20 is set to track at 17.8 mc. The signal from the r-f amplifier is coupled to the mixer grid (pin 6) through capacitor C6. A portion of the r-f amplifier output is applied through capacitor C8 to the oscillator plate (pin 3) which effectively neutralizes the interelectrode capacity between the oscillator plate and the mixer grid so that oscillator *pulling* is minimized. On the spread bands, the oscillator frequency is 455 kc lower than the incoming signal frequency. The oscillator and r-f signals are mixed within the electron stream of the converter. The difference frequency (i-f) is taken from the plate (pin 2) and is applied to i-f transformer T1.

## 49. I-F Amplifier

(fig. 19)

The i-f amplifier consists of a single stage tuned to 455 kc. I-f amplifier V3 uses a 1U4 tube. I-f transformers T1 and T2 are iron-core tuned. Capacitors C16, C17, C19, and C20A are fixed capacitors across the primary and secondary windings of T1 and T2 and are used for resonating the input and output circuits to 455 kc. Capacitor C18 does not provide complete bypassing for the screen grid of the i-f amplifier. Instead, capacitor C18, in conjunction with isolation resistor R12, provides a feedback path to the screen grid to neutralize the effect of the capacity between the signal grid and the plate. With an optimum value for capacitor C18, the gain of the i-f amplifier can be increased considerably without danger of self-oscillation. The 455-kc i-f output from the plate of V3 is applied to the tuned circuit consisting of capacitor C19 and the primary of transformer T2. The i-f signal is coupled to the tuned circuit consisting of the secondary of transformer T2 and capacitor C20A, and then is applied to the diode section of V4 for detection and development of avc voltages.

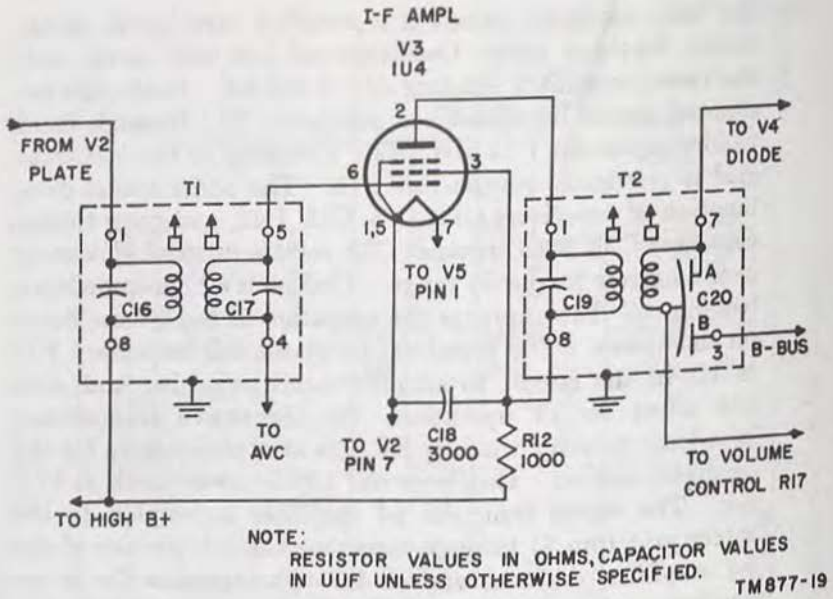



*Figure 19. I-f amplifier.*

## 50. Detector-Amplifier

(fig. 20)

Detector-amplifier stage V4 uses a 1U5 diode pentode. The 455-kc i-f signal from the secondary of i-f transformer T2 is applied between the diode plate and one side of the filament. The audio output appears across diode load resistors R16 and R32 and volume control R17. The audio signal is fed through coupling capacitor C21 to the control grid of the pentode amplifier section. Grid load resistor R18 is high enough in value to provide contact potential bias for class A operation. Screen voltage is supplied from the low B+ source through decoupling network R21 and C22. The amplified audio developed across plate load resistor R22 is fed through coupling capacitor C24 to the grid of the audio-output stage. Capacitor C23 bypasses the plate of the amplifier for radio frequencies. Plate voltage for the pentode amplifier section is supplied through voltage-dropping resistor R4. Additional filtering is provided by capacitor C25. The action of the avc circuit is discussed in paragraph 53.

## 51. Audio Output

(fig. 20)

The audio signal from the detector-amplifier is applied to the grid of the 3V4 (V5) audio-output stage across grid resistor R20. Screen voltage is supplied directly from the high B+ bus. Plate voltage also is provided from the high B+ bus through the primary winding of output transformer T3. Capacitor C45C bypasses the plate and

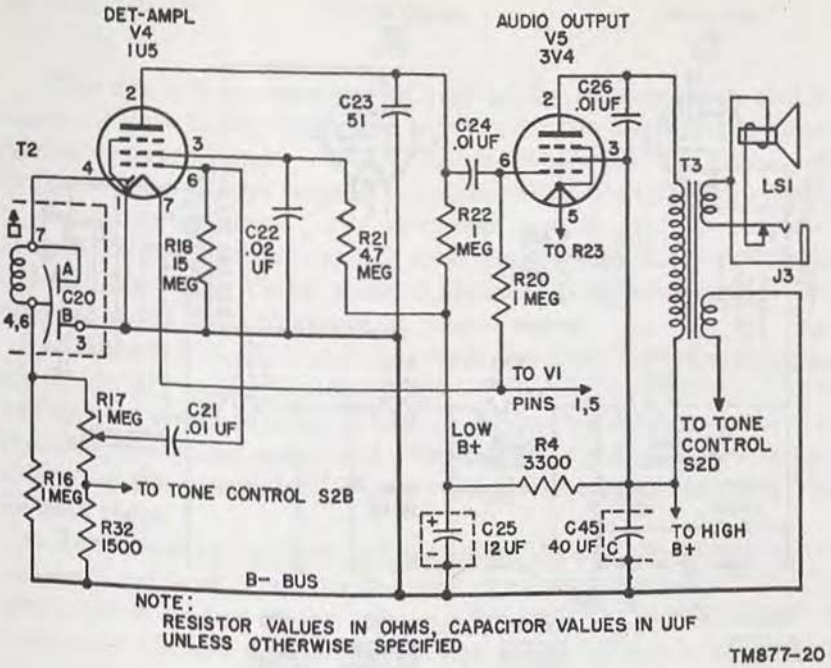



*Figure 20. Detector-amplifier and audio output stages.*

screen voltage source for audio frequencies. The correct grid bias is obtained by returning R20 to a point on the series filament circuit (par. 54). Capacitor C26 bypasses undesirable noise frequencies and prevents oscillations in transformer T3. The secondary of transformer T3 is coupled to loudspeaker LS1 through the normally closed contacts of jack J3. For headset operation, the loudspeaker is disconnected automatically when the headset plug is inserted in jack J3.

## 52. Tone Control Circuit

(fig. 21)

*a.* The operation of the tone control circuit depends on an inverse feedback voltage that is fed back to the volume control through a resistor-capacitor network from the tertiary winding on output transformer T3. The tone control resistor-capacitor network consists of resistors R16, R17, R32, R33, R34, R35, and capacitors C47, C48, and C49. The function of the four-tone control switches is to vary the resistor-capacitor network frequency characteristic which results in a change of a-f response. For example, when BASS tone control switch S2B is open, only the higher audio frequencies are fed back. The high audio frequencies are effectively suppressed in the output circuit, because they are fed back out of phase; this results in a bass boost effect. Since capacitor C48 has a higher reactance to the low audio

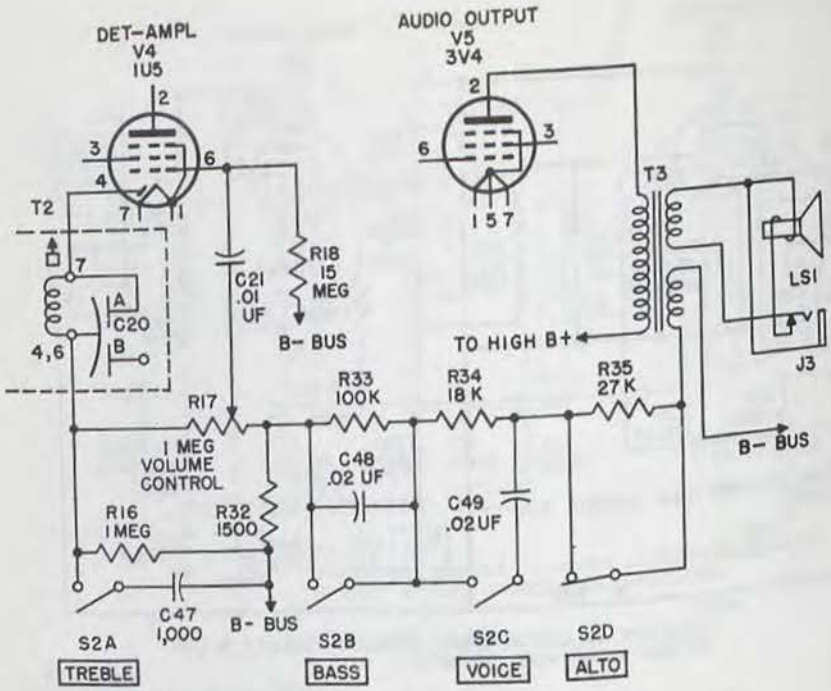



*Figure 21. Tone control circuit.*

frequencies, the low frequencies are boosted effectively when BASS switch S2B is open. When switch S2B is closed, capacitor C48 is shorted out and eliminates the bass boost; this results in increased treble response.

*b*. Resistor R33 is a limiting resistor and is used to prevent regeneration at the very low audio frequencies. Resistor R35 limits the amplitude of the audio frequencies fed back to the volume control circuit. When the ALTO switch, S2D, is open, R35 is placed in series with the feedback voltage and the output level of the low boost is reduced effectively. Capacitor C47 bypasses the higher audio frequencies around R16 when TREBLE switch S2A is closed. Capacitor C49 passes the higher frequencies more readily and produces a bass boost when switch S2C is closed because of the inverse feedback voltage. When switch S2C is closed, capacitor C49 is shunted across resistor R34; this causes a greater inverse feedback voltage of the high and middle frequencies. The gain at these high and middle audio frequencies is reduced by this inverse feedback. Since the gain at the lower audio frequencies is not affected, the low audio frequencies have been boosted in relation to the middle and higher audio frequencies.

## 53. Avc System

(fig. 22)

*a.* The avc system controls the gain of the r-f, converter, and i-f stages. Figure 22 shows the avc network for the broadcast and continuous coverage bands. On spread-band operation, the avc circuit for the r-f and i-f stages remains the same but no avc voltage is applied to the converter stage. The converter control grid is connected through the band selector switch from grid resistor R26 to r-f choke coil L11 (fig. 18). Under these conditions, 1L6 converter tube V2 operates at the point of maximum sensitivity.

*b.* Resistors R16, R17, and R32 form the diode load circuit across which the avc voltage is developed. Three different levels of avc voltages are obtained from a voltage-divider network connected between the diode load circuit and different points of the filament circuit to develop the correct level of avc voltage and correct operating bias for each stage.

*c.* To prevent r-f overload and distortion, the greatest portion of avc voltage is fed back to the control grid of r-f amplifier tube V1. The next greatest portion of avc voltage is fed back to the control grid of mixer tube V2, and the smallest portion of avc voltage is fed back to the i-f amplifier control grid of V3.

*d.* The maximum amount of avc voltage developed across the diode load is fed back to the control grid of V1 from the junction of R19 and R15 through isolation resistor R2. Resistors R14 and R10 are shunted by resistor R9 through part of the filament circuit. This branch is in series with resistor R13 to the diode load. This shunt divider network feeds avc voltage to the control grid of V2 through isolation resistor R26. From the junction of R14 and R10 the smallest portion of avc voltage is fed back to the control grid of V3. Filtering for the avc system is provided by capacitors C4, C43, and C44.

## 54. Bias System

(fig. 22)

*a.* The avc and bias voltages for the receiver are tied together in a combination bridge network to supply the proper bias voltage to each tube. The common B— bus of the receiver is used as the point of zero voltage. Bias voltage for the various tubes is provided by returning the control grid to the appropriate point in the complex voltage divider formed by the series tube filaments and the avc resistor network. Filament and bias voltage are derived from the 8.4-volt d-c filament supply (par. 59).

*b.* Avc voltage is developed across diode load resistors R16, R17, and R32, when an i-f signal is fed into the T2 secondary winding. The resistance network proportions the avc voltage to each control grid. Avc action reduces the gain of the r-f converter and i-f stage and

prevents overload and distortion on strong input signals. Normally, a potential of —.25 volt is developed across diode load resistor R16. The control grid to B— voltage of each tube is determined by the resistance networks between the diode plate and the various control grids.

*c.* Because the filament voltage on direct heater-type tubes varies along the physical length of the filament, the center of the filament is used as a reference point when measuring the grid bias, EG. The filament-center to B— voltage is determined by the electrical position the tube occupies in the series filament circuit.

*d.* The difference between the control grid and filament center voltage is the operating grid bias, EG, of each tube.

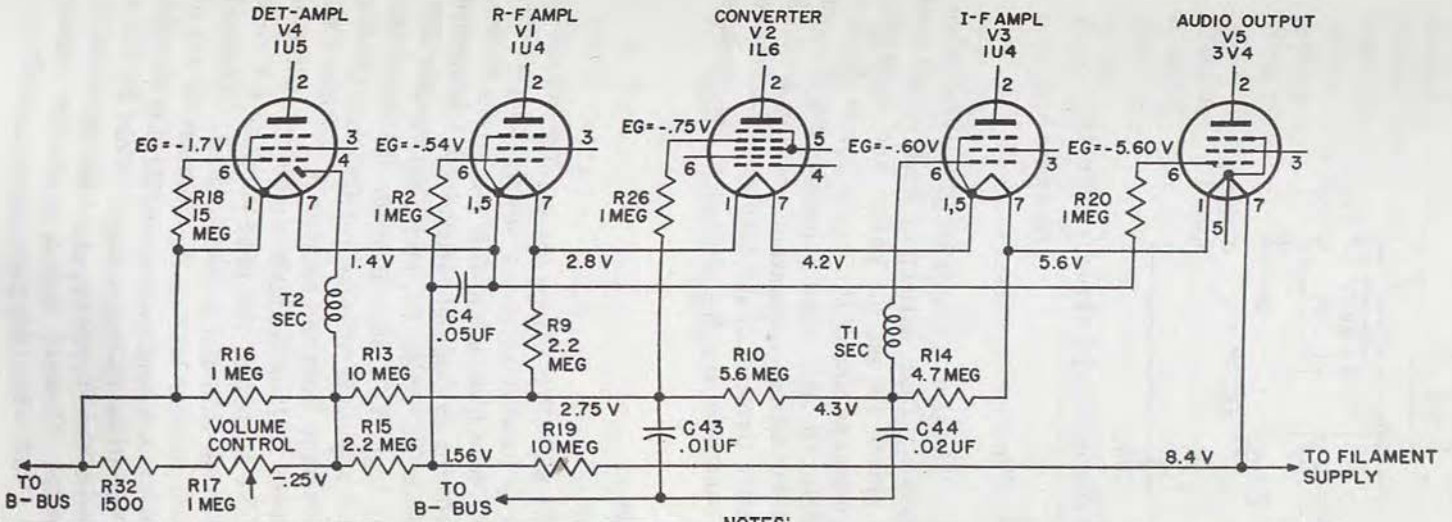
*e.* On spread-band operation, no avc is applied to the control grid of V2 (par. 48). The grid return which normally goes to R26 is switched to r-f choke coil L11 and returns to the negative end of its own filament (fig. 18).

*f.* The grid bias on the 3V4 power-amplifier tube is obtained by connecting the grid d-c return through resistor R20 to the junction of the 1U4 r-f and 1U5 detector-amplifier filaments. This junction is 1.4 volts positive with respect to B—. The 3V4 power-amplifier filament center is approximately 7.0 volts dc positive with respect to B—. This results in an operating bias EG of —5.6 volts on the grid of the 3V4 power-amplifier tube which is normal for class A audio operation for this type of pentode. The operating bias EG of 1.7 volts on the control grid of the 1U5 detector-amplifier tube is the sum of the internal contact bias created by normal filament emission plus the voltage existing between the center of the 1U5 filament and B—. The contact bias across resistor R18 is approximately —1 volt and the filament center-to-B— voltage is 0.7 volt. The resultant operating grid bias, EG, is therefore —1.7 volts. Figure 22 shows the manner in which the remainder of the tubes receive their operating bias, EG.

## 55. Power Control Circuit

(fig. 24).

Power for Radio Set R–520/URR is applied through switches S3A–S3B, S4, fuse F1, thermal resistor RT1, and power supply adapter Z1 (which is plugged permanently into J2 on the receiver chassis). Adapter Z1 is shown schematically in figure 23. Switch S4, located on the chassis and to the rear of the speaker, changes both the B+ and filament circuits from external power to battery power when the power plug is inserted in the socket of switch S4. Switch S3A–S3B, which is mounted on the volume control, controls the application of power to the radio set. It completes both the filament and B+ circuits to the receiver. The receiver requires an 8.4- to 9-volt d-c source for the series filament string and a 90- to 105-volt




| | | | VOLTAGES | | |
|---|---|---|---|---|---|
| | | | FILAMENT CENTER | GRID RETURN | EG |
| DET-AMPL | V4 | 1U5 | .7 V | −1.0V | −1.7 V |
| R-F AMPL | V1 | 1U4 | 2.1 V | 1.56V | − .54V |
| CONVERTER | V2 | 1L6 | 3.5 V | 2.75V | − .75V |
| I-F AMPL | V3 | 1U4 | 4.9V | 4.30V | − .60V |
| AUDIO OUTPUT | V5 | 3V4 | 7.0 V | 1.40V | −5.60V |

NOTES:

1. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL VOLTAGES ARE CALCULATED VALUES UNDER NO-SIGNAL CONDITION.
3. FILAMENT CENTER VOLTAGES AND GRID RETURN VOLTAGES ARE REFERRED TO B− BUS.
4. OPERATING GRID BIAS 'EG' IS THE DIFFERENCE BETWEEN THE FILAMENT CENTER VOLTAGE AND THE GRID RETURN VOLTAGE FOR EACH TUBE.
5. IN BAND SPREAD OPERATION [16M] [19M] [25M] [31M] NO AVC VOLTAGE IS APPLIED TO V2.

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*Figure 22. Radio Receiver R-520/URR, avc and bias system.*

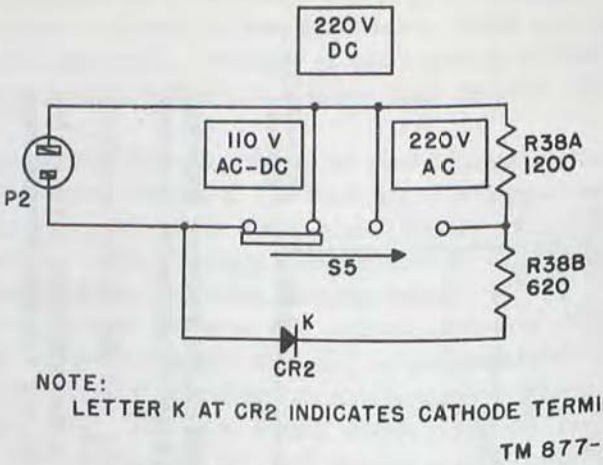



*Figure 23. Power supply adapter Z1.*

d-c source for the B+ line. The power circuit supplies these potentials whether the set is operating from battery or from an external power line source. With switch S4 set for power line operation, section A of switch S3 connects one side of the power line to the B− bus, while section B completes the B+ circuit through fuse F1 and R36. With switch S4 set for battery operation, section A of S3 connects the grounded negative terminal of the battery system to the B− bus, while section B completes the B+ circuit to the positive terminal of the B battery.

## 56. External Power Source

(figs. 24 and 25)

*a.* Selenium rectifiers CR1 and CR2 change the a-c line voltage to dc. Rectifier CR2, which is located in power supply adapter Z1, functions only when operation is from a 230-volt a-c or d-c source. The d-c output voltage from the cathode of rectifier CR1 is applied through surge limiting resistor R27, fuse F1, and filter resistor R36 to capacitor C45C and the high B+ bus. Resistor R4 drops this voltage to a lower value and applies it to capacitor C25 and the low B+ bus. The d-c output voltage from the cathode of rectifier CR1 is also applied through resistor R27 to the filter circuit consisting of C45A, RT1, and C45B. The output of the filter supplies 8.4 volts dc to the filament string through R30 and a section of S4. Thermal resistor RT1 is in series with resistor R30 to the filament circuit of the receiver and tends to maintain a constant current flowing through the tube filaments despite variations in line voltage. Fuse F1 has a 3/16-ampere rating and protects the power supply from overload in the B+ and filament circuits. Resistor R28 is a bleeder resistor which discharges capacitor C45A when the power is turned off.

*b.* Power supply adapter Z1, when plugged into receptacle connector J2 at the rear of the chassis, is in series with the power line. It consists of a three-position switch, S5; a selenium rectifier, CR2; and resistor R38A–R38B (fig. 23). The complete assembly is housed in a perforated metal can. Receptacle J2 is a closed circuit-type connector. Therefore, if power supply adapter Z1 is removed, the receiver may be operated from a 110-volt a-c or d-c power source. When switch S5 is in the 110 V. AC-DC position, plug connector P2 is shorted out and the power line is connected directly to the receiver. When switch S5 is in the 220 V. DC position, resistor R38, sections A and B, and selenium rectifier CR2 are placed in series with the power line to lower the voltage to 110 volts dc. When switch S5 is in the 220 V. AC position, resistor R38A is shorted out, leaving R38B and selenium rectifier CR2 in series with the line. Since filter capacitor C45A draws an appreciable amount of ripple current, the total current drawn through the line is greater on 230-volt a-c operation than on 230-volt d-c operation. Shorting-out resistor R38A compensates for the additional voltage drop that would occur through the power supply adapter and maintains the correct line voltage to the set.

*Note.* The receiver will not operate on dc if the polarity of the power line cord plug is reversed; however, electrolytic capacitor C45A, B, and C will not be harmed by reversed currents because selenium rectifiers CR1 and CR2 have a high back resistance.

## 57. Battery Power Source

(fig. 24)

*a.* For battery operation, a B supply voltage of 90 volts and an A supply voltage of 9 volts are required for operation of the receiver. The battery supply voltages are fed to the receiver through both sections of switch S3, and through switch S4. The negative side of the B battery is connected to the positive side of the A battery. This connection boosts the effective B+ voltage by the amount of the A supply voltage (9 volts). When the power line plug is inserted into socket switch S4 for battery operation, all the switch contacts of S4 may not make or break simultaneously. If the B+ and A+ contacts close before the A− contact, the B battery will charge electrolytic capacitor C45C through the tube filaments and the closed contacts of S3A–S3B. When this occurs, resistor R37 will limit the initial surge of charging current and thus prevent filament burnouts.

*b.* Resistor R29, which is connected from the B− bus of the receiver to chassis, forms a high-impedance path to the external power line. When the receiver is operating on batteries, the B− bus is shorted to the chassis through switches S3A and S4. Capacitor C46 minimizes signal and noise pickup from the power line when the receiver is operating from an external power line.

## 58. Plate and Screen Voltage Distribution

(fig. 24)

Plate and screen voltage for the receiver is supplied either from the batteries or from the power line through the rectifier-filter circuits, and is present at switch S3B (par. 55). When operating from batteries, 90 volts is applied to the high B+ bus through S3B. When operating from the power line, 105 volts is applied to the high B+ bus through S3B. The low B+ A bus (approximately 80 volts) is supplied through dropping resistor R4 and is filtered by capacitor C25.

*a.* The high B+ bus feeds voltage to the plate and screen grid of V3 (the 1U4 i-f amplifier) through dropping resistor R12. It also feeds voltage to the plate of V2 through the primary winding of i-f transformer T1, to the plate of V1 through resistor R3 and the primary of r-f coil L1, to the plate of V3 through resistor R12 and the primary of transformer T2, to the plate of V5 through the primary of transformer T3 and to the screen of V5.

*b.* The low B+ bus feeds voltage to the oscillator anode grid of 1L6 converter tube V2 through winding EF of oscillator coil L2. It also feeds voltage to the screen grid of V2 through dropping resistor R7. The screen grid of r-f tube V1 receives voltage from the low B+ bus directly, and the screen grid of detector-amplifier tube V4 receives voltage through dropping resistor R21. Voltage from the low B+ bus also is supplied to the plate of V4 through plate load resistor R22. Capacitor C25 is a filter for the low B+ bus and eliminates any hum voltage that may be present at that point.

## 59. Filament Circuit

(fig. 25)

*a.* Radio Receiver R–520/URR uses four 1.4-volt and one 2.8-volt, 50-ma (milliampere) filament-type tubes. The tube filaments are connected across the voltage source in a series arrangement. On power line circuit operation, the 105-volt d-c rectifier output is dropped down to 8.4 volts dc through thermal resistor RT1 and resistors R27 and R30. On battery operation, 9 volts from the A battery are applied across the filament circuit. During normal operation, the plate and screen grid currents of a d-c filament-type tube pass through the filament and add to the current flowing through the filament. This current accumulates toward the negative end of the filament. To prevent this extra current from burning out the filaments, shunting resistors R8, R5, R11, and R23 are incorporated in the circuit. Resistor R23 is placed across half of the filament of the 3V4 audio-output tube because most of the plate and screen grid current accumulates near the negative end (pin 1). Resistors R5 and R11 are shunted across the filaments of V2 and V3, respectively, to shunt the relatively heavy plate current for the 3V4 output tube around the

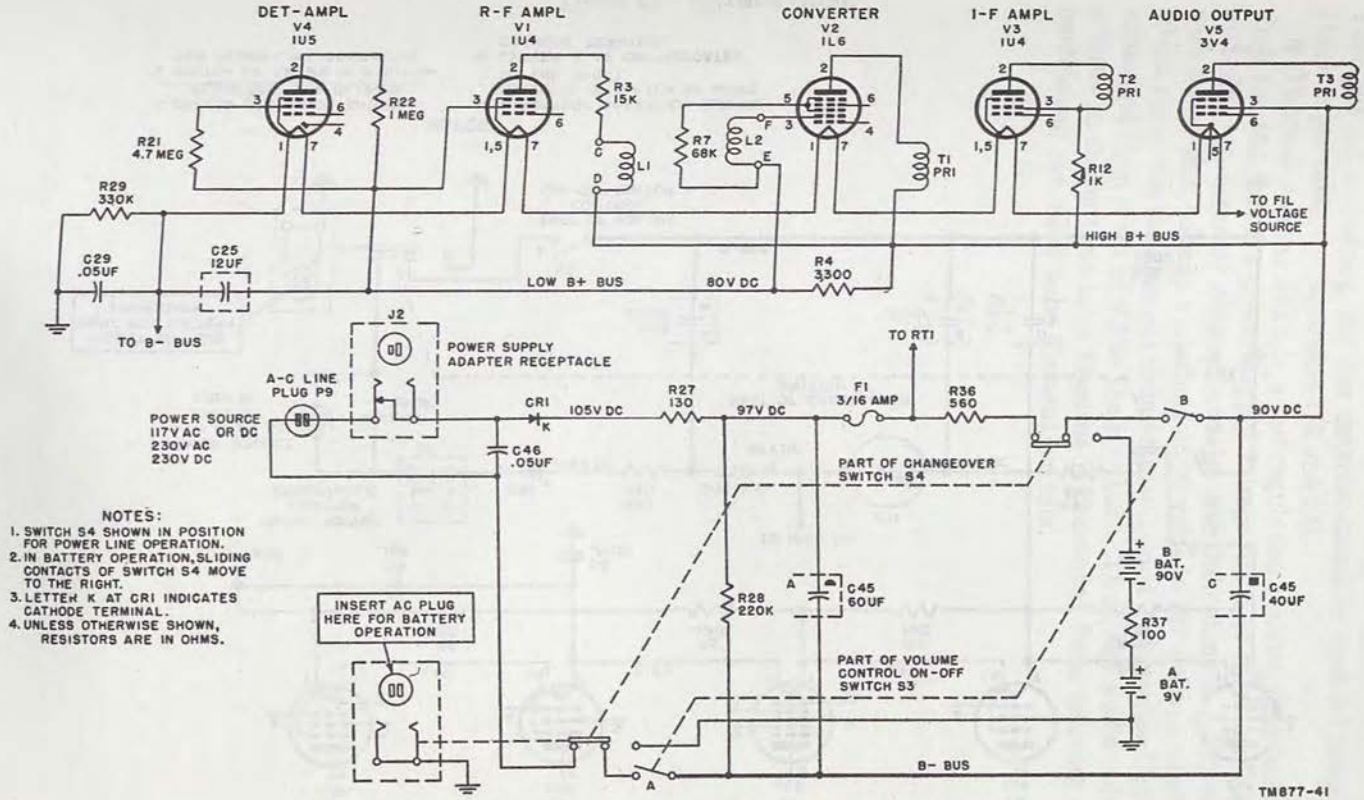
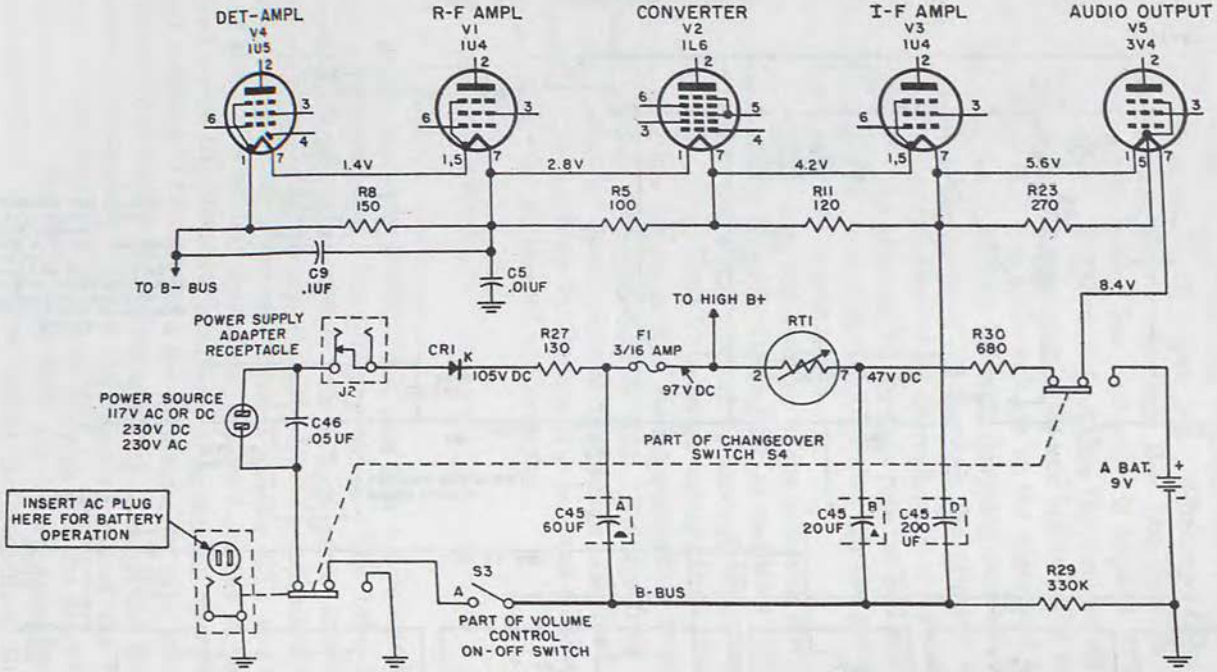



*Figure 24. Power supply circuit.*




NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.
2. SWITCH S4 SHOWN IN POSITION FOR POWER LINE OPERATION.
3. IN BATTERY OPERATION, SLIDING CONTACTS OF SWITCH S4 MOVE TO THE RIGHT.
4. LETTER K AT CR1 INDICATES CATHODE TERMINAL.

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*Figure 25. Filament circuit.*

filaments of V2 and V3. One resistor, R8, is used across the filaments of V4 and V1 because their plate and screen grid currents are small. Filament r-f bypassing for the detector-amplifier and r-f amplifier stages is provided by capacitors C5 and C9.

*b*. Thermal resistor RT1 is a self-regulating resistor that helps to drop the 105-volt d-c power supply voltage down to the required 8.4 volts dc. Its internal resistance varies from 600 ohms to 1,300 ohms with power-line voltage variations of 90 volts to 127 volts; a constant 50-ma current in the filament circuit is maintained. Capacitor C45D is connected from pin 1 of V5 to the B— bus. Thus, any audio voltage present in the output tube filament is prevented from entering and modulating the other tube filament circuits.

# CHAPTER 5

# FIELD MAINTENANCE INSTRUCTIONS

*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.

## Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

***Warning:*** The voltages present in the power supply are high enough to produce shock, and under certain conditions may be dangerous to life. When working on the equipment with voltages present, it is a good practice to place the equipment on an insulated surface first, particularly if the skin is wet or damp from perspiration or water. Do not let the receiver touch other sets or equipment.

### 60. Troubleshooting Procedures

*a. General.* The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the *major component or circuit* responsible for the abnormal operation of the set. 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, r-f arcing, and shorted transformers often can be located by sight, smell, and hearing. The majority of faults, however, must be localized by *checking voltages and resistances.*

***Warning:*** The failure of selenium rectifiers can result in the liberation of poisonous fumes and the deposit of poisonous selenium compounds. If a rectifier burns out or arcs over, the odor is strong. Provide adequate ventilation immediately. *Avoid inhaling the fumes and do not handle the damaged rectifier until it has cooled.*

*b. Component Sectionalization and Localization.* The tests listed below aid in isolating the source of trouble. To be effective, the procedure should be followed in the order given. Remember that servicing procedures should cause no further damage to the receiver. First, trouble should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection is to locate any visible trouble. Through this inspection alone, the repairman frequently may discover the trouble or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the receiver

that might occur through improper servicing methods (par. 39).

(2) *Input resistance measurements.* These measurements (par. 66) prevent further damage to the receiver if a short circuit exists. 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. 67) 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) *Troubleshooting chart.* The trouble symptoms listed in these charts (par. 68) will aid greatly in localizing trouble.

(5) *Signal substitution.* The principal advantage of signal substitution (pars. 70 through 73) is that it usually enables the repairman to localize a trouble accurately and quickly to a given stage when the general location of the trouble is not immediately evident from the tests above.

(6) *Stage gain and sensitivity chart.* This chart (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 may be made to appear by tapping or jarring the set. It is possible that the trouble is not in the radio itself but in the installation, or it may be caused by external conditions. In this event, test the installation, if possible.

## 61. Troubleshooting Data

Take advantage of the material in this manual. It will help in the rapid location of faults. Consult the following troubleshooting data:

| Fig. No. | Description |
|---|---|
| 22 | Radio Receiver R–520/URR, avc and bias system. |
| 24 | Power supply circuit. |
| 25 | Filament circuit. |
| 26 | Radio Receiver R–520/URR, chassis removal. |
| 27 | Voltage and resistance diagram. |
| 28 | Top view of chassis. |
| 29 | Bottom view of chassis. |
| 32 | Dial cord drive system. |

## 62. Test Equipment Required for Troubleshooting

The test equipment required for troubleshooting is listed below. The technical manuals associated with the test equipment also are listed.

| Test equipment | Publication |
|---|---|
| R-F Signal Generator Set AN/URM–25 | TM 11–5551 |
| Output Meter TS–585/U | TM 11–5017 |
| Frequency Meter Set SCR–211–(*) | TM 11–300 |
| Electronic Multimeter TS–505/U, or an equivalent | TM 11–5511 |
| Tube Tester I–177, I–177–A, or an equivalent | TM 11–2627 |
| Audio Oscillator TS–382A/U | TM 11–2684A |
| Multimeter TS–297/U | TM 11–5500 |
| .05-μf capacitor, 400 vdcw. | |
| .01-μf capacitor, 400 vdcw. | |
| Low-impedance headset (such as Headset HS–30–(*)). | |

## 63. General Precautions

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

*a.* If available, use an isolation transformer between the power line and the receiver.

*b.* Be careful when the bottom of the chassis is exposed; dangerous voltages are present.

*c.* Disconnect the external power line cord from the outlet before making repairs.

*d.* When working on the top of the chassis, be careful not to bend the ganged tuning capacitor plates; this could cause a short or misalinement.

*e.* Do not overtighten screws inserted through or threaded into plastic materials. This might strip the threads or produce cracks.

*f.* When changing a component held by screws or nuts, always replace the lockwashers.

*g.* 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.

(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; they may cause short circuits.

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

(5) When a part is replaced in the r-f or i-f circuits, it must be placed exactly as the original was placed. A part that 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 possible oscillation in the circuit.

## 64. Chassis Removal

(fig. 26)

To remove the chassis from the case, follow the procedure outlined below.

*a.* Rotate the tuning control knob counterclockwise until the dial pointer is at the low-frequency end of the tuning range.

*b.* Remove the volume control and the tuning control knobs by pulling them off the shafts.

*c.* Disconnect the battery cables and remove the batteries from the receiver.

*d.* Remove the four line cord adapters and the bracket assembly (fig. 4).

*e.* Loosen the two captive screws that hold protective cover A3 (fig. 4) to the chassis, and remove the cover.

*f.* Remove the wood screw that secures the band selector bracket to the wooden cabinet.

*g.* Remove the three chassis mounting screws and washers.

*h.* Disconnect the loop antenna cable from the socket at the rear of the chassis.

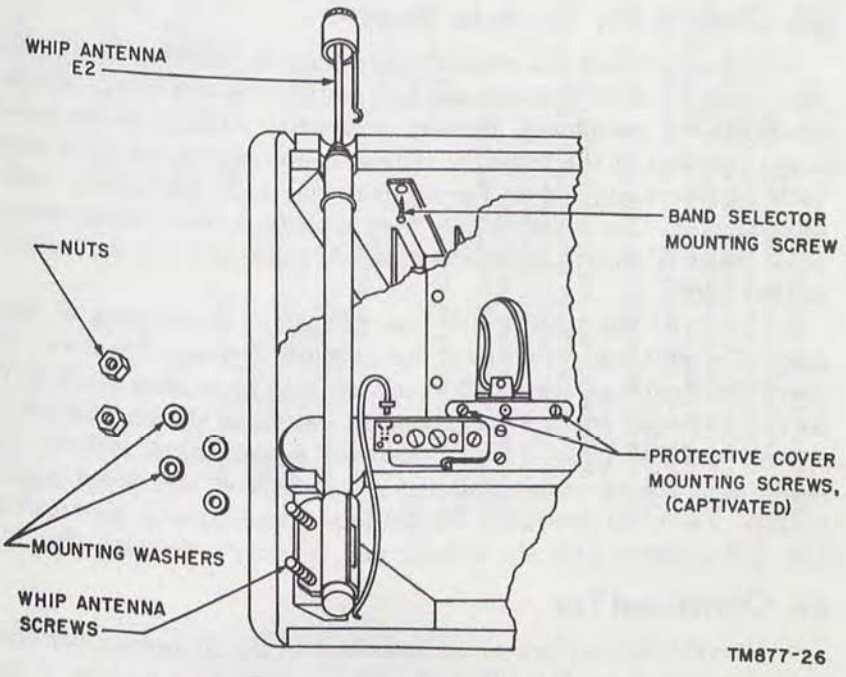



*Figure 26. Radio Receiver R–520/URR, chassis removal.*

*i*. Remove the whip antenna by taking off the two nuts and washers that secure it to the cabinet.

*j*. Remove the chassis.

## 65. Preliminary Inspection

When a radio set is brought in from the field for check or repair, remove the receiver from the case (par. 64) and inspect as follows:

*a*. Examine for burned insulation and resistors. Examine for wax leakage and any discoloration of apparatus and wire.

*b*. Inspect for broken connections to tube sockets, plugs, and other apparatus, as well as for defective solder connections. Examine for bare wires that touch the chassis or other wires.

*c*. Be sure that the markings on the tubes in the various sockets correspond to the correct tube types for these positions as given in the instruction book. Replace or interchange any tubes that have the wrong numbers. Replace broken tubes. Inspect for loose tube socket contacts.

*d*. Inspect the fuse. Check carefully for short circuits whenever a blown fuse is found.

*e*. Inspect the dial mechanism. Be sure that the dial turns smoothly.

*f*. Check all switches and controls for ease of operation.

*g*. Inspect all power plugs and cables. Repair or replace any plugs or cables that are broken.

*h*. Inspect for loose or missing screws.

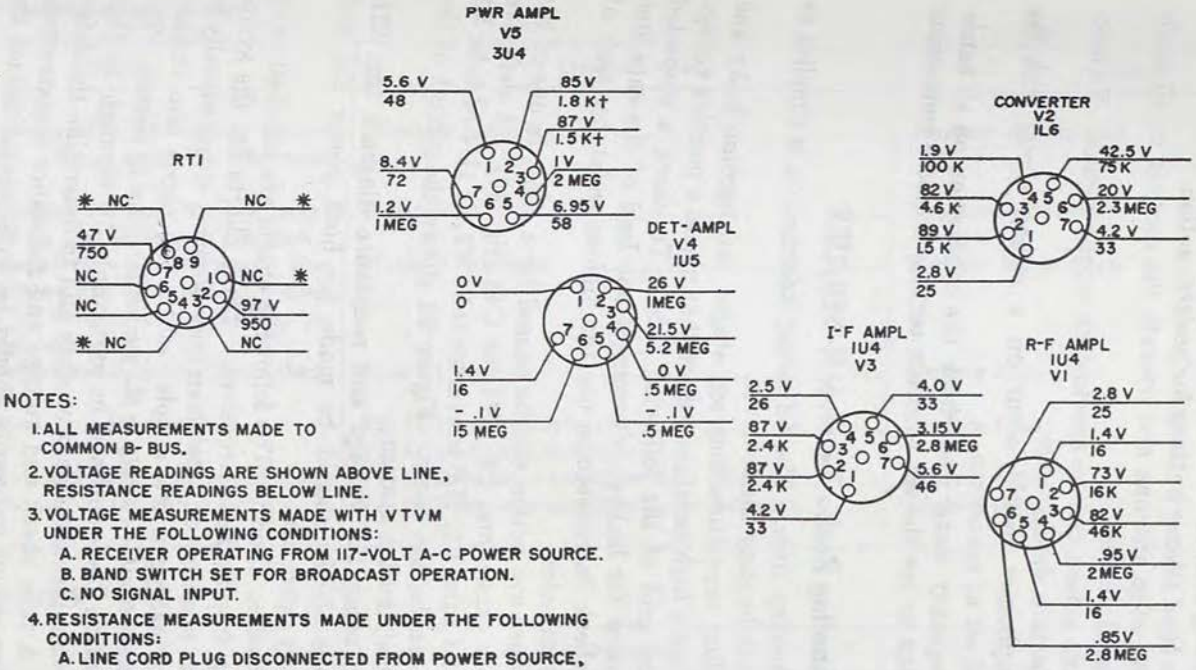
## 66. Checking Key Circuits for Shorts

*a*. Trouble within the receiver often may be detected by checking the resistance of the filament and high-voltage circuits before applying power to the equipment, thereby preventing damage to the power supply portion of the receiver. These measurements are to be made with no power applied to the receiver and with the battery cables disconnected. The readings may vary slightly in some instances from those listed. However, a reading noticeably different indicates trouble at that point.

*b*. A partial short on a B+ line will cause overheating of some associated part and eventually the part will become defective. To check for trouble of this kind, check the resistance from pin 3 of V5 to B— with the on-off volume control switch in the on position; it should be 1,500 ohms. This resistance measurement includes the filament circuit resistance shunted across part of the power supply output. Figure 24 shows the B+ voltage distribution in the receiver. Use this diagram with the voltage and resistance diagram (fig. 27).

## 67. Operational Test

*a*. Operate the equipment as described in the equipment performance checklist (par. 41). This checklist is important because it fre-

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NOTES:

1. ALL MEASUREMENTS MADE TO COMMON B- BUS.
2. VOLTAGE READINGS ARE SHOWN ABOVE LINE, RESISTANCE READINGS BELOW LINE.
3. VOLTAGE MEASUREMENTS MADE WITH VTVM UNDER THE FOLLOWING CONDITIONS:
   - A. RECEIVER OPERATING FROM 117-VOLT A-C POWER SOURCE.
   - B. BAND SWITCH SET FOR BROADCAST OPERATION.
   - C. NO SIGNAL INPUT.
4. RESISTANCE MEASUREMENTS MADE UNDER THE FOLLOWING CONDITIONS:
   - A. LINE CORD PLUG DISCONNECTED FROM POWER SOURCE, AND NOT INSERTED IN CHANGEOVER SWITCH S4.
   - B. ON-OFF VOLUME CONTROL SWITCH IN OFF POSITION.
   - C. † INDICATES MEASUREMENT MADE WITH ON-OFF VOLUME CONTROL SWITCH IN ON POSITION.
5. ✱ INDICATES CONNECTION SOMETIMES MADE INTERNALLY.
6. NC INDICATES NO CONNECTION.

*Figure 27. Voltage and resistance diagram.*

quently indicates the general location of trouble. Listen for background noise in the receiver or for received signals.

*b.* Check the *on-off* switch and *volume* control for positive action and smooth control of volume.

*c.* Try the *tuning* control for smoothness without slippage.

*d.* Check the *band selector* buttons for positive action.

*e.* Extend the whip antenna and operate the receiver on all bands to check for signal pickup.

*f.* Correct avc action can be checked on strong signals. No overloading or distortion should occur.

*g.* No microphonics should occur on a strong signal with the volume control set at maximum.

*h.* Use a frequency meter and check the calibration on all bands.

*i.* Finally, tap or jar the set to make certain no loose connections exist.

## 68. Troubleshooting Radio Receiver R–520/URR

*a. Troubleshooting Aids.* The following information is supplied as an aid in troubleshooting the receiver.

(1) Coupling capacitors between stages can become leaky and produce a high resistance short that places a positive voltage on the grid of the following tube. To check a suspected capacitor for leakage, disconnect one lead of the capacitor and check its resistance; use the highest resistance scale of the ohmmeter.

(2) Improper avc action can be caused by a short in one of the bypass capacitors, C4, C43, or C44 (fig. 40). A defective 1U4 r-f tube V1, 1L6 converter tube V2, or 1U4 i-f tube V3 also can be the cause. Figure 22 shows the circuit of the avc distribution system.

(3) When using the voltage and resistance diagram (fig. 27), voltage checks should be made for both power line and battery operation.

*b. Troubleshooting Charts.* The following charts are supplied as an aid in locating trouble in the receiver. These charts list the symptoms which the operator or repairman may observe, either visually or audibly, while making a few simple tests. *The charts also indicate how to sectionalize trouble quickly to the particular stage or circuit.* The signal substitution tests outlined in paragraphs 70 through 73 then can be used to supplement this procedure and to determine the defective circuit. A tube check and voltage and resistance measurement of the defective circuit ordinarily should be sufficient to isolate the defective part.

*Note.* First set the receiver controls as in the preparatory section of the equipment performance checklist (par. 41). Then apply power to the receiver and proceed with the following tests.

(1) *Sectionalizing trouble.*

| Symptom | Probable trouble | Correction |
|---|---|---|
| 1. Receiver inoperative on battery operation only. Neon light on dial scale glows. | Weak A batteries | Replace A batteries. |
| 2. Receiver inoperative on battery only; neon light on dial scale does not glow. | B batteries dead | Replace B batteries. |
| 3. Receiver operative on battery and line voltage. Neon dial light indicator does not glow on *battery*, but lights up on *line voltage* operation. | Weak B batteries | Replace B batteries. |
| 4. Receiver inoperative on power line or battery operation. | Fuse F1 open | Replace fuse. |
| 5. Motorboats on broadcast band | V3, 1U4 i-f tube defective<br>V1, 1U4 r-f tube defective. | Replace tube. |
| 6. Microphonic distortion on broadcast band | V4, 1U5 detector-amplifier tube defective | Replace tube. |
| 7. Distorted output on broadcast band | V4, 1U5 detector-amplifier tube defective | Replace tube. |

(2) *Localizing trouble.*

| Symptom | Probable trouble | Correction |
|---|---|---|
| 1. Low-frequency end of broadcast band cuts out, no signals. | Oscillator coil L2 defective | Replace coil. |
| 2. No signal on power line operation | CR1 or CR2 selenium rectifier defective | Replace rectifier. |
| | Poor contact on ballast adapter socket J2 | Reset contact on J2 socket. |

| Symptom | Probable trouble | Correction |
|---|---|---|
| 3. Weak audio | Coupling capacitor C24 partially shorted | Replace capacitor. |
| | Grid bias resistor R18 has low value resistance | Replace resistor. |
| 4. No audio from speaker | Headset jack J3 open | Reset contacts. |
| 5. Hum with volume control turned down | Filter capacitors C45A, C45B, C45C open or defective. | Replace filter. |
| 6. Slight hum with volume control turned up. | C21 audio grid blocking capacitor defective | Replace capacitor. |
| 7. Noise in speaker when operating band selector buttons. | Dirty contacts on band selector switch | Clean contacts with carbon tetrachloride. Refer to *caution*, in paragraph 31. |
| 8. Weak audio | Tone control resistor R32 has low resistance | Replace resistor. |
| 9. Weak signals on all bands, using power line operation. | Filter capacitors C45A, C45B, C45C defective; B+ voltage low. | Replace filter capacitor. |
| 10. Signals weak on broadcast band | Converter grid coupling capacitor C7 open | Replace capacitor. |
| 11. Image signals on broadcast band | Avc bypass capacitor C4 open | Replace capacitor. |
| 12. No signals on 4–8 MC band | Band selector contacts defective | Set contacts for positive action. |
| 13. No signals at 7.9 mc | Capacitor C39 open | Replace capacitor. |
| | Trimmer capacitor C40A shorted | Replace capacitor. |
| | Coupling capacitor C37 open | Replace capacitor. |
| 14. Receiver breaks into oscillation at 7.9 mc | Converter tube 1L6 defective | Replace tube. |
| | Filament bypass capacitor C9 open | Replace capacitor. |
| | Defective band selector switch contacts | Set band selector contacts. |
| | H-f oscillator capacitor C12 shorted | Replace capacitor. |
| 15. Signal shifts frequency when the receiver is jarred. | Lead wire to oscillator section C2E of ganged capacitor not taut. | Dress wire away from capacitor frame and coils. Check alinement (sec. III, ch. 5). |
| 16. Tone control buttons break off | Receiver chassis not tightened to cabinet | Tighten the chassis mounting screws. |

| | | |
|---|---|---|
| 17. Receiver noise present on broadcast band when loop antenna is swung up into position over cabinet or when jarred. | Rivet pin or pins of front cover hinge bracket assembly unsoldered, or solder connection broken. | Resolder rivet pins to mounting bracket (fig. 33). |
| 18. Signals weak at 3.9 mc or 7.8 mc | Plate coupling capacitor C6 open or high resistance leakage. | Replace capacitor. |
| 19. No signals on 16 M band | Oscillator coil L2 open | Replace coil. |
| 20. No signals on 16, 19, 25, and 31 M spread bands. | Defective contacts on band selector | Reset for positive action. |
| | Oscillator coil L2 has shorted turns | Replace coil. |
| | Coupling capacitor C37 open. Coupling capacitor C38 open, or high leakage resistance. Coupling capacitor C42 open, or high leakage resistance. | Replace defective capacitor. |
| 21. Set dead or off calibration at 3.9 mc | Capacitor C41 open | Replace capacitor. |
| | Oscillator coil L2 has shorted turns | Replace coil. |
| 22. All shortwave bands weak when using whip antenna. | Telescopic whip antenna capacitor C27 open | Replace capacitor. |
| 23. Signals weak at 3.9 mc | R-f trimmer capacitor C35B shorted | Replace defective capacitor. |
| 24. Signals weak on 16, 19, 25, and 31M spread bands. | Whip antenna capacitor C27 open. Coupling capacitor C34 open. Coupling capacitor C33 open. | Replace defective capacitor. |
| 25. No resonance at 3.9 mc for r-f trimmer capacitor C35B. | Trimmer capacitor C35B shorted. Band selector switch has defective contacts. | Replace trimmer capacitor. Set band selector contacts for positive action. |
| 26. No resonance at 7.9 mc for r-f trimmer capacitor C35A. | Trimmer capacitor C35A shorted. Band selector switch has defective contacts. | Replace trimmer capacitor. Set contacts for positive action. |
| 27. R-f trimmers C35A, C35B, broad peak | Coupling capacitor C34 open | Replace capacitor. |
| 28. Broad peak at 17.8 mc, 15.2 mc, 11.8 mc, and 9.6 mc. | Coupling capacitor C36 open. Coupling capacitor C38 open. | Replace defective capacitor. |
| 29. Broadcast band does not calibrate and signals are weak. | Three section ganged capacitors C2A, C2C, C2E mounting screw shorting to capacitor stator. | Set capacitor mounting screw for clearance. |

| Symptom | Probable trouble | Correction |
|---|---|---|
| 30. No 455-kc resonance for i-f transformer T1 secondary. | Resistance R14 has too low a value | Replace resistor. |
| | Capacitor C44 open or has high resistance short | Replace capacitor. |
| | Open secondary winding on T1 | Replace transformer. |
| 31. No resonance for converter trimmer C2D at 1,420 kc. | Converter coil L1 open | Replace coil. |
| 32. No resonance at 3.9 mc for antenna trimmer C31A. | Antenna coil L5 open | Replace coil. |
| 33. No resonance for loop antenna trimmer C2B at 1,500 kc. | Antenna loading coil L4 open | Replace coil. |
| 34. No resonance for broadcast loop antenna trimmer C2B. | Capacitor C30 too close to metal chassis. Lead wires from the loop antenna to loop receptacle are too close to the chassis. | Dress capacitor and lead wires away from the chassis. |
| 35. No resonance for broadcast r-f trimmer C2D. | Signal grid lead wire to pin No. 6 of 1L6 converter tube is too close to metal chassis. | Dress the wire away from the chassis. |
| 36. Broadcast band does not calibrate. | Oscillator coil L2 has shorted turns | Replace coil. |
| 37. No resonance on antenna or r-f coils on 16, 19, 25 or 31 M spread bands. | Band selector switch has defective contacts | Reset contacts. |
| 38. Oscillator coil L20 does not resonate at 17.8 mc | Lead wire from oscillator coil L20 to pin No. 3 of 1L6 converter tube is too close to the chassis. | Dress the lead wire away from the metal chassis. |

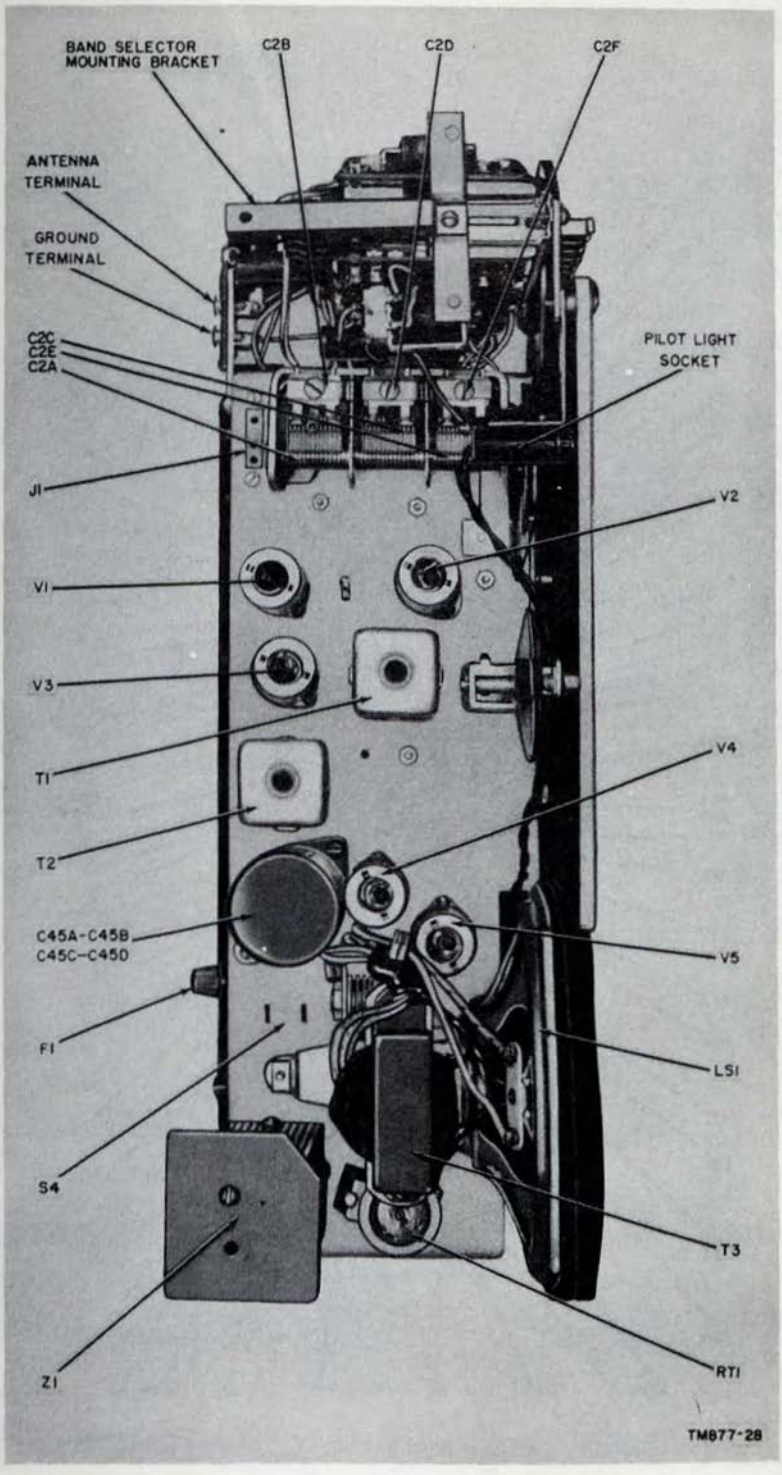


*Figure 28. Top view of chassis.*

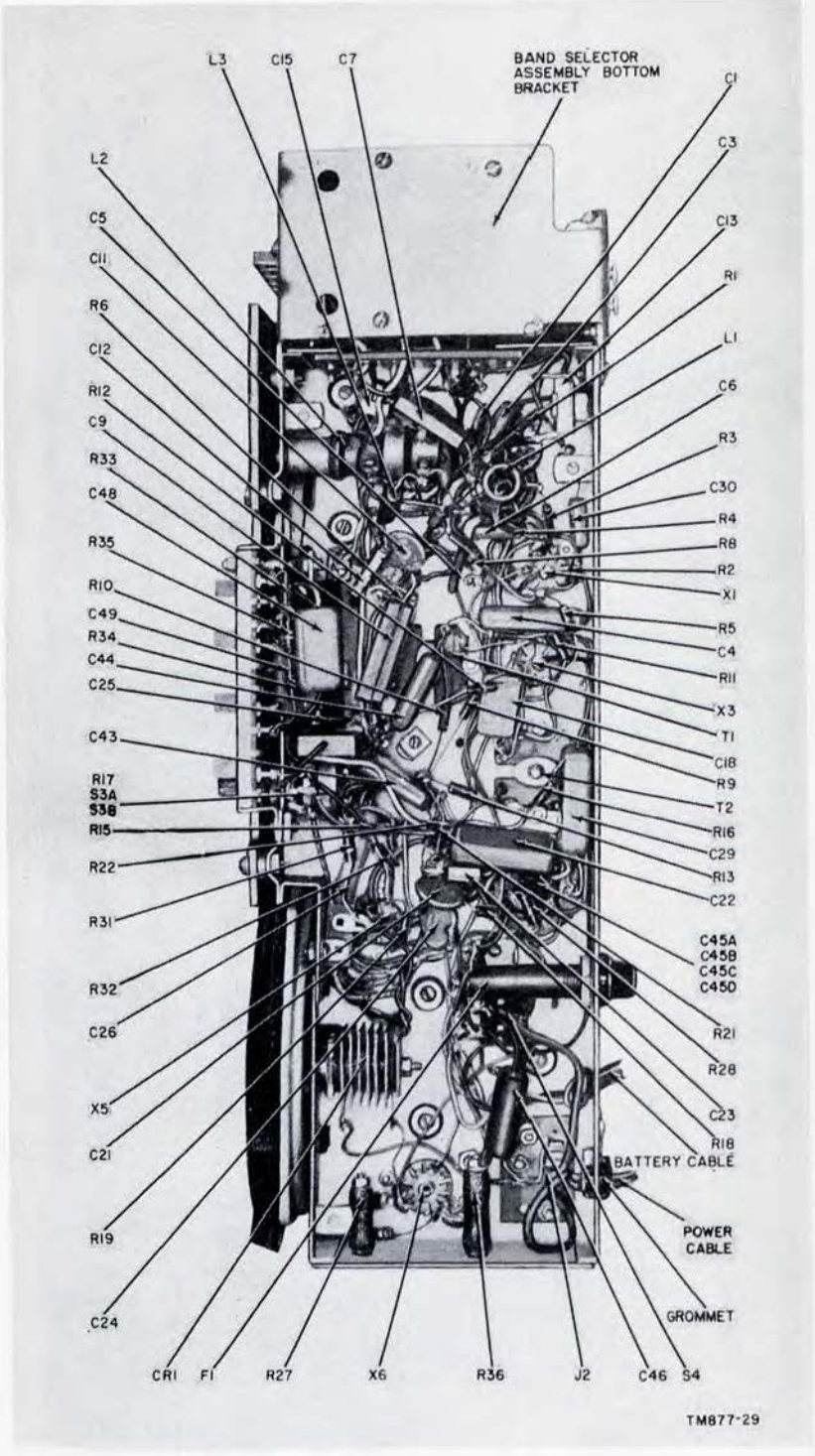


*Figure 29. Bottom view of chassis.*

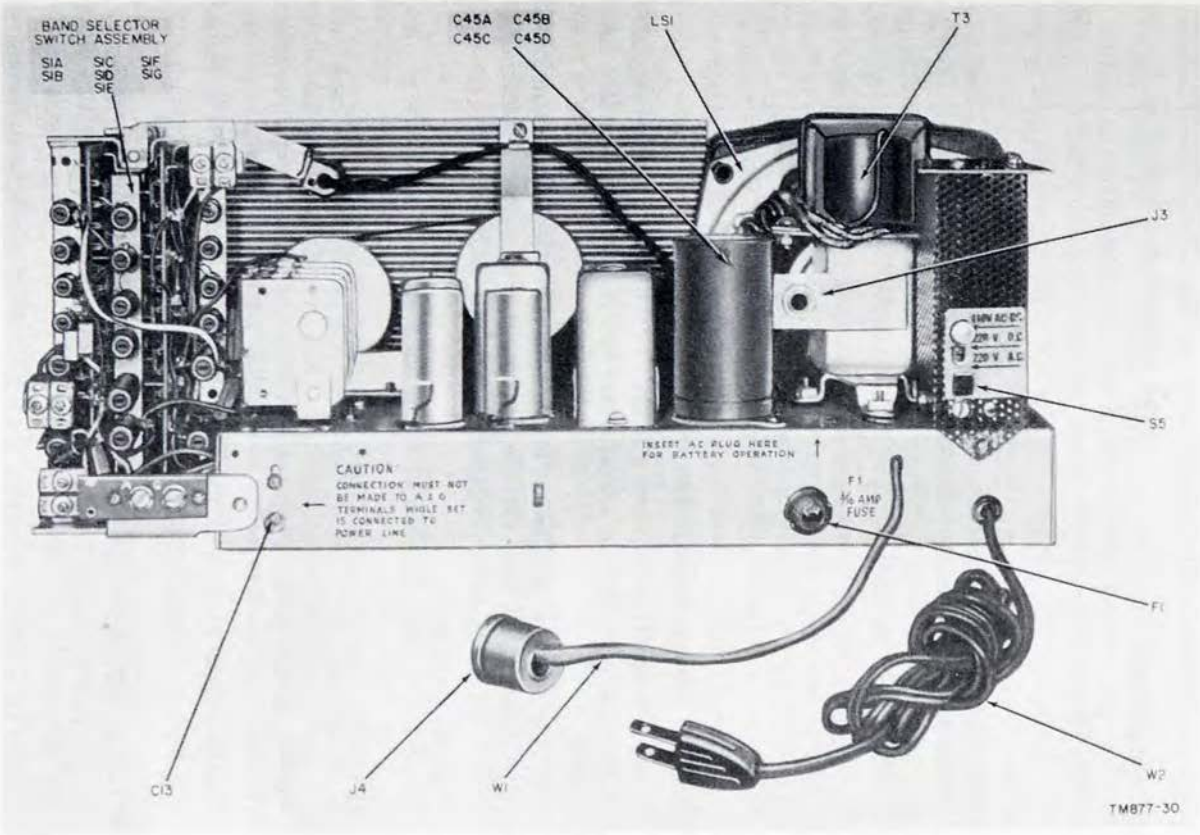


*Figure 30. Rear view of chassis.*

## 69. D-C Resistance of Transformers and Coils

The d-c resistance of the transformers and coils are listed below:

| Transformer or coil | Terminals or winding | Resistance (ohms) |
|---|---|---|
| L1 converter grid coil | AB | 8 |
| | CD | 6.1 |
| L2 oscillator coil | AC | .013 |
| | BD | 8.2 |
| | EF | 3.2 |
| | HG | .7 |
| L3 r-f choke coil | | 23 |
| T1 i-f transformer | 1 to 8 | 25 |
| | 4 to 5 | 25 |
| T2 i-f transformer | 1 to 8 | 25 |
| | 6 to 7 | 25 |
| T3 | Primary winding | 280 |
| | Voice coil winding | 3 |
| | Inverse feedback winding | 13 |
| E2 | Broadcast loop | .7 |

## 70. General Signal Substitution Notes

*a.* Signal substitution requires a source of audio, i-f, and r-f signals. If available, use an isolation transformer between the power line and the receiver.

*b.* Note the volume, and listen for serious distortion from the loudspeaker or headset at the various points in the signal substitution procedure. Where possible, compare operation with a receiver known to be in good condition.

*c.* Check the wiring and soldering in each stage during the procedure.

*Note.* Do not remove r-f and i-f shields from the chassis, or shield cans from the tuned units, until the trouble has been traced definitely to the particular unit. Do not damage wiring by pushing it back and forth during inspection. Be careful not to damage the receiver in any other way.

*d.* Misalinement of one or more stages of the receiver will cause reduced output. Misalinement of the h-f oscillator may prevent any output.

*e.* When trouble is localized in a given stage, test the tube, measure the voltage, and measure the resistances at the tube socket of that stage (fig. 27).

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

*g.* Remove only one tube at a time when testing. Check the type

number of the tube and test the tube. If it is not defective, return it to its proper socket before removing another tube.

*h.* Each step assumes the satisfactory completion of all previous steps. Isolate and clear any trouble located before proceeding with any succeeding steps.

## 71. A-F Signal Substitution Tests

Under normal conditions, with the volume control set to its maximum clockwise position, 25 mv (millivolt) of audio signal fed to the center lug of the volume control will deliver approximately 50 mw (milliwatt) of power to a 3-ohm resistive load connected across the audio-output transformer secondary. Output Meter TS-585/U, or an equivalent, set for a 3-ohm load may be connected to headset jack J3 by means of Plug PL-55. (The speaker voice coil is disconnected automatically.) The shielded or ground lead of the audio signal generator output cable should be connected to the B— bus of the receiver; for example, the negative lug of filter capacitor C45A, C45B, C45C, C45D, or the negative filament (pin 1) of the 1U5 detector-amplifier tube.

*a.* Apply a 25-mv, 1,000-cycle sine wave audio signal from the audio generator through a .05-$\mu$f (microfarad) capacitor to the center lug of volume control potentiometer R17, and turn the control to its maximum clockwise position. A high volume audio signal should come from the speaker or, if an output meter connected for a 3-ohm load is used, it should read 50 mw (0.4 volt ac). If there is no audio or the audio output is low, check the speaker, the output transformer, the headset jack, tubes V4 and V5, and the capacitors and resistors in the associated audio circuit.

*b.* Weak audio or audio with distortion or hum can be localized further by feeding the audio signal first to the signal grid (pin 6) of V5 and then to the center lug on the volume control (volume control on full) and comparing the two outputs. Approximately 50 times as much audio power should be developed with the volume control connection as compared with the signal grid connection of V5 with the same signal level from the audio generator.

## 72. I-F and Converter Signal Substitution Tests

*a.* Adjust the signal generator to 455 kc with 400-cycle 30-percent modulation applied. Apply this signal in series with a 0.1-$\mu$f capacitor to the signal grid (pin 6) of the 1U4 i-f tube V3. Connect the shield or ground lead of the signal generator cable to the B— bus and set the volume control to its maximum clockwise position. Set the band selector to BC.

*b.* Connect an output meter with Plug PL-55 into headset jack J3. With a 3,000-$\mu$v (microvolt) signal fed to the signal grid (pin 6) of V3, approximately 50 mw should be developed at the output.

*c.* Gain through a stage can be recognized by connecting the generator output to the signal grid, and then to the plate of the same tube. The output level should be higher at the grid connection.

*d.* If there is no signal or a weak signal when the signal generator is connected to the signal grid (pin 6) of V3, i-f transformer T2 may have a shorted or an open winding; capacitor C20A or C19 may be shorted, the transformer may be misalined, or tube V3 may be defective.

*e.* If the output is normal for a signal applied to the signal grid (pin 6) of V3, connect the signal generator output lead to pin 6 of 1L6 converter tube V2. With the signal generator output set for 100 $\mu$v, with 400-cycle 30 percent modulation, approximately 50 mw of power should be developed across a 3-ohm resistive load.

*f.* If there is no signal or if it is weak, T1 may have a shorted or an open winding; capacitor C16 or C17 may be shorted, the transformer may be misalined, or tube V2 may be defective.

## 73. R-F Signal Substitution Tests

Check the r-f stage for proper operation by connecting the signal generator output lead with 400-cycle 30-percent modulation to pin 6 of the 1U4 r-f tube V1. The following sensitivities should be measured for 50 mw into a 3-ohm load. Any deviation from the values listed below indicates misalinement or a defective component.

| Band | Input voltage (uv) |
|---|---|
| Broadcast | 15 to 30 |
| 2–4 MC | 40 to 70 |
| 4–8 MC | 40 to 70 |
| Spread | 30 to 75 |

## 74. Antenna Stage Test

Since a loop type antenna, whip antenna, and provisions for a long wire antenna are incorporated in Radio Receiver R–520/URR, antenna sensitivity will vary considerably, depending on conditions used in the measurements. Check loop antenna E2 and whip antenna E1 for shorts and open connections.

## 75. H-F Oscillator Test

Check the h-f oscillator for proper action by connecting a vacuum-tube voltmeter from the oscillator grid (pin 4) of the 1L6 converter tube to the negative side of the filament (pin 1). The following voltages should be read:

| Band | H-f oscillator grid voltage |
|---|---|
| Broadcast | −4 to −9 v |
| 2–4 MC | −3 to −5 v |
| 4–8 MC | −3 to −7 v |
| Spread | −2 to −4 v |

## 76. Stage Gain and Sensitivity Chart

*a.* When checking stage gain or sensitivity, observe the following points:

(1) If available, use an isolation transformer between the power line and the receiver.

(2) The dummy antenna for external antenna operation consists of a 400-ohm resistor in series with a 200-$\mu\mu$f (micromicrofarad) capacitor.

(3) The dummy antenna for shortwave operation consists of a 20-$\mu\mu$f capacitor. Disconnect the whip antenna and connect the 20-$\mu\mu$f capacitor to the whip antenna tip jack (fig. 26).

(4) When using the external antenna or whip antenna dummy connections, connect the ground lead of the signal generator to the ground terminal of the receiver.

(5) When checking the r-f amplifier, connect the signal generator output to the grid of the r-f amplifier through a 0.1-$\mu$f blocking capacitor. Connect the ground lead of the signal generator to the B− bus of the receiver.

(6) The dummy antenna for broadcast operation is a standard RMA (Radio Manufacturers' Association) test loop (par. 95). Do not ground the signal generator output cable to the receiver when using the RMA test loop.

*b.* The chart below lists the average input voltages required at each of the r-f and i-f stages of the receiver to produce a signal output of 50 mw which is equivalent to 0.4 volt ac across a 3-ohm resistive load. Use this chart as a standard when trouble shooting to check the overall gain of the receiver and the gain of each stage, or group of stages. When checking the sensitivity of the receiver on the broadcast band, locate the test loop and the receiver loop 19¾ inches apart on centers, and parallel to each other. Under these conditions, the field intensity at the receiver loop in $\mu$v/M (microvolts per meter) will be one-tenth the signal generator output voltage. When the receiver output is low, localize the defective stage by checking the signal voltage level of each stage against the chart while using either the signal tracing method of troubleshooting or measurement of the individual stage gain.

| Band | Test frequency (mc) (modulated 30 percent at 400 cycles) | Average sensitivity (input required for 50-mw output) | | | |
|---|---|---|---|---|---|
| | | R-f amplifier grid (pin 6 of V1) (μv) | Loop antenna (μv/M) | Whip antenna (μv) | External antenna (μv) |
| Broadcast | 0. 6 | 20 | 65 | -------- | 65 |
| | 1. 5 | 20 | 50 | -------- | 50 |
| 2–4 MC | 2. 1 | 35 | -------- | 28 | 20 |
| | 3. 9 | 40 | -------- | 5 | 20 |
| 4–8 MC | 4. 2 | 35 | -------- | 9 | 20 |
| | 7. 8 | 50 | -------- | 3 | 20 |
| 31 M | 9. 6 | 20 | -------- | 3 | 15 |
| 25 M | 11. 8 | 20 | -------- | 4 | 25 |
| 19 M | 15. 2 | 30 | -------- | 4 | 30 |
| 16 M | 17. 8 | 25 | -------- | 6 | 40 |

*c.* The following chart lists the approximate gain for each circuit in the receiver. For example, the gain of the r-f stage is measured as follows: Measure the signal generator voltage required at pin 6 of V2 to produce 50-mw output across a 3-ohm load. Measure the signal generator voltage required at pin 6 of V1 to produce the same output. Divide the first reading (the larger one) by the second reading to determine the stage gain. When making stage gain measurements, be sure to connect the ground lead of the signal generator to the B– bus.

| Stage | Test point | Test frequency (modulated 30 percent at 400 cycles) | Input | Average stage gain |
|---|---|---|---|---|
| R-f amplifier | Pin 6 of V1 | 600 kc | 20 μv | 5 |
| Converter | Pin 6 of V2 | 455 kc | 100 μv | 30 |
| I-f amplifier | Pin 6 of V3 | 455 kc | 3000 μv | 28 |
| Det-amplifier | Pin 6 of V4 | 400 cps | 25 mv | 65 |
| Audio output | Pin 6 of V5 | 400 cps | 1.6 volts | 14 |

## Section II. REPAIRS

### 77. Replacement of Parts

Most of the parts in Radio Receiver R–520/URR are accessible and easily replaceable. Figure 29 shows the location of parts beneath the chassis.

*a.* When the band selector switch assembly requires replacement, carefully mark the wires connected to the switch with tags or other devices to avoid errors in connections when the new switch is installed. Refer to figure 31.

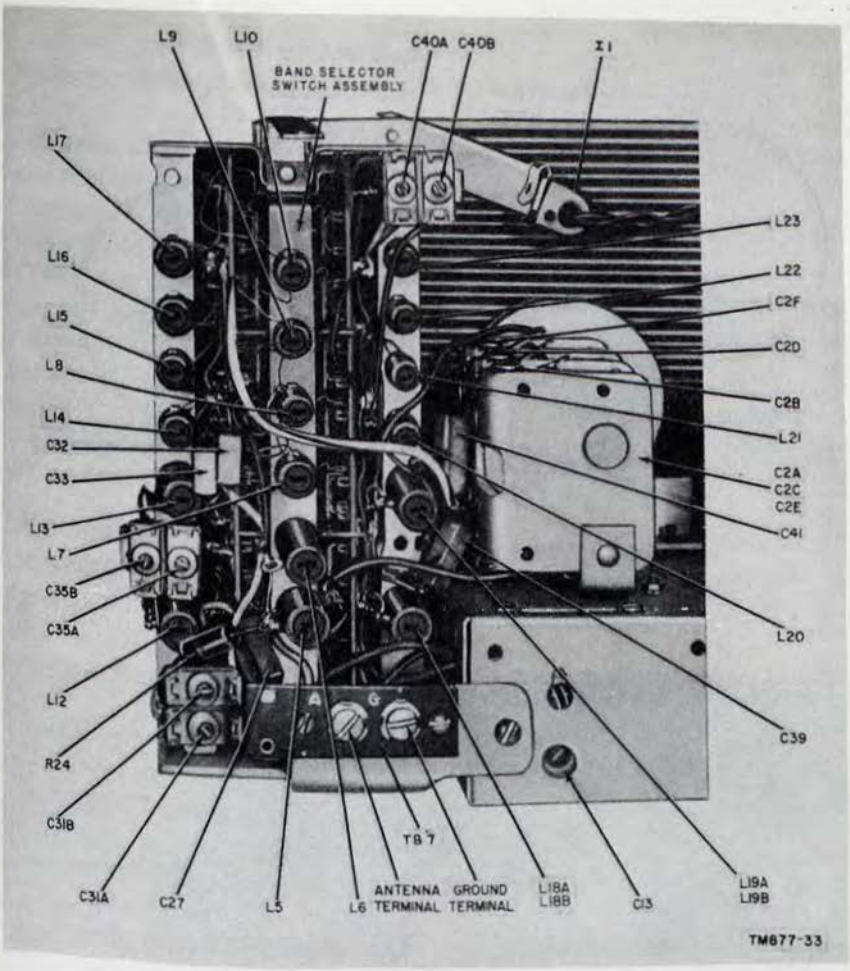


*Figure 31. Band selector switch, rear view.*

*b.* Figure 32 shows the dial cord drive system on Radio Receiver R–520/URR. Two dial cords are used—one for the dial tuning shaft and the other for the pointer pulley. To replace the dial cord for the pointer pulley, it is necessary to remove the dial scale. The tuning shaft dial cord can be strung without removing the dial scale. When it is replaced, the cord should be strung around the tuning shaft first.

## 78. Front Cover Hinge Repair

The two hinge bracket assemblies on the front cover are part of the electrical circuit that connects the loop antenna on the door to the receiver (fig. 33). A broken wire or a loose or broken solder connection on the rivet pin will create electrical interference or intermittent operation on the broadcast band. To repair, proceed as follows:

*a.* Disconnect the loop antenna cable plug from the set.

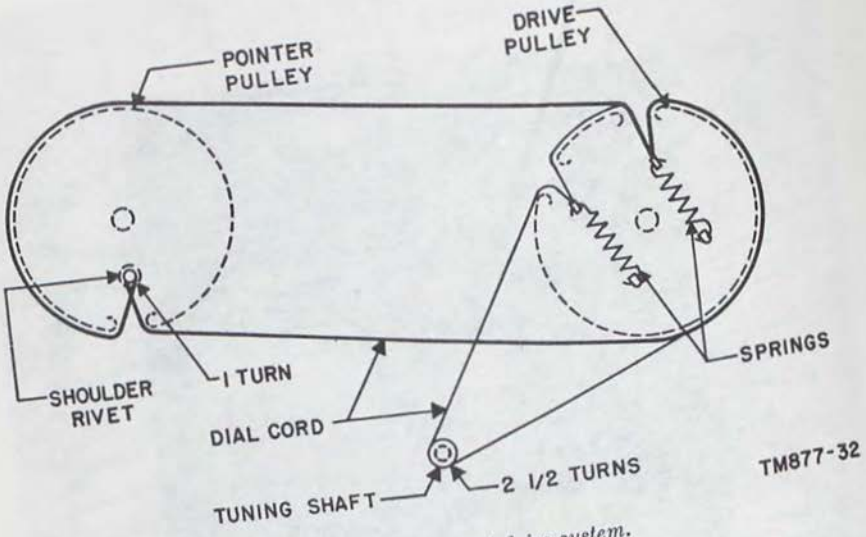


*Figure 32. Dial cord drive system.*

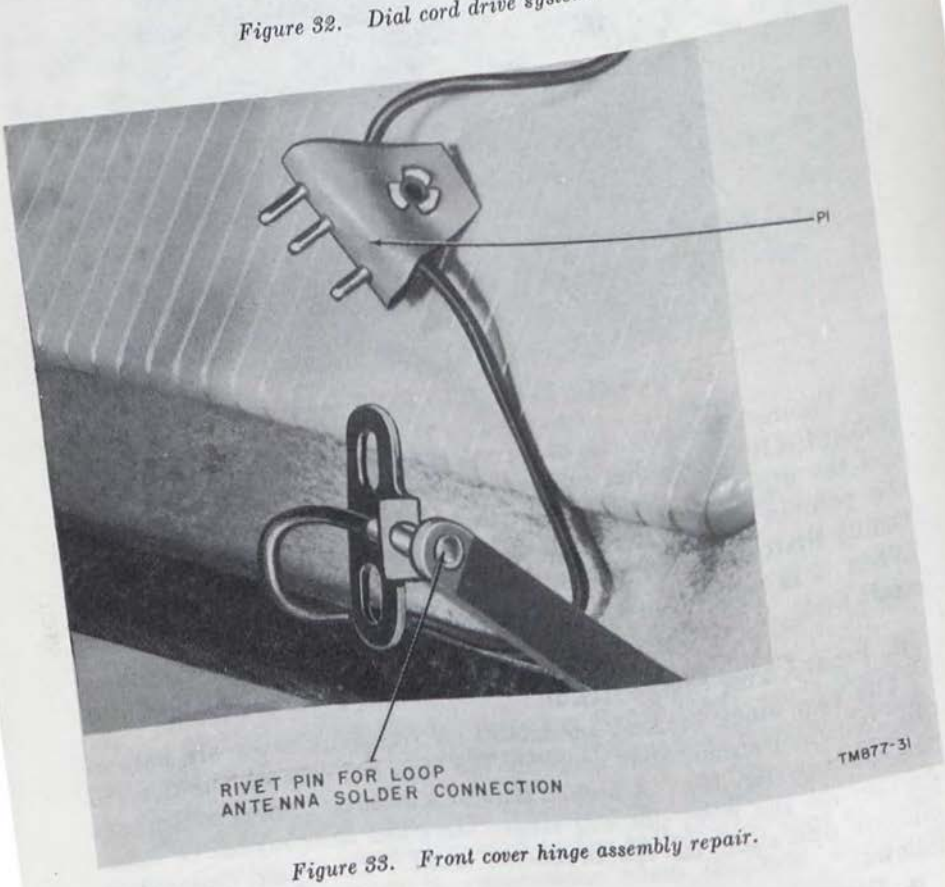


*Figure 33. Front cover hinge assembly repair.*

*b.* Remove the volume control knob and the tuning control knob.

*c.* Remove the receiver chassis and batteries from the cabinet (par. 64).

*d.* Remove all front panel screws that secure the panel to the cabinet and remove the front panel.

*e.* Remove both screws that hold the handle to the top of the cabinet and remove the handle.

*f.* Take out the five wood screws that hold the top panel to the cabinet and remove the panel.

*g.* Remove the four wood screws that hold both mounting brackets to the top of the cabinet and remove the top cover with the hinge assembly from the rest of the cabinet.

*h.* Resolder the broken solder connection of the rivet pin to the mounting bracket and reassemble in the reverse order.

### 79. Refinishing

Instructions for refinishing badly marred cabinets are given in paragraph 37.

## Section III. ALINEMENT PROCEDURES

### 80. Test Equipment Required for Alinement

*a. Signal Generator.* The signal generator (such as RF Signal Generator Set AN/URM–25) must be an accurately calibrated instrument capable of producing modulated and unmodulated r-f signals. The frequency range must extend from 400 kc to 25 mc. The alinement frequencies are shown in the alinement chart (par. 93). If necessary, the second harmonic generally can be used when the fundamental is not available. Thus, a signal generator with a top frequency of 12.5 mc also is suitable. The generator should have an output of at least 5,000 $\mu$v for best results in alining the r-f, h-f oscillator, and i-f circuits. Accurate frequency calibration of the signal generator is extremely important to insure that the receiver dial calibration will be correct.

*b. Output Meter.* The output meter should respond to audio frequencies and should provide readings at 50 mw and have a maximum range of 500 mw. For correct readings, the impedance of the meter must match the 3-ohm voice coil winding. Use Output Meter TS–585/U (or equivalent), set for a 3-ohm load.

*c. Frequency Meter.* When a highly accurate signal generator is not available, a frequency meter can be used to check the accuracy of the generator. Frequency Meter BC–221–(*) is suitable for this purpose.

*d. Headset or Permanent Magnet Loudspeaker.* The receiver loudspeaker or a headset (such as Headset HS–30–(*)) can be used for rough alinement.

*e. Alinement Tools.* The alinement tool, O 14, supplied with the receiver and an insulated screwdriver are required.

***Caution:*** Alinement tool O 14 is intended for alinement of the i-f and r-f transformers. *Do not attempt to use it for turning trimmer capacitors or as a screwdriver.*

## 81. Calibration of Signal Generator

The procedure below is used only when the signal generator calibration is not acceptable.

*a.* Accurate alinement of the h-f oscillator in the receiver requires the use of the frequency meter to check the signal generator setting, as follows:

(1) Place the generator and frequency meter near each other. Turn them on and allow them to warm up for at least 15 minutes.

(2) Calibrate the frequency meter according to the instructions furnished with the unit.

(3) Attach a piece of wire to the signal generator output connection and place the wire near the frequency meter antenna.

(4) Set the meter to the exact frequency to which the generator is to be used.

(5) While listening to the headset connected to the frequency meter, tune the generator to zero beat with the meter. The signal generator now is set for the frequency desired.

*b.* Turn off the frequency meter and remove the wire attached to the signal generator output connection.

## 82. Preparation for Alinement

*a.* Remove the chassis from the cabinet in accordance with instructions in paragraph 64.

*b.* If available, use an isolation transformer between the power line and the receiver.

*c.* Be sure the power supply adapter switch is in the correct position to conform to the power source that is available.

*d.* Connect the power cord to the external power line source. Turn the receiver on and let it warm up for 5 minutes.

(1) Turn the volume control to its maximum clockwise position.

(2) Set the receiver for broadcast operation.

(3) Connect a 3-ohm output meter to Plug PL–55 and insert it into jack J3.

(4) Aline the various sections of the receiver in the following order:

I-f stage.
Broadcast band.
4–8 MC continuous coverage band.
2–4 MC continuous coverage band.

31 M band.
25 M band.
19 M band.
16 M band.

*Note.* With the signal generator modulated 30 percent at 400 cycles, the final sensitivity measurements are taken at standard output of 50 mw across a 3-ohm load.

## 83. I-F Alinement Procedure

(fig. 28)

*a.* Adjust the i-f transformer cores with alinement wrench O 14 supplied with the receiver. This wrench should be inserted through the hole in the top of the can to adjust the top core of the transformer, then lowered through the top core to adjust the bottom core. Be careful when alining these transformers to keep each core approximately centered in relationship to its associated coil. If this is not done, it is possible to advance the top core beyond, and the bottom core above, its associated coil. This would result in an incorrect coefficient of coupling and unstable and improper alinement.

*Note.* Alinement wrench O 14 is a special purpose tool designed primarily for adjusting the i-f and r-f transformers. *Do not use the alinement wrench as a screwdriver or to turn trimmer capacitors.*

*b.* Set the signal generator to 455 kc, modulated 30 percent at 400 cycles, and connect its output through a 0.1-$\mu$f blocking capacitor to the stator terminal of capacitor C2C. The i-f signal is effectively applied to the 1L6 converter signal grid (pin 6). Do not set the signal generator output any higher than is necessary to provide a usable reading on the output meter (about 10 mw). Connect the ground lead of the signal generator output cable to the B— bus of the receiver.

*c.* With the alinement wrench, adjust the top and bottom cores of i-f transformer T2 for maximum output indication on the output meter.

*d.* Adjust the top and bottom cores of transformer T1 for maximum output indication on the output meter.

*e.* Repeat the adjustments given in *c* and *d* above.

## 84. Broadcast Band Alinement

*a.* Couple the signal generator output lead through a 0.1-$\mu$f blocking capacitor to the grid (pin 6) of r-f amplifier tube V1. Leave the ground load of the signal generator connected to the B— bus of the receiver.

*b.* Set the signal generator to 1,500 kc, modulated 30 percent at 400 cycles.

*c.* Press the BC band selector switch.

*d.* With the ganged tuning capacitor completely meshed (low-frequency end), mechanically set the dial pointer horizontally across the dial scale.

*e.* Turn the tuning control so that the dial pointer is set to 150 on the broadcast scale.

*f.* Adjust oscillator trimmer capacitor C2F (fig. 28) for resonance at 1,500 kc. Do not set the signal generator output any higher than is necessary.

*g.* Adjust r-f trimmer capacitor C2D (fig. 28) for maximum output indication on the output meter.

*h.* Set the signal generator to 600 kc, modulated 30 percent at 400 cycles.

*i.* Turn the tuning control so that the dial pointer is set to 60 on the broadcast scale.

*j.* Rock the ganged tuning capacitor while adjusting broadcast padder capacitor C13 (fig. 30) for maximum output indication on the output meter.

*k.* Repeat the operations outlined in *b* through *j* above.

*l.* Repeat operations outlined in *b* through *g* above.

*m.* Figure 34, which shows the switch connections for broadcast operation, is shown for reference purposes.

## 85. 4–8 MC Band Alinement Procedure
(fig. 31)

*a.* Disconnect the whip antenna and connect the signal generator output lead in series with a 20-$\mu\mu$f capacitor to the whip antenna tip jack. Connect the ground lead of the signal generator to ground terminal G.

*b.* Press the band selector switch marked 4–8 MC.

*c.* Set the signal generator to 7.8 mc, modulated 30 percent at 400 cycles.

*d.* Turn the tuning control so that the dial pointer is set to 7.8 mc on the 4- to 8-mc scale.

*e.* Adjust oscillator trimmer capacitor C40A for resonance at 7.8 mc.

*Note.* C40A has two resonant points. The correct one is near the maximum capacity of the trimmer. The second point is the image frequency, and care must be taken to avoid selecting the image.

*f.* Adjust r-f trimmer C35A for maximum output indication on the output meter. If two resonant points are noted, use the one nearest maximum trimmer capacity.

*g.* Set the signal generator to 4.2 mc, modulated 30 percent at 400 cycles.

*h.* Turn the tuning control so that the dial pointer is set to 4.2 mc on the 4- to 8-mc scale.

*Note.* There may be two resonant points on the shortwave coils in Radio Receiver R–520/URR. The correct setting for the oscillator coil cores is the one

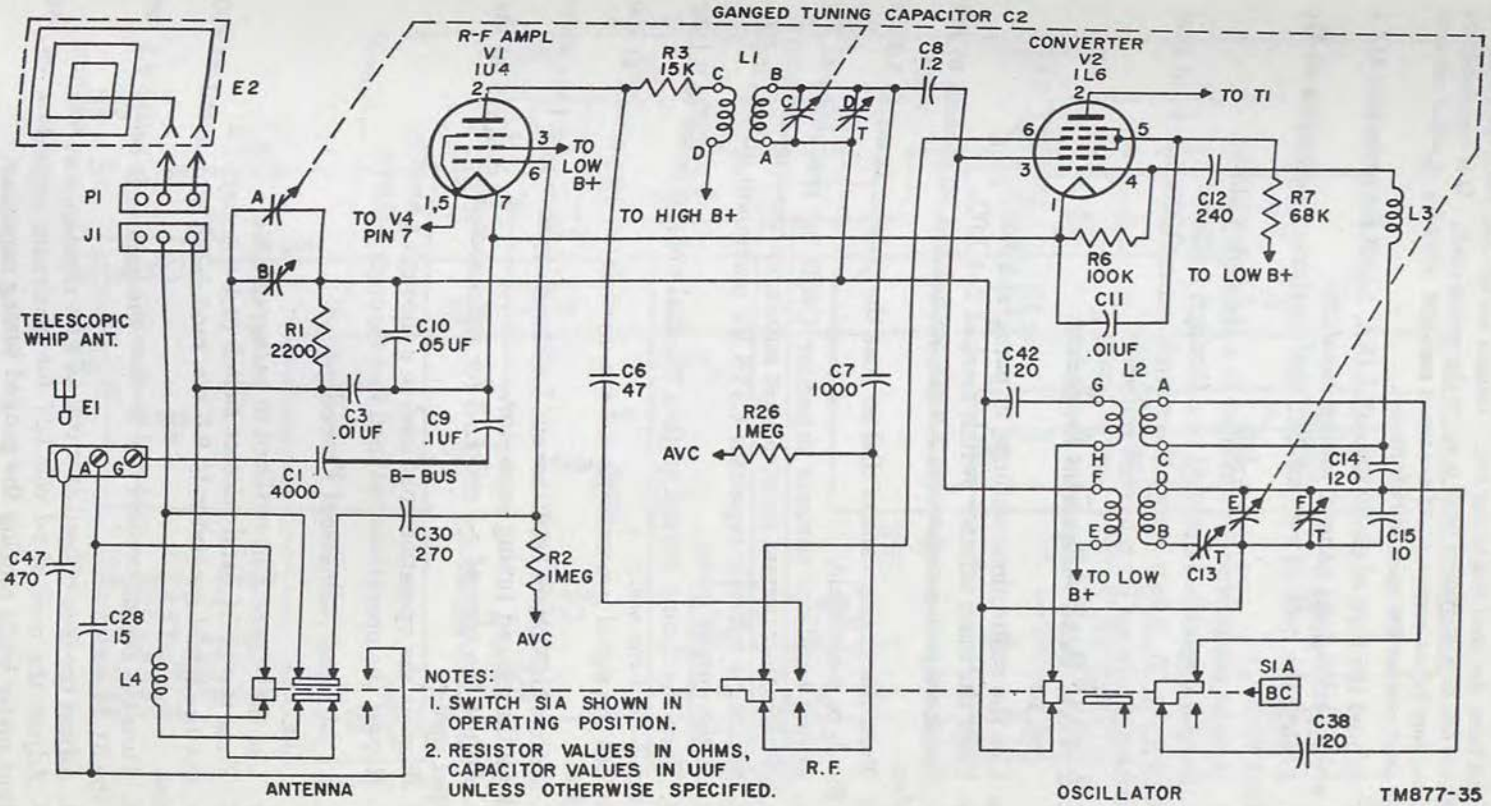


*Figure 34. Band selector switch shown in BC position.*

farthest from the open end of the coil. Images are created when the core of the oscillator coil on a shortwave band is set to the wrong peak. It is very important that the core be set correctly. The correct resonant point for all other coil cores is the peak nearest the open end of the coil.

*i*. Adjust the core of oscillator coil L18A, L18B for resonance at 4.2 mc while rocking the ganged tuning capacitor.

*j*. Adjust the core of r-f coil L12 for maximum indication on the output meter.

*k*. Repeat the operations outlined in *c* through *j* above.

*l*. Repeat operations outlined in *c* through *f* above.

*m*. Figure 35, which shows the switch connections for 4- to 8-mc operation, is shown for reference purposes.

## 86. 2–4 MC Band Alinement Procedure

(fig. 31)

*a*. Use the connections outlined in paragraph 85*a*.

*b*. Press the band selector switch marked 2–4 MC.

*c*. Set the signal generator to 3.9 mc, modulated 30 percent at 400 cycles.

*d*. Turn the tuning control dial so that the pointer is set to 3.9 mc on the 2- to 4-mc scale.

*e*. Adjust oscillator trimmer capacitor C40B for resonance at 3.9 mc. This is the resonant point nearest maximum trimmer capacity.

*f*. Adjust r-f trimmer capacitor C35B for maximum output indication on the output meter.

*g*. Turn the tuning control so that the dial pointer is set to 2.1 mc on the 2- to 4-mc scale.

*h*. Set the signal generator to 2.1 mc, modulated 30 percent at 400 cycles.

*i*. Adjust the core of oscillator coil L19 for resonance at 2.1 mc while rocking the ganged tuning capacitor.

*j*. Adjust the core of r-f coil L13 for maximum indication on the output meter.

*k*. Repeat the operations outlined in *c* through *i* above.

*l*. Repeat the operations outlined in *c* through *f* above.

## 87. 31 M Band Alinement Procedure

(fig. 31)

*a*. Use the connections outlined in paragraph 85*a*.

*b*. Press the 31 M band selector switch (9.4–9.8 mc).

*c*. Set the signal generator to 9.6 mc, modulated 30 percent at 400 cycles.

*d*. Turn the tuning control dial so that the pointer is set to 9.6 mc on the 31 M scale.

*e*. Adjust the core of oscillator coil L23 for resonance at 9.6 mc.

*f*. Adjust the core of r-f coil L17 for maximum indication on the output meter while rocking the ganged tuning capacitor.

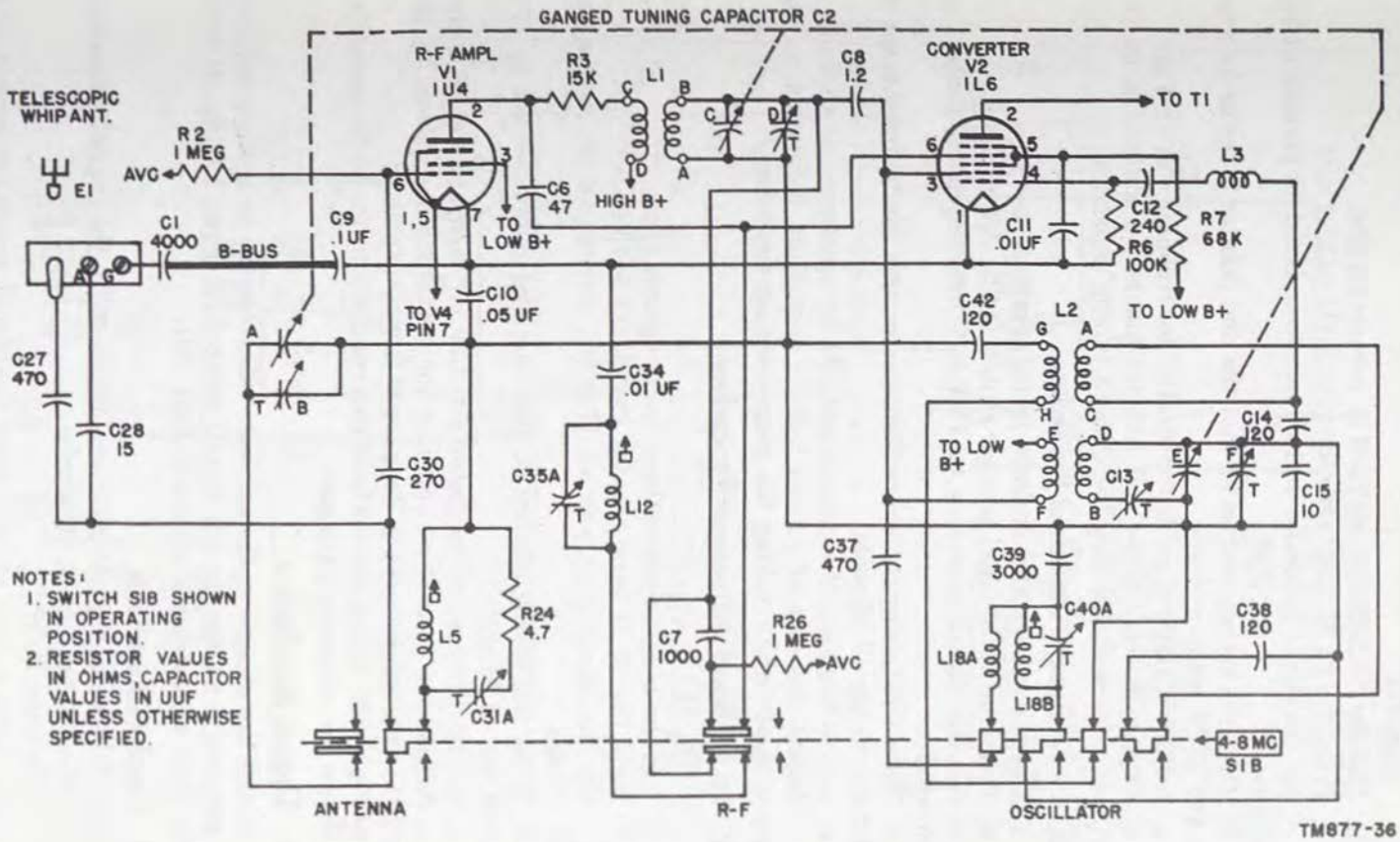


*Figure 35. Band selector switch shown in 4–8 MC position.*

## 88. 25 M Band Alinement Procedure

(fig. 31)

*a.* Use the connections outlined in paragraph 85*a*.

*b.* Press the 25 M band selector switch (11.6–12.0 mc).

*c.* Set the signal generator to 11.8 mc, modulated 30 percent at 400 cycles.

*d.* Turn the tuning control so that the dial pointer is set to 11.8 mc on the 25 M scale.

*e.* Adjust the core of oscillator coil L22 for resonance at 11.8 mc.

*f.* Adjust the core of r-f coil L16 for maximum indication on the output meter while rocking the ganged tuning capacitor.

## 89. 19 M Band Alinement Procedure

*a.* Use the connections outlined in paragraph 85*a*.

*b.* Press the 19 M band selector switch (14.9–15.5 mc).

*c.* Set the signal generator to 15.2 mc, modulated 30 percent at 400 cycles.

*d.* Turn the tuning control so that the receiver dial pointer is set to 15.2 mc on the 19 M scale.

*e.* Adjust the core of oscillator coil L21 for resonance at 15.2 mc.

*f.* Adjust the core of r-f coil L15 for maximum indication on the output meter while rocking the ganged tuning capacitor.

## 90. 16 M Band Alinement Procedure

(fig. 31)

*a.* Use the connections outlined in paragraph 85*a*.

*b.* Press the 16 M band selector switch (17.5–18.1 mc).

*c.* Set the signal generator at 17.8 mc, modulated 30 percent at 400 cycles.

*d.* Turn the tuning control so that the dial pointer is set to 17.8 mc on the 16 M scale.

*e.* Adjust the core of oscillator coil L20 for resonance at 17.8 mc.

*f.* Adjust the core of r-f coil L14 for maximum indication on the output meter while rocking the ganged tuning capacitor.

*g.* Figure 36, which shows the switch connections for 16 M operation, is shown for reference purposes.

## 91. Chassis Installation

Install the chassis in the cabinet. Reverse the procedure outlined in paragraph 64 but do not install protective cover A3 (fig. 4) until after final adjustments are made (par. 92).

## 92. Final Adjustments

The following adjustments are made with the signal generator modulated 30 percent at 400 cycles.

*a. Broadcast Band.*

(1) Loop a turn of wire from the signal generator output lead around broadcast loop antenna E2.

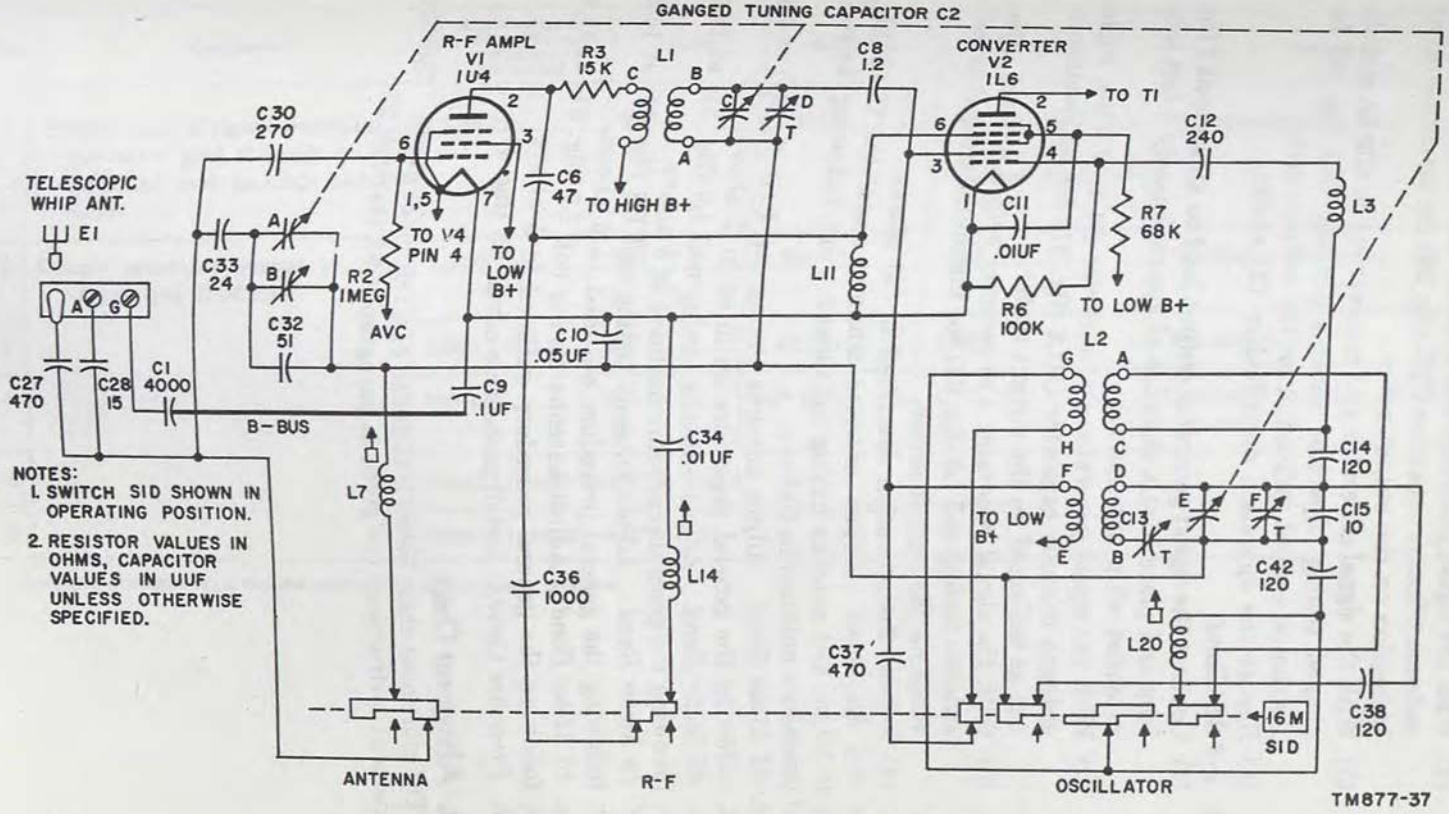


*Figure 36. Band selector switch shown in 16 M position.*

(2) With the signal generator and receiver set to 1,500 kc, adjust antenna trimmer capacitor C2B (fig. 28) for maximum output indication on the output meter.

(3) With the signal generator and receiver set to 600 kc, rock the ganged tuning capacitor while adjusting C13 (fig. 30) for maximum output indication on the output meter.

(4) Repeat the operation described in (2) above.

*b. 4–8 Mc Band.*

(1) Connect the signal generator output lead to an antenna 3 feet long and place it at a distance of approximately 1 foot from extended whip antenna E1.

(2) With the signal generator and receiver set to 7.8 mc, adjust antenna trimmer capacitor C31A (fig. 31) for maximum output as indicated on the output meter.

(3) With the signal generator and receiver set to 4.2 mc, adjust antenna tuning coil L5 (fig. 31) for maximum output as indicated on the output meter.

(4) Repeat the operation described in (2) above.

*c. 2–4 Mc Band.* Adjust antenna trimmer capacitor C31B (fig. 31) at 3.9 mc and antenna tuning coil L6 at 2.1 mc, following the general procedure outlined in *b* above.

*d. 31 Meter Band.* Adjust antenna tuning coil L10 (fig. 31) at 9.6 mc, following the general procedure outlined in *b* above.

*e. 25 Meter Band.* Adjust antenna tuning coil L9 (fig. 31) at 11.8 mc, following the general procedure outlined in *b* above.

*f. 19 Meter Band.* Adjust antenna tuning coil L8 (fig. 31) at 15.2 mc, following the general procedure outlined in *b* above.

*g. 16 Meter Band.* Adjust antenna tuning coil L7 (fig. 31) at 17.8 mc, following the general procedure outlined in *b* above.

*h. Protective Cover.* Install protective cover A3 (fig. 4).

## 93. Alinement Chart

The alinement chart below is included as a reference guide. Specific alinement instructions are given in paragraphs 83 through 92.

| Oper | Connection | Input signal frequency (30 percent modulated at 400 cycles) | Band | Set dial at | Adjust | Purpose |
|---|---|---|---|---|---|---|
| 1 | Output lead of signal generator to converter grid through a .1-μf capacitor and ground lead to B-bus. | 455 kc | BC | 600 kc | T2 top and bottom.<br>T1 top and bottom. | I-f alinement. |
| 2 | Couple generator output lead to r-f grid (pin 6) of V1. | 1,500 kc | BC | 1,500 kc | C2F | Oscillator alinement. |
| 3 | | 1,500 kc | BC | 1,500 kc | C2D | R-f alinement. |
| 4 | | 600 kc | BC | 600 kc* | C13 | Oscillator padder alinement. |
| 5 | | Repeat operations 2, 3, and 4. | | | | |
| 6 | | Repeat operations 2 and 3. | | | | |

*Indicates adjustment that requires rocking of the ganged tuning capacitor.

| Oper | Connection | Input signal frequency (30 percent modulated at 400 cycles) | Band | Set dial at | Adjust | Purpose |
|---|---|---|---|---|---|---|
| 7 | Couple generator output lead through a 20-$\mu\mu$f capacitor to whip antenna tip jack. Connect ground lead to terminal post G. | 7.8 mc | 4–8 MC | 7.8 mc | C40A<br>C35A. | Oscillator and r-f alinement. |
| 8 | | 4.2 mc | 4–8 MC | 4.2 mc* | L18.<br>L12. | |
| 9 | | Repeat operations 7 and 8. | | | | |
| 10 | | Repeat operation 7. | | | | |
| 11 | | 3.9 mc | 2–4 MC | 3.9 mc | C40B.<br>C35B. | |
| 12 | | 2.1 mc | 2–4 MC | 2.1 mc* | L19.<br>L13. | |
| 13 | | Repeat operations 11 and 12. | | | | |
| 14 | | Repeat operation 11. | | | | |
| 15 | | 9.6 mc | 31 M | 9.6 mc | L23.<br>L17.* | |

| | | | | | |
|---|---|---|---|---|---|
| 16 | | 11.8 mc | 25 M | 11.8 mc | L22.<br>L16.* |
| 17 | | 15.2 mc | 19 M | 15.2 mc | L21.<br>L15.* |
| 18 | | 17.8 mc | 16 M | 17.8 mc | L20.<br>L14.* |

19 Replace chassis in cabinet. Reconnect whip antenna tip lead and insert loop antenna plug into loop antenna socket.

| | | | | | | |
|---|---|---|---|---|---|---|
| 20 | One turn loop coupled loosely to broadcast loop antenna. | 600 kc | BC | 600 kc.* | C13 | Alinement of BC loop antenna. |
| 21 | | 1,500 kc | BC | 1,500 kc | C2B | |
| 22 | Connect generator output lead to 3 feet of wire approximately 1 foot from whip antenna. | 7.8 mc<br>4.2 mc | 4–8 MC | 7.8 mc<br>4.2 mc. | C31A.<br>L5. | |
| 23 | | 3.9 mc<br>2.1 mc | 2–4 MC | 3.9 mc<br>2.1 mc | C31B<br>L6. | Alinement of antenna. |
| 24 | | 9.6 mc | 31 M | 9.6 mc | L10. | |
| 25 | | 11.8 mc | 25 M | 11.8 mc | L9. | |
| 26 | | 15.2 mc | 19 M | 15.2 mc | L8. | |
| 27 | | 17.8 | 16 M | 17.8 mc | L7. | |

*Indicates adjustment that requires rocking of the ganged tuning capacitor.

## Section IV. FINAL TESTING

### 94. General

*a.* This section is intended as a guide to be used in determining the quality of a repaired Radio Receiver R–520/URR. The minimum test requirements outlined in paragraphs 96 through 101 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

*b.* The receiver should be operated from both an external power line source and batteries. Allow the receiver to warm up for a few minutes and make all measurements with a line voltage of 117 volts ac.

### 95. Test Equipment Required for Final Testing

*a.* The equipment needed for testing the repaired receiver is listed in paragraph 62. In addition, a standard RMA test loop is required.

*b.* If an RMA test loop is not available, a suitable substitute may be fabricated as follows (fig. 37):

(1) Wrap 3 turns of No. 20 wire on a 7⅞-inch diameter form, spaced 3 turns per half inch.

(2) Solder a 450-ohm noninductive resistor in series with one side of the loop.

(3) Solder the center conductor of a 4-foot length of shielded cable to the free end of the 450-ohm resistor, and the outer conductor to the other side of the loop. (The capacitance of the shielded cable should be 30 $\mu\mu$f for the 4-foot length.)

### 96. Operation of Controls

A complete check of the operation of the receiver controls should be made in accordance with the equipment performance checklist (par. 41).

### 97. Sensitivity

The overall sensitivity of the receiver should correspond to the readings in paragraph 76.

### 98. Selectivity

Connect the shielded cable of the RMA test loop to the r-f signal generator (center conductor to the high side of the generator, outer conductor to the low side). Locate the test loop and the receiver loop 19¾ inches apart on centers, and parallel to each other. Under these conditions, the field intensity at the receiver loop in $\mu$v/M will be one-tenth the signal generator output voltage. Set the signal generator to 930 kc, modulated 30 percent at 400 cycles and connect a 3-ohm output meter (such as Output Meter TS–585/U) to headset jack J3. Adjust the signal level for 50 mw at the output of the

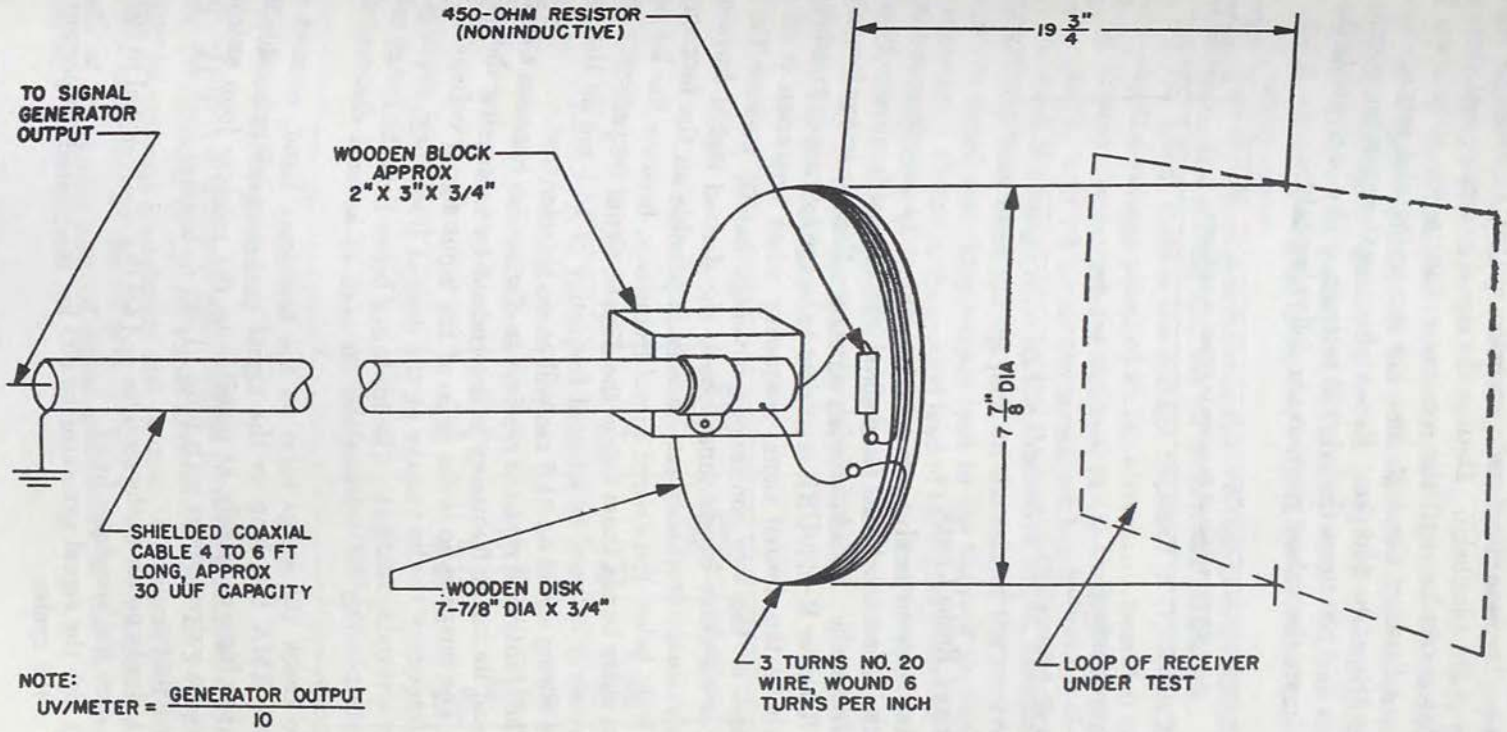


*Figure 37. RMA test loop setup.*

receiver. Increase the signal generator output to twice its original setting (6 db) (decibels). Detune the signal generator first above and then below 930 kc until the receiver output again is 50 mw. The difference between the high and low generator dial settings should be approximately 6.38 kc. Repeat for signal generator outputs of 10 times and 100 times the original settings. The bandwidths should approximate the values given in the following table:

| Ratio of input voltage off resonance to voltage at resonance | Average bandwidth (kc) |
|---|---|
| 1 (0–db) (reference) | 6.38 |
| 2 (6–db attenuation) | 15.32 |
| 10 (20–db attenuation) | 27.94 |
| 100 (40–db attenuation) | |

## 99. Image Ratio Check

*a.* Any superheterodyne receiver is subject to interference from a signal that is removed from the desired input signal frequency by twice the i-f frequency. This interfering signal is called the image frequency. Radio Receiver R–520/URR is subject to image frequency interference from above the desired signal frequency when operation is on the broadcast or the two continuous coverage bands, because the h-f oscillator on these bands tunes above the desired signal frequency. Similarly, image frequency interference is possible on the four spread bands from below the desired signal frequency, because the h-f oscillator on these bands tunes below the desired signal frequency. Thus, if the receiver is tuned to a signal frequency of 15.5 mc on the 19 M band, a strong signal on 14.5 mc will cause interference.

*b.* The ability of a repaired receiver to distinguish between a desired signal and its image frequency is determined by measuring the image ratio. The image ratio is the ratio of the input signal voltage at the image frequency to the voltage at the desired frequency, required to produce a standard output. The table in *d* below lists the image ratios and corresponding db attenuation for each of several different test frequencies.

*c.* To check the image ratio on the broadcast band, connect the standard RMA test loop to the signal generator output cable and couple the loop as closely as possible to the receiver loop antenna. Connect an output meter with Plug PL–55 to headset jack J3. Proceed as follows:

(1) Apply power to the receiver and set the receiver dial to 600 kc on the broadcast band.

(2) Set the signal generator to 600 kc, modulated 30 percent at 400 cycles.

(3) Adjust the signal generator output for 50 mw as read on the output meter.
(4) Note the signal generator output voltage as determined by the multiplier setting and the r-f level meter indication.
(5) Set the signal generator to the image frequency (1.51 mc), modulated 30 percent at 400 cycles.
(6) Readjust the signal generator output for 50 mw as read on the output meter.
(7) Note the signal generator output voltage as determined by the multiplier setting and the r-f level meter indication.
(8) The image ratio is the voltage obtained in (7) above divided by the voltage obtained in (4) above.
(9) Repeat the procedures outlined in (1) through (8) above for 930 kc and 1.5 kc on the broadcast band.

*d.* To check the image ratio on the shortwave bands, disconnect the whip antenna lead from the tip jack on the rear of the receiver, and couple the signal generator output lead to the tip jack through a 20-$\mu\mu$f capacitor. Connect the ground lead of the signal generator output cable to the receiver ground terminal. Connect an output meter with Plug PL–55 to headset jack J3. Measure the image ratios for each of the shortwave frequencies listed in the table below. Use a procedure similar to the one outlined in *c* above.

| Band | Signal frequency (mc) | Image frequency (mc) | Image ratio | db |
|---|---|---|---|---|
| BC | 0. 6 | 1. 51 | 5, 000 | 74 |
| BC | . 930 | 1. 84 | 1, 000 | 60 |
| BC | 1. 5 | 2. 41 | 300 | 49 |
| 2–4 MC | 2. 1 | 3. 01 | 400 | 52 |
| 2–4 MC | 3. 9 | 4. 81 | 55 | 35 |
| 4–8 MC | 4. 2 | 5. 11 | 350 | 50 |
| 4–8 MC | 7. 8 | 8. 71 | 30 | 30 |
| 31 M | 9. 6 | 8. 69 | 25 | 28 |
| 25 M | 11. 8 | 10. 89 | 15 | 24 |
| 19 M | 15. 2 | 14. 29 | 10 | 20 |
| 16 M | 17. 8 | 16. 89 | 5 | 14 |

## 100. Audio Response

*a.* Connect a standard audio signal generator such as Audio Oscillator TS–382A/U to the r-f signal generator. Set the r-f signal generator to external modulation and connect the output lead through a 0.05-$\mu$f capacitor to the r-f grid (pin 6) of V1. Connect the ground leads of the audio and r-f signal generators to the B— line of the receiver.



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*b.* Facing the front of the receiver, set the TREBLE, VOICE, and BASS tone control buttons to the right hand and the ALTO button to the left.

*c.* Set the receiver and the r-f signal generator to 930 kc. Set the audio signal generator to 400 cycles and adjust the output level for 30-percent modulation. Vary the modulating frequency from the audio signal generator. The audio response should be within the limits given in the following table (0 db is the reference point at 400 cycles):

| Audio response | Frequency (cps) |
|---|---|
| 0 db (reference) | 400 |
| +1.0 db to −4 db | 100 |
| −6.0 db to −23.0 db | 3,500 |

## 101. Avc and Power Output

*a.* Set the r-f signal generator and receiver to 930 kc and connect the output cable of the generator through a 0.05-$\mu$f capacitor to the r-f grid (pin 6) of V1. Modulate the r-f signal generator 30 percent with a 400-cycle audio signal, and connect the ground lead of the generator output cable to the B— line of the receiver. With a 3-ohm output meter connected to headset jack J3 the outputs should be within the limits given in the following table.

| Input | Output (mw) |
|---|---|
| 50 $\mu$v | 220 to 350 |
| 0.1 volt | 290 to 370 |

*b.* If the output is below the values in the table, the audio may be weak or r-f overloading may be occurring. Check the i-f and r-f tubes and capacitors associated with the avc circuit.

# CHAPTER 6

# SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

## Section I. SHIPMENT AND LIMITED STORAGE

### 102. General

Since the circumstances involved in shipment and storage vary, no definite procedure for repacking can be given. The exact procedure depends on the material available and the conditions under which the equipment is to be stored or shipped. If available, use the carton in which the unit was packed originally.

### 103. Repacking for Shipment or Limited Storage

*a.* Be sure the whip antenna is collapsed and locked in position.

*b.* If a headset is used, box or package it in a separate carton.

*c.* Roll up the power line cord and tuck it in the receiver near the speaker so that it will clear the rear cover of the cabinet when closed.

*d.* Insert the plug in power changeover switch socket S4 on the top of the chassis to prevent the plug from causing damage to the interior of the receiver during shipment.

*e.* Remove all batteries but do not remove battery case E23.

*f.* Place the red harness, W4, and the black harness, W6, in the cloth bag and stow the bag in the battery compartment of the receiver.

*g.* Be sure the four adapter plugs are in place on the bracket underneath the receiver case top panel.

*h.* Whenever practicable, place a dehydrating agent, such as silica gel, inside the receiver.

*i.* Wrap the unit in corrugated paper and protect each package with a waterproof barrier. Seal the seams of the paper barrier with a waterproof sealing compound or tape.

*j.* Pack the protected components in a wooden case, providing at least 3 inches of excelsior padding or other similar material between the paper barrier and the packing case.

## Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

### 104. General

The demolition procedures outlined in paragraph 105 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

## 105. Methods of Destruction

*a. Smash.* Smash the controls, tubes, switches, capacitors, and transformers; use sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

*b. Cut.* Cut internal and external wires and cables; use axes, handaxes, or machetes.

*c. Burn.* Burn cords, resistors, capacitors, wiring, and instruction books; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

*d. Bend.* Bend panels and chassis.

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

*f. Dispose.* Bury or scatter the destroyed parts in slit trenches, foxholes, or other holes, or throw them into streams.

*g. Destroy.* Destroy everything.

# APPENDIX I

# REFERENCES

*Note.* For availability of items listed, check SR 310–20–3, SR 310–20–4, and SR 310–20–5. Check SR 310–20–21 for Signal Corps Supply Manuals.

## 1. Army Regulations

| | |
|---|---|
| AR 380–5 | Military Security—Safeguarding Security Information. |
| AR 750–5 | Maintenance of Supplies and Equipment, Maintenance Responsibilities and Shop Operation. |

## 2. Supply

| | |
|---|---|
| SB 11–6 | Dry Battery Supply Data. |
| SR 725–405–5 | Preparation and Submission of Requisitions for Signal Corps Supplies. |
| SB 11–100 | Serviceability Standards for Signal Equipment in Hands of Troops. |

## 3. Test Equipment

| | |
|---|---|
| TM 11–300 | Frequency Meter Sets SCR–211–A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL, and AN. |
| TM 11–307 | Signal Generators I–72–G, H, J, K, and L. |
| TM 11–2627 | Tube Tester I–177 and I–177–A. |
| TM 11–2684A | Audio Oscillator TS–382A/U. |
| TM 11–5017 | Output Meters TS–585A/U and TS–585B/U. |
| TM 11–5500 | Multimeter TS–297/U. |
| TM 11–5511 | Electronic Multimeter TS–505/U. |
| TM 11–5527 | Multimeter TS–352/U. |
| TM 11–5551 | Instruction Book for RF Signal Generator Set AN/URM–25. |

## 4. Painting, Preserving, and Lubrication

| | |
|---|---|
| TB SIG 13 | Moistureproofing and Fungiproofing Signal Corps Equipment. |
| TB SIG 69 | Lubrication of Ground Signal Equipment. |
| TM 9–2851 | Painting Instructions for Field Use. |

## 5. Camouflage, Decontamination and Demolition

FM 5–20 ..... Camouflage, Basic Principles.
FM 5–25 ..... Explosives and Demolitions.
TM 3–220 ..... Decontamination.

## 6. Other Publications

FM 24–18 ..... Field Radio Techniques.
FM 72–20 ..... Jungle Warfare.
SR 310–20–3 ..... Index of Training Publications.
SR 310–20–4 ..... Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SR 310–20–5 ..... Index of Administrative Publications.
SR 310–20–7 ..... Index of Tables of Organization and Equipment, Reduction Tables, Tables of Organization, Tables of Equipment, Type Tables of Distribution, and Tables of Allowances.
SR 700–45–5 ..... Supplies and Equipment—Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247 (R1)).
AFR 65–26 .....
SR 745–45–5 ..... Shipment of Supplies and Equipment—Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), S and A–70–6 (Navy), and AF–MC–U2 (Air Force)).
Navy Shipping Guide, Article 1850–4.
AFR 71–4 .....
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 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.
TM 9–2857 ..... Storage Batteries, Lead-Acid Type.
TM 11–415 ..... Dry Batteries.
TM 11–430 ..... Batteries for Signal Communication, Except Those Pertaining to Aircraft.
TM 11–455 ..... Radio Fundamentals.
TM 11–466 ..... Radar Electronic Fundamentals.
TM 11–483 ..... Suppression of Radio Noises.

TM 11–496..... Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets.
TM 11–661..... Electrical Fundamentals (Direct Current).
TM 11–665..... C-w and A-m Radio Transmitters and Receivers.
TM 11–681..... Electrical Fundamentals (Alternating Current).
TM 11–4000..... Troubleshooting and Repair of Radio Equipment.

# APPENDIX II

# IDENTIFICATION OF REPLACEABLE PARTS

## 1. General

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/E, T/A, T/BA, SIG 6, SIG 7 & 8, SIG 7–8–10, SIG 10, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Manual applicable to the equipment covered in this manual is SIG 7 & 8–R–520/URR. For an index of available supply manuals in the Signal portion of the Department of the Army Supply Manual, see SR 310–20–21.

## 2. Identification Table of Parts for Radio Receiver R–520/URR

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | RADIO RECEIVER R–520/URR: A3 reception 540 to 18,200 kc range; 7 bands; 117/230 v, dc and 60 cyc, single ph; 10/20 w ac; 117/230 v, 65 ma; or battery operated; 6 ea A, 3 ea B; A battery 1.5 v, B battery 90 v; 17 5/16" lg x 11 1/16" h x 7 31/32" d o/a. | Receives a-m signals | 2C4180–520. |
| | TECHNICAL MANUAL TM 11–877 | | Order through AGC |
| Z1 | ADAPTER, power supply: steel case; female socket mtd; 1⅜ sq x 4¼" lg o/a; Zenith part/dwg #SG–6615. | Adapts receiver for 220-volt a-c or d-c operation. | 3H5Z. |
| E1 | ANTENNA: whip type; telescopic; 1 element, 8 sect.; 2-18 mc freq range; 725 ohms at .10 mc; 60½" extended; 9 15/16" collapsed; Ward Prod Corp part #G–SPP–208. | Receiving antenna, 2 to 18 mc | 2A288B–21. |
| E2 | ANTENNA: array type; 1 element; fixed type; 540–1600 kc freq range; 12" lg x 5" wd; Zenith part/dwg #SG6624. | Receiving antenna, broadcast band | 2A288B–22. |

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| A7 | *BRACKET, fastener: steel; cad pl; 1″ lg x 9/32″ h; Amer Cabt Hdwe part #3675A.* | Fastener for back door latch | 2Z1244–321. |
| *O52 through O57* | *BUSHING, mounting: steel; cad pl; fl 3/8″ dia x 1/32″ thk; shank 1/95″ dia x 7/32″ lg, .145″ dia hole; Cinch part #8359.* | *O52 through O54: Tuning capacitor mounting bushings.*<br>*O55 through O57: Speaker mounting bushings.* | 2Z1409–335. |
| C8 | CAPACITOR, fixed: ceramic dielectric; 1.2 μμf ±20%; 500 vdcw; .295″ lg x .160″ dia; Quality Components type QC–1.2. | Mixer neutralizing capacitor | 3D9001E2. |
| C15 | CAPACITOR, fixed: ceramic dielectric; 10 μμf ±1%; 500 vdcw; JAN type CC21SL100F. | Oscillator temperature compensating capacitor. | 3D9010–105. |
| C28 | CAPACITOR, fixed: ceramic dielectric; 15 μμf ±10%; 500 vdcw; JAN type CC21SL150K. | External antenna shortwave coupling capacitor. | 3D9015–62. |
| C33 | CAPACITOR, fixed: ceramic dielectric; 24 μμf ±5%; 500 vdcw; JAN type CC21CH240J. | R-f grid series band-spread capacitor for the 31, 25, 19, and 16 M bands. | 3D9024–65. |
| C6 | CAPACITOR, fixed: mica dielectric; 47 μμf ±10%; 500 vdcw; JAN type CM20B470K. | R-f amplifier to converter coupling capacitor. | 3K2047021. |
| C23, C32 | CAPACITOR, fixed: ceramic dielectric; 51 μμf ±10%; 500 vdcw; JAN type CC26SH510K. | C23: First audio plate r-f bypass capacitor.<br>C32: R-f grid shunt band-spread capacitor for the 31, 25, 19, and 16 M bands. | 3D9051–33. |
| C14 | CAPACITOR, fixed: ceramic dielectric; 120 μμf ±5%; 500 vdcw; durez coated; 1.180″ lg x .320″ dia; Erie type #333NPO ±60. | Oscillator grid coupling capacitor | 3D9120–54. |
| C38 | CAPACITOR, fixed: ceramic dielectric; 120 μμf ±5%; 500 vdcw; durez coated; .560″ lg x .320″ dia; Erie type #337N330 ±60. | Oscillator spread band range limiting capacitor. | 3D9120–55. |
| C12 | CAPACITOR, fixed: ceramic dielectric; 240 μμf ±5%; 500 vdcw; JAN type CC32UJ241J. | Oscillator grid coupling capacitor | 3D9240–22. |
| C30 | CAPACITOR, fixed: mica dielectric; 270 μμf ±10%; 500 vdcw; JAN type CM20B271K. | R-f amplifier grid coupling capacitor | 3K2027121. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
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| C27, C37 | CAPACITOR, fixed: mica dielectric; 470 $\mu\mu$f $\pm$10%; 500 vdcw; JAN type CM20B471K. | C27: Whip antenna coupling capacitor.<br>C37: Oscillator anode coupling capacitor for 2–4 MC and 4–8 MC bands. | 3K2047121. |
| C7 | CAPACITOR, fixed: mica dielectric; 1000 $\mu\mu$f $\pm$10%; 500 vdcw; JAN type CM30B102K. | Converter mixer grid coupling capacitor. | 3K3010221. |
| C36, C47 | CAPACITOR, fixed: paper dielectric; 1000 $\mu\mu$f $\pm$20%; 800 vdcw; JAN type CN301E102M. | C36: Converter mixer grid bandspread coupling capacitor.<br>C47: Treble tone control capacitor. | 3DA1–283. |
| C41 | CAPACITOR, fixed: mica dielectric; 2700 $\mu\mu$f $\pm$5%; 500 vdcw; JAN type CM30D272J. | Oscillator series padder capacitor for 2–4 MC band. | 3K3027242. |
| C39 | CAPACITOR, fixed: mica dielectric; 3000 $\mu\mu$f $\pm$5%; 500 vdcw; JAN type CM30B302J. | Oscillator series padder capacitor for 4–8 MC band. | 3K3030222. |
| C18 | CAPACITOR, fixed: paper dielectric; 3000 $\mu\mu$f $\pm$20%; 400 vdcw; JAN type CN22E302M. | I-f amplifier screen grid bypass capacitor. | 3DA3–154. |
| C1 | CAPACITOR, fixed: ceramic dielectric; 4000 $\mu\mu$f +50% −10%; 500 vdcw; ¾'' dia x 5/16'' thk; Sprague part #36C25A1. | External ground connection isolating capacitor. | 3DA4–114. |
| C3 | CAPACITOR, fixed: paper dielectric; 10,000 $\mu\mu$f $\pm$10%; 400 vdcw; JAN type CN41E103K. | External antenna loading capacitor | 3DA10–619. |
| C5, C11, C21, C24, C34. | CAPACITOR, fixed: ceramic dielectric; 10,000 $\mu\mu$f −20% +10%; 500 vdcw; ¾'' dia x 5/16'' thk; Sprague part #36C1B9. | C5: R-f amplifier filament bypass capacitor.<br>C11: Converter screen grid bypass capacitor.<br>C21: Detector-amplifier grid coupling capacitor. | 3DA10–618. |

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| | | C24: Audio output grid coupling capacitor.<br>C34: R-f amplifier plate load r-f bypass capacitor. | |
| C43 | CAPACITOR, fixed: paper dielectric; 10,000 μμf ±20%; 400 vdcw; JAN type CN41E103M. | Converter avc filter capacitor | 3DA10–441. |
| C26 | CAPACITOR, fixed: paper dielectric; 10,000 μμf ±20%; 600 vdcw; JAN type CN42E103M. | Audio output noise bypass capacitor | 3DA10–620. |
| C44, C48, C49 | CAPACITOR, fixed: paper dielectric; 20,000 μμf ±20%; 300 vdcw; JAN type CN35E203M. | C44: I-f amplifier avc filter capacitor.<br>C48: Bass tone control capacitor.<br>C49: Voice tone control capacitor. | 3DA20–192. |
| C22 | CAPACITOR, fixed: paper dielectric; single sect.; 20,000 μμf ±20%; 600 vdcw; JAN type CN42E203M. | Detector-amplifier screen bypass capacitor. | 3DA20–210. |
| C46 | CAPACITOR, fixed: paper dielectric; 47,000 μμf ±20%; 600 vdcw; 1 1/16" lg x .400" dia; Sprague part #81P47306S3. | Power line bypass capacitor | 3DA47–27. |
| C4 | CAPACITOR, fixed: paper dielectric; 50,000 μμf ±20%; 300 vdcw; JAN type CN42E503M. | R-f amplifier avc filter capacitor | 3DA50–364. |
| C10, C29 | CAPACITOR, fixed: paper dielectric; 50,000 μμf ±20%; 400 vdcw; JAN type CN43E503M. | C10: R-f amplifier grid circuit bypass capacitor.<br>C29: B— to chassis bypass capacitor. | 3DA50–304. |
| C9 | CAPACITOR, fixed: paper dielectric; 100,000 μμf ±20%; 400 vdcw; JAN type CN3E104M. | Filament circuit bypass capacitor | 3DA100–838. |
| C25 | CAPACITOR, fixed: electrolytic; single sect.; 12 μf; 150 vdcw; 2" lg x 5/8" dia; Sprague part #D4558. | Low B+ filter capacitor | 3DB12–48. |
| C45A, C45B, C45C, C45D. | CAPACITOR, fixed: electrolytic; 4 sect.; sect. #1, 60 μf 150 vdcw; sect. #2, 40 μf 150 vdcw; sect. #3, 20 μf 150 vdcw; sect. #4, 200 μf 10 vdcw; 3 1/8" lg x 1 3/8" dia; Sprague part #D4566. | C45A: B+ supply input filter capacitor.<br>C45B and C45D: Filament supply filter capacitors.<br>C45C: B+ supply output filter capacitor. | 3DB200–24. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
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| C40A, C40B---- | CAPACITOR, variable: mica dielectric; compression type; 2 sect.; sect. #1, 30 $\mu\mu$f; sect. #2, 55 $\mu\mu$f; 3/4" lg x 23/32" wd x 3/8" h o/a; Zenith part/dwg #22G3491. | C40A: Oscillator trimmer capacitor for 4–8 MC band.<br>C40B: Oscillator trimmer capacitor for 2–4 MC band. | 3D9055V–21. |
| C35A, C35B---- | CAPACITOR, variable: mica dielectric; compression type; 2 sect.; 55 $\mu\mu$f ea sect.; 3/4" lg x 23/32" wd x 3/8" h o/a; Electro Motive part #DP56208RCVA. | C35A: R-f trimmer capacitor for 4–8 MC band.<br>C35B: R-f trimmer capacitor for 2–4 MC band. | 3D9055V–20. |
| C31A, C31B---- | CAPACITOR, variable: mica dielectric; compression type; 2 sect.; 75 $\mu\mu$f ea; sect.; 3/4" lg x 23/32" wd x 3/8" h o/a; Zenith part/dwg #22G3467. | C31A: Antenna trimmer capacitor for MC band.<br>C31B: Antenna trimmer capacitor for 2–4 MC band. | 3D9075V–49. |
| C13---------- | CAPACITOR, variable: mica dielectric; compression type; 200 to 750 $\mu\mu$f; 250 vacw; 25/32" lg x 5/8" wd x 9/16" h approx; Zenith part/dwg #22G3490. | Broadcast oscillator padder capacitor. | 3D9750V–5. |
| C2A, C2B, C2C, C2D, C2E, C2F. | CAPACITOR, variable: air dielectric; plate meshing type; 3 sect.; 15 $\mu\mu$f min, 444.7 $\mu\mu$f max; 3 3/16" lg x 2 3/16" wd x 2 1/8" h excluding term. bushing; RCC type #325. | C2A: Main tuning capacitor, r-f amplifier grid tuning.<br>C2B: Main tuning capacitor, r-f amplifier grid trimmer.<br>C2C: Main tuning capacitor, converter mixer grid tuning.<br>C2D: Main tuning capacitor, converter mixer grid trimmer.<br>C2E: Main tuning capacitor, oscillator tuning.<br>C2F: Main tuning capacitor, oscillator trimmer. | 3D9444VE7. |

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| O 68 | CATCH, fastener: door; gold finish; 3 5/8" lg x 1/2" wd x 11/32" d o/a; Zenith part/dwg #156G3002. | Front cover fastener | 6Z1747–65. |
| A 1 | CLAMP, electrical: for material 3/4" dia; 2" lg x 1 3/8" wd x 3/4" h o/a; Zenith part/dwg #17G3026. | Whip antenna mounting clamp | 2Z2642. 830. |
| A 2 | CLAMP, electrical: for material 3/4" dia; 2" lg x 1 5/16" wd x 3/4" h o/a; Zenith part/dwg #12G3114. | Whip antenna mounting clamp | 2Z2642. 829. |
| O 50 | CLAMP, electrical: pilot light wire leads; for material 1/8" dia; 1/2" lg x 11/32" wd x 9/36" h o/a; Cinch part #1065P24–3. | Pilot light wire clamp | 2Z2642. 831. |
| TB5 | CLIP ASSEMBLY, electrical: 2 clips mtd on phenolic board; 2 1/16" lg x 3/4" dia x 17/32" h o/a; Zenith part/dwg #83G3146. | Holds alinement wrench O 14 | 2Z2714–4. |
| O 60 | CLIP ASSEMBLY, electrical: 5 clips mtd on brass bracket; 5 13/16" lg x 5/8" wd x 13/16" h o/a; Zenith part/dwg #SG6632. | Holder for spare tubes | 2Z2714–3. |
| O 1 | CLIP, electrical: beryllium copper; 3" lg x 3/4" wd; Zenith part/dwg #19G3023. | Holder for loop extension cable and suction cups. | 2Z2712.368. |
| O 2 | CLIP, electrical: beryllium copper; 2 9/16" lg x 1/2" wd x .0226" thk; Zenith part/dwg #19G3024. | Holder for spare fuse box | 2Z2712.369. |
| O 18 through O 35. | CLIP, electrical: steel; 27/64" lg x 23/64" wd x .093" h; Tinnerman type #C3918–012–157. | Coil retaining clips | 2Z2712.365. |
| O 36, O 37 | CLIP, electrical: steel; .450" lg x .405" wd x 17/64" h; Kast Prod Co part #K110. | Coil retaining clips | 2Z2712.366. |
| O 38 | CLIP, electrical: for mtg capacitor; steel; 21/32" ID x 21/32" wd x 3/4" h o/a; 1 1/16" max jaw opening; Prestole Corp part #500–625. | Capacitor retaining clip | 2Z2712.88. |
| O 58 | CLIP, electrical: bronze, nickel pl; .790" wd x 27/32" lg x 19/32" h o/a; 3/4" max jaw opening; Prestole Corp part 500–750. | Holder for spare thermal resistor | 2Z2712.248. |
| O 59 | CLIP, electrical: steel; zinc pl; 15/32" lg x 13/32" wd x 3/8" dia; 7/16" max jaw opening; Prestole Corp part #500–375. | Holder for spare neon glow lamp | 2Z2712.324. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
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| L 11 | COIL, RF: rf shunt; single wdg, 2 pie universal wnd; unshielded; ½'' lg x ½'' dia; Zenith part/dwg #20G3014. | Converter mixer grid load on 31, 25, 19, and 16 M bands. | 3C1084D–9. |
| L4 | COIL, RF: ant.; single wdg, universal wnd; unshielded; untapped; 13/64'' lg x 37/64'' dia Zenith part/dwg #20G3016. | Antenna loading coil for broadcast band. | 3C1084D–10. |
| L7 | COIL, RF: ant.; single wdg universal wnd; unshielded; 17.8 mc; 7/64'' lg x 21/64'' dia; Zenith part/dwg #SG6534. | Antenna coil for 16 M band | 3C1084D–11. |
| L8 | COIL, RF: ant.; single wdg, universal wnd; unshielded; 15.2 mc; ⅛'' lg x 11/32'' dia; Zenith part/dwg #SG6535. | Antenna coil for 19 M band | 3C1084D–12. |
| L9 | COIL, RF: ant.; single wdg, universal wnd; unshielded; 11.8 mc; untapped; ⅛'' lg x 11/32'' dia; Zenith part/dwg #SG6536. | Antenna coil for 25 M band | 3C1084D–13. |
| L5 | COIL, RF: ant.; single wdg, spaced solenoid wnd; unshielded 4–8 mc; untapped; 29/64'' lg x 7/16'' dia; Zenith part/dwg #SG6546. | Antenna coil for 4–8 mc band | 3C1084D–14. |
| L17 | COIL, RF: single wdg, universal wnd; unshielded, 9.6 mc; 3/16'' lg x 13/32'' dia; Zenith part/dwg #SG6533. | R-f coil for 31 M band | 3C1084D–15. |
| L16 | COIL, RF: single wdg, universal wnd; unshielded; 11.8 mc; 3/16'' lg x ⅜'' dia; Zenith part/dwg #SG6532. | R-f coil for 25 M band | 3C1084D–16. |
| L6, L13 | COIL, RF: ant.; single wdg, single solenoid wnd; unshielded 2–4 mc; 9/16'' lg x 13/32'' dia; Zenith part/dwg #SG6538. | L6: Antenna coil for 2–4 MC band<br>L13: R-f coil for 2–4 MC band | 3C1084D–17. |
| L15 | COIL, RF: single wdg, single layer wnd; unshielded; 15.2 mc untapped; 9/64'' lg x ⅜'' dia; Zenith part/dwg #SG6531. | R-f coil for 19 M band | 3C1084D–18. |
| L14 | COIL, RF: single wdg, universal wnd; unshielded; 17.8 mc; untapped; ⅛'' lg x 11/32'' dia; Zenith part/dwg #SG6530. | R-f coil for 16 M band | 3C1084D–19. |

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| L12 | COIL, RF: single wdg, spaced solenoid wnd; unshielded; 4–8 mc; untapped; 2 9/64" lg x 7/16" dia; Zenith part/dwg #SG6539. | R-f coil for 4–8 MC band | 3C1084D–20. |
| L10 | COIL, RF: ant.; single wdg, universal wnd; unshielded; 9.6 mc; untapped; 5/32" lg x 3/8" dia; part/dwg #SG6537. | Antenna coil for 31 M band | 3C1084D–21. |
| L3 | COIL, RF: choke; single wdg, close solenoid wnd; unshielded; untapped; 5/8" lg x 9/32" dia; Zenith part/dwg #20G3015. | Oscillator grid r-f choke | 3C339–27. |
| L20 | COIL, RF: osc; single wdg, universal wnd; unshielded; 9.6 mc; 3/16" lg x 13/32" dia; Zenith part/dwg #SG6533. | Oscillator coil for 16 M band | 3C1081–7B. |
| L21 | COIL, RF: osc; single wdg, solenoid wnd; unshielded; 15.2 mc; untapped; 1/8" lg x 9/32" dia; Zenith part/dwg #SG6541. | Oscillator coil for 19 M band | 3C1081–7C. |
| L22 | COIL, RF: osc; single wdg, universal wnd; unshielded; 11.8 mc; untapped; 9/64" lg x 11/32" dia; Zenith part/dwg #SG6542. | Oscillator coil for 25 M band | 3C1081–7D. |
| L23 | COIL, RF: osc; single wdg, universal wnd; unshielded; 9.6 mc; untapped; 3/16" lg x 23/64" dia; Zenith part/dwg #SG6543. | Oscillator coil for 31 M band | 3C1081–7E. |
| P15 | CONNECTOR, adapter: male 1 end, female other end; 2 split round male cont (continental type prongs); straight type; 1 21/32" lg x 1 3/8" dia o/a; Wood Elec part #2064. | Adapts line plug to foreign receptacle | 2Z303–2. |
| P16 | CONNECTOR, adapter: male 1 end female other end; 2 split male cont (English type prongs); straight type; 1 17/32" lg x 1 3/8" dia o/a; Wood Elec part #2073. | Adapts line plug to foreign receptacle | 2Z303–1. |
| P17 | CONNECTOR, ADAPTER: female American 1 end, Ediswan male cont other end; 1 1/8" dia x 7/8" o/a; Wood Elec part #2089. | Adapts line plug to foreign receptacle | 6Z111. |
| P1, P8 | CONNECTOR, plug: 3 round pol male cont; straight type 1" lg x 7/32" wd x 1/2" d o/a; Alcon Metal Prod part #18–1011. | P1: Loop antenna plug<br>P8: Loop antenna extension cable plug. | 2Z3023–106. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
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| P5 | CONNECTOR, plug: 4 round pol male cont; straight type; ½" lg x 1" dia o/a; u/w cable W4; Zenith part/dwg #58G3014. | Battery connector plug | 2Z3024–119 |
| P11, P12, P13 | CONNECTOR, plug: 7 round male cont; straight type; ½" lg x ⅝" dia; Cinch type 54B11731. | Battery connector plugs | 2Z3027–52. |
| P3, P6, P7 | CONNECTOR, plug: 8 round male cont; straight type; .656" lg x 61/64" dia; Cinch part #54B17722. | Battery connector plugs | 2Z3028–88. |
| P4 | CONNECTOR, plug: 8 round male cont; straight type; .656" lg x 61/64" dia o/a; Cinch part #54B17723. | Battery connector plug | 2Z3028–89. |
| P9 | CONNECTOR, plug: 2 flat male cont; straight; Y shape; 1⅛" lg x 9/16" wd x 1 7/16" h excluding term.; u/w cable W2; Snap-It Elec Devices per Zenith part/dwg #58G3022. | A-c line plug | 2Z3022–194. |
| J2 | CONNECTOR, receptacle: 2 round pol female cont; straight type; 1 7/16" lg x 1" wd x ¾" d excluding cont; Zenith part/dwg #78G3022. | Connector for power supply adapter Z1. | 2Z3056–13. |
| P2 | CONNECTOR, receptacle: 2 round pol male cont; straight type; 15/16" lg x 1 1/16" wd x 1/16" thk excluding cont; Zenith part/dwg #58G3012. | Male base plug on power supply adapter Z1. | 2Z3022–187 |
| J1 | CONNECTOR, receptacle: 3 round female cont; straight type; 1½" lg x ½" wd x 7/64" thk excluding cont; Zenith part/dwg #78G3024. | Receptacle for loop antenna extension cable. | 2Z3064–158. |
| A3 | COVER ASSEMBLY, protective: for electrical components in tuning sect.; aluminum; 7⅝" lg x 4 15/16" wd x 3⅝" dia o/a; Zenith part/dwg #SG6625. | Protective cover for r-f tuning assembly. | 2Z3351–529. |
| N1 | COVER, dial: polystyrene; 16⅛" lg x 7½" wd x 1 13/32" d o/a; depressed lettering on 7 band indicator button openings; Zenith part/dwg #57G3132. | Decorative cover for dial | 2Z3351–527. |

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| E24 | COVER, battery box: retains batteries in case; brass; 1⅛″ lg x 1 7/16″ dia; Zenith part/dwg #SG6942. | Battery retainer for Batteries BA–30/U. | 2Z3351–575. |
| N2 | COVER, electrical switch: voltage designation plate; aluminum; marked, top to bottom 110V. AC-DC., 220V, D. C., 220V. A. C.; 1 3/16″ lg x 1 3/32″ wd x .022″ thk o/a; Zenith part/dwg #57G3138. | Voltage designation plate | 2Z3351–528. |
| O15, O16 | CUP, suction: to allow distant mtg of loop ant.; rubber; 1″ dia tapered to 7/32″ dia; Zenith part/dwg #SG6619. | Suction cups for remote loop mounting. | 2Z3590–8. |
| O64 | DIAL CORD AND EYELET ASSEMBLY: tuning gang capacitor; nylon, blk; 13″ lg w/two #934 American brass eyelets; Zenith part/dwg #SG6616. | Tuning capacitor drive device | 2Z3765–21. |
| O65 | DIAL CORD AND EYELET ASSEMBLY: used to rotate dial pointer; nylon; 16″ lg w/two #934 American brass eyelets; Zenith part/dwg #SG6617. | Dial drive device | 2Z3765–20. |
| A4 | DIAL, scale: indicator of freq; 8 5/16″ lg x 5 5/16″ wd; Zenith part/dwg #26G3004. | Frequency dial scale | 2Z3723–432. |
| O12, O13 | FASTENER, snap: for loop ant.; brass nickel pl; ⅛″ dia hole; 9/64″ h x 27/64″ dia o/a; United Carr part #B–S–12302. | Electrical connectors for remote loop operation. | 6Z3810–4.8. |
| F1 | FUSE, cartridge: 3/16 amp 250 v; 1¼″ lg x ¼″ dia; Littelfuse type #3AG. | Receiver protection | 3Z2592–1. |
| E11 | FUSEHOLDER: extractor post type; for single 3AG fuse; 2.219″ lg x .719″ dia o/a; Littelfuse type #34005–45. | Holds fuse | 3Z3282–11.22. |
| O44 through O49 | GROMMET: rubber; blk; round; ½″ OD x 3/16″ ID x ¼″ thk; Reliable Rubber type #8051. | O44 through O46: Tuning capacitor shock mounting. O47 through O49: Speaker shock mounting. | 6Z4911E. |
| O42, O43 | GROMMET: nylon-molded; blk; 2 piece circular shape; .468″ dia x .375″ lg o/a; Heyman Mfg Co part #3–P–HYCO. | A-c line cord strain relief | 6Z4865–4. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
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| O69 | HANDLE, cabinet: polystyrene; brown: U shape; 5" lg x 2 7/16" h x 3/4" d o/a; Beco Plastics Co part #1000. | Cabinet carrying handle | 6Z5042–3. |
| E23 | HOLDER, battery: accom six 1½ v dry batteries; bakelite; 15 1/16" lg x 1 15/32" dia o/a; Zenith part/dwg SG6943. | Battery holder for Batteries BA–30/U. | 3D2190–10. |
| O39 | INDICATOR, frequency channel: mechanically operated; pointer w/disk; friction mtd; split hub 7/16" lg x .251" ID; 4" lg x 1 5/16" dia x 1 9/32" h o/a; J H Winn part #3441. | Dial pointer | 2C1582–30. |
| J4 | INSERT, electrical connector: connects rcvr for battery use; 4 round female cont; round phenolic; 1 5/16" dia x 7/16" d o/a; Zenith part/dwg #78G3025. | Connector for battery cable | 2Z5400–77. |
| E3, E4 | INSULATION, sleeving electrical: rigid; vinylite; 1 9/32" ID x 5/64" wall thk x 3/8" lg; Zenith part/dwg #199G3027. | Base insulation for whip antenna | 3G2253–1.2. |
| E12, E13 | INSULATOR, bushing: round shank; phenolic; natural; ½" dia x .035" x .172" x .281" o/a; Zenith part/dwg #93G3105. | Insulate resistor in power supply adapter Z1. | 3G100–305. |
| E21 | INSULATOR, bushing: round shank; phenolic; brown; 3/32" lg x 5/8" dia; 25/64" dia mtg hole; Switchcraft Inc part #M–108. | Insulating washer for headset jack | 3G100–306. |
| E10 | INSULATOR, plate: bakelite; round diamond shape; 2 3/16" lg x 1 17/32" wd x 1/16" thk; Zenith part/dwg #78G3021. | Insulator for electrolytic capacitor C45. | 3G320–367. |
| J3 | JACK, telephone: for 2 cond plug; JAN type JJ–034 | Headset jack | 2Z5598A–89. |
| O3, O4 | KNOB: round tentite brown; for ¼" dia shaft; w/o markings; w/5/8" dia gold disk; 15/16" lg x 15/16" dia; Zenith part/dwg #46G3013. | O3: Tuning knob<br>O4: Volume control knob. | 2Z5822–797. |
| O5 through O11 | KNOB: rect; brown; for ¼" dia shaft; w/o markings; 13/16" lg x 17/32" wd x 13/16" h; Zenith part/dwg #46G3012. | Band selector knobs | 2Z5822–798 |

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|---|---|---|---|
| I 1 | LAMP, glow: 105–120 v, 1/25 w, .003 amp; miniature bayonet base; 1 5/8" h o/a; GE type #NE–51. | On-off indicator | 2Z5888–5. |
| A 6 | LATCH, fastener: back door latch; steel; cad pl; 1 3/8" lg x 1" wd o/a; Amer Cabt Hdwe part #3675. | Back door latch | 6Z6917–10. |
| O 67 | LATCH, fastener: door fastener; gold finish; 4" lg x 1 17/32" wd x 1 1/32" d; Zenith part/dwg #156G3001. | Door fastener | 6Z6917–11. |
| X11 | LIGHT, panel: for miniature bayonet base; 1" lg x 29/64" dia; Zenith part/dwg #78G3026. | Socket and bracket for glow lamp | 2Z5991–327. |
| LS1 | LOUDSPEAKER, dynamic: 5 1/4" dia cone; PM field; Zenith part/dwg #SG6612. | Loudspeaker | 6C43–190. |
| H1 | NUT, plain: knurled; brass; #6–32 thd; class 2 fit; 5/8" dia x 3/8" lg; Zenith part/dwg #54G3064. | Loop mounting nut | 6L3406–32–10K. |
| H2 | NUT, plain: knurled; brass; loop mtg; #10–32 thd; NCT class 2 fit; 5/8" dia x 3/8" lg; Zenith part/dwg #54G3065. | Loop mounting nut | 6L3410–32K1. |
| O 17 | PAD, silencing: felt; blk; 7 rect slots; 4 15/32" lg x 1" wd x 1/16" thk; Zenith part/dwg #83G3134. | Cushions and silences bandswitch knobs. | 6Z7475. |
| O 66 | PULLEY, single groove: for rotating dial pointer; w/shaft; 1 11/16" lg x .250" dia; Zenith part/dwg #SG6644. | Dial pointer pulley | 2Z7334–15. |
| CR1 | RECTIFIER, metallic: selenium; input 117 v ac, single ph; output 130 v dc, 100 ma, half wave; 1" lg x 1 1/8" wd x 1 13/32" d; Sarkes Tarzian Co part #2SR–641–RVM. | A-c rectifier in receiver | 3H4860–251. |
| CR2 | RECTIFIER, metallic: selenium; input 117 v ac, single ph; output 130 v dc, 75 ma, half wave; 1" lg x 1/2" wd x 1" h; Sarkes Tarzian Co part #2SR–2H1–RVM. | A-c rectifier in power supply adapter Z1. | 3H4860–252. |
| R24 | RESISTOR, fixed: comp; 4.7 ohms ±10%; 1 w; 37/64" lg x 7/32" dia; AB type #GB–47G1. | Parasitic suppressor for 2- to 4-mc and 4- to 8-mc bands. | 3Z5994G7–5. |
| R25 | RESISTOR, fixed: comp; 47 ohms ±10%; 1/2 w; JAN type RC20BF470K. | Parasitic suppressor for mixer grid on 2- to 4-mc band. | 3RC20BF470K. |
| R5, R37 | RESISTOR, fixed: comp; 100 ohms ±10%; 1/2 w; JAN type RC20BF101K. | R5: Converter filament shunt.<br>R37: Battery surge limiting resistor. | 3RC20BF101K. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| R11 | RESISTOR, fixed: comp; 120 ohms ±10%; ½ w; JAN type RC20BF121K. | I-f amplifier filament shunt | 3RC20BF121K. |
| R27 | RESISTOR, fixed: WW; 130 ohms ±5%; 4.5 w; 1" lg x 1 3/32" OD; Ohmite part #1W30J131. | Rectifier surge limiter | 3Z6013–21. |
| R8 | RESISTOR, fixed: comp; 150 ohms ±10%; ½ w; JAN type RC20BF151K. | R-f amplifier and detector-amplifier filament shunt. | 3RC20BF151K. |
| R23 | RESISTOR, fixed: comp; 270 ohms ±10%; ½ w; JAN type RC20BF271K. | Audio output amplifier filament balancer. | 3RC20BF271K. |
| R36 | RESISTOR, fixed: comp; 560 ohms ±10%; ½ w; JAN type RC20BF561K. | B+ supply filter | 3RC20BF561K. |
| R38A, R38B | RESISTOR, fixed: WW; 2 sect.; 620 ohms and 1200 ohms; ±10%; ea sect.; 2" lg x 5/8" OD; Ohmite part #35060. | Voltage dropping resistor in power supply adapter Z1. | 3Z6062–20. |
| R30 | RESISTOR, fixed: WW; 680 ohms ±5%; 4.5 w; 1" lg x 1 3/32" OD; Ohmite part #1N30J681. | Filament supply filter | 3Z6068–22. |
| R12 | RESISTOR, fixed: comp; 1000 ohms ±10%; ½ w; JAN type RC20BF102K. | I-f amplifier plate decoupling | 3RC20BF102K. |
| R32 | RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; JAN type RC20BF152K. | Tone control resistor | 3RC20BF152K. |
| R1 | RESISTOR, fixed: comp; 2200 ohms ±10%; ½ w; JAN type RC20BF222K. | Antenna impedance-matching resistor. | 3RC20BF222K. |
| R4 | RESISTOR, fixed: comp; 3300 ohms ±10%; ½ w; JAN type RC20BF332K. | Low B+ supply filter resistor | 3RC20BF332K. |
| R3 | RESISTOR, fixed: comp; 15,000 ohms ±10%; ½ w; JAN type RC20BF153K. | R-f amplifier plate damping resistor | 3RC20BF153K. |
| R34 | RESISTOR, fixed: comp; 18,000 ohms ±10%; ½ w; JAN type RC20BF183K. | Tone control resistor | 3RC20BF183K. |

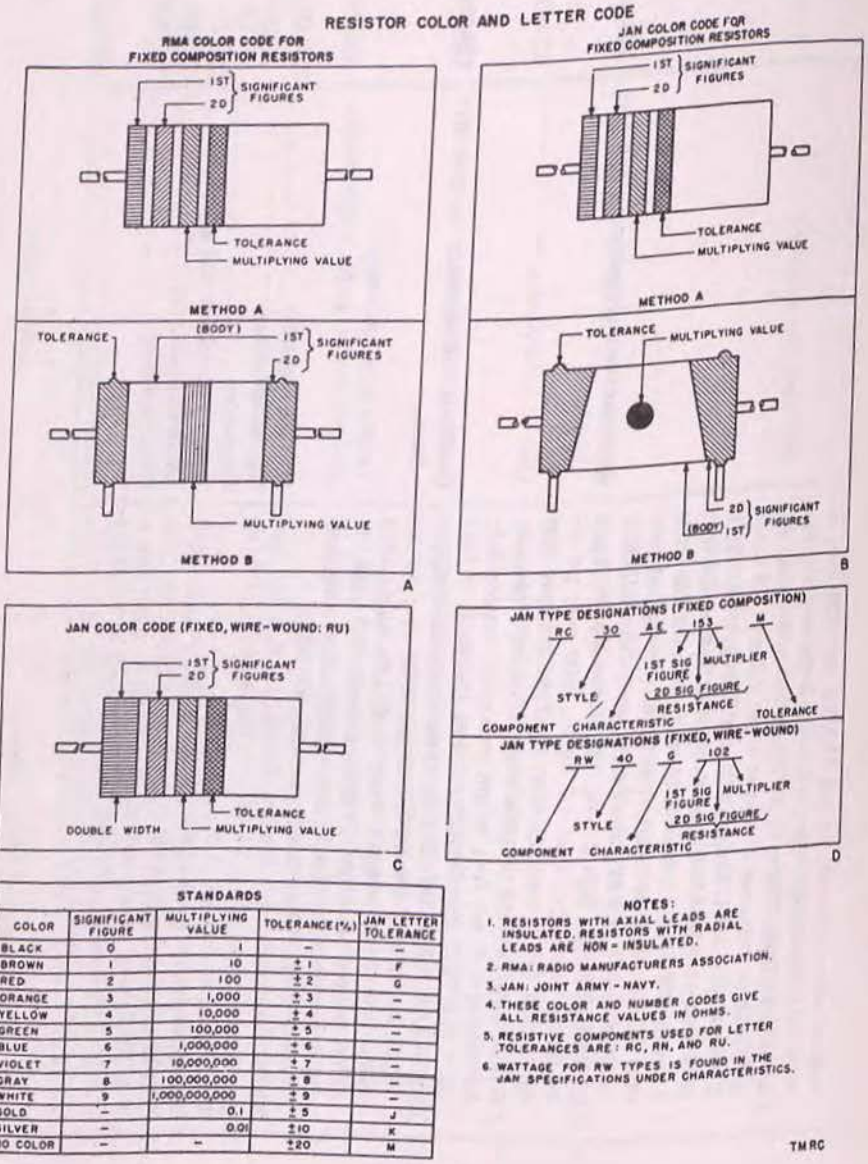
| | | | |
|---|---|---|---|
| R35 | RESISTOR, fixed: comp; 27,000 ohms ±10%; ½ w; JAN type RC20BF273K. | Tone control resistor | 3RC20BF273K. |
| R7 | RESISTOR, fixed: comp; 68,000 ohms ±10%; ½ w; JAN type RC20BF683K. | Converter screen dropping resistor | 3RC20BF683K. |
| R6, R31, R33 | RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ W; JAN type RC20BF104K. | R6: Oscillator grid leak resistor<br>R31: Glow lamp current limiting resistor.<br>R33: Tone control resistor. | 3RC20BF104K. |
| R28 | RESISTOR, fixed: comp; 220,000 ohms ±10%; ½ w; JAN type RC20BF224K. | B+ supply bleeder resistor | 3RC20BF224K. |
| R29 | RESISTOR, fixed: comp; 330,000 ohms ±10%; ½ w; JAN type RC20BF334K. | B− to chassis isolation resistor | 3RC20BF334K. |
| R2, R16, R20, R22, R26. | RESISTOR, fixed: comp; 1 meg ±10%; ½ w; JAN type RC20BF105K. | R2: R-f amplifier grid return<br>R16: Detector-amplifier diode load resistor.<br>R20: Audio output grid return.<br>R22: Detector-amplifier plate load resistor.<br>R26: Mixer grid return. | 3RC20BF105K. |
| R9, R15 | RESISTOR, fixed: comp; 2.2 meg ±10%; ½ w; JAN type RC20BF225K. | R9: Avc network bleeder resistor<br>R15: Avc network voltage-divider resistor. | 3RC20BF225K. |
| R14, R21 | RESISTOR, fixed: comp; 4.7 meg ±10%; ½ w; JAN type RC20BF475K. | R14: Avc network voltage-divider resistor.<br>R21: Detector-amplifier screen dropping resistor. | 3RC20BF475K. |
| R10 | RESISTOR, fixed: comp; 5.6 meg ±10%; ½ w; JAN type RC20BF565K. | Avc network bleeder resistor | 3RC20BF565K. |
| R13, R19 | RESISTOR, fixed: comp; 10 meg ±10%; ½ w; JAN type RC20BF106K. | Avc network voltage-divider resistors. | 3RC20BF106K. |
| R18 | RESISTOR, fixed: comp; 15 meg ±10%; ½ w; JAN type RC20BF156K. | Detector-amplifier grid return | 3RC20BF156K. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| RT1 | RESISTOR, terminal: glass 9 pin miniature base; 2⅝" lg o/a; Amperex type #MJ051T. | Filament circuit current regulator | 3Z6925–13. |
| R17, S3 | RESISTOR, variable: comp; 1 meg ±30%; ¼ w; DPST sw, 3 amp, 125 v; 15/16" lg x 1 27/32" d o/a; CTS part SL–7838. | R17: Volume control<br>S3: On-off switch. | 3Z7499–1.169. |
| O51 | RETAINER, electron tube: SS designed to accom 7 to 9 pin minature tube; .1695" dia hole in clip for locking on post; Times Facsimile type #1 HAT. | Thermal resistor retainer | 2Z7780–113. |
| H3 | SCREW, thumb: round knurled head; 4–40–⅜" lg thd class 2 fit; 7/16" h x 5/16" wd; Zenith part/dwg #112G3021. | Position lock for voltage selector switch on power supply adapter Z1. | 6L17104–14.8K. |
| O63 | SHAFT, tuning: steel; cad pl; 1 end slotted 1/16" wd x 33/64" d on slotted end shaft knurled 23/64" lg ⅛" radius groove 15/64" from slotted end; 1⅜" lg x ¼" dia; Zenith part/dwg #76G3034. | Tuning capacitor drive shaft | 2Z8203–746. |
| O75, O76, O77 | SHELL, electrical connector: brass; 4 crimp type mtg lugs; .640" lg x .625" OD; Cinch part #4754. | Battery socket shells | 2Z8276–67. |
| O72, O73, O74 | SHELL, electrical connector: steel; cad pl; cylindrical; 5/8" lg x 1" dia; Cinch type #16B11695–P88. | Battery socket shells | 2Z8276–105. |
| O71 | SHELL, electrical connector: steel; cad pl; cylindrical; 63/64" lg x 59/64" dia; Cinch type #7059. | Battery socket shell | 2Z8276–106. |
| P18 | SHELL, electrical connector: med screw base; 2 female parallel cont; straight type 1 3/16" dia x 1 9/32" lg o/a; Wood elec type #2053. | Adapts line plug to foreign receptacle | 6Z7560–9. |
| E5 through E9 | SHIELD, electron tube: cylindrical; locking type; JAN type TS102U02. | Tube shields | 2Z8304.276. |
| XV1 through XV5 | SOCKET, electron tube: 7 miniature cont; 1 piece saddle mtg; JAN type TS102P01. | Tube sockets | 2Z8677.94 |

| | | | |
|---|---|---|---|
| XRT1 | *SOCKET, electron tube: 9 miniature cont; 1 piece saddle mtg; JAN type TS103P01.* | *Tube socket for thermal resistor RT1* | 2Z8679.30. |
| O40, O41 | SPRING, dial cord tension: music wire; #24 AWG; 2 5/32" lg x 1 5/64" dia; 1/16" gap at both ends; Zenith part/dwg #80G3075. | Dial card tension springs | 2Z8878–97 |
| H6 | STUD, threaded: SS; external thd 5/32" OD; 32 thd per in. NC class 2 fit; 5/8" lg; 2 5/8" lg o/a; Times Facsimile Corp part #25. | Mounting stud for thermal resistor clamp. | 2Z7259–148. |
| S2A, S2B, S2C, S2D. | SWITCH ASSEMBLY: 4 sw; slide; 4 7/16" lg x 1 7/32" wd x 1 1/32" d; Muter part #10672. | Tone control selector | 3Z9903A–34.1. |
| S1A, S1B, S1D, S1E, S1F, S1G. | SWITCH, push: band sw; 7 units; unit #1, 13 stator cont; unit #2, #3, #4, 16 stator cont; unit #5, #6, 23 stator cont; unit #7, 19 stator cont; locking action; 2 3/4" lg x 1 5/32" wd x 5 21/32" h; Oak part #50716–130. | Band selector | 3Z9824–60.6. |
| S4 | SWITCH, slide: ac battery change-over sw; TPDT; 125 v 5 amp; 1 7/8" lg x 1 7/32" wd x 1 5/32" h excluding term.; Stackpole part #SS6. | Power line-battery change-over switch. | 3Z9835–1.7. |
| S5 | SWITCH, slide: voltage adapter; 3 position; 125 v .75 amp; 1 3/8" lg x 1 7/32" wd x .47875" h excluding term.; Stackpole part #SS7. | Power supply adapter voltage selector switch. | 3Z9835–1.6. |
| TB1 | TERMINAL BOARD: wiring; 1 solder lug term.; w/o barriers; 1" lg x 3/8" wd x 1/2" d; Cinch part #18A–18070. | Wiring terminal | 3Z770–1.41. |
| TB4 | TERMINAL BOARD: wiring; 2 solder lug term.; w/o barrier; 1 1/8" lg x 21/32" wd x 1/2" d; Zenith part/dwg #83G3143. | Wiring terminal | 3Z770–2.155. |
| TB2 | TERMINAL BOARD: wiring; 3 solder lug term.; w/o barriers; 1 1/2" lg x 21/32" wd x 1/2" thk; Alcon Metal Corp part #T–4–1162XXV. | Wiring terminal | 3Z770–3.97. |
| TB7 | TERMINAL BOARD: ant. connector; 3 term.; 2 solder lug; 1 pin jack; w/o barriers; 1 29/32" lg x 5/8" wd x 21/32" thk; Zenith part/dwg #83G3124. | Antenna connector | 3Z770–3.98. |

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| TB3 | TERMINAL BOARD: wiring; 4 solder lug term.; w/o barriers; 1⅞″ lg x 2 1/32″ wd x ½″ thk; Zenith part/dwg #83G3129. | Wiring terminal | 3Z770–4.169. |
| TB6 | TERMINAL BOARD: rf; 5 solder lug term.; w/o barriers; 2 7/32″ lg x 1½″ wd x ⅛″ thk; Zenith part/dwg #SG6607. | R-f terminal board | 3Z770–5.79. |
| O14 | TOOL, ALINEMENT: nylon; 1/32″ thk x 5/64″ wd, metal nib scdr 1 end; ctr portion fluted; 5″ lg x ¼″ dia; Zenith part/dwg #68G3012. | Alinement tool | 6Q336–1. |
| T3 | TRANSFORMER, AF: plate coupling type; pri 8000 ohms impedance; secd 3.2 ohms impedance; 7 ma dc; open steel frame; silicon steel core; 2⅞″ lg x 1⅞″ wd x 1¾″ h o/a; Zenith part/dwg #95G3036. | Couples audio from audio output stage to loudspeaker. | 2Z9632.756. |
| T2 | TRANSFORMER, IF: 455 kc peak freq; output; shielded; 1 3/16″ lg x 1 3/16″ wd x 2 3/16″ h o/a; Rollan Elec part #0–5096. | Second i-f transformer | 2Z9632.757. |
| T1 | TRANSFORMER, IF: 455 kc peak freq; input; shielded; 1 3/16″ lg x 1 3/16″ wd x 2 3/16″ h o/a; Rollan Elec part #0–5095. | First i-f transformer | 2Z9631.486. |
| L1 | TRANSFORMER, RF: 2 wdg, universal wnd; pri 177.5 uh at 1000 cyc; secd 179.6 uh at 1000 cyc; pri 91 turns, #36 AWG single celanese E copper wire; secd 95 turns, 7 strand #41 AWG single celanese E copper wire; pri .7 ohm secd .013 ohm dc resistance; untuned; untapped; unshielded; 1 9/64″ lg x 5 9/64″ dia; Zenith part/dwg #SG6529. | R-f coil assembly for broadcast band | 2Z9626.65. |
| L2 | TRANSFORMER, RF: 4 wdg; L1 pri universal wnd; L2 secd universal wnd; L3 pri solenoid wnd; L4 secd | Oscillator coil assembly | 2Z9626.66. |

| | | | |
|---|---|---|---|
| | *spaced solenoid wnd; L1 pri 47.7 uh at 1000 cyc; L2 secd 97.5 uh at 1000 cyc; L3 pri 1.2 uh at 1000 cyc; L4 secd 4 uh at 1000 cyc; L1 pri 50 turns, 3 strand #41 AWG single celanese E copper wire; L2 secd 72 turns, 3 strand #41 AWG single celanese E copper wire; L3 pri 5¾ turns, #38 AWG single celanese E wire; L4 secd 6 turns, #22 AWG plastic E copper wire; pri 3.2 ohms secd 8.2 ohms dc resistance; untuned; untapped; unshielded; 2 1/16" lg x ¾" dia; Zenith part/dwg #SG6528.* | | |
| L18A, L18B | TRANSFORMER, RF: 2 wdg, close solenoid wnd; pri 2.8 uh at 1000 cyc; secd 4.7 uh at 1000 cyc; pri 18 turns, #26 AWG copper wire; secd 15⅓ turns, #36 AWG copper wire; pri .084 ohm, secd .809 ohm dc resistance; 4–8 mc freq range; untapped; unshielded; 25/64" lg x 29/64" dia; Zenith part/dwg #SG6544. | Oscillator coil assembly for 4–8 MC band. | 2Z9626.67. |
| L19A, L19B | TRANSFORMER, RF: 2 wdg, close solenoid wnd; pri 10 uh at 1000 cyc; secd 3.7 uh at 1000 cyc; pri 31 turns, #30 AWG copper wire; secd 14⅓ turns, #36 AWG copper wire; pri .362 ohm, secd .717 ohm dc resistance; 2–4 mc freq range; untapped; unshielded; 25/64" lg x 29/64" dia; Zenith part/dwg #SG6545. | Oscillator coil assembly for 2–4 MC band. | 2Z9626.68. |
| V1, V3 | TUBE, electron: type 1U4 | V1: R-f amplifier<br>V3: I-f amplifier. | 2J1U4. |
| V2 | TUBE, electron: type 1L6 | Converter | 2J1L6. |
| V4 | TUBE, electron: type 1U5 | Detector-amplifier and avc | 2J1U5. |
| V5 | TUBE, electron: type 3V4 | Audio output | 2J3V4. |
| O 61, O 62 | WASHER, key: steel; cad pl; .335" OD x .025" thk x .145" ID; Zenith part/dwg #188G3022. | Shaft retainers | 2Z7858–154. |




| 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 |

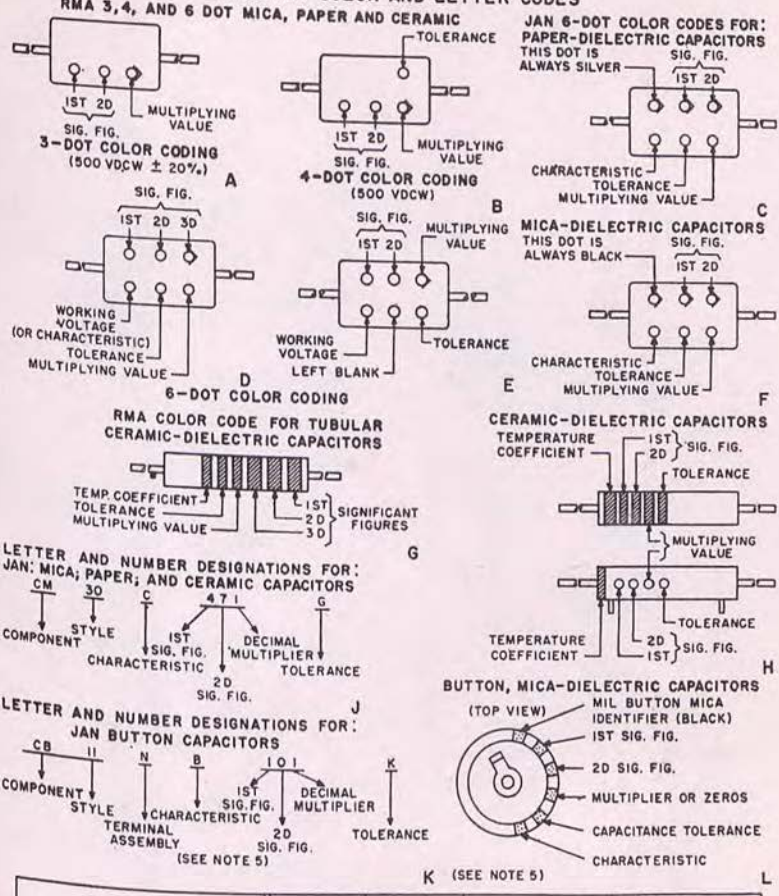
NOTES:

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 RV.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

*Figure 38. Register 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 ±20%

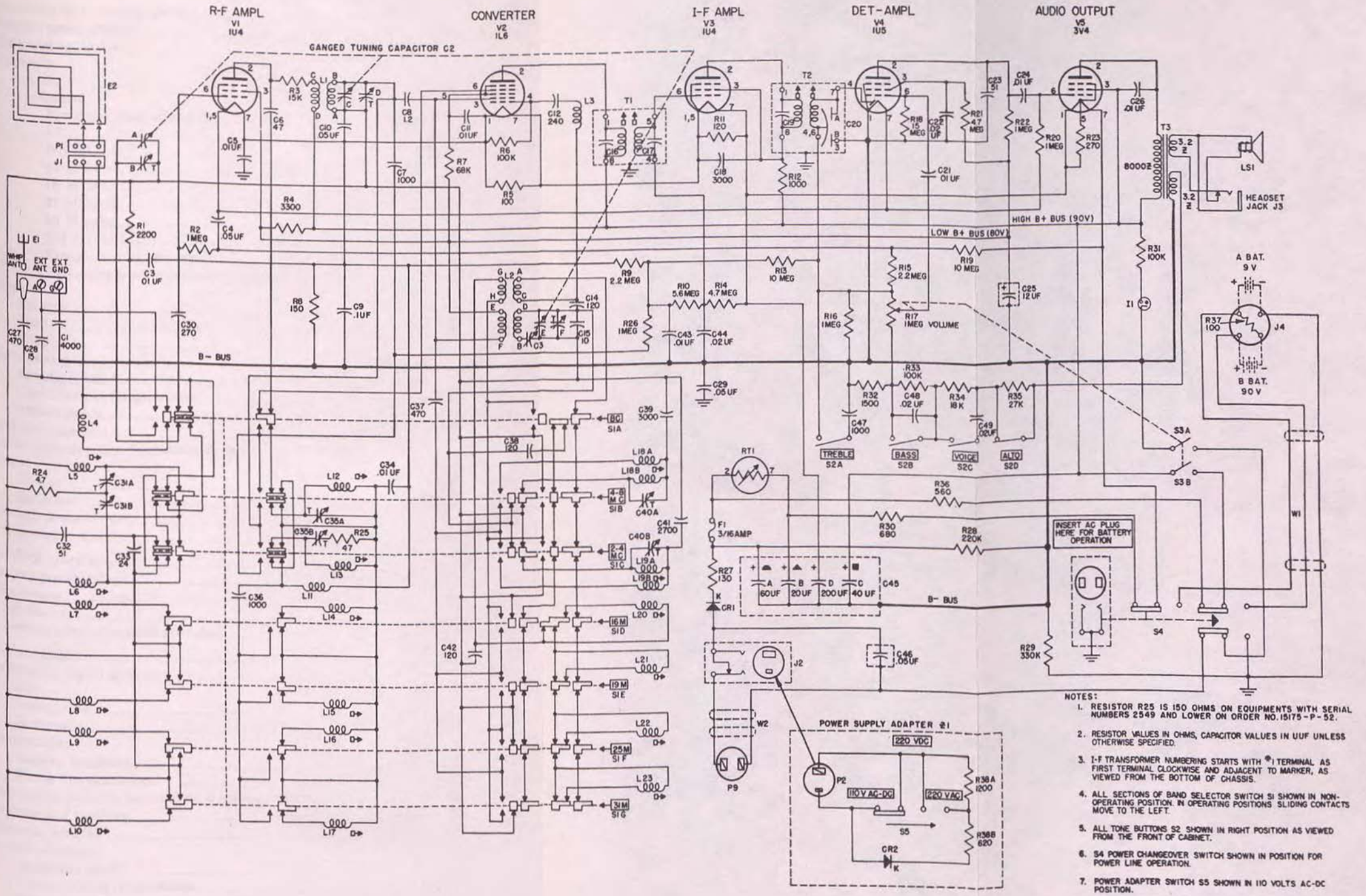
NOTES

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 39. Capacitor color codes.*




365011—55. Facing blank p. 128.

*Figure 40. Radio Receiver R-520/URR, schematic diagram.*

# INDEX

[AG 413.44 (23 Oct 53)]

BY ORDER OF THE SECRETARY OF THE ARMY:

M. B. RIDGWAY,
*General, United States Army,*
*Chief of Staff.*

OFFICIAL:

WM. E. BERGIN,
*Major General, United States Army,*
*The Adjutant General.*

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*Active Army:*

Tech Svc (1); Tech Svc Bd (1); AFF Bd (ea. Svc Test Sec) (1); AFF (5); AA Comd (2); OS Maj Comd (5); Base Comd (5); MDW (2); Log Comd (5); A (5); CHQ (2); FT (2); Sch (5) except 11 (25); Gen Dep (2); Dep 11 (20) except Sig Sec, Gen Dep (10); Tng Div (2); POE (2), OSD (2); Lab 11 (5); Mil Dist (3); Field Maint Shops 11 (3); Two (2) copies to each of the following T/O & E's: 11–107; 11–127; 11–128; 11–500, CA, CB, CC, CD, RA through RR; 11–587; 11–592; 11–597.

*NG:* Same as Active Army except one copy to each unit.

*Army Reserve:* None.

For explanation of distribution formula, see SR 310–90–1.



☆ U. S. GOVERNMENT PRINTING OFFICE: 1955 O—365011

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