electrical ground or tap for the tank circuit. Capacitor C224 is a variable panel control (CAL.) and is used to adjust the oscillator frequency to exactly 100 kc by zero beating the harmonic voltage output against a source of standard frequency transmissions such as are radiated from WWV.

c. The calibration oscillator component functions are as follows: resistor R118 is the grid resistor, resistor R119 is the cathode bias resistor, and C170 is the cathode bypass capacitor. Screen and plate voltage for V104 are obtained through voltage-dropping resistors R120 and R121, respectively. Capacitor C171 is the screen r-f bypass. The return side of R120 and R121 have a common decoupling unit consisting of capacitor C172 and resistor R122.

d. The CALIBRATE switch, S118, completes the cathode circuit for V104. When S118 is at the OFF position, the cathode is open and the oscillator is inoperative.

53. Power Supply

The receiver power supply (figs. 29 and 42) is a full-wave circuit using a rectifier tube V115, type 5V4. The supply can be operated from a 115-volt, 45- to 70-cycle source and has provisions for 230-volt operation.

a. The power transformer T108 has two primary windings parallel-connected for 110-volt operation, which can be connected in series for 230-volt operation. Fuse F101 protects the T108 primary winding and switch S113 completes the T108 primary circuit in the STANDBY and ON positions. Switch S113, when in the ON position, also completes the B+ circuits to the i-f amplifier tubes, V107, V108, and V109. Transformer T108 has three secondary windings; h-v winding 11–10–9 supplies the necessary potential for rectifier tube V115 plates; winding 5–6 supplies filament voltage for tube V115; and winding 7–8 supplies 6.3 volts ac for the receiver tube filaments.

b. The a-c plate voltage is applied to V115 (pins 4 and 6) and the rectified output is taken from the filament (pin 8). The filter section of the supply consists of input choke L122 followed by a pi-section consisting of choke L123 and filter capacitors C217A and C217B.

c. Voltage for the vfo unit and the a-f power tube, V115, is taken from the junction of chokes L122 and L123. The vfo unit voltage is regu-

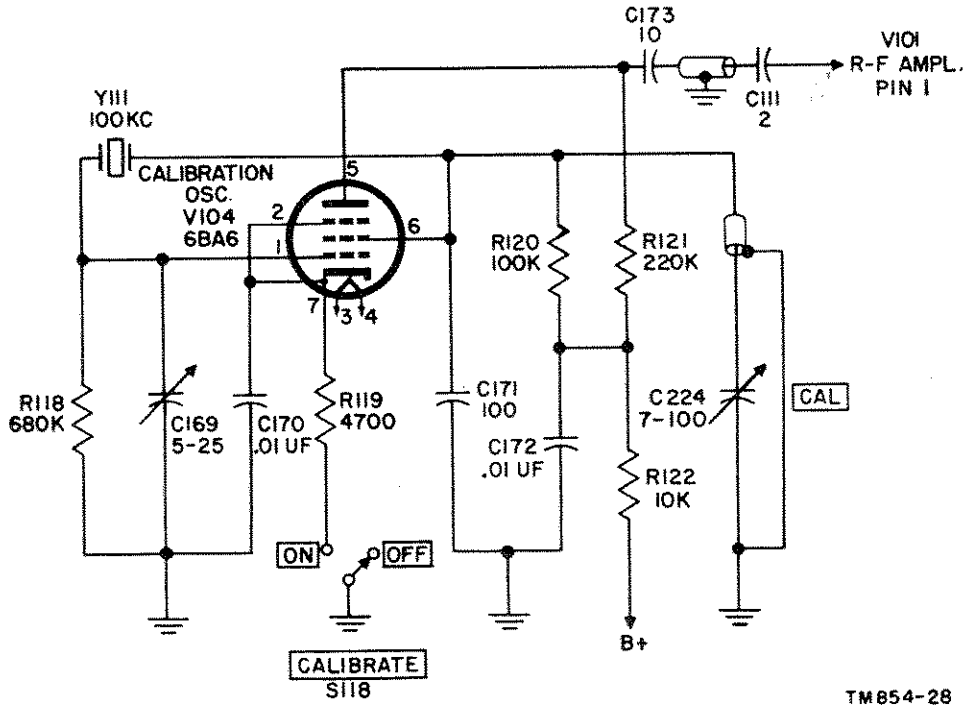


Figure 28. Calibration oscillator, schematic diagram.

lated by current limiting resistor R181 and voltage regulator tube V116 type OA2. Voltage for the remaining receiver circuits is taken from the output side of the supply, terminal 2 of choke L123, and supplied through the ON position contact of S113 and relay K101 contacts.

54. Input-Output Meter

A 0- to 1-ma meter mounted at the upper right side of the receiver panel functions as a tuning meter and an output meter. The meter is calibrated in 20-, 40-, 60-, 70-, and 100-db input signal levels and —10 to +6 db audio output level (6 mw reference). INPUT-OUTPUT METER switch S117, a momentary spring return toggle switch, is provided to change the meter connections.

a. Input Meter. When the INPUT-OUTPUT METER switch S117 is in its normal position (INPUT), the meter circuit is arranged as an S meter, as shown in figure 23. The i-f amplifier tube V107 and V108 screen voltage dividers have their return through resistor R170. Resistor R170, meter M101, and resistor R163 are series-connected across i-f amplifier tube V109 cathode bias resistor R140. R140 is variable and is used as a METER ZERO resistor. With no signal input to the receiver, the voltage drops across R163 and R170 are equal and opposite in potential and no current flows through the meter. When the input signal increases, the avc voltage fed back to the grid circuit of V107 and V108 increases with a resultant decrease in screen current of these tubes. The voltage drop across R170 in the return side of V107 and V108 screen voltage dividers increases, a voltage unbalance occurs across R170, M101, and R163, and current proportional to the signal strength flows through the meter.

b. Output Meter. When the INPUT-OUTPUT METER switch, S117, is in the OUTPUT position, meter M101 measures the audio output level of the receiver (fig. 26). Voltage-dropping resistor R173 and rectifier unit CR101 are in series across the 600-ohm output transformer T107 secondary winding. The rectified voltage is developed across rectifier CR101 load resistor R182. The rectified output level is indicated by M101 connected across resistor R182.

55. Band Switching

The band switching is done by rotary switches 1 to 11. These are ganged, wafer type switches that respond to the BAND CHANGE knob by a system of gear trains. The gear trains are arranged so that the correct switch combinations are selected to cut in the appropriate tuning components. Table II illustrates the functions of each switch for rough tuning on each band. For further information concerning the mechanical aspects of tuning, refer to paragraphs 56–59 and figures 30 and 31.

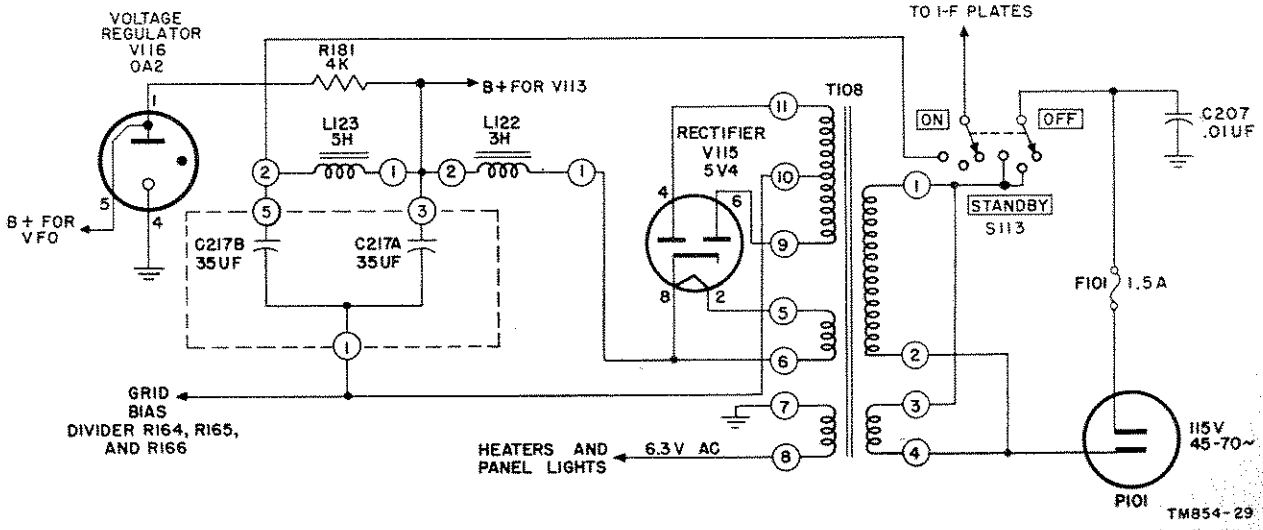


Figure 29. Power supply, schematic diagram.

Table II. Switches

Band	Frequency	S101	S102	S103	S104	S105	S106	S107	S108		S109	S110	S111
		Rotor attached to antenna input. Connects with	Rotor attached to antenna matching capacitor C230. Connects with	Rotor attached to grid (pin 1) of V101. Connects with	Rotor attached to plate 5 (pin 5) of V101. Connects with	Rotor attached to grid (pin 1) of V102. Connects with	Rotor attached to plate (pin 5) of V102. Connects with	Rotor attached to S110. Connects with	S108 has two contact wafers and rotors, A and B. S108 rotor is attached to the plate (pin 5) of V105 and cuts in appropriate load resistor with B+. S108 chooses coil and capacitor combination for harmonic tuning on various bands.		Rotor attached to grid (pin 1) of V105. Connects with crystals listed.	Variable i-f selector two-position.	Variable i-f selector two-position.
									A	B			
1	.5 to 1.5	C233	C230	L101	B-line	L110	L114 L115	V103 through L124	C161 C162 2d harmonic tuning C144 C145 3d harmonic tuning	R117	4 mc	L116 L117	L118 L119
2	1.5 to 2.5	C234	C234	L102	S107	———	———	S104	L121	R116		L116	L118
3	2.5 to 3.5	C235	C235	L103	S107	———	———	S104		R116		L116 L117	L118 L119
4	3.5 to 4.5	C236	C236	L104	L107	L111	S107	S106		R116	6 mc	L116	L118
5	4.5 to 5.5	C236	C236	L104	L107	L111	S107	S106		R116	8 mc	L116 L117	L118 L119
6	5.5 to 6.5	C236	C236	L104	L107	L111	S107	S106		R116	8 mc	L116	L118
7	6.5 to 7.5	C236	C236	L104	L107	L111	L107	LS106		R116	10 mc	L116 L117	L118 L119
8	7.5 to 8.5	C237	C231	L105	L108	L112	S107	S106		R116	10 mc	L116	L118
9	8.5 to 9.5	C237	C231	L105	L108	L112	S107	S106		R116	12 mc	L116 L117	L118 L119
10	9.5 to 10.5	C237	C231	L105	L108	L112	S107	S106		R116	12 mc	L116	L118
11	10.5 to 11.5	C237	C231	L105	L108	L112	S107	S106		R116	14 mc	L116 L117	L118 L119
12	11.5 to 12.5	C237	C231	L105	L108	L112	S107	S106		R116	14 mc	L116	L118
13	12.5 to 13.5	C237	C231	L105	L108	L112	S107	S106	C157 C158 2d harmonic tuning	R117	8 mc	L116 L117	L118 L119

										tuning				
14	13.5 to 14.5	C237	C231	L105	L108	L112	S107	S106	C157 C158 2d harmonic tuning	R117	8 mc	L116	L118
15	14.5 to 15.5	C237	C231	L105	L108	L112	S107	S106	C155 C156 2d harmonic tuning	R117	9 mc	L116 L117	L118 L119
16	15.5 to 16.5	C238	C232	L106	L109	L113	S107	S106	C155 C156 2d harmonic tuning	R117	9 mc	L116	L118
17	16.5 to 17.5	C238	C232	L106	L109	L113	S107	S106	C153 C154 2d harmonic tuning	R117	10 mc	L116 L117	L119 L119
18	17.5 to 18.5	C238	C232	L106	L109	L113	S107	S106	C153 C154 2d harmonic tuning	R117	10 mc	L116	L118
19	18.5 to 19.5	C238	C232	L106	L109	L113	S107	S106	C152 2d harmonic tuning	R117	11 mc	L116 L117	L118 L119
20	19.5 to 20.5	C238	C232	L106	L109	L113	S107	S106	C152 2d harmonic tuning	R117	11 mc	L116	L118
21	20.5 to 21.5	C238	C232	L106	L109	L113	S107	S106	C150 2d harmonic tuning	R117	12 mc	L116 L117	L118 L119
22	21.5 to 22.5	C238	C232	L106	L109	L113	S107	S106	C150 2d harmonic tuning	R117	12 mc	L116	L118
23	22.5 to 23.5	C238	C232	L106	L109	L113	S107	S106	C149-C151 tuning	R117	13 mc	L116 L117	L118 L119
24	23.5 to 24.5	C238	C232	L106	L109	L113	S107	S106	C149-C151 2d harmonic tuning	R117	13 mc	L116	L118

Band	Frequency	S101	S102	S103	S104	S105	S106	S107	S108		S109	S110	S111
									A	B			
25	24.5 to 25.5	C238	C230	L106	L109	L113	S107	S106	C148 2d harmonic tuning	R117	14 mc	L116 L117	L118 L119
26	25.5 to 26.5	C238	C230	L106	L109	L113	S107	S106	C148 2d harmonic tuning	R117	14 mc	L116	L118
27	26.5 to 27.5	C2382	C230	L106	L109	L113	S107	S106	C147 3d harmonic tuning	R117	10 mc	L116 L117	L118 L119
28	27.5 to 28.5	C238	C230	L106	L109	L113	S107	S106	C147 3d harmonic tuning	R117	10 mc	L116	L118
29	28.5 to 29.5	C238	C230	L106	L109	L113	S107	S106	C146 3d harmonic tuning	R117	10.6 mc	L116 L117	L118 L119
30	29.5 to 30.5	C2382	C230	L106	L109	L113	S107	S106	C146 3d harmonic tuning	R117	10.6 mc	L116	L118

Section II. MECHANICAL FUNCTIONING OF RECEIVER

56. General Description

The receiver is tuned by the movement of powdered iron cores (permeability tuning) in the rf, variable if, and vfo coils. Movement of the cores is controlled by cams (except for vfo coils) which are turned through gearing by the KILOCYCLES and MEGACYCLES dial knob on the front panel. Band changing is accomplished by turning the r-f, i-f, and crystal switches through gearing from the BAND CHANGE knob. In addition, the BAND CHANGE knob moves the cores in the r-f coils through successive 1-mc increments (using the same cams as are used for tuning). Details of the functioning of these mechanisms, and the means of frequency indication are given in the following paragraphs of this section (figs. 30 and 42).

57. Tuning Mechanisms

The i-f and r-f racks are positioned by their cams through the gearing of shafts A, B, C, D, and E, from the KILOCYCLES dial knob. Shaft A is turned directly by the knob and is limited to 10 revolutions by the 10-turn stop mounted on the shaft. Each revolution corresponds to 100 kc. Shaft A also turns a lead screw in the vfo which positions the core of coil L001 (fig. 42). Shaft B makes only one-tenth of a turn for each turn of shaft A, and thus can make only one complete revolution because A is limited to 10 turns.

a. I-F Rack. Shaft E is geared to shaft B through the 74-tooth gear and the detent gear, both of which act as idlers. Shaft E makes almost a full turn, and thus lifts the i-f rack from the lowest to the highest position during the complete turn of shaft B.

b. R-F Racks. Shaft D is geared to shaft B through shaft C, and the 16- and 41-tooth gears (fig. 30). The gearing ratio (48 to 48) is such that shaft C turns exactly as much as shaft B. The 41-tooth gear serves as an idler gear to transmit motion and change the direction of motion. Shaft D makes four-thirty-fifths of a turn for the complete turn of shaft B. Since only a half-turn of the heart-shaped cams is required to lift the r-f racks from their lowest to their highest positions, and since somewhat less than the full travel is used, this four-thirty-fifths of a turn corresponds to exactly one-fourth of the full movement for the 4- to 7-mc rack. That is, it corresponds to a 1-mc movement. The cam for the 8- to 15-mc rack turns only half as far as the first cam and, therefore, lifts the 8- to 15-mc rack only one-eighth of the full rack movement, or also 1 mc, for the same full turn of shaft C. Similarly, the cam for the 16- to 30-mc rack turns only half as far as the cam for the 8- to 15-mc rack and therefore lifts the 16- to 30-mc rack only one-sixteenth of the full rack movement, or 1 mc, for a full turn of shaft C. Thus, regardless of which set of coils may be connected in the circuit, that is, whatever tuning step the receiver is set to, the turning of shaft C one full turn always corresponds to an r-f rack movement proportional to 1 mc. Turns less than a full turn are also in exact proportion.

58. Band Change Mechanisms

a. R-F Racks. The cams for the r-f racks are turned for band changing purposes by means of shaft D, shaft C, and the two sets of sun and planet gears which are used for tuning. However, shaft B does not turn; instead, the planet gears are caused to *walk* around the sun gears by turning the spider gear in which the shaft of the planet gears is mounted. The spider gear is turned, through an idler, by the 85-tooth gear on the shaft of the BAND CHANGE knob. Every half-turn of the BAND CHANGE knob causes the spider gear to turn one-half revolution. This makes the planet gears *walk* halfway around their respective sun gears. As both planet gears are fixed to the same shaft, and as the 50-tooth sun gear does not turn when the KILOCYCLES dial knob is stationary, the 30-tooth sun gear is thereby caused to rotate exactly one full turn for each half turn of the spider gear. Shaft C is thus rotated one full turn (the same as if shaft B had been turned a full turn) and the cams for the r-f racks are moved precisely the right amount for 1 mc. To summarize, shaft C can be turned by *either* the

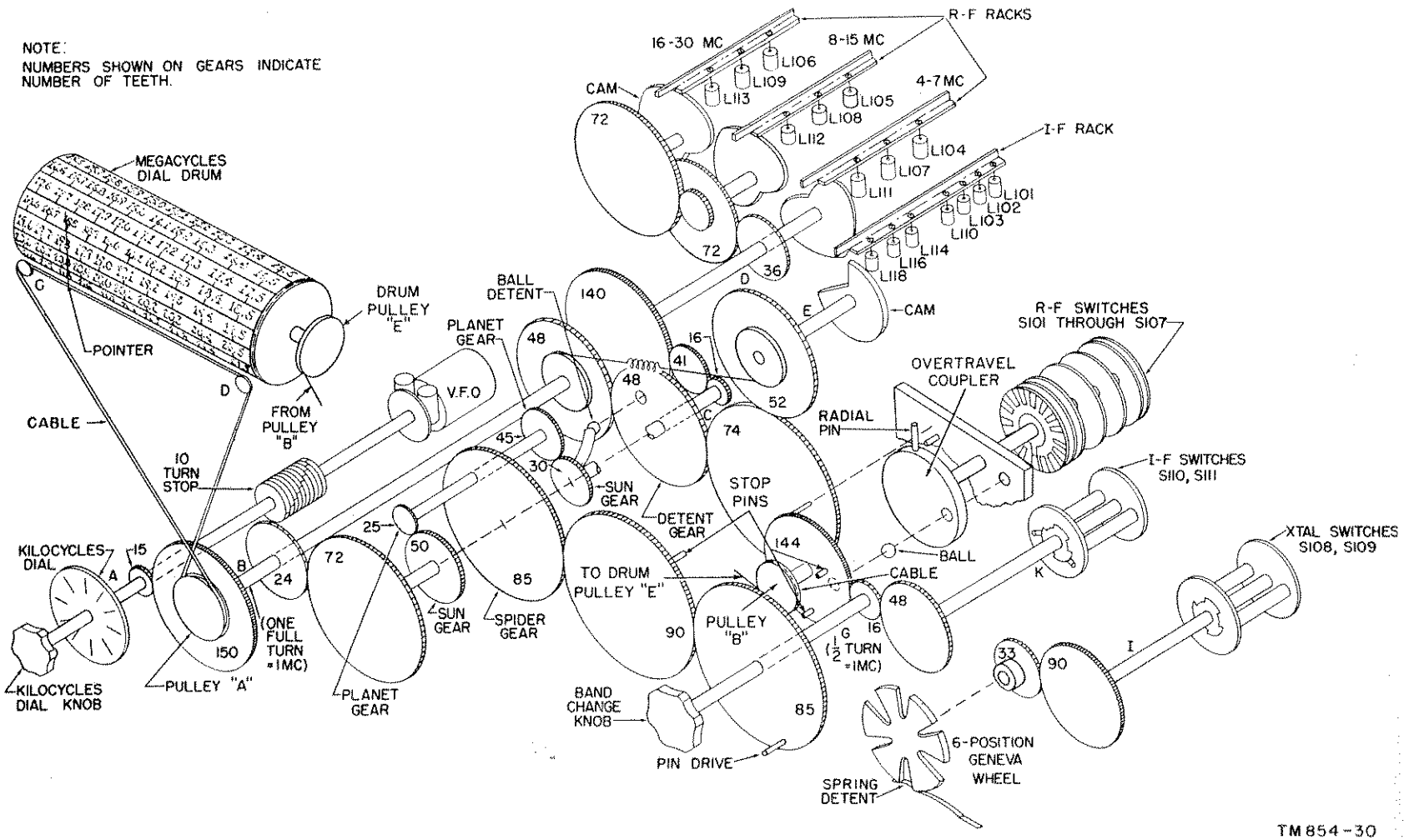


Figure 30. Functional diagram of tuning, band changing, and frequency indicating mechanisms.

BAND CHANGE knob and the spider gear or by the KILOCYCLES dial knob and shaft B.

b. Detent. In order to insure that the BAND CHANGE knob is turned only in half-revolution steps, a ball detent is provided between the 30-tooth sun gear (which makes one full turn per half turn of the knob) and the detent gear. (Note that the detent gear cannot turn when the KILOCYCLES dial knob is stationary).

c. I-F Racks. Note that turning the BAND CHANGE knob does not affect the position of shaft E and variable i-f rack. Shaft E turns only when the detent gear is turned, and the detent gear can be turned only through shaft B and the KILOCYCLES dial knob. Thus band changing does not affect the tuning of the i-f coils.

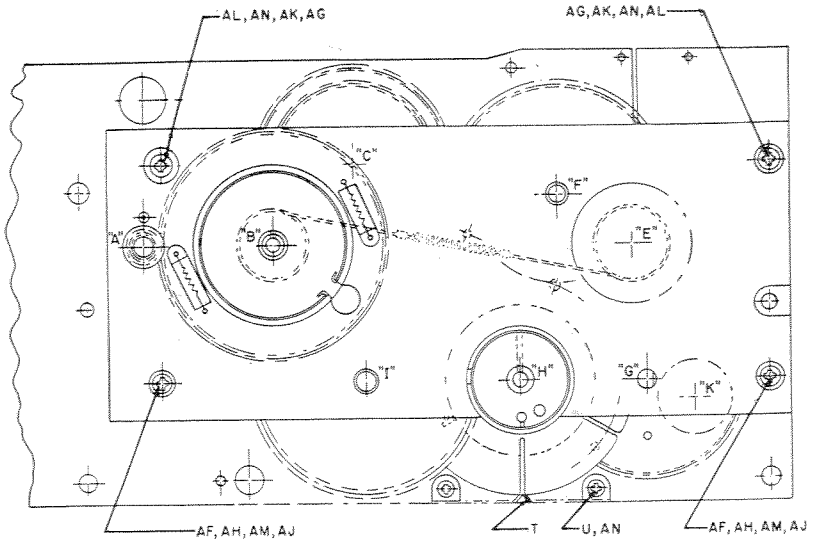
d. R-F Switches. R-f switches S101 through S107 are 18-position rotary switches of which only the first 16 positions are used. Of the 16 operative positions, one each is used for tuning steps 1 through 15, while the sixteenth position is used for all 15 remaining tuning steps. The position of the r-f switches is controlled by the BAND CHANGE knob through the 16- and 144-tooth gears, each half-turn of the knob causing a one-position shift of the switches until position 16 is reached. To prevent further turning of the BAND CHANGE knob from moving the switches beyond position 16, an overtravel coupler is interposed between the 144-tooth gear and the switches. The coupler permits the knob and associated gears to be turned beyond tuning step 16, to tuning step 30, and at the same time leaves the switches stationary at position 16. The coupler is driven by the detented ball held between it and the 144-tooth gear. The coupler thus follows the gear to each of the first 15 positions until, at position 16, the pin on the periphery of the coupler is arrested by the stationary stop pin, making only the gear free to move to the higher positions. When returning to the lower numbered tuning steps, the pin on the gear again engages the pin on the coupler at position 16, so that the gear can drive the coupler and switches to the lower tuning step positions.

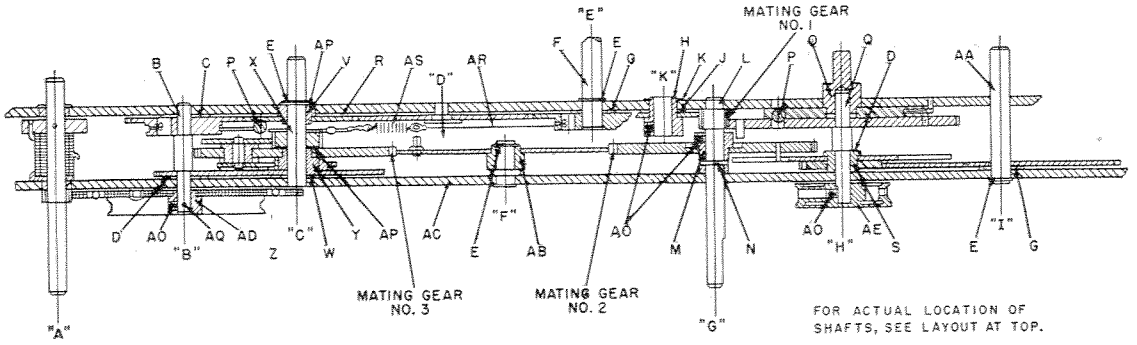
e. Crystal Switches. The crystal switches S108 and S109 are 18-position switches, of which only the first 16 positions are used, and are operated so that each position is used for two tuning steps. The switches are turned by the BAND CHANGE knob through the Geneva wheel and shafts H and I. The Geneva wheel makes one-sixth of a turn each time it is engaged by the drive pin on the 85-tooth gear attached to the shaft of the BAND CHANGE knob. Since this occurs only once each full turn of the knob, and since each half-turn of the knob equals a 1-mc tuning step change, the switches are turned one position only once every two tuning steps.

f. I-F Switches. I-f switches S110 and S111 are rotary switches, having two positions, with every other position electrically the same. These switches are turned one position for each half-turn of the BAND CHANGE knob, by means of shafts G and K.

59. Frequency Indication

The tuned frequency of the receiver is shown on two dials which must be read in combination. The KILOCYCLES dial which shows the *units* and *tens* figures of the frequency in kilocycles is turned directly by the tuning knob on the end of shaft A. The *hundreds* and *thousands* figures of the frequency in kilocycles are located on a slide rule type scale on the MEGACYCLES dial drum and are actually marked in decimal and unit megacycles. The pointer which indicated these figures is moved by a cable and pulley on shaft B which is turned by the main tuning knob. The scales on the MEGACYCLES dial drum extend over a range of 1 mc only and 30 scales are thus needed to cover the full frequency range of the receiver. The proper scale on the drum is turned into viewing position by means of a cord and pulleys which are turned by the BAND CHANGE knob, each half-turn of the knob causing another scale to come into view.





CROSS-SECTIONAL VIEW

SHAFT "A"	SHAFT "E"	SHAFT "A"	SHAFT "E"
0	0	2 + 270°	91° 23'
0 + 90°	8° 18'	3	99° 42'
0 + 180°	16° 37'	3 + 90°	108°
0 + 270°	24° 55'	3 + 180°	116° 18'
1	33° 14'	3 + 270°	124° 37'
1 + 90°	41° 32'	4	132° 55'
1 + 180°	49° 51'	4 + 90°	141° 14'
1 + 270°	58° 9'	4 + 180°	149° 32'
2	66° 28'	4 + 270°	157° 51'
2 + 90°	74° 46'	5	166° 9'
2 + 180°	83° 5'	5 + 90°	174° 28'

SHAFT "A"	SHAFT "E"	SHAFT "A"	SHAFT "E"
5 + 180°	182° 46'	8 + 90°	274° 9'
5 + 270°	191° 5'	8 + 180°	282° 28'
6	199° 23'	8 + 270°	290° 46'
6 + 90°	207° 42'	9	299° 5'
6 + 180°	216°	9 + 90°	307° 23'
6 + 270°	224° 18'	9 + 180°	315° 42'
7	232° 37'	9 + 270°	324°
7 + 90°	240° 55'	10	332° 18'
7 + 180°	249° 14'	10 + 90°	340° 37'
7 + 270°	257° 32'	10 + 180°	348° 55'
8	265° 51'	10 + 270°	357° 14'

POSITION OF SHAFT "A" GIVEN IN NO. OF TURNS PLUS DEGREES FROM CCW STOP. SHAFT "E" MUST POSITION WITHIN 27' OF ITS SPECIFIED FIGURE FOR EACH INCREMENT OF ROTATION ON SHAFT "A". SETTINGS ON "A" (EXCEPT END POSITIONS) TO BE APPROACHED IN BOTH CW AND CCW DIRECTIONS.

QUANTITY	ITEM NO.	PART NAME
1	A	BACK GEAR PANEL
1	B	REV. GEARS AND SHAFT ASSEMBLY
1	C	WASHER
2	D	WASHER
4	E	RETAINING RING I
1	F	I.F. DRIVER GEAR AND SHAFT ASSY
2	G	WASHER
1	H	GEAR ASSEMBLY - SWITCH I.F.
2	J	WASHER
1	K	RETAINING RING
1	L	MC KNOB SHAFT
1	M	KNOB GEAR AND HUB ASSEMBLY
1	N	GROOVE PIN
1	O	SHAFT ASSEMBLY - BAND SWITCH

QUANTITY	ITEM NO.	PART NAME
2	P	BALL
1	Q	SHAFT ASSEMBLY - GENEVA WHEEL
1	R	THRUST BEARING
1	S	HUB ASSEMBLY - GENEVA WHEEL
1	T	CENTERING SPRING
2	U	6-32 X 1/8 PBH SCREW
1	V	HUB ASSEMBLY - DETENT GEAR
1	W	WASHER
1	X	DETENT SPRING ASSEMBLY
1	Y	CENTER PLANET-GEAR AND HUB ASSY
1	Z	HUB ASSEMBLY - FLOATING
1	AA	SHAFT AND GEAR ASSEMBLY
1	AB	STOP IDLER GEAR HUB ASSEMBLY
1	AC	FRONT GEAR PANEL
1	AD	POINTER PULLEY ASSEMBLY

QUANTITY	ITEM NO.	PART NAME
1	AE	PULLEY - DRUM
2	AF	POST - LOWER SPACING
2	AG	POST - UPPER SPACING
4	AH	SCREW, 8-32 X 5/16
4	AJ	WASHER, NO. 8 FLAT
4	AK	6-32 X 1/4 SCREW
4	AL	WASHER, NO. 6 FLAT
4	AM	WASHER, NO. 8 SHAKE
6	AN	WASHER, NO. 6 SHAKE
6	AO	SET SCREW, 6-40 X 1/8
4	AP	WASHER
1	AQ	GROOVE PIN
2	AR	LOADING CABLE
1	AS	SPRING

NOTE:
DESIGNATION OF PARTS CONFORMS TO MANUFACTURER'S ASSEMBLY DRAWING 505 2189 004.

TM 854-31

Figure 31. Dial and band-switch gear box.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

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

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: Be extremely careful when servicing the receiver; dangerous high voltages are present. When checking voltages, use probes that are completely insulated except for the tip. Observe polarities to protect the meter. Take no continuity readings unless the receiver power is removed. Discharge capacitors before checking.

60. Trouble-Shooting Procedures

a. The first step in servicing a set is to attempt to sectionalize the fault. Sectionalizing means tracing the fault to the major component, circuit, or stage in the receiver responsible for 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 troubles such as burned-out resistors, r-f arcing, and shorted transformers can be located by sight, smell, or hearing. The majority of faults must, however, be localized by checking the voltage and resistance.

b. 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 procedure should cause no further damage to the receiver. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection is to locate any visible trouble. This is best done by using a strong light or a flashlight in areas of shadow. Through this inspection alone the repairman may frequently discover the trouble or determine the stage in which the trouble lies. This inspection is valuable in avoiding additional damage to the receiver that might otherwise occur as a result of improper servicing, and in forestalling future failures.

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

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

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

(5) *Signal substitution.* The principal advantage of the signal substitution method is that it usually enables the repairman to localize the trouble accurately and quickly to a given stage when the general location of the trouble is not immediately apparent from other tests.

(6) *Stage gain charts.* These charts can be used to localize obscure, hard-to-find troubles and should be referred to only after having exhausted other means.

(7) *Intermittents.* In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set. It is possible that the trouble is not in the receiver itself but in the installation, or the trouble may be caused by external conditions. In this event, check the installation, if possible.

61. Trouble-Shooting Data

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

Fig. No.	Description
42	Radio Receiver R–388/URR, schematic diagram.
32	Tube socket voltage and resistance chart.
33	Radio Receiver R–388/URR, top view.
34	Radio Receiver R–388/URR, bottom view compartmented.
35	Bottom view of chassis, compartment 1, capacitors.
37	Bottom view of chassis, compartment 2.
38	Bottom view of chassis, compartment 3.
5	Radio Receiver R–388/URR, rear view.
36	Bottom view of chassis, compartment 1.

62. Test Equipment Required for Trouble Shooting

The test equipment required for trouble-shooting Radio Receiver R–388/URR is listed below. The technical manuals associated with the test equipment are also listed.

Test equipment	Publication
Signal Generator TS–497A/URR (range 2 to 400 mc).	TM 11–5030
Audio Oscillator TS–382A/U	TO 16–35TS382–2
Tube Tester I–177 and I–177–A	TM 11–2627
Frequency Meter Set SCR–211–(*) (range 125 kc to 20 mc).	TM 11–300
Frequency Meter TS–174B/U	TM 11–5044
Electronic Multimeter TS–505/U	TM 11–5511
Ballantine VTVM Model No. 300 Multimeter TS–352/U	TM 11–5527
Output Meter TS–585A/U	TM 11–5017

63. General Precautions

Careless replacement of parts can cause additional troubles. Observe the following points.

a. Before a part is unsoldered, note the position of the leads. If a part, such as a transformer, has many taps, tag each lead for correct identification.

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

c. Do not allow drops of solder to fall into the set as they may cause shorts. If possible, place strip of cardboard beneath part to be soldered to catch drippings. Be sure iron is hot, clean, and tinned.

d. A carelessly soldered connection may create a new fault and is extremely difficult to locate.

e. When a part is replaced in the r-f or i-f circuit, it must be placed exactly as the original one was. A part which has the same electrical value, because of a difference in physical size, may cause trouble in the higher-frequency circuits, where slight resistance and capacitance changes can cause erratic operation. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Burnish or scrape the ground area before attaching wire. Failure to observe these precautions may result in decreased gain or, possibly, in oscillation of the circuit.

64. Checking Filaments and B+ Circuits for Shorts

a. The filaments operate at 6.3 volts a-c from a l-v (low-voltage) winding on the secondary of power transformer T108. A short in the filament circuit would hardly cause damage to the filaments, unless of course, a short circuit occurred across the h-v and l-v windings of transformer T108. Before applying power, check the taps on the transformer. Visual inspection of the miniature tubes with the power turned on should show whether each is lighted. A continuity check of the filament pins of the tube will determine if the tube is at fault; otherwise, check the filament contact at the sockets for shorts.

b. Before applying power to a set known to be defective, it is advisable to check the B+ line for shorts. Be sure the power is removed

before checking for a short. The preferable check is to replace the plug-in filter can. A resistance reading at the terminals of filter choke L122 should read approximately 100 ohms. A resistance reading at the terminals of output filter choke L123 should read approximately 300 ohms. If the output filter choke reading is appreciably less than 300 ohms, remove filter capacitor unit C217 connections and check pins for breakdown before replacing filter choke.

c. Refer to tube socket resistance and voltage chart (fig. 32). With power removed, check resistances at pins against reading as outlined. Apply power and check voltages.

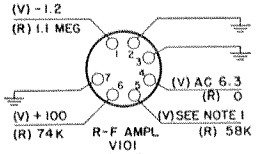
65. Operational Test

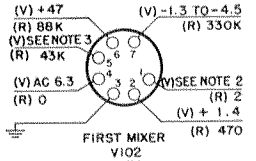
a. For rapid orientation with the operation of the receiver and for ready reference to the logical and usual sources of trouble, refer to the equipment performance checklist (par. 36).

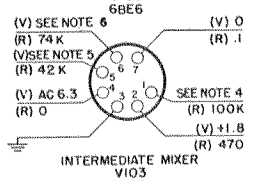
b. Use of the receiver meter in either the input and output position with the avc off may be helpful in determining whether the trouble is located before the detector stage or following it.

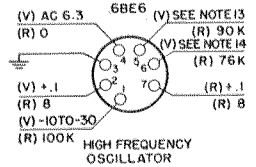
NOTES:

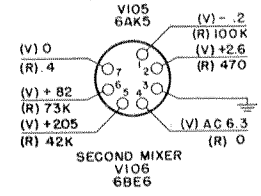
ALL MEASUREMENTS TAKEN FROM SOCKET PINS TO GROUND, RESISTANCE MEASUREMENTS TAKEN WITH NO AC INPUT, BUT POWER SWITCH ON.
GAIN CONTROLS ARE ON FULL. AVC IS ON.
ALL OTHER SWITCHES ARE OFF UNLESS OTHERWISE NOTED.
VOLTAGE MEASUREMENTS TAKEN WITH 115V AC INPUT, POWER SWITCH ON, BUT NO INPUT SIGNAL.
RF GAIN FULL ON, AUDIO GAIN OFF, AVC ON.
ALL OTHER SWITCHES ARE OFF UNLESS OTHERWISE NOTED.
VOLTAGES MEASURED WITH ELECTRONIC VOLTMETER, 11 MEGOHMS INPUT RESISTANCE.
ALL VOLTAGES EXCEPT HEATERS ARE D.C.
NC MEANS NO CONNECTION.

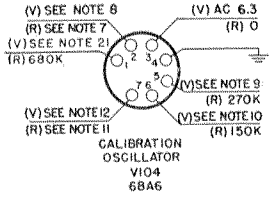


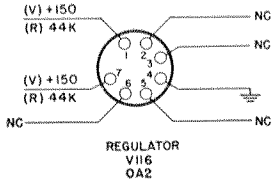


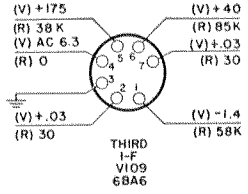


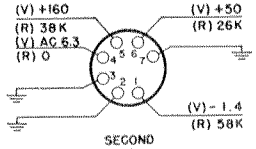


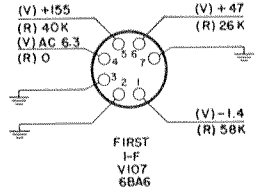


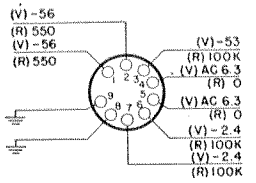


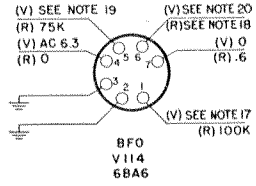


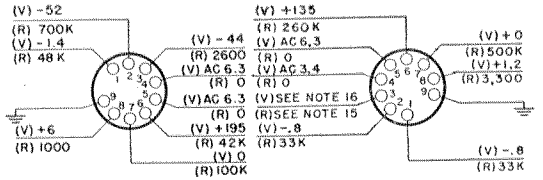


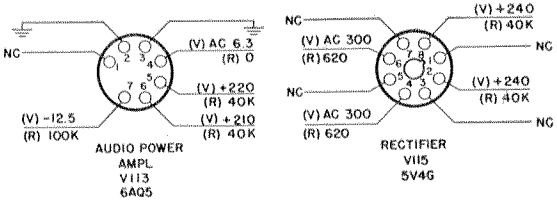












NOTES:

1. BAND 1 (V) +58
   BANDS 2 TO 3 (V) +190
   BANDS 4 TO 30 (V) +125
2. (V) 0 SMALL INDICATION ON BANDS 2 AND 3.
3. BAND 1 (V) +180
   BANDS 2 TO 3 SMALL IND.
   BANDS 4 TO 30 (V) +210
4. BAND 1 (V) -1.3
   BAND 2 (V) -2.0
   BANDS 3 TO 30 (V) 0
5. BAND 1 (V) +210
   BANDS 2 TO 30 (V) 0
6. BAND 1 (V) +85
   BANDS 2 TO 30 (V) +70
7. (R) OO CAL. OFF
   (R) 4700 CAL. ON
8. (V) +60 CAL. OFF
   (V) +7.2 CAL. ON
9. (V) +170 CAL. OFF
   (V) +80 CAL. ON
10. (V) +175 CAL. OFF
    (V) +64 CAL. ON
11. (R) ∞ CAL. OFF
    (R) 4700 CAL. ON
12. (V) +60 CAL. OFF
    (V) +7.2 CAL. ON
13. BANDS 1 TO 2 (V) +39
    BANDS 3 TO 12 (V) +165
    BANDS 13 TO 30 (V) +39
14. BANDS 1 TO 2 (V) +105
    BANDS 3 TO 12 (V) +115
    BANDS 13 TO 30 (V) +105
15. (R) 33K LIM. OUT
    (R) 1 MEG. LIM. IN
16. (V) -.8 LIM. OUT
    (V) -.3 LIM. IN
17. (V) -.5 BFO OFF
    (V) -10 BFO ON
18. (R) 0 BFO OFF
    (R) 142K BFO ON
19. (V) 200 BFO OFF
    (V) 140 BFO ON
20. (V) 0 BFO OFF
    (V) 69 BFO ON
21. (V) 0 CAL. OFF
    (V) -24 CAL. ON

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Figure 32. Tube voltage and resistance chart.

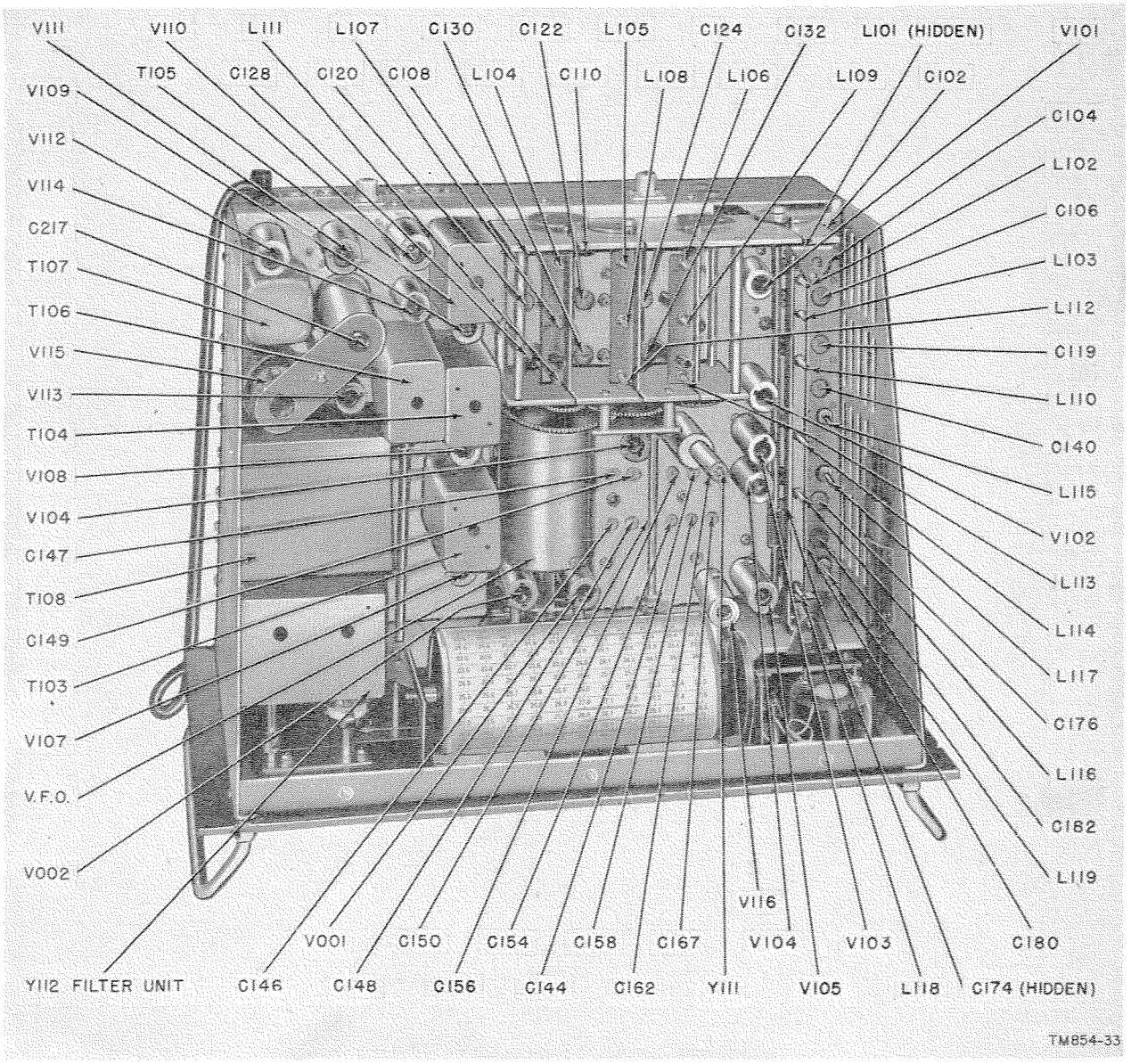


Figure 33. Radio Receiver R-388/URR, top view.

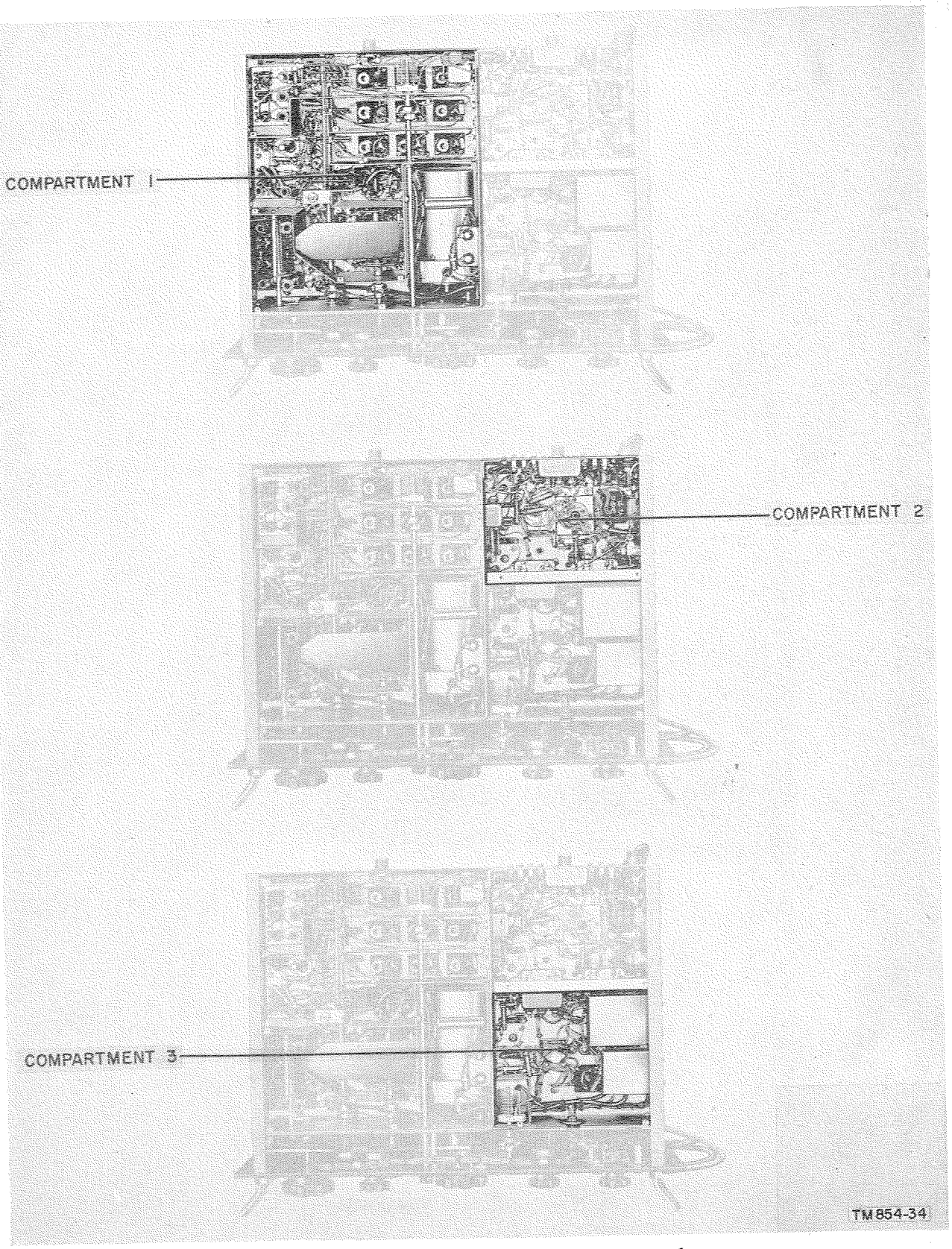


Figure 34. Bottom view of chassis, compartmented.

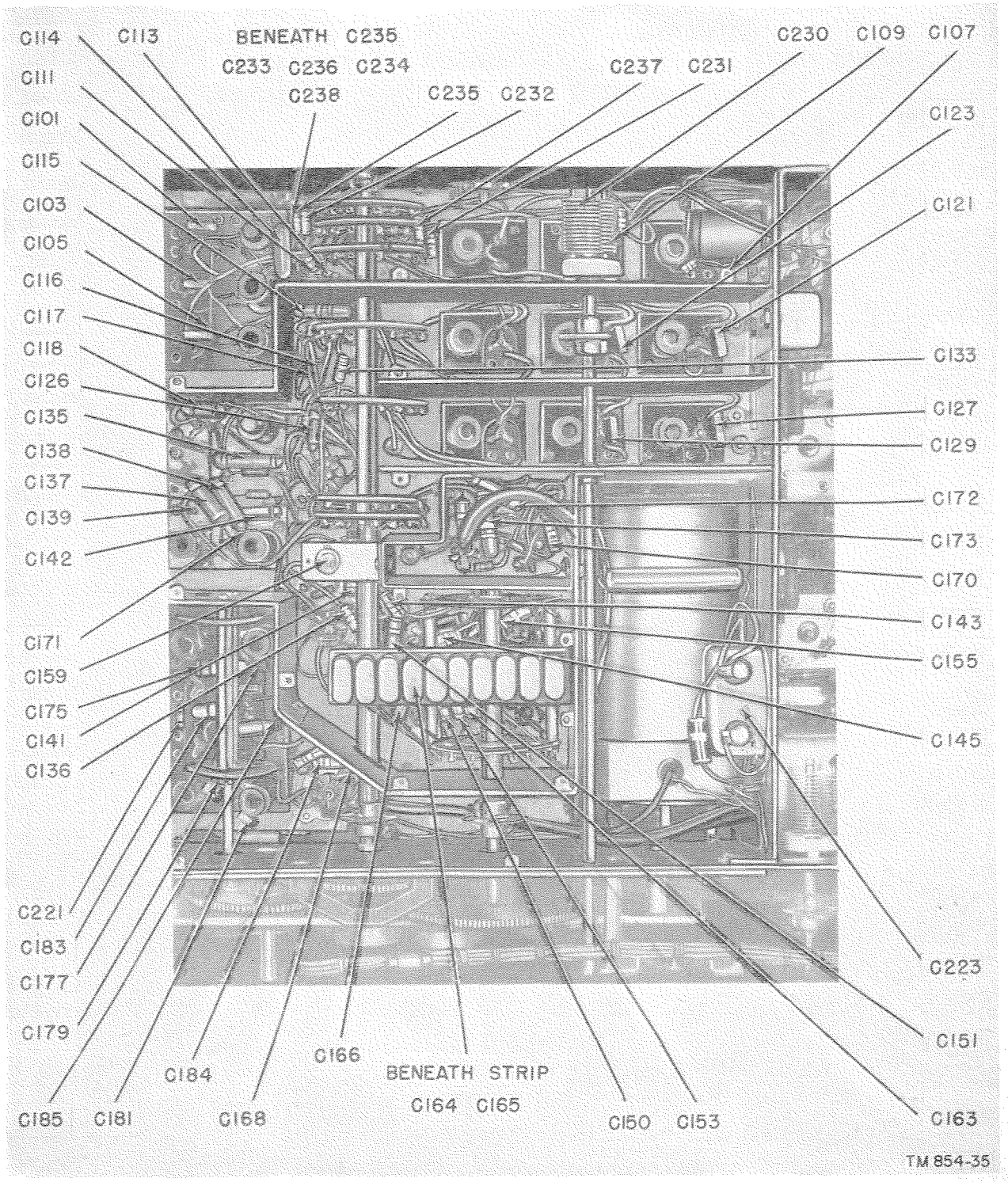


Figure 35. Bottom view of chassis, compartment 1, capacitors.

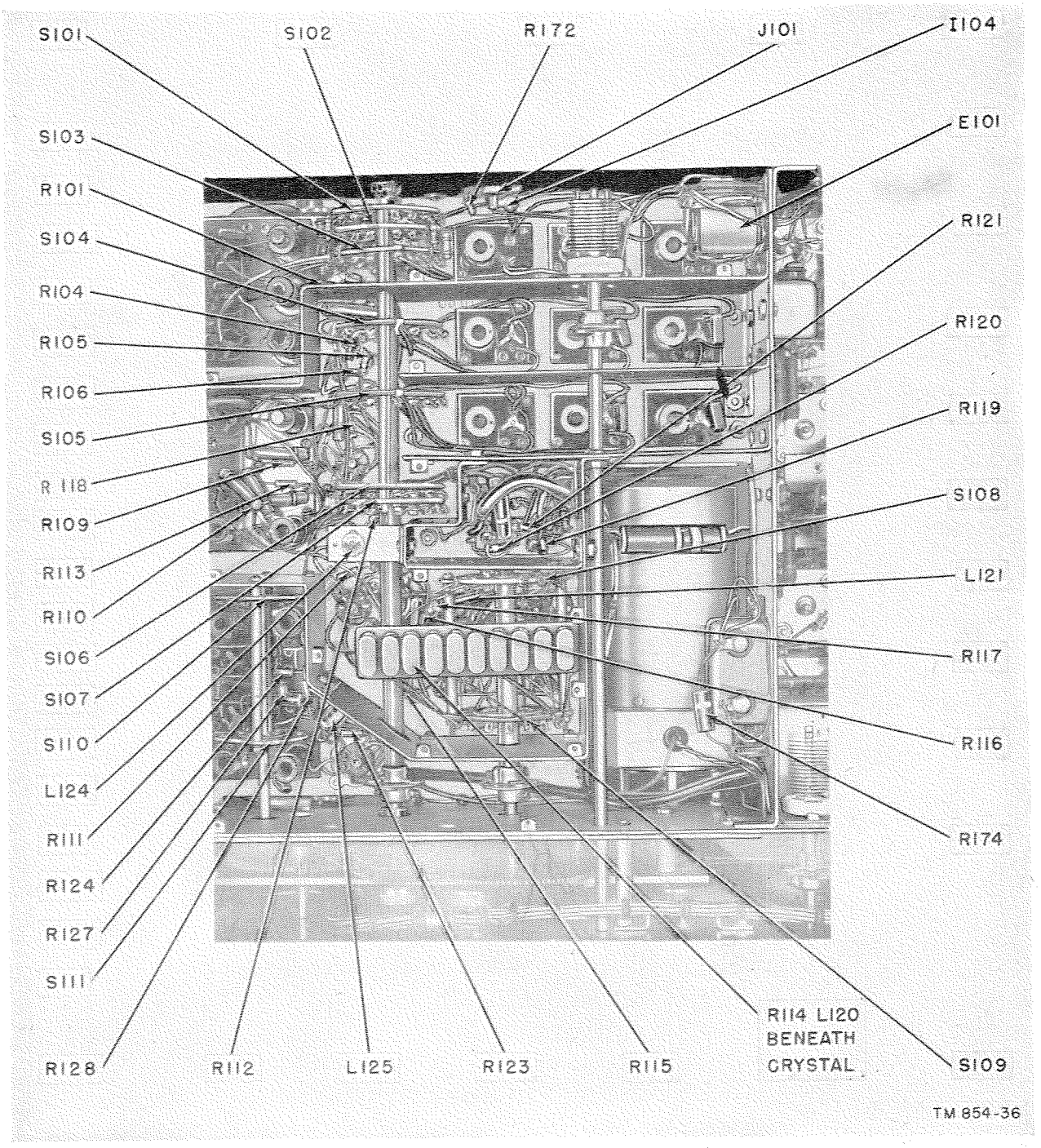


Figure 36. Bottom view of chassis, compartment 1.

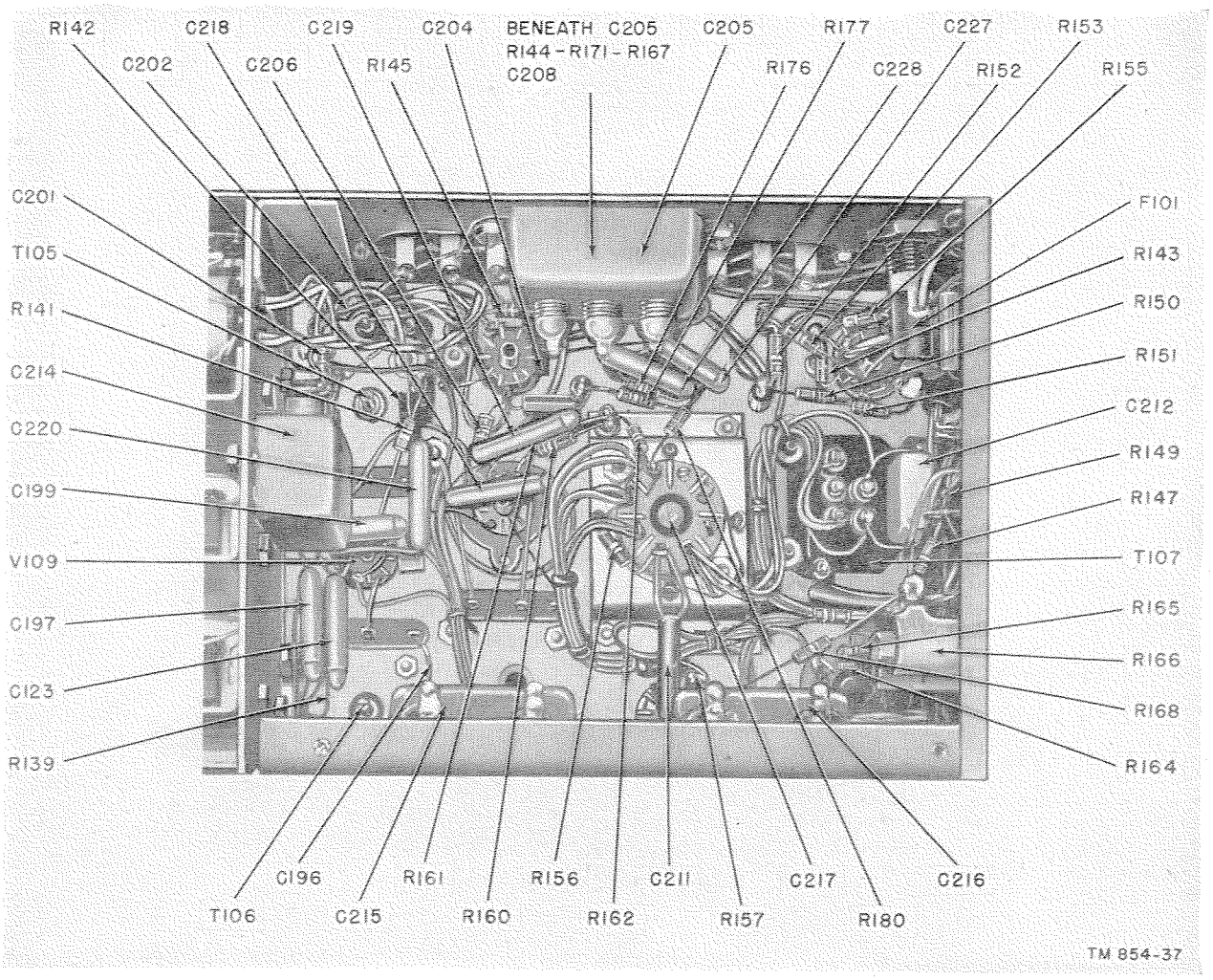


Figure 37. Bottom view of chassis, compartment 2.

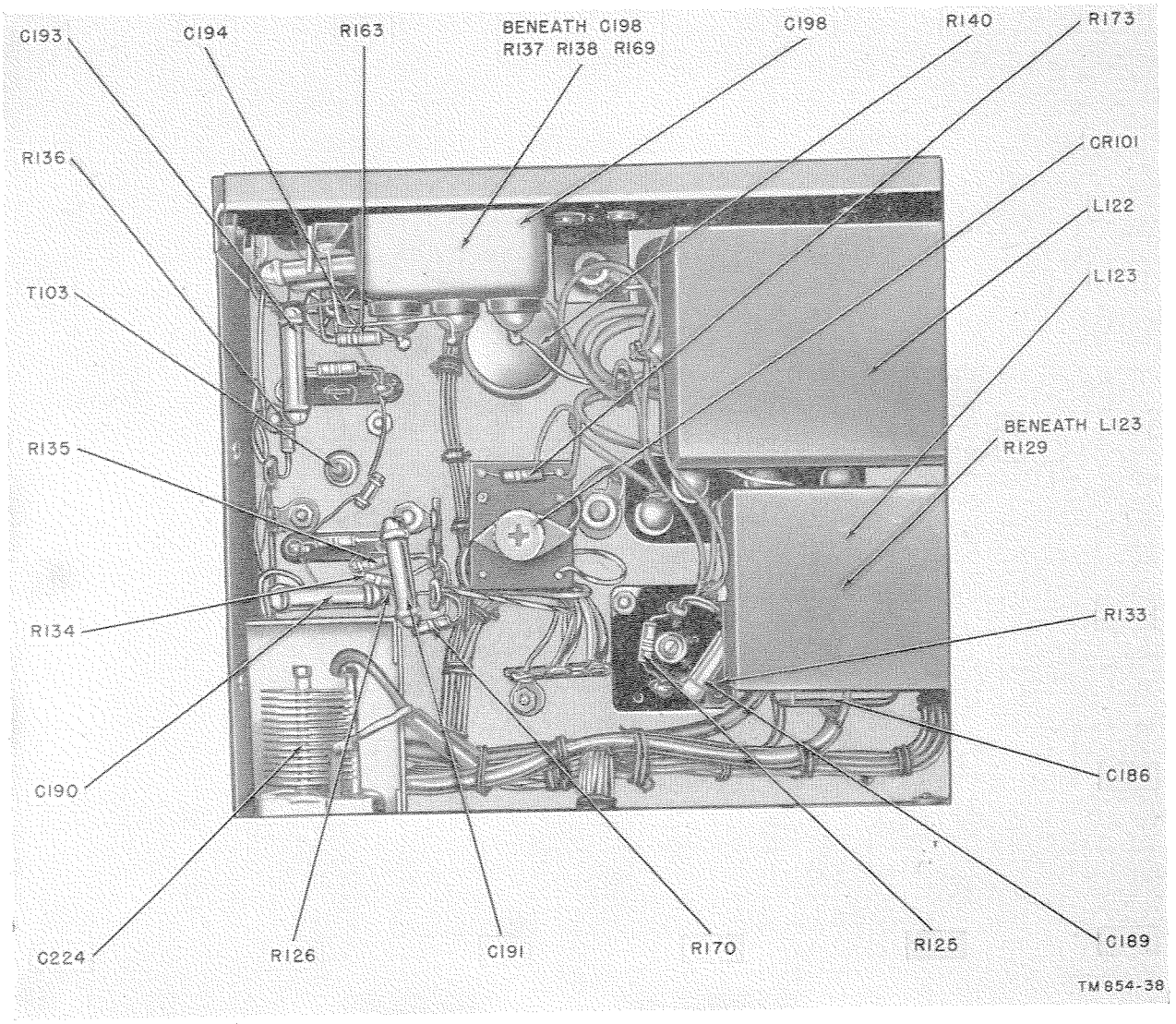


Figure 38. Bottom view of chassis, compartment 3.

66. Trouble-Shooting Chart

The following chart is supplied as an aid in locating trouble in the receiver. This chart lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. The chart also indicates how to localize the trouble quickly to the various stages. The signal substitution tests (par. 68) then can be used to supplement this procedure and to determine the defective stage. Once the trouble is localized to a stage or circuit, a tube check and voltage and resistance measurement of this stage or circuit should ordinarily be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in figure 32.

Symptom	Probable trouble	Correction
1. OFF-STANDBY-ON switch at ON position. Receiver inoperative, dial lamps do not light.	No line power.	Check power source.
	Blown fuse.	Replace fuse. If replaced fuse blows, check filter capacitor plug-in unit C217.
	Break in a-c cord, usually at plug end or where cord enters set.	Check cord for continuity, banding cord every few inches while watching ohmmeter for needle deflections.
	Crack in fuseholder or holder leads disconnected.	Check fuseholder and leads. Make repairs.
2. No receiver output with RF GAIN and AUDIO GAIN set at 10. Signal input indicated by meter with switch in INPUT position. No output from receiver.	Trouble lies in stages after second intermediate frequency.	Check tubes V109, V110, V111, V112, and V113.
		Check transformers T104, T105, and T107 for open circuits.
		Check capacitors C211 and C209 by replacing with capacitor of equal value.
		Check resistances R152 and R153.
		Check AUDIO GAIN control R154.
3. Receiver inoperative. Meter does not respond as receiver is tuned. Dial lamps light.	Rectifier tube V115 defective, chokes L122 and L123 open, filter capacitor plug-in unit C217 shorted.	Replace tube and/or chokes. Replace filter capacitor unit.
	Defect exists between antenna terminal and detector stage V110.	Check tubes V101 through V109. Check continuity, primary and secondary of transformers T105, T104, T103, T102, T101.
		Check continuity of L116, L117, L118, and L119 with the BAND CHANGE switch on the odd and even tuning steps.
	Trouble may occur in the switching. Try tuning on each band to determine whether the entire set is inoperative, one particular band, or variable i-f switches S110 and S111.	Refer to mechanical trouble-shooting data (par. 67).
	With CALIBRATE and BFO switches ON and the main tuning dial turned through 100 kc, and oscillatory note is heard at the output of the receiver.	Antenna relay K101 defective. Repair or replace.
4. A-m signals received but no c-w apparent at output with BFO switch ON and the set tuned to a c-w station.	Bfo defective.	Replace tube V114.
		Check bfo coupling capacitor C206.
		Check socket resistances and voltages against figure 32.
		Check T106 unit.
5. With CALIBRATE switch ON, and receiver tuned to WWV, no oscillatory note is heard at output.	Calibration oscillator defective.	Check tube V104.
		Check capacitor C111 and C173.
		Check switch S118.
		Check voltages and resistances at socket of V104 against figure 32.
		Check plug-in crystal Y111.
6. Reception weak. With no signal tuned in, rushing noise is not apparent at output, when AUDIO GAIN and RF GAIN controls are rotated through maximum. CRYSTAL FILTER switch at 0 position.	Poor antenna hook-up matching.	Tighten antenna connections. Check for grounds. Adjust ANT. TRIM control.
	Weak tubes particularly the rectifier, V115.	Check tubes. If receiver has been operated constantly over a long period, replace entire tube set.

Symptom	Probable trouble	Correction
7. With a station tuned in, receiver output is low. Meter appears sluggish.	Low plate or grid voltage caused by shorted capacitor in plate or screen return circuits.	Check voltages and resistances at sockets against figure 32.
	Receiver not properly alined.	Realine as outlined in paragraphs 80–94.
8. Reception distorted.	Open grid resistor in audio stage V113.	Check voltages and resistances at sockets against figure 32.
	Incorrect grid biases.	Check terminal 10 (h-v winding center tap) on secondary of power transformer T108 for high-resistance connection. Repair. Check grid voltages against chart number with AVC control at OFF. RF GAIN control R148 open or shorted.
	Poor output impedance match.	Check secondary taps of transformer T107 and speaker connections.
	Improper operating potentials.	Check tube voltages against chart number.
		Check filter chokes L122 and L123 for shorted turns, and filter capacitor C217 for excessive leakage.
	Leaky screen bypass and plate decoupling capacitors.	Replace bypass capacitors with good capacitors of equal value.
	1,250-kc heterodyne.	Adjust L124 (par. 94).
		Check grid return resistors in mixers.
	Strong signal with AVC control at OFF.	Reduce RF GAIN control, R148 setting.
9. Noise and fading signals.	Faulty RF GAIN and AUDIO GAIN controls.	Tune to station. First short AUDIO GAIN, then short RF GAIN control. If signals become stable under either one of these procedures, or noise is produced, a defective control is indicated and should be replaced.
	Swinging antenna.	Reduce sag in antenna. Tighten connections.
10. Hum at output.	Short turns in filter chokes L122 and L123.	Check resistance of chokes L122, 100 ohms; L123, 300 ohms.
	Defective filter capacitor unit C217.	Replace plug in unit.
11. Intermittent noise.	Defective tube, resistor, or capacitor.	With an insulated probe, gently tap and slightly move all tubes, resistors, capacitors, and soldered connections to locate loose elements in tubes or faulty connections.
12. Whistle or howl in receiver.	Defective tube, poor shielding and grounding.	Check tubes. Shunt bypass capacitors with capacitors of equal value to locate open unit.

67. Mechanical Trouble-Shooting Data

Failure of the receiver to operate properly often may be caused by mechanical faults. Some of the more probable mechanical sources of trouble are listed in the following table. See paragraphs 74–79 for repair instructions.

Symptom	Probable trouble	Correction
1. No detenting of bands takes place when BAND CHANGE knob is turned.	Ball and detent-spring assembly (on shaft C, fig. 30) bent or broken.	Repair or replace detent-spring assembly.
2. BAND CHANGE knob turns only one revolution, and then jams.	Centering spring for Geneva wheel loose, bent, or broken.	Tighten, repair or replace spring.
3. Receiver will not tune on some or all frequencies.	Cam rider for r-f slug rack or i-f slug rack stuck because of broken spring or dirty guide.	Clean and replace parts as required.
4. Turning BAND CHANGE knob causes wrong bands to be tuned in.	Overtravel coupler out of alinement.	Realine band-change mechanism.
5. Too much backlash occurs when reversing direction of tuning with KILOCYCLES dial knob.	Broken loading cord between shafts B and E (fig. 31).	Replace loading cord.
6. Band indicator drum does not turn.	Broken drum-drive cord.	Replace cord.
7. Dial pointer does not move.	Broken pointer cord.	Replace cord.

68. Signal Substitution Notes

a. Signal substitution requires a source of audio, i-f, and r-f signals. See paragraph 62 for a listing of suitable test equipment.

b. In addition, a headset or permanent magnet speaker is necessary.

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

d. In the test indicated in the following paragraphs, ground one side of the signal generator to the receiver chassis and connect the other side through a series capacitor (about .05 μf) to the receiver point as directed.

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

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

g. Misalinement of one or more stages in the receiver will cause reduced output. Misalinement of the oscillators, except the bfo, may prevent any output.

h. When trouble is localized to a given stage, first test the tube, then the voltage, and finally the resistance at the tube socket of that stage against figure 32.

i. Trouble in a circuit or stage may not cause changes in voltages or resistance measurements at the tube sockets. The instructions included in these paragraphs are merely a guide and should suggest other procedures, such as voltage and resistance measurements on individual parts, or any other tests that may be in order.

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

k. At each step, it is assumed that all previous steps were completed satisfactorily. Isolate and repair any troubles located before proceeding further.

69. A-F Tests

a. Apply an audio signal through a .05-μf capacitor to terminal 7 of V113. Listen for a signal at the headset. If no output signal is apparent, check tube V113 and taps of transformer T107. Check contacts at PHONES jack J103.

b. Apply an audio signal at tap 3 of the secondary of transformer T105. If no signal is audible at the output, check in turn, V112, AUDIO GAIN control R154, capacitor C209, and resistors R150, R152, and R153. Check the socket voltages of V112 and V113.

70. Fixed I-F Tests

For fixed i-f tests, set the controls as follows:

RF GAIN	Maximum.
AUDIO GAIN	Maximum.
BFO	OFF.
AVC	OFF.
LIMITER	OFF.
CRYSTAL FILTER SELECTIVITY.	0.

a. Apply a 500-kc modulated signal through a .05-μf capacitor to the plate (pin 5) of V109. The signal should be heard in the phones. If the signal is not heard, check the continuity of primary and secondary of transformer T105. Check capacitor C201.

b. Apply the 500-kc modulated signal to the grid (pin 1) of V109. The output signal should be louder. If not, check the voltage and resistance at the pins to determine the cause.

c. Repeat the procedure as outlined above with V108 and V107. Decrease the signal with each tube.

d. Apply the modulated 500-kc signal to the plate (pin 5) of V106. If no signal is heard at the output, check T101 for continuity.

71. Variable I-F Tests

a. Tune the receiver through its range on the odd- and even-numbered tuning steps. Notice the output.

b. If it is apparent that the receiver is not functioning properly only on the odd-numbered bands, check inductors L117 and L119 and capacitor C221.

c. If received signals develop insufficient or no output on the even-numbered bands, check inductors L116 and L118 and capacitor C220.

d. Check switches S110 and S111 on odd- and even-numbered tuning steps.

e. Refer to paragraphs 87 and 88, variable i-f alinement.

72. R-F Tests

a. The quickest r-f test and over-all check of the receiver can be made by using calibration oscillator V101. Turn the CALIBRATE switch to ON, the BFO switch to ON, and the RF GAIN and AUDIO GAIN controls at the halfway point (5). Revolve the main tuning knob across the spectrum of one of the lower bands. If a tone is heard at the harmonic frequencies of 100 kc throughout the tuning range, the receiver is operating. Defective r-f coils and capacitors can be detected by repeating this procedure over the 30 tuning steps. Also, faults in the switching can be brought to light.

b. If there is reason to suspect that the calibration oscillator is defective, an r-f modulated signal of known frequency can be applied to the grid (pin 1) of V101. If the set is operating properly, the signal should be audible at the output, and the main tuning control should read the correct frequency. A defective tuning step can be located by applying a modulated r-f signal from an accurately calibrated signal source.

73. Stage Gain Chart

The stage gain chart given in this paragraph lists the approximate input voltages required to produce a minimum of 500-mw signal output. Use these charts as standards when trouble shooting, to check the over-all gain of the receiver, and the gain of each stage listed below. When the receiver output is low and the tubes are performing in a satisfactory manner (as indicated by a tube checker), localize the defective stage by checking the signal voltage level of the stages against the chart, while using either the signal substitution or signal tracing method of trouble shooting.

a. Set the CALIBRATE, AVC, and BFO controls at OFF, and set the SELECTIVITY knob at 0. Increase the RF GAIN control setting until a reference voltage of 4 volts can be measured across the diode load resistor R151.

b. Allow 15 minutes for the signal generator to warm up. Ground the signal generator to the receiver chassis. Use short, well-shielded leads when applying signals. Feed the generator signals modulated 30 percent at 400 cycles through a 100-$\mu\mu$f capacitor and 50-ohm resistor.

Frequency	Signal generator output applied at	Signal generator output (microvolts)	Stage gain
500 kc	3d i-f V109, pin 1	53,000	73.5
500 kc	2d i-f V108, pin 1	1,500	35.5
500 kc	1st i-f V107, pin 1	27	55.5
2 or 3 mc	2d mixer V106, pin 7	29	.93
[a]11 mc	intermediate mixer V103, pin 7.	22	1.32
1 mc	1st mixer V102, pin 1	3	7.33
40 to 30 mc	1st mixer V102, pin 1	1.2 to 1.5	24 to 19.7
1 mc	r-f amplifier V101, pin 1	.3	10
2 to 30 mc	r-f amplifier V101, pin 1	.8 to 1.6	16 to 29

[a] Dial tuned to 1 mc.

Section II. REPAIR

74. Replacement of Parts

a. For the most part, the components of Radio Receiver R–388/URR are readily accessible and are easily replaced if found faulty. The sockets, capacitors, filter chokes, and inductors are mounted securely to the chassis with hexnuts and Phillips-head screws. The power transformer is bolted to the chassis. The bolts can be removed easily with socket wrenches, long-nosed pliers, and/or a Phillips screw driver. The dial knobs are removed with either of the wrenches mounted on the under side of the dust-cover. The crystal filter shield is lifted by removing one Phillips-head screw on top of the can and a hexnut beside the power transformer, beneath the receiver.

b. If any of the switch wafers require replacement, carefully mark the wires connected to the wafer with tags to avoid misconnection when the new switch is installed. Follow this practice whenever replacement requires the disconnection of numerous wires.

c. The parts that require special attention in their removal are listed in the following paragraphs.

75. Removal of VFO

a. When trouble occurs in the vfo unit, it is generally recommended that the entire unit be replaced. To begin this task, remove the V001 and V002 tube shields, then remove the tubes.

b. With the fluted socket type wrenches, remove the dial knobs listed below.

SELECTIVITY
PHASING
Main tuning
BAND CHANGE
ANT. TRIM
BFO PITCH

c. Remove the front panel by removing the 11 screws that secure the front panel, and unhook the 2 dial lamps over the MEGACYCLE dial drum and allow it to swing forward on wires.

d. Remove the KILOCYCLES dial.

e. Remove the three screws and spacers holding the oscillator to the chassis.

f. Tip rear of oscillator downward. Turn slightly to clear shaft, and lift out.

76. Tuning and Band-Change Gearing

a. General. Although the tuning and band-change gearing of the receiver can be removed as a complete unit, usually this is not necessary in order to make repairs. Almost all repairs can be made with the gears still in the receiver. Complete instructions for gaining access to the gearing, reassembling the gearing, and removing the entire gearing as a unit are given in the following subparagraphs.

b. Access to Gearing. Depending on the extent of repairs, the gear box may be removed from or left in the receiver. If the gear box is left in the receiver, perform steps 1, 2, and 3 only and proceed to *c* below for disassembly. If the gear box is to be removed from the receiver,

perform all of the following steps and those of *c* below.

(1) Turn the KILOCYCLE shaft to its counterclockwise stop and the MEGACYCLE shaft to its clockwise stop.

(2) Remove the SELECTIVITY, PHASING, BFO PITCH, BAND CHANGE, KILOCYCLE tuning, and ANT. TRIM knobs.

(3) Remove the collar, tension washer, and flat washer from the KILOCYCLE shaft. Remove the screws that fasten the front panel to the chassis. Lift off the panel, but do not detach it from the wiring to the chassis.

(4) Remove the end bracket from the right side of the chassis.

(5) Loosen the vfo, r-f slug, and i-f slug rack shaft coupler set screws which are accessible from the top of the receiver.

(6) Remove the two BAND CHANGE shaft coupler set screws which are accessible from the bottom of the receiver.

(7) Remove the vfo and gear box mounting screws.

c. Disassembly of Gearing.

(1) Turn shaft G (BAND CHANGE) clockwise to the stop below tuning step 1. Turn shaft A counterclockwise to the stop.

(2) Mark the mating gears which are referenced 1, 2, and 3 on figure 31. Make a mark across the 85-tooth spider gear and across the 90-tooth stop-pin gear (shaft F, fig. 31) using the top edge of the front gear panel for a guide.

(3) Make a radial mark on the 144-tooth gear below the Geneva wheel detent. Using the outline of the Geneva wheel as a template, make a mark on the 85-tooth Geneva wheel drive gear.

(4) Make a mark through the edge of the small dial cable pulley and the front gear panel.

(5) Extract the hub pin of the large dial cable pulley and remove the pulley and gear.

(6) Remove the small dial cable pulley and the retaining rings from shaft I and shaft F (fig. 31).

(7) Measure and note the length of the loading spring (AS, fig. 31).

(8) Remove the four front gear panel mounting screws. Remove the front gear panel, but do not allow the gears to unmesh, rotate, or ride up with the panel. Take care that the shim washers stay with their respective gears or shafts.

(9) Draw a line through the detent spring, the 48-tooth detent gear, and the rear gear panel. Draw another line through shaft E 52-tooth gear and the rear gear panel.

(10) Before removing any gears, mark all of them for identification. Note that the disk and gear of the overtravel coupler are detented. Do not lose the detent ball.

d. Reassembly of Gearing. The following instructions are given as a guide to the proper method of replacing parts. Apply a thin film of AN–G–25 or equivalent grease to all bearing surfaces when reassembling.

(1) *Loading cord.* When installing a new loading cord, cut the cord in half and tie a small loop in one end of each piece for attachment to the springs. To assemble, push the other end of each piece through the hole in the proper gear and knot it. The lengths of the cords (5 inches between knots) and the amount around each gear drum should be such that it will allow the stops on shaft A to operate before the spring strikes either gear drum. The spring is loaded to 6 pounds pull by disengaging a gear in the affected group, and winding the cord up on one of the gear drums. Coat the knots with Duco cement to prevent them from becoming untied.

(2) *Precautions in reassembling band-change gearing.* Observe the following precautions when reassembling the band-change gearing, shafts G and H.

(*a*) Place the centering spring so that it holds the slots in the Geneva

wheel in the path of the driving pin on the gear of shaft G.

(*b*) The radial pin on the overtravel coupler in the band-switch shaft assembly should be placed about 60° clockwise from the stop pin in the rear plate. After replacing ball, assemble Geneva-wheel shaft assembly, with the pin in the gear against the clockwise side of the radial pin.

(*c*) Use washers to shim shaft C so that a pull of 8 pounds minimum is required on the pin drive of shaft C for detent disengagement. These washers are shims which should be used on shafts C and H, respectively, in the quantity required to keep end play at a reasonable minimum.

(*d*) With shaft H assembled as explained, the two stop pins will be in the position shown in figure 31: one pin toward shaft E and the other 120° clockwise from it. The stop-idler gear should be rotated counterclockwise until its pin approaches the pin on shaft H as shown, with the ball detent on shaft C in its hole or detented position, and with the pin in the gear on shaft G directly under the shaft as shown in figure 30.

(*e*) Shaft G, when turned clockwise, must hit the stop after about 45° rotation. The ball on shaft C will then detent shaft G every 180°. When shaft G has rotated 7½ revolutions counterclockwise (or 15 detent positions), the pin in the gear on shaft H and the radial pin on band-switch shaft assembly, must have rotated clockwise until the radial pin is just touching or about to touch the pin in the rear plate. Further rotation of shaft G should cause the pin in the gear to leave the radial pin arrested by the pin in the rear plate. If the stop pins hit before 15 detent positions are made, readjust the mating of the gears. Shaft G must be able to rotate a minimum of 14½ revolutions (29 detent positions) (figs. 30 and 31).

77. R-F Slug Rack

a. General. Except for lubrication, the r-f slug rack requires very little maintenance. It should not be taken apart except to replace worn or broken parts. Follow the procedure below to check the proper alinement of cams when reassembling.

b. Cam Positions. Three cam-locating holes are located in the front plate of the r-f slug rack assembly. When correctly phased or synchronized, the tips of all three cams will appear simultaneously before their respective alining holes. It may be necessary to use a small mirror to observe the holes accurately. If this is not practicable, another method of checking the operation of the cams is as follows:

(1) Turn the BAND CHANGE knob to tuning step 30 (29.5 to 30.5 mc) and turn the tuning dial to the extreme clockwise position. View the cam of camshaft assembly (right-hand end) from the front. The cam rider, or follower, should be located approximately one-sixteenth inch to the right of the tip of the cam. The cam rider should descend along the right-hand edge of the cam when the tuning dial is turned counterclockwise.

(2) Turn the BAND CHANGE knob to tuning step 16 (15.5 to 16.5 mc) and turn the tuning dial to the extreme counterclockwise position. The cam rider should be on the descending portion of the cam but should not be bottomed at the lowest point of the cam.

(3) Turn the BAND CHANGE knob to tuning step 15 (14.5 to 15.5 mc) and turn the tuning dial to the extreme clockwise position. Viewing the center cam from the front, the cam rider should be positioned about one-sixteenth inch to the left of the tip of the cam.

(4) Turn the BAND CHANGE knob to tuning step 8 (7.5 to 8.5 mc) and turn the tuning dial to the extreme counter-

clockwise position. Viewing the center cam from the front, the cam rider should be on the descending portion of the cam but should not be bottomed at the lowest point of the cam.

(5) Turn the BAND CHANGE knob to tuning step 7 (6.5 to 7.5 mc) and turn the tuning dial to the extreme clockwise position. Viewing the left-hand cam from the front, the cam rider should be located approximately one-sixteenth inch to the right of the tip of the cam. The cam rider should descend along the right-hand edge of the cam when turning the tuning dial counterclockwise.

(6) Turn the BAND CHANGE knob to tuning step 4 (3.5 to 4.5 mc) and turn the tuning dial to the extreme counterclockwise position. The cam rider should be on the descending portion of the cam but should not be bottomed at the lowest point of the cam.

c. Realinement of Cams. If the cams are not properly alined, they can be realined by loosening the setscrews in the driving coupler on shaft C (fig. 31), adjusting the cam positions, and tightening the setscrews again.

78. Replacement of Dial Cables

(fig. 39)

a. General. To replace either the slide-rule pointer cable or the drum cable, it is necessary to remove the front panel. Use the following procedure:

(1) Remove the top and bottom dust-covers from the receiver.

(2) Remove the SELECTIVITY, PHASING, BFO PITCH, ANT. TRIM, KILOCYCLES dial, and BAND CHANGE knobs.

(3) Remove the front panel screws and lift off the panel but do not detach it from the wiring to the chassis.

b. Pointer Cable. To replace the pointer cable, a 36⅝-inch length of nylon-covered cable is required.

(1) Turn pulley A counterclockwise to the stop.

(2) Tie a loop in the end of the cable and string the cable on pulley A.

(3) Wind the cable twice around pulley A, run it around pulley D, then attach it to the pointer, and run it around pulley C.

(4) Terminate the cable at the end of the spring on pulley A. The spring should be pulled to full tension.

(5) Replace the front panel by reversing the procedure in *a* above.

c. Drum Cable. To replace the drum cable, a 27-inch length of nylon-covered string is required.

(1) Turn the BAND CHANGE shaft to tuning step 30 (29.5 to 30.5 mc) position, thus causing pulley E to reach its counterclockwise stop.

(2) Tie a loop in the end of the cable and attach it to pulley E and wind it around as shown in figure 39.

(3) Turn pulley E about one-half turn and hold it against the tension of the spring.

(4) Run the cable to pulley E and work it around the pulley one and one-half turns or more as required, before attaching the end.

(5) Loosen the setscrew in the hub of the drum and aline the 29.5- to 30.5-mc scale so that it will show in the window when the front panel is replaced. Tighten the setscrew.

79. Refinishing

Instructions for refinishing badly marred panels are given in TM 9–2851.

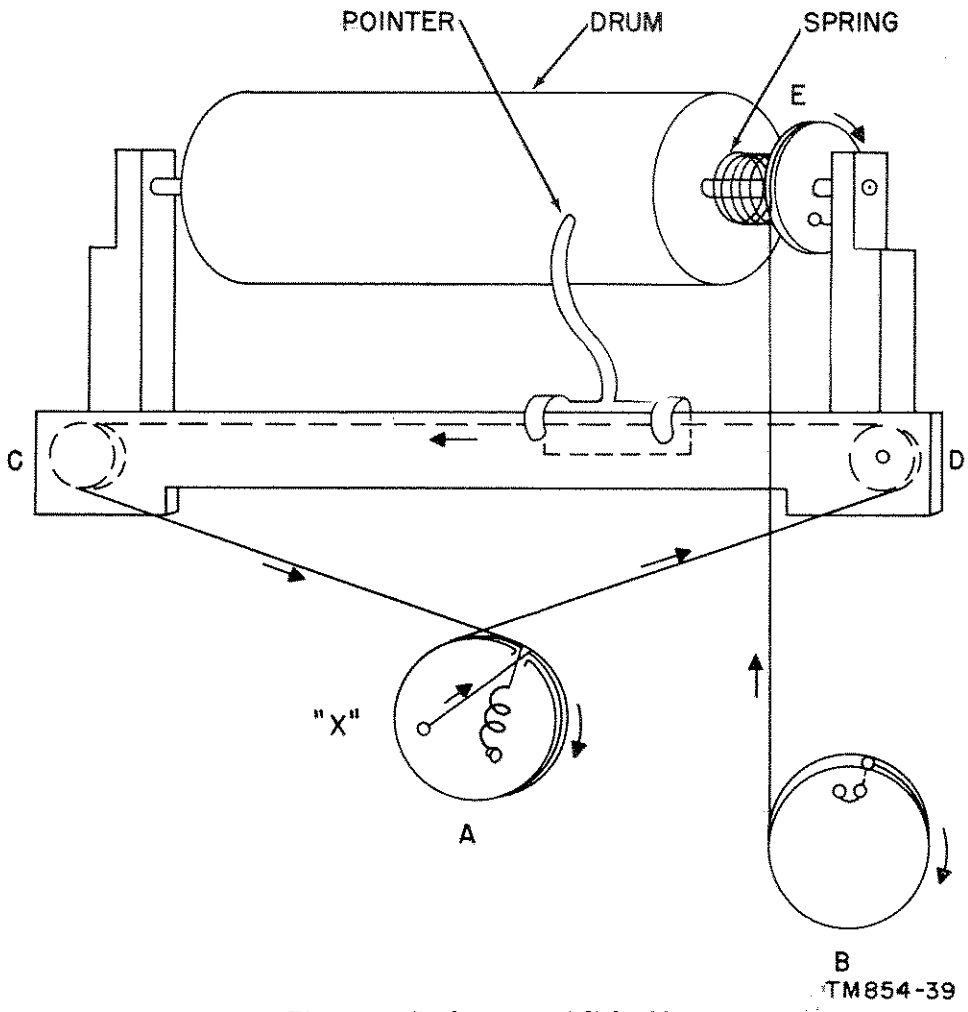


Figure 39. Replacement of dial cables.

Section III. ALINEMENT PROCEDURES

80. General

a. While alinement of the receiver can be considered a periodic necessity, the repairman should not go about this task in a haphazard manner or with inadequate facilities. Alinement should be undertaken only after all other tests and checks fail to improve the operation of a malfunctioning set.

b. Before beginning alinement, allow a warm-up period of at least 15 minutes for the receiver and test equipment.

c. While an adequate list of test equipment follows in paragraph 81, it is possible to aline the receiver, using the built-in calibration oscillator as a signal generator and S meter M101 in the OUTPUT position to trim the various capacitors for maximum output.

81. Test Equipment for Alinement and Adjustment

In addition to the test equipment listed in paragraph 62, the following items are required for alining and adjusting Radio Receiver R–388/URR:

a. Two bakelite alinement tools, with 1/8- and 5/16-inch screw-driver type bits, are required for adjusting cores and trimmer capacitors.

b. A head set or a permanent magnet type speaker will be required to provide aural response, since the receiver is not equipped with a speaker.

82. Crystal Oscillator V105 Trimmer Adjustment

a. Trimmer capacitor C167, marked XTAL on chassis, should be adjusted to provide an input capacity of 32 $\mu\mu$f across the crystal holders. If this capacitor is badly mistuned, the crystals will be off frequency and low in output.

b. Connect a 470,000-ohm resistor to pin 7 of V102. Connect a vtvm (vacuum-tube voltmeter) between free end of 470,000-ohm resistor and chassis. (Resistor is used to reduce capacity of meter probe).

c. In all the following adjustments, the trimmers should be peaked if the indicated voltage is not more than 2 volts. If the voltage is more than 2 volts, detune the trimmer toward minimum capacity until voltage reads 2. (See fig. 33 for location of trimmer). Repeat this procedure when performing the following adjustments.

(1) When tuning trimmer marked 30, with BAND CHANGE switch on tuning step 30 (29.5 to 30.5 mc).

(2) When tuning trimmer marked 28, with BAND CHANGE switch on tuning step 28 (27.5 to 28.5 mc).

(3) When tuning steps 26 through 14, tuning correspondingly marked trimmers (see par. 4*b* for MEGACYCLE dial markings).

(4) With BAND CHANGE switch on tuning step 1, adjust trimmer labeled BC which is nearest V105.

d. Remove the 470,000-ohm resistor. Connect the resistor to pin 1 of V103. Connect vtvm between free end of resistor and chassis.

e. Place BAND CHANGE switch on tuning step 1. Tune trimmer marked BC that was not previously tuned as described above.

83. 100-kc Calibration Oscillator Adjustment

Calibrate the 100-kc crystal oscillator as explained in paragraph 17.

84. I-F Amplifiers and Crystal Filter Unit Alinement

Connect the signal generator between the grid (pin 7) of V106 and chassis. Connect one end of a clip lead between C173 and C111 at the output side of the calibration oscillator. Hold the other end of the lead near the grid of V106. Set the CALIBRATE switch at ON. Set the signal generator to zero beat at 500 kc. Turn the calibrator oscillator off by setting the CALIBRATE switch to OFF. Connect detuning network (.01-μf capacitor in series with 4,700-ohm resistor) from plate of V107 to chassis. Connect a vtvm across diode load resistor R151. Place SELECTIVITY switch, S114, in the 0 position.

a. Tune the secondary (bottom) slug or T103 for maximum indication. Keep diode load voltage below 3 volts by adjusting signal generator output.

b. Connect detuning network from terminal 4 of T103 to chassis. Tune the primary (top) slug for maximum indication.

c. Connect the detuning network from plate of V108 to chassis. Tune the secondary of T104 for maximum indication.

d. Connect the detuning network to terminal 4 of T104. Tune the primary of T104 for maximum indication.

e. Connect the detuning network to the plate of V109. Tune secondary of T105 for maximum indication.

f. Connect the detuning network to terminal 4 of T105. Tune the primary of T105 for maximum indication.

g. Tune T101 for maximum vtvm indication.

85. BFO Adjustment

a. Turn the BFO switch to ON. Connect the signal generator between the grid (pin 7) of V106 and chassis. Set the BFO PITCH capacitor to midrange.

b. With a Bristo wrench loosen the BFO PITCH knob, and match the index line to line on the chassis. Tighten the knob.

c. Adjust the tuning core in T106 for zero beat, using insulated screw driver.

86. Alinement of Dial

a. Loosen the two front set screws on the vfo coupler with the wrench. (Insert the wrench from the right side of the oscillator cylinder).

b. Turn the vfo shaft by hand to an extreme clockwise position.

c. Turn BAND CHANGE switch to tuning step 2 (1.5 to 2.5 mc). Turn main tuning dial to 2.0 mc. Set the KILOCYCLES dial to zero-zero. Tighten set screws.

d. Connect one end of the clip lead to pin 7 of V106. Connect the other end of the lead between C173 and C111. Turn the CALIBRATE control to ON.

e. Rotate the vfo shaft counterclockwise by hand, noting beat note once every revolution. Stop at the sixth beat note and carefully set to zero beat. Tighten the coupler screws.

87. Tuning Step 2 and Variable I-F (for Even-Numbered Steps)

a. Connect the signal generator with a 270-ohm series resistor to the ANTENNA jack. Set BAND CHANGE switch to tuning step 2 (1.5 to 2.5 mc). Set the MEGACYCLE tuning dial to read 1.6 mc. Connect the vtvm between diode load resistor R151 and chassis.

b. Turn the BFO switch to ON and adjust the signal generator for 1.6-mc output. Adjust the output of signal generator to give some value of diode load voltage below 5 volts. Tune adjustments marked 1.6 (slugs in L116, L118, and L102) for a maximum indication (figs. 30 and 33). Continue to adjust signal generator output so that the diode load voltage does not rise over 5 volts.

c. Set the MEGACYCLE tuning dial to read 2.4 mc. Set generator to zero beat at 2.4 mc with the bfo. Tune adjustments marked 2.4 (trimmer capacitors C174, C180, and C104) for a maximum indication, keeping diode load voltage below 5 volts (fig. 33).

d. Repeat the tuning process as outlined above at 1.6 and 2.4 mc until no further increase in output can be obtained.

88. Tuning Step 3 and Variable I-F (for Odd-Numbered Steps)

a. Connect the signal generator and the vtvm as directed in paragraph 87.

b. Set the MEGACYCLES dial to read 2.6 mc. Set signal generator to zero beat at 2.6 mc with bfo. Turn off the bfo. Adjust the tuning cores of L117, L119, and L103 (fig. 33) marked 2.6 for maximum indication on the vtvm.

c. Set the MEGACYCLES tuning dial to read 3.4 mc. Set signal generator to zero beat at 3.4 mc with the bfo. Turn off the bfo. Adjust the trimmer capacitors marked 3.4 (C176, C182, and C106) for maximum indication on the vtvm. This completes the alinement of the variable i-f stage.

89. Tuning Steps 4 Through 7

a. Connect the signal generator and the vtvm as directed in paragraph 87. Set the BAND CHANGE switch to tuning step 4 (3.5 to 4.5 mc).

b. Set main tuning dial to read 4.0 mc. Set signal generator to zero beat at 4.0 mc with the bfo. Turn off the bfo. Adjust tuning cores marked 4.0 (in L104, L107, and L111) for maximum indication on the vtvm.

c. Set the BAND CHANGE switch to tuning step 7 (6.5 to 7.5 mc). Set main tuning dial to read 7.0 mc. Set signal generator to zero beat at 7.0 mc with the bfo. Turn off the bfo. Tune trimmer capacitors marked 7.0 (C108, C120, and C128) for maximum indication on the vtvm.

d. Repeat tuning procedures at 4.0 and 7.0 mc until no further increase is noticeable on the vtvm.

90. Tuning Steps 8 Through 15

a. Connect signal generator and the vtvm as directed in paragraph 87.

b. Set the BAND CHANGE switch to tuning step 8 (7.5 to 8.5 mc). Set the MEGACYCLES tuning dial to 8.0 mc. Set the signal generator to zero beat with the bfo at 8.0 mc. Turn off the bfo. Adjust tuning cores marked 8 (L105, L108, and L112) for maximum indication on the vtvm.

c. Set the BAND CHANGE switch to tuning step 15 (14.5 to 15.5 mc). Set the MEGACYCLES dial to read 15.0 mc. Set the signal generator to zero beat with the bfo at 15.0 mc. Turn off the bfo. Tune trimmer capacitors marked 15 (C110, C122, and C130) for maximum indication on the vtvm.

d. Repeat the tuning procedures at 8.0 mc until no further increase in output can be obtained.

91. Tuning Steps 16 Through 30

a. Connect the signal generator and vtvm as outlined in paragraph 87.

b. Set the BAND CHANGE switch to tuning step 16 (15.5 to 16.5 mc). Set the MEGACYCLES tuning dial to 16.0 mc. Adjust the tuning cores marked 16 (L106, L109, and L113) for maximum indication on the vtvm.

c. Set the BAND CHANGE switch to tuning step 30 (29.5 to 30.5 mc). Set the MEGACYCLES tuning dial to 30.0 mc. Adjust trimmer capacitors marked 30 (C124 and C132) for a maximum indication on the vtvm.

d. Repeat tuning procedures at 16 and 30 mc until no further increase in output is apparent.

92. R-F Alinement, Tuning Step 1

a. Connect the signal generator and the vtvm as directed in paragraph 87.

b. Set the BAND CHANGE switch to tuning step 1 (.5 to 1.5 mc). Set the MEGACYCLES tuning dial to .6 mc. Set the signal generator to zero beat with bfo at .6 mc. Turn off the bfo. Adjust core in L114 so that it is approximately in the same position in the inductor as the cores in L116 and L118.

c. Adjust tuning cores marked .6 (in L101 and L110) for a maximum indication.

d. Adjust trimmer capacitor marked .6 (C140) for a maximum indication.

Note. Two peaks may be found when tuning capacitor C140. Use the peak that requires the higher value of capacity.

e. Set the MEGACYCLES tuning dial to 1.4 mc. Set signal generator to zero beat with the bfo at 1.4 mc. Turn off the bfo. Tune trimmers marked 1.4 (C102 and C119) for a maximum indication on the vtvm. Adjust tuning core marked 1.4 (L115) for a maximum indication on the vtvm.

f. Repeat the tuning procedures at .6 and 1.4 mc until no further increase in output can be obtained.

93. VFO Alinement

a. The careful design of the vfo used in Radio Receiver R–388/URR makes it unlikely that the dial calibration will become inaccurate through normal use or treatment. However, should the dial calibration become inaccurate, the following paragraphs will show a capable technician with adequate facilities how to correct the dial calibration.

b. If the slide-rule calibration only is off frequency in the same directions on all bands, the dial pointer can be corrected by grasping the dial cord and sliding the pointer along the cord until the correct position for the pointer is found.

c. If the vernier dial calibration is incorrect by the same amount for all bands, aline in accordance with instructions in paragraph 86.

d. If all other correction measures fail and the calibration continues erratic or inaccurate, it can be assumed that one of the parts within the oscillator can is defective. In this case the oscillator must be removed as outlined in paragraph 75.

Caution: The vfo is inclosed in a hermetically sealed container. No attempt should be made to remove this shield unless adequate repair facilities are available.

94. Alinement of Inductor L124.

a. Turn the BAND CHANGE switch to tuning step 1 (.5 to 1.5 mc).

b. Tune to the spurious signal (whistle) at 1,250 kc.

c. From the bottom of the receiver, adjust L124 for the greatest attenuation of the spurious signal.

Section IV. FINAL TESTING

95. General

This section is intended as a guide in determining the quality of the repaired receiver. The minimum test requirements outlined in the following paragraphs may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

96. Test Equipment Required for Final Testing

The instruments needed for testing the repaired equipment are listed in paragraph 62. No attempt should be made to run performance checks unless the performance characteristics of the available test equipment are equal or superior to the equipment listed.

97. Beat-Frequency Oscillator

a. Calibration oscillator can be used. Tune receiver.

b. Turn the BFO switch to ON.

c. Turn the main tuning dial through 1 mc of tuning.

d. An oscillatory note will be heard when the kc indicator reads zero-zero with the hairline zero adjustment at dead center. The mc slide rule dial pointer will be superimposed on one of the calibration marks of the dial.

98. Sensitivity

a. Set the controls as follows:

AVC switch	OFF
RF GAIN control	Maximum
AUDIO GAIN control.	As required for 10–1 signal-plus-noise to noise.
SELECTIVITY	0
LIMITER switch	OFF
BFO	OFF

b. Apply an r-f signal, modulated 30 percent at 400 cps, to the ANTENNA jack through a 47-ohm resistor in series with a 100-$\mu\mu$f capacitor.

c. Make tests at the low-, middle-, and high-frequency points of each band.

d. The sensitivity on tuning step 1 shall be better than 15 uv. The sensitivity on tuning steps 2 through 30 shall be better than 5 uv.

e. The over-all gain on tuning steps 2 through 30 shall be enough to give 1 watt of audio with less than 5 uv input (AVC off).

f. The c-w sensitivity on tuning step 1 shall be better than 5 uv and on tuning steps 2 through 30, the c-w sensitivity shall be better than 1.6 uv.

99. Signal-Plus-Noise to Noise Ratio

a. This test is made most conveniently along with the sensitivity test described above.

b. After each section of the band is tested as outlined in paragraph 98, apply a 1,000-uv signal modulated 30 percent at 400 cps. The AUDIO GAIN should be adjusted to give 500 mw output.

c. Turn the generator modulation off. The noise level should be better than 45 db below the 500-mw level.

100. Selectivity

a. Turn SELECTIVITY to 0.

b. Set the signal generator modulated 30 percent at 400 cps at any frequency on tuning step 1.

c. Tune receiver to signal generator frequency.

d. Measure the selectivity at the 6-db and 60-db attenuation points.

e. The bandwidth at the 6-db point shall be between 5.5 kc and 6.5 kc.

f. The bandwidth at the 60-db point shall be between 17 kc and 20 kc.

101. AVC Characteristic

The avc will begin to take over on tuning step 1 at a threshold of 6 uv of input signal. On tuning steps 2 through 30, the avc will begin to take over at a threshold of 3 uv of input signal. For a rise of .5 uv of input signal to 125 uv of input signal, the output level should increase no more than 3.5 db. For a rise of 125 uv to 500,000 uv in the input signal, the output level should not increase more than 5 db. For references, apply a 4.9-mc input signal modulated 30 percent at 400 cps to the ANTENNA jack through a series-connected 100-$\mu\mu$f capacitor and a 47-ohm resistor.

102. Over-All Distortion for an Input of 1,000 UV

Modulation percent	Output	Max distortion percent
30	500 mw	7.5
30	1.5 w	11
80	500 mw	11
80	1.5 w	14
80	2.5 w	17

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

103. Disassembly

The circumstances involved in shipment and storage vary. Therefore no definite procedure for repacking can be given. The following instructions are recommended as a guide for preparing the radio receiver for transportation and storage. To disassemble the equipment reverse the procedure for setting up the unit.

a. Turn the OFF-STANDBY-ON switch to OFF.

b. Remove power plug P101.

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

d. Remove receiver from rack.

104. Repacking for Shipment and Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 10 and figure 7 and reverse the instructions given.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the receiver. Box or package the head set. Wrap each 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. 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 MATÉRIEL TO PREVENT ENEMY USE

105. General

The instructions below should be followed only upon order of the commander.

106. Destruction of Equipment

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

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

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

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

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

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

g. Destroy Everything.

APPENDIX I

REFERENCES

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

1. Army Regulations

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

2. Supply Publications

SB 11–6	Dry Battery Supply Data.
SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publications on Test Equipment

TM 11–300	Frequency Meter Set SCR–211–(*).
TM 11–2627	Tube Testers I–177 and I–177–A.
TM 11–5017	Output Meter TS–585A/U.
TM 11–5030	Signal Generator TS–497A/URR.
TM 11–5044	Frequency Meter TS–174B/U.
TM 11–5511	Electronic Multimeter TS–505/U.
TM 11–5527	Multimeter TS–352/U.
TO 16–35TS382–2	Audio Oscillator TS–382A/U.

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

FM 5–20	Camouflage, Basic Principles.

6. Decontamination

TM 3–220	Decontamination.

7. Demolition

FM 5–25	Explosives and Demolitions.

8. Other Publications

FM 24–18	Field Radio Techniques.
SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Army Training Tests, Graphic Training Aids, Joint Army-Navy-Air Force Publications, Combined Communications Board Publications, and Army Communications Publications).

SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5 AFR 71–4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army) and AF–MC–U2 (Air Force)).
TB 11–300–3	Rectifier Power Unit RA–133 and RA–133–A.
TB 11–499–( )*	Basic Radio Propagation Predictions.
TB 11–2627–2	Tube Test Data Cards for use With Tube Testers I–177, I–177-A, I–177-B, and with Tube Socket Adapter Kit MX–949/U.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TM 9–2857	Storage Batteries Lead-Acid Type.
TM 11–314	Antennas and Antenna Systems.
TM 11–415	Dry Batteries.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–477	Fixed Station Radio Repair and Maintenance (Personnel Training Text).
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 11–496	Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets.
TM 11–499	(Preliminary), Radio Propagation Handbook.
TM 11–661	Electrical Fundamentals (Direct Current).
TM 11–681	Electrical Fundamentals (Alternating Current).
TM 11–875	Radio Receivers R–203/SR and R–203A/SR.
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.

9. Abbreviations

a-c	alternating-current
a-f	audio-frequency
a-m	amplitude-modulated
amp	ampere
ampl	amplifier
avc	automatic volume control
bfo	beat-frequency oscillator
BP	band pass
C	centigrade
cps	cycles per second
cw	continuous wave
db	decibel

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

d-c	direct-current
diam	diameter
dimen	dimension
F	Fahrenheit
f-m	frequency-modulation
h-f	high-frequency
h-v	high-voltage
icw	interrupted continuous wave
i-f	intermediate-frequency
JAN	Joint Army-Navy
kc	kilocycle
l-f	low-frequency
LP	lowpass
ma	milliampere
mc	megacycle
mcw	modulated continuous wave
mh or MH	millihenry
mv	millivolt
mw	milliwatt
pa	power amplifier
r-f	radio-frequency
rms	root mean square
SLC	straight-line capacity
term	terminal
μf	microfarad
$\mu\mu$f	micromicrofarad
uw	microwatt
uv	microvolt
vfo	variable-frequency oscillator

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Items

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite a specific T/O&E, T/A, SIG 7&8, list of allowances of expendable material, or other authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7&8–R–388/URR. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

2. Identification Table of Parts for Radio Receiver R–388/URR

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	RECEIVER, radio: Radio Receiver R–388/URR; .5 to 30.5 mc in thirty 1-mc ranges; for 115- to 230-v operation at 45 to 70 cyc; 85 w power consumption; chassis w/panel 10½″ h x 19″ w x $\frac{7}{16}$″ thk for std rack mtg; 10½″ h x 19″ wd x 13½″ d behind panel; self-contained (does not incl speaker); 16-tube superheterodyne circuit; uses single, double, or triple conversion depending on freq of received signal; 500 kc if HF osc is Xtal controlled; BFO; crystal filter; integral calibration Xtal osc (100 kc); amplified AVC; series type noise limiter; Collins Model 51J3.	Reception of mcw, c-w and voice (a-m) signals.	2C4180–388
	BEARING, roller: single axial roller; .437″ bore, 1″ dia OD, ¼″ wd o/a; B&W dwg WE–A–2761–2.	Part of main gear assembly.	2Z581–85
	BEARING, ball: steel; spherical, $\frac{7}{16}$″ dia; Norma-Hoffman per Collins part #309 5200 00.	Part of main gear assembly.	3H227–2
	BOARD, terminal: 2 riveted brass solder lug term; ½″ between ctr; phenolic sheet LTS–E4; 1.375″ lg x 1″ wd x $\frac{31}{64}$″ h o/a; two .140″ dia mtg holes diagonally on 1.125″ x .750″ ctr; Collins part/dwg #505 2124 001; spec MIL–P–3115A.	Mounts antenna coil, tuning steps 16 through 30.	3Z770–2.101
	BOARD, terminal: general purpose; 2 brass solder lug cad pl term; ⅝″ lg x ⅜″ wd x $\frac{1}{16}$″ thk o/a.	Component mounting.	3Z770–2.79
	BOARD, terminal: general purpose; 3 brass solder lug term; 1⅛″ lg x ⅜″ wd x $\frac{1}{16}$″ thk o/a.	Component mounting.	3Z770–3.49
	BOARD, terminal: general purpose; 3 brass solder lug term; 3 cad pl steel screws; 2⅛″ lg x ⅝″ wd x $\frac{11}{16}$″ h o/a; two .136″ dia mtg holes 1¾″ between ctr.	Tie points.	3Z770–3.44
	BOARD, terminal: general purpose; 3 brass solder lug term; phenolic board; 1⅛″ lg x ⅜″ wd x $\frac{1}{16}$″ thk o/a.	Tie points.	3Z770–3.48
	BOARD, terminal: general purpose; 2 solder lug term, brass, cad pl; terms ⅜″ between ctr; phenolic board; ⅝″ lg x ½″ wd x $\frac{33}{64}$″ h; one .140″ dia mtg hole.	Component mounting.	3Z770–2.102
	BUTTON, plug: brass, nickel pl; for ⅜″ dia hole; .050″ to .062″ thk; ½″ dia x $\frac{17}{64}$″ thk; Collin part #308 0051 00.	Covers holes.	2Z1480.78
	BUTTON, plug: fits ½″ hole; $\frac{41}{64}$″ dia x $\frac{1}{16}$″ d, $\frac{7}{32}$″ lg prongs.	Covers hole.	2Z1607–76

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CABLE, assembly: stranded SS core .018" dia w/nylon coating .032 dia OD; 7 strands; 35 lbs pull; 8" lg; 1 end terminates in loop stripped of nylon, secured by brass sleeve; loop passes .031" min dia wire; Berkley Fly Co per Collins part #432 1011 00.	Loading cable (part of main gear assembly).	2Z1588–13
	CABLE, mechanical: stranded steel core .012" dia w/ nylon coating .032 OD.	Dial cable.	2Z8877.406
	CABLE, power: underwriters type SJ; two #18 AWG stranded cond (41 strands #34 AWG bare copper).	A-C power cable.	1B3018–2.28
O106, O118	CAM.	Variable i-f slug rack cams.	6C10A–2
O116	CAMSHAFT ASSEMBLY.	H-f, r-f slug rack cam assembly.	2Z8203–515
O117	CAMSHAFT.	Medium-frequency r-f slug rack cam assembly.	2Z8203–514
O115	CAMSHAFT ASSEMBLY.	L-f, r-f slug rack cam assembly.	2Z8203–516
C116	CAPACITOR, fixed: ceramic; 1.0 $\mu\mu$f ± .25 $\mu\mu$f; 500 vdcw; JAN type CC30CK010C.	V102 grid coupling.	3D9001–29
C133	CAPACITOR, fixed: ceramic; 1.5 $\mu\mu$f ± .25 $\mu\mu$f; 500 vdcw; JAN type CC30CK1R5C.	V102 grid coupling, tuning steps 4 through 7.	3D9001E5–11
C111, C117, C192, C196, C201, C221	CAPACITOR, fixed: ceramic; 2 $\mu\mu$f ± .25 $\mu\mu$f; 500 vdcw; JAN type CC30CK020C.	C111: 100 kc signal coupling to V101. C117: V101 grid coupling, tuning step 1. C192: T103 top coupling. C196: T104 top coupling. C201: T105 top coupling. C221: Variable i.f. top coupling.	3D9002–27
C220	CAPACITOR, fixed: ceramic; 4 $\mu\mu$f ± .25 $\mu\mu$f; 500 vdcw; JAN type CC30CK040C.	Variable i-f top coupling.	3D9004–25
C238	CAPACITOR, fixed: ceramic; 5 $\mu\mu$f ± ½ $\mu\mu$f; 500 vdcw; JAN type CC30CK050D.	Tuning steps 16 through 30 antenna coupling.	3D9005–121
C173, C187, C237	CAPACITOR, fixed: ceramic; 10 $\mu\mu$f ± 1 $\mu\mu$f; 500 vdcw; JAN type CC30CK100F.	C173: 100-kc signal coupling to V101. C187: Filter crystal parallel. C237: Tuning steps 8 through 15 antenna coupling.	3D9010–180
C151, C165	CAPACITOR, fixed: ceramic; 15 $\mu\mu$f ±5%; 500 vdcw; JAN type CC30CK150J.	C151: V105 crystal oscillator plate tuning. C165: V105 crystal oscillator feedback.	3D9015–133
C139	CAPACITOR, fixed: ceramic; 20 $\mu\mu$f ±5%; 500 vdcw; JAN type CC30CK200J.	L115 trimmer.	3D9020–63
C236	CAPACITOR, fixed: ceramic; 22 $\mu\mu$f ±5%; 500 vdcw; JAN type CC30CK220J.	Antenna coupling, tuning step 7.	3D9022–57
C232	CAPACITOR, fixed: ceramic dielectric; 24 $\mu\mu$f ±5%; 500 vdcw; JAN type CC30CK240J.	Antenna coupling, tuning steps 16 through 30.	3D9024–56
C153, C235	CAPACITOR, fixed: ceramic; 36 $\mu\mu$f ±5%; 500 vdcw; JAN type CC30CK360J.	C153: V105 xtal oscillator plate tuning. C235: Antenna coupling tuning step 3.	3D9036–14
C155	CAPACITOR, fixed: ceramic; 47 $\mu\mu$f ±5%; 500 vdcw; JAN type CC30CK470J.	V105 crystal oscillator plate tuning.	3D9047–38
C5	CAPACITOR, fixed: ceramic; 50 $\mu\mu$f ±2%; 500 vdcw; (choose 1 of 7, so that freq does not vary more than ±300 cps from freq at 30°C over temp range of 0°C to +60°C).	Part of bfo assembly (compensating cap).	3D9050–160

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C5	CAPACITOR, fixed: ceramic; 50 $\mu\mu$f $\pm$2%; 500 vdcw; (choose 1 of 7, so that freq does not vary more than $\pm$300 cps from freq at 30°C over temp range of 0°C to +60°C).	Part of bfo assembly (compensating cap).	3D9050–161
C5	CAPACITOR, fixed: ceramic; 50 $\mu\mu$f $\pm$2%; 500 vdcw; (choose 1 of 7, so that freq does not vary more than $\pm$300 cps from freq at 30°C over temp range of 0°C to +60°C).	Part of bfo assembly (compensating cap).	3D9050–159
C5	CAPACITOR, fixed: ceramic; 50 $\mu\mu$f $\pm$2%; neg temp coef 1200 (tol $\pm$180) $\mu\mu$f/μf/°C; 500 vdcw; (choose 1 of 7, so that freq does not vary more than $\pm$300 cps from freq at 30°C over temp range of 0°C to +60°C).	Part of bfo assembly (compensating cap).	3D9050–170
C5	CAPACITOR, fixed: ceramic; 50 $\mu\mu$f $\pm$2%; 500 vdcw; (choose 1 of 7, so that freq does not vary more than $\pm$300 cps from freq at 30°C over temp range of 0°C to +60°C).	Part of bfo assembly (compensating cap).	3D9050–171
C5	CAPACITOR, fixed: ceramic; 50 $\mu\mu$f $\pm$2%; 500 vdcw; (choose 1 of 7 so that freq does not vary more than $\pm$300 cps from freq at 30°C over temp range of 0°C to +60°C).	Part of bfo assembly (compensating cap).	3D9050–168
C5	CAPACITOR, fixed: ceramic; 50 $\mu\mu$f $\pm$2%; 500 vdcw; (choose 1 of 7 so that freq does not vary more than $\pm$300 cps from freq at 30°C over temp range of 0°C to +60°C).	Part of bfo assembly (compensating cap).	3D9050–169
C234	CAPACITOR, fixed: ceramic; 51 $\mu\mu$f $\pm$5%; JAN type CC30UK510J.	Antenna coupling, tuning step 2.	3D9051–68
C157	CAPACITOR, fixed: ceramic; 68 $\mu\mu$f $\pm$5%; 500 vdcw; JAN type CC30UK680J.	V105 crystal oscillator plate tuning.	3D9068–27
C231, C233	CAPACITOR, fixed: ceramic; 100 $\mu\mu$f $\pm$5%; 500 vdcw; JAN type CC30UJ101J.	C231: coil L105 (tuning steps 8 through 15) trimmer. C233: Antenna coupling, tuning step 1.	3D9100–230
C114, C115, C126, C134, C135, C137, C138, C141, C142, C163, C164, C170, C172, C178, C183, C185, C186, C189, C190, C191, C193, C194, C195, C197, C199, C200, C207,	CAPACITOR, fixed: ceramic; 10,000 $\mu\mu$f, guaranteed min value tol; 350 vdcw.	C114: V101 avc isolation. C115: V101 screen r-f bypass. C126: V101 plate circuit decoupling. C134: V102 cathode r-f bypass. C135: V102 screen r-f bypass. C137: L114 to L115 coupling. C138: V102 plate circuit decoupling. C141: V103 cathode r-f bypass. C142: V103 screen r-f bypass. C163: V105 plate circuit decoupling. C164: V105 screen r-f bypass. C170: V104 cathode r-f bypass. C172: V104 plate circuit decoupling. C178: V103 plate circuit decoupling. C183: V106 cathode r-f bypass.	3DA10–527

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C208, C209, C211, C213, C218, C219, C227, C228		C185: V106 screen r-f bypass. C186: V106 plate circuit decoupling. C189: V107 grid decoupling. C190: V107 screen r-f bypass. C191: V107 plate circuit decoupling. C193: V108 grid decoupling. C194: V108 screen r-f bypass. C195: V108 plate circuit decoupling. C197: V109 grid decoupling. C199: V109 screen r-f bypass. C200: V109 plate circuit decoupling. C207: A-c line filter. C208: Avc amplifier degenerative feedback. C209: Audio grid coupling to V112. C211: Audio grid coupling to V113. C213: Avc bypass. C218: V114 screen r-f bypass. C219: V114 plate circuit decoupling. C227: I-f output V111 plate bypass. C228: I-f output coupling.	
C223	CAPACITOR, fixed: electrolytic; 8 μf; 350 vdcw; JAN type CE63B080P.	B+ isolation.	3DB8–222
C215, C216	CAPACITOR, fixed: electrolytic; 20 μf; 150 vdcw; JAN type CE63C200J.	C215: V111 cathode bypass. C216: Bias filter for V113.	3DB20–112
C217	CAPACITOR, fixed: electrolytic; 2 sect; 35 μf ea sect; 450 vdcw ea sect; JAN type CE52F350R.	Power supply filter.	3DB35–3
C206	CAPACITOR, fixed: mica; 5 $\mu\mu$f $\pm$5%; 500 vdcw.	V114 to V110 bfo coupling.	3D9005–123
C109	CAPACITOR, fixed: mica; 20 $\mu\mu$f $\pm$5%; 500 vdcw.	L105 trimmer.	3D9020–77
C123, C129	CAPACITOR, fixed: mica; 75 $\mu\mu$f $\pm$5%; 500 vdcw.	C123: L108 trimmer. C129: L112 trimmer.	3D9075–51
C113, C136, C143, C166, C171, C184, C204, C226	CAPACITOR, fixed: mica; 100 $\mu\mu$f $\pm$5%; 500 vdcw.	C113: V101 grid coupling. C136: V102 injection coupling. C143: V103 injection coupling. C166: Oscillator feedback network. C171: V104 screen bypass. C184: V106 grid bypass for harmonic amplitude control. C204: Avc rectifier coupling. C226: V111 voltage divider.	3D9100–294
C107	CAPACITOR, fixed: mica; 130 $\mu\mu$f $\pm$5%; 500 vdcw.	L104 trimmer.	3D9130–23

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C145, C159	CAPACITOR, fixed: mica; 150 $\mu\mu$f $\pm$5%; 500 vdcw.	C145: L121 trimmer. C159: 1,250-kc filter trimmer.	3D9150–92
C175, C179	CAPACITOR, fixed: mica; 180 $\mu\mu$f $\pm$2%; 500 vdcw.	C175: L117 trimmer. C179: L118 trimmer.	3D9180–38
C161	CAPACITOR, fixed: mica; 200 $\mu\mu$f $\pm$2%; 500 vdcw.	V105 xtal oscillator plate tuning.	3D9200–109
C105, C121, C127, C168	CAPACITOR, fixed: mica; 220 $\mu\mu$f $\pm$2%; 500 vdcw.	C105: L103 trimmer. C121: L107 trimmer. C127: L111 trimmer. C168: V106 grid trap.	3D9220–34
C177, C181	CAPACITOR, fixed: mica; 300 $\mu\mu$f $\pm$2%; 500 vdcw.	C177: L117 trimmer. C181: L118 trimmer.	3D9300–69
C202	CAPACITOR, fixed: mica; 330 $\mu\mu$f $\pm$2%; 500 vdcw.	Diode load bypass.	3D9330–27
C103	CAPACITOR, fixed: mica; 430 $\mu\mu$f $\pm$2%; 300 vdcw.	L102 trimmer	3D9430–5
C101	CAPACITOR, fixed: mica; 820 $\mu\mu$f $\pm$2%; 500 vdcw.	L101 trimmer.	3D9820–14
C118	CAPACITOR, fixed: mica; 910 $\mu\mu$f $\pm$1%; 500 vdcw.	L110 trimmer.	3D9910–3
C212	CAPACITOR, fixed: mica; 6800 $\mu\mu$f $\pm$10%; 500 vdcw; JAN type CM40B682K.	Audio output equalizer.	3K4068221
C214	CAPACITOR, fixed: paper; 2 sect; 100,000-100,000 $\mu\mu$f +20% —10%; 600 vdcw; JAN type CP53B4EF104V.	K101 contact spark suppressor.	3DA100–770
C198A, B	CAPACITOR, fixed: paper; 2 sect; 100,000-100,000 $\mu\mu$f +20% —10%; 600 vdcw; JAN type CP54B4EF104V.	C198A: V109 cathode bypass. C198B: T108 filament winding bypass.	3DA100–777
C205A, B, and C	CAPACITOR, fixed: paper; 3 sect; 100,000 $\mu\mu$f +20% —10% ea sect; 600 vdcw ea sect; JAN type CP54B5EF104V.	C205A: Bias line bypass. C205B: Part of avc filter. C205C: Noise limiter filter.	3DA100–732
C167	CAPACITOR, variable: ceramic; rotary type; 3 to 12 $\mu\mu$f 1 sect.	Crystal trimming.	3D9012V–25
C110, C122, C124, C130, C132, C146, C147, C148, C149, C169	CAPACITOR, variable: ceramic; rotary type, 1 sect; 5 to 25 $\mu\mu$f.	C110: L105 trimming. C122: L108 trimming. C124: L109 trimming. C130: L112 trimming. C132: L113 trimming. C146: Crystal oscillator plate tuning. C147: Crystal oscillator plate tuning. C148: Crystal oscillator plate tuning. C149: Crystal oscillator plate tuning. C169: Calibration oscillator feedback.	
C188	CAPACITOR, variable: air dielectric; single sect plate meshing type; 3.5 to 27 $\mu\mu$f; SLC characteristic.	Crystal filter PHASING.	3D9027V–6
C102, C104, C106, C108, C119, C120, C128, C140, C144, C150, C152, C154, C156,	CAPACITOR, variable: ceramic; rotary type; 8 to 50 $\mu\mu$f, 1 sect.	C102: L101 trimmer. C104: L102 trimmer. C106: L103 trimmer. C108: L104 trimmer. C119: L110 trimmer. C120: L107 trimmer. C128: L111 trimmer. C140: L115 trimmer. C144: L121 trimmer. C150: Crystal oscillator tuning. C152: Crystal oscillator tuning.	3D9050V–117

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C158, C162, C174, C176, C180, C182		C154: Crystal oscillator tuning. C156: Crystal oscillator tuning. C158: Crystal oscillator tuning. C162: Crystal oscillator tuning. C174: L116 trimmer. C176: L117 trimmer. C180: L118 trimmer. C182: L119 trimmer.	
C224, C230	CAPACITOR, variable: air dielectric; single sect, plate meshing type; 7 to 100 $\mu\mu$f; SLC characteristic.	C224: CAL. control for 100-kc oscillator frequency adjustment. C230: ANT. TRIM capacitor.	3D9100V–85
	CLAMP: xtal; for .093″ dia crystal holder; incl ⅜″ x ⅜″ x ⅛″ sponge rubber pad cemented to clamp.	Secures 100-kc crystal.	2Z2642.359
L114, L116	COIL, RF: replacement coil.	L114: First mixer V102 plate coil for tuning step 1. L116: Variable i-f coil.	3C607B–1
L118	COIL, IF transformer: replacement coil.	Variable i-f coil.	3C607B–2
L115	COIL, RF: unshielded phenolic form, beryllium copper silver pl term rings.	Intermediate mixer V103 grid coil for tuning step 1.	3C357–48
L117, L119	COIL, RF: replacement coil.	L117: Variable i-f plate coil. L119: Variable i-f coil.	3C607B–3
L102	COIL, RF: antenna; single layer wnd; 48 turns #28E wire; 2⅜″ lg x .437″ dia phenolic coil form; adj iron core (not incl).	Antenna coil, tuning step 2.	3C1084S–65
L103	COIL, RF: antenna; single layer wnd; 43 turns #28E wire; 2⅜″ lg x .437″ dia phenolic form; adj iron core (not incl).	Antenna coil, tuning step 3.	3C1084S–64
L121	COIL, RF: single layer wnd; 46 turns #30 double E wire, closely spaced, tapped at 13 turns; ¾″ lg x .187″ dia bakelite form w/core.	V105 crystal oscillator plate coil.	3C1084S–47
L101, L110	COIL, RF: single layer wnd; 75 turns #35E wire; 2″ lg x .295″ dia phenolic form; slug tuning (core not incl).	L101: Antenna coil, tuning step 1. L110: V102 grid coil, tuning step 1.	3C1084S–43
L120	COIL, RF: choke; 3 universal wnd.	V105 crystal oscillator cathode choke.	3C357–49
L106, L109, L113	COIL, RF: single layer wnd; 15 turns #28E wire; 2″ lg x .295″ dia phenolic form; slug tuned (core not incl).	L106: Antenna coil, tuning step 16 through 30. L109: R-f amplifier V101 plate coil, tuning steps 16 through 30. L113: First mixer V102 grid coil, tuning, steps 16 through 30.	3C1084S–46
L105, L108, L112	COIL, RF: single layer wnd; 20 turns #28E wire; 2″ lg x .295″ dia phenolic form; slug tuned (core not incl).	L105: Antenna coil, tuning steps 8 through 16. L108: R-f amplifier V101 plate coil, tuning steps 8 through 16. L112: First mixer V102 grid coil, tuning steps 8 through 16.	3C1084S–45

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
L104, L107, L111	COIL, RF: single layer wnd; 27 turns #28E wire; 2″ lg x .295″ dia phenolic form; slug tuned (core not incl).	L104: Antenna coil, tuning steps 4 through 7. L107: R-f amplifier V101 plate coil, tuning steps 4 through 7. L111: First mixer V102 grid coil, tuning steps 4 through 7.	3C1084S–44
L125	COIL, RF: 3 pie universal wnd; 500 uh ±10% at 1000 kc; powdered iron form.	Part of V106 500-kc grid trap.	3C357–57
O136	COLLAR, shaft: SS; circular; ½″ OD x ¼″ ID x .221″ thk; two #6–40 NF–2 tapped holes at 90 deg.	For tuning knob tension.	2Z2935–93
P101	CONNECTOR, plug: 2 parallel blade male cont; straight.	Line cord plug.	6Z1727
J101, J104	CONNECTOR, receptacle: single round female cont; straight.	J101: Antenna coax connector. J104: IF OUTPUT connector.	2Z8799–239
	CONTACT, tube socket: phosphor bronze, silver pl; .57″ lg x .102″ wd x .104″ h; mts in xtal or tube socket base; for .050″ dia prong; Amphenol part #9–028–12.	Crystal socket contact.	2Z3193–136
	CORE, adjustable tuning: powdered iron core w/brass cad pl stud; freq 12 mc max; 1.187″ lg x .242″ dia; fits inside coil; Aladdin per Collins part #288 1062 00.	Part of coil assembly.	2Z3262–61
E149, E150, E151, E152, E153, E154, E155, E156, E157	CORE, adjustable tuning: $3\frac{13}{16}$″ lg o/a x .256″ dia.	E149: Tunes coil L104. E150: Tunes coil L105. E151: Tunes coil L106. E152: Tunes coil L107. E153: Tunes coil L108. E154: Tunes coil L109. E155: Tunes coil L111. E156: Tunes coil L112. E157: Tunes coil L113.	2Z3262–46
E144, E145, E146, E147, E148	CORE, adjustable tuning: $3\frac{7}{16}$″ lg x .25″ dia.	E144: Tunes coil L102. E145: Tunes coil L103. E146: Tunes coil L114. E147: Tunes coil L116. E148: Tunes coil L118.	2Z3262–45
E142, E143	CORE, adjustable tuning: $4\frac{7}{16}$″ lg o/a; .255″ dia.	E142: Tunes coil L101. E143: Tunes coil L110.	2Z3262–44
	COUPLING, flexible: for ¼″ shafts; 1¼″ wd x 1¼″ h x $\frac{33}{32}$″ d.	Crystal PHASING control coupler.	2Z3290
O102, O103	COUPLING, flexible: ¼″ to ⅜″ shaft coupling; 1.094″ dia x .672″ lg o/a.	O102: Oscillator switch shaft coupling. O103: Antenna switch shaft coupling.	2Z3295–148
	COUPLING, flexible: ¼″ - ¼″ shaft coupling 1.094″ dia x .672″ lg o/a.	Coupler on shaft extension.	2Z3295–152
O139	COUPLING, rigid: sleeve type; .2505″ shaft size ea end; 1″ lg x ½″ dia o/a, shaft 9.234″ lg extension from coupling.	Part of i-f drive shaft assembly.	2Z8203–493
O128	COUPLING, rigid: sleeve type; .2505″ shaft size ea end; 1″ lg x ½″ dia o/a.	Part of i-f drive shaft assembly coupling.	2Z3272–213
O108	COUPLING, rigid: sleeve type; .253″ shaft size ea end; ½″ lg x ½″ dia o/a.	Crystal filter shaft coupling.	2Z3273–239
Y104	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 9,000 kc.	Crystal for tuning steps 15 through 16.	2X209–9000

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
Y108	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 8,000 kc.	Crystal for tuning steps 5 through 6.	2X209–8000
Y102	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 13,000 kc.	Crystal for tuning steps 23 through 24.	2X209–13000
Y103	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 11,000 kc.	Crystal for tunings steps 19 through 20.	2X209–11000
Y106	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 12,000 kc.	Crystal for tuning steps 9, 10, 21, and 22.	2X209–12000
Y110	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 4,000 kc.	Crystal for tuning steps 1 through 2.	2X209–4000
Y109	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 6,000 kc.	Crystal for tuning steps 3 through 4.	2X209–6000
Y107	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 10,000 kc.	Crystal for tuning steps 7, 8, 17, 18, 27, and 28.	2X209–10000
Y101	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 10,666.67 kc.	Crystal for tuning steps 29 through 30.	2X209–10666.67
Y105	CRYSTAL UNIT: Crystal Unit CR–18/U; single xtal plate, Crystal Holder HC–6/U; 14,000 kc.	Crystal for tuning steps 11, 12, 25, and 26.	2X209–14000
Y111	CRYSTAL UNIT, quartz: single xtal plate; 100 kc nominal.	Calibration crystal.	2X226–100
Y112	CRYSTAL UNIT: Crystal Unit CR–7/U; single xtal plate; 500 kc ±500 cyc.	I-f filter crystal.	2X225–500
	DIAL: vernier dial; c/o dial hub and washer in soldered assem; brass hub, SS washer; circular; 1¼″ dia x .343″ d; mts on ¼″ shaft; has two #4–48 NF–2 holes at 90 deg for set screws.	Vernier dial.	2Z3723–292
I105	DIAL: drum.	Band indicating MEGACYCLES drum.	2Z3723–231
L124	FILTER, band suppression: 1½″ lg x ¾″ dia o/a; .260″ dia hole thru coil form for mtg; 2 wire lead term.	Part of spurious 1,250-kc filter Z111.	2Z4376–111
T102	FILTER, band pass: 490 to 510 kc min range (shunted by 65 $\mu\mu$f); 1 $\frac{7}{16}$″ x 1 $\frac{7}{16}$″ x 3 $\frac{5}{8}$″ max h o/a; 270,000-ohm parallel impedance; rectangular metal case; two ⅜″ studs on bottom diagonally located, 1.312″ between ctr; 2 solder lug term on top, 2 solder lug term on bottom; MFP, core adj from top or bottom.	Crystal filter output.	2Z4376–110
F101	FUSE, cartridge: 1.5 amp; 250 v.	A-c line fuse.	3Z2601.5
	GEAR ASSEMBLY: c/o:	Tuning and band changing gears.	2Z4875–412

Item	*Collins part dwg No.*
Back gear panel	505 2179 003
Front gear panel	505 2180 003
Rev gears and shaft assem	504 3111 002
I-f driver gear and shaft assem	504 3014 001
Gear assem, switch IF	504 3004 001
Mc knob shaft	504 2956 001
Knob gear and hub assem	504 3013 001
Shaft assem, band switch	504 3006 001
Ball, $\frac{1}{8}$″ dia (2 ea)	309 5200 00
Shaft assem, Geneva wheel	504 3012 001
Thrust bearing	504 2972 001
Rub assem, Geneva wheel	504 3015 001
Centering spring	504 2932 001
Hub assem, detent gear	504 3018 001
Detent spring assem	504 3025 001
Center planet, gear and hub assem	504 3020 001
Hub assem, floating	504 3016 001
Shaft and gear assem	500 3005 001

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	Item — *Collins part dwg No.*		
	Stop idler gear hub assem — 504 3009 001		
	Pointer pulley assem — 504 5645 002		
	Pulley, drum — 504 2954 001		
	Post, lower spacing — 505 2128 001		
	Post, upper spacing — 505 2127 001		
	Loading cable — 423 1011 00		
	Spring — 502 1158 002		
	Miscellaneous assem hdw 17⅛″ lg x 6″ wd x 4″ d approx o/a; mts by five .175″ dia holes irregularly spaced; Collins Rad part/dwg #505 2189 004.		
	GROMMET: synthetic rubber or neoprene; fits $\frac{1}{16}$″ dia hole.	Prevents abrasion.	6Z4856–53
	GROMMET: synthetic rubber or neoprene; fits $\frac{7}{16}$″ dia hole.	Prevents abrasion.	6Z4886
	GROMMET: synthetic rubber or neoprene; fits ⅜″ dia hole.	Prevents abrasion.	6Z4856–56
	GROMMET: synthetic rubber or neoprene; fits ¼″ dia hole.	Prevents abrasion.	6Z4914
	GROMMET: synthetic rubber or neoprene; fits $\frac{5}{16}$″ dia hole; ANA std type AN931–3–S.	Prevents abrasion.	6Z4895
XF101	HOLDER, fuse: extractor post; for one 3AG cartridge fuse.	Holds fuse F101.	3Z3285–2
O101A	HUB: coupler; SS, unfinished; rd 1.090″ dia x .327″ thk o/a; .1880″ dia ctr mtg hole for shaft, two #6–40 NF–2 tapped holes at 90 deg and perpendicular to shaft hole.	Part of vfo coupler.	2Z5180–35
O101C	HUB: SS, unfinished; 1.090″ dia x .327″ thk; .250″ dia ctr mtg hole for shaft, two #6–40 NF–2 tapped holes at 90 deg and perpendicular to shaft hole.	Part of vfo coupler.	2Z5180–36
	INSULATOR, stand-off: round post shape; natural bakelite; .750″ lg; ⅜″ OD, tapped #6–32 NC–2 x ½″ dia ea end.	Part of audio meter board assembly.	3G350–119
J102	JACK: Jack JJ–033; for 3 cond plug .206″ dia x 1.093″ lg.	SPEAKER jack.	2Z5533
J103	JACK: Jack JJ–034; for 2 cond plug .250″ dia.	PHONES jack.	2Z5534
	KNOB: round; black phenolic; for ¼″ dia shaft.	Controls.	2Z5822–484
	KNOB: round, tapered; black phenolic; for ¼″ dia shaft; one #8–32 tapped hole for set screw; $\frac{13}{16}$″ dia x $\frac{13}{32}$″ lg o/a; $\frac{1}{4}$″ dia shaft hole; surface knurled.	Control.	2Z5822–580
	KNOB: round; black phenolic; for ¼″ shaft; indicator mark filled white; 1⅛″ dia x $\frac{13}{16}$″ lg o/a; no insert.	Controls.	2Z5822–485
	KNOB: round, w/pointer; black phenolic; for ¼″ dia shaft.	Control.	2Z5821–4.1
	KNOB: round; black phenolic; for .253″ dia shaft; two #8–32 tapped holes for set screws; 1¾″ dia skirt; 1⅜″ dia x ⅞″ lg o/a; brass; $\frac{33}{64}$″ dia shaft hole; indicator mark filled white.	Control.	2Z5822–581
I104	LAMP, glow: Navy type #VG-12; 105-125 v, ¼ w; 1½″ lg o/a; bayonet base candelabra; GE type NE–48.	Receiver protective lamp.	2Z5889–3
I101, I102, I103	LAMP, incandescent: Lamp IM–52; 6 to 8 v, .15 amp; miniature bayonet base.	Dial illuminations.	2Z5925.1
XI103	LAMPHOLDER: miniature bayonet; $\frac{31}{32}$″ lg x $\frac{33}{64}$″ dia o/a.	Holder for I103.	2Z5883–349
XI101, XI102	LAMPHOLDER: miniature bayonet; 1⅜″ lg x $\frac{7}{16}$″ wd x $\frac{15}{16}$″ thk o/a.	XI101: Holder for I101. XI102: Holder for I102.	2Z5883–353

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
M101	METER, audio level: DC milliammeter calibrated for db; range 0 to 1 ma; round, plastic, flush panel mtg case.	Audio level meter.	3F3307.5–8
	MOUNTING, coil: holds coil and core (.375" OD); steel, cad plate; irregular shape; $\frac{41}{64}$" lg x $\frac{29}{64}$" wd x .274" h above mtg surface; mts in .417 dia hole and .080" dia hole, .310" between ctr.	Coil holder.	2Z6820.355
Z101	OSCILLATOR, RF: 2.0 to 3.0 mc; not xtal controlled; approx .001 w output; 5½" lg x 2⅝" wd x 2⅞" h approx; integral coil; receives power from main rectifier unit; mts on front panel by three #6–32 NC–2 tapped holes on 1.75" x 1.468" ctr; HS; Collins part # 7CE15, dwg #505 4011 004.	Variable-frequency oscillator.	2C2722–6
T106	OSCILLATOR SUBASSEMBLY: bfo; incl capacitors C1, 1600 $\mu\mu$f button silver mica (Collins part #912 0967 00), C2, 5 to 50 $\mu\mu$f var air, C3, 50 $\mu\mu$f ±1 $\mu\mu$f temp coef —1200 ±15% (Collins part #913 0065 00), C4, 50 $\mu\mu$f (selected item) ceramic compensating capacitor, C5, 100 $\mu\mu$f ±10% ceramic or silver resistor R1 JAN type RC20BF104M, coil: 81 turns #9–41 Litz tapped at 31 turns, powdered iron core, phenolic tubular form; encl in aluminum can; 480 to 520 kc freq range; 2" lg x 1$\frac{7}{16}$" wd x 4⅜" h o/a; two #4–40 NC–2 x $\frac{5}{16}$" mtg studs on $\frac{1}{18}$" ctr; two #6–32 NC–2 spade bolts on 1$\frac{5}{16}$" ctr.	Beat-frequency oscillator.	2C2798–17
H101	POINTER, indicator: sliding.	Indicator on MEGACYCLE drum.	2Z7258.94
	POST, spacing: cad pl steel; ⅜" lg x $\frac{5}{16}$" OD; .130" ID for mtg.	Band switch spacer.	2Z7259–119
	PULLEY: CRS, tin pl; circular; 2.125" dia x ¼" thk; .375" dia hole.	Dial drive pulley, large.	6Z7678–2
	PULLEY: dial drive; CRS, tin pl; circular; ⅝" dia x .193" thk; .127" dia hole.	Dial drive pulley, small.	6Z7678–3
L122	REACTOR: 3.0 hy, 120 ma; 100 ohms DC resistance; 2500 v RMS test; HS metal case; 2$\frac{1}{16}$" wd x 2$\frac{7}{32}$" lg x 3$\frac{5}{32}$" h; four #6–32 NC–2 mtg inserts on 1¼" x 1⅜" ctr; 2 solder lug terms on $\frac{5}{16}$" ctr.	Power supply input d-c filter choke.	3C547–37
L123	REACTOR: 5 hy, 80 ma; 300 ohms DC resistance; 2500 v RMS test; HS metal case; 1$\frac{13}{32}$" wd x 1⅞" lg x 2$\frac{13}{32}$" h; four #6–32 NC–2 mtg inserts on $\frac{1}{16}$" x 1$\frac{1}{16}$" ctr; 2 solder lug term on $\frac{5}{16}$" ctr.	Power supply output d-c filter choke.	3C547–38
	RECEIVER SUBASSEMBLY: 1$\frac{5}{32}$" lg x .812" dia o/a; .092" dia shaft for mtg.	Vernier drive assembly.	2C4180–388–1
Z110	RECEIVER SUBASSEMBLY: incl coil L104 and capacitors C107 and C108; 1⅜" lg x 1" wd x 2" h o/a; two .140" dia mtg holes diagonally located on 1⅛" x ¾" ctr.	Tuning steps 4 through 7 (antenna).	2C4180–388–4
Z104	RECEIVER SUBASSEMBLY: incl capacitors C122 and C123 and coil L108; 1⅜" lg x 1" wd x 2" h o/a; two .140" dia mtg holes on opposite corners of 1⅛" x ¾" mtg ctr.	R-f tuning steps 8 through 15.	2C4180–388–6
Z105	RECEIVER SUBASSEMBLY: incl coil L112, C129 and C130; 1⅜" lg x 1" wd x 2" h o/a; two .14" dia mtg holes on opposite corners of board; 1⅛" x 1¾" mtg ctr.	R-f tuning steps 8 through 15.	2C4180–388–6
Z102	RECEIVER SUBASSEMBLY: incl coil L109 and capacitor C124; 1⅜" lg x 1" wd x 2" h o/a; two .140" dia mtg holes on opposite corners of 1⅛" x ¾" mtg ctr.	R-f tuning steps 16 through 30.	2C4180–388–7

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
Z103	RECEIVER SUBASSEMBLY: incl coil L113 and capacitor C132; 1⅜" lg x 1" wd x 2" h o/a; two .14" dia mtg holes on opposite corners of board; 1⅛" x 1¾" mtg ctr.	R-f tuning steps 16 through 30.	2C4180–388–7
Z106	RECEIVER SUBASSEMBLY: incl coil L107 and capacitors C120 and C121; 1⅜" lg x 1" wd x 2" h o/a; two .140" dia mtg holes on opposite corners of 1⅛" x ¾" mtg ctr.	R-f tuning steps 4 through 7.	2C4180–388–3
Z107	RECEIVER SUBASSEMBLY: incl coil L111, C127 and C128; 1⅜" lg x 1" wd x 2" h o/a; two .14" dia mtg holes on opposite corners of board; 1⅛" x 1¾" mtg ctr.	R-f tuning steps 4 through 7.	2C4180–388–3
Z115	RECEIVER SUBASSEMBLY: incl coils L101, L102, L103, fixed capacitors C101, C103, C105, and var capacitors C102, C104, C106 mtd on board; 2⅝" lg x 2" wd x 2½" h o/a; four .140" mtg holes on .875" x 1.750" ctr.	Tuning steps 1 through 3 (antenna).	2C4180–388–2
Z109	RECEIVER SUBASSEMBLY: incl coil L105, C109, and C110 mtd on board; 1⅜" lg x 1" wd x 2" h o/a; two .140" dia mtg holes diagonally located on 1⅛" x ¾" ctr.	Tuning steps 8 through 15 (antenna).	2C4180–388–5
CR101	RECTIFIER, metallic: selenium; input 12.5 v AC, 1 to 5000 cyc, single ph; output 6.28 v DC, 64 ma max, full wave.	Meter M101 rectifier.	3H4955
K101	RELAY, armature: right 1C, left 1C cont arrangement (viewed from mtg end); 3 amp, 150 w cont rating; palladium cont; single wnd coil, 12 v DC, .016 amp DC max release, .021 amp DC max oper, 375 ohms DC resistance, ins; solder lug term; 1⅛" lg x 1⅛" wd x 1⅞" h max; two #4–40 holes on diagonally .437" vert between ctr; fast acting.	Disabling relay.	2Z7599A–328
R143	RESISTOR, fixed: comp; 10 ohms ±10%; ½ w; JAN type RC20BF100K.	V112 filament voltage dropping.	3RC20BF100K
R170	RESISTOR, fixed: comp; 100 ohms ±10%; ½ w; JAN type RC20BF101K.	INPUT meter circuit load resistor.	3RC20BF101K
R163	RESISTOR, fixed: comp; 160 ohms ±5%; ½ w; JAN type RC20BF161J.	INPUT meter balancing resistor.	3RC20BF161J
R107, R111, R127	RESISTOR, fixed: comp; 470 ohms ±10%; ½ w; JAN type RC20BF471K.	R107: V102 cathode bias. R111: V103 cathode bias. R127: V106 cathode bias.	3RC20BF471K
R149	RESISTOR, fixed: comp; 820 ohms ±10%; ½ w; JAN type RC20BF821K.	Determines minimum bias.	3RC20BF821K
R179, R182	RESISTOR, fixed: comp; 1000 ohms ±10%; ½ w; JAN type RC20BF102K.	R179: I-f output V111 bias resistor. R182: CR101 load resistor.	3RC20BF102K
R174	RESISTOR, fixed: comp; 1000 ohms ±10%; 2 w; JAN type RC42BF102K.	B+ isolation.	3RC42BF102K
R110, R116, R124, R129, R135, R138, R162, R168, R173, R180	RESISTOR, fixed: comp; 2200 ohms ±10%; ½ w; JAN type RC20BF222K.	R110: V102 plate decoupling. R116: V105 tuning steps 2 to 12 plate load. R124: V102 plate decoupling. R129: V106 plate decoupling. R135: V107 plate decoupling. R138: V108 plate decoupling. R162: V114 bfo decoupling. R168: V111 avc amplifier bias.	3RC20BF222K

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
		R173: AUDIO meter voltage dropping resistor. R180: V111 i-f output plate voltage dropping.	
R142	RESISTOR, fixed: comp; 2200 ohms ±10%; 1 w; JAN type RC30BF222K.	V109 plate decoupling.	3RC30BF222K
R155	RESISTOR, fixed: comp; 3300 ohms ±10%; ½ w; JAN type RC20BF332K.	A-f voltage amplifier cathode bias.	3RC20BF332K
R181	RESISTOR, fixed: WW; JAN type RW32F402.	Current limiting resistor.	3RW27929
R119, R132	RESISTOR, fixed: comp; 4700 ohms ±10%; ½ w; JAN type RC20BF472K.	R119: 100-kc oscillator cathode bias. R132: Crystal filter selectivity.	3RC20BF472K
R106	RESISTOR, fixed: comp; 6800 ohms ±10%; ½ w; JAN type RC20BF682K.	V101 plate decoupling.	3RC20BF682K
R105, R122, R133, R136, R139	RESISTOR, fixed: comp; 10,000 ohms ±10%; ½ w; JAN type RC20BF103K.	R105: V101 tuning step 1 plate load resistor. R122: 100-kc oscillator decoupling. R133: V107 avc decoupling. R136: V108 avc decoupling. R139: V109 avc decoupling.	3RC20BF103K
R131	RESISTOR, fixed: comp; 22,000 ohms ±10%; ½ w; JAN type RC20BF223K.	Xtal filter selectivity.	3RC20BF223K
R126	RESISTOR, fixed: comp; 27,000 ohms ±10%; ½ w; JAN type RC20BF273K.	R126: V107 screen bleeder.	3RC20BF273K
R147, R169	RESISTOR, fixed: comp; 27,000 ohms ±5%; ½ w; JAN type RC20BF273J.	R147: Bias bleeder. R169: V108 screen bleeder.	3RC20BF273J
R104, R113, R114, R128, R151, R161	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w; JAN type RC20BF333K.	R104: V101 screen voltage dropping. R113: V103 screen voltage dropping. R114: V105 screen voltage dropping. R128: V106 screen voltage dropping. R151: Diode load. R161: V114 bfo plate load.	3RC20BF333K
R109, R117, R134, R137, R141, R146	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K.	R109: V102 screen voltage dropping. R117: V105 tuning steps 14–30 plate voltage dropping. R134: V107 screen voltage dropping. R137: V108 screen voltage dropping. R141: V109 screen voltage dropping. R146: V111 plate load (avc).	3RC20BF473K
R150	RESISTOR, fixed: comp; 68,000 ohms ±10%; ½ w; JAN type RC20BF683K.	Diode load.	3RC20BF683K
R102, R112, R115, R120, R123, R130, R145, R157,	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K.	R102: V101 avc decoupling. R112: V103 injection grid. R115: V105 grid leak. R120: 100-kc oscillator screen voltage dropping. R123: V106 grid. R130: Crystal filter selectivity.	3RC20BF104K

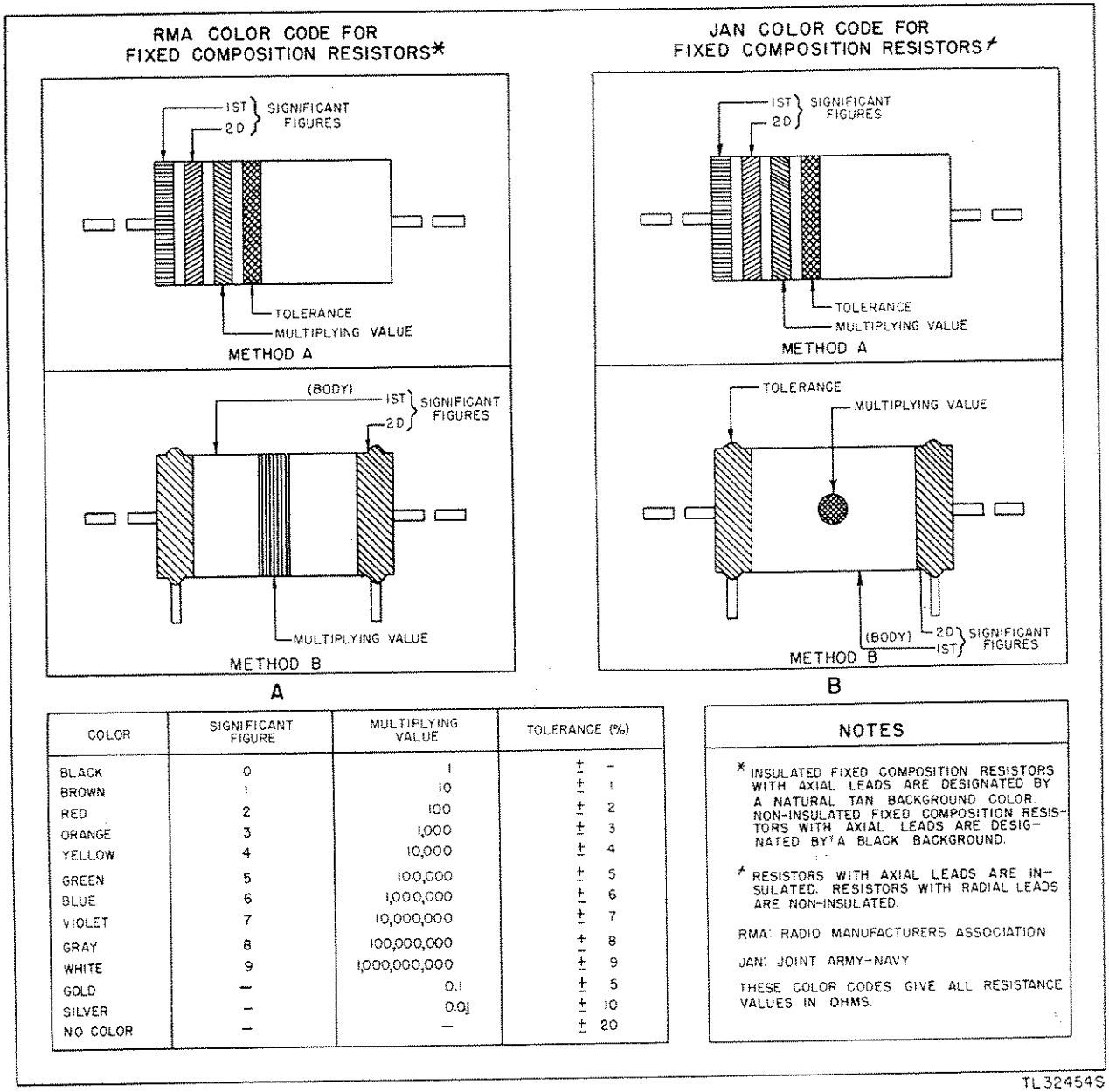
Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R160, R167, R178		R145: Avc rectifier load (V110). R157: V113 grid. R160: V114 bfo screen voltage dropping. R167: V111 avc degenerative feedback. R178: Part of detector load supplying i-f output tube V111 input voltage.	
R171	RESISTOR, fixed: comp; 120,000 ohms ±10%; ½ w; JAN type RC20BF124K.	V111 avc filter.	3RC20BF124K
R121, R156, R158, R159, R177	RESISTOR, fixed: comp; 220,000 ohms ±10%; ½ w; JAN type RC20BF224K.	R121: 100-kc oscillator plate load. R156: A-f voltage amplifier V112 plate load. R158: T103 primary damping. R159: T103 secondary damping. R177: Part of detector load supplying i-f output tube V111 input voltage.	3RC20BF224K
R108	RESISTOR, fixed: comp; 330,000 ohms ±10%; ½ w; JAN type RC20BF334K.	V102 injection grid.	3RC20BF334K
R125, R144, R152, R153, R172	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K.	R125: V107 grid. R144: Avc filter. R152: Noise limiter filter. R153: Noise limiter load. R172: Static drain.	3RC20BF474K
R118	RESISTOR, fixed: comp; 680,000 ohms ±10%; ½ w; JAN type RC20BF684K.	100-kc oscillator grid.	3RC20BF684K
R101	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; JAN type RC20BF105K.	V101 grid.	3RC20BF105K
R164, R166	RESISTOR, fixed: WW; 120 ohms ±5%; 8 w; JAN type RW30G121.	Part of bias voltage divider.	3RW18921
R165	RESISTOR, fixed: WW; 310 ohms ±5%; 8 w; JAN type RW30G311.	Part of bias voltage divider.	3RW21327
R140	RESISTOR, variable: comp; 100 ohms ±10%; 2 w; JAN type RV4ANSD101A.	METER ZERO control.	3RV21012
R148	RESISTOR, variable: comp; 10,000 ohms ±10%; 2 w; JAN type RV4ANFK103A.	RF GAIN control.	3RV41510
R154	RESISTOR, variable: comp; 500,000 ohms ±10%; 2 w; JAN type RV4ANFK504C.	AUDIO GAIN control.	3RV55048
	SCREWDRIVER: 90 deg offset; Phillips L shape; 1 end 3¼″ lg other end 1″ lg, 3¼″ lg o/a; .188″ dia round shank; #1 Phillips head both ends; Vaco type O1V.	Screw driver (Phillips head).	6R15490.1
O133	SHAFT: extension; 1.375″ lg x .250″ dia.	Crystal filter shaft extension.	2Z8204–162
O137	SHAFT: extension; steel, cad pl; round 4¾″ lg x ¼″ dia; mts in coupling; opposite sides flatted 4⅛″, .015″ x 45 deg chamfer both ends.	Shaft for switches S109 and S110.	2Z8203–598
O138	SHAFT: extension; 7.875″ lg x .249″ dia.	Bfo pitch adjustment.	2Z8202–68
O132	SHAFT: 3¾″ lg x .375″ dia o/a, .310″ wd at flatted portion.	Crystal switch shaft.	2Z8204–161
O131	SHAFT: 10″ lg x .375″ dia o/a, .310″ wd at flatted portion.	R-f switch shaft.	2Z8204–160
E117	SHIELD, tube: bayonet mtg; 1⅛″ ID x 2¼″ lg inside.	Tube shield for V113.	2Z8304–237

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E107, E108	SHIELD, tube: steel, cad pl; cylindrical, open top; bayonet mtg; .810" ID x 1⅜" lg inside; JAN type TSFOT101.	E107: Tube shield for V101. E108: Tube shield for V102.	2Z8304.57
E109, E110, E111, E112, E113, E114, E115, E116, E001, E002	SHIELD, tube: steel, cad pl; cylindrical, open top; bayonet mtg; .810" ID x 1¾" lg inside; JAN type TSFOT102.	E109: Tube shield for V103. E110: Tube shield for V104. E111: Tube shield for V105. E112: Tube shield for V106. E113: Tube shield for V107. E114: Tube shield for V108. E115: Tube shield for V109. E116: Tube shield for V114. E001: Tube shield for V001. E002: Tube shield for V002.	2Z8304.154
E104, E105, E106	SHIELD, tube: cad pl; cylindrical; bayonet mtg; .950" ID x 1 13/16" lg inside; JAN type TSFOT105.	E104: Tube shield for V110. E105: Tube shield for V111. E106: Tube shield for V112.	2Z8304.183
XY111	SOCKET: crystal.	Socket for crystal Y111.	2Z8761–64
XV101, XV102, XV103, XV104, XV105, XV106, XV107, XV108, XV109, XV113, XV114	SOCKET, tube: 7 cont miniature; 1 piece saddle mtg; JAN type TSE7T101.	XV101: Socket for V100. XV102: Socket for V102. XV103: Socket for V103. XV104: Socket for V104. XV105: Socket for V105. XV106: Socket for V106. XV107: Socket for V107. XV108: Socket for V108. XV109: Socket for V109. XV113: Socket for V113. XV114: Socket for V114.	2Z8677.94
XV115	SOCKET, tube: octal; 1 piece under chassis saddle mtg; JAN type TSB8T101.	Socket for V115.	2Z8678.326
XV110, XV111, XV112	SOCKET, tube: 9 cont noval; 1 piece saddle mtg; JAN type TSE9T101.	XV110: Socket for V110. XV111: Socket for V111. XV112: Socket for V112.	2Z8679.30
XY101	SOCKET ASSEMBLY, crystal: for 10 crystals.	Sockets for crystals Y101 thru Y110.	2Z8636–23
O101B	SPIDER, coupling: phosphor bronze; cylindrical; 1.090" dia x .157" thk; .250" dia ctr mtg hole.	Part of main oscillator coupling.	2Z3295–167
	SPRING: helical extension type; .029" dia spring wire, type 302 SS; .574" lg x .125" OD o/a; 13¾ turns; 90 deg hook term 1 ea end.	Gear loading spring (part of main gear assembly).	2Z8877.615
	SPRING: helical compression; .025" dia spring wire, #302 SS; 3½" lg x .312" OD o/a; 33 turns.	Variable i-f rack spring.	2Z8877.332
	SPRING: helical extension type; 1.262" lg x .312" OD; 39 turns.	R-f slug rack spring.	2Z8877.333
	SPRING: helical extension type; ⅜" free lg x .130" dia o/a; 6 turns.	R-f slug rack gear loading.	2Z8877.334
	SPRING: helical extension type; 13/32" lg x 5/32" dia o/a; 7 turns closely wnd.	Dial spring loading.	2Z8877.335
	SPRING: torsion type; 1" lg x .874" OD; 13¼ turns closely wnd.	MEGACYCLES drum dial tension.	2Z8877.336
	SPRING: loop type; SS wire type 302, .030" dia; .229" lg x .225" wd x .030" thk.	Part of slug table assembly of r-f tuner assembly.	2Z8877.614
S110, S111	SWITCH SECTION, rotary: 12 position (p/o rotary switch); 1 pole, 2 throw.	Variable i-f selecting.	3Z9903E–10.14
S108	SWITCH SECTION, rotary: 18 position (p/o rotary switch); 2 pole, 15 throw.	Crystal oscillator harmonic selecting.	3Z9903E–10.13
S101, S102,	SWITCH SECTION, rotary: 18 position (p/o rotary switch); 1 pole, 17 throw.	S101: Antenna coil selecting. S102: Antenna coil selecting.	3Z9903E–10.15

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
S106, S107, S109		S106: First mixer plate coil selecting. S107: First mixer plate circuit selecting. S109: Crystal selecting.	3Z9903E–10.12
S103, S105, S104	SWITCH SECTION, rotary: 18 position (p/o rotary switch); 1 pole, 18 position.	S103: R-f coil selecting. S105: Mixer grid circuit selecting. S104: R-f amplifier plate coil selecting.	3Z9825–50.2
S112, S115, S116, S118	SWITCH, rotary: DPDT.	S112: BFO ON-OFF. S115: AVC ON-OFF. S116: Noise LIMITER ON-OFF. S118: CALIBRATE ON-OFF.	3Z9825–58.198
S113	SWITCH, rotary: 2 pole, 3 position; 1 sect.	Receiver ON-STANDBY-OFF.	3Z9825–50.1
S114	SWITCH, rotary: 1 pole, 5 position; 1 sect.	SELECTIVITY switch.	3Z9863–52R
S117	SWITCH, toggle: DPDT; JAN type ST52R.	METER switch.	6Q335–2
	TOOL, alinement: natural phenolic, LTS–M3; 6¾" lg x ½" dia o/a; ⅜" lg scdr tip tapered to $\frac{1}{32}$" at tip; phenolic grip.	Alinement tool.	6Q335–1
	TOOL, alinement: natural phenolic, LTS–M3; 5$\frac{13}{16}$" lg x .315" dia o/a; 1½" lg scdr tip tapered to $\frac{1}{32}$" at tip w/$\frac{1}{16}$" d x $\frac{5}{32}$" wd notch in tip; opposite end has flat insert $\frac{1}{16}$" lg w/$\frac{1}{16}$" d x $\frac{5}{32}$" wd notch in end.	Alinement tool.	2Z9637.138
T107	TRANSFORMER, AF: line type; pri 5000 ohms impedance, 1500 v test; secd 600 ohms impedance, 1500 v test, tapped at 4 ohms; HS metal case, iron core; 1⅞" lg x 1¾" wd x 3" h; 3 w oper level; turns ratio 2.89:1; freq response; 100 cps ±3 db, 300 cps ±1 db, 1000 cps zero reference, 2500 cps ±1 db, 5000 cps ±3 db; solder lug term; four #6–32 x ⅜" h studs on 1$\frac{5}{16}$" x 1$\frac{1}{16}$" ctr.	Audio output transformer.	2Z9629–390
T101	TRANSFORMER, IF: 490 to 510 kc; shielded; 1$\frac{7}{16}$" lg x 1$\frac{7}{16}$" wd x 2⅝" h less term and mtg; tuned pri and secd; adj iron core tuning; solder lug term on bottom.	Crystal filter input.	2Z9641.328
T103, T104, T105	TRANSFORMER, IF: 500 kc; shielded; 2" lg x 1$\frac{7}{16}$" d x 3½" h o/a; tuned pri and secd; adj powdered iron core tuning.	T103: First i-f transformer. T104: Second i-f transformer. T105: Third i-f transformer.	
T108	TRANSFORMER, power: fil and plate; input 115 v 60 cyc, single ph; secd #1, 5 v, 2 amp; secd #2, 6.3 v, 5 amp; secd #3, 700 v CT, .090 amp; HS metal case; 3$\frac{13}{16}$" lg x 3$\frac{5}{16}$" d x 2¾" excluding term; solder lug ceramic bushing term.	Power transformer.	2Z9613.719
V101, V105	TUBE, electron: JAN type 6AK5.	V101: R-f amplifier. V105: Crystal oscillators.	2J6AK5
V102, V103, V106	TUBE, electron: JAN type 6BE6.	V102: First mixer. V103: Third mixer. V106: Second mixer.	2J6BE6
V001, V002, V104, V107, V108, V109, V114	TUBE, electron: JAN type 6BA6.	V001: Vfo. V002: Vfo. V104: Crystal oscillator. V107: First i-f. V108: Second i-f. V109: Third i-f. V114: Bfo.	2J6BA6

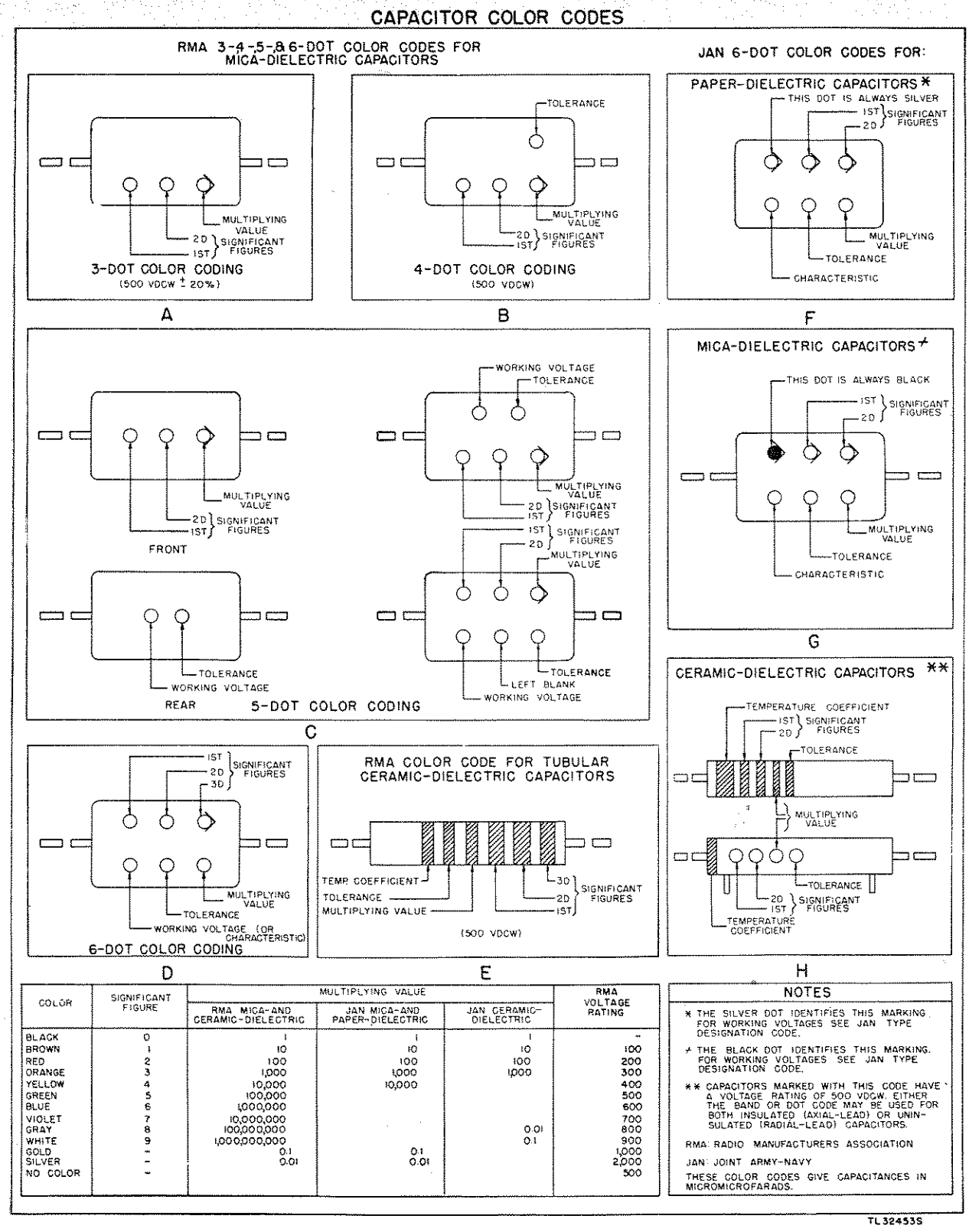
Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
V110, V112	TUBE, electron: JAN type 12AX7.	V110: Detector and avc rectifier. V112: Noise limiter, first audio.	2J12AX7
V111	TUBE, electron: JAN type 12AU7.	Avc amplifier.	2J12AU7
V113	TUBE, electron: JAN type 6AQ5.	Audio output.	2J6AQ5
V115	TUBE, electron: JAN type 5V4G.	Power supply rectifier.	2J5V4G
	WRENCH: Bristo set screw.	For No. 4 Bristo set screw.	6RK55232
	WRENCH: Bristo set screw.	For No. 6 Bristo set screw.	6R55230
	WRENCH: Bristo set screw.	For No. 8 Bristo set screw.	6R55231.1
	WRENCH: Bristo set screw.	For No. 10 Bristo set screw.	6R55230-10
V116	TUBE, electron: JAN type OA2.	Voltage regulator.	2JOA2

RESISTOR COLOR CODES



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± —
BROWN	1	10	± 1
RED	2	100	± 2
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
SILVER	—	0.01	± 10
NO COLOR	—	—	± 20

Figure 40. Resistor color codes.



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA- AND CERAMIC-DIELECTRIC	JAN MICA- AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	–
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	–	0.1	0.1		1,000
SILVER	–	0.01	0.01		2,000
NO COLOR	–				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

≠ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

Figure 41. Capacitor color codes.