CR-91A

GENERAL PURPOSE COMMUNICATIONS RECEIVER

/u SE 405

Manufactured by
RADIO CORPORATION OF AMERICA
ENGINEERING PRODUCTS DEPARTMENT
Camden, New Jersey, U. S. A.

RCA

PRINTED IN U. S. A.

IB-31017

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Frontispiece—CR-91A General Purpose Communications Receiver
(Front View)

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TECHNICAL SUMMARY

ELECTRICAL CHARACTERISTICS

Frequency Range—Total, Six Bands	73 to 550 kc and 1480 to 30,500 kc
Band 1	73 - 205 kc
Band 2	195 - 550 kc
Band 3	1480 - 4400 kc
Band 4	4250 - 12,500 kc
Band 5	11,900 - 19,500 kc
Band 6	19,000 - 30,500 kc
Power Source	100-117, 117-135, 135-165, 190-230, 200-260 volts, 50/60 cycles a.c.
or Batteries	6 volt "A" battery, 250-300 volts "B" battery
or Vibrator Power Supply Unit	MI-8319A
Power Consumption	100 watts
Circuit	Superheterodyne
Reception	AM Radiotelephone or CW
Intermediate Frequency	735 kc
Power Output, undistorted across 2.5 ohms	2.5 watts
Output Impedance	2.5 and 600 ohms
Antenna Input Impedance, balanced	200 ohms

TUBE COMPLEMENT

Type	No. Used	Where Used
6SG7	5	1st and 2nd RF; 1st, 2nd, and 3rd IF
6J5	2	Osc. and BFO
6SA7	1	1st Det.
6H6	2	2nd Det. and AVC; Noise Limiter
6SJ7	1	1st AF
6V6GT/G	1	Output
5Y3GT/G	1	Rectifier
VR150-30	1	Voltage Regulator

MECHANICAL SPECIFICATIONS

Overall Dimensions						Net Weight	
Width		Height		Depth			
Inches	Cm.	Inches	Cm.	Inches	Cm.	Lbs.	Kg.
19.25	48.9	11.0	27.9	19.25	48.9	98	44.5

PERFORMANCE DATA (Average Receiver)

Band No.	Frequency Kilocycles	Sensitivity, Microvolts For 0.5 Watt	Input Microvolts Signal-to-Noise Ratio 10 DB	Input Microvolts Signal-to-Noise Ratio 20 DB	Image Ratio
1	77 140 190	0.5	1.8	10.0	Greater than 1,000,000
2	205 375 500	0.6	1.0 1.0 1.5	7.0 8.0 10.0	Greater than 1,000,000
3	1,600 3,000 4,000	0.5 0.7 0.5	1.5 1.3 1.3	11.0 10.0 10.0	1,000,000 25,000
4	4,500 11,000	0.6	2.0 1.5	12.0 10.0	500,000 9,000
5	12,400 19,000	1.0 0.5	2.0	12.0	15,000 3,500
6	20,000 30,000	2.0 1.0	2.0	13.0	3,500 600

EQUIPMENT

The CR-91A General Purpose Communications Receiver is identified as MI-17091A, and is normally supplied complete with operational tubes in their sockets and one instruction book.

The following items are obtainable on separate order:

- Speaker MI-8303F
- Headphones MI-5803-6
- Vibrator Power Pack MI-8319A
- Chassis bottom shield (required for rack mounting) MI-17201

DESCRIPTION

GENERAL

The RCA CR-91A is a superheterodyne receiver which is tunable over the range of 73 to 550 kilocycles in two bands and 1480 to 30,500 kilocycles, in four bands. It is designed to withstand severe climatic and line voltage variations with no appreciable impairment of performance.

The receiver is supplied complete in a cabinet for table mounting but may be readily removed from its cabinet and mounted in a standard 19 inch rack.

Mechanical band spread is incorporated for ease of tuning and logging stations. Two tuned RF stages provide high image rejection ratio on all bands and three IF stages give a high degree of sensitivity and selectivity. Five IF selectivity positions, two without crystal and three with, give control over response from high fidelity to ultra-sharp. The oscillator circuits are temperature-compensated on all bands. Ceramic insulation is used throughout on the tuning capacitor, sockets, range switch, and selectivity switch.

A separate beat frequency oscillator tube is used for CW reception. An adjustable automatic noise limiter enables noise interference to be reduced to the equivalent of any desired percentage of modulation. High frequency audio response is controlled by a continuously variable attenuator. A tuning dial lock is included for service under conditions of vibration.

CIRCUITS

The CR-91A General Purpose Communications Receiver includes two RF stages each using an RCA-6SG7; a local oscillator using an RCA-6J5; a first detector using an RCA-6SA7; three IF stages each using an RCA-6SG7; a second detector and automatic gain control using an RCA-6H6; a beat frequency oscillator using an RCA-6J5; a noise limiter using an RCA-6H6; an AF amplifier using an RCA-6SJ7; an audio output stage using an RCA-6V6GT/G; a voltage regulator using an RCA-VR150; and a rectifier using an RCA-5Y3GT/G.

The antenna coupling system is designed to provide optimum high frequency coupling to a 200-ohm balanced transmission line and optimum low frequency operation from a single-ended 200 mmf antenna. The first RF circuit is provided with a trimmer capacitor, adjustable from the front panel, to insure the proper alignment of this circuit with individual antenna systems.

Two tuned RF stages are used, each employing an RCA-6SG7 pentode. These stages provide ample selectivity ahead of the first detector and minimize cross-modulation and blocking effects from strong interfering signals, thus assuring a high degree of image signal suppression.

The local oscillator uses an RCA-6J5 triode and operates at a frequency of 735 kilocycles above the signal frequency. The oscillator plate voltage is regulated by an RCA-OD3/VR150-30 regulator tube to provide maximum frequency stability under conditions of variations in power supply voltages.

The first detector uses an RCA-6SA7 pentagrid converter. The plate circuit of this stage is tuned to the intermediate frequency, and is coupled to the first IF grid circuit through a balanced link arrangement. A 735-kilocycle crystal is connected in one arm of the link circuit and a phasing capacitor (C75) is connected in the other.

The IF transformers are designed so that the crystal selectivity characteristic is not impractically sharp. The band width at points on the selectivity curve 3 db (or two times) down with respect to the response at resonance is adjustable to 500, 2000, 4000, 9000, and 16,000 cycles.

Three stages of IF amplification are used, each employing an RCA-6SG7 pentode. The first IF transformer has tuned primary and secondary, and is coupled through the crystal filter link to the first IF tube. The second and third IF circuits have four tuned circuits each (two transformers), whose coupling is adjusted by the selectivity switch to provide varying degrees of selectivity. The fourth IF transformer has two tuned circuits.

To obtain a good AGC characteristic with little overload distortion, the third IF stage is not connected to the AGC circuit or to the manual gain control. This also permits coupling the beat frequency oscillator to the grid circuit of this IF stage at a low injection level and without causing disturbance to the AGC circuit.

The beat frequency oscillator (BFO) uses an RCA-6J5 triode, which is electrostatically coupled to the third IF grid circuit. A panel control (C80) provides means for varying the audio beat note.

An RCA-6H6 twin-diode is used as a second detector and for automatic gain control (AGC). A variable AGC delay voltage is obtained, depending upon the setting of the RF gain control.

The AGC diode bias voltage is always higher than the rectified BFO voltage, to avoid decreasing the sensitivity of the receiver when the BFO is used.

A sensitivity control and a manual volume control are provided for control of the RF and IF sensitivity and the audio volume level respectively.

The noise limiter circuit uses an RCA-6H6 twin-diode. This circuit limits the noise interference to the desired equivalent percentage of modulation as determined by the setting of the noise limiter control. The noise limiter may be used either with or without AGC on modulated or CW reception.

An RCA-6SJ7 pentode is used as an AF amplifier. This stage is resistance-coupled to the audio output stage, which uses an RCA-6V6GT pentode. The output tube operates into an output transformer which has windings for matching a 2.5-ohm or 600-ohm load, and a headphone winding designed to deliver a maximum of approximately 10 milliwatts of power to 600-ohm phones. Terminals are provided on the rear apron for the 2.5- and 600-ohm outputs. The 600-ohm winding is balanced and ungrounded.

The output from the 2.5-ohm tap on the output transformer is fed to the 2.5-ohm terminals through a two-position jack which is mounted on the front panel. The headphone winding also connects to the jack. When the phone plug is partially inserted into the jack (first position) the phones are in parallel with the 2.5-ohm winding. When the plug is pushed into the jack as far as it will go (second position) the phones are connected to the phone winding and the 2.5-ohm output is disconnected from the rear terminals. When no load is connected to either the 2.5- or 600-ohm terminals, the phones should be used in the second position, as under this condition a load resistor is shunted across the 2.5-ohm tap to maintain proper impedance matching.

An RCA-5Y3GT/G rectifier is used in the power supply. A switch (S25) is provided on the rear apron of the chassis for changing the primary voltage tap on the power transformer.

A front panel mounted tuning meter is connected in the cathode circuit of the first i-f amplifier. The meter is calibrated in db above one microvolt, and indicates the comparative strength of received signals. It may also be used as an aid in tuning.

INSTALLATION

CAUTION: Before installing the receiver, determine the line voltage and set switch S25 (on the rear apron of the receiver) to the correct position.

Mounting—The receiver may be placed on a table or mounted in a standard rack. For rack mounting, loosen the front panel mounting screws and remove the receiver from the cabinet. A chassis bottom shield (RCA MI-17201, available on separate order) must be used for satisfactory rack mounted operation.

Battery or Other External Supply—For operation from batteries or a vibrator power supply, remove the plug fom the socket (J1) on the rear apron of the receiver. Connect batteries as shown in Figure 6, making use of a battery cable terminating in a male (octal) plug. A vibrator power supply (MI-8319-A) is available on separate order. This power supply will operate the receiver directly from a single 6-volt storage battery.

Tubes—Inspect the chassis before applying power, to be sure all tubes are firmly seated in their respective sockets.

Antenna—The receiver is designed to match a 200-ohm transmission line or a 200 mmf straight wire antenna. For general use, a straight wire antenna 25 to 50 feet long, including lead-in may be used.

Speaker—Terminals are provided on the rear apron for connection to a loudspeaker having a voice coil impedance of 2.5 ohms. RCA speaker MI-8303F is recommended.

Headphones—Headphones may be plugged in the jack on the front panel. The headphone plug may be inserted for two types of operation, as follows:

Plug partially inserted	Speaker and headphone both operative.
Plug fully inserted	Headphone operation only.

MAINTENANCE

The CR-91A Receiver requires little maintenance for satisfactory service. If a loss in sensitivity is noted after a period of time, check the tubes with a reliable tube tester, or substitute new tubes one at a time.

If trouble-shooting becomes necessary, check the affected circuit with suitable test equipment. A typical tube socket voltage chart is included on page 14. This chart should be referred to when checking voltages present on the tube elements. Use the voltage chart in conjunction with the schematic diagram. Voltages measured should be within 20% of the indicated values.

Do not disturb the alignment adjustments unless necessary as a part of maintenance. When re-alignment becomes necessary, follow the procedure outlined in the Alignment Section.

The RF Unit, consisting of the tuning capacitor, tuning unit, range switch, and all r-f and oscillator coils and trimmers, is mounted on a separate base which is bolted to the main chassis. Each of the coils and trimmers is held on its individual mounting bushing by means of a single nut.

For a major repair, such as replacement of the band switch, it is necessary first to remove the RF Unit from the receiver. Proceed as follows to accomplish this:

1. Remove the chassis and panel from the cabinet by removing the four panel mounting screws and then pulling the chassis forward out of the cabinet.

2. Remove the knobs by means of the small wrench which is mounted on the right-hand side of the chassis. Use an ordinary small screwdriver for the main tuning knob.

3. Remove the panel by removing the eight nuts with which it is held to the support brackets.

4. Remove the large cover from the top of the r-f unit by removing the four knurled nuts.

5. Remove the small cover from the tuning capacitor, by removing the eight knurled nuts with which it is supported.

6. Remove the dial light sockets from the tuning unit.

7. Remove the antenna trimmer shaft extension by loosening the setscrews in the coupling.

8. Remove the support bracket from the flywheel tuning shaft.

9. Loosen the setscrews then remove the main dial, vernier dial, and flywheel.

10. Disconnect the eight leads which connect the r-f unit to the main base. These leads are as follows:

   a. Two on the antenna terminal board (TB1). Blue on terminal 3 and black on terminal 2.

   b. One on number 7 pin of the 6V6GT output tube (brown).

   c. One on terminal E of the crystal load circuit (yellow).

   d. One on terminal E of the first i-f transformer (red).

   e. One on terminal F of the first i-f transformer (blue).

   f. One on pin 6 of the second i-f tube (green).

   g. One on pin 7 of the second i-f tube (brown).

11. Disconnect the ground lead from by-pass capacitor C121. This capacitor is located on the under side of the chassis near the second i-f tube socket.

12. Remove the eleven screws which hold the r-f unit to the main chassis base. Three are on the under side of the chassis along the front edge. The remaining eight are removed from the top.

13. Remove the r-f unit by lifting up the rear of the unit and then sliding it back out of the opening.

14. After the unit has been repaired, reassemble by following the dismounting procedure in reverse order.

ALIGNMENT

For complete alignment, follow the outlined procedure in the sequence indicated.

Alignment tools are provided for adjustment of the r-f and i-f circuits. The tools are held in fuse clips mounted on either side of the tuning capacitor cover. The shorter tool is to be used for all r-f and i-f core adjustments, and the longer tool is to be used for the plunger-type trimmers. One end of the latter tool is for turning the locking nut on the trimmer; the opposite end has a hook for engaging the hole in the end of the trimmer plunger.

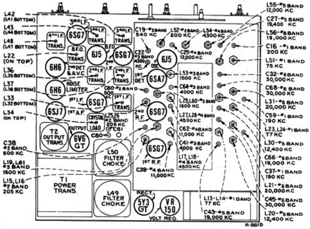


Figure 1—Diagram, Top of Chassis

I-F ALIGNMENT

I-F Transformers

The most satisfactory method of i-f alignment is by means of a sweep oscillator used in conjunction with a cathode ray oscilloscope. Set the center frequency of the sweep oscillator to the i-f frequency (735 kilocycles).

Equipment

Sweep Oscillator
Cathode Ray Oscilloscope
Capacitor, 0.01 mfd
Alignment Tools (supplied)

Procedure

1. Set the RANGE switch at position 1.
2. Rotate the OFF-TRANS.-REC. MOD., REC. C.W. switch to the REC. MOD. position.
3. Rotate the R.F. GAIN control to the fully clockwise position.
4. Set the SELECTIVITY switch at position 2.
5. Set MAN.-A.V.C. switch to the A.V.C. position.

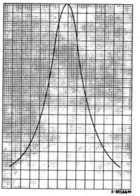


Figure 2—Fourth I-F Stage, Selectivity Curve

6. Rotate the TUNING CONTROL to the low end of band.

7. Keep controls not specified at nominal settings.

8. Connect the vertical "high" terminal of the oscilloscope to terminal C on the 4th i-f transformer (T9). Connect the vertical "low" terminal to the receiver chassis.

9. Connect the ground lead of the oscillator to the receiver chassis.

10. Connect the 735 kc output of the oscillator, in series with the 0.01 mfd capacitor, to each point as specified in the chart, and follow each step in sequence.

I-F CIRCUIT ADJUSTMENT

Step	Signal Tube	Signal Pin	Adjust	Circuit
1	V7	4	L48, L47	T9
2	V6	4	L44, L43	T8
3			L42, L41	T7
4	V5	4	L38, L37	T6
5			L36, L35	T5
*6	V4	8	L33, L32	T3

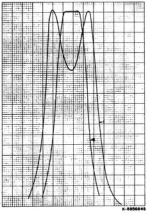


Figure 3—Third I-F Stage, Selectivity Curve

*NOTE—Before performing step 6, set the CRYSTAL PHASING control (C75) at about one-half its maximum capacity. This is approximately its final setting, and changing it appreciably will slightly detune the first i-f transformer (T3).

With the SELECTIVITY switch in position 2, the i-f band width is normal without overcoupling in the transformers. With the SELECTIVITY switch in position 1, the second and third i-f transformers are expanded and over coupled. Check the i-f curves with the switch in position 1 to see that the curves expand symmetrically.

Beat Frequency Oscillator Adjustment

1. With the OFF-TRANS.-REC. MOD.-REC. C.W. switch in the REC. MOD. position, tune in a signal.

2. Without changing the tuning, rotate the OFF-TRANS.-REC. MOD.-REC. C.W. switch to the REC. C.W. position.

3. Set the B.F.O. ADJ. control knob at mid-point.

4. Adjust b-f-o trimmer (L22) until zero beat is obtained.

Crystal Phasing Control Adjustment

For this adjustment, use a signal generator and a vacuum tube voltmeter (RCA VoltOhmyst).

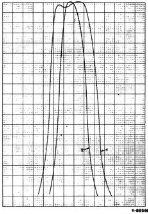


Figure 4—Combined Characteristics, Third and Fourth I-F Stages

Proceed as follows:

1. Connect the output of the signal generator, in series with a 0.01 mfd capacitor, to the grid (pin 8) of the 1st detector (V4).

2. Connect the positive side of the voltmeter to the receiver chassis, and the negative side to terminal C of i-f transformer T9.

3. Connect the ground terminal of the signal generator to the receiver chassis.

4. Rotate the SELECTIVITY switch to position 3.

5. Adjust the signal generator for an output frequency of approximately 742 kc.

6. Adjust the crystal phasing capacitor (C75) for minimum response.

NOTE—If the control knob pointer on C75 is not in a vertical position at the completion of the preceding adjustment, loosen the knob and reset with the pointer in that position.

Crystal Load Circuit Adjustment

1. Perform steps 1, 2, 3, and 4 as for the crystal phasing control adjustment.

2. Rock the signal generator frequency through the 735 kc i-f resonant frequency and simultaneously adjust the crystal load circuit trimmer (L34) for a symmetrical round-top curve.

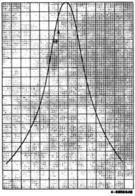


Figure 5—First I-F Stage, Selectivity Curve

3. Place the SELECTIVITY switch in position 4. Rock the signal generator frequency and adjust the trimmer (C81) for a symmetrical curve.

4. Place the SELECTIVITY switch in position 5. Adjust trimmer capacitor C80, rocking the signal generator frequency as before.

NOTE—The crystal load circuit adjustments are very critical, and must be made carefully to obtain symmetrical curves.

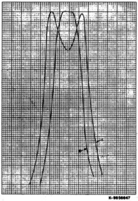


Figure 6—Second I-F Stage, Selectivity Curve

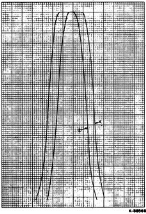


Figure 7—Combined Characteristics, First and Second I-F Stages

R-F ALIGNMENT

Wave Trap Adjustment

1. Set the RANGE switch to position 3.

2. Apply a 735-kilocycle modulated signal to the antenna and ground terminals.

3. Adjust the wave trap trimmer (L57) for minimum output.

NOTE—The wave trap should be adjusted before final r-f alignment on band no. 3, to avoid affecting the r-f coil alignment.

R-F CIRCUIT ADJUSTMENT

Equipment Required:

Signal Generator
Output Indicator (RCA VoltOhmyst)
Capacitor, 700 mmfd
Resistor, 200 ohms
Alignment Tools (supplied)
Speaker, 2.5-ohm voice coil, or
Resistor, 2.5-ohm, 5 watts

Procedure

1. Rotate the OFF-TRANS.-REC. MOD.-REC. C.W. switch to the REC. C.W. position.

2. Rotate the R.F. GAIN control to the fully clockwise position.

3. Set the SELECTIVITY switch at position 2.

4. Set MAN.-A.V.C. switch to the A.V.C. position.

5. Rotate the H.F. TONE control fully clockwise.

6. Rotate the A.F. GAIN control fully clockwise.

7. Set ANT. ADJ., RANGE, and TUNING controls in the R-F CIRCUIT ADJUSTMENTS table.

8. Connect the 2.5-ohm speaker or 2.5 ohm resistor across terminals 1 and 2 of TB2.

9. Connect the output indicator across the load resistor or speaker. (If an RCA VoltOhmyst is used as an indicator, set its range switch to 10 volts a-c).

10. Connect the signal generator output, in series with the dummy antenna specified, to the antenna and ground terminals.

11. Modulate the signal generator 30% at 400 cycles.

12. Perform each step in the chart in the order indicated. In each case, adjust the specified trimmer for peak indication on the output indicator. Under no conditions should the adjustment of the R-F and A-F gain controls be changed while following the steps outlined in the chart.

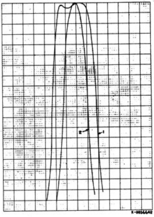


Figure 8—Overall Selectivity Curves

TYPICAL TUBE SOCKET VOLTAGES

Type Tube	Circuit Symbol	Voltage to Chassis		
		Plate	Screen	Cathode
6SG7	V1	235	150	0
6SG7	V2	235	150	0
6J5	V3	110	—	0
6SA7	V4	235	50	2.0
6SG7	V5	235	150	7.0
6SG7	V6	235	150	1.3
6SG7	V7	235	150	3.1
6H6	V8	—	—	—
6H6	V9	—	—	—
6SJ7	V10	83	34	0
6V6GT/G	V11	256	240	0
6J5	V12	40	—	0
VR150	V13	150	—	0
5Y3GT/G	V14	—	—	300

All voltages measured with 1000 ohms-per-volt d-c meter.

R-F CIRCUIT ADJUSTMENTS

Step	Range Switch	Dummy Antenna	Dial and Generator Frequency	Antenna Trimmer	Adjust for Peak Output
1	1	700 mmfd	75	—	L51
2			200		C16
3	Repeat 1 and 2 until frequencies check.				
4	1	700 mmfd	190	Max. Output	C37, C59
5			77	Unchanged	L2, L14, L24
6	Repeat 4 and 5. Check band alignment.				
7	2	700 mmfd	200	—	L52
8			540		C19
9	Repeat 7 and 8 until frequencies check.				
10	2	700 mmfd	500	Max. Output	C38, C60
11			205	Unchanged	L4, L16, L26
12	Repeat 10 and 11. Check band alignment.				
13	3	200 ohms	1500	—	L53
14			4300		C22
15	Repeat 13 and 14 until frequencies check.				
16	3	200 ohms	4000	Max. Output	C41, C64
17			1600	Unchanged	L6, L19, L29
18	Repeat 16 and 17. Check band alignment.				
19	4	200 ohms	4300	—	L54
20			12,000		C25
21	Repeat 19 and 20 until frequencies check.				
22	4	200 ohms	11,000	Max. Output	C39, C62
23			4500	Unchanged	L8, L18, L28
24	Repeat 22 and 23. Check band alignment.				
*25	5	200 ohms	12,000	—	L55
26			19,400		C27
27	Repeat 25 and 26 until frequencies check.				
28	5	200 ohms	19,000	Max. Output	C43, C66
29			12,400	Unchanged	L10, L20, L30
30	Repeat 28 and 29. Check band alignment.				

R-F CIRCUIT ADJUSTMENTS (Cont'd)

Step	Range Switch	Dummy Antenna	Dial and Generator Frequency	Antenna Trimmer	Adjust for Peak Output
*31	6	200 ohms	19,000	—	L56
32			30,000		C32
33	Repeat 31 and 32 until frequencies check.				
34	6	200 ohms	30,000	Max. Output	C45, C68
35			20,000	Unchanged	L12, L21, L31
36	Repeat 34 and 35. Check band alignment.				

NOTE 1—The oscillator frequency is above the signal frequency on all bands.

NOTE 2—If more than one peak is obtainable on any oscillator adjustment, use the higher frequency peak.

*Note 3—On bands 5 and 6, clockwise rotation of the oscillator coil cores (L55, L56) decreases the inductance. On all other bands, clockwise rotation increases the inductance.

REPLACEMENT PARTS LIST

When ordering replacement parts, please give Symbol, Description, and Stock Number of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part; however, it will be a satisfactory replacement, differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment.

CR-91A RADIO RECEIVER
MI-17091-A

SYMBOL No.	DESCRIPTION	Stock No.
C1	Capacitor, moulded oil impregnated, 6000 mmfd, –20%, +60%, 600 volts, d.c.	67906
C2	Capacitor, variable, antenna trimmer	42255
C3	Capacitor, variable, sections 1, 3 and 5, 0 to 361.8 mmfd; sections 2, 4 and 6, 0 to 120.6 mmfd; section 7, 0 to 420.0 mmfd; section 8, 0 to 80.4 mmfd	42235
C4, C5	Capacitor, ceramic, non-insulated, 220 mmfd, ±10%, 500 volts, d.c.	71920
C6	Capacitor, same as C3	
C9	Capacitor, ceramic, non-insulated, 10 mmfd, ±10%, 500 volts, d.c.	31709
C11	Capacitor, same as C1	
C12	Capacitor, ceramic, 56 mmfd, ±10% (part of L-57)	71924
C13	Capacitor, ceramic, non-insulated, 100 mmfd, ±10%, 500 volts, d.c.	45233
C14	Capacitor, same as C4	
C15	Capacitor, ceramic, non-insulated, 47 mmfd, ±5%, 500 volts, d.c.	48119
C16	Capacitor, variable air, 2 to 20 mmfd	60499
C17	Capacitor, fixed mica, 68 mmfd, 500 volts, d.c.	39624
C18	Capacitor, fixed mica, 39 mmfd, ±5%, 500 volts, d.c.	48121
C19	Capacitor, same as C16	
C20	Capacitor, fixed mica, 240 mmfd, 500 volts, d.c.	48120
C21	Capacitor, ceramic, non-insulated, 13 mmfd, 500 volts, d.c.	47433
C22	Capacitor, variable air, 2 to 12 mmfd	60500
C23	Capacitor, fixed mica, 1000 mmfd, ±5%, 375 volts, d.c.	62391
C24	Capacitor, fixed mica, 2500 mmfd, ±5%, 500 volts, d.c.	48122
C25	Capacitor, same as C22	
C26	Capacitor, same as C21	
C27	Capacitor, variable air, 2 to 20 mmfd	60498
C28	Capacitor, fixed mica, 3000 mmfd, ±5%, 500 volts, d.c.	63448
C29	Capacitor, ceramic, non-insulated, 27 mmfd, ±5%, 500 volts, d.c.	48162
C30	Capacitor, fixed mica, 3900 mmfd, ±5%, 500 volts, d.c.	64060
C31	Capacitor, ceramic, non-insulated, 36 mmfd, ±5%, 500 volts, d.c.	48164
C32	Capacitor, same as C27	

SYMBOL No.	DESCRIPTION	Stock No.
C33	Capacitor, same as C1	
C35	Capacitor, same as C3	
C36	Capacitor, fixed mica, moulded, 1500 mmfd, 500 volts, d.c.	69998
C37, C38, C39	Capacitor, same as C19	
C40	Capacitor, same as C3	
C41	Capacitor, same as C19	
C43	Capacitor, same as C27	
C44	Capacitor, ceramic, non-insulated, 6.8 mmfd, ±15%, 500 volts, d.c.	39043
C45	Capacitor, same as C27	
C46	Capacitor, same as C21	
C47	Capacitor, same as C1	
C48	Capacitor, bypass, oil filled, 3 sections, .05 mfd, 400 volts each	42264
C49, C50	Capacitor, same as C3	
C51, C52	Capacitor, same as C1	
C53	Capacitor, same as C44	
C54	Capacitor, same as C1	
C56	Capacitor, bypass, oil filled, 3 sections, .01 mfd, 400 volts each	42267
C57	Capacitor, same as C4	
C58	Capacitor, same as C36	
C59, C60	Capacitor, same as C19	
C61	Capacitor, same as C9	
C62	Capacitor, same as C19	
C63	Capacitor, same as C1	
C64	Capacitor, same as C19	
C66	Capacitor, same as C27	
C67	Capacitor, ceramic, 20 mmfd	31871
C68	Capacitor, same as C27	
C69	Capacitor, same as C67	
C70	Capacitor, same as C3	
C71	Capacitor, bypass, oil filled, 3 sections, .1 mfd, 400 volts each	42265
C74	Capacitor, moulded mica, 4700 mmfd, ±10%	60529
C75	Capacitor, variable, 3 to 15 mmfd	48132
C76	Capacitor, same as C56	
C77	Capacitor, same as C3	
C79	Capacitor, bypass, oil filled, 3 sections, .1 mfd, 400 volts each	42265
C80, C81	Capacitor, same as C16	
C82	Capacitor, fixed mica, 56 mmfd, ±5% (part of T10)	54863
C83	Capacitor, same as C1	
C84	Capacitor, same as C79	
C85	Capacitor, same as C82	
C86	Capacitor, same as C75	

REPLACEMENT PARTS LIST—Continued

SYMBOL No.	DESCRIPTION	Stock No.	SYMBOL No.	DESCRIPTION	Stock No.
C87	Capacitor, fixed mica, 1500 mmfd, ±10% (part of T10)	39656	L21	Coil, 19 to 30 mc (RFT), Band #6	72501
C88	Capacitor, same as C82		L23, L24	Coil, same as L13	
C92	Capacitor, same as C79		L25, L26	Coil, same as L15	
C93	Capacitor, same as C56		L27, L28	Coil, same as L17	
C95	Capacitor, same as C79		L29	Coil, same as L19	
C96, C97, C98	Capacitor, filter, paper, oil filled, 3 sections, 4 mfd, 500 volts	41943	L30	Coil, same as L20	
C99	Capacitor, bypass, oil filled, 3 sections, .25 mfd, 400 volts each	42266	L31	Coil, same as L21	
C102	Capacitor, same as C79		L49, L50	Coil, reactor, filter choke, impedance at 30 volts, 60 cycle, .090 ampere, d.c. Resistance: 400 ohms, ±10%	60504
C103	Capacitor, same as C48		L51	Coil, 75 to 200 kc (OT), Band #1	72502
C105	Capacitor, fixed mica, moulded, 560 mmfd, ±10%, 500 volts	39646	L52	Coil, 200 to 550 kc (OT), Band #2	72504
C106, C107	Capacitor, same as C48		L53	Coil, 1.5 to 4.5 mc (OT), Band #3	60511
C108	Capacitor, fixed mica, 180 mmfd, ±5% (part of T9)	51416	L54	Coil, 4.5 to 12 mc (OT), Band #4	72506
C109, C110	Capacitor, same as C48		L55	Coil, 12 to 19 mc (OT), Band #5	72505
C111	Capacitor, moulded, oil impregnated, 3000 mmfd, 600 volts, d.c.	68487	L56	Coil, 19 to 30 mc (OT), Band #6	72503
C112, C113	Capacitor, same as C99		L57	Coil, oscillator, wave trap includes C12	54595
C115	Capacitor, same as C108		L60, L61	Coil, same as L19	
C116	Capacitor, same as C111		M1	Meter, DB meter, 5 milliamperes, internal resistance 6 ohms	42242
C117, C118	Capacitor, same as C1		R1	Resistor, fixed composition, insulated, 27,000 ohms, ½ watt	30787
C119	Capacitor, paper, .003 mfd, ±20%, 1000 volts, d.c.	47420	R2	Resistor, fixed carbon, insulated, 212 megohms, ¼ watt	47431
C121	Capacitor, same as C1		R3	Resistor, fixed carbon, 1000 ohms, ½ watt	34766
C123	Capacitor, same as C4		R4	Resistor, fixed carbon, 56,000 ohms, ½ watt	35497
C124	Capacitor, ceramic, non-insulated, 150 mmfd, ±10%, 500 volts, d.c.	48125	R5	Resistor, fixed carbon, 1.0 megohm, ½ watt	30652
C125, C126	Capacitor, mica, 650 mmfd, 300 volts, d.c.	34581	R6	Resistor, same as R1	
C127	Capacitor, fixed mica, 240 mmfd, ±5%, 500 volts, d.c.	48120	R7	Resistor, fixed carbon, 330 ohms, ½ watt	8063
C128	Capacitor, fixed mica, 285 mmfd, ±5%, 500 volts, d.c.	68237	R9	Resistor, fixed carbon, 100,000 ohms, ½ watt	3252
C129	Capacitor, same as C21		R10	Resistor, same as R3	
C130	Capacitor, same as C105		R11	Resistor, fixed carbon, 10,000 ohms, ½ watt	3078
C131	Capacitor, same as C44		R12	Resistor, same as R3	
C132	Capacitor, ceramic, 2 mmfd, ±15%	92522	R13	Resistor, fixed carbon, insulated, 560 ohms, ½ watt	19783
F1	Fuse, 1½ ampere	2725	R14	Resistor, same as R9	
J1	Socket, tube, octal with retainer	60995	R15	Resistor, fixed carbon, 22,000 ohms, ±10%, ½ watt (part of T3)	30492
J2	Jack, phone, 3 contact, one N.O. and one N.C.	64219	R16	Resistor, same as R3	
L1, L2	Coil, 75 to 200 kc, Band #1	48136	R17	Resistor, same as R7	
L3, L4	Coil, 200 to 550 kc, Band #2	48137	R19	Resistor, fixed carbon, insulated, 33,000 ohms, ½ watt	30685
L5, L6	Coil, 1.5 to 4.5 mc, Band #3	60521	R20	Resistor, fixed carbon, 100 ohms, ½ watt	34765
L7, L8	Coil, 4.5 to 12 mc, Band #4	60522	R21	Resistor, variable, carbon, meter adjusting control	42250
L9, L10	Coil, 12 to 19 mc, Band #5	60523	R22	Resistor, same as R3	
L11, L12	Coil, 19 to 30 mc, Band #6	48138			
L13, L14	Coil, 75 to 200 kc (RFT), Band #1	72495			
L15, L16	Coil, 200 to 550 kc (RFT), Band #2	72496			
L17, L18	Coil, 4.5 to 12 mc (RFT), Band #4	72497			
L19	Coil, 1.5 to 4.5 mc (RFT), Band #3	60525			
L20	Coil, 12 to 19 mc (RFT), Band #5	72498			

REPLACEMENT PARTS LIST—Continued

SYMBOL No.	DESCRIPTION	Stock No.
R23	Resistor, fixed carbon, 560,000 ohms, ½ watt	30653
R24	Resistor, fixed carbon, 120,000 ohms, ±10%, ½ watt (part of T10)	30180
R26	Resistor, same as R3	
R27	Resistor, same as R23	
R28	Resistor, same as R24	
R29	Resistor, fixed carbon, 47,000 ohms, ±10%, ½ watt (part of T10)	30787
R30	Resistor, fixed, wire wound, 2700 ohms, ±10%, 4 watts	42262
R31	Resistor, same as R3	
R32	Resistor, fixed carbon, insulated, 3900 ohms, ½ watt	38138
R33	Resistor, same as R2	
R34	Resistor, same as R3	
R35	Resistor, fixed carbon, insulated, 680,000 ohms, ½ watt	30562
R36	Resistor, variable, carbon, insulated, 2.2 megohms, ±20%, ½ watt	47431
R37	Resistor, fixed carbon, insulated, 1.0 megohm, ±20%, ½ watt	47430
R38	Resistor, fixed carbon, insulated, 1.5 megohms, ±10%, ½ watt	31449
R39	Resistor, same as R20	
R40	Resistor, fixed carbon, insulated, 270,000 ohms, ±10%, ½ watt	63929
R41	Resistor, fixed carbon, insulated, 100,000 ohms, ±10%, ½ watt	19736
R42	Resistor, fixed carbon, 390,000 ohms, ½ watt	11988
R43	Resistor, fixed wire wound, 100 ohms, ±10%, 4 watts	42260
R44	Resistor, fixed wire wound, 150 ohms, ±10%, 4 watts	48134
R45	Resistor, fixed wire wound, 15 ohms, ±10%, ½ watt	64064
R46	Resistor, variable, carbon, R-F gain control, 66,000 ohms, ±10%	42248
R47	Resistor, same as R2	
R48	Resistor, same as R46	
R49	Resistor, same as R19	
R50	Resistor, same as R23	
R51	Resistor, variable, potentiometer, carbon, audio gain control, 2.0 megohms, ±20%	72494
R52	Resistor, variable, carbon, tone control, 1 megohm, ±20%	42247
R53	Resistor, fixed carbon, 330,000 ohms, ±10%, ½ watt	14983
R54	Resistor, fixed carbon, insulated, 2700 ohms, ½ watt	30730
R55	Resistor, same as R58	
R56	Resistor, fixed wire wound, 5 ohms, 4 watts	64220
R58	Resistor, fixed carbon, 5600 ohms, ½ watt	30734
R60	Resistor, same as R58	
R61, R62	Resistor, fixed carbon, 47 ohms, ½ watt	30732
R63	Resistor, same as R24	
R64, R65	Resistor, same as R23	
R66, R67	Resistor, fixed carbon, 2700 ohms, ½ watt	30730
R68	Resistor, fixed wire wound, 15 ohms, ½ watt	64064
R69, R70	Resistor, fixed wire wound, 10 ohms, ½ watt	18823

SYMBOL No.	DESCRIPTION	Stock No.
S1 to S16	Switch, range	48135
S17 to S20	Switch, selectivity, 3 section, 5 position	72493
S21, S22	Switch, AVC, N.L., 1 section, 4 position	55250
S23	Switch, off-transmission receiver switch, wafer, 2 section, 4 position, a.c.; switch, 1 ampere, 250 volts, or 3 amperes, 125 volts, S.P.S.T.	72492
S25	Switch, rotary, 5 contact tap	42245
	Select one T1 Only one required	
T1	Transformer, power, primary, 125 volts, 60 cycles, 240 volts, 60 cycles; plate, 690 volts, 345 volt c.t.; filament, 6.45 volts, 4.5 amperes; rectifier filament, 5.0 volts, 2.0 amperes	60502
T1	Transformer, power, primary, 117 volts, 25 cycles; secondary, plate, 660 volts, 330 volt c.t.; filament, 6.4 volts, 4.0 amperes; rectifier filament, 5.0 volts, 2.0 amperes	48126
T2	Transformer, output, primary impedance at 30 volts, 60 cycles, .022 ampere d.c., 4500 ohms minimum. Ratio: pri. to sec. #1 = 55:1, ±3%; pri. to sec. #1 & 2 = 109:1, ±3%; pri. to sec. #3 = 3.5:1, ±3%	47418
T3	Transformer, first I-F includes C55, C72, R15, L32, L33	48127
T4	Transformer, crystal load, I-F includes C34	48131
T5, T6, T7, T8	Transformer, second and third I-F includes C78, C89, C90, C91, C94, C100, C101, C104, L35, L36, L37, L38, L39, L40, L41, L42, L43, L44, L45, L46	48128
T9	Transformer, fourth I-F includes C108, C114, C115, L47, L48	48129
T10	Transformer, BFO, I-F includes C82, C85, C87, C88, R24, R28, R29, and L22	48130
X1, X2	Socket, tube, 8 contact	60996
X3, X4	Socket, tube, 8 contact	61031
X5, X6	Socket, tube, octal with retainer	60995
X7, X8	Socket, tube, 8 contact	60996
X9	Socket, tube, 8 contact	61031
X10	Socket, same as X5	
X11	Socket, same as X7	
X12	Socket, tube, 8 contact	60998
X13, X14	Socket, same as X5	
	MISCELLANEOUS	
	Cord, power cord and plug (120 inches long)	13524
	Flywheel, tuning balancing wheel	47416
	Dial, tuning assembly	48133
	Dial, vernier assembly	42240
	Holder, fuse	48894
	Lamp, pilot, ¼ ampere	11891
	Plug, 8 contact male	42246
	Socket, pilot lamp	47424
	Tool, trimmer adjusting	70180
	Tool, air trimmer adjusting	12636
	Tuning, unit complete	42241

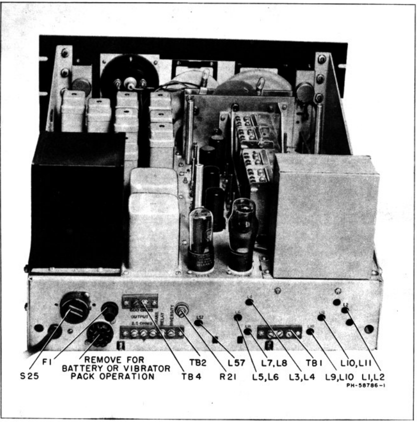


Figure 9—Rear View

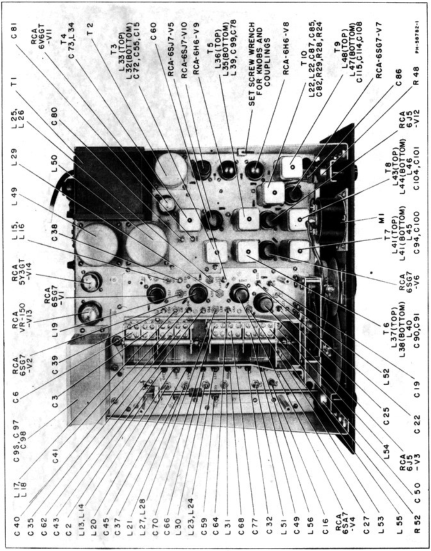


Figure 10—Top View, Covers Removed

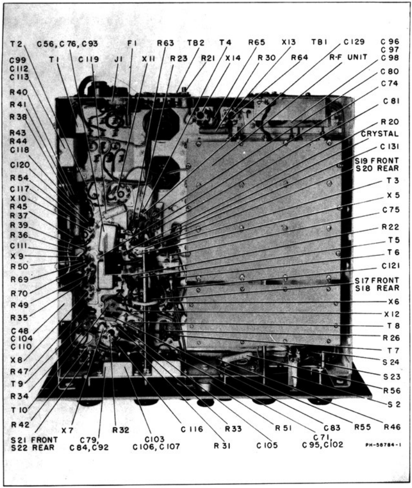


Figure 11—Bottom View

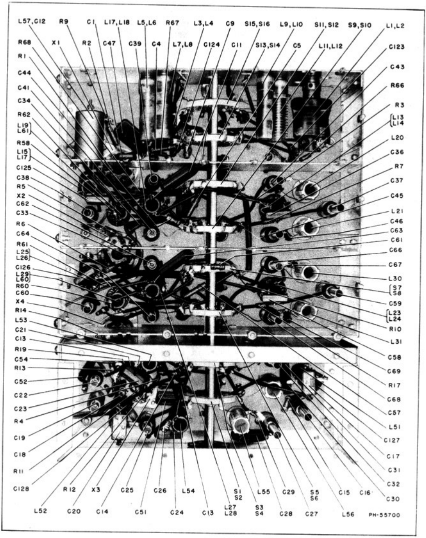
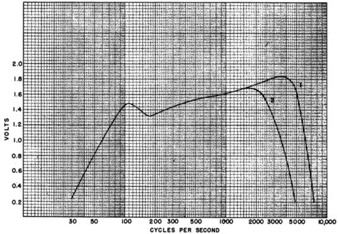
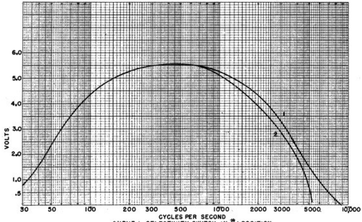


Figure 12—RF Unit, Bottom View, Cover Removed



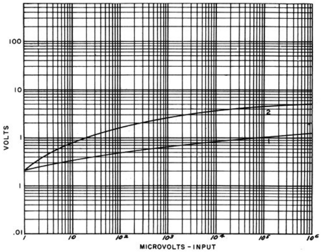
CURVE 1 = SELECTIVITY SWITCH IN NO.1 POSITION
CURVE 2 = SELECTIVITY SWITCH IN NO.2 POSITION

VOLTS ACROSS 600 OHM OUTPUT



CURVE 1 SELECTIVITY SWITCH IN #1 POSITION
CURVE 2 SELECTIVITY SWITCH IN #2 POSITION

Figure 13—Fidelity Curves



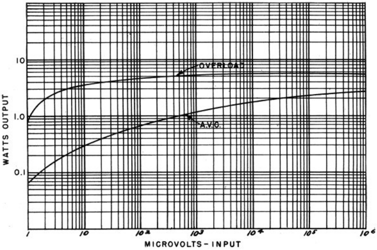


Figure 14—AVC Curves

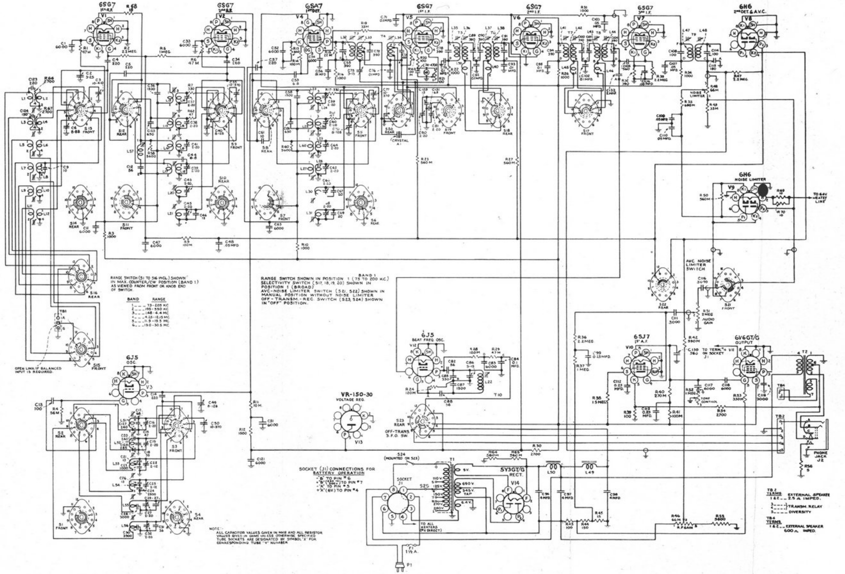


Figure 15—Schematic Diagram
W-303671