

MODEL F-88 (BAND SPREAD)

Eight-Tube, Five-Band, A-C Superheterodyne Receiver

Electrical Specifications

FREQUENCY RANGES

Standard Broadcast (A) 540-1,720 kc
"49 M" (49 Meters) 5,970-6,240 kc
"31 M" (31 Meters) 9,410-9,690 kc
"25 M" (25 Meters) 11,680-11,920 kc
"19 M" (19 Meters) 15,090-15,380 kc

R-F ALIGNMENT FREQUENCIES

"49 M" (49 Meters) 6,100 kc. (osc., det., ant.)
"31 M" (31 Meters) 9,600 kc. (osc.)
"25 M" (25 Meters) 11,700 kc. (osc.)
"19 M" (19 Meters) 15,300 kc. (osc.)
"Standard Broadcast" 600 kc. (osc.), 1,500 kc. (osc.)

Intermediate Frequency 460 kc.

RADIOTRON COMPLEMENT

(1) Type-6K7.....	R-F Amplifier	(5) Type-6Q7.....	Second det., A-F Amp., and A.V.C.
(2) Type-6J7.....	Heterodyne Oscillator	(6) Type-6F6.....	Power Output
(3) Type-6L7.....	First Detector (Converter)	(7) Type-6G5.....	Tuning Tube
(4) Type-6K7.....	Intermediate Amplifier	(8) Type-5W4.....	Full wave Rectifier

Pilot Lamps (2) Mazda No. 46, 6.3 volts, 0.25 amp.

POWER SUPPLY RATINGS

Rating A 105-125 volts, 50-60 cycles, 95 watts
Rating B 105-125 volts, 25-60 cycles, 95 watts

POWER OUTPUT

Undistorted 2.5 watts
Maximum 4.5 watts

LOUDSPEAKER

Type 12 inch Electrodynamic
Impedance (V.C.) 2.2 ohms at 400 cycles

Mechanical Specifications

Height 41 inches
Width 26 inches
Depth 15 $\frac{1}{8}$ inches
Weight (net) 75 pounds
Weight (shipping) 90 pounds
Chassis Base Dimensions 14 $\frac{7}{8}$ inches x 9 $\frac{3}{4}$ inches x 3 $\frac{1}{3}$ inches
Over-all Chassis Height 12 inches
Operating Controls (1) Power Switch-Tone, (2) Volume (3) Tuning (4) Range Selector
Tuning Drive Ratio 10 to 1

General Description

This receiver employs an eight-tube, five band, superheterodyne circuit, the arrangement of which is shown by the Schematic Circuit Diagram. Features of design include: an r-f amplifier stage with "cumulative-wound" antenna and detector "A" Band coil for high signal to noise ratio; magnetite-core i-f transformers and low frequency oscillator tracking; full

automatic volume control; phonograph terminal board; Tuning Tube; 12 inch dust-proof electrodynamic loudspeaker; plunger-type, air dielectric trimming capacitors; temperature-stabilized capacitors; aural-compensated audio volume control; and continuously variable high-frequency tone control.

Circuit Arrangement

The circuit consists of an r-f amplifier stage; first detector (converter) stage; separate heterodyne-oscillator stage; one i-f amplifier stage; second detector, audio voltage amplifier, and automatic volume control stage; power-amplifier stage; tuning indicator; and a full-wave rectifier.

The antenna and first-detector coils are constructed with a special type of winding (cumulative) to provide increased sensitivity and selectivity on the "Standard Broadcast" band. Special capacitors shunting the spread-band oscillator coils change in capacity with temperature variations to reduce oscillator frequency drift.

Spread-band tuning is accomplished electrically by shunting the low-capacity section of the oscillator variable capacitor with relatively large temperature-stabilized fixed capacitors for tuning the oscillator coil

on the "19M," "25M," "31M" and "49M" bands. Antenna and first-detector coils are designed to be sufficiently broad-tuned to require no variable tuning over the narrow frequency range of the spread-bands.

The spread-band oscillator coils and the "Standard Broadcast" band oscillator, first detector, and antenna coils are all wound on separate forms. The antenna and first detector spread-band coils are tapped. Undesirable interaction between coils is avoided by shorting proper unused sections by means of the range selector.

The intermediate-frequency amplifier consists of a Type 6K7 tube in a single stage transformer-coupled circuit. The windings of all i-f transformers are resonated by fixed capacitors and are adjusted by moulded magnetite cores to tune to 460 kc.

Service Data

The various diagrams of this booklet contain such information as will be needed to isolate causes for defective operation if such develops. The ratings of the resistors, capacitors, coils, etc., are indicated adjacent to the symbols signifying these parts on the diagrams. Identification titles such as R1, L1, C1, etc., provide reference between the illustrations and Replacement Parts List.

Loudspeaker.—Centering of the loudspeaker is made in the usual manner with three narrow paper feelers after first removing the front dust cover. This may be removed by softening its cement with a light application of acetone, using care not to allow the acetone to flow into the air gap. The dust cover should be cemented back in place with ambroid upon completion of adjustment.

Phonograph Attachment.—A terminal board is provided for connecting a phonograph into the audio amplifying circuit. The Model R-93 Record Player should be connected as follows: Remove link between terminals 1 and 2 on terminal board. Connect green wire in Radio-Record switch cable to terminal 1, yellow to terminal 2, and shield extension to terminal 3. Tape unused red and blue leads separately. Connect a 2-conductor twisted cable between the Record

Player binding posts and the screw terminals on Radio-Record switch.

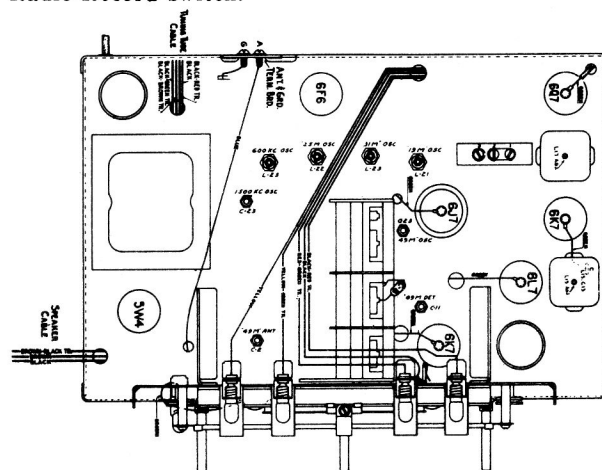


Figure 1—Radiotron, Coil, and Trimmer Locations

RADIOTRON VOLTAGES:—A.C. LINE VOLTAGE AT 120 VOLTS

Radiotron	Plate	Screen Grid	Cathode	Grid	Filament
(1) Type 6K7—R-F Amp.	250V	95V			6.6V
(2) Type 6J7—Osc.	165V	170V			6.6V
(3) Type 6L7—1st Det.	250V	95V			6.6V
(4) Type 6K7—I.F. Amp.	250V	95V			6.6V
(5) Type 6Q7—2nd Det.	90V			-1.5V	6.6V
(6) Type 6F6—Output	240V	255V		-17.0V	6.6V
(7) Type 6G5—Tuning Tube	230V				6.6V
(8) Type 5W4—Rectifier			370V		5.2V

Alignment Procedure

Calibrate the tuning dial by adjusting main dial pointer to the low-frequency (end) calibration mark on dial with the gang tuning-condenser plates in full-mesh position; then adjust the small (vernier) pointer to "O." These are friction adjustments.

Permit the set to operate at least five minutes before attempting alignment.

Perform alignment in proper order, tabulated below, starting with No. 1 and following all operations across, then No. 2, etc. Adjustment locations are shown on figures 1 and 2.

Cathode-ray alignment is highly preferable; the connections to the chassis are shown on figure 4. If an output indicator is used, connect it across the loud-speaker voice-coil and advance the receiver volume

control to full-volume position.

Connect the "low" output terminal of the test oscillator to the receiver "G" (ground) terminal for all alignment operations. Regulate the output of the test oscillator so that minimum signal is applied to the receiver to obtain an observable output indication. This will avoid a-v-c action.

The term "Dummy antenna" means the device which must be connected between the "high" test-oscillator output and the point of connection to the receiver in order to obtain ideal alignment. "No signal, 550-750 kc" means that the receiver should be tuned to a point between 550 and 750 kc where no signal or interference is received from a station or local (heterodyne) oscillator.

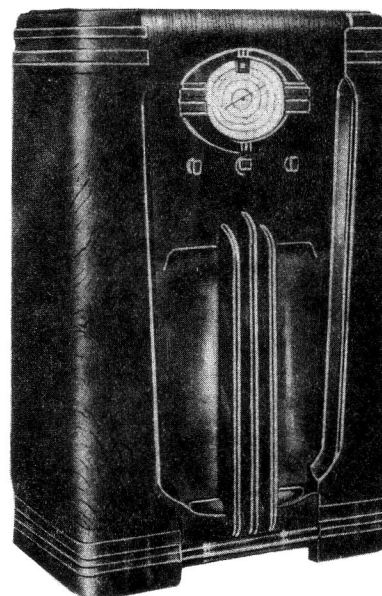
Order of Alignment	Test Oscillator			Range Selector	Receiver Dial Setting	Circuit to Adjust	Adjustment Symbols	Adjust to Obtain
	Connection to Receiver	Dummy Antenna	Frequency Setting					
1	6K7 2nd I.F. Grid Cap	.001 Mfd.	460 kc	"A"	No Signal 550-750 kc	2nd I.F. Trans.	L16 & L17	Max. (peak)
2	6L7 Det. Grid Cap	.001 Mfd.	460 kc	"A"	No Signal 550-750 kc	1st I.F. Trans.	L14 & L15	Max. (peak)
3	Ant. Term	300 Ohms	6,100 kc	"49 M"	6.1 mc	"49M" Osc.	C-23	Min. Deflection Tuning Tube
4	Ant. Term	300 Ohms	6,100 kc	"49 M"	6.1 mc	"49M" Det.	C-11	Min. Deflection Tuning Tube
5	Ant. Term	300 Ohms	6,100 kc	"49 M"	6.1 mc	"49M" Ant.	C-2	Min. Deflection Tuning Tube
6	Ant. Term	300 Ohms	9,600 kc	"31 M"	9.6 mc	"31M" Osc.	L-23	Min. Deflection Tuning Tube
7	Ant. Term	300 Ohms	11,700 kc	"25 M"	11.7 mc	"25M" Osc.	L-22	Min. Deflection Tuning Tube
8	Ant. Term	300 Ohms	15,300 kc	"19 M"	15.3 mc	"19M" Osc.	L-21	Min. Deflection Tuning Tube
9	Ant. Term	200 Mmfd.	1,500 kc	"A"	1,500 kc	"A" H-F Osc.	C-25	Min. Deflection Tuning Tube
10	Ant. Term	200 Mmfd.	600 kc	"A"	600 kc	"A" L-F Osc.	L-25	Min. Deflection Tuning Tube

Spread-Band Alignment.—The most satisfactory method of aligning or checking the spread-band ranges is on actual reception of short-wave stations of known frequency, by adjusting the magnetite-core oscillator coil for each band so that these stations come in at the correct points on the dial.

In exceptional cases, when the set is being serviced in a location where the noise level is high enough to prevent reception of short-wave stations, a test-oscillator may be used for alignment, but an extremely high degree of accuracy is required in the frequency settings of the test-oscillator, as a slight error will produce considerable inaccuracy on the spread-band dials. The frequency settings of the test-oscillator may be checked by one or both of the following methods:

1. Determine the exact dial settings of the test-oscillator (for frequencies at or close to the specified alignment frequencies) by zero-bearing the test-oscillator against short-wave stations of known frequency.
2. Use harmonics of the standard-broadcast range of a test-oscillator, first checking the frequency settings on this range by means of a crystal calibrator (GE Stock No. 9572), or by zero-bearing against standard broadcast stations.

When a test oscillator is employed for spread-band alignment, a final check should be made on actual reception of short-wave stations of known frequency, and the magnetite-core oscillator coil for each band should be re-adjusted so that the stations come in at the correct points on the dial.



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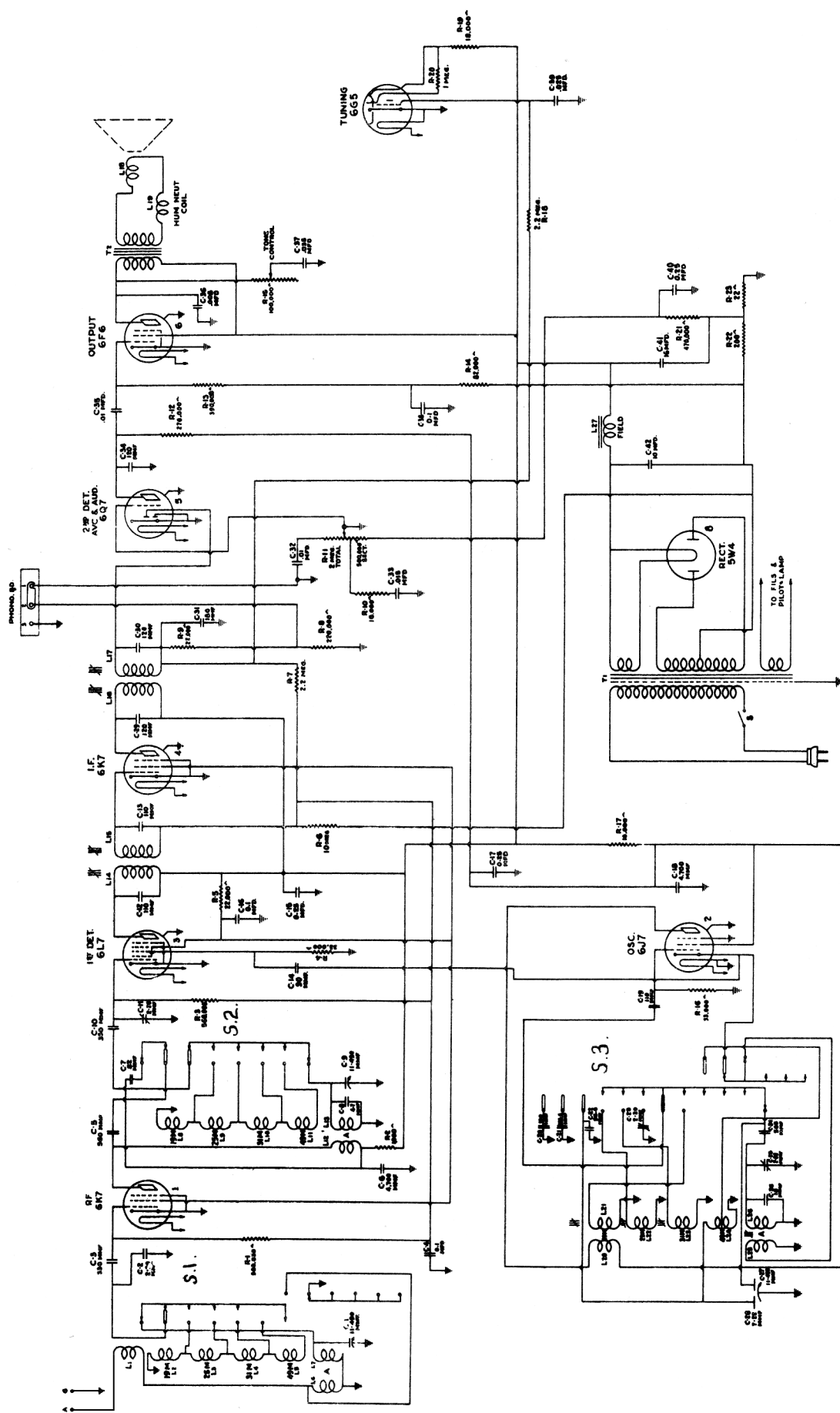


Figure 2—Schematic Circuit Diagram

Spread-band Adjustments. — Bottom shield-pan must be in place before attempting spread-band alignment. Alignment of the spread bands requires special procedure since test oscillators used alone are not ordinarily sufficiently accurate for this purpose. The GE Stock No. 9572 Crystal Calibrator affords a convenient and accurate alignment standard. Wrap a few turns of wire around the crystal calibrator and connect one free end to the antenna terminal of the receiver. Using the crystal calibrator to obtain the necessary accuracy, follow the tabulated alignment procedure for the "31M.", "25M.", and "19M." bands.

The "31M." band alignment, for example, is done as follows: Tune the receiver ("Standard broadcast" band) to the 1,000 kc crystal calibrator output with the crystal calibrator "Hi-Lo" switch in "Hi" position. Snap "Hi-Lo" switch to "Lo" and carefully tune receiver to 1,600 kc (the sixth 100 kc harmonic above 1,000 kc) for minimum "Tuning Tube" opening.

Move crystal calibrator away from antenna wire, connect test oscillator, and carefully adjust test oscillator for minimum "Tuning Tube" opening at a setting of approximately 1,600 kc. (If Stock No. 150 Test Oscillator is used, refer to second paragraph below.) Raise test-oscillator output to give sufficient harmonic output and use 6th harmonic (9,600 kc) for aligning in "31M." band at 9.6 mc. Align in the "25M." band at 11.7 mc (11,700 kc), the 9th harmonic of the test oscillator 1,300 kc output. Align in the "19M." band at 15.3 mc (15,300 kc), the 9th harmonic of the test-oscillator 1,700 kc output. In each case select the peak giving minimum "Tuning Tube" opening.

For the "49M." band, snap crystal calibrator "Hi-

Lo" switch to "Hi", turn the range selector to "49M." band, and set receiver dial pointer to 6.0 mc. Adjust oscillator trimming capacitor C10 for minimum "Tuning Tube" opening. Use the peak indicated by the alignment table. Snap "Hi-Lo" switch to "Lo" and locate 6,100 kc (the first 100 kc harmonic above 6,000 kc) by slightly readjusting C10 with the dial pointer set at 6.1 mc. This method insures selection of correct crystal-calibrator harmonic.

When aligning with the GE Stock No. 150 Test Oscillator use the variable (unmodulated) oscillator† and "Magic Eye" indication of receiver output. Set test-oscillator dial 800 kc lower than the desired signal for the four lower frequency ranges and 800 kc higher than the desired signal for the two high ranges and use in same manner as TMV-97-C. Insert an open-circuit telephone plug in the test oscillator "Ext. Mod." jack, so the modulated fixed-frequency oscillator will be cut off, and align on the unmodulated variable oscillator signal, which will close the "Tuning Tube" and evidence itself by a rushing noise in the speaker.

If the crystal calibrator signals are weak, disconnect test oscillator while using the crystal calibrator.

More accurate alignment in the spread-bands can be accomplished by making final slight adjustments using American, English, or German short-wave broadcasting stations of known frequency for frequency standards.

† The No. 150 Test Oscillator employs a fixed-frequency (800 kc), modulated oscillator and a variable, unmodulated oscillator. The scale is calibrated to the sum frequency for the two higher frequency ranges and to the difference frequency for the four lower frequency ranges.

REPLACEMENT PARTS MODEL F-88

STOCK NO.	DESCRIPTION	STOCK NO.	DESCRIPTION
RECEIVER ASSEMBLIES		RECEIVER ASSEMBLIES (Continued)	
14380	Arm-Band indicator operating arm and hub less set screw stock #14350.....	13669	Resistor-22,000 ohms, carbon type, 2 watt (R-5).....
12038	Band-Rubber band for tuning tube-Pkg. of 10	13735	Resistor-33,000 ohms, carbon type, 1/2 watt (R-4,R-16).....
14384	Belt-Variable condenser drive belt.....	14023	Resistor-82,000 ohms, carbon type, 1/2 watt (R-14).....
14517	Board-Antenna and ground terminal board..	11398	Resistor-220,000 ohms, carbon type, 1/10 watt (R-8).....
12717	Board-Phonograph terminal board.....	12199	Resistor-270,000 ohms, carbon type, 1/2 watt (R-12).....
S-2007	Bushing-Variable condenser mounting bushing assembly.....	13005	Resistor-390,000 ohms, carbon type, 1/10 watt (R-13).....
14394	Cable-Tuning tube cable and socket.....	12285	Resistor-470,000 ohms, carbon type, 1/2 watt (R-21).....
12607	Cap-First I.F. transformer shield cap....	11397	Resistor-560,000 ohms, carbon type, 1/10 watt (R-1,R-3).....
12581	Cap-Second I.F. transformer shield cap....	12013	Resistor-1 megohm, carbon type, 1/10 watt (R-20).....
11350	Cap-Grid contact cap-Pkg. of 5.....	12679	Resistor-2.2 megohm, carbon type, 1/2 watt (R-7,R-18).....
S-2018	Cap-Station selector indicator pointer cap	13601	Resistor-10 megohms, carbon type, 1/2 watt (R-6).....
12884	Capacitor-Adjustable trimmer(C-2,C-11,C-25)	14350	Screw-No. 8-32x3/16 square head set screw for drum stock #14345, arm stock #14380, and gear stock #30085-Pkg. of 10.....
14392	Capacitor - 4.7 Mmfd. (C-8).....	14342	Spring-Tension spring for idler stock #14341-Pkg. of 5.....
12722	Capacitor - 18 Mmfd. (C-26).....	12007	Spring-Retaining spring for core stock #12006-Pkg. of 10.....
12813	Capacitor - 82 Mmfd. (C-7).....	11195	Socket-5 contact 5W4 radiotron socket....
14910	Capacitor - 90 Mmfd. (C-14).....	11196	Socket-8 contact 6K7, 6L7, 6Q7, 6F6 or 6J7 radiotron socket.....
14908	Capacitor - 96.5 Mmfd. (C-22).....	14114	Socket-Dial lamp socket.....
14906	Capacitor - 100 Mmfd. (C-20).....	S-2002	Switch-Range switch. S-1,S-2,S-3
14907	Capacitor - 103.5 Mmfd. (C-21).....	S-1995	Tone control-Tone control and power switch (R-15).....
14909	Capacitor - 110 Mmfd. (C-19).....	14511	Transformer-Power transformer 105-125 volts, 60-cycle (T-1).....
14262	Capacitor - 110 Mmfd. (C-12,C-13).....	14512	Transformer-Power transformer 105-125 volts, 25 cycle (T-1).....
12724	Capacitor - 120 Mmfd. (C-34).....	14376	Transformer-First I.F. transformer (L-14,L-15,C-12,C-13).....
12404	Capacitor - 120 Mmfd. (C-29,C-30).....	14283	Transformer-Second I.F. transformer (L-16,L-17,C-29,C-30,C-31,R-8,R-9).....
14712	Capacitor - 180 Mmfd. (C-31).....	S-1996	Volume control (R-11).....
12952	Capacitor - 330 Mmfd. (C-3,C-10).....	REPRODUCER ASSEMBLIES (RL-70E-1)	
12537	Capacitor - 560 Mmfd. (C-5,C-24).....	13866	Cap-Dust cap for cone center-Pkg. of 5...
12897	Capacitor - 4700 Mmfd. (C-6,C-18).....	14354	Coil-Field coil (L-20).....
4838	Capacitor - .005 Mfd. (C-36).....	11469	Coil-Hum neutralizing coil (L-19).....
13138	Capacitor - .01 Mfd. (C-32,C-35).....	12667	Cone - Reproducer cone and dust cap(L-18)
11315	Capacitor - .015 Mfd. (C-33).....	5118	Connector-3-contact male plug for reproducer.....
4870	Capacitor - .025 Mfd. (C-39).....	14395	Reproducer-Reproducer complete.....
12670	Capacitor - .035 Mfd. (C-37).....	14355	Transformer-Output transformer (T-2).....
4839	Capacitor - 0.1 Mfd. (C-4,C-16)(C-38)	14357	Washer-Spring washer to hold field coil - Pkg. of 5.....
S-1592	Capacitor - 0.25 Mfd. (C-17,C-40).....	MISCELLANEOUS ASSEMBLIES	
12484	Capacitor - 0.25 Mfd. (C-15).....	S-1789	Escutcheon-Station selector escutcheon and crystal.....
11240	Capacitor - 10 Mfd. (C-42).....	12699	Knob-Station selector knob.....
5212	Capacitor - 16 Mfd. (C-41).....	11347	Knob-Volume control, tone control or range switch knob.....
S-1985	Coil-"A" band antenna coil(L-6,L-7).....	S-2024	Screw-Escutcheon mounting screw, large size-Pkg. of 20.....
S-1986	Coil-Special band spread antenna coil (L-1,L-2,L-3,L-4,L-5).....	S-2025	Screw-Escutcheon mounting screw, small size-Pkg. of 20.....
S-1987	Coil-"A" band detector coil(L-12,L-13)...	4982	Spring-Retaining spring for knob stock #12699-Pkg. of 5.....
S-1988	Coil-Special band spread detector coil (L-8,L-9,L-10,L-11).....	14270	Spring-Retaining spring for knob stock #11347-Pkg. of 5.....
S-1989	Coil-"A" band oscillator coil (L-25,L-26)		
S-1990	Coil-19 meter band oscillator coil (L-20,L-21).....		
S-1991	Coil-25 meter band oscillator coil(L-22)...		
S-1992	Coil-31 meter band oscillator coil(L-23)...		
S-1993	Coil-49 meter band oscillator coil(L-24)...		
S-2015	Condenser-3 gang variable tuning condenser (C-1,C-27,C-28,C-9).....		
5119	Connector-3-contact female connector for speaker cable.....		
12006	Core-Adjustable core and stud for stock #14376 and stock #14283.....		
S-2000	Core-Coil inductance adjustment assembly.		
S-2001	Dial-Dial scale.....		
S-2016	Drive-Variable condenser vernier drive pinion, gear and shaft.....		
14345	Drum-Variable condenser drive belt drum complete with set screws.....		
S-1795	Escutcheon-Tuning eye escutcheon.....		
11982	Fastener-Dial scale fastener-Pkg. of 25..		
30085	Gear-Indicator drive gear and hub and pointer stem and gear.....		
S-1998	Indicator-Band indicator.....		
S-1790	Indicator-Station selector indicator pointer.....		
14341	Idler-Station selector drive belt idler..		
5226	Lamp - Dial lamp-Pkg. of 2.....		
14028	Nut-Jamb nut for trimmer stock #12884-Pkg. of 10.....		
12471	Plate-6J7 socket mounting plate assembly for cushion socket - less socket.....		
14525	Resistor-22 ohms, carbon type, 1/2 watt(R-23)		
14526	Resistor-200 ohms, wire wound, 2 1/2 watts (R-22).....		
14720	Resistor-1000 ohms, carbon type, 1/2 watt (R-2).....		
8043	Resistor-10,000 ohms, carbon type, 2 watt (R-17).....		
11175	Resistor-18,000 ohms, carbon type, 1/2 watt (R-10).....		
30151	Resistor-18,000 ohms, carbon type, 1 watt (R-19).....		
14284	Resistor-22,000 ohms, carbon type, 1/10 watt (R-9).....		